555-4001-104

Meridian SL-100

Remote Peripherals

Reference Guide

MSL08 Standard 06.03 May 1998

NORTEL NETWORKS

Meridian SL-100

Remote Peripherals

General Description

Publication number: 555-4001-104
Product release: MSL08
Document release: Standard 06.03
Date: May 1998

Publication history

July 2002

Release 06.03, MSL08, Standard. Document was migrated to the new standard color template.s

May 1998

Release 06.02. Standard release applies to MSL08 software release.

February 1998

Release 06.01. Preliminary release applies to MSL08 software release. Added information about the availability of Integrated Services Digital Network (ISDN) line drawer for remote (ILDR) in the Meridian cabinet line module (MCLM) on the Meridian cabinet remote module-second series (MCRM-S) or Meridian cabinet remote module (MCRM).

October 1997

Release 05.02. Standard release applies to MSL07 software release. Added information about the capability to support ISDN to MCRM-S, remote line concentrating module (RLCM), and Meridian Cabinet remote unit (MCRU) by means of the ILDR.

Removed information about Meridian cabinet digital remote (MCDR) and remote digital line module (RDLM).

Added notes that Meridian cabinet remote module (MCRM), remote switching center (RSC), and remote cluster controller (RCC) are manufacturer discontinued (MD) but supported in the field. In addition, included notes that the MCRM, RSC, and RCC are replaced by the MCRM-S, RSC-S, and RCC-2 respectively.

Reorganized information to reflect MCRU/RLCM and MCRM-S development.

Combined information that was previously in two Administration and Maintenance chapters.

Combined information that was in two Remote Features chapters.

Changed references from line group controller (LGC) to line trunk controller (LTC).

June 1997

Release 05.01. Preliminary release applies to MSL07 software release. Added information about the capability to support Integrated Services Digital Network (ISDN) to Meridian cabinet remote module-second series (MCRM-S), remote switching center 2 (RSC-2), remote line concentrating module (RLCM), and Meridian cabinet remote unit (MCRU) by means of ISDN line drawer for remote (ILDR).

Remove information about Meridian cabinet digital remote (MCDR). Also remove information about remote digital line module (RDLM), which is inside the MCDR cabinet.

Added notes that Meridian cabinet remote module (MCRM), remote switching center (RSC), and remote cluster controller (RCC) are manufacturer discontinued (MD) but supported in the field. In addition, included notes that the MCRM, RSC, and RCC are replaced by the MCRM-S.

February 1995

Release 04.01. First release of this document with the new software restructure. Revised this document to remove any feature package references.

March 1993

Release 02.03. Added information on the Meridian cabinet remote module-second series (MCRM-S) and information on the RCC-2.

July 1991

Release 02.02. Removed AUTOVON-specific references.

May 1991

Release 02.01. Added information on the Meridian cabinet remote module-ISDN (MCRM-I); incorporated all information from *RLCM/RSC General Description*, into this document; and added information on the dual remote cluster controller (Dual RCC) configuration.

February 1998

Initial release.

Contents

About this document

Purpose and audience

This publication describes the hardware components and operation of the cabinetized Meridian SL-100 remote peripherals, consisting of the Meridian cabinet remote unit (MCRU), Remote Power Cabinet, Meridian cabinet remote module-second series (MCRM-S). The information in this document applies to all Meridian SL-100 Family offices.

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increases each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the next software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increases each time the document is revised but re-released in the same software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

FOR MORE INFORMATION

To determine whether you have the latest version of this document and how documentation for your product is organized, check the release information in the *Meridian SL-100 Master Index of Publications*.

What precautionary messages mean

The types of precautionary messages used in Nortel documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of

information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION - Information needed to perform a task

ATTENTION

If the unused DS-3 ports are not deprovisioned before a DS-1/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-1/VT Mapper, even though the DS-1/VT Mapper is properly provisioned.

DANGER - Possibility of personal injury

DANGER

Risk of electrocution

Do not open the front panel of the inverter unless fuses F1, F2, and F3 have been removed. The inverter contains high-voltage lines. Until the fuses are removed, the high-voltage lines are active, and you risk being electrocuted.

WARNING - Possibility of equipment damage

WARNING

Damage to the backplane connector pins

Align the card before seating it, to avoid bending the backplane connector pins. Use light thumb pressure to align the card with the connectors. Next, use the levers on the card to seat the card into the connectors.

CAUTION - Possibility of service interruption or degradation

CAUTION
Possible loss of service
Before continuing, confirm that you are removing the card from the inactive unit of the peripheral module. Subscriber service will be lost if you remove a card from the active unit.

Introduction to Meridian cabinet remotes

For customers needing a distributed campus-style switching system with one or more remote sites, the remote peripherals provide the capability for serving analog and digital telephone sets and data terminals at a physical location remote to the Meridian SL-100. This method of private local networking provides the customer with the most cost-effective means of serving multiple smaller remote sites while still retaining all the features and services of the larger host.

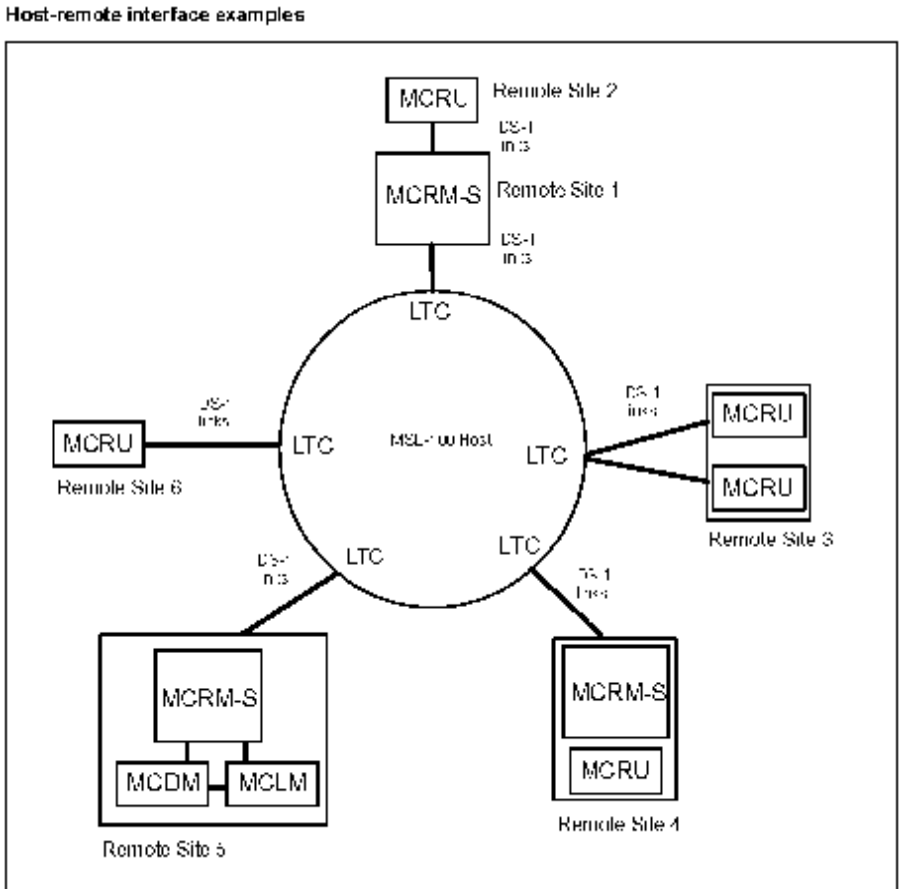
Remote switching can be routed to the host Meridian SL-100 through one or more Meridian cabinet remote unit/remote line concentrating module (MCRU/RLCM), Meridian cabinet remote module-second series (MCRM-S), or through MCRU connected to an MCRM-S. See the following Figure.

> ***Note:*** Meridian cabinet remote module (MCRM), remote switching center (RSC), and remote cluster controller (RCC) are manufacturer discontinued (MD) but are supported in the field. The MCRM, RSC, and RCC are replaced by the MCRM-S, remote switching center-second series (RSC-S), and enhanced remote cluster controller (RCC2) respectively.

The interface between the remotes and the host Meridian SL-100 is through standard DS-1 links: 2 to 6 primary links for the MCRU, and 2 to 16 primary links for the MCRM-S.

The DS-1 links are terminated on a line trunk controller (LTC) at the host Meridian SL-100. All links from a MCRU or MCRM-S must terminate on the same LTC.

Figure



The host extended peripheral module (XPM) must be an LTC. The following definitions apply to the Host XPM:

- terminates DS-1 links from the remote cluster controller 2 (RCC2) and switches them through the network

  Note: Although still supported in the field, the RCC is manufacturer discontinued (MD). The RCC2 replaces the RCC.

- optionally can terminate Meridian Cabinet line modules (MCLM) directly.
- must be LTC if there are trunks off the RCC2

  Note: When an MCRM-S requires trunking off remotes, it must be connected to an LTC at the host.

The maximum distance from the remotes to the MSL-100 host is 150 miles (240 km).

An intraswitching capability allows calls that both originate and terminate within the same MCRM-S to use channels internal to the MCRM-S. After call setup, an intra-MCRM-S call is transferred to the MCRM-S internal link and remains there, thus releasing its DS-1 channel to the host. However, this does not apply to calls requiring resources resident at the host, such as attendant consoles.

In the event that communication between a remote and the host is lost, the Emergency Stand Alone (ESA) feature supplies only local, basic intracalling service to remote stations until the connection with the host is restored. This is an optional feature. For MCRM-S, no additional hardware is required.

Maintenance and administration of the remotes are performed using MAP workstations located at either the host or the remote site. MAP workstations at the remote site communicate with the host through dial-up lines, except during ESA mode.

Cabinet concept

The remotes are housed in cabinets to provide the same efficiency and design improvements afforded by the cabinetized Meridian SL-100 host, as described in *Cabinetized General Description*.

The MCRM-S and MCRU are remote hardware switching modules which are mounted in 6-ft (1.8-m), Meridian gray product cabinets. This modularity gives the system flexibility in physical capability, allowing easy system expansion.

Because a majority of Meridian SL-100 applications fall within identified capacity parameters, the remotes have pre-engineered hardware modules. The modules are packaged in cabinets as off-the-shelf products to enable configurations to be determined quickly, and implemented at shorter intervals.

Advantages

The cabinetized remotes offer the following benefits:

- preconfigured, factory-assembled, cabled, and tested modules requiring reduced installation intervals
- a modular system that easily expands and accommodates variations in system size and feature choices, and allows integration of future system enhancements
- no additional external earthquake bracing needed by using pre-braced steel cabinets
- a modern, computer-style appearance, ideally suited for computer rooms having raised flooring and low, suspended ceilings
- a wide range of centralized and distributed corporate campus-style locations

The Meridian SL-100 family of remotes consists of the MCRU/RLCM and the MCRM-S. These remote modules home onto an MSL-100 host switch. One Meridian SL-100 host can accommodate up to 64 remote sites.

Therefore, commonality of hardware between the RLCM, MCLM, Meridian cabinet digital module (MCDM), MCRU, and the LCM exists.

The MCRU/RLCM or the MCRM-S allow the customer to offer sophisticated Meridian SL-100 features and services to locations beyond the host serving area. Subscribers served by any of these remotes are provided the same grade of service as those served by the host Meridian SL-100.

General cabinet description

The unified steel cabinets replace the open-rack frame for housing switching equipment. The cabinets are designed to be compatible with current technology, and to allow upgrading with system enhancements.

Cabinet dimensions

The exterior dimensions of the remote cabinets follow.

- height—6.0 ft. (1.8 m)
- width—28.5 in (72.4 cm)
- depth—28.0 in (71.1 cm)
- base recess—4.5 in (11.4 cm)
- base depth—23.5 in (59.7 cm)

Cabinet exterior design

The cabinet has two center-open doors on both front and rear. The doors are easily installed, removed for servicing, and replaced. A lock and catch assembly may be located in the top cap of each door.

The doors and end covers of the cabinet are Meridian product light gray or brown. The cabinet frame itself is dark gray.

To accommodate raised computer flooring, the depth of the cabinet fits standard North American and European raised floor tiles. A recess in the front at the base of the cabinet serves as an air intake for the cooling unit. Another air inlet is located at the rear of the cabinet, but is not recessed.

It is unnecessary to bolt the cabinets to the floor, except in earthquake risk areas.

Cabinet interior design

Inside the cabinet is room to mount four standard 24-in (61-cm) wide equipment shelves, with a frame supervisory panel (FSP) at the top of

the cabinet. Cooling units are located in or near the base of the cabinet, but do not interfere with equipment mounting space.

Cabinet cabling

Most cables are run horizontally within the cabinets in the same lineup. In this way, the electromagnetic interference (EMI) shield is not broken, and the lineup cables need not be routed through a shielded duct. All cabinets meet the requirements of FCC Part 15 EMI compliance.

Where raised flooring is used, external cables are routed under the flooring, through an opening in the base of the cabinet below the rear bulkhead. Where raised flooring is not used, cables are routed through the rear bulkhead opening at the top of the cabinet to cable racks, used for routing between cabinet lineups.

Earthquake resistance

Each steel cabinet is constructed of two single-piece side members, joined to a specially reinforced base, providing resistance to earthquake vibration damage. Bolting two or more reinforced cabinets together improves earthquake resistance.

Assuming the building housing the cabinets is not destroyed, damage resistance is provided against forces up to 150 percent of the NEBS Zone 4 and ATC 3-06 specifications.

Earthquake risk zones are considered to be ATC Zone 6 and 7, UBC Zone 4 and NEBS Zone 4. In these zones, a minimum of 3000 PSI concrete strength at 5.5 inches of concrete thickness is required to meet the specifications of the cabinet floor anchors.

The cabinet also exceeds the NEBS tipping specification, and so requires only four bolts and anchors for fastening to a solid floor in earthquake risk areas. In earthquake risk areas where raised flooring is used, a consulting engineer should supervise the installation of a suitable base structure.

System grounding

The grounding design for the cabinets fully isolates all powered circuitry from the steel walls and shelves. All cabinets are bonded together and connected to the building ground plate, providing personal hazard safety and lightning protection.

System logic grounds are connected together by a single-point configuration, preventing ground loops and ensuring proper reference levels between functionally connected modules. This grounding scheme virtually eliminates all system faults due to logic reference

differentials, such as cut-offs, network integrity failures, and memory transients by removing the effects of ground noise from the circuitry.

It is not necessary to isolate the cabinets from the floor and building structure. However, the customer may do so, if desired.

WARNING
Isolation from external grounding systems
With this isolated grounding design, external devices, such as MAP workstations, printers, modems, and trunk interfaces (digital carrier), should also be isolated from external grounding systems.

System performance

The specific power and environmental statistics for the remote cabinets are described in the following paragraphs.

Power consumption

The remote cabinets operate in the voltage range, –42 to –56 V DC.

The maximum power requirement for the remote cabinets at –48 V DC are given below by module:

- Meridian cabinet remote module (MCRM-S) 23A
- Meridian cabinet line module (MCLM) 20A
- Meridian cabinet digital module (MCDM) 18A
- Meridian cabinetized remote unit (MCRU) 20A
- Meridian cabinet line module enhanced (MCLME) 30A
- intelligent peripheral equipment cabinet (IPEC) 27A

Note: Although supported in the field, the MCDM is manufacturer discontinued (MD).

Environmental requirements

The following temperatures and relative humidity conditions are based on a maximum duration of 72 continuous hours and a total duration of 15 days each year. The maximum rate of temperature excursion should not exceed 1 degree Celsius a minute.

The minimum, maximum, then recommended values are given sequentially for each of the conditions listed.

- temperature—5C, 49C, 10-30C
- relative humidity—20%, 80%, 10-50%
- The atmospheric pressure should be at least 23.44 in Hg, corresponding to a maximum altitude of 7000 ft (213.4 m).

Battery backup

Battery backup can be provided in 4- or 8-hour increments. Batteries are the 20-year sealed cell type, mounted in an open frame. Battery capacities for the remotes are as follows:

The following list gives the 4-hour backup followed by the 8-hour backup each number of cabinets:

- 1–3 cabinets Model 50A4 Model 50A8
- 4–6 cabinets Model 100A4 Model 100AB
- 7–8 cabinets Model 150A4 Model 150A8

Remote cabinet components

This chapter briefly discusses the components of the Meridian cabinet remote unit (MCRU), the remote power cabinet, and Meridian cabinet remote module-second series (MCRM-S).

Meridian cabinet remote unit (MCRU)

The MCRU serves as an interface between remotely located subscriber lines and the Meridian SL-100 host. The MCRU is connected to the host either directly through DS-1 links or through MCRM-S connected to the host.

MCRU description

Each MCRU supports up to 640 lines (depending on traffic), providing the same line quality as the Meridian SL-100 host.

The MCRU provides an interface for the following types of equipment:

- 500/2500-type telephone sets
- electronic telephone sets (ETS)
- low-speed data units (LSDU)
- high-speed data units (HSDU)
- personal computer (PC) interfaces
- asynchronous interface line units (AILU)
- RS-422-compatible devices
- Integrated Services Digital Network (IDSN)/NI-1 compliant devices when used with the ISDN line drawer for remotes (ILDR)

These devices connect to the MCRU by plug-in line circuit cards. Each telephone set or data device has its own line card in the MCRU. This allows replacement of a faulty card without interruption of service to another line. The MCRU sends control data and digitized voice information from the subscriber to the line trunk controller (LTC) at the host site.

MCRU cabinet components

The MCRU is a single cabinet, supporting up to 640 lines. If –48 V power is not locally available, an optional power cabinet can be supplied for powering up to eight MCRU.

Starting at the bottom, the MCRU cabinet contains the components described in the following paragraphs.

Cooling unit

The cooling unit provides forced air cooling with a 2-speed fan. The fan normally runs at low speed to minimize noise. If a condition of thermal stress occurs, the fan switches to high speed.

Line concentrating array (LCA)

The LCA occupies two shelves and provides 640 line cards (320 lines for each shelf). Each shelf has its own central control (CC) If one CC fails, the CC in the other shelf assumes control, serving all 640 lines, but with limited call processing capacity.

Host interface equipment (HIE)

The HIE supports DS-1 host link interface packs, ringing generators, emergency stand alone (ESA) hardware (optional), and two link control cards (LCC) which control the DS-30A links to each line concentrating module (LCM) shelf.

Remote maintenance module (RMM)

The RMM supports metallic test access (MTA), incoming/outgoing test trunks, multi-line test unit (MTU), scan and signal distribution (SD) points, and DIGITONE receivers for ESA (optional).

Frame supervisory panel (FSP)

The FSP distributes and controls power and alarms in the cabinet.

Remote power cabinet

The optional power cabinet provides power for up to eight MCRU. The cabinet is wired for alternating current (AC) input, –48V direct current (DC) output, maximum current capacity of 200 A, alarms, and two, three, or four rectifiers.

Remote power cabinet description

The power cabinet is equipped with a meter, control, and alarm panel that

- monitors load voltage and current
- activates an alarm in the event of abnormal operating conditions
- contains provisions for testing and adjusting the alarm and control circuits

Remote power cabinet components

The optional power cabinet contains the components described in the following paragraphs.

Rectifiers

The number of rectifiers required for different sizes of configurations is as follows:

- two rectifiers required for 1–3 MCRUs
- three rectifiers required for 4–6 MCRUs
- four rectifiers required for 7–8 MCRUs

Control panel

The control panel provides meter control, low voltage disconnect, and alarm monitoring.

Fuse panels

The number of fuse panels required for different sizes of configurations is as follows:

- one fuse panel required for 1–6 MCRUs
- two fuse panels required for 7–8 MCRUs

Cooling unit

The cooling unit provides forced air cooling with a 2-speed fan. The fan normally runs at low speed to minimize noise. If a condition of thermal stress occurs, the fan switches to high speed.

Meridian cabinet remote module-second series (MCRM-S)

The MCRM-S is a large capacity remote, supporting up to 4006 Meridian cabinet line module (MCLM) lines: 3585 at 7.4 CCS plus 421 at 6 CCS. An MCRM-S acts as a remote LTC, which supports up to 3781 plain old telephone service (POTS) lines, up to 960 ISDN lines, or 3072 intelligent peripheral equipment (IPE) lines. When more than 3072 lines are required at a remote site, multiple MCRM-Ss are used.

MCRM-S description

The MCRM-S supports any combination of analog, digital, data, or ISDN terminals, up to the traffic capacity limit of the remote cluster controller 2 (RCC2). Digital terminals provide a cost-effective means of integrating desk-top voice and data services. No additional equipment or hardware changes are required in the MCRM-S when digital sets are equipped for data service.

Direct trunking to the local public telephone network can be provided on a limited basis. Up to four trunk packs can be provisioned. Digital trunks (DS-1) can be provisioned in place of line peripheral ports.

The MCRM-S is a single lineup of cabinets consisting of one MCRM-S plus the number of MCLMs, MCLM-Es, IPECs, and MCDMs needed to meet the customer's telephone/terminal requirements.

For a description of the MCLM and MCDM, refer to the *Cabinetized General Description*.

MCRM-S cabinet components

The MCRM-S cabinet contains the core equipment for the MCRM-S. The MCRM-S contains the components described in the following paragraphs.

Power distribution panel

The PDP supplies power to all other cabinets in the line-up.

Cooling unit

The cooling unit (fan) provides forced air cooling with a 2-speed fan. The fan normally runs at low speed to minimize noise. If a condition of thermal stress occurs, the fan switches to high speed.

Extension shelf

The extension shelf provides the capability for additional DS1 or D-channel handler (DCH) cards to support an expanding configuration as necessary.

Enhanced remote cluster controller (RCC2)

The RCC2 occupies one shelf and provides the control and switching functions for the MCRM-S. The RCC2 interfaces to the LTC at the host through three to sixteen DS-1 links. It interfaces to trunks, other remotes, or to a second RCC2 for up to 16 interlinks.

Remote maintenance module (RMM)

The RMM contains the service circuits for the MCRM-S. It provides the capability to perform line testing, diagnostics, and alarm monitoring at the remote site.

Frame supervisory panel (FSP)

The FSP distributes and controls power and alarms in the cabinet.

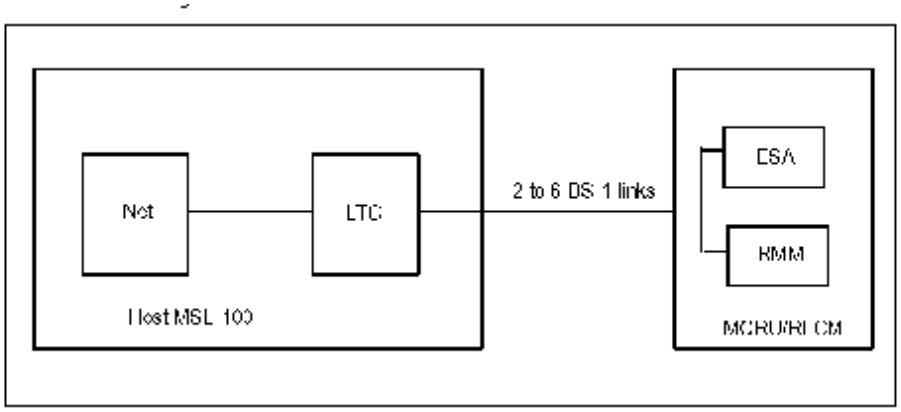
MCRU/RLCM configuration

The Meridian cabinet remote unit/remote line concentrating module (MCRU/RLCM) consists of two units: the interface to the MSL-100 host, and the Line concentrating module (LCM). The MCRU is a cabinetized version of the RLCM.

The Meridian cabinet remote unit/remote line concentrating module (MCRU/RLCM) consists of two units: the interface to the Meridian SL-100 host, and the Line concentrating module (LCM). The MCRU is a cabinetized version of the RLCM.

The MCRU/RLCM provides an interface between remotely located subscriber lines and an Meridian SL-100 host. A single MCRU/RLCM provides services for up to 640 lines, including DATAPATH. A typical MCRU/RLCM configuration the following Figure. The MCRU/RLCM supports the same line cards as the LCM in the host Meridian SL-100. It is possible to assign mixed combinations of plain old telephone service (POTS) electronic telephone set (ETS) and data line cards to the same line drawer (LD) in the remote configurations. Integrated Services Digital Network (ISDN) can be offered from the MCRU with software release MSL07 by way of ISDN line drawer remote (ILDR), which only supports U-loop line cards.

Figure MCRU/RLCM configuration



Advantages

The MCRU/RLCM satisfies the following objectives:

- provide growth capability with a small footprint
- provide intraswitching capabilities
- provide for Emergency Stand Alone (ESA) operation
- extend sophisticated integrated business network (IBN) features and services beyond the immediate service area of the host Meridian SL-100
- serve, if necessary, as a viable remote private branch exchange (PBX)
- eliminate the need for feeder cables
- supports ISDN/NI-1 features with the ILDR at remote locations

The cabinetized MCRU/RLCM provides a cost and time savings to the customer because:

- on-site assembly and testing of electromagnetic interference (EMI) hardware is eliminated
- installation is simplified because of increased compatibility with building dimensions
- need for external earthquake bracing is eliminated
- compatibility with current MCRU/RLCM configuration, diagnostics and engineering is maintained

Host interface

Interface between the various types of MCRU/RLCM and the Meridian SL-100 host is through standard DS-1 links. A maximum of two time slots are reserved for call processing, administration, and maintenance functions. There is full access from any line card in the remote to any channel on any of the DS-1 links. A minimum of two primary links for the MCRU/RLCM are required. Depending on traffic requirements, the quantity of links may be increased to a maximum of six for the MCRU/RLCM.

The DS-1 links are terminated on a LTC at the host MSL-100. All links from a given MCRU/RLCM must terminate on the same LTC. To facilitate efficient engineering, it is possible to mix host line peripherals and remotes on the same LTC.

The maximum distance of the MCRU/RLCM from the Meridian SL-100 host office is 150 miles (240 km). A maximum distance of 100 miles

(160 km) applies to conform with the 0 dB loss plan, without external devices.

At the MCRU/RLCM, the links are terminated on DS-1 interface cards (NT6X50) located in the host interface equipment (HIE) shelf. At the MCRU/RLCM configuration MCRM-S, the links are DS-1 interface cards (NTMX81) found in the RCC2. Messaging links should terminate on different DS-1 interface cards at both the host Meridian SL-100 and remote locations, thereby increasing reliability.

Two DS-1 channels for the MCRU/RLCM are required for signaling to the Meridian SL-100 host. The two message channels occupy the first channel on each of the two primary DS-1 links. If the system is equipped with the ESA option, the ESA processor requires two additional message channels. These additional channels occupy the second channel on each of the two primary DS-1 links. All other channels are available to the subscribers.

Traffic capacity

The MCRU/RLCM is designed to be economical, while allowing for future growth to a maximum of 640 lines at 8 ccs/line with 50 percent intra-remote traffic.

Reliability

All critical elements required for normal system operation are duplicated. This includes the LCM controllers, message channels, and associated interface. This arrangement provides for protection against all single-fault failures.

The MCRU/RLCM has control duplication. When a failure of one controller occurs, the mate controller is capable of automatically taking over the control functions of both controllers. There is no interruption of calls in the talking state during a controller takeover. Calls in the ringing or tone state are also maintained during these takeovers. The fault recognition and takeover period is a maximum of one second, so that there is no noticeable loss of service.

The MCRU/RLCM maintains diagnostics during control takeovers. it also maintains data required for billing and operational measurements (OM).

The predominant cause of MCRU/RLCM failures is frequent cable cuts. Diverse routing of the DS-1 links is recommended for all MCRU/RLCM installations. In applications where route diversity is not feasible, the ESA feature can provide intracalling capability, in the event of loss of all DS-1 links to the Meridian SL-100 host.

MCRU/RLCM packaging

The MCRU/RLCM is housed in a single bay that contains the following major elements:

- frame supervisory panel (FSP) that provides 48-volt distribution breakers, talk jacks, fuse alarm features.
- single shelf remote maintenance module (RMM) that supports metallic test access (MTA), incoming/outgoing test trunks, line test unit (LTU), scan and signal distribution (SD) points, and DIGITONE receivers (RCVRDGT) for Emergency Stand-Alone (ESA) operation.
- host interface equipment (HIE) shelf that supports DS-1 interfacing, link control, ESA processor and memory.
- standard dual shelf LCM that supports up to 10 line drawers of up to 64 lines each.
- Optional, MTU is required to support Integrated Services Digital Network (ISDN) line drawer remote (ILDR) if installed in the LCM.

Remote maintenance module

The remote maintenance module (RMM) occupies one shelf and is similar in configuration to the maintenance trunk module (MTM). The exception is that the RMM operates with a pair of DS-30 links to the LCC instead of the pair of DS-30 speech links to planes 0 and 1 of the network.

Also, there are two differences in the control and processor cards. The two DS-30A links ensure that the RMM is operable regardless of which line control card (LCC) is active.

The RMM can accommodate up to 14 service circuit cards. The cards are selected from a variety of types to meet the office requirements. Some of the service cards in an RMM are dedicated to performing MTA functions, which consist of

- MTA–applies operating signals to the remote MTA, as instructed by commands from the host MSL-100, through port 7 of the LCC.
- remote MTA–consists of a 2-wire metallic matrix with four horizontal buses and eight vertical. One horizontal bus is connected to the MTA bus for the 320 line circuits in LCA-0. Another is connected to a similar MTA bus in LCA-1. Two of the horizontal buses are

unused. The vertical buses are connected to service circuits or spare line circuits.

- line test position (LTP) monitor–provides an interface from an analog test trunk to an LTP where talk monitoring and other tests can be performed.

Connections for selecting a line circuit, applying tests to it, and displaying the results are made by the DS-30A links to the LCC, and hence through the DS-1 links to the MSL-100 host. At the Meridian SL-100, peripheral maintenance is performed using the MAP terminal.

Power requirements

The MCRU/RLCM requires a power source with a nominal level of –48 V (direct current) DC; maximum level of –55 V DC, and a minimum level of –42.5 V DC. All other required voltages are obtained from DC-DC converters located within the bay. The maximum current input requirement for a RLCM bay is 20 amps at –48 V DC.

Host interface

The host interface equipment (HIE) is housed on a separate shelf and consists of two or three DS-1 interface cards plus two link control cards, that control the DS30A links to each of the LCM shelves.

Each DS-1, 6X50, interface accepts two DS-1 links from the distant Meridian SL-100 host office line trunk controller (LTC) and interfaces them on six links to the LCC. The LCC, in turn, operates the Line Concentrating Array (LCA). When both LCCs are in-service, and under normal conditions, LCC-0 operates LCA-0 and LCC-1 operates LCA-1. LCC-0 services the even-numbered links (0, 2, 4) and LCC-1 services the odd-numbered links (1, 3, 5). If either LCC becomes inactive, the mate LCC takes over and services all six links through duplicated paths from the inactive LCC.

The LCC accepts DS30A links that provide intershelf (IR) channels (one link) and one link to the RMM from each LCC. Each LCC is connected to its LCA using eight DS30A ports (0-7) that operate as follows:

- Port 0, the primary port, carries the LCA shelf message channel 1 that is mapped onto the channel 1 of each of the two DS-1 links to the host. A minimum of two DS-1 interface cards must be provisioned, with one primary link terminated on each card, for reliability. Other channels carrying speech are mapped onto

channels 2 to 24 of the primary DS-1 link or used for intrashelf (IA) calling channels between the LCA.

- Ports 1 and 2 are used to carry speech channels from the other two DS-1 links, if provisioned, or additional IA channels, if the links are not used.
- Ports 3, 4, and 5 are normally inactive. These ports become active if the mate LCA and LCC are inactive and takeover occurs. Port 3 takes over mate port 0. Port 4 takes over mate port 1. Port 5 takes over mate port 2. The mapping of all channels to the DS-1 links is maintained, and the active LCC takes control of all DS-1 links.
- Port 6 provides a DS30A link for IR connections. During call processing, the channels on this port are used for two purposes:
  - — intracalling (IAC): providing IR connections between subscriber lines on different shelves of the same RLCM, without using the Meridian SL-100 host network. Connections between subscribers on the same shelf are handled through IA links within each LCC.
  - — Link sharing: allowing a subscriber line on one LCA to have access to a DS-1 channel to the MSL-100 host office, when the channel is controlled by the mate LCA and LCC.
  - — Port 7 provides duplicate DS30A links for access (one for each LCA) to RMM. If the RMM is not provisioned, this port is not used. Through the RMM ports, individual line circuits can be selected and MTA connections can be made to their tip and ring leads for test purposes.

LCM configuration

The LCM consists of a two-unit configuration, with each shelf having its own central control (CC), consisting of an LCM processor and digital group (digroup) control, as well as its own power converter. In normal operation each shelf provides one to three ports for the DS30A links to the LTC 30 to 90 speech channels. The digroup control outputs ten 32-channel digroups to the bus interface (BI) in ten line drawers (LD). Each of the three ports on both shelves is duplicated by normally-inactive duplicate ports that accept links from the mate shelf. Both shelves are in service during normal operation, with each shelf controlling 320 line circuit cards. Each LD receives two 32-channel digroups, one from the digroup control in its own shelf, and one from the digroup control in the mate shelf.

The BI card operates two subgroups of 32 line circuit cards, each of which is connected to an analog line. This gives each LD a capacity of

64 lines. Connections between lines connected to shelves of the same LCM are made through IAC on the 2-port interunit communication link.

The ten LDs in the two shelves are identified as LD-0 to LD-4 in the lower shelf, and LD-5 to LD-9 in the upper shelf. This gives a total line interface capability of 640 lines for both shelves of an LCM.

If one CC fails, the CC in the mate shelf assumes control and serves all 640 lines on both shelves using the three normally inactive DS30A ports, as well as its own active ports. A single power converter is capable of supplying power and applying ring voltages for both shelves. In the takeover mode, call processing capacity is reduced because only one digroup is available to each LD. Calls in the process of being connected at the time of takeover are terminated and must be re-dialed. Calls already connected and in progress are retained

There is a minimum of two DS30A ports for the two shelves of an LCM.

Each of the two buses carries one message channel to the LTC. A total of six ports can be accommodated on each LCM, depending on the traffic capacity and concentration required. This allows for a total of 60 to 180 speech channels. Two additional DS30A ports are used for interunit links. The number of ports used by a group of LCMs affects the relationship with their associated LTC. The total number of LCM ports on any one LTC cannot exceed 20.

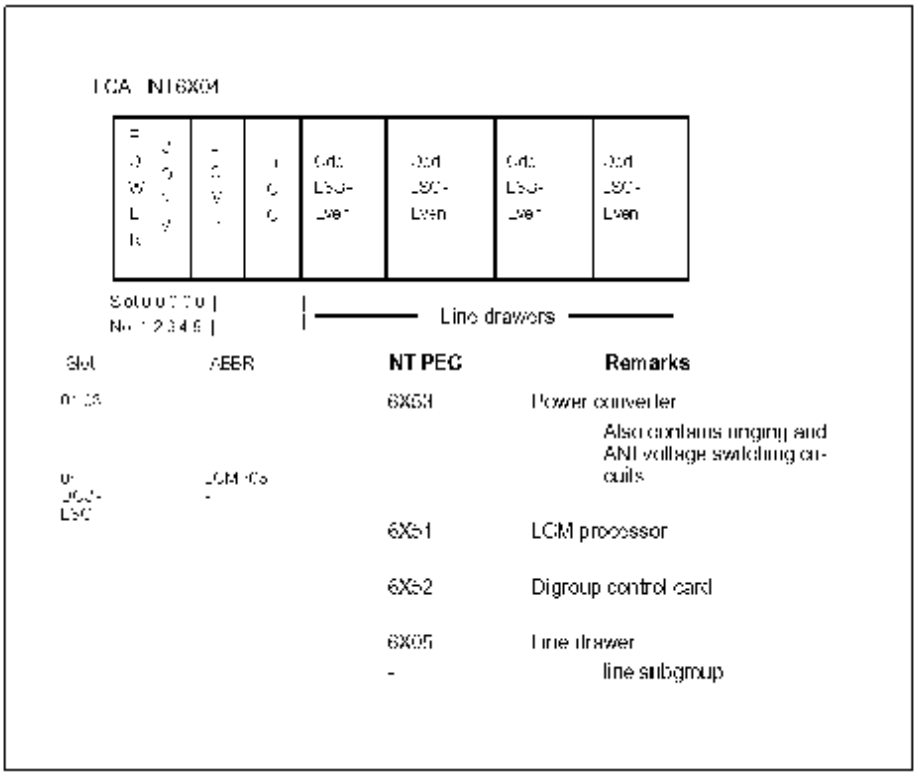
LCM frame and shelf layout

LCMs are housed in a standard Meridian SL-100 single-bay line concentrating equipment (LCE) frame. Each frame contains two LCMs, consisting of two shelves for each LCM. The LCM shelves are referred to as LCAs. The baffle and fuse panels above each LCA allow air circulation for convectional cooling, and carry sets of five +5 V and –48 V fuses for the LD. A pair of fuses for ring voltage output (RA, RB) are also found at this location.

The LCE frame also contains an FSP that provides power control and alarm circuits for both LCM, and for two ring generators (RG-0, RG-1). The bottom LCM (LCM-0) uses RG-0, and the top LCM (LCM-1) uses RG-1. In the event of a failure of either RG circuit, the remaining circuit is available for both LCMs.

A typical LCA shelf layout is illustrated in the following Figure. The power converter card at the far left occupies slots 01-03. The control complex cards are in slots 04 and 05, with the LD occupying the remainder of the shelf.

Figure Line concentrating array

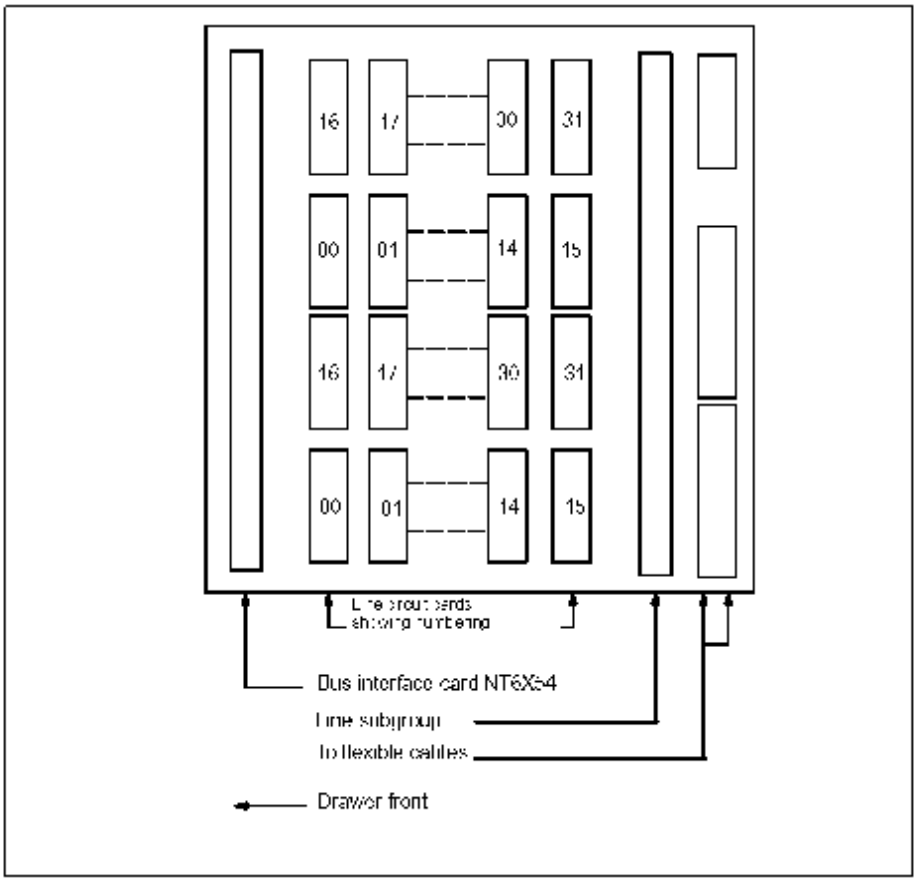


The power converter contains circuits for converting –48 V battery to regulated +5 V +15 V output for the shelf circuitry and relay circuits. These relay circuits control application of ringing from the RG to the LCM line circuits. Power connections to the two shelves of an LCM are arranged so that one converter can supply both shelves, in the event that its mate converter fails.

LD layout is shown in the following Figure. The LD can be pulled out from the frame for access to the circuit cards, while remaining in operation. This is due to the use of a flexible cable connection from the card to the rear of the receptacle.

The BI card is located at the front of the LD, behind the front faceplate.

FigureLine drawer layout



In addition to providing an interface between two the 32-channel digroups and the 64 line circuits, the BI card performs the following functions:

- scans line circuits for hook switch change or message present
- sends signals through a ringing multiplexer to control the relays in the power converter which selects ringing
- monitors LD activity circuit for maintenance purposes
- performs digital looparound on command from the maintenance system.

Line subgroups (LS) are located in four rows behind the BI card. For circuit identification purposes, the individual circuits are numbered by LS and LC numbers. LS numbers range from LS-00 to LS-19. LS-00 are the lower two rows of LC in LD-0. LS-19 are the upper two rows of LC in LD-9. LC numbers range from LC-00 to LC-31. The position of

LC-00 is assigned to a type A line card, which is used for analog ringing test purposes, and is therefore not available for connection to a subscriber line.

LCs are available in several types, their characteristics vary so that different types of analog or digital telephone equipment can be operated with the LCM. Present LCs and their product engineering code (PEC) are as follows:

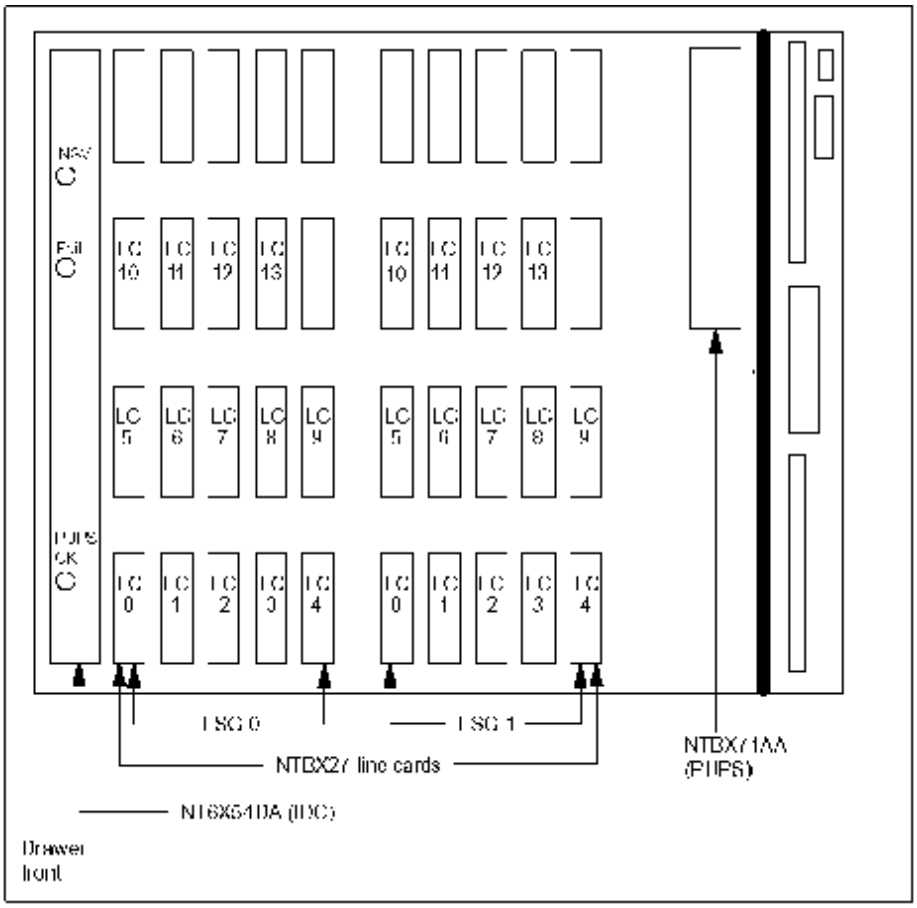
- Standard line card type A (NT6X17) operates with lines connected to single-line analog telephone sets (500 or 2500). It also has a takeover control circuit.
- Line card type B (Coin) (NT6X18) operates with analog pay telephone sets, requiring coin control, plus single-party, 2-party, or multi-party analog sets.
- a p-phone line card (NT6X21) operates with electronic multiline telephone sets and operator consoles.
- a data line card (NT6X71) provides data transmission for operation with computer terminals. The data line card (DLC) occupies two adjacent LC positions.
- a message waiting line card (NT6X19) provides all the features of the type A LC plus the message-waiting lamp driver card. When this circuit is activated, it causes the message-waiting lamp on the associated telephone set to flash at 1 Hz.
- a message-waiting converter (NT6X20) provides –150 V synchronized pulse for the message-waiting lamp circuit. The converter is synchronized from the 2.56 MHz clock pulse in the LCM.
- an ISDN u-loop (NTBX27) is supported with ILDR only.

ISDN support

For ISDN support, the ILDR can be used with the MCRU/RLCM.

The ILDR supports up to 28 basic rate interface (BRI) ISDN line cards (NTBX27) and the ISDN Drawer Controller (IDC) (NT6X54). The IDC is an interface card that also provides a D-channel handler and maintenance functions for each line card in the drawer. The following Figure illustrates the layout of the ILDR.

FigureISDN Line drawer for remote layout



Communication between the IDC and the host peripheral is by means of two DMSX (DMS proprietary protocol) channels. These channels terminate at the IDC on the drawer-side and at the Enhanced remote cluster controller (RCC2) of the host peripheral on the C-side. These DMSX channels are independent of the channels used by the LCM processor to communicate with the host peripherals. The IDC DMSX channels are used for

- downloading code and data to the IDC
- sending Q.931 signaling messages between the terminal and host peripheral
- sending maintenance and provisioning messages to the IDC
- downloading parameters to ISDN terminals

MCRM-S configuration

The Meridian cabinet remote module-second series (MCRM-S) is designed to meet the customer's requirements at the remote site. The basic MCRM-S is a single lineup consisting of one MCRM-S and multiple intelligent peripheral equipment cabinets (IPEC) and Meridian cabinet line modules/Meridian cabinet line module enhanced (MCLM/MCLME) as required to meet the customer's requirements at the remote site. The Meridian cabinetized remote unit (MCRU) can also be configured as "remote-off-remote" from the MCRM-S, as required. The MCRM-S size range can vary support up to 4006 analog lines or up to 960 digital lines (assuming normal PBX traffic rates).

MCRM-S is functionally much the same as the remote switching center (RSC). For example, like RSC, MCRM-S is available with or without Integrated Services Digital Network (ISDN). MCRM-S requires the same basic call processing software used by an RSC. However, MCRM-S is different in that it is a single cabinet enhanced version of the RSC product.

The traffic capacity of the MCRM-S is follows:

- all ISDN lines: 2400 at 11.4 CCS
- all intelligent peripheral equipment (IPE) lines: 1792 at 9.8 CCS plus 1280 at 6.2 CCS
- all MCDM lines: 1120 at 15.8 CCS plus 800 at 10.0 CCS
- all MCLME plain old telephone service (POTS): 3360 at 7.9 CCS plus 421 at 6.0 CCS
- all MCLM lines: 3585 at 7.4 CCS plus 421 at 6.0 CCS

Note: Although still supported, the MCRM is manufacturer discontinued. The MCRM-S replaces the MCRM. The MCDM is manufacturer discontinued. The IPE replaces the MCDM

MCRM-S benefits

The MCRM-S provides the following benefits:

- national ISDN-1
- service equivalency and transparency
- network planning flexibility
- capacity
- network survivability
- tariff advantages
- operation, administration, and maintenance (OA&M) cost reduction
- common hardware and software with the Meridian SL-100 host

MCRM-S packaging

The way the MCRM-S cabinet and its individual components are configured determines the services that the MCRM-S offers. The primary components of the MCRM-S are the remote maintenance module (RMM), the EXT shelf, and the enhanced remote cluster controller (RCC2). The MCRM-S components are provisioned on shelves rather than on the equipment frames. The MCRM-S is based on the RCC2 that acts as the master controller for all peripherals of the MCRM-S. The RCC2 is a single-shelf, module with increased processing capabilities. An MCRM-S extension shelf is available to house additional ISDN channel handlers or DS-1 interfaces.

Single-cabinet MCRM-S configuration

The MCRM-S is a single-cabinet RSC that supports service and maintenance circuits and DS-1 links to the host at a maximum distance of 100 miles.

A single-cabinet MCRM-S has one RSC cabinet with the following:

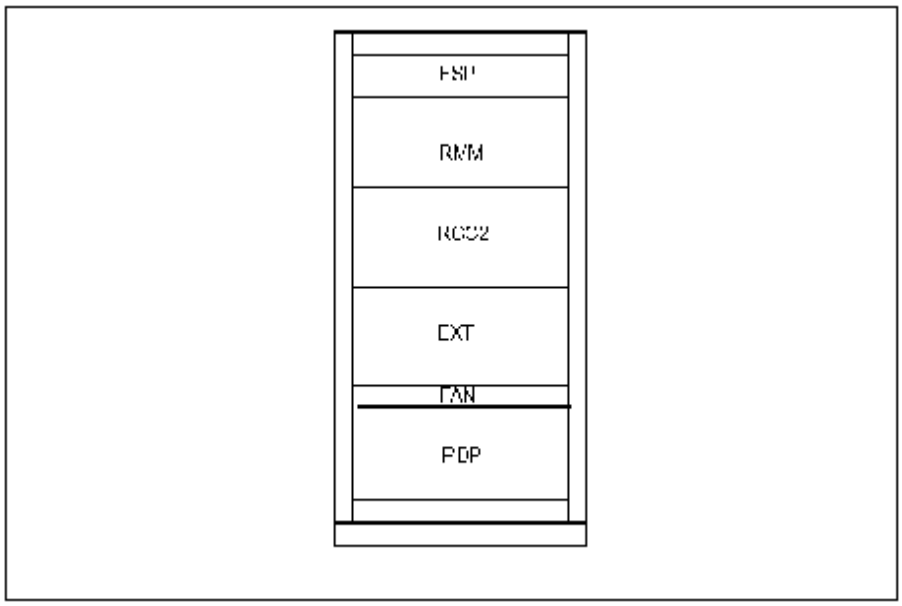
- one frame supervisory panel (FSP)
- the RMM, which served by dedicated DS30A links provides maintenance and service circuits
- one master controller RCC2 shelf (always provisioned)
- one EXT shelf
- one cooling unit
- one PDP shelf

The single MCRM-S central-side (C-side) interfaces are DS-1 links to a line trunk controller (LTC) host peripheral.

Provisioning options for the single-cabinet configuration include the Peripheral-side (P-side) DS-1 links for trunking and the C-side links for communication with the host.

The following Figure shows the cabinetized MCRM-S shelf layout.

FigureCabinetized MCRM-S shelf layout



Frame supervisory panel (FSP)
The FSP is used for power, control, and alarm circuits.

Remote maintenance module (RMM)
The RMM is based on the DMS-100 Family maintenance trunk module (MTM). The RMM performs diagnostic and line tests and monitors for alarm conditions. One DS30A P-side port is dedicated to the RMM.

The RMM may contain the following:

- one RMM control card
- one group coder-decoder (CODEC) card
- two power converters
- up to 14 service circuit cards, including scan, signal distribution (SD), metallic test access (MTA), test trunk, and line test unit

Enhanced remote cluster controller 2 (RCC2)
The MCRM-S is based on the RCC2, which acts as the master controller for all peripherals of a MCRM-S configuration. The RCC2 controls associated MCLM, RMMs, remotes, and Meridian cabinet digital modules (MCDM) as directed by the host.

The RCC2 is the remote office unit of the common peripheral module (CPM). The RCC2 is single-shelf, 68020-based module. This single shelf contains units 0 and 1. To ensure reliability, RCC2 units 0 and 1 run in an active/standby mode of operation

The RCC2 shelf contains the following:

- duplicated RCC2 processor cards containing a 68020-based processor
- duplicated expanded time switch, a high capacity switch matrix
- duplicated messaging interface circuit packs, which contain the interface to both C-side and P-side message channels
- duplicated power converters to power the above circuit packs
- a pulse code modulation (PCM) signaling card supporting all low level PCM signaling tasks
- DS-1 interface cards (eight DS-1 links per card) for host-directed DS-1 links for P-side link requirements
- a DS30A interface card that provides 32 DS30A links for interfacing to the enhanced line module (ELM) in a MCLM and RMMs located on another shelf of the MCRM-S
- a choice of universal tone receiver (UTR), class modem resource (CMR), DCH, or ISDN Signaling Preprocessor (ISP) service circuit packs

The RCC2 houses MCRM-S processor/memory cards for both normal and Emergency Stand-Alone (ESA) modes. In addition it contains time switches, tone generators, and power converters. The RCC2 also supports UTRs for lines and trunks in normal and ESA modes.

In addition, the RCC2 provides local switching for the following:

- host-directed calls [connects MCLM, MCDM, DS-1 trunking, MCRU, and data line card (DLC) channels to host-directed DS-1 channels]
- line and trunk calls internal to the MCRM-S and its subtending remotes (supported under the intraswitching feature)
- intraswitched calls during ESA (supported if the ESA feature is implemented)

This is accomplished through a total of 16 C-side ports and 54 P-side ports that support all the features of the existing RSC and RSC with ISDN and with increased capacity.

The RCC2 peripheral allows for C-side to P-side, P-side to C-side, P-side to P-side, and C-side to C-side connections. The C-side ports support host-to-remote capabilities.

The RCC2 performs the following termination functions:

- C-side links from the host LTC (for DS-1 electrical links), with a maximum of 16 DS-1 links, providing a maximum of 384 channels
- DS-1 links from the mate RCC2 in a dual configuration
- P-side DS30A links from RMMs
- P-side DS-1 links used for digital connectivity to MCRUs in the remote-off-remote configuration
- P-side DS-1 links

Extension shelf

The EXT increases the capacity of the RCC2**.** The hardware requirement to support 54 ports is greater than the physical capacity of the RCC2; therefore, the EXT shelf was developed. This shelf houses additional ISDN D-channel handlers or DS-1 interfaces.

The EXT provides room for additional DS-1 interfaces, as well as DCH packs. The EXT requires the DS60 pack, which provides twelve DS60 links to the RCC2 shelf.

The EXT shelf provides additional DS-1 links or supports additional DCHs to accommodate ISDN line requirements. This shelf works in conjunction with the RCC2 shelf. It is connected to the RCC2 shelf by a DS60 Plus power pack.

Mounted on the MCRM-S, the EXT shelf houses the following:

- 0 to 3 octal DS-1 interface cards (up to 24 DS-1 links)
- 0 to 10 DCH cards
- DS60 extension cards

Power distribution panel (PDP)
The PDP contains the power supply. It is located on the bottom shelf of the cabinet.

Multicabinet MCRM-S configuration
The cabinets and their components are described separately in the following list. These cabinets are not part of the MCRM-S. However, they each support MCRM-S operations.

A multicabinet MCRM-S configuration may include the following cabinets:

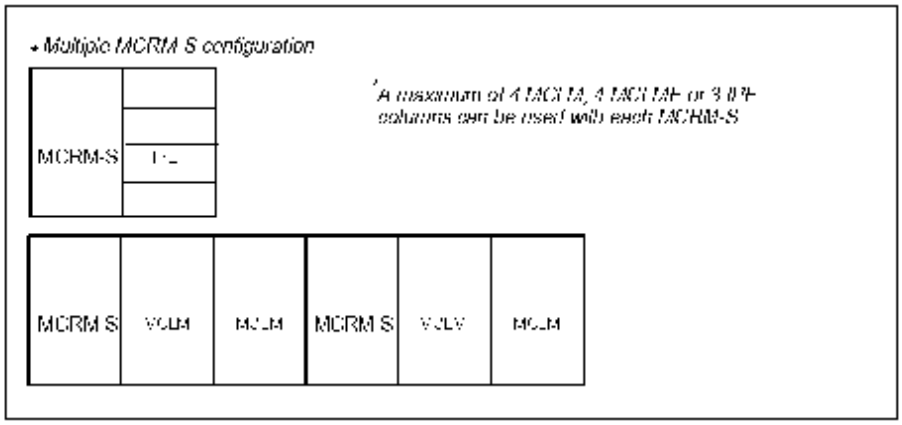
- Intelligent peripheral equipment (IPE)
- Meridian cabinet line module (MCLM)
- enhanced line concentrating module (MCLME)
- Meridian cabinet spares storage (MCSS)

The following provisioning options are also available for the multicabinet configuration:

- P-side DS-1 links for trunking
- C-side links for communication with the host

The following Figure shows samples of small, single, and multiple MCRM-S configurations.

FigureExample MCRM-S configurations



IPE

The IPE hardware has a different look than the MSL-100 cabinets. The Meridian SL-100 is an enclosed cabinet consisting of four shelves. On the other hand, the IPE uses a stackable module that is mounted on a pedestal and can be stacked up to four modules high depending on the amount of lines required. The module contains an Meridian SL-100 controller card (MCC) and 16 slots available for digital or analog lines. The MCC provides the primary interface and control functions for the IPE. The MCC receives messages from the RCC2 and terminating devices such as terminals and sets.

MCLM

The MCLM serves as the subscriber interface of the MCRM-S for lines. The MCLM contains two enhanced line concentrating modules (ELCM) or Line Concentrating Modules (LCM). The MCLM is used for POTS applications and is connected to the RCC2 by DS30A links. The MCLM supports up to two ISDN line drawer remotes (ILDR).

MCLME

The MCLME provides access for most existing LCM line types. The MCLME with 2B1Q ISDN format is a cabinet which houses two dual shelf LCME modules. Each LCME module houses eight 2B1Q type line drawers. Each line drawer has 60 available slots.

Additional MCLMs/MCLMEs are connected to the P-side of the RCC2 through DS30A links. The actual number of DS30A links for either MCLM or MCLME is engineered in accordance with the traffic requirements of the operating company.

MCSS

A single-configuration MCRM-S may contain an MCSS cabinet for spare card storage.

Dual RCC2 configuration

The remote switching center-Ssecond series (RSC-S) is the largest member of the remote family of systems offered by Nortel. Any RSC-S provides interface capabilities for a large number of analog lines, digital lines (or both), and digital trunking at a remote location. The RSC-S is designed in two separate configurations: a single RSC-S and the dual RSC-S. The single RSC-S, as described previously in this document, provides 6000 or more lines. The dual RSC-S configuration doubles this capacity by offering 12,000 or more lines, but still performs as one logical unit.

Note 1: Pertaining to the acronym RSC-S, S designates that this is a second generation product.

Note 2: Meridian cabinet remote module (MCRM), remote switching center (RSC), and remote cluster controller (RCC) are manufacturer discontinued (MD) but are supported in the field. The MCRM, RSC, and RCC are replaced by the Meridian cabinet remote module-second series (MCRM-S), (RSC-S), and remote cluster controller 2 (RCC2), respectively.

A single RSC-S contains one remote maintenance module (RMM) and up to nine line concentrating modules (LCM). However, the dual RSC-S configuration contains twice the number of shelves and modules. The dual RSC-S collocates two separate RSC-S (within 200 meters of each other) connected by two to six DS-1 links. These DS-1 links between the RSC-S are also called interlinks.

MCRM-S configurations

The dual RCC2 configuration also contains up to 60 links or intelligent peripheral equipment (IPE) or both served by 2 to 6 DS-30A links each

and up to 40 digital trunks. Table 6-1 compares the system capacity between single and dual RCC2 configurations.

Capacity differences between single and dual RCC2 systems

Parameter	Single RCC2	Dual RCC2
Traffic capacity (ccs)	15,000	30,000
Maximum POTS lines (at 3.5 ccs)	6,400	12,800
Maximum IBN lines (at 7.0 ccs)	2,000	4,000
Maximum line terminations	4,608	9,216
Maximum P-side trunks	8	16

Host interface

An RSC-S connects to the host through a maximum of 16 DS-1 links for each RCC2. These links connect the RCC2 to the line trunk controller (LTC). One LTC for each RCC2 is required in the host. (The host LTC does not interface with a second RCC2.)

The host interface is essentially the same as for the single RCC2 configuration. The following Figure shows an example of a dual RCC2 configuration and its connections to the host.

Intraswitch calls

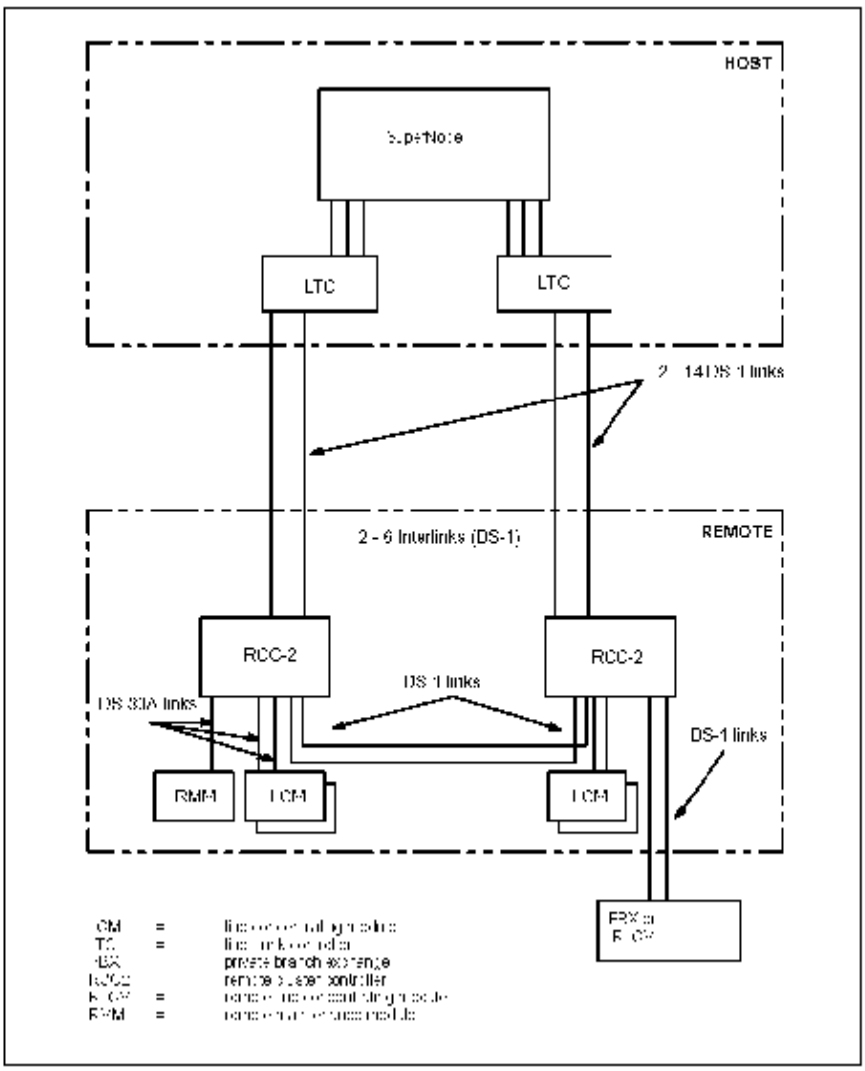
The dual RCC2 allows calls originating on one RCC2 to be routed to the intraconnected RCC2 once the call is set up. This capability is called intraswitching. Intraswitching occurs when a subscriber goes off-hook to make a call, and the system obtains a DS-1 link to the host. After the host determines that the call is to a subscriber off of the intraconnected RCC2, the system drops the host channel and uses an intralink channel.

The single RCC2 cards (NT6X50) that handle communication with the host, NTMX81 and NTMX73, also handle communication between RCC2s in the dual configuration. Ports 0 and 2 on the NTMX81 cards handle messaging links to the network (channel 1). In the dual RCC2, p-side ports 0 and 8 handle the messaging links between the two RCC2s (channel 2). The dual RCC2 requires these two messaging links as a minimum configuration.

The following conditions affect all types of intraswitched calls:

- If all intralink channels are busy or if the intralinks are out of service, the system switches the call through the host network.
- If a feature is invoked during an interswitched call, the call reverts to a network connection.
- If the interlink fails, the system drops all calls on that link.

FigureDual RCC2 configuration example



Line-to-line interswitching

Line-to-line call interswitching involves a call originating from an LCM or RLCM off the first RCC2 and terminating on an LCM or RLCM off the interconnected RCC2.

Some limitations exist for line-to-line calls in the dual RCC2 configuration:

- Line types supported during line-to-line calls include single-party lines, two-party lines, multi-party lines, IBN lines, electronic business set (EBS), and data units.
- If a subscriber invokes a feature during an interswitched call, the call reverts to a network connection.
- The system allows originations from a Multiple Appearance Directory Number (MADN) member to interswitch. However, only the primary directory number (DN) can interswitch on terminations to a Multiple Appearance Director Number (MADN) line.
- The system allows end-to-end signaling on the EBS phone lines while the call is interswitched.

Trunk interswitching

Trunk intraswitching is the ability to connect calls where both subscribers are off the same RCC2. Intraswitching trunks are assigned to intraswitched channels on unassigned C-side ports (dynamic trunks). These trunks retain the assigned ports at all times. If a dynamic trunk requires a network connection, the trunk uses a host channel. The trunk reverts to its assigned channel once the host channel is no longer needed.

In the dual RCC2 configuration, trunk intraswitching is extended to include trunk interswitching. The dynamic trunk is switched from its assigned intraswitch channel to an interswitch channel. Interlink channels between the two RCC2s are dynamically assigned, while the intraswitch channel remains reserved for the trunk. Trunk interswitching between the interconnected RCC2s includes the following call scenarios.

Line to dynamic trunk

A call from a subscriber off the first RCC2 is routed over an interlink to a channel dedicated for a dynamic trunk group off the second RCC2.

Dynamic trunk to line

A call from a dynamic trunk off the first RCC2 is routed over an interlink to a subscriber off the second RCC2.

Dynamic trunk to dynamic trunk

Calls that involve a private branch exchange (PBX) or community dial office (CDO) are interswitched. In this case, the system allows interswitching only for PBX-to-PBX, PBX-to-CDO, and CDO-to-PBX calls.

The following limitations affect interswitched trunk calls:

- If an interswitch channel is not available, the system uses a network channel to complete the call. The system provides channel blocking treatment (tone only) if a network channel is not available.
- If a subscriber invokes a feature during an interswitched call, the call reverts to a network connection. The subscriber receives a tone indicating that the feature request failed if a network channel is not available.
- All trunk maintenance activities require a network connection.
- The system performs interswitching on a trunk-group basis. Each trunkgroup must be unique to a site, and all members of that group must belong to that site. (Trunk groups cannot be spread across the two RCC2s.)

The system supports the same trunk types as supported for single RCC2 trunk intraswitching.

Dual emergency stand alone (DESA) mode

The DESA feature allows interswitched calls between the RCC2s to continue when both RCC2s have lost communication to the host. Both RCC2s also continue to handle their own intraswitched calls.

When the dual RCC2 enters the DESA mode, the NTMX81, NT6X69, and NTMX73 cards perform functions that allow both RCC2s to synchronize and send messages to each other.

Both RCC2s must be synchronized to the same source so that calls can be interswitched between each other. In normal operation, each RCC2 follows the timing of the corresponding host LTC. The timing element, a 125-microsecond frame pulse, is sent to all nodes in the network. Therefore, both RCC2s are synchronized to the same source.

Each RCC2, using the NTMX73 card, generates its own frame pulse. An internal XPM clock controls this pulse and adjusts to the network clock pulse so that the RCC2 is synchronized with the host. When communication to the host is lost, the internal clock for the active unit cannot synchronize with the host and enters free-run mode. The RCC2 can, however, synchronize with another source, the interconnected

RCC2. One of the RCC2s acts as the frame source and sends the frame pulses to the other RCC2 by links 1 and 3.

If one RCC2 goes into ESA, it synchronizes with the other RCC2 (which is still synchronized with the host). Because of this chain synchronization, if the active RCC2 were to enter ESA, dual ESA (DESA) would then be achieved more quickly. Plus, if the RCC2 in ESA were to exit ESA, that exit would be quicker because it is already synchronized with the host through the other RCC2. Interswitched calls are not possible with one of the RCC2s in ESA because the RCC2s are synchronized to different sources.

DESA force down option

A flag in table IRLNKINV enables the DSA force down option. If specified, this option forces an RCC2 into ESA mode if the other RCC2 has already entered ESA mode. When an RCC2 enters forced-down mode, link faults are simulated on its host messaging links (P-side links 0 and 8).

If the RCC2s cannot communicate over the interlinks during DESA with one RCC2 in the forced-down mode, the forced-down RCC2 starts a timer. If interlink messaging is not restored before the timer expires, the forced-down RCC2 stops simulating link faults and exits ESA mode. In this case, interlink communication is restored, and the RCC2 is forced into ESA mode again. However, if the interlink messaging is restored before the timer expires, then the forced-down RCC2 cancels the timer and reestablishes DESA.

The timer helps the RCC2 to avoid exiting forced-down mode due to bouncing interlinks. The amount of time is determined by office parameter RSC_ESAENTRY_BADLINK in Table OFCENG.

DESA and ESA similarities

The following information outlines the key similarities between DESA and standard ESA for the single RCC2 configuration.

Billing The system loses all billing information while the dual RCC2 is in DESA.

Plain old telephone service (POTS) calls The following services or features are restricted during DESA:

- only one home numbering plan area (HNPA) for each RSC-S ï no billing information
- no dial tone speed measurements
- no Equal Access features
- no foreign exchange features
- no support of automatic lines (AUL) originating on one RCC2 and terminating to the other RCC2
- no hunting supported for calls originating on one RCC2 and terminating to a hunt group on the other RCC2. The call completes only if the group member associated with the DN is idle.
- all calls dropped during DESA entry and exit

ESA data
Additional software enables the single RCC2 to process calls while in ESA. This ESA static data is downloaded either by command or by daily updates that are controlled by office parameters. In the dual RCC2, ESA data updated or reloaded for one RCC2 must also be reloaded for the interconnected RCC2. The system accomplishes this automatically when one of the RCC2s is downloaded with new ESA data.

Calls requiring host resources If a call cannot be processed because its destination is outside the dual RCC2 configuration and requires host resources, the calling subscriber receives reorder tone.

DESA and ESA differences

The following information outlines the key differences between DESA and standard ESA for the single RCC2 configuration.

Entering DESA
If one RCC2 enters ESA, it is still possible for the interconnected RCC2 to remain in communication with the host. However, at this point, the RCC2s are no longer synchronizing to the same source. Because frame slips can occur over the interlinks, the system does not allow interswitch calls with one of the RCC2s in ESA.

When a single RCC2 configuration enters ESA, the system reconfigures all P-side ports (except 0 and 8) as unequipped ports. This action frees the channels on those ports for use in call intraswitching. However, when the dual RCC2 enters DESA, the system does not reconfigure the ports. The ports can then continue to handle interswitched calls.

Processing calls during DESA

When a hunt group is split across both RCC2s, hunting for an idle member begins with the lines in the originating RCC2 regardless of whether the dialed DN resides on the interconnected RCC2.

ESA static data contains prefix information stored in table ESAPXLA. This table allows calls normally routed to the host to route to a special destination on the RCC2. In the dual RCC2 configuration, DESA prohibits this special routing across the RCC2s.

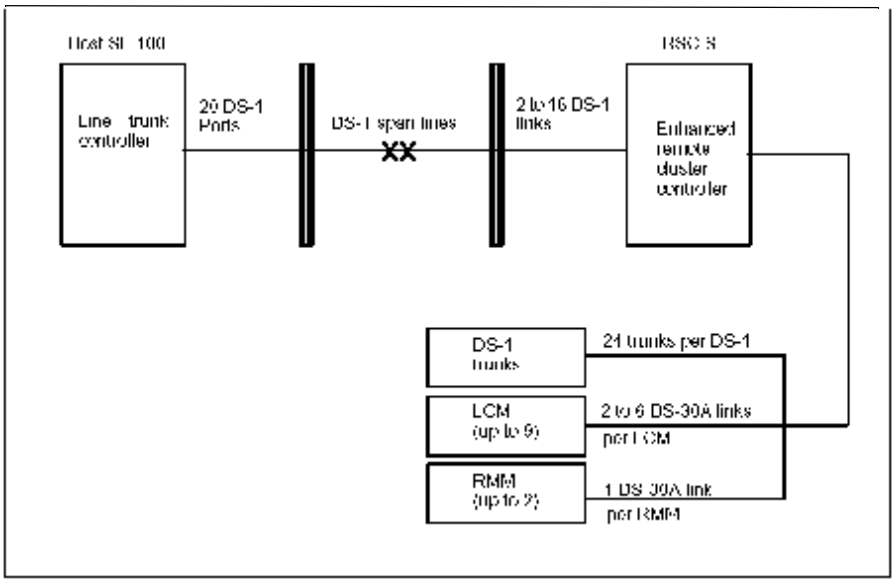
The RCC2s can continue to send messages to each other as long as one of the message links remains open. However, if a message audit sent by one of the RCC2s rebounds (indicating that the interconnected RCC2 is no longer processing messages), then the system closes all interlinks and stops call interswitching.

Remote features

The same line features available at the MSL-100 host are available to subscribers serviced by the remote line concentrating module (RLCM) remote switching center (RSC). This includes attendant consoles, electronic telephone sets (ETS), and DATAPATH features. The RLCM however, does not support either analog or digital trunking.

Types of LCMs include Meridian cabinet digital modules (MCDM) and Meridian cabinet line modules (MCLM). The following Figure an example of an MCRM-S

Figure Example of an MCRM-S configuration



The MCRM-S, with intraswitching and trunking options, has varying capacities, depending on the usage of these options. The MCRM-S is economical for initial applications in the range of 500 to 600 lines, while still allowing for growth to maximum capacity.

The MCRM-S is designed for economical expansion up to 5760 lines, in a low traffic, high intraswitching, no trunking configuration. A high traffic capacity of 8.00 ccs/line can be accommodated in low intraswitching areas with a maximum size of 2000 lines.

MCRM-S trunking options

Each type of MCRM-S is capable of handling non-toll trunking to a central office (CO), allowing the Meridian SL-100 host to route any calls that are line originated and terminated in the MCRM-S over these trunks. Tandem calls through the Meridian SL-100 host do not use this facility.

The trunking option is provided by digital trunks. Analog trunking and voice frequency (VF) interfaces require external channel bank interface.

Provisions are made for a maximum of 64 trunk groups. This includes both one-way and two-way trunk groups. When all trunks in a selected trunk group are busy, the host MSL-100 routes the call.

The trunking option can be used for local calls with fixed or variable numbering formats. The MCRM-S can receive or outpulse (or both) up to 15/15 digits and can delete or prefix (or both) up to 15/11 digits.

An MCRM-S supports a specific range of trunk circuits. These include interoffice trunks and PBX direct inward dial/direct outward dial (DID/DOD) trunks.

The following characteristics apply to those trunks:

- DS-1 digital trunking (analog facilities interface only through channel banks)
- Multifrequency (MF), Dial Pulse (DP) and Dual Tone Multifrequency (DTMF) signaling
- wink start, delay dial, and immediate dial supervision
- senderized, single stage outpulsing and digit reception
- trunk-to-line and line-to-trunk calls where both the line and trunk are in the MCRM-S

Intraswitching

Intraswitching is an optional software feature that allows both originating and terminating calls within a remote peripheral to be switched without Remote features using DS-1 links to the Meridian SL-100 host, except during initial call setup. Once a call is within the remote, internal (intra) channels are used. If no intrachannels are

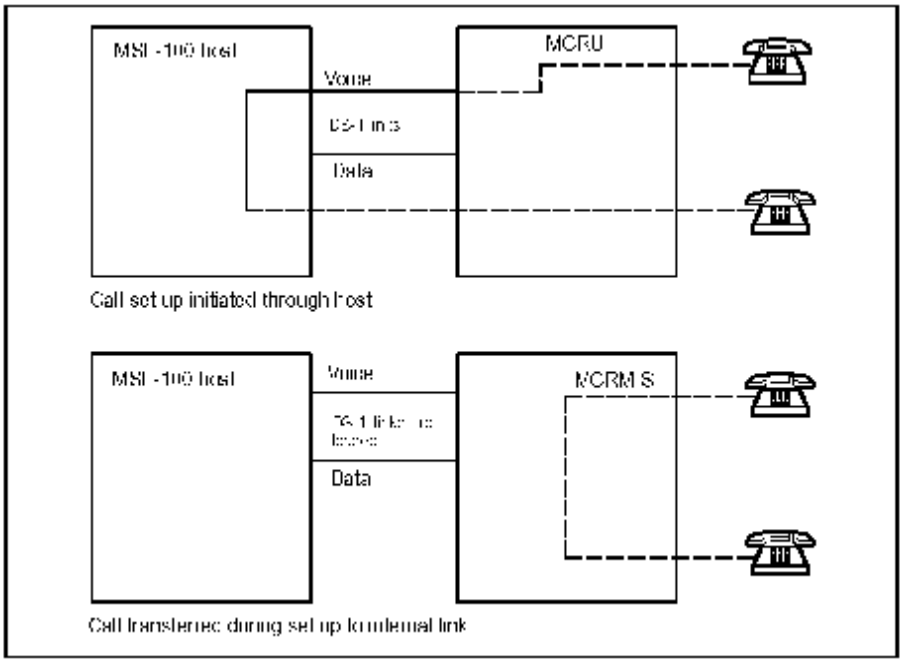
available, a connection is made and maintained through the Meridian SL-100 host office network for the duration of the call. The following Figure shows a diagram of intraswitching.

Intraswitching allows optimum use of host-directed DS-1 links. Depending on the degree of intraremote calling, the quantity of host Meridian SL-100 DS-1 facilities may be reduced.

Attendant calls, service analyzed calls, and DATAPATH (modem pooling) calls require host resources. The RLCM/RSC cannot handle these types of calls internally.

Lines that require host resources on demand (call waiting and three-way calling features), are allowed to intraswitch to the point at which host resources are requested. The call is maintained by the host for the remainder of the call, even when the feature is released.

Figure Intraswitching between the host, MCRU, and MCRM-S



Emergency stand alone

Emergency Stand Alone (ESA) is an optional feature that provides the remote peripherals with the intelligence to allow continued service for intraswitched calls, when communication to the Meridian SL-100 host is lost. This includes support of basic station-to-station calls within the

remote. Because they require the use of a modem in the host, attendant consoles are not supported during ESA operation.

The maximum number of simultaneous calls supported by the MCRU during ESA is 60. The MCRM supports a maximum of 300 simultaneous calls during ESA.

When communication is lost on the primary DS-1 link to the Meridian SL-100 host office, the remote automatically enters the ESA mode. ESA operation continues until communications are restored over at least one of the primary DS-1 links. During entry or exit of the ESA mode, established calls within the remote are lost. Calls in the process of being established are also lost. The following Figure shows an example of ESA mode switching.

During ESA, calls to subscribers outside the remote site receive overflow tone. Emergency and operator calls are routed to telephone company-specified lines in the remote. Requests for special features are ignored or receive reorder tone. Calls to subscribers within the remote site from outside receive reorder or busy tone.

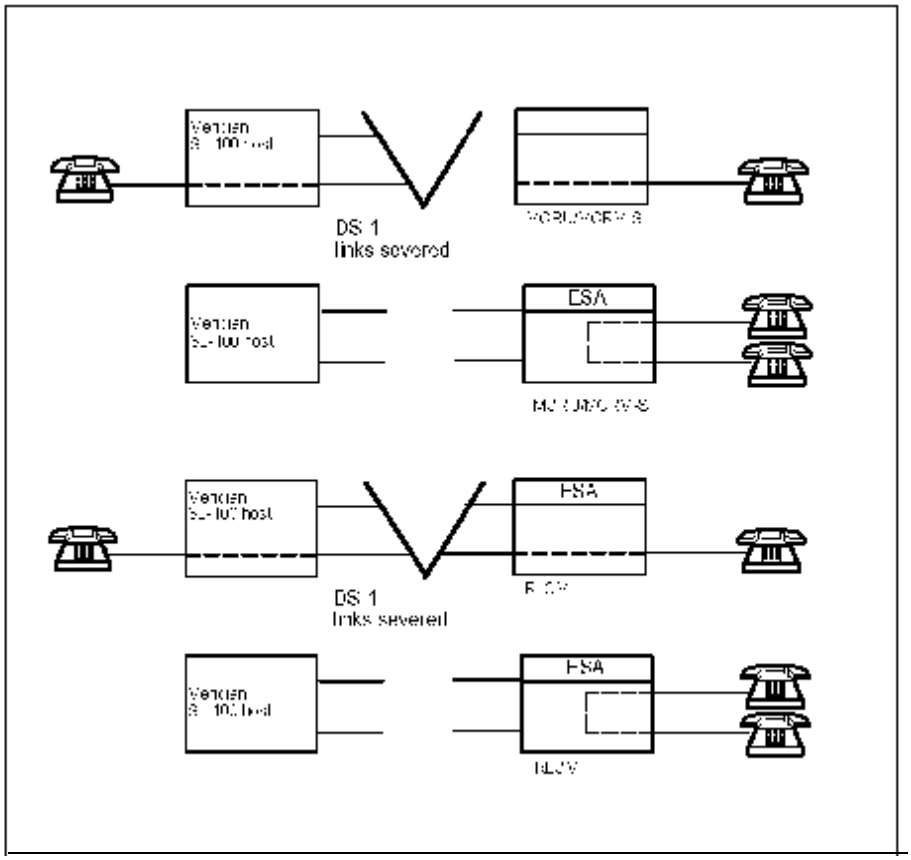
During ESA operation, there is no indication at the MAP workstation of the emergency condition. The remote is shown as SysB at the MAP workstation.

The ESA feature requires additional software. The required hardware consists of one ESA processor card, ESA clock and tone card, a master processor memory card, and at least one Digitone receiver, if Digitone service is provided (for the MCRU only). The ESA software performs functions such as digit accumulation, directory number translation, and call supervision.

Services supported during ESA include:

- services for single party, multi-party and PBX lines
- up to 16 prefixes or special numbers of up 15 digits each for special termination (0, 1, 411, 911)
- up to 32 prefixes for special numbers of up 15 digits each for special termination (such as 01, 411, or 911)
- 3 to 11 digit local dialing plan

Figure Emergency stand alone switching



- 3- to 7-digit local dialing plan
- invalid or vacant termination routing to reorder

IBN features supported during ESA include:

- up to 32 customer groups for each remote
- up to 640 stations in a customer group
- up to 32 prefix or special numbers of 15 digits maximum each for

each customer group

- up to 8 prefix or special numbers of up to 15 digits for each customer group (0+, 411, 9+)
- station-to-station dialing for 1- to 7-digit extension numbers
- denied incoming call for a station
- direct outward dialing with or without second dial tone for termination to another customer group or line within the remote
- inter-customer-group calling by the same dialing plan (except lines with denied incoming option)

Additional features supported during ESA include:

- dial pulse, Digitone reception
- all ringing types supported by the MCLM/DLM/MCLME/MCDM
- ground/loop start line
- automatic lines
- hunt group services (sequential only)
- local dialing plans

During ESA operation, calls that require connections to the Meridian SL-100 host office network are routed to reorder tone. Emergency and operator calls are routed to customer-specified lines in the MCRU/RLCM. Requests for special features are either ignored or routed to reorder.

Features not supported during ESA include:

- attendant consoles
- Local Automatic Message Accounting (LAMA)
- Multiple Appearance Directory Number (MADN) group operation
- recorded announcements
- maintenance and administration features
- maintenance and administration features integrated business network (IBN) services provided
- line restrictions

Routine exercising and diagnostics of all ESA hardware and software during normal operation ensures sanity and provides rapid fault detection and reporting.

Maintenance and administration

Maintenance and administration services

Maintenance and administration functions for the remotes are accessed through MAP workstations located at either the Meridian SL-100 host or remote site. Test access from the remote location is possible through a collocated or portable MAP workstation. MAP workstations at the remote site communicate with the host through dedicated lines, external to the remotes, or by dial-up lines through the remotes.

Fault detection and tracing can be performed to the circuit card level.

Fault detection is achieved by continuous self-monitoring of the system, routine audits, and both automatic and manual diagnostic procedures.

The following remote maintenance and administration features are fully integrated with the host. The following characteristics apply to

those trunks:

- subscriber line testing
- trunk testing
- maintenance test/diagnostics
- test access through MAP/line test position (LTP) and external test facilities
- alarms
- operational measurements
- service analysis
- service order system
- Station Message Detail Recording/Military Call Detail Recording (SMDR/MCDR)

Board testing

Automatic board-to-board testing (ABBT) is provided. This includes the capability of performing ABBT for remotes beyond the metallic range of the host. The Meridian cabinet remote unit/remote line concentrating module (MCRU/RLCM) is capable of supporting up to 56 signal distribution (SD) points.

Alarms

The remotes can detect and report the following failure conditions to the host:

- power failure
- hardware and firmware failure
- DS-1 interface failure
- digital link trouble (error rate threshold, loss of sync)

Line testing

CAUTION
Possible loss of service
The RMMs associated with the remote LCM must be equipped with MTUs rather than LTUs to allow diagnostics on the ISDN line card

Metallic access line tests can be performed at the MAP workstation or from external systems, such as mechanized loop testing (MLT). Line testing from the MAP requires provisioning the RMM with a remote metallic test access card, incoming/outgoing test trunks, and either a line test unit (LTU) or multiline test unit (MTU). The MTU performs the same tests as the LTU plus tests for ISDN lines.

Device control test access

Device control (DC) to the subscriber loops is provided so that external test systems can be used for maintenance of subscriber lines and loops. A minimum of one 2-wire metallic test access bus (vertical) is provided for each 320 lines (excluding requirements for line sparing).

Up to 12 horizontal buses are provided for metallic access on the MCRM-S. These horizontals are used to satisfy requirements for 711, 511, LTU/MTU and external test equipment. Requirements for line sparing are not included. The MCRU has up to eight horizontals provided for metallic access.

Operator verification functions can be performed without using the metallic access bus. Diagnostics and sectionalizing capabilities are provided for subscriber line faults in services such as electronic telephone set (ETS) and data lines.

DS-1 link maintenance

Both the remotes and the MSL-100 host monitor the DS-1 links. They report the following error conditions to the Meridian SL-100 host central control:

- bipolar violations
- frame slips
- loss of frame
- message channel loss

The error conditions are compared to limits specified by the telephone company. If the limit is exceeded on a particular link, it is removed from service. In the extreme case of total loss of communication with the host, the remote enters Emergency Stand Alone (ESA) mode, if provided.

Operational measurements

Operational measurements (OM) include those for intrasite calls and intraswitching links used by the remotes. OMs are recorded for the remotes in these categories:

- normal operation–common
- normal operation–dedicated
- ESA
- interswitch calls (dual remote cluster controller [RCC] configuration only)

Normal operation—common

Common OMs are those which are common to both the Meridian SL-100 host and the remotes. These OMs are recorded by the host office for non-emergency operation. They are provided on a unit basis, peripheral module basis, or on an office basis.

OMs common to the MSL-100 host and all remotes include:

- Office Traffic (OFZ)
- Traffic Separation Measurement System (TSMS)
- Subscriber Line Traffic Busy Usage/Peg Count (SLBU/SLPC)

The Trunk Group (TRK) OM is common to the Meridian SL-100 host the MCRM-S when using the trunking option.

Normal operation—dedicated

Dedicated OMs are specific operational measurements for each remote taken during normal operation. The following intraswitching measurements are performed:

- intraswitching line-to-line call attempts
- intraswitching line-to-line calls blocked by all-intraswitching-channels-busy condition
- intraswitching channels traffic busy
- interunit call attempts
- interunit calls blocked by all-intraswitching-channels-busy condition
- intrasite line-to-line calls blocked by all intraswitching channels busy condition
- interunit channels traffic busy
- intraunit-0 call attempts
- intraunit-0 channels traffic busy
- intraunit-1 call attempts
- intraunit-1 calls blocked by all-intraswitching-channels-busy condition
- intraunit-1 channels traffic busy

Emergency Stand Alone (EAS)

Operational measurements are provided for remotes having the ESA option. When a remote is in the ESA mode, the OM set is stored in the remote unit until control is resumed by the MSL-100 host. At that time, the results are collected by the host central control and stored for each remote.

The ESA software provides the following OMs:

- traffic peg counts
  - total origination attempts
  - total termination attempts
  - total calls completed
  - total originations blocked by lack of resources
  - total terminations blocked by lack of resources
  - total lines removed from service due to excessive errors
- error peg counts
  - line errors
  - ringing failures

Interswitch calls (dual RCC configuration only)

The system uses the OM group RSCIR to collect OMs for interswitched calls on the dual RCC or RCC2 configuration.

RSCIR collects the following peg counts:

- RSCIRALL–line-to-line RSC interswitch call attempts
- RSCIRBLL–line-to-line RSC interswitch calls blocked
- RSCIRALT–line-to-trunk RSC interswitch call attempts
- RSCIRBLT–line-to-trunk RSC interswitch calls blocked
- RSCIRATL–trunk-to-line RSC interswitch call attempts
- RSCIRBTL–trunk-to-line RSC interswitch calls blocked
- RSCIRATT–trunk-to-trunk RSC interswitch call attempts
- RSCIRBTT–trunk-to-trunk RSC interswitch calls blocked

The system increments these peg counts only for the originating RCC and only when the interlinks are in service. The RSCIR OM group is not used for *intra*switch calls. It is used only for *inter*switch calls.

This OM checks line-to-line, line-to-trunk, trunk-to-line, and trunk-to-trunk usage and increments the counter for busy interlink channels. This OM uses a recording interval of 100 seconds. This OM applies to both RCCs. (Both RCCs should have the same value for RSCIRCBU.)

ILDR operational measurements

The ISDN Line Drawer (ILD) OM groups are divided into registers. Each register represents a time of measurement within its respective group. The ILD OM registers (ACTIVE registers) are updated when ILD counters data is sent from the ILD firmware to the CM. The counters of the ILD are incremented when a event occurs (that is, the register that stores the number of total frames transmitted is incremented when a frame is transmitted.)

The data stored in the ILD OMs registers is sent in predefined intervals to the CM. These intervals are set in office parameters OMXFR and OMHISTORYON (tables OFCENG and OFCOPT, respectively).

Meridian SL-100

Remote Peripherals

General Description

Publication number: 555-4001-04
Product release: MSL08
Document release: Standard 06.03
Date: July 2002
Printed in the United States of America.

NORTEL NETWORKS