PremNet™ System
Multi-Ring Network

Configuration Manual

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About This Manual

Manual Description

The *PremNet System Multi-Ring Network Configuration Manual* provides the network administrator with the information needed to install, configure, troubleshoot, and maintain a PremNet multi-ring network. This manual is intended for use by personnel who are familiar with basic data communications and network management principles.

This manual is composed of the following sections:

Chapter 1 - Overview provides an introduction to multi-ring networks and describes the different types of nodes in multi-ring networks.

Chapter 2 - Compatibility Requirements describes the hardware and software configurations required to build a multi-ring network.

Chapter 3 - Configuring Multi-Ring Networks describes the procedures required to successfully install and connect a multi-ring network.

Chapter 4 - Upgrading Multi-Ring Networks describes the steps you must take to add nodes and rings to an existing multi-ring network.

Chapter 5 - Multi-Ring Network Command Menus describes the management functions that can be performed using an asynchronous terminal to configure and maintain a multi-ring network.

Appendix A - Regulatory Information

Appendix B - Alarm Messages and On-Line Messages lists the alarms that may display while configuring and maintaining a multi-ring network.

Appendix C - Troubleshooting describes the types of problems you may experience while configuring and maintaining a multi-ring network.

Glossary - Definition of terms that apply to multi-ring networks.

Terminology and Conventions

The following conventions are implemented throughout this manual to aid you in determining what messages are being displayed by the asynchronous terminal versus what you, as an operator, have to input.

Text displayed by the terminal, except what appears in screen figures, is shown in this type:

```
Login
```

Keyboard characters in brackets indicate that you must press a special keyboard key such as [ENTER] or [CTRL].

Characters that must be input by you exactly as indicated are shown in this type:

Y

For further information about PremNet Broadband Access systems, refer to the following manuals:

- *PremNet Broadband Access System Installation and Operation Manual* for information about how to install and configure the PremNet chassis
- Appropriate PremNet Interface Module Installation and Operation manuals
- *CMS 400 SNMP PremNet System Manager*

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Important Safety Instructions

1. Never install telephone wiring during a lightning storm.

2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.

3. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.

4. Use caution when installing or modifying telephone lines.

5. Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electrical shock from lightning.

6. Do not use the telephone to report a gas leak in the vicinity of the leak.

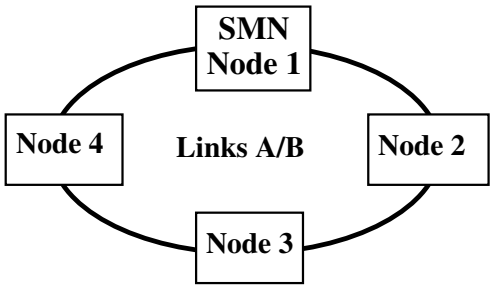
Caution: To ensure compliance with government regulations, do not install or operate this product until you have read the information contained in Appendix A.

Chapter 1
Overview

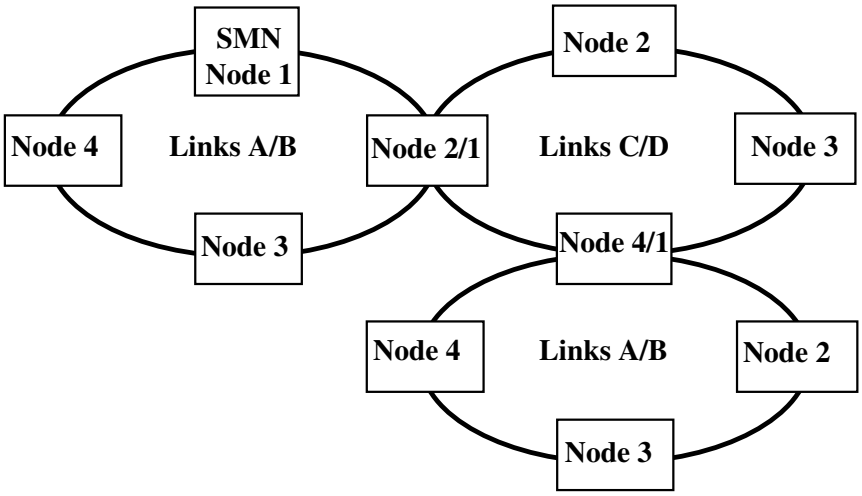
Introduction

This chapter provides an introduction to the PremNet multi-ring network features. The multi-ring features allows PremNet single-ring networks to interconnect via a common node. A single ring is limited to a maximum of 16 nodes. A multi-ring network can have a maximum of 241 nodes [241 = (16 rings • 16 nodes per ring) - 15 Interconnect Nodes (INs)]. For information about single-ring networks, refer to the *PremNet Broadband Access System Installation and Operation Manual*.

Figure 1-1 shows a single-ring versus a multiple-ring network.



Single-Ring Network



Multi-Ring Network

Figure 1-1. Single-Ring versus Multi-Ring Networks

Multi-Ring Features

A PremNet multi-ring network has many advanced features over a single ring. PremNet multi-ring features are:

Increased node support - extends the maximum number of PremNet nodes connected in a network from 16 to 241.

Flexibility in network design - offers various types of network topologies to suit the user's needs by allowing network partitioning into different rings, based on traffic patterns.

Increased bandwidth utilization - can offer increased utilization of bandwidth and timeslots (depending on network configuration), resulting in support of more interface modules.

Scalability - offers opportunities to extend the network for growth, by adding more rings.

Long-distance connectivity - extends the connectivity to longer distances by interfacing with Local Exchange Carrier or Inter Exchange Carrier networks through the use of SONET/SDH OC-3c/STM-1, T3, or ATM OC-3c/STM-1 link modules.

Multiple link type support - offers the flexibility to mix and match different types of link modules across various rings. For example, a 100 Mbps fiber-optic ring can connect to a SONET/SDH-based ring over a T3-based ring.

Redundancy within each individual ring - each individual ring can support redundancy (counter-rotating or non-counter-rotating) through the use of B or D link modules.

Centralized Network Management - offers single, centralized network management capabilities.

Multi-Ring Node Types

There are four different types of nodes in a multi-ring network:

- System Master Node (SMN)
- Interconnect Node (IN)
- Network Node (NN)
- Branch Node (BN)

Table 1-1 describes each of these nodes.

Table 1-1. Multi-Ring Node Descriptions

Node Type	Description
System Master Node (SMN)	The System Master Node (SMN) controls the network and issues commands for connection setup. All inter-ring management and control traffic is initiated in the SMN. The SMN is always node one of ring one, the main ring of the network.
Interconnect Node (IN)	An Interconnect Node (IN) is a member of two different rings. This node relays inter-node traffic, user traffic, and control and management traffic between two rings.
Network Node (NN)	A Network Node (NN) is neither a System Master Node nor an Interconnect Node. A Network Node is attached to only one ring in a PremNet system. A PremNet 5000 node supports eight interface modules and four link modules.
Branch Node (BN)	A Branch Node (BN) has the same functionality as a Network Node (NN). A Branch Node (BN) is attached to only one ring in a PremNet Branch system. A PremNet Branch node supports three interface modules and two link modules.

System Master Node (SMN)

There is only one SMN in a multi-ring network. The SMN is determined by the DIP switches located on the Enhanced Network Management Module (ENMM). The SMN is always Node 1 in Ring 1. See Chapter 3, “Configuring Multi-Ring Networks,” for DIP switch settings.

The System Master Node (SMN) is where a Milgo Management System or asynchronous terminal is connected to configure and manage the multi-ring network. The SMN provides the following network functions:

- Displays the screens to view, create, and modify the virtual connections in the system
- Manage the system clock
- Configure the database of the network topology
- Access any remote node or module within the network
- Collect and report all alarms in the system

Interconnect Node (IN)

An Interconnect Node (IN) is a member of two different rings. It is used to interconnect two single rings in a multi-ring network. The example in Figure 1-2 shows that Ring 1 (main ring) is the *Parent Ring*, and Ring 2 is the *Child Ring*. The ring and node address is determined by the DIP switch settings on the interconnect node's ENMM module. The IN is Node 4 of Ring 1 and Node 1 of ring 2, after configuration with the asynchronous terminal. See Chapter 3, "Configuring Multi-Ring Networks".

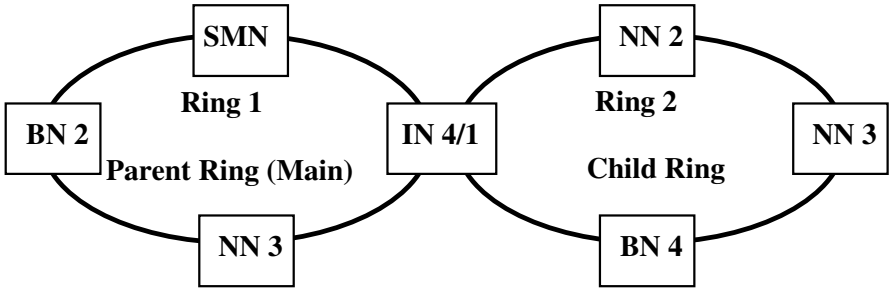


Figure 1-2. Basic Multi-Ring Network (Parent/Child)

From a terminal attached to an IN, you can perform the following functions:

- Detect the presence of a new node in the ring from the node polling, and poll the node for its node timeslot map, which includes the physical backplane/link timeslot assignment and any intra-node connections.
- Display the current alarms and alarm history for the ring.

Network Node (NN)

Network Node (NN) is the default setting for a node. If a node is to be either a System Master Node (SMN) or an Interconnect Node (IN), it must be configured as such. You configure an Interconnect Node through the CMS station or the asynchronous terminal connected to the node ENMM. The node type is stored in non-volatile memory on the ENMM in the node. You configure a System Master Node only by the DIP switch setting.

Branch Node (BN)

A Branch Node functions the same as a Network Node, except that it cannot be used as an Interconnect Node. A Branch Node has slots for three I/O modules, two link modules, one switch module, one ENMM, and one power supply. See "Network Node (NN)" in this section.

Multi-Ring Network Topologies

The multi-ring feature allows up to 16 rings to be interconnected into a single PremNet network. These rings can be interconnected to form one of the following five supported topologies:

1. Daisy Chain
2. Daisy Petal
3. Tree
4. Network Spanner
5. Hybrid

These topologies can have varied forms, but must conform to the guidelines in Chapter 3, "Configuring Multi-Ring Networks".

In each of the topologies, one ring is termed the *Main* ring (or *master* ring or *central* ring) and contains the System Master Node (SMN). The main ring always carries a ring number of 1. Rings that are connected to the main ring by an interconnect node are numbered from 2 and form the second layer of PremNet rings in the network.

The five supported topologies are described next.

Daisy-Chain Topology

The Daisy-Chain topology is ideal when customers encounter fiber-optic distance limitations in their networks. PremNet rings can be connected in a daisy chain to eliminate the distance limitations. The Daisy-Chain topology is shown in Figure 1-3.

Note: Ring 1 does not have to be at the beginning of the chain, as seen when viewing Figure 1-3 from left to right. Ring numbers 2, 3, and 4 indicate the order in which they were added to the network.

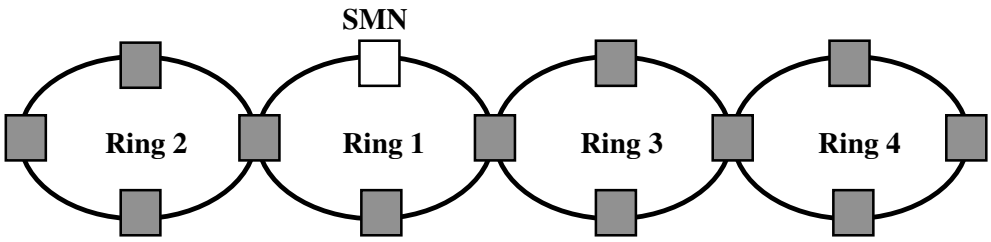


Figure 1-3. Daisy Chain Topology

Daisy-Petal Topology

The Daisy-Petal topology is ideal for applications that use more localized traffic than distance traffic, based on geographic patterns. For example, daily traffic might exist between the nodes in Ring 6; however, Ring 6 might only communicate with Ring 3 once a week. Therefore, Ring 6 traffic is on the central ring less frequently. The Daisy Petal topology is shown in Figure 1-4. This application is recommended for better bandwidth management.

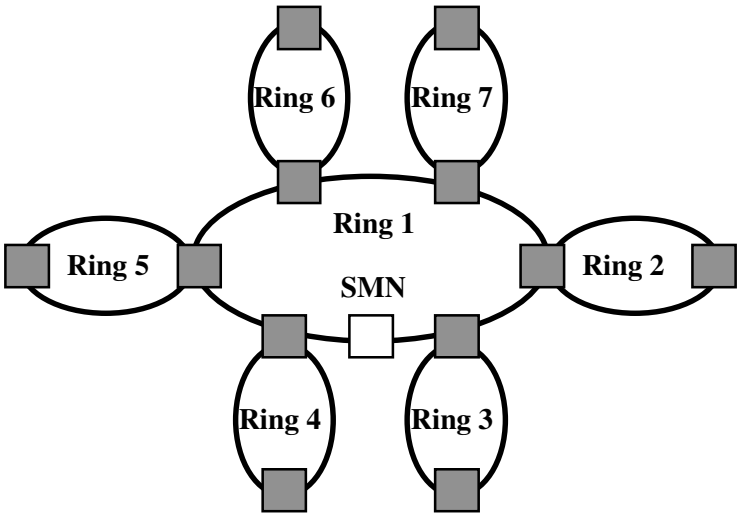


Figure 1-4. Daisy Petal Topology

Tree Topology

The Tree topology, shown in Figure 1-5, is a combination of the Daisy-Chain and the Daisy-Petal topologies.

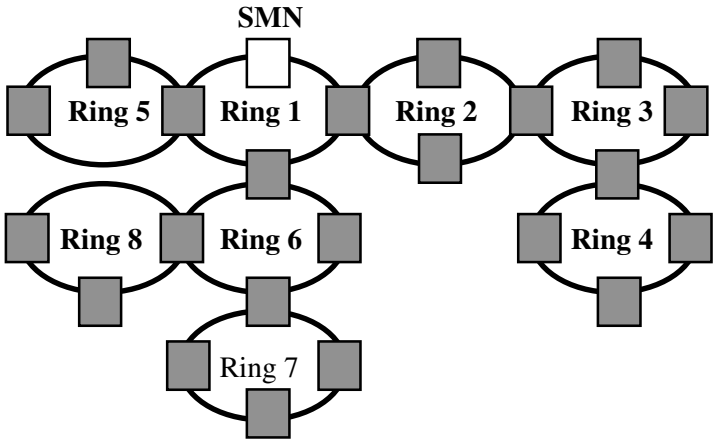


Figure 1-5. Tree Topology

Network Spanner Topology

The Network Spanner topology, shown in Figure 1-6, provides long-distance connectivity between multiple PremNet networks through the public T3 or SONET/SDH OC-3c/STM-1 network.

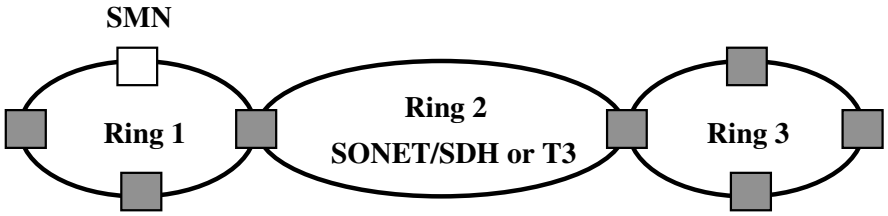


Figure 1-6. Network Spanner Topology

Hybrid Topology

The Hybrid topology combines two or more of the other four topologies. A network based on a Hybrid topology must follow the multi-ring configuration rules discussed in Chapter 3, “Configuring Multi-Ring Networks”.

Topologies Supported

These five topologies are supported in PremNet multi-ring networks. A multi-ring network can support up to 16 rings. Each ring can support up to 16 nodes. However, this includes interconnect nodes that are shared. Therefore, the maximum number of nodes supported in a multi-ring network is 241.

Note: The maximum number of nodes tested by Milgo is 76 in 5 rings. For more than 74 nodes, contact your local customer representative.

The exception to the 16-node maximum is in configurations involving a Non-Counter-Rotating-Ring (NCRR), because the maximum number of nodes supported by a NCRR ring is 14.

Certain interface modules have limits for the maximum number of virtual connections they can have. The following examples apply:

- The maximum number of Ethernet interface modules in a virtual connection is 32.
- The maximum number of ATM interface modules in a virtual connection is 16.

Topologies Not Supported

In a PremNet multi-ring network, the following topologies are not supported:

- Multiple paths from a node to the SMN
- The SMN cannot be an IN

Multiple Paths

Figure 1-7 shows a multi-ring configuration in which a Network Node has multiple paths to the System Master Node. Node 3 in Ring 3 can reach the SMN in Ring 1 through Ring 3, Ring 2, and Ring 1. There is also a path through Ring 3, Ring 4, and Ring 1. Therefore, the configuration in Figure 1-7 is not valid.

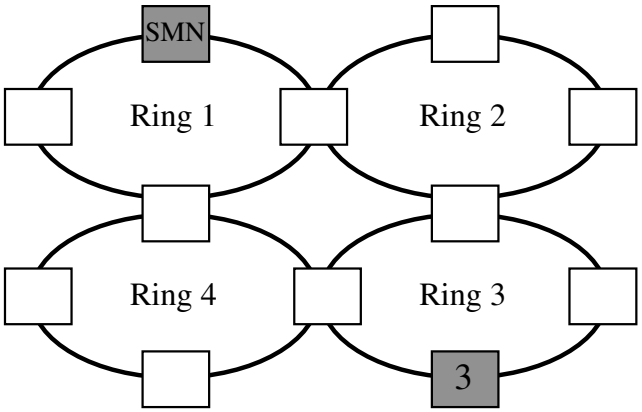


Figure 1-7. Multiple Paths to the SMN

SMN Cannot Be an IN

The SMN cannot act as an Interconnect Node. Figure 1-8 shows an example of this topology.

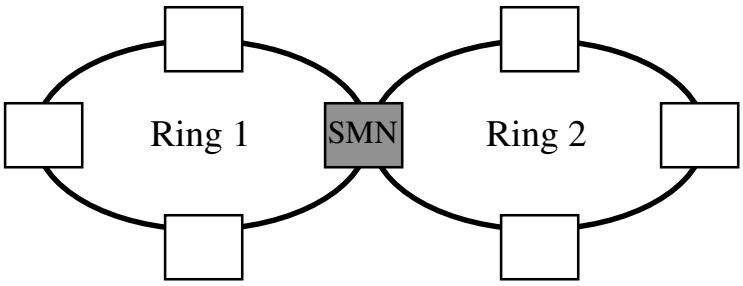


Figure 1-8. SMN as an Interconnect Node

Chapter 2
Compatibility Requirements

Introduction

To operate in a multi-ring network, with fault recovery, all PremNet modules must meet certain hardware and firmware (software) revision levels. Some interface modules may require upgrades to function in a multi-ring network.

Fault recovery utilizing the counter-rotating ring topology is supported in a PremNet multi-ring network.

Common Modules

Table 2-1 shows the minimum hardware and firmware revision levels required to operate a multi-ring network.

Table 2-1. Minimum Hardware/Firmware Revision Levels

Module	Node	Revision Level
ENMM	Master Node Interconnect Nodes	Firmware revision 3.4
ENMM	Network Nodes Branch Nodes	Firmware revision 1.0
NMM	Network Nodes	Firmware revision 05
Link Modules	SONET/SDH and T3 modules	All
	Standard modules	Firmware Revision 16 or higher
	Unilink modules	Firmware Revision 17 or higher
Switch Modules	20/30-timeslot switch modules (part # 850107)	All
	20- timeslot switch modules (part # 850015)	Hardware revision E or higher

Interface Modules

Table 2-2 lists the Interface modules that require upgrades to allow multi-ring connections.

Table 2-2. Multi-ring Interface Module Compatibility

Part Number	Module	Upgrade Kit Part Number	Minimum Revision Level
850060	4-Wire Voice (E&M)	850116	742-00153-08
850061	4-Wire Voice (RVR)	850116	742-00153-08
850062	4-Wire Voice (PTT)	850116	742-00153-08
850067	Ethernet B (Multipoint)	850117-06	742-00189-06, 742-00190-06
850074	Ethernet C (High-Performance)	850117-06	742-00242-06, 742-00243-06
850081	ATM DS3	850118	742-00281-15, 742-00282-15
850082	ATM DS3/TAXI	850118	742-00281-15, 742-00282-15

Chapter 3
Configuring Multi-Ring Networks

Introduction

This chapter describes the network and node-level configuration requirements for the Multi-Ring feature. It is assumed that you have a good understanding of single rings and single-ring variations. If you are not familiar with these procedures, you should refer to the *PremNet Broadband Access System Installation and Operation Manual*.

To successfully configure a multi-ring network, you must comply with the following steps:

- Adhere to the configuration rules described in this chapter.
- Assign the ring and node IDs by setting the DIP switches located on the ENMM.
- Configure the communications speed by setting the DIP switches located on the ENMM/NMM.
- Use the Node Command Menu to establish a virtual connection between rings in the network at the SMN.
- Determine node types for each node in the network.
- Follow the detailed instructions for configuring multi-ring networks are in Chapter 4, “Multi-Ring Network Command Menus”.

Multi-Ring Configuration Rules

Multi-ring configuration rules can exist at the network level, individual ring level, and node level. These rules are discussed below, and should be followed very carefully in multi-ring network configurations.

Network Level

- The multi-ring feature allows up to 16 rings to be interconnected into a single PremNet network.
- One of the rings in the multi-ring is the main or central ring, and this ring contains the System Master Node (SMN).
- The main ring always has a ring number of 1.

- Rings that are connected to the main ring by a common node are numbered starting with 2, and form the second layer of PremNet rings in the network.
- All nodes must have a unique path back to the SMN.
- All nodes in a multi-ring (or in a single-ring) should be set for multi-node mode.
- All rings in a PremNet multi-ring network are single-link rings. A multi-ring network cannot have a dual main ring configuration.
- There can be no duplicate ring numbers in multi-ring networks.
- There can be no duplicate node identifiers in any ring.
- After a ring number is established for a ring, that ring number cannot be changed unless all the connections to that ring are deleted. This means that the existing connections to a ring need to be taken down before the ring number of that ring is changed, and re-established after the ring number is changed.
- Every ring has its own master node (either the SMN or the IN), which has data structures that represent the condition of the ring.
- An ENMM with multi-ring firmware is required in the SMN and IN nodes.
- Modules in multi-ring networks are identified by three numbers. For example, (2,4,6) stands for Ring 2, Node 4, and Slot 6.

Ring Level

At the ring level, the main ring is parent ring and additional rings are child rings. The rules for the main ring are:

- Main ring is always ring number 1.
- Main ring always contains the SMN.
- Node 1 of the main ring is always a SMN.
- Main ring must always be an A/B ring.
- Always create the main ring first and then add subsequent rings.

Node Level

Different multi-ring rules apply to the different node types: System Master Node, Interconnect Node, and Network or Branch Node.

System Master Node (SMN)

- Only one SMN is allowed per network.
- SMN is always a member of the main ring only.
- SMN is always node 1 on the main ring (ring 1).
- An ENMM with multi-ring firmware (Release 3.x) is required in the SMN.
- SMN cannot be used to connect to another ring (i.e., an SMN cannot be an IN).
- The same rules of SMN apply to a redundant backup master node.
- All rings and nodes in the network are accessible from the SMN.
- All connections are created and controlled from the SMN.
- Full network topology view is available from the SMN.
- SMN can see the entire system's alarms.

Interconnect Node (IN)

- The IN is always node 1 of all rings other than the main ring.
- IN acts as a connector between two rings.
- IN uses at least one of the A/B link modules and at least one of the C/D link modules.
- An ENMM with multi-ring firmware (Release 3.x) is required in the IN.
- IN can see alarms only within the rings it belongs to.
- All rings and nodes are accessible from the IN.

Network Node (NN) or Branch Node (BN)

- NN/BN belongs to only one ring.
- There is only one path from NN/BN to the SMN.
- NN/BN can see only its node-specific alarms.

Configuration Procedure

This section outlines the steps you must take to establish a virtual connection in a PremNet ring. All of the options listed in this section are on the Node Command Menu. Use these options to configure each node in your network. See Chapter 5, "Multi-Ring Network Command Menus", for detailed instructions for using each option.

Note: The configuration procedure assumes that each node has an EMMM, not an NMM.

---

1. Identify the Master Node by setting the DIP switches on S2 and S3 located behind the alarm interface 50-pin DB connector on the ENMM. Refer to the ENMM DIP Switches section in this chapter. See Figures 3-1 and 3-2, and Tables 3-2 and 3-3 for appropriate DIP switch settings.

   a. Set the Node ID DIP switches on S3 to node ID 1.

   b. Set the Ring ID DIP switches on S2 to ring ID 1.

   c. Set the Baud Rate DIP switches on S3 to select the communication speed. The default is 9600 bps. See Table 3-4.

Note: The SMN is determined by the Multi-Ring software, based on the node you set as node 1.

---

2. Identify the Interconnect Nodes by setting their DIP switches on S2 and S3 of their ENMMs. See Tables 3-2 and 3-3 for appropriate DIP switch settings.

   a. Set the Node ID DIP switches on S3 for the Node ID in the parent ring from 2 to 16.

   b. Set the Ring ID DIP switches on S2 for the Ring ID to identify the node's child ring. This number must be from 2 to 16.

   c. Set the Baud Rate DIP switches on S3 to select the communication speed. The default is 9600 bps. See Table 3-4.

3. Identify the Network Nodes and Branch Nodes by setting their DIP switches on S2 and S3 of their ENMMs. See Tables 3-2 and 3-3 for appropriate DIP switch settings.

   a. Set the Node ID DIP switches on S3 for the Node ID (parent ring or child ring) from 2 to 16.

   b. Set the Ring ID DIP switches on S2 for the node's Ring ID (parent ring or child ring) to identify which ring the node is in.

   c. Set the Baud Rate DIP switches on S3 to select the communication speed. The default is 9600 bps. See Table 3-4.

4. Select the interconnect nodes and network nodes through the Service Affecting Commands option in the Node Command Menu.

5. Set the ring topology through the Service Affecting Commands option in the Node Command Menu (e.g., CRR or NCRR).

6. Configure the IP address through the SNMP network parameters option to configure the IP address, subnet mask, default router IP address, and the IP address for traps.

Note: These fields must be specified before the ENMM can initialize its SNMP interface.

---

7. Establish a logon ID and password through the Password and logon setup option.

8. Display system or node alarms through the Alarm display option to view any system or node alarms that may have occurred.

9. Display the current ring order through the Ring Configuration option.

10. Set the current date and time through the Set Time option.

11. Display the ring/node configuration through the View Ring/node Configuration option to display the configuration of the ring or local node.

12. Select the modules you want to configure through the Select Interface Module option. The procedures for configuring the modules are in the appropriate PremNet Interface Module manual.

13. Establish the virtual connections through the Connection Configuration option to establish the virtual connections between the modules in the nodes.

Note: Your network interconnection plan, which defines the physical locations, the logical numbers of the PremNet nodes, and the desired interconnection paths for the various types of transported data, dictates how you establish the virtual connections.

Once you have configured these parameters for each node in a properly connected multi-ring network, the System Master Node (SMN) is selected and the network is now functional. If you experience any difficulty, see Appendix B.

Note: The remaining options from the master Node Command Menu are not necessary to configure your network. However, you should review them to familiarize yourself with the system.

ENMM DIP Switches

The DIP switches on the ENMM identify the node ID and ring ID of each node and ring in the network and enable you to set the communications speed of the RS-232 asynchronous interface. There are two banks of DIP switches (labeled S2 and S3) located on the ENMM. These switches are located on the printed circuit board (PCB) assembly behind the alarm interface 50-pin DB connector. Use the DIP switches in banks S2 and S3 to set the following configurations for the ENMM:

- Set the communications speed using DIP switches 1, 2, and 3 on bank S3.
- Set the Node ID number using DIP switches 4, 5, 6, and 7 on bank S3.
- Set the Ring ID number using DIP switches 2, 3, 4, and 5 on bank S2.

Note: DIP switch 8 on bank S3 is not used. Additionally, DIP switch 1 on bank S2 must be set to the ON position for normal operation.

Table 3-1 lists the abbreviations used for the DIP switch settings, and their meanings.

Table 3-1. DIP Switch Setting Meanings

Abbreviation	Meaning
Ring #	DIP Switch setting on IN, the master node of a child ring
RID	An IN's Ring number ID
PID	Physical Node ID. For an IN, the node's ID in its Parent Ring. For a NN/BN, this is its node's ID number.

An abbreviation that does not apply to DIP Switch settings is LID, Logical Node ID.

This applies to an IN and is always 1. LID selection is accomplished from the Network Command Menu, Service Affecting Commands, Set Node Type, IN or NN.

Figures 3-1 and 3-2 illustrate the DIP switches located on banks S2 and S3 on the ENMM, and also show which switches are used to set node IDs, ring IDs, and baud rates.

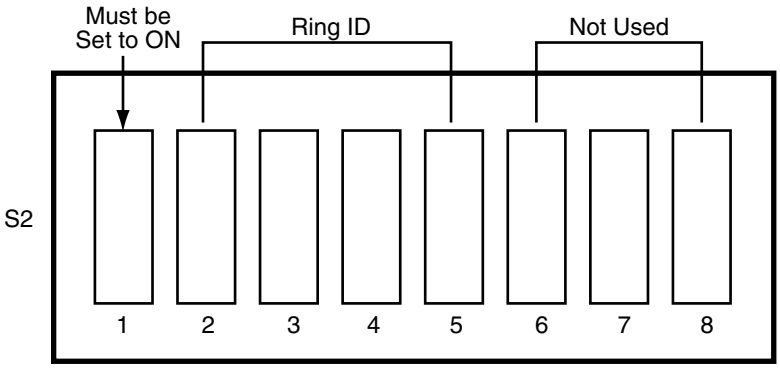


Figure 3-1. DIP Switch Settings on Bank S2

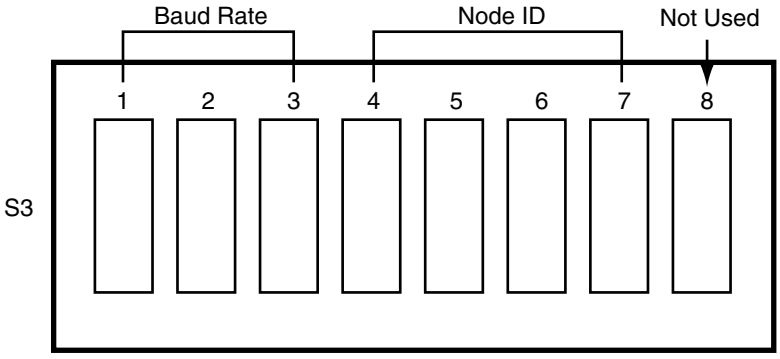


Figure 3-2. DIP Switch Settings on Bank S3

Setting the Node ID

Table 3-2 lists the default settings for DIP switches 4, 5, 6, and 7 of bank S3 of the ENMM. Use these switch settings to set the node ID. Node 1 is always the SMN. No two nodes can have the same setting.

Table 3-2. Node Identification Settings

Node Number	DIP Switch Number			
	4	5	6	7
1	on	on	on	on
2	off	on	on	on
3	on	off	on	on
4	off	off	on	on
5	on	on	off	on
6	off	on	off	on
7	on	off	off	on
8	off	off	off	on
9	on	on	on	off
10	off	on	on	off
11	on	off	on	off
12	off	off	on	off
13	on	on	off	off
14	off	on	off	off
15	on	off	off	off
16	off	off	off	off

Setting the Ring ID

Table 3-3 lists the ring identification default settings for DIP switches 2, 3, 4, and 5 of bank S2. Use these switch settings to set the ring ID. Ring 1 is always the master ring. No two rings can have the same setting.

Table 3-3. Ring Identification Settings

Ring Number	DIP Switch Number			
	2	**3**	**4**	**5**
1	on	on	on	on
2	off	on	on	on
3	on	off	on	on
4	off	off	on	on
5	on	on	off	on
6	off	on	off	on
7	on	off	off	on
8	off	off	off	on
9	on	on	on	off
10	off	on	on	off
11	on	off	on	off
12	off	off	on	off
13	on	on	off	off
14	off	on	off	off
15	on	off	off	off
16	off	off	off	off

Setting the Communication Speed

Table 3-4 lists the default settings for DIP switches 1, 2, and 3 on bank S3. Set the switches to match the communications speed of the external asynchronous terminal used to access the network management port.

Table 3-4. Communication Speed Settings

DIP Switch Numbers			Baud Rate
1	**2**	**3**	**(bps)**
on	on	on	300
off	on	on	1200
on	off	on	2400
off	off	on	4800
on	on	off	9600*
off	on	off	19200

* Factory-default setting

Chapter 4
Upgrading Multi-Ring Networks

Introduction

Upgrading a multi-ring network can involve:

- adding and new node to an existing ring
- adding a new ring to an existing network

This chapter describes the procedures for upgrading, testing, and configuring additions to the multi-ring network. It is assumed you have a spare node to preconfigure and test new nodes and modules before you put them into a network. Although PremNet networks can use T-3 link modules, the following procedures assume the use of fiber-optic link modules. All the steps are the same for both.

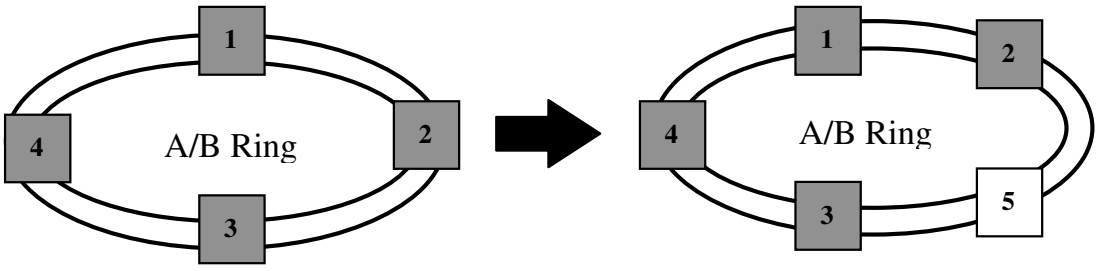
Adding a New Node to an Existing Ring

This section describes the procedure for adding a new node to an existing ring. This procedure is divided into three parts:

- Testing the New Node
- Configuring the New Node for the Network
- Connecting the New Node to the Existing Ring

Although this section deals with a single ring, the same procedure applies to multi-ring configurations as well. See Figure 4-1.

The first part of Figure 4-1 shows a single-ring network with four nodes, 1 through 4. To this example, you are adding Node 5 to this ring, as shown in the second part of Figure 4-1. The link modules mentioned in this procedure are A/B, because the ring is a single-ring configuration; in multi-ring configurations, the link modules can also be C/D.



A. Four Node Non-Counter-Rotating Single Ring

B. Adding a Node to the Ring in Step A

Figure 4-1. Adding a New Node to an Existing Ring

Note: To minimize customer downtime, use the spare node to preconfigure and test the new node before installing it into the network.

The following commands from the Node Command Menu are useful in this procedure:

Ring Configuration shows the ring map (ring numbers), links (A/B or C/D), redundancy configuration (CRR or NCRR), and node list (ring order).

Display Connection from the Connection Configuration menu shows connection name, timeslots available and used, and the actual connection.

Example: (1,1,3) - (4,7,1) - (5,11,2)

Display Node Time Slot Assignment from the Service Affecting Command menu displays time slot information such as ring number, links (A/B or C/D), maximum time slots, used time slots, and available time slots.

Alarm Display shows various types of alarms. The SMN displays all alarms. The IN displays all alarms within its rings. The NN and BN display their node-specific alarms.

Testing the New Node

The new node must be connected to the spare node to be tested. This section lists the steps to prepare the nodes for test, and to connect the two nodes for test.

New Node

Follow these steps to ensure proper performance of the new node:

1. Ensure that the minimum common logic modules (power, switch, ENMM) are installed properly.

2. Configure the ENMM module for correct ring configuration (ring ID, node ID, communications speed, IP addresses, etc.). These settings apply to the node's location in the network. In the example, the node ID is 5, and the communications speed is the same as nodes 1 through 4. The ring ID needs to be set only for the interconnect nodes.

3. Check the configuration by using the View ring/node configuration option.

4. Configure link module(s) A/B in the new node (Node 5) for correct configuration through the Service Affecting Commands option.

    - Using the Select Active Switch/Link option, select the active switch and active link modules (in our example, set Link A as active).

    - Using the Set Single/Multi Node Configuration option, set the node configuration to single or multi-node mode (in ring configurations, this is always multi-node).

    - Using the Set Ring Configuration option, configure the ring to operate in CRR or NCRR. Each node must be configured for either CRR or NCRR. In our example, we will configure Node 5 for CRR, because the ring is a Counter-Rotating Ring.

    - Using the Set 30/20 Backplane Timeslot Mode option, select the number of timeslots (two options are available - 20 or 30 timeslots).

    - Using the Set Node Type, set the node type (in our example, Node 5 is a Network Node).

Spare Node

Perform the previous four steps on the spare node with one exception. Configure the spare node as the SMN with node ID as 1. Proceed with the following steps:

1. Connect test fiber to the link modules in Node 5 and the spare node, as shown in Figure 4-2.

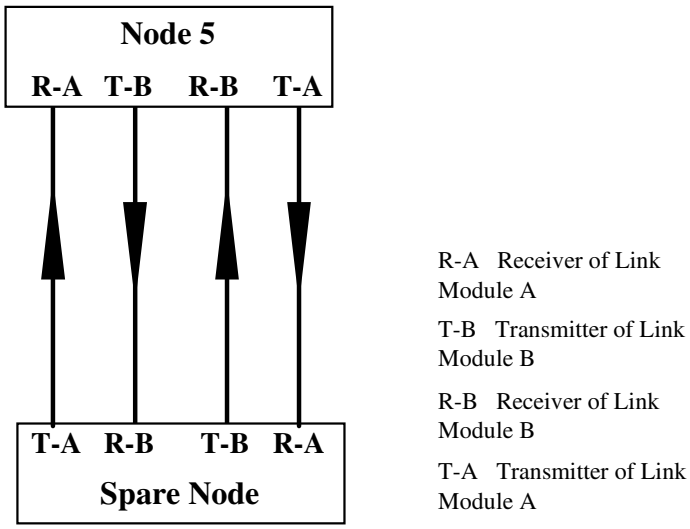


Figure 4-2. Testing the New Node

2. Ensure operation with link module (A) being active.

3. Disconnect fiber from the active link (A) to ensure operation with the backup link (B).

4. Reconnect the fiber to the link module A.

5. Use the Service Affecting Commands - Select Active Switch/Link option to make the standby link module active, and to ensure proper link module operation.

6. Use the Service Affecting Commands - Select Active Switch/Link option to make the standby switch module active, and ensure proper switch module operation.

7. Configure and test the interface modules used in Node 5.

8. If an Ethernet Interface module is available, create a temporary connection and use the backplane test to ensure operation. The Ethernet Interface module is the only module that can generate backbone traffic.

9. If possible, use this opportunity to test interface modules. Create and test connections between interface modules in Node 5 and the Spare Node.

Configure the New Node

Perform the following steps to ensure the new node is configured for the existing network:

1. After testing, delete all temporary connections.
2. Disconnect the fiber connected to the link module in Node 5.
3. Ensure the Node ID is the appropriate setting for the existing ring (in our example, the Node ID should be 5). Now the node is ready to be added to the existing ring.
4. Ship the node to the site where it is being added to the ring.

Connect Node to Existing Ring

Perform the following steps to connect the node to the existing ring:

1. Add the node to the network by connecting the link modules.
2. Check ring failure conditions by accessing the Alarm Display option.
3. Ensure that the SMN has communications with the new node (Node 5).
4. Check the node and ring configuration by using the View System/Node Configuration option.
5. Check the ring order by using the Ring Configuration option.
6. Save the new ring configuration.
7. Test various failure conditions involving the new node (such as link, switch, etc.) to make sure the system remains operational in the backup mode.
8. Create the desired connections by using the Connection Configuration option.

Adding a New Ring to Existing Rings

This section describes the procedure for adding a new ring to an existing ring, resulting in a multi-ring. The existing ring becames the parent ring of the new (child) ring. Although this procedure involves adding a single-ring configuration to another single-ring configuration, the same procedure applies to adding a single ring configuration to a multi-ring configuration. (See Figure 4-3.) This procedure is divided into four parts:

- Configuring the new child ring in a standalone single-ring configuration
- Testing the new child ring in a standalone mode to ensure proper operation
- Connecting the new child ring to an existing ring and making the appropriate connections
- Verifying the integrity of the two rings, connections, and the SMN

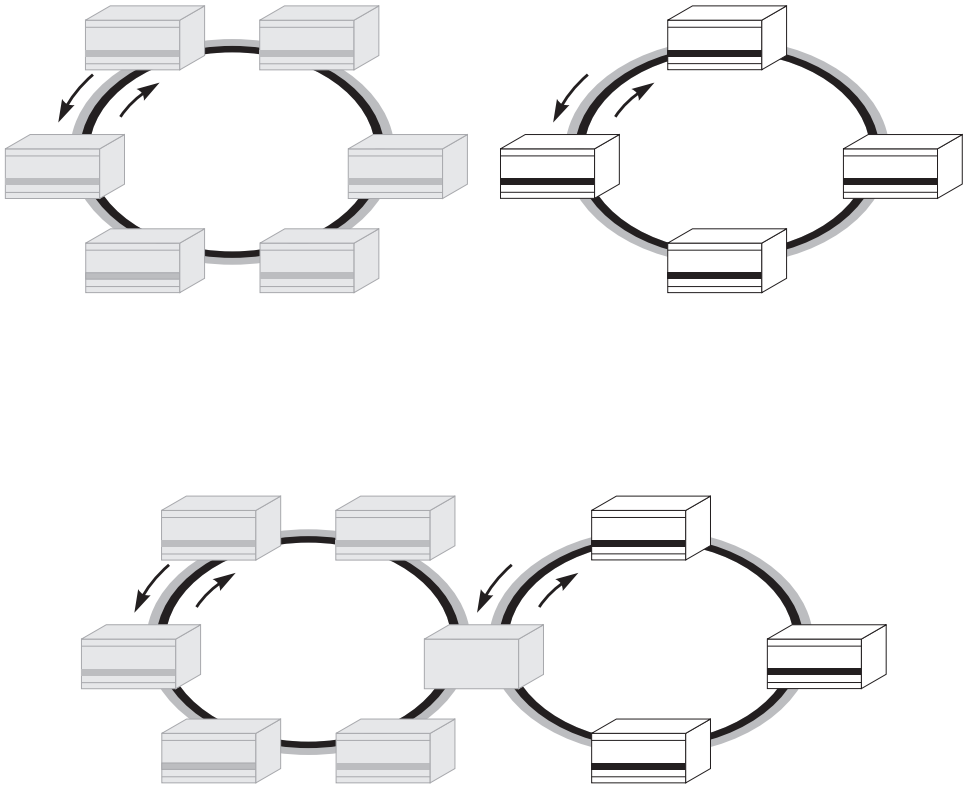


Figure 4-3. Adding a New Ring to an Existing Ring

Note: To minimize customer downtime, preconfigure and test the new ring before installing it into the network. Use the spare node as the master node before adding the new ring to an existing ring.

Configure the New Ring

Perform the following steps to configure the new ring:

1. Make sure the main (parent) ring is configured as an A/B ring. The main ring must always be configured first, and then subsequent rings should be added. This procedure assumes that the main ring is already configured and is functional as an A/B ring.

2. Create the new child ring with the necessary nodes (in our example, Ring 2 has four nodes including the spare node). This procedure assumes you are familiar with the configuration of single-ring networks.

3. Use the spare node in Ring 2, instead of the Interconnect Node (node 3) from Ring 1, to test Ring 2 in standalone mode before you connect it to the main ring, thus minimizing downtime for Ring 1.

4. Configure the link module(s) in the spare node as C/D. In general, these link modules can be A/B or C/D, depending on the existing ring. In our example, the link modules in Ring 2 should be configured for C/D, because Ring 1 is the main ring, and the main ring is always A/B. Any rings added directly to the main ring are always C/D rings. Any rings added to the C/D rings are always A/B rings. It is easy to see that this sequence alternates between A/B and C/D. For example, any ring added to Ring 2 in our example becomes an A/B ring.

5. Ensure that all nodes in Ring 2 are configured properly. Check for proper Ring ID, Node ID, communication speed, node configuration (CRR or NCRR), timeslots, and node type.

Test the New Child Ring

To ensure proper operation, perform the following steps to test the new child ring in standalone mode:

1. Create connections on the child ring (ring 2) between different nodes in the ring, and validate proper operation. Initiate failure conditions with link modules, switch modules, and interface modules to ensure proper operation of the ring.

2. Delete all temporary connections on the new child ring after testing.

3. Unplug the link modules from the spare node. You will install them in the Interconnect Node (node 3) of ring 1 when you connect the child ring to the parent ring.

Connect the New Child Ring

Perform the following steps to connect the new child ring to an existing ring, making appropriate connections:

1. On the ENMM module, in the Interconnect Node (node 3 of ring 1), change the ring ID to represent the child ring (in our example, the ring ID should be set to 2). Ring ID range is from 2 to 16, and can be set by using DIP switches 2, 3, 4, and 5 in bank S2 on the ENMM module.

Note: After a ring number is established for a ring, that ring number cannot be changed unless all the connections to that ring are deleted. This means that the existing connections to a ring need to be taken down before the ring number of that ring is changed, and re-established after the ring number is changed.

---

2. Install the link module(s) into the correct C/D slot(s) in the Interconnect Node (node 3 of ring 1). This will generate alarms on the main ring.

3. Use the Service Affecting Command - Set Node Type option to change the node type of node 3 in ring 1 from Network Node to Interconnect Node, and configure the child ring as C/D. This node (node 3 of ring 1) resets and sends timeslot information to the SMN.

4. Use the Service Affecting Command - Display Node Time Slot Assignment option at the SMN to verify the timeslot information.

5. Use the Service Affecting Command - Set Ring Configuration option to ensure that the redundancy option in the Interconnect Node (node 3 of ring 1 or node 1 of ring 2) is the same as that of ring 2. In our example, both A/B (parent, ring 1) and C/D (child, ring 2) are set for CRR configuration.

6. Reconnect the asynchronous terminal, and check ring ID and child ring order. The interconnect node should display 2,1 because it is ring 2, node 1.

7. Select ring 1 to ensure connectivity to the SMN.

8. Display the new ring order using the Ring Configuration - Display Ring Map option. The ring order in our example should display: 1-2-3R2-4-5-6 for Ring 1 and 1-2-3-4 for Ring 2.

Verify Integrity of the Network

Perform the following steps to verify the integrity of the two rings, connections, and the SMN:

1. Reconnect the asynchronous terminal to the SMN and check ring ID.

2. Check ring failure conditions by accessing the Alarm Display option.

3. Check the ring and node configuration by using the View System/Node Configuration option.

4. Test switch, link, and power failure conditions to ensure the system remains operational in the backup mode.

5. Verify that all existing connections (applications) on ring 1 are performing properly.

6. If Ethernet Interface modules are available, create a temporary connection between rings, and use the backplane test to ensure operation. The Ethernet Interface module is the only module that can generate backbone traffic.

7. Delete all temporary connections created for testing.

8. Create any new desired connections using the Connection Configuration option.

Chapter 5
Multi-Ring Network Command Menus

Introduction

The PremNet Multi-Ring network provides management functions through a single management connection. This single connection can be one of the following:

- An asynchronous terminal connected to the RS-232 network management port at the SMN or to any IN.
- An SNMP path to the Ethernet port at the SMN when connecting to a network management platform.

This chapter describes how to use the Node Command Menus viewed on an **asynchronous terminal** for the System Master Node (SMN), Interconnect Nodes (INs), Network Nodes (NNs), and Branch Nodes (BNs) to configure and monitor your PremNet multi-ring network. It is assumed in the following sections that both the SMN and INs have an ENMM with multi-ring software installed.

The Node Command Menus for the INs, NNs, and BNs contain a subset of the options available from the System Master Node Command Menu. The Node Command Menu for an NN and a BN enables you to configure and monitor only that ring. See Table 5-1 for a list of the options that are available from the different node types. The command options listed in Table 5-1 are described in detail in this chapter.

Table 5-1. Multi-Ring Network Command Options

Option	SMN	IN	NN/BN
Alarm display	x	x	x
Display link error	x	x	x
Connection configuration	x	N/A	N/A
Configure Ethernet port type	x	x	x
Service affecting commands	x	x	x
T7 setup	x	x	x
Monitor status	x	x	x
SNMP network parameters	x	x	x
Password and logon setup	x	x	x
Log off	x	x	x
Ring configuration	x	x	N/A
Select interface module	x	x	x
Set time	x	x	x
View configuration	x	x	x
External alarm configuration	x	x	x
Select active messaging ring	x	x	x
(?) or (/) Command menu	x	x	x
(#) Node select	x	x	x
($) Ring select	x	x	N/A

Accessing Node Command Menus

Access the Node Command Menus through an asynchronous terminal attached to the RS-232 port to view the screens in this chapter.

You can access the Node Command Menu for the SMN, an IN, or an NN from any SMN or IN that has an ENMM by selecting the Ring select/Node select option from the Node Command Menu on that node. Figure 5-1 shows the types of nodes you can access from a terminal (T1, T2, or T3).

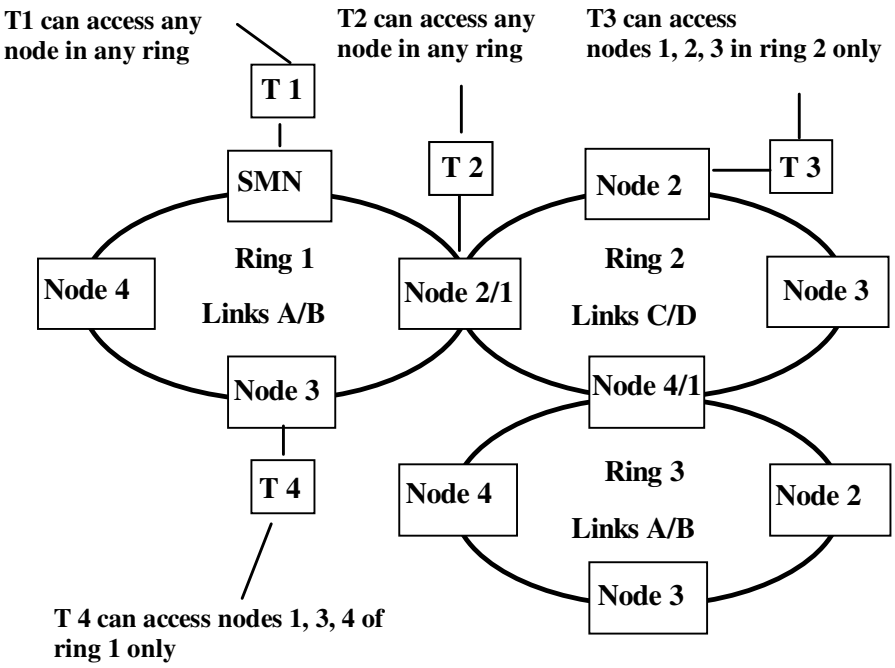


Figure 5-1. Multi-Ring Network Node Access

The terminal screen is blank when you power-up the system.

To access or Log On the Node Command Menu:

1. Press [ENTER] to display the PremNet Introduction screen.

2. Enter your password. On a new system, the default password is manager. Type **manager**, and press [ENTER]. The password is case-sensitive.

Note: If you enter the password incorrectly three times, the node locks for five minutes (default). Also, if you do not make an entry to the system for five minutes (default), the ENMM logs you off the system. You can change these defaults through the "Password and logon setup" option, described later in this chapter.

When using the terminal keyboard, remember to:

- Use lowercase letters to enter commands.

- Press [ESC] from any submenu or screen to exit that screen.

- Type **?** or **/** to return to the current command menu.

After you enter the correct password, you see a Node Command Menu (the menu that displays depends on your configuration) similar to the ones shown in Figure 5-2 through Figure 5-4.

If you have just powered up the system, the following system alarm appears at the bottom of the Master Node Command Menu, indicating that alarms have occurred on the system.

```
***ALARM!!! please see system alarm display.***
```

SMN Command Menu

The screen shown in Figure 5-2 is similar to the Node Command Menu for the System Master Node (Node 1 in the multi-ring network). When the terminal is attached at the SMN, all the nodes in the system are accessible.

```
Active nodes: #1 #2 #3 #8
Alarming nodes: None
Master node: #1
Node 01 Node Command Menu

(A) Alarm display                      (C) Connection configuration
(D) Select link module                 (E) Configure Ethernet port type
(F) Service affecting commands         (L) T7 setup
(M) Monitor system/node status         (N) SNMP network parameters
(P) Password and logon setup           (Q) Log off
(R) Ring configuration                 (S) Select interface module
(T) Set time                           (V) View ring/node configuration
(X) External alarm configuration       (Z) Select active messaging ring
(?) or (/) Command menu                (#) Node select
($) Ring select
01, 01 >
```

Figure 5-2. SMN Node Command Menu

The node configured as node 1 (using the DIP switch settings) on ring 1 assumes the role of the System Master Node.

IN Command Menu

Figure 5-3 shows the IN Command Menu. This menu displays when a node has been configured as an Interconnect Node. When the terminal is attached at the IN, all the nodes in the system are accessible.

```
Active nodes: #1 #9 #10 #11 #12 #13 #14 #15 #16
Alarming nodes: None
Node 01 Node Command Menu

(A) Alarm display                    (D) Select link module
(E) Configure Ethernet port type     (F) Service affecting commands
(L) T7 setup                         (M) Monitor system/node status
(N) SNMP network parameters          (P) Password and logon setup
(Q) Log off                          (R) Ring configuration
(S) Select interface module          (T) Set time
(V) View ring/node configuration     (X) External alarm configuration
(Z) Select active messaging ring     (?) or (/) Command menu
(#) Node select                      ($) Ring select
02, 01 >
```

Figure 5-3. IN Node Command Menu

NN or BN Command Menu

Figure 5-4 shows the Node Command Menu for Network Nodes (NNs) and Branch Nodes (BNs). Use the set node type option on the Service affecting commands menu to set the node type.

```
Node status: Active with alarm
Master node #1
Node 03     Node Command Menu

(A) Alarm display                    (D) Display link error
(E) Configure Ethernet port type     (F) Service affecting commands
(L) T7 setup                         (M) Monitor status
(N) SNMP network parameters          (P) Password and logon setup
(Q) Log off                          (S) Select interface module
(T) Set time                         (V) View configuration
(X) External alarm configuration     (Z) Select active messaging ring
(?) or (/) Command menu              (#) Node select
01, 03>
```

Figure 5-4. NN or BN Node Command Menu

The rest of this chapter describes each menu option as it is shown on the SMN screen.

Alarm display (A)

In Figure 5-2, the Alarm display option enables you to view both system and node alarms (from a terminal attached to the SMN only).

To select the Alarm display option for SMN:

1. Type **A** at the Node Command Menu prompt and press [ENTER]. The system displays the Alarm Display Menu shown in Figure 5-5.

```
01,01> Alarm display -
(1) current system alarm                (2) current ring alarm
(3) current node alarm                  (4) system alarm history
(5) ring alarm history                  (6) node alarm history
(7) clear main ring alarm history       (8) clear ALL SYSTEM alarm history
enter (1-8):
```

Figure 5-5. Alarm Display Menu

Note: The node alarm history, ring alarm history, and system alarm history options are useful when troubleshooting intermittent network alarm conditions because all alarm conditions are recorded and time-tagged. The current system alarm, current ring alarm, and current node alarm options may not have recorded the alarm condition by the time you view the display.

2. Select one of the available alarm options (1-8) from the Alarm Display Menu, and press [ENTER]. Table 5-2 describes each alarm option.

3. Press [ESC] to exit the option.

Table 5-2. Alarm Display Options

Option	Availability	Description
current system alarm (1)	SMN	Displays the current alarm status of the network. If alarms are present, the system displays the ring number and type of failure. This option is not available at an NN or IN or when the node is configured as a "single node".
current ring alarm (2)	SMN/IN	Displays all ring alarms that currently exist in the ring, and all alarming nodes in the ring with the same alarm type.
current node alarm (3)	All nodes	Displays the current alarm for the local node. All node-related alarms are displayed. The node alarms provide more detailed information about the alarm than the current system alarm option.
system alarm history (4)	SMN	Displays the past system alarms. All the alarms are time-tagged for reference and troubleshooting. The system alarm history option stores up to 100 past system alarm messages. This option is not available at an NN or IN or when the node is configured as a "single node".
ring alarm history (5)	SMN/IN	Displays the time the alarms were set and cleared for the current ring.
node alarm history (6)	All nodes	Displays the past 25 node alarms. All alarms are time-tagged for reference and troubleshooting.
clear main ring alarm history (7)	SMN	At the SMN, this command clears all alarm history buffers in the SMN, and all history buffers in all nodes in the main ring.
clear ALL SYSTEM alarm history (8)	SMN	Clears the alarm history from all nodes in the system. Clears the history buffer when troubleshooting intermittent alarm conditions.

(C) Connection configuration (SMN only)

In Figure 5-2, the Connection configuration option enables you to establish virtual connections between the nodes in the network. If the system is configured as a single node, connections can be made only on the backplane. (Backplane connections enable communication between compatible modules in the single node.)

Mapping Timeslots

A virtual connection is a group of similar interface modules connected by a common link timeslot. In a single-ring PremNet network, all connected interface modules, with their link timeslots in the ring, are mapped with a unique connection number. These connection numbers are then mapped to unique connection names.

In the multi-ring system, the ring connection/timeslot map is collected by the SMN, and the global connection is established by linking the individual ring connections that share common interconnecting timeslots.

When the SMN is creating a new virtual connection, it selects a global connection number, creates a new ring connection number, and then maps the connection to the appropriate link timeslot for all the rings involved in the connection.

To perform the mapping, the SMN uses connection tables, which include the connection name and connection bandwidth (number of link timeslots required).

In Figure 5-2, to access the Connection configuration option:

1. Type **C** at the SMN Node Command Menu prompt and press [ENTER]. The system displays a Connection Configuration Menu similar to the one shown in Figure 5-6.

```
(1) display connection
(2) create connection
(3) modify connection
enter (1-3):
```

Figure 5-6. Connection Configuration Menu

2. Type **1**, **2**, or **3** at the prompt, and press [ENTER]. From this menu, you can display, create, or modify any connection in the network. The connection options available from this menu are described in the next section.

(1) display connection

In Figure 5-6, the display connection option enables you to display all current connections in the network, including each connection name, the number of timeslots used in each connection, and the ring number, node number and module number of all modules involved in the connection.

To display connections:

> Type **1** at the Connection Configuration Menu prompt, and press [ENTER]. The system displays the Display Connections Menu shown in Figure 5-7.

```
(1) display all connections
(2) display single connection
(3) display ring timeslots
enter (1-3):
```

Figure 5-7. Display Connections Menu

display all connections (1)

In Figure 5-7, to display all network connections:

> Type **1** at the Display Connections Menu prompt, and press [ENTER]. The system displays a Current Network Connection Menu similar to the one shown in Figure 5-8.

```
Current connection
                Time
Name            slots       Connection
-------------------------------------------
Eth_02          2           (1,2,4)-(3,4,1)
TR_01           2           (2,4,8)-(2,1,5)
-------------------------------------------
(1) display connection
(2) create connection
(3) modify connection
enter (1-3):
```

Figure 5-8. Current Network Connection Menu

If there is more than a single screen of connections, the system prompts you to continue with the display of all the connections.

Figure 5-9 shows a connection screen with errors.

```
Current connection
                Time
Name            slots       Connection

Eth_02          2           (1,2,4) - &3,4,1&
TR_01           2           X2,4,8X-(2,1,5)

(1) display connection
(2) create connection
(3) modify connection
enter (1-3):
```

Figure 5-9. Current Network Connections With Errors

If there are errors in the virtual connections, the following indications are shown on the screen:

X indicates that module 8 is removed from the network.

& indicates that ring 3 is no longer on the network. All connections involved with ring 3 are marked with the &.

Note: If the ring or the module returns to the network, the ( ) are displayed.

display single connection (2)

In Figure 5-7, the display single connection option enables you to display a single connection in the network.

To display a single network connection:

1. Type **2** at the Display Connections Menu prompt, and press [ENTER]. The system displays the following message, prompting you to enter the name of the connection you want to view:

   ```
   Display connection
   connection name:
   ```

2. Type the name of the connection you want to view, and press [ENTER]. The system displays a Display Single Network Connection Menu similar to the one shown in Figure 5-10, which lists the connection name, the number of timeslots assigned, and the ring number, node number, and slot number of the module for each connection.

```
Current connection
                    Time
Name                slots    Connection
Eth_02                2      (1,2,4)-(3,4,1)

(1) display connection
(2) create connection
(3) modify connection
enter (1-3):
```

Figure 5-10. Display Single Network Connection Menu

display ring timeslots (3)

In Figure 5-7, the display ring timeslots option enables you to see how many timeslots are available and used on all the rings in your network.

In addition, the screen also displays which links are active, as well as the maximum number of timeslots available on each ring.

To display the timeslots on your network:

Type **3** at the Display Connections Menu prompt, and press [ENTER]. The system displays the Timeslot Information Menu shown in Figure 5-11.

```
Timeslot Information
Ring          Ring                        Timeslots
Number        Active      Max             Used        Available
1             A/B         20              0           20
2             C/D         20              3           17
5             A/B         30              5           25
7             C/D         20              12          8

(1) display connection
(2) create connection
(3) modify connection
enter (1-3):
```

Figure 5-11. Timeslot Information Menu

(2) Create connection

In Figure 5-6, the Create connection option enables you to assign timeslots by creating a connection between the same two types of modules installed in two separate nodes.

Caution: Although you can create a virtual connection between two different modules that use the same number of timeslots, the modules may not function properly.

To create a connection:

1. Type **2** at the Connection Configuration Menu prompt, and press [ENTER]. The system displays the following prompt:

   ```
   Create connection
   connection name:
   ```

2. Type the name you want to use for the connection. The name can have up to 10 alphanumeric characters (e.g., RS232-1). If you press [ENTER] without entering a connection name, the system uses the default connection name, *net x*. The system displays the following prompt:

   ```
   From (ring, node, module):
   ```

3. Type the ring number, node number, and slot number of the interface module you want to connect (e.g., 1, 5, 4), and press [ENTER]. The system displays the following information about this connection, followed by a prompt:

   ```
   (1,5,4): module ID = 31, timeslots required=2

   To (ring, node, module):
   ```

4. Type the ring number, node number, and slot number of the interface module you want to connect (e.g., 2,9,6), and press [ENTER].

   If you make a valid connection, the system displays the connection information and redisplays the Connection Configuration Menu, as shown in Figure 5-12.

   If you make an invalid connection, the system displays an error message. Examples of invalid connections include assigning a connection between modules with different timeslot requirements or assigning a connection to a vacant interface slot in the chassis.

5. Return to Step 1 and repeat the create connection procedure for other point-to-point virtual connections desired between Interface modules in the network.

```
Awaiting response from INODE ring 2
(2,9,6): module ID = 31, timeslots required=1
Awaiting response from INODE ring 2
OK

(1) display connection
(2) create connection
(3) modify connection
enter (1-3):
```

Figure 5-12. Connection Configuration Menu Redisplay

(3) Modify connection

In Figure 5-6, the modify connection option enables you to add, remove, delete, and rename connections.

To modify a connection:

1. Type **3** at the Connection Configuration Menu prompt, and press [ENTER]. The system displays the following message:

   ```
   Modify connection
   connection name:
   ```

2. Type the name of the connection you want to modify (e.g., Eth-01), and press [ENTER]. The system displays the current configuration for the connection you selected, followed by the Modify Connection Selection Menu shown in Figure 5-13.

```
Eth-01 (1,5,4)-(2,9,6)
(1) add module
(2) remove module
(3) delete connection
(4) rename connection

enter (1-4):
```

Figure 5-13. Modify Connection Selection Menu

add module (1)

In Figure 5-13, the add module option enables you to add another module to establish multiple connections. You must complete the following steps for each module you add to a connection.

To add a module:

1. Type **1** at the Modify Connection Selection Menu prompt, and press [ENTER]. The system displays the following message:

   Add (ring, node, module): **X, X, X**

2. Type the ring number, node number, and slot number of the interface module you want to add to the existing connection, and press [ENTER]. The system redisplays the Modify Connection Selection Menu.

remove module (2)

In Figure 5-13, to remove a module from the connection:

1. Type **2** at the enter (1-4): prompt, and press [ENTER]. The system displays the following message, prompting you to enter the connection to remove:

   Remove (ring, node, module): **X, X, X**

2. Type the ring number, node number, and slot number of the interface module you want to remove from the existing connection, and press [ENTER]. The system redisplays the Modify Connection Selection Menu.

delete connection (3)

In Figure 5-13, to delete a connection:

1. Type **3** at the enter (1-4): prompt, and press [ENTER]. The system displays the following prompt:

   Delete connection... are you sure ? (y/n):

2. Type **Y** to delete the connection; type **N** to maintain the connection. The system displays the OK message followed by the Modify Connection Selection Menu if the deletion was successful. If the connection was not successful, the system displays an error message.

rename connection (4)

In Figure 5-13, to rename a connection:

1. Type **4** at the enter (1-4): prompt, and press [ENTER]. The system displays the following prompt:

New connection name:

2. Type the new connection name, and press [ENTER]. The system redisplays the Modify Connection Selection Menu.

Establishing multiple connections

You can establish multiple connections for all types of interface modules.

To establish multiple connections:

1. Use the create connection option to establish the initial point-to-point connection.

2. Use the modify connection option, and select Add module to complete the connection to the next module in a multipoint connection.

3. Continue establishing connections until the network is completed.

(D) Select link module

In Figure 5-2, the Select link module option enables you to select a link module (A-D) installed in the node. When you power-up the system, it arbitrarily selects which link (A-D) or switch (A or B) module is active.

To select another link module:

1. Type **D** at the Node Command Menu prompt. The system displays the following message prompting you to enter the new active link module:

   Select link module - enter module position (A-D):

2. Type the letter of the link module you want to access (A-D), and press [ENTER]. The system displays the Link Module Command Menu. The menu displayed depends on the type of link modules installed in the node. Figure 5-14 shows the 1300nm Laser SM Module Command Menu as an example.

For information about other link modules, see the *PremNet Broadband Access System Installation and Operation Manual.*

1300nM-15db Laser SM	Module Command Menu
(A) display current error registers	(B) display ES/15-minute history
(C) display SES/15-minute history	(D) display ES/day history
(E) display SES/day history	(F) reset link error registers
(G) monitor link error	(H) Help
(I) toggle CRC error monitoring	(Q) Log off
(X) Exit	(?) or (/) Command Menu
(#) Link select	
01,LNA>	

Figure 5-14. 1300nM-15db Laser SM Module Command Menu

From the Link Module Command Menu, you can display error information for a specific link module. This function enables you to track that link module's bit error rate (BER) data over a given period of time.

Note: A Severe Error Second (*SES*) is each second that the data BER exceeds 10E-6 (which translates to 100 bit errors every second at the rate that the PremNet system operates). An Error Second (*ES*) is each second that the data's BER is 10E-9.

Note: Each option in the Module Command Menu displays a screen followed by the prompt. In this example the prompt is 01,LNA>. At the prompt, type **?** or **/** to return to the Module Command Menu.

(A) display current error registers

In Figure 5-14, the display current error registers option enables you to display a register that includes the number of error seconds and severe error seconds that have occurred in the last 15 minutes (ES/15-minute and SES/15-minute) as well as the number that have occurred over a 24-hour period ("ES/day" and "SES/day").

Type **A** at the Link Module Command Menu prompt to select the display current error registers option, and press [ENTER]. A screen similar to the one shown in Figure 5-15 appears.

```
Current error counts
                                        10-May-1997 12:13:12
ES/15 minute:          0
SES/15 minute:         0
ES/day:                1
SES/day:               0

01,LNA>
```

Figure 5-15. Current Error Counts Screen

(B) display ES/15-minute history

In Figure 5-14, the display ES/15-minute history option enables you to view the number of error seconds per 15-minute interval over 31 such intervals.

Type **B** at the Link Module Command Menu prompt to select the display ES/15 minute history option, and press [ENTER]. A screen similar to the one shown in Figure 5-16 appears.

```
ES/15–minute History
                                        12-May-1997 12:15:15

01>     0       17>     0
02>     1       18>     0
03>     0       19>     0
04>     0       20>     0
05>     0       21>     0
06>     0       22>     0
07>     0       23>     0
08>     0       24>     0
09>     0       25>     0
10>     0       26>     0
11>     0       27>     0
12>     0       28>     0
13>     0       29>     0
14>     0       30>     0
15>     0       31>     0
16>     0

01,LNA>
```

Figure 5-16. ES/15-minute History Screen

(C) display SES/15-minute history

In Figure 5-14, the display SES/15-minute history option enables you to view the number of severe error seconds per 15-minute interval over 31 such intervals.

Type **C** to select the display SES/15-minute history option, and press [ENTER]. Figure 5-16 shows the screen that is displayed when you select this option. Figure 5-16 is representative of both the "display ES/15-minute history" screen and the "display SES/15-minute history" screen.

(D) display ES/day history

In Figure 5-14, the display ES/day history option enables you to display the number of error seconds for the last six days.

Type **D** at the Link Module Command Menu prompt to select the display ES/day history option, and press [ENTER]. Figure 5-17 shows the screen that appears when you select this option.

```
ES/day History
                                    10-May-1997:     12:16:25
01>       0
02>       0
03>       0
04>       0
05>       0
06>       0

01,LNA>
```

Figure 5-17. ES/day History Screen

(E) display SES/day history

In Figure 5-14, the display SES/day history option allows you to display the number of severe error seconds for the last six days. Figure 5-17 shows the screen that is displayed when you select this option.

Type **E** at the Link Module Command Menu prompt to display the SES/day history, and press [ENTER]. Figure 5-17 is representative of both the "display ES/day History" screen and the "display SES/day history" screen.

(F) reset link error registers

In Figure 5-14, the reset link error registers option enables you to clear the link error registers by setting their contents to a value of zero.

To reset the link error registers:

1. Type **F** at the Link Module Command Menu prompt, and press [ENTER]. The system displays the following message, prompting you to enter a selection:

   ```
   reset link error registers-are you sure?..(y/n):
   ```

2. Type **Y** to reset the registers or type **N** to cancel the request, and press [ENTER]. If you type **Y**, the system displays the following message:

   ```
   Error counts reset at: 23-MAY-1997 12:18:25
   ```

   If you type **N**, the system returns you to the 01,LNA prompt.

(G) monitor link error

In Figure 5-14, the monitor link error option enables you to monitor the number of error seconds and severe error seconds that have occurred in the last 15 minutes as well as over the last 24 hours (see Figure 3-18). Unlike the error counts that are displayed on the "display current error register" screen, which represent only a snapshot of the errors counted at the moment of sampling, the error counts displayed on the "monitor link error" screen are continually updated.

To monitor link errors:

1. Type **G** at the Link Module Command Menu prompt, and press [ENTER]. The system displays a screen similar to the one shown in Figure 5-18.

2. Press [ENTER] to stop the scrolling screen and return to the 01,LNA prompt.

Node	Link	ES/15-min	SES/15-min	ES/Day	SES/Day	
2	A	0	0	317	315	12:32:58
2	A	0	0	317	315	12:32:59
2	A	0	0	317	315	12:33:00
2	A	0	0	317	315	12:33:01
2	A	0	0	317	315	12:33:02
2	A	0	0	317	315	12:33:03
2	A	0	0	317	315	12:33:04
2	A	0	0	317	315	12:33:05
2	A	0	0	317	315	12:33:06
2	A	0	0	317	315	12:33:07
2	A	0	0	317	315	12:33:08
2	A	0	0	317	315	12:33:09

Figure 5-18. Monitor Link Error Screen

(I) toggle CRC error monitoring

In Figure 5-14, the toggle CRC error monitoring option lets you enable or disable the CRC monitoring function.

To toggle CRC error monitoring:

1. Type **I** at the Link Module Command Menu prompt, and press [ENTER]. The system displays the following warning message and prompt:

   ```
   ******************WARNING******************

   CRC error monitoring requires compatible hardware.

   Check the hardware revision first.

   Continue? ... (y/n):
   ```

2. Type **N** and press [ENTER] to cancel the request and return to the prompt. Type **Y** and press [ENTER] to enable the monitoring function. The system displays the following message, prompting you for a selection:

   ```
   CRC error monitoring is disabled.
   Enable CRC error monitoring?...(y/n):
   ```

3. Type **N** and press [ENTER] to cancel the function and return to the prompt. Type **Y** and press [ENTER] to change the function. The system displays the following message, and then redisplays the Link Module Command Menu.

   ```
   CRC error monitoring is enabled.
   ```

(H) Help

In Figure 5-14, the Help option enables you to display a brief description of any of the selections available from the Link Module Command Menu.

(Q) Log off

In Figure 5-14, the Log off option enables you to log off of the system.

(X) Exit

In Figure 5-14, the Exit option enables you to return to the Node Command Menu.

(?) or (/) Command Menu

In Figure 5-14, the Command Menu option enables you to display the options available from the Link Module Command Menu.

(#) Link select

In Figure 5-14, the Link Select option enables you to access other link modules installed in the node.

(E) Configure Ethernet port type

In Figure 5-2, the Configure Ethernet port type option enables you to change the port type to match the media you are using. Before making a selection, ensure that the attached segment is properly terminated.

To configure the Ethernet port type:

1. Type **E** at the Node Command Menu prompt, and press [ENTER]. The system displays the following message, prompting you to make a selection:

   ```
   Current Ethernet port type: Thinnet Coax
   Enter new Ethernet port type (1=AUI 2= Thinnet coax):
   ```

2. Type **1** or **2** at the Enter new Ethernet port type prompt, and press [ENTER]. The system displays a message showing the change to the port type.

(F) Service affecting commands

In Figure 5-2, the Service affecting commands option allows you to perform the following network activities:

- Select the active switch or link module
- Display and organize node timeslot assignments
- Configure the switch to operate in single or redundant mode
- Configure the ring to operate in redundant or counter-rotating mode
- Set the node configuration to single- or multi-node mode
- Select between 20 and 30 timeslots (the default is 20)
- Set the node type

To access service affecting commands:

1. Type **F** at the Node Command Menu prompt, and press [ENTER]. The system prompts you to enter a password.
2. Type the password (the default password is manager), and press [ENTER]. The system displays the Service Affecting Command Menu, shown in Figure 5-19.
3. Select one of the options from the menu, and press [ENTER]. Each option is described in the following section.

```
Service Affecting Command Menu

(1) select active Switch/Link module
(2) display node timeslot assignment
(3) organize node timeslot assignment
(4) set single/redundant switch configuration
(5) set ring configuration
(6) set single/multi node configuration
(7) set 30/20 backplane timeslot node
(8) set node type
enter selection (1-8):
```

Figure 5-19. Service Affecting Command Menu

(1) select active Switch/Link module

In Figure 5-19, the select active Switch/Link module option allows you to change the active switch or link module in systems with redundant common modules. When you power-up the system, it arbitrarily selects which link (A or B) or switch (A or B) module is active. Use this option if you want to make the active link or switch module the same for each node.

To select the active switch or link module, complete the following steps:

1. Type **1** at the enter selection (1-8) prompt, and press [ENTER]. The system displays the following warning message:

```
**********WARNING!!!**********
Changing active Switch or Link module
will disrupt the data service.
For Multi-Ring, changing child links of the Interconnect Node is not
recommended.

continue? (y/n):
```

2. Type **N** to return to the Service Affecting Command Menu, or type **Y**, and press [ENTER]. The system displays a screen similar to the one shown in Figure 5-20 and prompts you to enter the new active switch and link module.

Node	Link A B C D	Switch A B ("A"=active,"S"=standby,"-"=invalid)
1	A S – –	S A
2	A S – –	S A
3	– – – –	– –
4	– – – –	– –
5	– – – –	– –
6	– – – –	– –
7	– – – –	– –
8	– – – –	– –
9	A S – –	S A
10	A S – –	S A
11	– – – –	– –
12	– – – –	– –
13	– – – –	– –
14	– – – –	– –
15	– – – –	– –
16	– – – –	– –

Select new active Switch (A or B or <CR> for no change):

Figure 5-20. Select Active Switch/Link Module Menu

3. Type the letter of the switch module (**A** or **B**) you want to activate, and press [ENTER]. The system prompts you to enter the new active link module.

   Select new active Link (A-D, or <CR> for no change):

4. Type the letter of the link module (**A** through **D**) you want to activate, and press [ENTER]. The system displays the Command in progress message while it activates the link module you selected. Then the Select Active Switch/Link Module Menu appears, showing the change(s) you made, as well as the Service Affecting Command Menu

(2) display node timeslot assignment

In Figure 5-19, the display node timeslot assignment option enables you to display the node timeslot assignment of link 1 (A/B pair), link 2 (C/D pair), and the backplane.

Each node on the PremNet ring has a timeslot assignment table, which details the timeslot allocation within the node. It indicates where a particular timeslot will obtain its input from. The number of timeslots available is either 20 or 30, depending on the link type.

To display the node's timeslot assignment:

Type **2** at the enter selection prompt, and press [ENTER]. The system displays a screen similar to the one shown in Figure 5-21, listing the assignments in hexadecimal.

```
Node 01 timeslot assignment

Link 1:      20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33

Backplane:   00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13
             02 3F 01 3F 05 3F 05 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F
```

Figure 5-21. Node Timeslot Assignment Screen

Link Modules

The node timeslot assignment screen displays only the link pair used in the displayed node. If an interconnect node in a multi-ring network is displayed, both link 1 and link 2 timeslot assignments are shown.

Backplane

The number of backplane I/O timeslots that an installed module occupies is shown on the second line of the backplane display in the node timeslot assignment screen. This is before a connection is made. The number displayed is one less than the slot number of the node (refer to Figure 5-21).

Node 1, slot 3 has a module that takes up one timeslot, because 02 indicates slot 3 and 02 is displayed once.

Node 1, slot 2 has a module that takes up one timeslot, because 01 indicates slot 2 and 01 is displayed once.

Node 1, slot 6 has a module that takes up two timeslots, because 05 indicates slot 6 and 05 is displayed twice.

Note: A display of 3F means an interface module slot is empty. Backplane timeslots are displayed in every other position, and wrap around to fill in blank positions when the line is full.

Virtual Connections

After a virtual connection is made, the node timeslot assignment screen shows which link timeslots are used by swapping numbers with the backplane. The top line of the backplane display shows the link timeslot numbers, while the link display line shows the backplane timeslot numbers. Figure 5-22 shows that backplane timeslot 04 has been assigned to link timeslot 20, and that backplane timeslot 06 has been assigned to link timeslot 22. This means that the module in slot 6 of Node 1 is in a virtual connection.

Node 01 timeslot assignment	
Link 1:	04 06 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33
Backplane:	00 01 02 03 20 05 21 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13
	02 3F 01 3F 05 3F 05 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F

Figure 5-22. Node Timeslot Assignment Screen (Connection)

Multi-Ring Network

Multi-ring networks have interconnect nodes that can also have Interface modules. The node timeslot assignment screen for an interconnect node is displayed in Figure 5-23. An interconnect node has both link pairs, A/B and C/D.

Node 01 timeslot assignment	
Link 1:	20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33
Link 2:	40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53
Backplane:	00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13
	02 3F 01 3F 05 3F 05 3F 3F 3F 3F 3F 03F 3F 3F 3F 3F 3F 3F 3F

Figure 5-23. Node Timeslot Assignment Screen (IN)

A multi-ring network is shown in Figure 5-24. The next example explains the node timeslot assignment screens for connections between ring 1 and ring 2.

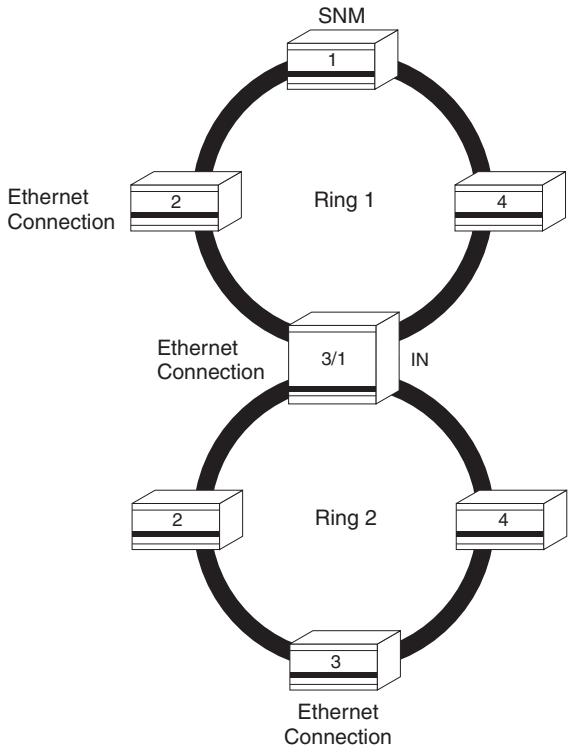


Figure 5-24. Multi-Ring Network

Ring 1

There is an Ethernet module in ring 1, node 2, slot 3. The Ethernet module occupies two timeslots and is in a virtual connection. The node timeslot assignment screen in Figure 5-25 shows the following assignments for this connection:

- Ring 1 has Link 1 (A/B pair). Link 1 timeslot numbers range from 20 (hex) to 33 (hex) for 20 timeslots. These numbers are assigned by timeslot tables in the firmware.

- The module in slot 3 takes up two timeslots. For slot 3, the number displayed is 02, and 02 appears twice in the bottom line of the backplane display.

- Backplane timeslot numbers 00 and 02 are assigned to link 1 timeslots 20 and 21. This assignment places the Ethernet traffic on the fiber in its appropriate timeslots.

Node 02 timeslot assignment	
Link 1:	00 02 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33
Backplane:	20 01 21 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13
	02 3F 02 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F

Figure 5-25. Node Timeslot Assignment Screen (Ring 1, Node 2)

Ring 2

There is an Ethernet module in ring 2, node 3, slot 4. The Ethernet module occupies two timeslots and is in a virtual connection. The node timeslot assignment screen in Figure 5-26 shows the following assignments for this connection:

- Ring 2 has Link 2 (C/D pair). Link 2 timeslot numbers range from 40 (hex) to 53 (hex) for 20 timeslots. These numbers are assigned by timeslot tables in the firmware.
- The module in slot 4 takes up two timeslots. For slot 4, the number displayed is 03, and 03 appears twice in the bottom line of the backplane display.
- Backplane timeslot numbers 00 and 02 are assigned to link 2 timeslots 40 and 41. This assignment places the Ethernet traffic on the fiber in its appropriate timeslots.

Node 03 timeslot assignment	
Link 2:	00 02 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53
Backplane:	40 01 41 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13
	03 3F 03 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F

Figure 5-26. Node Timeslot Assignment Screen (Ring 2, Node 3)

Interconnect Node

Figure 5-17 shows the multi-ring network with node 3/1 as the interconnect node. This means that the node is number 3 in ring 1, and number 1 in ring 2. If there are no Interface modules assigned to this node, the Ethernet traffic passes to and from the sample configuration (ring 1, node 2, slot 3 / ring 2, node 3, slot 4).

Figure 5-27 shows the node timeslot assignment screen for the interconnect node.

- As Ethernet traffic arrives on Link 1, the timeslot assignment sends it out Link 2 and vice versa. The two timeslots in each link exchange numbers (20 and 40 switch) (21 and 41 switch).

Node 03 or Node 01 timeslot assignment	
Link 1:	40 41 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33
Link 2:	20 21 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53
Backplane:	00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13
	01 3F 06 3F 06 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F

Figure 5-27. Node Timeslot Assignment Screen (Interconnect Node)

Interconnect Node With Interface Modules

An interconnect node can also have Interface modules. Figures 5-28 and 5-29 show the node timeslot assignment screen for an additional module connected to the existing Ethernet connection.

Interconnect Node (Ring 1, Node 3)

Figure 5-28 shows the assignments of the new connection to ring 1, node 3, slot 7. Notice that this connection is also ring 2, node 1, slot 7.

- Link 1 timeslots and the backplane timeslots are exchanged as if the connection were a regular link 1.
- The module in slot 7 takes up two timeslots. For slot 7, the number displayed is 06, and 06 appears twice in the bottom line of the backplane display.

Node 03 timeslot assignment	
Link 1:	02 04 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33
Link 2:	20 21 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53
Backplane:	00 01 40 03 41 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 01 3F 06 3F 06 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F

Figure 5-28. Node Timeslot Assignment Screen (Interconnect Node, Ring 1)

Interconnect Node (Ring 2, Node 1)

The timeslot assignments shown in Figure 5-29 are for the new Ethernet connection of ring 2, node 1, slot 7.

- Link 2 timeslots and the backplane timeslots are exchanged as if the connection were a regular link 2.
- The module in slot 7 takes up two timeslots. For slot 7, the number displayed is 06, and 06 appears twice in the bottom line of the backplane display.

Node 01 timeslot assignment	
Link 1:	40 41 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F 30 31 32 33
Link 2:	02 04 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53
Backplane:	00 01 20 03 21 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 01 3F 06 3F 06 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F 3F

Figure 5-29. Node Timeslot Assignment Screen (Interconnect Node, Ring 2)

(3) organize node timeslot assignment

In Figure 5-19, the organize node timeslot assignment option enables you to display any I/O connection errors existing in the node and to reorganize the assignment of the backplane timeslots. After you reorganize the timeslot assignment, those modules that

have not yet been assigned timeslots will be assigned timeslots, provided there are enough timeslots available.

To organize the node timeslot assignments:

Type **3** at the enter selection prompt, and press [ENTER]. The system displays the following message and prompt:

```
I/O not assigned with timeslot:  x
proceed to organize timeslot assignment?          (y/n):
```

where *x* indicates the slot number in which the module is installed.

If you want to reorganize the timeslot assignment, type **Y**, and press [ENTER]. The system displays a screen similar to Figure 5-25, showing the new timeslot assignment.

If you do not want to reorganize the timeslot assignment, type **N**, and press [ENTER]. The system redisplays the Service Affecting Command Menu.

(4) set single/redundant switch configuration

In Figure 5-19, the set single/redundant switch configuration option enables you to configure the system for either single or redundant switch operation. If you set redundant switch operation, an alarm is generated if a switch module fails.

To set the single/redundant switch configuration:

Type **4** at the enter selection prompt, and press [ENTER]. The system displays the current mode of operation, and prompts you to change it. Example:

```
Currently configured to allow single switch operation.

Change to alarm if NO Redundant switch module? (y/n):
```

If you want to change the mode of operation, type **Y**, and press [ENTER]. The system displays the following message and then redisplays the Service Affecting Command Menu:

```
Currently configured to alarm if NO Redundant switch module.
```

If you do not want to change the mode of operation, type **N**, and press [ENTER]. The system cancels the operation and redisplays the Service Affecting Command Menu.

(5) set ring configuration (SMN)

In Figure 5-19, the set ring configuration option enables you to configure the system with either a redundant or counter-rotating ring architecture. In either configuration, standby link modules installed in every node protect against loss of ring integrity should an

active link fail. However, ring integrity is not maintained in the event that both the active and standby links fail or a node fails unless the system is configured with the counter-rotating ring architecture. The counter-rotating architecture provides protection against loss of data flow in the standby links between any two nodes. Figure 5-30 shows how counter-rotating ring architecture provides fail-safe operation.

Note: System components are configured in a counter-rotating ring architecture by default. The set ring configuration option should be used only to upgrade a redundant system to a counter-rotating architecture. Milgo does not recommend that this option be used to switch between counter-rotating and redundant. All new system components should be configured for counter-rotating only.

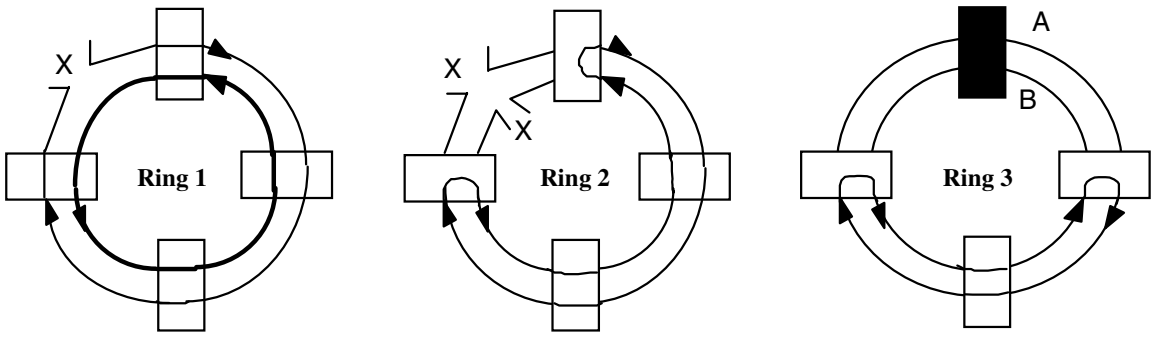


Figure 5-30. Counter-Rotating Ring Architecture

Fail-safe operation

The following explanations describe the actions of the ring configurations in Figure 5-30:

Ring 1: If the active ring fails, the data is transferred to the standby ring.

Ring 2: If both the active and standby rings fail, the nodes on either side of the break wrap around the failure.

Ring 3: If a node fails, the nodes on either side of the failed node wrap around the defective node.

To set the ring configuration:

1. Type **5** at the enter selection prompt, and press [ENTER]. The system displays the following message, followed by a prompt that asks you whether or not you want to reconfigure the ring:

```
**********WARNING**********
Execution of this command will RECONFIGURE the link modules based on a
DIFFERENT CABLING  configuration.  If the fiber has not been physically
reconfigured accordingly, DO NOT EXECUTE this command!!
....continue? (Y/n):
```

2a. Type **Y** to change the ring configuration. The following message appears:

```
Current configuration :  counter-rotating ring
Change to redundant...(Y/N):
```

If you want to change the ring configuration, type **Y**, and press [ENTER]. The system displays the new configuration followed by the enter selection prompt. If you do not want to change the ring configuration, type **N**, and press [ENTER]. The system returns you to the enter selection prompt.

2b. Type **N** to leave the setting the same. The system returns you to the enter selection prompt.

(5) set ring configuration (IN)

In Figure 5-19, to set the ring configuration for an interconnect node:

1. Type **5** at the enter selection prompt, and press [ENTER]. The system displays an Interconnect Node Link Configuration Menu similar to the one shown in Figure 5-31.

Note: Multi-Ring offers the option to mix NCRR and CRR rings in the same network.

```
Current configuration: Link A/B: CRR  Link C/D: CRR
Interconnect Node Link Configuration Menu

(1) Link A/B:CRR                Link C/D:CRR
(2) Link A/B:CRR                Link C/D:NCRR
(3) Link A/B:NCRR               Link C/D:CRR
(4) Link A/B:NCRR               Link C/D:NCRR
(5) Change configuration of links in alarm
enter selection (1-5):
```

Figure 5-31. Interconnect Node Link Configuration Menu

2a. Select one of the five options (1-5) from the menu, and press [ENTER]. The system displays the new configuration and the enter selection prompt.

2b. Press [ENTER] to leave the setting the same. The system returns you to the enter selection prompt.

(6) set single/multi node configuration

In Figure 5-19, the set single/multi node configuration option enables you to configure a node to operate either as a single node or in a multi-node configuration.

Note: This configuration is not appropriate for multi-ring networks. A single node configuration does not require a link module, since the unit is not connected to another node in the network.

---

(7) set 30/20 backplane timeslot mode

In Figure 5-19, the set 30/20 backplane timeslot mode option enables you to select either 20 or 30 timeslots for the backplane. The default is 20 timeslots. Switch module configuration for the different link modules is automatic.

Note: Some modules may not be compatible with 30 timeslots. Refer to the *PremNet Broadband Access System Installation and Operation Manual* for switch module and interface module compatibility.

To set the 30/20 backplane timeslot mode:

1. Type **7** at the enter selection prompt, and press [ENTER]. The system displays a message similar to the following, prompting you for a selection:

```
Current Switch node: 20 timeslots
Enter new switch node (20/30):
```

2. Type either **20** or **30**, and press [ENTER]. The system displays the node's new timeslot assignment followed by the Service Affecting Command Menu.

(8) set node type

In Figure 5-19, the set node type option enables you to define the node type for each node in the network.

To set the node type:

1. Type **8** at the enter selection prompt, and press [ENTER]. The system displays the following message:

```
********** WARNING!!!! **********
Changing node type will cause the ENMM to reset the node. continue?
(y/n):
```

2. Type **Y** to change the node type or type **N** to cancel your request and return to the Service Affecting Command Menu. If you type **Y**, the system displays a screen similar to the one shown in Figure 5-32. Go to step 3.

```
Current node type:  IN
Current Child Fiber Ring:  CD Ring
Set new node type?...(y/n):y
```

Figure 5-32. Current Node Type

3. Type **Y** if you want to set a new node type. The system displays a screen similar to the one shown in Figure 5-33. Go to step 4. Type **N** to cancel your request and return to the Service Affecting Command Menu.

```
select new node type:
(1) Interconnect Node
(2) Network Node
enter (1-2):
```

Figure 5-33. Set Node Type Menu

4. Choose whether to set a node as an Interconnect Node (IN) or Network Node (NN). The differences between these node types are described in Chapter 1, “Overview”.

Note: You cannot set a node to be the System Master Node (SMN). The Multi-Ring software automatically selects the node that has a Node ID of 1 on Ring 1 as the SMN. See Chapter 3, “Configuring Multi-Ring Networks”, for information about setting node and ring IDs.

Figure 5-34 shows a three-ring network configured with an SMN, Ins, and NNs/BNs.

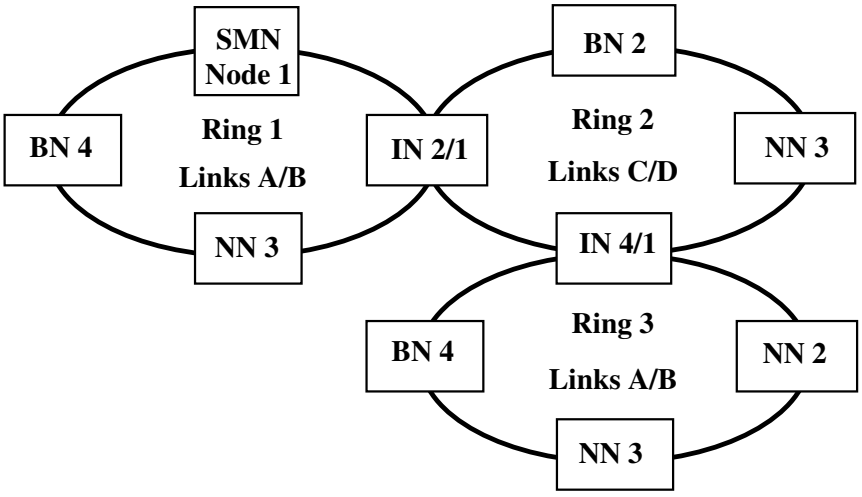


Figure 5-34. Node Types in a Multi-Ring Network

As shown in Figure 5-34, an IN is a member of two rings and is used to interconnect two single rings in a multi-ring network. It is the master node on its own ring, where it has a logical node ID of 1; but its node ID on the parent ring is determined by the DIP switch settings. An NN is connected to only one ring. This is the default node type for all nodes in the network.

(M) Monitor system/node status

In Figure 5-2, the Monitor system/node status option enables you to monitor the status of the system or the nodes in the network.

To monitor the system or node status:

Type **M** at the Node Command Menu prompt. The system displays the selection menu displayed in Figure 5-35.

Monitor system/node status
(1) display all modules in the ring continuously
(2) display all nodes in the ring continuously
(3) display master node continuously
(4) display all rings continuously
enter (1-4):

Figure 5-35. Monitor System/Node Status Menu

(1) display all modules in the ring continuously

In Figure 5-35, to display all modules in the ring continuously:

1. Type **1** at the prompt, and press [ENTER]. The system displays all of the nodes in the ring, the modules installed in each node, and the status of each module, as shown in Figure 5-36. The explanation of the symbols *, X, and - is at the top of the display.

2. Press any key to stop the screen.

Ring status 14-MAR-1997 07:52:25
(* good X alarm - not installed)

Node	Link				Switch		Power		Interface							
	A	B	C	D	A	B	1	2	1	2	3	4	5	6	7	8
01M	*	*	-	-	*	*	*	*	*	*	-	-	*	-	-	*
02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03	*	x	-	-	*	*	*	*	-	*	*	*	-	-	-	-
04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06	*	*	-	-	*	*	*	*	-	-	-	-	-	-	*	*
07	*	*	-	-	*	*	*	-	*	*	*	*	*	*	*	*
08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
09	*	*	-	-	*	*	*	*	*	*	-	-	*	-	-	*
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	*	x	-	-	*	*	*	*	-	*	*	*	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	*	*	-	-	*	*	*	*	-	-	-	-	-	-	*	*
15	*	*	-	-	*	*	*	-	*	*	*	*	*	*	*	*
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

02,01>

Figure 5-36. Monitor System Status Screen

(2) display all nodes in the ring continuously

In Figure 5-35, to monitor the status of the nodes in a ring:

1. Type **2**, and press [ENTER]. The system shows a continuous display of the status of each node in the ring, as shown in Figure 5-37.

2. To exit the display, press [ENTER]. The system displays the Node Command Menu (Figure 5-2).

(* good, x alarm, - not responding)

Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	*	-	*	-	-	*	*	-	*	-	*	-	-	*	*	-	08:11:35
	*	-	*	-	-	*	*	-	*	-	*	-	-	*	*	-	08:11:36
	*	-	*	-	-	*	*	-	*	-	*	-	-	*	*	-	08:11:37
	*	-	*	-	-	*	*	-	*	-	*	-	-	*	*	-	08:11:38
	*	-	*	-	-	*	*	-	*	-	*	-	-	*	*	-	08:11:39
	*	-	*	-	-	*	*	-	*	-	*	-	-	*	*	-	08:11:40
	*	-	*	-	-	*	*	-	*	-	*	-	-	*	*	-	08:11:41

Figure 5-37. Monitor Node Status Screen

(3) display master node continuously

In Figure 5-35, to select the display master node continuously option:

1. Type **3** at the prompt, and press [ENTER]. The system shows a continuous display of the status of the master node, as shown in Figure 5-38.

2. To exit the display, press [ENTER]. The system returns you to the Node Command Menu prompt: 01> (Figure 5-2).

3. Type **?** or **/** to display the Node Command Menu.

Ring status 14-MAR-1997 07:52:25
(* good X alarm - not installed)

Node	Link				Switch		Power		Interface							
	A	B	C	D	A	B	1	2	1	2	3	4	5	6	7	8
01M	*	*	-	-	*	*	*	*	*	*	-	-	*	-	-	*
01	-	-	-	-	-	-	-	-	*	*	-	-	*	-	-	*
01	*	x	-	-	*	*	*	*	*	*	-	-	*	-	-	*
01	-	-	-	-	-	-	-	-	*	*	-	-	*	-	-	*
01	-	-	-	-	-	-	-	-	*	*	-	-	*	-	-	*
01	*	*	-	-	*	*	*	*	*	*	-	-	*	-	-	*
01	*	*	-	-	*	*	*	-	*	*	-	-	*	-	-	*
01	-	-	-	-	-	-	-	-	*	*	-	-	*	-	-	*
01	*	*	-	-	*	*	*	*	*	*	-	-	*	-	-	*
01	-	-	-	-	-	-	-	-	*	*	-	-	*	-	-	*
01	*	x	-	-	*	*	*	*	*	*	-	-	*	-	-	*
01	-	-	-	-	-	-	-	-	*	*	-	-	*	-	-	*
01	-	-	-	-	-	-	-	-	*	*	-	-	*	-	-	*
01	*	*	-	-	*	*	*	*	*	*	-	-	*	-	-	*
01	*	*	-	-	*	*	*	-	*	*	-	-	*	-	-	*
01	-	-	-	-	-	-	-	-	*	*	-	-	*	-	-	*

02,01>

Figure 5-38. Monitor Master Node Status Screen

(4) display all rings continuously

This command is available only at the SMN.

In Figure 5-35, to display the status of all rings in the network:

1. Type **4** at the prompt, and press [ENTER]. The system displays the status of every ring once every second until you cancel, as shown in Figure 5-39.

2. To exit the display, press [ENTER]. The system returns you to the Node Command Menu prompt: 01> (Figure 5-2).

3. Type **?** or **/** to display the Node Command Menu.

(* good, x alarm, - not responding) 23 May 1997

Ring	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	*	-	*	-	-	*	*	-	-	*	*	-	-	-	*	*	08:11:35
	*	-	*	-	-	*	*	-	-	*	*	-	-	-	*	*	08:11:36
	*	-	*	-	-	*	*	-	-	*	*	-	-	-	*	*	08:11:37
	*	-	*	-	-	*	*	-	-	*	*	-	-	-	*	*	08:11:38
	*	-	*	-	-	*	*	-	-	*	*	-	-	-	*	*	08:11:39
	*	-	*	-	-	*	*	-	-	*	*	-	-	-	*	*	08:11:40
	*	-	*	-	-	*	*	-	-	*	*	-	-	-	*	*	08:11:41

Figure 5-39. Monitor All Rings in the Network

(N) SNMP network parameters

In Figure 5-2, the SNMP network parameters option enables you to configure the ENMM network interface for SNMP. The ENMM must know certain information before it can communicate on the network. You must define the following fields before initializing the ENMM's SNMP interface:

- IP address
- Subnet mask
- Default router IP address
- IP address for traps

To configure the SNMP parameters for the network:

1. Type **N** at the Node Command Menu prompt, and press [ENTER]. The system displays the following message prompting you to enter a password:

   password:

2. Enter the password (the default password is manager), and press [ENTER]. The system displays the SNMP Network Parameters Menu, shown in Figure 5-40.

Note: Only the SMN in a multi-ring network requires the SNMP parameters to be set.

```
SNMP Network Parameters
(1) IP Address:                 UNDEFINED
(2) Subnet Mask:                UNDEFINED
(3) Default Router IP Address:  UNDEFINED
(4) IP Address for Traps:       UNDEFINED
(5) SysName:                    Anaheim-Sunrise-Net
(6) SysLocation:                Anaheim
(7) SysContact:                 Joe Smith

enter selection (1-7):
```

Figure 5-40. SNMP Network Parameters Menu

3. Select the parameter you want to configure, and press [ENTER]. The network parameters are described in the following section.

(1) IP Address

In Figure 5-40, the IP Address field contains the IP address that the ENMM uses to communicate on the IP network over which it is managed. If you change the IP address after the SNMP has been initialized, the SNMP interface is reinitialized. The default IP address value is UNDEFINED.

To select the IP address:

1. Type **1** at the enter selection prompt, and press [ENTER]. The system displays the following message, prompting you to enter a valid IP address:

   ```
   Current IP address: UNDEFINED
   Enter new IP address:
   ```

2. Enter the new IP address, and press [ENTER]. The system redisplays the SNMP Network Parameters menu, showing the changes made.

   Example: **130.45.43.94**

3. Select another item to change or press [ENTER] to save the change(s) already made.

(2) Subnet Mask

In Figure 5-40, the Subnet Mask field contains the subnetwork address. A subnet is a network that is part of a larger extended network.

The subnet mask address is a bit mask in which 1's indicate the bits of an IP address to be interpreted as the subnetwork address, and 0's indicate the bits of an IP address to be interpreted as the host address on that (sub)network. The requesting client's subnet must have the same value as the subnet represented in the ENMM's own IP address. If it does not, the agent addresses the reply frame to the default router's IP address. If you change the subnet mask after the SNMP has been initialized, the SNMP interface is reinitialized. The default value is UNDEFINED.

To select the subnet mask:

1. Type **2** at the enter selection prompt, and press [ENTER]. The system displays the following message, prompting you to enter a valid subnet mask:

   ```
   Current subnet mask:
   Enter new subnet mask:
   ```

2. Type the new subnet mask, and press [ENTER]. The system redisplays the SNMP Network Parameters menu showing the changes made.

   Example: **255.255.255.0**

3. Select another item to change or press [ENTER] to save the change(s) already made.

(3) Default Router IP Address

In Figure 5-40, the Default Router IP Address field contains the IP address that the agent uses to communicate with network management systems that are not on its local subnet. If you change the default router's IP address after the SNMP is initialized, the SNMP interface is reinitialized. The default value is UNDEFINED.

To define a default router IP address:

1. Type **3** at the enter selection prompt, and press [ENTER]. The system displays the following message, prompting you to enter a valid default router IP address:

   ```
   Current default router IP address:
   Enter new default router IP address:
   ```

2. Type the new default router's IP address, and press [ENTER]. The system redisplays the SNMP Network Parameters Menu, showing the changes made.

   Example: **130.45.43.1**

3. Select another item to change, or press [ENTER] to save the change(s) already made.

(4) IP Address for Traps

In Figure 5-40, the IP Address for Traps field contains the address of the Network Management System to which the agent sends all traps (alarms). If you change the IP address for traps after the SNMP has been initialized, the SNMP interface is reinitialized. The default value is UNDEFINED.

To select the IP address for traps:

1. Type **4** at the enter selection prompt, and press [ENTER]. An IP Address for Traps Menu similar to the one shown in Figure 5-41 appears.

```
IP address for traps

(1) 130.45.43.94
(2) 130.45.221.72
(3) 130.45.221.72
(4) 130.45.43.82

(1) add an IP trap address
(2) modify an IP trap address
(3) delete an IP trap address

enter selection:
```

Figure 5-41. IP Address for Traps Menu

add an IP trap address (1)

In Figure 5-41, to add an IP trap address:

1. Type **1** at the enter selection prompt, and press [ENTER]. The following message appears:

   Enter IP address for trap

2. Type the new IP address for traps, and press [ENTER]. The system redisplays the SNMP Network Parameters Menu.

modify an IP trap address (2)

In Figure 5-41, to modify an IP trap address:

1. Type **2** at the enter selection prompt, and press [ENTER]. The following message appears:

   Enter the IP address you want to modify

2. Enter the number of the trap address (1-16) you want to modify. The following message appears:

   ```
   Current IP address for traps:
   Enter new IP address for traps
   ```

3. Enter the new IP address for traps, and press [ENTER]. The system returns to the SNMP Network Parameters Menu.

delete an IP trap address (3)

In Figure 5-41, to delete an IP trap address:

1. Type **3** at the enter selection prompt, and press [ENTER]. The following message appears:

   ```
   Enter the IP address you want to delete
   ```

3. Enter the number of the trap address (1-16) you want to delete. The system returns to the SNMP Network Parameters Menu.

(5) SysName

In Figure 5-40, the SysName field contains the MIB II parameter System Name (i.e., network name). The default value is all blanks.

To select the SysName:

1. Type **5** at the enter selection prompt, and press [ENTER]. The system displays the following message, which prompts you to enter a new system name:

   ```
   Current SysName:
   Enter new SysName <up to 20 chars max>:
   ```

2. Type the new system name, and press [ENTER]. The system redisplays the SNMP Network Parameter Menu, showing the change(s) you made.

   Example: **Milgo System Test**

3. Select another item to change, or press [ENTER] to save the change(s) already made.

(6) SysLocation

In Figure 5-40, the SysLocation field contains the SysLocation MIB II parameter. The default value is all blanks.

To change the system location name:

1. Type **6** at the enter selection prompt, and press [ENTER]. The system displays the following message, prompting you to enter a new system location name:

   ```
   Current SysLocation:
   Enter new SysLocation <45 chars max>:
   ```

2. Type up to 45 characters for the new system location name, and press [ENTER]. The system redisplays the SNMP Network Parameters Menu, showing the changes made.

   Example: **Milgo Sunrise FL**

3. Select another item to change or press [ENTER] to save the change(s) already made.

(7) SysContact

In Figure 5-40, the SysContact field contains the MIB II parameter SysContact. The default is all blanks.

To change the contact information:

1. Type **7** at the enter selection prompt, and press [ENTER]. The system displays the following message, prompting you to add contact information:

   ```
   Current SysContact:
   Enter new SysContact <45 chars max>:
   ```

2. Type up to 45 characters for the contact's name, telephone number, and address, and then press [ENTER]. The system redisplays the SNMP Network Parameter Menu showing the change(s) you made.

   Example: **Milgo Customer Service**

3. Select another item to change or press [ENTER] to save the change(s) already made.

Password and logon setup (P)

In Figure 5-2, the Password and logon setup option enables you to change the network password, the idle logoff time, and the lockout time.

There are two levels of passwords available: user and manager. The user password enables you to view the configuration parameters available from the Node Command Menu. The manager password enables you to configure the system. The default manager password is manager. You must set the user password.

The passwords are maintained in the ENMM/NMM. When a password is changed, the new password is communicated throughout the network to all of the ENMM/NMMs. Access to the system at any node is denied unless the new password is entered. Passwords are stored in memory, even if the network power is lost or all ENMM/NMMs are manually removed from the chassis.

To change the passwords and logons:

Type **P** at the Node Command Menu prompt. The system displays the Password and Logon Setup Menu shown in Figure 5-42.

```
Password and logon setup -
(1) Change password
(2) Change idle logoff time
(3) Change logon lockout time
enter (1-3):
```

Figure 5-42. Password and Logon Setup Menu

(1) Change password

In Figure 5-42, to change the password, complete the following steps:

1. Type **1** at the enter (1-3) prompt, and press [ENTER]. The system prompts you to enter your current password.

   ```
   Enter your current password:
   ```

2. Type your password, and press [ENTER]. The system prompts you to change the user's password:

   ```
   Change user's password?...(y/n):
   ```

If you do not want to change the user's password, type **N**, press [ENTER], and go to Step 3.

If you want to change the user's password, type **Y**, press [ENTER]. The system prompts you to enter a new password.

```
Enter new user's password:
```

Type the new user's password, and press [ENTER]. The system prompts you to verify the password you just entered:

```
Verify new password:
```

Type the new user's password again, and press [ENTER].

3. The system prompts you to change the manager password:

```
Change manager's password?...(y/n):
```

If you do not want to change the manager's password, type **N**, and press [ENTER], and go to Step 4.

If you want to change the manager's password, type **Y**, and press [ENTER]. The system prompts you to enter the new password:

```
Enter new manager's password:
```

Type the new manager's password, and press [ENTER]. The system prompts you to verify the password you just entered:

```
Verify new password:
```

Type the new manager's password again, and press [ENTER].

4. The system returns you to the Password and Logon Setup Menu, Figure 5-42.

(2) Change idle logoff time

In Figure 5-42, the Change idle logoff time option enables you to change the amount of time that the system is allowed to remain idle before the terminal automatically logs off.

To change the idle logoff time:

1. Select **2** at the enter (1-3) prompt, and press [ENTER]. The system displays a message similar to the one shown in the following example (the default value is DISABLED) and prompts you to change the idle logoff time.

```
Current idle logoff time: disabled
Enter new idle logoff time in minutes <1-30 or 0 to disable>:
```

2. Enter a new idle logoff time, and press [ENTER]. The valid values are 1 through 30 minutes. Enter **0** to disable the idle logoff time.

(3) Change logon lockout time

In Figure 5-42, the Change logon lockout time option enables you to change the amount of time that the management terminal is locked out.

To change the logon lockout time:

1. Select **3** at the enter (1-3) prompt, and press [ENTER]. The system displays a message similar to the following, and prompts you to change the lockout time.

```
Current idle lockout time: disabled
Enter new idle lockout time in minutes <1-30 or 0 to disable>:
```

2. Enter the new idle lockout time, and press [ENTER]. The valid values are 1 through 30 minutes. Enter **0** to disable the lockout time.

Log off (Q)

In Figure 5-2, to log off the system:

1. Type **Q** at the master Node Command Menu prompt, and press [ENTER]. The system displays a message similar to the one shown in the following example, indicating the date and time you logged on and off the system:

```
Log on:  23-May-1997 09:45:21
Log off:  23-May-1997 12:30:41
```

2. Press [ENTER]. The system displays the PremNet Introduction screen and prompts you to enter the manager's password to log back on. See the Accessing Node Command Menus section earlier in this chapter.

Ring configuration (R)

In Figure 5-2, the Ring configuration option enables you to display the ring map saved by the ENMM, display the current ring order, and save the current ring order.

Note: Ring Configuration applies only to the System Master Node and Interconnect Nodes. This option does not apply to Network Nodes or Branch Nodes.

Under normal operating conditions, the current and saved ring orders are the same. However, if the network is interrupted because of a node failure or the loss of both links between any two nodes, the ring order changes to accommodate the new flow of data.

Figure 5-43 illustrates two examples of ring data flow.

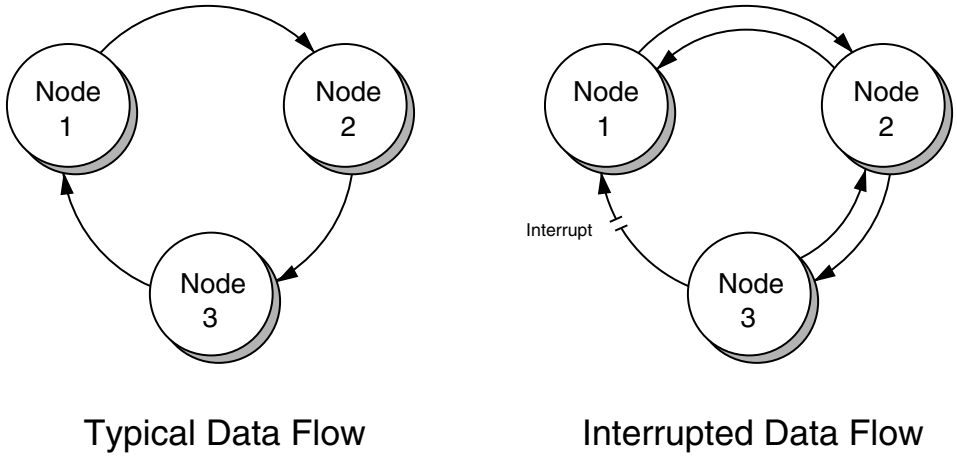


Figure 5-43. Counter-Rotating Ring Configurations

As shown in Figure 5-43, the typical flow of data in a three-node ring is circular (node 1 to node 2 to node 3 to node 1, etc.). If communication between node 3 and node 1 is interrupted and the system is configured in a counter-rotating ring architecture, the new ring order is node 1 to node 2 to node 3 to node 2 to node 1, etc. The data flow wraps at node 3 and node 1. When you display the current ring order, the data flow links are shown, thereby indicating where the fault exists.

Note: On a new system, the current and saved ring orders are not the same. Once the network is operational, save the current configuration for each ring on the network.

To select the Ring configuration option:

1. Type **R** at the master Node Command Menu prompt. The system displays the Ring Configuration Menu, shown in Figure 5-44.

```
01,01> Ring configuration
(1) display ring map
(2) display/save current ring order
enter (1-2):
```

Figure 5-44. Ring Configuration Menu

(1) display ring map

In Figure 5-44, the display ring map option is available only at the SMN. The ring map displays the ring order for all the rings in the network. All nodes appear with their node number except the INs, which show their node ID on the parent ring followed by their ring ID on their child ring, of which they are the master node.

To display the ring map:

1. Type **1** at the prompt, and press [ENTER]. The system displays the ring order for all the rings in the network, as shown in Figure 5-45.

Current Ring Map:

Ring	Links	Config	Node-List
1	A/B	CRR	1-2-3-4-5-6-7-8R2
2	C/D	CRR	1-9-10-11-12-13-14-15-16

Figure 5-45. Ring Map Display Screen

As shown in Figure 5-45, all nodes display with their node number, except the IN, which displays as:

<parent ring node number> R <child ring number>

For example, a node that displays as 8R2 means that it is node 8 on the parent ring and node 2 on its child ring.

(2) display/save current ring order

In Figure 5-44, the display/save current ring order option enables you to display the current and saved ring configurations and prompts you to save the current ring order. This option is available only at the Ring Master Node.

To select the display/save current ring order option:

1. Type **2** at the prompt, and press [ENTER]. The system displays the current and saved ring order for the ring, as shown in Figure 5-46.

```
Current configuration:  counter-rotating ring

Ring order saved:  1A-2A-3A-4A-5A-6A-7A-8A
Current ring order:1A-2A-3A-4A-5A-6A-7A-8A
Save current ring order?...(y/n):
```

Figure 5-46. Ring Configuration Screen

2. Type **Y** to save the current ring order; type **N** to leave the ring order unchanged. The system returns to the Ring Configuration Screen.

(S) Select interface module

In Figure 5-2, the Select interface module option enables you to access each interface module in the system. To select a module installed in the node:

1. Type **S** at the Node Command Menu prompt, and press [ENTER].

2. Enter the slot number of the Interface module you want to access, and press [ENTER]. The appropriate Module Command Menu appears.

(T) Set time

In Figure 5-2, the Set time option enables you to set the current time and date. To access this option, complete the following steps:

1. Type **T** at the Node Command Menu prompt, and press [ENTER]. The system displays the current time and date and prompts you to change them:

   ```
   Current time:  18:39:24
   Current date:  01-May-1997
   Change time and date?.... (y/n):
   ```

2. Type **Y** to change the time and date or type **N** to cancel, and press [ENTER].

   If you type **N**, the system displays the Node Command Menu prompt.

   If you type **Y**, the system prompts you to enter the date. Go to Step 3.

3. Enter the day, month, and year at the prompt, as follows:

   ```
   New date: 01-May-1997
   ```

4. Press [ENTER] when finished typing the date. The system then prompts you to enter the time:

   New time:

5. Type the hours, minutes, and seconds as six digits in 24-hour format.

   For example, type 3:05 (PM) as **15:05:00**. The system displays the new time and date you typed and exits the option.

(V) View ring/node configuration

In Figure 5-2, the View ring/node configuration option enables you to view the configuration of the ring or the configuration of the local node. This option enables you to check that the ring recognizes all modules in each node on the ring and the configuration and expandability of each node.

After you install the interface modules in each node, as required in the network configuration, access the View ring/node configuration option as follows:

Type **V** at the Node Command Menu prompt, and press [ENTER]. The system displays the following message:

View ring/node configuration - enter (R/S) ring or (N) node:

Note: To view the entire network, use the Ring Configuration option on the Node Command Menu.

View ring configuration (R or S)

The View ring configuration option provides you with an overview of the kind of services available in the ring. This option is available only at the SMN/IN.

To verify that the ring recognizes each module:

Type **R** or **S** at the enter (R/S) ring or (N) node prompt, and press [ENTER].

The system displays the nodes in the system, and the link, switch, and interface modules installed in each node, as shown in Figure 5-47. Each module is identified by an identification number (ID #), as shown in Tables 5-3 and 5-4.

System configuration 12-APR-1996 11:47:21
(# module ID, - not installed)

	Link				Switch		Interface							
Node	A	B	C	D	A	B	1	2	3	4	5	6	7	8
01M	21	21	21	21	2	2	-	-	45	31	45	-	31	-
02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03	21	21	21	21	2	2	-	-	-	-	-	-	-	-
04	21	21	-	-	2	2	44	44	44	-	-	-	-	-
05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07	-	-	-	-	-	-	-	-	-	-	-	-	-	-
08	-	-	-	-	-	-	-	-	-	-	-	-	-	-
09	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 5-47. View Ring/System Configuration Screen

Table 5-3. Interface Module ID Numbers

Interface Modules	ID#	Interface Modules	ID#	Interface Modules	ID#
Token-Ring 4M	1	DS1 2-Port	17	5250 8-Port	42
RS-232 32-Port	3	DS1A 2-Port	19	5250 4-Port	43
V.35 4-Port	5	E1 2-Port	21	ATM DS3	45
RS-422 4-Port	7	4-Wire E&M	24	ATM OC-3c/STM-1 MM	46
Token-Ring 4 (16) M	8	4-Wire RVR	25	ATM OC-3c/STM-1 SM	47
Token-Ring 16 (4) M	9	4-Wire PTT	26	1 Way Video In	51
Token-Ring MAU	10	Ethernet 850074	33	1 Way Video Out	52
RS-232 Multidrop	11	Ethernet 850127	34	2 Way Video	53
3270 32-Port	12	4 (16) Token Ring RI/RO	40		
3270 8-Port Coax	14	16 (4) Token Ring RI/RO	41		

Note: Number sequence breaks indicate reserved or obsolete modules.

Table 5-4. Link and Switch Modules ID Numbers

Link Modules	ID#
850 nm - 10 dB LED MM	2
1300 nm - 15 dB LED MM	4
1300 nm - 15 dB SM Laser	6
1300 nm - 25 dB SM Laser	7
1500 nm - 25 dB SM Laser	8
ATM OC-3c MM	16
ATM OC-3c SM	17
T3	19
SONET/SDH LR	20
SONET/SDH IR	21
Switch Module	**ID#**
30/20 Timeslot	2

View node configuration (N)

The View node configuration option enables you to display all modules in the node with their detailed information.

To view the configuration of the node:

1. Type **N** at the enter (R/S) ring or (N) node prompt, and press [ENTER]. The system displays the Node Configuration screen, shown in Figure 5-48.

```
Node configuration                                    08-AUG1997  11:47:28

Position    ID                        Cnfg    Status      S/N       S/W   H/W
ENMM        Node 1                    CRR     Active      XXXXXXX   XX    XX
Link A      1300nM-15db Laser SM      CRR     Active      XXXXXXX   XX    XX
Link B      SONET/SDH                 CRR     Active      XXXXXXX   XX    XX
Link C      -----
Link D      -----
Switch A    20/(30) TS Switch                 Standby     XXXXXXX   XX    XX
Switch B    20/(30) TS Switch                 Active      XXXXXXX   XX    XX
I/O 1       ATM I/O                           Standby     XXXXXXX   XX    XX
I/O 2       Ethernet 850074                   Standby     XXXXXXX   XX    XX
I/O 3       -----
I/O 4       AS/400 4-port                     Standby     XXXXXXX   XX    XX
I/O 5       ATM I/O                           Standby     XXXXXXX   XX    XX
I/O 6       -----
I/O 7       Ethernet 850074                   Standby     XXXXXXX   XX    XX
I/O 8       -----
01,
01>
```

Figure 5-48. Node Configuration Screen

The fields displayed on the Node Configuration Screen are described in the following section.

Position

Indicates the position of each slot and identifies the type of module (i.e., ENMM, Link, Switch or Interface) that belongs in that position.

ID

Describes the type of module located in each slot.

Cnfg.

Indicates the type of ring configuration that is currently selected. This option applies only to the ENMM, Link, and Switch modules. The possible options are:

- CRR for a counter-rotating ring configuration.
- NCRR for a non-counter-rotating ring configuration.
- SN for a single-node configuration.

Status

This field lists the operating status for all modules in the node. Table 5-5 describes the operating status.

Table 5-5. Node Operating Status

Status	Meaning
Active	Indicates that a link timeslot has been assigned.
Standby	Indicates that a link timeslot has not been assigned.
Inactive	Indicates that there are insufficient backplane timeslots available for the application.

S/N

The serial number of the module.

S/W

The software revision level for each module.

H/W

The hardware revision level for each module.

(X) External alarm configuration

In Figure 5-2, the External alarm configuration option enables you to configure the alarm levels and the alarm text strings associated with the four external signaling channels (SSC1-4). You must configure this option at each node through that ENMM's Node Command Menu.

Note: The alarm codes associated with the external signaling channels are unused alarm codes on earlier-version NMMs. These unused PremNet alarm codes are displayed in the system alarm logs on old NMM system alarm logs (Current System Alarms and System Alarm History) as A13, A1, A17, and A18. This constraint applies only when an old NMM is installed in the master node.

Table 5-6 lists the alarm codes that are generated for the external signaling channels, along with their associated default text strings and default alarm levels. Alarm levels are significant only for CMS and E2A interfaces.

Table 5-6. External Alarm Codes

Alarm Code	Default String	Default Level
13	External signaling channel 1	MINOR
16	External signaling channel 2	MINOR
17	External signaling channel 3	MINOR
18	External signaling channel 4	MINOR

Note: The text strings the system displays in the node alarm history logs for external signaling alarms are the currently configured strings. If an external signaling alarm is currently recorded in the node alarm history log, and you use this option to modify the associated text string, the system displays the changes you made to the text string in the history log.

To configure the external alarm:

1. Type **X** at the Node Command Menu prompt, and press [ENTER]. The system displays the following prompt, where you are asked to enter your password.

   password:

2. Enter your password, and press [ENTER] (the default password is manager). The system displays the External Alarm Configuration Menu shown in Figure 5-49.

```
External Alarm Configuration
(1) set Signaling Channel alarm level
(2) set Signaling Channel alarm text
enter selection (1-2):
```

Figure 5-49. External Alarm Configuration Menu

(1) set Signaling Channel alarm level

In Figure 5-49, the set Signaling Channel alarm level option enables you to switch between major and minor alarm levels for the four signaling channels.

To set the Signaling Channel alarm level:

1. Type **1** at the enter selection prompt, and press [ENTER]. The system displays the following message, prompting you to make a selection:

   Signaling channel <1> currently configured to MAJOR alarm. Change to MINOR alarm? (y/n):

2. Type **N,** and press [ENTER] to cancel the operation. Type **Y,** and press [ENTER] to change the alarm levels for that signaling channel. The system displays a message similar to the following, indicating the change you made:

   currently configured to Minor alarm

3. Continue changing the alarm levels for the signaling channels, or press [ENTER] to redisplay the External Alarm Configuration Menu.

(2) set Signaling Channel alarm text

In Figure 5-49, the set Signaling Channel alarm text option enables you to change the text displayed in the four signaling channel alarms. See the note in this section that describes the constraints associated with displaying alarm text.

To set the Signaling Channel alarm text:

1. Select **2** at the enter selection prompt**,** and press [ENTER]. The system displays the following message, prompting you to change the alarm text:

   Signaling channel <*n*> alarm text is: signaling channel 1 alarm
   Enter new text. (25 chars max):

Note: CMS 400 displays the default text strings for external signaling alarms in the system alarm log.

---

2. Enter the new text (up to 25 characters) that will display in the alarm logs**,** and press [ENTER]. The system displays a new alarm message similar to the one shown in the following example:

   Signaling channel 1 alarm is: ssc1 alarm

3. Press [ENTER] to change the alarm message for the next signaling channel, or press [ENTER] to redisplay the External Alarm Configuration Menu.

(Z) Select Active Messaging Ring

In Figure 5-2, the Select Active Messaging option applies to dual main ring configurations. The messaging channel is the communications path for inter-nodal communications. The link A/B pair is referred to as Ring 1, and the link C/D is referred to as Ring 2. In the event of ring failures, this command enables you to switch the path of the messaging to re-establish communications with remote nodes.

To change the communications path for dual main ring configurations:

1. Type **Z** at the Node Command Menu prompt. The system displays the following message, which prompts you to enter a selection:

   Select active messaging ring - display/select active messaging ring

2. To view the current ring configuration, press [ENTER]. The following message appears:

   Current Ring configuration: A/B Ring

Note: When you have a C/D Ring, the configuration is C/D.

(?) or (/) Node Command Menu

In Figure 5-2, to redisplay the options on the Node Command Menu, type **?** or **/** at the prompt.

(#) Node select

In Figure 5-2, to access a module installed in a different node, you must access the Node Command Menu for that node.

To access the Node Command Menu for a different node in the network:

1. Type **#** at the Node Command Menu prompt.

2. Enter the number of the node you want to access**,** and press [ENTER].

Note: If the node you select is an IN, then you are changing rings. To return to the parent ring or select a node on another ring, use the Ring Select option.

Each Interface module in the system must be configured for the desired application. Each module has its own command menu for selecting the setup requirements for your application.

For detailed information about configuring the individual Interface modules, see the module's documentation.

($) Ring select

In Figure 5-2, the Ring select option enables you to access the master node of the ring you selected. This option is available only at the ring master node (SMN or IN).

To select a ring:

1. Type **$** at the Node Command Menu prompt. The system displays the following message:

   Ring select - enter ring number (1-16): 2

2. Enter a ring number from 1 to 16 at the prompt**,** and press [ENTER]. The system displays the active nodes on the ring and any nodes that are in alarm state, as shown in Figure 5-50.

```
Active nodes:    #1 #9 #10 #11 #12 #13 #14 #15 #16
Alarming nodes: None
```

Figure 5-50. Active Node Display Screen

3. Type **?** or **/** to return to the Node Command Menu.

Appendix A
Regulatory Information

FCC Part 15: Radio/Television Interference

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. 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 his own expense.

Changes or modifications to this equipment not expressly approved by Milgo Solutions can void the user's authority to operate this equipment.

For FCC CFR 47 Part 15 compliance, Milgo-specified shielded interconnecting cables or their equivalent must be used. See the installation instructions in this manual for Milgo part numbers for these cables.

Special Notice

The instructions in this manual involving actions with the device and requiring a tool* for access, must be performed only by qualified service personnel.

* A tool is defined as any implement used to facilitate a mechanical operation, such as operating a fastener or similar fixing device.

Chaque fois que le manuel d'instructions recommande d'utiliser un outil* pour effectuer une opèration á l'intèrieur du dispositif, cette opèration doit absolument être confiée á un personnel de service qualifié.

* Un outil est défini tout dispositif utilisé pour faciliter une opération mécanique, p.ex., le fonctionnement d'un organe de fixation ou autre dispositif semblable.

Notice to Canadian Users

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the Radio Interference Regulations of Industry Canada.

Le présent appareil numérique n`émet pas de bruits radioélectricques dépassant les limites applicables aux appareils numériques de la Class A prescrites dans le réglement sur le brouillage Radioélectrique édicté par le Industrie Canada.

Do not perform internal service or adjustment to the equipment unless another person, capable of rendering first aid and resuscitation, is present.

Do not substitute parts or perform any unauthorized modification to the equipment. Return the equipment to a Milgo Solutions Sales and Service Office for service and repair to ensure that the safety features are maintained.

CAUTION

Two power cords provided. Disconnect both power cords prior to servicing.

VORSICHT

Zwei Netzkabel vorhanden. Vor Öffnen des Gehäuses beide Netzkabel ziehen.

CAUTION

This system contains electrostatic sensitive devices.

VORSICHT

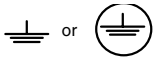
Dieses System enthaelt empfindliche Bauteile!

Achtung fuer Elektrostatischer Aufladung!

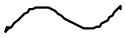
Safety Symbols

The following safety symbols are used on the equipment:

Indicates that the user should refer to the instruction manual in order to protect against damage to the equipment.



Indicates that the equipment must be connected to ground before operating.



Indicates alternating current power (power line).

Non-Connection Declaration

Equipment which can be connected to the public communications network but is not meant for this purpose (in accordance with article 2, guideline 91/263/EEC) must be provided with the following EC-marking (in accordance with article 11, section 4, guideline 91/263/EEC). See Figure 1.

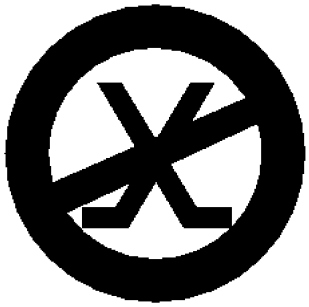


Figure 1. EC-Marking for Pseudo-Telecommunication Peripherals

Note: Do not connect the PremNet 5000 or the PremNet Branch Broadband Multiplexer system to the public telecommunications network.

The connection of such equipment to a public telecommunications network in a Community Member State is in violation of the national law implementing Directive 91/263/ECC on the approximation of the laws of that Members States concerning telecommunications terminal equipment, including the mutual recognition of their conformity.

Laser Light Warning!

The following warnings relate to modules that utilize Laser Diode Transmitters:

DANGER

LASER LIGHT - AVOID DIRECT EYE EXPOSURE.

CAUTION

LASER LIGHT - DO NOT STARE INTO BEAM.

DANGER

LASER LIGHT EMITTED FROM THIS MODULE AVOID EXPOSURE.

CAUTION

USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

CAUTION

THE USE OF OPTICAL INSTRUMENTS WITH THIS PRODUCT WILL INCREASE EYE HAZARD.

CLASS 1 LASER PRODUCT

Cable Installation Requirements

To meet FCC Part 15J requirements, you must perform the following steps before you can use your PremNet system.

When you connect a non-shielded RS-232 cable to a PremNet Network Management Module (NMM), a split ferrite core (Part No. 3C144-03SC) must be installed on the RS-232 cable. To install a split ferrite core on the cable, follow these steps:

1. Open the split ferrite core.
2. Place the RS-232 cable in one of the grooves on the split ferrite core. Make sure that the split ferrite core is as close as possible to the 25-pin connector that connects to the NMM.
3. Close the split ferrite core around the RS-232 cable, as shown in Figure 2.

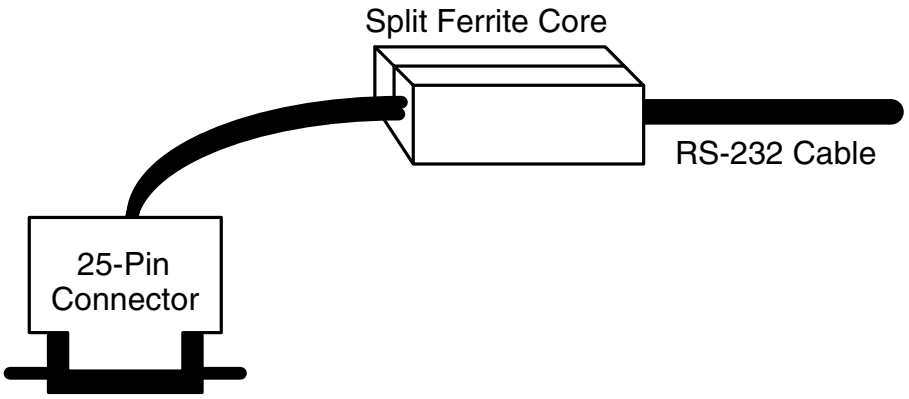


Figure 2. Split Ferrite Core Around RS-232 Cable

Milgo Solutions recommends that you use an RS-232 shielded cable with the PremNet RS-232 4-Port I/O Module.

When you connect an RS-232 cable to a PremNet RS-232 32-port I/O module, the RS-232 cable must be wrapped three times, with a 2-inch diameter (approximate). Secure the cable with tie wraps as close to the I/O module as possible (see Figure 3).

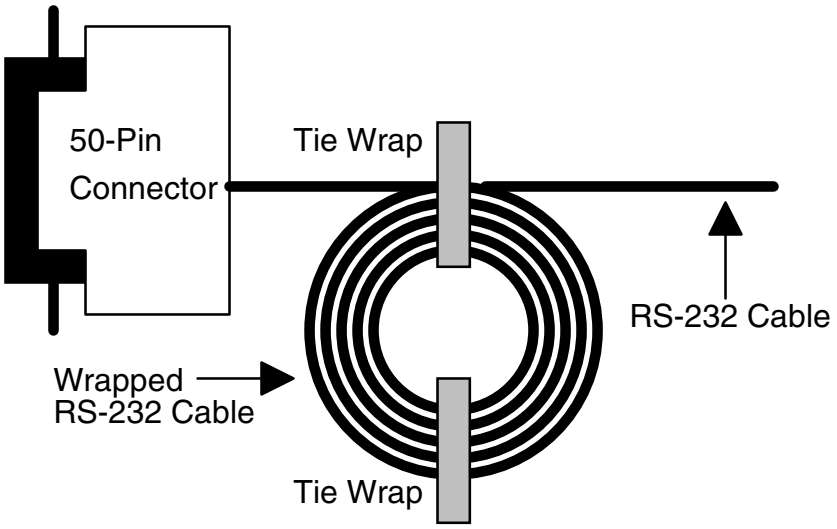


Figure 3. RS-232 Cable with Tie Wraps

When you connect a power cord to the 850007 or 850013 PremNet AC-power supply module, you must install a split ferrite core (Part No. 3C144-04SC) on the power cord. To install a split ferrite core, follow these steps:

1. Open the split ferrite core.
2. Place the cable in one of the grooves on the split ferrite core. Make sure that the split ferrite core is as close as possible to the input connector that connects to the AC-power supply.
3. Close the split ferrite core around the power cord, as shown in Figure 4.

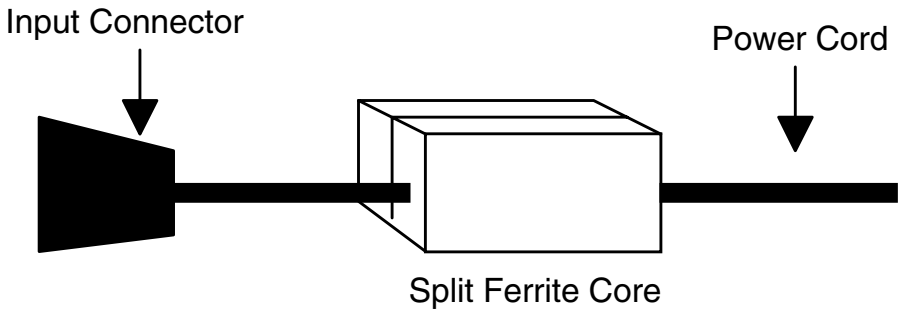


Figure 4. Split Ferrite Core Around Power Cord

Note: The 850014 and 850079 AC-power supply module does not require that you install a split ferrite core around the power cord.

Appendix B
Alarm Messages and On-Line Messages

Introduction

The PremNet Multi-Ring network provides you with an extensive list of alarm messages that can be used to troubleshoot the network. You can view current alarms and history alarms at the network, ring, or node level.

Determining Alarm Conditions

Whenever you experience a system alarm condition, use the following procedure to determine the problem:

1. Select the **Alarm display** option from the Node Command Menu. The system displays the Alarm Display menu.

2. Select the **current system alarm (1)** option. The system displays the ring number (if you are at a SMN) of the ring experiencing the problem and the type of problem.

To obtain more detailed information about the problem, access the alarming ring or node as described in the following sections.

Master Node Alarms

If the master node is in alarm mode, select the **current node alarm (3)** option from the Alarm Display menu. The system displays a list of alarm messages. From the alarm messages displayed, you can determine which module is in alarm. Replace the defective module if necessary.

Node-Level Alarms

If another node is in alarm mode, complete the following procedure:

1. Return to the Node Command Menu and select the **node select (#)** option. Enter the node number of the node in alarm. The system displays the Node Command Menu for that node.

2. Access the **Alarm Display** option from that menu and select the current node alarm option from the Alarm display menu. The system displays a list of alarm messages.

3. Isolate the alarm condition and replace the defective module.

Alarm Types

The ring master node, either an IN or the SMN, checks its ring alarm table every five seconds and reports any changes to the ENMM. The types of alarms that may occur in a multi-ring network are as follows:

- Major alarms
- Minor alarms
- Connection management error messages
- External signaling channel alarms

See the next section of this chapter for brief explanations of the messages and a possible solution to the alarm.

Alarm Messages

The PremNet Multi-Ring system provides you with an extensive list of alarm messages that can be used to troubleshoot the network. You can view current alarms and history alarms at the system or node level. The system alarm history and ring alarm history options store up to 100 of the past system alarm messages and the node alarm history option enables you to display the past 25 node alarms. History alarms are useful when tracking intermittent conditions on the network. For more information about these alarm options, see Chapter 5.

Each alarm message listed contains a brief explanation of the message along with a possible solution to the alarm. All of the alarms indicate the affected node or ring number (if at the SMN) at the beginning of the alarm message, as shown in the following example:

Ring *n*

Node *n*

Table B-1 lists the conventions used in the alarm messages. Refer to the appropriate PremNet I/O Module Manual for a listing of module alarms that apply to the module you are configuring.

Table B-1. Alarm Message Conventions

Convention	Description
n	Represents the ring number and node number of the alarm. Valid values for *n* are 1 through 16, inclusive.
m	Represents the slot number of the module installed in the PremNet node. Valid values for *m* are 1 through 8, inclusive.
XX	Represents the port number on the module. The valid values for *XX* are 1 to the maximum number of ports on the module.
XXX	Represents the alarm code for the alarm message. The valid values for *XXX* are 1 through 16.

Major Alarms

A major alarm occurs when one of the common modules (i.e., ENMM, switch, or link) is in alarm condition. Table B-2 lists the major alarm categories.

Table B-2. Major Alarm Types

Category	Description
Node and switch errors	Major alarms display at the SMN or IN when the ENMM or the switch modules are in alarm condition.
Link errors	The link modules are in alarm condition.
Major, audible	An optional alarm interface that can be connected to an external audible indicator.
Major, visual	An optional alarm interface that can be connected to an external visual indicator.

FIFO overflow alarm

Explanation: The switch module is unable to clock data out of FIFO to the I/O modules.

Solution: Replace the switch module.

Link *n* configuration error

Explanation: Link A-D at node *n* is in a different ring configuration mode than the ENMM at node *n*. This might occur because either the link or the ENMM at node *n* was replaced with a link or an ENMM that is configured for a different ring configuration mode (e.g., the link or ENMM that was replaced was configured for the redundant ring mode while the replacement link or ENMM is configured for the counter-rotating ring mode).

The default configuration mode for all link modules or ENMMs is counter-rotating ring mode.

Solution: Select the **Ring configuration** option from the alarming node's command menu and configure the ENMM or the link modules for the proper ring configuration mode.

Link (A or B) Configuration error

Explanation: Link A or B in node *n* is in a different ring configuration mode than the ENMM at node *n*. This might occur because either the link module or the ENMM at node n was replaced with a link module or ENMM with a different ring configuration mode. For example, the replacement link module or ENMM was configured for redundant ring mode while the replacement link module or ENMM is configured for counter-rotating ring mode.

The default configuration mode for all link modules or ENMMs is counter-rotating ring (CRR).

Solution: Select the **Ring configuration** option from node *n*'s Command Menu and configure the ENMM or link module for the proper ring configuration.

Link A no inter-link message

Explanation: Link A is not receiving any message from link B.

Solution: If link B is installed and is configured for counter-rotating ring, replace link B.

Link B no inter-link message

Explanation: Link B is not receiving any message from link A.

Solution: If link A is installed and is configured for counter-rotating ring, replace link A.

Link (A/B or C/D) BER exceeds 10E-6

Explanation: The bit error rate of the data being received by the link module has exceeded 1 bit error in 1 million bits received. At the rate the PremNet system is operating, this condition is equal to 1 bit error every 10 msec. This error causes the system to switch over to the standby link module.

Solution: Check the link module at the transmitting node.

Link (A/B or C/D) BER exceeds 10E-9

Explanation: The bit error rate of the data being received by the link module has exceeded 1 bit error in 1 billion bits received. At the rate the PremNet system is operating, this condition is equal to 1 bit error every 10 msec.

Solution: Check the link module at the transmitting node.

Link (A/B or C/D) parity error

Explanation: The link module is receiving parity errors from the switch module.

Solution: Replace the active switch module.

Link (A/B or C/D) no inter-node messages

Explanation: The communication messages between the nodes have been interrupted. This can be caused by a power outage at one of the nodes in the network or by a broken or disconnected fiber.

Solution: Verify the network ring order by accessing the node's command menu and selecting the **Ring configuration** option. The *saved* ring order of the network and the *current* ring order are displayed. The *saved* ring order indicates the initial order established on the network. The *current* order indicates the order under which the system is currently operating.

If a break in the network has occurred, the *current* order should indicate the missing node or the location of the damaged fiber.

Link *n* Node *n* beaconing

Explanation: The communication messages between nodes have been interrupted. This alarm message is displayed at the master node only. Each downstream node that is still active in the ring (nodes that are still communicating with the master node) transmits an alarm message indicating that reception of the communication channel has been lost. Figure B-1 shows an example of a network break ("X"). In the figure, Node 4 transmits the "beaconing" message toward the master node. The alarm at the master node is *Link A Node 4 beaconing*.

Solution: Verify the network ring order by selecting the **Ring configuration** option from the node's command menu. The display shows the *saved* ring order of the network and the *current* ring order. The *saved* ring order indicates the initial order established on the network. The *current* order indicates the order under which the system is currently operating.

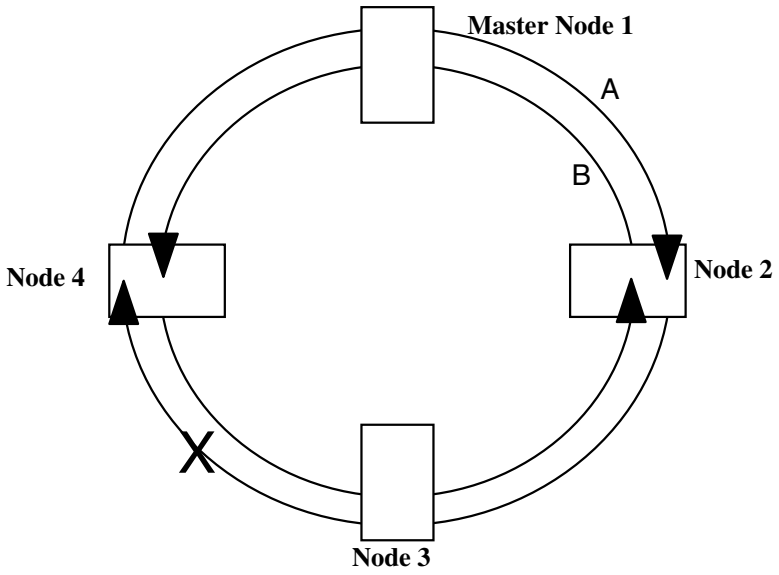


Figure B-1. Network Interrupted, Causing the Node 4 beaconing Alarm

No active Link module

Explanation: A link module is installed, but it is not receiving good data.

Solution: Check the fiber cables and the link module at the transmitting node for faults.

No link module

Explanation: There is no link module installed in the master node.

Solution: Install a link module or configure the node in single-node mode.

No switch module

Explanation: There is no switch module installed in the master node. This alarm is displayed only if you are monitoring the node locally. Remote monitoring does not produce this alarm message because the node is down.

Solution: Install a switch module.

Ring adjustment

Explanation: The FIFO in the switch module went into an underflow condition.

Solution: None. The underflow condition, which is caused by jitter, is a normal operating condition to compensate for jitter.

Sonet major alarm

Explanation: This message displays on the current alarm display or in the alarm history when a major alarm occurs at a SONET Link module.

Solution: See the *SONET/SDH Link Module Administrator's Manual* for detailed information.

Switch (A or B) backplane parity error

Explanation: The switch (A or B) module is receiving parity errors from the I/O modules.

Solution: Replace the switch module. If the alarm still exists, check the backplane for a data bus short.

Switch (A or B) Phase Lock Loop error

Explanation: A Phase Lock Loop (PLL) problem exists on the switch module. The switch (non-master) is not receiving the proper clock speed from the link, because either the fiber or the switch module's (master) PLL is defective.

Solution: Check the fiber. If the fiber is good, replace the defective switch module.

Minor Alarms

Minor alarms occur when the I/O modules, connections, node failures, power supply failures, or local node are in alarming condition. Table B-3 lists the minor alarm categories.

Table B-3. Minor Alarm Types

Category	Description
Interface module	The I/O module(s) are in alarm condition.
Connection (carrier alarms)	The virtual connection is in error.
Node failures	The node is not responding to the polling.
Local node (near-end) alarms	Local node is in alarm condition.
Remote node (far-end) alarms	Remote node is in alarm condition. Far-end alarm messages do not display on alarming nodes.
Minor, audible	An optional alarm interface that can be connected to an external audible indicator.
Minor, visual	An optional alarm interface that can be connected to an external visual indicator.

Interface Module *m* alarm

Explanation: The I/O module in slot *m* is not functioning properly. The alarm indicates either incorrect data or an I/O module failure. The incorrect-data condition is indicated by other alarm messages to common modules.

Solution: If the alarm is not related to a link failure, complete the following steps:

1. Access the I/O module's command menu by selecting the **Select interface module** option from the Node Command Menu of the node where the I/O module is installed.

2. Type the desired slot number and select the **Alarm display** option from the menu. The system displays the alarm messages for the I/O module.

For more detailed explanations and possible solutions to individual I/O module alarm messages, see the *PremNet 5000 I/O Module Management Manual*.

Interface Module *m* error

Explanation: There are two possible reasons for this message:

- No timeslot has been assigned to the I/O module indicated, because either all of the backplane time slots have been used or there are no adjacent backplane time slots available.

- A backplane parity error exists on bus A or B.

Solution: There are two possible solutions:

- Count the number of backplane timeslots that each I/O module requires to verify that there are still timeslots available. If there are timeslots available, contact field service for assistance. The timeslots need to be reassigned so that additional modules can be added.

- If the error occurs on bus A (assuming switch A has been selected to be the active switch, making bus A the active bus), an I/O module is not functioning properly. Replace the defective I/O module.

  If the error occurs on bus B (assuming switch B has been selected to be the standby switch, making bus B the redundant or standby bus), any one of the I/O modules configured might be the cause. Test every I/O module and replace the defective I/O module.

Interface Module Connection *n* error

Explanation: An I/O module was removed from the node, but its virtual circuit connection was not removed.

Solution: Remove the connection by accessing the **Connection configuration** option from the Node Command Menu, or reinstall the module.

Note: Always remove a module's virtual circuit connection before removing the module from the network.

I/O *m* no time slot assigned

Explanation: The I/O module is not assigned to the proper time slots.

Solution: Assign the module to the proper time slots, using the **Service affecting commands** option.

Interface module *m* alarm *XXX*

Explanation: The I/O module in slot *X* is not functioning properly. This could indicate a number of I/O-module-specific alarm conditions.

Solution: View the alarm message for the I/O module in slot *X* at the I/O module level for a more detailed message on the alarm condition. For more detailed alarm message explanations and possible solutions to the alarm conditions, refer to the appropriate *PremNet Interface Module Installation and Operation Manual*.

Interface module *m* port *XX* alarm

Explanation: A port on the I/O module *X* is not functioning properly.

Solution: Access the command menu for the I/O module and use the **Alarm display** option to view the detailed alarm description. Refer to the appropriate PremNet I/O module manual for instructions.

I/O *m* backplane parity error on bus A

Explanation: The switch module is detecting parity errors on the data being received from I/O module *m*. This means that the I/O *m* is defective (assuming switch A has been selected to be the active switch, making bus A the active bus).

Solution: Replace the defective I/O module.

I/O *m* backplane parity on bus B

Explanation: The switch module is detecting parity errors on the data being received from I/O module *m*. If bus A is the active bus and bus B is in standby mode, this alarm should not appear during normal operation, because bus B should not be carrying any data when bus A is active. One of the configured I/O modules may be sending bad data onto bus B.

Solution: Unlike backplane parity errors on the active bus, the backplane parity error on the standby bus is not cleared by the next I/O module to transmit data after a faulty one. Therefore, the parity error that is detected on the backplane may have been caused at any time by any of the configured I/O modules.

Link *n* alarm

Explanation: The link module is not functioning properly. This alarm does not display at the remote node.

Solution: Access the alarming node's **current node alarm** option from the Alarm Display Menu for a more detailed alarm message.

Module *m* alarm *X*

Explanation: Module *m* is not functioning properly.

Solution: Access the **Alarm Display Menu** for the I/O module to determine the problem. Refer to the appropriate I/O Module documentation for a brief explanation of the alarm message.

Node *n* fails to respond

Explanation: There is no ENMM installed in the node or the ENMM is damaged.

Solution: Access the **Alarm Display Menu** to clear the system alarm message. If the ENMM is damaged, replace the module.

No link module

Explanation: A link module is not installed in the node being monitored. This alarm is displayed only if the node is being monitored locally. Remote monitoring does not produce this alarm because the node without the link module is not able to communicate with the master node. This alarm does not appear if the node has been configured in single-node mode.

Solution: Install a link module or use the Service affecting commands option to change the ring configuration to single-node mode (node 1 only).

No Switch module

Explanation: No switch module is installed in the node.

Solution: Install a switch module.

Power Supply 1 Failure

Explanation: Power supply 1 is not functioning (low or dead voltages) or the power supply module is turned off or unplugged.

Solution: Check that the power supply module is plugged and turned on. If it is turned on, replace the defective module.

Power Supply 2 Failure

Explanation: Power Supply 2 is not functioning (low or dead voltages) or the power supply module is turned off or unplugged.

Solution: Check that the power supply module is plugged in and turned on. If it is turned on, replace the defective module.

SONET minor alarm

Explanation: This message displays on the current alarm display or in the alarm history when a minor alarm occurs at a SONET link module.

Solution: See the *SONET/SDH Link Module Administrator's Manual* for detailed information.

Switch *n* alarm

Explanation: The switch module (either A or B) is not functioning properly. This alarm does not display at the remote node.

Solution: Access the alarming node's **current node alarm** option from the Alarm display menu for a more detailed alarm message.

Connection Error Messages

The Connection management error messages display at the SMN whenever a multi-ring connection configuration cannot be completed.

Command only available at SMN

Explanation: Some commands are available only at the SMN.

Solution: Table 5-1 for a listing of the available commands from the different node types.

Manager is already on line at Node *n*

Explanation: Manager access is granted by the SMN only if two Network Management Stations get manager status at the same time, The ring master node reports this request to the SMN. The SMN grants manager status to the one that it receives first and rejects the other.

Solution: If your request is rejected, try again.

Manager is already on line at Ring *n*

Explanation: Manager access is granted by the SMN only if two Network Management Stations get manager status at the same time, the ring master node reports this request to the SMN. The SMN grants manager status to the one that it receives first and rejects the other.

Solution: If your request is rejected, try again.

Module cannot connect to itself

Explanation: You entered the same ring number, node number and slot number for both ends of the connection.

Solution: Select the **Connection configuration** option from the Node Command Menu at the SMN, then select the **modify connection** option to change the connection's configuration.

Module number out of range

Explanation: You entered a module (slot) number that was not between 1 and 8.

Solution: Enter a valid module number.

Module number specified already in a connection

Explanation: The slot number you specified in this connection is already in use by another connection.

Solution: Select the **View ring/node configuration** option on the Node Command Menu, then type **R** to view the slot numbers on that ring.

Name not found in connection table

Explanation: The connection name you entered for display or modification is not a valid connection.

Solution: Select the **Connection configuration** option from the Node Command Menu, then **select display connection**, followed by **display all connections**, to display all connection names on the network.

Node number out of range

Explanation: You entered a node number that was not between 1 and 16.

Solution: Enter a valid node number.

Node number specified not on network

Explanation: The node number you entered in the connection configuration is not a valid node number on the network.

Solution: Select the **Ring configuration** option from the Node Command Menu then select the **display ring map** option to display all the nodes for each ring in the network. This option is available only at the SMN.

Ring number out of range

Explanation: You entered a ring number that was not between 1 and 16.

Solution: Enter a valid ring number.

Ring number specified not on network

Explanation: The ring number you entered in the connection configuration is not a valid ring number on the network.

Solution: Select the **Ring configuration** option from the Node Command Menu, then select the **display ring map** option to display all the rings in the network. This option is available only at the SMN.

This node is being accessed by Node *n*

Explanation: This message displays if another terminal is accessing this node, so you cannot log on to this node.

Solution: Try again later.

External Signaling Channel Alarms

The ENMM enables you to configure the alarm levels (major or minor) and the alarm text strings that are associated with the four external signaling channels. Table B-4 shows the default text strings that display in the alarm history log. See the External alarm configuration (X) option in Chapter 5 for detailed information.

Table B-4. External Signaling Channel Alarms

Default String	Default Level
External signaling channel 1	Minor
External signaling channel 2	Minor
External signaling channel 3	Minor
External signaling channel 4	Minor

Appendix C
Troubleshooting

Introduction

This appendix discusses some of the most common problems that you might experience when configuring and maintaining a PremNet multi-ring network.

Loss of a System Master Node (SMN)

When the SMN fails, the following procedure occurs on the network:

- The remainder of the master ring loops back the fibers to heal around the failed SMN.
- The node with the lowest node ID in the main ring provides the clock source for the whole network.
- There will not be a SMN, therefore you cannot perform multi-ring management functions. However, any user data connection that does not involve the failed node will continue to function.
- The user circuits continue to operate except for the endpoints contained in the failed SMN.
- When the SMN recovers, it re-polls all the rings to reconstruct the global connections for the whole network. During the fault condition, you can reconfigure the virtual circuit. However, this procedure is not recommended because the connection name is not preserved when the SMN recovers.

Figure C-1 shows what happens when a System Master Node is lost.

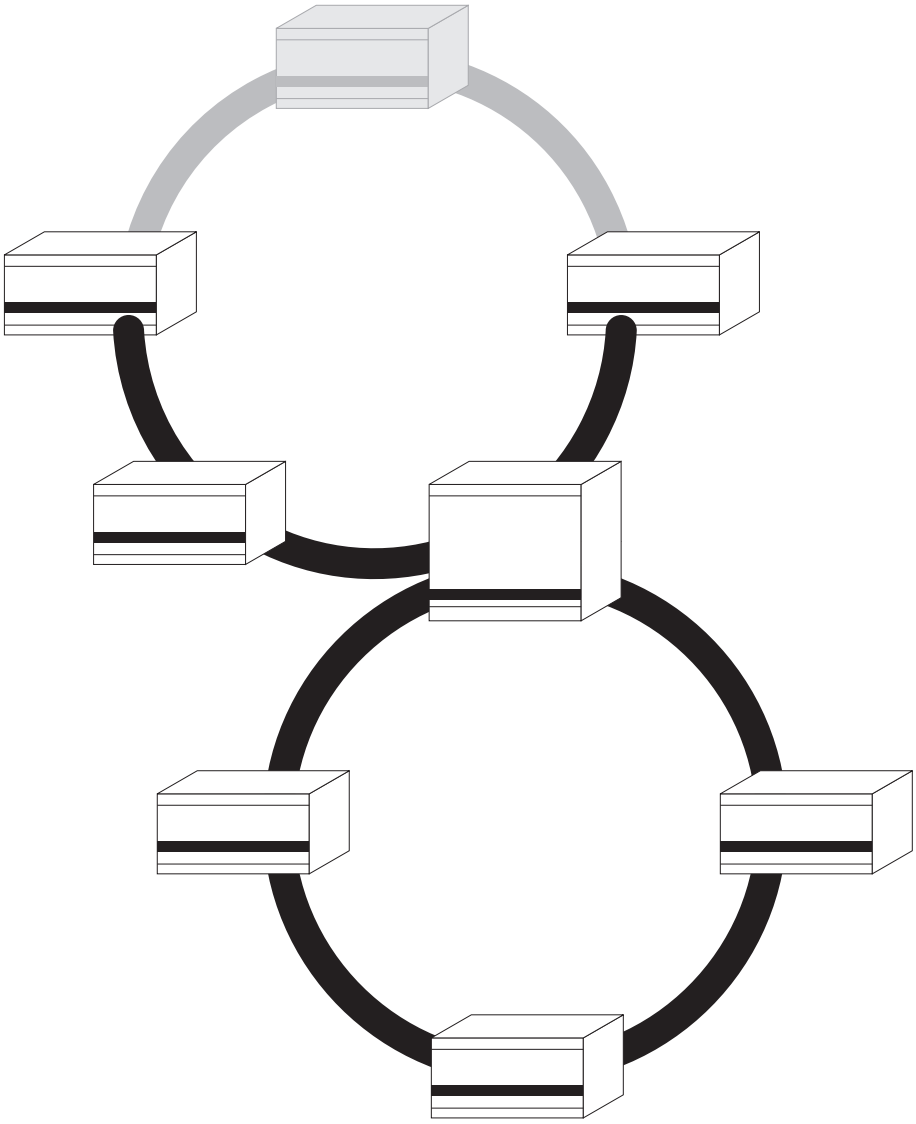


Figure C-1. Example of a System Master Node Failure

Loss of an Interconnect Node (IN)

When an IN fails, the following procedure occurs on the network:

- The network separates into two sections. One section is with the SMN, and the other is without the SMN.

- The failed ring selects a new master node, which is the node with the lowest node ID in the remaining nodes. If the section without the SMN contains more than one ring, the new master node of the failed ring must be an ENMM with multi-ring software to become the new SMN of the section.
- The nodes adjacent to the failed node loops back the fibers to heal around the failed node. The node with the lowest node ID on the isolated subnetwork provides the clock source.
- The main ring and the sub-rings are not connected.
- There is no SMN for the isolated subnetwork. However, there is a new clock master, and user circuits continue to operate if the endpoints are still reachable.
- The section with the SMN remains active because it is still synchronized to the clock from the SMN.
- The section that includes the sub-ring of the failed IN and all the rings attached are not active until a clock source can be obtained.
- At the SMN, all modules in the connection table associated with the Ring controlled by the IN will be marked with an &.

Redundant Rings

If the failed ring is a redundant ring, it is not be able to recover its ring integrity to provide the clock. Therefore, this separated section of the system will not be active until the failed IN is fixed.

Counter-Rotating Rings

If the failed ring is a counter-rotating ring, one of the remaining nodes with the lowest node ID (either IN or NN) becomes the master node of the ring, and starts providing clock source for the ring as well as for all attached rings to keep this section active. Connections within this separated section are still valid and passing data. However, without the SMN attached, you cannot manage the connections. Figure C-2 shows what happens on the network when an Interconnect Node fails.

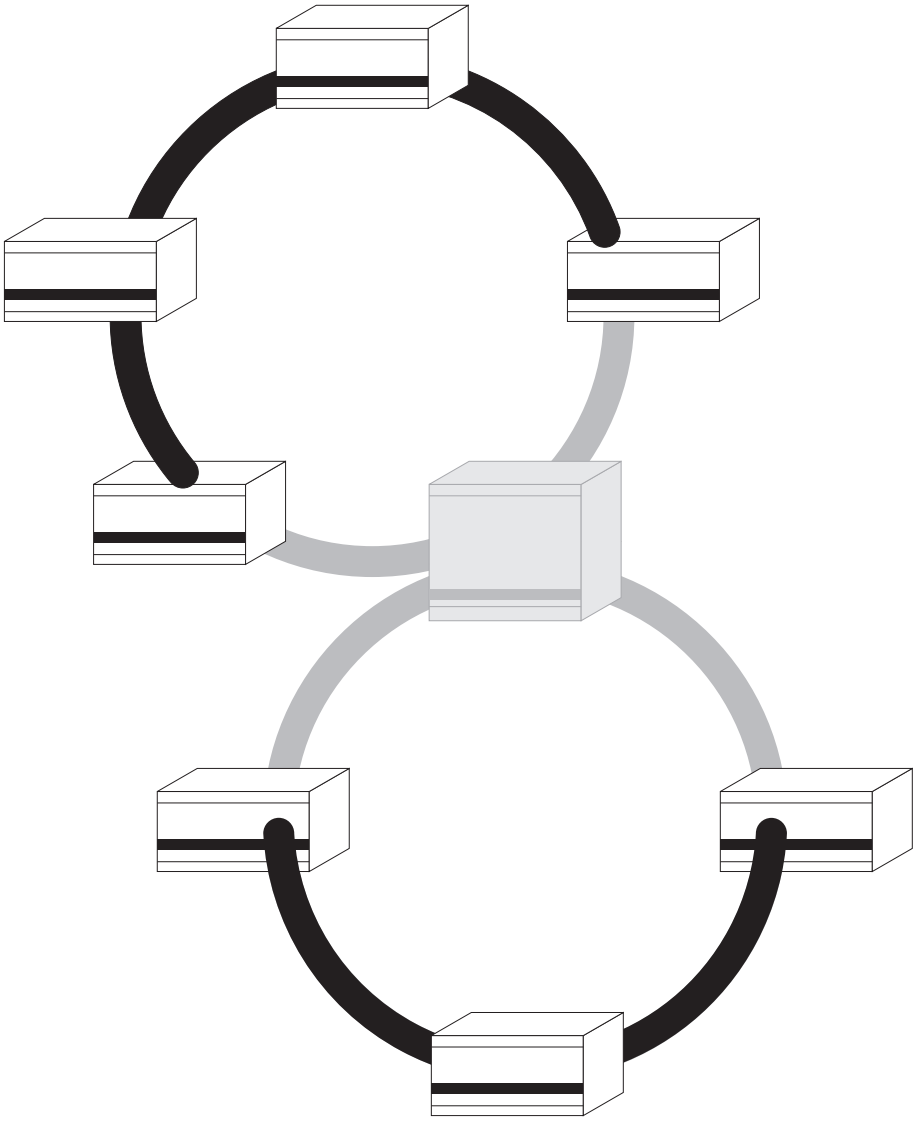


Figure C-2. Example of an Interconnect Node Failure

Loss of a Network Node (NN)

When an NN fails, the following procedure occurs on the network:

- The user circuits continue to operate except for the endpoints contained in the failed NN.

- If a NN is lost and a redundant link is available, then the nodes adjacent to the failure loop their fibers back and heal the ring connectivity by isolating the failed node. This recovery is identical to the recovery on single-ring, counter-rotating rings.

- At the SMN, all modules in the connection table associated with the failed node will be marked with an X.

Redundant Rings

If the failed ring is a redundant ring, it will not be able to recover its ring integrity from the fault. The failed ring and all the attached rings are lost from the system until the fault is corrected.

Counter-Rotating Rings

For counter-rotating ring system, the ring with the failure uses both fiber rings to bypass the failed node and recover the ring integrity. The network integrity is recovered, and no nodes or rings are lost.

Figure C-3 shows what happens when a Network Node or a Branch Node is lost.

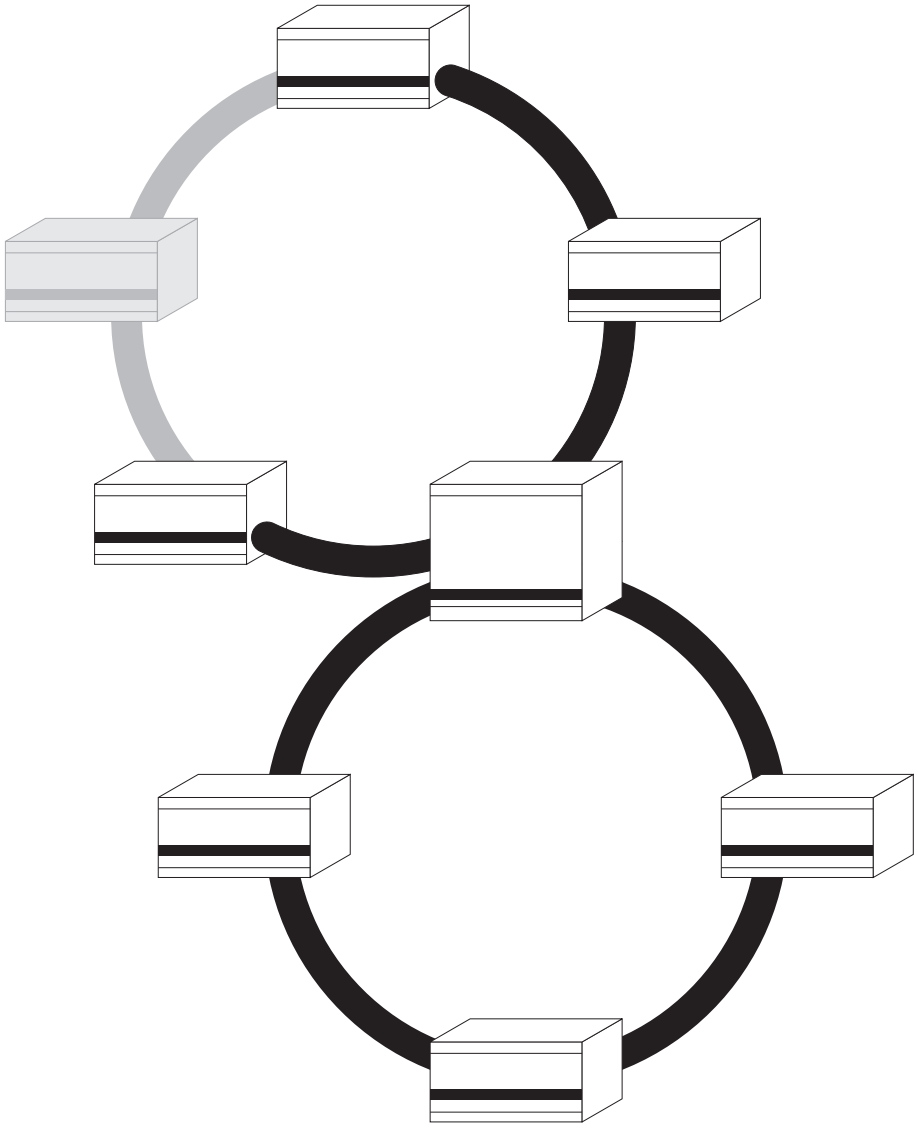


Figure C-3. Example of a Network Node Failure

Master Clock Recovery

As a synchronous system, PremNet requires a valid system clock throughout the entire network. The system clock is provided by the SMN, and is passed from the master ring to the sub-rings at all the INs. When an IN or SMN fails, you must provide an alternate clock source to maintain the synchronization of the system. See “Loss of an Interconnect Node” section in this appendix for more information.

Accessing Remote Nodes

To manage a multi-ring network, a Network Management System (NMS) must be physically attached to either the SMN or an IN that has an ENMM with multi-ring software installed. If an NMS is attached at an NN, you can access and manage only the nodes that are in the same ring.

If an NMS is attached at an NN with an old NMM, it can access only the NNs within the ring and the ring master node. The ring master node screens display as an old master node because the attached node does not support ENMM.

When an NMS of a ring master node is accessing a node of another ring, then the ring attached with NMS and the ring accessed are locked out. Any NMS from this ring cannot access any node on the other ring. However, any NMS within these rings can still access nodes in their own rings. Figure C-4 shows an example of remote node access.

Remote Node Access Range

As shown in Figure C-4, terminals T1 and T2 can access all nodes in the network. Terminals T3 and T4 can only access nodes in their own ring.

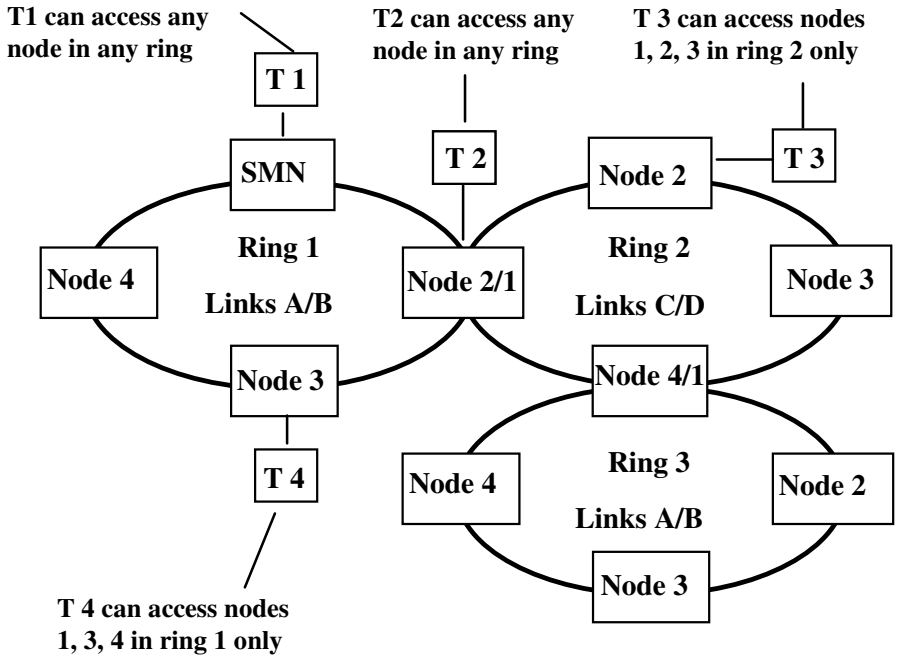


Figure C-4. Remote Node Access

Ring lockout

Ring lockout occurs when the terminal at the SMN is accessing a node in a remote ring, and another terminal tries to access the same remote node. The second terminal is locked out because the SMN has priority.

Example of Ring Lockout: As shown in Figure C-4, terminal T1 is accessing node 2 of ring 2. Terminal T2 is also trying to access Ring 2. Terminal T2 is locked out by the communication of Terminal T1. The message Ring 2 is busy appears.

Removing Active Modules from the Network

When an active module (a module connected to a virtual circuit) is removed from the network, it is not removed from the connection because a multi-ring network does not reconfigure the connection dynamically. The network, however, generates a "Interface connection error" alarm to indicate that an active module is missing.

When a node or ring fails to respond to the polling, the node or ring is treated as if it is disconnected from the network. Active modules in the node or ring are removed from their connections. If all the modules in the connection are removed because of the failure, the connection will be deleted.

If the failed node or ring returns and its timeslot map remains unchanged, connections to the node/ring are reconstructed. The new connection created from the reconstruction is assigned a default name.

Configuring Virtual Connections

The multi-ring network does not reconfigure the virtual connections dynamically. You must configure all virtual connections through the NMS.

However, when you power-up or reset the PremNet multi-ring network, it reconstructs virtual connections by restoring the node timeslot mapping located in each node's switch module. When the virtual connections are reconstructed, their connection names default to net 1, net 2, and so on.

Fiber Breaks

When a fiber break occurs in the network, the procedure that follows depends on the current link status, as follows:

- Active fiber link
- Standby fiber link

Standby Fiber Link Break

If a standby fiber link breaks, the ring integrity of the faulted ring is not affected, and the system integrity is maintained.

Active Fiber Link Break

If an active fiber link breaks, the failed ring either:

- Switches the receiving node of the broken fiber to receive from the other link (the standby link) if it is set to redundant ring

  or

- Switches the entire active ring to the other link if it is set to counter-rotating ring.

In either case, system integrity is recovered as soon as the ring integrity of the failed ring is recovered.

Both Fiber Breaks Between Nodes

If both fiber links between two nodes are broken, what happens on the network depends on the type of ring configuration, either redundant or counter-rotating. Figure C-5 shows examples of fiber breaks on redundant and counter-rotating rings.

Redundant Rings

If both fiber links between a pair of nodes are broken, and the failed ring is set as a redundant ring, the failed ring is not able to recover its ring integrity. The failed ring with all the rings attached are lost from the network due to the fiber fault.

Counter-Rotating Rings

If the failed ring is set to counter-rotating ring, the network uses both fiber rings to bypass the fault and recover the ring integrity. The system integrity is recovered, and no nodes or rings are lost. Refer to Figure C-5 and Figure C-6.

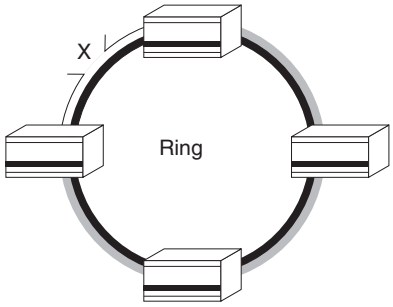


Figure C-5. Loss of One Link

With the loss of one of the two links between two nodes in Ring 1, the ring switches over to the standby link.

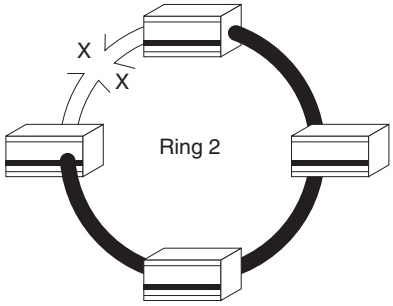


Figure C-6. Loss of Both Links

With the loss of both links between two nodes in Ring 2, the ring loops back the link in each of the nodes adjacent to the fiber fault.

Glossary

A Ring

The fiber ring created by connecting PremNet nodes together through their "A" Link Module chassis slots.

Branch Node (BN)

Enhanced Node with three interface module slots and two link module slots, that can function in a Multi-Ring network on either Link Group 1 or Link Group 2. A Branch node cannot become an Interconnect node.

B Ring

The fiber ring created by connecting PremNet nodes together through their "B" Link Module chassis slots.

Child Ring

Associated with each Interconnect Node (IN), it is the ring on which the given IN functions as a primary node. See RID and PID.

C Ring

The fiber ring created by connecting PremNet nodes together through their "C" Link Module chassis slots.

D Ring

The fiber ring created by connecting PremNet nodes together through their "D" Link Module chassis slots.

Enhanced Node

Any PremNet node containing an ENMM with Multi-Ring firmware. An Enhanced Node can assume the role of System Master Node, Interconnect Node, or Network Node.

Fiber ring

Physical configuration created by connecting multiple fiber segments together to form a ring. All link modules in a fiber ring must occupy the same chassis slots, either A, B, C, or D.

Fiber segment

Created by connecting the transmitter of a link module in one PremNet node to the receiver of a link module in another PremNet node. The link module at one segment endpoint must occupy the same chassis slot as the one at the other segment endpoint, i.e., Link A in one node must connect to Link A in the other node, Link B in one node must connect to Link B in the other node, etc.

A fiber segment has one link module (and hence one PremNet node) at each endpoint, but may be muxed/demuxed or repeated between endpoints.

Interconnecting connection

A type of connection that allows INs to interconnect time slots between link group 1 (A/B ring) and link group 2 (C/D ring).

Interconnect Node (IN)

Enhanced Node (ENMM with Multi-Ring firmware) that contains link modules in both Link Group 1 and Link Group 2 chassis locations. This configuration allows the node to "interconnect" a parent ring and a child ring, and to route management messages and map time slots between them for inter-ring communication and data transport (virtual circuits).

Inter-node

General term used to describe any path, communications or data, which traverses multiple nodes in a PremNet network. The network type can be Single Main Ring, Dual Main Ring, or Multi-Ring, and the path can be an intra-ring path or an inter-ring path.

Inter-ring

Any path, communications or data, that traverses multiple connected single rings in a Multi-Ring network.

Intra-ring

Any path, communications or data, that is confined to a single ring in a Multi-Ring network.

LID

Logical Node ID of an IN in its sub-ring (always 1), and is always associated with an IN.

Link Group 1

The A/B link chassis slots in a PremNet node. Link 1 may be used to reference only Link Module A, only Link Module B, or both A and B together.

Link Group 2

The C/D link chassis slots in a PremNet node. Link Group 2 may be used to reference only Link Module C, only Link Module D, or both C and D together.

Main Ring

The ring which has the SMN, always Ring 1.

Multi-Ring

Network created by connecting two or more single rings together through a set of Interconnect Nodes. The network contains an SMN (which sources the network clock and provides global network management capabilities), INs, and NNs or BNs.

Network Node (NN)

Enhanced Node (ENMM with multi-ring firmware) that can function in a Multi-Ring network on either Link Group 1 or Link Group 2.

NMS

Network Management Station (or System).

Parent Ring

Associated with each Interconnect Node (IN), it is the ring on which the given IN functions as a secondary node, and from which the given IN obtains its clock. See PID.

PID

Physical Node ID, as configured by ENMM DIP switches. For an IN, this is the node's ID in its *parent* ring. For NNs and BNs, this is the node's ID in its *only* ring.

RID

Ring ID of an Interconnect Node's child ring, as configured on the IN's ENMM DIP switches.

Ring

Any PremNet ring entity (e.g. Ring 1, Ring 2, Ring 1 AND Ring 2, etc.).

Ring #

Ring number ID of the IN's sub-ring. as configured on the IN's DIP switches.

Ring Master Node

The master node of a component single ring in a multi-ring network. One and only one ring master within a given "connected" multi-ring network will source the clock for the entire network.

Single ring

Each of the composite rings in a Multi-Ring network. Each ring is either Link Group 1 or Link Group 2.

Sub-rings

Associated with each Interconnect Node (IN), it is the ring on which the given IN functions as the ring master node. It also refers to any ring on the network that is not the main ring (ring 1).

System Master Node (SMN)

One per Multi-Ring network. The SMN sources the clock , and provides a central point of access for NMS control of the entire (connected) Multi-Ring network. The SMN is determined by software. The SMN must be an Enhanced Node.

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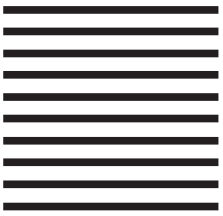

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