Meridian 1

Fiber Remote IPE

Description, installation, and maintenance

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Standard, release 4.00. Reissued to remove the DANGER sign because the laser was replaced with an LED. Also *span* is replaced by *link*. Changes are noted by revision bars in the margins.

June 1999

Standard, release 5.00. Reissued for technical content.

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About this document

This document is a supplement to Meridian 1 NTPs. Provides information specific to the Meridian 1 implementation of the Fibre Remote Intelligent Peripheral Equipment (IPE) service.

It describes the operation of the fibre-optic equipment and provides specific information on how to install and maintain this equipment as an integral part of the Meridian 1 system. Fibre Remote IPE configuration procedures are identical to the equivalent non-fibre equipment in Meridian 1. However, there are some additional software commands that can be executed using the Man-Machine Interface (MMI) terminal to specifically control fibre-optic equipment.

The following describes what you will find in this document:

Product description describes the Fibre Remote IPE functional and physical characteristics, general engineering guidelines, and planning and ordering information.

Installation and configuration explains how to prepare the site, how to install fibre-optic equipment at Meridian 1 and Fibre Remote IPE sites, and how to connect the local and the remote sites to the fibre-optic span.

Acceptance testing describes how to perform functional tests to verify that the installed Fibre Remote IPE service is operating correctly.

Maintenance describes how to perform routine administrative and maintenance functions and how to troubleshoot the Fibre Remote IPE equipment and the fibre-optic span connections. It explains how to isolate problems, fix or replace defective equipment, and verify that the equipment is operating correctly after corrections or replacements have been made.

Appendix A lists messages generated by the Meridian 1 CPU and the remote fibre-optic equipment. These messages indicate the status of the equipment and identify a faulty component when problems occur.

This document provides detailed information on how to install, configure, and maintain the fibre-optic equipment; however, it also refers to various Meridian 1 NTPs that contain additional information, which may be required when installing and maintaining the Fibre Remote IPE.

References

The following is a list of documents that are referred to in this document for additional information:

— *Meridian 1 installation planning* (553-3001-120)

— *Meridian 1 system engineering* (553-3001-151)

— *Meridian 1 power engineering* (553-3001-152)

— *Meridian 1 system installation procedures* (553-3001-210)

— *X11 features and services* (553-3001-305)

— *X11 input/output guide* (553-3001-400)

Fibre Remote IPE product description

This chapter describes Fibre Remote Intelligent Peripheral Equipment (IPE), its architecture, and its hardware options.

It also describes how to plan and engineer a fibre-optic link.

CAUTION

Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.

WARNING

When working with fibre-optic cables, you must adhere to standard precautions used for optical fibres. Before you can handle optical fibres, you must take necessary training and become certified in working with fibre-optic cables.

System overview

Meridian 1 is a Private Branch Exchange (PBX) that links local subscribers to private and public networks and provides a large number of functions and features.

In addition to supporting local subscribers, Meridian 1 can be configured using Remote IPE modules or small cabinets as a distributed system that supports remote subscribers. They are connected to the PBX at long distances using fibre-optic links.

Subscriber connections at local Meridian 1 IPE Modules are the same as the Remote IPE Modules or small cabinet. The subscriber functions and features at the Meridian 1 are also the same as for the Remote IPE site.

This document focuses on the Meridian 1 PBX and Remote IPE equipment specifically designed to provide fibre-optic links between the network functions in Meridian 1 and the peripheral controller functions in the Remote IPE.

System description

The Fibre Remote IPE provides Meridian 1 functionality with the installation of only IPE Modules and IPE cards at a distant site. The Remote IPE shares Meridian 1 common and network equipment to provide the same functions and features to remote subscribers that are available to local Meridian 1 subscribers.

To explain the implementation of Fibre Remote IPE functions, we will describe:

— Fibre Remote IPE physical architecture

— Fibre Remote IPE functional architecture

Fibre Remote IPE physical architecture

To configure a Meridian 1 system with Fibre Remote IPE, you can install a floor-standing column or wall-mounted cabinet at a remote site and connect it using fibre-optic links to an existing Meridian 1 system.

New equipment specifically designed to support the fibre-optics interface consists of:

— an NT1P61 Fibre Superloop Network card, which is housed in a Meridian 1 network card slot

— an NT1P62 Fibre Peripheral Controller card, which is housed in the Remote IPE module or cabinet

— NT1P63 Electro-optical interface packlets, installed onto the Fibre Superloop Network card and the Fibre Peripheral Controller card to provide a fibre-optic link between Meridian 1 and Remote IPE

— an optional NT1P63 Electro-optical interface packlet at each site to provide a redundant fibre-optic link

— an NT1P70 wall-mounted cabinet for the remote site

— NT1P75AA fibre-optic patchcords, one for each Electro-optical packlet

— NT1P79AA fibre-optic cable between the fibre management frame and the Fibre Peripheral Controller in the wall-mounted cabinet and the floor-standing column

— NT1P76AA cable connecting the Fibre Superloop Network card to the I/O panel and providing Serial Data Interface (SDI) and system monitor ports

— NT1P78AA cable connecting the Fibre Peripheral Controller card to the I/O panel and providing TTY and system monitor ports

Figure 1 illustrates Meridian 1 and Remote IPE equipment linked with fibre-optic cables. The only equipment specifically designed to support this configuration are the cards and the cabinet listed above. All the other equipment is pre-release 20 Meridian 1 hardware.

At the local site, fibre-optic cables contain fibre-optic connectors mounted on the I/O panel connector slots at the rear of the Meridian 1 network module. At the remote site, fibre-optic cable connectors are also installed on the I/O panel connector slots at the rear of the floor-standing Remote IPE module. For the wall-mounted Remote IPE cabinet, the fibre-optic link cable from the fibre management frame is connected directly to the FC/PC fibre-optic connectors of the Electro-optical packlets located on the Fibre Peripheral Controller card.

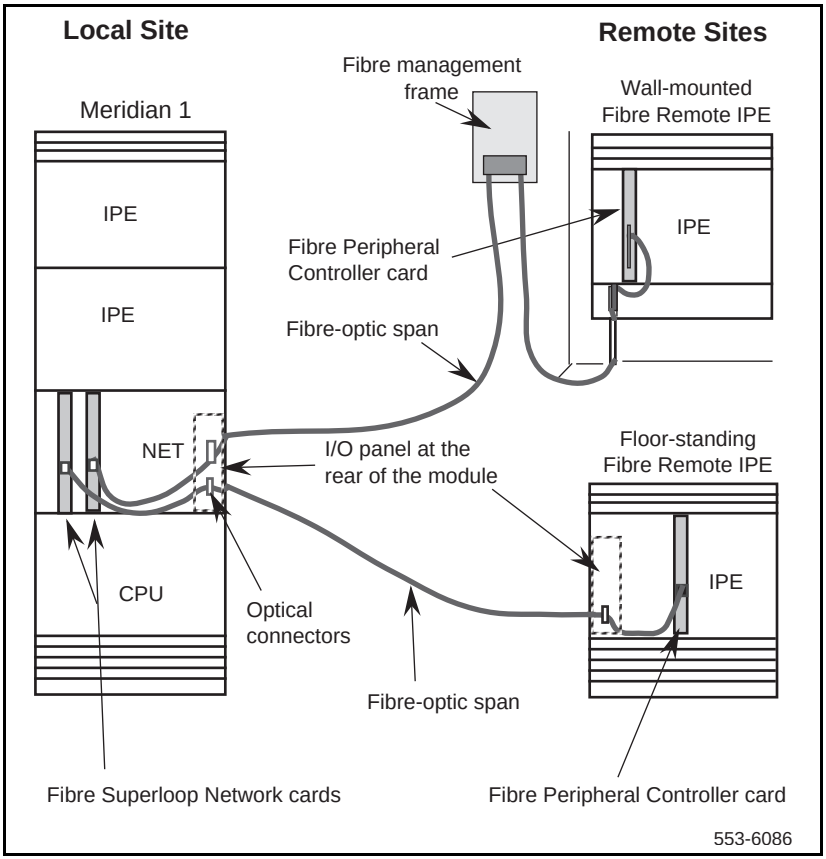
Subscriber loops at the Remote IPE are connected to 50-pin connectors on the I/O panel at the rear of the module or at the bottom front of the cabinet as in pre-release 19 hardware. For more details about subscriber connections to Meridian 1 and the Remote IPE, refer to *Meridian 1 system installation procedures* (553-3001-210).

You can select one of two options for the Remote IPE enclosure:

— Floor-standing Remote IPE module

— Wall-mounted Remote IPE cabinet

Figure 1
Meridian 1 to Remote IPE fibre-optic links

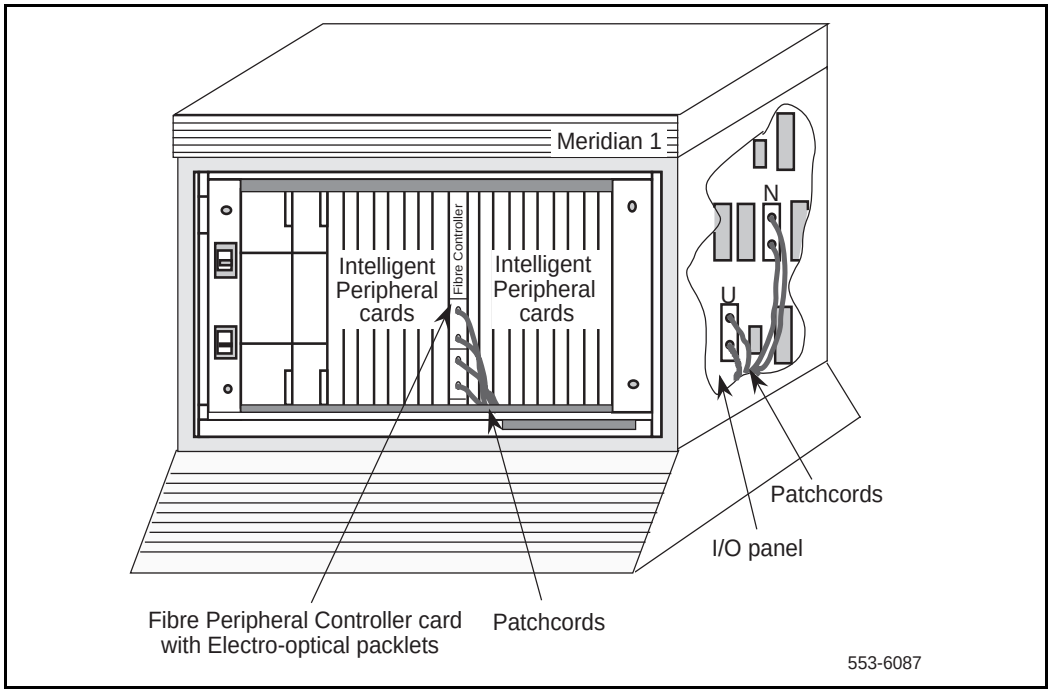


Floor-standing Remote IPE

The floor-standing Remote IPE comprises a pedestal, one or more IPE Modules, and a top cap. The IPE Module houses a maximum of 16 line cards and a Fibre Peripheral Controller card. The communication and signaling between the Meridian 1 central processing unit (CPU) and the Fibre Peripheral Controller card Micro Processing Unit (MPU) is performed over the fibre-optic link. The fibre-optic link also transmits voice and data information originating and terminating at Remote IPE subscriber stations.

Figure 2 illustrates the front view of the floor-standing Remote IPE column with the cross section of the rear of the module showing the I/O panel. The front view shows the location of the Fibre Peripheral Controller card and the fibre-optic cables that connect the fibre-optic interface on the Fibre Peripheral Controller to the optical I/O panel at the rear of the IPE Module.

Figure 2
Floor-standing Fibre Remote IPE column



Wall-mounted Remote IPE cabinet

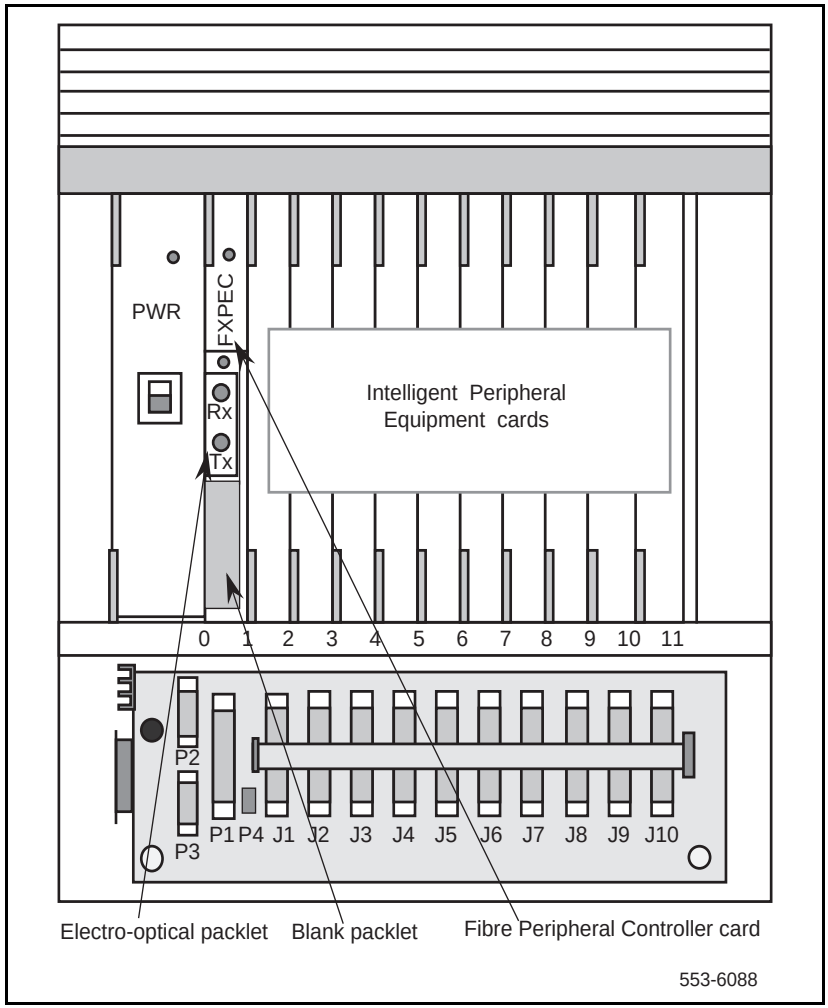
The NT1P70 main wall-mounted Remote IPE cabinet houses a maximum of 10 line cards and a Fibre Peripheral Controller card. The communication and signaling between the Meridian 1 CPU and the Fibre Peripheral Controller card MPU is performed over the fibre-optic link. The fibre-optic link also transmits voice and data information originating and terminating at the Remote IPE subscriber stations.

To expand the number of line cards from 10 to 16, use the first six card slots in the NTAK12 expansion cabinet. Card slots 7 through 12 in the expansion cabinet are not configurable and must not be used. The expansion cabinet is connected to the Fibre Peripheral Controller card housed in the main cabinet with a cable. This allows the Fibre Peripheral Controller card to control the line cards in both cabinets.

Wall-mounted main and expansion cabinets can be AC- or DC-powered. The power source is directly connected to the shelf power supply for the AC-powered system and to the shelf power converter for the DC-powered system.

Figure 3 illustrates the front view of the NT1P70 wall-mounted Remote IPE cabinet. It shows the location of the Fibre Peripheral Controller card and the Electro-optical packlet on the Fibre Peripheral Controller card. A blank packlet is used in the lower packlet position of the Fibre Peripheral Controller faceplate for a nonredundant link configuration in both the floor-standing IPE Module and the wall-mounted cabinet.

Figure 3
Wall-mounted Remote IPE cabinet



Fibre Remote IPE functional architecture

Fibre Remote IPE functions are controlled by the Meridian 1 CPU and the firmware in the Fiber Superloop Network and Fibre Peripheral Controller cards. The CPU uses software instructions to execute call processing, administration, and diagnostic functions. These functions can be divided into three basic categories:

— CPU functions

— Network functions

— IPE functions

Figure 4 illustrates the Meridian 1 functional architecture in a broad block diagram to show the three basic types of functions and system modules supporting these functions.

CPU functions

Meridian 1 CPU functions are executed by the system software in the CPU Module normally located at the bottom of the Meridian 1 column. The CPU responds to the interrupt requests from the network equipment and the IPE, and performs the following functions:

— controls call origination, call termination, and feature operation for switched voice and data calls

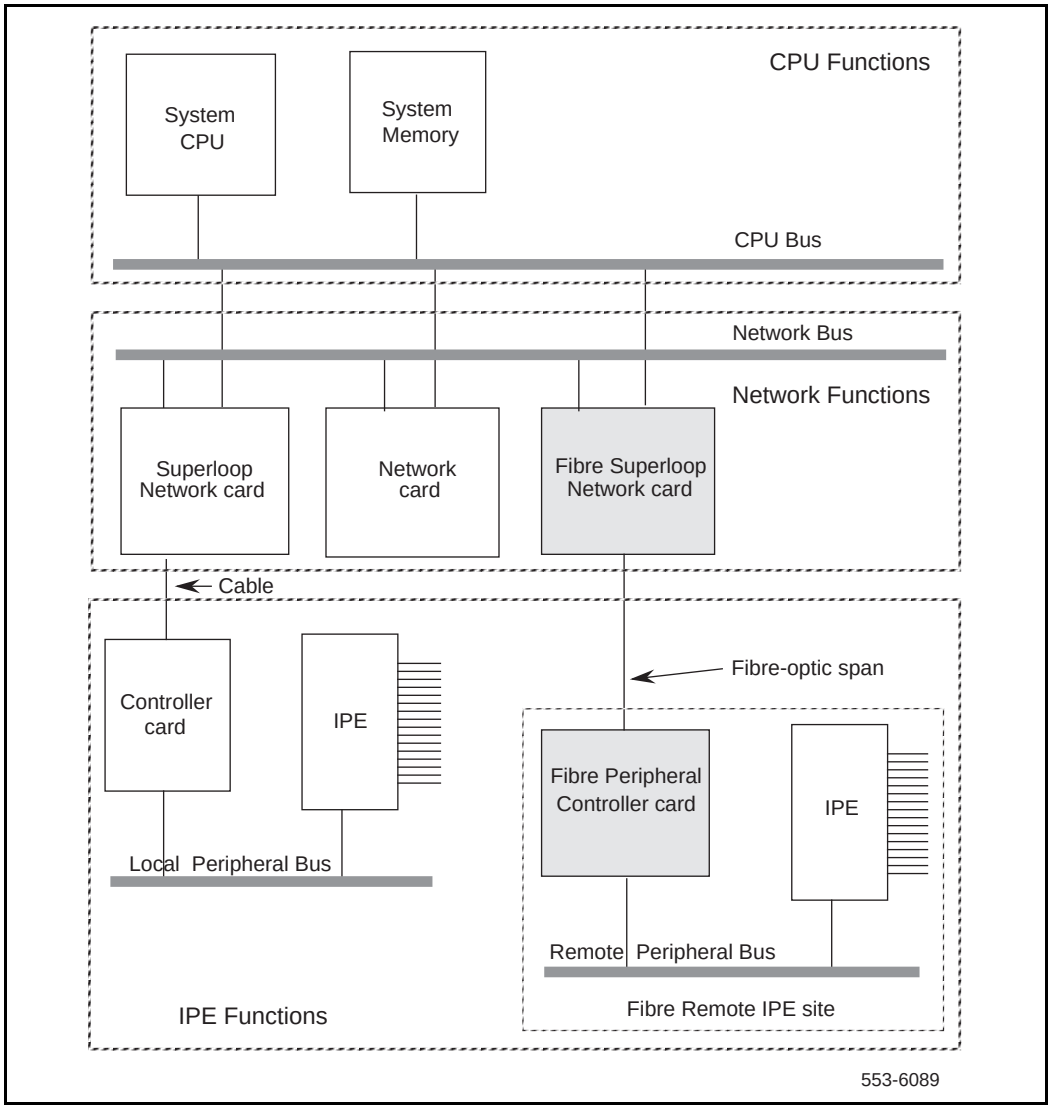
— executes system administration and configuration functions

— coordinates system diagnostic activities

— controls system utility functions such as software loading, initialization, data dumping, traffic logging, and system auditing

Even though the Remote IPE is removed from Meridian 1, the Meridian 1 CPU controls its functions the same way it controls functions of local IPE Modules.

Figure 4
Meridian 1 functional architecture



Network functions

Network switching functions are executed by the equipment housed in Meridian 1 network card slots. The Fibre Superloop Network card is installed in a network card slot. Through its fibre-optic link, it connects to the Fibre Peripheral Controller card installed in the Remote IPE module or cabinet.

These network functions do the following:

— Perform hardware initialization and self-test upon power up

— Establish call connections between the stations connected to Remote IPE line cards and stations local to Meridian 1 or to trunks for long distance trunk calls over public or private networks

— Communicate switching, peripheral signaling, and maintenance information to and from the CPU and the Peripheral Controller MPU

— Monitor fibre-optic link integrity and transmission quality and provide automatic link switching from the failed primary link to the redundant link

— Provide local and remote loopback testing and fault isolation functions

IPE functions

Intelligent peripheral equipment functions are performed by the Fibre Peripheral Controller card and line cards in the Remote IPE Module or cabinet.

These IPE functions do the following:

— Perform hardware initialization and self-test upon Fibre Peripheral Controller power-up

— Assign time slots to line cards to establish call connections

— Communicate with the Fibre Superloop Network card MPU to provide Remote IPE configuration and maintenance functions

- Monitor fibre-optic link integrity and transmission quality and provide automatic link switching from the failed primary link to the redundant link on the Remote IPE side
- Provide Card-LAN management by polling IPE cards and reporting their status
- Control local stations' ringing functions
- Provide a serial port for local configuration and maintenance functions
- Provide local and remote loopback testing and fault isolation functions

Functional description

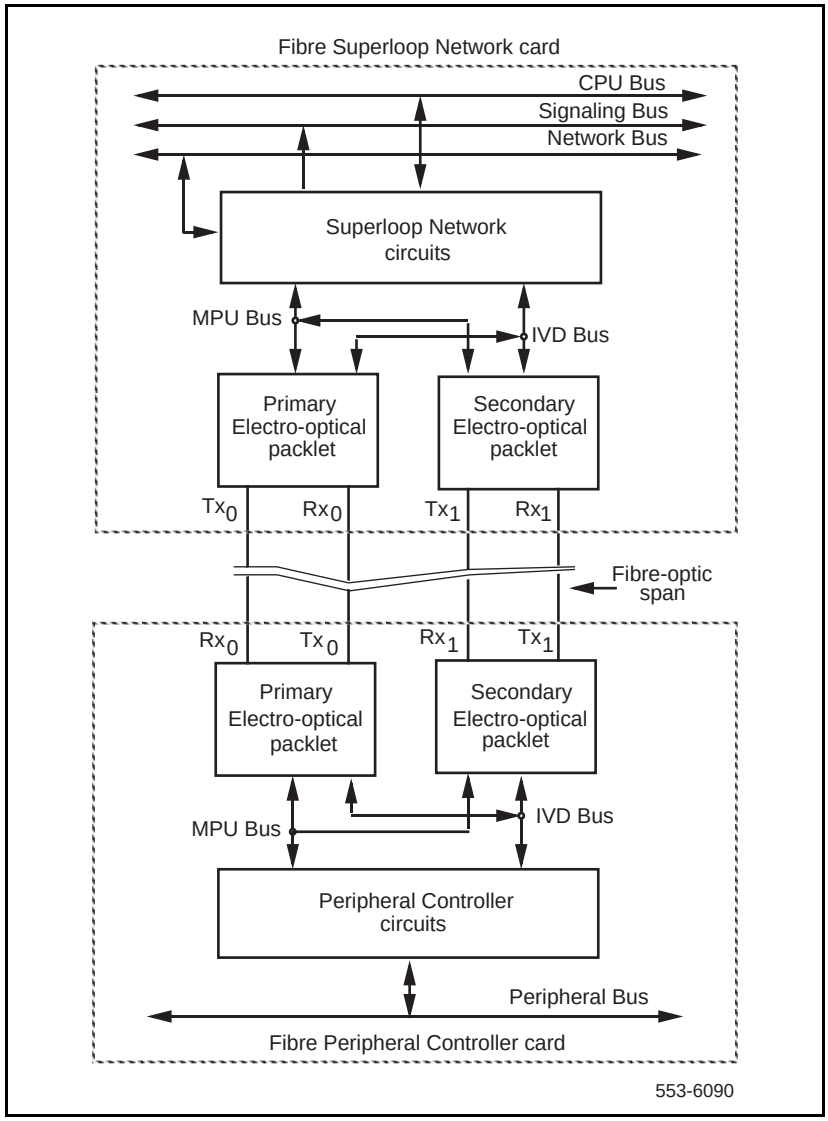
Meridian 1 is controlled by the CPU. The CPU performs read/write functions on the network control and status registers and communicates with the network equipment over the CPU bus. Through these messages, the CPU monitors the system's status, provides call connection sequences, monitors traffic activities, downloads application software and configuration data, and performs system administration and diagnostics.

Fibre Remote IPE utilizes fibre-optic links to provide the same subscriber functionality at the remote site as at the Meridian 1 local site.

Figure 5 illustrates the Meridian 1 Fibre Remote architecture. It shows the Fibre Superloop Network card, the Fibre Peripheral Controller card, and the internal bus structure that connects them to other system components.

Figure 5 also describes the Electro-optical packlet to provide an understanding of the internal system communication and call processing activities through the fibre-optic link.

Figure 5
Meridian 1 Fibre Remote architecture



Fibre Superloop Network card

The NT1P61 Fibre Superloop Network card is a microprocessor-controlled network interface between the Meridian 1 CPU and the remote peripheral equipment. To communicate with the CPU, it uses the network, the signaling, and the CPU buses located in the Meridian 1 network module.

The Fibre Superloop Network card occupies one network card slot and supports four network loops or 128 time slots; 8 for signaling and 120 for voice and data transmission with the Fibre Peripheral Controller card. The Electro-optical packlet mounted on the Fibre Superloop Network and Fibre Peripheral Controller cards provide a dedicated link between these two cards.

The main Fibre Superloop Network card performs the following functions:

— Provides a single or a redundant dedicated optical link to connect the Remote IPE to Meridian 1

— Assigns any network time slot to any time slot available on the fibre-optic link to support peripheral equipment time slot assignments

— Supports eight signaling channels for Common Channel Signaling (CCS) in servicing Scan and Signal Distributor (SSD) messages, card maintenance, and card enable messages

— Provides an interface for system power and alarm monitoring

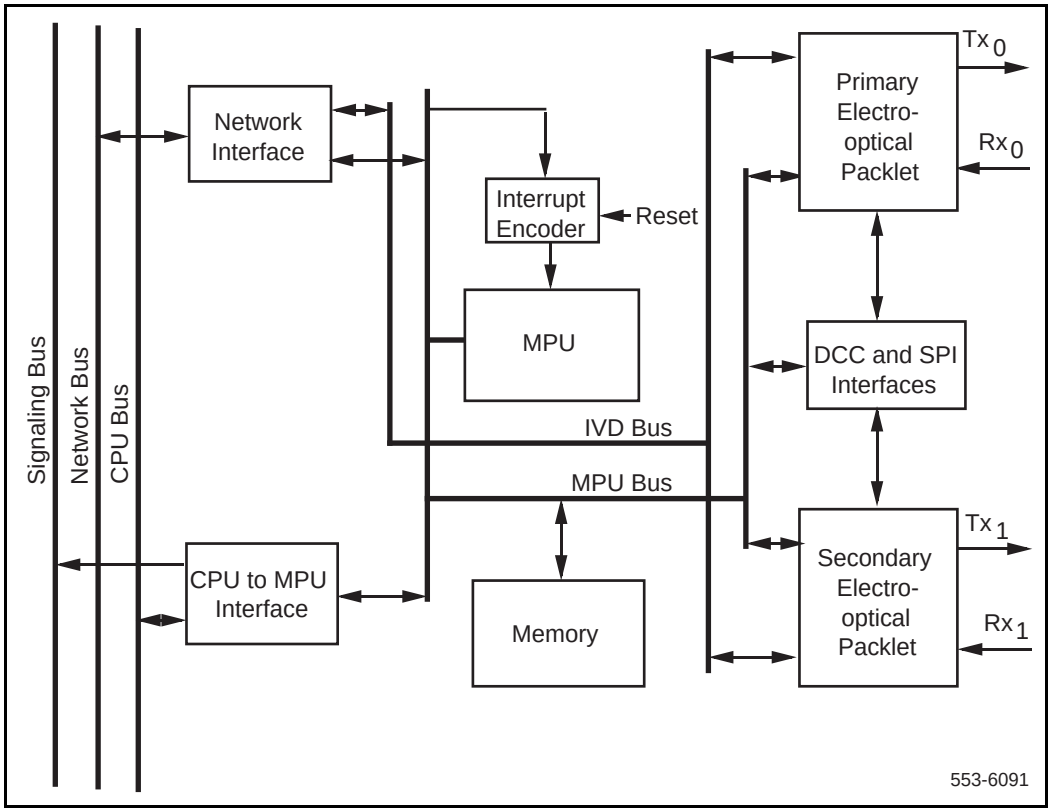
— Provides an interface for a maintenance port

— Provides continuity test pattern generation and detection for loopback testing

— Performs diagnostic self-tests during power-up and when requested by the CPU

Figure 6 shows the Fibre Superloop Network card block diagram illustrating major functional blocks.

Figure 6
Fibre Superloop Network card functional block diagram



Micro Processing Unit (MPU)

The MPU coordinates and controls data transfer and the addressing of peripheral devices and communicates with the Meridian 1 CPU using a message channel on the CPU bus. The tasks the MPU performs depend on the interrupts it receives. These interrupts are prioritized by the importance of the tasks they control.

The MPU is highly integrated and provides most of the decision making logic on the chip. These include controllers, timers, control and arbitration logic, address decoding, dual port RAM and independent direct memory access, parallel input/output ports, and three independent full duplex serial communication channels that support various protocols and a synchronous SPI interface.

The MPU can be reset by:

— powering up the Fibre Superloop Network card

— the watchdog timer

— the ENB/DIS switch

— the Meridian 1 CPU command

Memory

The Fibre Superloop Network memory stores programs and data for the following functions in the following locations:

— Boot code and self-test code are stored in the EPROM.

— Data is stored in the RAM.

— The main function code is stored in the Fibre Superloop Network card FLASH memory.

— Data containing the Fibre Superloop Network card identification and version is stored in the EEPROM.

CPU to MPU bus interface

Information exchange between the Meridian 1 CPU and the Fibre Superloop Network MPU is performed with packetized messages transmitted over the CPU bus.

This interface uses shared static random access memory (SRAM) as a communication exchange point between the CPU and the MPU. Both the CPU and the MPU can access this memory over the transmit and receive channels on the CPU bus.

Network bus interface

The network bus interface performs two major functions:

— Converts bit interleaved serial data received from the network bus into byte interleaved data for transmission over the 128 time slots used by the IVD bus

— Accepts byte interleaved data transmitted from the IVD bus and converts it into a bit interleaved data stream for transmission over the network bus

Fibre-optic interface

Two NT1P63 Electro-optical packlets can be installed on each Fibre Superloop Network card to provide redundant fibre-optic interfaces, or the Fibre Superloop Network card can be equipped with only one Electro-optical packlet for a nonredundant link. The fibre-optic interface provides a 155.52 Mbps point-to-point transmission facility.

The fibre-optic interface performs the following functions:

— Connects Meridian 1 to Remote IPE using a dedicated single mode fibre-optic link

— Provides a synchronous communication channel between the Fibre Superloop Network card MPU and the Fibre Peripheral Controller card MPU

— Uses one or, optionally, two Electro-optical packlets installed on the Fibre Superloop Network card to provide redundant fibre-optic links

— Uses buffers and transceivers to extend the MPU data, address, and control buses to the Electro-optical packlet

— Provides Electro-optical packlet version identification, which is stored in the packlet's EEPROM

— Monitors transmission quality of the fibre-optic link; if the transmission is degraded or fails, the Fibre Superloop Network card automatically transfers to the redundant link, if equipped.

Fibre Peripheral Controller card

The NT1P62 Fibre Peripheral Controller card is a microprocessor controlled peripheral interface between the Fibre Superloop Network card and the Remote IPE line cards. To communicate with the Fibre Superloop Network card, the Fibre Peripheral Controller card uses the Electro-optical interface and the fibre-optic link. To communicate with the peripheral equipment, the Fibre Peripheral Controller uses 16 full duplex serial loops, one for each line card in the IPE Module.

The Fibre Peripheral Controller card occupies one card slot in the IPE Module. The adjacent card slot is not the full width and must remain empty; however, a dummy faceplate should be installed in this empty card slot to provide a better air flow between cards. This is necessary because a non-fibre Peripheral Controller card occupies two card slots in the IPE Module and the Fibre Peripheral Controller card that plugs into the same card slot occupies only one card slot. The dummy faceplate is used in the floor-standing IPE Module but is not necessary in the wall-mounted IPE cabinet.

The main Fibre Peripheral Controller card performs the following functions:

— Provides a single or redundant dedicated optical link to connect the Remote IPE to Meridian 1

— Assigns any of the 120 time slots on the fibre-optic link to any time slot of the 16 full duplex serial loops assigned to line cards in the IPE Module

— Converts the SSD-type signaling format received from the Fibre Superloop Network card to the signaling format for digital telephone sets, and from digital telephone sets format to SSD-type format

— Polls telephone sets to determine the set type and its signaling protocol and transmits this information to the Fibre Superloop Network card

— Supports CCS protocol between the Fibre Superloop Network and the Fibre Peripheral Controller cards

— Provides an interface for a maintenance port

— Provides a Card-LAN port

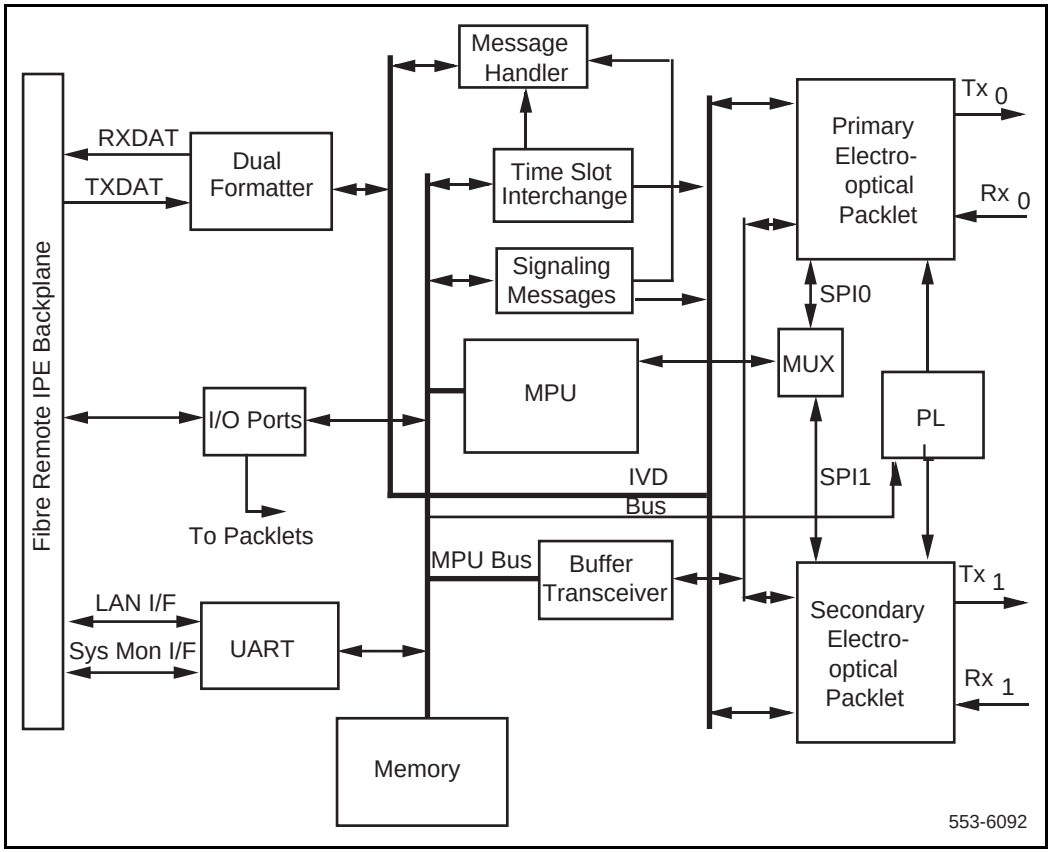
— Provides continuity test and line card polling, enabling, and disabling

— Provides an interface for system power and alarm monitoring

— Performs diagnostic self-tests during power-up and when requested by the CPU

Figure 7 shows the block diagram of the Fibre Peripheral Controller card which illustrates major functional blocks. Functions of these blocks are described below.

Figure 7
Fibre Peripheral Controller card functional block diagram



Micro Processing Unit (MPU)

The MPU coordinates and controls data transfer and the addressing of peripheral devices and communicates with the Fibre Superloop Network card using serial communication channels. In addition, the MPU has a special communication channel used to communicate with the microcontroller on one Electro-optical packlet at a time. The tasks the MPU performs depend on the interrupts it receives. These interrupts are prioritized by the importance of tasks they control.

The MPU is highly integrated and provides most of the decision-making logic on the chip. Functions on the MPU include controllers, timers, control logic, address decoding, dual port RAM and independent direct memory access, parallel input/output ports, and three independent full duplex serial communication channels that support various protocols.

The MPU can be reset by:

— powering up the Fibre Peripheral Controller card

— the watchdog timer

Memory

The Fibre Peripheral Controller memory stores programs and data for the following functions in the following locations:

— Boot code and self-test code are stored in the EPROM.

— Data is stored in the RAM.

— The main MPU function code is stored in the Fibre Peripheral Controller card FLASH memory.

— Data containing the Fibre Peripheral Controller card identification and version is stored in the EEPROM.

Card-LAN interface

To implement the Card-LAN interface, the Fibre Peripheral Controller card uses a dual UART device. One UART channel provides a serial communication interface to IPE cards.

The Card-LAN is a 19.2 kbps asynchronous interface. It is used to poll and communicate with IPE cards through the Fibre Peripheral Controller to transmit maintenance messages, which include:

— LED control of the IPE card enable/disable

— peripheral card configuration

— peripheral card type and version information

IPE interface

The IPE interface links IPE cards to the Fibre Peripheral Controller MPU using sixteen DS-30X loops, one for each IPE card. It contains the following Fibre Peripheral Controller circuits:

— Dual formatter that transforms serial peripheral loop information into parallel Integrated Voice and Data (IVD) bus information and parallel IVD bus information to serial peripheral loop information.

— Message handler that performs channel associated signaling to and from the IPE cards. It receives signaling information from the IPE cards, and then the MPU accesses this information, interprets it, and sends it to the Fibre Superloop Network in the appropriate format. From the Fibre Superloop Network, the signaling messages are received and interpreted by the Fibre Peripheral Controller MPU and sent to the serial peripheral loops in the appropriate format.

— Time slot interchange that provides the correspondence between the 120 voice and data time slots on the fibre-optic link and the 640 time slots on the IVD bus. The time slots on the IVD bus correspond directly to the peripheral line card loops.

— Common channel signaling that handles the SSD signaling to and from the Fibre Superloop Network card. It receives signaling packets from Fibre Superloop Network, checks for CRC errors, strips start/stop bits and sends the rest of data to the Fibre Peripheral Controller MPU for processing. It also processes the signaling information in the opposite direction by receiving the messages from the MPU, adds CRC and start/stop bits, and transmits these as SSD messages to the Fibre Superloop Network over the fibre-optic link.

Fibre-optic interface

Two NT1P63 Electro-optical packlets can be installed on each Fibre Peripheral Controller card to provide redundant fibre-optic interfaces. The Fibre Peripheral Controller card can be equipped with only one Electro-optical packlet for a nonredundant link operation. The fibre-optic interface provides a 155.52 Mbps point-to-point transmission facility.

The fibre-optic interface performs the following functions:

— Connects Meridian 1 to Remote IPE using a dedicated single mode fibre-optic link

— Provides a synchronous communication channel between the Fibre Superloop Network card MPU and the Fibre Peripheral Controller card MPU

— Uses buffers and transceivers to extend the MPU data, address, and control buses to the Electro-optical packlet

— Uses one or, optionally, two Electro-optical packlets installed on the Fibre Peripheral Controller card to provide redundant fibre-optic links

— Provides Electro-optical packlet version identification, which is stored in the packlet's EEPROM

— Monitors transmission quality of the fibre-optic link; if the transmission is degraded or fails, the Fibre Peripheral Controller card automatically transfers to the redundant link, if equipped

Engineering guidelines

Meridian 1 general system engineering guidelines are described in *Meridian 1 system engineering* (553-3001-151). The following information deals specifically with engineering guidelines for the Fibre Remote IPE planning and implementation. It also describes the fibre-optic interface specifications and fibre-optic link characteristics.

Fibre Remote IPE capacity

Meridian 1 physical capacity depends on the system's configuration and size. System options 21E, 51, 51C, 61, 61C, 71, 81, and 81C are designed to provide port capacities from tens to thousands of ports. These ports are normally local to Meridian 1, however, by implementing Fibre Remote IPE, some of these ports can be located at one or more remote sites.

The overall system capacity does not change by installing Fibre Remote IPE. The difference between the Meridian 1 system with Fibre Remote IPE and without Fibre Remote IPE is the distribution of the line cards, that is, the subscriber loops. Fibre Remote IPE allows you to distribute the peripheral equipment at long distances from Meridian 1 and provide the same functions and features to remote subscribers as to local subscribers.

> ***Note:*** System capacity may be affected by the capacity of the Fibre Superloop Network card, which supports only one IPE Module instead of the two IPE Modules supported by the Superloop Network card.

The Fibre Remote IPE capacity can be tailored according to port capacity requirements at the remote site. When planning a Fibre Remote IPE site, you must determine the number of IPE cards required to support the existing and future traffic needs. Based on these requirements, two Fibre Remote IPE hardware options are available:

— Floor-standing Remote IPE column

— Wall-mounted Remote IPE cabinet

Floor-standing Fibre Remote IPE

The floor-standing Fibre Remote IPE consists of the Meridian 1 pedestal, IPE Module, and a top cap. One IPE Module supports up to 16 line cards, or 256 ports if each line card has 16 ports. If more ports are required, additional IPE Modules can be added to the column. A column contains a maximum of four modules. Each IPE Module requires one Fibre Peripheral Controller card located in the IPE Module and a corresponding Fibre Superloop Network card located in a Meridian 1 network card slot.

> ***Note:*** In a Meridian 1 column, a Superloop Network card can support up to two IPE Modules. However, in a Meridian 1 system with the Fibre Remote IPE configuration, a Fibre Superloop Network card supports only one Remote IPE Module. This is due to the dedicated fibre-optic link configuration between the Fibre Superloop Network card and the Fibre Peripheral Controller card. Since fibre-optic links are dedicated, they cannot be shared between two different IPE Modules at the remote site.

Wall-mounted Fibre Remote IPE

The wall-mounted Fibre Remote IPE consists of NT1P70 main and NTAK12 expansion cabinets. The main cabinet supports the Fibre Peripheral Controller card and up to 10 IPE cards or 160 ports. If more ports are required, an expansion cabinet can be installed adjacent to the main cabinet.

These two cabinets are linked with an inter-cabinet cable that plugs into P1 50-pin connectors located at the bottom left-hand corner of each cabinet. This cable extends six peripheral bus DS-30X loops to the first six IPE card slots in the expansion cabinet. One Fibre Peripheral Controller card located in the main cabinet supports cards in both main and expansion cabinets as long as the expansion cabinet contains no more than 6 IPE cards installed in the first six IPE card slots.

Engineering the fibre-optic link

A fibre-optic link can be constructed using single-mode or multi-mode fibre-optic cables. The type of fibres you select will depend on various factors:

— distance between Meridian 1 and the Fibre Remote IPE site

— possible existence of a fibre-optic link you wish to use for this application

— cost, availability, and so on

When engineering a fibre-optic link, you must consult the component manufacturer's data sheets to determine whether the cable, connectors, and other components meet the transmission characteristics and the signal loss plan for the transmission distance required for your specific Fibre Remote IPE application.

Fibre-optic bandwidth

When using a single-mode fibre, the optical link transmission distance is strictly loss-limited and not dispersion limited. When using multi-mode fibre, the transmission distance will be loss and dispersion limited. Appropriate calculations must be made to determine the maximum link distance. The data rate over the multi-mode fibre is limited by the optical bandwidth of this multi-mode fibre. The bandwidth is defined as the frequency at which a sinusoidal signal is attenuated by 3 dB relative to a DC signal.

For the Fibre Remote IPE, the bandwidth is defined to be 1310 nanometers. The bandwidth-length product for single-mode is 5 GHz km and for the graded index multi-mode is 800 MHz km.

When you engineer a fibre-optic link, you must make sure that the total signal attenuation between the Fibre Superloop Network and the Fibre Peripheral Controller Electro-optical interfaces does not exceed 13 dB loss.

> ***Note:*** If the fibre-optic link already exists, check the link's characteristics and end-to-end loss to determine if it can support a Fibre Remote IPE and, if it can, at what distance between Meridian 1 and the Fibre Remote IPE.

Bandwidth engineering rules

The eye closure due to dispersion must not exceed 0.5 dB to ensure reliable operation of the Electro-optical packlets. Based on this, the normalized bandwidth (B_N) must not be less than 0.71.

The maximum fibre length for a link can be calculated by the following equation, where **L** is the fibre-optic link length, $\mathbf{B_L}$ is the bandwidth-length product, $\mathbf{B_T}$ is the NRZ bit rate of 155.52 MHz, and $\mathbf{B_N}$ is the maximum allowable optical bandwidth of 0.71 when normalized to the above bit rate.

$$L = \frac{B_L}{B_T x B_N}$$

To engineer a multi-mode fibre link, use the following steps:

1 Obtain bandwidth-length product of the fibre from the manufacturers' data sheet.

2 Calculate the maximum link length using the above equation.

3 Measure the eye closure of the fibre. When measured at 155.52 MHz and 1310 nanometers it should be less than 0.5 dB.

4 Measure the attenuation of the fibre link. When measured at 1310 nanometers the attenuation should not exceed 10 dB.

Example: A maximum link length of a multi-mode fibre link with bandwidth-length product of 500NHz km would be:

$$L = \frac{500 MHz km}{155.52 MHz x 0.71} = 4.53 km$$

This multi-mode fibre link should not exceed 4.53 kilometers in length. A 3 dB safety margin should be allowed when engineering a multi-mode link to compensate for additional attenuation as a result of core size variations in fibers. The single-mode fibre core size varies between 8 and 9 microns and the multi-mode fibre core size varies between 50 and 62.5 microns.

Fibre-optic interface specification

When planning a fibre-optic link, you must consider the transmit and receive signal power and the signal attenuation of each component in the link to determine total signal attenuation.

Table 1 shows the transmit and receive signal power level at the signal source and the signal destination. In the table, for simplicity use **FXNET** for Fibre Superloop Network and **FXPEC** for Fibre Peripheral Controller cards. The receive circuit on the Electro-optical packlet must be able to detect a signal at a level as low as –28 dBm.

Table 1
Fibre-optic transmit and receive signal levels

Signal source	Transmitted power		Received power	
	Min	Max	Min	Max
FXNET Card	–15 dBm	–8 dBm	–28 dBm	–8 dBm
FXPEC Card	–15 dBm	–8 dBm	–28 dBm	–8 dBm

Fibre-optic link loss characteristics

The fiber-optic link components add to the total end-to-end link signal attenuation. The fibre-optic cable attenuation depends on the type of cable selected. The manufacturer's data sheet provides necessary parameter values, which must be considered when engineering the link. In addition, the signal attenuation is also affected by the number of splices in the link and the signal loss in the link terminating the fibre-optic connectors.

Table 2 shows an example of different fibre-optic link components and the total signal attenuation for a 10 km link of 11.2 dB.

Table 2
Example of fibre-optic link components and their attenuation factors

Component	Quantity	Attenuation in (dB)	Total attenuation in (dB)
Fibre (10 km)	1	0.6/km	6.0
Splices	10	0.2/splice	2.0
FC/PC Connectors	4	0.8/connector	3.2

Maximum calculated signal attenuation across the link is 12 dB, which allows 1dB safety margin.

> ***Note:*** Actual attenuation must be determined from specific manufacturer's data sheets for each link component.

Fibre-optic cable handling considerations

Fibre-optic cable selection, installation, and routing require special considerations. Splices and connector contacts represent discontinuities that contribute to the attenuation of the signal as it propagates through the link.

Routing the fibre-optic cable must be considered with care. The most critical routing areas are tight spots where the cable must be bent. When bending a cable you must make sure that the minimum bending radius of 1.4 inches (3.5 cm) is not exceeded. If the cable is bent tighter than the minimum radius, the attenuation increases and the cable may break or become damaged.

Before you start routing and splicing fibre-optic cables, read the cable specification sheet and adhere to the specified installation rules.When handling optical fibres, follow the safety recommendations at all times. Keep all connectors capped while the cables are disconnected.

WARNING

When handling optical fibers, follow the recommended safety procedures at all times.

Before you can handle optical fibres, you must take necessary training and become certified in working with fibre-optic cables.

Cable types and their terminations

Single-mode fibres and fibre-optic connectors allow only one path for light to propagate because of the small diameter of the fibre. These are used for high speed transmission and longer transmission distances. Multi-mode fibres and fibre-optic connectors allow more than one mode of propagation for a specific wavelength. These cause dispersion of light and limit the effective bandwidth and distance of communication. For the Fibre Remote IPE, Northern Telecom recommends single-mode fibre-optic cables.

If a multi-mode fibre-optic link already exists, it must be evaluated to determine if it will support the Fibre Remote IPE application and, if it will, at what distance from Meridian 1. The distance of the link can be determined by finding a point of the fibre-optic link where the signal loss is less than 13 dB for a given transmission rate.

To evaluate an existing link, contact your Northern Telecom distributor to learn the method and instrumentation required to test the link’s suitability for the Fibre Remote IPE application.

A fibre-optic link may be composed of single-mode or multi-mode fibres, splices, and fibre-optic connectors. In a floor-standing Fibre Remote IPE, the fibre-optic link terminates at the optical I/O panel FC/PC fibre-optic connectors. In a wall-mounted Fibre Remote IPE cabinet, the fibre-optic link terminates at the fibre management frame and continues from the fibre management frame to the Electro-optical packlet FC/PC fibre-optic connectors installed on the Fibre Peripheral Controller card. In both cases, FC/PC fibre-optic connectors have to be installed onto fibres of the link so that the link can be directly connected to the FC/PC fibre-optic connectors of the Fibre Remote IPE.

System planning and ordering

Meridian 1 provides the user with a variety of system sizes and features. To select a system that will best suit your current and future communication needs, you must plan carefully. Contact your Northern Telecom representative or your Northern Telecom distributor to help you plan the system.

If you are installing a new Meridian 1 with Fibre Remote IPE, refer to *Meridian 1 installation planning* (553-3001-120) and *Meridian 1 system engineering* (553-3001-151) for overall system information. To obtain specific planning and ordering information for the fibre-optic link and network and peripheral cards interfacing with this link, follow the information below.

If you have an existing fibre-optic link, you must evaluate it to determine if the link characteristics such as loss, fibre-optic mode, and so on, can support a Fibre Remote IPE. You also must evaluate the distance between Meridian 1 and the Fibre Remote IPE—the link loss should not exceed 13 dBs.

System selection

Determine the type of Fibre Remote IPE enclosure. This selection may be dictated by the installation preference, blocking considerations, and the number of IPE cards required at the remote site.

If you plan a floor-standing system, you must select the Meridian 1 modular column. If you plan a wall-mounted system, you must select the cabinet.

In some applications where non-blocking or low blocking traffic considerations are important, you have to limit the number of peripheral cards supported by each Fibre Peripheral Controller card. For a non-blocking condition, the 120 voice/data time slots will support seven or eight 16-port line cards. Each additional line card in the IPE Module or the wall-mounted cabinet increases call blocking under high traffic conditions. Refer to *Meridian 1 system engineering* (553-3001-151) to calculate traffic.

The system type may also be dictated by the number of ports required at the remote site. The modular column configuration supports 16 line cards and provides a maximum of 256 ports. This column may be expanded by adding a second IPE Module to support an additional 256 ports. Each IPE Module requires a Fibre Peripheral Controller card at the remote site and a corresponding Fibre Superloop Network card at the local Meridian 1 site.

In addition to line cards, the Fibre Remote IPE supports all the cards that do not require external connection to Meridian 1 common or network equipment.

The wall-mounted configuration supports 10 line cards. You may want to select the wall-mounted system if your system size requirement is less then ten IPE cards. To expand this type of system beyond 10 IPE cards, you must add an expansion cabinet adjacent to the main cabinet and install up to six IPE cards into the first six IPE card slots of the expansion cabinet.

Fibre Remote IPE site planning

When you select a site for your Fibre Remote IPE, you must consider the number of ports currently required at the site and the possibility of expansion to meet future needs. You also must consider environmental, power, and cable routing requirements.

Environmental requirements

Fibre Remote IPE equipment conforms to the same environmental requirements as the rest of the Meridian 1 equipment. Temperature, humidity, and altitude for Meridian 1 equipment operation should not exceed the specifications shown in Table 3.

Table 3 shows the operating and storage environmental specifications. Ideally Meridian 1 equipment should operate in a stable environment at 22° C (72° F); however, the system is designed to operate in the temperature and humidity ranges specified in the table.

Table 3
Environmental requirements

Condition	Environmental specifications
Operating	
Temperature	0° to 60° C (32° to 140° F)
Relative humidity	5% to 95% noncondensing
Altitude	3,048 meters (10,000 feet) max
Storage	
Temperature	–50° to 70° C (–58° to 158° F)
Relative humidity	5% to 95% noncondensing

Power requirements

At the remote site, cards in the IPE Module are powered by the power supply installed on the left-hand side of the IPE Module. The power consumption of the Fibre Peripheral Controller card is not significantly different from the power consumption of the standard Peripheral Controller card. This allows the standard IPE Module's power supply to be used in Fibre Remote IPE.

Similarly, the wall-mounted cabinet power supply, which is installed in the left-hand side of the cabinet shelf, provides power to the Fibre Peripheral Controller card and up to 10 IPE cards. The expansion cabinet requires its own power supply to provide power to an additional six IPE cards.

Table 4 shows the power supply DC output voltages and the current they supply to the Fibre Superloop Network and Fibre Peripheral Controller cards in a redundant and nonredundant fibre-optic link configuration. It also shows the corresponding total power consumption for each card.

Table 4
FXNET and FXPEC with single and dual Electro-optical packlets power requirements

Voltage source in VDC	Nonredundant link		Redundant link	
	FXNET card	FXPEC card	FXNET card	FXPEC card
+5 V	2100 mA	1700 mA	2300 mA	1900 mA
–4.5 V	650 mA	650 mA	1300 mA	1300 mA
+15 V		50 mA		50 mA
–15 V		50 mA		50 mA
+12 V	50 mA		50 mA	
–12 V	50 mA		50 mA	
Total Power	14.6 W	13 W	20 W	18.5 W

Fibre-optic cable requirements

A fibre-optic link may be composed of single-mode or multi-mode fibres, splices, and fibre-optic connectors. In a floor-standing Fibre Remote IPE, the fibre-optic link terminates the optical I/O panel FC/PC fibre-optic connectors. In a wall-mounted Fibre Remote IPE cabinet at the fibre-optic link terminates at the a fibre management frame and continues from the fibre management frame to the Electro-optical packlet FC/PC fibre-optic connectors installed on the Fibre Peripheral Controller card. In both cases, FC/PC fibre-optic connectors have to be installed onto fibres of the link so that the link can be directly connected to the FC/PC fibre-optic connectors of the Fibre Remote IPE.

> ***Note:*** Single-mode fibres and fibre-optic connectors allow only one path for light to propagate because of the small diameter of the fibre. These are used for high speed transmission and longer distances. Multi-mode fibres and fibre-optic connectors allow more than one mode of propagation for a specific wavelength. These cause dispersion of light and limit the effective bandwidth and distance of communication. For the Fibre Remote IPE, Northern Telecom recommends single-mode fibre-optic cables.

To connect the Electro-optical packlet from the Fibre Superloop Network and Fibre Peripheral Controller card faceplate to the optical I/O panel, two optical patchcords are used. For a redundant configuration, four optical patchcords are used, two for transmit sides and two for receive sides.

Electro-optical equipment planning form—example

Table 5 shows a sample planning form. It lists components required to construct a fibre-optic link.

Table 5
Example of the planning form for a wall-mounted Fiber Remote IPE

Item	Part Number	Quantity at Meridian 1	Quantity at Remote IPE
FXNET card		1	
FXPEC card			1
EOI packlet		1 or optionally 2	1 or optionally 2
EOI packlet blank		1 for a non-redundant link	1 for a non-redundant link
I/O panel		1	1
I/O to faceplate cords		2	2
FP/CP connectors		2	2
Fibre-optic cable (if 1 km lengths)			10 (10 km link)
Splicing			

Electro-optical equipment planning form

Enter the part number and the quantity for each item required at Meridian 1, for the fibre-optic link, and at the Fibre Remote IPE.

Table 6
Ordering form

Item	Part Number	Quantity at Meridian 1	Quantity at Remote IPE

Equipment installation and configuration

This chapter describes the installation of the Fibre Remote IPE as an integral part of the Meridian 1 system. It explains how to prepare the site and check the equipment before installing it.

System overview

Fibre Remote IPE service can be added to existing Meridian 1 system options 21E, 51, 51C, 61, 61C, 71, 81, and 81C originally installed and operating without Fibre Remote IPE, or it can be an integral part of a newly installed Meridian 1 system. In either case, the connection of the Fibre Remote IPE to the NT1P61 Fibre Superloop Network card over the fibre-optic link should begin after:

— A previously installed Meridian 1 system is upgraded to run on generic software X11 release 19 or higher. It should operate correctly.

— A newly installed system using generic software X11 release 21 or higher. It should operate correctly.

To install a new Meridian 1 system or expand an existing one, refer to *Meridian 1 system installation procedures* (553-3001-210). It provides the information on how to install, verify, and maintain the Meridian 1 system.

Adding one or more Fibre Remote IPE sites to a Meridian 1 system is treated as a straightforward system expansion, that is, the system should be fully operational before the Fibre Remote IPE equipment is installed and connected to Meridian 1. This simplifies installation and fault isolation during installation. To complete the installation of a Fibre Remote IPE site, you should perform the preinstallation procedures to prepare the site, install the fibre-optic link, and install and connect the equipment.

Preinstallation procedures include:

— Preparing the site

— Unpacking and inspecting the equipment

— Routing and splicing fibre-optic cables to create a fibre-optic link between two sites

— Connecting the fibre-optic link FC/PC optical connector to the Fibre Remote IPE

— Taking an inventory of Fibre Remote IPE equipment

— Selecting the Meridian 1 network slot for the NT1P61 Fibre Superloop Network card

Installation procedures include:

— Installing the NT1P61 Fibre Superloop Network card in the selected network card slot

— Installing the NT1P63 Electro-optical packlets into the NT1P61 Fibre Superloop Network card

— Installing the fibre-optic patchcords between the Fibre Superloop Network faceplate FC/PC optical connectors and the optical I/O panel at the rear of the Meridian 1 module housing the NT1P61 Fibre Superloop Network card

— Connecting the fibre-optic link FC/PC optical connector to the optical I/O panel at the rear of the Meridian 1 module housing the NT1P61 Fibre Superloop Network card

— Connecting the master system monitor and TTY terminal cables at the local site

— Connecting the fibre-optic link to the I/O panel

— Installing the Fibre Remote IPE column or cabinet

— Installing the NT1P62 Fibre Peripheral Controller card in Remote IPE module or cabinet controller card slot

— Installing the NT1P63 Electro-optical packlet(s) on the NT1P62 Fibre Peripheral Controller card

— Installing the fibre-optic patchcords between the Fibre Peripheral Controller faceplate FC/PC optical connectors and the optical I/O panel at the rear of the module

— Connecting the slave system monitor and TTY terminal cables at the remote site

— Connecting the fibre-optic link to the Fibre Remote IPE

Fibre Remote IPE is offered in two versions to provide flexibility in line size and equipment location. These are:

— Floor-standing column

— Wall-mounted cabinet

Note: The floor-standing column consists of one IPE Module and houses up to 16 IPE cards. The wall-mounted cabinet may consist of only the main cabinet when 10 or fewer IPE cards are required, or the main and expansion cabinets when up to 16 IPE cards are required.

Preinstallation preparation

Preinstallation preparation consists of preparing the site, unpacking and inspecting components, taking inventory, selecting the network slot for the NT1P61 Fibre Superloop Network card, installing the card, installing the fibre-optic link, and preparing the remote site cables, grounding, power source, and the location of the Remote IPE column or cabinets.

Preparing the site

When preparing a site, you must address environmental, structural, and electrical factors. These factors must be considered for the entire system, that is, Meridian 1 and Fibre Remote IPE sites. This information is available in:

— *Meridian 1 installation planning* (553-3001-120)

— *Meridian 1 system engineering* (553-3001-151)

— *Meridian 1 power engineering* (553-3001-152)

To prepare the site for Fibre Remote IPE installation, you must first:

1 Install and verify the operation of Meridian 1 without linking Meridian 1 to the Fibre Remote IPE site(s). Refer to *Meridian 1 system installation procedures* (553-3001-210).

2 Install the Fibre Remote IPE column. Also refer to *Meridian 1 system installation procedures* (553-3001-210), or

Install the cabinet version of Fibre Remote IPE as described in "Installing the wall-mounted cabinet" on page 65.

3 Route and splice the fibre-optic cable between the Meridian 1 site and Fibre Remote IPE site(s) as described in "Connecting the fibre-optic link to the Remote IPE Module" on page 64.

Unpacking and inspection

Unpack and inspect the equipment for damage. When unpacking, follow general precautions recommended by computer and telephone equipment manufacturers:

— Remove items that generate static charge from the installation site.

— Use antistatic spray if the site is carpeted.

— Ground yourself before handling any equipment.

— Remove equipment carefully from its packaging.

— Visually inspect the equipment for obvious faults or damage. Any damaged component must be reported to your sales representative and the carrier who delivered the equipment.

— Do not bend and twist the fibre-optic cables excessively. Make sure that the cable is not bent beyond the specified minimum bending radius of 1.4 inches (3.5 cm) when handled or installed.

— Hold the plug-in cards by their nonconducting edges and keep them in their antistatic bags until you are ready to install them.

— Do not stack the plug-in cards on top of each other.

Taking inventory

After the equipment has been unpacked and visually inspected, verify that all the equipment is at the site before the installation begins. Equipment received must be checked against the shipping documents. Any shortages must be noted and reported to your sales representative.

Installing the fibre-optic link

If the fibre-optic link already exists, check the fibre-optic link characteristics and the end-to-end loss to determine if the link can support a Fibre Remote IPE and, if it can, at what distance between Meridian 1 and the Fibre Remote IPE.

Consult your Northern Telecom distributor to learn how to verify that the existing fibre-optic link is suitable for the Fibre Remote IPE application and what equipment to use to do so.

To install the fibre-optic link to the Fibre Remote IPE, the link fibres must be terminated with FC/PC optical connectors at the Meridian 1 site. At the Fibre Remote IPE, the link fibers are also terminated with FC/PC optical connectors for the floor-standing modular system. For the wall-mounted cabinet system, however, the link fibres are terminated into a fibre management frame and continue from the fibre management frame to the Electro-optical packlet FC/PC optical connectors on the Fibre Peripheral Controller faceplate.

When routing the cables to the Meridian 1 column, the floor-standing Fibre Remote IPE column, or wall-mounted Fibre Remote IPE cabinet, take the following precautions:

— Do not bend the fibre-optic cable or individual fibres beyond the minimum bending radius of 1.4 inches (3.5 centimeters).

— Protect the exposed parts of the cable and fibres with plastic conduit.

— Terminate each selected fibre with an FC/PC optical connector (a fibre-optic cable may contain more fibres than required by the single or redundant link design). At the fibre management frame, the type of optical connectors used depends on the available frame optical connectors.

Mark each fibre with Tx (transmitting) or Rx (receiving) designator behind the FC/PC optical connector to identify its function in the link.

WARNING

When handling optical fibers, follow the recommended safety procedures at all times.

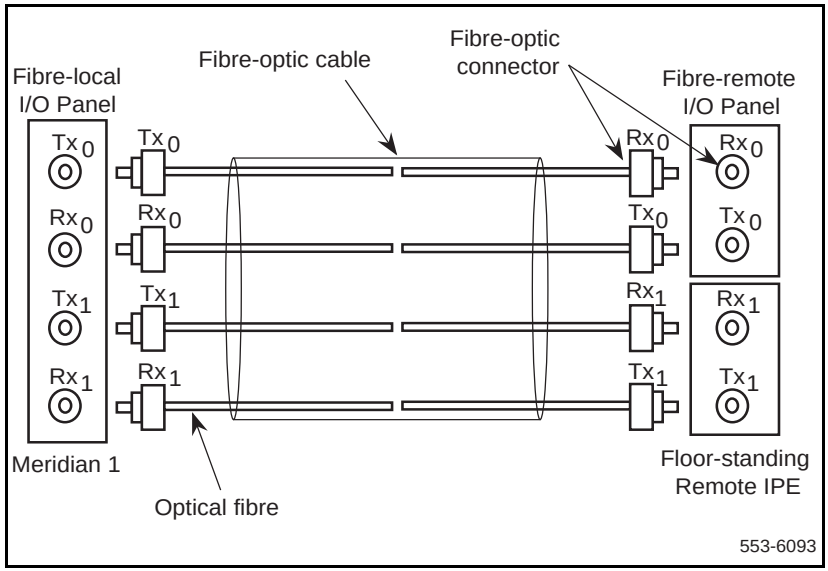
Before you can handle optical fibres, you must take necessary training and become certified in working with fibre-optic cables.

If possible, shut off power to all external transmission equipment so light beams will not be present at the exposed ends of the fiber cables. Keep all connectors capped while the cables are disconnected.

Handle fibers with extreme care. Observe a minimum bending radius of 1.4 inches (3.5 cm) at all times. Optical connections to the optical units should be finger-tightened only.

The link fibre marked Tx_0 at the remote site must be marked Rx_0 at the local site, and the link fibre marked Rx_0 at the remote site must be marked Tx_0 at the local site. For a redundant link, in addition to Tx_0 and Rx_0, Tx_1 at the remote site must be marked Rx_1 at the local site, and Rx_1 at the remote site must be marked Tx_1 at the local site as shown in Figure 8.

Figure 8
Fibre optic link



Selecting the Fibre Superloop Network card slot

The position of the NT1P61 Fibre Superloop Network card in Meridian 1 depends on the Meridian 1 system option installed at the local site. The system option determines what type of module will house the card.

Table 7 lists modules that provide network card slots, the system options where these modules are used, and card slots where network cards can be housed.

Table 7
Modules supporting a Fibre Superloop Network card

Modules	System option	Network card slot
NT5D21 Core/Network Module	51C, 61C, 81C	Card slots 0–7
NT8D11 CE/PE Module	21E	Card slots 4–9
NT8D35 Network Module	71, 81, 81C	Card slots 5–12
NT9D11 Core/Network Module	51C, 61C	Card slots 0–7
NT6D39 CPU/Network Module	51, 61	Card slots 1–8

Network card slots in modules listed in Table 7 also house other network-type cards that contend with the NT1P61 Fibre Superloop Network card for space in the module. If one or more network card slots are empty, where to install the NT1P61 Fibre Superloop Network card is determined as follows:

1 Check all network cards in the module and see if there are any NT8D04 Superloop Network cards.

2 If no NT8D04 Superloop Network cards are installed, you can use any empty network card slot to install an NT1P61 Fibre Superloop Network card.

3 If the module contains one or more NT8D04 Superloop Network cards, you must install the NT1P61 Fibre Superloop Network card at least one network card slot away from the NT8D04 Superloop Network card. Otherwise, refer to *Meridian 1 system engineering* (553-3001-151) for a detailed explanation of where to install the NT1P61 Fibre Superloop Network card when only slots adjacent to NT8D04 Superloop Network cards are available.

Note: Each network card slot supports two network loops. Although an NT8D04 Superloop Network card physically occupies only one card slot, it nevertheless occupies four network loops. That means that two network loops of an adjacent network card slot are also occupied by the NT8D04 Superloop Network card. Therefore, only a network card not requiring network loop access can be installed in the empty card slot whose network loops are being used by the NT8D04 Superloop Network card.

Meridian 1 fibre-optic equipment installation

To complete the installation of the fibre-optic interface that links Meridian 1 to the Fibre Remote IPE equipment, you must:

— Install and verify the operation of the Meridian 1 system, if it is not already installed and operating correctly

— Identify the network card slot and install the NT1P61 Fibre Superloop Network card in Meridian 1

— Install the NT1P75 fibre-optic patchcords

— Connect the fibre-optic link to the optical I/O panel

Installing and verifying Meridian 1 operation

The Fibre Remote IPE facilities can be added to an existing Meridian 1 system running on X11 release 19 or higher, by installing the appropriate electro-optical equipment in the system, installing one or more Fibre Remote IPEs at different remote sites, and linking Meridian 1 with remote sites using single or redundant fibre-optic links.

To install a new Meridian 1 system, follow the instructions in *Meridian 1 system installation procedures* (553-3001-210). It describes how to install a complete Meridian 1 system and how to connect the power, the internal and external communication cables, and subscriber loops.

If a new Meridian 1 system is configured with Fibre Remote IPE facilities, the system will normally be assembled at the factory with cards already installed and NT1P75 fibre-optic patchcords connected between the NT1P61 Fibre Superloop Network card faceplate and the optical I/O panel at the rear of the module housing this card. All you would have to do is connect the fibre-optic link to the Meridian 1 and the Fibre Remote IPE optical I/O panels to complete the link. However, if the card is not installed, follow the steps on page 48.

Installing the Fibre Superloop Network card

The purpose of the following steps is to instruct you how and where to install the Superloop Network card(s). In a new Meridian 1 system, the cards would have been installed in a network card slot at the factory; however, you may have to install additional NT1P61 Fibre Superloop Network cards to expand the number of remote sites or replace a defective card.

NT1P63 Electro-optical packlets, which are installed on the NT1P61 Fibre Superloop Network card, are normally installed in the factory, however, you may have to install an additional NT1P63 Electro-optical packlet on the NT1P61 Fibre Superloop Network card when you want to make a single fibre-optic link into a redundant link. The packlet and the card can be installed when the system is powered up and running.

To install these cards:

1 Set the ENB/DIS switch on the Fibre Superloop Network card to DIS.

2 Pull the NT1P61 Fibre Superloop Network card's upper locking device away from the faceplate and press the lower locking device downwards. While holding the card by these locking devices, insert it into the card guides of the selected network card slot.

3 Slide the card into the module until it engages the backplane connector.

4 Carefully push the upper locking device lever towards the faceplate and the lower locking device upwards to insert the card connector into the backplane connector and lock the card in place.

5 If not already installed, install the NT1P63 Electro-optical packlet(s) onto the NT1P61 Fibre Superloop Network card by inserting the NT1P63 Electro-optical packlet, connector first, through the NT1P61 Fibre Superloop Network card faceplate opening and plugging it into the connector on the NT1P61 Fibre Superloop Network card. For consistency, install the NT1P63 Electro-optical packlet into the top connector location if only one NT1P63 Electro-optical packlet is required (for nonredundant link operation). Install the blank packlet into the bottom connector location. For a redundant link, install both NT1P63 Electro-optical packlets.

6 Install the optical I/O patch-panel, which is a part of the NT1P76AA cable assembly, in the empty connector slot of the module's I/O panel by screwing its top and the bottom screws into the slot screw holes on the I/O panel. Use one connector slot for the FC/PC optical connectors that link the NT1P61 Fibre Superloop Network card and the NT1P63 Electro-optical packlets to the fibre-optic link, as shown in Figure 9.

7 Use another empty connector slot in the I/O panel for the System Monitor/TTY ports I/O patch-panel, also part of the NT1P76AA cable assembly, as shown in Figure 10. Screw the top and the bottom screws of the cable's connector bracket into the connector slot screw holes on the I/O panel.

8 Set the ENB/DIS switch on the Fibre Superloop Network card to ENB and observe the LED on the card as it performs self-tests. The LED should blink three times and then stay ON until enabled by software. When enabled by software, the LED turns OFF permanently, if operational.

Installing fibre-optic patchcords

NT1P75 fibre-optic patchcords connect NT1P63 Electro-optical packlets to fibre-optic connectors on the I/O panel at the rear of the network module housing the NT1P61 Fibre Superloop Network card. Figure 9 illustrates NT1P63 Electro-optical packlet FC/PC fibre-optic connectors on the NT1P61 Fibre Superloop Network card and the I/O panel at the rear of the module. To install patchcords:

1 Carefully push each patchcord through the cable channel from the front of the module to the back. For a single fibre-optic link, use one patchcord that contains two fibres, one for the receive side and one for the transmit side. For a redundant link, you need two patchcords. When handling fibre-optic cables, do not bend them more than their minimum allowed bending radius of 1.4 inches (3.5 cm).

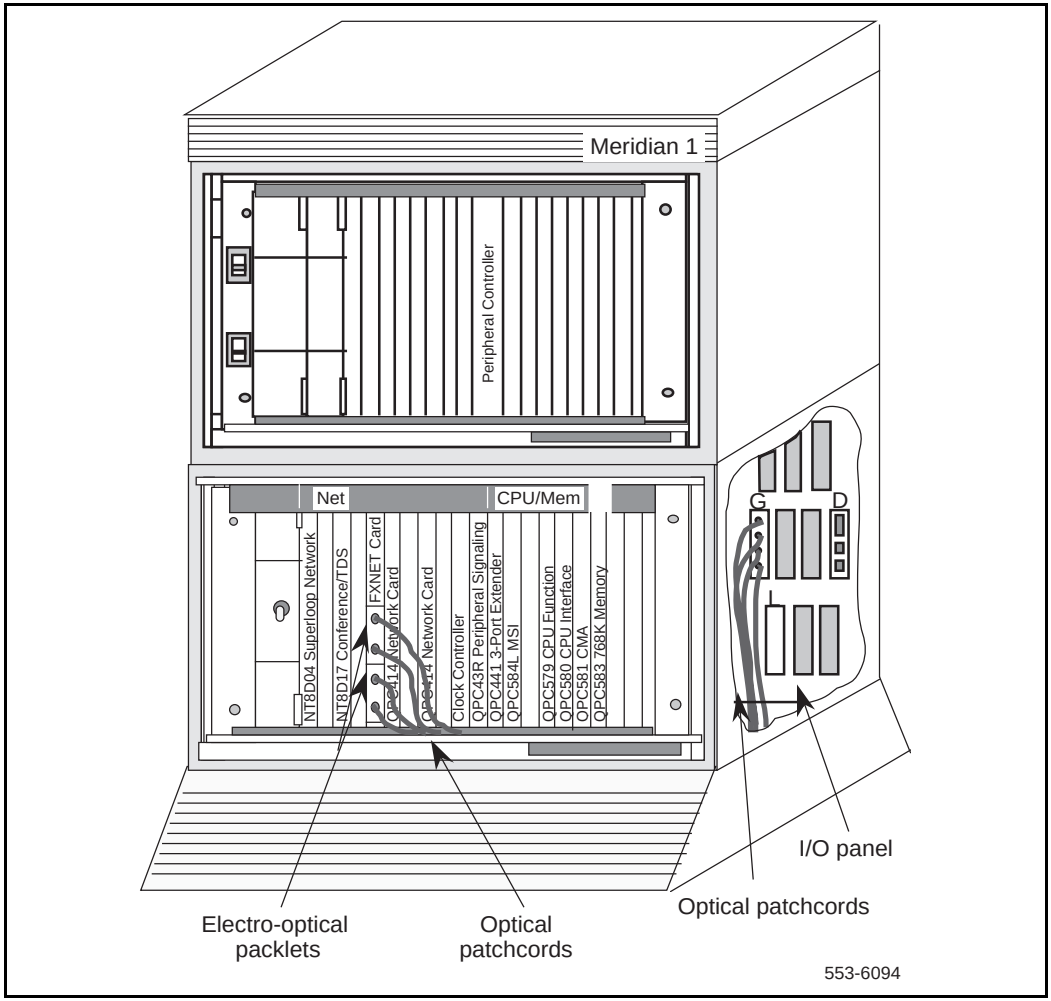
2 Install the optical I/O patch-panel in the empty connector slot of the module's I/O panel. Find an empty connector slot that matches the size of the patch-panel bracket and use two screws and two washers to install it on the I/O panel. The optical I/O patch-panel can contain up to four FC/PC fibre-optic connectors, which are used for a redundant link configuration.

3 Plug the NT1P75 fibre-optic patchcord FC/PC optical connectors into the appropriate NT1P63 Electro-optical packlet FC/PC optical connectors on the NT1P61 Fibre Superloop Network card faceplate. The receive (Rx) is the top connector on each packlet and transmit (Tx) is the bottom connector.

4 Plug the other NT1P75 fibre-optic patchcord FC/PC optical connectors into connectors at the optical I/O patch-panel at the rear of the module. Use Tx and Rx designators to identify transmit and receive patchcord connectors. Repeat this step for all patchcords.

Figure 9 shows a Meridian 1 option 51 with the NT1P61 Fibre Superloop Network card and patchcords installed.

Figure 9
Fibre Superloop Network card patchcord connections in Meridian 1



Installing system monitor and TTY cables

The system monitor cable is normally installed in the factory and does not have to be installed at the site. The cable that has to be installed at the site is the cable connecting the terminal or TTY to the RJ45 connector on the I/O panel located at the rear of the module that contains the NT1P61 Fibre Superloop Network card.

Refer to Figure 10 to see the I/O panel and the top connector. The top connector is used to connect the terminal or TTY to the Fibre Superloop Network card when the MMI port is in the MMI mode, or to connect the Fibre Superloop Network card to an SDI port when the MMI port is in the SL-1 mode.

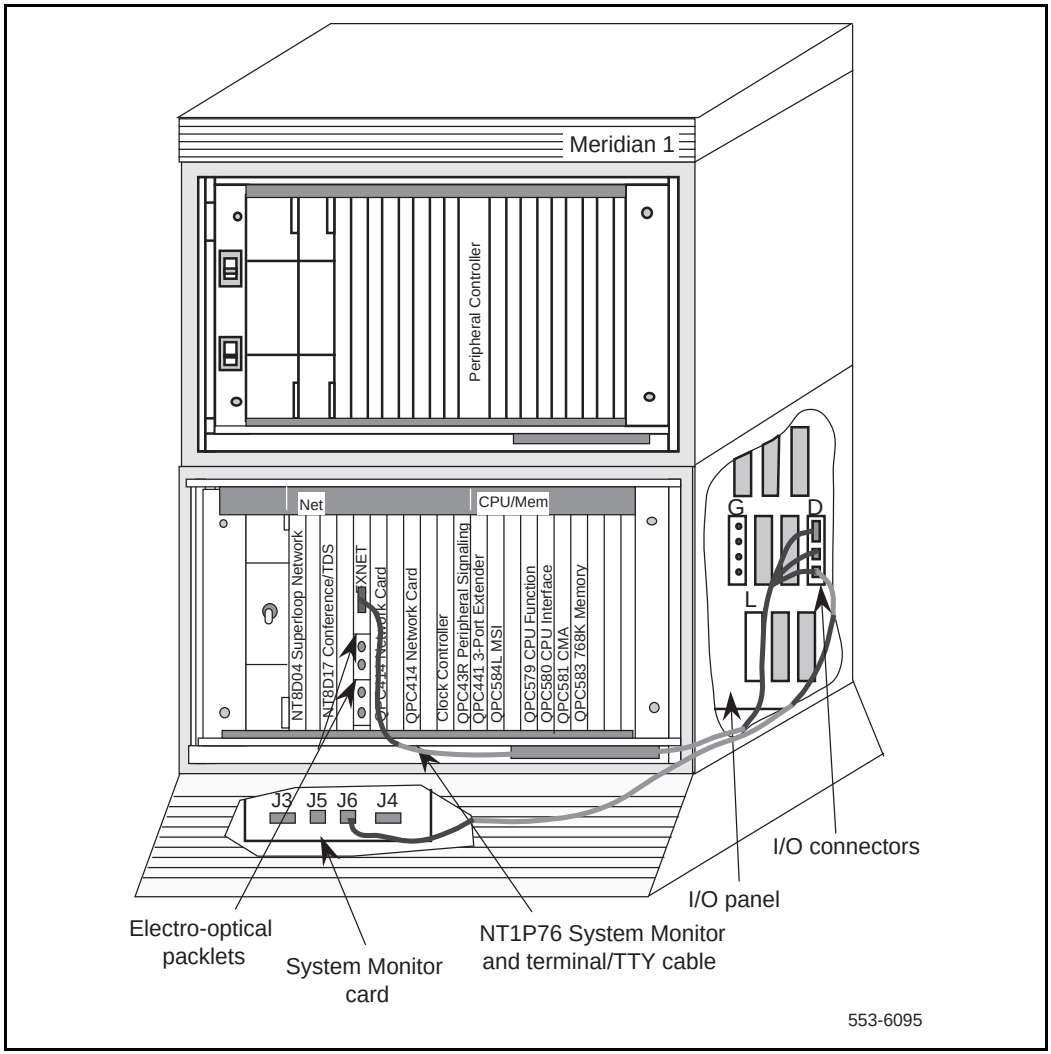
> ***Note:*** To connect the Fibre Superloop Network card to an SDI port of the SDI cards such as NTND02BA, QPC841C, or QPC139B, you must connect the RJ45 connector on the I/O panel to the RS-232 port on the front panel of the SDI card. The cable must be a null modem type with pin 2 (TD) and pin 3 (RD) swapped and provide DSR and CTS pins high (+12 V), such cable is P0695821. To connect to an NT8D41AA SDI Paddle Board to the Fibre Superloop Network card, use NT8D84 AA and NT8D93AJ cables between the SDI port and the I/O panel at the rear of the module. For switch setting on individual SDI cards, refer to *Circuit card installation and testing* (553-3001-211).

In the local Meridian 1 column, the pedestal contains a master system monitor that monitors system alarms. Alarms from a Fibre Remote IPE site are reported over the fibre-optic link and the NT1P61 Fibre Superloop Network card to the Meridian 1 master system monitor and from there to the CPU. The CPU sends alarm messages to the system terminal or TTY identifying the problem.

Figure 10 shows NT1P61 Fibre Superloop Network card connections to the I/O panel to provide an MMI, a slave system monitor, and master system monitor port.

Figure 10 also shows the connection between the system monitor card and the master monitor port on the I/O panel.

Figure 10
System monitor and TTY cable connections



To connect the NT1P61 Fibre Superloop Network card to the system monitor in the pedestal, to the slave system monitor in an adjacent column, and to the terminal or TTY:

1 Plug the 15-pin D-type connector at the one end of the NT1P76AA cable into the 15-pin D-type connector located on the faceplate of the NT1P61 Fibre Superloop Network card.

2 Route the other end of the cable through the cable channel to the I/O panel at the back of the module with the NT1P61 Fibre Superloop Network card.

3 Install the electrical I/O patch-panel into an empty I/O panel connector slot by screwing the top and bottom screws of the cable connector bracket to the connector slot on the I/O panel. The electrical I/O patch-panel (bracket) is part of the NT1P76AA cable.

4 Plug the RJ11 connector at one end of the cable into the RJ11 receptacle on the I/O panel to provide an RS422 interface to the system monitor.

5 Plug the other end of the cable RJ11 connector into J6 receptacle on the system monitor in the pedestal.

6 Connect an RJ11 cable between the second RJ11 receptacle on the I/O panel and daisy-chain the I/O patch-panel connectors to other Fibre Superloop Network cards as shown in Figure 9, if required.

7 Plug the RJ45 connector at the one end of the A0361365 terminal cable into an empty connector slot on the I/O panel.

8 Plug the other end of the A0361365 terminal cable into the RJ45/RS232 adapter, and then plug this adapter into the terminal or TTY RS232 connector. An RJ45 to DB25 adapter can be used to connect a terminal that has a DB25 type connector for its RS232 interface.

9 If the Fibre Superloop Network card is connected to an SDI card, connect the A0695821 cable to the SDI port in the module.This DB-25 male to DB-25 female cable is a null modem type with DSR and CTS pulled up to +12 V. Refer to *Circuit card installation and testing* (553-3001-211) for switch setting for the specific SDI card.

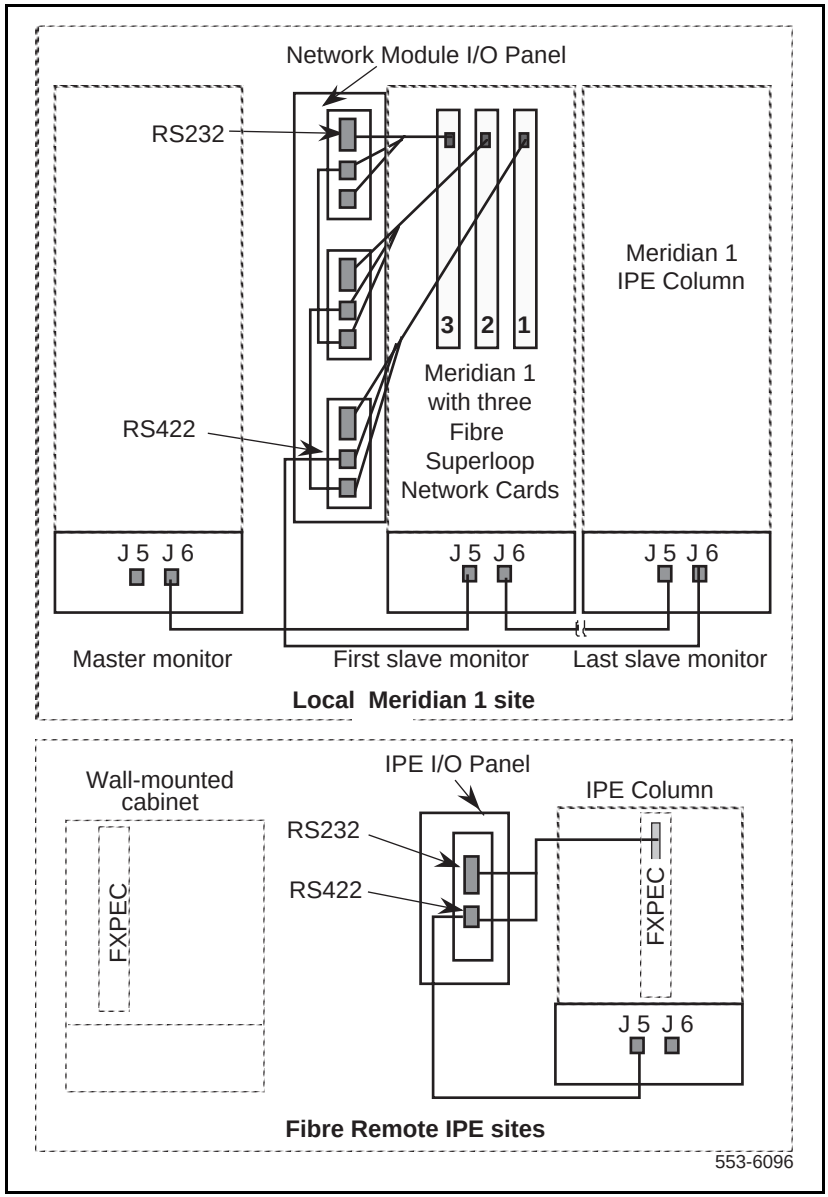
10 Plug the other end of the A0695821 cable into a DB-9 to DB-25 adapter and plug the DB-9 adapter connector into the DB-9 connector on the I/O patch-panel.

Figure 11 shows Meridian 1 columns and three NT1P61 Fibre Superloop Network cards that support three remote sites. Cable connected to the NT1P61 Fibre Superloop Network card faceplate connector provides an RS232 SDI/MMI port and two RS422 system monitor ports. Figure 11 also shows system monitor connections between multiple Fibre Superloop Network cards and the master system monitor residing in the pedestal. It shows the connection between the master and slave system monitors when multiple adjacent columns exist. At the remote site, the system monitor connects only to the module on top of the pedestal, as shown in the figure.

From Fibre Superloop Network #1, you can extend an RJ11 cable to the lowest slave system monitor J6 connector in the pedestal. This connection makes the three Fibre Superloop Network cards the lowest slave system monitors in the chain where Fibre Superloop Network card #3 is the lowest.

The Fibre Remote IPE alarms are received over the link and through the Fibre Superloop Network cards to the system monitor J6 connector.

Figure 11
System monitor connections at the Meridian 1 and the Fibre Remote IPE



Connecting the fibre-optic link to Meridian 1

Each required fibre of the fibre-optic cable, at each end of the link, must be terminated with an FC/PC optical connector. This connector plugs into the FC/PC optical connector on the I/O panel.

For a single link, you need to install connectors on only two fibres at each end of the link, one for the transmit side and one for the receive side. For a redundant link, four fibres must have connectors installed at each end.

To connect the link to the network optical I/O panel at the local Meridian 1 site:

1 Identify the link FC/PC optical connector marked Tx_0 and Rx_0 for a single link, or marked Tx_0, Rx_0, Tx_1, and Rx_1 for a redundant link.

2 Identify the transmit and receive connectors on the optical I/O panel (bracket) installed in an empty network I/O panel connector slot at the local Meridian 1 site.

3 Plug the link FC/PC optical connector marked Tx_0 into the I/O panel FC/PC optical connector marked Tx_0.

4 Plug the link FC/PC optical connector marked Rx_0 into the I/O panel FC/PC optical connector marked Rx_0.

5 Repeat steps 3 and 4 for the Tx_1 and Rx_1 if you have a redundant link.

Floor-standing column Fibre Remote IPE installation

To complete the installation of floor-standing Fibre Remote IPE equipment, you must:

— Install the floor-standing column

— Install the cards in the IPE Module

— Install the NT1P75 fibre-optic patchcords

— Connect the fibre-optic link to the optical I/O panel

Note: All Fibre Remote IPE modules or cabinets are installed in the factory with cards already in their respective card slots. The only exception is the power supply, which is packaged separately and must be installed at the site.

Installing the floor-standing column

The column is normally assembled in the factory with cards already installed and NT1P75 fibre-optic patchcords connected between the NT1P62 Fibre Peripheral Controller card faceplate and the optical I/O panel at the rear of the IPE Module.

If the column is not assembled in the factory, to install the Meridian 1 type modular column (floor-standing column) at the remote site, follow the instructions in *Meridian 1 system installation procedures* (553-3001-210). It describes how to install the pedestal, the IPE Module, and the top cap and how to connect the power, the internal and external communication cables, and subscriber loops.

To install the PFTU to the floor-standing Fibre Remote IPE, follow the instructions in *Meridian 1 system installation procedures* (553-3001-210).

Installing cards in the Remote IPE Module

The purpose of the following steps is to instruct you how and where to install the cards in the Remote IPE Module. Even though the cards might have been shipped installed from the factory, we provide step-by-step instructions for card installation, which should be followed when additional IPE cards are installed or defective cards are replaced.

NT1P63 Electro-optical packlets, which are installed on the NT1P62 Fibre Peripheral Controller card, are normally installed in the factory; however, you may have to install an additional NT1P63 Electro-optical packlet onto the NT1P62 Fibre Peripheral Controller card when you want to make a single fibre-optic link into a redundant link.

To install these cards:

1 Pull the NT1P62 Fibre Peripheral Controller card's upper locking device away from the faceplate and press the lower locking device downwards. Which holding the card by these locking devices, insert it into the card guides into the Controller slot left-hand card guide, which is located immediately to the right of slot 7.

2 Slide the card into the cabinet until it engages the backplane connector.

3 Push the upper locking device lever towards the faceplate and the lower locking device upwards to insert the card connector into the backplane connector and lock the card in place.

4 Observe the LED on the card as it performs self-tests. The LED should blink three times and then stay ON until enabled by software. When enabled by software, the LED turns OFF permanently, if operational.

5 Install the NT1P63 Electro-optical packlet onto the NT1P62 Fibre Peripheral Controller card by inserting the NT1P63 Electro-optical packlet, connector first, through the NT1P62 Fibre Peripheral Controller card faceplate opening and plugging it into the connector on the NT1P62 Fibre Peripheral Controller card. For consistency, install the NT1P63 Electro-optical packlet into the top connector if only one Electro-optical packlet is required (for single link operation). Install a blank packlet in place of the second NT1P63 Electro-optical packlet.

6 Install IPE cards in slots 0 through 7 and 8 through 15 by pulling the card locking devices away from the faceplate and inserting the cards into the card guides of an IPE card slot.

7 Slide the card into the module until it engages the backplane connector, and then push the locking device levers towards the faceplate to insert the card connector into the backplane connector and lock the card in place.

8 Repeat steps 6 and 7 for each IPE card.

9 Remove the back panel to access the I/O panel connector slots.

10 Install the optical I/O patch-panel in the empty connector slots of the IPE Module's I/O panel by using two screws and two washers for each connector. Use connector slots J2 and J3 for the FC/PC optical connectors that link the NT1P62 Fibre Peripheral Controller card and NT1P63 Electro-optical packlets, using patchcords, to the fibre-optic link, as shown in Figure 12. Use the empty J4 and J5 connector slots in the I/O Panel for the System Monitor and TTY I/O patch-panels, as shown in Figure 13.

Installing fibre-optic patchcords

NT1P75 fibre-optic patchcords connect NT1P63 Electro-optical packlets to FC/PC fibre-optic connectors on the I/O panel at the rear of the IPE Module. Figure 12 illustrates NT1P63 Electro-optical packlets FC/PC fibre-optic connectors and FC/PC fibre-optic connectors on the I/O panel at the rear of the module. To install the patchcords:

1 Carefully push each NT1P75 fibre-optic patchcord through the cable channel from the front of the module to the back. For a single fibre-optic link, use one patchcord that contains two fibres, one for the receive side and one for the transmit side. For a redundant link you need two patchcords. When handling fibre-optic cables, do not bend them more than their minimum allowed bending radius of 1.4 inches (3.5 cm).

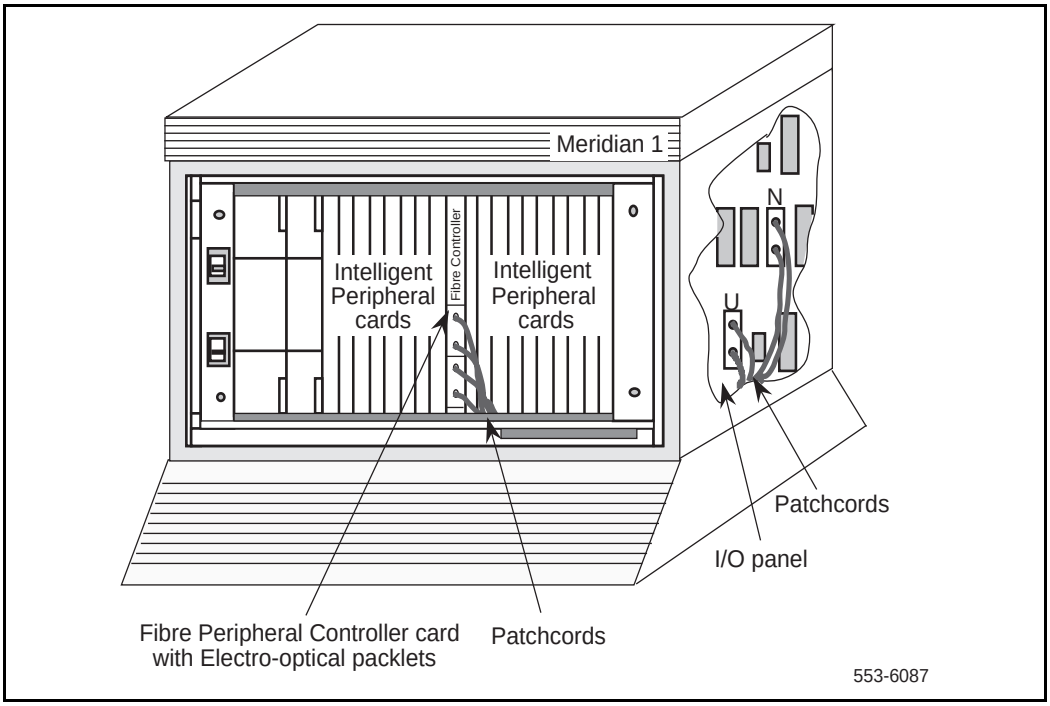
2 Plug NT1P75 fibre-optic patchcord FC/PC optical connectors into the appropriate NT1P63 Electro-optical packlet FC/PC optical connectors on the NT1P62 Fibre Peripheral Controller faceplate.

3 Plug the other NT1P75 fibre-optic patchcord FC/PC optical connectors to the FC/PC fibre-optic connectors on the I/O panel.

4 Repeat steps 2 and 3 for all patchcords.

Figure 12 shows the Fibre Remote IPE Module with IPE cards and the NT1P62 Fibre Peripheral Controller card already installed. It also shows the NT1P75 fibre-optic patchcords routing from the NT1P62 Fibre Peripheral Controller card faceplate to the module's FC/PC optical connectors on the I/O panel.

Figure 12
Patchcord connections on the IPE Module



Installing system monitor and TTY cables

The system monitor cable is normally installed in the factory and does not have to be installed at the site. The cable that has to be installed at the site is the cable connecting the terminal or TTY to the 9-pin D-type connector on the IPE Module I/O panel (the MMI port).

In the remote floor-standing column, the pedestal contains a slave system monitor used to monitor Fibre Remote IPE system alarms. These alarms are reported over the fibre-optic link and through the NT1P61 Fibre Superloop Network card to the Meridian 1 master system monitor and from there to the CPU. The CPU sends alarm messages to the system terminal or TTY identifying the problem.

These alarms are also displayed or printed on the remote site terminal or TTY. Figure 13 shows the system monitor and TTY cable connections for a floor-standing column.

To connect the NT1P62 Fibre Peripheral Controller card to the terminal or TTY and the slave system monitor in the pedestal; you must follow these steps to install NT1P78AA Y cable between the backplane and the I/O panel:

1 Plug the NT1P78AA cable 24-pin connector into the 24-pin connector (SL0 position) located at the top center of the backplane behind the NT1P62 Fibre Peripheral Controller card.

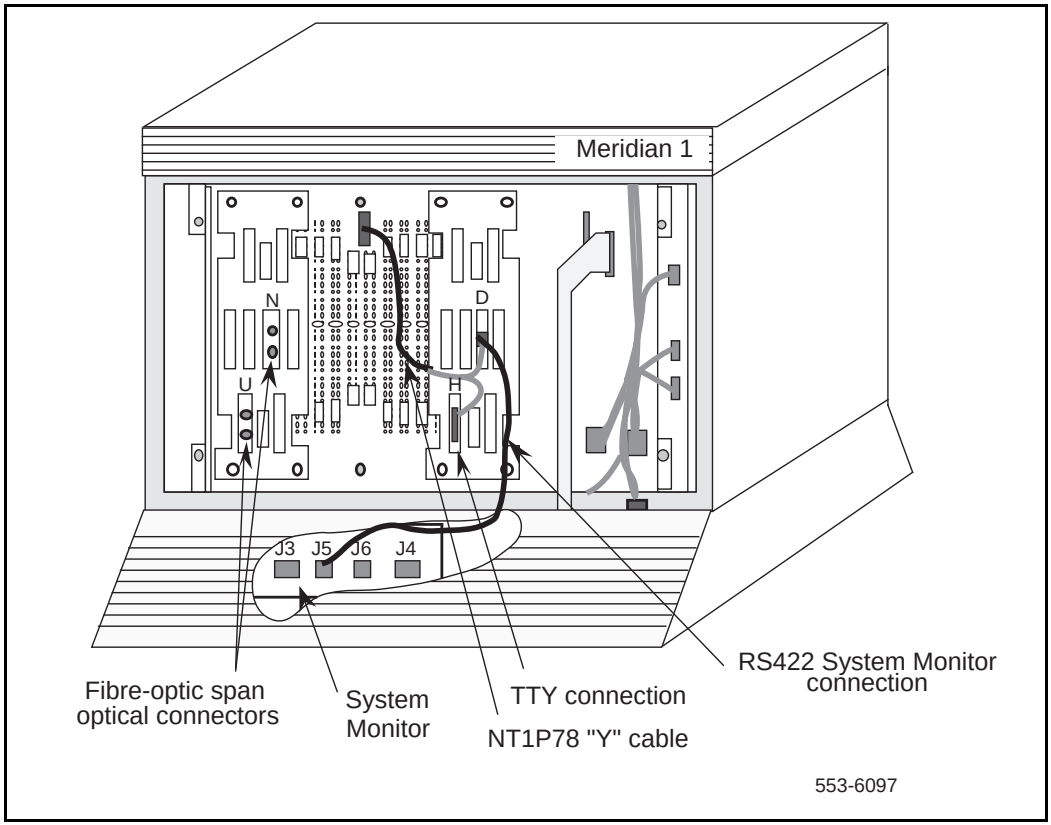
2 Install the NT1P78AA I/O D-type patch-panel into the empty connector slot of the IPE Module I/O panel.

3 Install the NT1P78AA cable RJ11 I/O patch-panel on the empty connector slot of the IPE Module I/O panel.

4 Plug the RJ11 connector at one end of the cable into the RJ11 receptacle on the IPE Module I/O panel. This cable provides an RS422 interface to the system monitor.

5 Plug the other end of the cable RJ11 connector into the J6 receptacle on the system monitor in the pedestal. Refer to Figure 11 for connecting system monitoring cables for a column with the IPE Module.

Figure 13
System monitor and TTY cable connections



6 Check the NT8D22 System Monitor factory switch settings for the slave system monitor. Refer to *Option settings, Circuit card installation and testing* (553-3001-211).

7 Plug the NTAK1108 9-pin D-type connector into the 9-pin D-type connector on the IPE Module I/O panel.

8 Plug the other end of the NTAK1108 cable into the terminal or TTY RS232 connector.

Connecting the fibre-optic link to the Remote IPE Module

The fibre-optic link connects the optical I/O panel connector at the rear of the Remote IPE Module to the optical I/O panel at the rear of the module housing the NT1P61 Fibre Superloop Network card in the Meridian 1 system. The routing and splicing of fibre-optic cables along the link should have been completed before the Fibre Remote IPE site installation.

Each fibre of the fibre-optic cable, at each end of the link, must be terminated with an FC/PC optical connector. This connector plugs into the FC/PC optical connector on the I/O panel.

For a single link, you need to connect only two fibres at the end of the cable, one for the transmit side and one for the receive side. For a redundant link, four fibres must be connected.

To connect the link to the Remote IPE I/O panel:

1 Identify one link fibre as Tx_0 and another as Rx_0 for a single link, or identify four fibres as Tx_0, Rx_0, Tx_1, and Rx_1 respectively for a redundant link.

2 Identify the transmit and receive connectors on the optical I/O panel at the rear of the Remote IPE Module.

3 Plug the link FC/PC optical connector marked Tx_0 into the I/O panel FC/PC optical connector marked Tx_0.

4 Plug the link FC/PC optical connector marked Rx_0 into the I/O panel FC/PC optical connector marked Rx_0.

5 Repeat steps 3 and 4 for the Tx_1 and Rx_1 if you have a redundant link.

Wall-mounted Fibre Remote IPE installation

To complete the installation of wall-mounted Fibre Remote IPE equipment, you must:

— Install the wall-mounted cabinet

— Install the cards in the cabinet

— Connect the fibre-optic link to the fibre management frame and the Fibre Peripheral Controller card

Installing the wall-mounted cabinet

To install NT1P70 main and NTAK12 expansion wall-mounted cabinets that house the Fibre Remote IPE, follow the instructions below.

The NT1P70 main wall-mounted cabinet is shipped from the factory completely installed, that is, all IPE cards and the NT1P62 Fibre Peripheral Controller card are already installed. The power supply is shipped separately. The NTAK12 expansion cabinet is optional and is ordered only if you require more than 10 IPE cards at the remote site.

To install wall-mounted Remote IPE cabinets, locate and prepare the wall area, install cabinets, connect the ground wires, and connect the power. When selecting the wall area for the cabinet installation, make sure you provide for convenient fibre-optic and subscriber loop cable routing.

To complete these tasks, follow the steps below:

1 Unpack and inspect the cabinet.

2 Level and install the mounting bracket on the wall as shown in Figure 14. If you are installing the expansion cabinet next to the main cabinet, line up the two brackets and use the provided spacer between brackets.

3 Remove the front cover and all cards from the cabinet to make the cabinet lighter and to prevent card damage in case the cabinet drops when being installed on the wall.

4 Position the cabinet over the mounting bracket so that the bracket hook engages the slot at the rear of the cabinet. The slot is located at the top center of the cabinet as shown in Figure 14.

5 Bolt the cabinet down by using two wood screws at the lower front of the cabinet. See Figure 14 for the location of the screw holes.

6 Install the 6 AWG copper ground wire between the approved building ground and the ground lug at the bottom of the cabinet.

7 Repeat steps 3 through 6 for the expansion cabinet, if required.

Figure 14 shows the Fibre Remote IPE cabinet with the mounting bracket and the mounting holes. It also shows the ground lug for ground connection.

8 Install the power supply in slot 0 in the NT1P70 main cabinet shelf and turn the power switch to OFF.

9 At the building ground end of the wire, use two fastening clamps to connect the wire to the building ground, insulate the connection with electric tape, and post a DO NOT DISCONNECT tag.

10 Measure the ground resistance between the ground lug at the bottom of the NT1P70 main cabinet and the ground prong on the cabinet power cord. It should measure 0 Ohms. If the resistance is greater then 0 Ohms, check the ground terminal on the power supply power connector continuity to the cabinet chassis.

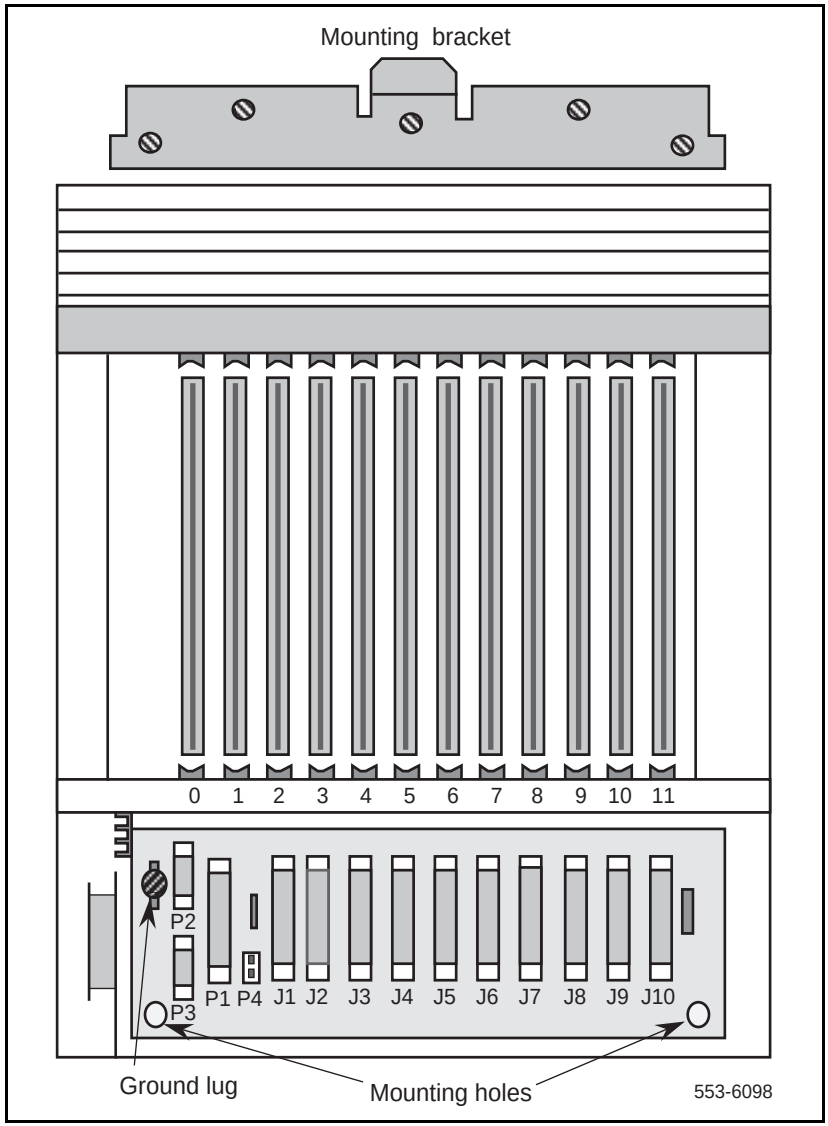
11 Connect the power cord from the IPE shelf power supply to the commercial AC power outlet for an AC system. For a DC system, connect the IPE shelf power converter cord to the DC power source.

12 Disconnect the building ground wire from the ground lug on the NT1P70 main cabinet and measure the resistance between the tip of the disconnected ground wire and the ground lug on the cabinet. If the resistance is more than 5 Ohms, check the building ground and the ground terminal at the AC wall outlet where the cabinet power cord is connected.

13 Disconnect the power cord from the wall outlet for the AC system or the DC power source for the DC system and reconnect the 6 AWG ground wire to the cabinet ground lug.

14 Reconnect the supply power cord to the AC power outlet for an AC system or to the DC source for a DC system.

Figure 14
Fibre Remote IPE cabinet



15 If the Fibre Remote IPE requires an expansion cabinet to accommodate up to 16 IPE cards, repeat steps 1 through 14 for the NTAK12 expansion cabinet.

16 Connect the NT1P70 main cabinet to the NTAK12 expansion cabinet by installing the cable between connector P1 of the main cabinet and P1 of the expansion cabinet.

This completes the cabinet installation and system ground test. You can now install the plug-in cards.

Installing cards in the wall-mounted cabinet

The purpose of the following steps is to instruct you how and where to install the cards in the Fibre Remote IPE cabinet. Even though the cards are shipped in the cabinet from the factory, for safety and ease of installation, you have removed these cards from the cabinet before you installed it onto the wall.

NT1P63 Electro-optical packlets, which are installed on the NT1P62 Fibre Peripheral Controller card, are normally installed in the factory; however, you may have to install an additional NT1P63 Electro-optical packlet on the NT1P62 Fibre Peripheral Controller card when you want to make a single fibre-optic link into a redundant link.

To install these cards:

1 Pull the NT1P62 Fibre Peripheral Controller card's locking devices away from the faceplate. While holding the card by these devices, insert the card into the card guides in slot 1. Refer to Figure 16 for card positions in the shelf.

2 Slide the card into the cabinet until it engages the backplane connector, and then push the locking device levers towards the faceplate to insert the card connector into the backplane connector and lock the card in place.

3 If not already installed, install the NT1P63 Electro-optical packlet on the NT1P62 Fibre Peripheral Controller card by inserting the NT1P63 Electro-optical packlet, connector first, through the NT1P62 Fibre Peripheral Controller card faceplate opening and plugging it into the connector on the NT1P62 Fibre Peripheral Controller card. If only one NT1P63 Electro-optical packlet is required (for single link operation), for consistency, insert the NT1P63 Electro-optical packlet into the top connector and install the blank packlet into the bottom connector.

4 Install IPE cards in slots 2 through 11 by pulling the card locking devices away from the faceplate and inserting the cards into the card guides, engaging the backplane connector, and locking the card in place by pressing the locking devices against the card faceplate.

Connecting fibre-optic link to the wall-mounted cabinet

In the wall-mounted cabinet configuration, the fibre-optic link connects to the fibre management frame located within 100 feet of the cabinet. From the fibre management frame, the optical cable is routed to the cabinet and connected directly to the NT1P63 Electro-optical packlet FC/PC optical connectors located on the NT1P62 Fibre Peripheral Controller card faceplate. Figure 15 shows a fibre-optic link connected to the NT1P63 Electro-optical packlets.

Note: For detailed information on how to interconnect the fibre-optic link and the Fibre Remote IPE wall-mounted cabinet at the fibre management frame, refer to the *Interconnect Configuration Installation and maintenance* (A0392186) documentation package.

To connect the link:

1 Install optical connectors on the link fibres and connect the link to the fibre management frame optical connectors.

2 Install the optical connectors at the end of each fibre of the NT1P79 optical cable, and insert each connector into the fibre management frame connector where the corresponding link fibre is connected. Repeat this for each NT1P79 optical cable coming from the wall-mounted Fibre Remote IPE cabinet.

3 At the Remote IPE cabinet, carefully push the cable end(s) through the protective tubing to guide, support, and protect the cable under the cabinet, as shown in Figure 15.

Note: When handling fibre-optic cables, do not bend them more than their minimum allowed bending radius of 1.4 inches (3.5 cm).

4 Wrap each cable around a plastic drum located at the bottom left-hand side of the cabinet as viewed from the front. Extend it through the hole at the bottom of the cabinet as shown in Figure 15. For a redundant link, repeat this step for the second cable.

5 At the wall-mounted cabinet, plug the fibre-optic cable with FC/PC optical connectors at one end (as supplied with the cabinet) into the Fibre Peripheral Controller card Electro-optical packlet(s) in the cabinet.

- Identify the transmit and receive FC/PC optical connectors on the cable and the transmit and receive FC/PC optical connectors on the NT1P62 Fibre Peripheral Controller faceplate.
- Plug the cable FC/PC optical connector marked Tx_0 into the lower FC/PC fibre-optic connector on the Electro-optical packlet marked Tx_0 located on the Fibre Peripheral Controller faceplate.
- Plug the link's FC/PC optical connector marked Rx_0 into the upper FC/PC fibre-optic connector on the Electro-optical packlet marked Rx_0 located on the Fibre Peripheral Controller faceplate.
- Repeat the previous two steps for the link's FC/PC optical connectors Tx_1 and Rx_1, for a redundant link.

Figure 15 shows the tube that protects the fibre-optic link cable from damage. It also shows the routing of the fibre-optic link to the FC/PC optical connectors on the NT1P63 Electro-optical packlets installed in the NT1P62 Fibre Peripheral Controller card.

Figure 15
Optical cable routing for the wall-mounted cabinet

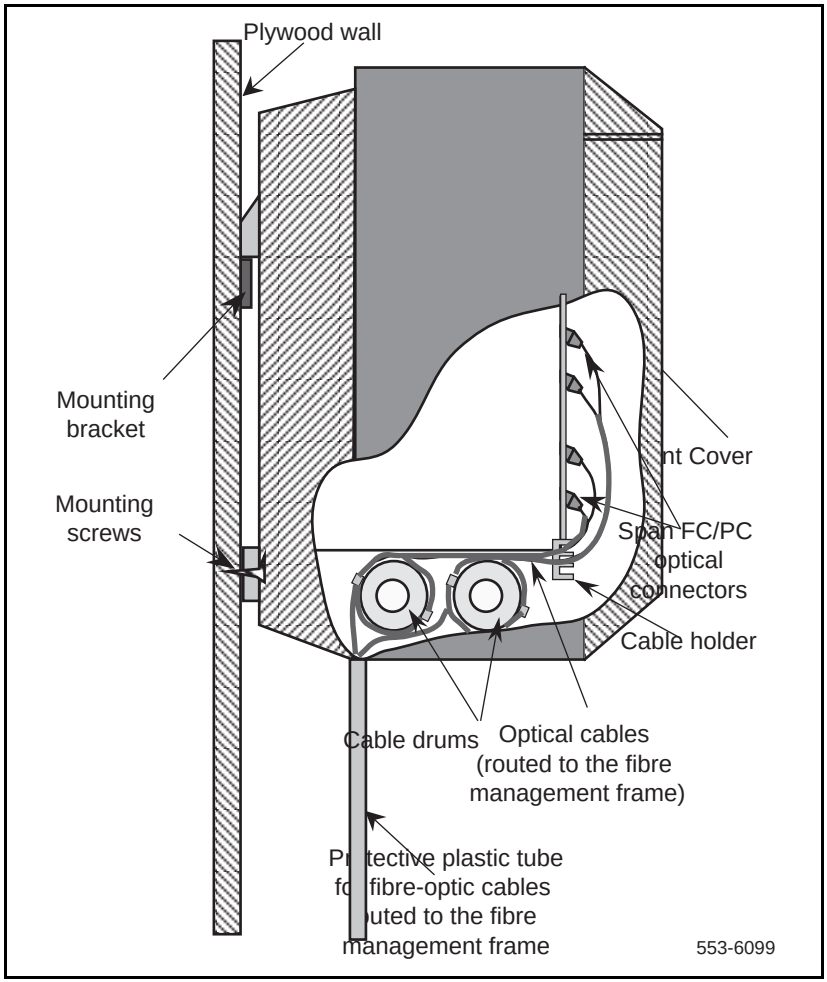
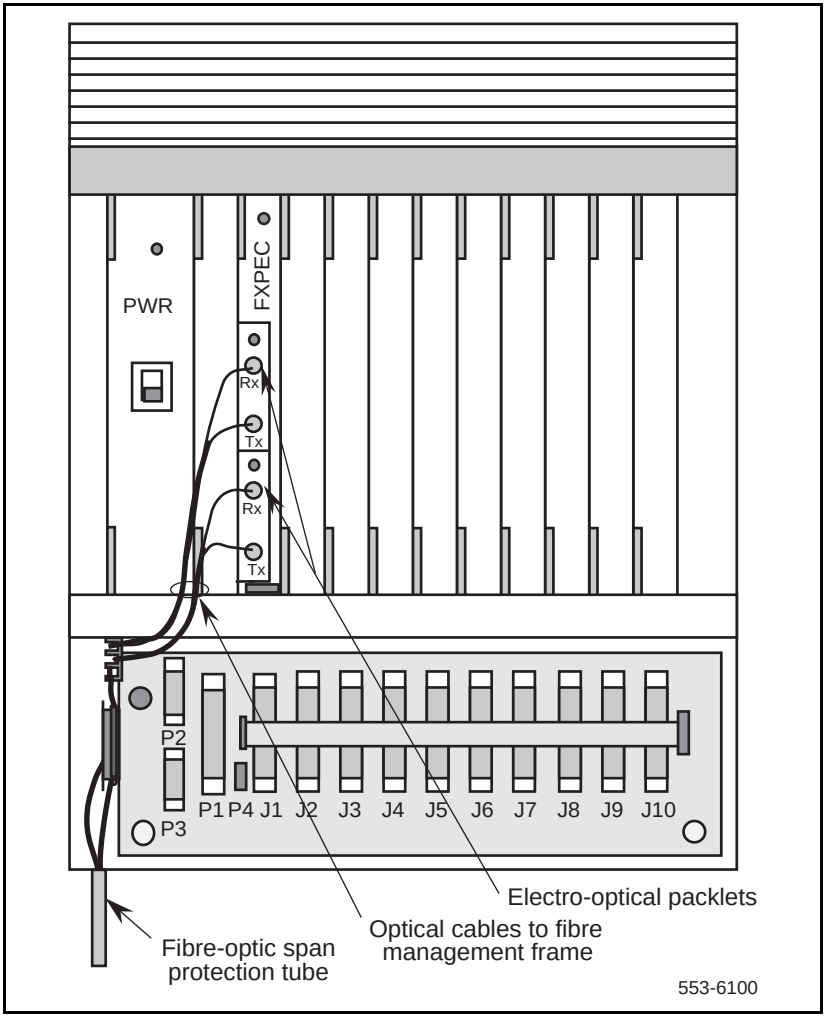


Figure 16 shows the Fibre Remote IPE cabinet with IPE cards, the NT1P62 Fibre Peripheral Controller card, and link connectors already installed.

Figure 16
Link connections on the IPE cabinet



Connecting TTY and subscriber loop cables

In the cabinet option, the monitoring is performed by the NT1P62 Fibre Peripheral Controller card, which receives power fail signals from the power supply through the backplane and sends the information to the NT1P61 Fibre Superloop Network card for processing by the Meridian 1 CPU.

A terminal or a TTY connection to the MMI port and subscriber loop connections at the bottom of the cabinet should be made as shown in Figure 17. The terminal or the TTY is used for configuration and maintenance of the remote site. The terminal or TTY transmission characteristics are 9600 bps, 8 bits, no parity.

> ***Note:*** To set the TTY interface characteristics on an SDI card, refer to switch settings in *Circuit card installation and testing* (553-3001-211).

To connect a terminal or TTY to the MMI port:

1 Plug the 9-pin D-type connector at the one end of the NT8D46AG cable into the P2 connector located at the lower left-hand side of the backplane, when viewed from the front or the cabinet.

2 Plug the other end of the NT8D46AG cable into the terminal or TTY RS232 connector.

To connect subscriber loop (tip and ring) cables to the cabinet's 50-pin connectors J1 through J10, refer to Figure 17. These cables have already been connected to the Main Distribution Frame (MDF) in the preinstallation preparation phase according to the instructions in *Cabling lines and trunks, Meridian 1 system installation procedures* (553-3001-210):

1 Remove the locking bar from connectors J1 through J10.

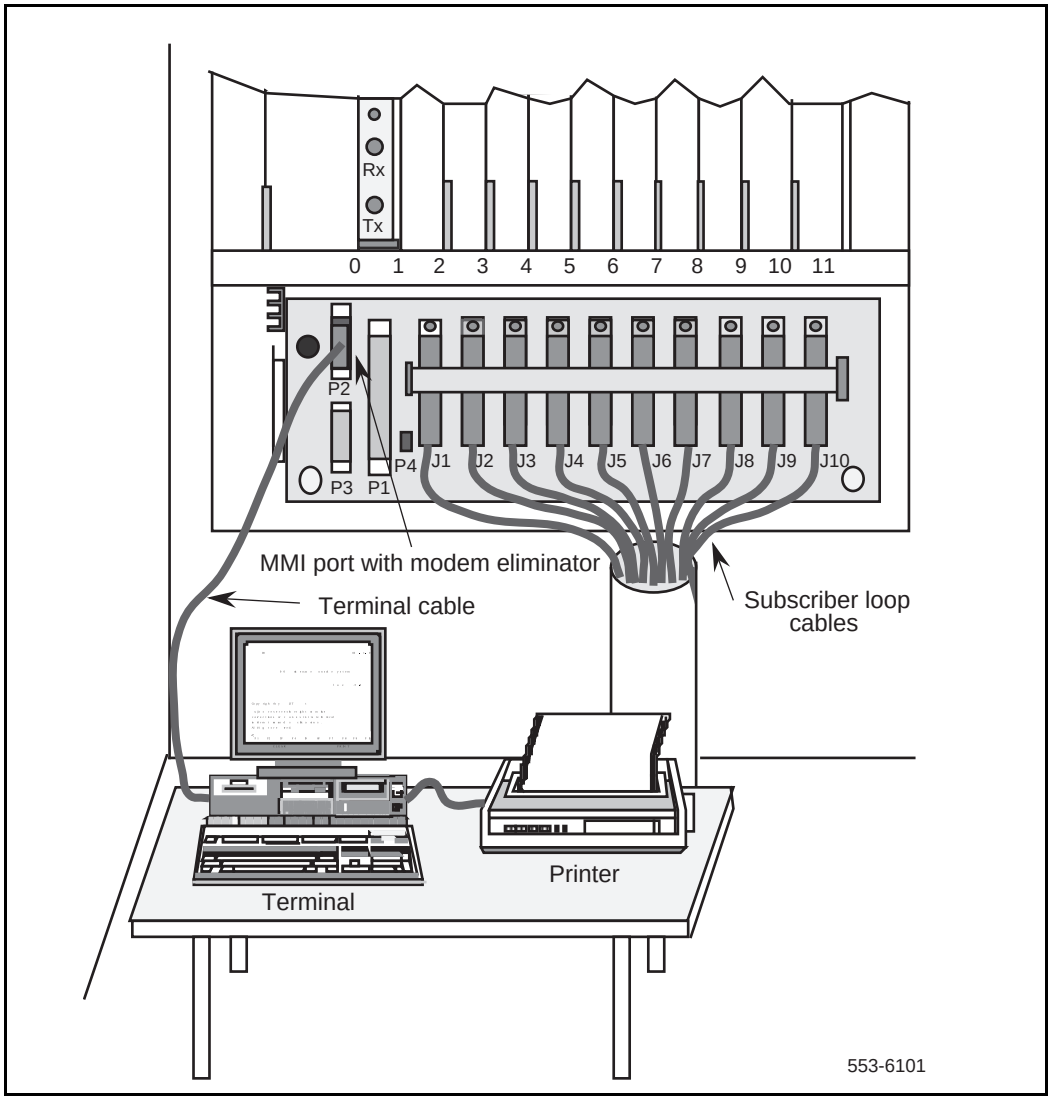
2 Install the 50-pin connector terminating the cable designated J1 and plug it into the connector at the bottom of the cabinet also designated J1.

3 Repeat step 2 for the remaining tip and ring cables from J2 through J10.

4 Replace the locking bar over the cable connectors you just installed.

Figure 17 shows the subscriber loop (tip and ring) connectors that link line cards to the MDF and the terminal connection.

Figure 17
TTY and subscriber loop cable connections



Connecting attendant console power cord to the wall-mounted Fibre Remote IPE

The wall-mounted cabinet backplane contains P4, a two-pin power connector that provides +15 V and –15 V power source for the attendant console.

To make this connection:

1. Connect the attendant console power cord to P4 on the wall-mounted cabinet backplane.
2. Install and configure the attendant console. Refer to *Telephone and attendant console installation* (553-3001-215) and *M1250 and M2250 Attendant Consoles description* (553-2201-117).

Connecting PFTU to the wall-mounted Fibre Remote IPE

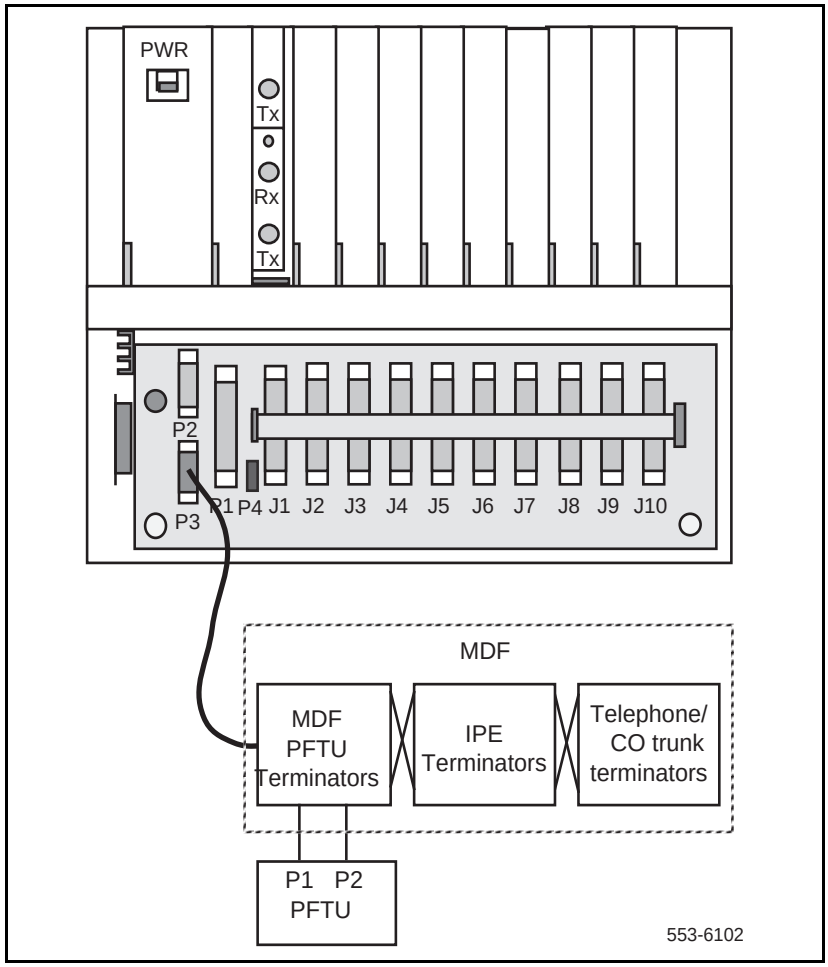
In the wall-mounted cabinet option, the Power Fail Transfer Unit (PFTU) is connected as shown in Figure 18.

To make this connection:

1. Install the PFTU near the MDF and connect it to the MDF according to the instructions in the PFTU user manual.
2. Install the required cable between the PFTU and the P3 15-pin D-type connector on the wall-mounted cabinet. For more information on how to install the PFTU, refer to *Meridian 1 system installation procedures* (553-3001-210).

Figure 18 illustrates the front view of the wall-mounted Remote IPE cabinet. It shows the connection of the P3 Auxiliary 15-pin D-type connector on the Fibre Remote IPE wall-mounted cabinet linking the cabinet to the PFTU and the MDF.

Figure 18
Connecting PFTU to the wall-mounted Remote IPE cabinet



Configuring the Fibre Remote IPE

The configuration and administration of the Fibre Remote IPE and the corresponding fibre-optic equipment at the Meridian 1 local site is identical to the standard Meridian 1 configuration and administration and does not require special considerations.

However, some initial setup functions must be considered at the remote site to identify the remote site system monitor functions of the wall-mounted cabinet to the Meridian 1 CPU. These functions are administered over a Man-Machine Interface (MMI) port connected to a terminal or a TTY at the remote site. These are:

— Configuring fibre-optic cards

— Configuring the system monitor address

— Defining the loadware

— Configuring the MMI port

Configuring fibre-optic cards

When the Fibre Remote IPE equipment is first installed, you must specify the following functions:

— Define the NT1P61 Fibre Superloop Network and NT1P62 Fibre Peripheral Controller cards as standard NT8D04 Superloop Network and NT8D01 Peripheral Controller cards.

— Load Configuration Record Program LD 97 to configure the Fibre Remote and superloop parameter data blocks.

Prompt	Response	Comment
Fibre Remote Parameters Data Block		
REQ	CHG	Change the Fibre Remote parameters
TYPE	FIRP	Fibre Remote parameters
SUPL	0-156	Superloop number associated with the Remote IPE shelf
NNDC	5-(7)-8	No-New-Data-Calls condition threshold
XSMN	(0)–63	System monitor address on the Remote IPE shelf

Superloop Parameters Data Block

REQ	CHG	Change superloop data block
TYPE	SUPL	Superloop type
SUPL	0-156	Superloop number in multiples of 4
ST21	(NO) YES	System type 21
SLOT	(L) R	Network slot default (left) or right
SUPT	FIBR	Superloop type (Fibre)
XPE0	x 0 3	x= Fibre Peripheral Controller card, 0= starting segment, 3= ending segment
XPE1	<cr>	Fibre Peripheral Controller card 1. Usually not equipped in Fibre Remote IPE.
XPEC	1-95	Fibre Peripheral Controller card number. The superloop block is built with default parameters.

Configuring the system monitor address

Configure the system monitor address and Fibre Peripheral Controller card parameters:

— Set switches on the system monitor card to specify a unique number from 1 to 63 and the slave mode for the floor-standing Fibre Remote IPE.

— Define the system monitor address using the MMI port to identify the system monitoring functions for a wall-mounted Fibre Remote IPE cabinet, which does not contain an actual system monitor card. Specify a unique number from 1 to 63 for this system monitoring function.

— Enter time-and-date using the terminal or TTY connected to the MMI port of the Fibre Peripheral Controller or NT1P61 Fibre Superloop Network card.

Defining the loadware

Define the loadware version being downloaded using the terminal or TTY connected to the MMI port as follows:

— Load Print Program LD 22 on the system TTY and print the PSDL directory by executing

Prompt	Response	Comment
REQ	PRT	Request printing of peripheral software versions
TYPE	.PSWV	Peripheral software versions downloaded to the Fibre Superloop Network and Fibre Peripheral Controller cards

— Through the MMI port, enter the QVER command to check the firmware and loadware version on the Fibre Superloop Network card and the Fibre Peripheral Controller card.

— Compare the loadware version obtained by printing the PSDL directory using Print Program LD 22 with the version obtained using the QVER command over the MMI terminal. The two versions must be identical. If not identical, use the SVER command at the MMI terminal to set the PSDL number of the card equal to the number obtained by Print Program LD 22.

— Parameters configured with default values, such as MMI default mode, should not be changed unless default values are not acceptable.

Command	Comment
HELP	Displays a list of commands
<ESC>L	Changes the Fibre Superloop Network or Fibre Peripheral Controller card to MMI mode.
<ESC>R	Changes the Fibre Superloop Network or Fibre Peripheral Controller card to SL-1 mode.
SDEF L/R	Sets default mode to **L**ocal or **R**emote.
QDEF	Queries the MMI port default mode. Response can be **Local** or **Remote.**
STAD <d/m/y/h/m/s>	Sets the time-and-date.
SXSM n	Wall-mounted Fibre Remote IPE cabinet does not have a system monitor card. **n** specifies a slave system monitor number (1–63), which is identified by the Meridian 1 CPU as a slave system monitor.

Configuring the MMI port

The MMI port may be configured in the local (or MMI) mode or the remote (or SL-1 mode).

MMI (local) mode

In the MMI mode, a terminal or TTY is connected to the local MMI port at the Fibre Superloop Network card and another terminal or TTY is connected to the local MMI port at the Fibre Peripheral Controller card. Each terminal is controlling the local MMI functions of the card it is connected to.

MMI commands can be issued at each terminal to control local functions or a submit (SUBM) command and a string can be issued from a terminal or TTY to control the functions of the card at the opposite end of the fibre-optic link.

Note: When entering MMI commands, use solid caps.

The default MMI interface characteristics are set in the Fibre Peripheral Controller card EEPROM as follows:

— Speed—1200 bps

— Character width—8 bits

— Parity bit—none

— 1 stop bit

Note 1: If an SDI port is to be connected to this for remote TTY access, then this port should be configured also for the above settings.

Note 2: A null modem may or may not be required depending on SDI port setup for DTE or DCE.

SL-1 (remote) mode

In the SL-1 mode, a terminal or TTY is connected to the MMI port at the Fibre Peripheral Controller card. This terminal or TTY becomes the Meridian 1 TTY. At the Fibre Superloop Network card, the MMI port is connected to an SDI port and not to a terminal or a TTY.

For the MMI port at the Fibre Peripheral Controller card to be able to communicate with the SDI port connected to the Fibre Superloop Network card MMI port, the interface characteristics must be as follows:

— Speed—9600 bps

— Character width—7 bits

— Parity bit—space

Note: A null modem connector is required in the terminal cable.

Using Fibre Peripheral Controller card MMI terminal, place the Fibre Superloop Network card in the remote mode by executing >**SUBM R <cr>** and place the Fibre Peripheral Controller card in the remote mode by executing >**(esc) R <cr>**.

Therefore, no interface configuration steps are required whether the MMI port at the Fibre Remote IPE is configured in the MMI mode or the SL-1 mode.

Fibre Remote IPE acceptance testing

This section describes the acceptance testing of the Meridian 1 Fibre Remote IPE. The purpose of acceptance testing is to verify that the functions and features of the Fibre Remote IPE are operating correctly.

Overview

Acceptance testing is conducted after the system has been installed, powered up, and appears to be functioning correctly, that is, all LEDs, displays, and system messages indicate that the system is operating correctly. The Fibre Remote IPE acceptance testing should be conducted after:

— A previously installed Meridian 1 system is upgraded with Fibre Remote IPE equipment and generic software X11 release 19 or higher and operates correctly without Fibre Remote IPE equipment

— A newly installed system with Fibre Remote IPE equipment using generic software X11 release 19 higher appears to operate correctly

Acceptance testing verifies the operation of Meridian 1 functions and features at the remote site equipped with the Fibre Remote IPE.

Acceptance testing consists of:

— Checking the system

— Preparing the system for testing

— Testing Meridian 1 functions at the Fibre Remote IPE site

Checking the system

After Fibre Remote IPE equipment has been installed and configured, you can visually inspect Fibre Remote IPE cards to make sure that they are operating correctly by observing their LEDs:

— On the Fibre Superloop Network card, check the card LED located at the top of the faceplate. If the LED on the Fibre Superloop Network card is off, and the Electro-optical packlet(s) LED is also off, the card and packlets are enabled and operating correctly. If the card LED is off and the Electro-optical packlet(s) LED is on, the card is enabled and operating but the packlet is faulty. If the card LED is on, the card is disabled or faulty. To enable the Fibre Superloop Network card or to correct a problem, go to “Fibre Remote IPE fault isolation and correction” on page 111 in the Maintenance section of this manual.

— On the Fibre Peripheral Controller card, check the card LED located at the top of the faceplate. If the LED on the Fibre Peripheral Controller card is off, and the Electro-optical packlet(s) LED is also off, the card and packlets are enabled and operating correctly. If the card LED is off and the Electro-optical packlet(s) LED is on, the card is enabled and operating but the packlet is faulty. If the card LED is on, the card is disabled or faulty. To enable the Fibre Peripheral Controller card or to correct a problem, go to “Fibre Remote IPE fault isolation and correction” on page 111 in the Maintenance section of this manual.

— Check the hexadecimal display on the Fibre Peripheral Controller card. Refer to Appendix A to identify hexadecimal codes displayed by the Fibre Peripheral Controller card during self-test.

If the display and all indicator LEDs on Fibre Remote IPE equipment indicate good operating conditions, the equipment is functional and you may proceed with setting up the necessary equipment for this test.

Setting up test conditions

To conduct acceptance testing, you must have a setup that can verify basic Meridian 1 functions and features initiated and terminated at the Fibre Remote IPE site. You may be able to use the system as configured at the site according to the customer requirements and not have to modify the configuration to perform the acceptance testing.

To conduct the acceptance testing, make sure that the Fibre Remote IPE at the remote site contains at least one IPE (line) card with at least two telephones connected to its subscriber loops. If possible, use some 2500 telephones to check the ringing generator and some digital telephones to check the dual tone multifrequency (DTMF) operation. Also, make sure that a terminal or a TTY is connected to the MMI port through the Fibre Peripheral Controller card backplane connector.

If you have a wall-mounted main and extension cabinets, install at least one line card in each cabinet and connect at least one telephone to each line card subscriber loop.

Performing acceptance testing

Since functions and features at the Fibre Remote IPE site are identical to functions and features at the local Meridian 1 site, the main purpose of acceptance testing is to verify that fibre-optic equipment is functioning correctly. This can be accomplished by:

— performing basic voice calls

— using the MMI terminal to configure and maintain Fibre Remote IPE equipment

— checking the protection switching of the fibre-optic link

Voice calls

A voice call can be established between two voice terminals across a network, between two terminals on the same PBX, and even between two terminals on the same line card.

Acceptance testing of Fibre Remote IPE voice calls is conducted when testing the following basic system features supported by telephone sets connected to subscriber loops at the remote site:

— placing a call to the remote site

— placing a call in call hold/call retrieve

Placing a call to the remote site

From the local Meridian 1 site, place a call to a Fibre Remote IPE site by dialing a remote station directory number (extension number).

> ***Note:*** Meridian 1 treats Fibre Remote IPE subscriber loops as local loops; thus, you need to dial only the extension number to access that station.

To perform a call test:

1 From a terminal at the local Meridian 1 site, dial a terminal at the Fibre Remote IPE site and establish an active call connection.

2 Verify voice transmission by talking with the person at the other terminal. Make sure the speech is clear in both directions.

3 Maintain the connection and ask the person at the remote site to test basic calling features such as call hold/call retrieve.

4 Terminate the call.

Call hold/call retrieve

Call hold is used to place an active call on hold in order to answer an incoming call or place an outgoing call. After releasing an incoming or an outgoing call, you can retrieve the call on hold. For the wall-mounted main and expansion cabinets, you establish calls from stations connected to the subscriber loops in the main and expansion cabinets to verify the inter-cabinet cable connection.

To perform a call hold/call retrieve test:

1 From a terminal at the local Meridian 1 site, dial a terminal at the Fibre Remote IPE site and establish an active call connection.

2 Verify voice transmission by talking with the person at the other terminal.

3 Press the Hold key at the remote site to place the active call on hold.

Note: To find out how to use the feature keys on different terminals, consult the user manual supplied with the terminal.

4 Now, place an outgoing call from the terminal at the remote site by dialing an idle terminal located at the local Meridian 1 site.

5 Complete this outgoing call by first checking the voice clarity in both directions, and hang up.

6 Have another terminal call you while the first call is still on hold.

7 Answer the incoming call and place it on hold.

8 Retrieve the call first held.

9 Complete the call and hang up.

10 Retrieve the second call on hold.

11 Complete the call and hang up.

You may repeat this test for terminals connected to different subscriber loops on the same card or for different subscriber loops on different line cards in the Fibre Remote IPE module or cabinet. By making these calls, you generate traffic, which will be shown in the traffic report.

Checking the MMI terminal operation

Connect an MMI terminal to the Fibre Superloop Network card at the local site and another MMI terminal at the Fibre Remote IPE site.

1. Set the current mode of the MMI terminal to MMI mode by executing the **<esc>L** command on the MMI terminal at the local Meridian 1 site. Enter MMI commands in solid caps.
2. Check the status of the Fibre Superloop Network card by executing the **STAT** command.
3. Check the status of the Fibre Peripheral Controller card by executing the **SUMB STAT** command. This command is sent over the fibre-optic link to the Fibre Peripheral Controller card for execution.
4. Check the response to the STAT command for the local and remote sites.
5. Check the log file content by executing the **PLOG 5** to print five log messages from the file starting with the oldest message. Examine the messages.

Additional exercise of the MMI terminal will be conducted when testing the link protection switching.

Checking link protection switching

To verify that the link protection switching is operating correctly, conduct the following tests with the link:

— manual switch-over

— forced switch-over

Note: These tests can be conducted only with a redundant link configuration.

Manual switch-over

This is a unidirectional switch-over. To conduct this test:

1. Check the status of the fibre-optic link by executing the **QFIB** command from the MMI terminal. Make sure that both the PRIM and the SEC links are functional without an alarm condition.
2. Establish a call from the Fibre Remote IPE to the local Meridian 1 site. Refer to “Voice calls” on page 86 to establish the call.

3 Assuming that the traffic is carried by the primary link, perform the following step.

4 Switch the link to the secondary packlet by executing the **MANS SEC** command from the MMI terminal.

5 Verify that the call is still established over the secondary link.

6 Unplug the Tx_1 FC/PC optical connector from the secondary packlet at the local or remote site. The transmit path should automatically switch to the primary packlet.

7 The call should continue to be established.

8 Reconnect the Tx_1 FC/PC optical connector.

Forced switch-over

Forced switch-over is used when replacing an Electro-optical packlet. To conduct this test:

1 Check the status of the fibre-optic link by executing the **QFIB** command from the MMI terminal. Make sure that both the PRIM and the SEC links are functional without an alarm condition.

2 Establish a call from the Fibre Remote IPE to the local Meridian 1 site. Refer to “Voice calls” on page 86 to establish the call.

3 Assuming that the traffic is carried by the primary link, perform the following step.

4 Switch the link to the secondary packlets by executing the **FORC SEC** command from the MMI terminal.

5 Verify that the call is still established over the secondary link.

6 Clear forced switch-over by executing the **MCLR** command from the MMI terminal to enable automatic switch-over capability.

Removing the test setup

After acceptance testing has been completed and the results show that the system is operating correctly, you should remove the setup you used to conduct the testing and restore equipment according to the customer configuration.

If you used the actual customer configuration to perform these tests, you do not have to change or remove the setup.

Generating traffic reports

Use system traffic report to identify calls made during acceptance testing from the Fibre Remote IPE site and to the Fibre Remote IPE site.

To verify traffic generated during acceptance testing, use the following command to print the report:

TOPS r r

The parameters for this command are:

r r are report options. This must be one or more of the following numbers:

1 = Network traffic report

2 = Service loops traffic report

5 = Selected terminals traffic report

For more information on traffic reports, refer to the Traffic control program LD 02 in *X11 input/output guide* (553-3001-400).

Fibre Remote IPE maintenance

This section describes Meridian 1 maintenance tools and procedures for identifying Fibre Remote IPE faults, locating defective equipment, correcting problems by fixing or replacing defective equipment, and verifying the operation of Fibre Remote IPE after corrections or replacements have been made.

System overview

Fibre Remote IPE maintenance deals with two types of problems:

— Installation

— Operation

Installation problems are created during the installation of an entire Meridian 1 with the Fibre Remote IPE or during the addition of the Fibre Remote IPE to an existing system.

Operation problems occur when components fail or equipment is accidentally disconnected during normal system operation.

In either case, identifying the problem should be approached systematically. A problem may have more than one cause. To isolate the cause, a knowledge of Meridian 1 Fibre Remote IPE operation is required. This information can be found in “Fibre Remote IPE product description” on page 3. Once the cause is identified, the problem can be corrected by replacing the defective card, connecting accidentally disconnected cables, or correcting the software problem.

Meridian 1 provides built-in self-diagnostic indicators and software and hardware tools. These diagnostic facilities simplify system troubleshooting and reduce mean-time-to-repair (MTTR).

This document focuses on the maintenance of Fibre Remote IPE equipment at the remote site and in the Meridian 1 system. It requires that Meridian 1 non-Fibre Remote IPE functions operate correctly before you start diagnosing Fibre Remote IPE problems. System installation and maintenance guide sections of *Meridian 1 general maintenance information* (553-3001-500), *Meridian 1 fault clearing* (553-3001-510), and *Meridian 1 hardware replacement* (553-3001-520) describe how to maintain the entire Meridian 1 system. This chapter describes how to maintain the Fibre Remote IPE equipment as an integral part of Meridian 1.

Diagnostic tools

Diagnostic tools are used to troubleshoot problems in Meridian 1 including problems with the Fibre Remote IPE. When diagnosing Fibre Remote IPE problems, you may have to use more than one of these tools.

Hardware diagnostic tools

Meridian 1 hardware diagnostic tools consist of:

— card self-tests

— LED indicators

— display codes

— enable/disable switches

Self-test

A self-test is automatically performed by each Fibre Remote IPE card when you insert it in an operating system module, when you enable the card, or when you power up or reset the system. You can also perform a self-test on a card using software commands.

This test checks general card functions and determines if they are operating correctly. It is very useful when you first install the cards; on insertion, the card automatically starts self-test and it gives you an immediate indication of its operating status.

LED indicators

Meridian 1 cards are equipped with red LED indicators, and module power supplies are equipped with green LED indicators. These indicators show the status of each card or power supply.

Figure 19 shows the NT1P61 Fibre Superloop Network card. It also shows the LED that indicates the status of the Fibre Superloop Network card and one LED on each Electro-optical packlet that indicates the status of the link.

Display codes

Some Meridian 1 cards, such as the NT1P62 Fibre Peripheral Controller card, are equipped with an alphanumeric display on the faceplate. Figure 20 shows two seven-segment displays on the faceplate of the Fibre Peripheral Controller card. They are used to automatically display the card status and identify possible faults with the card. These codes are displayed in hexadecimal notation and are listed and interpreted in Appendix A of this manual and in section (HEX) in *X11 input/output guide* (553-3001-400).

Codes displayed on the common equipment cards are logged into a history file and can be printed and reviewed to analyze the sequence of events leading to the presently displayed status. The last 16 codes displayed by the Fibre Peripheral Controller card are stored in memory and can be reviewed and then cleared by using Network and Signaling Diagnostic Program LD 30.

Figure 20 shows the NT1P62 Fibre Peripheral Controller card with two hexadecimal displays that display the status of the card. It shows the card LED that also indicates the state of the Fibre Peripheral Controller card and one LED on each Electro-optical packlet that shows the status of the link.

Enable/disable switch

Some Meridian 1 cards, such as the Fibre Superloop Network card shown in Figure 19, are equipped with an ENL/DIS switch. This ENL/DIS switch is located on the card’s faceplate. It is used to disable the card before you remove it from an operating Meridian 1 system without disrupting other system functions. After you repair or replace the card, you can place it back in service by setting the switch to the enable position.

Figure 19
Fibre Superloop Network card

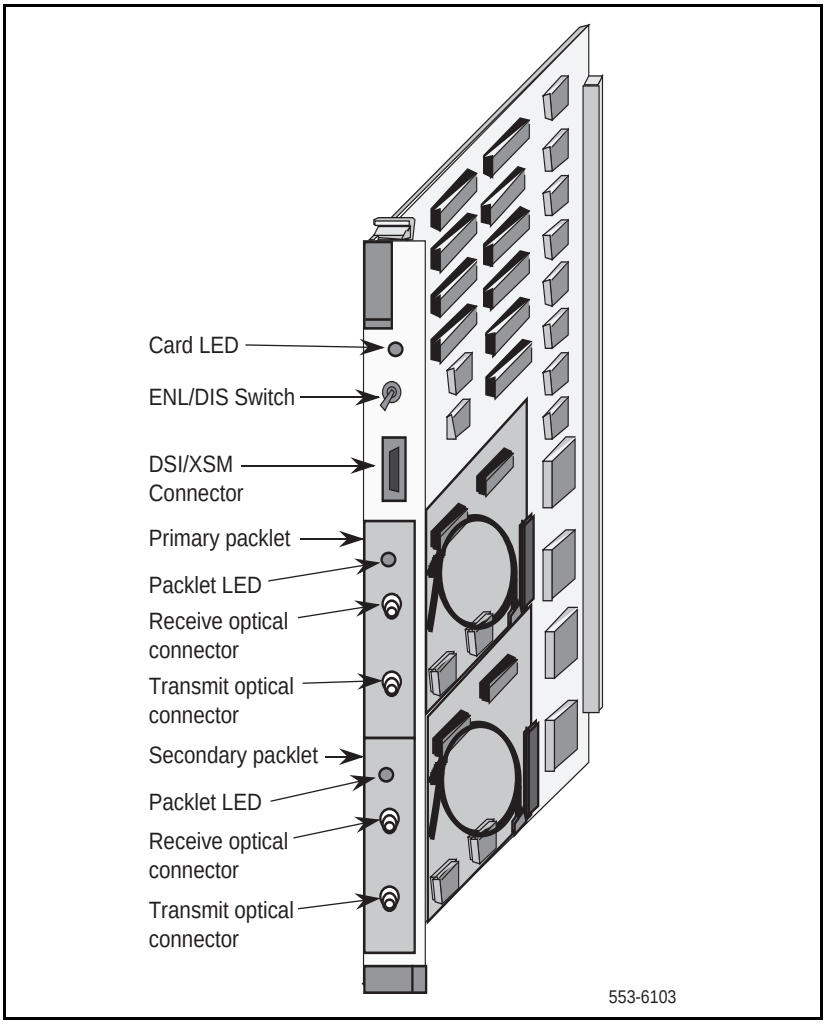
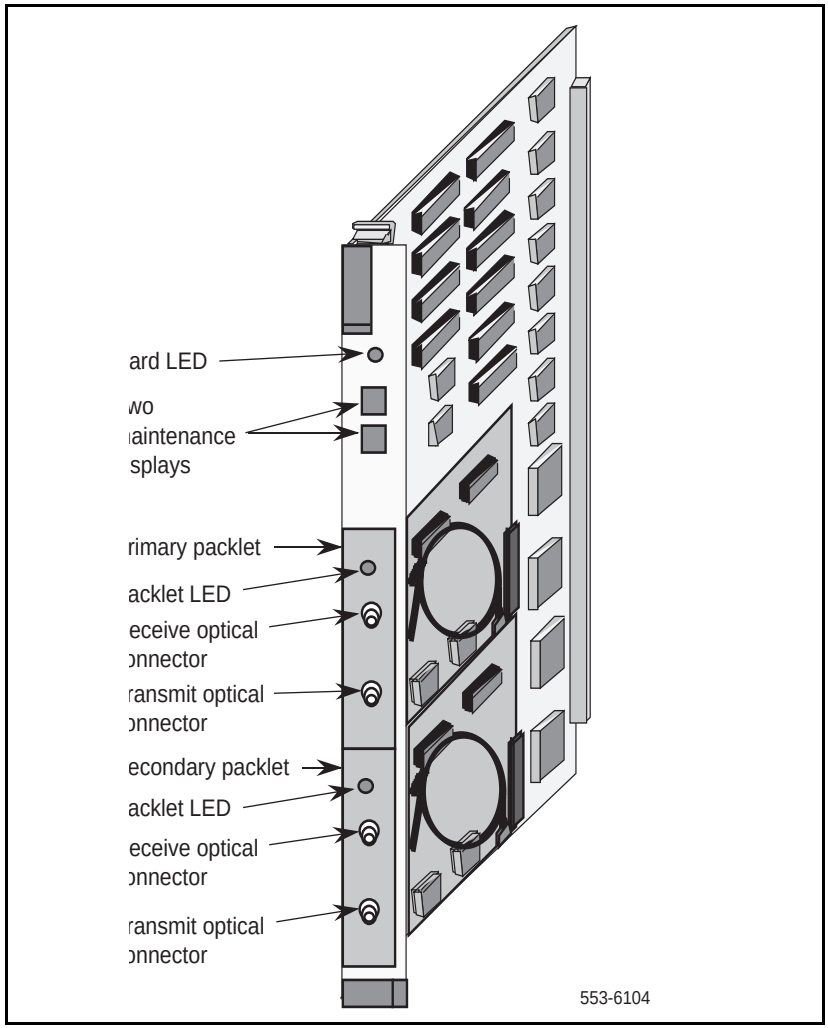


Figure 20
Fibre Peripheral Controller card



System monitors and alarms

Meridian 1 system monitoring units continuously monitor the environmental and power status of the system and the individual system modules including the Fibre Remote IPE equipment.

The system monitor issues alarms when:

— CPU fails or system reloads

— main power source is lost

— power supply in the modules fails

— system temperature exceeds limits because of blower or fan failure

Meridian 1 alarms are based on the type and severity of faults reported by the system monitors and indicators. These alarms are divided into:

— major alarms, which indicate serious problems that require your immediate attention

— minor alarms, which indicate isolated faults relative to a limited number of call connection problems that do not require your immediate attention

Fibre Remote IPE issues a red alarm when a major alarm occurs at the local Meridian 1 site and a yellow alarm when a major alarm occurs at the Fibre Remote IPE site.

Software diagnostic tools

Meridian 1 software diagnostic tools are used to monitor the system status, provide the ability to test various system functions and equipment suspected of being faulty, and log and display system fault history. These are:

— resident diagnostic programs

— interactive nonresident diagnostic programs

— History File

— user reports

Resident programs

Meridian 1 resident programs are diagnostic and administration programs that continuously monitor system operation and report faults and generate system messages, which are displayed on the system terminal or printed on a system printer. These system messages are listed in *X11 input/output guide* (553-3001-400).

These messages are:

— maintenance display codes listed under HEX that indicate status and error conditions in the system

— maintenance messages listed under XMI in Appendix A and reported to the terminal over the MMI port that indicate status and faults with Fibre Remote IPE equipment

— error messages listed under ERR that indicate hardware faults and under BUG that indicate software faults

— overload messages that indicate faulty peripheral cards listed under OVD

— error messages listed under PWR that indicate power faults

— fault history file that can be printed and reviewed to identify fault events leading to the present status

Resident administration programs provide automatic system administration routines that facilitate system initialization and fault recovery.

These are:

— overlay loader program that finds, loads, and executes all nonresident programs selected to run as midnight and background routines

— system loader program that downloads the call processing programs and starts checking main memory when executing sysload

— system initialization program that automatically starts after the system loader program completes the downloading process and outputs the initialization messages listed under INI in *X11 input/output guide* (553-3001-400)

Nonresident programs

Nonresident programs can be interactive or automatically executed programs. These programs are stored on the system hard disk or floppy disks and are downloaded by the overlay loader program to system memory on demand or at a predetermined time of day such as for midnight and background routines testing.

You can access interactive programs through a maintenance terminal or a maintenance telephone, as described in this chapter. These programs are used to:

— test the equipment and place lines and trunks out of service when testing or faulty and back into service when testing is completed or the line or trunk has been repaired or replaced

— verify the status of a fault

— verify that a fault has been corrected and the equipment is operating correctly

You can select a number of nonresident diagnostic programs by using Configuration Record Program LD 17. This is a program that selects other diagnostic programs and executes them automatically as midnight and background routines. These programs test the entire system and print a report that lists the test results.

You can also manually select continuity tests that check continuity between the Fibre Superloop Network card and the Fibre Peripheral Controller card, as well as other network and peripheral controller cards. You can specify these tests in Background Signaling and Switching Diagnostics LD 45.

Superloop and Controller cards maintenance commands

The maintenance commands of the NT1P61 Fibre Superloop Network card and NT1P62 Fibre Peripheral Controller card are identical to those of the standard NT8D04 Superloop Network and NT8D01 Peripheral Controller cards. These commands are used to manipulate the operational status and perform diagnostic tests on these cards. These commands are located in Network and PE Diagnostic LD 32, which can be accessed using the administration terminal or the maintenance telephone.

Table 8 lists superloop maintenance commands provided by Network and PE Diagnostic LD 32.

Table 8
Meridian 1 network superloop maintenance commands

Maintenance command	Maintenance command description
DISL loop	Disables network loop
ENLL loop	Enables network loop
DISS l s	Disables a shelf or module
ENLS l s	Enables a shelf or module
DSXP x	Disables Peripheral Controller and all IPE cards
ENXP x	Enables Peripheral Controller and all IPE cards
ENXP XPEC x	Enables Peripheral Controller but not IPE cards
STAT loop	Displays status for one or all network loops
SUPL loop	Prints data for one or all superloops
XNTT loop	Self-test on a Network card for a specific loop
XPCT x	Self-test on Peripheral Controller x
XPEC x	Prints data for Peripheral Controller x

Fibre Remote IPE MMI maintenance commands

Fibre Superloop Network card and Fibre Peripheral Controller card provide a man-machine interface (MMI) port to connect a configuration and maintenance terminal. Through this terminal, you can directly issue commands to these cards to test and maintain Meridian 1 fibre-optic equipment including the fibre-optic link.

Table 9 list these commands. However, for a detailed description of these commands, refer to Appendix A in this document, where they are listed in alphabetical order.

Table 9 lists MMI commands directly issued to the system over the MMI terminal. They can be connected to the Fibre Superloop Network card and the Fibre Peripheral Controller card MMI port.

Table 9
MMI maintenance commands (Part 1 of 2)

Maintenance command	Maintenance command description
HELP	Displays the list of MMI commands
<esc>L	Changes the MMI terminal to Local mode
<esc>R	Changes the MMI terminal to Remote mode
SUBM R	Places the Fibre Superloop Network card in Remote mode
SU R	Sets Fibre Superloop Network card in Remote mode when the MMI port is connected to an SDI port
SDEF L/R	Sets the default mode to Local or Remote
QDEF	Checks the default mode of the MMI port
STAD dd mm yy hh mm ss	Sets time and data
TTAD	Checks time and date
SUBM string	Sends a command to the other side of the link, where string = actual command
PLOG{n}	Prints n messages from a log file

Table 9
MMI maintenance commands (Part 2 of 2)

Maintenance command	Maintenance command description
NLOG {n}	Prints the next n messages from a log file
CLOG	Clears the log file
STAT	Checks the card status
IDC M/P/S	Checks the card ID for the main board, the primary packlet, or the secondary packlet
SXSM n	Sets system monitor port number for the wall-mounted Fibre Remote IPE
QXSM	Checks the system monitor port number
TEST P/S	Tests the main card if a parameter is not specified (card must be disabled).Test idle primary packlet if P is specified, or test idle secondary packlet if S is specified. When testing a packlet, the packlet must be idle but the card can be enabled and active.
SVER version	Sets PSDL version that matches the card version. It should also match the loadware version of the standard Superloop Network or Peripheral Controller card.
QVER	Checks the firmware and loadware version
QFIB	Checks the status of fibre-optic links
MANS PRI/SEC	Manual switch to primary or secondary link
FORC PRI/SEC	Forced switch to primary or secondary link
MCLR	Clears manual switch, resumes automatic backup

History File

Meridian 1 can be equipped with the History File feature, which allows the system to store events such as:

— service changes

— maintenance messages

— software errors

— initialization and system download messages

— traffic messages

These messages can be printed and analyzed to identify the events that led to the status. You can select the type of messages you wish to store. For information on how to select messages to be logged into the History File, refer to *X11 features and services* (553-3001-305).

User reports

User reported faults may give you a clue of what failed in the system. These are:

— major alarms reported by attendant

— calls with no ringing or no dial tone

— trouble with calls in specific Fibre Remote IPE modules

— trouble with specific terminals

— calls that cannot be transferred, and so on

Using maintenance programs

To use Meridian 1 maintenance programs, you must access Meridian 1 using a maintenance terminal or maintenance telephone.

Logging in on the maintenance terminal

To access the program, you must enter a valid password. To do this, type **LOGI** and press the Enter key. The following appears:

```
PASS?
```

Type your password and press the Enter key. Blanks will appear on the screen as you type your password. If you see:

```
OVL015
>
```

you entered an invalid password. Type your password again and press the Enter key. If you entered a valid password, you will see:

```
>
```

This means you are logged in. You are now communicating with Meridianþ1 and can access the program.

Accessing the program

To access any program on Meridian 1, type LD followed by a space and the program number after the > prompt and press the Enter key.

For example, to access Network and PE Diagnostic Program LD 32, type **LDþ32** after the **>** prompt and press the Enter key. At the prompt, type the command you wish to execute.

If for example, you wish to enable network loop 3 that is supported by a Fibre Superloop Network card, at the prompt type:

```
.ENLL 3
```

This will attempt to enable the Fibre Superloop Network card supporting network loop 3.

Responding to error messages

If you enter incorrect information after a prompt, the program displays a warning message or an error message. The prompt is displayed again below the error message so you can enter the correct information.

Exiting the program

To exit the program, type ******** and press the Enter key. You see

```
>
```

This means that you have successfully exited the program. Now, you can either access another program or log out.

Logging out

After you exit the program, you should log out. To do this, type **LOGO** at the > prompt and press the Enter key.

Logging in and using a maintenance telephone

You can use a telephone as a maintenance terminal if you define its class-of-service as MTA (maintenance set allowed) in Telephone Set Program LDþ11. This feature allows you to access diagnostic programs in Meridian 1 and execute a limited set of maintenance commands to test system functions.

To enter commands on a maintenance telephone you have to use its key pad. The numbers on the key pad represent numbers and letters that you normally use on a video display terminal keyboard.

Table 10 shows the translation from a terminal keyboard to a telephone key pad.

Table 10
Keyboard to key pad translation table

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

To use a diagnostic program on Meridian 1:

1 Press the prime DN key.

2 Place the telephone in maintenance mode by entering **xxxx91** on the key pad, where **xxxx** is the customer's Special Prefix number (SPRE) as defined in LD 15. Normally xxxx is 1, thus, you would enter **191**.

3 Enter ** to check if the communication link is idle.

4 If you detect a busy tone, Meridian 1 is in session with another maintenance or administration terminal. Enter **** to force the other terminal to log out. If you do not detect a busy tone, Meridian 1 is idle and you can automatically access Meridian 1.

5 Enter **53#xx##** to load a diagnostic program, where **xx** is the program number. For example, to load Network and PE Diagnostic Program LD 32, you would enter **53#32##**.

6 Perform the maintenance tasks by executing the maintenance commands resident in the program you loaded. For example, from Network and PE Diagnostic Program LD 32 you can disable a fibre network loop by executing (**DISL loop**), where loop is the Fibre Superloop Network card loop, say 3. To execute this command, enter on the key pad **3475#3##**.

7 Press the Release key to log out.

Isolating and correcting faults

Now that you are familiar with the troubleshooting tools, you can begin troubleshooting Fibre Remote IPE equipment. Based on whether Fibre Remote IPE equipment has just been installed and is not yet operational or it had been operating correctly and is now faulty, you can determine what may be the most probable cause of failure.

Types of faults

Problems can occur in the following areas:

— Hardware

— Configuration

— Software

The types of faults you must isolate and correct depend on when the faults occur during installation or in a previously operating system. For example, in a newly installed system, the fault may be in any or all of the three areas; however, in a previously operating system, the fault will probably be in the hardware.

Fault isolation steps

The following steps show you how to isolate system and Fibre Remote IPE faults using the diagnostic tools described in this chapter:

1 Observe and list the problem symptoms the system is exhibiting. Typical symptoms can include the: Fibre Superloop Network card or Fibre Peripheral Controller cards lighting their red LEDs on, the Fibre Peripheral Controller card faceplate display showing a fault code, or the Electro-optical interface LEDs indicating no transmission on the fibre-optic link. Others include common equipment or power supplies having their green LEDs turned off, maintenance codes being displayed on some of the common equipment, network cards displaying codes that indicate faults, and so on.

2 Note whether Fibre Remote IPE was just installed and has not been operating, or if it has been operating correctly and is now faulty. Based on this, refer to “Newly installed Fibre Remote IPE” on page 108 or “Previously operating Fibre Remote IPE” on page 108 for lists of the most common problems.

3 Take the action recommended by the fault isolation and correction tables, which will guide you through fault isolation steps and recommend what test procedures to use.

4 If after following the diagnostic procedures Fibre Remote IPE still does not operate correctly, contact your field service representative.

Newly installed Fibre Remote IPE

Problems that occur during the installation of an entire system, including the Fibre Remote IPE, are usually caused by:

— improperly installed cards

— loose or improperly connected external communication cables, fibre-optic patchcords, or fibre-optic link cables

— incorrect software version

— incorrect Fibre Remote IPE configuration

These types of problems may also occur when:

— installing additional Fibre Remote IPE equipment into an already operating system

— installing a new software version or changing Fibre Remote IPE configuration

Check the symptoms listed in Table 12 that are related to problems with a newly installed Fibre Remote IPE.

Previously operating Fibre Remote IPE

Problems that occur during the normal operation of Fibre Remote IPE are usually caused by:

— faulty equipment

— accidental disconnection of cables

— improper environmental conditions

Check the symptoms listed in Table 12 that are related to problems with a previously operating Fibre Remote IPE.

Meridian 1 fault isolation and correction

To isolate Fibre Remote IPE faults in the Meridian 1 system, you must first isolate and correct the common, the network, and the power equipment faults to make Meridian 1 non-Fibre Remote IPE functions operational. You can then proceed with fault isolation and fault correction of Fibre Remote IPE functions.

To aid you in isolating the problems in a systematic way, use the fault isolation and correction tables. These tables guide you through logical steps to determine the cause of the problem based on the visual fault indicators and system fault messages you see.

Table 11 lists Meridian 1 problem symptoms, a diagnosis of the problem based on the observed symptoms, and the recommended solution to the problem.

Table 11
Meridian 1 common and network equipment problems (Part 1 of 2)

Symptoms	Diagnosis	Solution
Green LEDs on the power equipment are off.	Power source lost, power defective, or disconnected power cables.	Check the power source, circuit breakers, and power cables. Refer to *Meridian 1 fault clearing* (553-3001-510) to correct the problem.
Maintenance terminal displays PWRxxxx messages.	Power supply, Power Distribution Unit, or Blower/Fan unit defective.	Refer to *X11 input/output guide* (553-3001-400) for a list of PWR messages. Also refer to Appendix A for wall mounted cabinet PWRxxxx HW SM UEM U message format. Based on the message, take the appropriate action to resolve the problem.
Some red LEDs on the common, network, and/or peripheral equipment are on and call processing has stopped.	Common or network equipment cards faulty. Peripheral equipment cards faulty.	Observe the error messages on the terminal and check for ERR and/or BUG messages listed in *X11 input/output guide* (553-3001-400). Use this information to locate and correct the fault. Refer to *Meridian 1 fault clearing* (553-3001-510).

Table 11
Meridian 1 common and network equipment problems (Part 2 of 2)

Symptoms	Diagnosis	Solution
Maintenance terminal displays OVDxxxx messages.	Superloop Network Card, Network Card, and/or Peripheral Signaling Card are disabled.	Observe the OVD messages on the terminal and check the description of these messages listed in *X11 input/output guide* (553-3001-400). Use this information to locate and correct the fault. Refer to *Meridian 1 fault clearing* (553-3001-510).
Maintenance display codes on the CPU cards and storage devices show fault codes.	Common equipment disk drives hardware faults, memory faults, or interrupt faults.	Refer to *X11 input/output guide* (553-3001-400) for a list of all the HEX codes. Based on the maintenance display codes description, take the appropriate action and resolve the problem.
Maintenance display codes on network cards show faults.	Indicates bus error or card problem.	Reinsert the card and observe the self-test codes. Refer to *X11 input/output guide* (553-3001-400) for a list of all self-test codes and their description. If the problem remains, replace the card.
Major or minor alarms.	Common, network, and/or peripheral equipment failure.	Refer to *Meridian 1 fault clearing* (553-3001-510) to identify the cause of alarm. Check the history file.

After you isolate and correct common equipment and network equipment faults, all the other system and card faults may clear and the system may start operating normally. If this does not occur, you must proceed with troubleshooting Fibre Remote IPE equipment as described in “Fibre Remote IPE fault isolation and correction” on page 111.

If you cannot resolve the problem after exhausting all the available diagnostic tools and test procedures, make a list of all the symptoms you observed and contact your field service representative.

Fibre Remote IPE fault isolation and correction

After Meridian 1 non-Fibre Remote IPE system functions are operating correctly, you can proceed with fault isolation and fault correction of Fibre Remote IPE equipment.

Table 12 deals specifically with Fibre Remote IPE service problems. To diagnose these problems, the table refers you to the test procedures in this manual that will most likely be able to resolve them.

Table 12
Meridian 1 Fibre Remote IPE equipment problems (Part 1 of 2)

Symptoms	Diagnosis	Solution
Red LED on the Fibre Superloop Network card or Fibre Peripheral Controller card permanently on.	Card is disabled or faulty.	Go to *Procedures 1, 2,* and *5* in this chapter to check the card status and perform self-test. Also enter the **STAT** command on the MMI terminal to check the card status.
LED on the Electro-optical packlet is on.	Fibre-optic link is in red alarm state and there is no communication over the link.	Check fibre-optic link connections and go to *Procedure 3* to test the link using the loopback test.
Link is OK but no communication with the system monitor.	System monitor address incorrect.	Define a unique address correctly. Observe the XMI messages on the MMI terminal and check the description of these messages listed in *Appendix A*. Use this information to locate and correct the fault.
Display on the Fibre Peripheral Controller card shows fault codes.	Card faulty: failed self-test or problem communicating with peripheral equipment.	Go to *Procedures 4* and *6* to check tracking and loopback. Also refer to *X11 input/output guide* (553-3001-400) for a list of codes. Based on the maintenance display codes description, take the appropriate action and resolve the problem.

Table 12
Meridian 1 Fibre Remote IPE equipment problems (Part 2 of 2)

Symptoms	Diagnosis	Solution
Error messages printed on the MMI terminal or the Meridian 1 TTY.	Hardware or software problems with the Fibre Remote IPE.	Note various error messages. Refer to *Appendix A* in this manual and *X11 input/output guide* (553-3001-400) for a list of these messages and their description. Based on the code's description, take the appropriate action to resolve the problem.
Red alarm is displayed on the TTY.	Fibre network and/or peripheral equipment failure.	Query the status on the fibre-optic links by entering the **QFIB** command at the MMI terminal.

If you cannot resolve the problem after exhausting all available diagnostic tools and test procedures, make a list of the symptoms and contact your field service representative.

Fibre Superloop Network card fault isolation and correction

The NT1P61 Fibre Superloop Network card provides a communication interface between the CPU and the Fibre Peripheral Controller card.

The Fibre Superloop Network card processes signaling information and data received from the Fibre Peripheral Controller card over the fibre-optic link.

Problems with the Fibre Superloop Network card may be caused by hardware faults, incorrect configuration, a disabled Fibre Superloop Network card, or continuity problems between the card and other network cards connected to the network bus. To isolate and correct problems with the Fibre Superloop Network card, follow the procedures below.

Procedure 1
Checking the status of Fibre Superloop Network card

The diagnosis in Table 12 indicates that the Fibre Superloop Network card may be faulty or disabled. The first step in identifying the problem is to verify the status of the Fibre Superloop Network card. The status of a Fibre Superloop Network card is obtained by executing the **STAT loop** command in Network and Signaling Diagnostic Program LD 30.

To obtain the Fibre Superloop Network card status:

1 Log in on the maintenance terminal as described in “Using maintenance programs” on page 103 in this document.

2 At the **>** prompt, type **LD 30** and press the Enter key to access the Network and Signaling Diagnostic Program LD 30.

3 Type **STAT loop** and press the Enter key, where **loop** is the loop number of the Fibre Superloop Network card you are testing.

4 If the response is UNEQ = then the loop is not equipped (the Fibre Superloop Network card is not installed).

5 If the Fibre Superloop Network card is manually disabled using LD 30, the response can be:

DSBL: NOT RESPONDING = the loop is disabled and the card is not responding (the card is missing, disabled by the EBL/DIS switch, or faulty).

DSBL: RESPONDING = the loop is disabled and the card is responding (the card is disabled with DISL command, the Peripheral Signaling card is disabled, or an overload condition exists).

Note: Overload conditions are indicated by OVDxxx messages. Refer to *X11 input/output guide* (553-3001-400) for the message description and indication of the problem.

x BUSY, y DSBL = the loop is enabled with x channels busy and y channels disabled.

CTYF L1 L2… = loop specified in STAT command cannot receive speech from one or more loops or there is a possible continuity test failure due to a faulty network card such as the Fibre Superloop Network card.

Type **ENLL loop** and press the Enter key to enable the loop, where **loop** is the Fibre Superloop Network card loop number. A message indicating that the Fibre Superloop Network card is enabled and working is displayed on the console. Also observe the red LED on the Fibre Superloop Network card. If it turns off, the Fibre Superloop Network card is functioning correctly. If the LED continues to stay on, the Fibre Superloop Network card probably failed self-test and a message should be displayed on the maintenance terminal to that effect.

If the message indicates that the Fibre Superloop Network card is faulty, replace the card.

Procedure 2
Performing the Fibre Superloop Network card self-test

If the NT1P61 Fibre Superloop Network card appears faulty, you should conduct the self-test to verify that it is actually faulty before you replace it. This test verifies the basic Fibre Superloop Network card functions and outputs a fail or pass message after the test is completed.

To perform the self-test, follow the steps below:

1 Log in on the maintenance terminal as described in “Using maintenance programs” on page 103 in this document.

2 At the **>** prompt, type **LD 32** and press the Enter key to access the Network and PE Diagnostic Program.

3 Type **DISL loop** and press the Enter key to disable the Fibre Superloop Network card, where **loop** is the Fibre Superloop Network card loop number you are disabling.

4 Type **XNTT loop** and press the Enter key to start the self-test, where **loop** is the Fibre Superloop Network loop number specified for self-test.

If the response is:

TEST PASSED

The Fibre Superloop Network card passed the self-test and is functional; it must be enabled to turn off the red LED and to start processing calls.

If the Fibre Superloop Network card passed the self-test, but the problem persists, the loop or other cards that interface with the Fibre Superloop Network card may be faulty. To verify the integrity of the network bus and connections between the Fibre Superloop Network card and other network and peripheral equipment cards interfacing with the Fibre Superloop Network card, go to Procedure 3.

If the response is

TEST FAILED REASON: xxxx

XPE0 {NOT} CONNECTED

XPE1 NOT CONNECTED

The Fibre Superloop Network card failed the self-test and is faulty, where **xxxx** can be one of the following values:

0–ROM checksum failed
1–FLASH checksum failed
2–A21 #1 faulty
3–A21 #2 faulty
4–R71 faulty
Replace the Fibre Superloop Network card as described in Replacement procedures. NPRxxx message may be displayed as a result of a command activated self-test if the Fibre Superloop Network card is missing, not configured, and so on.

5 Exit LD 32 by typing ******** at the prompt.

Procedure 3
Performing the Fibre Superloop Network loopback tests

If the NT1P61 Fibre Superloop Network card self-test indicates that the card is not faulty, you should conduct loopback tests to isolate the problem that may exist on network cards, network buses, or fibre-optic link connections between the Fibre Superloop Network card and the Fibre Peripheral Controller card.

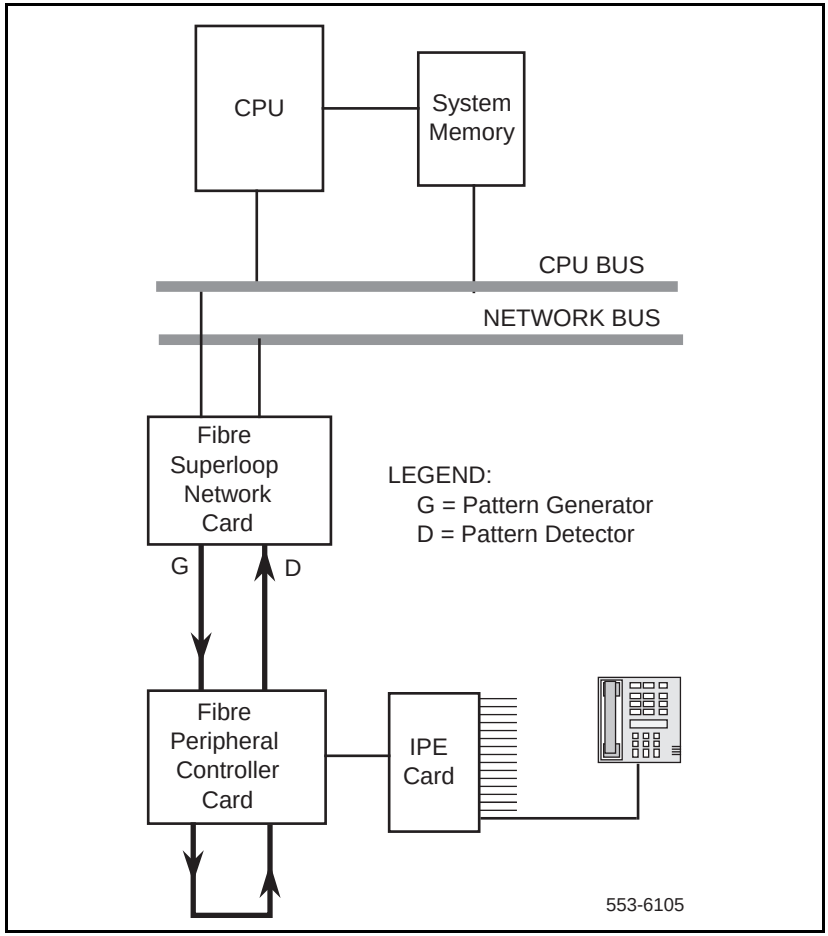
Loopback tests check the continuity between various interface points in the system. This is performed by sending a known signal pattern from the originating point to the destination and receiving it back at the originating point or a designated detecting point. If the pattern is detected and it matches the transmitted pattern without errors, the test verifies that the tested equipment and their connections are operating correctly. However, if the pattern is not detected or it is detected with errors, the equipment or the connections between the equipment are faulty.

The loopback uses the Fibre Superloop Network card as a pattern generator and detector. The signal is transmitted by the Fibre Superloop Network card to the Fibre Peripheral Controller card and looped back to the Fibre Superloop Network card over the fibre-optic link.

Note: For a Fibre Remote IPE with the redundant fibre-optic link, the loopback is automatically routed over the functioning link, not the faulty link. To identify the Electro-optical packlet that may be faulty, you can perform the packlet test at each end of the link by following the instructions in step 6 of this Procedure.

Figure 21 illustrates the loopback path and shows the Fibre Superloop Network card as a test pattern generator and detector.

Figure 21
Loopback path for XCON test 6



To start the loopback test:

1 Log in on the maintenance terminal as described in “Using maintenance programs” on page 103 in this document.

2 At the **>** prompt, type **LD 45** and press the Enter key to access the Background Signaling and Switching Program.

3 Select test condition:

— Enter XCON 0 and press the Enter key if you wish to perform only one loopback test.

— Enter one test period shown in XCON H 1-255, M 1-255, Sþ1-255 and press the Enter key to select continuous loopback testing for a selected time link, where Hþ1-255 is 1 to 255 hours, M 1-255 is 1 to 255 minutes, and S 1-255 is 1 to 255 seconds.

Example: XCON M 5 specifies the duration of the test to be 5þminutes.

4 At the TEST prompt, type **6** and press the Enter key. Continue responding to the prompts to configure the loopback test as follows:

Command	Range	Description
TEST	6	XCON test number
PATT	0–7	Signal pattern
TYPG	N	Fibre Superloop Network card—generator
SUPL	0–156	Superloop in multiple of 4
SLOT	xx	Timeslots 2–31, 34–63, 66–95, 98–127
TYPD	N	Fibre Superloop Network card—detector
SUPL	0–156	Superloop in multiple of 4
LBTY	P	Loopback through Fibre Controller
LBTN	l1 s 99	Special Fibre Controller loopback channel
TAG x	0–15	Tag number assigned by the system

5 Check the loopback test results. The results are automatically displayed if you specified XCON 0 test conditions; otherwise, you must specify XSTA or XSTP with the test TAG number to check the status. XSTA gets the status of the manual continuity test and XSTP stops the manual continuity test. If the results show BSDxxx messages, refer to the list and description of these messages in *X11 input/output guide* (553-3001-400). The BSDxxx messages indicate the possible causes of the problem, which you should check to isolate the actual problem.

— If the loopback continuity test passes, the problem may be somewhere in the IPE cards.

— If the loopback continuity fails, go to Procedure 3.

6 Perform the Electro-optical packlet test by using the MMI terminal or TTY at each end of the link:

— From the MMI terminal execute the **TEST P/S**, where **P** = primary packlet and **S** = secondary packlet

— Connect the transmit port to the receive port with a short fibre-optic patchcord on the Electro-optical packlet being tested.

— The packlet is operating correctly if the red LED turns off and stays off during the test with the patchcord installed. Otherwise, the packlet is faulty and should be replaced.

— Repeat step 6 for the other end of the link.

Fibre Peripheral Controller card fault isolation and correction

The NT1P62 Fibre Peripheral Controller card provides a communication interface between the Fibre Superloop Network card and the IPE cards housed in the Fibre Remote IPE module or cabinet.

Problems with the Fibre Peripheral Controller card may be caused by hardware faults, incorrect configuration, a disabled Fibre Peripheral Controller card, or continuity problems between the card and IPE cards connected to the peripheral bus. To isolate and correct problems related to the Fibre Peripheral Controller card, follow the procedures below.

Procedure 4
Checking the Fibre Peripheral Controller card tracking status

The Fibre Peripheral Controller card can display tracking information, which shows the status of the Fibre Peripheral Controller card phase-lock loop and to what clock source it is locked. To obtain this information, execute the **RPED l s** command in Network and Signaling Diagnostic Program LD 30.

To obtain the Fibre Peripheral Controller card tracking status:

1. Log in on the maintenance terminal as described in "Using maintenance programs" on page 103 in this document.
2. At the **>** prompt, type **LD 30** and press the Enter key to access the Network and Signaling Diagnostic Program LD 30.
3. Type **RPED l s** and press the Enter key, where **l** is the loop number of the Fibre Superloop Network card and **s** is the shelf or module you are testing.

   The Fibre Peripheral Controller card may return one of the following codes:

   C0—clock is locked on the primary Electro-optical packlet

   C1—clock is locked on the secondary Electro-optical packlet
4. Exit LD 30 by typing ******** at the prompt.
5. Check the incoming signal. If present, replace the packlet; otherwise, find the problem on the link.

Procedure 5
Performing the Fibre Peripheral Controller card self-test

If the Fibre Peripheral Controller card appears faulty, you should conduct the self-test to verify that it is actually faulty before you replace it. This test verifies the basic Fibre Peripheral Controller card functions and outputs a fail or pass message after the test is completed. During self-test the Fibre Peripheral Controller card displays HEX messages indicating the test performed. To identify the codes displayed, refer to Table 14.

To perform the self-test, follow the steps below:

1 Log in on the maintenance terminal as described in "Using maintenance programs" on page 103 in this document.

2 At the **>** prompt, type **LD 32** and press the Enter key to access the Network and PE Diagnostic Program.

3 Type **DSXP x** and press the Enter key to disable the Fibre Peripheral Controller card, where **x** is the Fibre Peripheral Controller card you are disabling.

4 Type **XPCT x** and press the Enter key to start the self-test, where **x** is the Fibre Peripheral Controller card specified for self-test.

If the response is:

TEST PASSED

The Fibre Peripheral Controller card passed the self-test and is functional. It must be enabled to turn off the red LED and start processing calls.

Type **ENXP x** and press the Enter key to enable the card.

If the Fibre Peripheral Controller card passed the self-test, but the problem persists, the link or other cards that interface with the Fibre Peripheral Controller card may be faulty. To verify the integrity of the peripheral bus and the Fibre Peripheral Controller card, go to Procedure 6.

If the response is:

TEST FAILED REASON: xxxx

The Fibre Peripheral Controller card failed the self-test and is faulty, where **xxxx** specifies the cause of the fault. An NPRxxx message may be displayed as a result of a command activated self-test if the Fibre Peripheral Controller card is missing, not configured, and so on.

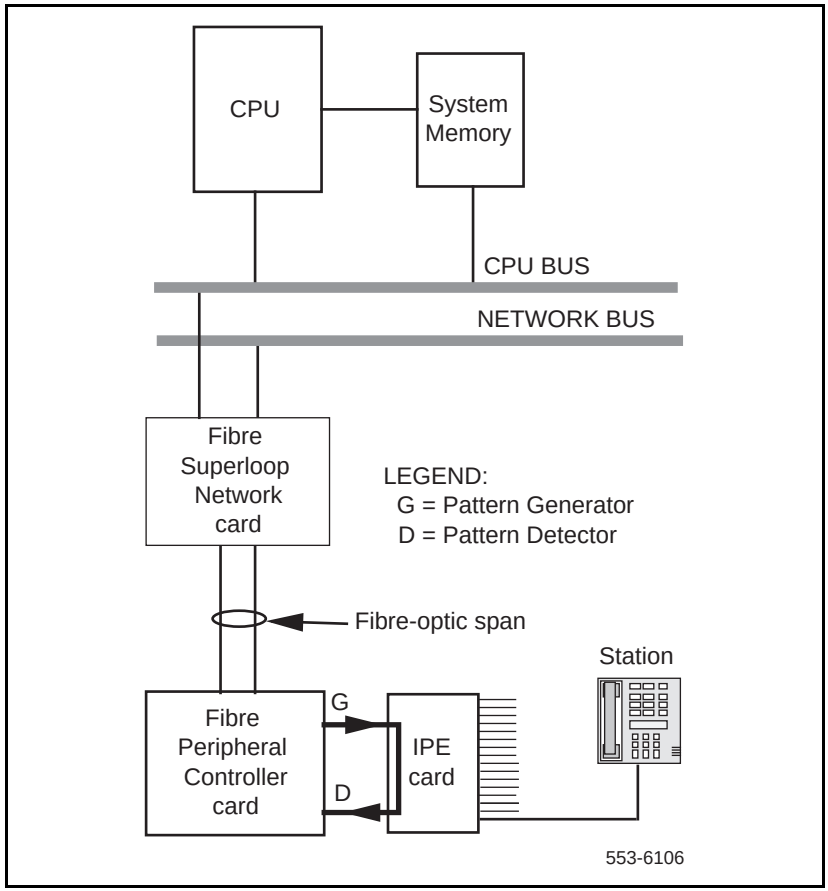
5 Exit LD 32 by typing ******** at the prompt.

Procedure 6
Performing the Fibre Peripheral Controller card loopback test

The loopback uses the Fibre Peripheral Controller card as a pattern generator and detector. The signal is transmitted by the Fibre Peripheral Controller card back to the Fibre Peripheral Controller card over a special loopback channel on the peripheral bus.

Figure 22 illustrates the loopback path and shows the Fibre Peripheral Controller card as a test pattern generator and detector.

Figure 22
Loopback path for XCON test 7



To perform the loopback test:

1 Log in on the maintenance terminal as described in “Using maintenance programs” on page 103 in this document.

2 At the **>** prompt, type **LD 45** and press the Enter key to access the Background Signaling and Switching Program.

3 Select test condition:

— Enter XCON 0 and press the Enter key if you wish to perform only one loopback test.

— Enter one test period shown in XCON H 1-255, M 1-255, Sþ1-255 and press the Enter key to select continuous loopback testing for a selected time link, where Hþ1-255 is 1 to 255 hours, M1-255 is 1 to 255 minutes, and S 1-255 is 1 to 255 seconds.

Example: XCON M 5 specifies the duration of the test to be 5þminutes.

4 At the TEST prompt, type **7** and press the Enter key. Continue responding to the prompts to configure the loopback test as follows:

Command	Range	Description
TEST	7	XCON test number
PATT	0–7	Signal pattern
TYPG	P	Fibre Peripheral Controller card—generator
TN	l s 99 0	Special Fibre Peripheral Controller loopback channel
TAG x	0–15	Tag number assigned by the system

5 Check the loopback test results. The results are automatically displayed if you specified XCON 0 test conditions; otherwise, you must specify XSTA or XSTP with the test TAG number to check the status. XSTA gets the status of the manual continuity test and XSTP stops the manual continuity test. If the results show BSDxxx messages, refer to the list and description of these messages in *X11 input/output guide* (553-3001-400). The BSDxxx messages indicate the possible causes of the problem, which you should check to isolate the actual problem.

— If the loopback continuity test passes, the problem may be somewhere in the IPE cards.

— If the loopback continuity fails, replace the card.

Fault isolation and correction using MMI maintenance commands

You can perform some testing and troubleshooting of the Fibre Remote IPE from a local or a remote MMI terminal or TTY by typing MMI commands on the terminal without loading system diagnostic programs (overlays).

These commands provide current equipment status, invoke card testing, check equipment performance, print messages from log files, and so on.

Procedure 7
Checking Fibre Remote IPE using MMI commands

This procedure uses MMI commands to maintain Fibre Remote IPE cards, and fibre-optic link status.

You can send these commands from the local MMI terminal to be executed by the remote site MMI terminal and vice versa by executing the **SUBM string** command, where string is the actual command sent to the other side.

For example, **SUBM PLOG 10** entered at the local MMI terminal will request that the remote site prints 10 messages from the log file located in the Fibre Peripheral Controller card memory.

To obtain the Fibre Superloop Network and Fibre Peripheral Controller cards status:

1 Log in on the MMI maintenance terminal.

2 Type **STAT** to check the status or the card connected to the MMI terminal.

The response:

Enabled/Disabled PLL: lock/unlock prim/sec

The card is enabled by the CPU, when enabled. The phase-lock loop can be locked to the incoming signal or not, and the PLL may be locked on the primary or secondary packlet.

3 Type **TEST P/S** and press the Enter key, where **P** tests the primary packlet and **S** tests the secondary packlet.

The response is one of the self-test messages listed in Appendix A.

4 Type **QFIB** and press the Enter key to query the status of the fibre-optic link.

The response:

PRIM physical/signal/direction
SEC physical/signal/direction

physical represents the status of the Electro-optical packlet, which can be **equipped, unequipped**, or **faulty**.

signal represents the status of the incoming signal, which can be **SF** (signal failed), **SD** (signal degrade not implemented in Rev 1 H/W), or **NA** (no alarm).

direction represents the direction of traffic on the link, which can be **incoming, outgoing, bothways**, or **none**.

5 Type **QALM** and press the Enter key to query the alarm status of the fibre-optic link.

The response:

PRIM alarm type
SEC alarm type

alarm on the Electro-optical packlet can be **red** (local alarm), **yellow** (remote alarm), or **clear** (no alarm).

type indicate one of the following types of alarm when it exists: **LOS**, **LOF**, **LOP**, or **FERF**.

6 Type PRPM {prim/sec} and press the Enter key to print the Performance Monitoring report for the primary and secondary fibre-optic links.

The format of the response is shown in Table 13.

Table 13 shows the format for the Performance Monitoring report. The report shows a matrix or fibre-optic link performance parameter values for different interval counters listed in the header and intervals listed in the first column.

Table 13
Performance Monitoring report form

link: prim/sec			**date: *mm/dd/yy***			**time: *hh/mm***		
Interval	**Section**				**Line**			
	SEFS	**CV**	**ES**	**SES**	**CV**	**ES**	**SES**	**PSC**
C	n	n	n	n	n	n	n	n
1	n	n	n	n	n	n	n	n
2	n	n	n	n	n	n	n	n
3	n	n	n	n	n	n	n	n
4	n	n	n	n	n	n	n	n
CD	n	n	n	n	n	n	n	n
PD	n	n	n	n	n	n	n	n

Section parameter description:

SEFS (Severely Errored Framing Seconds) indicates the number of seconds when at least one out-of-frame (OOF) or one change of frame alignment (COFA) occurred.

CV (Section Coding Violations) counts section BIP-8 violations in the STS-3 frame.

ES (Section Errored Seconds) indicates a second during which at least a coding violation (CV), an out-of-frame (OOF), or a change of frame alignment (COFA) occurred.

SES (Section Severely Errored Seconds) counts the number of seconds when et least 16 coding violations (CV), an out-of-frame (OOF), a change of frame alignment (COFA), or loss-of-signal (LOS) occurred

Line parameter description:

CV (Line Coding Violations) counts all line BIP-8 violations over all STS-3 frames.

ES (Section Errored Seconds) indicates a second during which at least a coding violation (CV) or a line alarm indication signal (AIS) state was detected.

SES (Section Severely Errored Seconds) counts the number of seconds with et least 32 line coding violations (CV) when the line alarm indication signal (AIS) state was detected.

PSC (Protection Switching Counts) counts the number of times when link protection switching occurred due to signal fail (SF) or signal degrade (SD) condition.

Interval parameter description:

C (Current interval) is the status of section and line parameters at the time interval when the Performance Monitoring report is issued.

1 through **4** are subsequent four intervals

CD is current day or the day the report was issued

PD is previous day or the day before the report was issued.

Replacing Fibre Remote IPE cards

If after completing troubleshooting you determine that one or more Fibre Remote IPE cards are defective, you will have to remove them and replace them with spares. When you insert a spare Fibre Superloop Network card or Fibre Peripheral Controller card in the module or wall-mounted cabinet, observe the card LED (the uppermost LED on the faceplate) to determine if the card passed self-test. Package and ship the defective cards to an authorized repair center.

Unpacking replacement cards

Unpack and visually inspect replacement cards as follows:

1 Inspect the shipping container for damage. Notify your distributor if you find that the container is damaged.

2 Remove the unit carefully from the container. Do not puncture or tear the container—use a utility knife to open it. Save the container and the packing material for shipping the defective card.

3 Visually inspect the replacement card for obvious faults or damage. Report the damage to your sales representative.

4 Keep cards in their antistatic bags until you are ready to install them. Do not stack them on top of each other.

5 Install cards. When handling the cards, hold them by their nonconducting edges to prevent damage caused by static discharge.

Removing and replacing a card

A Fibre Remote IPE card can be removed from and inserted into a Meridian 1 module or the Remote IPE module or wall-mounted cabinet without turning off the power to the module or cabinet. This feature allows Meridianþ1 to continue normal operation when you are replacing a Fibre Superloop Network card in Meridian 1 or a Fibre Peripheral Controller card in the Remote IPE module or cabinet.

Removing and replacing a Fibre Superloop Network card

1. Disable the Fibre Superloop Network card by logging in to the system terminal, loading the Network and Peripheral Equipment Diagnostic Program LD 32, and executing **DIS loop**, where **loop** is the actual loop number of the Fibre Superloop Network card.
2. Set the ENL/DIS switch to DIS.
3. Disconnect all the fibre-optic patchcords and the SDI/System Monitor cable from the card faceplate.
4. Unlatch the card's locking devices by squeezing the tabs and pulling the upper locking device away from the card and pressing the lower locking device downward.
5. Pull the card out of the network module and place it into an antistatic bag away from the work area.
6. Check the replacement card and make sure that the Electro-optical packlets are already installed. If not installed, install the new packlets or remove the packlets from the faulty Fibre Superloop Network card and install them on the replacement card if you are sure that the packlets are not faulty.
7. Set the replacement card ENL/DIS switch to DIS.
8. Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.
9. Pull the upper locking device away from the faceplate on the card and press the lower locking device downward and insert the card firmly into the backplane connector. Press the upper locking device firmly against the faceplate and press the lower locking device upwards to latch the card inside the module.
10. Set the ENL/DIS switch on the Fibre Superloop Network card to ENL. The Fibre Superloop Network card automatically starts the self-test.

11 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 on to step 12. If it does not flash three times and then stays on, it has failed the test. Pull the card partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the Fibre Superloop Network card.

12 Connect the SDI/System Monitor cable and the fibre-optic patchcords to the faceplate connectors of Fibre Superloop Network card.

13 Set the ENL/DIS switch to ENL. If the upper most red LED on the Fibre Superloop Network card faceplate turns off, the card is functioning correctly and is enabled. The outcome of self-test will also be indicated on the system terminal or TTY (or the MMI terminal connected to the SDI/System Monitor connector on the faceplate of the Fibre Superloop Network card). If the LED stays on, go to “Isolating and correcting faults” on page 107 in this document.

14 Tag the defective card(s) with a description of the problem and prepare them for shipment to your equipment supplier’s repair depot.

Removing and replacing a Fibre Peripheral Controller card

1 Log in on the maintenance terminal as described in “Using maintenance programs” on page 103 in this document.

2 At the > prompt, type LD 32 and press the Enter key to access the program.

3 Type **DSXP x**, where **x** is the Fibre Peripheral Controller card, and press the Enter key to disable the card. The Fibre Peripheral Controller card is now disabled and you can remove it.

4 Disconnect all the fibre-optic patchcords from the card faceplate.

5 Unlatch the card’s locking devices by squeezing the tabs and pulling the upper locking device away from the card and the lower locking device downwards.

6 Pull the card out of the IPE module or cabinet and place it in an antistatic bag away from the work area.

7 Check the replacement card and make sure that the Electro-optical packlets are already installed. If not installed, install the new packlets or remove the packlets from the faulty Fibre Peripheral Controller card and install them on the replacement card if you are sure the packlets are not faulty.

8 Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.

9 Pull the upper locking device away from the faceplate on the card and the lower locking device downwards and insert the card firmly into the backplane connector. Press the upper locking device firmly against the faceplate and the lower locking device upwards to latch the card inside the module. The Fibre Peripheral Controller card automatically starts the self-test.

10 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 11. If it does not flash three times and then stays on, it has failed the test. Pull the card partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the Fibre Peripheral Controller card.

11 Connect the fibre-optic patchcords to the optical connectors of the Fibre Peripheral Controller card faceplate. For a wall-mounted Fibre Remote IPE, plug the fibre-optic link FC/PC optical connectors into the FC/PC optical connectors on the Fibre Peripheral Controller card faceplate.

12 At the: prompt in the LD 32 program, type **ENXP x**, where **x** is the Fibre Peripheral Controller card, and press the Enter key to enable the card. If the uppermost red LED on the Fibre Peripheral Controller card faceplate turns off, the card is functioning correctly and is enabled. The outcome of self-test will also be indicated by LD 32 on the MMI terminal connected to the Fibre Peripheral Controller card. If the LED stays on, go to “Isolating and correcting faults” on page 107 or replace the card.

13 Tag the defective card(s) with a description of the problem and prepare them for shipment to your equipment supplier’s repair depot.

Reinstalling covers

When you determine that the Fibre Remote IPE is operating correctly, do the following:

1 Reinstall the covers on Meridian 1 module.

2 Reinstall the cover on the Remote IPE floor-standing module or the wall-mounted cabinet.

3 Terminate you session with Meridian 1 by logging out on your maintenance terminal: type LOGO at the: prompt and press the Enter key. If using the MMI terminal, log out to complete the test and troubleshooting session.

Packing and shipping defective cards

To ship a defective card to a Northern Telecom repair center, you should:

1 Tag the defective card with the description of the problem.

2 Package the defective card for shipment using the packing material from the replacement card. Place the card in an antistatic bag, put in the box, and securely close the box with tape.

3 Obtain shipping and cost information from Northern Telecom and mail the package to an authorized repair center.

Appendix A: System messages and MMI commands description

This appendix lists system messages displayed or printed on the Meridian 1 and MMI terminal or TTY and Fibre Peripheral Controller card HEX messages displayed during selftest on the two-character display located on the Fibre Peripheral Controller faceplate.

It also lists in alphabetical order MMI commands and describes the function of each command.

Table 14
System messages displayed on the system terminal of TTY (Part 1 of 6)

MMI port messages	
Chk_Thresh: B1 errors on primary/secondary	Transmission degrade: receiver signal contains occasional error at a low rate. If the message repeats, check optical cables, connectors, and optical packlets.
Chk_Thresh: R71 bad idle bytes	
Chk_Thresh: R71 crc error threshold exceeded	
Chk_Thresh: R71 End of Packet missing	
RSIG lost sync error: x	
Chk_Thresh: R71 message has been truncated	
R71 failure - Reinit	All these messages indicate problem with R71 (RSIG) signaling. If problem persists, do selftest.

Table 14
System messages displayed on the system terminal of TTY (Part 2 of 6)

TN read register unblocked, cnt= x	Problem with the Peripheral Signaling interface. Check to see if the Fibre Superloop Network card is seated correctly in its card slot.
FXNET Reset: Power-up/Watchdog/MSL-1 Boot version: xx	Reset caused by the CPU. **xx** is the boot code version. Multiple unassisted power-up resets indicate card, backplane, or supply failure. Watchdog reset may indicate firmware problem.
FXPEC Reset: Power-up/Watchdog/MSL-1 Boot version: xx	Reset caused by the MPU. **xx** is the boot code version. Multiple unassisted power-up resets indicate card, backplane, or supply failure. Watchdog reset may indicate firmware problem
Card ID: string	Prints the card ID stored in the EEPROM.
FXNET/FXPEC Main code version: xx {+pROBE}	This message appears at the end of the boot process.
TSIC Memory Mismatch . . . Rebuild OK	
BRSC Local Switch Memory Mismatch, IVDch = x . . . Rebuild OK	Hardware or firmware fault (switching mechanism). Check to see if the Fibre Superloop Network card is seated correctly in its card slot.
Stuck RSIG	
R71 CRC. cnt = x	
R71 trunc. Cnt = x	
R71 misalign. Cnt = x	
R71 no resync. Cnt = x	All these messages indicate problem with R71 (RSIG) signaling. If problem persists, do selftest to identify the problem, which may be hardware.

Table 14
System messages displayed on the system terminal of TTY (Part 3 of 6)

Self-test messages
Card test started...PASSED! or FAILED! In case of selftest failure, the self-test is restarted and a message is printed to indicate the cause of failure. If the fault persists, replace the card. The system will output a message to identify the fault. Failed component messages and their description are listed as follows:
MPU confidence test failed The basic confidence test of the MPU of the tested card failed.
MPU int mem test failed: address=*addr* expected=*x* received =*y* MPU internal memory failed at address=**addr**; **x** is the test pattern when writing, and **y** is the read value.
EPROM test failed: calculated chksum=*checksum* The data in the boot EPROM is corrupt. The field ***checksum*** is calculated by the MPU. When the EPROM is good the checksum=0.
FLASH EPROM failed: calculated chksum=*checksum* The data in the FLASH EPROM is corrupt. The field ***checksum*** is calculated by the MPU. When the EPROM is good the checksum=0.
Shared RAM failed: address=*addr* expected=*x* received=*y* Shared memory failed at address=**addr**; **x** is the test pattern when writing, and **y** is the read value.
Main RAM failed: address=*addr* expected=*x* received=*y* Shared memory failed at address=**addr**; **x** is the test pattern when writing, and **y** is the read value.
MPU addressing failed The MPU addressing modes failed the test.

Table 14
System messages displayed on the system terminal of TTY (Part 4 of 6)

EEPROM failed: pattern/address/program	
	EEPROM cannot be reprogrammed. If the test passed, the card ID is printed.
Timer 1 failed	Internal timer in the card selftest failed.
Timer 2 failed	Internal timer in the card selftest failed.
Watchdog timer failed	
	One of the MPU internal timers failed. The timer ID is indicated in the message.
DUART failed	The system monitor port UART is faulty.
A21_1 failed	Network bus interface failed.
A21_2 failed	Network bus interface failed.
RSIG failed: *type*	
	RSIG is faulty. **type** is the type of failed test, which can be **reg** (register), **cont** (continuity), **xcvr** (receivers).
Interrupt failed: vect=*n*	
	MPU interrupt test failed, where **n** is the interrupt vector number that failed.
TSIC failed: *cause*	
	The FXPEC TSIC logic failed, where ***cause*** identifies the cause of failure.
A31 failed: *cause*	
	The FXPEC TSIC logic failed, where ***cause*** identifies the cause of failure.
Electro-optical packlet testing	
Packlet #n equipped! testing...PASSED! or **FAILED!**	
	If the test result is FAILED!, the additional information printed on the TTY can be one of the following:

Table 14
System messages displayed on the system terminal of TTY (Part 5 of 6)

EOI #n failed: *cause*	
	EOI packlet **n** failed and ***cause*** indicates the cause of the fault.
EOI #n loopback failed	
	The loopback test failed on the EOI #n.
P/EEPROM failed: pattern/address/program	
	EEPROM cannot be reprogrammed. If the test passed, the card ID is printed.
General card messages	
FXNET/FXPEC time: HH:MM dd/mm/yy	
	Time stamp is printed every 15 minutes, where HH:MM is hour and minute, dd/mm/yy is the day, month, and year.
Illegal command	Unrecognized command issued by the craftsperson.
Illegal parameter	Incorrect parameter entry.
MMI: string from remote: *string*	
	String is received from the FXPEC, but FXNET is in the MMI mode. ***string*** represents the actual command received from the other side.
MMI: switched to MSL-1 mode	
	SUBM R command was executed at the opposite site to place the MMI terminal in the MSL-1 mode.
PLL locked	FXNET PLL lock was successful.
PLL start bit not ready	
	Problem with PLL. Unplug the card and plug it back in. In the message reappears, replace the packlet.
PLL locked on prim/sec	
	FXPEC successfully locked on the signal from the Electro-optical packlet identified by **prim** or **sec**.
PLL lock lost	PLL is in the process of trying to lock.

Table 14
System messages displayed on the system terminal of TTY (Part 6 of 6)

PWR messages
PWRxxxx HW SM UEM U Where **HW**=**PWSP** (power supply), **DCSP** (DC battery), **SM**=System monitor address (**1-63**) defined by the FXPEC MMI port. **UEM**=**0** for the main wall-mounted cabinet and **1** for the expansion wall-mounted cabinet. **U**=unit (not used).
XMI000 *loop message* This is the general format of MMI messages printed on the system TTY. ***loop*** is the superloop number of the FXNET and ***message*** is the text sent by the card.
XMI000 *loop* OIF: switched to prim/sec Indication is that the span switched to primary or secondary link.
XMI000 11 RSIG link lost - Reinitialized
XMI000 11 R71 CRC Error threshold exceeded Failure of R71 (RSIG) communication to the Fibre Peripheral Controller card.

Table 15
Fibre Peripheral Controller selftest HEX codes (Part 1 of 2)

HEX code	Test description
01	MPU confidence test
02	MPU internal RAM
03	Boot EPROM test
04	RAM test
05	MPU addressing mode test
06	ID EEPROM test
07	FLASH EPROM test (the programmable part)
08	Watchdog timer test
09	MPU timers test
0A	DUART port A
0B	DUART port B
0C	A31 #1 external buffer
0D	A31 #1 internal context memory (phase A)
0E	A31 #1 internal context memory (phase B)
0F	A31 #1 internal TXVM memory
10	A31 #1 configuration memory
11	A31 #1 external FIFO
12	A31 #2 external buffer
13	A31 #2 internal context memory (phase A)
14	A31 #2 internal context memory (phase B)
15	A31 #2 internal TXVM memory
16	A31 #2 configuration memory

Table 15
Fibre Peripheral Controller selftest HEX codes (Part 2 of 2)

HEX code	Test description
17	A31 #2 external FIFO
18	R72 N-P switching control memory
19	R72 320x8 NIVD buffer
1A	R72 N-P Quiet code register
1B	R72 P-N switching control memory
1C	R72 640-8 XIVD buffer
1D	R72 640-8 XIVD loopback buffer test
1E	R72 P-N Quiet code register
1F	R71 register test
20	R71 continuity test, peripheral side
21	R71 continuity test, network side
22	R71 packet transmission test
23	Interrupt test
24	R71 continuity test, peripheral side DS30X

Table 16
Alphabetical list of MMI commands (Part 1 of 4)

Command	Description
CLOG	Clears the log file and deletes all the messages.
CXSM	For remote floor-standing column. Checks the communication between the Fibre Peripheral Controller and the system monitor in the pedestal. The output is: **Wait...** during the test and after the test it displays: **XSM** responding or **XSM not responding**.
EOIA on/of	Default is off. Monitors EOI laser controller and reports the result: #n= 0 (primary), #n=1 (secondary) EOI #n ALARMS: Transmitter Fail EOI #n ALARMS: Transmitter is OK EOI #n ALARMS: Laser Fail EOI #n ALARMS: Laser is OK EOI #n ALARMS: Transmitter Input Clock Loss EOI #n ALARMS: Transmitter Input Clock is OK EOI #n ALARMS: Laser Degrade EOI #n ALARMS: Laser Degrade is OK EOI #n ALARMS: Laser ShutDown EOI #n ALARMS: Laser ShutDown is OK EOI #n ALARMS: Receiver Fail, alarm= x EOI #n ALARMS: Receiver is OK EOI #n ALARMS: Receiver Optical Input Fail, alarm= x EOI #n ALARMS: Receiver Optical Input is OK EOI #n ALARMS: Low Optical Input Power, alrm= x EOI #n ALARMS: Low Optical Input Power is OK EOI #n ALARMS: High Optical Input Power, alrm= x EOI #n ALARMS: High Optical Input Power is OK
<ESC>L	Changes the MMI port to local or MMI mode. ESC must be the first character in the command and must be preceded with 1.5 seconds of no-input.
<ESC>R	Changes the MMI port to remote or SL-1 mode. ESC must be the first character in the command and must be preceded with 1.5 seconds of no-input.

Table 16
Alphabetical list of MMI commands (Part 2 of 4)

Command	Description
FORC PRI/SEC	Performs forced switch of the active span to PRI=primary or SEC=secondary packlet.
HELP	Displays the list of commands.
IDC M/P/S	Query card ID information where M=main board (default setup), P=primary packlet, and S=secondary packlet
MANS PRI/SEC	Performs manual switch to the primary or secondary link in a redundant link configuration.
MCLR	Clears manual link switching and restores the automatic link backup.
NLOG {n}	Prints the next n messages from a log file starting with the message following the last printed. If **n** is omitted, one message is printed.You can change the last message printed by executing **PLOG** command.
PLOG {n}	Prints **n** messages from the log file starting with the oldest message. If **n** is omitted, one record is printed. If **n** is larger than the file or if **n**=0, the entire file is printed.
QDEF	Query the default mode of the MMI port. The response can be: **Local** or **Remote**
QFIB	Query the status of fibre-optic links. The response format is: **PRIM physical signal direction** **SEC physical signal direction** where **physical** can be: **equip, unequip**, or **faulty signal** can be: **SF** (failed), **SD** (degrade), or **NA** (no alarm) **direction** can be: **incoming**, **outgoing**, **both**, or **none**.

Table 16
Alphabetical list of MMI commands (Part 3 of 4)

Command	Description
QVER	Query version of the firmware and loadware.The response is: **Boot: xx Main: yy PSDL: zz** where **xx**= version of the boot firmware in EPROM **yy**= version of the main program, which is the last real download or the factory issue **zz**= version defined by the **SVER** command
QXSM	Query the system monitor port number that can be from 1 to 63.
SCID M/P/S string	Sets card ID of: **M**=main board, **P**=primary packlet, or **S**=secondary packlet. The string is programmed on an EEPROM. A maximum of 32 characters can be contained in the string. A password is required to execute the command. The response to the command can be: **OK** if the command execution is successful or **FAILED** if the execution failed.
SDEF L/R	Sets the default mode to **L**ocal (MMI mode) or **R**emote (SL-1 mode).This command does not affect the current working mode, but it does affect the default mode after the reset or power-up.
STAD d m y h m s	Sets time and date with **day, month, year, hour, minute**, and **second**
STAT	Query card status. The response can be: **Enabled/Disabled PLL: lock/unlock prim/sec** Enabled/Disabled indicates the status of the card. If Enabled, the CPU enabled it; otherwise, the response is Disabled. **PLL: lock/unlock** indicates the status of the PLL on the card. If locked, it indicates whether it is locked on the **primary** or **secondary** link. At the Fibre Superloop Network card an additional response is printed: **n busy** shows the number of time slots busy.

Table 16
Alphabetical list of MMI commands (Part 4 of 4)

Command	Description
SUBM string	Submits a command to the other side of the span where **string** represents the actual command executed by the other side. The response, if any, is printed locally.
SVER version	Sets the PSDL version, which is presented to the CPU. The parameter **version** is a decimal number and it must match the actual version of the non-fibre superloop and peripheral controller card version. This command affects only the cards on which it is executed.
SXSM n	Defines the system monitoring address **n** for a wall-mounted cabinet Fibre Remote IPE. The address is also stored in the Fibre Peripheral Controller card EEPROM. The command is in effect immediately.
TEST {P/S}	Tests the entire card if **P/S** is omitted, tests only the primary packlet if **P** is specified, or tests only the secondary packlet if **S** is specified. To test the entire card, you must first disable the card. To test the packlet the card can be active but the packlet you are testing must be idle. Test results are printed on the MMI terminal. If any of the tests fail, refer to Table 15, “Fibre Peripheral Controller selftest HEX codes (Part 1 of 2),” on page 139 for explanation.
TTAD	Query time and date.

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Meridian 1

Fiber Remote IPE

Description, installation, and maintenance

Information is subject to change without notice. Northern Telecom reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant. This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules, and the radio interference regulations of Industry Canada. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.
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