SL-1

Meridian 1

General maintenance information

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About this document

This document describes maintenance features for Meridian 1 system options 21A, 21, 21E, 51, 61, 61C, 71, and 81. The chapters in this document describe the following:

- Precautions: guidelines to avoid personal injury and equipment damage
- Communicating with the system: methods for exchanging information with the system
- Routine maintenance: requirements for servicing batteries and air filters
- Hardware maintenance tools: descriptions of circuit card hardware, CPU controls, system alarms, and system monitor indicators
- Software maintenance tools: descriptions of diagnostic programs, the History File, and interactive diagnostics
- User reports: problems typically reported by users
- Customer technical assistance service: information on Northern Telecom Technical Assistance Centers and services

This document does not provide procedures for locating faults, clearing faults, or replacing equipment. See *Fault clearing* (553-3001-510) to locate and clear faults. See *Hardware replacement* (553-3001-520) to replace faulty equipment.

References

See the *Meridian 1 planning and engineering guide* for

- *Master index of publications* (553-3001-000)
- *System overview* (553-3001-100)
- *Equipment identification* (553-3001-154)

See the *Meridian 1 installation and maintenance guide* for

- *System installation procedures* (553-3001-210)
- *Circuit card installation and testing* (553-3001-211)
- *Telephone and attendant console installation* (553-3001-215)
- *Fault clearing* (553-3001-510)
- *Hardware replacement* (553-3001-520)

See the *X11 software guide* for an overview of software architecture, procedures for software installation and management, and a detailed description of all X11 features and services. This information is contained in two documents:

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

See the *X11 input/output guide* (553-3001-400) for a description of all administration programs, maintenance programs, and system messages.

Precautions

General precautions

Meridian 1 equipment is sensitive to static electricity and environmental conditions. Follow the precautions in this chapter to avoid personal injury or equipment damage.

WARNING

Module covers are not hinged; do not let go of the covers. Lift covers away from the module and set them out of your work area.

WARNING

To avoid the danger of electric shock, be very careful when you work with power equipment and connections. Warning notices are displayed and must be heeded.

There are no user repairable components or assemblies in the power system. If a power unit fails, the complete unit must be replaced. Do not disassemble a power unit under any circumstances because of the risk of electric shock.

Circuit cards

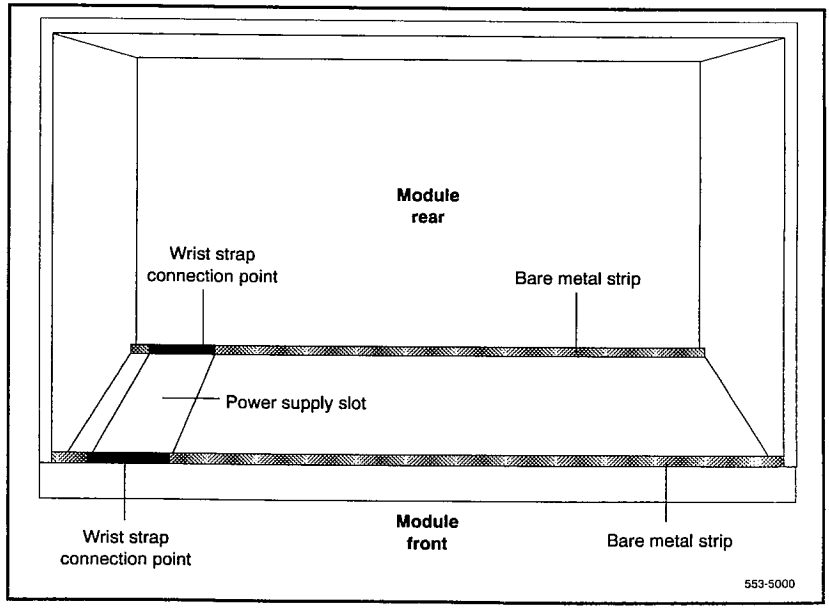
WARNING

Circuit cards may contain a lithium battery. There is a danger of explosion if the battery is incorrectly replaced. Do not replace components on any circuit card; you must replace the entire card.

Dispose of circuit cards according to the manufacturer's instructions.

To avoid damage to circuit cards from static discharge, wear a properly connected antistatic wrist strap when you work on Meridian 1 equipment. If a wrist strap is not available, regularly touch one of the bare metal strips in a module to discharge static. Figure 1 shows the recommended connection points for the wrist strap and the bare metal strips you should touch.

Figure 1
Static discharge points



Handle cards as follows:

- Handle cards by the edges only. Do not touch the contacts or components.
- Set cards on a protective antistatic bag. If an antistatic bag is not available, hand-hold the cards, or set them in card cages unseated from the connectors.
- Unpack or handle cards away from electric motors, transformers, or similar machinery.
- Store cards in protective packing. Do not stack cards on top of each other unless they are packaged.
- Store cards in a dry, dust-free area.

During repair and maintenance procedures do the following:

- Insert cards into compatible slots only.
- Turn off the circuit breaker or switch for a module power supply before the power supply is removed or inserted.

  Note: In AC-powered systems, capacitors in the power supply must discharge. Wait five full minutes between turning off the circuit breaker and removing the power supply from the module.

- Software disable cards, if applicable, before they are removed or inserted.
- Hardware disable cards, whenever there is an enable/disable switch, before they are removed or inserted.
- Return defective or heavily contaminated cards to a repair center; do not try to repair or clean them.

Data disks

Make sure disks are labeled with the software generic and issue number if you remove them from the system.

Follow the precautions below to avoid damaging disks:

- Handle only the hard surface of the disk; never touch the recording surface.
- Keep disks away from strong magnetic fields.
- Avoid exposing disks to extreme heat, rapid changes in temperature, or high humidity.
- Store disks in a suitable container.

Before installing a new disk do the following:

- Check the disk identification to make sure it is the correct disk. Compare software options with the data cartridge.
- Look for any damage to the disk.
- Make sure the arrow on the label is pointing up and the rounded corner on the disk is on the bottom (see Figure 2).

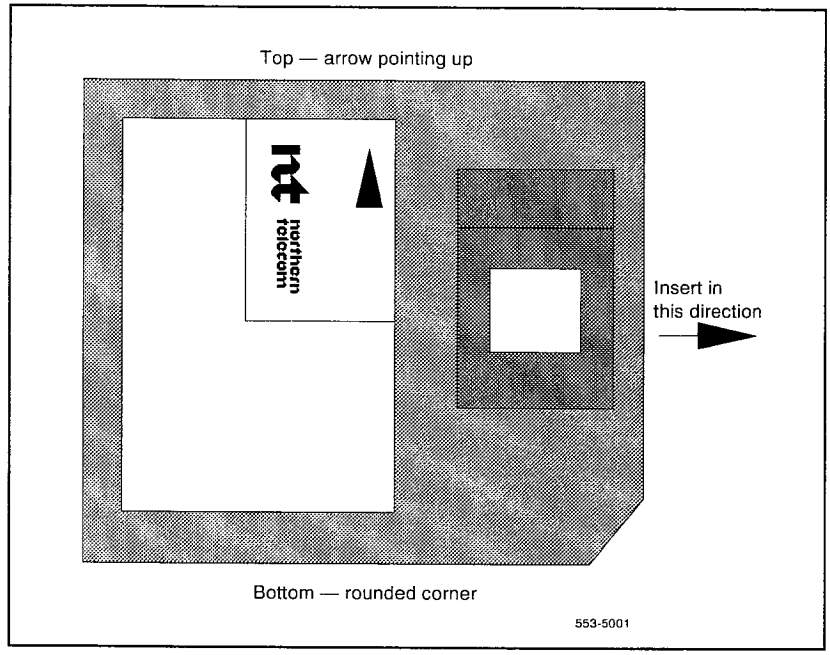
CAUTION

The disk drive can be damaged if an upside-down disk is forced into the slot. If there is significant resistance when you try to insert a disk, remove the disk and check the position.

For more detailed information on data disks, see *X11 software management* (553-3001-300).

Note: No maintenance or cleaning is required on the disk drives.

Figure 2
Disk position



Communicating with the system

You can exchange information with the system through system terminals and maintenance telephones. This chapter discusses these tools for communicating with the system.

> ***Note:*** Before X11 release 19, only one device at a time can communicate with the system. Accessing a device while another is logged in will log out the device that was already connected. The Multi User Login feature, available with X11 release 19 and later, allows more than one device to interact with the Meridian 1. Refer to *X11 system management application* (553-3001-301) for details on using this feature.

System terminal

You can send maintenance commands and receive system messages (status and error messages) by accessing the central processing unit (CPU) through an RS-232 device, such as a video display terminal (VDT) or teletypewriter (TTY).

For most system options, only the code is displayed or printed when the CPU sends system messages. For the interpretation of the code and any required action, refer to the *X11 input/output guide* (553-3001-400). Option 61C and option 81 provide the code, a plain text explanation, and required actions.

Before X11 release 18, if the same data is printed on more than one port, the throughput of each port is equal to the speed of the slowest device. If, for example, a traffic report is printed on two ports, one configured for 9600 baud and the other for 300 baud, the effective throughput of both ports is 300 baud.

X11 release 18 and later provide enhanced I/O buffering (independent throughout). With this capability, devices with higher baud rates run faster than devices that are limited to slower speeds.

Message format

Through the system terminal, you can enter commands that tell the system to perform specific tasks; the system performs the tasks and sends messages back to the system terminal, indicating status or errors. System messages, along with indicators such as maintenance display codes and light emitting diode (LED) indicators, identify faults in the system.

System messages are codes with a mnemonic and number, such as PWR0014. The mnemonic identifies an overlay program or a type of message. The number identifies the specific message. Table 1 gives an example of the format for a system message.

Table 1
System message format

System message: PWR0014	Interpretation
PWR	This message (generated by the system monitor) indicates power and temperature status or failures.
0014	This message means the system monitor failed a self-test.

With option 61C and option 81, system messages generated from the Core Common Equipment Diagnostic (LD 135) and the Core Input/Output Diagnostic (LD 137) include the interpretation and any action required. For example, if a CPU test from LD 135 fails, the message displayed is "CCED200 CPU test failed Check the CP card."

See the *X11 input/output guide* (553-3001-400) for a description of all maintenance commands and the interpretation of all system messages.

Local and remote access

A terminal or a modem must remain permanently connected to an SDI port in a network slot to provide a constant I/O interface to the system. Although only one device can communicate with the system at a time, many devices can be installed at local and remote locations.

When a system terminal is installed locally, it is connected directly to a serial data interface (SDI) card, located within a module. When a system terminal is installed at a remote location, modems (or data sets) and a telephone line are required between the terminal and the SDI card.

For a modem connection to the Meridian 1, Bell 103/212 compatible dumb modems are recommended for all systems, except options 61C and 81.

CAUTION

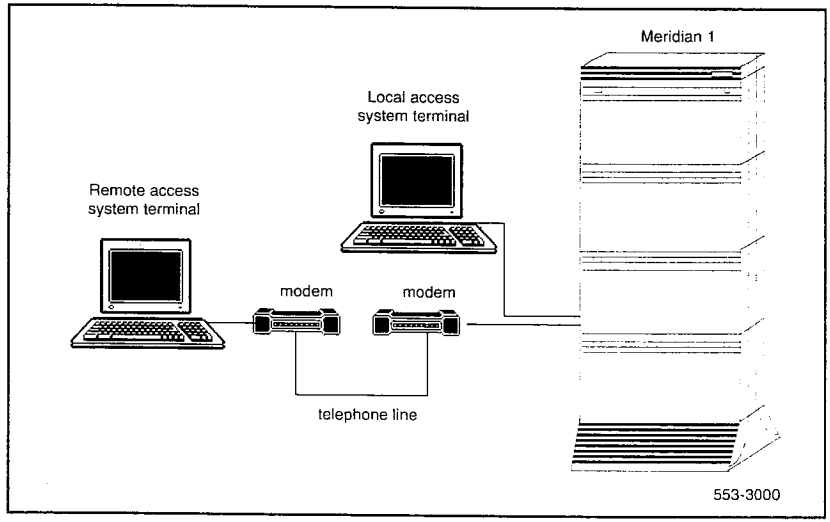
If a Hayes command-set compatible (smart) modem is used at the Meridian 1 end, you *must* select the dumb mode of operation, Command Recognition OFF and Command Echo OFF, before connecting the modem to the SDI port. Refer to the modem instructions to set the mode of operation.

If a printer is connected to an SDI port (locally or remotely), you must disable XON/XOFF flow control so that no characters or signals are sent to the port, to avoid a "ping-pong" effect.

Figure 3 shows typical system terminal configurations. See "Access through the system terminal" in *Fault clearing* (553-3001-510) or *Hardware replacement* (553-3001-520) for the access procedure.

For information specific to option 61C and option 81, see "Options 61C and 81 terminal and modem guidelines" on page 12.

Figure 3
Local and remote access to a system terminal



Options 61C and 81 terminal and modem guidelines

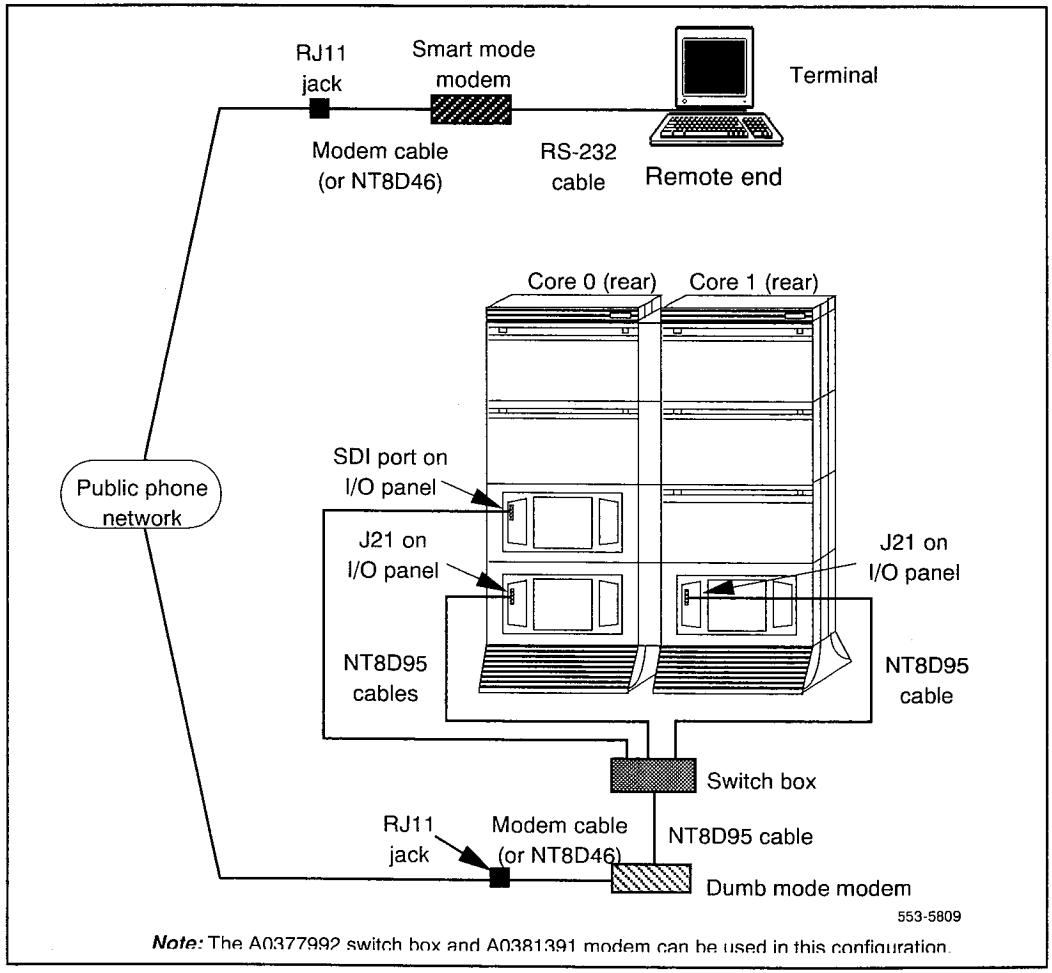
Each NT6D66 Call Processor (CP) Card provides a data terminal equipment (DTE) port at J21 and a data communication equipment (DCE) port at J25 on the Core and Core/Network Module I/O panel. The designations DTE and DCE refer to the function of the port, not the type of device that connects to the port. Therefore, a modem (which is DCE) connects to the DTE port at J21, and a terminal (which is DTE) connects to the DCE port at J25.

The input/output ports on the CP card (CPIO ports) are used for access to the Core or Core/Network Module, which houses the card. The CPIO ports are active only when the Core associated with the CP card is active. Therefore, the CPIO ports should not be used as the only I/O connection for the system.

Note: For correct operation, terminals used with options 61C and 81 must be set to 9600 baud, 7 data, space parity, one stop bit, full duplex, XON.

Figure 4 shows the recommended configuration for remote maintenance monitoring on option 81, which also applies to option 61C. In this configuration, a switch box is normally set to the SDI port to remotely monitor general system operation. The CPIO ports can be accessed for debugging and patch downloading (through your Northern Telecom representative).

Figure 4
Modem to a switch box and SDI and CPIO ports



Note: The A0377992 switch box and A0381391 modem can be used in this configuration.

See "Options 61C and 81 terminal and modem connections" in *System installation procedures* (553-3001-210) for detailed information on configuring and connecting terminals and modems with options 61C and 81.

> *Note:* The A0377992 Black Box ABCDE-Switch, A0381391 UDS FastTalk modem, and cables required for the configuration are available through Northern Telecom.

Modems must meet the following required specifications to be compatible with option 61C and option 81. Modems that meet the following recommended specifications must also meet the required specifications.

- *Required:* true, not buffered, 9600 baud support (required for remote Northern Telecom technical support)
- *Required:* CCITT V.32 or V.32bis compliance
- Recommended: the ability to adjust to lower and higher speeds, depending on line quality, while maintaining 9600 baud at local DTE
- Recommended: V.42 error correction
- Recommended: V.42bis data compression

The following models have been tested and verified as compatible with option 61C and option 81:

- Hayes V-series ULTRA Smartmodem 9600
- UDS FastTalk V.32/42b (available through Northern Telecom)
- US Robotics Courier HST Dual Standard V.32bis

A dispatch or call back modem, normally connected to the SDI port, can be used if it meets the requirements listed above. If you want to use a modem of this type that does not meet the requirements, the modem can only be used in addition to a modem that does meet specifications.

Maintenance telephone

A telephone functions as a maintenance telephone when you define the class of service as maintenance set allowed (MTA) in the Multi-line Telephone Administration program (LD11). A maintenance telephone allows you to send commands to the system through the following maintenance overlays: LD 30, LD 32, LD 33, LD 34, LD 35, LD 36, LD 37, LD 38, LD 41, LD 42, LD 43, LD 45, LD 46, LD 60, LD 61, and LD 62.

> *Note:* The Core Common Equipment Diagnostic (LD 135) and Core I/O Diagnostic (LD 137) are among the overlays that cannot be accessed through a maintenance telephone.

You can test tones and outpulsing through the maintenance telephone. Specific commands for tone testing are given in the Tone and Digit Switch and Digitone Receiver Diagnostic (LD 34).

To enter commands on a maintenance telephone, you press the keys that correspond to the letters and numbers of the command (for example, to enter *LD 42 return*, key in *53#42##*). Table 2 shows the translation from a terminal keyboard to a telephone dial pad.

See "Access through the maintenance telephone" in *Fault clearing* (553-3001-510) or *Hardware replacement* (553-3001-520) for the access procedure.

Table 2
Translation from keyboard to dial pad

Keyboard				Dial pad
			1	1
A	B	C	2	2
D	E	F	3	3
G	H	I	4	4
J	K	L	5	5
M	N	O	6	6
P	R	S	7	7
T	U	V	8	8
W	X	Y	9	9
			0	0
			Space or #	#
			Return	##
			*	*

Note: There is no equivalent for Q or Z on a dial pad.

Routine maintenance

You must service batteries and air filters regularly. Follow the guidelines in this chapter to maintain batteries and air filters.

Pedestal air filter

There is an air filter in the pedestal of each column (in all options except 21A). Service the air filters once a month. For instructions on replacing the air filter, see *Hardware replacement* (553-3001-520).

If an air filter is damaged in any way, discard it and install a new one. If a dirty air filter is not damaged, you can clean it with warm water and mild detergent. (Do not use compressed air because it may damage the filter.) When the filter is completely dry, you can reinsert it in the pedestal or store it as a spare.

Option 21E battery pack assembly

An A0378252 Battery Pack Assembly on the NTND02 Misc/SDI/Peripheral Signaling (MSPS) Card is used in option 21E. The battery is constantly recharged through a trickle charging circuit on the NTND01 Integrated CPU/Memory (ICM) Card.

You can run a battery checking routine manually using the command BATT in the Common Equipment Diagnostic (LD35), or as part of the midnight routines. A battery failure generates system message CED503.

Replace the battery pack every three years, even if no battery failures have occurred. For instructions on replacing the battery pack assembly, see *Hardware replacement* (553-3001-520).

DC-power battery systems

External batteries, often used with DC-powered systems, generally require regular visual inspections. They may also require charger or rectifier tests and pilot cell tests. Perform all inspections and tests according to the supplier's instructions.

To comply with safety requirements, consult the following articles before working with any battery systems:

- Read the "Material Safety Data Sheet" that must be posted to meet Occupational Safety and Health Administration (OSHA) requirements. This article outlines appropriate reserve battery handling procedures.
- Refer to National Electric Code 645-10. This article outlines requirements that call for the installation of AC- and DC-power kill switches to battery systems in certain environments.

Hardware maintenance tools

There are fault indicators and hardware features that help you perform maintenance tasks (particularly identifying and clearing faults). These maintenance tools include the following:

- circuit card features that include card level tests and status indicators
- CPU controls that allow you to control common equipment functions
- system alarms that categorize the severity of a system failure
- system monitor indicators that identify power and temperature faults

Circuit card features

Battery backup for CPU memory

The NTND02 MSPS Card, used in option 21E, is equipped with the A0378252 Battery Pack Assembly. If power to the system is lost, the battery retains CPU memory for up to 60 minutes.

Card test

A card test checks to see that a card is working correctly. Many cards perform a self-test on power-up. You can also force card-level tests through software commands.

Enable/disable switch

Some cards have a switch on the faceplate that enables or disables the hardware for that card.

When you remove a card, whenever possible disable the software, then disable the hardware by setting the switch to Dis.

Hardware disable a card (set the switch to Dis) before you install it. After the card is locked into position, set the switch to Enb then enable the software. Software disable and enable cards as described in the *X11 input/output guide* (553-3001-400).

Figure 5 shows the typical location of an enable/disable (Enb/Dis) switch.

LED

Many cards have one or more light emitting diodes (LEDs) on the faceplate. The LED gives a visual indication of the status of the card or of a unit on a card.

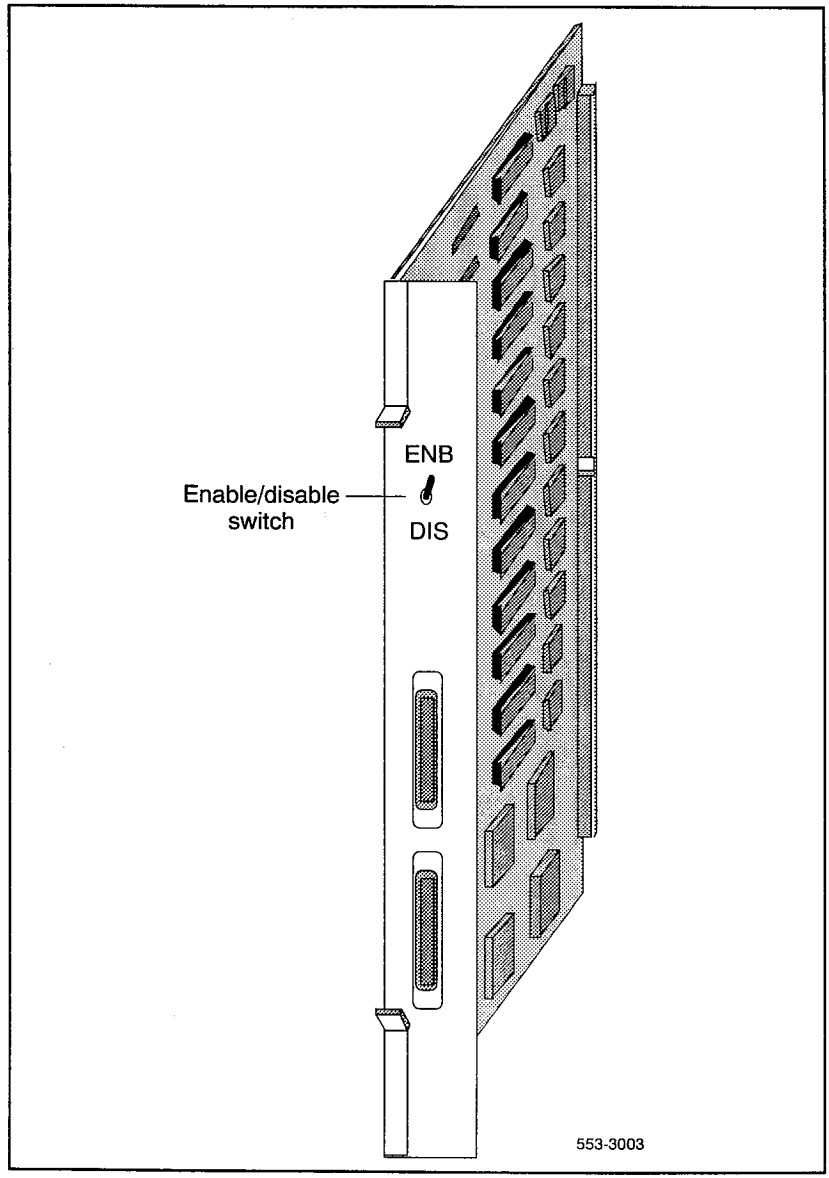
When a *green* LED is steadily lit, it indicates the card is operating normally. When a green LED is off, it indicates the card is disabled or faulty.

When a *red* LED is steadily lit, it indicates the card, or a unit on it, is disabled or faulty. When a red LED is off and power is available to the card, it indicates the card is operating normally.

> *Note 1:* The shape of the LED (some are round and some are rectangular) does not indicate a different function.
>
> *Note 2:* In option 61C and option 81, the red LEDs on the NT6D65 Core to Network Interface (CNI) Cards are lit when the associated Core is inactive. This is normal operation.

When intelligent peripheral cards are installed, the red LED on the faceplate remains lit for two to five seconds while a self-test runs. (The time required for the self-test depends on the type of card.) If the test is successful, the LED flashes three times and remains lit until the card's software is configured and enabled, and then the LED goes out. If the LED does not follow the pattern described or operates in any other manner (such as continually flashing or remaining weakly lit), the card should be replaced.

Figure 5
Sample enable/disable switch



In option 61C and option 81, when Core common control cards are installed, a self-test runs. If the self-test is successful, the LED flashes three time, then goes out.

Table 3 gives two examples of LED indications.

Table 3
Sample LED indications

Type of card	LED color	Status
Common equipment power supply	green	LED lit = operation normal
Digital line card	red	LED lit = disabled

Figure 6 shows the location of the LED on the faceplate of an intelligent peripheral line card.

Maintenance display code

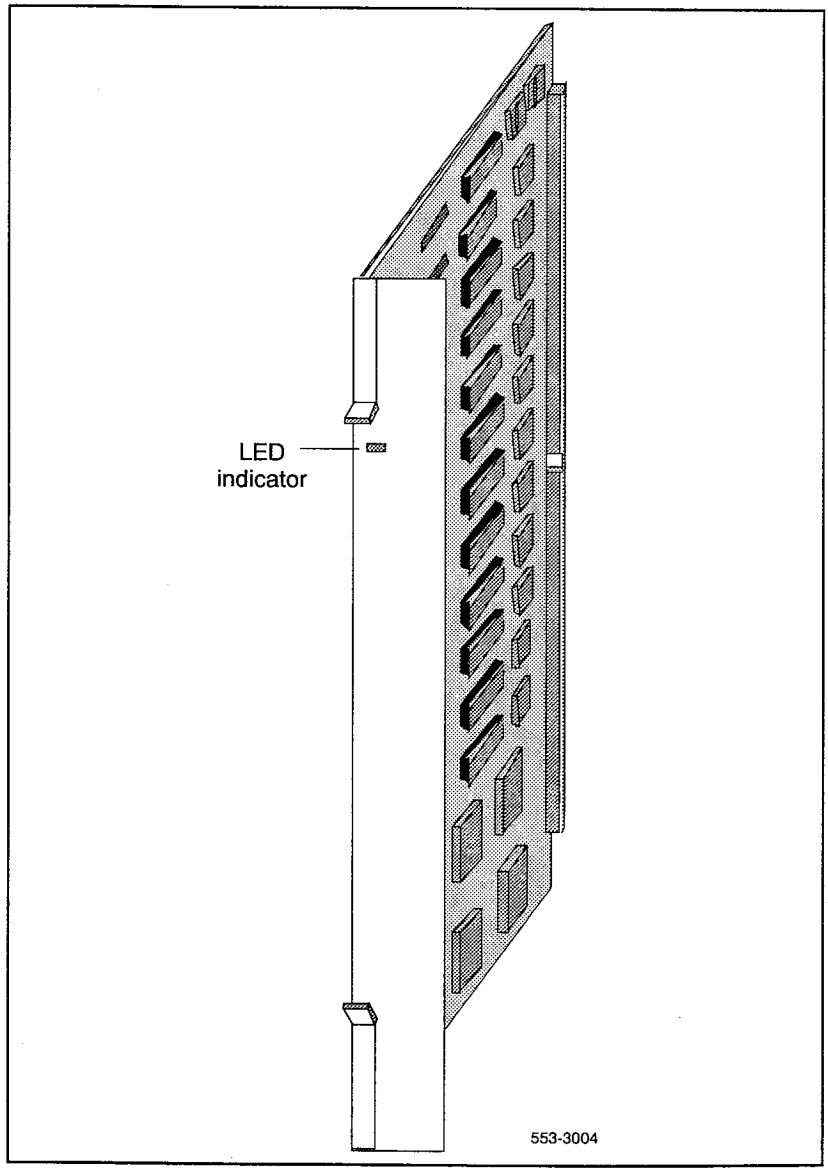
Maintenance displays are located on the faceplate of some circuit cards. A hexadecimal code is displayed. Interpretations of the maintenance display codes are listed under "HEX" in the *X11 input/output guide* (553-3001-400). You should examine previous codes, system messages, and visual indicators with any current maintenance display codes to properly analyze faults.

In option 61C and option 81, the maintenance display on the NT6D66 Call Processor (CP) Card shows two lines of information with up to 16 characters per line. The hexadecimal code and its definition are shown on the display.

Each new code shown on a maintenance display overwrites the one before it. However, note the following:

— All codes received on common equipment displays are recorded. You can review them by printing the History File.

Figure 6
Sample LED indicator



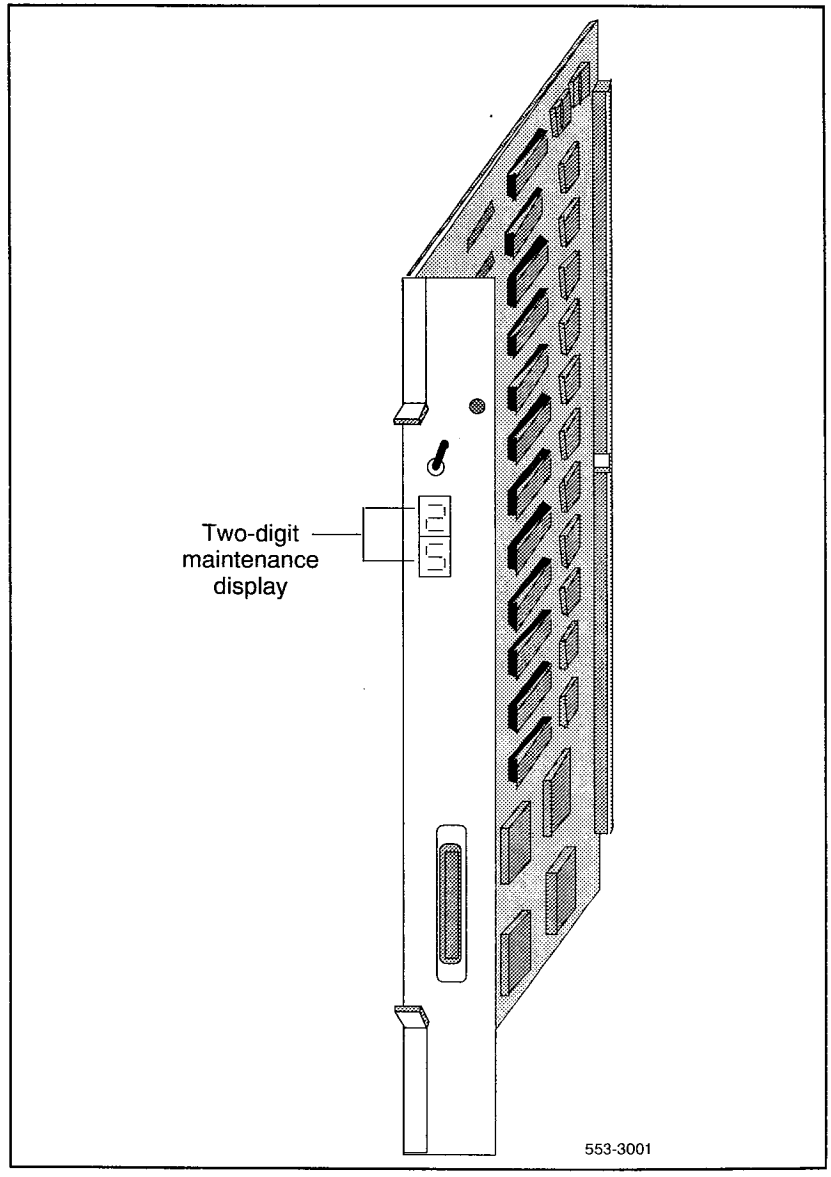
- The most recent 16 codes displayed on a controller card stay in memory. You can review them and reset the counter through the Network and Signaling Diagnostic (LD30).
- In option 61C and option 81, the most recent 64 displays on a CP card stay in memory. You can review the displays on the active CP card through the Core Common Equipment Diagnostic (LD135).

Table 4 lists the cards with maintenance displays and the type of information the codes indicate on each card. Figure 7 shows the location of the maintenance display on the faceplate of a floppy disk interface card.

Table 4
Circuit cards with maintenance displays

System options	Circuit card	Display indication (for all related cards)
— 21A, 21 — 21E — 51, 61, 71 — 61C, 81	— NT8D19 Memory/Peripheral Signaling Card — NTND01 ICM Card — QPC580 CPU Interface Card — NT6D66 Call Processor Card	Sysload (system reload) status Interrupt faults Memory faults Common equipment hardware faults
— 21A, 21, 21E, 51, 61 — 51, 61, 71 — 61C, 81	— QPC742 Floppy Disk Interface Card — QPC584 Mass Storage Interface Card — NT6D63 I/O Processor Card	Faults on the disk drive unit Faults on the disk drive interface card
— 21, 21E, 51, 61, 61C, 71, 81	— NT8D01 Controller Card	During normal operation, display shows self-test codes and port number on which controller clock is tracking

Figure 7
Sample maintenance display



CPU controls

Switches and buttons on common equipment cards allow you to control CPU activity and clear common equipment faults.

Initialize button

Pressing the manual initialize (Man Int) button associated with the active CPU starts the Initialize Program. The Initialize Program clears common equipment faults and then rebuilds call-dependent data and generates system messages indicating the status of the system. This process is called an *initialization*. Call processing is briefly interrupted during an initialization.

Manual initialize buttons are located on the following cards:

- In options 21A and 21, the initialize button is on the NT8D19 Memory/Peripheral Signaling Card.
- In option 21E, the initialize button is on the NTND01 ICM Card.
- In options 51, 61, and 71, the initialize button is on the QPC580 CPU Interface Card.
- In option 61C and option 81, the initialize button is on the NT6D66 Call Processor (CP) Card.

Normal/maintenance switch

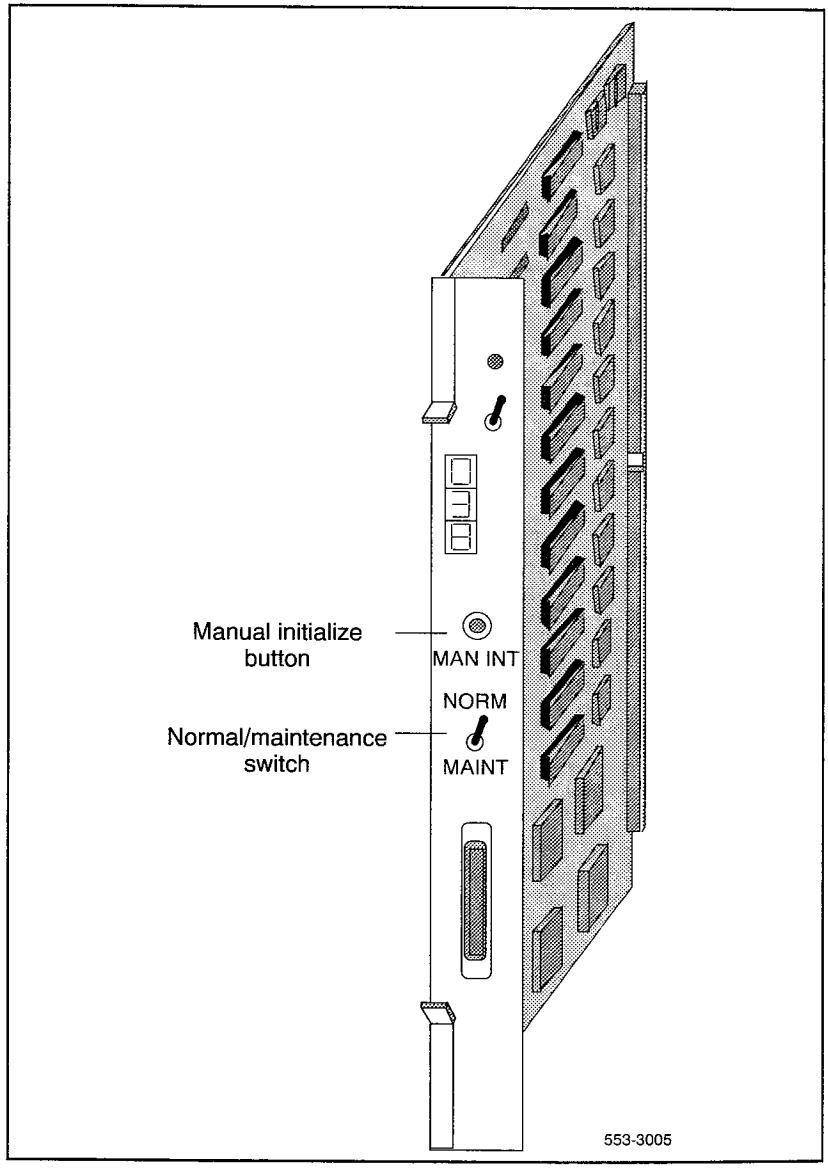
There is a normal/maintenance (Norm/Maint) switch on the QPC580 CPU Interface Card and the NT6D66 CP Card. In dual CPU systems (options 61, 61C, 71, and 81), you use this switch as follows to keep the dual CPUs from switching, or trying to switch, when you are testing or replacing common equipment hardware on the inactive CPU:

- On the CPU you are not testing or replacing, set the switch to Maint. This CPU will be *active*.
- On the CPU you are testing or replacing, set the switch to Norm. This CPU will remain *inactive* as long as the other CPU is set to Maint.

For regular operation in dual CPU systems, set both normal/maintenance switches to Norm. For option 51 (a single CPU system), set the switch to Maint.

Figure 8 shows the location of both the manual initialize button and the normal/maintenance switch on the QPC580 CPU Interface Card.

Figure 8
Manual initialize button and normal/maintenance switch on the CPU interface card



Reload button

Reload (Rld or Man Rst) buttons allow you to manually activate the System Loader program. The System Loader initiates call processing and starts memory-checking diagnostics. This process is called a *sysload* or *system reload*. Here are the locations of the reload button for the various options:

- In options 21A and 21, the reload button is on the QPC687 CPU Card.
- In option 21E, the reload button is on the NTND01 ICM Card.
- In option 51, the reload button is on the NTND10 Changeover and Memory Arbitrator (CMA) Card (or QPC581 before X11 release 18).
- In options 61 and 71, the reload button is on the NTND10 (or QPC581) CMA Card. To start a sysload, you must simultaneously press the reload button on both CMA cards.
- In option 61C and option 81, the reload button (Man Rst) is on the NT6D66 CP Cards. To start a sysload, you must simultaneously press the reload buttons on both CP cards.

Figure 9 shows the location of the reload button on a QPC581 CMA Card.

CAUTION

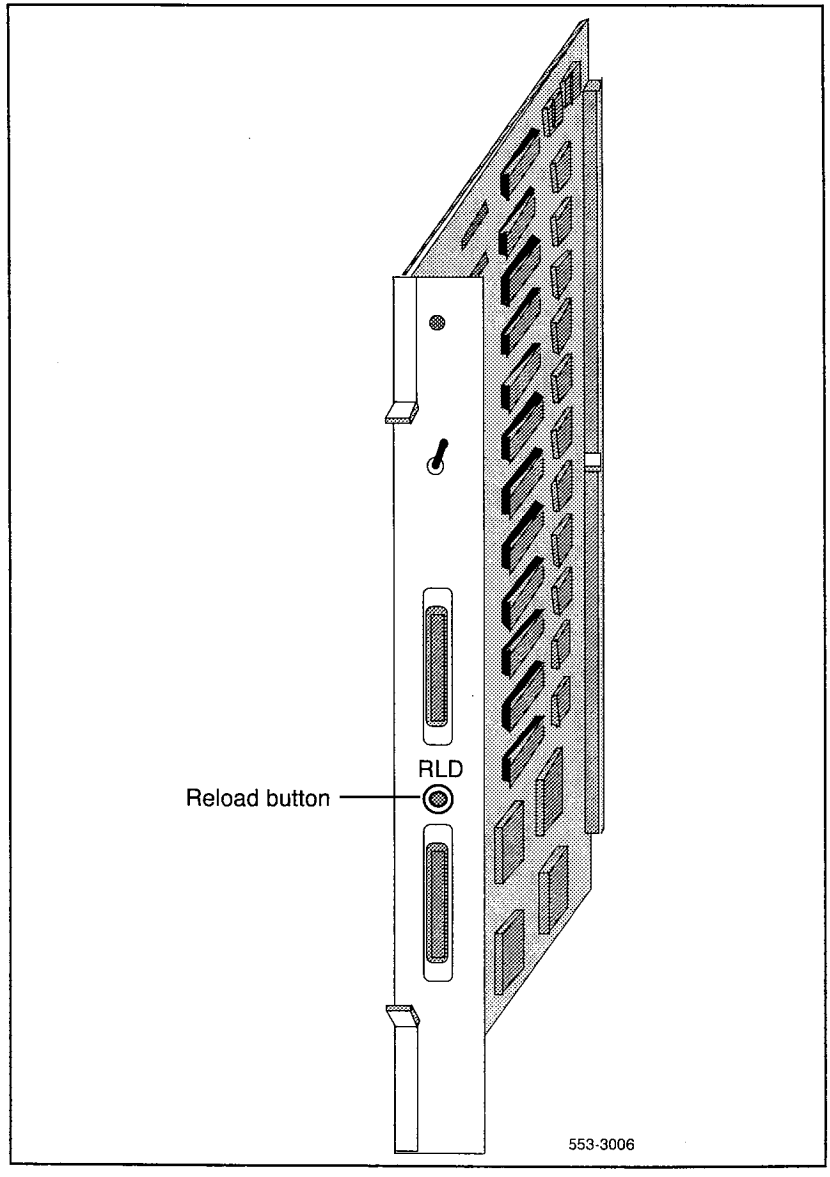
Active calls are disconnected and the system goes into an emergency line transfer state during a sysload. Use the reload button only if you are specifically instructed to do so in Northern Telecom Publications.

System alarms

System alarms are based on various fault monitors and indicators. The category of the alarm — major, minor, or remote — indicates the severity of the system failure:

- A major alarm requires immediate action by the technician.
- A minor alarm requires attention, but not necessarily immediate attention, by the technician.
- A remote alarm may require attention by the technician.

Figure 9
Reload button on the changeover and memory arbitrator card



Major alarms

A major alarm indicates a fault that seriously interferes with call processing. The following faults cause a major alarm:

- CPU or control bus failure
- disk system failure when attempting to load the system
- system power failure (without reserve power)
- temperature fault (excessive heat)

When there is a major alarm, the red LED at the top of the affected column lights. A major alarm also activates a display on all attendant consoles.

When a Meridian 1 is equipped with a power failure transfer unit, a major alarm causes designated 500/2500 telephones to connect directly to Central Office trunks; this is called a line transfer. Minor alarms

A minor alarm indicates the system hardware or software has detected a fault requiring attention. The following faults cause a minor alarm: Automatic identification of outward dial (AIOD) trunk failure

- conference failure
- digitone receiver failure
- memory failure
- more than one fault on different line and trunk cards in one shelf (indicated on affected customer's console only)
- network failure (indicated on affected customer's console only)
- peripheral signaling failure
- serial data interface failure
- tone and digit switch failure

A minor alarm displays an alarm on attendant consoles in customer groups affected by the fault. (A minor alarm indication on the console is an optional feature, enabled and disabled on a customer basis through data administration procedures.)

Remote alarms

A remote alarm is an optional extension of a major alarm to another location, such as a monitoring or test center, or to an indicator, such as a light or bell. When a major alarm occurs, the Meridian 1 provides relay contact closure across two remote alarm lines, REMALMA and REMALMB. These lines are extended to the main distribution frame (MDF) through the system monitor to MDF cable for customer use. The relay contacts are rated at 30 V dc and 2 amps. The REMALMB line is the return or ground for the REMALMA line. Northern Telecom does not extend remote alarm lines beyond the MDF.

System monitor indicators

The system monitor checks the column temperature, cooling system status, and system voltage status and controls line transfer states accordingly.

NT7D15 System Monitor

System option 21A is equipped with the NT7D15 System Monitor, which is a paddle board installed on the rear of the backplane. This system monitor performs the following:

- If the main circuit breaker in the system trips (for example, if there is a power surge or short circuit), the system monitor starts a line transfer and sends a remote alarm signal.
- If the temperature of the column reaches 70 degrees C (158 degrees F), the system monitor trips the main circuit breaker, starts a line transfer, and sends a remote alarm signal.
- If the power supply loses +5 volts, the system monitor starts a line transfer and sends a remote alarm signal.
- If the power supply loses any voltage other than +5 volts, the system monitor lights the column LED, sends a major alarm indication to the CPU, and sends a remote alarm signal.
- If call processing stops, the system monitor lights the column LED and starts a line transfer.

  Note: The NT7D15 System Monitor does not generate system messages.

When major system failures occur, the system monitor sends a remote alarm signal. As an option, an indicator, such as a bell or light, can be connected to the system monitor to receive the remote alarm signal.

NT8D22 System Monitor

System options 21, 21E, 51, 61, 61C, 71, and 81 are equipped with the NT8D22 System Monitor, which is installed in the rear of the pedestal in each column. Table 5 lists faults monitored by this system monitor.

Note: The NT8D15 System Monitor must be used in option 21A. In multiple-column systems, there is one master system monitor, located in the column with CPU 0, and multiple slave system monitors. A switch setting on each system monitor defines the master or the address of each slave.

Table 5
Faults monitored by the NT8D22 System Monitor

Power faults	Source
CPU condition	CPU failure Sysload (system reload)
Main power loss	System input power, AC or DC
Power supply failure	Common equipment power supply Common/peripheral equipment power supply Peripheral equipment power supply Ringing generator
Temperature alarm	Blower unit Column temperature sensors

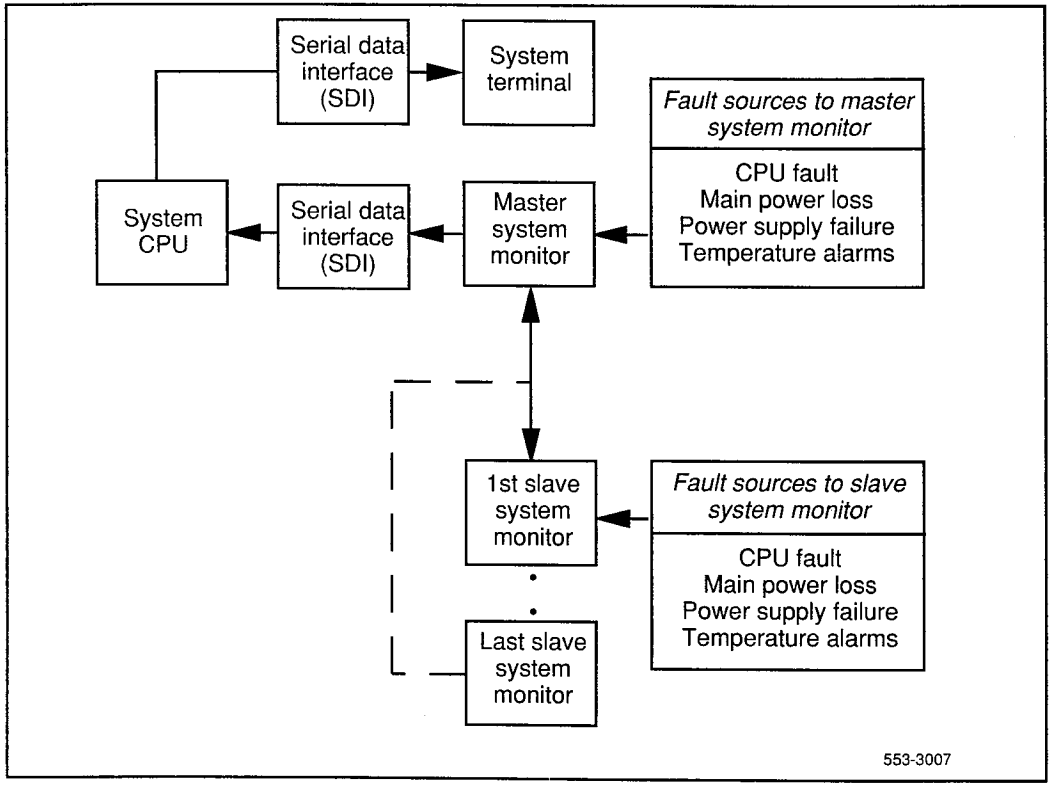
The master system monitor checks the CPU column and periodically polls the slaves to check their status. When polled, the slaves report their status to the master. If a slave does not respond when it is polled, the master reports the address as a faulty slave.

If a slave is removed, the master cannot communicate with higher addresses. Therefore, the master considers the removed slave and all slaves with a higher address as disabled. For example, if slave 2 is disabled, the master also reports slaves 3, 4, and up as disabled.

The system monitor reports power equipment status and faults to the CPU. (Only the master system monitor communicates with the CPU.) System messages generated by the system monitor are identified by the mnemonic PWR. Figure 10 shows the flow of messages from NT8D22 System Monitors to the system terminal.

If there is a fault, the system monitor lights the LED on the affected column.

Figure 10
NT8D22 System Monitor message flow



Line transfer

As an option, you can connect one or more power failure transfer units (PFTUs) to the Meridian 1. Each PFTU connects up to eight designated 500/2500 telephones to Central Office trunks. If call processing stops, those 500/2500 telephones are transferred through the PFTU to the Central Office so that you still have outside connections. A line transfer occurs during the following situations:

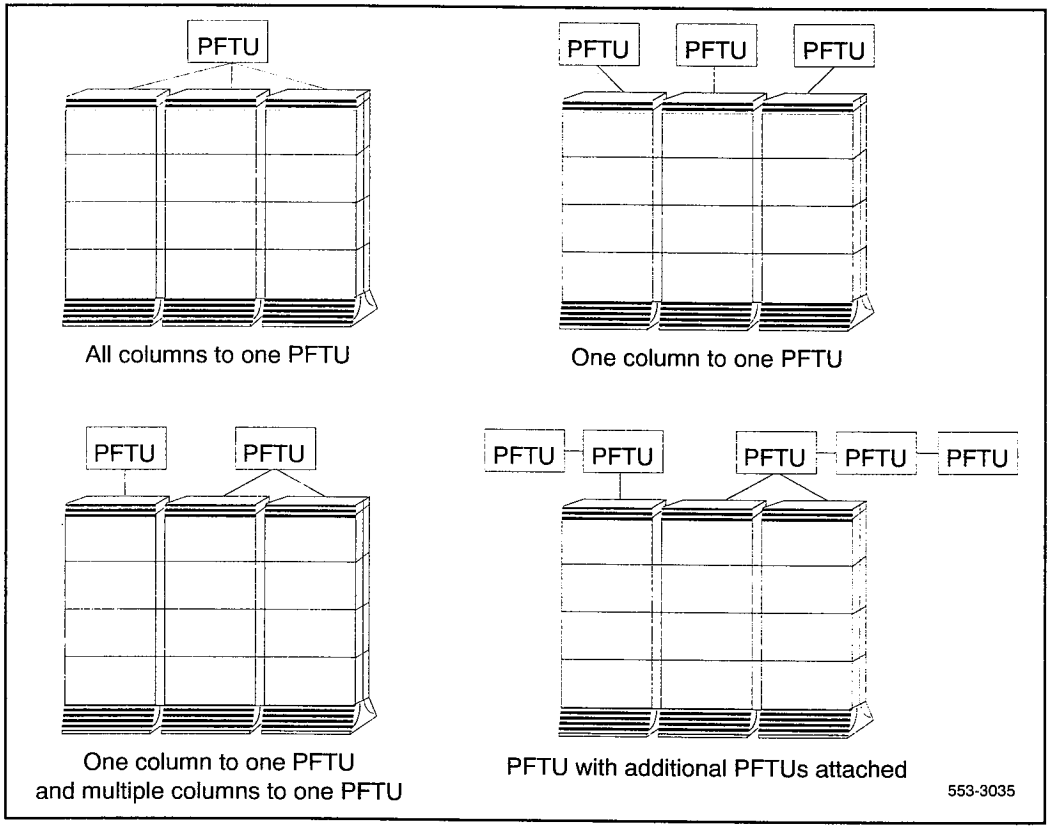
- during a sysload (system reload)
- if there is a major power failure in a DC-powered system (as detected by the TRIP signal)
- if call processing stops because of a CPU failure
- if there is a loss of power to the column
- if there is a loss of power to the PFTU
- if the temperature in a column is too high
- if a line transfer button on the attendant console is pressed (this applies on a customer basis)
- if a line transfer switch on the PFTU is turned on

  Note: If position 4 on switch 1 (SW1) is set to OFF on a system monitor, that system monitor's column will not activate a line transfer if the temperature is too high.

Figure 11 shows four ways multiple-column systems and PFTUs can be configured. You can configure in the following ways:

- connect all the columns in a system to a single PFTU
- connect each column to an individual PFTU
- combine connecting individual columns to individual PFTUs and multiple columns to a single PFTU
- attach additional PFTUs to a PFTU that is connected to one or multiple columns

Figure 11
PFTU configurations



Main power loss

The system monitor receives status and control signals from the external power system. The system monitor then generates system messages that indicate the status of main and reserve power supplies.

You can connect a reserve (back-up) power supply to the Meridian 1: either an uninterruptible power supply (UPS) for AC-powered systems or reserve batteries for DC-powered systems. If the main source of external power is lost, power to the system is maintained by the UPS or reserve batteries.

If the main power supply is lost, the system monitor generates a major alarm. The NT8D22 System Monitor also generates system messages to indicate the system is running on reserve power.

Module power supply failure

There are four types of module power supplies:

- common equipment (CE) power supply
- common/peripheral equipment (CE/PE) power supply
- peripheral equipment (PE) power supply
- ringing generator

The NT8D22 System Monitor handles complete or partial failures in a module power supply as follows:

- If the output voltage is higher than the threshold for +5 volts, the affected power supply shuts down, the column LED lights, and a system message is sent.
- If the output voltage is higher than the threshold for other than +5 volts, power for only that voltage shuts down in the affected power supply, the column LED lights, and a system message is sent.
- If the output voltage is lower than the threshold for any voltage, power for only that voltage shuts down in the affected power supply, the column LED lights, and a system message is sent.
- If the input voltage is lower than the threshold, the affected power supply shuts down and then recovers when the input level recovers.

To help you pinpoint a power supply problem, the master NT8D22 System Monitor identifies the following:

- the column with the fault (system monitor 0-63)
- the module (0-3) in that column
- the power supply unit (1-2) in the module

Figure 12 shows the power equipment designations in a column.

Temperature alarms

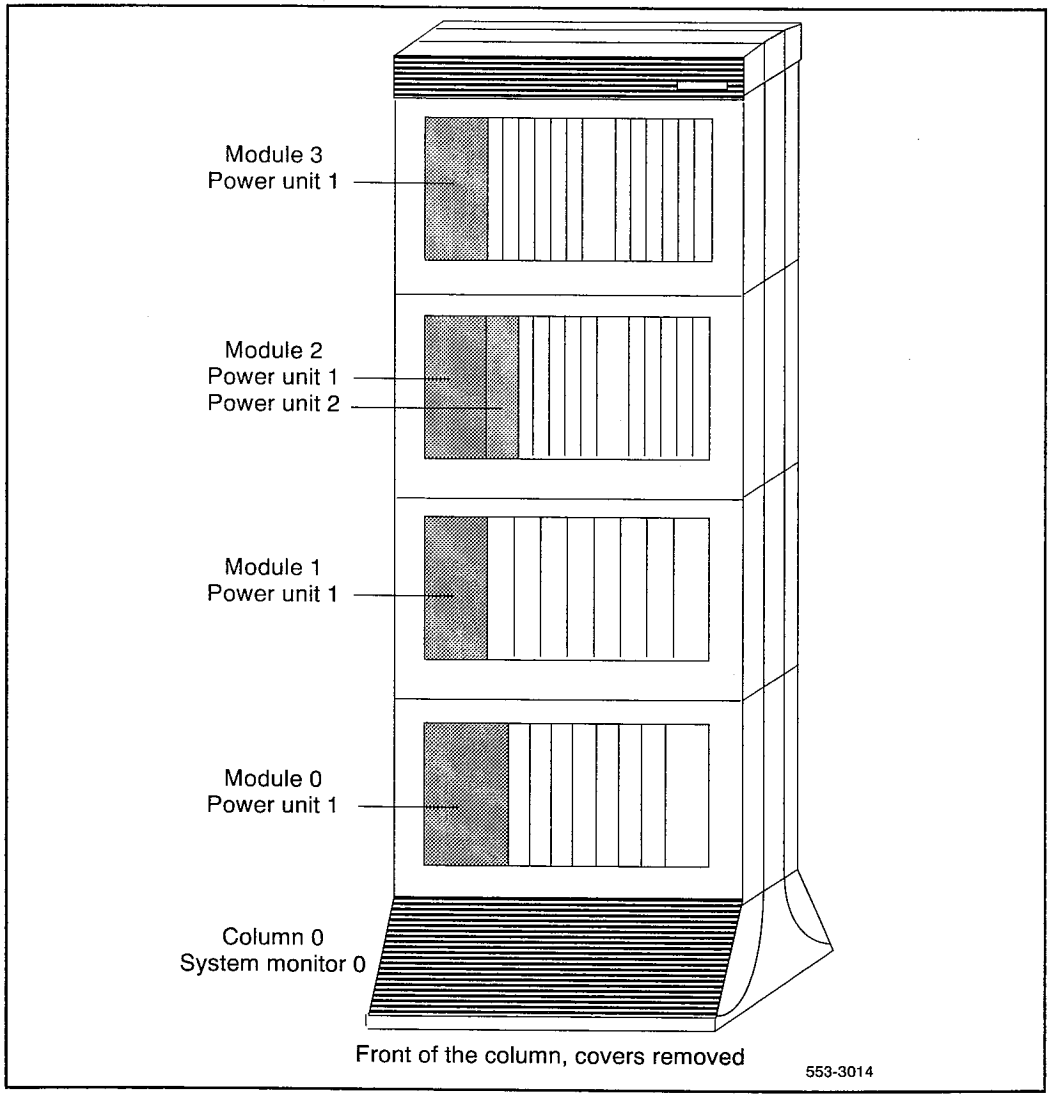
System option 21A has two fans in the top cap. If the temperature of the system exceeds 70 degrees C (158 degrees F), the NT7D15 System Monitor trips the main circuit breaker to prevent further overheating.

Each column in options 21, 21E, 51, 61, 61C, 71, and 81 is cooled by a blower unit (NT8D52AB with AC power or NT8D52DD with DC power) in the pedestal. All of these systems are equipped with the NT8D22 System Monitor, which performs the following functions:

- If there is a partial or complete failure in a blower unit, the system monitor lights the column LED and generates a system message.
- If the thermostats in a column report a temperature exceeding 70 degrees C (158 degrees F), the system monitor lights the column LED, generates a system message, then, providing this condition exists for 30 seconds, shuts down power to the column in 30 seconds.

The NT8D22 System Monitor generates a system message if the air leaving the column exceeds 55 degrees C (131 degrees F). This thermal alarm may indicate a loss of air-conditioning in the room, loss of ventilation in the column, a problem with the blower unit, or a blocked air filter.

Figure 12
Power equipment designations from the master NT8D22 System Monitor



Software maintenance tools

Diagnostic programs

Note: See "Options 61C and 81 features" on page 47 for information specific to option 61C and option 81.

Diagnostic software programs monitor system operations, detect faults, and clear faults. Some programs run continuously; some are scheduled.

Diagnostic programs are *resident* or *non-resident*. Resident programs, such as the Error Monitor and Resident Trunk Diagnostic, are always present in system memory. Non-resident programs, such as the Input/Output Diagnostic and Common Equipment Diagnostic, are used as Midnight and Background Routines or for interactive diagnostics. Non-resident programs are loaded from the system disk and are run as scheduled or upon request.

Non-resident programs are called overlay programs or loads. They are identified by a title and a number preceded by the mnemonic for load (for example, Trunk Diagnostic—LD 36).

See the *X11 input/output guide* (553-3001-400) for detailed information on all diagnostic programs.

Error Monitor

The Error Monitor is a resident program that continuously tracks call processing. The Error Monitor generates system messages if it detects invalid or incorrectly formatted call- processing information.

System messages generated by the Error Monitor are preceded by the mnemonic ERR, which usually indicates hardware faults, or the mnemonic BUG, which usually indicates software problems. With prompt ERRM in the Configuration Record (LD 17), you can instruct the system to print or not print ERR or BUG messages.

Initialize Program

The Initialize Program momentarily interrupts call processing as it clears common equipment faults. It then rebuilds call-dependent data and generates system messages, with the mnemonic INI, that indicate the status of the system. This process is called an *initialization.*

Through an initialization, you can download firmware from the CPU to superloop network cards and controller cards. Call processing is interrupted for an additional amount of time during this process.

You can activate an initialization by pressing the manual initialize (Man Int) button on the following:

- NT8D19 Memory/Peripheral Signaling Card in options 21A and 21
- NTND01 ICM Card in option 21E
- QPC580 CPU Interface Card in options 51, 61, and 71
- NT6D66 CP Card in option 61C and option 81

An initialization always occurs automatically after the System Loader program runs. An initialization often occurs when a software or firmware fault is detected and when a common equipment hardware fault is detected.

Midnight and Background Routines

In the Configuration Record (LD 17), you can select the overlay programs that will run in the *Midnight Routine* and *Background Routine.* These routines automatically perform maintenance checks. Programs included in the Midnight Routine are defined with the prompt DROL (derived from "daily routine overlay"). Programs included in the Background Routine are defined with the prompt BKGD.

> *Note:* A memory test must be run once a day on options 21 and 21E. Therefore, the Common Equipment Diagnostic (LD 35) runs as part of the Midnight Routine even if it is not programmed.

The Midnight Routine runs once every 24 hours. This routine is preset to run at midnight when a system is shipped, but you may assign a different time in the Configuration Record. When it is time for the Midnight Routine to start, the system cancels any other program.

The Background Routine runs when no other program is loaded in the overlay area. The programs included in the Background Routine run in sequence repeatedly until the Midnight Routine runs or there is another request to use the overlay area (for example, if you log on to check the status of a circuit card).

You may include the programs listed in Table 6 in Midnight and Background Routines. Your maintenance requirements and the configuration of your system determine the programs you include in Midnight and Background Routines.

> *Note:* Software Audit (LD 44) should always be used in the Background Routine.

Table 6
Programs used in Midnight and Background Routines

Program number	Program function
LD 30	Network and Signaling Diagnostic
LD 32 (Midnight only)	Network and Peripheral Equipment Replacement
LD 33	1.5 Mbyte Remote Peripheral Equipment Diagnostic
LD 34	Tone and Digit Switch and Digitone Receiver
LD 35 (see Note 1)	Common Equipment Diagnostic
LD 36	Trunk Diagnostic 1
LD 37 (see Note 1)	Input/Output Diagnostic
LD 38	Conference Circuit Diagnostic
LD 40	Call Detail Recording Diagnostic
LD 41	Trunk Diagnostic 2
LD 43 (Midnight only)	Data Dump (see Note 2)
LD 44	Software Audit
LD 45	Background Signal and Switching Diagnostic
LD 46	Multifrequency Sender Diagnostic for ANI
LD 60 (Midnight only)	Digital Trunk Interface Diagnostic
LD 61 (Midnight only)	Message Waiting Lamps Reset

Note 1: For option 61C and option 81, use LD 135 instead of LD 35. Use LD 137 *and* LD 37.

Note 2: LD 43 will automatically be activated during midnight routines if changes have been made within the past 24 hour.

Overlay Loader

This resident program locates, loads, and checks all overlay programs. It automatically activates the Midnight and Background Routines. You can load programs manually by entering commands through the system terminal or maintenance telephone. Once the program is loaded, you see the program mnemonic (such as TRK for Trunk Diagnostic) on the system terminal.

You can also use the Overlay Loader to enable, disable, and display the status of the disk drive unit.

Overload Monitor

The system continuously monitors the volume of system messages. If it detects too many error messages are detected from a line or trunk card, the system activates the Overload Monitor program. The Overload Monitor disables the faulty card and generates system messages with the mnemonic OVD.

Resident Trunk Diagnostic

This program automatically monitors all trunk calls and records apparent faults on each trunk. If the number of faults on a trunk exceeds the threshold for that trunk, the program generates a system message identifying the trunk and the type of fault.

A failure on a trunk may keep the trunk from detecting incoming calls. The threshold mechanism cannot detect such a failure, so this program also records how many days it has been since each trunk received an incoming call. If you suspect some incoming calls are not being processed, you can use the command LMAX in Trunk Diagnostic 1 (LD 36) to identify the trunk with the maximum idle days.

System Loader

The System Loader program loads all call-processing programs and data, and starts memory-checking diagnostics. After all required programs and data have been loaded and all checks performed, the System Loader is erased from system memory, the Initialize Program runs, and normal call processing begins. This process is called a *sysload* or *system reload.*

The System Loader operates automatically on system power up or if a common equipment or power fault destroys information in the system memory. For maintenance purposes, you generally activate this program only if call processing has stopped.

You can start a sysload manually by pressing the reload (Rld) button on the following:

- QPC687 CPU Card in options 21A and 21
- NTND01 ICM Card in option 21E
- NTND10 (or QPC581) CMA Card in options 51, 61, and 71 (simultaneously press both buttons in options 61 and 71)
- NT6D66 CP Card in option 61C and option 81 (simultaneously press both buttons)

Note: The system loses the time and date during a sysload (except on option 61C and option 81). You should reset the time and date using LD02.

CAUTION

Active calls are disconnected and the system goes into an emergency line transfer state during a sysload. Activate the System Loader only if you are specifically instructed to do so in Northern Telecom Publications.

To minimize sysload time, you can enable the Short Memory Test capability in LD 17 (prompt SMEM). If you enable the test, only one pass of memory testing is performed on a normal reload. If any subsequent system failure causes an automatic reload, the full six-pass Memory Test is performed on all system memory.

Note: A sysload completes so quickly on option 61C and option 81 that the Short Memory Test is not useful. Therefore, the package was not designed to be compatible with options 61C and 81.

Options 61C and 81 features

When option 61C and option 81 receive a system reload signal, the sysload occurs in two to five minutes, depending on the size of the customer database. During the sysload, option 61C and option 81 perform a core shelf test, which includes self-tests on the CP and IOP cards. The results of the self-tests are displayed on the liquid crystal display (LCD) on the CP card, the hex display on the IOP card, and the system terminal. On the other Core cards, the LED blinks three times after a successful test.

Options 61C and 81 typically performs an initialization in under 90 seconds. You can manually initialize only the active core side.

In option 61C and option 81, the overlays reside in dynamic random access memory (DRAM) after they are loaded from the hard disk during an initial software load (software is shipped on redundant hard disks). Since they are always in resident memory, the overlays can be loaded quickly.

Option 61C and option 81 can diagnose faults in field replaceable units for all Core hardware, including cables. In case of a failure, a message in a natural language (such as English) appears on the system terminal and on the liquid crystal display (LCD) on the CP card.

If there is a hardware fault, the system attempts a recovery. In the case of a redundant hardware failure, under certain conditions option 61C and option 81 will attempt a graceful switchover to the core side without the failure.

Option 61C and option 81 remote operation capabilities include remote access to both Core Modules, the ability to sysload, initialize, or put the system in a split mode, and the ability to upload and download the customer database. You can access the core complex in each Core Module through the I/O ports on the CP cards.

The History File feature

If you have a printer connected to the system, each system message is printed as it is received. If you do not have a printer connected, you can use the History File to store a limited number of system messages in protected memory. The contents of the file may then be printed on demand using Print Routine 3 (LD 22).

The messages stored are specified on a system basis and can be one or more of the following types:

- customer service changes (CSC)
- maintenance messages (MTC)
- service changes (SCH)
- software errors (BUG)
- initialization and sysload messages (INI and SYS)
- traffic messages (TRF)

For information on selecting the messages to be stored, see *X11 features and services* (553-3001-305).

The contents of the History File are erased during a sysload or if you change the History File's length. However, because the History File is located in protected data store, the contents survive an initialization.

You can change the length of the History File with the prompt HIST in the Configuration Record (LD 17). The maximum length of the file depends on the amount of protected data store available, which in turn depends on the number of system features that require protected data store.

If the History File is full, the first messages stored are replaced by incoming messages. If this happens, the system gives a "file overflow" message at the start of a printout so you know some information has been replaced by newer messages.

Interactive diagnostics

You can load overlay programs, including programs called *maintenance routines*, into memory through the system terminal or maintenance telephone. This function is performed by the Overload Loader program.

> *Note:* The programs used in Midnight and Background Routines are also used manually as interactive diagnostic programs (see Table 6).

Maintenance routines are used interactively with a command/response format. In this format, you enter a command that tells the system to perform a specific task. The system performs the task and sends system messages indicating the status or errors back to you.

With interactive diagnostics you can do the following:

- disable, test, and enable specific equipment
- verify that a reported fault still needs to be cleared
- verify that a repair procedure has cleared a fault

All maintenance programs, commands, and system messages are described in detail in the *X11 input/output guide* (553-3001-400).

The Enhanced Maintenance feature

System software sometimes requires modifications, called *patches*, provided by Northern Telecom Technical Assistance Centers. The command ISS in Print Routine 3 (LD 22) prints the software generic and issue. A plus sign (+) by the issue number means a patch is in service.

The Enhanced Maintenance feature does the following:

- allows patches to automatically survive a sysload
- permits patches on non-resident programs
- records all patches in the system
- allows data disks to be shipped with pre-loaded patches

If there is a problem with a patch, the CPU sends system messages with the mnemonic EHM to the system terminal or the History File.

Manual continuity tests

You can perform manual continuity tests on superloop network cards, intelligent peripheral equipment, and Basic Rate Interface (BRI) equipment. A continuity test generates a signaling pattern at one point, monitors its progress, and checks for its detection at an end point. For example, when a superloop network card sends a signal to a controller card, the continuity test verifies the following:

- the superloop network card sent the signal
- the loop carried the signal to the controller card
- the controller card received the signal

In a point-to-point continuity test, a superloop network card or a controller card can generate or detect the test pattern. In loopback tests, one card, a superloop network card, a controller card, or a multi-purpose ISDN signaling processor (MISP) card, is both the generator and the detector. Only idle timeslots are tested in any of the continuity tests.

There are two types of loopback tests for BRI equipment. In one type of test, the pattern generated by the MISP card loops back through the digital subscriber loop (DSL) interface. In the other type of test, the pattern generated by the MISP card loops back through an S/T-interface line card (SILC) or a U-interface line card (UILC), depending on which is specified. Both types of test are accessed as Test 9, but responses to the series of prompts for Test 9 determine the loopback point.

Fifteen continuity tests can run simultaneously. When a test is completed, it stops, the status is reported, and the other tests continue running. You can check the status of any test at any time. When all the tests end, the number of tests run and any failed tests are reported to the CPU. You can display the results at any time during the procedure.

There are nine continuity test configurations. You can run each test by entering a set of prompts outlined in the Background Signaling and Switching Diagnostic (LD 45). Figure 13 shows point-to-point configurations. Figure 14 shows loopback configurations.

Figure 13
Manual continuity tests: point-to-point configurations

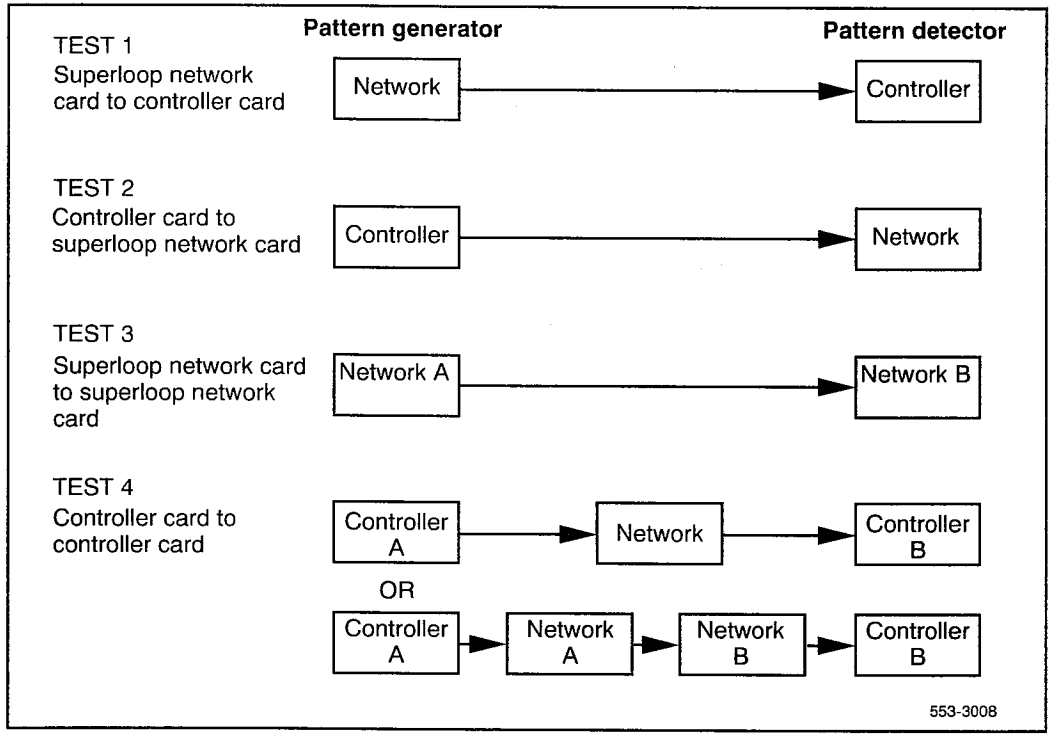
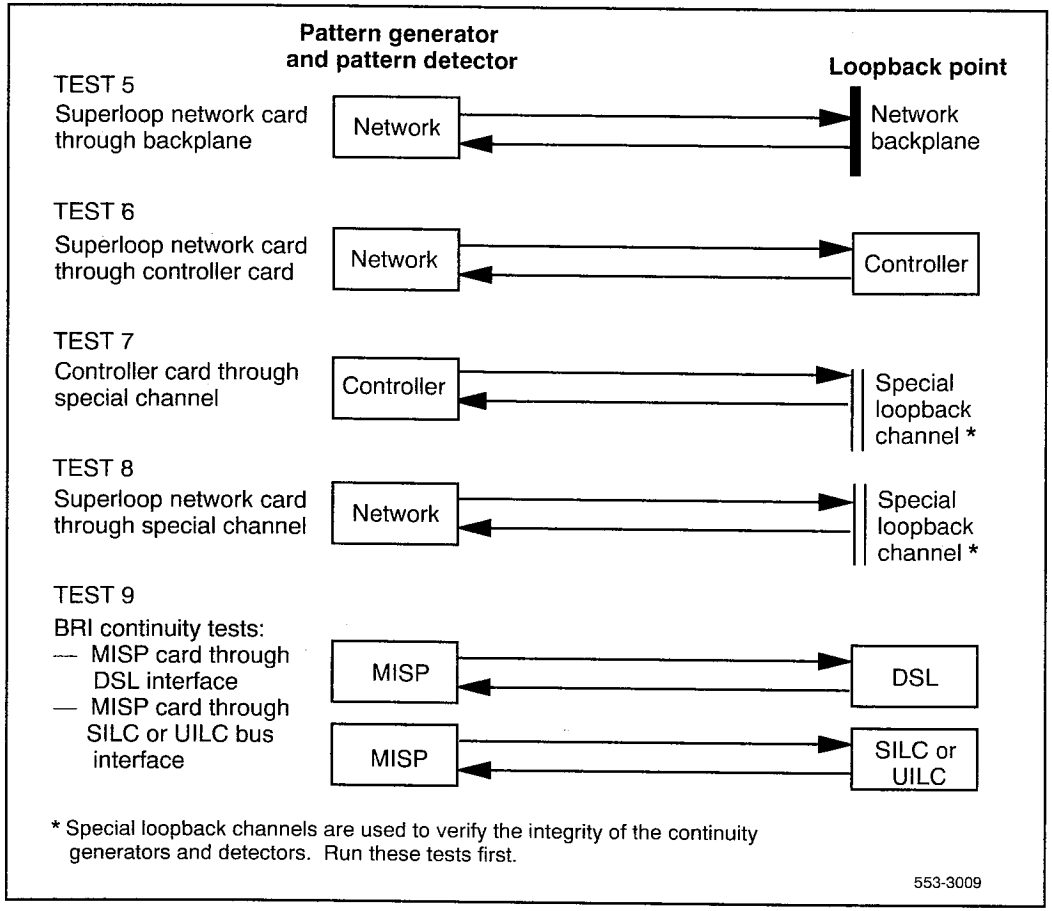


Figure 14
Manual continuity tests: loopback configurations



User reports

Reports from system users often tell you about problems that the system may not indicate. Many faults reported by users, such as a damaged telephone or data set, are obvious and can be fixed by replacing the damaged equipment.

Some faults are less obvious and may be caused by other equipment, such as a defective peripheral equipment line or trunk card. To classify the fault in these cases, check for system messages and visual fault indications. You may also need to have the user reproduce the problem so you can determine the sequence of events that led to the fault.

Table 7 lists problems users typically report.

Table 7
User report indications

User report	Type of fault
Major alarm reported by attendant No ring on 500/2500 telephones	Power
Major alarm reported by attendant	Common equipment
Minor alarm reported by attendant Users cannot transfer or conference Users cannot dial out on 500/2500 telephones	Network equipment
Trouble with calls on attendant console Trouble with calls on 500/2500 telephones Trouble with calls on SL-1, M1000, or digital telephones	Peripheral equipment
Users have trouble with a specific trunk Callers report continuous ringing Trouble with calls on console or telephones, or both	Trunk
Trouble with calls Trouble with equipment (such as handset, headset, or display)	Attendant console
Trouble with calls Trouble with equipment (such as handset or add-on module)	Telephone

Technical assistance service

Northern Telecom provides technical assistance in resolving system problems. To access a Technical Assistance Center, contact your Northern Telecom representative. Services available include the following:

— diagnosing and resolving software problems not covered by support documentation

— diagnosing and resolving hardware problems not covered by support documentation

— assisting in diagnosing and resolving problems caused by local conditions

Several types of class-of-service are available. Emergency requests (Class E1 and E2) receive an immediate response. Service for emergency requests is continuous until normal system operation is restored. Non-emergency requests (Class S1, S2, and NS) are serviced during normal working hours. Service classifications are described further in Tables 8 and 9.

Except as excluded by the provisions of warranty or other agreements with Northern Telecom, a fee for technical assistance may be charged, at rates established by Northern Telecom. Information on rates and conditions for services are available through Northern Telecom representatives.

Collect the information listed in Table 10 before you call for service.

Table 8
Technical service emergency classifications

Class	Degree of failure	Symptoms
E1	Major failure causing system degradation or outage	System out of service with complete loss of call-processing capability Loss of total attendant console capability Loss of incoming or outgoing call capability Loss of auxiliary Call Detail Recording (CDR) in resale application Call processing degraded for reasons such as: — trunk group out of service — 10% or more lines out of service — frequent initializations (seven per day or more) — inability to recover from initialization or sysload — consistently slow dial tone (eight seconds or more delay)
E2	Major failure causing potential system degradation or outage	Standby CPU out of service Frequent initializations (one per day or more) Disk drive failure Two sets of disks inoperative

Table 9
Technical service non-emergency classifications

Class	Degree of failure	Symptoms
S1	Failure that affects service	Software or hardware trouble directly and continuously affecting user's service or customer's ability to collect revenue Problem that will seriously affect service at in-service or cut-over date
S2	Intermittent failure that affects service	Software or hardware faults that only intermittently affect service System-related documentation errors that directly result in or lead to impaired service
NS	Failure that does not affect service	Documentation errors Software inconsistencies that do not affect service Hardware diagnostic failures (not defined above) that cannot be corrected by resident skills Test equipment failures for which a back-up or manual alternative can be used Any questions concerning products

Table 10
Checklist for service requests

Name of person requesting service	
Company represented	
Telephone number	
System option number/identification	
System serial number	
Installed software generic and issue (located on data disk)	
Modem telephone number and password (if applicable)	
Request classification (see Tables 8 and 9)	
Description of assistance required	

SL-1

Meridian 1

General maintenance information

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