Meridian 1

Multi-purpose Serial Data Link
Description

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Revision history

April 2000

Standard 7.00. This is a global document and is up-issued for X11 Release 25.0x. Document changes include removal of: redundant content; references to equipment types except Options 11C, 51C, 61C, and 81C; and references to previous software releases.

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Standard, release 6.00. Reissued to include editorial changes.

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Standard, release 4.00. Reissued to include editorial changes, revision bars are not used.

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Standard, release 2.00. This document is issued to include updates for X11 release 19. Changes are noted with revision bars in the margins.

December 1994

Standard, release 3.00. Reissued to include editorial changes and indexing. Due to the extent of the changes, revision bars are not used.

December 1992

Standard, release 1.00. This document is issued for the X11 release 18 product introduction. Revision bars are omitted.

Contents

Introduction

Content list

The following are the topics in this section:

Reference list

The following are the references in this section:

- *Capacity Engineering* (553-3001-149)

- *Meridian 1 Serial Data Interface Cards: Description* (553-3001-107)

- *Meridian Link ISDN/AP General Guide* (553-2901-100)

- *X11 Administration* (553-3001-311)

- *Meridian Link description* (553-3201-110)

- *X11 System Management Applications* (553-3001-301)

The Multi-purpose Serial Data Link card facilitates smooth communication between the Meridian 1 system and peripheral devices or D-channels.

Document overview

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

This document describes the Multi-purpose Serial Data Link (MSDL) card. This card provides multiple interface types with four full-duplex serial I/O ports that can be independently configured for various operations. Peripheral software downloaded to the MSDL controls functionality for each port. Synchronous operation is permitted on all MSDL ports. Beginning with X11 release 19, port 0 can be configured as an asynchronous Serial Data Interface (SDI).

About MSDL

An MSDL card occupies one network card slot in the Meridian 1 Network, or Core Network Module and communicates with the CPU over the CPU bus and with I/O equipment over its serial ports. It can coexist with other cards that support the same functions. For example, three cards supported with the MSDL (NT6D80) are QPC757 (DCHI), QPC513 (ESDI), QPC841 (SDI) and NTSD12(DDP).

Though the MSDL is designed to coexist with other cards, the number of ports supported by a system equipped with MSDL cards is potentially four times greater than when using other cards. Since each MSDL has four ports, representing a single device, a Meridian 1 can support as many as 16 MSDL cards with a maximum of 64 ports.

MSDL cards are supported on Meridian 1 systems running X11 release 18 and later.

Other documentation

For information on MSDL engineering guidelines, refer to the following documentation:

•   *Capacity Engineering* (553-3001-149)

For complete discussions of other interface cards, refer to the following documentation:

•   *Meridian 1 Serial Data Interface Cards: Description* (553-3001-107)

For information regarding D-channel, Application Module Link, and X11 features, refer to the following documents:

•   *Meridian Link ISDN/AP General Guide* (553-2901-100)

•   *X11 Administration* (553-3001-311)

•   *Meridian Link description* (553-3201-110)

To read about the Serial Data Interface (SDI) and Single Terminal Access (STA) features available with the MSDL, see *X11 System Management Applications* (553-3001-301).

Figure 1 shows connection examples and the number of ports provided by an MSDL, a DCHI, and an ESDI card.

Hardware

The MSDL card is a standard size Meridian 1 circuit card that occupies one network card slot and plugs into the module's backplane connector to interface with the CPU bus and to connect to the module's power supply. On the faceplate, the MSDL provides five connectors, four to connect to I/O operations and one to connect to a monitor device that monitors MSDL functions. Figure 2 illustrates major MSDL components and their locations on the printed circuit card.

Note: Switches S9 and S10 are configured to reflect the device number set in LD 17 (DNUM). S10 designates tens, and S9 designates ones. For example, set device number 14 with S10 at 1 and S9 at 4.
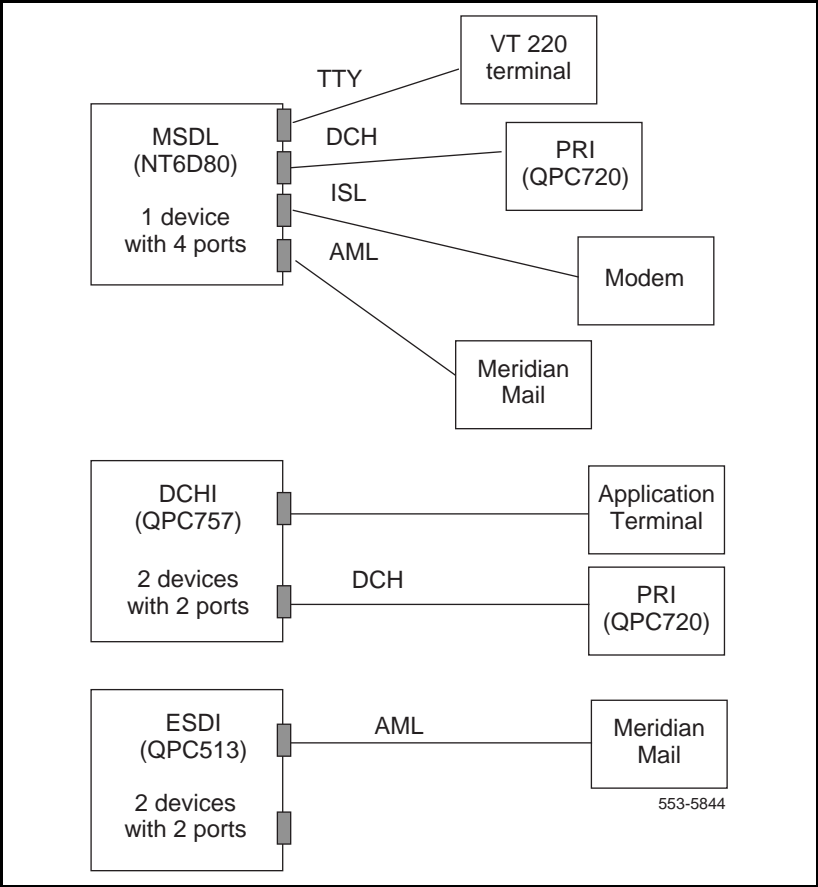
Figure 1
Card connection examples

Figure 2
MSDL component layout
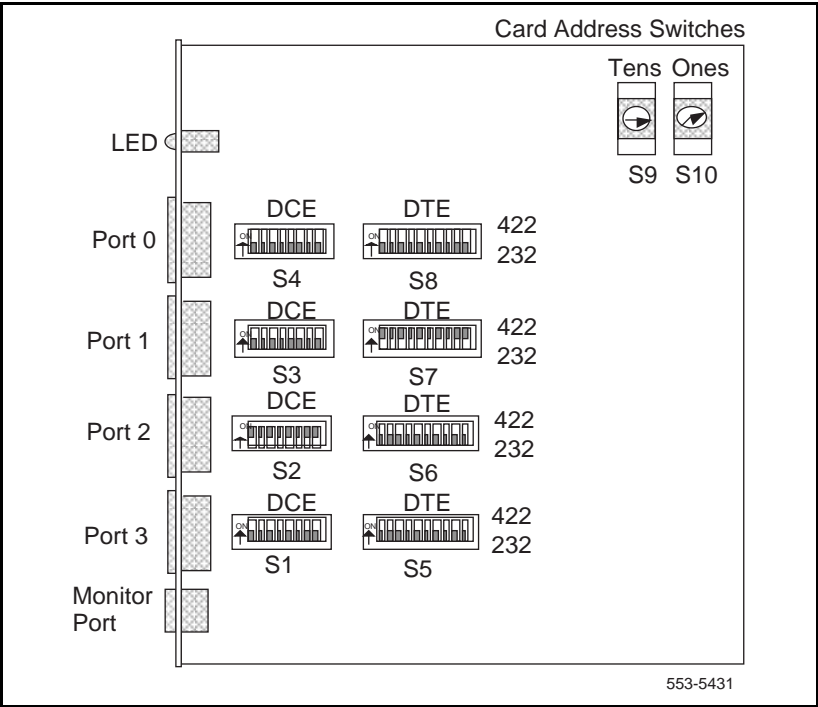
Architecture

Figure 3 illustrates the MSDL functional block diagram. The MSDL card is divided into four major functional blocks:

- CPU bus interface

- Micro Processing Unit (MPU)

- Memory

- Serial interface

Two processing units serve as the foundation for the Meridian 1/MSDL operation: the Meridian 1 Central Processing Unit (CPU) and the MSDL Micro Processing Unit (MPU). Meridian 1 software, MSDL firmware, and peripheral software control MSDL parameters. Peripheral software downloaded to the MSDL controls MSDL operations.

The MSDL card's firmware and software do the following:

- communicate with the Meridian 1 CPU to report operation status

- receive downloaded peripheral software and configuration parameters

- coordinate data flow in conjunction with the CPU

- manage data link layer and network layer signaling that controls operations connection and disconnection

- control operation initialization and addressing

- send control messages to the operations

CPU bus interface

The CPU bus transmits packetized information between the Meridian 1 CPU and the MSDL MPU. This interface has a 16-bit data bus, an 18-bit address bus, and interrupt and read/write control lines.

Shared Random Access Memory (RAM) between the Meridian 1 CPU and the MSDL MPU provides an exchange medium. Both the Meridian 1 CPU and the MSDL MPU can access this memory.

Figure 3
MSDL block diagram

553-5432
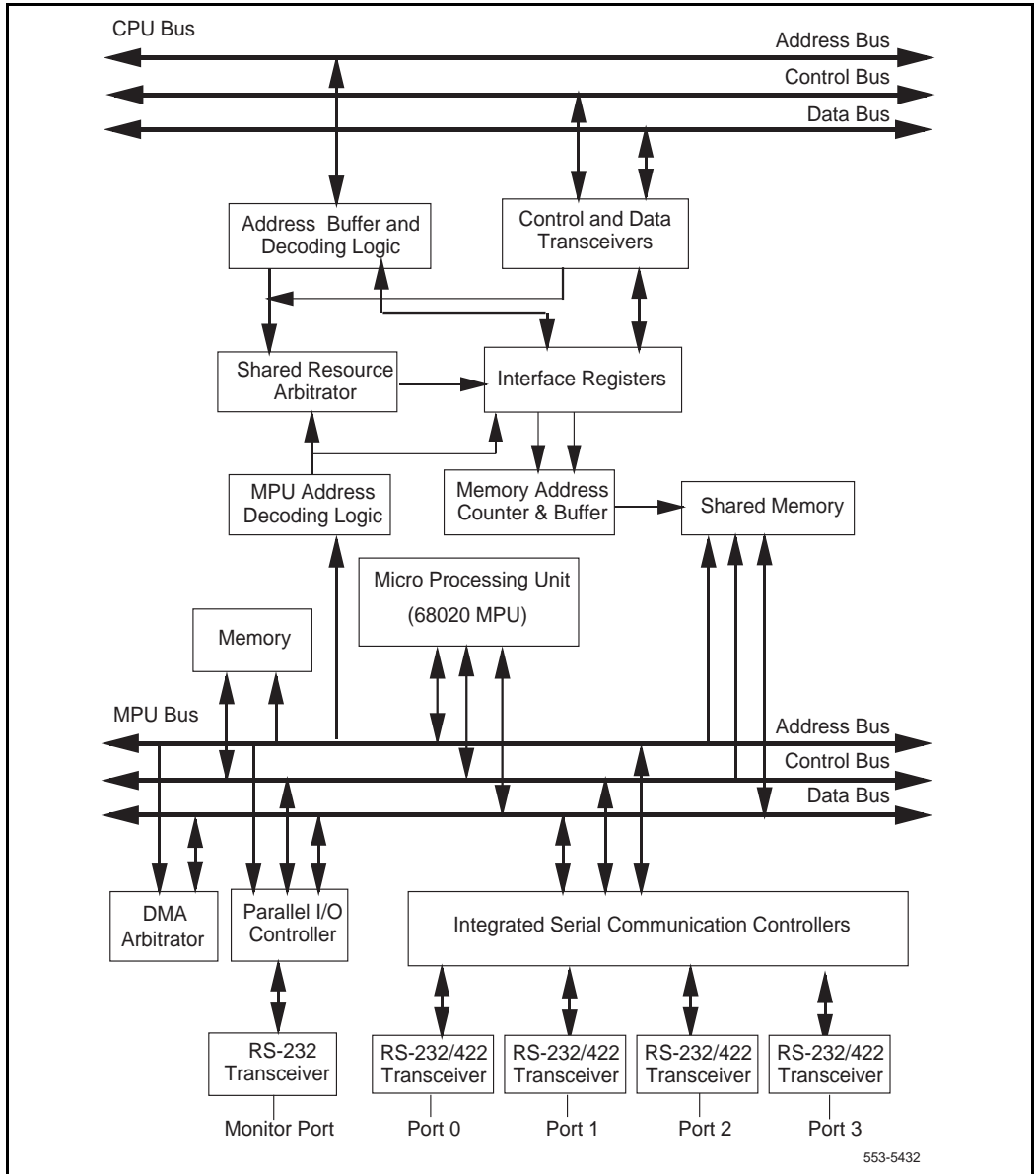
Micro Processing Unit (MPU)

The MPU, which is based on a Motorola 68020 processor, coordinates and controls data transfer and port addressing, communicating via the CPU bus with the Meridian 1. Prioritized interrupts tell the MPU which tasks to perform.

Memory

The MSDL card contains two megabytes of Random Access Memory (RAM) for storing downloaded peripheral software that controls MSDL port operations. The MSDL card includes the shared RAM that is used as a communication interface buffer between the CPU and the MPU.

The MSDL Flash Erasable Programmable Read Only Memory (Flash EPROM) also includes the peripheral software to protect it against a power failure or reset. MSDL can copy peripheral software directly from the Flash EPROM after power up or reset instead of requesting that the Meridian 1 CPU download it.

The MSDL card also contains Programmable Read Only Memory (PROM) for firmware that includes the bootstrap code.

Serial interface

The MSDL card provides one monitor port and four programmable serial ports that can be configured for the following various interfaces and combinations of interfaces:

- synchronous ports 0–3

- asynchronous port 0

- DCE or DTE equipment emulation mode

- RS-232 or RS-422 interface

Transmission mode All four ports of the MSDL can be configured for synchronous data transmission by software. Port 0 can be configured for asynchronous data transmission for CRT, TTY, and printer applications only.

Equipment emulation mode Configure an MSDL port to emulate DCE or DTE by setting switches on the card and downloading LD 17 interface parameters.

I/O port electrical interface Each MSDL port can be configured as an RS-232 or RS-422 interface by setting the switches on the MSDL card. MSDL ports use Small Computer Systems Interface (SCSI) II 26- pin female connectors.

Figure 4 shows Meridian 1 architecture using the MSDL as an operational platform. It illustrates operation routing from the Meridian 1 CPU, through the MSDL, to the I/O equipment. It also shows an example in which DCH operation peripheral software in the MSDL controls functions on ports 2 and 3.

MSDL operations

The Meridian 1 automatically performs self-test and data flow activities. Unless a permanent problem exists and the system cannot recover, there is no visual indication that these operations are taking place.

The Meridian 1 controls the MSDL card with software that it has downloaded. The MSDL and the Meridian 1 enable the MSDL by following these steps:

1   When the MSDL card is placed in the Meridian 1, the card starts a self-test.

2   When the MSDL passes the test, it indicates its state and L/W version to the Meridian 1. The Meridian 1 CPU checks to see if downloading is required.

3   After downloading the peripheral software, the Meridian 1 enables the MSDL.

4   MSDL applications (DCH, AML, SDI) may be brought up if appropriately configured.

Figure 4
MSDL functional block diagram
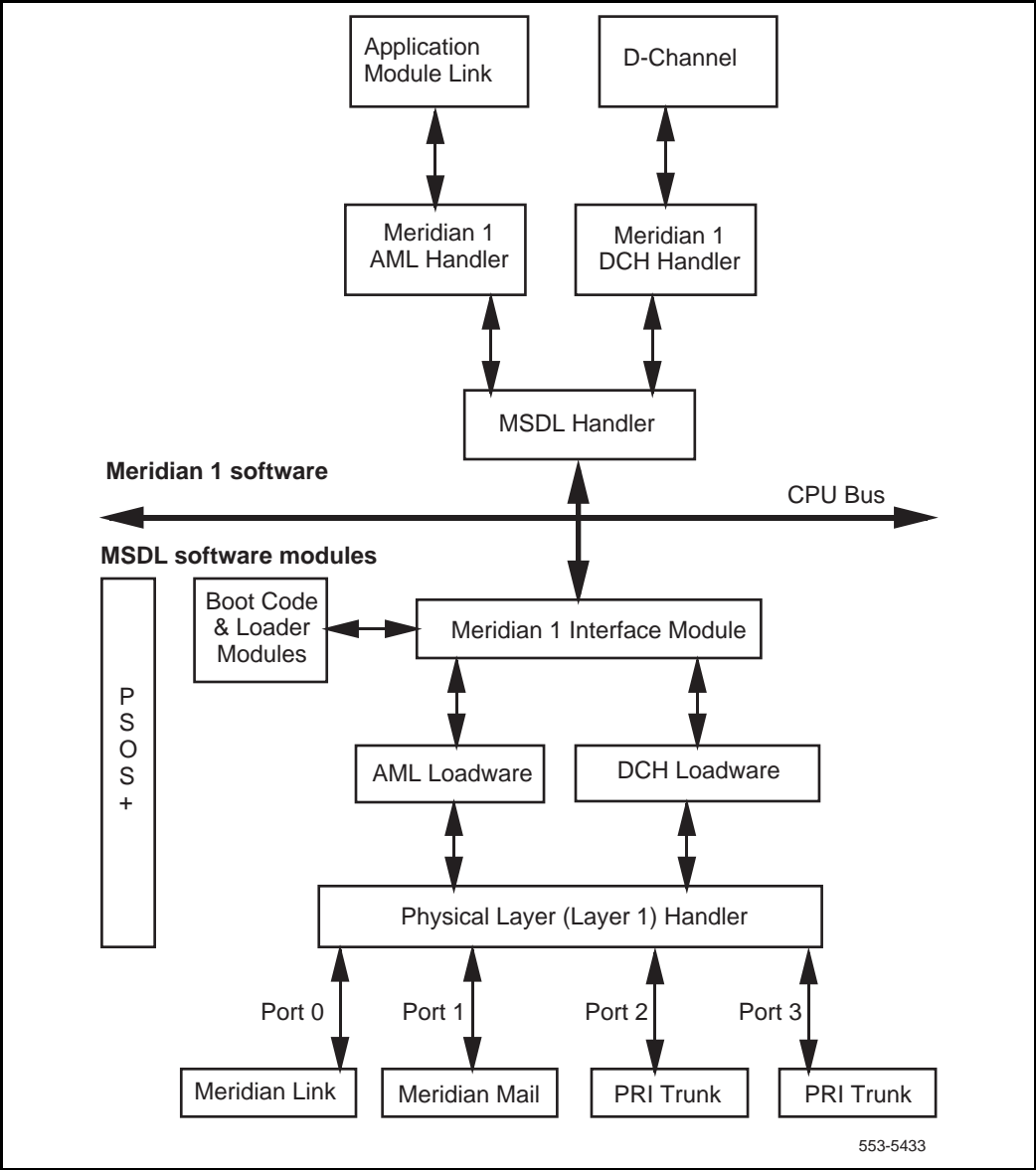
Data flow

The MSDL transmit interface, managed by the MSDL handler, sends data from the Meridian 1 to the MSDL. This interface receives packetized data from the Meridian 1 and stores it in the transmit buffer on the MSDL. The transmit buffer transports these messages to the appropriate buffers, from which the messages travel over the MSDL port to the I/O equipment.

The MSDL uses the MSDL receive interface to communicate with the Meridian 1. The MSDL card receives packetized data from the I/O equipment over the MSDL ports. This data is processed by the MSDL handler and sent to the appropriate Meridian 1 function.

The flow control mechanism provides an orderly exchange of transmit and receive messages for each operation. Each operation has a number of outstanding messages stored in buffers waiting to be sent to their destinations. As long as the number of messages does not exceed the threshold specified, the messages queue in the buffer in a first-in-first-out process.

If the outstanding number of messages for an operation reaches the threshold, the flow control mechanism informs the sender to wait until the number of messages is below the threshold before sending the next message.

If buffer space is not available, the request to send a message to the buffer is rejected and a NO BUFFER fault indication is sent.

Engineering guidelines

Content list

The following are the topics in this section:

Reference list

The following are the references in this section:

- *Meridian 1 Serial Data Interface Cards: Description* (553-3001-107)

- "Installation" on page 29

Meridian 1 supports a maximum of 16 MSDL cards regardless of system size. Systems that lack available network card slots may not be physically able to accommodate 16 MSDL cards.

Available network card slots

The number of available network slots in Meridian 1 depends on the system option, the system size, and the number of available network slots in each module for the selected system option.

Table 1 lists Meridian 1 system options, their corresponding network module types, and the network card slot numbers for the type of module used in the system.

Table 1
MSDL card location

Meridian 1	Module	Card slots
21E	NT8D11 CE/PE	Network slots 4–9
51	NT6D39 CPU/Network	Network slots 1–8
61	NT6D39 CPU/Network	Network slots 1–8
71	NT8D35 Network	Network slots 5–13
81	NT8D35 Network	Network slots 5–13
STE	QCA136 CE	Network slots 5–13
RT	QCA147 Network	Network slots 2–10, 12
NT	QSD39 Network (LH) QSD40 Network (RH)	Network slots 2–10, 12, 13 Network slots 5–13, 3
XT	QSD39 Network (LH) QSD40 Network (RH)	Network slots 2–10 Network slots 5–13

Some of these network card slots are normally occupied by Network Cards, Superloop Network Cards, Conference/TDS, and others, leaving a limited number of unused slots for MSDL and other cards.

Meridian 1 card mix

A Meridian 1 that exclusively uses MSDL cards can support up to 16 such cards, providing 64 ports. These ports can be used to run various synchronous and asynchronous operations simultaneously.

The Meridian 1 system will also support a mix of interface cards (MSDL, DCHI, and ESDI for example). However, using multiple card types will reduce the number of cards and ports available.

Refer to *Meridian 1 Serial Data Interface Cards: Description* (553-3001-107) for complete discussions of the specific card types.

Address decoding

The MSDL card decodes the full-length address information received from the Meridian 1. This provides 128 unique addresses. Since MSDL ports communicate with the CPU using a single card address, the Meridian 1 can support 16 MSDL cards providing 64 ports.

The MSDL card addresses are set using decimal switches located on the card. These switches can select 100 unique card addresses from 0 to 99.

An address conflict may occur between the MSDL and other cards because of truncated address decoding by the other cards. For example, if a DCHI port is set to address 5, its companion port will be set to address 4, which means that none of the MSDL cards can have hexadecimal address numbers 05H, 15H, …75H, nor addresses 04H, 14H, …74H. To avoid this conflict, X11 release 19 limits the MSDL card addresses from 0 to 15.

Port specifications

The MSDL card provides four programmable serial ports configured with software as well as with switches for the following modes of operation:

Transmission mode Configure an MSDL port for synchronous or asynchronous data transmission using LD 17.

Synchronous transmission uses an external clock signal fed into the MSDL.

Table 2 lists the synchronous interface specifications and the means of configuring the interface parameters.

Table 2
Synchronous interface specifications

Parameter	Specification	Configured
Data bits	In packets-Transparent	N/A
Data rate	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 48, 56, and 64 kbps	Software
Transmission	Full Duplex	N/A
Clock	Internal/External	Software
Interface	RS-232	Software
	RS-422	Switches
Mode	DTE or DCE	Switches

Asynchronous transmission uses an internal clock to generate the appropriate baud rate for serial controllers.

Table 3 lists asynchronous interface specifications and the means of configuring interface parameters.

Table 3
Asynchronous interface specifications

Parameter	Specification	Configured
Data bit, parity	7 bits even, odd or no parity, or 8 bits no parity	Software
Data rate	0.3, 0.6, (1.2), 2.4, 4.8, 9.6, 19.2, and 38.4 kbps	Software
Stop bits	1 (default), 1.5, 2	Software
Transmission	Full Duplex	N/A
Interface	RS-232	Software
	RS-422	Switches
Mode	DTE or DCE	Switches

Emulation mode Each port can be configured to emulate a DCE port or a DTE port by setting the appropriate switches on the MSDL. For details on how to set the switches, refer to "Installation" on page 29 of this document.

DCE is a master or controlling device that is usually the source of information to the DTE and may provide the clock in a synchronous transmission linking a DCE to a DTE.

DTE is a peripheral or terminal device that can transmit and receive information to and from a DCE and normally provides a user interface to the system or to a DCE device.

Interface Each MSDL port can be configured as an RS-232 or an RS-422 interface by setting the appropriate switches on the card.

Table 4 lists the RS-232 interface specifications for EIA and CCITT standard circuits. It shows the connector pin number, the associated signal name, and the supported circuit type. It also indicates whether the signal originates at the DTE or the DCE device.

This interface uses a 26-pin (SCSI II) female connector for both RS-232 and RS-422 circuits.

Table 4
RS-232 interface pin assignments

Pin	Signal name	EIA circuit	CCITT circuit	DTE	DCE
1	Frame Ground (FG)	AA	102	—	—
2	Transmit Data (TX)	BA	103	X	
3	Receive Data (RX)	BB	104		X
4	Request to Send (RTS)	CA	105	X	
5	Clear to Send (CTS)	CB	106		X
6	Data Set Ready (DSR)	CC	107		X
7	Signal Ground (SG)	AB	102	—	—
8	Carrier Detect (CD)	CF	109		X
15	Serial Clock Transmit (SCT)	DB	114		X
17	Serial Clock Receive (SCR)	DD	115		X
18	Local Loopback (LL)	LL	141	X	
20	Data Terminal Ready (DTR)	CD	108.2	X	
21	Remote Loopback (RL)	RL	140	X	
23	Data Rate Selector (DRS)	CH/CI	111/112	X	
24	External Transmit Clock (ETC)	DA	113	X	
25	Test Mode (TM)	TM	142		X

Table 5 lists RS-422 interface specifications for EIA circuits. It shows the connector pin number, the associated signal name, and the supported circuit type. It also indicates whether the signal originates at the DTE or the DCE device.

Table 5
RS-422 interface pin assignments

Pin	Signal Name	EIA Circuit	DTE	DCE
1	Frame Ground (FG)	AA	—	—
2	Transmit Data (TXa)	BAa	X	
3	Receive Data (RXa)	BBa		X
4	Request to Send (RTS)	CA	X	
5	Clear to Send (CTS)	CB		X
7	Signal Ground (SG)	AB	—	—
8	Receive Ready (RR)	CF		X
12	Receive Signal Timing (RST)	DDb		X
13	Transmit Data (TXb)	BAb		X
14	Transmit Signal Timing (TSTb)	DBb		X
15	Transmit Signal Timing (TSTa)	DBa		X
16	Receive Data (RXb)	BBb		X
17	Receive Signal Timing (RSTa)	DDa		X
20	Data Terminal Ready (DTR)	CD	X	
23	Terminal Timing (TTa)	DAb	X	
24	Terminal Timing (TTb)	DAa	X	

Implementation guidelines

The following are guidelines for engineering and managing MSDL cards:

- An MSDL can be installed in any empty network card slot.

- A maximum of eight MSDL cards can be installed in a fully occupied module because of the module's power supply limitations.

- The Clock Controller Card should not be installed in a module if more than 10 MSDL ports are configured as active RS-232 (rather than RS-422) ports in that module because of the module's power supply limitations.

- The MSDL address must not overlap other card addresses.

- Before downloading a peripheral software module for an MSDL, disable all MSDL ports on cards running the same type of operation.

Environmental and power requirements

The MSDL card conforms to the same requirements as other interface cards. The temperature, humidity, and altitude for Meridian 1 equipment, including the MSDL, should not exceed the specifications shown in Table 6.

Table 6
Environmental requirements

Condition	Environmental specifications
Operating	
Temperature	0° to 50° C (32° to 122° F)
Relative Humidity	5% to 95% noncondensing
Altitude	3,048 meters (10,000 feet) maximum
Storage	
Temperature	–50° to 70° C (–58° to 158° F)
Relative Humidity	5% to 95% noncondensing

A stable ambient operating temperature of approximately 22°C (72°F) is recommended. The temperature differential in the room should not exceed ±3°C (±5°F).

The internal power supply in each module provides DC power for the MSDL and other cards. Power consumption and heat dissipation for the MSDL is listed in Table 7.

Table 7
MSDL power consumption

Voltage (VAC)	Current (Amps)	Power (Watts)	Heat (BTUs)
+5	3.20	16.00	55.36
+12	0.10	1.20	4.15
−12	0.10	1.20	4.15

Installation

Content list

The following are the topics in this section:

Reference list

The following are the references in this section:

- *Circuit Card: Installation and Testing* (553-3001-211)

- *Meridian Link ISDN/AP General Guide* (553-2901-100)

- *Meridian Link description* (553-3201-110)

MSDL cards are supported on Meridian 1 systems running X11 Release 18 and later.

Device number

Before installing MSDL cards, determine which of the devices in the system are available. If all 16 devices are assigned, remove one or more installed cards to replace them with MSDL cards.

Make sure that the device number assigned to the MSDL card is not used by an installed card, even if one is not configured. Use the MSDL planning form, at the end of this section, to assist in configuring MSDL cards.
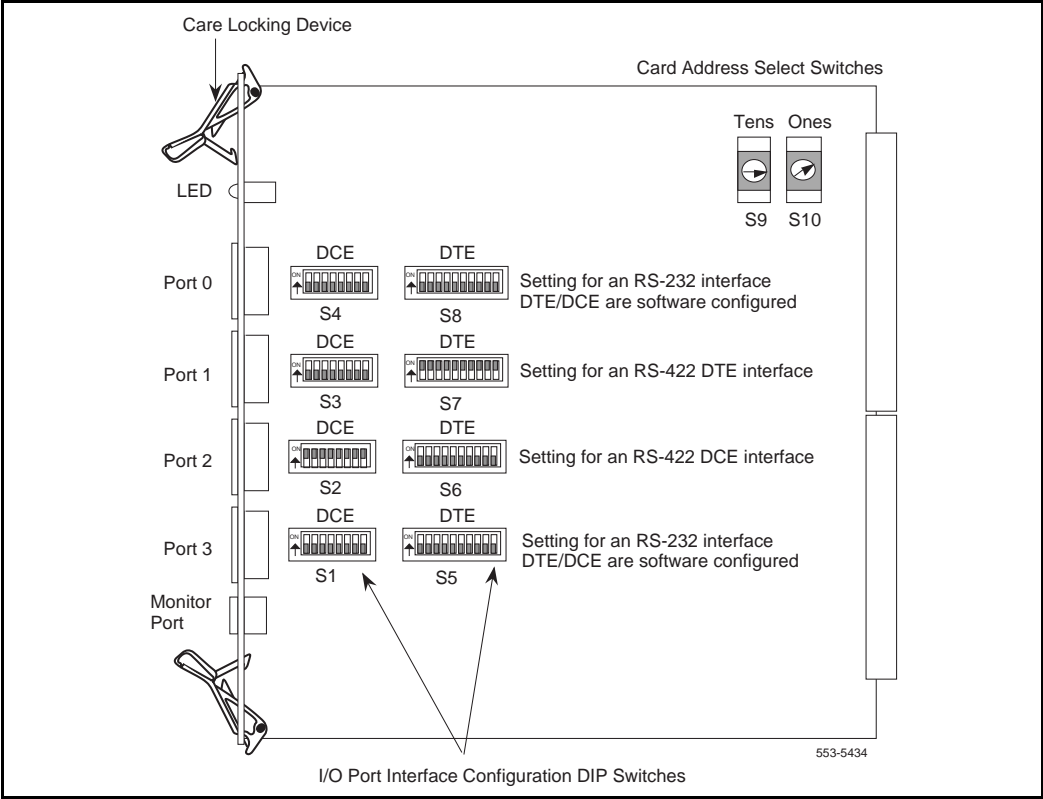
MSDL interfaces

Before installing the cards, select the switch settings that apply to your system, the interfaces, and card addresses.

Table 8 shows the switch positions for the DCE and the DTE interface configurations on the MSDL card. Figure 5 shows the MSDL and the location of configuration switches on the MSDL. The switch settings shown in this figure are an example of the different types of interfaces available. Your system settings may differ. Refer to *Circuit Card: Installation and Testing* (553-3001-211) for switch information.

Table 8
MSDL interface switch settings

DCE switch	DTE switch	Interface	Comment
OFF	OFF	RS-232	DTE/DCE is software configured
OFF	ON	RS-422 DTE	All switches configured
ON	OFF	RS-422 DCE	All switches configured
ON	ON	N/A	Not allowed

Figure 5
MSDL switch setting example

Care Locking Device

Card Address Select Switches

Tens   Ones

S9   S10

LED

Port 0
DCE   DTE
S4   S8
Setting for an RS-232 interface
DTE/DCE are software configured

Port 1
DCE   DTE
S3   S7
Setting for an RS-422 DTE interface

Port 2
DCE   DTE
S2   S6
Setting for an RS-422 DCE interface

Port 3
DCE   DTE
S1   S5
Setting for an RS-232 interface
DTE/DCE are software configured

Monitor
Port

I/O Port Interface Configuration DIP Switches

553-5434

Installing the MSDL card

To install an MSDL into the Meridian 1 module, follow these steps:

1   Set Device Number S10 and S9.

2   Hold the MSDL by its card-locking devices. Squeeze the tabs to unlatch the card locking devices and lift the locking device out and away from the card. Be careful not to touch connector pins, conductor traces, or integrated circuits. Static discharge may damage integrated circuits.

3   Insert the MSDL card into the selected card slot of the module following the card guides in the module.

4   Slide the MSDL into the module until it engages the backplane connector.

5   Push the MSDL firmly into the connector using the locking devices as levers by pushing them toward the card's front panel.

6   Push the card-locking devices firmly against the front panel of the card so they latch to the front lip in the module and to the post on the card.

7   Observe the red LED on the MSDL faceplate. If it turns on, flashes three times, and stays on continuously, the MSDL is operating correctly but is not yet enabled. Go to step 7.

    If the LED turns on and stays on continuously without flashing three times, the card may be defective. Go to steps 8 and 9.

8   Connect the cables. The installation is complete.

9   Unplug the MSDL card and reinsert it. If the red LED still does not flash three times, leave the card installed for approximately 10 minutes to allow the card to be initialized.

10 After 10 minutes unplug the card and reinsert it. If the card still does not flash three times, the card is defective and must be replaced.

Cable requirements

The MSDL card includes four high-density 26-pin (SCSI II) female connectors for ports and one 8-pin miniature DIN connector for the monitor port. See Figure 6 for a diagram of the MSDL cabling configuration.

Figure 6
MSDL cabling
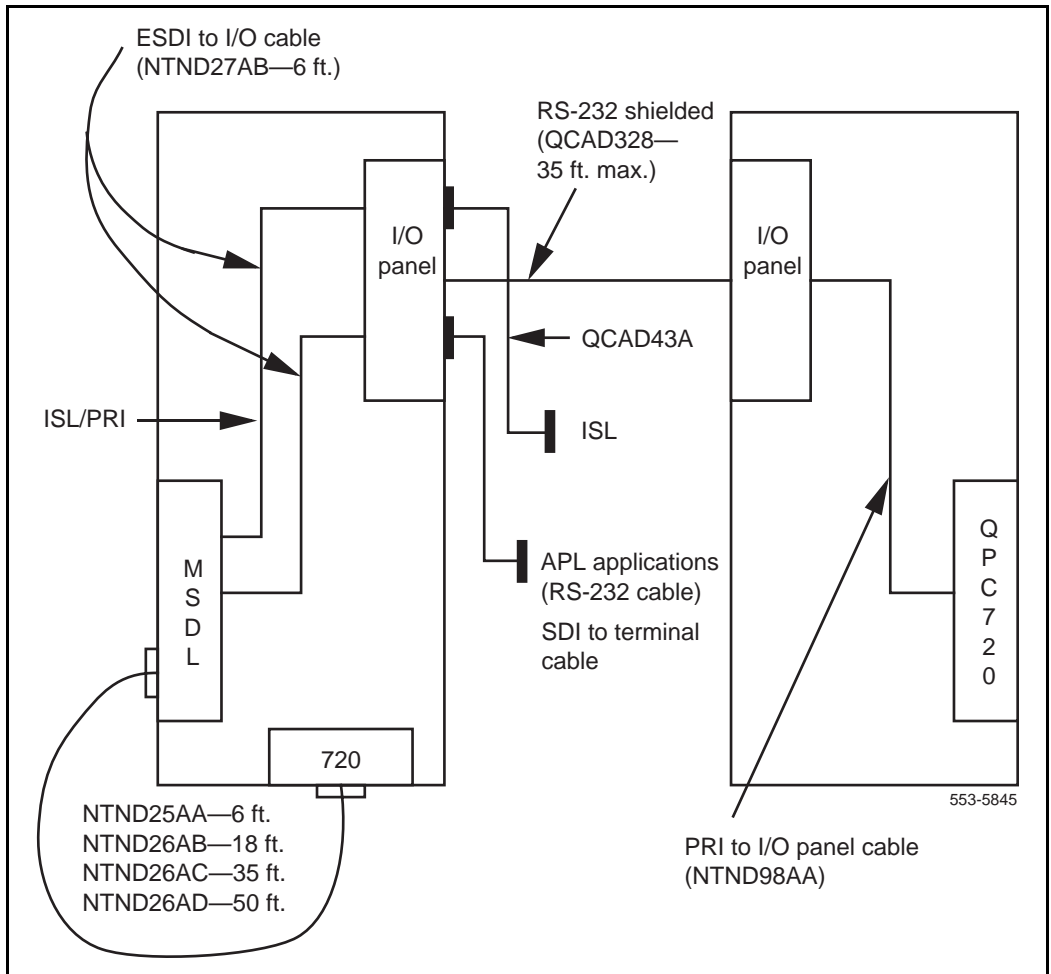
A D-Channel on the MSDL requires a connection from the appropriate MSDL port connector to the DCH connector located on the ISDN PRI trunk faceplate.

Other operations on the MSDL are connected to external devices such as terminals and modems. To complete one of these connections, connect the appropriate I/O connector on the MSDL to a connector on the I/O panel at the back of the module where the MSDL is installed. If a terminal is connected to the regular SDI port, use 8 bit, VT100 terminal emulation. If the terminal is connected to the SDI/STA port with line mode editing, use 8 bit, VT220 terminal emulation.

To determine the type and number of cables required to connect to MSDL cards, you must determine the type of operation you wish to run and select the appropriate cable to connect the operation to the MSDL port. Different types of cables, as described in Table 9, connect the MSDL port to a device.

- NTND26, used to connect the MSDL port to the ISDN PRI trunk connector J5, for DCH

- QCAD328, when cabling between two different columns, that is, I/O to I/O (when MSDL is in one row and QPC720 is in another row)

- NTND98AA (J5 of QPC720 to I/O panel)

- NTND27, used to connect the MSDL port to the I/O panel at the rear of the module, for other interface functions

Table 9
Cable types

Function	Cable type	Cable length
DCH	NTND26AA	6 feet
	NTND26AB	18 feet
	NTND26AC	35 feet
	NTND26AD	50 feet
AML, ISL, SDI	NTND27AB	6 feet

Cable installation

When the MSDL card is installed, connect the cables to the equipment
required for the selected operation.

PRI trunk connections

D-channel operations require connections between the MSDL and a PRI
trunk card. Refer to *Meridian Link ISDN/AP General Guide* (553-2901-100)
for a complete discussion of PRI and D-channels.

The following steps explain the procedure for cable connection:

1   Identify the MSDL and the PRI cards to be linked.

2   Select the appropriate length cable for the distance between the MSDL
    and the PRI card.

3   Plug the 26-pin SCSI II male connector end of a cable into the
    appropriate MSDL port.

4   Route the cable through cable troughs, if necessary, to the appropriate
    PRI card.

5   Plug the DB15 male connector end of the cable into the J5 DB15 female
    connector on the PRI card.

6   Secure the connections in place with their fasteners.

7   Repeat steps 1 through 6 for each connection.

I/O panel connections

Operations aside from PRI require cable connections to the I/O panel.
Connections between the I/O panel and Application Equipment Modules
(AEM) are described in "Application Module description," *Meridian Link
description* (553-3201-110).

The following steps explain the procedure for cable connection:

1   Identify the MSDL card and the I/O panel connector to be linked.

2   Using the NTND27AB cable, plug the 26-pin SCSI II male connector end of a cable into the appropriate MSDL port.

3   Route the cable to the rear of the module next to the I/O panel.

4   Plug the DB25 male connector end of a cable into a DB25 female connector at the back of the I/O panel.

5   Secure cable connectors in place with their fasteners.

6   Repeat steps 1 through 5 for each connection.

MSDL planning form

Use the following planning form to help sort and store information concerning the MSDL cards in your system as shown in the sample. Record switch settings for unequipped ports as well as for equipped ports.

MSDL data form					
	Device no.	Shelf	Slot	Card ID	Boot Code version
	Date installed	Last update			
Ports	Operation	Logical no.	Switch setting	Cable no.	Operation information
0					
1					
2					
3					

Sample					
	Device no. 13	Shelf 3	Slot 5	Card ID NT6D80AA-110046	Boot Code version 004
	Date installed 2/1/93	Last update 5/5/93			
Ports	Operation	Logical no.	Switch setting	Cable no.	Operation information
0	TTY	13	RS-232 DCE	NTND27AB	maint TTY 9600 baud
1	DCH	25	RS-422 DTE	NTND26AB	PRI 27 to hdqtrs
2	AML	3	RS-232 DCE	NTND27AB	Meridian Mail
3	Spare		RS-232		

Maintenance

Content list

The following are the topics in this section:

Reference list

The following are the references in this section:

- *General Maintenance Information* (553-3001-500)

- *X11 Administration* (553-3001-311)

- *X11 Maintenance* (553-3001-511)

- "Symptoms and actions" on page 51

Routine maintenance consists of enabling and disabling MSDL cards and downloading new versions of peripheral software. These activities are performed by an authorized person such as a Meridian 1 administrator.

Troubleshooting the MSDL consists of determining problem types, isolating problem sources, and solving the problem. A craftsperson normally performs these activities.

Meridian 1 systems have self-diagnostic indicators as well as software and hardware tools. These diagnostic facilities simplify MSDL troubleshooting and reduce mean-time-to-repair (MTTR). For complete information concerning Meridian 1 maintenance, refer to *General Maintenance Information* (553-3001-500).

For complete information regarding X11 software maintenance programs, refer to *X11 Administration* (553-3001-311).

MSDL states

MSDL states are controlled manually by maintenance programs or automatically by the system. Figure 7 shows MSDL states and the transitions among them. These are the three states the MSDL may be in:

- Manually disabled

- Enabled

- System disabled

The following sections describe the relationships between these states.

Figure 7
MSDL states

553-5435
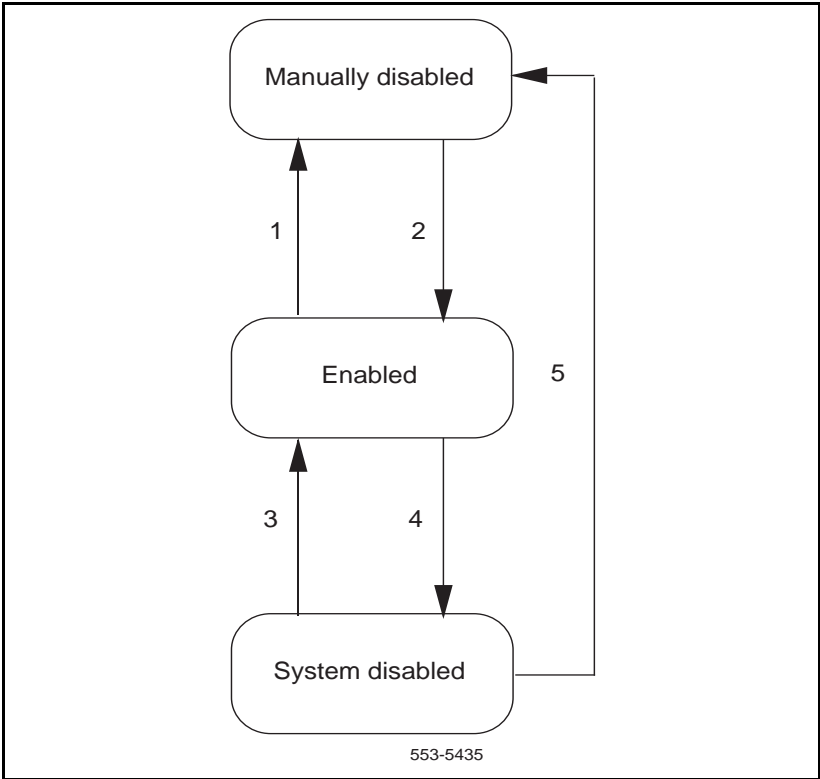
Manually disabled

In this state, the MSDL is not active. The system does not attempt to communicate or attempt any automatic maintenance on the MSDL.

A newly configured MSDL automatically enters the manually disabled state. An operating MSDL can be manually disabled by issuing the **DIS MSDL x** command in LD 37 (step 1 in Figure 7).

Entering the **DIS MSDL x** command in LD 37 moves the card to manually disabled status and stops all system communication with the card (step 5 in Figure 7).

Manually enabled

When the card has been manually disabled, re-enable it with the **ENL MSDL x** command in LD 37 (step 2 in Figure 7).

System disabled

When the Meridian 1 disables the MSDL card (step 4 in Figure 7), it continues to communicate and attempt maintenance procedures on the card. To stop all system communication with the card, enter **DIS MSDL x** to disable it (step 5 in Figure 7). Otherwise, the system periodically tries to enable the card, attempting recovery during the midnight routines (step 3 in Figure 7).

The system disables the MSDL if the card

- exhibits an overload condition

- does not respond to system messages

- is removed

- resets itself

- encounters a fatal error

- is frequently system disabled and recovered

When an MSDL is system disabled, a substate indicates why the MSDL is disabled. These are the substates:

- **Not Responding** Meridian 1 cannot communicate with the MSDL.

- **Self-Testing** The MSDL card is performing self-tests.

- **Self-tests Passed** The MSDL card successfully completed self-tests and Meridian 1 is determining if download is required or the software downloading is complete.

- **Self-tests Failed** The MSDL card self-tests failed.

- **Shared RAM Tests Failed** The Meridian 1 failed to read/write to the MSDL shared RAM.

- **Overload** Meridian 1 received an excessive number of messages within a specified time period.

- **Reset Threshold** Meridian 1 detected more than four resets within 10 minutes.

- **Fatal Error** The MSDL card encountered a fatal condition from which it cannot recover.

- **Recovery Threshold** The MSDL card was successfully enabled by the MSDL autorecovery function five times within 30 minutes. Each time it was system disabled because of a problem encountered during operation.

- **Bootloading** The MSDL base software is in the process of being downloaded to the MSDL.

Detailed information on system disabled substates and the action required for each substate appears in "Troubleshooting actions" on page 52.

Maintaining the MSDL

The Meridian 1 system controls automatic MSDL maintenance functions. A craftsperson or system administrator performs manual maintenance by changing the card status, downloading new versions of peripheral software, or invoking self-tests.

System controlled maintenance

Built-in diagnostic functions constantly monitor and analyze the system and individual card, performing the following operations:

- using autorecovery to automatically correct a temporarily faulty condition and maintain the system and its components

- printing information and error messages to indicate abnormal conditions that caused a temporary or an unrecoverable error

During system initialization, the Meridian 1 examines the MSDL base code. If the base code needs to be downloaded, the Meridian 1 CPU resets the MSDL card and starts downloading immediately following initialization. At the same time, all other MSDL peripheral software programs are checked and, if they do not correspond to the system disk versions, the correct ones are downloaded to the card.

If manual intervention is required during initialization or operation, information and error messages appear on the console or the system TTY to suggest the appropriate action. For a complete discussion of the information and error messages, refer to *X11 Administration* (553-3001-311). Detailed information of system disabled substates and the action required for each substate is found at the end of this document.

Manually controlled maintenance

Use manual maintenance commands found in the following programs to enable, disable, reset, get the status of, and perform self-tests on the MSDL card:

• Input/Output Diagnostic Program LD 37

• Program LD 42

• Link Diagnostic Program LD 48

• PRI D-channel Diagnostic Program LD 96

For a complete discussion of these programs, refer to *X11 Administration* (553-3001-311).

Note 1: Enter commands after the dot (.) prompt.

Note 2: The "**x**" in the commands below represents the DNUM value of the card number.

Enabling the MSDL

Enter **ENL MSDL x** to enable the MSDL manually. If the MSDL base code has not been previously downloaded or if the card version is different from the one on the system disk, the software is downloaded and the card is enabled.

To force software download and enable the card, enter **ENL MSDL x FDL**. This command forces the download of the MSDL base code and the configured peripheral software even if it is already resident on the card. The card is then enabled.

To enable a disabled MSDL and its ports, enter **ENL MSDL x ALL**. This command downloads all peripheral software (if required) and enables any configured ports on the card. This command can be issued to enable some manually disabled ports on an already enabled MSDL.

Disabling the MSDL

To disable an MSDL card, enter **DIS MSDL x**.

To disable the MSDL and all its ports, enter **DIS MSDL x ALL**.

Resetting the MSDL

To reset an MSDL and initiate a limited self-test, the MSDL must be in a manually disabled state. To perform the reset, enter **RST MSDL x**.

Displaying MSDL status

To display the status of all MSDL cards in Meridian 1, enter **STAT MSDL**.

To display the status of a specific MSDL, enter **STAT MSDL x**. The status of the MSDL, its ports, and the operation of each port appears.

The command **STAT MSDL x FULL** displays all information about an MSDL (card ID, bootload firmware version, base code version, base code state, operation state, date of base code activation) as well as the version, state, and activation date for each card operation.

Self-testing the MSDL

To perform extensive self-testing of an MSDL, enter **SLFT MSDL x**. This test can be activated if the card is in the manually disabled state. If the test passes, the Meridian 1 outputs the card ID and a pass message. If it fails, the system displays a message indicating which test failed.

Manually isolating and correcting faults

Problems are due to configuration errors that occur during installation or hardware faults resulting from component failure during operation. See "Symptoms and actions" on page 51 for more information on problem symptoms and required responses.

Isolate MSDL faults using the diagnostic tools described below:

1   Observe and list the problem symptoms; for example, a typical symptom is a permanently lit LED.

2   If the LED flashes three times but the card does not enable, verify that the card is installed in a proper slot as shown in Table , "Installation," on page 29.

3   Check that the address is unique; no other card in the system can be physically set to the same device number as the MSDL.

4   If installation is correct and no address conflict exists, refer to "Newly installed MSDL cards" on page 47 or "Previously operating MSDL cards" on page 48.

5   If the MSDL still does not operate correctly, contact your Nortel Networks representative.

Newly installed MSDL cards

Problems that occur during MSDL card installation usually result from improperly installed, incorrectly addressed, or faulty cards.

If the LED on a newly installed MSDL does not flash three times after insertion, wait 5 minutes, then remove and reinsert. If the LED still does not flash three times, the card is faulty.

Previously operating MSDL cards

Problems that occur during normal operation usually result from faulty cards. Follow these steps to evaluate the situation:

1   Use the **STAT MSDL x** command to check MSDL card status. See "Displaying MSDL status" on page 46.

2   If the card has been manually disabled, try to enable it using **ENL MSDL x**. See "Enabling the MSDL" on page 45. If this fails, perform self-testing as described in step 4.

3   If the card has been disabled by the system, disable it manually with **DIS MSDL x**. See "Disabling the MSDL" on page 46.

4   Invoke self-testing with the **SLFT MSDL x** command. See "Self-testing the MSDL" on page 46. If self-tests fail, replace the card. If self-tests pass, try to enable the card again, as in step 2. If the card does not enable, note the message output to the TTY and follow the recommended action.

Replacing MSDL cards

After completing MSDL troubleshooting you may determine that one or more MSDL cards are defective. Remove the defective cards and replace them with new ones.

An MSDL card can be removed from and inserted into a Meridian 1 module without turning off the power to the module. Follow these steps:

1 Log in on the maintenance terminal.

2 At the > prompt, type **LD 37** (you can also use LD 42, LD 48, or LD 96) and press Enter.

3 Type **DIS MSDL x ALL** and press Enter to disable the MSDL and any active operations running on one or more of its ports. The MSDL card is now disabled.

4 Disconnect the cables from the MSDL faceplate connectors.

5 Unlatch the card-locking devices, and remove the card from the module.

6 Set the switches on the replacement card to match those on the defective card.

7 Insert the replacement card into the same card slot.

8 Observe the red LED on the front panel during self-test. If it flashes three times and stays on, it has passed the test. Go to step 8.

If it does not flash three times and then stay on, it has failed the test. Pull the MSDL partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the MSDL.

9 Connect the cables to the MSDL faceplate connectors.

10 At the **.** prompt in the **LD 37** program, type **ENL MSDL x ALL** and press Enter to enable the MSDL and its operations. If the red LED on the MSDL turns off, the MSDL is functioning correctly. Since self-tests were not invoked, no result message appears.

11 Tag the defective card(s) with a description of the problem and return them to your Nortel Networks representative.

Symptoms and actions

Content list

The following are the topics in this section:

Reference list

The following are the references in this section:

- "Manually isolating and correcting faults" on page 47

- *X11 Maintenance* (553-3001-511)

- "Maintaining the MSDL" on page 44

- "Previously operating MSDL cards" on page 48

Explained here are some of the symptoms, diagnoses, and actions required to resolve MSDL card problems. Contact your Nortel Networks representative for further assistance.

Troubleshooting actions

These explain the causes of problems and the actions needed to return the card to an enabled state following installation or operational problems.

Symptom: The LED on the MSDL card is steadily lit.

Diagnosis: The MSDL card is disabled or faulty.

Action: Refer to "Manually isolating and correcting faults" on page 47.

or

Diagnosis: Peripheral software download failed because of MSDL card or system disk failure.

Action: If only one MSDL card has its LED lit, replace it.

Symptom: Autorecovery is activated every 30 seconds to enable the MSDL. MSDL300 messages appear on the console or TTY.

Diagnosis: The MSDL card has been system disabled because of an incorrect address.

Action: Verify the switch settings.

or

Diagnosis: The MSDL card has been system disabled because of peripheral software or configuration errors.

Action: Refer to "System disabled actions" on page 53.

System disabled actions

These explain the causes of problems and the actions needed to return the card to an enabled state following system disabling.

SYSTEM DISABLED—NOT RESPONDING

Cause: The MSDL card is not installed or is unable to respond to the messages from the Meridian 1.

Action:

Check the MSDL messages on the console and take the action recommended. Refer to *X11 Administration* (553-3001-311).

Verify that the address switches on the MSDL are set correctly.

Verify that the card is properly installed in the shelf for at least 5 minutes.

If the problem persists, manually disable the card by entering the **DIS MSDL x**. Follow the steps described in "Previously operating MSDL cards" on page 48.

SYSTEM DISABLED—SELF-TESTING

Cause: The MSDL card has reset itself or Meridian 1 has reset the card to perform self-tests. Self-tests are in progress.

Action:

Wait until self-tests are completed. Under some circumstances, the self-tests may take up to 6 minutes to complete.

Take the action described in the appropriate section below ("SYSTEM DISABLED—SELF-TESTS PASSED" or "SYSTEM DISABLED—SELF-TESTS FAILED").

SYSTEM DISABLED—SELF-TESTS PASSED

Cause: The MSDL card passed self-tests. Meridian 1 will automatically download the MSDL base code, if needed, and attempt to enable the card using autorecovery. If a diagnostic program (overlay) is active in the Meridian 1, the downloading of the MSDL base code occurs later.

Action:

Wait to see if the system will enable the card immediately. If the MSDL is enabled, no further action is necessary.

If the MSDL base code download fails five times, autorecovery stops. The following appears in response to the **STAT MSDL x** command;

```
MSDL 10: SYS DSBL—SELFTEST PASSED
NO RECOVERY UNTIL MIDNIGHT: FAILED BASE DNLD 5 TIMES
        SDI    10   DIS   PORT 0
        AML    11   DIS   PORT 1
        DCH    12   DIS   PORT 2
        AML    13   DIS   PORT 3
```

Error messages will usually indicate the problem in this case. See "Maintaining the MSDL" on page 44.

SYSTEM DISABLED—SELF-TESTS FAILED

Cause: The card did not pass self-tests. These tests repeat five times. If unsuccessful, autorecovery stops until midnight unless you take action.

Action:

Allow the system to repeat the self-tests.

If self-tests fail repeatedly, disable the card using the **DIS MSDL x** command and replace the card.

SYSTEM DISABLED—SRAM TESTS FAILED

Cause: After self-tests passed, Meridian 1 attempted to perform read/write tests to the shared RAM on the MSDL and detected a fault. The shared RAM test will be repeated five times, and, if unsuccessful, autorecovery will not resume until midnight unless you take action.

Action:

Allow the system to repeat the self-tests.

If self-tests fail repeatedly, disable the card using the **DIS MSDL x** command and replace the card.

SYSTEM DISABLED—OVERLOAD

Cause: The Meridian 1 received an excessive number of messages from the MSDL card in a certain time. If the card invokes overload four times in 30 minutes, it exceeds the recovery threshold as described in "SYSTEM DISABLED—RECOVERY THRESHOLD." The system resets the card, invokes self-tests, and attempts to enable the card. The problem may be due to excessive traffic on one or more MSDL ports. Traffic load redistribution may resolve this condition.

Action:

Check the traffic report, which may indicate that one or more MSDL ports are handling excessive traffic.

By disabling each port, identify the port with too much traffic and allow the remaining ports to operate normally. Refer to "Maintaining the MSDL" on page 44. If the problem persists, place the card in the manually disabled state by the **DIS MSDL x** command and follow the steps in "Previously operating MSDL cards" on page 48.

SYSTEM DISABLED—RESET THRESHOLD

Cause: The Meridian 1 detected more than four MSDL card resets within 10 minutes. The system attempts to enable the card again at midnight unless you intervene.

Action:

Place the card in the manually disabled state with the **DIS MSDL x** command and follow the steps in "Previously operating MSDL cards" on page 48.

SYSTEM DISABLED—FATAL ERROR

Cause: The MSDL card encountered a fatal error and cannot recover. The exact reason for the fatal error is shown in the MSDL300 error message output to the console of TTY when the error occurred.

Action:

Check the MSDL300 message to find out the reason.

Alternatively, display the status of the MSDL, which also indicates the cause of the problem, with the **STAT MSDL x** command and check the information to find the cause of the fatal error.

Allow the system to attempt recovery. If this fails, either by reaching a threshold or detecting self-test failure, place the MSDL in the manually disabled state with the **DIS MSDL x** command and follow the steps in "Previously operating MSDL cards" on page 48.

SYSTEM DISABLED—RECOVERY THRESHOLD

Cause: The Meridian 1 attempted autorecovery of the MSDL card more than five times within 30 minutes and each time the card was disabled again. The system attempts to enable the card again at midnight unless you intervene.

Action:

Place the MSDL card in a manually disabled state with the **DIS MSDL x** command and follow the steps in "Previously operating MSDL cards" on page 48.

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Meridian 1

Multi-purpose Serial Data Link

Description

N⊘RTEL
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How the world shares ideas.