

---

Meridian 1

# Carrier Remote IPE

Description, installation, and maintenance

---

Document Number: 553-3001-021

Document Release: Standard 3.00

Date: October 1997

---

© 1997

All rights reserved

Printed in the United States of America

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.

SL-1 and Meridian 1 are trademarks of Northern Telecom.

---

# Revision history

---

**September 1995**

Standard, release 1.00. Initial release.

**August 1996**

Standard, release 2.00. This document is reissued to incorporate cabling changes and addition of wiring diagrams in Appendix C.

**October 1997**

Standard, release 3.00. This document is reissued to include editorial changes.

---

# Contents

---

<b>About this document</b> .....	<b>1</b>
References .....	2
<b>Carrier Remote IPE product description</b> .....	<b>3</b>
System overview .....	3
System description .....	4
Carrier Remote IPE physical architecture .....	4
Carrier Remote IPE functional architecture .....	16
Functional description .....	21
Local Carrier Interface card .....	23
Remote Carrier Interface card .....	27
Engineering guidelines .....	33
Carrier Remote IPE capacity .....	33
Traffic engineering .....	37
System planning and ordering .....	45
System selection .....	45
Carrier Remote IPE site planning .....	46
<b>Equipment installation and configuration</b> .....	<b>51</b>
Quick reference to system installation and configuration .....	51
Installation overview .....	55
Preinstallation preparation .....	57
Preparing the site .....	57
Unpacking and inspection .....	58
Taking inventory .....	58

Routing carrier links to the Carrier Remote IPE site . . . . .	59
Selecting the Local Carrier Interface card slot . . . . .	60
Selecting the I/O Panel connector cutouts to install the Carrier I/O panel assemblies . . . . .	61
Carrier Remote IPE connection record label . . . . .	64
Meridian 1 equipment installation . . . . .	66
Installing and verifying system operation . . . . .	66
Installing the Local Carrier Interface card . . . . .	67
Installing the Local Carrier Interface cable assemblies . . . . .	71
Installing SDI and local MMI terminal cables . . . . .	76
Connecting the system monitor cables . . . . .	85
Connecting the carrier link to the Meridian 1 . . . . .	89
Carrier installation into NT and XT systems . . . . .	91
Installing carrier equipment and verifying system operation . . . . .	91
Installing the Local Carrier Interface card . . . . .	92
Installing Local Carrier Interface faceplate cables . . . . .	94
Installing SDI and MMI terminal cables . . . . .	96
Connecting carrier links to the NT/XT system cabinet . . . . .	102
Carrier Remote IPE column installation . . . . .	103
Installing the Carrier Remote IPE column . . . . .	103
Installing cards into the Remote IPE module . . . . .	104
Installing the backplane cable assemblies . . . . .	109
Installing system monitor cables . . . . .	113
Installing remote MMI terminal cables . . . . .	114
Connecting the carrier link to the Remote IPE module . . . . .	115
Carrier Remote IPE cabinet installation . . . . .	117
Installing the Carrier Remote IPE cabinet . . . . .	117
Removing the fiber I/O bracket assembly . . . . .	121
Installing the NT7R94AA Remote Cabinet Cable Assembly . . . . .	122
Installing cards into the Carrier Remote IPE cabinet . . . . .	124
Connecting carrier links to the Carrier Remote IPE cabinet . . . . .	125
Connecting remote MMI terminal and subscriber loop cables . . . . .	128
Connecting the attendant to the Carrier Remote IPE cabinet . . . . .	131
Connecting the PFTU to the Carrier Remote IPE cabinet . . . . .	131
Configuring the Carrier Remote IPE . . . . .	133
Configuring the carrier interface cards . . . . .	133

---

Configuring the remote MMI terminal port .....	138
Configuring the carriers .....	141
Verifying carrier link connections at the remote site .....	147
<b>Carrier Remote IPE acceptance testing .....</b>	<b>153</b>
Overview .....	153
Checking the system .....	154
Setting up test conditions .....	155
Performing acceptance testing .....	155
Voice calls .....	156
Data calls .....	158
Checking the MMI terminal operation .....	159
Checking carrier link protection switching .....	159
Removing the test setup .....	161
Generating traffic reports .....	161
<b>Carrier Remote IPE maintenance .....</b>	<b>163</b>
Maintenance overview .....	163
Diagnostic tools .....	164
Hardware diagnostic tools .....	164
Software diagnostic tools .....	170
Using system maintenance programs .....	178
Logging in on the maintenance terminal .....	178
Accessing the program .....	178
Responding to error messages .....	179
Exiting the program .....	179
Logging out .....	179
Logging in and using a maintenance telephone .....	179
Isolating and correcting faults .....	181
Type of faults .....	181
Fault isolation steps .....	182
System fault isolation and correction .....	183
Carrier Remote IPE fault isolation and correction .....	185
Local Carrier Interface card fault isolation and correction .....	187
Remote Carrier Interface card fault isolation and correction .....	194

Fault isolation and correction using MMI maintenance commands	198
Replacing Carrier Remote IPE cards	204
Unpacking replacement cards	204
Removing and replacing a card	204
Reinstalling covers	207
Packing and shipping defective cards	207
<b>Appendix A: System messages</b>	<b>209</b>
<b>Appendix B: Regulatory approvals</b>	<b>215</b>
Regulatory notices	216
Notice for United States Installations	216
Network connection information	218
Notice for Canadian Installations	219
<b>Appendix C: Connection diagrams and external connectors pin assignment</b>	<b>221</b>

---

## List of figures

---

Figure 1	
Meridian 1 to Remote IPE links . . . . .	11
Figure 2	
Carrier Remote IPE column . . . . .	13
Figure 3	
Carrier Remote IPE cabinet . . . . .	15
Figure 4	
System functional architecture . . . . .	17
Figure 5	
Meridian 1 Carrier Remote architecture . . . . .	22
Figure 6	
Local Carrier Interface card functional block diagram . . . . .	24
Figure 7	
Remote Carrier Interface card functional block diagram . . . . .	29
Figure 8	
Carrier Remote IPE Connection Record label . . . . .	65
Figure 9	
Local Carrier Interface card DIP-switch positions and function . . . . .	69
Figure 10	
Local Carrier Interface card faceplate cable connections in Meridian 1 . . . . .	73
Figure 11	
System monitor, local MMI terminal, and carrier links cable connections . . . . .	77
Figure 12	
Daisy-chaining multiple Local Carrier Interface cards . . . . .	84

Figure 13	
System monitor connections at Meridian 1 and the Carrier Remote IPE	88
Figure 14	
Local Carrier Interface card faceplate cable connections in NT or XT system	93
Figure 15	
Remote Carrier Interface card DIP-switch locations and functions	107
Figure 16	
Backplane to I/O panel connections on the IPE module	112
Figure 17	
Carrier Remote IPE cabinet	120
Figure 18	
Carrier cable routing for the Carrier Remote IPE cabinet	123
Figure 19	
Carrier cable routing for the Carrier Remote IPE cabinet	127
Figure 20	
TTY and subscriber loop cable connections	130
Figure 21	
Connecting the PFTU to the Carrier Remote IPE cabinet	132
Figure 22	
TTY or terminal modes at the local and the remote sites	140
Figure 23	
NT7R51 Local Carrier Interface card	166
Figure 24	
Remote Carrier Interface card	168
Figure 25	
Loopback path for XCON test 6	192
Figure 26	
Loopback path for XCON test 7	196
Figure 27	
Single LCI connection diagram (local site connections)	222

---

Figure 28	
Multiple LCIs connection diagram (local site daisy-chain connection)	223
Figure 29	
Remote Carrier IPE IPE module connection diagram (single RCI configuration) . . . . .	224
Figure 30	
Remote Carrier IPE cabinet connection diagram (single RCI configuration) . . . . .	225
Figure 31	
Local site system monitor connection diagram (single and multiple LCI configuration) . . . . .	226
Figure 32	
RJ48-type 8-pin modular plug pin assignments . . . . .	234

---

## List of tables

---

Table 1	
Local site carrier hardware list . . . . .	5
Table 2	
Remote Carrier IPE module hardware list . . . . .	7
Table 3	
Carrier Remote IPE wall-mounted cabinet hardware list . . . . .	8
Table 4	
Carrier capacity calculations . . . . .	37
Table 5	
Environmental requirements . . . . .	47
Table 6	
LCI and RCI power requirements . . . . .	48
Table 7	
Planning form . . . . .	49
Table 8	
Meridian 1 modules supporting Local Carrier Interface cards . . . . .	60
Table 9	
System cabinet shelves supporting Local Carrier Interface cards . . . . .	61
Table 10	
Local Carrier Interface standard (default) switch settings . . . . .	68
Table 11	
NT7R51 Local Carrier Interface card maintenance daisy-chain address	70
Table 12	
Remote Carrier Interface standard (default) switch settings . . . . .	106

Table 13	
NT7R52 Remote Carrier Interface card system monitor address selection . . . . .	108
Table 14	
NTAK04 AC/DC and NTAK05 DC power supply switch settings . .	118
Table 15	
MMI commands used in setting the carrier parameters . . . . .	144
Table 16	
System carrier superloop maintenance commands . . . . .	174
Table 17	
System carrier test command in LD 45 . . . . .	175
Table 18	
MMI commands . . . . .	176
Table 19	
Keyboard to keypad translation table . . . . .	180
Table 20	
System common and network equipment problems . . . . .	184
Table 21	
Carrier Remote IPE equipment problems . . . . .	185
Table 22	
System error messages related to the CRI . . . . .	209
Table 23	
Remote Carrier Interface HEX error codes for self-test . . . . .	213
Table 24	
Carrier Remote IPE network interfaces . . . . .	218
Table 25	
8-pin modular jack pin assignment for all carrier connections . . . . .	227
Table 26	
NT7R58AA Maintenance Panel 6-pin modular jack system monitor pin assignment for J5 and J6 connectors . . . . .	228

---

Table 27	
NT7R58AA Local Maintenance Panel maintenance DCE port DB-9F and NT7R67DA External Maintenance Cable assembly connector pin assignment for P1 DB-9M, P2 DB-9M, and P3 DB-9F connectors . .	229
Table 28	
NT7R61 Remote Maintenance Panel maintenance port DB-9 male connector pin assignment . . . . .	230
Table 29	
NT7R60AA Carrier/Alarm Panel DB-15 HD alarm connector pin assignment for Carrier Remote IPE module . . . . .	231
Table 30	
NT7R60AA Carrier/Alarm Panel DB-15 HD alarm connector pin assignment for Carrier Remote IPE cabinet . . . . .	232
Table 31	
Local and Remote Carrier IPE to CSU cable (NT7R87AA) pin assignment . . . . .	233

---

# About this document

---

This document is a supplement to Meridian 1 NTPs and provides the information specific to system options 21E, 51, 51C, 61, 61C, 71, 81, and 81C as well as NT and XT system implementations of the Carrier Remote IPE feature.

Meridian 1 Carrier Remote IPE system complies with Part 68 of the United States Federal Communication Commission (FCC) rules. For detailed information, refer to *Appendix B: FCC Rules, Part 68* in this document.

It describes the operation of the carrier equipment and provides specific information on how to install and maintain this equipment as an integral part of the PBX systems and system options. Carrier Remote IPE equipment configuration is identical to the equivalent standard equipment in Meridian 1. However, there are some additional carrier specific commands that can be executed using the man machine interface (MMI) terminal to specifically control carrier equipment.

The following describes what you will find in this document:

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

**Installation and configuration** steps you through preparing the site, installing carrier interface equipment at the local system site and the Carrier Remote IPE site, and connecting the local and the remote site to the T1 or E1 carrier links.

**Acceptance testing** describes how to perform some functional tests to verify that the installed Carrier Remote IPE feature is operating correctly.

**Maintenance** describes how to perform routine administrative and maintenance functions and how to troubleshoot the Carrier Remote IPE equipment and the carrier link 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 system CPU and the remote carrier equipment. These messages indicate the status of the equipment and identify a faulty component when problems occur.

**Appendix B** provides general information about FCC Rules, Part 69 supplied to the user as required by the FCC.

**Appendix C** provides connection diagrams at the local and remote sites and connector pin assignments for all external connectors that connect carrier links, the TTY terminal, the SDI port, and the external alarms.

This document provides detailed information on how to install, configure, and maintain the carrier equipment. However, it also references various NTPs, which contain additional information that may be required when installing and maintaining the Carrier Remote IPE.

## References

The following is a list of documents that are referenced 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)

---

# Carrier Remote IPE product description

---

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

## System overview

Meridian 1 system options 21E, 51, 51C, 61, 61C, 71, 81, and 81C as well as NT and XT systems are private branch exchange (PBX) systems that support Carrier Remote IPE service.

In addition to supporting local subscribers, each system can be configured as a distributed system that supports remote subscribers using Carrier Remote IPE modules in a column or Carrier Remote IPE cabinets. They are connected to the PBX at long distances using T1 or E1 carrier facilities.

To support the Carrier Remote IPE, the system must be running on X11 release 21 or later and must be equipped with the Carrier Remote IPE software package REM\_IPE 286.

Subscriber loops at the local system site (at the PBX) are the same as at the Carrier Remote IPE modules or Carrier Remote IPE cabinets. The subscriber functions and features at the local system site are also the same as at the Remote IPE site.

This document focuses on the equipment within the PBX and the Remote IPE that is specifically designed to provide T1 or E1 carrier links between the network functions in the system and the peripheral controller functions in the Remote IPE.

## System description

The Carrier Remote IPE provides PBX functionality by installing only IPE modules and IPE cards at a distant site. The Remote IPE shares the system common and network equipment to provide the same functions and features to remote subscribers that are available to local system subscribers.

To successfully implement Carrier Remote IPE functions, you must understand:

- Carrier Remote IPE physical architecture
- Carrier Remote IPE functional architecture

### Carrier Remote IPE physical architecture

To configure a system with Carrier Remote IPE, you can install an IPE column or Carrier Remote IPE cabinet at a remote site and connect it, using T1 or E1 carrier links or direct copper connection (if the distance is less or equal to 200 meters or 655 feet), to an existing system. [Tables 1](#) and [2](#) list specific equipment required to support the Carrier Remote IPE at the local site and at the remote site.

**Note:** The cards and the cable assemblies listed in [Tables 1](#), [2](#) and [3](#) are common to T1 and E1 carrier systems, however, if E1 carrier links are terminated with BNC connectors, an external adapter cable (not supplied with the equipment) is used to connect each 8-pin modular (RJ48-type) jack on the system I/O panel assembly to the BNC connectors on each E1 carrier link.

[Table 1](#) lists all the hardware components required at the local system site to support Carrier Remote IPE service. Only one type of carrier can be supported by each Local Carrier Interface card. The carrier type is switch-selected on the Local Carrier Interface card. Appendix C provides connection diagrams and connector pin assignments for all external connectors on the I/O panel assemblies.

**Table 1**  
**Local site carrier hardware list (Part 1 of 2)**

Component	Description
NT7R51 Local Carrier Interface card	Local Carrier Interface card installed in a network card slot.
NT7R66AA SDI Cable Kit	This cable kit provides a DB-9 male to DB-25 male 10-foot cable and a DB-25F/DB-25F adapter. To connect the standard SDI card to the DB-9 female P2 connector of the NT7R67DA cable at the local site, you would use the entire kit except for the DB-25F/DB-25F adapter, which is used with the SDI Paddleboard.
NT7R66BA MMI Cable	This is a DB-9 female to DB-25 male 32-foot cable. Connect the MMI terminal to the DB-9 male P3 connector of the NT7R67DA cable at the local site and directly to the MMI port of the Carrier Remote IPE site.
NT7R67BA Local Carrier/Monitor Cable Assy	This cable assembly connects the Local Carrier Interface to the network I/O panel. It consists of the NT7R67HA cable, the NT7R57AA Carrier Panel assembly, and the NT7R58AA Maintenance Panel assembly. The P1 DB-25 male connector plugs into the faceplate, the P2 DB-15HD male connector plugs into the NT7R58AA Maintenance Panel assembly, which provides two 6-pin modular system monitor jacks and one DB-9 female MMI maintenance connector. The P3 DB-15HD female connector plugs into the NT7R57AA Carrier Panel assembly, which provides three 8-pin modular carrier jacks. Refer to Appendix C, Figures 27, 28, and 31.
NT7R67CA Local Daisy-chain Cable Assy	This cable provides P1 DB-9 male connector that plugs into the faceplate and P2 DB-9 male connector that plugs into the NT7R58AA Maintenance Panel assembly. This cable is used with multiple Local Carrier Interface cards in a daisy-chain configuration or in a single Local Carrier Interface configuration to connect the MMI terminal. Refer to Appendix C, Figures 27, 28, and 31.
NT7R67DA Local External Maint. Cable Assy	Cable with the P1 DB-9 male connector that plugs into the NT7R58AA Maintenance Panel DB-9 female connector, the P3 DB-9 male connector that plugs into the MMI terminal or modem cable (or the preceding Local Carrier Interface connection in a daisy-chain), and the P2 DB-9 female connector that plugs into the SDI port (or the following Local Carrier Interface connection in the daisy-chain). Refer to Appendix C, Figures 27 and 28.
NT7R67EA Coaxial Interface Adapter Cable	Cable with one 8-pin modular plug that plugs into the NT7R57AA Carrier Panel Assy 8-pin modular jack and two BNC connectors that plug into the carrier link BNC connectors.

**Table 1**  
**Local site carrier hardware list (Part 2 of 2)**

Component	Description
NT7R69AA Extension Local Carrier Cable Assy	Cable extends the NT7R67BA cable assembly. It plugs into the DB-25 connector on the Local Carrier Interface card faceplate and into the DB-25 P1 connector of the NT7R67BA cable assembly.(Used for NT and XT (QCA55/QCA58) type cabinet systems. This assembly also includes the P0846521 Connector Adapter Plate.
NT7R69BA Extension Local Maint. Cable Assy	Cable extends the NT7R67CA cable assembly. It plugs into the DB-9 connector on the Local Carrier Interface card faceplate and the P1 DB-9 connector of NT7R67CA cable assembly. Used for NT and XT (QCA55/QCA58) type cabinet systems. This assembly also includes the P0846521 Connector Adapter Plate.
NT7R87AA T1 CSU Cable Kit	This cable kit consists of a DB-15M/RJ48 adapters and a 9.75 m 32-foot RJ48 to RJ48 cable. The appropriate adapter is used to connect to a CSU and the cable is used to connect the adapter to the NT7R57AA Carrier Panel Assy RJ48 connector.
NT8D46AL System Monitor Serial Link Cable	Connects the 6-pin modular jack J5 on the NT7R58AA Maintenance Panel assembly to the system monitor jack J6 in the pedestal.
NT8D93AJ XSDI I/O to DTE or DCE Cable	This is a DB-9 male to DB-25 male 4.8 m 16-foot cable used to connect the SDI Paddleboard to the NT7R67DA Local External Maintenance Cable P2 DB-9 female connector. The entire NT7R66AA SDI Cable Kit must also be used.
NT5D40AA Hybrid kit	Used to replace BTUs in some network modules. The replacement is necessary to be able to install the Local Carrier Interface card in that slot.

[Table 2](#) lists the hardware required for the Carrier Remote IPE UEM column at the remote site. Appendix C provides external connectors pin assignments.

**Table 2**  
**Remote Carrier IPE module hardware list (Part 1 of 2)**

Component	Description
NT7R52 Remote Carrier Interface card	Remote Carrier Interface card (installed in the Remote IPE module or the Remote IPE cabinet).
NT8D37 IPE Module	Carrier Remote IPE module.
NT7R66BA MMI Cable	This is a 32-foot DB-9 female to DB-25 male cable. Connect the MMI terminal to the DB-9 male MMI connector on the NT7R61AA Maintenance Panel Assy.
NT7R68AA Remote Carrier/Alarm Cable Assy	This cable assembly connects the Remote Carrier Interface to the I/O panel at the rear of the IPE module for T1/E1 and auxiliary customer alarm connections. Consists of the NT7R68HA cable with 24-pin block P1 connector that plugs into the SL1 backplane connector, the NT7R59AA Carrier Panel assembly already connected to the cable with P2 DB-15HD male connector, and the NT7R60AA Carrier/ Alarm Panel assembly connected to the cable with P3 DB-9 female connector. The NT7R59AA Carrier Panel assembly provides two 8-pin modular carrier jacks and the NT7R60AA Carrier/Alarm Panel assembly provides one 8-pin modular carrier jack and one DB-15 female alarm connector. Refer to Appendix C, Figure 29.
NT7R68BA Remote Maintenance Cable Assy	This cable assembly connects the Remote Carrier Interface to the I/O panel at the rear of the IPE module for system monitor and MMI connections. Consists of the NT7R68GA cable with 24-pin block P1 connector that plugs into the SL1 connector on the backplane, the NT7R61AA Maintenance Panel assembly already connected to the cable with P2 DB-15 male cable connector. The NT7R61AA Maintenance Panel assembly provides one 6-pin modular jack for system monitor and one DB-9 male MMI port connector. Refer to Appendix C, Figure 29.
NT7R67EA Coaxial Interface Adapter Cable	Cable with one 8-pin modular plug that plugs into the NT7R68AA Remote Carrier/Alarm Panel Assy 8-pin modular jack and two BNC connectors that plug into the carrier link BNC connectors.

**Table 2**  
**Remote Carrier IPE module hardware list (Part 2 of 2)**

Component	Description
NT7R86AA Auxiliary Alarm Cable Assy	Connects auxiliary alarms, such as customer external alarms, to the DB-15HD female Alarm connector on the NT7R60AA Carrier/Alarm Panel. The cable is 9.75 m 32 feet long.
NT7R87AA T1 CSU Cable Kit	This cable kit consists of a DB-15M/RJ48 adapters and a 9.75 m 32-foot RJ48 to RJ48 cable. The appropriate adapter is used to connect to a CSU and the cable is used to connect the adapter to the NT7R59AA Carrier Panel Assy and the NT7R60AA Carrier/Alarm Panel Assy RJ48 connector.
NT8D46AL System Monitor Serial Link Cable	Connects the 6-pin modular jack J5 on the NT7R61AA Maintenance Panel assembly to the J6 system monitor jack in the pedestal.

[Table 3](#) lists the Carrier Remote IPE cabinet equipment. Appendix C provides external connectors pin assignments.

**Table 3**  
**Carrier Remote IPE wall-mounted cabinet hardware list (Part 1 of 3)**

Component	Description
NT7R52 Remote Carrier Interface card	Remote Carrier Interface card (installed in the Remote IPE module or the Remote IPE cabinet).
NTIP70 Main Cabinet Assy	Main wall-mounted (or pedestal mounted) Carrier Remote IPE cabinet. The NT1P70 consists of the NT1P60 Main Cabinet and mounting hardware.
NTBK70 Expansion Cabinet	Expansion Carrier Remote IPE cabinet. Expands the capacity by six IPE cards. Requires the NTAK1204 Inter-Cabinet cable to connect to the main cabinet.
NTAK27 Pedestal for the Cabinet (optional)	This pedestal allows the Carrier Remote IPE cabinets to be floor-mounted.
NT7R66BA MMI Cable	This is a 9.75 m 32-foot DB-9 female to DB-25 male cable. Connect the MMI terminal to the DB-9 male MMI connector on the NT7R61AA Maintenance Panel Assy.
NT7R67EA Coaxial Interface Adapter Cable	Cable with one 8-pin modular plug that plugs into the NT7R68CA Remote Carrier/Alarm Panel Assy 8-pin modular jack and two BNC connectors that plug into the carrier link BNC connectors.

**Table 3**  
**Carrier Remote IPE wall-mounted cabinet hardware list (Part 2 of 3)**

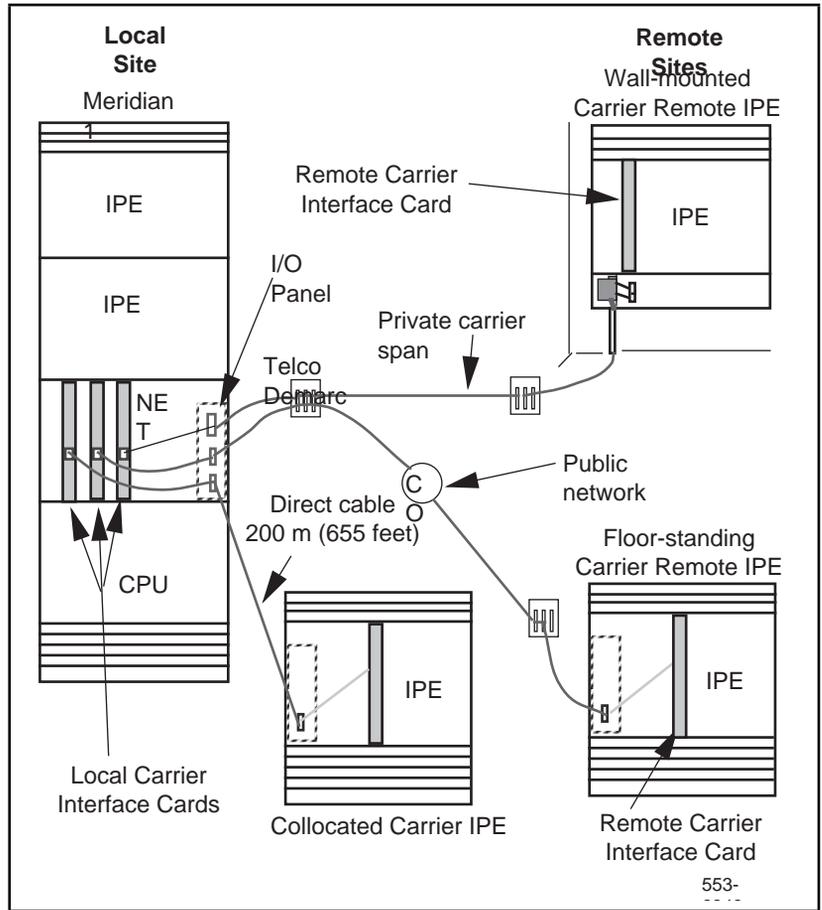
Component	Description
NT7D68DA Remote Maintenance Cable Assy to Cabinet	This cable assembly connects the Remote Carrier Interface to the I/O bracket on the wall-mount IPE cabinet for system monitor and MMI connections. Consists of the NT7R68NA cable that connects with P1 DB-9 male connector to the TTY connector on the backplane and is already connected to the NT7R61AA Maintenance Panel assembly with the DB-15 male P2 cable connector. The DB-15 female P3 cable connector must be plugged into the NT7R60AA Carrier/Alarm Panel assembly connector during cable installation. The NT7R61AA Maintenance Panel assembly provides a DB-9 male MMI port connector. Refer to Appendix C, Figure 30.
NT7R86AA Auxiliary Alarm Cable Assy	Connects auxiliary alarms, such as customer external alarms, to the DB-15HD female Alarm connector on the NT7R60AA Carrier/Alarm Panel. The cable is 9.75 m 32 feet long.
NT7R87AA T1 CSU Cable Kit	This cable kit consists of a DB-15M/RJ48 adapters and a 9.75 m 32-foot RJ48 to RJ48 cable. The appropriate adapter is used to connect to a CSU and the cable is used to connect the adapter to the NT7R59AA Carrier Panel Assy and the NT7R60AA Carrier/Alarm Panel Assy RJ48 connector.
NT7R94AA Remote Cabinet Cable Assy	This Remote Cabinet Cable Assembly consists of the NT7R68CA Remote Carrier/Alarm Cable Assy, the NT7R68DA Remote Maintenance Cable Assy, and the NT7R62AA Bracket. All components are preinstalled in the factory.
NT7D68CA Remote Carrier/Alarm Cable Assy to Cabinet	This cable assembly connects the Remote Carrier Interface to the I/O bracket of the wall-mount IPE cabinet for T1/E1 and auxiliary customer alarm connections. It consists of the NT7R68LA cable that connects with DB-15 male P1 to the Auxiliary Connector on the backplane, the NT7R59AA Carrier Panel assembly that connects to P2 DB-15 female cable connector, and the NT7R60AA Carrier/Alarm Panel assembly that connects to P3 DB-9 female cable connector. The NT7R59AA Carrier Panel (installed in slot 1 of the bracket) provides two 8-pin modular carrier jacks and the NT7R60AA Carrier/Alarm Panel (installed in slot 2 of the bracket) provides one 8-pin modular jack and one DB-15 female alarm connector. The two panels are already connected to the NT7R68LA cable. Refer to Appendix C, Figure 30.
NT7D68DA Remote Maintenance Cable Assy to Cabinet	This cable assembly connects the Remote Carrier Interface to the I/O bracket on the wall-mount IPE cabinet for system monitor and MMI connections. Consists of the NT7R68NA cable that connects with P1 DB-9 male connector to the TTY connector on the backplane and is already connected to the NT7R61AA Maintenance Panel assembly with the DB-15 male P2 cable connector. The DB-15 female P3 cable connector must be plugged into the NT7R60AA Carrier/Alarm Panel assembly connector during cable installation. The NT7R61AA Maintenance Panel assembly provides a DB-9 male MMI port connector. Refer to Appendix C, Figure 30.

**Table 3**  
**Carrier Remote IPE wall-mounted cabinet hardware list (Part 3 of 3)**

<b>Component</b>	<b>Description</b>
NTAK04 AC/DC Power Supply for Cabinet	Used when the Carrier Remote IPE cabinet is AC-powered by the commercial power source or UPS.
NTAK05 DC Power Supply for Cabinet	Used when the Carrier Remote IPE cabinet is DC-powered by a - 52VDC power source.
NTAK410 Power Cable for DC Power Supply	Used to connect the cabinet to a reserve battery power supply or to a DC power source through the NTAK28 Junction Box.
NTAK1204 Inter-cabinet Cable	Used to connect the main to the expansion Carrier Remote IPE cabinet.

[Figure 1](#) illustrates Meridian 1 and Remote IPE equipment linked with T1 or E1 carriers over the private network, the public network, and for distances of 655 feet (200 m) or less direct copper cable connection to a collocated Carrier IPE column. The T1 and normally E1 carrier links use 120-ohm twisted pair wires. However, if the E1 carrier links use coaxial cable, 75-ohm impedance must be selected using SW1, SW2, SW5, and SW8 on the Local and Remote Carrier Interface cards (refer to [Figure 9](#) and [Figure 15](#)).

**Figure 1**  
Meridian 1 to Remote IPE links



The only equipment specifically designed to support this configuration are the types of cards, cables, and cabinets listed previously in [Tables 1](#) and [2](#). All the other equipment is standard Meridian 1 hardware.

At the local site, there are two cables that plug into the Local Carrier Interface card faceplate connectors. At the other end, the cable connectors connect to the I/O panel connectors at the rear of the Meridian 1 network module. At the remote site, two cables that plug into the backplane connectors behind the Remote Carrier Interface card contain connectors that are also plugged into the I/O panel connectors at the rear of the Carrier Remote IPE module.

All systems use the same carrier hardware. The cable routing and the location of the I/O panel assemblies is different.

For the Carrier Remote IPE cabinet, two cables connect P2 and P3 backplane connectors to the I/O panel connectors installed on a bracket at the lower left-hand side of the cabinet backplane as shown in [Figure 3](#).

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 standard 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:

- Carrier Remote IPE column
- Carrier Remote IPE cabinet

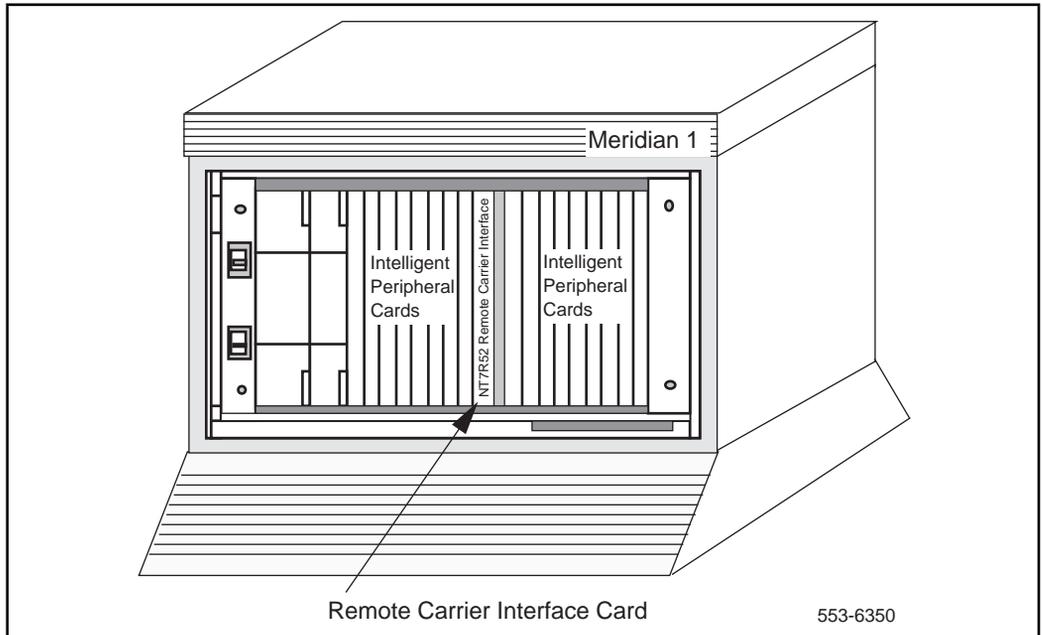
### Carrier Remote IPE column

Floor-standing Carrier Remote IPE column includes a pedestal, one or more standard NT8D37 IPE Modules, and a top cap. The IPE module houses a maximum of 16 line cards and a Remote Carrier Interface card. Each Remote Carrier Interface card supports IPE cards in only one IPE module. Therefore, each IPE module requires a Remote Carrier Interface card and one to three T1 or E1 carrier links.

The T1 or E1 carrier link is connected to the Remote Carrier Interface card through the carrier connectors located on the I/O panel at the rear of the IPE module. A cable connects the Remote Carrier Interface card through the backplane to the I/O panel at the rear of the IPE module to establish a connection to the carrier link.

[Figure 2](#) illustrates the front view of the Carrier Remote IPE column with the Remote Carrier Interface card and the IPE cards already installed.

**Figure 2**  
**Carrier Remote IPE column**



### **Carrier Remote IPE cabinet**

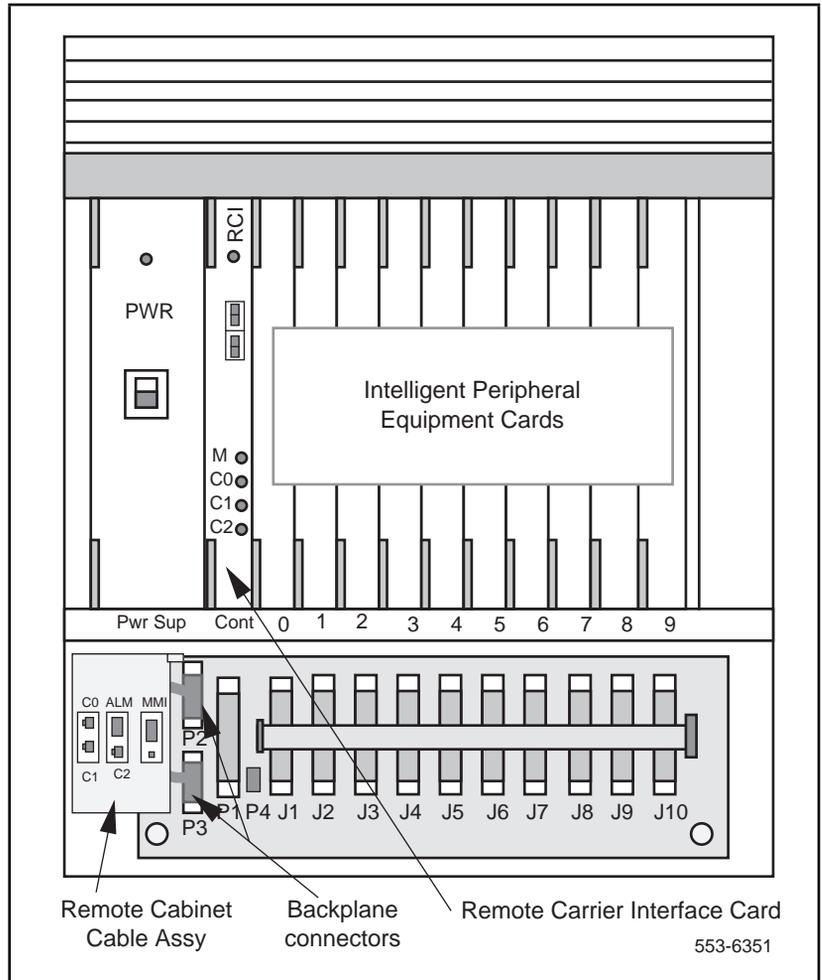
Each Remote Carrier Interface card supports up to 16 IPE cards. The NT1P70/NT1P60 main Carrier Remote IPE cabinet houses an NT7R52 Remote Carrier Interface card and up to 10 IPE cards. This cabinet is the same as used in the Fiber Remote Carrier IPE application. The cabinet is then modified for the Carrier Remote IPE application by simply replacing the existing I/O bracket with NT7R94AA Remote Cabinet Cable Assembly. If additional IPE cards are required, you must use the NTBK70 expansion cabinet, which can house up to six additional cards in card slots 10 through 15. Card slots 16 through 19 in the expansion cabinet are not configurable and must not be used. The main and the expansion cabinets are interconnected by a cable that plugs into the P1 connector located in the lower left-hand corner of each cabinet's backplane.

The T1 or E1 carrier link is connected to the Remote Carrier Interface card through P2 and P3 backplane connectors. These backplane connectors are connected to the I/O panel, which is mounted on a bracket at the lower left-hand corner of the cabinet backplane.

Carrier Remote IPE 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/NT1P60 Carrier Remote IPE cabinet. It also shows the location of the NT7R52 Remote Carrier Interface card.

**Figure 3**  
Carrier Remote IPE cabinet



## Carrier Remote IPE functional architecture

Carrier Remote IPE functions are controlled by the system CPU and the firmware in the Local Carrier Interface and Remote Carrier Interface cards. The CPU uses software instructions to execute call processing, administration, and diagnostic functions. These functions can be divided into three basic categories:

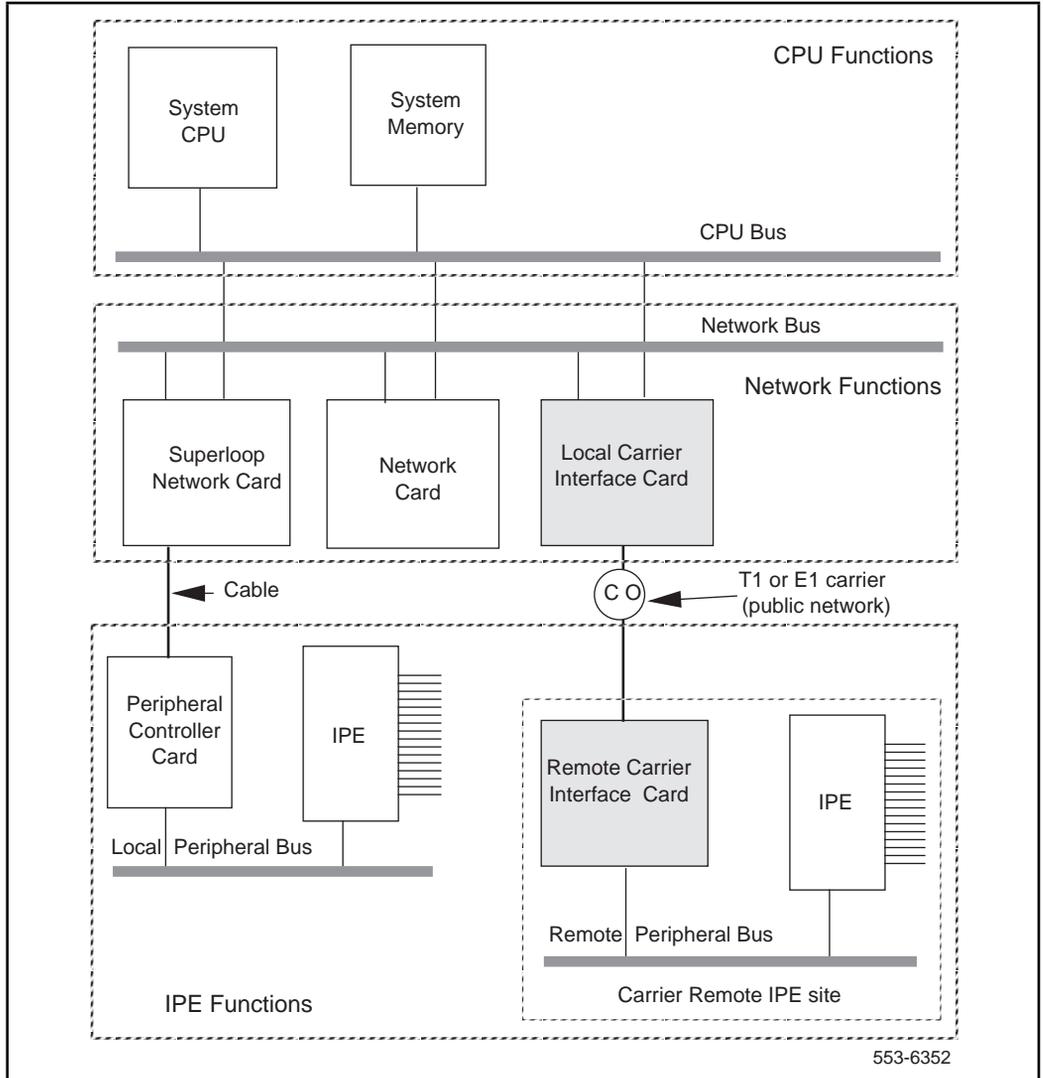
- CPU functions
- Network functions
- IPE functions

The communication and signaling between the system and the Carrier Remote IPE is performed over the first three timeslots of each T1 or E1 carrier link including the spare link. The other timeslots of each carrier link are used to transmit voice and data information originating and terminating at Remote IPE subscriber stations. All three carriers transmit the same messages and signaling across the carrier link; however, the system selects only one carrier for signaling and message handling. Which carrier it uses depends on the past carrier link events, or when one carrier has a lower error rate than the other carriers in the link, the system selects the carrier with the lowest error rate for signaling and message extraction.

A T1 or an E1 carrier link between the Local Carrier Interface card and a Remote Carrier Interface card can be configured with one to three carrier links, where all three links carry traffic or where one of the two links can be assigned as a spare link that is standing by to take over traffic when an active link fails.

Figure 4 illustrates the system functional architecture on a broad block diagram level to show the three basic types of functions.

**Figure 4**  
**System functional architecture**



To maintain optimum service during carrier failure and recovery, the system automatically enables the exact number of timeslots required for the number of active physical links between the system and the Carrier Remote IPE. All the other timeslots provided by the superloop are inhibited to prevent system assignment of too many timeslots for the number of active carriers in the link. If the number of active links changes due to failure of one or more links, or if reactivation of a previously faulty link occurs, the system dynamically adjusts the number of available timeslots to support currently active carriers in the link.

### **CPU functions**

CPU functions are executed by the system software in the CPU module or shelf. The CPU responds to the interrupt requests from the network equipment and the IPE, and performs the following functions:

- controls originating calls, terminating calls, and feature operation for switched voice and data calls
- prevents establishing new data calls if CALS= 2
- 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 the system, the system CPU controls its functions the same way it controls functions of telephones and stations connected to line cards in local IPE modules.

## Network functions

Network switching functions are executed by the equipment housed in the system network card slots. The Local Carrier Interface card is installed in a network card slot and, through its T1 or E1 carrier links, connects to the Remote Carrier Interface card installed in the Carrier Remote IPE module or cabinet.

The system provides these network functions:

- performs hardware initialization and self-test upon power up
- establishes call connections between stations connected to Remote IPE line cards and stations local to the system or to trunks for long distance trunk calls over public or private networks
- communicates switching, peripheral signaling, and maintenance information to and from the CPU, the Local Carrier Interface card MPU, and the Remote Carrier Interface MPU
- manages timeslot assignment for active carrier links and timeslot blocking of the remaining timeslots on the superloop that are not required to support the existing active carrier links
- monitors T1 or E1 carrier link integrity and transmission quality and provides automatic link switching from the failed primary link to the spare link, if so configured
- optionally, if PRI/DTI/BRI cards are not installed in the system, provides clock to the Clock Controller card to synchronize the network bus to the T1 or E1 carrier clock
- provides local and remote loopback testing and fault isolation functions

### **IPE functions**

Intelligent peripheral equipment functions are performed by the Remote Carrier Interface card and line cards in the Carrier Remote IPE module or Carrier Remote IPE cabinet.

The system provides these IPE functions:

- performs hardware initialization and self-test upon Remote Carrier Interface card power-up
- assigns timeslots to line cards to establish call connections
- communicates with the Local Carrier Interface card MPU to provide Remote IPE configuration and maintenance functions
- monitors the link integrity and transmission quality and notifies the Local Carrier Interface card, which provides automatic carrier switching from the failed primary carrier to the spare carrier 2 if the link is set up with the spare carrier option
- provides Card-LAN management by polling IPE cards and reporting their status
- controls local station ringing functions
- provides a serial port for local configuration and maintenance functions
- provides local and remote loopback testing and fault isolation functions

## Functional description

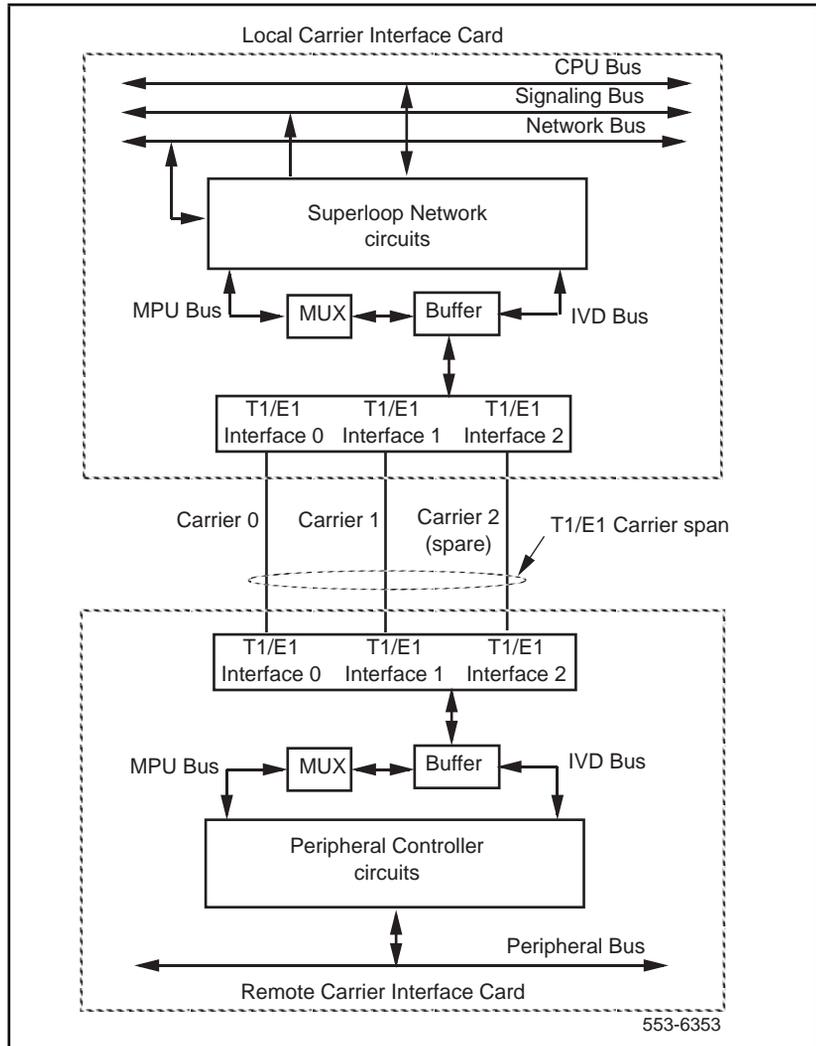
The system is controlled by the CPU. The CPU performs read/write functions on the network control and status registers and communicates with the network equipment over the CPU bus. Through these messages, the CPU monitors the system status, provides call connection sequences, monitors traffic activities,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

Carrier Remote IPE utilizes T1 or E1 carrier links to provide the same subscriber functionality at the remote site as at the Meridian 1 local site.

[Figure 5](#) illustrates the Carrier Remote architecture. It shows the Local Carrier Interface card, the Remote Carrier Interface card, and the internal bus structure that connects them to other system components.

Figure 5 shows the carrier interface circuits to provide an understanding of the internal system communication and call processing activities through the T1 or E1 carrier link.

**Figure 5**  
**Meridian 1 Carrier Remote architecture**



## Local Carrier Interface card

The Local Carrier Interface card is a microprocessor-controlled network interface between the system CPU and the remote peripheral equipment. To communicate with the CPU, the system uses the network, the signaling, and the CPU buses located in the system network module.

The Local Carrier Interface card occupies one network card slot and supports a maximum of 120 timeslots for voice and data transmission with the Remote Carrier Interface card.

A subset of these available timeslots are dynamically activated depending on T1 or E1 carrier and the number of active links in the carrier link. A maximum of 63 timeslots are used for a T1 link with three active carriers or a maximum of 81 timeslots are used for an E1 link with three active carriers. Timeslots that are not associated with physical T1 or E1 carriers are disabled. This prevents assigning carrier-inaccessible timeslots to the peripheral equipment.

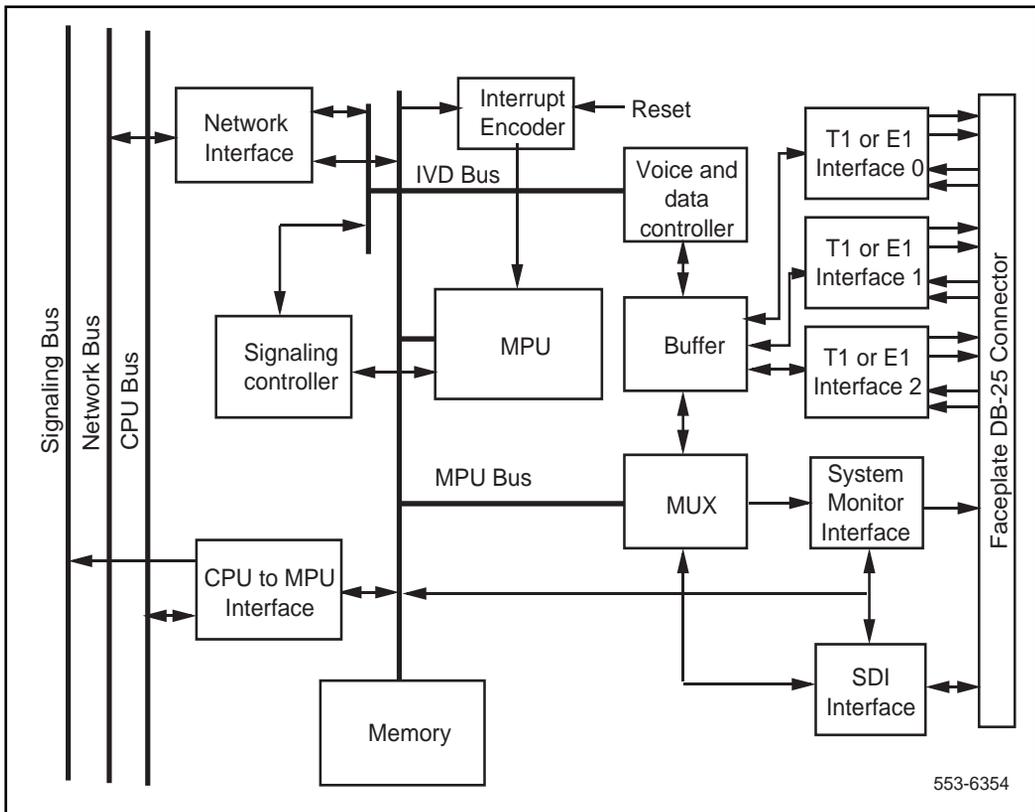
The main Local Carrier Interface card provides the following functions:

- provides from one to three dedicated T1 or E1 carrier links to connect the Carrier Remote IPE to the system
- assigns specific network timeslots to each T1 or E1 carrier link to communicate with the peripheral equipment
- synchronizes the system Clock Controller with the clock signal recover from the carrier link
- manages the carrier administration, maintenance, performance monitoring, and automatic carrier reconfiguration
- provides a miscellaneous timeslot (timeslot 2) in each T1 or E1 link to support multiplexed Card-LAN, SDI transport, system monitor, and carrier maintenance information
- supports two signaling timeslots (timeslots 0 and 1) in each carrier link to transmit signaling information across the link
- provides elastic store (two frames long) to compensate for delays between different carriers in the link and allow for proper alignment of all the timeslots on the internal voice/data (IVD) bus

- 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 also when requested by the CPU

Figure 6 shows the Local Carrier Interface card block diagram illustrating major functional blocks.

**Figure 6**  
**Local Carrier Interface card functional block diagram**



### **Micro Processing Unit (MPU)**

The MPU coordinates and controls data transfer and addressing of the peripheral devices and communicates with the system CPU using a message channel on the CPU bus. The tasks that 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. Functions of the MPU include controllers, timers, control and arbitration logic, address decoding, dual-port RAM and independent direct memory access, input/output ports, and independent full-duplex serial communication channels that support various protocols.

The MPU can be reset by:

- powering up the Local Carrier Interface card
- the watchdog timer
- the ENB/DIS switch
- the system CPU command

### **Memory**

The Local Carrier Interface memory stores the following programs and data:

- Boot code, self-test code, and operating firmware are stored in the EPROM.
- Data is stored in the RAM.
- Code that is downloaded by the Meridian 1 CPU to the Local Carrier Interface card MPU and main function code are stored in the RAM.
- Data containing the Local Carrier Interface card identification and version is stored in the EEPROM.

### **CPU to MPU bus interface**

Information exchange between the system CPU and the Local Carrier Interface 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 timeslots 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

### **Carrier interface**

Each Local Carrier Interface card has three T1/E1 interfaces to provide two primary links and a spare, or three primary T1 or E1 carrier links. Each T1 or E1 carrier interface is switch-selectable to a 1.5 Mbps T1 or a 2 Mbps E1 point-to-point transmission facility. A carrier interface card does not support a combination of T1 and E1 carrier links on a carrier link; it supports only T1 or E1 carriers.

The T1 or E1 carrier interface performs the following functions:

- Connects the system to Remote IPE using one to three T1 or E1 carrier links.
- Provides a communication channel between the Local Carrier Interface card MPU and the Remote Carrier Interface card MPU over timeslot 2 of each carrier. It also multiplexes the system monitor, Card-LAN, and the SDI port information and transmits it over timeslot 2 across the link.

- Transmits signaling information across the carrier link by using timeslots 0 and 1 of each carrier.
- Provides a distance-selectable switch that selects the distance from the Local Carrier Interface card to the first signal regenerator such as a repeater, a CSU, or an LTU in the carrier link to be from 0 to 200 m (0 to 655 ft).
- Uses elastic store buffers to store two frames of carrier data stream to compensate for possible information propagation delays between different carrier timeslots in the link. This allows for proper timeslot alignment of all the carriers on the IVD bus.
- Identifies the card and firmware versions, which are stored in the EEPROM.
- Monitors transmission quality of the link. If the transmission is degraded or fails, the Local Carrier Interface card automatically transfers to the spare link, if equipped.

## **Remote Carrier Interface card**

The Remote Carrier Interface card is a microprocessor-controlled peripheral interface between the Local Carrier Interface card and the Remote IPE line cards. To communicate with the Local Carrier Interface card, the Remote Carrier Interface card uses one to three T1 or E1 carrier links. To communicate with the peripheral equipment, the Remote Carrier Interface uses 16 full-duplex serial loops, one for each line card in the Carrier Remote IPE module or Carrier Remote IPE cabinets.

The Remote Carrier Interface card occupies one controller card slot in the IPE module. However, the adjacent card slot is not the full width and must remain empty. This narrower card slot is due to the fact that a standard peripheral controller card occupies two card slots in the IPE module, and the Remote Carrier Interface card that plugs into the same backplane connector, occupies only one card slot. The dummy faceplate can be used in the empty card slot in the Carrier Remote IPE module for aesthetic reasons but is not needed in the Carrier Remote IPE cabinet.

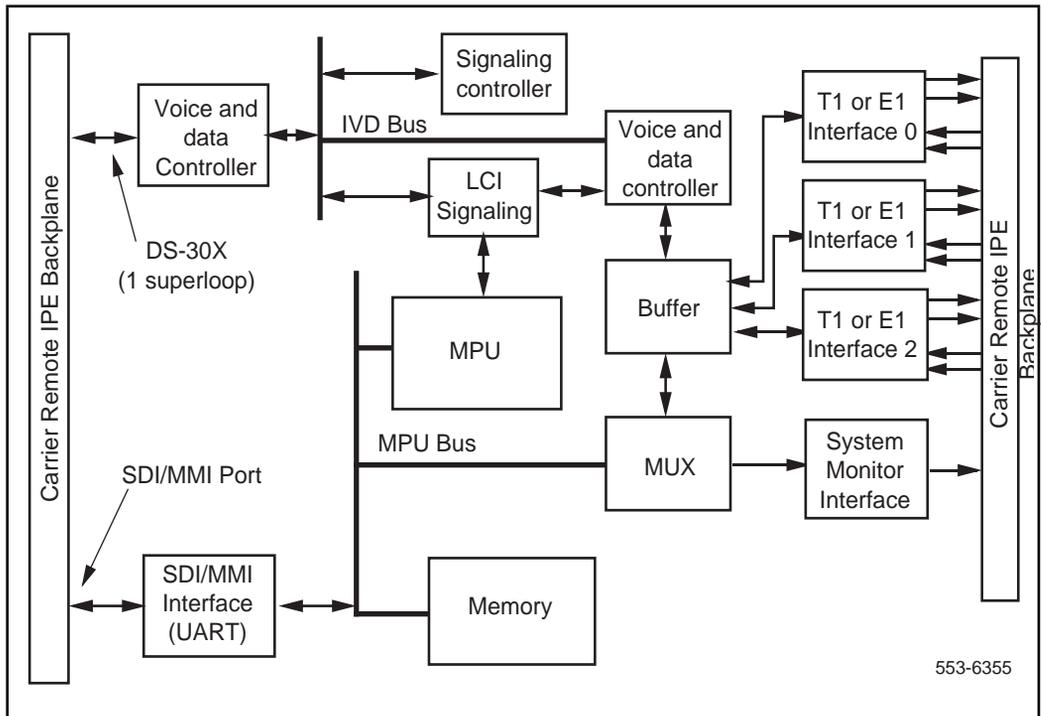
The main Remote Carrier Interface card provides the following functions:

- Provides one to three T1 or E1 carrier links to connect the Carrier Remote IPE to the system.
- Assigns timeslots on the T1 or E1 carrier link to timeslots of the 16 full-duplex serial loops assigned to line cards in the IPE module.
- Provides a Remote Carrier Interface Microprocessor (RCIM) to execute administrative and MMI port commands and manage the carrier administration, maintenance, performance monitoring, and automatic carrier reconfiguration.
- Transmits signaling information across the carrier link by using timeslots 0 and 1 of each carrier.
- Provides a communication channel between the Local Carrier Interface card MPU and the Remote Carrier Interface card MPU over timeslot 2 of each carrier. It also multiplexes the system monitor, Card-LAN, and the MMI port information and transmits it over timeslot 2 across the carrier link.
- Uses elastic store buffers to store two frames of carrier data stream to compensate for possible information propagation delays between different carriers in the link. This allows for proper timeslot alignment of all carriers on the IVD bus.
- Provides a distance-selectable DIP switch that selects the distance from the Remote Carrier Interface card to the first signal regenerator such as a repeater, a CSU, or an LTU in the carrier link to be from 0 to 200 m (0 to 655 ft).
- Converts SSD-type signaling format received from the Local Carrier Interface card to the signaling format for digital telephone sets, and from the digital telephone sets format to SSD-type format.
- Polls telephone sets to determine the line type and its signaling protocol and transmits this information to the Local Carrier Interface card.
- Provides an interface for MMI administration and maintenance ports.

- Provides continuity test, line card polling, card enabling/disabling, and loopback testing functions.
- Accesses up to three external alarm inputs, which are multiplexed with maintenance and diagnostic messages sent to the Local Carrier Interface card MPU.
- 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 Remote Carrier Interface card block diagram illustrating major functional blocks. Functions of these blocks are described in the following sections.

**Figure 7**  
**Remote Carrier Interface card functional block diagram**



### **Micro Processing Unit (MPU)**

The MPU coordinates and controls data transfer and addressing of the peripheral devices and communicates with the Local Carrier Interface card using serial communication channels over the carrier timeslot 2. Tasks that 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. Functions of the MPU include controllers, timers, control logic, address decoding, dual-port RAM and independent direct memory access, parallel input/output ports, and independent full-duplex serial communication channels that support various protocols.

The MPU can be reset by:

- powering up the Remote Carrier Interface card
- the watchdog timer

### **Memory**

The Remote Carrier Interface memory stores the following programs and data:

- Boot code and self-test code are stored in the EPROM.
- Data is stored in the RAM.
- Code that is downloaded by the system CPU to the Remote Carrier Interface card and main MPU function code are stored in the RAM.
- Data containing the Remote Carrier Interface card identification and version is stored in the EEPROM.

### **Card-LAN interface**

To implement the Card-LAN interface, the Remote Carrier Interface card uses a dual-UART device. One UART channel is a serial communication interface to IPE cards and the other channel is the communication link between the Local Carrier Interface card and the Remote Interface card MPUs over the carrier link. Card-LAN function is performed in the system and it doesn't provide an external physical connection.

The Card-LAN is a 19.2 kbps asynchronous interface. It is used to poll and communicate with IPE cards through the Remote Carrier Interface card 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 Remote Carrier Interface MPU using sixteen DS-30X loops, one for each IPE card, and contains the following Remote Carrier Interface 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; then the MPU accesses this information, interprets it, and sends it to the Local Carrier Interface in the appropriate format. From the Local Carrier Interface, the signaling messages are received and interpreted by the Remote Carrier Interface MPU and sent to the serial peripheral loops in the appropriate format.
- Timeslot interchange that provides the correspondence between the voice and data timeslots on the T1 or E1 carrier link and the timeslots on the IVD bus. Timeslots on the IVD bus correspond directly to the peripheral line card loops.
- Signaling timeslots on each carrier link that handle the signaling to and from the Local Carrier Interface card. It receives signaling information from the Local Carrier Interface card and transmits it to the Remote Carrier Interface card MPU for processing. It also processes the signaling information in the opposite direction by receiving the signaling information from the Remote Carrier Interface card MPU and transmitting it to the Local Carrier Interface card MPU over the T1 or E1 carrier links.

### **Carrier interface**

Each Remote Carrier Interface card provides three T1 or E1 carrier interfaces. The Remote Carrier Interface card can have three primary links or two primary links and one spare. It provides a switch-selectable 1.5 Mbps T1 or a 2.0 Mbps E1 point-to-point transmission facility.

The T1 or E1 carrier interface performs the following functions:

- Connects the system to Remote IPE using one to three T1 or E1 carrier links.
- Provides a distance-selectable switch that selects the distance from the Remote Carrier Interface card to the first signal regenerator such as a repeater, a CSU, or an LTU in the carrier link to be from 0 to 200 m (0 to 655 ft).
- Transmits signaling information across the link by using timeslots 0 and 1 of each carrier.
- T1 line signal coding across the carrier link is B8ZS.
- Extended Superframe (ESF) is preferred (instead of D4) for T1 links because it provides CRC6 error monitoring, which provides end-to-end performance checking.
- E1 line signal coding across the carrier link is HDB3.
- Meridian 1 system is used as the clock source to synchronize the communication between the local and remote sites over carrier links.
- Provides a communication channel between the Local Carrier Interface card MPU and the Remote Carrier Interface card MPU over timeslot 2 of each carrier link. It also multiplexes the system monitor and the SDI port information and transmits it over this carrier timeslot across the link.
- Uses elastic store buffers to store two frames of carrier data stream to compensate for possible information propagation delays between different carriers in the link. This allows for proper timeslot alignment of all the carrier links on the IVD bus.
- Identifies card and firmware versions, which are stored in the EEPROM.
- Monitors transmission quality of T1 or E1 carrier links. If the transmission is degraded or fails, the Remote Carrier Interface card automatically transfers to the spare 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 Carrier Remote IPE planning and implementation.

### Carrier Remote IPE capacity

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

The system's physical capacity depends on the system type. Systems supporting Carrier Remote IPE service are NT and XT. They provide port capacities from tens of ports to thousands of ports.

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

**Note:** System port capacity may be affected by the capacity of the Local Carrier Interface card, which supports only one IPE module instead of two IPE modules as supported by the standard superloop network card. Call blocking grade of service for the remote voice and data terminals depends on the number of active carriers in the link.

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

- Carrier Remote IPE column
- Carrier Remote IPE cabinet

### **Carrier Remote IPE column**

The Carrier Remote IPE column 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 Remote Carrier Interface card located in the IPE module and a corresponding Local Carrier Interface card located in the system network card slot.

*Note:* A superloop network card can support up to two IPE modules. However, in a system with the Carrier Remote IPE configuration, a Local Carrier Interface card supports only one Remote IPE module. This is due to the dedicated carrier link configuration between the Local Carrier Interface card and the Remote Carrier Interface card. Since T1 or E1 carrier links are dedicated to one Remote Carrier Interface card, they cannot be shared between two different IPE modules at the remote site.

### **Carrier Remote IPE cabinet**

The Carrier Remote IPE cabinet consists of an NT1P70/NT1P60 main and an NTBK70 expansion cabinets. The main cabinet supports the Remote Carrier Interface card and up to ten 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 50-pin connector P1 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 Remote Carrier Interface card located in the main cabinet supports cards in both main and expansion cabinets as long as the expansion cabinet contains no more than six IPE cards installed in the first six IPE card slots. The remaining card slots from 17 through 20 must not be used.

### **Engineering the T1 carrier link**

A T1 carrier link is constructed using twisted-pair wire over the private or public network.

When engineering a carrier link, you must determine the number of links required to support the traffic at the remote site. Local and Remote Carrier Interface cards support from one to three T1 carrier links. These three links can be used as primary links without a spare, or two links can be used as primary and the third link can be used as a spare link. The spare link is used when one of the primary links fails. In that case, the traffic from the failed link is automatically switched to the spare link.

The T1 carrier link used twisted-pair wire. The public network link construction is the responsibility of the local telephone company. The only cable routing that has to be done at the local and remote sites is from the telephone company's telco demarcation point or line terminating unit (LTU) to the system and to the Carrier Remote IPE column or Carrier Remote IPE cabinet.

If a private T1 network is used, the same conditions as with the public network apply, that is, the only cable routing that has to be done at both sites is from the CSU or telco demarcation point to the system and to the Carrier Remote IPE column or Carrier Remote IPE cabinet, assuming that the carrier link already exists and does not have to be constructed.

The local carrier interface and the remote carrier interface to the carrier link are designed for in-house environment carrier protection. To protect the carrier link in the external environment, which is susceptible to lightning, external line protection circuits similar to trunk protection circuits are required before the carrier link exits the building.

The carrier link line coding is B8ZS. The source of the clock for the carrier links is the Meridian 1 system. The preferred framing for the T1 link is ESF (D4 is also supported).

### **Engineering the E1 carrier link**

An E1 carrier link can be constructed using coaxial cable or twisted-pair wire over the private or public network.

When engineering a carrier link, you must determine the number of links required to support the traffic at the remote site. Local and Remote Carrier Interface cards support from one to three E1 carrier links. These three links can be used as primary links without a spare, or two links can be used as

primary and the third link can be used as a spare link. The spare link is used when one of the primary links fails. In that case, the traffic from the failed link is automatically switched to the spare link.

The E1 carrier link, in some applications, may use coaxial cable to span the distance between the system and the Carrier Remote IPE. The public network link construction is the responsibility of the local telephone company. The only cable routing that has to be done at the local and remote sites is from the telephone company's demarcation point or line terminating unit (LTU) to the system and to the Carrier Remote IPE column or Carrier Remote IPE Cabinet. If the E1 link uses coaxial cables and BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable (one RJ -48 to BNC adapter cable for each carrier in the link) and the impedance must be set to 75 Ohm using SW1, SW2, SW5, and SW8 on the Local and Remote Carrier Interface cards (refer to [Figure 9](#) and [Figure 15](#)).

An E1 carrier link may use coaxial cable connection from the Meridian 1 system and the Carrier Remote IPE to the corresponding LTU or telco demarcation point, but from there on, the network can use twisted pairs, coaxial cable, microwave, etc. as long as it meets the transmission quality required for E1 carrier communication.

If a private E1 network is used, the same conditions as with the public network apply, that is, the only cable routing that has to be done at both sites is from the LTU or telco demarcation point to the system and to the Carrier Remote IPE column or Carrier Remote IPE cabinet, assuming that the carrier link already exists and does not have to be constructed.

The local carrier interface and the remote carrier interface to the carrier link are designed for in-house environment carrier protection. To protect the carrier link in the external environment, which is susceptible to lightning, external line protection circuits similar to trunk protection circuits are required before the carrier link exits the building.

The T1 carrier link line coding is B8ZS. The E1 carrier link line coding is HDB3. The source of the clock for the carrier links is the Meridian 1 system.

## Traffic engineering

Network blocking in Meridian 1 can potentially occur at three stages: the network loop or superloop associated with the originating port (line or trunk), the loop or superloop where the call terminates, and the inter-group junctors bridging the connection between two network groups in a multi-group system.

**Note:** When carriers are configured with carrier 2 as spare, carrier 0 will always have the sparing priority over carrier 1. If carrier 1 is spared and carrier 0 becomes faulty, carrier 0 will be spared and carrier 1 will be released.

In order to meet the overall Grade Of Service (GOS) requirement of 0.01 network blocking requirement, each blocking component in the network should not be greater than one third of the total blocking. Therefore, the blocking for a call at the originating part of the connection should be 0.0033 or less. It is this blocking probability that yields 660 CCS capacity for a loop and 3500 CCS capacity for a superloop in the traffic engineering procedure.

The engineering of Carrier Remote IPE is equivalent to engineering a segment of the call connection; it should follow the procedure recommended in this document. The rest of the system engineering will not be impacted by this component.

### Traffic capacity

Traffic capacities of carriers meeting GOS requirements are summarized in [Table 4](#).

**Table 4**  
**Carrier capacity calculations**

Carrier Type	T1			E1		
	1	2	3	1	2	3
Number of Carriers	1	2	3	1	2	3
Number of Channels	21	42	63	27	54	81
Traffic in CCS	408	1016	1665	575	1384	2235

There are some general guidelines to be followed before you start to engineer a Carrier Remote IPE:

- Traffic engineering for a Carrier Remote IPE with or without Central Office between Local Carrier Interface card and Remote Carrier Interface card is the same. This implies that available channels for any specific configuration in the CO or CO network are at least equal to the channels on the carrier to provide the GOS required.
- One Local Carrier Interface card is connected to one Remote Carrier Interface card only. There is no concentration option on the Carrier Remote IPE.
- One carrier out of two, or one carrier out of three, equipped is allowed to be a spare which serves as a backup during active carrier failure but will not carry traffic under normal conditions.
- Capacity calculation of carriers (E1 or T1) should exclude the spare carrier. In other words, if a spare carrier is provided, the maximum number of channels available for traffic is 42 for T1 and 54 for E1.
- If the number of equipped ports (lines or trunks) is less than the number of channels (or time slots) in the carrier, there will be no blocking at the carrier or superloop. Traffic per port can be up to 36 CCS.
- Non-blocking on a carrier Carrier Remote IPE superloop is not sufficient to guarantee a non-blocking system. Other parts of the call connection need to be considered.
- Traffic requirements for lines or trunks are normally specified by a customer. When it is not specified, the default number of 6 CCS per line, 26 CCS per trunk, 30 CCS per ACD agent and 18 CCS per data port can be used.
- Current digital line card allows 16 voice ports and 16 data ports. Unused data ports can not be used for voice lines. In other words, an Integrated Voice and Data line card can support 16 voice lines or 16 integrated voice and data pairs. A port is the generic term for a line, trunk, or data terminal.

- A trunk card can provide eight trunk ports.
- An IPE module can accommodate 16 cards, of which any combination of cards are permitted.
- Digitone Receiver (DTR) cards should not be installed into the Carrier Remote IPE cabinet or the Carrier Remote IPE module due to the unnecessary use of carrier channels and remote IPE card slots.
- A Carrier Remote IPE cabinet version of the Carrier Remote IPE may consist of a 10-slot main cabinet and 6-slot expansion cabinet providing a maximum of 16 card IPE capacity. There may be cost advantages to equipping Carrier Remote IPE cabinets in a multi-shelf configuration, if a cabinet is equipped with no more than 10 cards.
- All line/trunk cards, card slot and carrier calculations are to be rounded up to the next higher integer number.
- Capacity calculations of lines and trunks allowed per carrier should be rounded down to the next lower number.
- When several IPE modules or Carrier Remote IPE cabinets are required in the configuration, it is preferable to fill up the first IPE module or cabinet card slots until either all slots are filled or the carrier traffic limit is reached before equipping the second one. This way, when adding traffic or cards to the partially filled enclosure, the first module or cabinet will not need re-engineering.
- When no growth is planned, even distribution of traffic among several IPE modules or Carrier Remote IPE cabinets is quite acceptable.
- Carrier Remote IPE cabinet installation guide: (1) 1–10 cards, use a Carrier Remote IPE cabinet. (2) 11–16 cards, use an IPE module. (3) 17–20 cards, use two Carrier Remote IPE cabinets. (4) 21–26 cards, use one IPE module and one Carrier Remote IPE cabinet. (5) 27–32 cards, use two IPE modules. Repeat the same rule for additional card slots required. Of course, the final configuration will also depend on traffic requirements.

### **Engineering Procedure**

The following procedures determine the system terminal configuration for determining system traffic capacity.

#### **Given the number of carriers, calculate ports allowed.**

- 1** Determine traffic capacity at the carriers. Read off the CCS number from [Table 4](#) under the specified number of carriers as the maximum capacity allowed for that carrier size.
- 2** Determine the number of lines allowed. Divide the CCS number by 6 CCS for line or 26 CCS for trunk or any other numbers provided by the customer.
- 3** Determine the number of card slots required. The number of lines divided by 16, the number of trunks divided by 8 or the number of integrated voice and data lines divided by 32 to obtain the number of card slots required.
- 4** An IPE module has 16 card slots, a Carrier Remote IPE cabinet has 10 card slots.
- 5** If the number of card slots is less than or equal to 16 (or 10), the resulting configuration is within the traffic capacity of the carrier provided.
- 6** If the number of card slots allowed is greater than 16 (or 10), it means that the carrier can handle more traffic than an IPE module or Carrier Remote IPE cabinet can generate. When all 16 (or 10) card slots are filled, the carrier may still have spare capacity for extra traffic.

#### **Given port CCS, determine the number of carriers required.**

- 1** Multiply the number of lines by CCS per line, the number of trunk by CCS per trunk, etc. and sum them up to obtain the total traffic offered to the carrier.
- 2** Look up [Table 4](#) under the T1 or E1 column to find the CCS number greater than the calculated number, and find the corresponding carrier number to determine the number of carriers required.

- 3 If no number in [Table 4](#) is large enough to cover the calculated number, it means that the given configuration and traffic is too large for three carriers. Either the number of ports, or the CCS per port or both have to be reduced. The resulting number has to be less than the entry from [Table 4](#) in order for the carrier to handle the given configuration.
- 4 If traffic and number of lines have to be maintained, multiple lines of carriers and cabinets will be needed.
- 5 Be sure to use only columns with 1 or 2 carriers in [Table 4](#), if a spare carrier is to be used.
- 6 The port counts in the final configuration should be within the slot limitation of the Carrier Remote IPE enclosure (16 for IPE module, 10 for the Main Carrier Remote IPE cabinet and 6 for the Expansion Carrier Remote IPE cabinet).

### Engineering Examples

Engineering examples are developed to illustrate the procedure described above. They cover only traffic capacity issues specifically associated with Carrier Remote IPE engineering.

#### **Given the number of carriers to find allowed ports and required enclosures.**

**Example 1:** Three T1 carriers are provided to serve a Carrier Remote IPE. All ports are lines with 6 CCS each.

Find the maximum number of lines three T1 carriers can support.

- 1 From [Table 4](#), the CCS that can be handled by three T1 carriers is 1665.
- 2 Divide CCS by 6:  $1665/6=277$ . Traffic generated by 277 lines at 6 CCS each can be supported by three T1 carriers.
- 3 Calculate card slots:  $277/16=17$ . This number is greater than the 16 slots available in an IPE module.
- 4 Calculate maximum allowed lines:  $16 \times 16=256$ , or  $16 \times 10=160$ . 256 lines (or 160 lines) with 6 CCS each are the maximum number of lines allowed for each Remote IPE module or Remote IPE cabinet for three T1 carriers.

### Configuration for Mixed Sets, Trunks and Data Terminals.

**Example 2:** A remote data processing center is connected to the main office through private E1 carriers. For reliability purposes, spare carriers are required as backups.

Find the configuration to support 80 integrated voice and data lines at 6 CCS for voice and 14 CCS for data, and 20 trunks at 26 CCS each.

- 1 From [Table 4](#) under E1 heading, two carriers can serve 1384 CCS (with spare, two carriers are the maximum link size per each Carrier Remote IPE module or Carrier Remote IPE cabinet).
- 2 Calculate total offered traffic:  $80 \times 6 + 80 \times 14 + 20 \times 26 = 1600 + 520 = 2120$  CCS. This number is larger than 1384 but less than 2768 ( $=2 \times 1384$ ). The offered traffic is too much for two carriers but within the capacity of four carriers (two lines of two carrier links). Note that the integrated lines alone generate more traffic (1600 CCS) than two carriers can handle, they need to be split between two IPE modules or Carrier Remote IPE cabinets.
- 3 Calculate card slots:  $(80+80)/32 + 20/8 = 5 + 3 = 8$ . There are sufficient card slots in one cabinet to handle the required ports. Even though the configuration exceeds the traffic capacity of one carrier group in Step 2, it is still a good idea to check physical constraints to determine whether traffic is the only constraining parameter.
- 4 Configuration Summary:  
IPE1 (Carrier Remote IPE cabinet): 3 32-port IVD cards, 1 trunk card, 3 E1 carriers including one spare.  
IPE2 (Carrier Remote IPE cabinet): 2 32-port IVD cards, 2 trunk cards, 3 E1 carriers including one spare.

**Given ports and traffic to find carriers and cabinets. Non-blocking Sets Only (two Carrier Remote IPE cabinets)**

**Example 3:** A Carrier Remote IPE is located in an airport fire station two miles from the main terminal building where the Meridian 1 is installed. There are 80 lines in the Carrier Remote IPE where non-blocking network and a spare carrier on the carrier group are required. What is the most cost effective configuration to serve this site?

- 1 To provide non-blocking to 80 lines, 80 channels are required at the carrier.
- 2 From [Table 4](#), two T1 carriers can provide 42 channels, which are just enough to serve half of the requirement.
- 3 Calculate card slots:  $80/16 = 5$ . Only five card slots are needed for this application. However, if three cards are fully equipped with lines in one IPE module or Carrier Remote IPE cabinet, the 48 lines will exceed the channel capacity of two-carriers at 42 for non-blocking. Three partially equipped cards are needed. The total ports should be 42 or less at any IPE module or Carrier Remote IPE cabinet.
- 4 Configuration Summary:  
IPE1 (Carrier Remote IPE cabinet): 42 non-blocking lines, 3 cards, 3 E1 carriers including one spare.  
IPE2 (Carrier Remote IPE cabinet): 38 non-blocking lines, 3 cards, 3 E1 carriers including one spare.

To split lines 40-40 in this application is also acceptable. However, future growth should be kept to 42 lines maximum at each cabinet.

**Blocking Network (one IPE module and one Carrier Remote IPE cabinet)**

**Example 4:** A university providing E1 carrier telephone services to 400 boarding students is located one mile away from the main administrative building where the Meridian 1 is located.

Find the configuration required to serve this remote site, if the estimated busy hour per line is 6 CCS.

- 1 Calculate traffic:  $400 \times 6 = 2400$  CCS. This number is greater than the capacity of 3 E1 carriers (2235 CCS). From a traffic standpoint, two IPE modules are needed.
- 2 Calculate card slots:  $400/16 = 25$ . This also indicates that two IPE modules are needed. However, one IPE Module with 16 card slots and a Carrier Remote IPE cabinet with 10 card slots are sufficient to meet the need.
- 3 Calculate traffic, card slots and carriers for the first IPE module:  
 $2235/6 = 372$  lines.  
 $372/16 = 24$  cards. This number is  $> 16$ . Only 16 cards are allowed for the first IPE module.  
 $16 \times 16 = 256$ . 256 lines at 6 CCS each is equipped for the first IPE module  
 $256 \times 6 = 1536$  CCS. From Table 3, this number still requires three E1 carriers.
- 4 Calculate traffic, card slots and carriers for the second IPE module or Carrier Remote IPE cabinet:  
Remaining lines:  $400 - 256 = 144$   
Card slots:  $144/16 = 9$   
Traffic:  $144 \times 6 = 864$  CCS  
Carriers required: From [Table 4](#), 2 E1 carriers can handle 1384 CCS which should be enough to serve the 864 CCS from 144 lines (but one carrier at 575 CCS is not quite enough).
- 5 Configuration Summary:  
IPE1 (IPE module): 6 CCS/line, 256 lines, 16 cards, three E1 carriers.  
IPE2 (Carrier Remote IPE cabinet): 6 CCS/line, 144 lines, 9 cards, two E1 carriers.

## System planning and ordering

Meridian 1 and SL-1 systems provide the user with a variety of system size and feature options. To select a system option that will best suit your current and future communication needs, you must carefully plan your system. 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 Carrier 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 T1 and E1 carrier links interfacing with network and peripheral cards, see the following sections.

### System selection

Determine the type of Carrier 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 can use the Carrier Remote IPE column or the pedestal mounted Carrier Remote IPE cabinet. If you plan a wall-mounted system, you need the Carrier Remote IPE cabinet.

In some applications where nonblocking or low blocking traffic considerations are important, you have to limit the number of peripheral cards supported by each Remote Carrier Interface card. For a nonblocking condition, the 63 voice/data timeslots for three T1 carriers support four 16-port line cards; the 81 voice/data timeslots for three E1 carriers support five 16-port line cards. Each additional line card in the IPE module or the Carrier Remote IPE cabinet increases call blocking under high traffic conditions. Refer to *Meridian 1 system engineering* (553-3001-151) for traffic calculations.

With a spare carrier for a nonblocking traffic condition, the number of stations is reduced by 21 for the T1 carrier and by 27 for the E1 carrier.

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 can be expanded by adding a second IPE module to support an additional 256 ports. Each IPE module, however, requires a Remote Carrier Interface card at the remote site and a corresponding Local Carrier Interface card at the local Meridian 1 or SL-1 site.

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

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

## **Carrier Remote IPE site planning**

When you select a site for your Carrier 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 the environmental, power, and cable routing requirements.

### **Environmental requirements**

Carrier Remote IPE equipment conforms to the same environmental requirements as the system equipment. Temperature, humidity, and altitude for the system operation should not exceed the specifications shown in [Table 5](#).

[Table 5](#) shows the operating and storage environmental specifications. Ideally the system 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 [Table 5](#).

**Table 5**  
**Environmental requirements**

Condition	Environmental specifications
<b>Operating</b>	
Temperature	0° to 50° C (32° to 122° F)
Relative humidity	5% to 95% noncondensing
Altitude	3,048 meters (10,000 feet) max
<b>Storage</b>	
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 Remote Carrier Interface card is not significantly different from power consumption of the standard Peripheral Controller card. This allows the standard IPE module's power supply to be used in the Carrier Remote IPE column.

Similarly, the Carrier Remote IPE main cabinet power supply, which is installed in the left-hand side of the cabinet shelf, provides power to the Remote Carrier Interface card and up to ten IPE cards. The expansion cabinet requires its own separate power supply to provide power to an additional six IPE cards.

The Carrier Remote IPE cabinet can be powered with an AC power system using the NTAK04 AC/DC power supply.

It can also be powered with a DC power system using the NTAK05 DC power supply from a -52 V battery source through the NTAK28AA Junction box and the NTAK410 power cable. For additional information refer to *Option 11 Installation guide 553-3011-210*.

**Table 6** shows the power supply DC output voltages and currents they supply to the Local Carrier Interface (LCI) and Remote Carrier Interface (RCI) cards. It also shows the corresponding total power consumption for each card.

**Table 6**  
**LCI and RCI power requirements**

Voltage source in VDC	LCI card	RCI card
+5V	4.0 A	3.7 A
+15V	70 mA	50 mA
-15V	70 mA	50 mA
+12V	70 mA	50 mA
-12V	70 mA	50 mA
Total Power	23.8 W	21.2 W

**Carrier cable requirements**

A link can include up to three carriers. In a Carrier Remote IPE column, the carrier link terminates into the I/O panel connectors at the rear of the IPE module. In a Carrier Remote IPE cabinet, the carrier link terminates into the I/O panel connectors mounted on a bracket at the lower left-hand side at the front of the Carrier Remote IPE cabinet.

The Carrier Remote IPE UEM column and the Carrier Remoter IPE cabinet support T1 or E1 carrier links. These carrier links are terminated as follows:

- T1/E1 carrier links use twisted-pair wires (120-ohm impedance) and terminate into 8-pin modular jacks.
- E1 carrier links may in some cases use coaxial cables (75 ohm impedance) and terminate into BNC connectors, requiring a RJ48 to BNC adapters (supplied with the equipment) to connect the link to the Carrier Panel assembly at the UEM I/O panel.



---

# Equipment installation and configuration

---

This chapter describes the installation of the Carrier Remote IPE as an integral part of system options 21E, 51, 51C, 61, 61C, 71, 81, and 81C as well as NT and XT systems.

## Quick reference to system installation and configuration

If you are familiar with the system operation and general Meridian 1 installation practices, follow the steps below and refer to Appendix C for connection diagrams, to speed up the installation of the Remote Carrier IPE at the local and remote sites:

- 1 Take inventory of the carrier equipment by comparing the received equipment against the shipping documents. Refer to [Tables 1, 2, and 3](#) in the *Carrier Remote IPE product description* chapter on page 3 for carrier components part numbers and their description.
- 2 Identify empty network card slots, refer to:
  - Table 8 “Meridian 1 modules supporting Local Carrier Interface cards” on page 60 or
  - Table 9 “System cabinet shelves supporting Local Carrier Interface cards” on page 61 and
- 3 Configure the NT7R51 Local Carrier Interface card DIP-switches to set the Local Carrier Interface card address and other parameters. Refer to:
  - Figure 9 “Local Carrier Interface card DIP-switch positions and function” on page 69 for switch settings.
  - Table 11 “NT7R51 Local Carrier Interface card maintenance daisy-chain address” on page 70.

- 4    Install the NT7R51 Local Carrier Interface card into a network card slot:
  - “Installing the Local Carrier Interface card” on page 67, for Meridian 1 system options.
  - “Installing the Local Carrier Interface card” on page 92, for NT/XT systems.
  - Figure 14 “Local Carrier Interface card faceplate cable connections in NT or XT system” on page 93.
- 5    Install the NT7R51 Local Carrier Interface card faceplate connector assemblies. Refer to:
  - “Installing the Local Carrier Interface cable assemblies” on page 71 and
  - Appendix C, [Figure 27](#) and [Figure 28](#), and
  - Figure 10 “Local Carrier Interface card faceplate cable connections in Meridian 1” on page 73 or
  - Figure 14 “Local Carrier Interface card faceplate cable connections in NT or XT system” on page 93 and
  - “Installing Local Carrier Interface faceplate cables” on page 94.
- 6    Install the system monitor, local MMI terminal, and carrier link cables to the carrier and maintenance panel assembly connectors. Refer to:
  - “Installing SDI and local MMI terminal cables” on page 76, and
  - Appendix C, [Figure 31](#).
  - “Connecting the carrier link to the Meridian 1” on page 89, and
  - Figure 11 “System monitor, local MMI terminal, and carrier links cable connections” on page 77.
  - Refer to Appendix C on page 221 for connector pin assignments.
- 7    At the remote site, install the Carrier Remote IPE column or wall-mounted (or pedestal mounted) Carrier Remote IPE cabinet. Refer to:
  - “Installing the Carrier Remote IPE column” on page 103 or
  - “Installing the Carrier Remote IPE cabinet” on page 117.

- 8** Configure the NT7R52 Remote Carrier Interface card. Refer to:
- Figure 15 “Remote Carrier Interface card DIP-switch locations and functions” on page 107 for switch settings and
  - “Installing system monitor cables” on page 113.

**Note:** For the floor-standing Carrier Remote IPE column, select the system monitor address on the Remote Carrier Interface card and on the System Monitor card in the pedestal. The system monitor address in both places must be the same and a unique number from 0 to 31.

- 9** Install the NT7R52 Remote Carrier Interface card into the **Cont** card slot in the IPE Module or the Carrier Remote IPE cabinet. Also install the power supply and the IPE cards.

- 10** Install the internal cable assemblies. Refer to:
- “Installing the backplane cable assemblies” on page 109 and
  - Appendix C, [Figure 29](#), and
  - Figure 16 “Backplane to I/O panel connections on the IPE module” on page 112 for the Carrier Remote IPE column, or refer to
  - “Installing the NT7R94AA Remote Cabinet Cable Assembly” on page 122 and
  - Appendix C, [Figure 30](#), and
  - Figure 18 “Carrier cable routing for the Carrier Remote IPE cabinet” on page 123 for the Carrier Remote IPE cabinet.

- 11 Install the external cables to the I/O panel. Refer to:
  - “Installing system monitor cables” on page 113 and
  - Appendix C, [Figure 29](#), and
  - “Connecting the carrier link to the Remote IPE module” on page 115 for the Carrier Remote IPE column, or refer to
  - “Connecting carrier links to the Carrier Remote IPE cabinet” on page 125 and
  - Appendix C, [Figure 30](#), and
  - “Connecting remote MMI terminal and subscriber loop cables” on page 128 for the Carrier Remote IPE cabinet.
  - “Verifying carrier link connections at the remote site” on page 147
  - Refer to Appendix C on page 221 for connector pin assignments.
- 12 Configure the Carrier Remote IPE local and remote sites. Refer to:
  - “Configuring the carrier interface cards” on page 133 and
  - “Configuring the remote MMI terminal port” on page 138.
  - “Configuring the carriers” on page 141.
- 13 Conduct system acceptance testing. Refer to:
  - “Carrier Remote IPE acceptance testing” chapter on page 153 in this manual.

## Installation overview

Carrier 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 Carrier Remote IPE, or it can be an integral part of a newly installed Meridian 1 system.

The Remote IPE service can also be added to NT and XT systems with X11 release 21 or higher generic software.

In either case, the connection of the Carrier Remote IPE to the system over T1 or E1 carrier links should begin after a previously installed system, or a newly installed system using generic software X11 release 21 or higher operates correctly. The system must also be equipped with Carrier Remote IPE software package REM\_IPE 286. The carrier service has been ordered, installed, and tested up to the telco demarcation point.

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.

To upgrade NT and XT systems to X11 release 21 or higher, refer to *Software conversion procedures* (553-2001-320).

Adding one or more Carrier Remote IPE sites to a system is treated as a straightforward system expansion, that is, the system should be fully operational before the Carrier Remote IPE equipment is installed and connected to the system. This simplifies installation and fault isolation during installation.

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

- Carrier Remote IPE column
- Carrier Remote IPE cabinet

**Note:** The Carrier Remote IPE column consists of a pedestal, an IPE module that houses up to 16 IPE cards, and a top cap. The Carrier Remote IPE cabinet may consist of only the main cabinet when 10 or fewer IPE cards are required, or the main and the expansion cabinets when up to 16 IPE cards are required.

To complete the installation of a Carrier Remote IPE site, you should perform the preinstallation procedures to prepare the site before installing and connecting the equipment. The general preinstallation and installation points are listed below. The actual installation procedure steps start in “Meridian 1 equipment installation” on page 66.

Preinstallation procedures include:

- ordering carrier service from telco
- preparing the site
- unpacking and inspecting the equipment
- inventorying Carrier Remote IPE and system carrier equipment
- selecting a network slot for the Local Carrier Interface card

Local site installation procedures include:

- installing the Local Carrier Interface card into the selected network card slot
- installing cables between the Local Carrier Interface faceplate connectors and the I/O panel assembly at the rear of the Meridian 1 module housing the Local Carrier Interface card or the NT or XT system cabinet
- connecting the system monitor daisy-chain, the Meridian 1 host SDI, and the MMI terminal cables at the local system site
- connecting the Local Carrier Interface maintenance cables in a daisy-chain for multiple Local Carrier Interface cards
- connecting the carrier link to the I/O panel assembly

Remote site installation procedures include:

- installing the Carrier Remote IPE column or cabinet
- installing the Remote Carrier Interface card into the Remote IPE module or cabinet controller card slot
- installing cables between the backplane connectors behind the Remote Carrier Interface card and the I/O panel assembly at the rear of the module or the bottom of the Carrier Remote IPE cabinet

- connecting the slave system monitor and MMI terminal cables at the Carrier Remote IPE site
- connecting the carrier link to the Carrier Remote IPE

## Preinstallation preparation

Preinstallation preparation consists of preparing the site, unpacking and inspection, taking inventory, selecting the network slot for the Local Carrier Interface card, installing the card, selecting the T1 or E1 carrier link, and preparing the remote site cables, grounding, power source, and the space for 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 Carrier 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)

**Note:** The NT and XT systems have been previously installed and are only upgraded for Carrier Remote IPE service. If these systems have been upgraded using Meridian 1 column, you can use the system monitor in the pedestal to process system alarms received from the Carrier Remote IPE site. Without the system monitor in the pedestal, the system alarms from the Carrier Remote IPE site cannot be processed.

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

- Install and verify the operation of Meridian 1, without linking Meridian 1 to the Carrier Remote IPE sites. Refer to *Meridian 1 system installation procedures* (553-3001-210). An NT or XT system should have already been installed and must be operational.
- Install the Carrier Remote IPE column. Also refer to *Meridian 1 system installation procedures* (553-3001-210), or

Install the cabinet version of Carrier Remote IPE as described in [“Installing the Carrier Remote IPE cabinet” on page 117](#) in this chapter.

## 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 using a wrist strap and an antistatic mat 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.
- Hold the plug-in cards by their nonconductor 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. Refer to [Tables 1, 2, and 3](#) in the *Carrier Remote IPE product description* chapter on page 3 for carrier equipment description.

## Routing carrier links to the Carrier Remote IPE site

A carrier link connecting the system to the Carrier Remote IPE can use a private or a public T1 or E1 network. The carrier link can consist of one to three T1 or E1 carriers.

A carrier link terminates in a telco demarcation point and from the telco demarcation point, carrier links are routed to the intended telecommunications equipment. The distance between the system or Carrier Remote IPE and the first T1 or E1 repeater, the CSU, or the LTU should not exceed 200 m (655 ft). Therefore, the system and the Carrier Remote IPE should be located within 200 m from their respective telco demarcation points and the first repeater boxes. The actual distance is DIP-switch selectable on the Local and Remote Carrier Interface cards.

**Note:** The NT7R87AA T1 CSU Cable Kit provided with the Carrier Remote IPE equipment is used to connect the Local and Remote Carrier Interface cards to CSUs at a distance of 32 feet (9.75 m). Install this cable kit, if applicable, between the telco demarcation point (CSU) and the Local Carrier Interface card at the local site and the Remote Carrier Interface card at the remote site as a preinstallation procedure.

Route twisted pairs for T1 or E1 carrier links from the telco demarcation point to the carrier equipment. Use standard cable routing procedures to prevent cable exposure to possible damage from contact with machine and human traffic. Terminate the twisted-pair wires with 8-pin modular plug. If coaxial cables are used, they must be terminated with BNC-type connectors.

**Note:** For an E1 carrier system that uses coaxial cable, the impedance must be set on the Local and Remote Carrier Interface card to 75 Ohm. Refer to [Figure 9](#) and [Figure 15](#) to set SW1, SW2, SW5, and SW8 for E1 carrier impedance of 75 Ohm.

## Selecting the Local Carrier Interface card slot

The position of the Local Carrier Interface card in Meridian 1 depends on the Meridian 1 system option installed at the local site. The system option determines in what type of module the card will be housed.

### CAUTION

Check if the module is equipped with BTUs that protrude between card slot connectors in the network shelf. Make sure that you do not attempt to install the Local Carrier Interface card in the card slot immediately to the left of a BTU. If Network Hybrid Kit NT5D40AA is use instead of BTUs, you can install the Local Carrier Interface card into any superloop network card slot with the network hybrid.

[Table 8](#) lists modules that provide network card slots, the system options where these modules are used, and card slots where network cards can be installed. Card slots that may be physically restricted by BTUs are identified by a Note in [Table 8](#) and [Table 9](#). You can also use the right-hand superloop card slots if the slot does not have a BTU

**Table 8**  
**Meridian 1 modules supporting Local Carrier Interface cards**

Modules	System option	Network card slot
NT5D21 Core/Network Module	51C, 61C, 81C	0-7
NT8D11 CE/PE Module	21E	4-9
NT8D35 Network Module	71, 81, 81C	5-10, 11&12 (Note)
NT9D11 Core/Network Module	61C	0&1 (Note), 2-7
NT6D39 CPU/Network Module	51, 61	1&2 (Note), 3-8
<p><b>Note:</b> Card slot 11 and 12 can be used with NT8D35BA and NT8D35EA vintage Network Modules or Network Modules with NT8D3507 backplane, which are equipped with network Hybrid Kit NT5D40AA instead of BTUs. In older vintage NT8D35 Network Modules, NT9D11 Core/Network Modules, and NT6D39 CPU/Network Modules, a BTU upgrade kit can be used to replace the BTUs to be able to use the card slots identified with the <b>Note</b> for the installation of the Local Carrier Interface card.</p>		

The NT5D40AA Hybrids Kit includes four network hybrids require to replace two BTUs in a single network shelf or module. The kit also includes the extraction tool that must be used if a network hybrid has to be removed.

[Table 9](#) lists NT and XT cabinet shelves that provide network card slots, the systems where these shelves are used, and card slots where network cards can be installed. You can also use the right-hand superloop card slots if the slot does not have a BTU.

**Table 9**  
**System cabinet shelves supporting Local Carrier Interface cards**

System Shelf	System	Network card slot
Network shelf (QSD39)	NT, XT	3 (Note), 4-10
Network shelf (QSD40)	NT, XT	5-10, 11&12 (Note)
<b>Note:</b> To use 3, 11, or 12 network card slots, a BTU upgrade kit should be used. This NT5D40AA Hybrid kit replaces BTUs in the network shelf.		

Network card slots in the modules and shelves listed house other network-type cards that are contending with the Local Carrier Interface card for space in the module or shelf. If one or more network card slots are empty, the choice of where to install the Local Carrier Interface card is shown in the following section.

**Note:** Each network card slot supports two network loops. Although an NT8D04 Superloop Network card physically occupies only one card slot, it occupies four network loops.

## Selecting the I/O Panel connector cutouts to install the Carrier I/O panel assemblies

Meridian 1 systems contain Network Modules and modules that contain network card slots among card slots for common and sometimes peripheral equipment. Each module type has a different I/O panel and may or may not have connector cutouts suitable for installation of the carrier remote panel assemblies.

Before you install the carrier panel assemblies into the I/O panel connector cutouts, you should carefully select the appropriate connector cutouts, identify their connector number, and use the Carrier Remote IPE Connection Record label below to record the installation characteristics for each Local Carrier Interface card.

### **Network Module I/O Panel connector cutouts selection**

When installing the carrier remote panel assemblies for each Local Carrier Interface card, use the recommendations listed below:

- Use Local Carrier Interface card I/O extension cables, NT7R69AA and NT7R69BA, if it is necessary to reach available I/O panel connector cutouts in other network modules or Core/IF modules.
- When installing multiple Local Carrier Interface cards and their respective carrier panel assemblies into a Network Module, use the following recommendations for the P0745716 Universal I/O panel:
  - Left I/O Panel:  
**For the first Local Carrier Interface card**, install the NT7R57AA Carrier Panel Assembly into the I/O panel connector cutout J22 and the NT7R58AA Maintenance Panel Assembly into the connector cutout J26.
  - Right I/O Panel:  
**For the second Local Carrier Interface card**, install the NT7R57AA Carrier Panel Assembly into the I/O panel connector cutout J2 and the NT7R58AA Maintenance Panel Assembly into the connector cutout J6.

### Carrier Remote IPE Module I/O panel connector selection

- When installing the carrier remote panel assemblies for the Remote Carrier Interface card at the rear of the IPE Module, use the recommendations listed below:
  - Left I/O Panel:  
Install the NT7R59AA Carrier Panel Assembly into the J4 connector cutout.  
Install the NT7R60AA Carrier/Alarm Panel Assembly into the J5 connector cutout.
  - Right I/O Panel:  
Install the NT7R61AA Maintenance Panel Assembly into the J2 connector cutout.
- Locate connector cutouts that are 2.25 inches high on the I/O panel at the rear of the module containing the Local Carrier Interface card.

*Note:* Some old network modules have 2.00 inch connector cutouts, which are not suitable for carrier panel assembly installation. To be able to install these carrier panel assemblies, you must replace the module's I/O panels with the latest version that have 2.25 inch connector cutouts.
- Use the left-hand-side I/O panel connector cutouts for the Local Carrier Interface card carrier panel assemblies installation to avoid cable congestion on the right-hand side, if possible.
- Use side-by-side connector cutouts for the Local Carrier Interface card panel assemblies starting at the top of the I/O panel. This avoids obstruction of internal cable-way and associates the carrier panel assemblies with their respective Local Carrier Interface cards.

**Note:** The current left-hand I/O panel for the Network Module has the highest numbered connector position (J38) in the lower left-hand corner. Older left-hand-side I/O panels on the Network Modules have the highest numbered connector position (J28) in the lower left-hand corner.

- This older Network Module Universal I/O panel such as P075058 can accommodate only one set of carrier panel assemblies, which correspond to one Local Carrier Interface card. Side-by-side connector cutouts suitable for carrier panel assembly installation are:
  - Left I/O Panel:  
**For the first Local Carrier Interface card**, install the NT7R57AA Carrier Panel Assembly into the I/O panel connector cutout J17 and the NT7R58AA Maintenance Panel Assembly into the connector cutout J16.
  - Right I/O Panel:  
**For the second Local Carrier Interface card**, install the NT7R57AA Carrier Panel Assembly into the I/O panel connector cutout J2 and the NT7R58AA Maintenance Panel Assembly into the connector cutout J1.

## Carrier Remote IPE connection record label

Affix this label ([Figure 8](#)) at the rear of the module housing the Local Carrier Interface card(s). Place the label at the same level as the corresponding I/O panel connector cutouts used to install its Carrier and Maintenance Panel Assemblies for that specific Local Carrier Interface card. If the label is not available, make your own and paste them on the module.

Label entries description:

**Remote Site**—Name of the Remote Carrier IPE site associated with this Local Carrier Interface card superloop number (SUPC)

**Local Carrier Interface Superloop (SUPC)**—Enter here the designated superloop number for this specific Local Carrier Interface card.

**Carrier I/O Panel Connector Position**—Enter the number of the selected connector cutout on the I/O panel where the Carrier Panel Assembly is installed, for example J22.

**Figure 8**  
**Carrier Remote IPE Connection Record label**

<b>Carrier Remote IPE Connection Record</b>	
Remote Site: _____	
Local Carrier Interface Superloop (SUPC): _____	
Carrier I/O Panel Connector Position: <u>  J  </u> _____	
Maint. I/O Panel Connector Position: <u>  J  </u> _____	
Maint. Daisy-chain	Sys. Mon. Daisy-chain
P2: _____	J5: _____
P3: _____	J6: _____
Telco Circuit ID:	
C0: _____	
C1: _____	
C2: _____	

553-7488

**Maint. I/O Panel Connector Position**—Enter the number of the selected connector cutout on the I/O panel where the Maintenance Panel Assembly is installed, for example J26.

**Maint. Daisy-chain**—Enter the appropriate information for P2 and P3 connectors of the NT7R67DA Local External Maintenance Cable Assembly to identify what they are connected to. They can be connected as follows (refer to Figure 12 on page 84):

P3 can be connected to the; **MMI terminal** or to **P2 of SUPCxxx**.

P2 can be connected to the; **Host SDI port x**, or **P3 of SUPCxxx**.

where **xxx** in SUPCxxx is the superloop number of the Local Carrier Interface card in the daisy-chain.

**Sys. Mon. Daisy-chain**—Enter the appropriate information for J5 and J6 modular jacks to identify what they are connected to. They can be connected as follows (refer to Figure 13 on page 88):

**J5** can be connected to; **J6 of Master Sys. Mon.** or to the next **slave system monitor** in the direction of the **master system monitor**, or to the next **LCI SUPCxxx J6** in the direction of the **master system monitor**.

**J6** can be connected to; **J5** of the next **system monitor** in the direction away from the **master system monitor**, or to **J5** of the next **LCI SUPCxxx** in the direction away from the **master system monitor**, where **xxx** in SUPCxxx is the superloop number of the Local Carrier Interface card in the daisy-chain.

**Telco Circuit ID**—Enter the telco circuit ID number for each carrier link coming from the telco demarcation point.

For a collocated installation, where telco network is not used, specify the cable pairs used for each carrier link.

## Meridian 1 equipment installation

To complete the installation of the T1 or E1 carrier interface that links the system to the Carrier Remote IPE equipment, you must:

- install and verify the operation of the system, if not already installed and operating correctly
- identify the network card slot and install the Local Carrier Interface card in the system
- install the faceplate cables
- connect the cable to the SDI, the system monitor, and the TTY ports
- connect the carrier link to the I/O panel assembly

### Installing and verifying system operation

The Carrier Remote IPE facilities can be added to an existing Meridian 1 system running on X11 release 21 or later and carrier software REM\_IPE 286 by installing the appropriate carrier equipment into the system, installing one or more Carrier Remote IPEs at different remote sites, and linking Meridian 1 with remote sites using T1 or E1 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.

If a new Meridian 1 system is configured with Carrier Remote IPE facilities, the system will normally be assembled at the factory with the Local Carrier Interface and the associated cards already installed and internal cables connected between the Local Carrier Interface card faceplate and the I/O panel assembly at the rear of the module housing this card. After the system is installed, you have to connect the T1 or E1 carrier links to the Meridian 1 and the Carrier Remote IPE I/O panel assembly T1 or E1 connectors. However, if the Local Carrier Interface card is not installed, follow the steps in the next section.

## Installing the Local Carrier Interface card

The following steps show you how and where to install the Local Carrier Interface cards. In a new system, the card is shipped installed in a network card slot from the factory. However, you may have to install additional Local Carrier Interface cards to expand the number of remote sites or replace a defective card. The card can be installed when the system is powered up and running. [Table 12](#) lists the default (factory provided switch settings) on the Local Carrier Interface card. Verify the switch settings before installation.

To install these cards:

- 1 Set the ENB/DIS switch on the NT7R51 Local Carrier Interface card to DIS.
- 2 Set the DIP switches to specify the carrier type (T1 or E1), the distance to the first signal regenerator (repeater, CSU, or LTU), the MMI terminal baud rate, the card site (local), and the card address in a daisy-chain, as shown in [Figure 9](#). The DIP switch setting will depend on the physical system configuration. [Figure 9](#) shows that carriers are selected for T1 transmission because all the switches from SW2 through SW10 are pointing towards T1 positions. Also SW1 position 8 selects T1 or E1 in firmware.
- 3 Pull the NT7R51 Local Carrier Interface card locking devices away from the faceplate. Holding the card by these locking devices, insert it into the card guides of the selected network card slot. Make sure the card slot does not have a BTU installed in that position. Verify that there is no BTU obstructing the card slot.
- 4 Slide the card into the module until it engages in the backplane connector.

- 5 Carefully push the locking device levers toward the faceplate to insert the card connector into the backplane connector and lock the card in place.
- 6 Set the ENB/DIS switch on the NT7R51 Local Carrier Interface card to ENB and observe the card LED at the top of the faceplate as the Local Carrier Interface card performs self-tests. The card LED should blink three times and then stay on until enabled by software. When enabled by software, the card LED turns off permanently, as long as the card is operational. Refer to “LED indicators” on page 165 for more information about the Local Carrier Interface card carrier and maintenance LEDs.

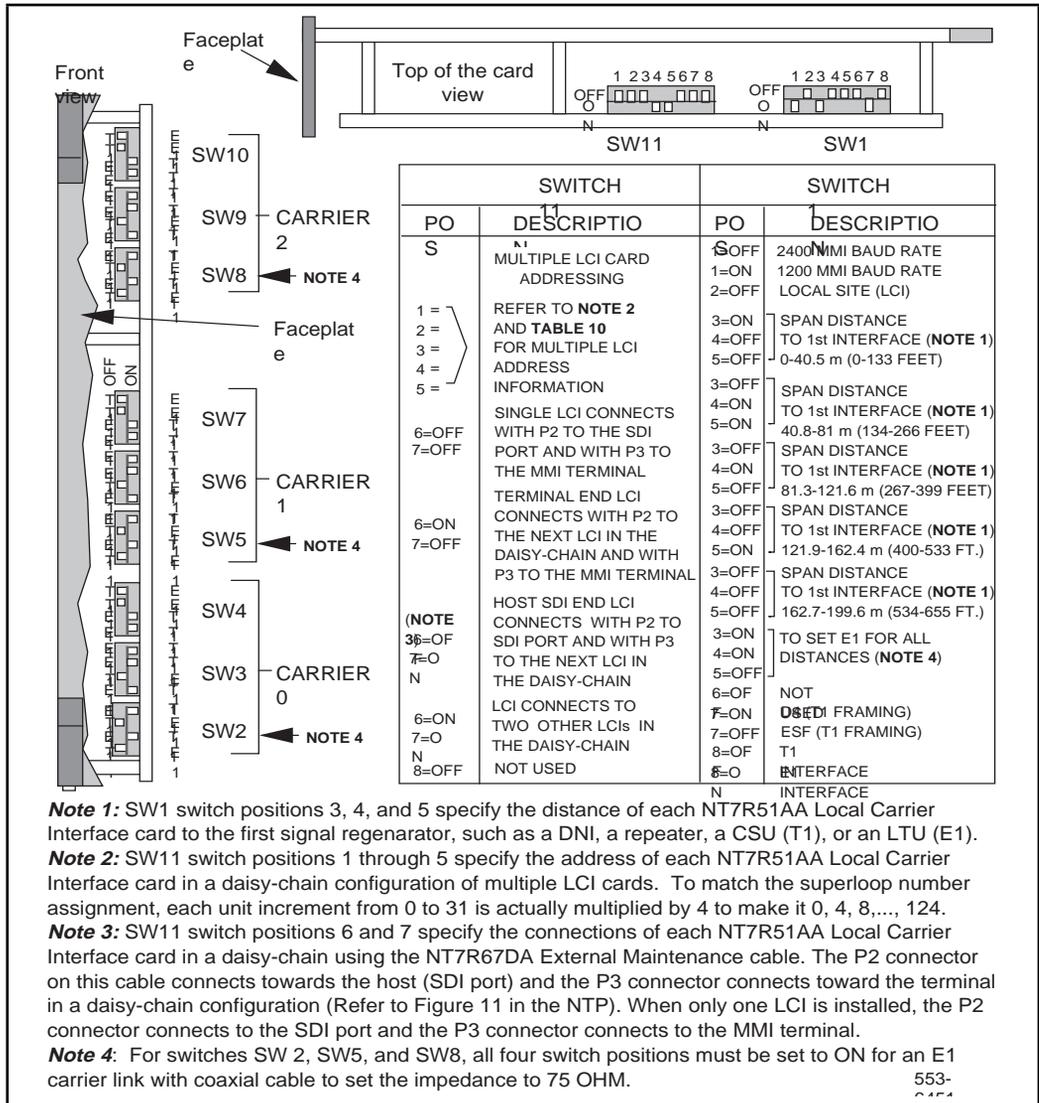
*Note:* When the ENB/DIS switch is switched to ENB, it also enables the carrier clocking. This allows the T1 carrier links to be tested even before the Local Carrier Interface card is software enabled.

**Table 10**  
**Local Carrier Interface standard (default) switch settings**

Switch	Switch positions							
	1	2	3	4	5	6	7	8
SW1	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
SW11	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SW2	OFF	ON	OFF	ON	-	-	-	-
SW3	ON	OFF	ON	ON	-	-	-	-
SW4	ON	ON	OFF	OFF	-	-	-	-
SW5	OFF	ON	OFF	ON	-	-	-	-
SW6	ON	OFF	ON	ON	-	-	-	-
SW7	ON	ON	OFF	OFF	-	-	-	-
SW8	OFF	ON	OFF	ON	-	-	-	-
SW9	ON	OFF	ON	ON	-	-	-	-
SW10	ON	ON	OFF	OFF	-	-	-	-

Figure 9 shows the Local Carrier Interface card DIP switches SW1 through SW11 and their functions.

Figure 9  
Local Carrier Interface card DIP-switch positions and function



[Table 11](#) lists all possible addresses for an NT7R51 Local Carrier Interface card, which are selected on the card with switch SW11 switch positions 1 through 5 (refer to [Figure 9](#) for the SW11 switch position). The address is used to address a specific Local Carrier Interface card in a daisy-chain configuration.

**Table 11**  
**NT7R51 Local Carrier Interface card maintenance daisy-chain address**

LCI Address	SW11 Positions 1–5 (1 = ON, 0 = OFF)				
	1 (bin 16)	2 (bin 8)	3 (bin 4)	4 (bin 2)	5 (bin 1)
0	0	0	0	0	0
4	0	0	0	0	1
8	0	0	0	1	0
12	0	0	0	1	1
16	0	0	1	0	0
20	0	0	1	0	1
24	0	0	1	1	0
28	0	0	1	1	1
32	0	1	0	0	0
36	0	1	0	0	1
40	0	1	0	1	0
44	0	1	0	1	1
48	0	1	1	0	0
52	0	1	1	0	1
56	0	1	1	1	0
60	0	1	1	1	1
64	1	0	0	0	0
68	1	0	0	0	1
72	1	0	0	1	0
76	1	0	0	1	1
80	1	0	1	0	0
84	1	0	1	0	1
88	1	0	1	1	0
92	1	0	1	1	1
96	1	1	0	0	0
100	1	1	0	0	1
104	1	1	0	1	0
108	1	1	0	1	1
112	1	1	1	0	0
116	1	1	1	0	1
120	1	1	1	1	0
124	1	1	1	1	1

**Note:** For SUPC 0-124 the Local Carrier Interface card MMI address (SW 11, POS 1-5) should match the superloop number. For SUPC 128-156, where the Local Carrier Interface card is installed in Network Group 4, the Local Carrier Interface card address cannot match the superloop number but the address must be unique within the MMI maintenance daisy-chain. Document on the LCI Connection Record card any Local Carrier Interface card MMI address that does not match the SUPC superloop number.

## Installing the Local Carrier Interface cable assemblies

The Local Carrier Interface card has two connectors located on the faceplate. These connectors provide:

- connection to the NT7R58AA Maintenance Panel assembly for daisy-chaining the Local Carrier Interface cards and the system monitor
- connection to the NT7R57AA Carrier Panel assembly for the carrier links

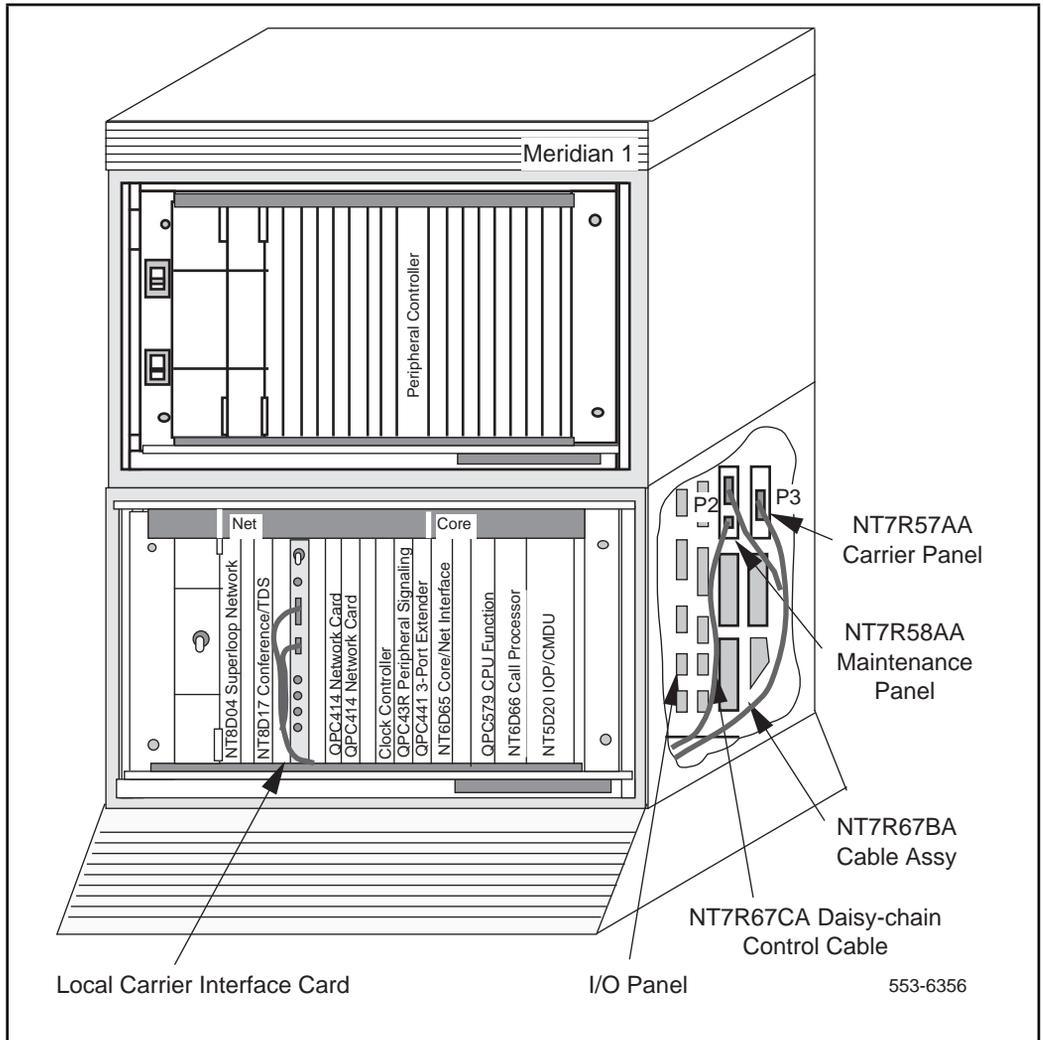
A DB-9 female connector on the faceplate of the NT7R51 Local Carrier Interface card connects to the NT7R58AA Maintenance Panel when more than one Local Carrier Interface card is equipped in the system. This allows daisy-chaining of these Local Carrier Interface cards to provide access to any of the Local Carrier Interface cards using the local MMI terminal at Meridian 1 SDI port as Host.

A DB-25 connector on the Local Carrier Interface card faceplate connects the Local Carrier Interface card to the NT7R57AA Carrier Panel assembly for connection to the local system monitor and the carrier links. The carrier connectors on the NT7R57AA Carrier Panel assembly are 8-pin modular jacks, which connect directly to the carrier link 8-pin modular plugs. It also connects to the NT7R58AA Maintenance Panel assembly to provide the SDI port and the MMI terminal connections. If an E1 carrier link is a coaxial cable terminated with BNC connectors, the NT7R67EA Coaxial Interface Adapter cable (8-pin modular plug to BNC) is used to connect the 8-pin modular jacks at the NT7R57AA Carrier Panel assembly to the BNC carrier link connectors. Also refer to [Figure 9](#) and [Figure 15](#) to set SW1, SW2, SW5, and SW8 for E1 operation and carrier impedance of 75 Ohm.

**Note:** For multiple Local Carrier Interface cards connected in a daisy-chain, it may not always be possible to find empty network card slots and or suitable I/O panel connector cutouts to accommodate two or more Local Carrier Interface cards. In that case, you may have to use suitable network card slots in a different module or column. If the cable assemblies are not long enough to span between the faceplates and the I/O panels, you may have to use extension cables that are used for this purpose in the NT and XT systems. Refer to Figure 14 “Local Carrier Interface card faceplate cable connections in NT or XT system” on page 93.

Figure 10 shows a Meridian 1 option 51C example with the Local Carrier Interface card and faceplate cable already installed to the NT7R57AA Carrier and NT7R58AA Maintenance Panel assemblies.

**Figure 10**  
Local Carrier Interface card faceplate cable connections in Meridian 1



### **Installing the NT7R67BA Local Carrier/Monitor Cable Assembly into a module**

Before you can plug the NT7R67BA Local Carrier/Monitor Cable Assembly P1 connector into the faceplate DB-25 female connector, install the NT7R57AA Carrier Panel and the NT7R58AA Maintenance Panel assemblies. These assemblies are installed into the empty connector slots on the I/O panel at the rear of the network module where the NT7R51 Local Carrier Interface card(s) is installed. Refer to [“Network Module I/O Panel connector cutouts selection” on page 62](#) recommendations.

*Note:* The NT7R57AA Carrier and the NT7R58AA Maintenance Panel assemblies together with the NT7R67HA cable are integral parts of the NT7R67BA Local Carrier/Monitor Cable Assembly. To assist you in connecting the cable assemblies, refer to Appendix C, [Figure 27](#).

To install the NT7R57AA Carrier and the NT7R58AA Maintenance Panel assemblies and to plug the cable P1 connector into the faceplate connector:

- 1** Remove the back panel at the rear of the module to access the I/O panel connector slots and later to route the NT7R67HA cable P1 connector to the front of the module.
- 2** Identify a pair of empty connector cutouts that are the appropriate size for the panel assemblies mounting holes. These cutouts must be vertically or horizontally adjacent on the same I/O panel.
- 3** From the rear of the module, route the DB-25 female P1 connector of the NT7R67BA cable assembly through the module’s cable channel to the front of the module and ensure that the cable connectors with attached panel assemblies remain at the rear of the module next to the module’s I/O panel connector cutouts.
- 4** Install the NT7R57AA Carrier Panel assembly already connected to the P3 DB-15 HD female connector of the NT7R67BA cable assembly. Mount it into the selected I/O panel connector cutout so that the 8-pin modular jack tabs are to the left. Refer to Figure 11 “System monitor, local MMI terminal, and carrier links cable connections” on page 77 for connector orientation. Fasten the panel to the cutout by using the screw at the top of the cutout.

- 5 Install the NT7R58AA Maintenance Panel assembly already connected to the P2 DB-15 HD male connector of the NT7R67BA cable assembly. Mount it into the selected I/O panel connector cutout by using the screw at the top of the cutout.
- 6 Plug the DB-25 male P1 connector of the NT7R67BA cable assembly into the DB-25 female connector located on the faceplate of the NT7R51 Local Carrier Interface card.

### **Installing the NT7R67CA Local daisy-chain cable**

This cable is installed only when multiple NT7R51 Local Carrier Interface cards are equipped and are connected in a daisy-chain. The daisy-chain configuration provides an easy access to each Local Carrier Interface card from the local MMI terminal and allows the remote MMI terminal access to the Meridian 1 SDI port as host. To install this cable between the Local Carrier Interface card and the NT7R58AA Maintenance Panel, refer to Appendix C, [Figure 28](#) and follow these steps:

- 1 Pull the NT7R67CA Daisy-chain Cable assembly P1 connector through the cable channel to the front of the module.
- 2 Plug the DB-9 male P1 connector of the NT7R67CA cable assembly into the DB-9 female connector located on the faceplate of the Local Carrier Interface card.
- 3 Plug the DB-9 male P2 connector at the other end of the NT7R67CA cable assembly into the DB-9 female connector on the NT7R58AA Maintenance Panel.

## Installing SDI and local MMI terminal cables

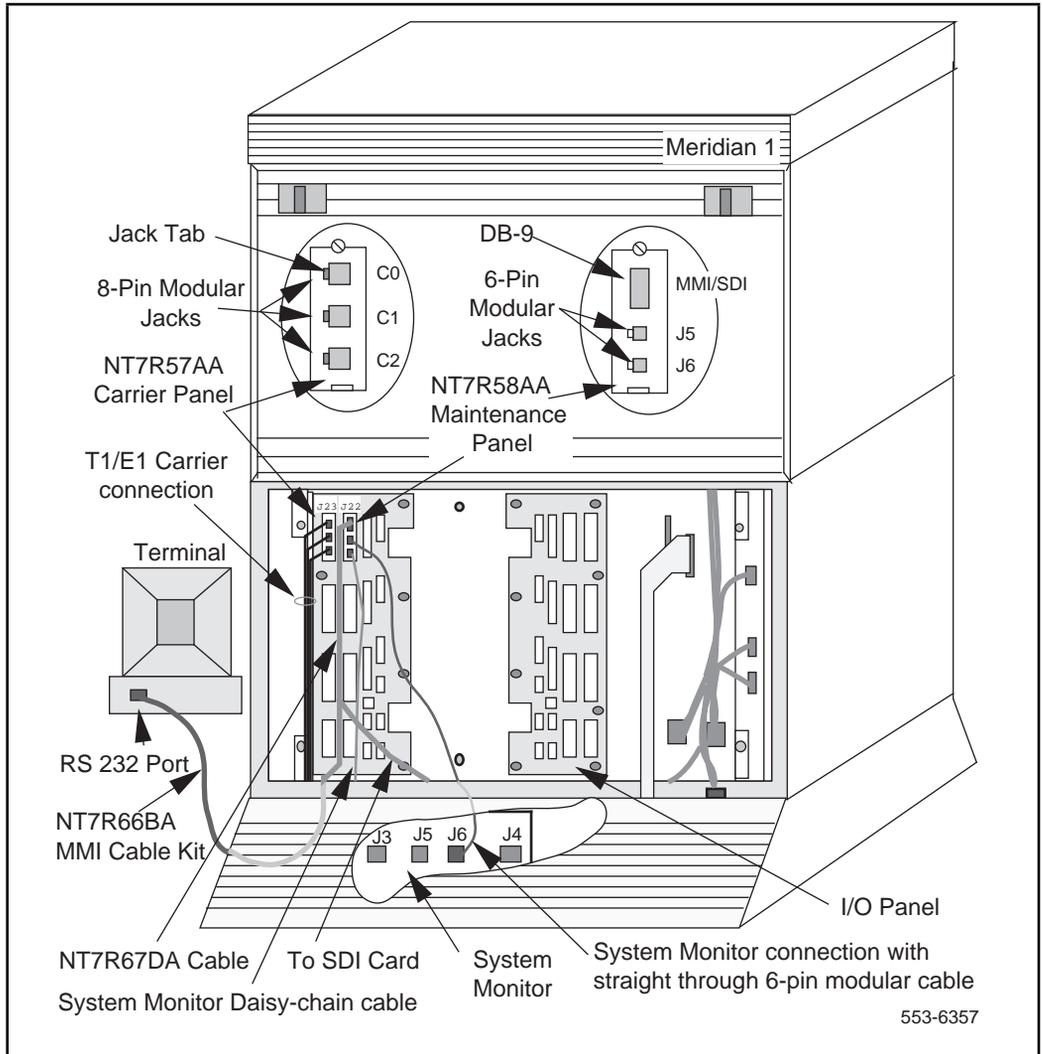
The NT7R67DA External Maintenance Cable Assembly connects the SDI card and the TTY terminal to the DB-9 connector on the NT7R58AA Maintenance Panel assembly located at the rear of the module that houses the NT7R51 Local Carrier Interface card.

For a single Local Carrier Interface card equipped in the Meridian 1 system the P3 DB-9 male DCE connector on the NT7R67DA cable assembly is used to connect to the local MMI terminal and the P2 DB-9 female DTE connector is used to connect to an SDI port on an SDI card, which allows the MMI terminal to access the Meridian 1 system as a host. Refer to [Figure 11](#) and Appendix C, [Figure 27](#).

For multiple Local Carrier Interface cards, refer to Figure 12 on page 84 and Appendix C, [Figure 28](#) that shows how to connect multiple Local Carrier Interface cards to multiple I/O panel assemblies to provide MMI and SDI connections for all Local Carrier Interface cards. To facilitate equipment maintenance, follow the same order as for the system monitor daisy-chain in descending order from the MMI terminal to the SDI port.

**Figure 11** shows the NT7R57AA Carrier Panel and NT7R58AA Maintenance Panel assemblies with the system monitor, the SDI/TTY, and the carrier connections. The NT7R58AA Maintenance panel assembly connector is used to connect the SDI port and the local MMI terminal. The NT7R57AA Carrier panel assembly is used to connect the three carriers.

**Figure 11**  
**System monitor, local MMI terminal, and carrier links cable connections**



## Connecting a single Local Carrier Interface card to the MMI terminal

- 1 To connect a single NT7R51 Local Carrier Interface card to the MMI terminal:

*Note:* Appendix C provides connection diagrams ([Figure 27](#)) and pin assignment information for all external connectors that connect to the SDI port, the MMI terminal, the system monitor card, the external alarms, and the carrier links.

- Plug the DB-9 male P1 connector at the common end of the NT7R67DA Local External Maintenance Cable assembly into the DB-9 female connector on the NT7R58AA Maintenance Panel assembly.
- Plug the DB-9 male P3 connector of the NT7R67DA cable assembly into the DB-9 female connector of the NT7R66BA MMI Cable.
- Plug the DB-25 male end of the NT7R66BA MMI Cable into the MMI terminal RS-232 connector. If you have to change the gender at the terminal, use the appropriate compact gender changer.
- To connect P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable directly to the DB-9 male RS-232 serial communication port of a laptop computer, use a NT7R66BA MMI Cable and the appropriate compact adapter.

- 2** MMI terminal connection using a modem:
  - If you need a modem to connect a distant MMI terminal to the MMI port on the Meridian 1 I/O panel, plug the DB-9 female connector of the NT7R66BA MMI Cable into the P3 DB-9 male connector of the NT7R67DA cable.
  - Plug the DB-25 male connector of the NT7R66BA MMI Cable into a DB-25F/DB-25M nullmodem.
  - Connect the nullmodem DB-25 male connector to the modem DB-25 female connector. Use the appropriate gender changer, if required.
  
- 3** MMI terminal connection using an A/B switch box:
  - Connect the P3 of the NT7R67DA Local External Maintenance Cable assembly DB-9 male connector into the DB-9 female connector of the NT7R66BA MMI Cable.
  - Plug the DB-25 male and of the NT7R66BA MMI Cable into the A/B switch box DB-25 female C connector.
  - From the switch box, you can connect a local MMI terminal directly to the A position on the switch box using a standard DB-25M/DB-25M straight-through cable.
  - You can also connect a distant MMI terminal over a standard DB-25M/DB-25M straight-through cable, a nullmodem, and a modem to the switch box B position.
  
- 4** Terminal/Modem connections over the MSDL Single Terminal Access:
  - To avoid using the A/B switch box, you can use three ports on the MSDL card.
  - Connect one MSDL port to the Meridian 1 local MMI terminal
  - Connect the second MSDL port to a modem.

- Connect the third MSDL port to the P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable assembly by using the NT7R66BA MMI Cable.

### **Connecting a single Local Carrier Interface card to the SDI card**

Refer to Appendix C and [Figure 27](#) to see the SDI connection diagram.

**1** To connect a single NT7R51 Local Carrier Interface card to the QPC 841 or other SDI cards:

- Route the DB-9 female P2 connector of the NT7R67DA cable assembly to an available SDI port on an SDI card.
- Plug the DB-9 male connector of the NT8D93AJ XSDI I/O cable into the DB-9 female SDI connector on the I/O panel.
- Plug the DB-25 male connector of the NT8D93AJ XSDI I/O cable into the DB-25 female connector on the NT7R66AA SDI Cable Kit.
- Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the DB-9 female connector into the NT7R67DA cable P2 connector.

**2** To connect other SDI cards:

- Route and install the DB-9 female P2 connector of the NT7R67DA cable assembly to an available SDI port on an SDI card.
- Plug the DB-25 male connector of the NT7R66AA SDI Cable Kit to connect the DB-25 female SDI connector at the I/O panel. (The DB-25F/DB-25F adapter is not used).
- Plug the DB-9 male connector on the NT7R66AA SDI Cable Kit into the P2 connector on the NT7R67DA cable.

To test the MMI and Host SDI login, refer to “MMI mode” on page 139 and “Host SDI mode” on page 141 for login instructions.

**Note:** For additional information about types of SDI cards, their SDI ports, and special cables required to connect these ports, refer to *Meridian 1 serial data interface cards description* (553-3001-107).

## Connecting multiple Local Carrier Interface cards to the MMI terminal

Make sure that all the NT7R51 Local Carrier Interface cards are properly configured for the daisy-chain card addressing as shown in Figure 9 “Local Carrier Interface card DIP-switch positions and function” on page 69 and Appendix C, [Figure 28](#).

*Note:* For maintenance convenience, use the daisy-chain addressing in descending order from the MMI terminal side to the host SDI side.

Make sure the NT7R67CA Local Daisy-chain Cable Assembly is installed for all Local Carrier Interface cards in the daisy-chain. Refer to “Installing the NT7R67CA Local daisy-chain cable” on page 75.

- 1 To connect multiple NT7R51 Local Carrier Interface cards in a daisy-chain configuration and to the MMI terminal, connect the cables as shown in [Figure 12](#) and Appendix C, [Figure 28](#):
  - Plug the DB-9 male P1 connector at the common end of the NT7R67DA cable into the DB-9 female connector on the NT7R58AA Maintenance Panel assembly that corresponds to Local Carrier Interface card #1.
  - Install the NT7R67DA cable assembly #2, as in step 1, for the Local Carrier Interface card #2.
  - Connect the DB-9 male P3 connector from the cable in position #1 with the DB-9 female P2 connector of the NT7R67DA cable assembly in position #2.
  - Install the NT7R67DA cable assembly #3, as in step 1, for the Local Carrier Interface card #3.
  - Connect the DB-9 male P3 connector from the cable in position #2 with the DB-9 female P2 connector of the NT7R67DA cable assembly in position #3.
  - Plug the DB-9 male P3 connector of the NT7R67DA cable assembly in position #3 into the DB-9 female connector of the NT7R66BA MMI Cable.

- Plug the DB-25 male end of the NT7R66BA MMI Cable into the DB-25 female connector of the MMI terminal RS-232 connector. If you have to change the gender at the terminal, use the appropriate compact gender changer.
- 2    MMI terminal connection using a modem:
- If you need a modem to connect a distant MMI terminal to the MMI port on the Meridian 1 I/O panel, plug the DB-9 female connector of the NT7R66BA MMI Cable into the P3 DB-9 male connector of the NT7R67DA cable.
  - Plug the DB-25 male end of the NT7R66BA MMI Cable into a DB-25F/DB-25M nullmodem.
  - Connect the nullmodem DB-25 male connector to the modem DB-25 female connector.
- 3    MMI terminal connection using an A/B switch box:
- Connect the P3 of the NT7R67DA Local External Maintenance Cable assembly DB-9 male connector into the DB-9 female connector of the NT7R66BA MMI Cable.
  - Plug the DB-25 male end of the NT7R66BA MMI Cable into the A/B switch box DB-25 female C connector.
  - From the switch box, you can connect a local MMI terminal directly to the A position on the switch box using a standard DB-25M/DB-25M straight-through cable.
  - You can also connect a distant MMI terminal over a standard DB-25M/DB-25M straight-through cable, a nullmodem, and a modem to the switch box B position.
- 4    Terminal/Modem connections over the MSDL Single Terminal Access:
- To avoid using the A/B switch box, you can use three ports on the MSDL card.
  - Connect one MSDL port to the Meridian 1 local MMI terminal.
  - Connect the second MSDL port to a modem.

- Connect the third MSDL port to the P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable assembly by using the NT7R66BA MMI Cable.

### Connecting multiple Local Carrier Interface cards to the SDI card

Refer to Appendix C, [Figure 28](#) to see the SDI connection diagram.

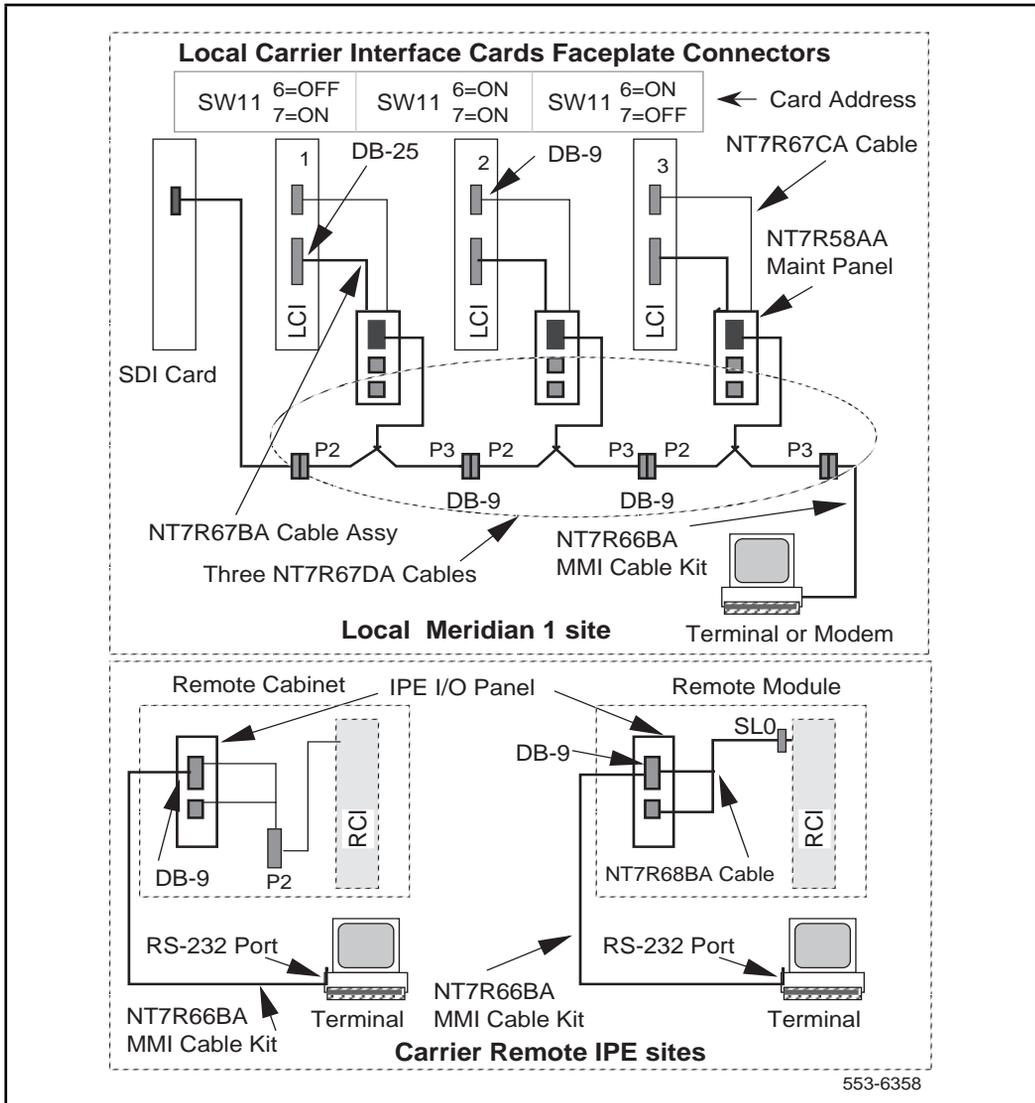
- 1 To connect a single NT7R51 Local Carrier Interface card to the QPC 841 or other SDI cards:
  - Route the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card #1 to an available SDI port on an SDI card.
  - Plug the DB-9 male connector of the NT8D93AJ XSDI I/O cable into the DB-9 female SDI connector on the I/O panel.
  - Plug the DB-25 male connector of the NT8D93AJ XSDI I/O cable into the DB-25 female connector on the NT7R66AA SDI Cable Kit.
  - Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the DB-9 female connector into the NT7R67DA cable P2 connector.
- 2 To connect other SDI cards:
  - Route and install the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card #1 to an available SDI port on an SDI card.
  - Plug the DB-25 male connector of the NT7R66AA SDI Cable Kit to connect the DB-25 female SDI connector at the I/O panel. (The DB-25F/DB-25F adapter is not used).
  - Plug the DB-9 male connector on the NT7R66AA SDI Cable Kit into the P2 connector on the NT7R67DA cable.
- 3 Secure cables with tie-wraps as appropriate.

To test the MMI and Host SDI login, refer to “MMI mode” on page 139 and “Host SDI mode” on page 141 for login instructions.

**Note:** For additional information about types of SDI cards, their SDI ports, and special cables required to connect these ports, refer to *Meridian 1 serial data interface cards description* (553-3001-107).

Figure 12 shows daisy-chaining of multiple Local Carrier Interface cards to allow sharing of an SDI port and a terminal or TTY.

**Figure 12**  
**Daisy-chaining multiple Local Carrier Interface cards**



## Connecting the system monitor cables

The NT7R58AA Maintenance Panel assembly provides two 6-pin modular jacks to connect to the system monitor located in the pedestal and one DB-9 SDI/TTY connector. The 6-pin modular jack J5 is used to connect to the system monitor J6 jack in the pedestal, as shown in [Figure 11](#), and the J6 jack on the NT7R58AA Maintenance Panel is used to connect to a slave system monitor daisy-chain as shown in [Figure 12](#).

In the local Meridian 1 column, the pedestal contains a master system monitor that monitors system alarms. Alarms from a Carrier Remote IPE site are reported over the carrier link and the Local Carrier Interface 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.

### Connecting a single Local Carrier Interface card to the system monitor

To connect the system monitor cable from the NT7R58AA Maintenance Panel assembly to the system monitor in the same column, refer to [Figure 11](#), Appendix C, [Figure 31](#), and perform these steps:

- 1 Verify existing system monitor daisy-chain first by executing the **STAT XSM** command in LD 37.
- 2 Determine the system monitor addresses for new Carrier Remote IPE column or wall-mount cabinet.
- 3 Set master system monitor slave polling address range to cover the new system monitor addresses.
- 4 Set the Remote Carrier Interface card (SW11 positions 1-5) for the new system monitor address.
- 5 Connect the system monitor daisy-chain to include new Local Carrier Interface cards by following instructions in steps 6 and 7.
- 6 Plug the 6-pin modular plug at one end of the NT8D46AL cable into the 6-pin modular jack J5 on the NT7R58AA Maintenance Panel assembly to provide an RS-422 interface to the system monitor.
- 7 Plug the other end of the NT8D46AL cable 6-pin modular plug into the J6 jack on the next system monitor in the direction of the master system monitor.

- 8 Plug the next NT8D46AL cable jack into the J6 of the NT7R58AA Maintenance Panel assembly.
- 9 Plug the other jack of the NT8D46AL cable into the J5 of the next slave system monitor in the direction away from the master system monitor.
- 10 Test the system monitor daisy-chain by executing the STAT XSM command in LD 37 and ensure that every local and remote system monitor responds to the master system monitor after the remote site is properly installed and configured.

*Note:* If Meridian 1 with the Carrier Remote IPE is shipped to a site, steps 6 and 7 are completed in the factory.

### **Connecting multiple Local Carrier Interface cards to the system monitor**

Connect the Local Carrier Interface cards for system monitor daisy-chain in the same sequence as you daisy-chained the maintenance cables for the local MMI terminal and the Meridian 1 host SDI access for multiple Local Carrier Interface cards.

To daisy-chain the system monitor cables to multiple columns and multiple NT7R51 Local Carrier Interface cards, refer to [Figure 13](#), Appendix C, [Figure 31](#), and perform these steps:

- 1 Starting from the top of [Figure 13](#), plug the NT8D46AL cable 6-pin modular plug from one NT7R58AA Maintenance Panel assembly 6-pin modular jack J6 into the 6-pin modular jack J5 on the next NT7R58AA Maintenance Panel assembly.

*Note:* Each NT7R58AA Maintenance Panel assembly belongs to a different NT7R51 Local Carrier Interface card.

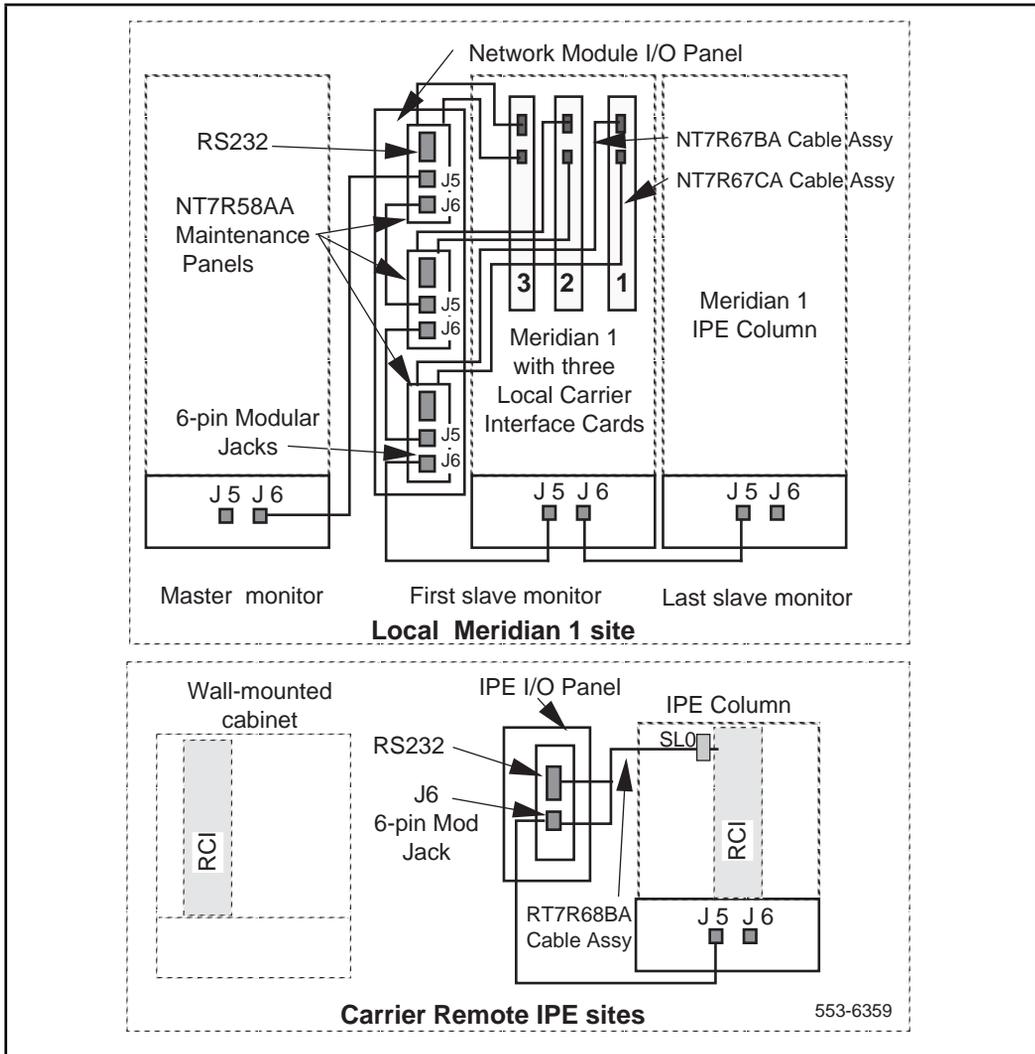
- 2 Repeat step 1 for all NT7R58AA Maintenance Panel assemblies.
- 3 Connect J5 modular jack of the top NT7R58AA Maintenance Panel assembly in [Figure 13](#) to J6 modular jack of the next system monitor towards master system monitor using the NT8D46AL modular cable.

- 4 Connect J6 modular jack in the bottom NT7R58AA Maintenance Panel assembly to the J5 modular jack of the next slave system monitor away from the master system monitor using the NT8D46AL cable.
- 5 Connect J6 modular jack of the slave system monitor to the J5 modular jack of the next slave system monitor outbound (away) from the master system monitor using the NT8D46AL cable.

**Note:** The columns do not have to be daisy-chained in the sequence according to the system monitor address. The system monitor daisy-chain is broken when a Local Carrier Interface card is unplugged from the network card slot. This will cause PWR error messages for polling failure on all slave system monitors that follow the removed Local Carrier Interface card in the chain. If possible, Local Carrier Interface cards should be connected at the end of the system monitor daisy-chain after all the local slave system monitors.

Figure 13 shows system monitor daisy-chain connections at Meridian 1 and Carrier Remote IPE sites. The alarm information is sent over the carrier link from the Remote Carrier IPE to the Meridian 1 CPU.

**Figure 13**  
**System monitor connections at Meridian 1 and the Carrier Remote IPE**



## Connecting the carrier link to the Meridian 1

T1 or E1 carrier links are connected to the NT7R57AA Carrier Panel assembly connectors at the rear of the module housing the Local Carrier Interface card. Carrier links are routed from the telco demarcation point to the Meridian 1 column for connection to the NT7R57AA Carrier Panel assembly containing three 8-pin modular jacks, as shown in Figure 11 on page 77.

**Note 1:** Before connecting the carrier link to the system, the connection between the telco demarcation point such as CSU, should have been completed using the NT7R87AA T1 CSU Cable Kit.

**Note 2:** To connect an E1 carrier terminated with BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable to connect the 8-pin modular jacks at the I/O panel to the BNC connector on each E1 carrier link coming from the telco demarcation point. Also refer to [Figure 9](#) and [Figure 15](#) to set SW1, SW2, SW5, and SW8 for E1 operation and carrier impedance of 75 Ohm.

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

- 1 Route carrier links to the rear of the Meridian 1 column housing the Local Carrier Interface card.
- 2 Identify carrier 0, 1, and 2 connectors and the corresponding NT7R57AA Carrier Panel assembly connectors.
- 3 Plug each carrier cable 8-pin modular plug into the corresponding NT7R57AA Carrier Panel assembly 8-pin modular jack for each T1 carrier link.
- 4 Record the telco carrier circuit ID for each carrier link (link 0, 1, and 2).

**Note:** These carrier circuit IDs will be used at the remote site to identify the links that corresponds to carrier 0, 1, and 2 at the local site. This will prevent mismatch of carrier links between the Local Carrier Interface card and the Remote Carrier Interface card. Enter the carrier connection information into the Carrier Remote IPE Connection Record label, refer to Figure 8 on page 65.

- 5**    If an E1 coaxial carrier link is terminated with BNC connectors, use one NT7R67EA Coaxial Interface Adapter cable to connect each 8-pin modular jack on the NT7R57AA Carrier Panel assembly to BNC carrier link connectors.
- 6**    If the NT7R67EA Coaxial Interface Adapter cable is used for each E1 carrier link, identify BNC connectors on each Adapter cable that correspond to the appropriate carrier (carrier 0, carrier 1, and carrier 2) at the NT7R57AA Carrier Panel Assembly 8-pin jack.
- 7**    Connect each NT7R67EA Coaxial Interface Adapter BNC connector to the appropriate BNC connector on the carrier link.
- 8**    Secure the carrier link cables with tie-wraps as appropriate.

## Carrier installation into NT and XT systems

To complete the installation of the T1 or E1 carrier interface that links an NT or XT system to the Carrier Remote IPE equipment, you must:

- verify the operation of the system
- make sure the system is Meridian 1 ready
- identify the network card slot and install the Local Carrier Interface card in the system shelf
- install the faceplate cables
- connect the cable to the Meridian 1 host SDI and the MMI terminal ports
- connect the carrier link to the NT7R57AA Carrier Panel assembly

**Note:** If NT and XT systems have been upgraded using Meridian 1 column, you can use the system monitor in the pedestal to process system alarms received from the Carrier Remote IPE site. Without the system monitor in the pedestal, the system alarms from the Carrier Remote IPE site cannot be processed.

### Installing carrier equipment and verifying system operation

The Carrier Remote IPE facilities can be added to existing NT and XT systems running on X11 release 21 or later. This requires installing the appropriate carrier equipment into the system, installing one or more Carrier Remote IPEs at different remote sites, and linking the system with remote sites using T1 or E1 carriers.

The NT and XT systems have been previously installed and are normally operational. These systems must be Meridian 1 ready and must be operating correctly before they can be equipped with the Carrier Remote IPE feature. To upgrade these systems to X11 release 21 or higher, refer to *Upgrade system installation* (553-3001-250).

## Installing the Local Carrier Interface card

The following steps show you how and where to install the NT7R51 Local Carrier Interface cards. The card can be installed when the system is powered up and running.

To install these cards:

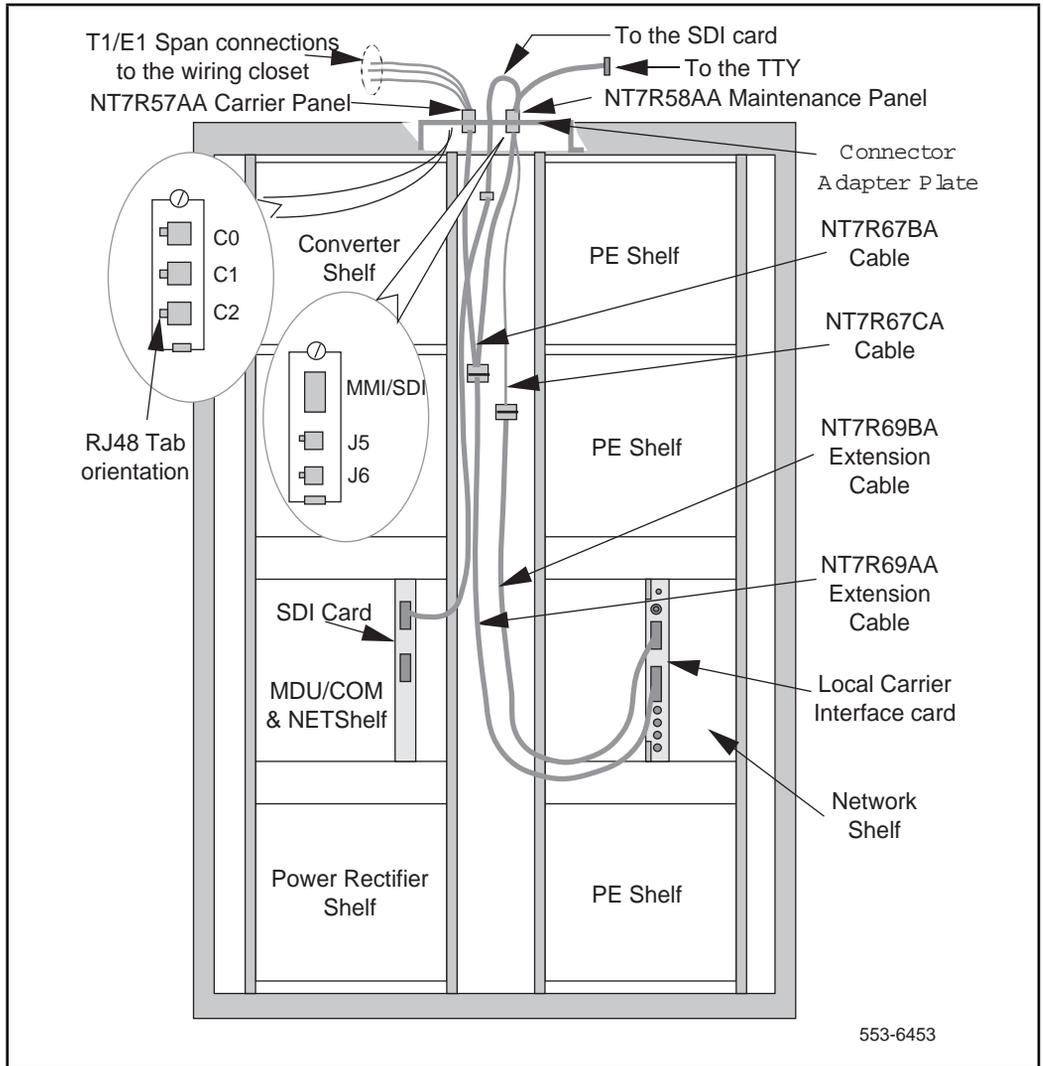
- 1 Set the ENB/DIS switch on the NT7R51 Local Carrier Interface card to DIS.
- 2 Set the DIP switches to specify the carrier type (T1 or E1), the distance to the first repeater/CSU/LTU, the terminal baud rate, the SDI/MMI terminal connection state, and addressing of multiple Local Carrier Interface cards, as shown in Figure 9 on page 69.

**Note:** The DIP switch setting will depend on the system configuration. [Figure 9](#) shows that carriers are selected for T1 transmission because all the switches from SW 2 through SW10 are pointing towards T1 positions.

- 3 Pull the Local Carrier Interface card locking devices away from the faceplate. Holding the card by these locking devices, insert it into the card guides of the selected network card slot. Refer to [Table 9](#).
- 4 Slide the card into the shelf until it engages the backplane connector.
- 5 Carefully push the locking device levers toward the faceplate to insert the card connector into the backplane connector and lock the card in place.
- 6 Set the ENB/DIS switch on the Local Carrier Interface 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. You do not have to enable the card until all the hardware is installed.

Figure 14 shows an NT/XT system with the NT7R51 Local Carrier Interface card and faceplate cables already installed to the NT7R57AA Carrier Panel and NT7R58AA Maintenance Panel assemblies at the top of the cabinet.

**Figure 14**  
**Local Carrier Interface card faceplate cable connections in NT or XT system**



## Installing Local Carrier Interface faceplate cables

The Local Carrier Interface card has two connectors located on the faceplate. These connectors provide:

- connection to the NT7R58AA Maintenance Panel assembly for the MMI terminal and the SDI ports
- connection to the NT7R57AA Carrier Panel assembly for the carrier link

A DB-9 connector on the Local Carrier Interface card faceplate connects to the NT7R58AA Maintenance Panel assembly for connection to the local MMI terminal and the SDI ports. From the Maintenance Panel assembly DB-9 female connector, you can connect to the MMI port for the TTY connection and to an SDI port of an SDI card, or you can daisy-chain to other Local Carrier Interface card SDI connectors, as shown in Figure 12 on page 84.

A DB-25 connector on the Local Carrier Interface card faceplate connects the Local Carrier Interface card to the NT7R58AA Maintenance Panel assembly and the NT7R57AA Carrier Panel assembly. The Carrier Panel assembly uses 8-pin modular jacks to connect to the T1 or E1 carrier links.

### Installing the NT7R67BA Local Carrier/Monitor Cable Assembly in a cabinet

Before you can connect the NT7R67BA Local Carrier/Monitor Cable Assembly to the NT7R51 Local Carrier Interface card, install the NT7R57AA Carrier Panel and the NT7R58AA Maintenance Panel assemblies. These panel assemblies are installed into the empty connector slots on the I/O panel at the top of the cabinet.

**Note:** The NT7R57AA Carrier Panel and the NT7R58AA Maintenance Panel assemblies together with the NT7R67HA cable are integral parts of the NT7R67BA Local Carrier/Monitor Cable Assembly.

- 1 Identify the empty connector cutouts at the top center of the cabinet to be used for the NT7R57AA Carrier Panel and the NT7R58AA Maintenance Panel assemblies installation.
- 2 Install the appropriate connector housing kit if you cannot find existing empty connector cutouts.
- 3 If required, install the P0702380 connector housing kit, which mounts at the top of the cabinet for NT and XT systems.

- 4 Install the NT7R57AA Carrier Panel assembly and the NT7R58AA Maintenance Panel assembly in the connector cutouts by using screws at each end of the selected connector cutout. Remember these panel assemblies are integral parts of the NT7R67BA cable assembly. Install the NT7R57AA Carrier Panel so that the 8-pin modular jack tabs are to the left placing carrier 0 at the top as shown in [Figure 14](#).
- 5 Install the adapter plate covering 5 adjacent connector slots on top of the connector housing.

### Connecting the cables to the faceplate connectors

To connect the NT7R51 Local Carrier Interface card to the MMI port, the SDI port, and the carrier links, refer to [Figure 14](#) and follow these steps:

- 1 Plug the DB-25 male connector of the NT7R69AA Extension Local Carrier Cable into the DB-25 female connector located on the NT7R51 Local Carrier Interface card faceplate.
- 2 Plug the DB-25 female connector of the NT7R69AA Extension Local Carrier Cable into the DB-25 male P1 connector of the NT7R67BA Local Carrier/Monitor Cable assembly.
- 3 Verify that the P2 and P3 connectors of the NT7R67BA Local Carrier/Monitor Cable Assembly are connected to the NT7R57AA Carrier Panel assembly and the NT7R58AA Maintenance Panel assembly, as follows:
  - The P3 DB-15 HD female connector is connected to the DB-15 HD male connector of the NT7R57AA Carrier Panel assembly.
  - The P2 DB-15 HD male NT7R67BA cable assembly connector is connected to the DB-15 HD female connector of the NT7R58AA Maintenance Panel assembly.

**Note:** These panel assemblies and the NT7R67HA cable are parts of the NT7R67BA Local Carrier/Monitor Cable Assembly and are normally attached to the cable connectors in the factory. These panels cannot be ordered separately, they have to be ordered as the NT7R67BA cable assembly.

## Installing SDI and MMI terminal cables

The NT7R58AA Maintenance Panel assembly provides connectors to connect the NT7R51 Local Carrier Interface card to the MMI terminal and to an SDI port as shown in Figure 12 on page 84.

### Connecting a single Local Carrier Interface card to the MMI terminal in the NT or XT cabinet

- 1 To connect a single NT7R51 Local Carrier Interface card to the MMI terminal:

*Note:* Refer to Appendix C, [Figure 27](#) for connection diagrams and tables listing pin assignment information for all external connectors that connect to the SDI port, the MMI terminal, the system monitor card, the external alarms, and the carrier links.

- Plug the NT7R69AA Extension cable DB-9 male connector into the DB-9 female connector on the NT7R58AA Maintenance Panel assembly.
- Plug the DB-9 male P1 connector at the common end of the NT7R67DA Local External Maintenance Cable assembly into the NT7R69AA Extension cable DB-9 female connector.
- Plug the DB-9 male P3 connector of the NT7R67DA cable assembly into the DB-9 female connector of the NT7R66BA MMI Cable.
- Plug the DB-25 male end of the NT7R66BA MMI Cable into the MMI terminal RS-232 connector. If you have to change the gender at the terminal, use the appropriate compact gender changer such as a DB-25F/DB-25F gender changer.
- To connect P3 DB-9 female connector of the NT7R67DA Local External Maintenance Cable directly to the DB-9 male RS-232 serial communication port of a laptop computer, use the NT7R66BA MMI Cable and the appropriate compact gender changer.

- 2** MMI terminal connection using a modem:
  - If you need a modem to connect a distant MMI terminal to the MMI port on the NT or XT system I/O housing, plug the DB-9 female connector of the NT7R66BA MMI Cable into the P3 DB-9 male connector of the NT7R67DA cable.
  - Plug the DB-25 male end of the NT7R66BA MMI Cable into a DB-25F/DB-25M nullmodem.
  - Connect the nullmodem DB-25 male connector to the modem DB-25 female connector.
  
- 3** MMI terminal connection using an A/B switch box:
  - Connect the P3 of the NT7R67DA Local External Maintenance Cable assembly DB-9 male connector into the DB-9 female connector of the NT7R66BA MMI Cable.
  - Plug the DB-25 male end of the NT7R66BA MMI Cable into the A/B switch box DB-25 female C connector.
  - From the switch box, you can connect a local MMI terminal directly to the A position on the switch box using a standard DB-25M/DB-25M straight-through cable.
  - You can also connect a distant MMI terminal over a standard DB-25M/DB-25M straight-through cable, a nullmodem, and a modem to the switch box B position.
  
- 4** Terminal/Modem connections over the MSDL Single Terminal Access:
  - To avoid using the A/B switch box, you can use three ports on the MSDL card.
  - Connect one MSDL port to the Meridian 1 local MMI terminal
  - Connect the second MSDL port to a modem.
  - Connect the third MSDL port to the P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable assembly using the NT7R66BA MMI Cable.

### **Connecting a single Local Carrier Interface card to the SDI card in the NT or XT cabinet**

Refer to Appendix C and [Figure 27](#) to see the SDI connection diagram.

- 1** To connect a single NT7R51 Local Carrier Interface card to the QPC 841 or other SDI cards:
  - Route the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card to an available SDI port on an SDI card.
  - Plug the DB-9 male connector of the NT8D93AJ XSDI I/O cable into the DB-9 female SDI connector on the I/O panel.
  - Plug the DB-25 male connector of the NT8D93AJ XSDI I/O cable into the DB-25 female connector on the NT7R66AA SDI Cable Kit.
  - Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the DB-9 female connector into the NT7R67DA cable P2 connector.
  
- 2** To connect other SDI cards:
  - Route and install the DB-9 female P2 connector of the NT7R67DA cable assembly to an available SDI port on an SDI card.
  - Plug the DB-25 male connector of the NT7R66AA SDI Cable Kit (do not use the DB-25F/DB-25F adapter) to connect the DB-25 female SDI connector at the I/O panel.
  - Plug the DB-9 male connector on the NT7R66AA SDI Cable Kit into the P2 connector on the NT7R67DA cable.

To test the MMI and Host SDI login, refer to “MMI mode” on page 139 and “Host SDI mode” on page 141 for login instructions.

*Note:* For additional information about types of SDI cards, their SDI ports, and special cables required to connect these ports, refer to *Meridian 1 serial data interface cards description (553-3001-107)*.

### **Connecting multiple Local Carrier Interface cards to the MMI terminal**

Make sure that all the NT7R51 Local Carrier Interface cards in the NT or XT system are properly configured for the daisy-chain card addressing as shown in Figure 9 “Local Carrier Interface card DIP-switch positions and function” on page 69 and Appendix C, [Figure 28](#).

Make sure the NT7R67CA Local Daisy-chain Cable Assembly is installed for all Local Carrier Interface cards in the daisy-chain. Refer to “Installing the NT7R67CA Local daisy-chain cable” on page 75.

- 1 To connect multiple NT7R51 Local Carrier Interface cards in a daisy-chain configuration and to the MMI terminal, connect the cables as shown in [Figure 12](#) and Appendix C, [Figure 28](#):
  - Plug an NT7R69AA Extension cable DB-9 male connector into each DB-9 female connector on each NT7R58AA Maintenance Panel assembly belonging to Local Carrier Interface card #1.
  - Plug the DB-9 male P1 connector at the NT7R67DA Local External Maintenance Cable assembly #1 into the corresponding NT7R69AA Extension cable DB-9 female connector for Local Carrier Interface card #1.
  - Plug the NT7R67DA cable assembly #2 into the NT7R69AA Extension cable DB-9 female connector for Local Carrier Interface card #2.
  - Connect the DB-9 male P3 connector from the cable in position #1 with the DB-9 female P2 connector of the NT7R67DA cable assembly in position #2.
  - Plug the NT7R67DA cable assembly #3 into the NT7R69AA Extension cable DB-9 female connector for Local Carrier Interface card #3.
  - Connect the DB-9 male P3 connector from the cable in position #2 with the DB-9 female P2 connector of the NT7R67DA cable assembly in position #3.
  - Plug the DB-9 male P3 connector of the NT7R67DA cable assembly in position #3 into the DB-9 female connector of the 3NT7R66BA MMI Cable.
  - Plug the DB-25 male end of the NT7R66BA MMI Cable into the DB-25 female connector of the MMI terminal RS-232 connector. If you have to change the gender at the terminal, use the appropriate compact gender changer.

- 2    MMI terminal connection using a modem:
  - If you need a modem to connect a distant MMI terminal to the MMI port on the Meridian 1 I/O panel, plug the DB-9 female connector of the NT7R66BA MMI Cable into the P3 DB-9 male connector of the NT7R67DA cable.
  - Plug the DB-25 male connector of the NT7R66BA MMI Cable into the DB-25 female end of a DB-25F/DB-25M nullmodem.
  - Connect the nullmodem DB-25 male connector to the modem DB-25 female connector.
- 3    MMI terminal connection using an A/B switch box:
  - Connect the P3 of the NT7R67DA Local External Maintenance Cable assembly DB-9 male connector into the DB-9 female connector of the NT7R66BA MMI Cable.
  - Plug the DB-25 male and of the NT7R66BA MMI Cable into the A/B switch box DB-25 female C connector.
  - From the switch box, you can connect a local MMI terminal directly to the A position on the switch box using a standard DB-25M/DB-25M straight-through cable.
  - You can also connect a distant MMI terminal over a standard DB-25M/DB-25M straight-through cable, a nullmodem, and a modem to the switch box B position.
- 4    Terminal/Modem connections over the MSDL Single Terminal Access:
  - To avoid using the A/B switch box, you can use three ports on the MSDL card.
  - Connect one MSDL port to the Meridian 1 local MMI terminal
  - Connect the second MSDL port to a modem.

- Connect the third MSDL port to the P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable assembly by using the NT7R66BA MMI Cable.

### **Connecting multiple Local Carrier Interface cards to the SDI card**

Refer to Appendix C, [Figure 28](#) to see the SDI connection diagram.

**1** To connect a single NT7R51 Local Carrier Interface card to the QPC 841 or other SDI cards:

- Route the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card #1 to an available SDI port on an SDI card.
- Plug the DB-9 male connector of the NT8D93AJ XSDI I/O cable into the DB-9 female SDI connector on the I/O panel.
- Plug the DB-25 male connector of the NT8D93AJ XSDI I/O cable into the DB-25 female connector on the NT7R66AA SDI Cable Kit.
- Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the DB-9 female connector into the NT7R67DA cable P2 connector.

**2** To connect other SDI cards:

- Route and install the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card #1 to an available SDI port on an SDI card.
- Plug the DB-25 male connector of the NT7R66AA SDI Cable Kit to connect the DB-25 female SDI connector at the I/O panel. (The DB-25F/DB-25F adapter is not used).
- Plug the DB-9 male connector on the NT7R66AA SDI Cable Kit into the P2 connector on the NT7R67DA cable.

**3** Secure cables with tie-wraps as appropriate.

To test the MMI and Host SDI login, refer to “MMI mode” on page 139 and “Host SDI mode” on page 141 for login instructions.

**Note:** For additional information about types of SDI cards, their SDI ports, and special cables required to connect these ports, refer to *Meridian 1 serial data interface cards description* (553-3001-107).

## Connecting carrier links to the NT/XT system cabinet

The T1 or E1 carrier links are connected to the NT7R57AA Carrier Panel assembly at the top of NT and XT system cabinets. Carrier links are routed from the telco demarcation point to the system cabinet I/O panel containing NT7R57AA Carrier Panel assembly with three 8-pin modular jacks, as shown in Figure 14 on page 93.

**Note 1:** Before connecting the carrier link to the system, the connection between the telco demarcation point such as CSU, should have been completed using the NT7R87AA T1 CSU Cable Kit.

**Note 2:** To connect an E1 carrier link terminated with BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable to connect 8-pin modular jacks at the I/O panel to the BNC connector on each E1 carrier link coming from the telco demarcation point. Also refer to [Figure 9](#) and [Figure 15](#) to set SW1, SW2, SW5, and SW8 for E1 carrier impedance of 75 Ohm.

To connect carrier links to the NT7R57AA Carrier Panel assembly at the local system site:

- 1 Route the three carrier links to the top of the NT and XT systems cabinets.
- 2 Identify carrier 0, 1, and 2 connectors and the corresponding NT7R57AA Carrier Panel assembly 8-pin modular jacks.
- 3 Plug the carrier link cable 8-pin modular plugs into the corresponding NT7R57AA Carrier Panel assembly 8-pin modular jacks for each carrier.
- 4 Record the telco carrier circuit ID for each carrier link (link 0, 1, and 2).

**Note:** These carrier circuit IDs will be used at the remote site to identify links that corresponds to carrier 0, 1, and 2 at the local site. This will prevent mismatch of carrier links between the Local Carrier Interface card and the Remote Carrier Interface card. Record the connection information on the [“Carrier Remote IPE Connection Record label” on page 65](#).

- 5 If an E1 coaxial carrier link is terminated with BNC connectors, use one NT7R67EA Coaxial Interface Adapter cable to connect each 8-pin modular jack on the NT7R57AA Carrier Panel assembly to BNC carrier link connectors.
- 6 Identify BNC connectors on each NT7R67EA Coaxial Interface Adapter cable that corresponds to the appropriate carrier (carrier 0, carrier 1, and carrier 2) at the NT7R57AA Carrier Panel Assembly 8-pin jack.
- 7 Connect each NT7R67EA Coaxial Interface Adapter BNC connector to the appropriate BNC connector on the carrier link.
- 8 Secure all carrier link cables with tie-wraps as appropriate.

## Carrier Remote IPE column installation

To complete the installation of the Carrier Remote IPE column equipment, you must:

- install the Carrier Remote IPE column
- install the cards into the IPE module
- install the cable assemblies from the I/O panel to the backplane
- connect carrier links to the carrier panel assembly
- configure the carrier equipment using overlays and MMI commands

**Note:** All Carrier Remote IPE modules or cabinets are preinstalled 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 Carrier Remote IPE column

The column is normally assembled in the factory with cards already installed and the cable already connected between the backplane connector and the I/O panel at the rear of the IPE module.

If the column is not assembled in the factory, you will need to install the Meridian 1 type modular column (floor-standing column) at the remote site. To do this, 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 Power Fail Transfer Unit (PFTU) to the Carrier Remote IPE column, follow the instructions in *Meridian 1 system installation procedures* (553-3001-210).

## Installing cards into the Remote IPE module

The following steps show you how and where to install the NT7R52 Remote Carrier Interface card and other IPE cards in the Remote IPE module. Although the cards usually are shipped installed from the factory, this document provides step-by-step card installation, which should be followed when additional IPE cards are installed or defective cards are replaced.

To install cards in the Remote IPE Module:

- 1 Set the DIP switches on the NT7R52 Remote Carrier Interface card to specify the carrier type (T1 or E1), the distance to the first repeater, the MMI terminal baud rate, and the system monitor address. The DIP switch setting will depend on the physical system configuration.
- 2 Verify that SW1 position 2 is set to **ON** to specify the remote site.

**Note:** [Figure 15](#) shows the location of the DIP switches and their functions. Switches 2, 3, and 4 determine if carrier 0 is a T1 or an E1 link, switches 4, 6, and 7 determine if carrier 1 is a T1 or an E1 link, and switches 8, 9, and 10 determine if carrier 2 is a T1 or an E1 link. All three carrier links must be of the same type, for example, T1 or E1. DIP switches S 1 and SW11 define parameter listed in the table in [Figure 15](#). Correspondingly, [Figure 9](#) “Local Carrier Interface card DIP-switch positions and function” on page 69, shows the Local Carrier Interface card DIP switches SW1 through SW11 and their functions. Refer to [Figure 9](#) “Local Carrier Interface card DIP-switch positions and function” on page 69 for DIP switch settings for the Local Carrier Interface card.

- 3** Determine the system monitor address for each remote site by setting SW11 positions 1-5 on the Remote Carrier Interface card. Before you select the address, you must determine which are the available system monitor addresses, as follows:
  - Execute the **STAT XSM** command in **LD 37** to poll all system monitors. Correct any problems.
  - Determine available system monitor addresses to be assigned to the Remote IPE module or the wall-mounted Carrier Remote IPE cabinet.
  - Set master system monitor slave polling address range to cover the new Carrier Remote IPE system monitor address.
  - Set Remote Carrier Interface card **SW 11** positions **1-5** for the new system monitor address.
  - Re-connect the system monitor daisy-chain to include new Local Carrier Interface cards.
  - Test the system monitor daisy-chain by executing the **STAT XSM** command in **LD 37** to ensure that every local and remote system monitor or Remote Carrier Interface card system monitor emulation in the remote cabinet is responding to the master system monitor.

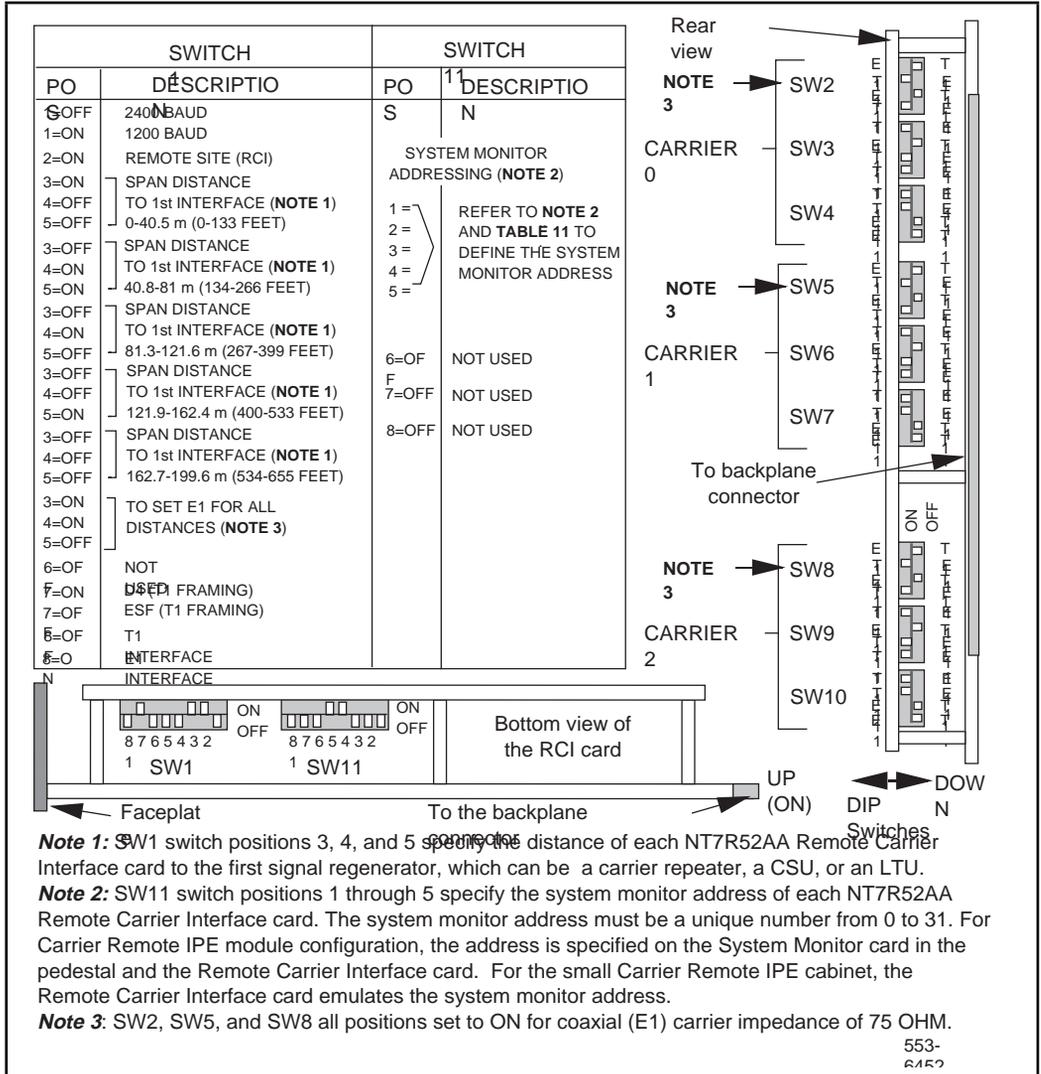
**Table 12** lists the default (factory provided switch settings) for the Remote Carrier Interface card. These settings can be used in the majority of applications, however, if different settings are required, you should change the switch settings before installing the Remote Carrier Interface card.

**Table 12**  
**Remote Carrier Interface standard (default) switch settings**

Switch	Switch positions							
	1	2	3	4	5	6	7	8
SW1	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
SW11	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
SW2	OFF	ON	OFF	ON	-	-	-	-
SW3	ON	OFF	ON	ON	-	-	-	-
SW4	ON	ON	OFF	OFF	-	-	-	-
SW5	OFF	ON	OFF	ON	-	-	-	-
SW6	ON	OFF	ON	ON	-	-	-	-
SW7	ON	ON	OFF	OFF	-	-	-	-
SW8	OFF	ON	OFF	ON	-	-	-	-
SW9	ON	OFF	ON	ON	-	-	-	-
SW10	ON	ON	OFF	OFF	-	-	-	-

Figure 15 shows the NT7R52AA Remote Carrier Interface card DIP switches. SW2 through SW10 select the carrier characteristic. SW1 and SW11 define repeater distance, baud rate, and system monitor address.

Figure 15 Remote Carrier Interface card DIP-switch locations and functions



[Table 13](#) lists system monitor addresses for the Remote Carrier Interface card, which are selected using switch SW11 switch positions 1 through 5. A unique address is selected for each Remote Carrier Interface card. Refer to [Figure 15](#) for the SW11 switch location on the card.

**Table 13**  
**NT7R52 Remote Carrier Interface card system**  
**monitor address selection**

RCI System Monitor Address	SW11 Positions 1–5 (1 = ON, 0 = OFF)				
	1	2	3	4	5
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
4	0	0	1	0	0
5	0	0	1	0	1
6	0	0	1	1	0
7	0	0	1	1	1
8	0	1	0	0	0
9	0	1	0	0	1
10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0
21	1	0	1	0	1
22	1	0	1	1	0
23	1	0	1	1	1
24	1	1	0	0	0
25	1	1	0	0	1
26	1	1	0	1	0
27	1	1	0	1	1
28	1	1	1	0	0
29	1	1	1	0	1
30	1	1	1	1	0
31	1	1	1	1	1

- 4 Pull the NT7R52AA Remote Carrier Interface card locking devices away from the faceplate. Holding the card by these locking devices, insert it into the card guides in the card slot marked *Cont.*, which is located to the right of slot 7. Make sure to use the card guides immediately to the right of slot 7.
- 5 Slide the card into the module until it engages the backplane connector.
- 6 Push the locking device levers towards the faceplate to insert the card connector into the backplane connector and lock the card in place.
- 7 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.
- 8 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 card into the card guides of an IPE card slot.
- 9 Slide the card into the module until it engages the backplane connector and then push the locking device levers toward the faceplate to insert the card connector into the backplane connector and lock the card in place.
- 10 Repeat steps 7 and 8 for each IPE card.

## **Installing the backplane cable assemblies**

The Remote Carrier Interface card backplane connectors provide access to three carrier links, the system monitor, external alarms, and the MMI maintenance port. The NT7R68AA Remote Carrier/Alarm Cable assembly is routed from the Remote Carrier Interface card lower backplane connector SL1 to the I/O panel connectors that support carrier link and auxiliary or external alarm connections. The NT7R68BA Remote Maintenance Cable assembly connects the upper backplane connector SL0 to the I/O panel connectors that support the system monitor and the SDI/MMI terminal connections.

### **Installing the NT7R68AA Remote Carrier/Alarm Cable Assembly**

The NT7R68AA Remote Carrier/Alarm Cable assembly consists of the NT7R68HA cable, the NT7R59AA Carrier Panel, and NT7R60AA Carrier/Alarm Panel assemblies.

Before you can plug the cables into the IPE module backplane, you must install the NT7R59AA Carrier Panel and NT7R60AA Carrier/Alarm Panel assemblies into the connector cutouts on the I/O panel at the rear of the IPE module, refer to [Figure 16](#) and Appendix C, [Figure 29](#) for details. To install the panel assemblies:

- 1** Remove the back panel at the rear of the IPE module to be able to access the I/O panel connector cutouts.
- 2** Identify the empty connector cutouts that are the appropriate size for the panel assemblies. Refer to “Carrier Remote IPE Module I/O panel connector selection” on page 63 for connector cutouts selection recommendation.
- 3** Install the NT7R59AA Carrier Panel assembly into the recommended connector cutout in the I/O panel. Install it so that 8-pin modular jack tabs are positioned to the left of the connectors, placing carrier 0 at the top of the NT7R59AA Carrier Panel assembly and carrier 1 at the bottom. Tighten the retaining screw.
- 4** Install the NT7R60AA Carrier/Alarm Panel assembly into the recommended J5 empty connector cutout in the I/O panel. Tighten the retaining screw. This panel contains an 8-pin modular jack for carrier 2 at the bottom and a DB-15 HD female auxiliary alarm (external alarm) connector at the top of the panel assembly.
- 5** Plug the P1 24-pin block connector of the NT7R68AA Remote Carrier/Alarm Cable assembly into the SL1 connector on the IPE Module’s backplane.

**Installing the NT7R68BA Remote Maintenance Cable Assembly**

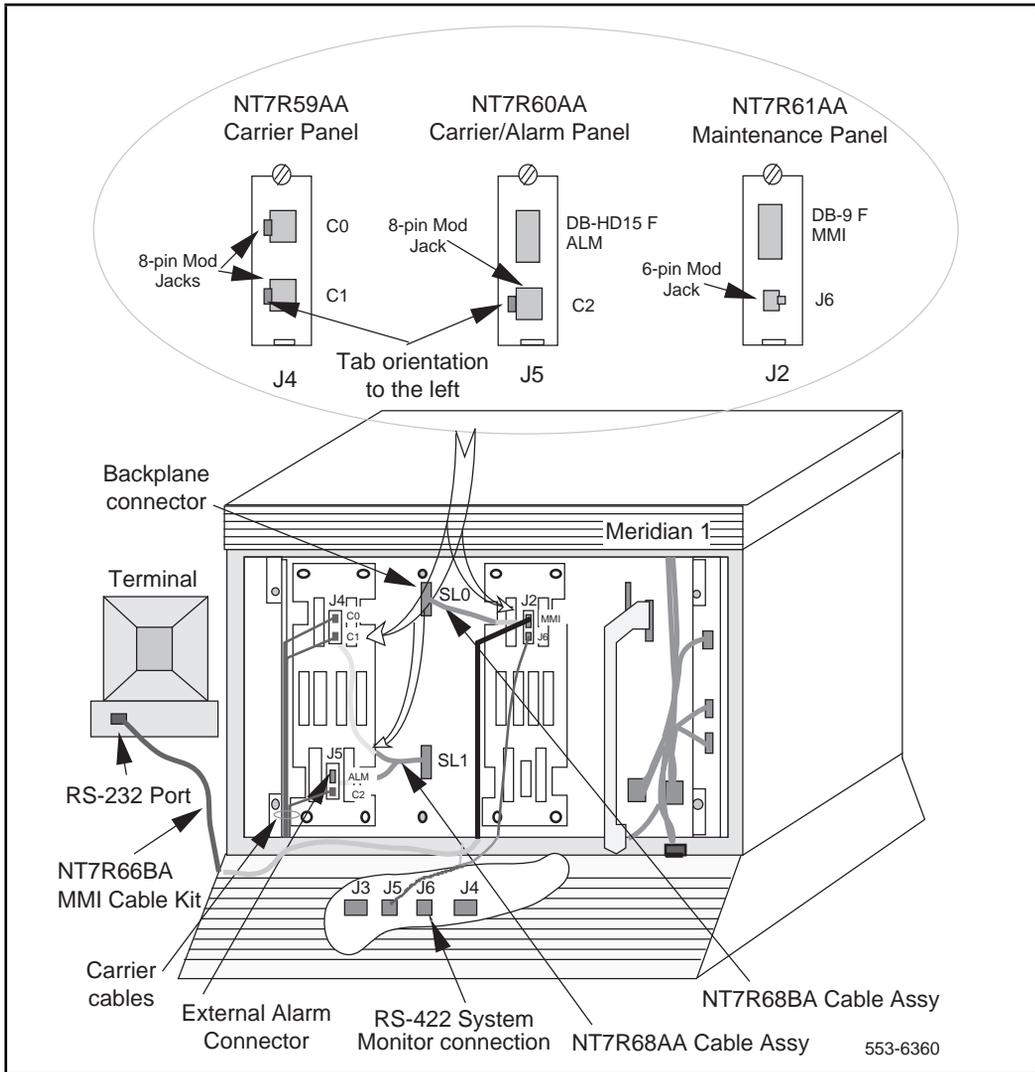
The NT7R68BA Remote Maintenance Cable assembly consists of the NT7R68GA cable and NT7R61AA Maintenance Panel assembly.

Before you can plug the cable into the IPE module backplane, you must install the NT7R61AA Maintenance Panel assembly into the connector cutout on the I/O panel at the rear of the IPE module, refer to [Figure 16](#) and Appendix C, [Figure 29](#). To install the panel assembly:

- 1** Identify the empty connector cutout that is the appropriate size for the NT7R61AA Maintenance Panel assembly. Refer to “Carrier Remote IPE Module I/O panel connector selection” on page 63 or connector cutouts selection recommendation.
- 2** Install the NT7R61AA Maintenance Panel assembly into the recommended J2 connector cutout on the I/O panel. Tighten the retaining screw.
- 3** Plug the P1 24-pin connector of the NT7R68BA Remote Maintenance Cable assembly into the SL0 connector on the IPE Module’s backplane.

Figure 16 shows the rear of the Carrier Remote IPE module and cables connecting the backplane connectors to the module's I/O panel assembly connectors installed into the recommended connector cutouts.

Figure 16  
Backplane to I/O panel connections on the IPE module



## Installing system monitor cables

The NT8D46AL system monitor cable is normally installed in the factory and does not have to be installed at the site.

In the remote floor-standing column, the pedestal contains a slave system monitor used to monitor Carrier Remote IPE system alarms. These alarms are reported over the carrier link and the Local Carrier Interface card to the Meridian 1 master system monitor and from there to the CPU. The CPU sends PWR alarm messages to the system maintenance TTY identifying the problem.

[Figure 16](#) shows the system monitor cable connections for a Carrier Remote IPE column. To connect the slave system monitor in the pedestal:

- 1 Plug the 6-pin modular plug at one end of the NT8D46AL cable into the J6 6-pin modular jack on the IPE module NT7R61AA Remote Maintenance Panel assembly. This cable provides an RS-422 interface to the system monitor.
- 2 Plug the other end of the NT8D46AL cable 6-pin modular plug into the J5 modular jack on the system monitor in the pedestal.
- 3 Check the NT8D22 System Monitor factory switch settings for the slave system monitor. Refer to “Option settings” in *Circuit card installation and testing* (553-3001-211).

**Note:** Set the system monitor address on the system monitor card in the pedestal to be identical to the system monitor address set on the Remote Carrier Interface card using SW11 switch positions 1 through 5. Set the slave system monitor to the same address that corresponds to the master system monitor at the local site.

- 4 For multiple Carrier Remote IPE modules on a single pedestal, connect only one Remote Carrier Interface card to the system monitor in the pedestal. However, set the system monitor address on all Remote Carrier Interface cards to be the same as the system monitor address in the pedestal. This will allow you to connect any Remote Carrier Interface card to the system monitor in the pedestal.

## Installing remote MMI terminal cables

The cable that has to be installed at the site is the terminal cable connecting the terminal or TTY to the DB-9 female connector on the NT7R61AA Remote Maintenance Panel assembly.

[Figure 16](#) shows the MMI terminal cable connections for a Carrier Remote IPE column. Also, refer to and Appendix C, [Figure 29](#). To connect the MMI terminal:

- 1 Plug the DB-9 female connector of the NT7R66BA MMI Cable into the MMI DB-9 male connector on the IPE module NT7R61AA Remote Maintenance Panel assembly.
- 2 Plug the other end of the NT7R66BA MMI Cable DB-25 male connector into the MMI terminal RS-232 connector. If the MMI terminal has a male connector, use a compact gender changer to connect the MMI terminal.
- 3 If an distant MMI terminal is connected to the MMI connector on the Maintenance Panel Assembly over a modem, use the NT7R66BA MMI Cable and a nullmodem to connect the modem to the MMI D-9 male connector on the NT7R61AA Remote Maintenance Panel Assembly.
- 4 For multiple Carrier Remote IPE modules at a single site, use an A/B/C switch box to connect each MMI DB-9 male connector on the Maintenance Panel assembly to a single MMI terminal. To do this, use the NT7R66BA MMI Cable between the A/B switch box connector C and the MMI connector on each IPE module. Use a DB-25M/ DB-25M straight through cable to connect the A/B switch box connector A to the MMI terminal.

**Note:** Appendix C provides the external connectors pin assignment for the SDI port, the MMI terminal, the carrier links, and the external alarms.

---

## Connecting the carrier link to the Remote IPE module

The T1 or E1 carrier links are connected to the I/O panel assembly at the rear of the IPE module housing the Remote Carrier Interface card. Carrier links are routed from the telco demarcation point to the Carrier Remote IPE column for connection to the NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assembly. The NT7R59AA Carrier Panel assembly contains two 8-pin modular jacks and the NT7R60AA Carrier/Alarm Panel assembly contains one 8-pin modular jack, which are used to connect carrier links. [Figure 16](#) shows the carrier connectors and the carrier link cable routing.

**Note 1:** Before connecting the carrier link to the system, the connection between the telco demarcation point such as CSU, should have been completed using the NT7R87AA T1 CSU Cable Kit.

**Note 2:** To connect an E1 carrier terminated with BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable to connect the 8-pin modular jacks at the I/O panel to the BNC connector on each E1 carrier link coming from the telco demarcation point. Also refer to [Figure 9](#) and [Figure 15](#) to set SW1, SW2, SW5, and SW8 for E1 operation and carrier impedance of 75 Ohm.

To connect carrier links to the IPE module's NT7R59AA Carrier Panel and NT7R60AA Carrier/Alarm Panel assemblies at the remote site:

- 1 Route all three carrier links to the rear of the Carrier Remote IPE column housing the Remote Carrier Interface card.
- 2 Identify carrier 0 (primary), carrier 1 (primary), and carrier 2 (primary or spare) and the corresponding connectors on the NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies.

**Note:** Compare carrier circuit ID numbers of carrier links at the local site (that you recorded during the installation of the carrier links at the local site) with the carrier circuit ID numbers of the carrier links at the remote site. Make sure they match so that the circuit ID of carrier 0 at the local site matches with circuit ID of carrier 0 at the remote site. Repeat this matching for carrier 1 and carrier 2. This will eliminate cross-connection of carrier links, which causes transmission problems. Refer to “Verifying carrier link connections at the remote site” on page 147.

- 3 Plug each carrier cable 8-pin modular plug into the corresponding 8-pin modular jack on the NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies for each T1 carrier.
- 4 If an E1 coaxial carrier link is terminated with BNC connectors, use one NT7R67EA Coaxial Interface Adapter cable to connect each 8-pin modular jack on the NT7R59AA Carrier Panel and NT7R60AA Carrier/Alarm Panel assemblies to BNC carrier link connectors.
- 5 Identify BNC connectors on each NT7R67EA Coaxial Interface Adapter cable that corresponds to the appropriate carrier (carrier 0, carrier 1, and carrier 2) at the NT7R57AA Carrier Panel Assembly 8-pin jack.
- 6 Connect each NT7R67EA Coaxial Interface Adapter BNC connector to the appropriate BNC connector on the carrier link.

*Note:* These carrier link connections will be verified at the end of hardware installation by executing appropriate MMI commands on the MMI terminal. Refer to “Verifying carrier link connections at the remote site” on page 147.

- 7 Secure the carrier link cables with tie-wraps as appropriate.

The NT7R60AA Maintenance Panel assembly that contains one 8-pin modular jack for carrier 2, also contains the DB-15HD female external alarm input connector. This DB-15HD connector connects the NT7R86AA Auxiliary Alarm Cable assembly to auxiliary alarm (external alarm) indicators at the MDF or directly to the auxiliary alarm devices. These alarm devices report alarm conditions through relay contact closures.

## Carrier Remote IPE cabinet installation

To complete the installation of Carrier Remote IPE cabinet equipment, you must:

- install the Carrier Remote IPE cabinet(s)
- install cards into the cabinet(s)
- install the Remote Cabinet Cable assembly and connect to the backplane
- connect the carrier links

### Installing the Carrier Remote IPE cabinet

To install NT1P70/NT1P60 main and NTBK70 expansion Carrier Remote IPE cabinets that house the Carrier Remote IPE, follow the instructions in this section.

**Note:** The NT1P70 is the Main Cabinet Assembly consisting of the NT1P60 Main Cabinet and cabinet mounting hardware.

The NT1P70/NT1P60 Remote Carrier IPE main cabinet is shipped from the factory installed, that is, all IPE cards and the Remote Carrier Interface card are already installed. The exceptions are the NT7R94AA Remote Cabinet Cable Assembly and the power supply, which are shipped separately. The NTBK70 Carrier Remote IPE expansion cabinet (also used in Option 11) is optional and is ordered only if you require more than 10 IPE cards at the remote site.

The Carrier Remote IPE cabinet can be powered with an AC power system using the NTAK04 AC/DC power supply. It can also be powered with a DC power system using the NTAK05 DC power supply from a -52 V battery source through the NTAK28AA Junction box and the NTAK410 power cable. Before you install the power supply into the cabinet set switches SW1 through SW 4 as shown in [Table 14](#):

**Table 14**  
**NTAK04 AC/DC and NTAK05 DC power supply switch settings**

Voltage	SW1	SW2	SW3	SW4
Message Waiting; -150 V	ON			
Message Waiting; -120 V	OFF			
Ringing; 86 Vrms		OFF	OFF	OFF
Ringing; 80 Vrms		ON	OFF	OFF
Ringing; 75 Vrms		OFF	ON	OFF
Ringing; 70 Vrms		OFF	OFF	ON
<p><i>Note:</i> Ringing frequency selection is made with a three-way switch located to the left of the 4-position DIP switch at the top of the power supply. Typical North American setting is -150 V, 86 Vrms, and 20 Hz.</p>				

To install Carrier Remote IPE Cabinets, locate and prepare the wall area for the wall-mounted installation or use the pedestal for the floor installation, 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 carrier and subscriber loop cable routing.

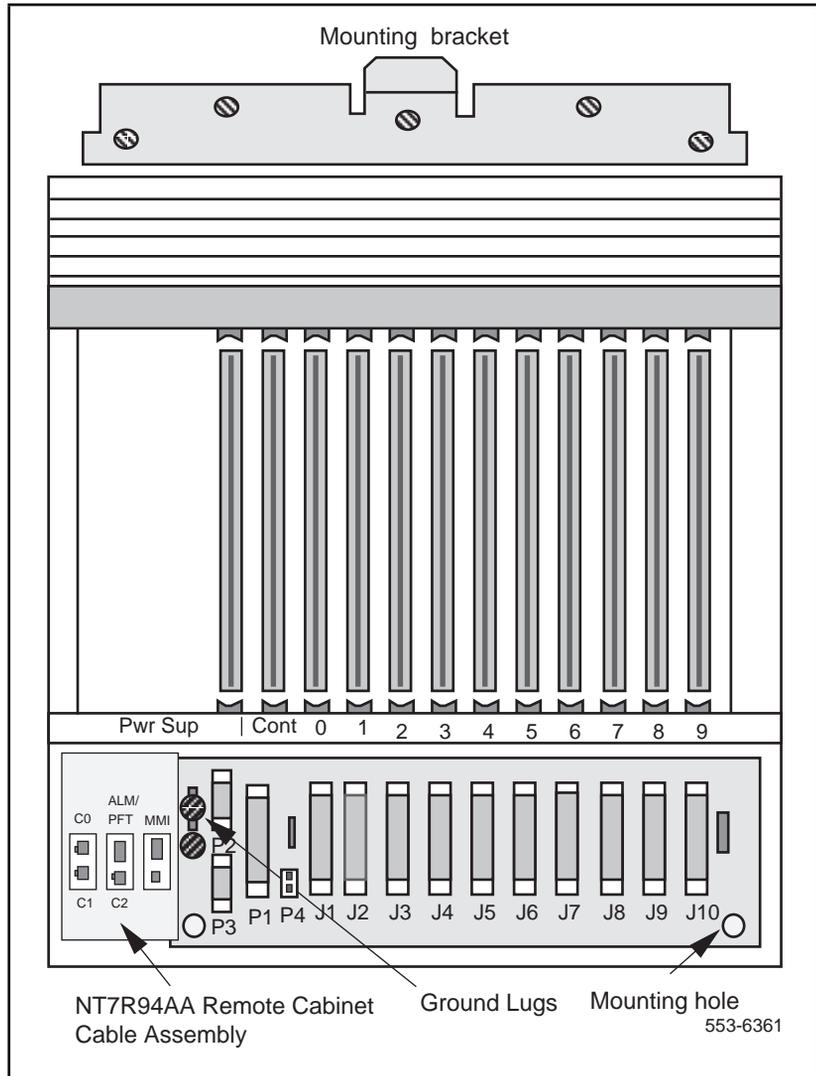
To complete these tasks, follow the steps below:

- 1 Unpack and inspect the cabinet.
- 2 Level and install the mounting bracket on the wall as shown in [Figure 17](#). If you are installing the expansion cabinet next to the main, 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 onto 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 17](#).
- 5 Bolt the cabinet to the wall by using two wood screws at the lower front of the cabinet. See [Figure 17](#) for screw hole locations.
- 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.
- 8 Install the power supply in the *Pwr Sup* slot in the NT1P70/NT1P60 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 Disconnect the building ground wire at the ground lug on the NT1P70/NT1P60 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.
- 11 For an AC system, connect the NTAK98AA Power Cord from the IPE shelf NTAK04 AC/DC power supply to the commercial AC power outlet. For a DC system, connect the IPE shelf NTAK05 DC power converter cord to the DC power source over the NTAK28AA Junction Box and the NTAK410 power cable.
- 12 Measure the ground resistance between the ground lug at the bottom of the NT1P70/NT1P60 main cabinet and the ground prong on the cabinet power cord. It should measure 0 ohms. If the resistance is greater than 0 ohms, check the ground terminal on the power supply power connector for continuity to the cabinet chassis.

Figure 17 shows the Carrier Remote IPE cabinet with the mounting bracket and the mounting holes. It also shows the ground lugs for ground connections.

**Figure 17**  
**Carrier Remote IPE cabinet**



- 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 NTAK98AA supply power cord to the AC power outlet for an AC system or to the DC source for a DC system.
- 15** If the Carrier Remote IPE requires an expansion cabinet to accommodate up to 16 IPE cards, repeat steps 1 through 14 for the NTBK70 expansion cabinet.
- 16** Connect the NT1P70/NT1P60 main cabinet to the NTBK70 expansion cabinet by installing the cable between connector P1 of the main cabinet and P1 of the expansion cabinet. Install the cabinets side-by-side or above each other keeping in mind that the inter-cabinet cable is 7 feet (21 m) long.
- 17** Install the adhesive label strip to the expansion cabinet designating the card slots from 10 to 15.

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

## Removing the fiber I/O bracket assembly

The NT1P70/NT1P60 main Carrier Remote IPE cabinet is equipped with a I/O bracket assembly used in Fiber Remote IPE. This bracket must be removed and the NT7R94AA Remote Cabinet Cable Assembly must be installed in its place. Refer to [Figure 18](#).

To remove this bracket:

- 1** Unscrew the retaining screw holding the bracket in place. The screw is located at the upper front of the bracket.
- 2** Remove the retaining screw and swing the front of the bracket to the left by 45 degrees.
- 3** Slide the entire bracket forward to clear the hinge tabs at the rear of the bracket. Remove the bracket.

## Installing the NT7R94AA Remote Cabinet Cable Assembly

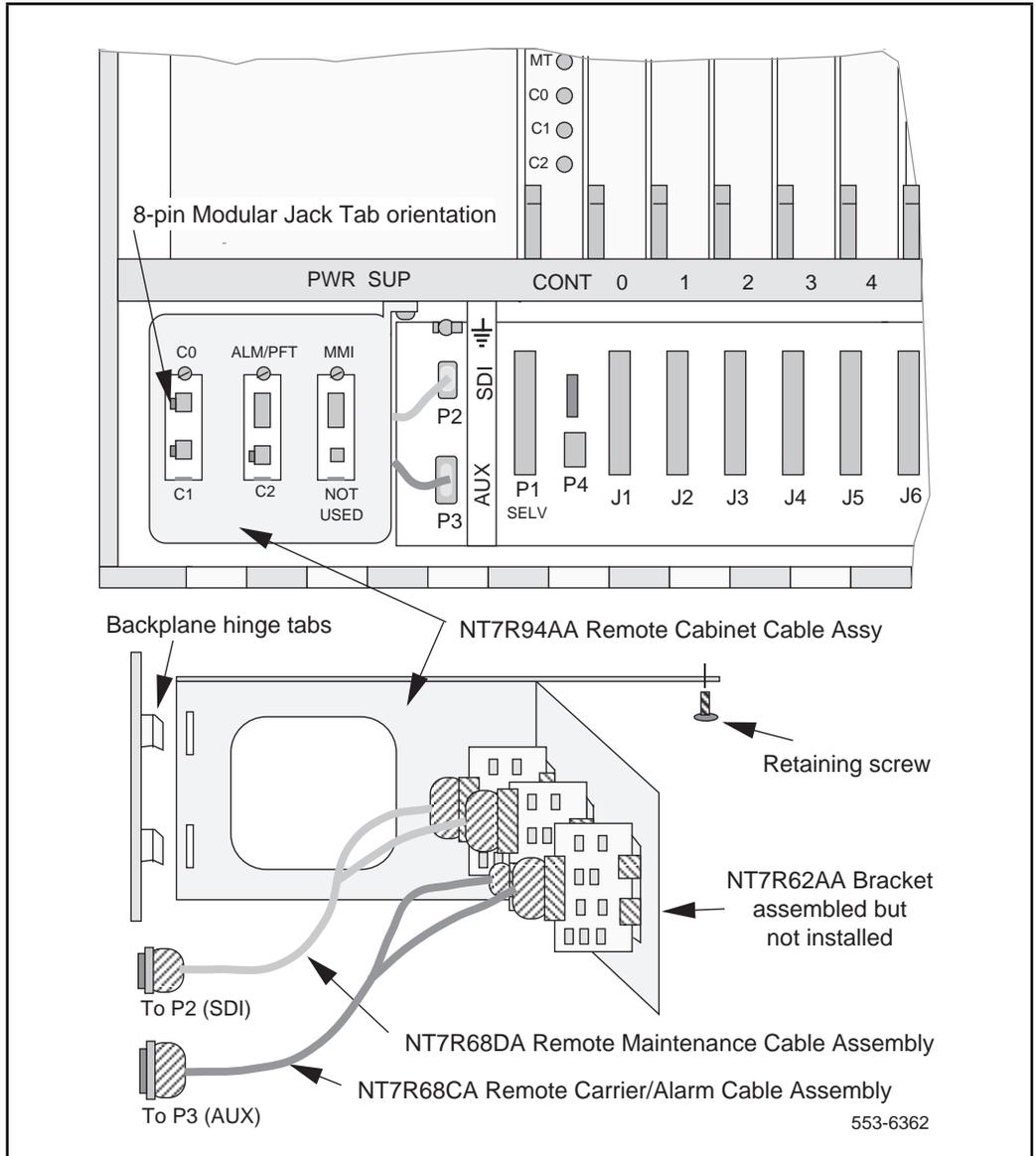
The NT7R94AA consists of the NT7R62AA Bracket, the NT7R68CA Remote Carrier/Alarm Cable Assembly, and the NT7R68DA Remote Maintenance Cable Assembly. These components are pre-assembled in the factory to become the NT7R94AA Remote Cabinet Cable Assembly.

To install the NT7R94AA Remote Cabinet Cable Assembly into the cabinet:

- 1 Align the two bracket holes with the two hinge tabs as shown in [Figure 18](#).
- 2 Swing the front of the assembly by 45 degrees to the left with respect to the hinge tabs.
- 3 Slide the entire assembly backwards and insert the hinge tabs into the two holes on the bracket.
- 4 Move the front of the assembly by 45 degrees to the right to be at the right angle to the backplane and install the retaining screw.
- 5 Plug the DB-15 male P1 connector at the common end of the NT7R68CA cable assembly into the P3 (auxiliary) DB-15 female connector located on the backplane.
- 6 Plug the DB-9 male P1 connector at the common end of the NT7R68DA cable assembly into the P2 (TTY) DB-9 female connector located on the backplane.

[Figure 18](#) shows an installed and connected Remote Cabinet Cable Assembly. The cables are connected to P2 and P3 located on the cabinet backplane to provide connections to carrier links, the SDI/MMI terminal or TTY, the PFTU, and the customer external alarms (alarms 1 and alarm 2 only).

**Figure 18**  
**Carrier cable routing for the Carrier Remote IPE cabinet**



## Installing cards into the Carrier Remote IPE cabinet

The following steps show you how and where to install the cards in the Carrier Remote IPE cabinet. Even though the cards are shipped in the cabinet from the factory, for safety and ease of installation, you were instructed to remove these cards from the cabinet before you installed it onto the wall.

To install these cards:

- 1 Set the DIP switches on the NT7R52 Remote Carrier Interface card to specify the carrier type (T1 or E1), the distance to the first repeater, the terminal characteristics, and the system monitor address emulation. The DIP switch setting will depend on the physical system configuration.

*Note:* Figure 15 on page 107, shows the location of the DIP switches and their functions. Switches 2, 3, and 4 determine if carrier 0 is a T1 or an E1 link, switches 4, 6, and 7 determine if carrier 1 is a T1 or an E1 link, and switches 8, 9, and 10 determine if carrier 2 (spare carrier) is a T1 or an E1 link. All three carrier links must be of the same type, that is, T1 or E1. Switches 2 through 10 are not read by firmware. Switches 1 and 11 define parameter listed in the table of [Figure 15](#). Verify that SW1 position 2 is set to **ON** to indicate remote site. Switches 1 and 11 are read by firmware.

- 2 Pull the Remote Carrier Interface card locking devices away from the faceplate and, holding the card by these devices, insert the card into the card guides in slot *Cont*. Refer to Figure 17 on page 120 for card slot positions in the shelf.
- 3 Slide the card into the cabinet until it engages the backplane connector and then push the locking device levers toward the faceplate 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 The Remote Carrier Interface card is enabled by software. When enabled by software, the LED turns off permanently, if the card is operational.
- 5 Install IPE cards in slots 0 through 9 by pulling the card locking devices away from the faceplate, 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.
- 6 Repeat step 5 for card slots 10 through 15 in the expansion cabinet.

## Connecting carrier links to the Carrier Remote IPE cabinet

In the Carrier Remote IPE cabinet configuration, the carrier link connects to the telco demarcation point and, from the telco demarcation point, the carrier link cables are routed to the cabinet and connected to the Remote Carrier Interface card through the NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies, as shown in [Figures 18](#) and [19](#).

**Note 1:** Before connecting the carrier link to the system, the connection between the telco demarcation point such as CSU, should have been completed using the NT7R87AA T1 CSU Cable Kit.

**Note 2:** To connect an E1 carrier terminated with BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable to connect the 8-pin modular jacks at the I/O panel to the BNC connector on each E1 carrier link coming from the telco demarcation point. Also refer to [Figure 9](#) and [Figure 15](#) to set SW1, SW2, SW5, and SW8 for E1 operation and carrier impedance of 75 Ohm.

To connect the carrier link to the carrier panel assemblies:

- 1 Route the T1 or E1 carrier 0, carrier 1, and carrier 2 (spare carrier) pair wires from the telco demarcation point to the Carrier Remote IPE cabinet I/O bracket.
- 2 Identify carrier 0, 1, and 2 connectors and the corresponding NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies connectors. Refer to “Verifying carrier link connections at the remote site” on page 147.

**Note:** Compare carrier circuit ID numbers of carrier links at the local site (that you recorded during the installation of the carrier links at the local site) with the carrier circuit ID numbers of the carrier links at the remote site. Make sure they match so that the circuit ID of carrier 0 at the local site matches with circuit ID of carrier 0 at the remote site. Repeat this matching for carrier 1 and carrier 2. This will eliminate the mismatched connection of carrier links, which causes time slot connection problems indicated by no talk-path or cross-talk. To avoid this problem, refer to “Verifying carrier link connections at the remote site” on page 147.

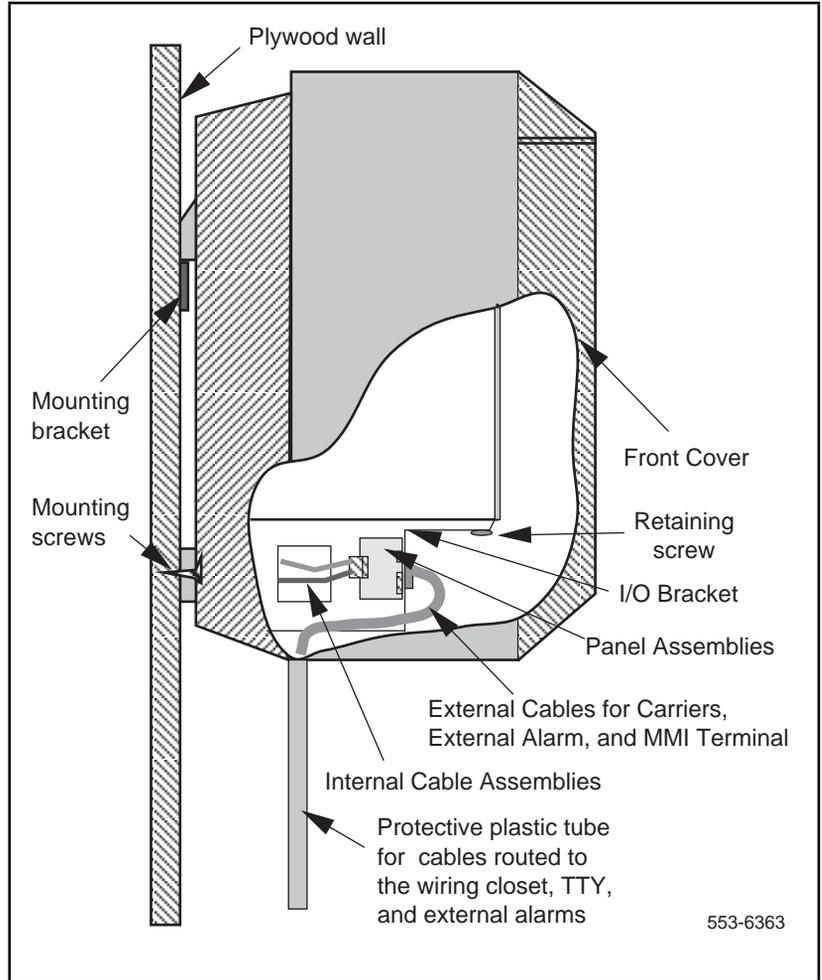
- 3 Plug the carrier link 8-pin modular plug into the corresponding NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies 8-pin modular jack for each carrier.
- 4 If an E1 coaxial carrier link is terminated with BNC connectors, use one NT7R67EA Coaxial Interface Adapter cable to connect each 8-pin modular jack on the NT7R59AA Carrier Panel and NT7R60AA Carrier/Alarm Panel assemblies to BNC carrier link connectors.
- 5 Identify BNC connectors on each NT7R67EA Coaxial Interface Adapter cable that corresponds to the appropriate carrier (carrier 0, carrier 1, and carrier 2) at the NT7R57AA Carrier Panel Assembly 8-pin jack.
- 6 Connect each NT7R67EA Coaxial Interface Adapter BNC connector to the appropriate BNC connector on the carrier link.

*Note:* These carrier link connections will be verified at the end of hardware installation by executing appropriate MMI commands on the MMI terminal. Refer to “Verifying carrier link connections at the remote site” on page 147.

- 7 Secure the carrier link cables with tie-wraps at the exit from the cabinet as appropriate.

**Figure 19** shows the Carrier Remote IPE cabinet and the carrier cable connecting carrier links to the cabinet.

**Figure 19**  
**Carrier cable routing for the Carrier Remote IPE cabinet**



## Connecting remote MMI terminal and subscriber loop cables

In the Carrier Remote IPE cabinet option, the alarm monitoring is performed by the Remote Carrier Interface card, which receives power fail signals from the power supply through the backplane and sends the information over carrier links to the Local Carrier Interface card for processing by the Meridian 1 CPU. Refer to Appendix C, [Figure 30](#) for the connection diagram.

### MMI terminal connection

A terminal connection to the MMI port should be made as shown in [Figure 20](#). The MMI terminal is used for configuration and maintenance of the remote site. The MMI terminal transmission characteristics are 2400 bps, 8 bits, no parity (or emulate the VT100 dumb terminal).

To connect the MMI terminal to the MMI port:

- 1 Plug the DB-9 female connector at one end of the NT7R66BA MMI Cable into the MMI DB-9 male connector on the NT7R61AA Maintenance Panel assembly.
- 2 Plug the DB-25 male connector end of the NT7R66BA MMI Cable into the MMI terminal RS-232 connector. If the MMI terminal requires a different gender connector use a compact gender changer.
- 3 If a distant MMI terminal is connected to the MMI connector on the Maintenance Panel Assembly over a modem, use the NT7R66BA MMI Cable and a DB-25F/DB-25M nullmodem to connect the modem to the MMI D-9 male connector on the NT7R61AA Maintenance Panel Assembly.
- 4 For multiple Carrier Remote IPE modules at a single site, use an A/B/C switch box to connect each MMI DB-9 male connector on the Maintenance Panel assembly to a single MMI terminal. To do this, use the NT7R66BA MMI Cable between the A/B switch box connector C and the MMI connector on the NT7R61AA Maintenance Panel Assembly and use DB-25M/DB-25M straight through cable between the A/B switch box connector A and the MMI terminal.

### **Main Distribution Frame connections**

To connect subscriber loop (tip and ring) cables to the cabinet 50-pin connectors J1 through J10, refer to [Figure 20](#). If an expansion cabinet is also used, connect subscriber loop (tip and ring) cables to the cabinet 50-pin connectors J11 through J16. These cables have already been connected to the MDF in the preinstallation preparation phase according to the instructions in “Cabling lines and trunks” in *Meridian 1 system installation procedures* (553-3001-210):

- 1 Remove the locking bar from connectors designated J1 through J10.
- 2 Install the 50-pin connector terminating the MDF cable marked J1 and plug it into the connector at the bottom of the cabinet also designated J1.
- 3 Repeat step 2 for the remaining MDF cables from J2 through J10 for card slot 1 through 9.
- 4 If the expansion cabinet is also installed, identify the 50-pin connectors terminating the MDF cable designated J11 through J16 and plug them into their respective connectors at the bottom of the cabinet also designated J11 through J16 for card slots 10 through 15.
- 5 Replace the locking bar(s) in the cabinet(s) over the cable connectors.

### **Auxiliary alarm connections**

To connect the auxiliary or external alarm indicators to the NT7R60AA Carrier/Alarm Panel assembly connector, use the NT7R86AA Auxiliary Alarm Cable assembly:

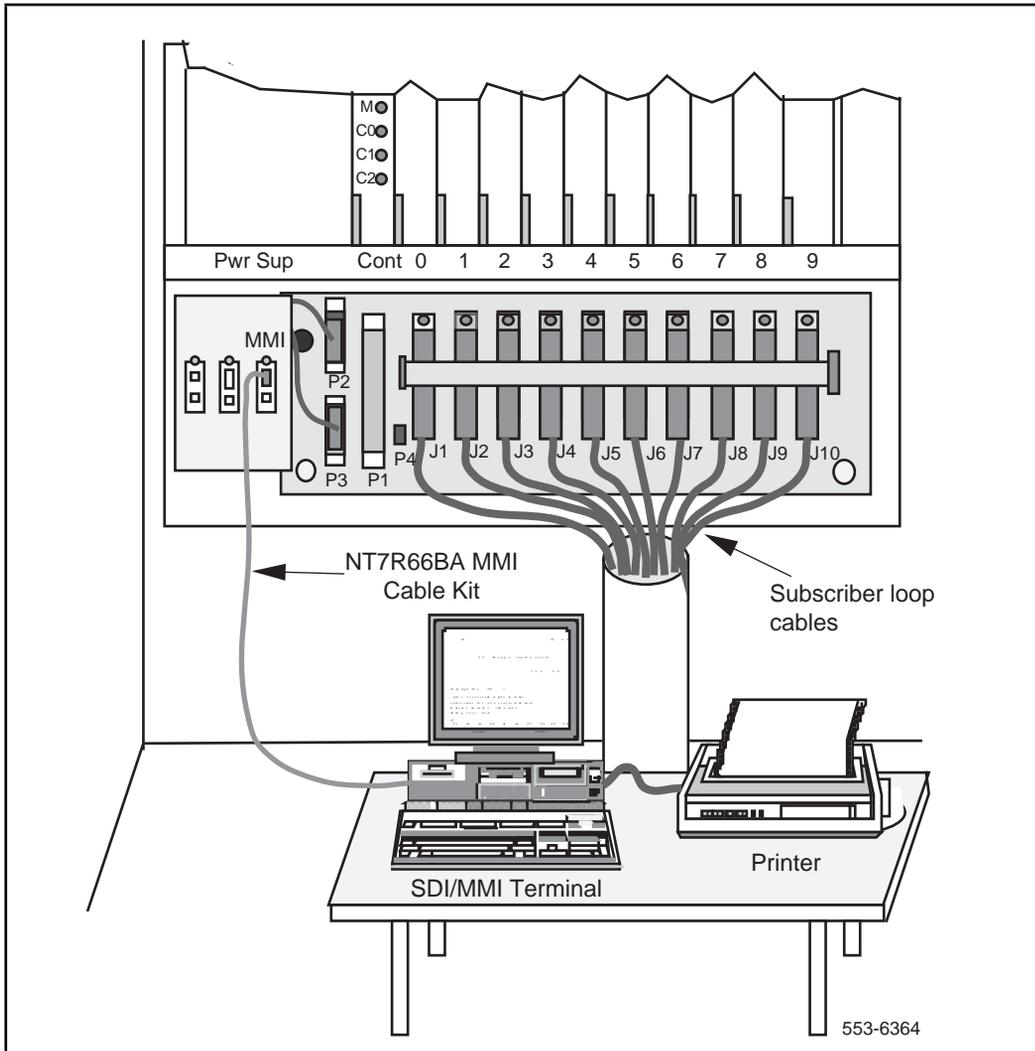
- 1 Plug the NT7R86AA Auxiliary Alarm Cable assembly DB-15HD male cable connector into the DB-15HD female connector on the NT7R60AA Carrier/Alarm Panel assembly. The DB-15HD connector pin assignment is shown in Appendix C, [Table 29](#).
- 2 Connect the other end of the NT7R86AA Auxiliary Alarm Cable assembly bare wires to the external alarm device terminals.

The customer auxiliary (external) alarms 1 and 2 are input only alarms that produce CRI33n1 and CRIn2 alarm messages when activated. These should be connected across open relay contacts. No external voltage should be present across the contacts.

The customer auxiliary alarm feature can be used for any premise alarm application where an alarm condition activates a relay contact closure.

Figure 20 shows the subscriber loop (tip and ring) connectors that link line cards to the MDF and the terminal connection. It also shows the MMI terminal connection to the NT7R61AA Maintenance Panel DB-9 connector.

Figure 20  
TTY and subscriber loop cable connections



## Connecting the attendant to the Carrier Remote IPE cabinet

The Carrier Remote IPE cabinet backplane contains P4, a 2-pin power connector which provides a +15 V and –15 V power source for the attendant console.

To make this connection:

- 1 Connect the attendant console power cord to P4 connector ( $\pm 15$  V power pins) on the Carrier Remote IPE 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 the PFTU to the Carrier Remote IPE cabinet

In the Carrier Remote IPE cabinet option, the Power Fail Transfer Unit (PFTU) is connected as shown in [Figure 21](#).

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 NT7R86AA cable between the PFTU and the NT7R60AA Carrier/Alarm Panel assembly connector DB-15 female (Alarm) connector on the Carrier Remote IPE cabinet. For more information on how to install the PFTU, refer to *Meridian 1 system installation procedures* (553-3001-210).



## Configuring the Carrier Remote IPE

The configuration and administration of the Carrier Remote IPE and the corresponding carrier equipment at the Meridian 1 local site are identical to the standard Meridian 1 configuration and administration and do not require special considerations.

However, there are some initial setup functions that must be considered at the local and the remote sites. These functions are administered over a man machine interface (MMI) port connected to a terminal or a TTY at the local and the remote site.

When configuring Carrier Remote IPE functions at the local and the remote sites you can configure:

- Local and Remote Carrier Interface cards using Configuration Record programs LD 17 and LD 97
- Carrier parameters using the MMI commands

### Configuring the carrier interface cards

When the Carrier Remote IPE equipment is first installed, you must define the Local Carrier Interface and Remote Carrier Interface cards as standard NT8D04 Superloop Network and NT8D01 Peripheral Controller cards.

To do this you must:

- print the current system configuration record to identify possible available superloops
- remove an existing superloop data block if it already exists for a non-carrier superloop

**Note:** To remove superloop data blocks, remove all terminal numbers (TNs) associated with the peripheral controller, disable the superloop, and remove the data block associated with the peripheral controller. You can also move data blocks of one superloop to a different superloop number using Move Data Blocks Program LD 25.

- configure a superloop data block to correspond to the Local Carrier Interface card
- configure a peripheral controller data block to correspond to the Remote Carrier Interface card

Before you can define a carrier superloop, you must find available superloops in the system. To do this, logon and print system configuration data using Print Program LD 22. If you don't know how to logon refer to [“Logging in on the maintenance terminal” on page 178.](#)

**Request CFN printout**

Prompt	Response	Comment
REQ	PRT	Print request
TYPE	CEQU PKG, PSWV	Configuration data

**CFN configuration data print format- find unused superloop**

CEQU		
MPED	SD/DD/4D/8D	Prints maximum peripheral density for the system (use 8D for systems with IPE)
TERM	xxx xxx xxx...	Prints all terminal loops
REMO	xxx xxx xxx...	Prints remote EPE loop numbers configured in LD 17
SUPL	xxx xxx xxx...	Lists all local Superloop Network card superloop numbers
SUPC	xxx xxx xxx	Lists all carrier remote superloops when REM_IPE 286 software package is installed
PKG		
REM_IPE	286	Software package for Carrier Remote IPE
PSWV		
XPEC:	XX	Software version number
LCRI:	XX	Software version number downloaded to Local Carrier Interface cards. A forced PSDL is initiated upon execution of the ENLL and ENXP commands (Note).

**Note:** Parameter Software Download (PSDL) ensures that the latest loadware is downloaded into the Local and Remote Carrier Interface cards. PSDL is initiated upon:

Initialization (INIT).

ENXP after power reset or the Local or Remote Interface card.

ENXP of the Remote Carrier Interface card by adding peripheral software version parameter after the Peripheral Controller ID.

ENLL of the Local Carrier Interface card by adding the PSW version parameter after the SUPC number.

To change the system configuration record and to configure the Remote Carrier Interface at the Carrier Remote IPE column or cabinet site, load Configuration Record Program LD 17 and Configuration Record Program LD 97.

**To change the system configuration record (LD 17)**

Prompt	Response	Comment
REQ	CHG	Change the configuration record
TYPE	CFN	Configuration record
CEQU	YES	Change equipment
MPED	8D	Peripheral density

**To configure the Remote Carrier IPE site (LD 97)**

REQ	CHG	Remote Carrier Interface definition
TYPE	XPE	Remote Peripheral Controller (RCI) ID
SUPL	0-156	Prints superloop type and number
XPEC	2	Controller ID number.
LOC	SCLARA	remote site location example. Use any six alphanumeric characters to identify the remote site.
RGTP	(8)/16	Number of concurrent ringers. Change to 16 unless ringing generator is an older type.

After you have you have defined the new Peripheral Controller (RCI) define the superloop for the Local Carrier Interface card.

**To define a carrier superloop**

Prompt	Response	Comment
REQ	CHG	Adding a new Local Carrier Interface card
TYPE	SUPL	Adding a superloop for the Local Carrier Interface card.
SUPL	0–156	Superloop number
SLOT	(L)/R	Superloop card side for the Local Carrier Interface card, where L (left) is default position.
SUPT	CARR	Carrier superloop type. Prompted when REM_IPE 286 software package is installed.
XPEC	1–95	Remote Carrier Interface card (Controller ID number) previously equipped. Defaults to shelf 0 segment 0-3 for SUPT = CARR

To configure the Carrier Remote IPE superloop and the Carrier Remote IPE column or cabinet site, load Configuration Record Program LD 17 and Configuration Record Program LD 97.

**Configuring the SDI port for the Local Carrier Interface card connection (LD 17)**

REQ	CHG	Change the SDI record
TYPE	CFN	Configuration record
IOTB	YES	
HIST		I/O terminal history file buffer length
ADAN	NEW/TTY 0–15	Add, change, or remove an I/O device, type aaa, or port x
USER	BUG, MTC, SCH	Enter one of the output message types that will be the message of this port
XSM	(NO)	SDI port for the system monitor

To enable the superloop for the Local Carrier Interface card and the Remote Carrier Interface card, load Maintenance and Diagnostic Program LD 32 and execute the **ENLL x** command.

**To enable the carrier superloop x**

<b>Command</b>	<b>Response</b>	<b>Comment</b>
ENLL x	ok & prompt	Enables specified superloop x

To remove the configuration of the Remote IPE superloop, load Maintenance and Diagnostic Program LD 32 and execute the **DISL x** command to disable the superloop, and then load Configuration Record Program LD 97 to delete the configuration records of the superloop for the Local Carrier Interface card and the Remote Carrier Interface card.

**To delete the configuration record for the carrier superloop**

<b>Prompt</b>	<b>Response</b>	<b>Comment</b>
REQ	CHG	Deleting the Local Carrier Interface card configuration record
TYPE	SUPL	Carrier superloop
SUPL	X8	Remove record for superloop number 8

**To delete the configuration record for the Carrier Remote IPE module (shelf)**

REQ	CHG	Change configuration record
TYPE	XPE	Remote Carrier IPE
XPEC	X2	Delete configuration record for peripheral controller 2, i.e., the Remote Carrier Interface card

To check the carrier status, loading the LD 32 and executing the **STAT <SUPC>**, where <SUPC> is the Local Carrier Interface superloop number. For additional examples of carrier status, refer to the Maintenance section, Procedure 7 “Checking the carrier performance status” on page 199.

**LD 32**

**NPR000**

**STAT sl**

<b>CARR</b>	<b>CALS</b>	<b>TTSA</b>	<b>NND</b>	<b>SPARED</b>
0	0	21/21	NO	NOT SPARED
1	0	21/21	NO	NOT SPARED
2	0	N/A	N/A	AVAIL

Parameter description:

CARR—Carriers 0, 1, and 2 (carrier 0 has priority over carrier 1 when sparing carrier links)

CALS—Carrier Alarm Status (0 indicates Alarm Level 0 indicates no alarm)

TTSA—Timeslots currently available for voice and data (n/21 for T1 and n/27 for E1)

NND—Indicates if No New Data is disallowed (NO = not disallowed)

SPARED Indicates if a carrier is spared (in the example none are spared) and N/A indicates that carrier 2 is primary not spare

**Configuring the remote MMI terminal port**

The MMI port can be configured in the SDI or the MMI mode. When the MMI terminal is in the SDI mode, you can perform system administration tasks from the local or the remote site. When the MMI terminal is in the MMI mode you can:

- perform carrier functions such as display status, logs, performance information, history, and messages
- enable or disable alarms
- clear errors and logs
- set performance parameters
- specify tests

**MMI mode**

In the MMI mode, a terminal or TTY is connected to the local MMI port at the Local Carrier Interface card and another terminal or TTY is connected to the MMI port at the Carrier Remote IPE as described in *Installing SDI and TTY cables* in this chapter. Each terminal controls the local MMI functions of the card it is connected to and some display functions at the distant site.

The default MMI interface characteristics are set in the Local and Remote Carrier Interface card EEPROM as follows:

- Speed: 2400 bps (speed is an exception, it is selected using DIP SW1 position 1 where OFF = 2400 bps and ON = 1200 bps)
- Character width: 7
- Parity bit: mark
- Stop bit: 1

The MMI mode is accessed from the initial (INIT) mode by entering **L** on the MMI terminal or TTY to log in. For multiple Local Carrier Interface cards connected in a daisy-chain, to log in to the specified Local Carrier Interface card, enter **L <sl>**, where **sl** is the address and the superloop number of the specified superloop, as shown in [Figure 22](#) and [Table 11, “NT7R51 Local Carrier Interface card maintenance daisy-chain address.” on page 70](#).

Password is **MILINK**

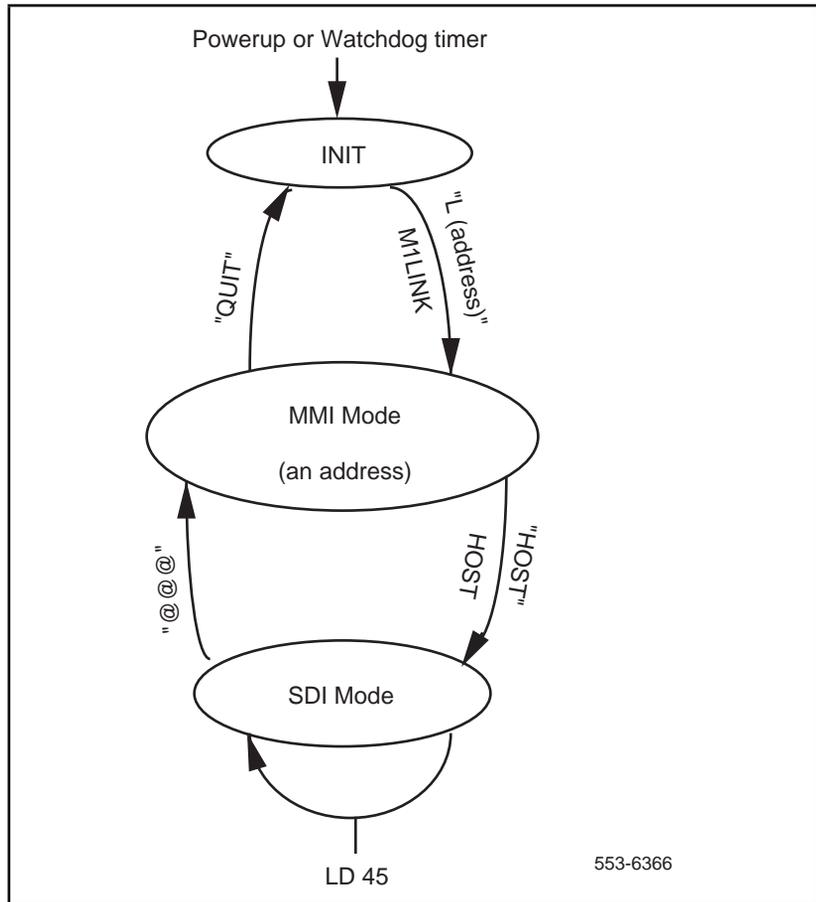
The MMI command line prompt in the initial mode is: **CRI>**, but after logging in, the prompt changes to: **CRI::>**

The prompt in a Maint/SDI daisy-chain configuration is **CRI: nnn>**, where **nnn** is the address of the LCI in the chain.

To exit the MMI mode and return to the INIT mode, enter **Q** at the terminal or TTY.

Figure 22 shows modes that a terminal or a TTY can be in and paths taken to transition from one mode to the next. The three modes are Initial, MMI, and SDI. The words in quotation marks shown along the paths must be entered on the terminal to go from one mode to the next.

**Figure 22**  
**TTY or terminal modes at the local and the remote sites**



## Host SDI mode

In the Host SDI mode, a terminal is connected to the MMI port at the Carrier Remote IPE. This terminal becomes the Meridian 1 maintenance and service change TTY. At the Meridian 1 site the Local Carrier Interface card connects to the MMI port and to an SDI port of an SDI card.

For the MMI port at the Remote Carrier Interface card to be able to communicate over the SDI port connected to the Local Carrier Interface card, the interface characteristics must be the same:

- Speed: 2400 bps or 1200 bps (Set by SW1 position 1)
- Character width: 7 bits
- Parity bit: mark
- Stop bit: 1

In this mode, the remote TTY or terminal becomes a Meridian 1 system TTY that can access overlays and perform system configuration, maintenance, and diagnostics, which are the same functions performed by the local Meridian 1 system TTY.

To log into the host for SDI operation, you should first log in using the MMI terminal in the MMI mode, then you should log into the terminal as host:

<b>CRI&gt;L</b>	Login command
<b>CRI::&gt;</b>	Prompt after logging in
Enter Password > <b>M1LINK</b>	Type in the password.
<b>CRI::&gt; HO</b>	To access the Host SDI mode
Enter Password > <b>HOST</b>	Enter the password <b>HOST</b>

The Host SDI mode is accessed from the MMI mode by entering **HOST** at the terminal or TTY. In this mode you can configure and maintain the entire Meridian 1 system. [Figure 22](#) shows that, for example, LD 45 can be activated to perform loopback testing.

To exit this mode, enter @@@

## Configuring the carriers

To configure the Carrier Remote IPE using the MMI terminal, you must logon, enter the password, and use appropriate MMI commands.

*Note:* The commands are not case sensitive (you can use upper or lower case letters). The exception is the password, which must always be entered in upper case.

### **Default factory carrier configuration**

Carrier 0 equipped  
Carrier 1 equipped  
Carrier 2 equipped (not a spare)  
Alarms enabled (automatic clearing of Carrier Alarm Indication)

Before you start configuring the Carrier Remote IPE, you should check the current (default) configuration and determine whether the communication is established with the distant end. The S A and the S C commands affect the distant end automatically only when the distant end is communicating.

To display the configuration parameters, execute the **D C** command on the MMI terminal. This is an example of what the MMI terminal may display:

#### **CRI::> D C**

```
CRI Remote IPE S/N L1105-A4 Software Version 1.00 8/17/95 10:48
Local Site
Alarm Enabled: YES Self Clearing Enabled: YES
Sparing Enabled/Disabled: Enabled
All Link Maps Normal
Alarm Level 1 Threshold Value E-6 Threshold Duration (in seconds) 1
Alarm Level 2 Threshold Value E-5 Threshold Duration (in seconds) 1
Alarm Level 3 Threshold Value E-4 Threshold Duration (in seconds) 1
Frame Slip Alarm Level Threshold 100 Threshold Duration (in hours) 2
Current DIP Switch S1 Settings (s1-s8) OFF OFF ON ON OFF ON ON
OFF
Current DIP Switch S11 Settings (s1-s8) OFF OFF OFF ON ON OFF OFF
OFF
```

Unless you have a particular reason to change the default parameters, you should leave them unchanged.

Execute the **D C D** command for the distant site and compare the configuration settings at the local and the remote sites. If you are able to obtain the distant configuration report and they are both configured correctly, the MicroLink is up and the communication is established.

To also verify that the communication is established, display the status at each end of the carrier by executing the **D S** and **D S D** commands on the MMI terminal. If MicroLink is up (carrier is good end-to-end), the communication across the link is established.

**To display local carrier status:**

<b>CRI:: &gt; D S</b>	Display carrier status
CRI Remote IPE S/W L1105-A4 Software Version 1.00 8/11/95 10:45	
Local Site	Status at the local site
In Alarm Status: NO	No alarms detected
All Link Maps Normal	No link has been spared
Link 0 Alarm Level 0	Carrier 0 status
Link 1 Alarm Level 0	Carrier 1 status
Link 2 Alarm Level 0	Carrier 2 status

**To display remote carrier status:**

<b>CRI::&gt; D S D</b>	Display distant carrier status
Distant End Ready	Distant end acknowledged
D S	Command received
CRI Remote IPE S/W R1105-B6 Software Version 1.00 8/11/95 10:45	
Remote Site	Status at the remote site
In Alarm Status: NO	No alarms detected
All Link Maps Normal	No link has been spared
Link 0 Alarm Level 0	Carrier 0 status
Link 1 Alarm Level 0	Carrier 1 status
Link 2 Alarm Level 0	Carrier 2 status

[Table 15](#) lists MMI commands used to display and configure carrier parameters such as setting alarm thresholds, setting time and date, configuring carrier links, connecting to the SDI port, and testing the carriers and interfaces to the carrier link.

**Table 15**  
**MMI commands used in setting the carrier parameters**

Command	Description
D C	Display configuration. Displays current configuration of the Local and Remote Carrier Interface cards.
D C D	Display configuration distant. Displays current configuration of distant Local and Remote Carrier Interface cards.
D S	Display status. Displays near-end carrier status.
D S D	Display status distant. Displays far-end carrier status.
L	Log into the MMI terminal when the system has one Local Carrier Interface card. The password is M1LINK.
L sl	Log into a specific superloop when the system has more than one Local Carrier Interface card daisy-chained in the network module. Refer to <a href="#">Figure 22</a> to see the path L (address). The password is M1LINK.
S A	Set carrier alarm threshold and duration parameters
S T	Set time or verify current time
S D	Set date or verify current date
S C	Set configuration
S N	Set site name and superloop
HOST or HO	Terminal in Host SDI mode. The password is HOST.
@ @ @	Terminates the Host SDI connection
T	Specifies a test from 1 to 5 to be run on the equipment
Q	Logs the terminal user out

**To configure the carriers and specify carrier 2 as a spare carrier:**

<b>CRI &gt; L</b>	To login to the MMI terminal
Enter Password > M1LINK	Password is <b>M1LINK</b>
CRI:: >	Prompt requesting an MMI command
<b>CRI::&gt; S C</b>	To set carrier parameters
Equipped carrier 0 (Yes or No) Y	Enable carrier 0. Enter Y to enable or N to disable.
Equipped carrier 1 (Yes or No) Y	Enable carrier 1.
Equipped carrier 2 (Yes or No) Y	To enable carrier 2
Enable #2 for Spare (Yes or No) Y	Defines carrier 2 as spare
Enable self clearing Alarms (Yes or No) Y	To enable/disable alarm clearing

**To configure the carrier alarm thresholds.** Defaults threshold values are set in the factory and should not be changed unless there is a good reason for doing so:

CRI:: >	Prompt requesting an MMI command
<b>CRI::&gt; S A</b>	To set carrier alarm parameters
Alarm 1 Threshold: Current value E-6 New value E-6 Threshold Duration (in seconds) Min –1 Max – 3600 Current value 1	
Alarm 2 Threshold: Current value E-5 New value E-5 Threshold Duration (in seconds) Min – 1 Max – 2148 Current value 1	
Alarm 3 Threshold: Current value E-4 New value E-4 Threshold Duration (in seconds) Min – 1 Max – 218 Current value 1	
Frame Slip Threshold (Min – 1 Max – 255) Current Value 255	
Frame Slip Threshold Duration (in Hours) Min – 1 Max – 24 Current Value 1	

**Note:** Threshold Duration parameter for BER thresholds should not be longer than 10 seconds to allow fast recovery of a faulty carrier when the bit error rate improves. For example, if the duration is set to one hour, a faulty carrier that starts operating correctly will wait one 1 hour before the alarm condition is cleared and the carrier becomes available for traffic again.

Parameter values explanation:

**Alarm 0**—No alarm, the carrier is operating without bit errors and without excessive out of frame. If carrier was previously spared it is automatically unspared.

**Alarm 1**—The alarm indicates a low bit error rate (BER maintenance threshold). The transmission continues without trying to spare this link. Carrier maintenance should be scheduled. The alarm LED comes ON.

**Alarm 2**—Bit error rate is high and the carrier is automatically spared if the spare carrier is available (BER No New Data Calls). Otherwise, the carrier continues to operate normally for voice calls but no new data calls are allowed on this carrier.

**Alarm 3**—Very high bit error rate (OOS: BER, LOF, LOS, Blue Alarm, Excessive Frame Slip). If the spare carrier is available, this faulty carrier will be spared. Otherwise, the carrier is placed out of service and all calls on this carrier are disconnected.

**Alarm Threshold**—Number of bipolar violation. E-6 represents  $10^{-6}$  or 1 error in 1 million bits, E-5 represents  $10^{-5}$  or 1 error in 100,000 bits, and E-4 represents  $10^{-4}$  or 1 error in 10,000 bits.

**Threshold duration**— Carrier signal monitoring duration (1 second to 3600 seconds) to detect bipolar violation errors. The error counter is updated every second for the length of the threshold duration.

**Frame Slip Threshold**—Number of controlled carrier frame slips allowed in a given time duration. Preferred threshold is 255.

**Frame Slip Threshold duration**—Carrier frame synchronization monitoring duration (1 hour to 24 hours) to detect the number of frame slips specified by the Frame Slip Threshold. Preferred duration is 1 hour.

The fewer the bipolar violations and/or frame slips, the better the carrier link performance. Based on the frequency of errors and frame slips, the specified thresholds determine the occurrence of Alarm 1, Alarm 2, and Alarm 3.

**Alarm Disable command** If the Maintenance LED comes ON and stays ON, a possible cause may be that the Alarm Disable (A D) command has been executed, which causes this condition.

**To configure time and date:**

CRI:: >	Prompt requesting an MMI command
<b>CRI::&gt; S T</b>	To set time
Current Time 10:06:14 10:15:25	Enter correct time at the cursor, if required.
Current Time 10:15:25	
<b>CRI::&gt; S D</b>	To set date
Current Date 8/10/95 18/11/95	Enter correct date at the cursor, if required.
Current Date 8/11/95	
<b>CRI::&gt; S N</b>	Set site name
Change Site Name (Yes or No) Y	Change name or add name if not previously entered.
Enter Site Name SFO	

**Note:** Time and date should be set correctly to allow correlation of the Carrier Remote Interface Alarm Log with error messages in the Meridian 1 History File.

**Verifying carrier link connections at the remote site**

When all the carriers are connected and equipped, all carrier alarm LEDs may be turned OFF and the signaling across the link will work even though there may be a mismatch in carrier link connection between the local and remote ends. However, the voice and data connections may not work due to the scrambling of the time slots, which are assigned to specific carriers and cannot be used by other carriers. However, Carrier Test 1 may not show any errors under these conditions.

**Note:** All carriers will show Out of Frame alarm if the Local Carrier Interface card faceplate ENB/DIS switch is set to DIS. Carrier clocking is enabled when the switch is set to ENB. Carrier alarms may clear even while the Local Carrier Interface card is not software enabled when the switch is set to ENB.

All equipped carriers have been previously connected and configured at the local site and the carrier circuit ID recorded for each link 0-2. All carrier facilities (carrier links) should have been installed and tested by the carrier network provider up to the demarcation point at both ends.

To insure that all equipped carrier links are connected to their corresponding I/O panel connectors at the remote site, you must identify, test, and tag each carrier link individually as follows:

- 1** Configure all equipped carrier links by executing the **S C** (Set Configuration) command. Any unused carrier links must be configured as “unequipped” to prevent the carrier alarm LED from being constantly ON. Configure carrier #2 as spare or primary (not spare). Default parameters should not be changed unless you have a good reason for changing them.  
Execute the **D C** (Display Configuration) command to verify the configuration.
- 2** Identify the circuit ID for carrier #0 at the carrier network demarcation point and connect the corresponding patch cable to the I/O panel connector (8-pin modular jack) for carrier #0.
- 3** Observe the carrier alarm LEDs on the faceplate of the Remote Carrier Interface card. Initially carrier alarm LEDs for all equipped carrier links should be ON due to Loss-of-Signal. The LED for carrier #0 should be turned OFF approximately 10 seconds after the patch cable for the selected carrier #0 is plugged into the Remote Carrier Interface card I/O panel connector for carrier #0.  
If a good quality signal is received by both the Remote Carrier Interface card and the Local Carrier Interface card on carrier #0, the link is installed in the appropriate I/O panel connectors at both ends. If the connection is mismatched (carrier #0 at one end connects to carrier #1 or #2 connectors at the other end), the alarm LED will remain ON. The LED also remains ON if there is a carrier alarm on the Remote Carrier Interface card (near end), however, the LED is turned OFF if there is no carrier alarm on the Remote Carrier Interface card (near end) and communication cannot be established across the link due to alarm on the Local Carrier Interface card (distant end).  
Distant end carrier alarms cause the near end LED to turn ON only if the Remote Carrier Interface card and Local Carrier Interface card can communicate.

- 4 Test the carrier 0 link by executing the carrier status commands (**D S**-display carrier status and **D S D**-display carrier status distant) using the MMI terminal. Compare the carrier status on both the Remote Carrier Interface card (near end) and the Local Carrier Interface card (far end). Refer to “Configuring the carriers” on page 141 to see the displays of these two MMI commands. There are four possible conditions:
  - If the LED for carrier #0 is OFF and the Remote Carrier Interface card and Local Carrier Interface card have established signaling communication, both ends will show “No Alarm” for carrier #0 and “Loss of Signal” for carrier #1 and carrier #2. No mismatch.
  - If the LED for carrier #0 stays ON due to a mismatch, the Local Carrier Interface card (far end) will show “Loss of Signal” for carrier #0 and “No Alarm” for carrier #1 and carrier #2.
  - If the LED for carrier #0 stays ON due to a carrier alarm condition on the Remote Carrier Interface card (near end), the **D S** command will show the type of carrier alarm on carrier #0, and the **D S D** command cannot retrieve the far end status.
  - If the LED for carrier #0 Remote Carrier Interface card (near end) is OFF but the Remote Carrier Interface card and the Local Carrier Interface card cannot establish communication due to a carrier alarm condition on the Local Carrier Interface card (far end), the **D S** command will show “No Alarm” on the carrier #0 on the Remote Carrier Interface card (near end), and the **D S D** command cannot retrieve the far end status.
- 5 Disconnect the patch cable from the I/O panel connector for the carrier #0 that was just tested and repeat steps 1 through 5 for carrier #1 and carrier #2 as equipped before proceeding to step 6.
- 6 Any carrier faults must be isolated and corrected. In case of mismatched carriers, the patch cables must be traced to the demarcation point at each end, and the carrier circuit IDs verified at both ends to determine which end of the carrier has been miswired or incorrectly identified.
- 7 After all carriers have been identified and labeled at the I/O panel connectors, they should all be plugged into the proper I/O panel connectors for the Remote Carrier Interface card and tested individually using the MMI Carrier Test 3 (Remote Loopback). Refer to Procedure 9 “Testing the carriers” on page 201.

The carrier links are now connected correctly. This will be further established during acceptance testing when the actual calls are made to verify the voice and data transmission across the carrier links.

### **Display current carrier equipment configuration**

Before you conclude the installation and configuration of the Carrier Remote IPE, re-verify the configuration parameters and make sure that they are set properly.

To display the configuration parameters, execute the **D C** command on the MMI terminal. This is an example of what the MMI terminal may display:

**CRI::> D C**

CRI Remote IPE S/N L1105-A4 Software Version 1.00 8/17/95 10:48

Local Site (*Note*)

Alarm Enabled: YES Self Clearing Enabled: YES

Sparing Enabled/Disabled: Enabled

All Link Maps Normal

Alarm Level 1 Threshold Value E-6 Threshold Duration (in seconds) 1

Alarm Level 2 Threshold Value E-5 Threshold Duration (in seconds) 1

Alarm Level 3 Threshold Value E-4 Threshold Duration (in seconds) 1

Frame Slip Alarm Level Threshold 100 Threshold Duration (in hours) 2

Current DIP Switch S1 Settings (s1-s8) OFF OFF ON ON OFF ON ON  
OFF

Current DIP Switch S11 Settings (s1-s8) OFF OFF OFF ON ON OFF OFF  
OFF

*Note:* When the **D C** command is executed for the Carrier Remote IPE cabinet at the remote site, it displays “XSM Emulation Active”.

Parameter values explanation:

**Alarm Enabled**—Alarm monitoring and logging is enabled. CRI messages are enabled.

**Self Clearing Enabled**—The alarm indicators (LED and external contact closure) will automatically clear when the operational alarm level is cleared.

**Sparing Enabled/Disabled**—Carrier 2 is enabled or disabled as a spare carrier.

**All Link Maps are Normal**—No link has been spared. This is always the case when carrier 2 is configured as a primary carrier link.

**Alarm Threshold**—Number of bipolar violations. E-6 represents  $10^{-6}$  or 1 error in 1 million bits, E-5 represents  $10^{-5}$  or 1 error in 100,000 bits, and E-4 represents  $10^{-4}$  or 1 error in 10,000 bits.

**Threshold duration**—Carrier signal monitoring duration (1 second to 3600 seconds) to detect bit error rate (CRC and BIPV) exceeding threshold. The error counter is updated every second for the length of the threshold duration.

**Frame Slip Threshold**—Number of carrier frame slips allowed in a given time duration.

**Frame Slip Threshold Duration**—Carrier frame synchronization monitoring duration (1 hour to 24 hours) to detect the number of frame slips specified by the Frame Slip Threshold.

**Current DIP Switch S1 and S11 Settings**—Shows the setting of switch positions 1 through 8 for both SW1 and SW11 of the Local Carrier Interface card if you are displaying the local site or SW1 and SW11 of the Remote Carrier Interface card if you are displaying the remote site.

---

# Carrier Remote IPE acceptance testing

---

This section describes Carrier Remote IPE functional testing to verify that functions and features associated with the Carrier Remote IPE are operating correctly.

## Overview

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

- a previously installed system is upgraded with Carrier Remote IPE equipment and generic software X11 release 21 with REM\_IPE 286 carrier software or higher and operates correctly without Carrier Remote IPE equipment
- a newly installed system with Carrier Remote IPE equipment using generic software X11 release 21 with REM\_IPE 286 carrier software or higher appears to operate correctly

Acceptance testing verifies the operation of system functions and features at the remote site equipped with the Carrier Remote IPE.

Acceptance testing consists of:

- checking the system
- preparing the system for testing
- testing system functions at the Carrier Remote IPE site

## Checking the system

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

- Execute the **D S** and **D S D** commands to check carrier alarm levels for each carrier at both the local and remote site. If all alarm levels are 0 at both ends, carrier links are operating correctly.
- Check the card LED located at the top of the Local Carrier Interface card faceplate. If the card LED on the Local Carrier Interface card is off, the card is operating correctly. If the card LED is on, the card is disabled or faulty. To enable the Local Carrier Interface card or to correct a problem, go to [“Carrier Remote IPE fault isolation and correction” on page 185](#).
- Check carrier LEDs on the Local Carrier Interface card faceplate. If all LEDs are off, carriers are operating correctly. If one or more carrier LEDs are on, one or more carriers are faulty. If the amber LED is on, the card is in the maintenance state.
- Check the card LED located at the top of the Remote Carrier Interface card faceplate. If the card LED on the Remote Carrier Interface card is off, the card is enabled and operating correctly. If the card LED is on, the card is disabled or faulty. To enable the Remote Carrier Interface card or to correct a problem, go to [“Carrier Remote IPE fault isolation and correction” on page 185](#).
- Check carrier LEDs on the Remote Carrier Interface card faceplate. If all LEDs are off, carriers are operating correctly. If one or more carrier LEDs are on, one or more carriers are faulty. If the amber LED is on, the card is in the maintenance state.
- Check the hexadecimal display on the Remote Carrier Interface card. Refer to the Appendix A to identify hexadecimal codes displayed by the Remote Carrier Interface card during self-test.

If the display and all indicator LEDs on Carrier Remote IPE equipment indicate good operating condition, the equipment is functional and you can proceed with setting up the necessary equipment for acceptance testing.

## Setting up test conditions

To conduct acceptance testing, you must have a setup that can verify basic system functions and features initiated and terminated at the Carrier 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.

Configure carrier links with a spare link so that you can test the transfer of traffic from a primary link to the spare link.

To conduct the acceptance testing, make sure that each Carrier Remote IPE line card has at least one telephone connected to one of its subscriber loops. If possible, use some 2500 telephones to check the ringing generator and the DTMF operation. Also, make sure that a terminal is connected to the MMI port.

If you have Carrier Remote IPE main and expansion cabinets, install at least one line card in test card slots 0, 9, 10, and 15 of cabinets and connect at least one telephone to each line card subscriber loop.

## Performing acceptance testing

Since functions and features at the Carrier Remote IPE site are identical to functions and features at the local system site, the main purpose of acceptance testing is to verify that the carrier equipment and the carrier links are functioning correctly. This can be accomplished by:

- performing basic voice calls
- using the MMI terminal to configure and maintain Carrier Remote IPE equipment
- checking the protection switching of carrier links when configured with one spare carrier 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 Carrier 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 system site, place a call to a Carrier Remote IPE site by dialing a remote station directory number (extension number).

*Note:* The system treats Carrier Remote IPE subscriber loops as local loops, so you need to dial only the extension number to access that station.

To perform a call test:

- 1 From a terminal at the local system site, dial a terminal at the Carrier Remote IPE site and establish an active call connection.
- 2 Verify that voice transmission is established 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 some 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 Carrier Remote IPE main and expansion cabinets, establish calls from stations connected to the subscriber loops in the main and the expansion cabinets to verify the intercabinet cable connection.

To perform a call hold/call retrieve test:

- 1 From a terminal at the local system site, dial a terminal at the Carrier Remote IPE site and establish an active call connection.
- 2 Verify that voice transmission is established 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 that is supplied with the terminal.
- 4 Place an outgoing call from the terminal at the remote site by dialing an idle terminal located at the local system site.
- 5 Complete this outgoing call by first checking the voice clarity in both directions and then 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 can repeat this test for terminals connected to different subscriber loops on the same card and different subscriber loops on different line cards in the Carrier Remote IPE module or cabinet. By making these calls you generate traffic, which will be shown in the traffic report.

## Data calls

Use only one carrier link between the local and the remote sites. To verify that a call connection supports data calls and that when a carrier link is in Alarm Level 2 no new data calls will be allowed, follow the steps below:

- 1 From a computer or a data terminal at the remote site, access a terminal or computer at the local Meridian 1 site, or vice versa.
- 2 Transmit and receive data files in both directions. Open a transmitted file to verify its integrity.
- 3 Use the BERT set to insert bit errors into the carrier link transmitting data so it exceeds Alarm Level 2 threshold.
- 4 Since the sparing feature is not available, the carrier will continue to operate in Alarm Level 2 condition.
- 5 From a different data terminal attempt to establish a data call to a computer or terminal at the opposite side of the link.
- 6 The connection will not be established and the No New Data (NND) parameter on the display will show YES (yes no new data) for the carrier used, when you execute the **STAT** command in LD 32.
- 7 Remove the BERT set from the carrier link and retry the data call connection. Wait a few minutes or use the MMI command **CA** before retrying so that the carrier bit error monitor will determine that the cause of bit errors is no longer present. The data call will now be established because the bit error source has been removed and the Alarm Level is back to 0.
- 8 Verify the integrity of this data connection by checking the transmitted files.
- 9 Disconnect the data calls.

## Checking the MMI terminal operation

Connect an MMI terminal to the Local Carrier Interface card at the local site and another MMI terminal at the Carrier Remote IPE site.

- 1 Set the current mode of the MMI terminal to the MMI mode by executing the **L <address>** command on the MMI terminal at the local system site. The Password is: **MILINK**.
- 2 Check the status of the Local Carrier Interface card by executing the **D S [P]** command.
- 3 Check the status of the Remote Carrier Interface card by executing the **D S D [P]** command. This command is sent over the carrier link to the Remote Carrier Interface card for execution.
- 4 Check the log file content by executing the **D L [P]** command to display log messages from the file starting with the oldest message. Examine the messages.

## Checking carrier link protection switching

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

- forced carrier failure (disconnect carrier link at the I/O panel)
- forced switchover

**Note:** This test can be conducted only when carrier 2 is configured as a spare carrier link.

If both carrier 0 and carrier 1 are faulty, carrier 0 will always have sparring priority over carrier 1.

### Forced carrier failure switchover

To conduct this test:

- 1 Check the status of all three links by executing the **D S [P]** command from the MMI terminal. Make sure that the two primary and the spare links are functional without an alarm condition.
- 2 Establish a call from the Carrier Remote IPE to the local system site over carrier link 1. Refer to [“Voice calls” on page 156](#) to establish the call.
- 3 Manually disable carrier link 1 by unplugging the link at the I/O panel. The call will be transferred to carrier link 2 (spare).
- 4 The call should continue to be established.
- 5 Manually disable carrier link 0 by unplugging the carrier cable at the I/O panel.
- 6 The spare link 2 should release carrier link 1 and spare carrier link 0.

*Note:* Carrier 0 has sparing priority over carrier link 1, therefore, when carrier 0 was disabled, the spare carrier 2 terminated carrier 1 sparing and established sparing of carrier 0.

- 7 Verify that the call is no longer established over the spare link (link 2), since the call was established over carrier 1, which has been dropped and is no longer spared. Execute the **STAT** command in LD 32 to show the sparing status.
- 8 Reconnect carrier link 0. As soon as carrier link 0 recovers and becomes operational, the spare carrier 2 will automatically spare carrier 1.
- 9 Reestablish the call over carrier link 1, which is now spared over carrier link 2.
- 10 Check and make sure that the call is established.
- 11 Reconnect carrier link 1 and wait until carrier 1 has reestablished communication. The established calls should continue to be connected over the carrier link 1.
- 12 Disconnect the call by hanging up the receiver on the telephone.

## 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 reports to identify calls made during acceptance testing to and from the Carrier Remote IPE site.

The system traffic network loop report TFS001 provides statistics on the number of timeslots used by each loop and the traffic over these loops as measured in CCS (hundred call-seconds).

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

---

# Carrier Remote IPE maintenance

---

This section describes system maintenance tools and procedures to guide you in identifying Carrier Remote IPE faults, locating defective equipment, correcting problems by fixing or replacing defective equipment, and verifying the operation of Carrier Remote IPE after corrections or replacements have been made.

## Maintenance overview

Carrier 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 Carrier Remote IPE or during the addition of the Carrier Remote IPE to an existing system.

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

In either case, the problem identification should be approached systematically. A problem may have more than one cause. To isolate the cause, a knowledge of Carrier Remote IPE operation is required. This information can be found in the [“Carrier 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.

The system 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 Carrier Remote IPE equipment at the remote site and in the system. It requires that system non-Carrier Remote IPE functions operate correctly before you start diagnosing Carrier Remote IPE problems. The system installation and maintenance guide documents: *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 system. This chapter describes how to maintain the Carrier Remote IPE equipment as an integral part of the system.

## Diagnostic tools

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

### Hardware diagnostic tools

System 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 Carrier Remote IPE card when you insert it into 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 useful when you first install the cards because, upon insertion, the card automatically starts the self-test and gives you an immediate indication of its operating status.

### LED indicators

System 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.

**Carrier Remote IPE LED indicators.** Both the Local Carrier Interface card and the Remote Carrier Interface card have LED indicators on the front panel. These are:

**Card LED**—is a red LED that indicates the status of the card. If the LED is ON, the card may be faulty or disabled. When the card is powered up, it blinks three times during self-test if functioning correctly, otherwise it turns ON and stays ON. The LED turns OFF when the card is software enabled.

**Carrier LEDs**—each red carrier LED is OFF when the carrier is operating correctly or it is not equipped by the MMI command **S C** (Set Configuration). If the carrier is faulty at either end, the carrier LED will turn ON and stay ON until faults are corrected at both ends.

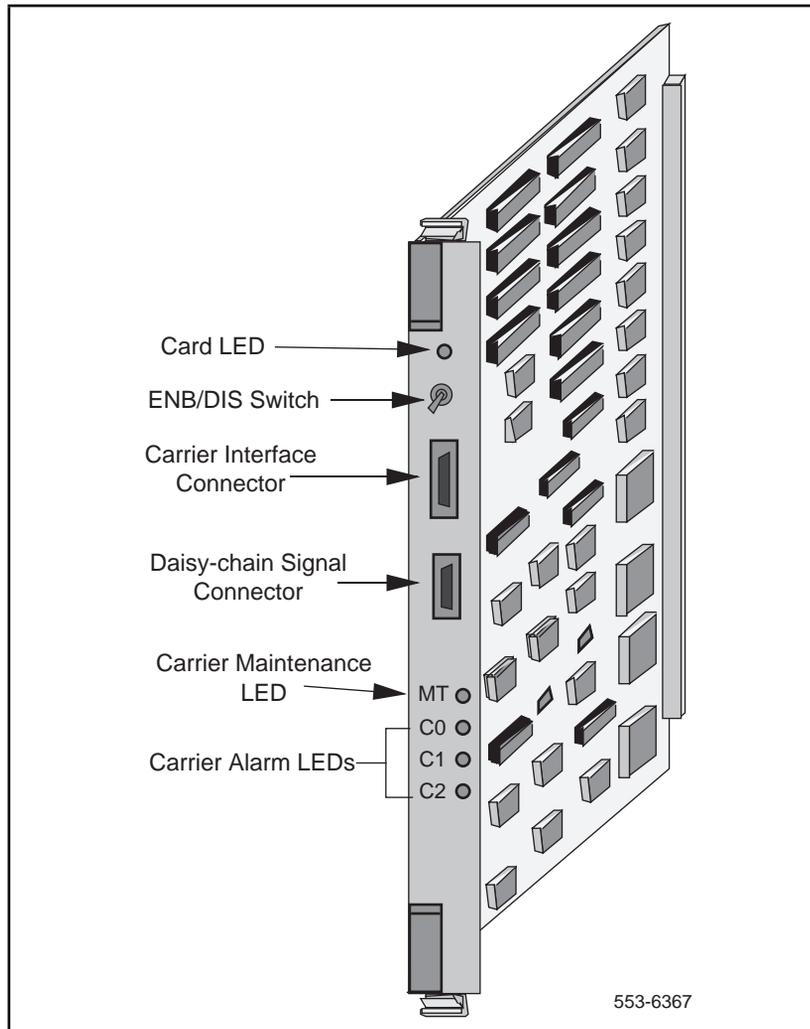
*Note:* Far-end alarms are communicated across the link if the MicroLink is up i. e. a carrier is good end-to-end in both directions.

**Maintenance LED**—is an amber LED that turns ON when the card is in the maintenance mode, i. e., when carrier tests are running by the MMI command over a carrier, or when alarms are disabled by the MMI command **A D**, or when certain option DIP switches are set incorrectly (SW1, pos 2 that selects the LCI or RCI card).

Carrier Remote IPE issues a local alarm (CRI1nnn) when a major alarm occurs at the local system site and a remote alarm (CRI2nnn) when a major alarm occurs at the Carrier Remote IPE site. In either case, the LED indicating the alarm turns red. These alarms are printed on the TTY or displayed on the maintenance terminal.

Figure 23 shows the Local Carrier Interface card. It also shows the card LED that indicates the status of the Local Carrier Interface card and each carrier link.

**Figure 23**  
**NT7R51 Local Carrier Interface card**



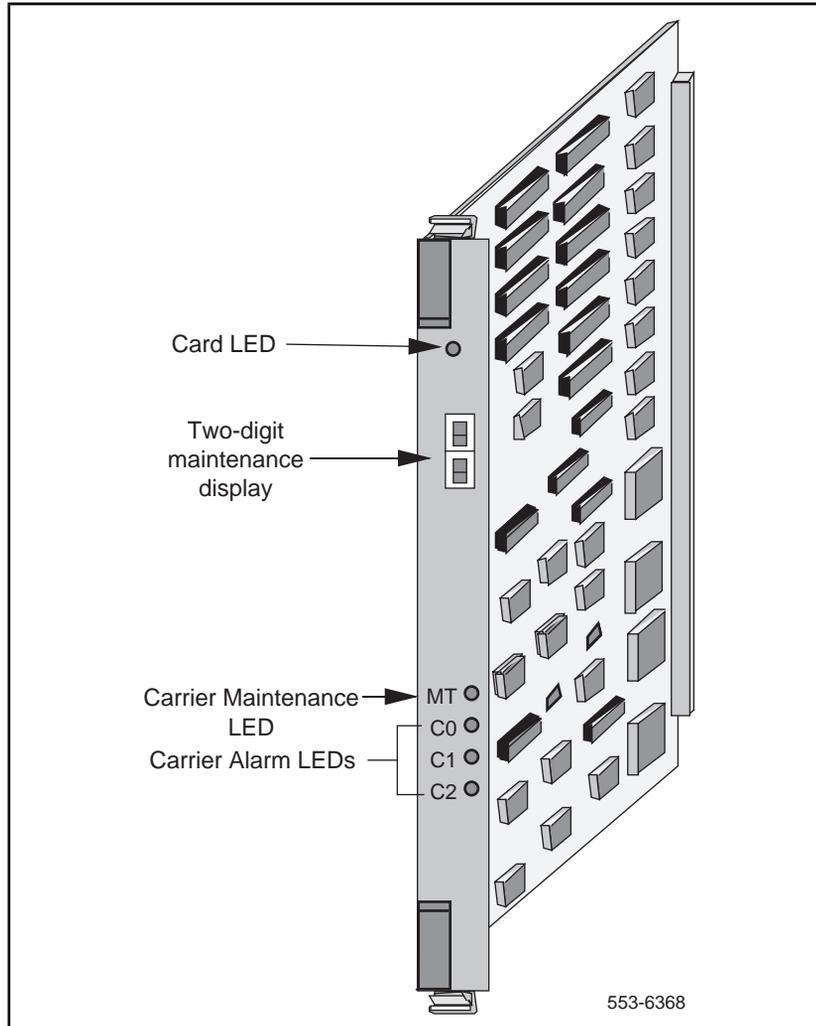
### Display codes

Some system cards, such as the Remote Carrier Interface card, are equipped with an alphanumeric display on the faceplate.

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 Remote Carrier Interface card are stored in memory and can be reviewed and then cleared by using Network and Signaling Diagnostic Program LD 30.

[Figure 24](#) shows two seven-segment displays on the faceplate of the Remote Carrier Interface 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: “System messages” on page 209 and in the *X11 input/output guide* (553-3001-400).

**Figure 24**  
**Remote Carrier Interface card**



### **Enable/disable switch**

Some system cards, such as the Local Carrier Interface card shown in [Figure 23](#), are equipped with an ENB/DIS switch. This ENB/DIS switch is located on the card's faceplate. It is used to disable the card before you remove it from an operating 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. This switch enables carrier clocking even if the Local Carrier Interface card is not software enabled.

### **System monitors and alarms**

System monitoring units continuously monitor the environmental and power status of the system and the individual system modules including the Carrier Remote IPE equipment.

The system monitor issues alarms when the:

- CPU fails or the system reloads
- main power source is lost
- power supply in the modules fails
- system temperature exceeds limits due to blower or fan failure

System alarms are categorized for alerting and maintenance action on the type and severity of faults reported by the system monitors and indicators. These alarms are divided into:

- major alarms, which indicate serious system 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

## Software diagnostic tools

System 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. Diagnostic tools are:

- resident diagnostic programs
- interactive nonresident diagnostic programs
- history file
- user reports

### Resident programs

System 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 the *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 (CRInnnn) listed in Appendix A: “System messages” on page 209 and reported to the terminal over the Meridian 1 maintenance TTY that indicate status and faults with Carrier Remote IPE equipment
- error messages listed under SCH and ERR that indicate hardware faults and under BUG that indicate software faults
- overload messages (OVDnnn) that indicate faulty peripheral cards listed under OVD
- error messages listed under PWR that indicate power faults detected by system monitors or Remote Carrier Interface cards at remote sites
- a 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 programs are:

- an overlay loader program that finds, loads, and executes all nonresident programs selected to run as midnight and background routines
- a system loader program that downloads the call processing programs and starts main memory checking when executing sysload
- a system initialization program that automatically starts after the system loader program completes the downloading process and outputs the initialization messages listed under INI in the *X11 input/output guide* (553-3001-400)
- a peripheral software download program that downloads loadware to the Local and Remote Carrier Interface cards

### **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 in 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 all the test results.

You can also manually select continuity tests that check continuity between the Local Carrier Interface card and the Remote Carrier Interface card, as well as other network and peripheral controller cards. You can specify these tests in Background Signaling and Switching Diagnostics LD 45 and Network and PE Diagnostic Program LD 32.

### **History file**

The system 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 present 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
- no ringing or no dial tone
- trouble with calls in specific Carrier Remote IPE modules
- trouble with specific terminals
- cannot transfer calls, etc.

**Local and Remote Carrier Interface cards system maintenance commands**

Local Carrier Interface card and Remote Carrier Interface card maintenance commands are identical to 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 16](#) lists carrier-related superloop maintenance commands provided by Network and PE Diagnostic LD 32. The full list of LD 32 commands is described in the *X11 input/output guide* (553-3001-400). Detailed output of maintenance commands is explained in various maintenance procedures in this chapter.

**Table 16**  
**System carrier superloop maintenance commands**

Command	Response	Description
DISL sl	Prompt	Disables a specific superloop
ENLL sl	OK and prompt	Enables a specific superloop
STAT sl	listing and prompt	Displays status for one or all network loops. Shows carrier alarm status, number of idle time slots per carrier, type of carrier (T1/E1), No-New-Data status, and sparing status
IDC sl		Displays the Local Carrier Interface card ID, the superloop number, and the corresponding Remote Carrier Interface card ID
	LCRI VERS=xxx FW IS SANE	Local Carrier Interface card xxx= loadware version
	aaaaaaaaaaaa	Content of the LCI card ID in the EEPROM.
	XPEC VERS=xxx FW IS SANE	Remote Carrier Interface card xxx= loadware version
	aaaaaaaaaaaa	Content of the RCI card ID in the EEPROM
XPEC	nn	Maps RCI (Peripheral Controller) to LCI (carrier superloop) and shows software status of the RCI (Peripheral Controller)
SUPL	nnn	Maps LCI (carrier superloop) to RCI (Peripheral Controller)

[Table 17](#) lists carrier-related test commands provided by Background Signaling and Switching Program LD 45. The full list of LD 45 commands is described in the *X11 input/output guide* (553-3001-400).

**Table 17**  
**System carrier test command in LD 45**

Command	Response	Description
TEST		Enter the test number of the test you wish to run XCON 1 to 10.
		SL (superloop) or CR (carrier) to specify the entire superloop or just a carrier remote loop.
	PATT	Pattern (0 to 7)
	TYPG	N or P, where N= Local Carrier Interface and P= Remote Carrier Interface, is the pattern generator.
	SLOT	If TYPE SL was selected, the SLOT_STD prompt is automatically displayed. The user can then use the preexisting timeslot mapping or carriage return. If TYPE SL was selected to be a carrier, the SLOT_CARR is displayed. The user can use timeslot mapping as follows: For E1 carrier configuration use Timeslots 5 to 31 for Carrier 0 Timeslots 37 to 63 for Carrier 1 Timeslots 69 to 95 for Carrier 2 For T1 carrier configuration use Timeslots 5 to 25 for Carrier 0 Timeslots 37 to 57 for Carrier 1 Timeslots 69 to 89 for Carrier 2
	TAG	Tag number from 0 to 15 is assigned by the system.

### Carrier Remote IPE MMI maintenance commands

The Local Carrier Interface card and Remote Carrier Interface card provide a man-machine interface (MMI) port to connect to a TTY or a configuration and maintenance terminal. Through this terminal you can directly issue commands to test and maintain system carrier equipment including the carrier links.

[Table 18](#) lists MMI commands that are directly issued to the system over MMI terminals, which are connected to the Local Carrier Interface card MMI port and the Remote Carrier Interface card MMI port. When entering MMI commands, separate the command letters with spaces (A space D) and [P] indicates a pause. Detailed output of maintenance commands is explained in various maintenance procedures in this chapter.

**Table 18**  
**MMI commands (Part 1 of 2)**

Command	Description
A D	Alarm disable. Disables all local and remote carrier alarms. Maint LED lit.
A E	Alarm enable. Enables all local and remote carrier alarms.
C A	Clear alarm. Clears all local and remote carrier alarms.
C A L	Clear alarm log. Clears near-end alarm log.
C A L D	Clear alarm log distant. Clears far-end alarm log.
C E	Clear error. Clears local and remote error counters for a all carriers.
C E D	Clear error distant. Clears a far-end error counter for all carriers.
D A L [P]	Display alarm log [pause]. Displays near-end alarm log with pause at full screen.
D A D [P]	Display alarm log distant [pause]. Displays far-end alarm log with pause at full screen.
D C	Display configuration. Displays current configuration of the Local and Remote Carrier Interface cards.
D H [P]	Display history [pause]. Displays near-end performance counters for a specified carrier for the last 24 hours with full screen pause.

**Table 18**  
**MMI commands (Part 2 of 2)**

Command	Description
D H D [P]	Display history distant [pause]. Displays far-end performance counters for a specified carrier for the last 24 hours with full screen pause.
D P	Display performance. Displays near-end performance counters for a specified carrier for the current hour.
D P D	Display performance distant. Displays far-end performance counters for a specified carrier for the current hour.
D S	Display status. Displays near-end carrier status.
D S D	Display status distant. Displays far-end carrier status.
HE or ?	Help. Displays the help screen.
HOST	Connect the SDI port. Connects to the SDI port and @@@ terminates the connection. The password is <b>HOST</b> .
L	Log in. Logs into the MMI terminal when the system has one Local Carrier Interface card. The password is <b>M1LINK</b> .  <i>Note:</i> If logged in and you type L and an incorrect password, it will log you out.
L sl	Log superloop. Logs into a specific superloop when the system has more than one Local Carrier Interface card daisy-chained in the network module. The password is <b>M1LINK</b> .
Q	Quit. Logs the terminal user out.
S A	Set alarms. Set carrier alarm threshold and duration parameters.
S C	Sets carrier configuration such as equipped/unequipped, automatic clearing of LED alarm indications, and carrier sparing.
S D	Set date. Set date or verify current date.
S T	Set time. Set time or verify current time.
@@@	Terminate the terminal connection.
T	Test. Specifies a test from 1 to 5 to be run on the specified carrier link.
T D	Test distant. A test from 1 through 5 conducted from the far-end.

## Using system maintenance programs

To use system maintenance programs, you must access the system 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. Cursor will be moving without showing characters 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 Meridian 1 and can access the program.

### Accessing the program

To access any program on the system, 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 **LD 32** 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 superloop #4 which is supported by a Local Carrier Interface card, at the prompt type the following:

```
.ENLL 4
```

This command will attempt to enable the Local Carrier Interface card supporting network superloop 4.

## 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 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 LD 11. This feature allows you to access diagnostic programs in the system and execute a limited set of maintenance commands to test system functions.

To enter commands on a maintenance telephone, you use its keypad. The numbers on the keypad represent numbers and letters that you normally use on a video display terminal keyboard.

[Table 19](#) shows the translation from a terminal keyboard to a telephone keypad.

**Table 19**  
**Keyboard to keypad 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 the system:

- 1 Press the prime DN key.
- 2 Place the telephone in the maintenance mode by entering **xxxx91** on the keypad, 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, the system 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, the system is idle and you can automatically access the system.

- 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, 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 network loop by executing **DISL loop**, where loop is the Local Carrier Interface card loop, say 3. To execute this command enter **3475#3##** on the keypad.
- 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 Carrier Remote IPE equipment. Based on whether Carrier 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.

### Type of faults

Problems can occur in the following areas:

- hardware
- configuration
- software

The type of faults that you have to isolate and correct depends on whether faults occur during installation or due to component failure 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 Carrier 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 be: the Local Carrier Interface card or Remote Carrier Interface card has its red LEDs turned on the Remote Carrier Interface card faceplate display shows a fault code, some common equipment or power supplies have their green LEDs turned off, some of the common equipment or network cards display codes that indicate faults, and so on.
- 2 Note if Carrier 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 Carrier Remote IPE" below for lists of the most common problems.
- 3 Take the action recommended by the fault isolation and correction tables, which guide you through fault isolation steps and recommend what test procedures to use.
- 4 If after following the diagnostic procedures Carrier Remote IPE still does not operate correctly, contact your field service representative.

### Newly installed Carrier Remote IPE

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

- improperly installed cards
- loose or improperly connected external communication cables, internal cables, or carrier link cables
- incorrect software version
- incorrect Carrier Remote IPE configuration

These types of problems can also occur when:

- installing additional Carrier Remote IPE equipment into an already operating system
- installing a new software version or changing the Carrier Remote IPE configuration

Check the symptoms listed in [Table 21](#) that are related to problems with a newly installed Carrier Remote IPE.

### **Previously operating Carrier Remote IPE**

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

- faulty equipment
- accidental disconnection of cables
- improper environmental conditions

Check the symptoms listed in [Table 21](#) that are related to problems with a previously operating Carrier Remote IPE.

## **System fault isolation and correction**

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

[Table 20](#) lists system problem symptoms, diagnosis of the problem based on the observed symptoms, and a recommended solution to the problem.

**Table 20**  
**System common and network equipment problems**

Symptoms	Diagnosis	Solution
Green LED on the power equipment is off.	Power source lost, power defective, or disconnected power cables.	Check the power source, circuit breakers, and power cables. Refer to <i>Meridian 1 fault clearing</i> (553-3001-510) to correct the problem.
Maintenance terminal displays PWRxxxx messages.	Power supply, Power Distribution Unit, or Blower/Fan unit defective.	Refer to <i>X11 input/output guide</i> (553-3001-400) for a list of PWR messages. 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 <i>X11 input/output guide</i> (553-3001-400). Use this information to locate and correct the fault. Refer to <i>Meridian 1 fault clearing</i> (553-3001-510).
Maintenance terminal displays OVDxxxx messages.	Excessive input messages from IPE cards, peripheral signaling card, network cards, and/or IPE cabling.	Observe the OVD messages on the terminal and check the description of these messages listed in <i>X11 input/output guide</i> (553-3001-400). Use this information to locate and correct the fault. Refer to <i>Meridian 1 fault clearing</i> (553-3001-510).
Maintenance display codes on the CPU cards and storage devices show fault codes.	Common equipment disk drive hardware faults, memory faults, or interrupt faults.	Refer to <i>X11 input/output guide</i> (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 <i>X11 input/output guide</i> (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 <i>Meridian 1 fault clearing</i> (553-3001-510) to identify the cause of alarm. Check the history file.

After you isolated and corrected 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 Carrier Remote IPE equipment as described in [“Remote Carrier Interface card fault isolation and correction” on page 194](#).

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.

## Carrier Remote IPE fault isolation and correction

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

If you cannot resolve the problem after exhausting all available diagnostic tools and test procedures, make a list of all the symptoms you observed and contact your field service representative. Refer to Table 22 on page 209 in Appendix A to identify the HEX codes that indicate possible problems with the Carrier Remote IPE.

[Table 21](#) deals specifically with Carrier 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 these problems based on the symptoms these problems are exhibiting.

**Table 21**  
**Carrier Remote IPE equipment problems (Part 1 of 2)**

Symptoms	Diagnosis	Solution
Red card LED on the Local Carrier Interface or Remote Carrier Interface is permanently on.	Card is disabled or faulty.	Go to <a href="#">Procedures 1, 2, and 4</a> in this chapter to check the card status and perform self-test. Also go to <a href="#">Procedure 7</a> to check the carrier status using the MMI terminal commands.
Carrier LEDs show alarm condition.	One or more carrier alarm LEDs are on. No activity on the carrier.	Alarm Level 2 or 3. Alarm Level 2 allows voice calls but no new data calls on the carrier. Check carrier link connections and go to <a href="#">Procedure 3</a> to test the link using the loopback test.

**Table 21**  
**Carrier Remote IPE equipment problems (Part 2 of 2)**

Symptoms	Diagnosis	Solution
Carrier link is OK but remote TTY cannot access system.	Protocol not set properly or terminal not in SDI mode.	Check the protocol setup and make sure the MMI terminal is in the host SDI mode.
No communication with the system monitor.	System monitor address incorrect.	Observe the system 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 Remote Carrier Interface card shows fault codes.	Card faulty, failed self-test or problem communicating with peripheral equipment.	Go to <a href="#">Procedures 4</a> and <a href="#">5</a> to check tracking and loopback. Also refer to <i>X11 input/output guide</i> (553-3001-400) for a list of codes. Based on the maintenance display codes description, take the appropriate action and resolve the problem.
Error messages printed on the MMI terminal or the Meridian 1 TTY.	Hardware or software problems with the Carrier Remote IPE.	Note various error messages. Refer to Appendix A and <i>X11 input/output guide</i> (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.
Signaling works but no talk path.	Carriers are crossed over. External loopback left in place no end-to-end connection.	Check each carrier and make sure they are not crossed over. Refer to "Connecting the carrier link to the Remote IPE module" on page 115.  Remove the external loopback.
Amber maintenance LED is on.	Test is performed over one or more carrier in the link. Alarms disabled. SW1 position 2 set wrong.	Wait until the test is completed and analyze the test data. Enable the alarms. Set SW1 position 2 correctly.
Near and far end Alarm Level 2 or Alarm Level 3.	Carrier network, and/or peripheral equipment failure.	Query the alarm status on carrier links by entering the <b>D A L [P]</b> command to display the near-end log file and <b>D A D [P]</b> to display the far-end log file. Check alarm settings with <b>D C</b> command.
Messages corrupted (ERR080).	Hardware problems.	Check Procedures 1 through 5.

## Local Carrier Interface card fault isolation and correction

The Local Carrier Interface card provides a communication interface between the CPU and the Remote Carrier Interface card.

The Local Carrier Interface card processes signaling information and data received from the Remote Carrier Interface card over the carrier link.

Problems with the Local Carrier Interface card may be caused by hardware faults, incorrect configuration, a disabled Local Carrier Interface card, or continuity problems between the card and other network cards connected to the network bus. To isolate and correct the Local Carrier Interface card-related problems, follow [Procedures 1, 2, and 3](#).

### Procedure 1

#### Checking the Local Carrier Interface card status

The diagnosis in [Table 21](#) indicates that the Local Carrier Interface card may be faulty or disabled. The first step in identifying the problem is to verify the status of the Local Carrier Interface card. The status of a Local Carrier Interface card is obtained by executing the **STAT sl** command in Maintenance and Diagnostic Program LD 32.

To obtain the Local Carrier Interface card status:

- 1 Log in on the maintenance terminal as described in ["Using system maintenance programs" on page 178](#).
- 2 At the > prompt, type **LD 32** and press the Enter key to access the Maintenance and Diagnostic Program LD 32.
- 3 Type **STAT sl** and press the Enter key, where **sl** is the superloop number. It shows the highest alarm value of both cards you are checking. The far-end alarm does not show at the near end.

#### LD 32

#### NPR000

#### STAT sl

CARR	CALS	TTSA	NND	SPARED
0	0	21/21	NO	N/A
1	0	21/21	NO	N/A
2	0	21/21	NO	N/A

*Note:* This example shows 3 primary carriers and no spare, all carriers without alarm, and are available for New Data Calls. No calls in progress.

**LD 32**

**NPR000**

**STAT sl**

<b>CARR</b>	<b>CALS</b>	<b>TTSA</b>	<b>NND</b>	<b>SPARED</b>
0	3	0/21	YES	N/A
1	0	21/21	NO	N/A
2	0	21/21	NO	N/A

*Note:* This example shows 3 primary carriers and no spare, carrier 0 in los-of-signal (LOS) fault status.

**LD 32**

**NPR000**

**STAT sl**

<b>CARR</b>	<b>CALS</b>	<b>TTSA</b>	<b>NND</b>	<b>SPARED</b>
0	0	21/21	NO	NOT SPARED
1	0	21/21	NO	NOT SPARED
2	0	N/A	N/A	AVAIL

*Note:* This example shows 3 carriers equipped, carrier 2 is spared and available, and are available for New Data Calls. No calls in progress.

**LD 32**

**NPR000**

**STAT sl**

<b>CARR</b>	<b>CALS</b>	<b>TTSA</b>	<b>NND</b>	<b>SPARED</b>
0	3	21/21	NO	SPARED
1	0	0/21	YES	NOR SPARED
2	0	N/A	N/A	SPARING FOR 0

*Note:* Carrier 1 unequipped and carrier 2 sparing for carrier 0.

Parameter description:

CARR—Carriers 0, 1, and 2

CALS—Carrier alarm status (0 means that the Alarm Level is 0—no alarm)

TTSA—Timeslots currently available for voice and data

Carrier 0 superloop timeslots (5 to 25) for T1 and (5 to 31) for E1

Carrier 1 superloop timeslots (37 to 57) for T1 and (37 to 63) for

E1 carriers

Carrier 2 superloop timeslots (69 to 89) for T1 and (69 to 95) for E1 carriers

NND—No New Data calls. (NO—indicates new data calls are not disallowed) i.e. MCAs may originate or terminate new data calls

SPARED—Indicates if a carrier is spared by carrier 2. N/A indicates that carrier 2 is equipped as a primary not a spare carrier.

If carrier 2 is configured as a spare, the traffic will be handled by carrier 0 and carrier 1 reducing the traffic capacity to 2/3, but by providing a spare, established calls are protected if one of the primary carrier links fails.

**Note:** If 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.

If the message indicates that the Local Carrier Interface card is faulty, replace the card.

## **Procedure 2**

### **Performing the Local Carrier Interface card self-test**

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

To start the self-test:

- 1 Log in on the maintenance terminal as described in [“Using system maintenance programs” on page 178](#).
- 2 At the > prompt, type **LD 32** and press the Enter key to access the Network and PE Diagnostic Program.
- 3 Type **DISL sl** and press the Enter key to disable the Local Carrier Interface card, where **sl** is the Local Carrier Interface card superloop number you are disabling.

- 4 Type **XNTT sl** and press the Enter key to start the self-test, where **sl** is the Local Carrier Interface card superloop number specified for self-test.

If the response is:

TEST PASSED

the Local Carrier Interface card passed the self-test and is functional but must be enabled to turn off the red LED and become active.

If the Local Carrier Interface card passed the self-test, but the problem persists, the carrier link or other cards that interface with the Local Carrier Interface card may be faulty. To verify the integrity of the network bus and connections between the Local Carrier Interface card and other network and peripheral equipment cards interfacing with the Local Carrier Interface card, go to [Procedure 3](#).

If the response is:

TEST FAILED REASON: xxxx

XPEC NOT CONNECTED

the Local Carrier Interface 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 Local Carrier Interface card as described in "[Removing and replacing a Local Carrier Interface card](#)" on page 205. NPRxxx message may be displayed as a result of a command-activated self-test if the Local Carrier Interface card is missing, not configured, and so on.

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

### Procedure 3 Performing the Local Carrier Interface system loopback tests

If the Local Carrier Interface 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 carrier link connections between the Local Carrier Interface card and the Remote Carrier Interface card.

The system loopback test is not service interrupting. However, if carrier 2 is not a spare carrier but an primary carrier, the system may respond with error message BSD202 if TEST ALL command is executed in LD 45. To avoid this problem, do not perform the TEST command manually on the system that has one or more Carrier Remote superloops with carrier #2 configured as an active carrier.

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 difference between loopback tests for the Carrier Remote IPE and the Superloop Network and Peripheral Controller cards is the selection of specific timeslots that have to be assigned for the Carrier Remote IPE loopback testing.

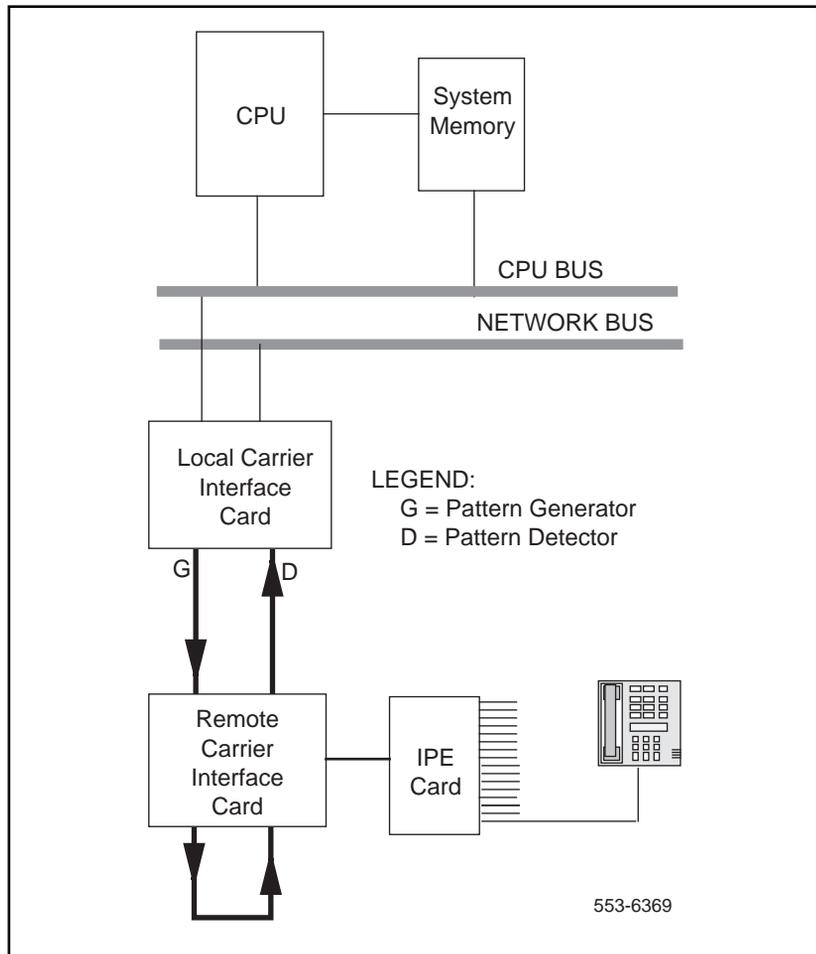
The system loopback test also tests the superloop network switching functions and the peripheral controller loopback functions on the Local Carrier Interface card and the Remote Carrier Interface motherboards respectively. Where, the on-line test 1, using the MMI command, tests the loopback between the daughterboards of these two cards.

The loopback uses the Local Carrier Interface card as a pattern generator and detector. For example, the signal is transmitted by the Local Carrier Interface card to the Remote Carrier Interface card and looped back to the Local Carrier Interface card over the carrier links.

**Note:** For a Carrier Remote IPE with a spare link, the loopback is automatically routed over the functioning carrier link, not the faulty link. To identify the carrier that may be faulty, you can perform the carrier test at each end of the link by following the instructions in step 4 of this procedure.

Figure 25 illustrates the loopback path and shows the Local Carrier Interface card as a test pattern generator and detector.

**Figure 25**  
**Loopback path for XCON test 6**



To start the loopback test:

- 1 Log in on the maintenance terminal as described in [“Using system maintenance programs” on page 178](#).
- 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, S 1-255 and press the Enter key to select continuous loopback testing for a selected time span, where H 1-255 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 5 minutes.

- 4 At the TEST prompt, type **6** and press the Enter key to test the loop from the Local Carrier Interface card through the carrier link and the Remote Carrier Interface card back to the Local Carrier Interface card. 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
TYPE	CR	Carrier transmission type
TYPG	N	Local Carrier Interface card—generator
SUPL	0–156	Superloop in multiple of 4
SLOT_CARR	xx	Carrier timeslots ranges: E1 Carrier 0 (5–31) E1 Carrier 1 (37–63) E1 Carrier 2 (69–95) T1 Carrier 0 (5–25) T1 Carrier 1 (37–47) T1 Carrier 2 (69–89)
TYPD	N	Local Carrier Interface card—detector
SUPL	0–156	Superloop in multiple of 4
LBTY	P	Loopback through Remote Carrier Interface card
LBTN	l1 s 99	Special Remote Carrier Interface 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 test fails, go to [Procedure 4](#).

## Remote Carrier Interface card fault isolation and correction

The Remote Carrier Interface card provides a communication interface between the Local Carrier Interface card and the IPE cards housed in the Carrier Remote IPE module or cabinet.

Problems with the Remote Carrier Interface card may be caused by hardware faults, incorrect configuration, a disabled Remote Carrier Interface card, or continuity problems between the card and IPE cards connected to the peripheral bus. To isolate and correct the Remote Carrier Interface card-related problems, follow procedures 4 and 5.

### Procedure 4 Performing the Remote Carrier Interface card self-test

If the Remote Carrier Interface card is faulty, you should conduct the self-test to verify that it is actually faulty before you replace it. This test verifies the basic Remote Carrier Interface card functions and outputs a fail or pass message after the test is completed. During self-test the Remote Carrier Interface card displays HEX messages indicating the test performed. To identify the codes displayed, refer to Table 22 on page 209.

To start the self-test:

- 1 Log in on the maintenance terminal as described in ["Using system maintenance programs" on page 178](#).
- 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 Remote Carrier Interface card, where **x** is the number of the Remote Carrier Interface card you are disabling.

- 4 Type **XPCT x** and press the Enter key to start the self-test, where **x** is the Remote Carrier Interface card specified for self-test.

If the response is

TEST PASSED

the Remote Carrier Interface card passed the self-test and is functional but must be enabled to turn off the red LED and to start processing calls.

Type **ENXP x (v)** and press the Enter key to enable the card and the associated IPE cards, where **x** is the Remote Carrier Interface card number and **(v)** is the optional download software version **v**.

If the Remote Carrier Interface card passed the self-test, but the problem persists, the carrier link or other cards that interface with the Remote Carrier Interface card may be faulty. To verify the integrity of the peripheral bus and the Remote Carrier Interface card, go to [Procedure 5](#).

If the response is

TEST FAILED REASON: xxxx

the Remote Carrier Interface 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 Remote Carrier Interface card is missing, not configured, etc.

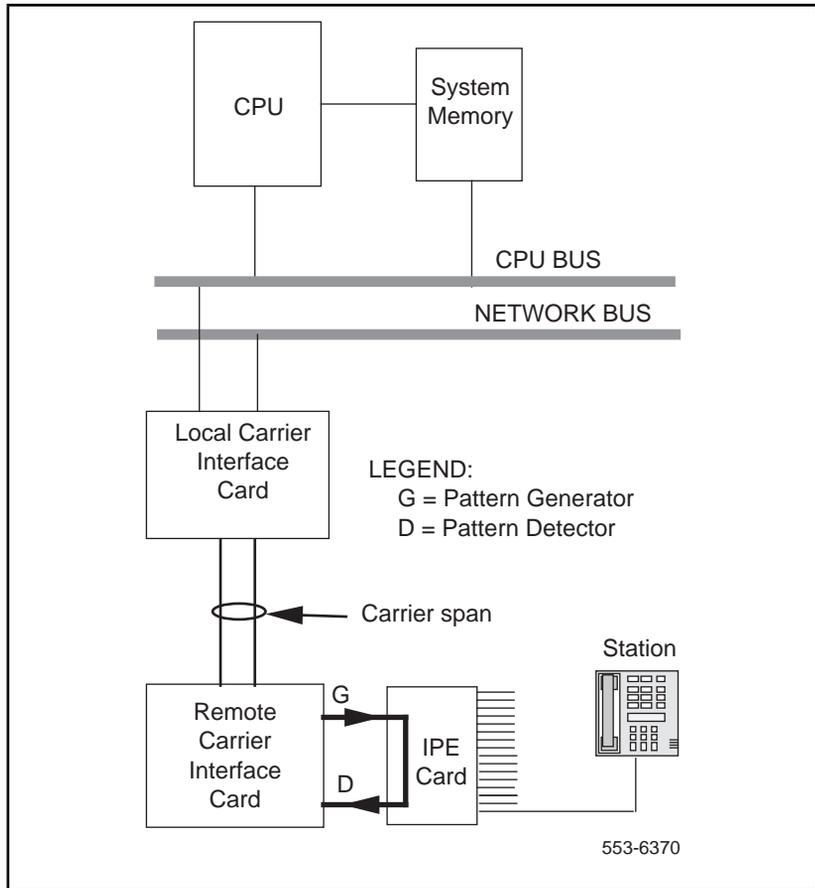
- 5 Exit LD 32 by typing **\*\*\*\*** at the prompt.

**Procedure 5**  
**Performing the Remote Carrier Interface card loopback test**

The loopback uses the Remote Carrier Interface card as a pattern generator and detector. The signal is transmitted by the Remote Carrier Interface card back to the Remote Carrier Interface card over a timeslot of a specified carrier.

**Figure 26** illustrates the loopback path and shows the Remote Carrier Interface card as a test pattern generator and detector.

**Figure 26**  
**Loopback path for XCON test 7**



To start the loopback test:

- 1 Log in on the maintenance terminal as described in [“Using system maintenance programs” on page 178](#).
- 2 At the > prompt, type **LD 45** and press the Enter key.
- 3 Select the 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, S 1-255 and press the Enter key to select continuous loopback testing for a selected time span, where H 1-255 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 5 minutes.

- 4 At the TEST prompt, type **7** and press the Enter key to test Remote Carrier Interface to Remote Carrier Interface through a special loopback channel. 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	Remote Carrier Interface card—generator
TN	1 s 99 0	Special Remote Carrier Interface 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 test fails, replace the card.

## Fault isolation and correction using MMI maintenance commands

You can perform some testing and troubleshooting of the Carrier 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, and print messages from log files.

### Procedure 6 Checking Carrier Remote IPE status using MMI commands

This procedure uses MMI commands to maintain Carrier Remote IPE cards and carrier status.

In the MMI mode the terminal issues direct commands to the system to display operational conditions, to set up carrier parameters, and to test individual carrier links.

To obtain the Local and Remote Carrier Interface card status:

- 1 Log in on the MMI maintenance terminal:  
**CRI::>L** Login command  
Enter Password > **M1LINK** Type in the password.
- 2 Type **D S** to display near-end carrier status. Type **D S D** to display far-end carrier status.

The response is displayed on the screen and shows: the firmware version, present time and date, individual carrier fault threshold parameters, and the present status of each carrier link.

Example:

```
CRI::>D S  
CRI Remote IPE S/N Software Version x.xx mm/dd/yy hh:mm  
Remote Site  
In Alarm State: NO (carriers are not in the alarm state)  
All Link Maps Normal  
Link 0 Alarm Level 0  
Link 1 Alarm Level 0  
Link 2 Alarm Level 0
```

If carrier links mismatch exists, the status will display unequal alarm levels across a mismatched link. To verify that carrier links are connected correctly at both ends perform the tests in "Verifying carrier link connections at the remote site" on page 147 in the Installation section.

- 3 Display the alarm log by executing the **D A** and the **D A D** commands to see the list of the most recent 100 alarms with the date and time they occurred.

### Procedure 7 Checking the carrier performance status

The Remote Carrier Interface card can display carrier performance information for the current hour and for the last 24 hours. The data and total errors are shown separately in the report for both the local and the remote site. The report displays the bit error rate, loss of frame count, loss of signal, alarm indication count, and frame slip count. To obtain the information for the current hour, execute command **D P** (Display performance) for near-end or **D P D** (Display performance distant) for the far-end carrier performance status using the MMI terminal.

To obtain the carrier link performance status:

- 1 Log in on the maintenance terminal as described in ["Using system maintenance programs" on page 178](#).
- 2 At the **>** prompt, type **D P** and press the Enter key.

The report displays the following carrier error counts monitored for 45 minutes for carrier 1

CRI::> D P

Which Carrier (0, 1, or 2): 1

#### IPE Interface Performance Log

For Carrier Number 1

8/15/95 9:45

Data for the first 45 Minutes

Errored Seconds	Bursty Seconds	Severely Eroded Seconds	Unavailable Seconds	Loss Frame Seconds	Frame Slip Seconds	Error Counter
0	0	0	0	0	0	1

**Note:** These performance measurements indicate the service quality of the carrier link you selected (carrier 1 in this example). Ideally all errored second categories should be 0. If a number other than 0 appears in one or more columns, it indicates momentary or continuous problem on the link. If the numbers are small and the carrier is not in alarm state, the errors may have been temporary and the link may continue to operate within the specified thresholds. You may clear the cumulative error counter by executing the **C E** and **C E D** commands. This error clearing does not affect the errored second counters.

- 3 To display a similar report for the 24 hour period listed in 1 hour increments execute the **D H** (Display history) for the near-end or **D H D** (Display history distant) for the far-end.

CRI::> D H

Which Carrier (0, 1, or 2): 1

**IPE Interface History Performance Log**

**For Carrier Number 1**

**8/15/95 9:45**

Hour Ending	Errored Seconds	Bursty Seconds	Unavailable Seconds	Loss Frame Seconds	Frame Slip Seconds	Error Counter
9:00	0	0	0	0	0	0
8:00	1	0	0	0	0	1
7:00	0	0	0	0	0	0
0:00	0	0	0	0	0	0
23:00	1	1	0	0	0	1
22:00	0	0	0	0	0	0
21:00	0	0	0	0	0	0
11:00	1	1	1	1	1	1
10:00	0	0	0	0	0	0

**Note:** This report list the 24-hour performance history for this carrier. Ideally all the parameters should show 0 for optimum performance. However, if the carrier is not in alarm state, it may continue to perform within the specified threshold limits.

**Procedure 8****Disabling a carrier when idle to check the carrier sparing function or to perform off-line carrier tests**

- 1 Execute the **S C** command to disable the primary carrier of your choice. This command allows the calls in progress to complete before the carrier can be disabled. The MMI terminal displays the following screen to allow you to change carrier status:

**To disable carrier 1** (set Equipped carrier 1 parameter to N):

<b>CRI::&gt; S C</b>	To set carrier parameters
Equipped carrier 0 (Yes or No) Y	Enable carrier 0. Enter Y to enable or N to disable.
Equipped carrier 1 (Yes or No) N	Disable carrier 1.
Equipped carrier 2 (Yes or No) Y	To enable carrier 2
Enable #2 for Spare (Yes or No) Y	Defines carrier 2 as spare
Enable self clearing Alarms (Yes or No) N	To enable/disable alarm clearing

- 2 Track the number of calls still active on carrier 1 by executing the STAT command:

**LD 32**

**NPR000**

**STAT sl**

<b>CARR</b>	<b>CALS</b>	<b>TTSA</b>	<b>NND</b>	<b>SPARED</b>
0	0	19/21	NO	NOT spared
1	1	18/21	YES	NOT spared
2	0	21/21	NO	NOT spared

**Note:** In the CALS column for carrier 1, it shows that carrier alarm status has alarm level 1 and no new data is allowed.

**Procedure 9****Testing the carriers**

- 1 After you check the carrier status report and performance log and you find that one or more carriers are faulty, proceed to isolate the cause by testing the carriers using the **T** (test) command.

There are two types of tests that can be performed using the **T** command. These are on-line tests and off-line tests.

The **on-line carrier test (Test #1)** is end-to-end carrier test performed without affecting the system performance and determines that a failure exists but cannot pinpoint the faulty component. Perform Test #1 on a known good carrier to switch signaling communication over this carrier. Don't test a carrier in alarm condition using Test #1, it may disrupt traffic for the duration of the test. A better approach is to disable the carrier you wish to test and perform one of the other tests to determine where the problem lies.

**Note:** Disabling a carrier will prevent any new calls being placed over that carrier; however, it will not effect calls in progress over the disabled carrier. Performing Test #2 or #3 on a carrier will interrupt any calls in progress over that carrier for the duration of the test.

The **off-line carrier tests (Tests #2, #3, #4, and #5)** isolate the failure to a field-replaceable unit. These tests are usually performed on carriers that are not carrying traffic. The user must specify the carrier to be tested and the duration of the test.

**Test #2** tests the near-end card by looping back the carrier link side and verifies if the card is good.

**Test #3** tests the far-end card by looping back the carrier link side on the distant card and verifies if that card is good.

**Test #4** tests the carrier link side by looping back at the near-end or far-end CSU to test the link from the telco demarcation point to the Meridian 1 or Carrier Remote IPE or from the far-end CSU to test the carrier link.

**Test #5** provides a near-end loopback on the card to allow the distant testing of the near-end card across the carrier link.

**Note:** Test #2 and #3 may show occasionally false failure indication when a false bit error is detected by the test logic falsely indicating a test failure. If only one or two errors are shown out of 15 tests, try the test again. If the test passes on the second or third attempt, the carrier is probably performing correctly. To verify the performance, execute C A and C A D to clear errors. Then display performance by executing the D P and D P D commands. The carrier is operational if no additional errors are detected. The STOP command terminates a test prematurely; however, it does not terminate the remote loopback during carrier Test #3 and may interrupt the traffic for several seconds. If the STOP command causes a problem, execute Test #3 again with 0 duration to undo the far-end loopback or do not use the STOP command on Test #3.

Test 5 places the carrier in the loopback and test 4 works only if you first establish an external loopback at the network or at the far-end.

Split pairs in the twisted pair patch cable between the telco network interface and the Local and Remote Carrier Interface cards may cause repetitive loss of frame errors despite passing loopback tests on both ends of the cable.

- 2 Logon and type **T** and press the Enter key to display the selection of tests. Select the appropriate test and press the Enter key:

**CRI:>L**

**Enter Password: M1LINK**

**CRI::>L**

**CRI::>T**

**Test 1: Online Test**

**Test 2: Near End Loopback Test**

**Test 3: Remote Loopback**

**Test 4: Network Loopback**

**Test 5: Loop only**

**(1, 2, 3, 4, 5, or S to cancel): 1**

**Which carrier (0, 1, or 2): 2**

**Carrier Currently ENABLED**

**Enter Duration of Test (1-98 minutes, 0= once, 99= forever): \_**

**Test will not interfere with calls in progress**

**Hit Q to quit or any key to continue**

**Near End Testing**

**Carrier 2 Test 1 Completed. Total Test 1 Total Errors 0.**

If an off-line test is selected, the user is prompted with:

**This test will interfere with calls currently in progress, continue ?:  
(Y or N): \_**

- 3 Check the results of the test and correct the identified fault. Replace the faulty card or fix the problem in the carrier link if so indicated in the test report.

## Replacing Carrier Remote IPE cards

If after completing troubleshooting you determine that one or more Carrier Remote IPE cards are defective, you will have to remove them and replace them with spares. When you insert a spare Local Carrier Interface card or a Remote Carrier Interface card into the module or Carrier Remote IPE cabinet, observe the card LED (the uppermost LED on the faceplate) to determine if the card passed the 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 shipment of 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 nonconductor edges to prevent damage due to static discharge.

### Removing and replacing a card

A Carrier Remote IPE card can be removed from and inserted into a Meridian 1 module or the Remote IPE module or Carrier Remote IPE cabinet without turning off the power to the module or cabinet. This feature allows Meridian 1 to continue normal operation when you replace a Local Carrier Interface card in the system or a Remote Carrier Interface card in the Remote IPE module or cabinet.

### Removing and replacing a Local Carrier Interface card

- 1 Disable the Local Carrier Interface card by logging into the system terminal, loading the Network and Peripheral Equipment Diagnostic Program LD 32, and executing **DISL sl**, where **sl** is the actual loop number of the Local Carrier Interface card.
- 2 Set the ENB/DIS switch to DIS.
- 3 Disconnect the cable from the Local Carrier Interface card faceplate.
- 4 Unlatch the card locking devices by squeezing the tabs and pulling the locking devices away from the card.
- 5 Pull the card out of the network module and place it into an antistatic bag away from the work area.
- 6 Set the replacement card ENB/DIS switch to DIS.
- 7 Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.
- 8 Pull the upper and lower locking devices away from the faceplate on the card and insert the card firmly into the backplane connector. Press the card locking devices firmly against the faceplate to latch the card inside the module.
- 9 Upon insertion, the Local Carrier Interface 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 Local Carrier Interface card.
- 11 Connect the cable to the Local Carrier Interface card faceplate connector.

- 12 Set the ENB/DIS switch to ENL. If the uppermost red LED on the Local Carrier Interface card faceplate turns off, the card is functioning correctly and is enabled. The outcome of the self-test will be indicated on the system terminal or TTY (or the MMI terminal connected to the SDI/System Monitor connector on the Local Carrier Interface card faceplate). If the LED stays on, go to [“Isolating and correcting faults” on page 181](#) in this chapter.
- 13 Tag the defective cards with a description of the problem and prepare them for shipment to your equipment supplier’s repair depot.

### Removing and replacing a Remote Carrier Interface card

- 1 Log in on the maintenance terminal as described in [“Using system maintenance programs” on page 178](#).
- 2 At the > prompt, type **LD 32** and press the Enter key to access the program.
- 3 Type **DSXP x**, where **x** is the Remote Carrier Interface card number, and press the Enter key to disable the card. The Remote Carrier Interface card is now disabled and you can remove it.
- 4 Unlatch the card locking devices by squeezing the tabs and pulling them away from the card.
- 5 Pull the card out of the IPE module or cabinet and place it into an antistatic bag away from the work area.
- 6 Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.
- 7 Pull the upper and lower locking devices away from the faceplate on the card and insert the card firmly into the backplane connector. Press the card locking devices firmly against the faceplate to latch the card inside the module. The Remote Carrier Interface card automatically starts the self-test.
- 8 Observe the red LED on the front panel during the self-test. If it flashes three times and stays on, it has passed the test. Go to step 9. 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 Remote Carrier Interface card.

- 9 At the . prompt in the LD 32 program, type **ENXP x (v)**, where **x** is the Remote Carrier Interface card number and **v** is the loadware version that can be optionally downloaded after the enabling process, and press the Enter key to enable the card. If the uppermost red LED on the Remote Carrier Interface card faceplate turns off, the card is functioning correctly and is enabled. The outcome of the self-test will be indicated by LD 32 on the MMI terminal connected to the Remote Carrier Interface card. If the LED stays on, go to [“Isolating and correcting faults” on page 181](#) in this chapter or replace the card.
- 10 Tag the defective cards 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 Carrier Remote IPE is operating correctly, do the following:

- 1 Reinstall covers on the system module.
- 2 Reinstall the cover on the Remote IPE floor-standing module or the wall-mounted (or pedestal-mounted) Carrier Remote IPE cabinet.
- 3 Terminate your session with the system by logging out on your maintenance terminal by typing **LOGO** at the . prompt and pressing 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, into 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

[Table 22](#) in this appendix lists CRI-related system messages displayed or printed on the system and MMI terminal or TTY.

*Note:* CRInnnn messages are suppressed for a given superloop if alarms are disabled by the MMI command **A D** (Alarm Disable). CRInnnn messages are suppressed for a given carrier link if it is UNEQUIPPED by the MMI command **S C** (Set Configuration).

[Table 23](#) lists HEX codes displayed by the alphanumeric display on the Remote Carrier Interface card faceplate.

**Table 22**  
**System error messages related to the CRI (Part 1 of 5)**

Error Code	Message description
BSD805/806	Superloop timeslot not available. Check the timeslot allocation for each T1/E1 carrier.
NPR0019	LCI did not respond to the request of disable/enable the RTE superloop. Ensure that the LCI is installed and that the ENL/DIS switch is in ENL position.
NWS0019	LCI did not respond to the request of disable/enable the superloop. Ensure that the LCI is installed and that the ENL/DIS switch is in ENL position.
PWRxxxx	Carrier Remote IPE cabinet system monitor emulation.
SCH6575	REM_IPE package is not equipped.
SCH6576	Missing LCI software from disk.
SCH6577	Cannot change SUPT in the defined superloop. Superloop is not disabled.

**Table 22**  
**System error messages related to the CRI (Part 2 of 5)**

Error Code	Message description
CRIabcd	Where a=1 for local and 2 for remote, 3 for external, b= carrier 0, 1, or 2, c= alarm lever 1, 2, or 3, and d= 0 for bit error, 1 for frame slip, 2 for loss of signal, 3 for blue alarm, 4 for out-of-frame, 5 for within threshold, and 6 for MMI enabled i.e. carrier equipped via MMI configuration commands. This is shown in subsequent system error messages.
<b>Bit error rate error code description</b>	
CRI1010	Local Carrier 0 Alarm Level 1. Bit error rate exceeded.
CRI1020	Local Carrier 0 Alarm Level 2. Bit error rate exceeded.
CRI1030	Local Carrier 0 Alarm Level 3. Bit error rate exceeded.
CRI1110	Local Carrier 1 Alarm Level 1. Bit error rate exceeded.
CRI1120	Local Carrier 1 Alarm Level 2. Bit error rate exceeded.
CRI1130	Local Carrier 1 Alarm Level 3. Bit error rate exceeded.
CRI1210	Local Carrier 2 Alarm Level 1. Bit error rate exceeded.
CRI1220	Local Carrier 2 Alarm Level 2. Bit error rate exceeded.
CRI1230	Local Carrier 2 Alarm Level 3. Bit error rate exceeded.
CRI2010	Remote Carrier 0 Alarm Level 1. Bit error rate exceeded.
CRI2020	Remote Carrier 0 Alarm Level 2. Bit error rate exceeded.
CRI2030	Remote Carrier 0 Alarm Level 3. Bit error rate exceeded.
CRI2110	Remote Carrier 1 Alarm Level 1. Bit error rate exceeded.
CRI2120	Remote Carrier 1 Alarm Level 2. Bit error rate exceeded.
CRI2130	Remote Carrier 1 Alarm Level 3. Bit error rate exceeded.
CRI2210	Remote Carrier 2 Alarm Level 1. Bit error rate exceeded.
CRI2220	Remote Carrier 2 Alarm Level 2. Bit error rate exceeded.
CRI2230	Remote Carrier 2 Alarm Level 3. Bit error rate exceeded.

**Table 22**  
**System error messages related to the CRI (Part 3 of 5)**

<b>Error Code</b>	<b>Message description</b>
<b>Frame slip error code description</b>	
CRI1031	Local Carrier 0 Alarm Level 3. Frame slip threshold exceeded.
CRI1131	Local Carrier 1 Alarm Level 3. Frame slip threshold exceeded.
CRI1231	Local Carrier 2 Alarm Level 3. Frame slip threshold exceeded.
CRI2031	Remote Carrier 0 Alarm Level 3. Frame slip threshold exceeded.
CRI2131	Remote Carrier 1 Alarm Level 3. Frame slip threshold exceeded.
CRI2231	Remote Carrier 2 Alarm Level 3. Frame slip threshold exceeded.
<b>Loss of signal error code description</b>	
CRI1032	Local Carrier 0 Alarm Level 3. Loss of signal.
CRI1132	Local Carrier 1 Alarm Level 3. Loss of signal.
CRI1232	Local Carrier 2 Alarm Level 3. Loss of signal.
CRI2032	Remote Carrier 0 Alarm Level 3. Loss of signal.
CRI2132	Remote Carrier 1 Alarm Level 3. Loss of signal.
CRI2232	Remote Carrier 2 Alarm Level 3. Loss of signal.
<b>Blue alarm error code description</b>	
CRI1033	Local Carrier 0 Alarm Level 3. Blue alarm.
CRI1133	Local Carrier 1 Alarm Level 3. Blue alarm.
CRI1233	Local Carrier 2 Alarm Level 3. Blue alarm.
CRI2033	Remote Carrier 0 Alarm Level 3. Blue alarm.
CRI2133	Remote Carrier 1 Alarm Level 3. Blue alarm.
CRI2233	Remote Carrier 2 Alarm Level 3. Blue alarm.

**Table 22**  
**System error messages related to the CRI (Part 4 of 5)**

Error Code	Message description
<b>Out of frame error code description</b>	
CRI1034	Local Carrier 0 Alarm Level 3. Out of frame.
CRI1134	Local Carrier 1 Alarm Level 3. Out of frame.
CRI1234	Local Carrier 2 Alarm Level 3. Out of frame.
CRI2034	Remote Carrier 0 Alarm Level 3. Out of frame.
CRI2134	Remote Carrier 1 Alarm Level 3. Out of frame.
CRI2234	Remote Carrier 2 Alarm Level 3. Out of frame.
<b>Operation within threshold message description</b>	
CRI1005	Local Carrier 0 Alarm Level 0. Within threshold.
CRI1105	Local Carrier 1 Alarm Level 0. Within threshold.
CRI1205	Local Carrier 2 Alarm Level 0. Within threshold.
CRI2005	Remote Carrier 0 Alarm Level 0. Within threshold.
CRI2105	Remote Carrier 1 Alarm Level 0. Within threshold.
CRI2205	Remote Carrier 2 Alarm Level 0. Within threshold.
<b>Disabled/unequipped error code description</b>	
CRI1036	Carrier 0 MMI disabled/unequipped.
CRI1136	Carrier 1 MMI disabled/unequipped.
CRI1236	Carrier 2 MMI disabled/unequipped.
CRI1006	Carrier 0 MMI enabled/equipped.
CRI1106	Carrier 1 MMI enabled/equipped.
CRI1206	Carrier 2 MMI enabled/equipped.

**Table 22**  
**System error messages related to the CRI (Part 5 of 5)**

<b>Error Code</b>	<b>Message description</b>
<b>External alarm error code description</b>	
CRI3311	RCI external alarm closure. Alarm contact 1 closed.
CRI3312	RCI external alarm closure. Alarm contact 2 closed.
CRI3313	RCI external alarm closure. Alarm contact 3 closed.
CRI3301	RCI external alarm closure. Alarm contact 1 open.
CRI3302	RCI external alarm closure. Alarm contact 2 open.
CRI3303	RCI external alarm closure. Alarm contact 3 open.

**Table 23**  
**Remote Carrier Interface HEX error codes for self-test (Part 1 of 2)**

<b>HEX code</b>	<b>Test description</b>
00	Peripheral Controller ID while waiting for PSDL.
01	RAM test
02	A31 #1 external buffer
03	A31 #1 internal context memory (phase A)
04	A31 #1 internal context memory (phase B)
05	A31 #1 internal TXVM memory
06	A31 #1 configuration memory
07	A31 #1 external FIFO
08	A31 #2 external buffer
09	A31 #2 internal context memory (phase A)
0A	A31 #2 internal context memory (phase B)
0B	A31 #2 internal TXVM memory
0C	A31 #2 configuration memory
0D	A31 #2 external FIFO

**Table 23**  
**Remote Carrier Interface HEX error codes for self-test (Part 2 of 2)**

HEX code	Test description
0E	A31 #1 Peripheral side W72 loopback test
0F	A31 #2 Peripheral side W72 loopback test
10	R72 N-P switching control memory
11	R72 320x8 NIVD buffer
12	R72 N-P Quiet code register
13	R72 P-N switching control memory
14	R72 640-8 XIVD buffer
15	R72 640-8 XIVD loopback buffer test
16	R72 P-N Quiet code register
17	R71 register test
18	R71 continuity test, peripheral side
19	R71 continuity test, network side
1A	R71 packet transmission test
1B	DUART port A
1C	DUART port B
1D	RCIM shelf test
1E	End of test
1F	R72 #2 N-P quiet-code register test
EE	Bus error, exception errors, etc.

**Note:** After PSDL, the display on the Carrier Remote Interface card alternates between Peripheral Controller ID and the carrier 0 indicating that the clock reference is being received from carrier 0.

---

## Appendix B: Regulatory approvals

---

This appendix provides the general information that is supplied to the user as required by the FCC.

The general information that should be provided:

- The FCC registration number and a list of all ports that connect to the network
- Explanation and use of the ringer equivalence number
- Rights of the telephone company
- What happens in case of telephone company equipment modification and in case of equipment trouble
- Location of a repair center in the U. S. A.
- List of repairs a user or customer may be allowed to make
- Rules about the coin service and state tariffs

## Regulatory notices

### Notice for United States Installations

Meridian 1 Carrier Remote IPE equipment complies with Part 68 of the United States Federal Communication Commission (FCC) rules. On the rear of the pedestal unit of the switching equipment cabinet is a label that contains, among other information, the FCC registration numbers and ringer equivalence number (REN) for this equipment. If required, this information must be provided to the telephone company.

Meridian 1 regulatory labels include:

- FCC registration: AB6982-14234-MF-E
- FCC registration: AB6982-62937-PF-E
- FCC registration: AB6USA-18923-KF-E
- FCC registration: AB6CAN-18924-KF-E
- FCC registration: AB6CAN-61116-PF-E
- FCC registration: AB6CAN-61117-MF-E
- Service Code: 9.0F, Ringer equivalent: 1.1B (1.0A)

If your Meridian 1 Carrier Remote IPE equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company will notify the customer as soon as possible. You will also be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications to maintain uninterrupted service.

If you experience trouble with Meridian 1 Carrier Remote IPE equipment, please contact your authorized distributor or service center in the U.S. A. for repair/warranty information. If you do not know how to contact your distributor, please call Northern Telecom Inc., 2221 Lakeside Drive, Richardson, TX 75082 at 1-800-328-8800. If the trouble is causing harm to the telephone network, the telephone company may request you to remove the equipment from the network until the problem is resolved. There is no user repair involved with this equipment.

The equipment cannot be used on public coin service provided by the telephone company. Connection to Party Line Service is subject to state tariffs. Contact the state public utility commission, public service commission, or corporation commission for information.

Allowing Meridian 1 Carrier Remote IPE equipment to operate without proper answer supervision signals is a violation of FCC Rules, Part 68. Therefore:

- This equipment returns proper answer supervision signals to the Public Switched Telephone Network (PSTN) when:
  - answered by the called station
  - answered by the attendant
  - routed to a recorded announcement device that can be administered by the CPE user
  - routed to a dial prompt
- This equipment returns answer supervision on all DID calls forwarded back to the PSTN. Permissible exceptions are:
  - a call is unanswered
  - a busy tone is received
  - a reorder tone is received

This equipment is capable of providing users access to interstate providers of operator services through the use of equal access codes. Failure to provide equal access capabilities is a violation of the Telephone Operator Consumer Services Improvement Act of 1990 and Part 68 of the FCC Rules.

## Network connection information

Listed in [Table 24](#) are the Carrier Remote IPE network interfaces (Manufacturers Port ID) one located at the Meridian 1 system site and the other at the remote site.

**Table 24**  
**Carrier Remote IPE network interfaces**

Reg. Status	Digital Interfaces (FIC)	Manufacture Port ID	Service Order Code	Network Jacks
M	04DU9-BN	NT7R51 NT7R52	6.0P	N/A
M	04DU9-DN	NT7R51 NT7R52	6.0P	N/A
M	04DU9-1KN	NT7R51 NT7R52	6.0P	N/A
M	04DU9-1SN	NT7R51 NT7R52	6.0P	N/A
<b>Note:</b> Digital Interfaces represent the Facility Interface Codes (FIC)				

---

## Notice for Canadian Installations

Meridian 1 regulatory labels include:  
Department of Communication (CS03): 332 404 A

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee that the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the use to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

### **WARNING**

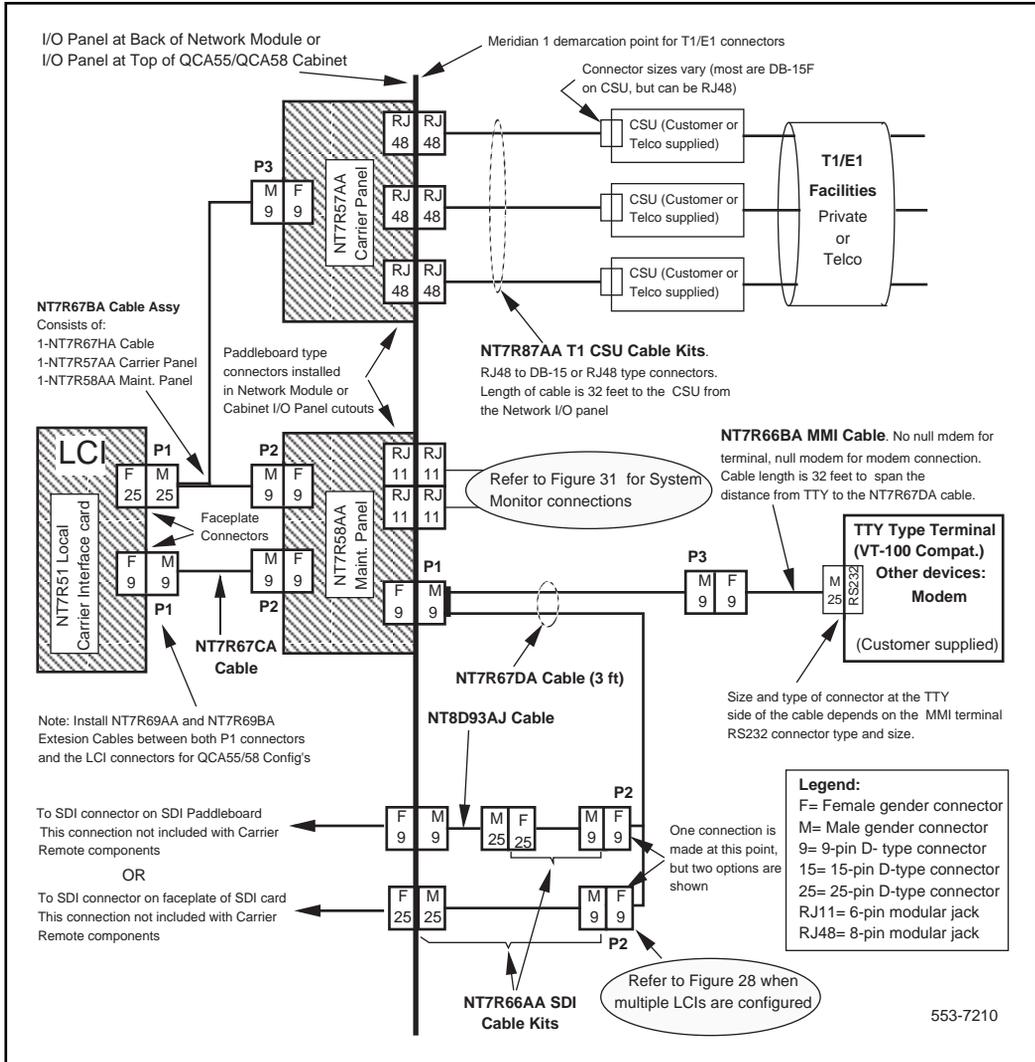
Users should not attempt to make electrical ground connections, but should contact the appropriate electrical inspection authority or an electrician, as appropriate.

## **Appendix C: Connection diagrams and external connectors pin assignment**

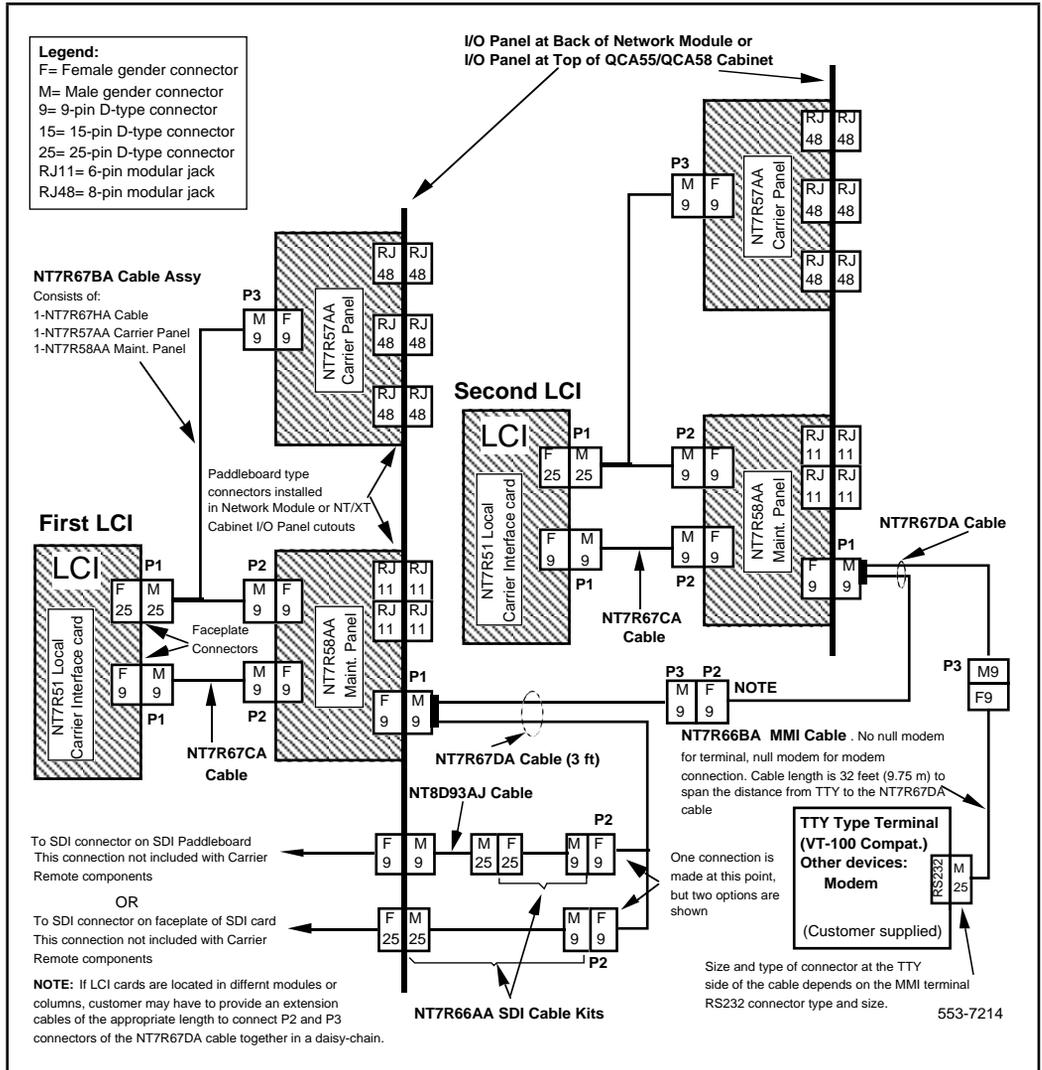
---

This appendix provides connection diagrams and pin assignment information for all connectors interfacing with external equipment.

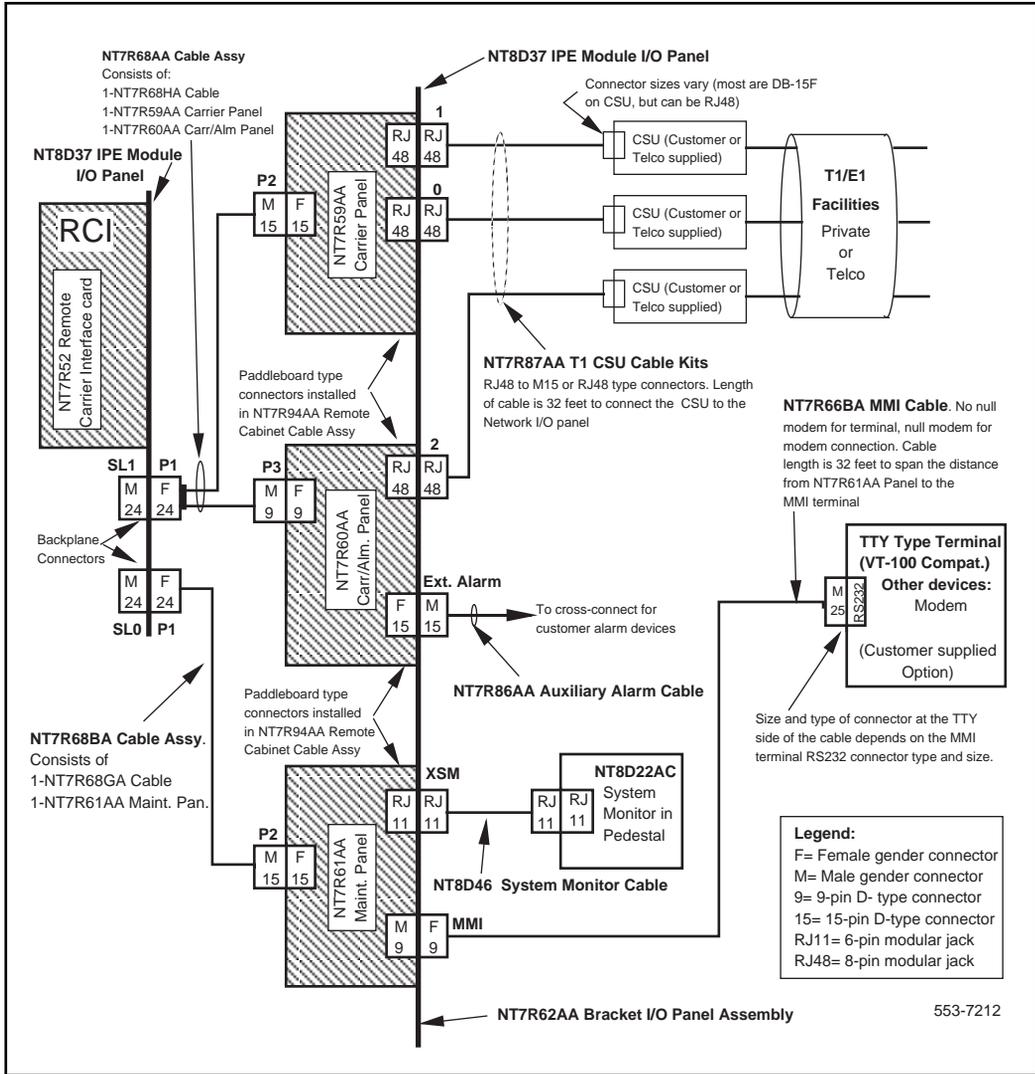
**Figure 27**  
**Single LCI connection diagram (local site connections)**



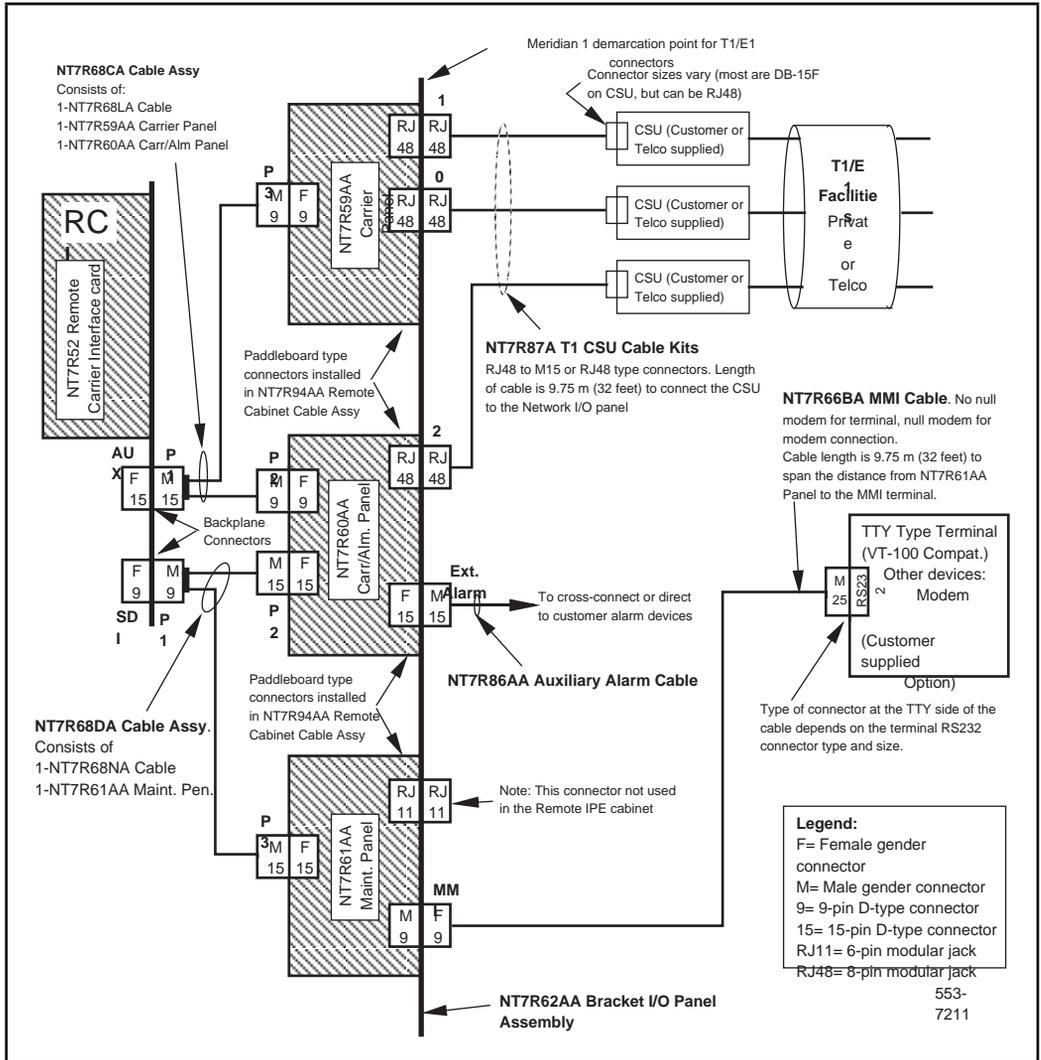
**Figure 28**  
**Multiple LCIs connection diagram (local site daisy-chain connection)**



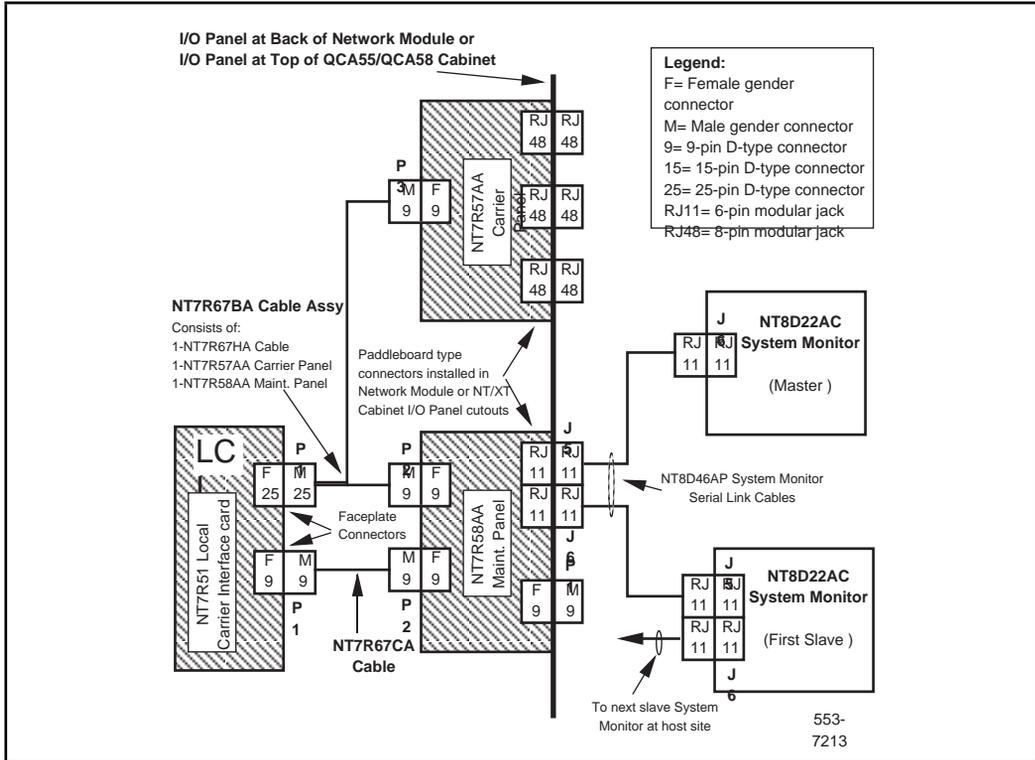
**Figure 29**  
**Remote Carrier IPE IPE module connection diagram (single RCI configuration)**



**Figure 30**  
**Remote Carrier IPE cabinet connection diagram (single RCI configuration)**



**Figure 31**  
**Local site system monitor connection diagram (single and multiple LCI configuration)**



It also provides the pin assignment for the NT7R57DA External Maintenance Cable assembly, which connects the Maintenance port on the I/O panel to the SDI port and the MMI terminal.

**Table 25**  
**8-pin modular jack pin assignment for all carrier connections**

<b>T1/E1 Carrier Link 8-Pin Modular Jack Pinouts</b>		
<b>8-Pin Modular Jack</b>	<b>Signal Name</b>	<b>Signal Description</b>
1	RTIPx	T1/E1 Carrier Receive Tip (from net)
2	RRINGx	T1/E1 Carrier Receive Ring (from net)
3	N/C	No connection
4	TRINGx	T1/E1 Carrier Transmit Ring (to net)
5	TTIPx	T1/E1 Carrier Transmit Tip (to net)
6	N/C	No connection
7	N/C	No connection
8	N/C	No connection

**Note:** The cable that connects to this connector is provided in the NT7T87AA T1 CSU Cable Kit. The cable is a straight through cables between the Carrier Remote IPE 8-pin modular jack and the Telco demarcation point. If the carrier links are just hardwired without using Telco network, pins 1 and 2 must be turned over (swapped) with pins 5 and 4 respectively at one end of the cable.

**Table 26**  
**NT7R58AA Maintenance Panel 6-pin modular jack system monitor pin assignment for J5 and J6 connectors**

<b>System Monitor 6-Pin Modular Jack Pinouts</b>		
<b>8-Pin Modular Jack</b>	<b>Signal Name</b>	<b>Signal Description</b>
J5-1	N/C	No connection
J5-2	XSTXB	Transmit (NEGATIVE)
J5-3	XSTXA	Transmit (POSITIVE)
J5-4	XSRXB	Receive (NEGATIVE)
J5-5	XSRXA	Receive (POSITIVE)
J5-6	N/C	No connection
J6-1	N/C	No connection
J6-2	XMTXB	Transmit (NEGATIVE)
J6-3	XMTXA	Transmit (POSITIVE)
J6-4	XMRXB	Receive (NEGATIVE)
J6-5	XMRXA	Receive (POSITIVE)
J6-6	N/C	No connection

**Note:** J5 modular jack provides signals towards the Master system monitor and J6 modular jack provides signals away from the Master system monitor.

**Table 27**  
**NT7R58AA Local Maintenance Panel maintenance DCE port DB-9F and**  
**NT7R67DA External Maintenance Cable assembly connector pin**  
**assignment for P1 DB-9M, P2 DB-9M, and P3 DB-9F connectors**

<b>DB-9 Local Maintenance Port and NT7R67DA Cable Connector Pinouts</b>				
<b>DB-9 Pins</b>	<b>NT7R67DA Cable Connectors Pins</b>		<b>Signal Name</b>	<b>Signal Description</b>
1	P1-1	P3-2	MNTX	MMI Transmit
2	P1-2	P3-3	MNRX	MMI Receive
3	P1-3	P2-3	SDITX	SDI Transmit
4	P1-4	P2-2	SDIRX	SDI Receive
5	P1-5	P2/P3 Pin 5	GND	Signal Ground (RS-232)
6	P1-6	P2/P3 Pin 7	REQA	Request from MMI Port
7	P1-7	P2/P3 Pin 9	REQB	Request from SDI Port
8	N/C	N/C	N/C	No connection
9	N/C	N/C	N/C	No connection
—	—	P2-4 to P2-6	DTR/DSR	Pins connected with 30 AWG wire

**Table 28**  
**NT7R61 Remote Maintenance Panel maintenance port DB-9 male**  
**connector pin assignment**

<b>DB-9 Remote Maintenance Connector Pinouts</b>		
<b>DB-9 Connector Pins</b>	<b>Signal Name</b>	<b>Signal Description</b>
1	N/C	No connection
2	SDITX	SDI Transmit
3	SDIRX	SDI Receive
4	N/C	No connection
5	GND	Signal Ground (RS-232)
6	N/C	No connection
7	N/C	No connection
8	N/C	No connection
9	N/C	No connection

**Table 29**  
**NT7R60AA Carrier/Alarm Panel DB-15 HD alarm connector pin assignment for Carrier Remote IPE module**

High Density DB-15 Alarm Connector Pinouts			
DB-15 Alarm Connector Pins	Signal Name	Signal Description	Wire Color Code
P1-1	N/C	No connection	N/C
P1-2	N/C	No connection	N/C
P1-3	N/C	No connection	N/C
P1-4	N/C	No connection	N/C
P1-5	N/C	No connection	N/C
P1-6	GND	Ground Return	Green
P1-7	ALM2	Customer External Alarm Input 2	Brown
P1-8	N/C	No connection	N/C
P1-9	N/C	No connection	N/C
P1-10	GND	Ground Return	See Note
P1-11	ALM1	Customer External Alarm Input 1	Blue
P1-12	ALM3	Customer External Alarm Input 3	White/Blue
P1-13	N/C	No connection	N/C
P1-14	N/C	No connection	N/C
P1-15	N/C	No connection	N/C

**Note:** This connection is jumpered to pin 6 inside the P1 DB-15 connector hood. No external voltage should be placed across the alarm inputs.

**Table 30**  
**NT7R60AA Carrier/Alarm Panel DB-15 HD alarm connector pin assignment for Carrier Remote IPE cabinet**

High Density DB-15 Alarm Connector Pinouts			
DB-15 Alarm Connector Pins	Signal Name	Signal Description	Wire Color Code
P1-1	N/C	No connection	N/C
P1-2	N/C	No connection	N/C
P1-3	N/C	No connection	N/C
P1-4	N/C	No connection	N/C
P1-5	N/C	No connection	N/C
P1-6	GND	Ground Return	Green
P1-7	ALM2	Customer External Alarm Input 2 (5 V)	Brown
P1-8	-48 V	-48 V for PFTU	White/Brown
P1-9	PFTS	Power Fail Transfer Signal	White/Green
P1-10	GND	Ground Return	See Note 1
P1-11	ALM1	Customer External Alarm Input 1 (5 V)	Blue
P1-12	ALM3	Customer External Alarm Input 3 (5 V)	White/Blue
P1-13	BTRN	Battery Return for PFTU	Orange
P1-14	N/C	No connection	N/C
P1-15	N/C	No connection	N/C

**Note:** This connection is jumpered to pin 6 inside the P1 DB-15 connector hood. This connector is used to connect the NT7R87AA T1 CSU Cable Kit.

[Table 31](#) provides the pin assignment relationship between the 8-pin modular jack and the DB-15 connectors to provide a connection between the Local Carrier Interface and Remote Carrier Interface to the CSU.

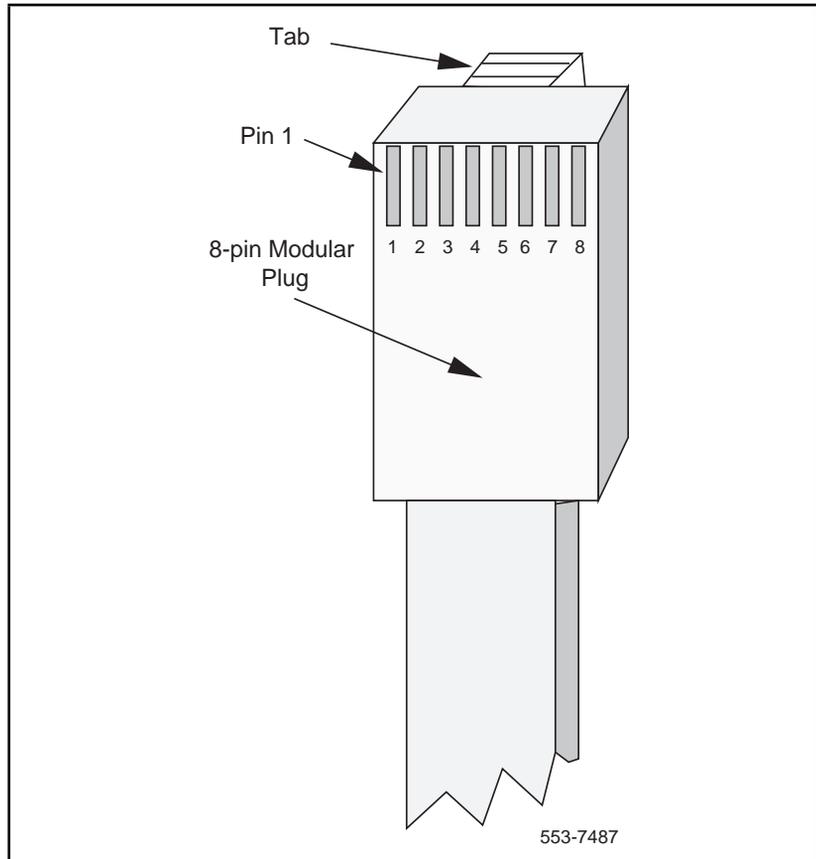
**Table 31**  
**Local and Remote Carrier IPE to CSU cable (NT7R87AA) pin assignment**

<b>Carrier Panel 8-pin Modular Jack to CSU DB-15 Pin Assignment</b>			
<b>8-pin jack Pins</b>	<b>DB-15 Pins</b>	<b>Signal Name</b>	<b>Signal Description</b>
1	11	RTIPx	Carrier Receive Tip (from network)
2	3	RRINGx	Carrier Receive Ring (from network)
4	9	TRINGx	Carrier Transmit Ring (to network)
5	1	TTIPx	Carrier Transmit Tip (to network)

**Note:** If the carrier links are just hardwired without using Telco T1 or E1 carrier links, the 8-pin modular plug pins 2 and 1 must be turned over (swapped) with pins 4 and 5 at one end. However, if you are using a T1 or an E1 Telco network, the network provides that turnover.

[Figure 32](#) is showing the 8-pin modular plug pin positions from left to right when the tab is in the back.

**Figure 32**  
**RJ48-type 8-pin modular plug pin assignments**



**Note:** If wires are color-coded, hold modular plugs at both ends in the same orientation and verify that the cable is straight through wired when the color-coded wires are in the same pin position for both 8-pin modular plugs. For flat silver satin cable, verify straight through wiring when plug at one end faces up and at the other end faces down. Also verify that pins 1, 2, 4, and 5 are wired at both ends.

Meridian 1

## **Carrier Remote IPE**

Description, installation, and  
maintenance

© 1997 Northern Telecom

All rights reserved

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.

SL-1 and Meridian 1 are trademarks of Northern Telecom.

Publication number: 553-3001-021

Document release: Standard 3.00

Date: October 1997

Printed in the United States of America

**NORTEL**

NORTHERN TELECOM

## Copyright Statement

© 1998 Northern Telecom

All rights reserved

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.

SL-1 and Meridian 1 are trademarks of Northern Telecom.

**NORTEL**

NORTHERN TELECOM