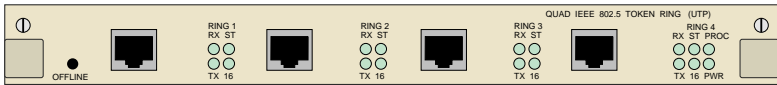
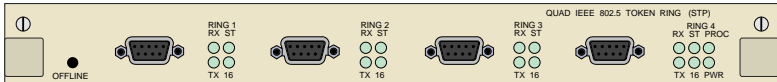


TOKEN RING SWITCH MODULE (3T02-04 AND 3T01-04) USER GUIDE



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CHAPTER 1

INTRODUCTION

This manual is for system administrators responsible for configuring, monitoring and maintaining the ATX. It should be used with the *ATX User Guide* and the *ATX MIB User Guide*. The contents of each chapter are described below.

- Chapter 1, **Introduction**, provides general descriptions of the modules.
- Chapter 2, **Connecting to the Network**, describes how to physically attach the modules to a Token Ring network.
- Chapter 3, **Configuring**, discusses the software configuration options for the modules.
- Chapter 4, **Statistics**, provides information on Token Ring port statistics.
- Chapter 5, **Diagnostics and Troubleshooting**, discusses identifying possible problems with the modules.
- Chapter 6, **Adding/Swapping Modules**, gives instructions for adding and replacing Token Ring modules.
- Appendix A, **Technical Specifications**, lists the pertinent technical information about the modules.
- Appendix B, **Bridging Methods**, discusses transparent, source routing, and source routing transparent bridging.

1.1 DOCUMENT CONVENTIONS

The following conventions are used in presenting information in this manual:

Commands, prompts, and information displayed by the computer appear in Courier typeface:

```
Current Number of Station Addresses: 5
Current Number of Learned Addresses: 133
Number of Defined Filters: 4
```

Information that you enter appears in Courier bold typeface:

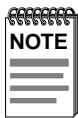
```
ATX >status
```

Information that you need to enter with a command is enclosed in angle brackets <>. For example, you must enter a <ring speed> for the selected port:

```
ATX >ringspeed <9 16>
```

In this example, the ring speed for port 9 is set to 16 megabits/second.

Field value options appear in bold typeface. For example, a filter type can be either **Entry** or **Exit**.



Note symbol. Calls the reader's attention to any item of information that may be of special importance.



Tip symbol. Conveys helpful hints concerning procedures or actions.



Caution symbol. Contains information essential to avoid damage to the equipment.



Warning symbol. Warns against an action that could result in equipment damage, personal injury or death.

1.2 RELATED MANUALS

You may need to refer to the following documentation when you are using a Token Ring module:

- *ATX User Guide* – contains installation and configuration instructions for the ATX.
- *ATX MIB Reference Guide* – contains Cabletron's enterprise MIB.

If you need internetworking reference material, you may find the following books helpful:

- *Interconnections, Bridges and Routers*, Radia Perlman, Addison Wesley © 1992.
- *Internetworking with TCP/IP: Protocols, and Architecture* (2nd edition), Volumes I and II, Douglas Comer, Prentice Hall © 1991.
- *The Simple Book, An Introduction to Management of TCP/IP-based Internets*, Marshall T. Rose, Prentice Hall © 1991.

1.3 GETTING HELP

If you need additional support related to this device, or if you have any questions, comments, or suggestions concerning this manual, contact Cabletron Systems Technical Support:

By phone	(603) 332-9400
	Monday – Friday; 8 A.M. – 8 P.M. Eastern Time
By CompuServe	GO CTRON from any ! prompt
By Internet mail	support@ctron.com
By FTP	ctron.com (134.141.197.25)
Login	<i>anonymous</i>
Password	<i>your email address</i>

1.4 GENERAL DESCRIPTION

Cabletron Systems 3T01-04 and 3T01-02 modules connect the ATX to a 4 or 16 Mbps Token Ring network. The modules enable connectivity to FDDI, Ethernet, and Token Ring Networks, and can be configured to support Transparent Spanning Tree, Source Route, or Source Routing Transparent Bridging. The ATX is also able to translate higher level protocols to allow communication between end-user devices on Token Ring and end-user devices on FDDI or Ethernet. Protocols translated include: TCP/IP, Novell NetWare, and AppleTalk Phase II.

The Token Ring module ports can be connected to one Token Ring network. The module contains connectors for shielded twisted pair (STP) and unshielded twisted pair (UTP) cabling. Each module has eighteen LEDs which indicate the current status of the module and the Token Ring networks. The offline button allows you to remove the module for swapping.

Up to four Token Ring networks can be attached to either module. The module is available in two models: STP (3T01-04) and UTP (3T01-02). Each module contains four connectors (STP or UTP), 18 status LEDs, and an offline button.

The Token Ring module may be installed in any of the five interface slots and the ATX can simultaneously support up to five Token Ring modules. If five of either the 3T01-04 or 3T02-04 modules are installed, up to 20 networks can be connected.

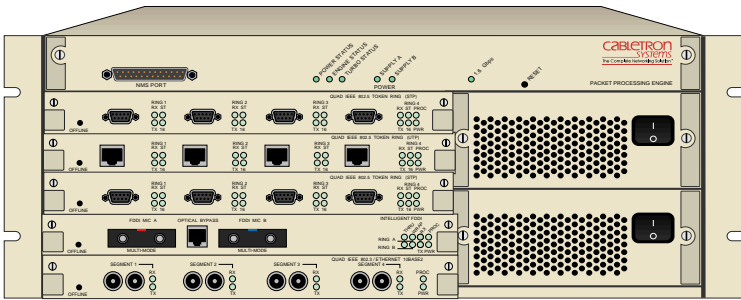


Figure 1-1 ATX Front Panel

1.5 STANDARDS

The physical and electrical characteristics of the Token Ring module conform to the IEEE 802.5 standard. The protocol for the MAC layer is specified by the IEEE 802.5 standard while that for the Logical Link Layer is specified by the IEEE 802.2.

1.6 CONNECTORS

The Token Ring modules are available in versions for either UTP or STP lobe cabling. The STP version of the four port Token Ring module has four DB9 connectors; the UTP version has four RJ45 connectors. Power for the module is provided by the ATX backplane.

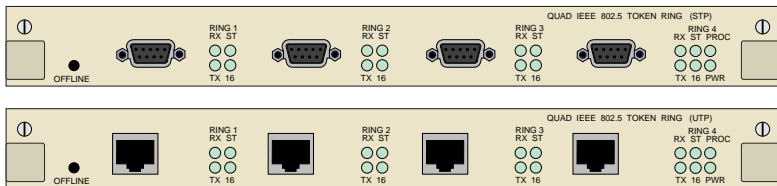


Figure 1-2 3T02-04 and 3T01-04 Front Panels

1.7 LEDs

Each Token Ring module provides 18 green LEDs for troubleshooting and status monitoring. For each of the four Ring ports there are four LEDs labeled RX, TX, ST, and 16. Additionally there are two module LEDs labeled PROC and PWR. The LEDs are described in Chapter 5 of this manual.

CHAPTER 2

CONNECTING TO THE NETWORK

2.1 INTRODUCTION

Installation of a Token Ring network typically requires more planning and explicit configuration than does a transparently-bridged Ethernet network. This chapter provides reference material and instructions that network administrators can use to configure the Token Ring modules.

For instructions on adding a Token Ring module to the ATX, see Chapter 6, **Adding/Swapping Modules**.

2.2 POWER-UP LED SEQUENCE

Power up the ATX and observe the LED sequence. It takes about 1 minute for the ATX to complete the power-up diagnostics. The ATX begins system diagnostics on the PPE (topmost module) and then individually on each installed module progressing from top to bottom.

The power-up LED sequence for the Token Ring module not attached to a network is as follows:

1. All LEDs flash.
2. The POWER and 16 LEDs remain on.
3. After a few seconds the PROC LED comes on.
4. The ST LEDs come on.
5. The RX and TX LEDs flash briefly.
6. The ST and PROC LEDs go off.
7. The PROC LED comes on and the 16 LEDs go off.
8. The TX and RX LEDs flash briefly.
9. The Token Ring module then boots with the PROC and PWR LEDs on.
10. All other LED activity beyond this point is a function of the configuration and connection of the ATX.

2.3 TYPICAL CONFIGURATIONS

Physical connectivity to a Token Ring network is provided by either shielded twisted pair (STP) or unshielded twisted pair (UTP) cabling that connects the Token Ring module to a Hub. Each Token Ring switch module provides only one kind of connector, either four DB9 connectors for STP cabling or four RJ45 connectors for UTP cabling.

2.4 CONNECTING THE TOKEN RING MODULE TO A HUB

It is not possible to attach workstations directly to the ATX Token Ring port. Either an active or a passive Hub must be used. A passive Hub contains fairly simple electronics (principally relays) which form a self-healing electrical ring. An active Hub contains more sophisticated ring-maintenance circuitry and may be manageable.

2.4.1 Unshielded Twisted Pair

When using Unshielded Twisted Pair cabling in a Token Ring environment, make sure that it conforms to the specifications in Table 2-1 (this assumes patch cables that are no longer than 8 feet or 2.4 meters):

Table 2-1 Unshielded Twisted Pair Cabling Specifications

Data Rate	Compatibility	Cable Type	Longest Lobe^a
4 Mbps	IBM and IEEE UTP 802.5 Token Ring	EIA/TIA Category 3/4 EIA/TIA Category 5	100 m (328 ft.) 125 m (410 ft.)
16 Mbps	IBM and IEEE UTP 802.5 Token Ring	EIA/TIA Category 3/4 EIA/TIA Category 5	45 m (147 ft.) 45 m (147 ft.)

a. To assure compatibility with future LANs, the longest lobe should be limited to 100 meters.

Refer to the Hub manufacturer's manual for specific cabling information for connecting workstations to the Hub.

To connect the Token Ring module to a UTP Hub, attach one end of a UTP cable to the Token Ring module's RJ45 connector and connect the other end with the appropriate connector to any port *except* the Ring In or Ring Out ports on a UTP Hub. The Ring In/Ring Out ports are used for interconnecting Hubs. Refer to the example shown in Figure 2-1.

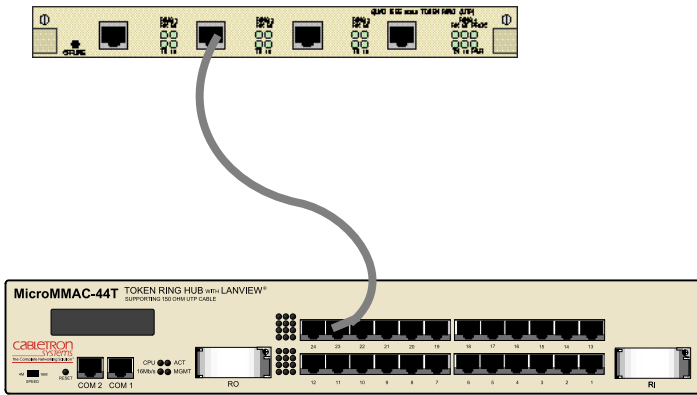


Figure 2-1 Connecting a Token Ring Module to a UTP Hub

2.4.2 Shielded Twisted Pair

When using Shielded Twisted Pair cabling, refer to the following (this assumes patch cables that are no longer than 8 feet or 2.4 meters):

Table 2-2 Shielded Twisted Pair Cabling Specifications

Data Rate	Compatibility	Cable Type	Longest Lobe ^a
4 Mbps	IBM and IEEE 802.5 Token Ring	IBM Types 1	240 m (787 ft.)
16 Mbps	IBM and IEEE 802.5 Token Ring	IBM Types 1	100 m (328 ft.)

a. To assure compatibility with future LANs, the longest lobe should be limited to 100 meters.

To connect to an STP MAU, attach the DB9 end of a Token Ring adapter cable to the Token Ring module's DB9 connector. Attach the Media Interface Connector (MIC), on the other end of the cable, to any port *except* the Ring-In or Ring-Out ports on a STP MAU. The Ring-In/Ring-Out ports are used for interconnecting MAUs. Refer to the example shown in Figure 2-2.

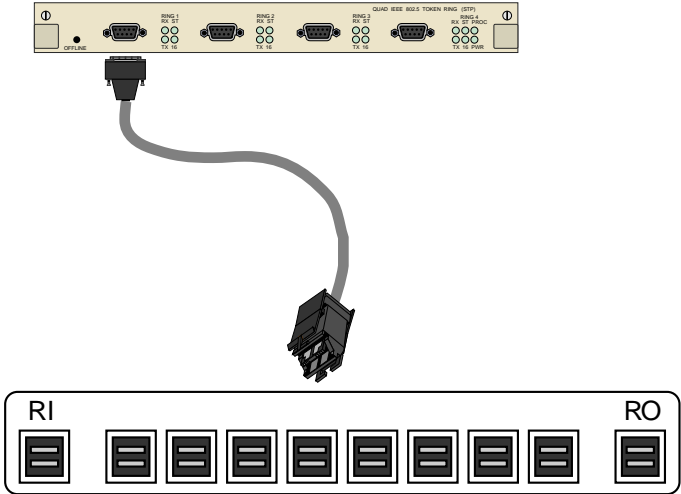


Figure 2-2 Connecting a Token Ring Module to an STP MAU

CHAPTER 3

CONFIGURING

3.1 INTRODUCTION

You can configure the Token Ring module using the Local Console Manager (LCM), which allows you to monitor, manage, and configure your ATX through an out-of-band RS-232 connection. You can also use any SNMP compliant network management system.

For more details about LCM, see your *ATX User Guide*. For details about the other network management software, refer to the product's documentation.

The following attributes are configurable using LCM:

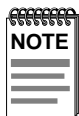
- Speed of the Token Ring network (4 or 16 Mbps)
- Port's IP address for originating and receiving IP packets
- Enabling/disabling a port's Transparent Spanning Tree, Source Routing or Source Routing Transparent mode
- Protocol translations

Additionally, the following attributes are configurable using network management software (refer to the network management software documentation for specific instructions):

- 48-bit unique MAC address
- Alarm thresholds for hardware errors
- Parameters for diagnostic loopback testing of a port

Filtering normally occurs as part of the Transparent Spanning Tree and Source Routing algorithms. In addition, configurable criteria may be established for filtering, to allow greater management control for security or network congestion reasons. All configured filtering criteria are

maintained in non-volatile memory and are saved across power cycles. Filtering information is covered in the *ATX User Guide*.



Once the Token Ring module is installed in the ATX, the ring speed must be configured prior to connecting the module to a network. The default ring speed is 4 Mbps; the ring speed only needs to be configured if your network is running at 16 Mbps.

After the ring speed is set, you may connect the module to a network and then complete the software configuration, or you could complete all the software configurations and then attach the module to a network.

3.2 CONNECTING THE LCM

Connect the Local Console Manager (LCM) to the ATX. Refer to Chapter 2, **Installation**, of the *ATX User Guide* for specific instructions.

Make sure the ATX is powered on and press the <Return> key twice. When the ATX> prompt appears LCM is ready to use.

3.3 LCM COMMANDS

Refer to the *ATX User Guide* for the generic LCM commands. Familiarize yourself with LCM before configuring the module.

Specific instructions for setting the ring speed, enabling/disabling a port's bridging type, and translations for the Token Ring module follow in this chapter.

If you are enabling IP routing, you need to assign addresses to the ports which will be performing routing functions. Refer to the *ATX User Guide* for instructions on assigning an IP address.

3.4 SETTING THE RING SPEED

Before the Token Ring module can be connected to a network, the ring speed must be set. Token Ring signaling takes place at either 4 or 16 Mbps. The default setting is for 4 Mbps. All stations on the same ring must operate at the same speed.



A single station configured to the wrong speed may bring down the entire ring, therefore, the ATX should be configured to the appropriate speed before physically connecting it to the network.

Using LCM, at the ATX> prompt, type `ringspeed` followed by the port number and the desired speed. For example, to set port 9 to 16 Mbps type:

```
ATX> ringspeed 9 16
```

The LCM displays `16000000 bits/second`.

If set to 4 Mbps, LCM displays `4000000 bits/second`.

The Token Ring modules include an LED for each Token Ring port that indicates for which speed the port is configured. If the port is configured for 16 Mbps, the LED will be on; if configured for 4 Mbps, the LED will be off. For Token Ring Switch Modules, set each port's ring speed, if necessary.

3.5 CONFIGURING THE BRIDGING TYPE

3.5.1 Transparent

The ATX defaults to transparent bridging for all ports. If this is acceptable, no further configuration is necessary.

3.5.2 Source Routing and SRT

Source routing and SRT bridging can be configured from LCM, or from a generic MIB browser. It is necessary to configure:

- Bridging method for each port
- Segment (ring) number for each port
- Bridge number for the ATX as a whole

A port must be configured for source routing or SRT before configuring the segment and bridge numbers. Unlike transparent bridging, source routing and SRT require explicit designation of segment (ring) numbers and bridge numbers.

3.5.2.1 Bridging Method

To configure bridging from LCM, enter `bridge` followed by the port number, and the keyword `sr` for source routing or `srt` for source routing transparent. For example, to enable IBM source routing on Token Ring port 9, type:

```
ATX> bridge 9 sr
```

To change the port back to transparent bridging, type:

```
ATX> bridge 9 transparent
```

3.5.2.2 Segment Number

Segment numbers range from 1 to 4095 and must be unique within the bridged network. To set the segment number from LCM for either source routing or source routing transparent, use the `srsegment` command, followed by the port number and the desired segment number. For example, to set the segment number for port 9 to 109, enter:

```
ATX> srsegment 9 109
```

3.5.2.3 Bridge Number

The ATX, unlike some multiport source routing bridges, does not impute an internal pseudo-ring, and so its bridge number must be unique on each of the segments to which it is attached. The omission of the pseudo-ring has the advantage of increasing the allowable network diameter by consuming one hop per transit instead of two.

Bridge numbers range from 1 to 15 and must be unique between any pair of segments. To set the bridge number from LCM for either source routing or source routing transparent, use the `srbridge` command followed by its value. For example, to set the bridge number to 7, enter:

```
ATX> srbridge 7
```

3.6 TRANSLATION OPTIONS

The ATX offers unique abilities to bridge between Ethernet and Token Ring (as well as FDDI), despite protocol differences between the dissimilar media. The ATX provides a number of options for overcoming translating problems. The options are specific to the higher-layer protocol family.

You can set the types of translations that are available for Token Ring ports. Ports may have a combination of different translation types. The translation options are:

- ARP - translates incoming and/or outgoing ARP packets
- srArp - translates incoming ARP packets that are source routing explorer frames
- IPX - translates incoming and outgoing Novell IPX packets
- APPLE - translates incoming and outgoing AppleTalk ELAP, TLAP, and AARP packets

The types of custom mixed LAN translations that are available, as well as the translations that have been activated for your Token Ring ports, can be displayed. (Currently, custom mixed LAN translations may only be specified for Token Ring ports.) To display this information enter:

```
ATX> translate
```

To display the translations that have been activated for indicated ports, enter `translate` followed by a Token Ring port range. For example:

```
ATX> translate 2-4
```

To display the options that are available for the specified translation type, enter:

```
ATX> translate port range translation type
```

Token Ring ports may have any combination of the different translation types. To enable the translation type in the manner specified by option for the indicated ports, enter:

```
ATX> translate {port range} {translation type} option
```

To disable all translation types for the indicated ports enter:

```
ATX> translate {port range} none
```

3.6.1 ARP Translation

The ARP translation options are intended to compensate for any likely implementation of IP's ARP on 802.5 Token Rings. The possibilities for option are the following:

- Off – no special ARP translation to be performed
- Bitswap1 – embedded MAC addresses for ARP packets with hardware type 1 (Ethernet) will be bit swapped (this applies to all ARP packets received by the port, and to all ARP packets to be transmitted by the port).
- Bitswap6 – embedded MAC addresses for ARP packets with hardware type 6 (IEEE 802) will be bit swapped (this applies to all ARP packets received by the port, and to all ARP packets to be transmitted by the port).
- Bitswap61 – both type 1 and type 6 ARP packets will be bit swapped.
- Oneto6 – incoming type 6 ARP packets will be changed to type 1 and outgoing type 1 ARP packets will be changed to type 6, both without bit swapping.

- Oneto6swap – incoming type 6 ARP packets will be converted to type 1 and outgoing type 1 to type 6, with embedded addresses bit swapped.

3.6.2 Source Routing ARP Translation

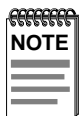
The Source Routing ARP translation options specify when bridging IP ARP packets that are source routing explorer frames, whether the routing information is to be stripped or propagated. The possibilities for option are the following:

- Off – no special ARP translation is to be performed.
- PassRif – the packet is bridged as is, with route discovery proceeding as expected (the passRif option is identical to the off option).
- StripRif – the routing information field is stripped before being propagated (this option allows non source routing (e.g., Ethernet) IP hosts to communicate transparently).
- PassBoth – both the original source routed packet and its transparent equivalent are propagated (this option provides maximum connectivity at some expense in network traffic).

3.6.3 IPX Translation

The IPX translation options specify, when bridging Novell IPX packets, whether the packets are to be translated to Ethernet-like format. The possibilities for option are:

- Off – no special IPX translation is to be performed
- On – the default IPX translation of the switch is to be performed (If no ports have any IPX options, then the default option is ethernet8023.)
- Ethernet8023 – the 802.3 header is to be used without an 802.2 frame (this also changes the default to Ethernet 8023 framing)
- Ethernet2 – Ethernet 2 framing is to be used, with ether Type 8137 (this changes the default to Ethernet2 framing)
- Ethernet8022 – the LLC header e0, e0, 03 is to be used in conjunction with the 802.3 header (this also changes the default to ethernet8022 framing)



All Token Ring ports that have IPX translation enabled should always use the same option.

To enable the default option for port 5, enter:

```
ATX> translate 5 ipx on
```

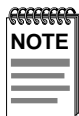
To change the default to ethernet2, and change the IPX option to ethernet2 for ports 5 and 6.

```
ATX> translate 6 ipx ethernet2
```

To change the default to ethernet8022, and change the IPX option to ethernet8022 for ports 5, 6, and 7.

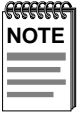
```
ATX> translate 7 ipx ethernet8022
```

3.6.4 AppleTalk Translation



AppleTalk Phase 1 does not exist on Token Ring and so is not a concern here. Also, since the ATX does not have physical LocalTalk connections, LocalTalk/LLAP is not a concern. Apple Macintoshes may be attached directly to standard LANs or may employ various LocalTalk-to-Ethernet routers to access LAN internetworks.

Ethernet AppleTalk (ELAP) differs from Token Ring AppleTalk (TLAP) in AARP packets and in the use of zone multicast addresses. If so configured, the ATX will translate AARP packets and will exchange zone multicast addresses as needed.



On Token Ring, certain AppleTalk packets are transmitted as source routing explorers. If translation is enabled, the ATX will pass both the original frame and a stripped copy of the frame. This may double the multicast traffic on the Internet. Given AppleTalk's propensity for frequent multicast packets, network administrators should use this option with care.

The AppleTalk translation options specify when bridging AppleTalk ELAP, TLAP, and AARP packets, whether the packets are to be translated to Ethernet-like format. The possibilities for option are:

- Off - perform no translation
- On - translate the packets

To enable AppleTalk translation from LCM, enter `translate` followed by a Token Ring port range, `apple` and `on`. For example:

```
ATX> translate 4-6 apple on
```


CHAPTER 4

STATISTICS

4.1 DISPLAYING PORT STATUS

Using LCM, you can obtain the status of a specific Token Ring port by typing `status <port number>`. (Type `status` to display all the ATX port numbers.) A sample display of a Token Ring port status is shown below.

```
ATX >status 7
Port 7 (1st port on module 3) Status
Type: 4Mbps 802.5 Token Ring
Bridging: Source Routing Transparent Bridging (segment=0,
bridge=0)
Routing: IP Routing
Enabled/Disabled: Bridging/Routing functions enabled
Spanning Tree: Forwarding
Packets Transmitted: 324
Packets Received: 627
Small Buffers: 65
RxQ Overflows: 37
Ring State: Open
Ring Status: No Problems
```

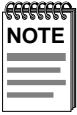
The status of a Token Ring port includes the following information:

- **Type** - whether the ring is operating at 4 or 16 Mbps, and the module type, i.e., 802.5 Token Ring.
- **Bridging** - which functions have been enabled for bridging (see the `bridge` command).
- **Routing** - which functions have been enabled for routing (see `iproute` and `ipxroute` commands in your NMS manual).
- **Enabled/Disabled** - enabled if it is operational, or disabled if you used the `disable` command to disable it. If the port is enabled but not operational, its status will be broken. (A port could be broken if it is so badly misconfigured as to be unusable. You might also see a status of broken if an FDDI or Token Ring port can't connect to a logical ring, or if an Ethernet port continually fails as it tries to transmit.). Refer to your NMS manual for commands.

- Spanning Tree - the port's Spanning Tree state. This entry shows status only; it is not selectable. The following states apply to Spanning Tree:
 - Blocking - The port is not currently the designated port to the LAN and is therefore not forwarding any packets. (This means there is another route to that LAN and, since the Spanning Tree protocol does not allow simultaneous redundant paths, this port is blocked. If the other route to that LAN goes down, this port would then begin forwarding packets.)
 - Listening - The port is listening for other bridges on the network to determine if it should go to the forwarding or blocking state.
 - Learning - The port is listening for other bridges on the network and making a table of addresses from packets that it has received. Once the port goes to the forwarding state, it can then use the address information it has learned.
 - Forwarding - The port is the designated port for the LAN and is forwarding packets and sending out bridge protocol packets.
 - Broken - The port is not forwarding packets. Reasons include no cable connected, no link status, the ring is not operational, or an NMS has disabled the port.
 - Disabled - The port is not configured for Spanning Tree.
- Packets Transmitted - number of packets transmitted from the port. This entry shows status only; it is not selectable. This includes any packets that might have experienced transmission errors. (The port's statistics are reset whenever the port is started.)
- Packets Received - number of good packets received through the port. This entry shows status only; it is not selectable. Packets with reception errors are not included, nor are packets local to that segment that are hardware filtered.
- Small Buffers - number of buffers currently assigned to the port (see RX_Q Overflows below). This entry shows status only; it is not selectable.

- **RX_Q Overflows** - number of incoming packets dropped by the port due to a lack of buffers. This entry shows status only; it is not selectable. After a reboot, the ATX tries to automatically re-allocate the Small Buffers among the ports so that the total number of RX_Q Overflows is minimized.
- **Ring State** - either opened, closed, or ring failure. This entry shows status only; it is not selectable.
- **Ring Status** - normally No Problems Detected. This entry shows status only; it is not selectable. If there are ring problems, one of the following will be displayed:
 - **Ring Recovery** - This could be a normal state, indicating that a new station has just inserted into the ring and temporarily broken it. The ring should be back to normal in seconds. If it is not, check for stuck relays on a passive MAU, DB9 connectors plugged into the video port, mismatched ring speed (some stations at 4, some at 16), or poor wiring or connections.
 - **Single Station** - The module's Token Ring port is the only station it sees on the ring.
 - **Auto Removal** - There is a serious problem with the connection, which resulted in the Token Ring port removing itself from the ring. Check the conditions listed under Ring Recovery.
 - **Lobe Wire Fault** - The cable between the ATX and the MAU is defective causing the loopback test to fail. Therefore, the Token Ring port isn't inserted into the ring.
 - **Soft Error** - Historically indicates that an error has occurred. This can be caused by inserting a new station into the ring. Since this value represents a historical set, it may not necessarily indicate a current error condition.
 - **Hard Error** - This frequently occurs when a new station is inserted into the ring; it can be ignored.
 - **Transmitting Beacons** - As state similar to Ring Recovery. Follow the guidelines above.
 - **Signal Loss** - The Token Ring port is unable to communicate with the ring.

- Remove Received - The Token Ring port has removed itself from the ring.



All of the counter values are reset to zeros if the ATX is rebooted or if the module housing that port is halted and restarted.

4.2 MODULE STATISTICS

Interface-related statistics are maintained for NMS examination in several portions of the management information base (MIB). These include the “if” portion of MIB II, the bridge MIB[5], the 802.5 MIB, and proprietary MIB entries. The proprietary MIB port statistics are summarized below:

- `sifRxPackets` - The number of received packets by category. Each of the possible 25 categories is the cross-product of the five destination addresses and the five forwarding outcomes (see Table 4-1).

Table 4-1 Destination Addresses and Forwarding Outcomes

Destination Address	Forwarding Outcome
1. a bridge management unicast address	i. packet forwarded
2. a bridge management multicast address	ii. packet filtered (local traffic)
3. a known non-management address	iii. packet filtered (port blocked)
4. an unknown non-management unicast address	iv. packet filtered (source restriction)
5. an unknown non-management multicast address	v. packet filtered (destination restriction)

- `sifRxChar0s` - The number of characters in the forwarded received packets.
- `sifRxChar1s` - The number of characters in the filtered received packets.

- `sifRxSizeErrors` - The number of received packets discarded due to size errors.
- `sifRxHwFCSs` - The number of received packets discarded due to FCS errors.
- `sifTxPackets` - The number of transmitted packets divided into five categories. The number of packets in each category is encoded as a series of 4 bytes, which should be converted into a 32 bit counter. The five categories of destination addresses are described in Table 4-1.
- `sifTxCongests` - The number of packets not transmitted due to transmit congestion.
- `sifTxStorms` - The number of packets not sent due to protection against a multicast storm.
- `sifTxDests` - The number of packets not sent due to a destination port filtering restriction.
- `sifTxSizes` - The number of packets not sent due to size limitations.

CHAPTER 5

DIAGNOSTICS AND TROUBLESHOOTING

5.1 POWER-UP DIAGNOSTICS

5.1.1 Power-up Tests

The power-up diagnostics assure that the ATX and all the installed modules are operational. During diagnostic mode, the status LEDs are used differently than during normal operation.

When the ATX is powered-up, it automatically senses the installed boards and reassigns port numbers starting with the PPE as port 1.

During a normal power-up test, the diagnostics test the entire ATX starting with the PPE and proceeding slot by slot from the top down. The normal power-up sequence is described in Chapter 2, **Connecting to the Network**.

5.1.2 Power-up Results

After completion of the power-up diagnostic sequence, all status LEDs on the ATX front panel should be on (lit), indicating that the modules have passed the power-up tests.

Refer to Table 5-1 for descriptions of the LEDs during normal operation.

Table 5-1 Meaning of LEDs

LED	Meaning
RX	Token Ring port is receiving data (LED flashes)
ST	Ring status of port, on if port is inserted into the ring
PROC	Token Ring processor is ready for operation (LED on)
TX	Token Ring port is transmitting data (LED flashes)
16	If LED is on, then port ring speed is set for 16 Mbps, if not on then port ring speed is set for 4 Mbps
POWER	Token Ring module hardware is receiving power (LED on)

5.2 OPERATIONAL DIAGNOSTICS

5.2.1 Loopback Tests

Built-in local and remote loopback tests can be used to test individual ports while the ATX is operational. When in local loopback, a port is disconnected from its network. The ATX generates loopback packets for the port, and the port loops the packets back without sending them onto its network.

During a remote loopback test, the port is in normal operation, sending and receiving packets to its network. The ATX generates loopback packets which are sent out of the port to a particular destination device on the port's network. The destination device echoes the packet back onto the network, and the originating port receives the packet.

For both types of tests, normal operation is indicated when generated packets are received back (after looping) without errors. For remote loopback tests, the ATX creates LLC Type 1 test packets for LANs and PPP echo-request packets for WANs and UARTs.

Both types of loopback tests can be initiated by the NMS, and test results are reported to the NMS.

5.2.2 Diagnostic Results

The ATX diagnostic results are indicated in two ways: by observing the front panel LEDs (which are explained later in this chapter) or by reading NMS trap messages. Both power-up and loopback diagnostics produce traps, which are sent to the NMS and may be logged for future reference. In some cases it may be more convenient to simply observe the LEDs, but in most cases traps provide more information. There are no LEDs for the loopback tests—the results of these tests must be observed (i.e., accurate packet transmission) or read using an NMS (i.e., examine traps).

5.3 TROUBLESHOOTING

5.3.1 If the Module Fails to Power Up

If the Token Ring module fails to power up when the ATX is on and functioning properly:

1. Check the status of ports using LCM.
2. Reset the Token Ring module and observe the power-up sequence again.

3. If the sequence is still abnormal:
 - a. Remove the interface module by unscrewing the two retaining screws on the module's front panel. Pull the module out using the "ears" on the front panel.
 - b. Carefully but firmly press down on all socketed components.
 - c. Re-install the module. Make sure the module is properly seated and tighten the retaining screws.
 - d. Reset the ATX and observe the power-up sequence.
4. If it is still abnormal, contact Cabletron Systems Technical Support.

5.3.2 Connectivity Problems

If the Token Ring module powers up normally but the workstations are unable to communicate:

1. Check the LEDs for abnormalities which may help indicate the source of the problem. (LED behavior during normal operation is explained earlier in this chapter.)
2. Check the status of the ports using LCM.
3. Make sure the ring speed for all stations on the same ring are set for the same speed. One station configured for a different speed may disrupt ring operation.
4. Check for loose connections between the Token Ring module and the MAU and between the MAU and the workstations. Remember, the Token Ring ports *cannot* be connected directly to workstations. Also refer to the MAU's documentation for additional information, such as wrapped or open ports.

CHAPTER 6

ADDING/SWAPPING MODULES

Once you have received your ATX, you may want to add a new module to expand your network bandwidth, replace a module with a module of a different type, or swap a module with another module of the same type. If you are:

- Adding a module to a previously vacant slot or to a slot that had a different type of module, refer to the section **Adding a Token Ring Switch Module** below, for instructions.
- Replacing a Token Ring module, refer to Section 6.3, **Swapping a Module**, for instructions.

Before adding or swapping modules, refer to the latest version of the ATX Release Notes (provided with your ATX software) for information about software and hardware version numbers and compatibility.

6.1 UNPACKING THE TOKEN RING SWITCH MODULE

Unpack the module carefully, handling it by the edges only, and inspect it for possible damage. If any damage is evident, contact Cabletron Systems Technical Support immediately. Save the original container and antistatic wrap in case the module needs to be repaired.

6.2 ADDING A TOKEN RING SWITCH MODULE

If the module you are adding is of a different type than the module that previously occupied that slot, or if the slot was previously vacant, you have to reboot the ATX so it will recognize the new module.

If the module you are adding has a different number of ports than the module you are removing, before you can power cycle the ATX you must:

- Delete all static addresses
 - Delete all ARP addresses and IP routing table entries
 - Delete all filters
1. Make sure the ATX is powered off.
 2. Remove the network connections from the module you are going to replace.
 3. Loosen the screws at each end of the front panel of the interface module you are going to replace.
 4. Remove the installed interface module by pulling gently but firmly on the ears at the ends of the module's front panel.
 5. Gently slide the new module into the plastic guides in the module slot until it is completely inserted. Push the module firmly into place, as far as it will go, to fully engage the connectors at the back of the module with the backplane at the rear of the ATX chassis.
 6. Tighten the screws on each side of the Token Ring module front panel.
 7. Power on the ATX, and check the module LED power-on sequence as described in Chapter 2, **Connecting to the Network**.
 8. Make the connections to the network as described in Chapter 2.

6.3 SWAPPING A MODULE

When swapping identical modules, it is recommended that you remove power from the ATX. However, the module you are replacing must be taken offline first, as described below.

1. Take the module to be replaced offline, either by pressing the OFFLINE button on the module front panel, or by using the Local Console Manager `offline` command.
2. Remove power from the ATX.
3. Remove the network connections from the module. Note the ports to which the network connections attach.
4. Loosen the screws at each end of the front panel of the module to be replaced.
5. Remove the installed module by pulling gently but firmly on the ears at the ends of the module's front panel.
6. Gently slide the new module into the plastic guides in the module slot until it is completely inserted. Push the module firmly into place, as far as it will go, to fully engage the connectors at the back of the module with the backplane at the rear of the ATX chassis.
7. Tighten the screws on each side of the module's front panel.
8. If you took the original module offline by pressing the OFFLINE button, the new Token Ring module will automatically come back online when it is inserted in the slot.
9. If you used the LCM `offline` command to take the original module offline, you must use the `online` command to bring the new module online.
10. Check the module LED power-on sequence as described in Chapter 2, **Connecting to the Network**.
11. Make the connections to the network as described in Chapter 2.

APPENDIX A

TECHNICAL SPECIFICATIONS

Standards Compliance

- IEEE 802.5, 802.2, 802.5m, 802.1(d)
- Compatible with IBM Token-Ring environments
- IBM Source Routing

Protocol Translations

- TCP/IP
- IPX
- AppleTalk

Dimensions

Length:	30.99 cm (12.2 in)
Width:	24.13 cm (9.5 in)
Weight:	1.02 Kg (2.25 lb)

Environmental Requirements

Operating temperature	5° C to 40° C (41° F to 104° F)
Storage temperature	-30° C to 90° C (-22° F to 194° F)
Relative humidity	0% to 95%, non-condensing

Connectors

- DB9 for STP
- RJ45 for UTP

LEDs

- Power
- Module status
- Ring speed
- Ring status
- Receive activity
- Transmit activity

Bridging Domains

- Transparent
- Source Routing
- Source Routing Transparent

Certifications

Safety	UL 1950, CSA C22.2 950, EN60950, and IEC 950
Emission	FCC Part 15 Class A, EN55022 Class A, and VCCI Class I
Immunity	EN50082-1

APPENDIX B

BRIDGING METHODS

B.1 OVERVIEW

Each port of the ATX can be configured for transparent (802.1d) bridging, IBM source routing bridging, or source routing transparent bridging (802.5M). Depending on network topology, it may be desirable to include a mix of these methods within a single ATX.

The choice of bridging methods is determined both by end station requirements and by other internetworking equipment.

Source routing end stations may use any of the three bridging methods. Transparent end stations must use either transparent or SRT bridging. When in doubt, transparent bridging is the easiest to configure and use.

If redundant links are employed along with IBM source routing bridges, then the attached ATX port should be configured for source routing. This will enable the mesh of bridges to derive a spanning tree suitable for spanning tree explorer frames and for multicast packets.

If source routing is desired, and either Ethernet or FDDI is to be used as a backbone between Token Rings, then the Ethernet or FDDI port should be configured for SRT bridging. (SRT over Ethernet is not a standard, but is available for use between multiple ATX chassis in backbone applications. In this case, the "Ethernet" may actually be a microwave or satellite link with an Ethernet-like interface.)

A common mixture of bridging modes may occur when Ethernet segments and Token-Ring segments do not exchange data but share an FDDI backbone. In this case, the Ethernets may be configured for transparent bridging, the Token Rings for source routing, and the FDDI backbone for SRT. (Don't infer from this example that SRT is the sum of transparent and source routing bridging; it is a distinct third method).

The bridging method is dependent on the configuration of the bridge entry and exit ports, and the value of the Routing Indicator (RII) bit in the received frame. The following chart summarizes the interaction between the bridging method.

		Exit Port Configuration		
Entry Port Config.	RII	SRT (Source Routing Transparent)	SR (Source Routing)	TST (Transparent Spanning Tree)
SRT	0	spanning tree	block	spanning tree
	1	source route	source route	spanning tree ^a
SR	0	block	block	block
	1	source route	block	block
TST	0	spanning tree	block	spanning tree
	1	spanning tree ^a	block	spanning tree ^a

a. source address is not learned

B.2 TRANSPARENT BRIDGING

Transparent or spanning tree bridging requires no initial programming. After being installed on the network, they “learn” and remember the location of the attached devices by reading the source addresses of incoming packets. Then they place the source address and port information in a lookup table.

When a packet comes into a port, the bridge reads the destination address and attempts to find the location of the destination node using its lookup table. If the address is in the table, the bridge simply re-transmits the packet out of the appropriate port. If the address is not found in the table the bridge re-transmits the packet out of all the ports except the source port.

Transparent or spanning tree bridges also usually provide some packet filtering capabilities. On some networks it is desirable to prevent certain stations from accessing other segments. The ATX uses this bridging method.

B.3 SOURCE ROUTING BRIDGING

Source routing bridging (SR) is an alternative to transparent or spanning tree bridging, and is widely used in Token Ring networks. The ATX supports source routing bridging on Token Ring LANs, and an enhancement to source routing called SRT on all LANs.

With source routing bridging, all networked devices participate in the source routing protocol. Each packet that crosses a bridge specifies the originator's LAN segment, the particular bridge, and the destination LAN segment. It may also specify intermediate LAN segments and bridges.

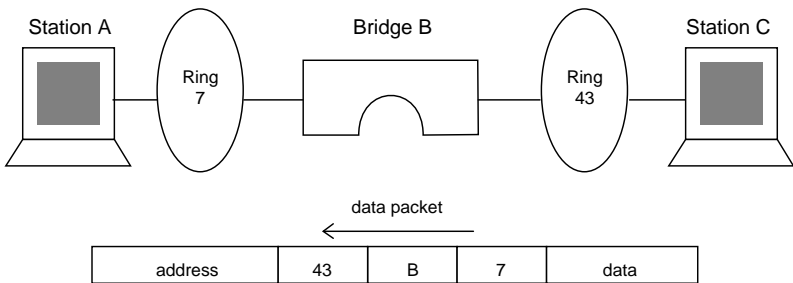


Figure B-1 Source Routing Example

In the example in Figure B-1, a data packet traveling from station C on LAN 43 through bridge B to station A on LAN 7 must specify the full route it is to take. The source station is responsible for specifying the route, hence the term “source routing.”

Bridges in a source routing network must be configured with the LAN numbers (normally 1 to 4095) to which it is connected and a bridge number (normally 1 to 15). The network administrator chooses the numbers; the LAN numbers must be unique in the source routed network and the bridge numbers must be unique between each pair of LANs.

Source routing workstations need not be configured with route information; instead they discover the best route to a destination through the use of explorer frames. In the Figure B-1 example, station C might first transmit an empty explorer frame. Bridge B would add 43-B-7 as its portion of the route, and then transmit the explorer on all other LANs. When the packet reaches station A, it can reverse the route to send a reply back to C. When C receives the reply, both stations have all of the routing information needed to converse, with no further explorer frames needed.

Part of the original intent of source routing bridging was to enable LANs to be richly connected by low-performance, low-cost bridges. As shown in Figure B-2, source routing allows an end station to choose a less-congested path through a chain of bridges, where each bridge is likely to become congested.

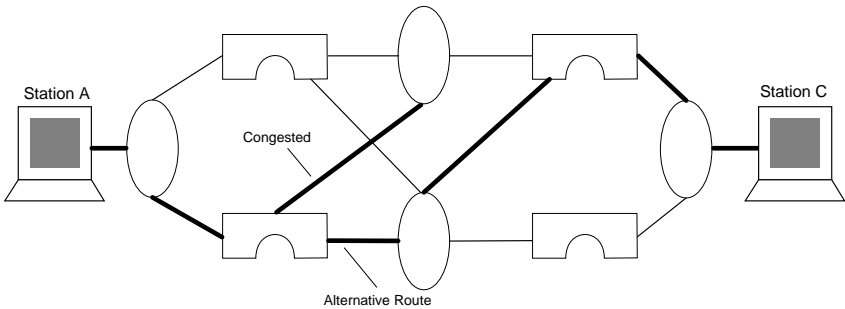


Figure B-2 Data Path Using Source Routing Bridging

In contrast to spanning tree bridging, all bridges and all links are active with source routing bridging; the least-congested path is chosen at discovery time. With products like the ATX, such congestion avoidance is rarely necessary, since the bridge is capable of handling nearly any traffic load without experiencing congestion.

B.4 SOURCE ROUTING TRANSPARENT BRIDGING

Source Routing Transparent (SRT) bridging is a method that merges IBM-style source routing with transparent spanning tree bridging. If a route is present in a packet, then the bridge uses it; otherwise the bridge applies transparent learning rules. It represents an attempt by the IEEE standards committee to standardize source routing and correct some shortcomings in source routing (notably multicast transmission). IEEE has defined SRT bridging for Token Rings, and ANSI has incorporated it into the FDDI standards. The ATX supports SRT bridging on these, as well as on Ethernet (for Ethernet, there is no such standard; the ATX provides this as a proprietary backbone service).

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