

# M400 FDDI Concentrator Users Guide

# **M400 FDDI Concentrator Users Guide**

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(according to ISO/IEC Guide 22 and EN 45014)

**Manufacturer's Name:** Interphase Corporation  
**Manufacturer's Address and  
Phone Number:** 13800 Senlac  
Dallas, Texas 75234  
U.S.A.  
214/654-5000

*declares, that the product:*

**Product Name: FDDI Concentrator**

**Model Number: M400**

*conforms to the following Standards:*

**Safety:** EN 60950:1988 + A1, A2  
IEC 825 -1 & -2 1993

**EMC:** EN 55022:1988 class A  
EN 50082-1 Part 1 1992

## **Supplementary Information:**

This product complies with the requirements of the **Low Voltage Directive 73/23/EEC** and the **EMC directive 89/336/EEC**.

Dallas, March 4, 1996



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# M400 FDDI Concentrator

## Quick Installation Guide

### To install the concentrator in a 19-inch rack:

1. Make sure the mounting brackets are securely attached.
2. Place the concentrator in the rack and attach the brackets to the sides of the rack.
3. Leave at least one-half inch of clearance above the concentrator for proper air flow.

### To install the concentrator for desktop usage:

1. Place the concentrator on its bottom or on its side as needed. Do not place the concentrator so that it sits face-up as this will allow dust to fall into the ports.
2. Remove the mounting brackets, if desired.
3. Leave at least one-half inch of clearance above the top of the concentrator for proper air flow.

### To turn on the concentrator:

1. Attach the power cable to the back of the concentrator and to a compatible (50 Hz/60 Hz) AC power outlet. Acceptable values for the AC source are 90 to 260 volts, 47 to 63 Hz.
2. Press the switch on the back of the concentrator to turn it on.

The concentrator will execute on-board diagnostics. When diagnostics are complete, unconnected ports will blink green, indicating that they are available to accept connections. A connect request is issued to SMT automatically after power up.

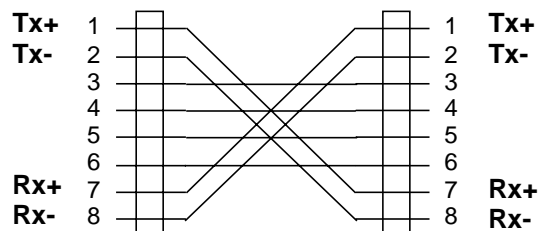
### LED semantics:

Off or Dark	Port is disabled.
Blinking green	Port is waiting for a connection.
Solid green	Port connection is active.
Solid amber	Port connection withheld by this port.
Blinking amber	Port connection withheld by neighboring port.
Solid red	Port is currently Tracing.

### Copper cable wiring requirements:

The copper wiring defined for TP-PMD by ANSI uses the following connections:

UTP:



### Managed M400 Setup Interface

#### To attach a terminal to the local interface:

Baud: 9600  
Parity: None  
Data bits: 8  
Stop bits: 1  
RS-232 connector: DB9 female, configured as a DCE.  
Cable: Should be straight-through.

Default password: cvadmin  
Terminal: Requires 24x80 character resolution.

### To run diagnostics:

1. Access the local interface. Use the system disconnect command to deactivate the concentrator before executing diagnostic tests.
2. Enter **diagnostics internal** to exercise the MAC, the data paths, and part of the port hardware.
3. Enter **diagnostics external** to exercise the MAC, the data paths, and all of the port hardware. This test requires external loopback connectors in every port.

### To set the IP address:

1. Access the local interface.
2. Enter the following command:

```
ifconfig -i ip_address
```

The default IP address is null (0.0.0.0). While the IP address is null, RARP and BOOTP will execute and higher layer protocol traffic will be disabled.

### To “ping” another device:

1. Access the local interface.
2. Enter the following command:

```
ping ip_address
```

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# Section I: Managed M400 FDDI Concentrator

## 1. Getting Started

This section will tell you just what you need to know to get started with the managed version of the M400 FDDI concentrator. This section will:

- Describe the product and what it is capable of doing,
- Assist you in unpacking the concentrator and checking to see that all the pieces are there,
- Tell you how to install the concentrator into your FDDI network environment,
- Tell you how to attach a terminal so that you can access the local management interface,
- Describe the default configuration options provided with the concentrator, and
- Tell you how to turn on the concentrator.

If you would like more detailed information about the operation of the M400 FDDI concentrator, or you are having problems using the product, see section 2. *Reference Manual* on page 11 for additional information. *Appendix A: SMT Connection Policies* on page 41 provides a brief description of the various port types defined for FDDI and the rules governing their interconnection. *Appendix B: Local Management Interface Commands* on page 44 provides detailed manual pages for all of the commands available through the local interface. *Appendix C: MIB Reference* on page 114 describes the FDDI management information base (MIB) attributes that are accessible through the SMT and SNMP interfaces.

**Note:** If you are having problems using the M400 FDDI concentrator, read 2.2. *Troubleshooting* on page 12 for a step-by-step analysis of concentrator behavior. You may find that you are able to solve your problems before calling your dealer or service representative.

### 1.1. Description

The M400 is a manageable FDDI concentrator with either four (4) or eight (8) ports. The actual number of ports provided by the concentrator will depend on the configuration that you ordered.

#### 1.1.1. Number and Type of Ports

Each port has three parts:

1. A **media connector** that provides connection of the concentrator to another FDDI device. This will be either a media interface connector (MIC) for multimode fiber or an RJ45 connector for category 5 unshielded twisted-pair.
2. A **label** that indicates the port type. The M400 can function as a dual-attach concentrator, a single-attach concentrator, or a null-attach concentrator. Therefore, the left-most port can be type A, S, or M, as the label indicates. (See *Appendix A: SMT Connection Policies* on page 41 for a description of port types and how they can be connected.) The port label also shows the number of the port. The port label is located above the media connector.
3. A **three-color light emitting diode (LED)** that indicates port status. The LED for each port is located to the right of each media connector.

The M400 can function as any of the following configurations:

- **Dual-attach concentrator (DAC).** When the M400 is configured as a DAC, it has one A port, one B port, and either 2 or 6 M ports. A DAC can be connected directly to a dual-ring, can be inserted into a tree of concentrators, or can form the root of a tree of connections. In

this configuration, the left-most port is the A port and the port immediately to its right is the B port. The remaining ports are of type M.

- **Single-attach concentrator (SAC).** When the M400 is configured as a SAC, it has one S port and either 3 or 7 M ports. A SAC should be inserted into a tree of concentrators or can form the root of a tree of connections. In the SAC configuration, the left-most port is the S port. The remaining ports are of type M.
- **Null-attach concentrator (NAC).** When the M400 is configured as a NAC, all of its ports are of type M. A null-attach concentrator may only be used to form the root of a tree of connections.

The active configuration of the M400 FDDI concentrator is selectable through software. You may change the configuration of the concentrator by using the local interface. As shipped, the concentrator is configured to function as a DAC.

### 1.1.2. Manageability

The M400 FDDI concentrator is fully manageable. There are several ways to manage the concentrator:

1. **Via the local management interface.** The RS232 port on the front of the concentrator is provided for attachment of a terminal. Through this connection, you can access the commands that make up the local interface. These commands will allow you to monitor the operation of the concentrator, change the behavior of the concentrator, execute diagnostics, etc. See *Appendix B: Local Management Interface Commands* on page 44 for a detailed description of the commands.
2. **Via TELNET.** The M400 FDDI concentrator features a TELNET server. TELNET is a TCP protocol that supports remote terminal-oriented communications. After you assign the concentrator an IP address, you may use a TELNET client from elsewhere on the network to access the local management interface. See *Appendix B: Local Management Interface Commands* on page 44 for a detailed description of the commands.
3. **Via the Station Management (SMT) protocols.** The M400 FDDI concentrator supports the ability to receive and respond to SMT parameter management frame (PMF) Get and Set requests. The Get request allows a remote user to examine, but not alter, the operation of the concentrator. The Set request allows a remote user to change the behavior of the concentrator.
4. **Via the Simple Network Management Protocol (SNMP).** The M400 FDDI concentrator supports the ability to receive and respond to SNMP Get and Set requests. The Get request allows a remote user to examine, but not alter, the operation of the concentrator. The Set request allows a remote user to change the behavior of the concentrator.

In addition, the M400 FDDI concentrator also supports the internet control message protocol (ICMP), the reverse address resolution protocol (RARP), the trivial file transfer protocol (TFTP), and the bootstrap protocol (BOOTP).

### 1.1.3. Internal Data Paths

The M400 FDDI concentrator supports two full internal data paths — primary and secondary. The MAC and the M ports can be placed in the primary or secondary data paths independently. You might use the secondary data path in the following ways:

- To perform load balancing. By moving selected M port traffic to the secondary ring, you may be able to alleviate some of the load on the primary ring.
- To form a private internal ring. You may use this ring to carry traffic that is local to a certain segment of your network.

The resulting configuration of your concentrator depends on the configuration values you choose through the local interface. See *Appendix B: Local Management Interface Commands* on page 44 for detailed information on changing the configuration of your concentrator through the local interface.

**Note:** The two internal data paths are currently limited to primary and secondary only. The secondary data path cannot be reconfigured to provide all of the functions of a local data path.

#### 1.1.4. Optional Optical Bypass

For configurations in which the two left-most ports use multimode fiber, the M400 will support an optional optical bypass. The female Mini-DIN connector on the front panel is for attachment of an optical bypass control cable. This is a self-sensing connector and will operate the optical bypass automatically whenever it is attached. See section 1.7. *Attaching an Optical Bypass (Fiber Units Only)* on page 7 for more information about how to attach an optical bypass.

On configurations on which the two left-most ports are not multimode fiber, the optical bypass attachment will not be present.

## 1.2. Package Contents

The M400 concentrator package includes:

- One (1) FDDI concentrator with either 4 ports or 8 ports.
- One (1) AC power cord.
- One (1) users guide.
- One (1) 3.5 inch, MS-DOS floppy disk containing ASN.1 descriptions of the SNMP MIBs.

Make sure that the above items are in your package and that the AC power cord is compatible with your local power source. If there are any discrepancies you should contact your dealer or service representative.

**Note:** Do not apply power to the concentrator if there are any incompatibilities with the supplied power cord.

## 1.3. Installation

The M400 FDDI concentrator is suitable for use in desktop environments and for installation in standard 19 inch racks. It is shipped with detachable rack-mount brackets.

1a. To use the M400 concentrator as a desktop unit, do the following:

Remove the rack-mount bracket.

Place the concentrator on a flat surface that provides sufficient airflow to the cooling fan in the back of the enclosure. Do not position the enclosure so that dust can fall into the ports.

1b. To install the M400 concentrator in a standard 19 inch rack, do the following:

Position the enclosure in the rack with at least one-half inch of clearance at the top. Insert two mounting screws through each of the two brackets and into the rack.

**Note:** There are several important safety precautions that must be observed when installing the concentrator in a rack. Please see section 1.10.3. *Rack installation* on page 10 for a detailed listing of these precautions.

2. Plug the AC power cord that was shipped with the concentrator into the socket that is on the

back of the enclosure below the power switch.

3. Plug the other end of the power cord into an AC power source. Acceptable values for the AC source are 90 to 260 volts and 47 to 63 Hz. If your power source is not compatible, or if the power cord is of the wrong type, do not use the unit. Contact your dealer or service representative.

## 1.4. Using the Local Management Interface

The local interface is a character-based command-line interface that allows you to examine and change the operational state of the concentrator, run diagnostics, and observe the status of the FDDI network. This interface can be accessed in two ways: (1) by attaching a terminal to the RS232 port on the concentrator, or (2) by assigning an IP address to the concentrator and using TELNET to access the interface remotely.

### 1.4.1. Attaching a Terminal

The RS232 port requires only a standard ASCII terminal. However, it must provide at least 24 lines by 80 columns of resolution. In order to connect your terminal to the RS232 interface, take the following steps:

1. The RS232 port is configured with the following options:

**Baud:** 9600  
**Parity:** None  
**Data bits:** 8  
**Stop bits:** 1

Ensure that your terminal is also configured with these RS232 options.

2. Connect your terminal to the RS232 port on the front of the concentrator. The connector on the front of the concentrator is a female DB9 connector. Therefore, you may need a gender changer and/or a DB9-DB25 adapter to connect your terminal. The RS232 port is configured as a DCE. Therefore, your terminal should be configured as a DTE. If your terminal is also a DCE, you will require a null modem connector. You must use a straight-through cable to attach the terminal to the RS232 connector if your terminal is a DTE. Attaching a terminal:RS232 connector;
3. Hit the enter key of your terminal to activate the local interface. You should see the following prompt:

```
Interphase Corporation. M400 FDDI Concentrator.  
Local Management Interface v2.1  
Please enter the password:
```

When you receive the concentrator, it will be preconfigured with one defined password.

Type:

```
cvadmin
```

at the password prompt and press enter. You may change this password from the local interface.

4. At this point, the local interface should be accessible from your terminal and you should see the following prompt:

```
Type 'list' to get a list of commands.  
Type 'help' to get additional information.  
M400 >
```

This means that the system is ready to receive your commands. See *Appendix B: Local Management Interface Commands* on page 44 for a detailed description of the commands and how they may be used.

#### 1.4.2. Using TELNET

The local management interface of the concentrator can also be accessed with the TELNET protocol. Using TELNET requires the following:

- You must have a TELNET client with access to the FDDI network on which the Interphase M400 FDDI concentrator resides.
- The M400 FDDI concentrator must have a valid IP address assigned.

The concentrator can be assigned an IP address in two ways.

- a) If the IP address is null, the concentrator will automatically request an address from the network using the BOOTP and RARP protocols. These protocols will alternate in their attempts to assign an address.
- b) You can use the **ifconfig** command to assign an IP address directly. See *Appendix B: Local Management Interface Commands* on page 44 for a description of this command. You will need to use a terminal attached to the RS232 interface to initially assign an IP address.

The command syntax used to start a TELNET connection will depend on your specific TELNET client. You will need to enter the IP address of the concentrator, e.g.,

```
telnet 193.0.1.1
```

If the connection was successful, you will see the introductory prompt:

```
Interphase Corporation. M400 FDDI concentrator.  
Local Management Interface v2.1  
Please enter the password:
```

Type the default password, `cvadmin`, or the password you assigned the concentrator.

Sometimes you may see the following message when you attempt to start a TELNET connection:

```
Connection unavailable; local interface is active.
```

This message indicates that the concentrator's local interface is already in use via a terminal attached to the RS232 port, **and** that a user command is in progress. The TELNET server cannot seize the user interface while the concentrator is in the middle of processing a command entered from the local terminal.

Similarly, an attempt to use the local RS232 terminal connection while a TELNET session is in progress will result in the following message:

```
Active TELNET connection from 193.0.1.5.  
Local terminal connection not available.
```

This message shows the IP address of the TELNET client that initiated the connection. The M400 FDDI concentrator cannot support a TELNET session and a local RS232 terminal session simultaneously.

After you have started the TELNET connection, you may enter any of the user commands described in *Appendix B: Local Management Interface Commands* on page 44. However, there are several important considerations:

- You cannot run diagnostic tests on the concentrator (using the **diagnostics** command) via TELNET. This is because diagnostics require that the concentrator first be disconnected from

the network.

- Any command which resets the concentrator will break the TELNET connection.
- Changing certain MIB attributes may break the TELNET connection. For example, if you use the **set** command to clear the fddiMACMA-UnitdataEnable flag, all frame services will be suspended and the TELNET connection will be lost.

**Note:** If you use the **system defaults** command to reset the concentrator to its factory default values, the IP address will be reset to null. This will prevent any TELNET connections from starting until a valid IP address has once again been assigned to the concentrator.

## 1.5. Field Upgrades

The M400 FDDI concentrator features Flash memory, which allows for field upgrades of the software via the BOOTP and TFTP protocols. You must configure the BOOTP/TFTP servers on your network with the new binary image in order to take advantage of this feature.

When the concentrator is reset, it will send out a BOOTP message requesting an IP address, if one is not already assigned. The BOOTP server responds with an IP address and the path name of the boot image file. The concentrator will then send a TFTP read request to initiate a file transfer of the boot image, if the boot image contains a later release than the concentrator's resident software.

The last character in the image file name is used to control whether the image is burned into Flash memory. The image file name has the form `cntcr_02.2a0`, where 02.2a is the version number of the software release. When the last character is '0', the image will be downloaded but will not be burned into Flash. This allows you the chance to try the new software before permanently altering the concentrator. If the last character in the file name is changed to 'f', i.e., `cntcr_02.2af`, the image will be downloaded **and** burned into Flash memory.

## 1.6. Default Configuration Options

This section enumerates the default configuration settings for the M400 FDDI concentrator. If the settings below are correct for your network application, then you do not need to change them before using the unit. If you do wish to change these settings, then see *Appendix B: Local Management Interface Commands* on page 44 for a detailed discussion of how to use the local interface.

### 1.6.1. Station Options

<b>Configuration</b>	Dual-attach concentrator (DAC) — one A port, one B port, and either 2 or 6 M ports, depending on the configuration you ordered.
<b>Connection policy</b>	The M400 will accept all connections <b>except</b> the following: A to A B to B M to M
<b>T_Notify</b>	30 seconds. This is the frequency with which the MAC transmits a NIF frame, informing the ring of its continued presence.
<b>Duplicate address resolution</b>	Issue a disconnect and leave the ring.
<b>Status report frames</b>	Enabled.
<b>IP Address</b>	0.0.0.0.
<b>PMF set requests</b>	Denied.
<b>SNMP set requests</b>	Denied.
<b>SNMP community field</b>	"public" .
<b>SNMP trap address</b>	0.0.0.0.
<b>User Data</b>	"Interphase M400 FDDI Concentrator". This string is null terminated.
<b>Password</b>	"cvadmin".

### 1.6.2. MAC Options

- MAC placement** The MAC is placed on the primary data path. Data from the MAC will exit the B port when the concentrator is in the “Thru” configuration.
- T-Req** 165.007 milliseconds
- TVX** 2.498 milliseconds
- FrameErrorThreshold** 65,535. This is the highest possible value for FrameErrorThreshold. It means that **all** frames detected by the MAC must be lost or in error in order for a FrameErrorEvent to be announced to the ring.

### 1.6.3. Port Options

- LER-Alarm** The M400 will issue a warning of a marginal link at a link error rate estimate of  $10^{-8}$ .
- LER-Cutoff** The M400 will disconnect a link automatically due to excessive link errors at a link error rate estimate of  $10^{-7}$ .
- Port placement** The following table describes the default path placement of each of the port types:

Type	Configuration
A	Configured to enter the Thru state when the B port is active; concatenate the primary and secondary paths when the B port is not active; and remain isolated when either the A port or the B port is in Tree mode.
B	Configured to enter the Thru state when the A port is active and concatenate the primary and secondary data paths when the A port is not active or when either the A port or the B port is in Tree mode.
S	Configured to concatenate the primary and secondary data paths when the connection is active and to remain isolated when the connection is inactive.
M	Configured to reside on the primary data path when the connection is active and to remain isolated when the connection is inactive.

**Table 1-1. Default Port Configurations**

## 1.7. Attaching an Optical Bypass (Fiber Units Only)

For units on which the two left-most ports (i.e., the A and the B ports when the concentrator is a DAC) support multimode fiber, you have the option of attaching an optical bypass. The Mini-DIN connector on the front of the unit is provided for the attachment of an optical bypass. (For concentrators on which the two left-most ports are not fiber (e.g., UTP) the optical bypass attachment is not present.) In order to attach an optical bypass to the M400 FDDI concentrator, take the following steps:

1. Make sure that your unit is configured as a **dual-attached concentrator (DAC)**. In SAC and NAC units, routing the optical data between the first two ports automatically may produce undesirable network configurations.
2. Remove the MIC plugs from the two left-most MIC connectors.
3. Insert the MIC portions of the optical bypass into the two left-most ports. Make sure that you insert each of the MIC plugs from the optical bypass into the correct ports on the concentrator. If you insert them incorrectly, you may have a wrapped ring or your ports may not become active.
4. Attach the optical bypass control cable to the Mini-DIN connector on the front of the concentrator. If your optical bypass does not use a standard Mini-DIN connector or has a female

connector, then you will need an adapter.

The Mini-DIN connector on the front of the concentrator is self-sensing. It detects the presence of an optical bypass automatically. The application of power to the optical bypass by the concentrator causes the mirrors that redirect the optical signal to disengage, allowing the incoming optical signal to enter the first two ports. When power to the optical bypass is lost, the mirrors automatically engage, redirecting the incoming optical signal past the concentrator and back out onto the ring.

## 1.8. Operation

1. Before using the concentrator for the first time, make sure that all of the ports are empty so that you can observe the results of the diagnostics.
2. Turn on the concentrator by depressing the power switch on the back of the unit.

When you turn it on, the M400 concentrator will automatically execute the following procedures in the following order:

- Memory diagnostics.
- FDDI diagnostics.
- Station management (SMT) software.

The LEDs indicate the progress of the diagnostics and the operation of SMT. When the LEDs are blinking red or amber, it indicates that the memory diagnostics and FDDI diagnostics are currently running.

If any of the LEDs are not green or amber after diagnostics are complete, it indicates that a failure has occurred with the associated port. You should check the local interface for relevant information. You may also need to contact your dealer or service representative.

If you have a terminal attached to the RS232 port for the local management interface, you will also see something like the following message during boot diagnostics:

```
Boot memory diagnostics... Passed.
Boot FDDI diagnostics...0 1 2 3
Diagnostics passed.

MAC:Passed   Primary Path:Passed   Secondary Path:Passed
Port1:Passed   Port2:Passed   Port3:Passed   Port4:Passed
Port5:Passed   Port6:Passed   Port7:Passed   Port8:Passed
```

The numbers indicate the individual repetitions of the diagnostics. You may execute additional diagnostic tests through the local management interface.

After passing the boot diagnostics, the M400 software will automatically issue a connect request to SMT. When the LEDs are blinking green, it indicates that SMT is now active and that the ports are ready to accept connections. This is the normal and correct state for unconnected ports.

## 1.9. Making FDDI Connections

**Note:** When using building wiring, for safety reasons, always ensure that your building cable plant conforms to the Electronics Industry Association “Commercial Building Telecommunications Wiring Standard” EIA/TIA-568.

In order to make a connection between the M400 FDDI concentrator and another FDDI device, the connected ports must have:

- compatible media types, and
- compatible data encoding schemes.

In other words, you may connect multimode fiber ports only to multimode fiber ports on other FDDI devices and category 5 unshielded twisted-pair (UTP) ports only to category 5 UTP ports on other FDDI devices.

In the case of category 5 UTP, you must also ensure that the correct data encoding scheme is used. The M400 FDDI concentrator uses the MLT-3 encoding scheme for its UTP ports. Encoding scheme compatibility is not a concern with multimode fiber ports.

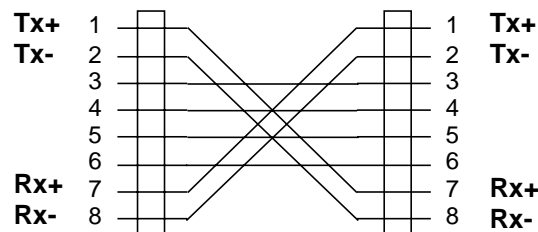
**Note:** MLT-3 is the encoding scheme used in the ANSI TP-PMD standard. It allows for the transmission of FDDI data over copper wire at distances of up to 100 meters. When connecting a UTP port on the M400 FDDI concentrator to another FDDI device, you must ensure that the attached port also uses the MLT-3 encoding scheme.

With the exception of the first two ports, the media connectors for multimode fiber are keyed for the port type. Make sure that the MIC plugs that you use are unkeyed or fitted with compatible keys. If you have difficulty inserting the MIC plug into the media connector, check the key type inserted on your MIC plug. The UTP connectors are not keyed.

In addition, for UTP, you must make sure that the cable you use to connect the ports is a “cross-over” cable. The pin definitions for the UTP connectors are the same for all port types. Therefore, you must ensure that the wires that comprise your connection cable do not go straight through, but cross from the appropriate pin on one side of the cable to the appropriate pin on the other side of the cable. A cross-over cable is required for every type of connection in FDDI UTP networks, regardless of the types of ports being connected. Check with your cable supplier to ensure that the cable you are using is of the correct type.

The cross-over wiring defined for TP-PMD by ANSI uses the following connections:

UTP:



## 1.10. Precautions

### 1.10.1. Handling

- ⚠ To prevent electric shock, do not open the enclosure. There are no user-serviceable parts inside. Refer servicing to qualified service personnel.
- ⚠ Do not allow liquids to penetrate the concentrator enclosure.
- ⚠ Do not **store** the concentrator beyond the following temperature range: -20° C/-4° F to 85° C/185° F.

### 1.10.2. Operation

- ⚠ The input power source must be within the following voltage and frequency ranges: 90 – 260 volts and 47 – 63 Hz.
- ⚠ Use a grounding-type power outlet with the three-wire power cord and plug that is included with the unit.

- ‡ Do not put heavy objects on the power supply cord. A damaged power supply cord may cause fire or electric shock.
- ‡ Do not **operate** the concentrator beyond the following ambient temperature and humidity ranges: 0° C/32° F to 50° C/122° F and 0% to 95% non-condensing humidity.
- ‡ For proper operation, keep the concentrator adequately ventilated. Always ensure that there is at least one-half inch/1.27 cm of clearance above the air flow grill on the top of the concentrator.
- ‡ If the concentrator does not operate properly, turn off the power switch and remove the power plug from the outlet.

#### *1.10.3. Rack installation*

- ‡ If the concentrator is to be installed in an enclosed rack, the ambient temperature of the rack may be higher than that of the surrounding room. Ensure that the ambient temperature inside the rack is within the following ambient temperature and humidity ranges: 0° C/32° F to 50° C/122° F and 0% to 95% non-condensing humidity.
- ‡ Maintain proper air flow through the concentrator. Always ensure that there is at least one-half inch/1.27 cm of clearance above the air flow grill on the top of the concentrator.
- ‡ Do not overburden or unbalance the concentrator or its rack-mounting equipment. Mounting of the concentrator in a rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.
- ‡ Do not overload the circuit that provides power to the concentrator.
- ‡ Always ensure that the concentrator is properly grounded. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g., the use of power strips).

#### *1.10.4. Use of building wiring*

- ‡ Ensure that your building cable plant conforms to the Electronics Industry Association “Commercial Building Telecommunications Wiring Standard” EIA/TIA-568.

## 2. Reference Manual

This section describes the operation of the M400 concentrator in detail and also presents information on resolving problems. It assumes that you have a working technical knowledge of FDDI, FDDI networks, and station management (SMT).

### 2.1. Operation Description

#### 2.1.1. *Boot Diagnostics*

The M400 FDDI concentrator contains a suite of sophisticated diagnostics that are executed automatically when the concentrator receives power. These diagnostics are designed to detect, and recover, if possible, from virtually any failure that the concentrator may experience. This section describes what the concentrator diagnostics do and what the results of the tests mean.

##### 2.1.1.1. Memory Diagnostics

The memory diagnostics include a ROM checksum and RAM tests that are executed several times. The LEDs for the first two ports on the left will change colors briefly to show test progress. A failure at this stage of the diagnostics will prevent the concentrator from operating. In other words, the remaining diagnostics will not be performed, SMT will not run, and the fatal failure will be indicated through the local management interface.

##### 2.1.1.2. FDDI Diagnostics

The FDDI diagnostics use internal loopback paths in the concentrator to test FDDI operation. The test progress is indicated by an amber light that moves from left to right for several seconds. The ports are tested individually and in parallel. If an individual port fails its diagnostic tests, the faulty port is disabled and bypassed so that it is not used during normal concentrator operation. The LED for the faulty port will remain off, indicating that the port cannot be used.

#### 2.1.2. *SMT*

If no fatal failures are encountered in the diagnostic procedures, the concentrator will execute its resident station management (SMT) software and will issue a connect request. All fully functional ports will then be available to accept connections. The status LEDs on unconnected ports will blink green, indicating that the port is available for connection to another FDDI device. The concentrator executes revision 7.3 of the ANSI SMT standard.

The M400 FDDI concentrator provides two internal data paths: primary and secondary. Ports are switched in and out of the primary and secondary data paths according to the SMT path configuration algorithms.

#### 2.1.3. *Port Status*

During normal operation, the LED to the right of each port indicates the state of the port. The following table describes each of the possible port states and the associated LED color. The blink period is 1 second, on for one-half second then off for one-half second.

Note that, when the concentrator is inactive (i.e., has received a disconnect request), the LEDs will flash red, one port at a time, from left to right.

**Table 2-1. M400 Port LED Semantics**

LED	Port State
Off or Dark	Port disabled, off, or otherwise inactive.
Blinking Green	Port connecting or available for a connection.
Solid Green	Port active. There is a connection with the neighboring port.
Solid Amber	Connection withheld by this port.
Blinking Amber	Connection withheld by neighboring port.
Blinking Red	Connection broken because an excessive number of link errors was detected.
Solid Red	The port is in the Trace state indicating that there is a ring fault upstream of this port.

## 2.2. Troubleshooting

This section describes some of the problems you might see when attempting to connect another FDDI device to the M400 FDDI concentrator. Each subsection describes the symptoms, discusses possible causes, and provides an algorithm for gathering more information.

### 2.2.1. LED is not solid green. Port connection does not appear to be active.

When one of the concentrator ports is connected to another functioning FDDI device, the LED should become steady green, indicating that the connection is active. If a connected port does not reach the active state within about 30 seconds use this checklist to try to resolve the problem.

**Note:** An understanding of SMT connection policies will help you solve problems like this. See *Appendix A: SMT Connection Policies* on page 41 for a brief tutorial on SMT connection rules if you are not already familiar with them.

The situation depends on the state of the LED and the type of port (i.e., A, B, S, or M).

#### 2.2.1.1.LED is off (dark).

During normal concentrator operation, the LED on an unconnected concentrator port will be blinking green. If the LED is off, it indicates that SMT has disabled this port because a fault was detected in the port hardware that renders it unusable.

**Note:** Do not attempt to connect a port whose LED is off to another FDDI device. The dark LED indicates that SMT has detected a fault with the port and has disabled the port, rendering it unusable.

#### 2.2.1.2.LED is steady amber

If the LED is steady amber the connection is being withheld by this concentrator port according to the SMT topology rules. There are a number of reasons why a port on the M400 concentrator will withhold a connection. First, check the value of PC-Withhold for the port. (You can do this through the local interface **get** or **status** command .) It should have one of the following values:

- M\_to\_M (1) You have attempted to connect an M port to another M port. Regardless of the current ConnectionPolicy setting, this type of connection is always prohibited by SMT.
- Other (2) You have attempted to connect two ports whose types are incompatible according to your current connection policies. First, check the type of the port on your concentrator and the type of the neighboring port. Then check your current ConnectionPolicy settings. It may be that your current settings prohibit this type of connection. (You can use the **get** command to retrieve this information.)

- No\_Paths (3) You have configured your device such that the paths you have requested are not available or such that making this connection active would cause a MACless wrap point. The SMT configuration algorithms are designed to prevent the existence of MACless wrap points for A, B, and S ports. An A, B, or S port will not join a data path unless there exists a MAC or another port on that data path. Note that this configuration will not occur unless you have changed the concentrator such that it no longer uses the default settings.
- In the case of the A port, a value of No\_Paths may indicate that **dual homing** is in effect. If you have connected the A port and the B port to other devices such that *either* port is connected to an M port, then the B connection will be active (solid green) and the A port connection will be withheld (solid amber).
- In addition, a PC\_Withhold value of No\_Paths might be generated if you have sustained a failure in your system that prevents the port from attaining the desired configuration. For example, if you have specified that an M port is to be placed on the secondary data path and the secondary data path has failed diagnostics and has been disabled, the M port connection will be withheld.
- In general, you should not alter the default configuration settings of the concentrator unless you are familiar with the SMT path configuration algorithms and understand the ramifications of the resulting configuration on your network.

Note that, when a connection is being withheld, an extended link confidence test with a duration of 50 seconds is being run. After this test is over, the connection will be restarted automatically in a new attempt to establish a connection. Therefore, the LED may blink once every 50 seconds when the connection attempt is restarted.

#### 2.2.1.3.LED is blinking amber

If the LED is blinking amber, then the connection is being withheld by the neighboring port. The value of PC\_Withhold should be Not\_Withheld (0). This means that the connection was not withheld by this port. However, if you have console message display enabled, you will see an event indicating that the connection has been withheld by the neighboring port.

The most common reason for this condition is **dual-homing**. A dual-attached device (e.g., a station, another concentrator) is said to be dual-homed when its A and B ports are both connected to another device and at least one of the ports is connected to a concentrator M port. In this situation, SMT has been designed to favor the B port. In dual-homed configurations, the B port connection will be active and the A port connection will be withheld as a backup. If the B port connection fails for any reason (e.g., inactive concentrator, cut cables), the A port connection will become active automatically. The ability to dual-home gives dual-attached devices an extra measure of fault tolerance.

Therefore, if a port on the M400 FDDI concentrator is showing blinking amber, you should first check to see whether the other side of the connection is an A port withholding the connection because of dual homing. If so, then the connection is behaving properly and there is no error.

In general, the neighboring port will withhold a connection for any of the reasons described in section 2.2.1.2. *LED is steady amber* on page 12. You should examine the other FDDI device and its internal SMT topology and configuration rules to determine why it is withholding the connection. (See *Appendix A: SMT Connection Policies* on page 41.)

#### 2.2.1.4.LED is blinking green

If the LED is blinking green, it indicates that the neighboring port is not participating in the estab-

ishment of the connection or that there is a problem with the connecting cable.

First, verify the correct operation of the port itself. If a loopback connector is available, place the loopback connector into the port to verify its operation. If it is an A, B, or M port the LED should become steady amber. If it is an S port the LED will become either steady amber or steady green. If this loopback test passes then the problem is related to either the cabling or the neighboring port.

Next, verify the integrity of the connecting cable:

- Are the connectors securely inserted into both ports? If not, make sure they are snugly attached.
- Is there dirt or dust on the plugs or the connectors? If so, clean them.
- If you are connecting category 5 UTP ports, are you using a cross-over cable with the proper internal wiring? A straight-through cable means that Transmit is wired to Transmit and Receive is wired to Receive. Check with your cable supplier to verify that you are using the correct cable.
- If the port on the attached FDDI device uses ST type connectors, check to see that the ST plugs are on the correct connectors. If you have the plugs attached incorrectly, Transmit will be wired to Transmit, Receive will be wired to Receive, and both ports will be unable to function. Try switching each plug to the alternate connector.
- If the problem persists, try replacing the cable with a new one.

Next, verify that the neighboring port can establish a connection.

- Is the neighboring device turned on and properly configured?
- Does the neighboring device use the same data encoding scheme as the concentrator port?
- Has the neighboring device received a connect request, asking it to initiate new FDDI connections?

Finally, you may be experiencing continuous link confidence test failures. The link confidence test (LCT) is a bit error rate sampling algorithm that every port executes prior to activating the connection. If the bit error rate is too high, then the connection is broken and restarted. If you suspect the bit error rate is too high, you might consider replacing the cable or cleaning the media connectors.

You can check the value of `fddiPORTLCTFail-Ct` if you suspect this is the problem.

#### 2.2.1.5.LED is steady red

If the LED is steady red then there is a fault in the ring that is causing this port to enter the Trace state. Trace is an automatic SMT algorithm used to recover from stuck beacon conditions on the network. SMT will allow the Trace sufficient time to propagate upstream and will then execute its internal diagnostics.

You do not need to take any action if a port is displaying a red LED. SMT will handle the situation automatically. However, if you are seeing a large number of Traces on your FDDI ring, you may want to examine your network for faulty devices.

#### 2.2.1.6.LED is blinking red

While it is active, each port continuously monitors the link error rate (LER) of its connection to the neighboring port. If the link error rate becomes too high, it means that the quality of the link is not high enough to permit transmission and reception of data in a reliable manner. When the link error rate becomes too high, the port will break its connection to the neighboring port and will cause the LED to blink red.

When the LED is blinking red, the port is NOT active. If the problem persists, you must identify and remove the source of the link errors.

Link errors have many sources. They are generally introduced by the cable plant, but may occasionally be introduced by older or faulty hardware. The following list describes some of the sources of link errors:

Fiber:

- Connectors (plugs and receptacles) that are dusty or dirty. Fiber connectors will gather dirt over time and this dirt will obstruct the flow of optical signals.
- Fiber that is bent beyond its minimum bend radius. Fiber can develop micro-fractures when bent too sharply. These fractures can cause link errors.
- Patch panels with substandard connectors or substandard patch cables.
- Configurations in which multiple, consecutive optical bypasses are engaged. An optical bypass weakens the signal that passes through it. If several bypasses are engaged in a row, the resulting signal may become error-filled or unreadable.
- Cable runs that exceed the maximum recommended port-to-port distance. For multimode fiber, this distance is 2 km.

Copper:

- Connectors (plugs and receptacles) that are dusty or dirty. Copper connectors will gather dirt over time and this dirt will obstruct the flow of electrical signals.
- Loose port connectors. Copper connectors in particular are prone to loose connections. This intermittent contact with the port leads can introduce link errors.
- Copper cables that are running through strong electrical or magnetic fields.
- Copper cables or cable runs that exceed the maximum recommended port-to-port distance. For category 5 unshielded twisted pair, this is 100 meters.
- Copper cable plants that do not conform to EIA/TIA 568 wiring specifications. Note that punchdown blocks, patch cable, and patch panels must be rated for category 5 UTP. Note also that crossovers between transmit and receive must be accomplished within a cable and not in the patch panel.

#### 2.2.1.7. All LEDs on front of unit are blinking red, from left to right

This indicates that the concentrator has been disconnected from the network and is awaiting a connect request to re-establish its connections to other network devices. Generally, a station becomes disconnected for one of the following reasons:

- After failing a path test,
- After detecting that its MAC address is duplicated on the ring, or
- Through local or remote interface management activity.

If you find that your concentrator is disconnected and you or your network administrator did not disconnect the concentrator intentionally, verify that your concentrator is in full working order before issuing a connect request.

There are three different ways to issue a connect request:

- Through the local interface by using the **system connect** command.
- Through the SMT protocols (if PMF Sets are enabled) by setting parameter type 0x103C (fddiSMTStationAction) to have a value of 0.
- Through the SNMP protocols (if SNMP Sets are enabled) by setting the SNMP MIB object fddimibSMTStationAction.1 to have a value of 2.

## 3. Monitoring Your FDDI Network

This section describes how to use the FDDI Monitor feature that is available with your M400 FDDI concentrator.

### 3.1. How to use the ‘ringmap’ command

The **ringmap** command polls the stations on your local FDDI ring and constructs a logical map of the token flow. This map lists the MACs that are on your ring and the order in which data flows through them. It also lists several configuration characteristics of the MACs (such as whether they are associated with a station or a concentrator) and any error flags that the mapping algorithm can detect.

The ring map that is generated contains a great deal of information that will allow you to:

#### 1. See how your network is wired.

The map output will tell you whether a device is a station or a concentrator. It will also tell you whether a device is on the dual ring or not. Therefore, you can determine when a device is attached to the ring through a concentrator and you can usually determine which concentrator it is.

#### 2. Detect configuration changes on your ring.

Continuous generation of new ring maps will allow you to identify when stations leave the ring, when stations join the ring, and when the ring wraps or segments.

#### 3. Identify stations that are overburdened or nonresponsive.

If you use the `-v` option for the **ringmap** command, you will be alerted to any inconsistencies in the information that the various stations are reporting. You will also be notified when a station fails to respond to the network query as expected. Map inconsistencies and nonresponsive stations are indicative of stations that have recently left the ring, of stations that are too busy to respond to SMT frames, or of stations that are on the ring, but incapable of transmitting and/or receiving frames.

The network map will display a ‘?’ next to a device that was recently active in the network but that failed to respond to the ring map query. The network map will create a place holder entry (e.g., “??-??-??-??-??-??”) for a hole in the network map that cannot be filled from the available data. Both map uncertainties indicate that there may be stations that are overburdened or nonresponsive.

#### 4. Determine whether the dual ring is wrapped and, if so, where.

When a map entry has equal signs (“=”) around it, the device is on the dual ring. If the map entry also has the wrapped error flag set (‘W’), then this device is also wrapped. If all of the devices that are on the dual ring do not have the wrapped flag set, then your ring is complete. However, if you see map entries that are displaying the wrapped flag, then your ring is wrapped. There will normally be either zero or two of these wrap points in your network map<sup>1</sup>.

#### 5. Detect twisted ring conditions.

A twisted ring is caused by A-A and B-B connections. Normally, these types of connections

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<sup>1</sup> Actually, the use of MACless concentrators on the ring can create a situation in which only one device is reporting the ‘W’ flag.

are prevented by the SMT connection policies. However, the SMT connection policies can be altered by the user of an FDDI device and undesired configurations can result. A twisted ring can cause some MACs to be placed on the secondary, or backup, ring where they will be unable to communicate with the rest of the stations on the network.

The network map uses the 'T' flag to identify twisted ring conditions. The map display will identify the stations that currently have A-A or B-B connections.

#### **6. Detect duplicate MAC address conditions on the network.**

Duplicate MAC address conditions can be serious barriers to network performance. It is possible for a pair of stations with the same MAC address to prevent the entire ring from becoming operational. The FDDI protocols assume unique MAC addresses for all addressable devices on the ring and the SMT standard defines protocols to detect and resolve duplicate address conditions.

The network map will display a 'D' flag next to a device that is reporting a duplicate address condition.

#### **7. Identify network devices that may have operational problems.**

The network map will display additional error flags so that you may examine the associated devices further. The 'F' flag is used when a device is reporting an increase in the number of frames lost or the number of error frames detected. The 'L' flag is used when a device has identified a network link whose bit error rate is dangerously high. You may use these flags to examine the behavior of a device in more detail and to remedy the problem, if necessary.

### **3.2. How to use the 'monitor' command**

The **monitor** command has two options. You may monitor ring stability or network utilization.

- When you monitor ring stability, you are focusing on the number of times your ring bounces and the frequency with which the ring bounces. A ring "bounce" is defined as a change in the operational state of the ring: from Ring-Op to Non-Op, or from Non-Op to Ring-Op.
- Ring bounces occur when stations enter the ring, when stations leave the ring, when links are disconnected for bit error rate reasons, when internal configuration changes are made within a device, or when certain FDDI MAC timers expire. When the ring bounces, the MACs on the ring are undertaking the claim process, during which they send claim frames around the ring and negotiate the target token rotation time. This generally takes less than one millisecond and is a normal part of FDDI ring operation. Once the negotiation is complete, a new token is generated and the ring is operational.
- However, if your ring bounces too frequently, it could indicate a problem with some part of your network. A "normal" or "acceptable" number of ring bounces depends on the size and structure of your network. For example, a small FDDI backbone with two concentrators and six routers should never bounce. A large FDDI desktop network with connections to more than 100 servers and clients will bounce more frequently as stations are turned on and off. The **monitor** command gives you the ability to see how frequently your ring bounces and to see whether your ring is becoming more or less stable.
- When you monitor network utilization, you are focusing on the percent of your network capacity that is currently being used. If your FDDI ring should become too busy, it might be a good idea to consider segmentation or reconfiguration. However, since FDDI uses a timed token protocol to govern access to the ring, average access times will remain fair and deter-

ministic even in the presence of very high traffic loads.

- The network utilization option also gives you the ability to monitor changes to T-Neg (the target token rotation time that is negotiated during the claim process), the actual token rotation time, and the latency of your network. The sections below explain what changes in these values can mean.

### 3.3. How to use the ‘view’ command

With the **view** command, you have the ability to gather configuration and performance information about the FDDI devices on your local ring. You can display a summary of station status or you can focus on MAC or port performance. You may display information for a single device on your ring or you may display information for all the devices on your ring. See the manual page for the **view** command for a detailed description of the data that this command provides.

The **view** command is most useful when:

- You suspect a specific device may be having a problem or causing trouble on the network and you want more information.
- You want to know which station won the claim process.
- You want to know if any stations are overburdened.
- You want to identify the busiest station(s) on the network.
- You want to identify the station(s) that contribute most heavily to the network traffic.
- You want to characterize the traffic flows on your ring.

### 3.4. What to do when...

#### 3.4.1. ...you receive a ‘Trace’ message.

Message: ‘Trace initiated’, ‘Trace terminated’, ‘Trace propagated’, or ‘Trace timed out’

#### What it means:

*Trace* is an SMT protocol that is used to resolve stuck beacon conditions. A stuck beacon condition occurs when there is a logical fault on the ring that prevents data from being transmitted normally. When this logical fault destroys the token, stations on the ring will claim, will fail to resolve the claim process (because the fault is destroying the claim frames), will beacon, and will fail to resolve the beacon process (because the fault is destroying the beacon frames). Due to the nature of the beacon protocol, the MAC that is still beaconing must be immediately downstream of the fault. This MAC is said to be *stuck beaconing* and it initiates the Trace protocol.

Trace will signal upstream along the token path, from the MAC that is stuck beaconing to the next MAC upstream. All of the physical devices in this fault domain, including the stations on each end, will be required to execute a diagnostic path test in an attempt to resolve the problem.

- When you see the ‘Trace initiated’ message, it means that the MAC on the M400 FDDI concentrator initiated the Trace protocol because it was stuck beaconing.
- When you see the ‘Trace terminated’ message, it means that the MAC on the M400 FDDI concentrator lies on the upstream side of the fault domain and that the path test is about to begin.
- When you see the ‘Trace propagated’ message, it means that the M400 FDDI concentrator lies within the fault domain and that the appropriate Trace signals were received on one port (probably from the MAC that initiated Trace) and propagated to the next port upstream (probably to the MAC that will terminate Trace). The path test required by the Trace protocol is

about to begin.

- When you see the ‘Trace timed out’ message, it is always accompanied by one of the previous messages. This message means that the M400 FDDI concentrator lies somewhere within the fault domain and that the Trace timer that was started when the Trace protocol began has expired. The path test required by the Trace protocol is about to begin.

The most important thing to do is ensure that the logical fault is repaired or removed so that the ring can become operational once more. This sort of problem is extremely serious and will cripple an FDDI network until it is repaired.

### What to do:

Normally, you don’t need to do anything. The Trace protocol is automatic. It identifies all of the physical devices in the token path, from the concentrator to the next upstream MAC, and causes all of them to execute a path test. If a device passes this path test, it will rejoin the ring; if it fails, it will disconnect. If your ring is able to sustain operation afterward without suffering a similar logical fault, then the problem has been corrected.

However, sometimes the problem doesn’t go away. If you see these ‘Trace’ messages more than once, then you should suspect a device in the vicinity of the concentrator and you should take corrective measures.

The first step is to examine a *previous* ring map (i.e., use the **ringmap -o** command) and identify the Trace *fault domain*. The logical fault that is causing the stuck beacon condition must lie somewhere in the fault domain.

- If the concentrator initiated Trace, then the fault domain includes all devices between the concentrator and the MAC that lies immediately upstream of the concentrator (i.e., the next entry counterclockwise on the network map).
- If the concentrator terminated Trace, then the fault domain includes all devices between the concentrator and the MAC that lies immediately downstream of the concentrator (i.e., the next entry clockwise on the network map).
- If the concentrator propagated Trace, then it is extremely probable that the fault domain starts with a device that is connected to one of the concentrator’s M ports and ends with another device that is connected to another one of the concentrator’s M ports. The ‘Trace propagated’ message will identify the port on which Trace was received. In all likelihood, the station that is connected to this port initiated trace.

It is important to note that any *active component* in the token path (a port, a MAC, a segment of an internal data path) could be the cause of the problem. It is necessary to identify every active device through which the data stream passes, even if it does not encounter a MAC, in the fault domain.

For example, if the station that initiated Trace is connected to concentrator M port 4 and the MAC that terminated Trace is connected to concentrator M port 3, then you must suspect every active component in this token flow between the two, including both MACs, all ports (on the stations and the concentrator), and all data path segments.

Once you have identified the fault domain, the next step is to isolate each and every device in the fault domain. Disconnect each device from the ring and from all other devices (the rest of your ring should be operational). Subject each device to a thorough inspection and an extended period of testing and diagnostics. If a device passes, then you may consider placing it back on the ring.

It is prudent to place each device on the ring one at a time and observe its effect on the ring. If

the ring remains stable and operational, add the next device. If not, then you have identified the problem station.

Other suggestions:

- If you rearrange your network configuration, but the same concentrator always generates a 'Trace' message, then you should remove that unit from the ring and contact your service provider for return or a replacement.
- If you rearrange your network configuration and find that different units are generating the 'Trace' messages, see if there is a common device in the relevant fault domain. If so, then you should remove that unit from the ring and replace it.

### 3.4.2. ...you receive a 'Stuck beacon condition' message.

#### What it means

When the MACs on an FDDI ring need to negotiate the target token rotation time (TTRT), they use claim frames to do so. Each station transmits claim frames with its bid for the TTRT. The frame with the lowest bid wins and makes it all the way around the ring. When the station with the lowest bid receives its own claim frame, it knows that it won and issues a token. This is called the claim process.

However, when the claim process cannot complete, the MACs change mode and begin transmitting beacon frames instead. Beacon frames are used only when there is an error. Their purpose is to resynchronize the MACs on the ring so that the claim process can start again. When a station receives its own beacon frames, it begins issuing claim frames again.

A *stuck beacon condition* occurs when there is a logical fault on the ring that prevents the beacon process from completing. If a device has been transmitting beacon frames for approximately eight seconds without receiving its own beacon frames, it will decide that it is stuck beaconing and will initiate the Trace protocol. (See section 3.4.1. ...you receive a 'Trace' message. on page 18.)

When you see this message, it means that a serious logical fault has been detected on the ring and that the Trace protocol is being initiated by the stations in the fault domain. The message will include the address of the MAC that is stuck beaconing.

**Note:** Section 3.4.1. ...you receive a 'Trace' message. on page 18 discusses the 'Trace' messages generated by the concentrator. These messages will appear when the concentrator is physically included in the domain of the logical fault. You will receive the 'Stuck beacon condition' message when the fault lies elsewhere on the ring. This message is provided so that you can know when Trace is being invoked on your ring and so that you can take any necessary corrective actions.

#### What to do

Normally, you don't need to do anything. The Trace protocol is automatic. It identifies all of the physical devices in the token path, from the MAC that is stuck beaconing to the next upstream MAC, and causes all of them to execute a diagnostic path test. If a device passes this path test, it will rejoin the ring; if it fails, it will disconnect. If your ring is able to sustain operation afterward without suffering a similar logical fault, then the problem has been corrected.

However, sometimes the problem doesn't go away. If you see 'Stuck beacon condition' messages more than once, then you should take corrective measures.

The first step is to examine a *previous* ring map (i.e., use the **ringmap -o** command) and identify the likely location of the fault. Find the MAC that is stuck beaconing on the old network map. The logical fault that is causing the stuck beacon condition **must** lie somewhere between the MAC that is stuck beaconing and the next MAC upstream (that is, the next entry counterclock-

wise on the network map).

It is important to note that any *active component* in the token path (a port, a MAC, a segment of an internal data path) could be the cause of the problem. Therefore, it is necessary to identify every active device through which the data stream passes, even if it does not encounter a MAC, in the fault domain.

For example, if the station that is stuck beaconing is connected to concentrator M port 4 and the MAC that is immediately upstream is connected to concentrator M port 3, then you must suspect every active component in the token flow between the two, including both MACs, all ports (on the stations and the concentrator), and all data path segments.

Once you have identified the fault domain, the next step is to isolate each and every device in the fault domain. Disconnect each device from the ring and from all other devices (the rest of your ring should be operational). Subject each device to a thorough inspection and an extended period of testing and diagnostics. If a device passes, then you may consider placing it back on the ring.

It is prudent to place each device on the ring one at a time and observe its effect on the ring. If the ring remains stable and operational, add the next device. If not, then you have identified the problem station.

### 3.4.3. ...you receive a 'Ring instability' message.

#### **What it means**

When the monitor generates the 'Ring instability' message, it means that the state of the ring is oscillating rapidly between operational and non-operational or it is oscillating between the claim and the beacon processes. The result is that the ring is unable to sustain operational status for even a short period of time. While your ring is non-operational, data is not being transmitted or received.

Claim is the process by which the MACs on the ring negotiate the target token rotation time (TTRT). Each MAC transmits claim frames with its bid for TTRT. The frame with the lowest bid wins and makes it all the way around the ring. When the MAC with the lowest bid receives its own claim frame, it knows that it won and it issues a token.

Beacon is the process that takes place when the claim process does not resolve normally. When a MAC has been transmitting claim frames for a sufficiently long time without receiving its own claim frame or a token, it changes mode and begins transmitting beacon frames instead. Beacon frames are used only when there is an error. Their purpose is to resynchronize the MACs on the ring so that the claim process can start again. When a station receives its own beacon frames, it begins issuing claim frames again.

You will receive the 'Claim/beacon oscillation' message if the Monitor detects three or more transitions between Claim and Beacon within 10 seconds. Claim/beacon oscillation is a serious problem. It occurs when the ring is attempting to become operational, but is prevented from doing so by a problem on the ring. Duplicate MAC addresses, faulty hardware, and loose port connections are the primary causes of claim/beacon oscillation.

#### **What to do**

There are many possible causes of ring instability. The easiest way to specify the next course of action is to list the possible causes and how you might identify each one.

- Links with high bit error rates.
- Each port on the network continuously monitors the bit error rate of the link that connects it with the neighboring port. If the bit error rate becomes too high, the port-to-port connection

is broken and restarted. When a connection is broken, it may cause a brief ring transition to non-operational status. Likewise, when a connection is re-established, it may cause another brief ring transition to non-operational status.

- If your ring has many links with high bit error rates, then you will have many connections that are continuously broken and re-established. This can make your ring unstable.
- You can verify this hypothesis by using the **view ports all** command. This command will display a performance report for every manageable port on the local FDDI ring. It will show the current bit error rate estimate as well as the bit error rate at which the connection will be broken. If the bit error rate is high enough to cause concern, the 'L' flag will appear in the right-most column of the display for the port that is a problem. If you have many ports that are showing the 'L' flag, then you should be concerned about the bit error rate on your network.
- High bit error rates can have several causes:
  - Loose port connections.
  - Dirty or dusty cable connectors.
  - Fiber cables that have been bent such that the minimum bend radius has been exceeded.
  - Copper cables that are running through strong electrical or magnetic fields.
  - Copper cables that are exceeding the maximum recommended port-to-port distance.
  - Copper cable plants that do not conform to EIA/TIA 568 wiring specifications.
  - Configurations with multiple, consecutive optical or electrical bypasses that are engaged.
  - Older, damaged, or faulty FDDI hardware.
- You should examine your cable plant, cabling, and port connections closely to determine which of these might be causing a problem.
- An unresolved duplicate address condition.
- The FDDI protocols are designed to function with unique MAC addresses only. Duplicate address conditions can prevent the ring from becoming stable. Station management (SMT) has several protocols designed to detect and resolve duplicate address conditions. Normally, MACs that detect that they are duplicated when the ring is non-operational will leave the ring in some fashion. However, it is possible that duplicate MACs may remain on the ring.
- The best way to test this theory is to examine a previous ring map (i.e., use the **ringmap -o** command) and see if any devices are reporting a duplicate address condition via the 'D' flag. If so, then you should locate those stations and remove them from the ring immediately.
- Loose port connections.
- Loose port connections can cause stations to join and leave the ring repeatedly. If you notice (via the **ringmap** command) that stations are joining and leaving the ring frequently or that the bit error rate for several ports is high (via the **view ports** command), then you should check each station or port to ensure that the port connectors are snugly attached to the port receptacle.
- Faulty hardware.
- FDDI hardware can cause errors on the FDDI network. Sometimes these errors cause the ring to become unstable. If, through use of the **ringmap** and **view** commands, you identify a particular device that always seems to be located in or around a fault domain, then you should remove the device from the network and subject it to extensive diagnostic testing.

- Users inserting and removing stations from the ring rapidly.
- Each time a station joins or leaves the ring, it causes a claim process. This is entirely normal. Claim is the process by which the remaining MACs renegotiate the target token rotation time as well as scrub the ring clean of frame fragments.
- However, if you have many stations joining and leaving the ring very frequently, your ring may become unstable. This includes stations that are turned on and off frequently.
- One way to identify this situation is to use the **ringmap -c** command. If the number of stations in the map changes constantly, this is a good indication that your ring instability is caused by stations joining and leaving the ring.

**Note:** Make sure that stations are joining and leaving the ring because of user intervention and not because of some other error. Faulty hardware or marginal data links, for example, can also cause stations to join and leave the ring frequently.

#### 3.4.4. ...your ring stability is decreasing.

##### What it means

When the number in the right-most column of the **monitor stability** command is decreasing, it means that your network is becoming increasingly unstable. It means that the state of the ring is oscillating rapidly between operational and non-operational. The result is that the ring is unable to sustain operational status for even a short period of time. While your ring is non-operational, data is not being transmitted or received.

##### What to do

See the discussion in section 3.4.3. ...you receive a 'Ring instability' message. on page 21 that covers the possible causes of ring instability.

#### 3.4.5. ...your ring utilization is very high.

##### What it means

Network utilization measures the percent of the available 100 Mbps bandwidth that is currently being used by the devices on the local FDDI ring. Although average transmit times scale nicely and remain deterministic on FDDI as traffic levels increase, network utilization that is consistently high represents a potential problem. A high network utilization can be an insidious problem. As load increases, some network devices will be unable to keep up and packets will be lost. Higher layer protocols will request retransmission of these lost packets, some of which may be lost again. The result is that more packets are required to do the same amount of work in a greater amount of time. Meanwhile, the network becomes busier and busier...

##### What to do

The first thing to do is to determine if the high network load is a problem. It is difficult to specify exactly when to worry about the network utilization level. Since FDDI scales well with increased traffic load, an FDDI network will run properly at 99% utilization, guaranteeing each station an orderly opportunity to transmit frames. In general, once your FDDI network is operating at 70%-80% of capacity, you should begin paying closer attention to the behavior of the following network components<sup>2</sup>:

- **Network devices.** Can they handle the added load?

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<sup>2</sup> It is important to consider the nature of the traffic levels as well. Is the traffic sustained or bursty? This analysis pertains to sustained traffic levels only. Bursty network traffic generally does not have the same deleterious effects on network components.

- **Network applications.** Are the transmission opportunities long enough or frequent enough?

In other words, you should ask the following questions: Are network users complaining of delays using their applications? Are network devices failing or suffering performance problems?

If everything seems to be functioning properly, then you generally don't have anything to be concerned about. You should continue to watch the network carefully.

However, if you do have user complaints or device failures, then you should consider alleviating the load on the FDDI network. The most common way to alleviate high traffic levels is segmentation. There are two ways to do this:

- **Bridges or routers.** With a small bridge or router, you may create several different FDDI rings. Try to place the stations that communicate with each other most frequently on the same ring. This will reduce the amount of traffic that the bridge or router must forward.
- **Switches.** A new trend involves high-speed, multi-port switches, in which each port provides full FDDI bandwidth to one or more FDDI devices. Switches represent an easy, if expensive, way to create many independent FDDI rings.

An alternative to segmentation is traffic reduction. You may choose to analyze the traffic patterns on your network to see if the traffic level can be easily reduced. This will require an FDDI protocol analyzer as well as an understanding of FDDI and application frame formats.

#### 3.4.6. ...a station is reporting an unknown upstream/downstream neighbor address.

##### What it means

Upstream neighbor address (UNA) is the address of the MAC that is immediately upstream on the FDDI network. Downstream neighbor address (DNA) is the address of the MAC that is immediately downstream on the FDDI network. FDDI devices periodically exchange information frames on the ring. This is known as the neighbor notification protocol and each station executes this protocol approximately once every 30 seconds. During the neighbor notification process, stations exchange frames in such a way that each station identifies the MAC that is immediately upstream. Stations running SMT version 7.3 and some pre-7.3 stations are also able to identify the MAC that is immediately downstream.

Keeping track of the upstream neighbor is mandatory for all FDDI devices, regardless of SMT version. The UNA information is updated regularly. If UNA is not reconfirmed within 3 minutes and 48 seconds<sup>3</sup>, UNA will be reset to 'Unknown'.

Keeping track of the downstream neighbor is mandatory for all FDDI devices running SMT version 7.3. Some pre-7.3 devices are also able to identify the downstream neighbor. Like UNA, DNA information is updated regularly. If DNA information is not reconfirmed within 3 minutes and 48 seconds, the DNA will be reset to 'Unknown'.

When a station reports a UNA or a DNA of 'Unknown', it means one of two things:

- The station reporting the unknown address has lost the ability to receive frames or is unable to participate in SMT protocols.
- The upstream or downstream neighbor has lost the ability to transmit and/or receive frames or is unable to participate in SMT protocols.

Of these, the second is more likely.

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<sup>3</sup> The derivation of this specific time-out value is described in the ANSI Station Management specification, in section 8.2.2.3, for those of you brave enough to look.

## What to do

The first step is to identify the suspect station. You need to look at the UNA value, the DNA value, and the SMT version of a device to determine where the problem is likely to lie. Use the following matrix<sup>4</sup>:

UNA	DNA	SMT version	Probable suspect	Probable problem
Set	Set	7.3	--	None. Everything is OK
Set	Set	Pre-7.3	--	None. Everything is OK.
Set	UNKNOWN	7.3	Downstream neighbor	Possibly unable to transmit or receive frames. Possible failure of SMT.
Set	UNKNOWN	Pre-7.3	--	Not necessarily a problem. Don't be concerned unless the DNA had been set previously. If so, then the downstream neighbor may have lost the ability to transmit or receive frames.
UNKNOWN	Set	7.3	Upstream neighbor	Possibly unable to transmit frames. Possible failure of SMT.
UNKNOWN	Set	Pre-7.3	Upstream neighbor	Possibly unable to transmit frames. Possible failure of SMT.
UNKNOWN	UNKNOWN	7.3	This station	Possibly unable to receive frames. Possible failure of SMT.
UNKNOWN	UNKNOWN	Pre-7.3	This station or its upstream neighbor	This station may be unable to receive frames. The upstream neighbor may be unable to transmit frames.

**Table 3-1. Unknown Upstream and Downstream Neighbor Address Resolution Algorithm**

The next step is to confirm that the suspect device is really the cause of the problem. The ring map is a useful tool for identifying the upstream and downstream neighbors of a given device. In the network map, a station reporting an unknown UNA or DNA will be preceded or followed, respectively, by one of two items:

- A station that did not respond. This device will have a MAC address with the '?' flag next to it. If this is the case, use the **view**, **walk**, or **get** command to retrieve information from that specific MAC address. If the station responds, then it was probably a transient problem that no longer exists. You should pay close attention to this station for a while, to see if the problem reappears.
- If the station does not respond to the query, then it is not functioning properly. You should remove this station from the network and subject it to diagnostic testing.
- A place holder entry, with a MAC address composed of question marks (e.g., "??-??-??-??-??-??"). If this is the case, then you will not be able to identify the problem station from the map data. Your only course of action will be to walk to the station reporting the unknown UNA and trace the wiring upstream to the next device. Remove this device from the ring and

<sup>4</sup>. This analysis covers the station reporting the unknown UNA or DNA only. If you are familiar with the SMT neighbor notification process, then you should also consider the UNA and DNA information from the devices upstream and downstream of the station in question. This additional information may help you identify the problem more quickly.

subject it to diagnostic testing.

**Note:** Make sure that you walk upstream to the next device with a MAC. For example, if the station reporting the unknown UNA is connected to concentrator M port 4, then its upstream neighbor is very probably the MAC that is connected to concentrator M port 3. You do not need to disconnect the concentrator.

Stations with transient problems should be watched carefully. If the problem persists or reappears, then the station should be replaced or repaired.

#### 3.4.7. ...the ring map contains entries with question marks for the MAC address.

##### What it means

The network mapping algorithm gathers neighbor information from all of the devices on the local FDDI ring and then attempts to construct a logical map of the ring from this data. When two stations on the ring report unknown upstream and downstream neighbor information, the mapping algorithm encounters a “hole” in the network map that cannot be filled from the available data. When this happens, the mapping algorithm creates a place holder entry with a MAC address that is composed entirely of question marks (e.g., “??-??-??-??-??-??”). This indicates that zero or more **nonresponsive** FDDI devices reside at that map location.

##### What to do

The first thing to do is to determine if the problem is transient or persistent. Run the **ringmap** command again, this time with the verbose option (i.e., **ringmap -v**). If the place holder entry disappears, then the problem was transient and probably caused by the timer variance in the SMT protocols.

If the place holder entry remains for more than 30 seconds, then you probably have one or more devices on the ring that are no longer participating in SMT protocols or no longer able to transmit or receive frames. In this case, your only option is to examine the physical segment of your network where the place holder entry rests. Identify the MAC addresses on either side of the place holder entry and determine the physical location of both devices.

Next, you’ll need to determine if any other FDDI devices lie in between them in the token flow. You may have to follow cables or access the wiring closet in order to do this. If you find that there are devices in between the ones that appeared on the network map, then you should remove these devices from the ring and subject them to extensive diagnostic testing.

If you find that the MAC addresses on the network map represent devices that are next to each other, then you should consult section 3.4.6. *...a station is reporting an unknown upstream/downstream neighbor address.* on page 24 for a discussion of unknown upstream and downstream MAC addresses.

#### 3.4.8. ...you see the ‘?’ flag on your network map.

##### What it means

The network mapping algorithm gathers neighbor information from all the devices on the local FDDI ring and then attempts to construct a logical map of the ring from this data. When one station on the ring reports an unknown upstream or downstream neighbor address, the mapping algorithm encounters a “hole” in the network map. When the mapping algorithm has sufficient information to fill this hole, it infers the missing MAC address and labels it with a question mark error flag (i.e., ‘?’) to indicate that the station did not respond to the network map query.

##### What to do

It is very likely that this problem is caused by the timer variance in the SMT protocols and is transient. Use the **ringmap** command again to see if the problem persists. If, after 30 seconds, the

question mark flag remains, then you probably have a station that is unable to transmit or receive SMT frames.

The next step is to use the **view station** command to display configuration information about the station with the question mark (if possible), the station immediately upstream, and the station immediately downstream. You should make a note of the upstream and downstream neighbor information from each device and then follow the instructions in section 3.4.6. *...a station is reporting an unknown upstream/downstream neighbor address.* on page 24.

#### 3.4.9. *...you see the 'D' flag on your network map.*

##### **What it means**

The 'D' flag indicates that you have a duplicate address condition on your network. The FDDI protocols are designed to function with unique MAC addresses only. Duplicate address conditions can prevent the ring from becoming stable. Station management (SMT) has several protocols designed to detect and resolve duplicate address conditions. When SMT detects that its MAC address is duplicated, it will normally do one of two things:

- If the ring is not operational, the station will probably disconnect and leave the FDDI ring<sup>5</sup>.
- If the ring is operational, the station will set the "Duplicate Address" flag and remain on the ring.

Therefore, if you see the 'D' flag associated with a network map entry, it means that the station has detected that its MAC address is duplicated, but it has remained on the ring.

**Note:** Because of the way that the FDDI MAC protocols operate, you will probably see only one of the duplicated MAC addresses on the network map. This will probably be the duplicate that is upstream of the FDDI Monitor concentrator.

##### **What to do**

Duplicate MAC addresses on a single FDDI ring can cause serious operational problems and should be resolved as quickly as possible. If you see a network map entry with the 'D' flag, then you should remove the device from the ring, check its MAC address(es), and subject it to extensive diagnostic testing. If the device passes diagnostics, you may consider changing the MAC address (if possible) and placing it back on the network.

After the station with the duplicated address has been removed from the ring, use the **ringmap** command again to see if there are any other duplicate MAC addresses on the network. Continue to remove and test stations with duplicate MAC addresses until there are no more 'D' flags on the network map.

#### 3.4.10. *...you see the 'F' flag on your network map.*

##### **What it means**

The 'F' flag indicates that, during the network map query interval, there was an increase in frames lost (fddiMACLost-Ct) or frames in error (fddiMACError-Ct) for a given MAC.

##### **What to do**

The first step is to determine if this increase actually represents a problem or not. The frequency of error frames and frames lost is a function of:

- Physical ring length;
- Traffic levels;

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<sup>5</sup>. Some devices may elect to remain on the ring, but change the MAC address such that it is no longer duplicated.

- The frequency with which configuration changes are made;
- Hardware quality.

For example, you will probably truncate a single frame when you connect or disconnect an FDDI port. This is normal and is nothing to worry about. However, a faulty device may also be damaging frames. This is not normal and is a cause for concern.

Generally, you should pay attention to the distribution and frequency of error frames and frames lost. (You can also use the **view** command to gather MAC-specific performance data.) If a specific station always shows the 'F' flag or if a single device shows a significant increase in the number of error frames or frames lost, then you should examine the station more closely. You might also want to examine the devices that precede it in the token flow, as these stations may be damaging data.

#### 3.4.11. ...you see the 'L' flag on your network map.

##### **What it means**

The 'L' flag indicates that one or more ports on the device are reporting a marginal link. A link is the physical connection between any two FDDI ports. A link is considered to be marginal when the bit error rate is high (generally, greater than or equal to  $10^{-8}$ ). If the bit error rate climbs too high (generally greater than or equal to  $10^{-7}$ ) then the logical port-to-port connection will be broken, tested, and restarted.

##### **What to do**

Use the **view** command to identify the specific port or ports that are exhibiting the high bit error rates. In the **view** command output, these ports will be identified by the 'L' flag in the right-most column. If you have many ports that are showing the 'L' flag, then you should be concerned about the bit error rate on your network.

High bit error rates can have several causes:

- Loose port connections.
- Dirty or dusty cable connectors.
- Fiber cables that have been bent such that the minimum bend radius has been exceeded.
- Copper cables that are running through strong electrical or magnetic fields.
- Copper cables that are exceeding the maximum recommended port-to-port distance.
- Copper cable plants that do not conform to EIA/TIA 568 wiring specifications.
- Configurations with multiple, consecutive optical or electrical bypasses that are engaged.
- Older, damaged, or faulty FDDI hardware.

You should examine your cable plant, cabling, and port connections closely to determine which of these might be causing a problem.

#### 3.4.12. ...you see the 'T' flag on your network map.

##### **What it means**

The 'T' flag indicates that you have a twisted ring condition on your network. Twisted rings occur only on the dual ring and are caused by A-to-A or B-to-B connections. Generally, SMT will disallow such connections. However, since it is possible for users to alter the connection policies of SMT, it is possible for these types of connections to occur.

Twisted rings can be bad. If your dual ring is wrapped, then the only effect of a twisted ring will be a reordering of the MACs on your network map. If your dual ring is not wrapped, however, then some of your MACs may actually be on the secondary (backup) ring and unable to commu-

nicate with the other devices on your network.

### What to do

Twisted ring conditions take only a moment to fix. Use the **view station** command and look at the “Twisted” field. This will have one of the following values:

- **A-to-A** If the B port is empty, move the connector from the A port to the B port. If the B port is not empty, then switch the A and B port connectors.
- **B-to-B** If the A port is empty, move the connector from the B port to the A port. If the A port is not empty, then switch the A and B port connectors.
- **Both** This means that there is an A-to-A and B-to-B twisted ring condition. Switch the A and B port connectors.
- **None** This indicates that the device does not currently have a twisted ring condition. You’re looking at the wrong station.

Do this for every device on the network map that is displaying the ‘T’ flag. You may also want to reset the SMT connection policies to prevent A-to-A and B-to-B connections in the future.

#### 3.4.13. ...you see the ‘W’ flag on your network map.

### What it means

The ‘W’ flag means that a device has a peer wrap condition. A peer wrap condition occurs if a station’s A, B, or S ports are connected to other A, B, or S ports and the device is wrapped<sup>6</sup>. For the purposes of the network map, the ‘W’ flag will appear if the device is on the dual ring and it is wrapped. It indicates that your dual ring is wrapped. It also helps identify the location of the wrap point.

### What to do

The ‘W’ flag is provided for informational purposes only. It does not necessarily indicate a problem with your network. If you know that your ring is wrapped or you don’t care that your ring is wrapped, then you may disregard the flag.

However, if the availability of your dual ring is fairly important and you want to ensure that it is always capable of sustaining one failure, then this flag will be helpful to you. It will notify you when the ring wraps and where the wrap has occurred. If you want more information about the cause of the wrap, poll the wrapped device with the **view station** command to determine the cause of the A or B connection failure.

## 3.5. How to find out...

### 3.5.1. ...if your ring is wrapped

Use the **ringmap** command. Look for stations displaying the ‘W’ flag. Any map entry with a ‘W’ to the right of the MAC address is on the dual ring and is wrapped. This procedure will help you identify where the ring has wrapped, as well.

### 3.5.2. ...which station won the claim process

Use the **view macs all** command. This will provide a list of all the MACs on your local FDDI ring. The right-most column of output indicates the T-Req value that each MAC used during the

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<sup>6</sup> Peer wrap condition is true if a device is wrapped and has one of the following connections: A-A, A-B, A-S, B-A, B-B, B-S, S-A, and S-B. It is not true for S-S, since this represents a permanently wrapped backbone of two devices only.

claim process. This value is displayed in milliseconds.

The claim winner is the device with the lowest T-Req. If there are several stations bidding the same T-Req value, then the station with the highest 48-bit MAC address (in MSB order) wins.

**Note:** When attempting to identify the claim winner using the **view** command, make sure that MAC addresses are displayed in raw, MSB format so that you may use the MAC address information to break T-Req ties.

# Section II: Unmanaged M400 FDDI Concentrator

## 1. Getting Started

This section will tell you just what you need to know to get started with the unmanaged version of the M400 FDDI concentrator. This section will:

- Describe the product and what it is capable of doing,
- Assist you in unpacking the concentrator and checking to see that all the pieces are there,
- Tell you how to install the concentrator into your FDDI network environment, and
- Tell you how to turn on and use the concentrator.

If you would like more detailed information about the operation of the M400 FDDI concentrator, or you are having problems using the product, see section 2. *Reference Manual* on page 35 for additional information.

**Note:** If you are having problems using the M400 FDDI concentrator, read section 2.2. *Troubleshooting* on page 12 for a step-by-step analysis of concentrator behavior. You may find that you are able to solve your problems before calling your dealer or service representative.

### 1.1. Description

The M400 is a single-attach MAC-less FDDI concentrator with either four (4) or eight (8) ports. The actual number of ports provided by the concentrator will depend on the configuration that you ordered. The MAC PHY module provides the network management functionality.

Each port has three parts:

1. A **media connector** that provides connection of the concentrator to another FDDI device. This will be either a keyed MIC connector for multimode fiber or an RJ45 connector for category 5 unshielded twisted-pair.
2. A **label** that indicates the type of the port. The M400 is delivered with one (1) port of type S and either three (3) or seven (7) additional ports of type M. The S port is the first port on the left of the concentrator, when viewing the concentrator from the front. The first M port is the second port from the left of the concentrator. The port label is located above the media connector.
3. A **three-color light emitting diode (LED)** that indicates port status. The LED for each port is located to the right of each media connector.

The fact that the M400 does not have a MAC PHY module means that there is no network-addressable entity within the concentrator. The M400 will not send frames, nor will it be able to receive frames. You cannot manage the M400. However, the M400 will not affect the regular traffic flowing through it to other attached FDDI devices.

### 1.2. Package Contents

The unmanaged M400 concentrator package includes:

- One (1) FDDI concentrator with either 4 ports or 8 ports.
- One (1) AC power cord.
- One (1) users guide.

Make sure that the above items are in your package and that the AC power cord is compatible with your local power source. If there are any discrepancies you should contact your dealer or service

representative.

**Note:** Do not apply power to the concentrator if there are any incompatibilities with the supplied power cord.

### 1.3. Installation

The M400 FDDI concentrator is suitable for use in desktop environments and for installation in standard 19-inch racks. It is available with attachable rack-mount brackets.

1a. To use the M400 concentrator as a desktop unit, do the following:

Place the concentrator on a flat surface that provides sufficient air flow to the cooling fan in the back of the enclosure. If the concentrator has fiber optic ports, do not position the enclosure so that dust can fall into these ports.

1b. To install the M400 concentrator in a standard 19-inch rack, do the following:

Attach the enclosed rack-mount brackets to the sides of the concentrator case using the screws provided. Ensure that the screws are securely tightened.

Position the enclosure in the rack with at least one-half inch of clearance at the top and insert two mounting screws through each of the two brackets and into the rack.

**Note:** There are several important safety precautions that must be observed when installing the concentrator in a rack. Please see section 1.6.3. *Rack installation* on page 34 for a detailed listing of these precautions.

2. Plug the AC power cord that was shipped with the concentrator into the socket that is on the back of the enclosure below the power switch.
3. Plug the other end of the power cord into an AC power source. Acceptable values for the AC source are 90 to 260 volts and 47 to 63 Hz. If your power source is not compatible, or if the power cord is of the wrong type, do not use the unit and contact your dealer or service representative.

### 1.4. Operation

1. Before using the concentrator for the first time, make sure that all of the ports are empty so that you can observe the results of the diagnostics.
2. Turn on the concentrator by depressing the power switch on the back of the unit.

When you turn it on, the M400 concentrator will automatically execute the following procedures in the following order:

- Memory diagnostics.
- FDDI diagnostics.
- Station management (SMT) software.

The LEDs indicate the progress of the diagnostics and the operation of SMT. When the LEDs are blinking red or amber, it indicates that the memory diagnostics and FDDI diagnostics are currently running.

If any of the LEDs on the first four ports are red, it indicates that a fatal failure has been detected by the diagnostics. This is a failure that prevents the concentrator from functioning. You should contact your dealer or service representative if your concentrator does not function.

After passing the boot diagnostics, the M400 software will automatically issue a Connect request to SMT. When the LEDs are blinking green, it indicates that SMT is now active and that the ports are ready to accept connections. This is the normal and correct state for unconnected ports.

## 1.5. Making FDDI Connections

**Note:** When using building wiring, for safety reasons, always ensure that your building cable plant conforms to the Electronics Industry Association “Commercial Building Telecommunications Wiring Standard” EIA/TIA-568.

In order to make a connection between the M400 FDDI concentrator and another FDDI device, the connected ports must have:

- compatible media types, and
- compatible data encoding schemes.

In other words, you may connect multimode fiber ports only to multimode fiber ports on other FDDI devices, and category 5 unshielded twisted-pair (UTP) ports only to category 5 UTP ports on other FDDI devices.

In the case of category 5 UTP, you must also ensure that the correct data encoding scheme is used. The M400 FDDI concentrator uses the MLT-3 encoding scheme for its UTP ports. Encoding scheme compatibility is not a concern with multimode fiber ports.

**Note:** MLT-3 is the encoding scheme used in the ANSI TP-PMD standard. It allows for the transmission of FDDI data over copper wire at distances of up to 100 meters. When connecting a UTP port on the M400 concentrator to another FDDI device, you must ensure that the attached port also uses the MLT-3 encoding scheme.

The media connectors for multimode fiber are keyed for the port type. Make sure that the MIC plugs that you use are unkeyed or fitted with compatible keys. If you have difficulty inserting the MIC plug into the media connector, check the key type inserted on your MIC plug. The UTP connectors are not keyed.

In addition, for UTP, you must make sure that the cable you use to connect the ports is a “cross-over” cable. The pin definitions for the UTP connectors are the same for all port types. Therefore, you must ensure that the wires that comprise your connection cable do not go straight through, but cross from the appropriate pin on one side of the cable to the appropriate pin on the other side of the cable. A cross-over cable is required for every type of connection in FDDI UTP networks, regardless of the types of ports being connected. Check with your cable supplier to ensure that the cable you are using is of the correct type.

## 1.6. Precautions

### 1.6.1. Handling

- ⚠ To prevent electric shock, do not open the enclosure. There are no user-serviceable parts inside. Refer servicing to qualified service personnel.
- ⚠ Do not allow liquids to penetrate the concentrator enclosure.
- ⚠ Do not **store** the concentrator beyond the following temperature range: -20° C/-4° F to 85° C/185° F.

### 1.6.2. Operation

- ⚠ The input power source must be within the following voltage and frequency ranges: 90 – 260 volts and 47 – 63 Hz.
- ⚠ Use a grounding-type power outlet with the three-wire power cord and plug that is included with the unit.
- ⚠ Do not put heavy objects on the power supply cord. A damaged power supply cord may cause fire or electric shock.
- ⚠ Do not **operate** the concentrator beyond the following ambient temperature and humidity rang-

es: 0° C/32° F to 50° C/122° F and 0% to 95% non-condensing humidity.

- ‡ For proper operation, keep the concentrator adequately ventilated. Always ensure that there is at least one-half inch/1.27 cm of clearance above the air flow grill on the top of the concentrator.
- ‡ If the concentrator does not operate properly, turn off the power switch and remove the power plug from the outlet.

#### *1.6.3. Rack installation*

- ‡ If the concentrator is to be installed in an enclosed rack, the ambient temperature of the rack may be higher than that of the surrounding room. Ensure that the ambient temperature inside the rack is within the following ambient temperature and humidity ranges: 0° C/32° F to 50° C/122° F and 0% to 95% non-condensing humidity.
- ‡ Maintain proper air flow through the concentrator. Always ensure that there is at least one-half inch/1.27 cm of clearance above the air flow grill on the top of the concentrator.
- ‡ Do not overburden or unbalance the concentrator or its rack-mounting equipment. Mounting of the concentrator in a rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.
- ‡ Do not overload the circuit that provides power to the concentrator.
- ‡ Always ensure that the concentrator is properly grounded. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g., the use of power strips).

#### *1.6.4. Use of building wiring*

- ‡ Ensure that your building cable plant conforms to the Electronics Industry Association “Commercial Building Telecommunications Wiring Standard” EIA/TIA-568.

## 2. Reference Manual

This manual describes the operation of the unmanaged M400 concentrator in detail and also presents information on resolving problems. It assumes that you have a working technical knowledge of FDDI, FDDI networks, and station management (SMT).

### 2.1. Operation Description

#### 2.1.1. Diagnostics

The M400 FDDI concentrator contains a suite of sophisticated diagnostics that are executed automatically when the concentrator receives power. These diagnostics are designed to detect, and recover, if possible, from virtually any failure that the concentrator may experience. This section describes what the concentrator diagnostics do and what the results of the tests mean.

##### 2.1.1.1. Memory Diagnostics

The memory diagnostics include a ROM checksum and RAM tests that are executed several times. The LEDs for the first two ports on the left will change colors briefly to show test progress. A failure at this stage of the diagnostics will prevent the concentrator from operating. In other words, the remaining diagnostics will not be performed, SMT will not run, and the fatal failure will be indicated on the LEDs. (Refer to section 2.1.1.3. *Failure Codes* on page 35.)

##### 2.1.1.2. FDDI Diagnostics

The FDDI diagnostics use internal loopback paths in the concentrator to test FDDI operation. The test progress is indicated by an amber light that moves from left to right for several seconds. The ports are tested individually and in parallel. If an individual port fails its diagnostic tests, the faulty port is disabled and bypassed so that it is not used during normal concentrator operation. The LED for the faulty port will remain off, indicating that the port cannot be used.

SMT will run if there are at least two fully functional ports. If there are fewer than two fully functional ports, this is considered to be a fatal failure that prevents concentrator operation and the failure will be indicated on the LEDs. (Refer to section 2.1.1.3. *Failure Codes* on page 35.)

##### 2.1.1.3. Failure Codes

If a fatal failure is detected during the diagnostics sequence, the first 4 LEDs on the left will indicate the failure code. The failure codes are enumerated in Table 2-1.

Codes 1, 2, 4, and 5 are indicated in steady red, since the failure does not involve a specific port. Codes 3 and 6 involve specific, non-functional ports. Therefore, codes 3 and 6 are indicated in blinking red followed by a steady green on all ports that are inoperative.

Since all of these errors prevent the concentrator from functioning properly, the LEDs will continue to indicate error status until the power is removed from the concentrator. In this situation, you will not be able to use the concentrator for any FDDI connections.

**Note:** There are no user-serviceable parts inside the M400 FDDI concentrator. If you have any kind of failure, do not open the enclosure. Contact your dealer or service representative for repair, replacement, and warranty information.

Code	S	M	M	M	Problem Description
1	off	red	red	off	ROM checksum failure.
2	off	red	red	red	RAM test failure.
3	red	off	off	off	Internal path test failure.
4	red	off	off	red	Software watchdog time-out.
5	red	off	red	off	Unexpected interrupt.
6	red	off	red	red	Fewer than two working ports detected.

**Table 2-1. M400 Diagnostic Failure Codes**

### 2.1.2.SMT

If no fatal failures are encountered in the diagnostic procedures, the concentrator will execute its resident station management (SMT) software and will issue a Connect request. All fully functional ports will then be available to accept connections. The status LEDs on unconnected ports will blink green, indicating that the port is available for connection to another FDDI device.

The M400 FDDI concentrator provides only one internal data path. Ports are switched in and out of this data path according to the SMT path configuration algorithms. Data flows from left to right, when viewing the concentrator from the front. In other words, a station connected to the first M port will be upstream of a station connected to the second M port.

### 2.1.3.Port Status

During normal operation, the LED to the right of each port indicates the state of the port. The following table describes each of the possible port states and the associated LED color. The blink period is 1 second, on for one-half second then off for one-half second.

LED	Port State
Off or Dark	Port disabled, off, or otherwise inactive.
Blinking Green	Port connecting or available for a connection.
Solid Green	Port active. There is a connection with the neighboring port.
Solid Amber	Connection withheld by this port.
Blinking Amber	Connection withheld by neighboring port.
Blinking Red	Connection broken because an excessive number of link errors was detected.
Solid Red	The port is in the Trace state indicating that there is a ring fault upstream of this port.

**Table 2-2. M400 Port LED Semantics**

## 2.2. Troubleshooting

This section describes some of the problems you might see when attempting to connect another FDDI device to the M400 FDDI concentrator. Each subsection describes the symptoms, discusses possible causes, and provides an algorithm for gathering more information.

### 2.2.1. LED is not solid green. Port connection does not appear to be active.

When an FDDI port is connected to a functioning concentrator port, the LED should become steady green, indicating that the connection is active. If a connected port does not reach the active state in about 30 seconds use this checklist to try to resolve the problem.

**Note:** An understanding of SMT connection policies will help you solve problems like this. See *Appendix A: SMT Connection Policies* on page 41 for a brief tutorial on SMT connection rules if you are not already familiar with them.

The situation depends on the state of the LED and the type of port (i.e., A, B, S, or M).

#### 2.2.1.1. LED is off or dark.

During normal concentrator operation, the LED on an unconnected concentrator port will be blinking green. If the LED is off, it indicates that SMT has disabled this port because a fault was detected in the port hardware that renders it unusable.

**Note:** Do not attempt to connect a port whose LED is dark to another FDDI device. The dark LED indicates that SMT has detected a fault with the port and has disabled the port, rendering it unusable.

#### 2.2.1.2. LED is solid amber.

If the LED is amber the connection is being withheld by this concentrator port according to the SMT topology rules. There are only two reasons why a port on the M400 concentrator will withhold a connection:

- a) It is an M to M connection. This type of connection is expressly prohibited by the SMT specification.
- b) It is the S port and there are no active M ports. SMT is structured such that MACless wrap points are prevented. If the S port were to become active without a MAC or active M ports, then data would simply enter the S port, traverse the internal data path, and exit the S port. This configuration add latency to the ring without adding any valid connections. Therefore, since there is no MAC, SMT will withhold the S port connection if there are no active M ports. **This is not an error.** As soon as at least one M port becomes active, the S port connection will become active automatically.

#### 2.2.1.3. LED is blinking amber.

If the LED is blinking amber, then the connection is being withheld by the neighboring port.

The most common reason for this condition is **dual-homing**. A dual-attached device (e.g., a station, another concentrator) is said to be dual-homed when its A and B ports are both connected and at least one of the ports is connected to a concentrator M port. In this situation, SMT has been designed to favor the B port. In dual-homed configurations, the B port connection will be active and the A port connection will be withheld as a backup. If the B port connection fails for any reason (for example, inactive concentrator, cut cables), the A port connection will become active automatically. The ability to dual-home gives dual-attached devices an extra measure of fault tolerance.

Therefore, if a port on the M400 FDDI concentrator is showing blinking amber, you should first check to see whether it is the A port side of a dual-homed connection. If so, then the connection is behaving properly and there is no error.

In general, the neighboring port will withhold a connection in compliance with SMT topology rules

or with a set of proprietary connection rules. You should examine the other FDDI device and its internal SMT topology rules to determine why it is withholding the connection. (See *Appendix A: SMT Connection Policies* on page 41.)

#### 2.2.1.4.LED is blinking green.

If the LED is blinking green, it indicates that the neighboring port is not participating in the establishment of the connection or that there is a problem with the connecting cable.

First, verify the correct operation of the port itself. If a loopback connector is available, place the loopback connector into the port to verify its operation. If it is an M port the LED will become steady amber. If it is an S port the LED will become either steady amber or steady green. If this loopback test passes then the problem is related to either the cabling or the neighboring port.

Next, verify the integrity of the connecting cable:

- Are the connectors securely inserted into both ports? If not, make sure they are snugly attached.
- Is there dirt or dust on the plugs or the connectors? If so, clean them.
- If you are connecting UTP ports, are you using a cross-over cable with the proper internal wiring? A straight-through cable means that Transmit is wired to Transmit and Receive is wired to Receive. Check with your cable supplier to verify that you are using the correct cable.
- If the port on the attached FDDI device uses ST type connectors, check to see that the ST plugs are on the correct connectors. If you have the plugs attached incorrectly, Transmit will be wired to Transmit, Receive will be wired to Receive, and both ports will be unable to function. Try switching each plug to the alternate connector.
- If the problem persists, try replacing the cable with a new one.

Next, verify that the neighboring port can establish a connection.

- Is the neighboring device turned on and properly configured?
- Does the neighboring device use the same data encoding scheme as the concentrator port?
- Has the neighboring device received a connect request, asking it to initiate new FDDI connections?

#### 2.2.1.5.LED is blinking red.

While it is active, each port continuously monitors the link error rate (LER) of its connection to the neighboring port. If the link error rate becomes too high, it means that the quality of the link is not high enough to permit transmission and reception of data in a reliable manner. When the link error rate becomes too high, the port will break its connection to the neighboring port and will cause the LED to blink red.

When the LED is blinking red, the port is NOT active. If the problem persists, you must identify and remove the source of the link errors.

Link errors have many sources. They are generally introduced by the cable plant, but may occasionally be introduced by older or faulty hardware. The following list describes some of the sources of link errors:

Fiber:

- Connectors (plugs and receptacles) that are dusty or dirty. Fiber connectors will gather dirt over time and this dirt will obstruct the flow of optical signals.
- Fiber that is bent beyond its minimum bend radius. Fiber can develop micro-fractures when

bent too sharply. These fractures can cause link errors.

- Patch panels with substandard connectors or substandard patch cables.
- Configurations in which multiple, consecutive optical bypasses are engaged. An optical bypass weakens the signal that passes through it. If several bypasses are engaged in a row, the resulting signal may become error-filled or unreadable.
- Cable runs that exceed the maximum recommended port-to-port distance. For multimode fiber, this distance is 2 km.

#### Copper:

- Connectors (plugs and receptacles) that are dusty or dirty. Copper connectors will gather dirt over time and this dirt will obstruct the flow of electrical signals.
- Loose port connectors. Copper connectors in particular are prone to loose connections. This intermittent contact with the port leads can introduce link errors.
- Copper cables that are running through strong electrical or magnetic fields.
- Copper cables or cable runs that exceed the maximum recommended port-to-port distance. For category 5 unshielded twisted-pair, this is 100 meters.
- Copper cable plants that do not conform to EIA/TIA 568 wiring specifications. Note that punchdown blocks, patch cable, and patch panels must be rated for category 5 UTP. Note also that crossovers between transmit and receive must be accomplished within a cable and not in the patch panel.

#### 2.2.1.6.LED is solid red.

If the LED is red then there is a fault in the ring that is causing this port to enter the Trace state. Trace is an automatic SMT algorithm used to recover from stuck beacon conditions on the network. SMT will allow the Trace sufficient time to propagate upstream and will then execute its internal diagnostics.

You do not need to take any action if a port is displaying a red LED. SMT will handle the situation automatically. However, if you are seeing a large number of Traces on your FDDI ring, you may want to examine your network for faulty devices.

#### 2.2.2.Port is active, but the connection seems to be behaving poorly.

The M400 concentrator disables faulty ports in order to continue providing service on the remaining functional ports. While this is a very desirable fault-tolerant feature, there may be rare situations when a disabled port interferes with the normal operation of the concentrator. This can happen when the nature of the failure prevents the port hardware from being isolated from the internal data path properly. In this case, the FDDI ring is either broken or ring data is corrupted, resulting in loss of data service among stations on the ring.

If you have disabled ports on your concentrator and you suspect that you have this problem, the simplest test is as follows:

1. Disconnect all the ports on the concentrator.
2. Connect an FDDI station or network analyzer to a functioning M port. The concentrator will form an internal ring, with data flowing in the M port, across the internal data path, and out the M port.
3. Determine the state of the MAC on the attached FDDI station or network analyzer. You can do this in a number of ways:
  - An LED that indicates Ring\_Op.

- The value of the MIB attribute fddiMACRMTState has a value of 2 (Ring\_Op).
  - A local interface that displays the status of the station or network analyzer.
4. If the MAC is operational and is able to transmit and receive data correctly, then you do not have this problem and your symptoms are caused by a fault somewhere else.
  5. If, however, the MAC is not operational or is unable to remain operational for several seconds, then one or more disabled ports in the M400 concentrator may be interfering with data transmission. In this case, your concentrator cannot be used at all. Contact your dealer or service representative for repair, replacement, and warranty information.

## Appendix A: SMT Connection Policies

This section presents a brief overview of SMT connection policies. SMT connection policies are heavily influenced by the presence of a concentrator on the FDDI ring. Knowledge of these connection policies will allow you to construct your FDDI network quickly and efficiently.

SMT defines four types of ports: A, B, S, and M. A and B ports are used in dual-attached devices. The counter-rotating trunk ring is formed by connecting the A port of a dual-attached device to the B port of a different dual-attached device. A and B ports may also be connected to concentrator M ports as well as to S ports, although the latter can form undesirable connections.

S (for slave) ports are used in single-attached devices and generally connect only to concentrator M ports. Since they provide only one duplex connection to the network, single-attached devices lack some of the fault tolerance offered by dual-attached devices.

M (for master) ports exist in concentrators only. They are used to provide a single duplex connection to another FDDI device. The most common type of connection is S-M.

### A.1 Managed M400

As a default, the Managed M400 FDDI concentrator ships with the SMT connection policies described by the following table:

**Table A-1: Default SMT Connection Policy for Managed M400**

		Other Port			
		A	B	S	M
This Port	A	NO	yes	yes	yes
	B	yes	NO	yes	yes
	S	yes	yes	yes	yes
	M	yes	yes	yes	NO

where:

- yes indicates a permitted connection; and
- NO indicates an illegal or undesirable connection.

You may change the connection policies used by SMT through the local interface. However, M to M connections will always be illegal, regardless of how you change the connection policies.

When you connect two ports together, they undertake a rapid negotiation sequence. This sequence includes such pieces of information as:

- This port type
- The neighbor's port type
- Whether this connection is permitted or not
- The duration of the link confidence test.

SMT is structured such that if either port accepts the connection, the connection will be allowed. In other words, both ports must reject the connection in order for the connection to be prevented.

When you connect one port to another, the following types of connections result:

- A to A Undesirable connection that creates twisted primary and secondary rings.
- A to B Normal trunk ring peer connection.
- A to S Peer connection that creates a wrapped ring.
- A to M Tree connection that provides possible redundancy. (Dual homing)
- B to A Normal trunk ring peer connection.
- B to B Undesirable connection that creates twisted primary and secondary rings.
- B to S Peer connection that creates a wrapped ring.
- B to M Tree connection that provides possible redundancy. (Dual homing)
- S to A Peer connection that creates a wrapped ring.
- S to B Peer connection that creates a wrapped ring.
- S to S Connection that creates a single ring of two slave stations.
- S to M Normal tree connection.
- M to A Tree connection that provides possible redundancy. (Dual homing)
- M to B Tree connection that provides possible redundancy. (Dual homing)
- M to S Normal tree connection.
- M to M Illegal connection that creates a tree of rings topology.

## A.2 Unmanaged M400

The Unmanaged M400 FDDI concentrator ships with the SMT connection policies described in the following table:

**Table A-2: SMT Connection Policy for the Unmanaged M400**

		Other Port			
		A	B	S	M
This Port	S	yes	yes	yes	yes
	M	yes	yes	yes	NO

where:

- yes indicates a valid connection; and
- NO indicates an illegal connection.

When you connect two ports together, they undertake a rapid negotiation sequence. This sequence includes such pieces of information as:

- This port type
- The neighbor's port type
- Whether this connection is permitted or not
- The duration of the link confidence test

SMT is structured such that, if either port accepts the connection, the connection will be allowed. In other words, both ports must reject the connection in order for the connection to be prevented. As you can see, the M400 FDDI concentrator will accept any connection except for M-M, which is expressly prohibited by the SMT standard.

When you connect one port to another, the following types of connections result:

- S to A Peer connection that creates a wrapped ring.
- S to B Peer connection that creates a wrapped ring.
- S to S Connection that creates a single ring of two slave stations.
- S to M Normal tree connection.
- M to A Tree connection that provides possible redundancy.
- M to B Tree connection that provides possible redundancy.
- M to S Normal tree connection.
- M to M Illegal connection that creates a tree of rings topology.

## Appendix B: Local Management Interface Commands

This section presents detailed descriptions of the commands that comprise the local management interface. Each command has a manual page describing the syntax and behavior of the command. The manual pages are organized alphabetically by function name.

Each manual page starts on a new page and has the following format:

<b>Description</b>	will tell you what the command does and how it is used.
<b>Syntax</b>	will tell you exactly what arguments the command may take and in which order. Optional commands are enclosed in square brackets, []. Arguments that are enclosed in curly brackets, {}, represent a set of choices. For these type of arguments, you must select one from the set.
<b>Notes</b>	will provide additional information about the command, including comments about behavior, side effects, and what you should do next.
<b>Output</b>	will describe what you see as a result of running the command.
<b>Examples</b>	will provide one or more examples that illustrate how to use the command.
<b>See Also</b>	will reference other commands that may be germane to the task at hand.

In addition, the next several sections describe characteristics of the local management interface that you will want to understand before using it.

### B.1. Partial Match Capability

The command parser includes a **partial match capability**. It can identify a command or argument from a fragment. You need type only enough of a command or argument for the parser to determine what you mean. For example, if you type

```
sys con
```

the parser will be able to determine that you have entered the

```
system connect
```

command. The partial match capability is also active when using the **get**, **set**, **snmpget**, **snmpget-next**, or **snmpset** command to access the resident MIBs via parameter name.

### B.2. Case Insensitivity

For the names of MIB parameters, the command line interface is **case insensitive**. You may enter MIB parameter names in upper and/or lower case. This applies to the SMT and SNMP MIBs. For purposes of clarity, MIB parameter examples are presented in lower case.

### B.3. Format of Numeric Values

You can use **decimal**, **binary**, or **hexadecimal** format to enter numeric values. If you want to enter a hexadecimal value, the number must have a '0X' or '0x' prefix. If you want to enter a binary value, the number must have a '0B' or '0b' prefix.

The following examples describe the same numeric value in different formats:

```
20
0x0014
0X14
0b10100
```

### B.4. Format of Time Values

**Timer values** are displayed and must be entered in second, millisecond, or nanosecond units. You may specify which units you are using by providing the name or the appropriate abbreviation after

the numeric value. For example:

```
165.736 milliseconds
165.736 ms
12500 nanoseconds
12500 ns
7.048 seconds
7.048 secs
```

## B.5. Format of MAC Address Values — Bit Order

Because the M400 FDDI concentrator supports SMT and SNMP management, there are two different ways that addresses can be displayed: MSB (most significant bit first) and IEEE canonical. FDDI and SMT generally use MSB format. Addresses displayed in MSB format are always shown as six groups of two hexadecimal digits, separated by colons. For example:

```
00:03:b9:7f:2a:01
```

Any address shown in this manner is being displayed in MSB format.

IEEE canonical is another way of displaying the same data. Each octet of IEEE canonical is the same as in MSB, except that the bits are shown in the opposite order. Addresses displayed in IEEE canonical order are always shown with a hyphen separating each octet. For example:

```
00-c0-9d-fe-54-80
```

is the same address above shown in IEEE canonical order. Any address shown in this manner is being displayed in IEEE canonical format.

The **address** command toggles the display format of MAC addresses between MSB and IEEE canonical. The **address** command does not alter the input format of MAC address. You may enter a MAC address in either MSB order or IEEE canonical order, using the formats listed here.

## B.6. Format of MAC Address Values — OUI vs. Company Name

In FDDI, MAC addresses are administered by the IEEE and have a specific structure:

- The first three octets of the MAC address are specified by the IEEE and identify the company to which the MAC address space is registered. These first three octets are called the **organizationally unique identifier (OUI)**.
- The last three octets of the MAC address are under the control of the company to which the MAC address space has been registered. They are assigned as desired by the company.

For example, if a MAC address (in MSB format) is:

```
00:03:b9:00:20:70
```

then the first three octets (00 03 b9) identify this address as coming from Interphase's assigned address space. The last three octets (00 20 70) have been assigned by Interphase.

The M400 FDDI concentrator is capable of displaying MAC address information with a company abbreviation substituted for the first three octets of the MAC address. This abbreviation is called a company alias and it identifies the company that manufactured the FDDI device. Since several of the local interface commands display MAC address information, you may specify whether an address is displayed with a company alias or in raw format.

- MAC addresses displayed with a company alias are shown with an abbreviated company name replacing the first three octets of the MAC address. For example:

```
Interphase 00:20:70
```

- This identifies the device as being of Interphase manufacture.

- MAC addresses displayed in raw format are shown without the company alias, as a series of hexadecimal digits only. For example:

```
00:03:b9:00:20:70
```

The M400 FDDI concentrator ships with OUI-company name mappings for more than 50 different vendors. You may alter the display of MAC addresses using the **address** command. As a default, MAC addresses will be displayed without the company alias.

**Note:** Whether a MAC address is displayed with or without the company alias has no effect on whether the address is displayed in MSB format or IEEE canonical format. In other words, the same address may be displayed four different ways:

```
00:03:b9:00:20:70
Interphase 00:20:70
00-c0-9d-00-04-0e
Interphase 00-04-0e
```

Use the **address** command to alter the display format of MAC address information. Choose the display format that is most convenient for you.

## B.7. Quick Restart vs. Full Restart

Since there are several local management interface commands that require a restart of the unit, the M400 FDDI Concentrator uses two types of restart:

- **Full restart** is executed after power up only. Full restart executes memory diagnostics and multiple iterations of internal FDDI diagnostics. It requires about 30 seconds to complete.
  - **Quick restart** is executed after a command that requests or requires a restart of the unit. It executes one iteration of internal FDDI diagnostics and requires about 4 seconds to complete. The commands which require a quick restart are listed below.
- 
- The **configure** command, when changing the external configuration of the concentrator.
  - The **ifconfig** command, when changing the IP address, the subnetwork mask, or the MTU.
  - The **set** command, when a path test is requested.
  - The **snmpset** command, when a path test is requested.
  - The **system** command, when a reset or a return to factory defaults is requested.

# address

## Description:

Change the display format of MAC addresses.

## Syntax:

**address** [ msb | canonical ] [ raw | name ]

where:

msb	indicates that MAC address information should be presented in MSB format.
canonical	indicates that MAC address information should be presented in IEEE canonical format.
raw	indicates that MAC address information should be presented in hexadecimal numeric format.
name	indicates that a company alias should be substituted for the first three octets of a MAC address when MAC address information is displayed.

## Notes:

- FDDI and SMT use most significant bit first (MSB) format to exchange MAC address information. In MSB format, the most significant bit of each address octet is displayed (or transmitted) first. For the M400 FDDI concentrator, MSB addresses are displayed as six sets of two hexadecimal digits, separated by colons. For example:

```
00:03:b9:7f:2a:01
```

- Any MAC address displayed in this format is in MSB order.
- SNMP and its associated UDP/IP protocol stack use IEEE canonical format to exchange MAC address information. In IEEE canonical, the least significant bit of each address octet is displayed (or transmitted) first. For the M400 FDDI concentrator, IEEE canonical addresses are displayed as six pairs of hexadecimal digits, separated by hyphens (“-”). For example:

```
00-c0-9d-fe-54-80
```

- Any MAC address displayed in this format is in IEEE canonical order.
- The first three octets of the MAC address are specified by the IEEE and identify the company to which the MAC address space is registered. These first three octets are called the **organizationally unique identifier** (OUI). The last three octets of the MAC address are under the control of the company to which the MAC address space has been registered. They are assigned as desired by the company.
- As a default, MAC addresses are displayed in raw, IEEE canonical format.
- The **address** command will toggle the display format of MAC address information between MSB and IEEE canonical and between hexadecimal numeric and the use of a company alias. The **arp**, **messages**, **ringmap**, **status**, and **view** commands will change the display format of subsequent MAC address output based on the current setting of the **address** command.
- The **get** and **walk** commands always display MAC address information in raw, MSB format, regardless of the current setting of the **address** command.
- The **snmpget**, **snmpgetnext**, and **snmpwalk** commands always display MAC address information in raw, IEEE canonical format regardless of the current setting of the **address** command.

- The **address** command has no effect on the input format of MAC addresses. Wherever an argument calls for a MAC address, you may enter the address in MSB or IEEE canonical order. If you are entering a MAC address in MSB order, be sure to enter six groups of two hexadecimal digits separated by colons. If you are entering a MAC address in IEEE canonical order, be sure to enter six pairs of hexadecimal digits separated by hyphens.
- The M400 FDDI concentrator ships with more than 50 OUI-company alias mappings. If you request that MAC addresses be displayed with a company alias and the concentrator receives a frame with an OUI that is unknown, the MAC address will be displayed in raw format.
- The active display format of MAC addresses is stored in non-volatile RAM and is preserved across interruptions in concentrator service.

### Output:

The **address** command will tell you which format is used to display MAC address information. MAC addresses that are presented in raw, MSB order are displayed in the following format:

```
00:03:b9:7f:2a:01
```

MAC addresses that are presented in raw, IEEE canonical order are displayed in the following format:

```
00-c0-9d-fe-54-80
```

MAC addresses that are presented in MSB order using a company alias are displayed in the following format:

```
Interphase 7f:2a:01
```

MAC addresses that are presented in IEEE canonical order using a company alias are displayed in the following format:

```
Interphase fe-54-80
```

### Examples:

```
address
```

will indicate the current display mode for MAC address information.

```
address msb name
```

will cause all new displays of MAC address information to be presented in most significant bit format with the appropriate company alias substituted for the first three octets of the MAC address.

```
address raw
```

will cause all MAC address information to be presented in raw, hexadecimal numeric format, regardless of the bit order.

### See Also:

**arp**

**messages**

**ringmap**

**status**

**view**

# alias

## Description:

Create, delete, or display IP alias table entries.

## Syntax:

**alias** [ -d ] [ ip\_address ] [ identifier ]

where:

- d is used to delete entries from the alias table. If used with an argument, the -d option will cause the entry associated with the specified IP address or identifier to be deleted. If used without an argument, the -d option will cause all entries in the alias table to be deleted.
- ip\_address is a 32-bit IP address, represented in dotted decimal notation, of the form a.b.c.d, where 'a', 'b', 'c', and 'd' are integers in the range 0 to 255.
- identifier is an alphanumeric identifier to be associated with this IP address. This identifier must not contain any white space (i.e., spaces, tabs, etc.) and may not exceed 15 characters in length. In addition, the identifier must begin with a letter. You can use this identifier in place of the associated IP address throughout the local management interface.

## Notes:

- This command is used to display and modify the alias table. The alias table is a mapping between alphanumeric identifiers and IP addresses. It is provided as a convenience for use with the other local management interface functions. If you populate the alias table, then you will be able to provide an identifier for several other local management interface commands that call for an IP address. Alias table identifiers can be used with the **arp**, **ping**, and **route** commands.
- When used without arguments, the **alias** command will display the entire alias table. You may also display the entries associated with a specific IP address or identifier by using the appropriate argument.
- If you use the **alias** command with an IP address *and* an alphanumeric identifier, a new entry will be created in the alias table mapping between the two.
- The IP addresses and identifiers in the alias table must be unique. You may use the **alias** command to map only one identifier to only one IP address. The command parser must be able to identify a specific entry in the alias table. Therefore, IP addresses and alphanumeric identifiers may not be duplicated in the alias table.
- Use of this command is optional. It has no effect on the operation of the concentrator.
- The alias table is stored in non-volatile RAM and is saved across interruptions in concentrator service. However, there is no default value for the alias table. Therefore, if you reset the system to factory defaults, the alias table will be deleted.
- The alias table is limited to ten (10) entries.

## Output:

The alias table has the form:

```
IP Address Identifier
193.12.0.4 europa
```

```
193.12.0.13alfred
193.12.0.5 power_tool
193.12.0.74print_server1
```

This is the type of output that you will see when you display the entire alias table.

When you search the alias table for the IP address associated with a specific identifier, you will see the following output:

```
IP Address Identifier
193.12.0.4 europa
```

If you attempt to create an entry in the alias table that duplicates an existing identifier or IP address, you will see something like the following message:

```
europa already in alias table.
```

### **Examples:**

```
alias
```

will display the current alias table.

```
alias -d
```

will delete the entire alias table.

```
alias europa
```

will search for “europa” in the alias table and will display its alias table entry.

```
alias 193.12.0.4
```

will search for the specified IP address entry in the alias table and will display its associated alias table entry.

```
alias -d europa
```

will delete the alias table entry associated with the identifier “europa”.

```
alias -d 193.12.0.4
```

will delete the alias table entry associated with the specified IP address.

```
alias 193.12.0.4 europa
```

will add an entry to the alias table mapping between the identifier “europa” and IP address 193.12.0.4.

### **See Also:**

**arp**

**ping**

**route**

**system**

## arp

### Description:

Create, delete, or display address resolution protocol (ARP) table entries.

### Syntax:

```
arp [ -d ] [ ip_address ] [ mac_address ]
```

where:

- d is used to delete entries from the ARP table. If you provide an IP address or a MAC address with the -d option, then only the associated entries in the ARP table will be deleted. If you use the -d option without arguments, the entire ARP table will be deleted.
- ip\_address is a 32-bit IP address, represented in dotted decimal notation, of the form a.b.c.d, where 'a', 'b', 'c', and 'd' are integers in the range 0 to 255.
- mac\_address is a long, 48-bit MAC address. You may enter this address in most significant bit first (MSB) or IEEE canonical format. See section *B.5. Format of MAC Address Values — Bit Order* on page 45 for more information about address formats.

### Notes:

- This command is used to display and modify the ARP table. The ARP table is a mapping between IP addresses and MAC addresses. It is used by the UDP/IP protocol stack to identify the MAC (physical) address associated with a specific IP address.
- When used without any arguments, the **arp** command will display the entire ARP table. You may also display the entries associated with a specific IP address or MAC address by specifying the appropriate address argument.
- You do not need to create the ARP table manually. The address resolution protocol (ARP) will operate automatically on your network. As ARP discovers the mapping between IP addresses and physical addresses, it will create its own entries in the ARP table.
- If you use the **arp** command with an IP address *and* a MAC address argument, a new entry will be created in the ARP table mapping between the two addresses. Entries added in this manner are subject to standard ARP table processing.
- If you create an entry in the ARP table and the ARP protocol later finds that this address mapping is incorrect or has changed, it will update the ARP table automatically.
- The MAC addresses in the ARP table need not be unique. You may use the **arp** command to map several IP addresses to the same MAC address.
- However, the IP addresses in the ARP table must be unique. The command parser must be able to identify a specific IP address in the ARP table. You may not have several MAC addresses mapped to the same IP address.
- If you attempt to create an entry in the alias table that duplicates an existing IP address, the command parser will assume that you intend to update the ARP table information and will replace the existing ARP table entry with the new information.
- If you delete a MAC address from the ARP table, then all associated IP address entries will be removed from the table.
- The ARP table is not stored in non-volatile RAM and, therefore, is not carried across inter-

ruptions in concentrator service. In addition, there is no default state of ARP table entries. If you return the concentrator to its factory default settings, then your ARP table entries will be deleted.

- The ARP table is limited to 50 entries.

### Output:

The ARP table has the form:

State	IP Address	MAC Address	Time to live
Resolved	193.12.0.12	00-c0-9d-00-2a-01	12656 seconds
Resolved	193.12.0.8	00-c0-9d-00-2a-01	12657 seconds
Resolved	europa	00-c0-9d-1a-02-82	13979 seconds
Pending	193.12.0.7	00-00-00-00-00-00	14399 seconds

This is the type of output that you will see when you display the entire ARP table. In this sample output, the MAC address 00-c0-9d-00-2a-01 has two associated IP addresses. Note that the third table entry uses information from the alias table.

The **address** command controls the display format of MAC address information. You may display MAC addresses in MSB format (e.g., 00:03:b9:7f:2a:01) or IEEE canonical format (e.g., 00-c0-9d-fe-54-80). You may also display the MAC addresses in raw, hexadecimal format or with a company alias substituted for the first three octets of the address.

The state of an ARP table entry indicates whether the entry has been confirmed or not. State can have one of two values:

- Pending** indicates that an ARP request has been sent for the specified IP address, but that no response has been received. This means that there are queued outgoing LLC frames for the specified IP address. You should ignore the MAC address value for ARP table entries that are pending, as this value has not yet been confirmed.
- Resolved** indicates that the ARP request has been resolved over the network or that the ARP information has been entered manually. It indicates that the IP to MAC address mapping is valid and will be used with LLC frames destined for the specified IP address.

Time to live indicates the amount of time in seconds until the ARP entry expires. Since the ARP addressing information is critical, it must be kept up to date. Therefore, each entry has a specific “expiration date” when it is created. The time to live for a new ARP table entry is 4 hours (14,400 seconds). The time to live is reset each time an ARP frame relating to the specified address mapping is received. When the time to live reaches zero, the associated ARP table entry is deleted.

### Examples:

```
arp
```

will display the current ARP table.

```
arp -d
```

will erase the current ARP table.

```
arp 00-c0-9d-00-2a-01
```

will search for and display all the entries in the ARP table associated with the MAC address 00-c0-9d-00-2a-01.

```
arp 193.12.0.4
```

will search for the specified IP address entry in the ARP table and will display its associated

MAC address. Note that you may also use information from the alias table here.

```
arp -d 00-c0-9d-00-2a-01
```

will delete all of the ARP table entries associated with the MAC address 00-c0-9d-00-2a-01.

```
arp -d 193.12.0.4
```

will delete the alias table entry associated with the specified IP address.

```
arp 193.12.0.4 00-c0-9d-00-2a-01
```

```
arp 193.12.0.4 00:03:b9:00:54:80
```

will add an entry to the alias table mapping between the IP address 193.12.0.4 and the MAC address 00-c0-9d-00-2a-01 (or 00:03:b9:00:54:80 in MSB format). If you have provided a mapping between 193.12.0.4 and an alphanumeric identifier in the alias table, then the identifier will be listed when you display the ARP table.

**See Also:**

**address**

**alias**

**route**

# configure

## Description:

Alter the external or internal configuration of the concentrator.

**Note:** Be careful when using this command. The internal configurations of the M400 FDDI concentrator are very complex. You may inadvertently create undesirable network configurations. This command assumes that you have a working knowledge of SMT internal configuration algorithms. In general, it is easier to use the default configuration values unless you have a specific network configuration that you wish to support. The **system defaults** command will restore the concentrator to its factory settings.

## Syntax:

**configure** [ dac | sac | nac ]

**configure** { ab | s | m index | mac } new\_state

where:

- dac changes the external configuration to be a dual-attach concentrator. In this configuration, port 1 is of type A, port 2 is of type B, and the remaining ports are of type M. Using this configuration option will cause the concentrator to restart. ***This is the default configuration of the concentrator.***
- sac changes the external configuration to be a single-attach concentrator. In this configuration, port 1 is of type S and the remaining ports are of type M. Using this configuration option will cause the concentrator to restart.
- nac changes the external configuration to be a null-attach concentrator. In this configuration, all ports are of type M. Using this configuration option will cause the concentrator to restart.
- ab changes the internal data path locations for the A and the B ports on a dual-attach concentrator. This option changes the configuration of the A and the B ports together as a unit. The new\_state of the A and B port must be one of the following:
  - thru** Configure the A and B ports such that data from the dual ring flows into the A and B ports, across both data paths, and out the B and A ports, respectively. ***This is the default configuration of the A and B port pair.***  
In this configuration, the B port will take precedence when either the A port or the B port is connected to an M port (i.e., dual-homing). However, if the A port and the B port are both connected to M ports and there are resources on the secondary data path, then the Wrap\_AB configuration will be used instead.
  - c\_wrap\_a** Configure the A and B ports such that the A port provides external ring access to *both* the primary and secondary data paths. The primary and secondary paths are concatenated through the A port. In this configuration, the B port will remain isolated with a PC\_Withhold value of No\_Paths.
  - wrap\_a** Configure the A and B ports such that the A port provides external ring access to the secondary data path *only*. In this configuration, resources on the primary data path will not be able to access the external ring through the A port. The B port will also remain isolated with a PC\_Withhold value of No\_Paths.

- c\_wrap\_b** Configure the A and B ports such that the B port provides external ring access to *both* the primary and secondary data paths. The primary and secondary paths are concatenated through the B port. In this configuration, the A port will remain isolated with a PC\_Withhold value of No\_Paths.
- wrap\_b** Configure the A and B ports such that the B port provides external ring access to the primary data path *only*. In this configuration, resources on the secondary data path will not be able to access the external ring through the B port. The A port will also remain isolated with a PC\_Withhold value of No\_Paths.
- wrap\_ab** Configure the A and B ports such that the A port provides external ring access to the secondary data path *while* the B port provides simultaneous external ring access to the primary data path. In this configuration, the A and the B ports reside on independent data paths and do not communicate with each other.
- isolated** Remove the A and the B ports from all internal data paths. This has the effect of creating a null-attach concentrator and generally should not be used. If you make the A and B ports isolated, they will not connect to other FDDI devices and will not function in the concentrator.

s changes the internal data path location of the S port on a single-attach concentrator. The new\_state of the S port must be one of the following:

- c\_wrap\_s** Configure the S port such that it provides external ring access to *both* the primary and the secondary data paths when it is active. ***This is the default configuration of the S port.***
- wrap\_s** Configure the S port such that it provides external ring access *only* to the primary data path when it is active. In this configuration, resources on the secondary data path will not be able to access the external ring through the S port.
- isolated** Remove the S port from all data paths. This has the effect of creating a null-attach concentrator and generally should not be used. If you make the S port isolated, it will not connect to other FDDI devices and it will not function in the concentrator.

m changes the internal data path location of a specific M port. Since there are multiple M ports on the M400 FDDI concentrator, the index argument must be used to specify which M port should be moved. Indexing of all ports begins at 1. The new\_state of the M port must be one of the following:

- primary** Place the M port on the primary data path. When a dual-attached concentrator is in the Thru configuration and the dual ring is not wrapped, the primary data path corresponds to the primary ring. ***This is the default path placement of all M ports.***
- secondary** Place the M port on the secondary data path. When a dual-attached concentrator is in the Thru configuration and the dual ring is not wrapped, the secondary data path corresponds to the secondary ring.
- isolated** Remove the M port from all data paths. If you make an M port

isolated, it will not connect to other FDDI devices and it will not function in the concentrator.

**mac** changes the internal data path location of the MAC. The `new_state` of the MAC must be one of the following:

- primary** Place the MAC on the primary data path. On the primary path, data from the MAC will exit a dual-attach concentrator via the B port in Thru mode and via the S port in a single-attach concentrator. *This is the default path placement of the MAC.*
- secondary** Place the MAC on the secondary data path. On the secondary path, data from the MAC will probably exit a dual-attach concentrator via the A port in Thru mode. For single-attach concentrators, the exit port will probably be an M port.
- isolated** Remove the MAC from all data paths. Making the MAC isolated will render the concentrator unmanageable from the network.

### Notes:

- This command can be used to change the **external** configuration of the concentrator between a dual-attach concentrator (DAC), a single-attach concentrator (SAC), and a null-attach concentrator (NAC). When you change the external configuration of the concentrator, a quick restart of the system is required and will take place automatically. After the restart, you must enter the current password in order to access the local interface commands.
- If you change the external configuration of the concentrator when either of the first two ports is connected to another device, be sure to check that the resulting port-to-port connections are legal. By changing the configuration of the concentrator, you may create an illegal or undesirable network configuration.
- This command can also be used to alter the **internal** configuration of the concentrator. The concentrator's configuration switches respond to changing network conditions. Normally, the following configurations will apply:
  - The MAC will be located on the primary path.
  - The M ports will be located on the primary path.
  - The S port will provide access to the primary and secondary paths. This is called `C_Wrap_S`.
  - The A and B ports will provide access to both the primary and secondary data paths. This is called Thru.
- If you have a specific network configuration you want to create and you understand the consequences for your network, then you can use the **configure** command to alter the internal behavior of the concentrator.
- When used without arguments, the **configure** command will display the current internal and external configuration preferences for the concentrator. Note that, for the internal configuration, these values are preferred configuration settings only and do not necessarily represent the current configuration state of the concentrator multiplexers.
- If you have created a concentrator configuration that you do not understand or believe may be causing unexpected behavior in your network, use the **system defaults** command to restore the concentrator's external and internal configuration to factory settings. The **system defaults**

command will restore the concentrator to the default settings above. However, note that this option involves a restart of the concentrator and will reset the external configuration as well as the IP address.

- In general, moving any resource from one data path to another will cause a claim process on the affected data paths.
- Note that, while a connection is being withheld, an extended link confidence test with a duration of 50 seconds is being run. After this test is over, the connection will be restarted automatically in a new attempt to establish a connection. Therefore, the LED will blink once and a new message will be generated every 50 seconds while a connection is being withheld.
- With regard to changing the internal behavior of the concentrator, the **configure** command is provided as a convenience. You can perform the same tasks via the **set** command. However, use of the **set** command requires knowledge of the specific bitmaps used in the SMT configuration management algorithms.
- Use the **status** command to see the current and actual configuration of the concentrator.
- The internal and external configuration settings of the concentrator are stored in non-volatile RAM and preserved across interruptions in concentrator service. In other words, the concentrator will restart with the same configuration that it had prior to a power loss.
- A copy of the internal configuration settings is saved for *each* external configuration setting. In other words, you may specify a preferred internal configuration for the DAC, SAC, and NAC external configurations separately.

### Output:

When used without arguments, the **configure** command produces the following output:

```
External configuration: dac
Preferred internal configuration:
    MAC:    primary
    AB:     thru
    M [3]:  primary
    M [4]:  primary
    M [5]:  primary
    M [6]:  primary
    M [7]:  primary
    M [8]:  primary
```

The first line indicates that the current external configuration is DAC (dual-attached concentrator). The following nine lines describe the *preferred* internal configuration of the various concentrator resources. This example indicates that the MAC and all of the M ports are requesting the primary data path and that the attachment ports (A, B) are requesting the Thru configuration. Note that, depending on the state of the network, the actual configuration may not match the preferred configuration.

### Examples:

- To change an 8-port unit such that it has 1 S port and 7 M ports, type the following command:  

```
configure sac
```
- To move the MAC to the secondary path, use the following command:  

```
configure mac secondary
```
- To move the second M port (port number 4 in a dual-attach concentrator), to the secondary

path, use the following command:

```
configure m 4 secondary
```

- To configure a dual-attach concentrator such that the A port is isolated, the B port provides external ring access to the primary path, and the left-most 4 M ports (on an 8-port unit) are on their own ring on the secondary path, use the following commands:

```
configure ab wrap_b  
configure m 5 secondary  
configure m 6 secondary  
configure m 7 secondary  
configure m 8 secondary
```

- Note that ports 3 and 4 will still be located on the primary data path, along with the B port and the MAC. This is one example of how you can use the M400 FDDI concentrator as a hub for completely disjoint FDDI rings.

**See Also:**

**set**

**status**

**system**

# diagnostics

## Description:

Cause the concentrator to execute a series of diagnostic self tests and report the results.

## Syntax:

```
diagnostics [-c ] { internal | external }
```

where:

- c indicates that the diagnostics should be executed continuously until terminated from the keyboard.
- internal exercises the internal FDDI interfaces, including the primary and secondary data paths and all of the configuration control multiplexers, as well as the PHY, MAC, and system interface functions. Each resource in the concentrator is first tested individually. Then, all resources are configured into an internal ring and tested together.
- external stresses the external PMD portion of the FDDI interfaces. To run this test, each port must be looped back using a loopback connector that is suitable for the specific media type of your PMD. The diagnostic test sends symbols and frames through the external interface and verifies that the same symbols and frames are received correctly.

**Note:** The 'external' diagnostic tests require that every concentrator port have a suitable loopback connector inserted. Any port that lacks a loopback connector during the 'external' test will fail and be disabled.

## Notes:

- Running the diagnostics is useful after you have unpacked the concentrator and before you have inserted it into your network. Diagnostics are also useful if you suspect you are having problems with the concentrator.
- You will not be able to execute diagnostics while the concentrator is connected and active in the network. Since the diagnostic tests are intrusive, they will break all connections to other FDDI devices and destroy any data currently passing through the unit. Use the **system disconnect** command to deactivate the concentrator before executing diagnostic tests.
- When the -c option is used, the diagnostics will run continuously until you press any key on your keyboard. Pressing any key will terminate the test. The system will display the number of diagnostics iterations as they are executed.
- When the -c option is omitted, the diagnostics will execute one time and report the results.
- After you have terminated the diagnostics, a connect request is required to restart the unit. Use the **system connect** command to restart the concentrator.
- Internal resources, such as ports and MACs, that fail diagnostic tests will be disabled. If possible, the concentrator will continue to operate without the faulty resources. The output of the diagnostics command will tell you when this happens.
- Disabled resources are not exercised during subsequent diagnostic tests. When a resource is marked as faulty, it is disabled until the next system reset or initialization. Therefore, resources that have been disabled previously will be reported as having failed diagnostics until the next system reset or reinitialization.
- Make sure that you insert appropriate loopback connectors in every port before executing an

external diagnostic test. Ports that lack this loopback connector during the external test will fail, will be marked as faulty, and will be disabled. If this happens, use the **system reset** command to reset the concentrator. Then, execute external diagnostics again (with the loopback connectors) to ensure that all ports are functioning properly.

- Since the external diagnostics transmit symbols out the media connector and test for correct reception, you can use the external tests to exercise your cable plant as well as your FDDI concentrator. The test may pass through as much cabling and as many cable connectors as FDDI permits. Simply ensure that the transmit path out of an FDDI port is looped back to the receive path *of the same port*.

### Output:

When you execute any kind of diagnostic test, all of the LEDs on the front of the concentrator will blink amber, from left to right. This indicates that the diagnostics are in progress; it does not indicate which port is being tested by the diagnostics.

When you start a continuous diagnostic test, you will see the following message:

```
Strike any key to terminate this test.
```

followed by a numerical indication of test progress:

```
0 1 2 3 4 5...
```

When you terminate the continuous diagnostic test by hitting a key, you will see the following report:

```
Test terminated from the keyboard.
```

```
MAC: Passed      Primary path: Passed      Secondary path: Passed
Port 1: Passed   Port 2: Passed   Port 3: Passed   Port 4: Passed
Port 5: Passed   Port 6: Passed   Port 7: Passed   Port 8: Passed
```

If, during the course of the test, any component fails, you will see an error message like the following:

```
Port 1 failure. The port is disabled. Diagnostics continuing.
```

### Examples:

```
diagnostics -c internal
```

will cause the concentrator to execute its internal diagnostics continuously until you terminate the tests by pressing any key.

```
diagnostics external
```

will cause the concentrator to execute its external physical layer diagnostics one time. Appropriate loopback connectors are required for this test.

### See Also:

**status**

**system**

# exit

## Description:

Terminate the current local management interface session.

## Syntax:

**exit**

## Notes:

- This command will terminate the current local management interface session. You will be required to know the current password to start a new session.
- If you are concerned about security, do not leave your current local management interface session unattended or accessible without using the **exit** command.
- If you are concerned about security, do not remove your terminal from the RS232 connector without using the **exit** command. The current session is not terminated when you break the RS232 connection. If you do not use the **exit** command, unauthorized individuals can access the still-active session by attaching their own terminal to the RS232 connector.
- Asynchronous messages will be displayed on the console even when there is no active local management interface session. If the display of asynchronous messages to the management console is enabled (using the **messages** command) when you exit, then messages will continue to be displayed on the console.

## Output:

When you end the current local interface session, you will see the following prompt:

```
Interphase M400 FDDI Concentrator.  
Local Management Interface v2.1  
Please enter the password:
```

You must enter the current password to begin another local interface session.

## See Also:

**messages**

**passwd**

# frconfig

## Description:

Configure the behavior of in-band SMT parameter management frame (PMF) set requests.

## Syntax:

**frconfig** [ on | off ]

where:

- on indicates that SMT PMF set requests should be accepted and parsed according to standard frame processing rules.
- off indicates that the SMT PMF set requests should be unconditionally rejected.

## Notes:

- This command is used to do two things:
  - Display the current status of in-band SMT PMF set requests.
  - Enable or disable the acceptance of SMT PMF set requests.
- As shipped, SMT PMF set requests are unconditionally rejected by the M400 FDDI concentrator.
- When used without arguments, the **frconfig** command will indicate whether SMT PMF set requests are currently honored or rejected.
- Use the **on** option to enable SMT PMF set requests. When SMT set requests are allowed, the concentrator will honor received PMF set requests, provided that they are properly formatted and semantically correct.
- Use the **off** option to disable SMT PMF set requests. When SMT set requests are disabled, the concentrator will unconditionally reject all received PMF set requests with a reason code of “Frame Class Not Supported”. Use this option if you are concerned about security on your network or you want to prevent unauthorized network access to the concentrator MIB. This is the default setting for SMT set requests.

**Note:** SMT provides no sophisticated authorization or authentication mechanisms for its get or set frames whatsoever. Therefore, when you allow the concentrator to honor SMT set requests, you are giving network users that understand SMT frames and the SMT MIB the capability to alter the behavior and configuration of the concentrator. If you are concerned about security, then it is prudent to deny SMT set requests and restrict concentrator access to the local management interface.

However, also note that SMT frames are restricted to the local FDDI ring. They cannot be transmitted across bridge or router boundaries. Therefore, you may choose to allow SMT set requests if you feel that physical access to the local FDDI ring is secure.

- This command controls the behavior of SMT set requests across the network only. It has no effect on the operation of the **set** command. It has no effect on the ability of the concentrator to respond to SMT PMF get requests. It has no effect on the ability of the concentrator to transmit SMT status report frames (SRFs).
- The PMF set configuration setting is stored in non-volatile RAM and is saved across interruptions in concentrator service.

## Output:

When you use the **frconfig** command without arguments, you will see the following status:

```
SMT PMF SETs are rejected.
```

**Examples:**

To cause the concentrator to reject SMT PMF set requests unconditionally, use the following command:

```
frconfig off
```

To cause the concentrator to accept SMT PMF set requests, use the following command:

```
frconfig on
```

**See Also:**

**set**

**snmpconfig**

## get

### Description:

Retrieve a value from the FDDI SMT MIB of the local concentrator or of a remote device.

### Syntax:

```
get [ -c ] { parameter_id | parameter_name } [ index ] [ mac_address ]
```

where:

**-c** indicates that the retrieval and display of the MIB value should be continuous. When you use the **-c** flag, the MIB value you requested will be displayed once per second until you stop the display. Pressing any key will pause the display. Pressing 'q' will terminate the display when it is paused.

**parameter\_id**

is the two-octet SMT parameter identifier for a specific MIB attribute. A list of these is provided in *Appendix C: MIB Reference* on page 114. The SMT identifier is usually entered in hexadecimal format, preceded by a '0x'.

**parameter\_name**

is an alternative to the numeric **parameter\_id**. You may enter the name of the MIB variable instead. A list of parameter names is provided in *Appendix C: MIB Reference* on page 114. Remember that names may be entered in upper or lower case.

**index**

is the index of the associated object, where appropriate. There are four objects in the SMT MIB: SMT, MAC, Path, and Port. When you get information about one of these objects, the parser must be able to determine which instance of the object applies. The M400 FDDI concentrator has one (1) SMT instance, one (1) MAC instance, two (2) Path instances, and either four (4) or eight (8) Port instances. Therefore, you should omit the index argument for the SMT and MAC objects. If the index argument is omitted for the Path and Port objects, the command line parser will assume an index of one (1). Indices always start with one (1).

**mac\_address**

is the 48-bit address of a MAC on your local FDDI ring. You may enter this address in most significant bit first (MSB) or IEEE canonical format. See *B.5. Format of MAC Address Values — Bit Order* on page 45 for more information about MAC address formats. You may not use a broadcast address for this option.

### Notes:

- You should use the **get** command when you would like specific concentrator information that is unavailable through the **status** or **diagnostics** command.
- You may also use the **get** command to retrieve specific SMT MIB information from a remote device that is on your local FDDI ring.

**Note:** Because of the frame formats used, the **get** command can retrieve SMT MIB attributes from a remote device only if the device supports SMT revision 7.3. The **get** command cannot access the MIB of a device running an SMT revision that is earlier than 7.3.

**Note:** Because SMT frames do not pass over bridge, switch, or router boundaries, you may use this command to retrieve MIB information from remote devices that are on your local FDDI ring only.

- You may use the **get** command to retrieve SMT MIB attributes only. If you want to retrieve

values from the SNMP MIB, you should use the **snmpget**, **snmpgetnext**, or **snmpwalk** commands.

- You may monitor the value of a MIB object by using the **-c** option. When you request continuous display, the value of the MIB object will be retrieved and displayed once per second until you press any key to pause the display. Once paused, the display may be terminated by pressing 'q'.
- SMT parameter identifiers are most easily entered in hexadecimal format and should be preceded by a '0x' to inform the parser that the value is hexadecimal.
- When you provide a parameter name as the first argument to the **get** command, the command parser will use its partial match capability to find the argument that best matches the fragment provided. Therefore,

```
get ler-cutoff 2
```

will display the current value of fddiPORTLer-Cutoff for port number 2.

- The local management interface displays SMT MIB variables in the most readable form possible. Flags are presented as 'True' and 'False'; time values are presented in seconds, milliseconds, microseconds, or nanoseconds, as appropriate; enumerated values are presented as strings; and bitmaps are expanded to show their component parts.
- Indices always start with one. The Port index value will match the numeric part of the port label on the front of the concentrator.
- The index argument is not used for attributes from the SMT object or attributes from the MAC object. It will default to a value of one (1) if omitted for the Path or Port objects.
- You may also use the **walk** command to step through a local or remote SMT MIB automatically.
- MAC addresses retrieved from the SMT MIB using the **get** command are *always* displayed in most significant bit first (MSB), raw format. The **address** command has no effect on the output of the **get** command.
- When used without the parameter or index arguments, the **get** command will retrieve and display the last SMT MIB attribute accessed.

### Output:

The information retrieved from the MIB has four component parts: the SMT identifier, the name, the index, and the value. For example, in the following output:

```
0x403a PORTLer-Cutoff[2]: 7
```

The first item, 0x403a, is the two-octet SMT identifier. This will be present even if you used the name to get the variable.

The second item, PORTLer-Cutoff, is the name of the variable.

The third item, [2], indicates that this value is for the second port on your concentrator. For SMT and MAC attributes, this item will not appear in the output.

The final item, 7, is the requested value. See *Appendix C: MIB Reference* on page 114, for a discussion of the semantics of each variable in the MIB.

In some cases, additional output is provided. The following output shows the time value measured in milliseconds, as well as its MIB value. The value stored in the MIB is the unsigned two's complement format of the time as measured in 80-nanosecond units:

```
0x2033 MACT-Req: 162.172 milliseconds [0xffe11900]
```

Other variables have more sophisticated output. The following output shows the numeric value of the variable (0x7). However, since this attribute is encoded as a bitmap, it also shows the meaning of the bits that are set.

```
0x2020 MACRequestedPaths: [0x7]
      = 'Local'
      = 'Secondary-alternate'
      = 'Primary-alternate'
```

If you attempt to access the SMT MIB of a non-local device on your FDDI ring, but communication cannot be established, you will see the following message:

```
Station not responding...
```

### Examples:

You may enter a hexadecimal SMT identifier or a decimal SMT identifier for the `parameter_id` argument. The following commands produce the same output:

```
get 0x1022
get 4130
```

Likewise, a variety of names may be entered. The following commands produce the same output:

```
get ler-cutoff 2
get fddiportler-cutoff 2
```

If you want to monitor the number of frames copied by the concentrator MAC, use the following command:

```
get -c copied-ct
```

You may also use this command to retrieve SMT MIB information from a remote device on your local FDDI ring. For example:

```
get 0x1012 00-c0-9d-00-04-0e
get ler-cutoff 2 00:03:b9:00:20:70
get -c copied-ct 00-c0-9d-00-04-0e
```

### See Also:

**diagnostics**

**set**

**snmpget**

**snmpgetnext**

**snmpset**

**snmpwalk**

**status**

**view**

**walk**

Appendix C: MIB Reference

# help

## Description:

Obtain help for the local management interface commands.

## Syntax:

**help** [ command\_name ]

where:

command\_name

is the name of one of the local management interface commands. A summary of these commands may be obtained by using the **list** command.

## Notes:

- Use the **help** command if you cannot remember the syntax or behavior of a local management interface command.
- Use the **list** command to obtain a summary of the local interface commands. The **help** command can then be used to obtain more detailed information about a specific command.

## Output:

The output of the **help** command describes the syntax of the specified command along with a brief description of the command's function.

## Examples:

```
help walk
```

will produce the following output:

```
walk - Initiate a display of the local or a remote SMT MIB space.
```

```
usage: walk [ -c ] [ mac_address ]
```

where:

-c indicates that the SMT MIB display should be continuous until terminated from the keyboard.

mac\_address is a 48-bit MAC address of a device on your local FDDI ring. This address may be entered in MSB or IEEE canonical format.

When used without arguments, 'walk' will retrieve and display each attribute in the local SMT MIB space one time. If the '-c' flag is used, 'walk' will step through the SMT MIB space continuously. Pressing any key will pause the display. When the display is paused, entering 'q' will terminate the display. If you provide a MAC address, 'walk' will retrieve the SMT MIB from the specified device. You may not use a broadcast address for this option.

## See Also:

**list**

# ifconfig

## Description:

Display and modify the settings for the local internet protocol (IP) interface.

## Syntax:

```
ifconfig [ -i ip_address ] [ -s subnet_mask ] [ -m mtu_size ]
```

where:

- i indicates that the current IP address should be changed.
- ip\_address is an IP address for use by the UDP/IP protocol stack. This is a standard 32-bit IP address, represented in dotted decimal notation, of the form a.b.c.d, where each component is an integer in the range 0 to 255. There are no restrictions on the class or content of this address.
- s indicates that the current subnetwork mask should be changed.
- subnet\_mask is the subnetwork mask used by the resident UDP/IP protocol stack. This mask is used to identify the subnetwork portion of the IP address. This is a standard 32-bit address mask, represented in dotted decimal notation, of the form a.b.c.d, where each component is an integer in the range 0 to 255.
- m indicates that the concentrator's maximum transmission unit (MTU) size limit should be changed.
- mtu\_size is the new maximum transmission unit size limit for the concentrator. This value should be an integer value, no larger than 4352. The maximum transmission unit size is an integer which represents the largest link layer control (LLC) frame that can be transmitted or received by the concentrator. The default MTU size for transmission of IP frames over FDDI is 4352 bytes. You may specify that the concentrator transmit smaller frames by reducing the MTU value.

## Notes:

- When invoked without arguments, the **ifconfig** command will display the current values for the IP address, the subnetwork mask, and the maximum transmission unit (MTU) size, in the formats described above.
- When invoked with the -i argument, the **ifconfig** command will set the IP address to the specified value and then restart the concentrator. The new IP address must be provided in the format described above. Note that no error checking is performed on the IP address that is provided.
- As shipped, the M400 FDDI concentrator has an IP address of 0.0.0.0 (null). There are two ways in which this address might be changed:
  - a) If its IP address is null, the concentrator will automatically request an address from the network using BOOTP or the reverse address resolution protocol (RARP). Both protocols will alternate their attempts to assign an IP address. If successful, BOOTP will also assign a subnetwork mask.
  - b) You may use the **ifconfig** command to set the IP address directly.
- BOOTP and RARP will run only if the IP address is null and will not overwrite an existing, non-null address. If you want to use BOOTP or RARP to obtain an IP address, but your IP address is not null, you may use the **ifconfig** function to set the IP address to null. This will cause the concentrator software to request an IP address from the network automatically.

- While its IP address is null, the concentrator will not provide network or transport layer services, with the exception of BOOTP and RARP. This means that the SNMP agent will not be able to respond to network requests. The IP address must have a non-null value in order for this higher-layer protocol software to function.
- The subnetwork mask is used by the UDP/IP protocol stack to identify in more detail the format of the IP address (i.e., which portion of the host address is the subnetwork component and which portion is the host identifier). As shipped, the M400 FDDI concentrator has a subnetwork mask of 0.0.0.0 (null). The **ifconfig** function and the BOOTP protocol are the only ways to change the subnetwork mask<sup>7</sup>.
- The maximum transmission unit (MTU) size governs the maximum size packet that the concentrator can receive and that the concentrator will transmit. The default value is 4352 bytes, which, according to RFC 1390 and the relevant ANSI standards, is the maximum size packet for an FDDI network. If you are managing the concentrator from an Ethernet or Token Ring subnetwork, you may want to set the MTU to a smaller value so that your network bridges or routers can pass the response frames from the concentrator to the management station without fragmentation.
- If the concentrator receives a packet that is larger than its current MTU, it will discard the frame and increment an error counter.
- The IP address, the subnetwork mask, and the MTU value are written into non-volatile storage and will be preserved across interruptions in concentrator service.
- Use of the **ifconfig** command to change any interface configuration information will cause a quick restart of the concentrator. After the diagnostic sequence is complete, you will be required to enter the current password before you can access the local management interface. Do not use the **ifconfig** command unless you know the current password.

### Output:

When used without arguments, the **ifconfig** command will display output in the following format:

```
IP address: 193.12.0.4
Subnet mask: 255.255.255.0
Maximum transmission unit (MTU): 4352
```

When used with any argument, you will see the following prompt:

```
Enter 'y' to save these values and reinitialize the concentrator:
```

Enter 'Y' to save the new IP options and restart the concentrator. If you enter anything else, the new information will not be saved and the concentrator will not be restarted.

---

<sup>7</sup> If you specify an IP address, but no subnetwork mask, the concentrator will attempt to obtain a subnetwork mask using ICMP frame services.

**Examples:**

```
ifconfig
```

will display the current IP address, subnetwork mask, and MTU size.

```
ifconfig -i 193.12.0.4
```

will change the IP address to the address provided and will restart the concentrator.

```
ifconfig -s 255.255.255.0 -m 1496
```

will change the subnetwork mask to be 255.255.255.0, will change the maximum transmission unit size to 1496 bytes, and will restart the concentrator.

**See Also:**

**snmpconfig**

**status**

**system**

## **list**

### **Description:**

List the names of the local management interface commands.

### **Syntax:**

**list**

### **Notes:**

- The **list** command provides a list of all of the local management interface commands.
- Use the **help** command to obtain more information about the syntax and behavior of each command.

### **Output:**

The **list** command provides a list of all of the local management interface commands.

```
address, alias, arp, configure, diagnostics, exit, frconfig, get,  
help, ifconfig, list, messages, passwd, ping, route, set,  
snmpget, snmpgetnext, snmpset, snmpwalk, status, system, walk
```

### **See Also:**

**help**

# messages

## Description:

Enable or disable the display of asynchronous messages to the local interface console.

## Syntax:

**messages** [ on | off ]

where:

- on indicates that the display of messages to the console should be enabled.
- off indicates that the display of messages to the console should be disabled.

## Notes:

- From time to time, the resident software on the concentrator will detect events and conditions that might be of interest to a local administrator. The local interface will display this information on the attached terminal console as it occurs. The **messages** command controls the display of this information.
- When used without arguments, the **messages** command shows the current status of message display (i.e., whether it is on or off) as well as the nine most recent messages generated by the concentrator software.
- Use the **on** option to enable the display of these messages to the console. This is the *default* setting of the **messages** command.
- When message display is enabled, current commands will not be interrupted. Messages are buffered until the local interface is idle.
- When active, messages will be displayed on the system console at a maximum rate of one message per second, even if the events and conditions occur more rapidly.
- Messages will be displayed even if there is no local management interface session active. In other words, even if you use the **exit** command and terminate the current session, messages will be displayed to the console if they are enabled.
- The following events and conditions are displayed on the terminal:
  - ⇒ **Boot image burned in Flash.** This message is generated when a new software release is successfully burned into the concentrator's Flash memory.
  - ⇒ **Boot image downloaded.** This message is generated when a new software image is successfully downloaded to the concentrator via the trivial file transfer protocol (TFTP).
  - ⇒ **Boot image not downloaded.** This message is generated when TFTP attempted and failed to download a new software image to the concentrator.
  - ⇒ **Downstream neighbor change.** A change in the identity of the downstream neighbor. This indicates a network configuration change. The new MAC address is displayed.
  - ⇒ **Duplicate address detected.** This message indicates that the address of the concentrator MAC is duplicated on the network. When this happens in a manner that prevents the ring from becoming operational, the concentrator will issue a disconnect and leave the network.
  - ⇒ **Duplicate address resolved.** This message indicates that the duplicate MAC address condition previously reported has now been resolved.
  - ⇒ **Faulty resource.** Detection of a faulty resource inside the concentrator. This will be a port, a path, or the MAC. Faulty resources are detected during diagnostics and during path test. Faulty resources are always disabled. If possible, the concentrator will continue operation.
  - ⇒ **Flash operation failure.** This message indicates that the concentrator failed to load the new software release into its Flash memory during an update.
  - ⇒ **IP address change.** This message will be generated when the IP address is changed via the reverse address

resolution protocol (RARP) or BOOTP, or is loaded from nonvolatile storage. The new IP address is indicated.

- ⇒ **Link disconnected.** This message is generated when a link experiences a sufficient number of bit errors to indicate that the quality of the connection is very poor and the link has been disconnected. The value of LER-Cutoff controls this event.
  - ⇒ **Marginal link detected.** This message will be generated when a sufficient number of bit errors is detected on a connection to indicate that the quality of the connection is marginal. The value of LER-Alarm controls the detection of this condition.
  - ⇒ **Marginal link improved.** This message will be generated when a link that was marginal has operated long enough and with a sufficiently low number of bit errors that the quality of the connection can be considered good. The value of LER-Alarm controls the detection of this condition.
  - ⇒ **Path test executed.** A path test is executed as the result of a stuck beacon condition on the ring. A path test is similar to the internal diagnostic tests. This message indicates that a path test has been run and what the results of the test are. Frequent path tests indicate that you probably have a faulty MAC somewhere on your ring.
  - ⇒ **Port link confidence test failure.** While initiating a connection, a port tests the quality of the link to its neighbor. If too many bit errors are detected during this test, the connection will not be allowed and this message will be generated.
  - ⇒ **Port withheld.** This message indicates that a port to port connection was withheld. The reason for withholding the connection is also shown.
  - ⇒ **Ring instability detected.** This message indicates that the ring is unstable: it is either oscillating between operational and non-operational or it is oscillating between the claim process and the beacon process. This event has many possible causes, from an unresolved duplicate address condition to faulty hardware to a loose port connection. For more information, see section 3. *Monitoring Your FDDI Network* on page 16.
  - ⇒ **Stuck beacon condition.** This message indicates that a MAC on your local FDDI ring is stuck in the beacon state. Such an occurrence is usually caused by a logical (not physical) interruption in the integrity of the ring. The message will display the address of the MAC that is stuck beconing.
  - ⇒ **Stuck bypass.** This message indicates that the optical bypass is stuck and cannot disengage. A stuck bypass prevents the A and B ports from connecting to other FDDI devices.
  - ⇒ **Trace event.** This message indicates that the concentrator was involved in a trace event. Trace is an SMT protocol used to resolve stuck beacon conditions. This message will tell you whether the trace was initiated, propagated, terminated, or timed-out on the concentrator so that you may gauge the concentrator's level of involvement in the problem. For more information, see section 3. *Monitoring Your FDDI Network* on page 16.
  - ⇒ **Upstream neighbor change.** A change in the identity of the upstream neighbor. This indicates a network configuration change. The new MAC address is displayed.
- Use the **off** option to disable the display of asynchronous messages.
  - Each message is displayed with a time-stamp indicating when it was reported. This time-stamp indicates the amount of time that has passed since the concentrator was started. The units displayed here are:
    - days:hours:minutes:seconds
  - Use the **status** command to display the current value of this timer.
  - Messages are *not* written to non-volatile storage and therefore are *not* preserved across interruptions in concentrator operation.
  - The downstream neighbor change and upstream neighbor change events include information about the new MAC address. This address can appear in MSB or IEEE canonical order. It may also appear in raw, hexadecimal format or with a company alias substituted for the first three octets of the address. The format of this MAC address is governed by the **address** command. Note that the format of the address is determined at the time the message is generated.

## Output:

```
012:22:20:04 Duplicate address detected. DISCONNECTING FROM THE NETWORK.
```

indicates that the address of the MAC is duplicated on the network in a manner that prevents correct operation of the network. Since the FDDI MAC protocols assume unique addresses, the concentrator will issue a disconnect request and will leave the ring. You should not reconnect your concentrator until you have resolved the duplicate address condition.

005:22:20:04 Marginal link detected. Port 3 has LER estimate of  $10^{-8}$ .

indicates that the link connecting port 3 to its neighbor has experienced a sufficient number of bit errors to calculate the link error rate (LER) at  $10^{-8}$ . Although the link has not been disconnected, its quality is low enough to warrant further attention.

006:07:20:10 Marginal link improved. Port 3 has LER estimate of  $10^{-9}$ .

indicates that the quality of a link previously marked as marginal has improved and that the quality of the connection is no longer in doubt.

012:14:20:04 Port 4 connection withheld: Illegal M-M connection.

indicates that the connection on port 4 has been withheld because it is an illegal M-to-M connection.

010:22:20:11 Port 1 connection withheld: Requested paths are unavailable.

indicates that the connection on port 1 has been withheld by the concentrator because the requested internal paths are not available at this time.

011:05:20:02 Port 3 connection withheld: By neighboring port.

indicates that the neighboring station has withheld the connection on port 3.

011:30:20:03 Upstream neighbor changed to 0003 b901 2a09.

indicates that the upstream neighbor has changed and that the MAC address of the new neighbor is 0003 b901 2a09. Although the address in this example is shown in MSB format, MAC address information can appear in IEEE canonical format as well. See sections *B.5. Format of MAC Address Values — Bit Order* on page 45 and *B.6. Format of MAC Address Values — OUI vs. Company Name* on page 45 for more information.

### Examples:

`messages`

shows the current status of message display and the nine most recent messages.

`messages on`

enables the display of asynchronous messages to the local management interface console.

`messages off`

disables the display of asynchronous messages to the local management interface console.

### See Also:

**address**

**status**

# monitor

## Description:

Display utilization or stability information about the local FDDI ring.

## Syntax:

**monitor** [ -c ] { stability | utilization }

where:

- c indicates that information about the FDDI ring should be displayed continuously until terminated from the keyboard.
- stability indicates that data describing the number and frequency of Ring\_Op changes since the monitor was started should be displayed.
- utilization indicates that ring utilization, ring latency, and ring token rotation time should be displayed.

## Notes:

- The **stability** option displays the following pieces of information:
  - How long the monitor command has been running.
  - The number of Ring\_Op changes since the monitor has been running.
  - The average number of seconds per Ring\_Op change since the monitor began.
- Use this option if you suspect that your ring is not stable.
- The **utilization** option displays the following pieces of information:
  - Percent utilization of ring bandwidth.
  - The token rotation time as measured in microseconds.
  - The ring latency as measured in microseconds.
  - The current value of the T-Negotiated timer.
- Use this option if you would like to determine the current propagation delay, token rotation time, or utilization of the local FDDI ring.
- Use the -c option to display time or utilization information continuously.
- You may pause the display by pressing any key. When the display is paused, you may restart it by pressing any key or terminate it by pressing 'q'.

## Output:

The **monitor -c stability** command produces output in the following format:

```
Time: 00:00:00:09   Ring_Ops:      2   Avg (Time/Ring_Op): 00:00:00:04
Time: 00:00:00:10   Ring_Ops:      2   Avg (Time/Ring_Op): 00:00:00:05
Time: 00:00:00:11   Ring_Ops:      2   Avg (Time/Ring_Op): 00:00:00:05
Time: 00:00:00:12   Ring_Ops:      2   Avg (Time/Ring_Op): 00:00:00:06
Time: 00:00:00:13   Ring_Ops:      3   Avg (Time/Ring_Op): 00:00:00:04
Time: 00:00:00:14   Ring_Ops:      4   Avg (Time/Ring_Op): 00:00:00:03
Time: 00:00:00:15   Ring_Ops:      4   Avg (Time/Ring_Op): 00:00:00:03
Time: 00:00:00:16   Ring_Ops:      4   Avg (Time/Ring_Op): 00:00:00:04
Time: 00:00:00:17   Ring_Ops:      4   Avg (Time/Ring_Op): 00:00:00:04
```

- The first column (“Time”) indicates how long the monitor has been running. The format of this field is:

days:hours:minutes:seconds

- The second column (“Ring\_Ops”) indicates how many times the ring has changed state (from non-operational to operational, or from operational to non-operational) since the monitor has been running. These Ring\_Op transitions are frequently referred to as ring “bounces”. If your ring has not bounced since you started the monitor, this number will be zero. The **status** command shows how often the ring has bounced since the concentrator was last reset.
- The third column (“Avg (Time/Ring\_Op)”) is the average frequency with which your ring changes state since the monitor has been running. If your ring is operational and has not bounced since you started the monitor, then this field will have a value of “Stable”. If your ring is non-operational and has not become active since you started the monitor, then this field will have a value of “Non-Op”.
- The number in this column describes the average uptime of your ring while the monitor has been active. If this number is increasing over time, then your ring is becoming increasingly stable. If this number is decreasing over time, then your ring is bouncing and becoming increasingly unstable. If this number is relatively stable over time, then your ring bounces regularly with the specified frequency. The format of this field is:

days:hours:minutes:seconds

The **monitor -c utilization** command produces something like the following output:

```
Utilization: 0.5%   TRT: 7.9 us   Latency: 7.8 us   T_Neg: 15.0 ms
Utilization: 0.0%   TRT: 7.9 us   Latency: 7.9 us   T_Neg: 15.0 ms
Utilization: 1.0%   TRT: 7.9 us   Latency: 7.8 us   T_Neg: 15.0 ms
Utilization: 0.0%   TRT: 7.9 us   Latency: 7.9 us   T_Neg: 15.0 ms
Utilization: 0.0%   TRT: 7.9 us   Latency: 7.9 us   T_Neg: 15.0 ms
Utilization: 0.0%   TRT: 7.9 us   Latency: 7.9 us   T_Neg: 15.0 ms
Utilization: 0.9%   TRT: 7.9 us   Latency: 7.8 us   T_Neg: 15.0 ms
```

- The first column (“Utilization”) represents the current utilization estimate for the FDDI ring.
- The second column (“TRT”) represents the current token rotation time for the FDDI ring. This data is displayed in microseconds.
- The third column (“Latency”) represents the propagation delay for the FDDI ring. This is the amount of time it will take for data to traverse the entire ring in the absence of errors or configuration changes. This data is displayed in microseconds.
- The fourth column (“T\_Neg”) is the negotiated token holding time for the ring. This time is negotiated by all of the MACs on the ring during the claim process, with the lowest value winning. This data is displayed in milliseconds.

Network utilization is simply the difference between network latency and actual token rotation time. Token rotation time is a function of three variables: the network propagation delay (the network latency), the negotiated token holding time (“T\_Neg”), and the amount of time that stations actually hold the token. Since propagation delay and T\_Neg change relatively infrequently, the token rotation time generally varies with the time that stations actually hold the token. Since this is a function of network load, there is a correlation between token rotation time and network utilization.

Note that latency will vary, even on stable network configurations. The port’s elasticity buffers will periodically insert Idle symbols into the data stream (between frames) to even it out. The variance of the network latency will depend on the number of FDDI ports on your network.

### Examples:

In order to monitor the stability of your FDDI ring continuously, use the following command:

```
monitor -c stability
```

In order to see a current utilization estimate for your FDDI network, use the following command:

```
monitor utilization
```

**See Also:**

**status**

# passwd

## Description:

Change the password protecting access to the local management interface.

**The Interphase FDDI M400 ships without a password. To enter a password, see *Output*.**

## Syntax:

**passwd**

## Notes:

- This command will change the password that protects the local management interface. If you are concerned about security, then you should change the password immediately after unpacking, installing, and initializing your concentrator. All M400 FDDI concentrators are shipped with no password.
- Use of this command requires that you know the current password before the new password can be entered. The current password will not be echoed to the screen as you enter it.
- When you use this command, you will be asked to enter the new password twice so that it may be checked for correctness. The new password will not be echoed to the screen as you enter it. You may enter a password containing up to 31 characters.
- Although the M400 ships with a null password, you cannot create a null password. All passwords you create must contain at least three non-blank characters.
- The password information is written into non-volatile storage and will be preserved across interruptions in concentrator service.
- The password information is *not* affected by the **system reset** or the **system defaults** command.

## Output:

When you use the **passwd** command for the first time, you see the following output:

```
Enter old password: <Press Enter.>
Enter new password: <Enter the new password here.>
Enter new password again: <Enter the new password again.>
The password has been changed.
```

When you use the **passwd** command subsequently, you see the following output:

```
Enter old password: <Enter the old password here.>
Enter new password: <Enter the new password here.>
Enter new password again: <Enter the new password again.>
The password has been changed.
```

If you enter the new password incorrectly, you will see the following message:

```
The two passwords do not match. Please try again.
```

If you enter an incorrect password when attempting to access the local interface, you will see the following message:

```
Invalid password. Access denied.
```

## See Also:

**exit**

# ping

## Description:

Send ICMP echo request frames to other IP hosts.

## Syntax:

```
ping [ -c ] ip_address [ size ]
```

where:

- c indicates that the transmission of echo requests should be continuous. When you use the -c flag, **ping** will transmit echo frames to the specified host continuously. Pressing any key will pause the display. Pressing 'q' will stop the display when it is paused.
- ip\_address is a standard 32-bit IP address, represented in dotted decimal notation, of the form a.b.c.d, where each component is an integer between 0 and 255. If you have created a mapping in the alias table between the IP address and an alphanumeric identifier, then you may use the identifier here instead.
- size is the size of the information field in the outgoing ICMP echo request frame. If you do not specify a value, then an information field of 64 bytes will be used. You may specify a value up to 4300 bytes.

## Notes:

- Use the **ping** command to verify connectivity to other IP systems after you have completed set up of the IP interface characteristics and the alias, ARP, and routing tables.
- When you use the -c option, **ping** will transmit echo frames to the specified host continuously. It will report the reception of each response during the test. Press any key to pause the test. Pressing 'q' will terminate the test when it is paused.
- If you do not specify a size, **ping** will transmit an echo request with an information field size of 64 bytes. You may specify any alternate information field size you wish, up to 4300 bytes. If you specify an ICMP information field size larger than your current MTU size, the IP layer will fragment the outgoing frame.
- The **ping** command uses a default time-out of 1 second. If the target station does not respond to the echo request within 1 second, **ping** will transmit another echo request (if the -c option is used) or will terminate.

## Output:

When used to transmit a single echo request, the **ping** command will report whether the specified IP host is alive or not.

```
europa is alive
```

When used to transmit a series of echo requests, the **ping** command will report each received response frame. When the display is terminated, ping will report the percentage of ICMP echo frames that were not returned by the specified host. For example,

```
1408 octets from 193.0.0.2: icmp_seq 0
1408 octets from 193.0.0.2: icmp_seq 1
1408 octets from 193.0.0.2: icmp_seq 2
1408 octets from 193.0.0.2: icmp_seq 4
1408 octets from 193.0.0.2: icmp_seq 5
1408 octets from 193.0.0.2: icmp_seq 6
1408 octets from 193.0.0.2: icmp_seq 7
```

Press 'q' to quit, or any other key to continue  
received 7/8 packets (13% loss)

### **Examples:**

```
ping 193.12.0.4
```

will transmit one ICMP echo request frame to the IP address 193.12.0.4 and will report any successful response.

```
ping -c europa 1400
```

will continuously send ICMP echo request frames with an information field size of 1400 bytes to the IP address represented by “europa” in the alias table. Transmission of these frames will continue until it is paused from the keyboard.

### **See Also:**

**alias**

**arp**

**ifconfig**

**route**

# ringmap

## Description:

Display a logical map of the local FDDI ring.

## Syntax:

```
ringmap [ -c ] [ -o | -v ]
```

where:

- c causes the ring map display to repeat continuously until terminated from the keyboard.
- o displays the previously generated ring map only. With this option, a new map will not be created.
- v is the verbose option. With this option, any inconsistencies with the map data detected by the mapping algorithm are reported to the terminal.

## Notes:

- This command is used to generate and display a logical map of the local FDDI ring. A logical ring map is an ordered list of the MACs on the ring as they appear in token order.
- When used without the -o option, this command will gather neighbor information from the local network stations and display a new, logical map of the local FDDI ring.
- Use the -o option to display a previously generated map without building a new one. This option is useful if your network configuration changed and you wish to examine the previous configuration.

**Note:** Only one map is stored at any time. If you build a new ring map (i.e., use the **ringmap** command without the -o option), the previous map will be replaced with the new one.

- Use the -c option to generate and display a map continuously. If you don't use the -o option, then a new map is generated each time. This is a good way to monitor changes to your network configuration.
- You may pause the map display by pressing any key. When the display is paused, you may restart it by pressing any key or terminate it by pressing 'q'.
- Use the -v option to check for inconsistencies in the connection information reported by the stations on your FDDI ring. When you use the verbose option, any inconsistencies detected by the mapping algorithm will be displayed. The mapping algorithm will report four types of map inconsistencies:

**Unknown upstream neighbor address.** A station on the ring is reporting an upstream neighbor address (UNA) of "Unknown". If this condition persists, it indicates one of three problems: 1) that the station reporting the unknown UNA is unable to receive frames properly, 2) that the station's upstream neighbor is unable to transmit frames properly, or 3) that there is a problem with the network that prevents frame transmission and reception generally. A persistent unknown UNA always indicates a problem.

**Unknown downstream neighbor address.** A station on the ring is reporting a downstream neighbor address (DNA) of "Unknown". This is not necessarily a problem. Maintaining the downstream neighbor address is optional for versions of SMT prior to 7.3. If a station that is running SMT 7.3 reports an unknown DNA persistently, then it indicates that the station's downstream neighbor has possibly entered a state in which it is unable to transmit and/or receive frames reliably.

**Inconsistent upstream and downstream neighbor information.** This message is generated when two distinct stations are reporting upstream neighbor address (UNA) and downstream neighbor address (DNA) data that are inconsistent. This is usually a transient condition that is caused by changes in the network configuration. However, if this condition persists, you should check that the stations reporting inconsistent information are still able to transmit and receive frames correctly.

**Station not responding.** This message is generated when a station, reported as the upstream or downstream neighbor of an active station on the ring, fails to respond during map generation. This condition typically occurs when a station leaves the ring and a map is generated before the remaining devices update their neighbor information. However, if this problem persists, it may indicate that the missing station is overburdened and unable to respond to network requests.

- From time to time, the mapping algorithm will encounter a “hole” in the network map. A hole is a piece of missing information in the data that describes the token flow. This missing piece of information may be caused by a station that recently left the ring or a station that failed to respond to the network query sent out by the **ringmap** command.
- The mapping algorithm will handle these holes in one of two ways:
  1. If there is sufficient information to identify the station that did not respond to the query, the mapping algorithm will insert the **missing station** and will place a question mark (“?”) next to the MAC address to indicate that the placement and existence of the station are questionable. If the -v option is also used, the mapping algorithm will display a message that the station in question did not respond.
  2. If there is not sufficient information to determine how the hole should be filled, the mapping algorithm will create a **place holder station** for the hole. A place holder map entry uses a MAC address that is composed of question marks (e.g., “?:?:?:?:?:?”). Note that a place holder station indicates that *zero or more* actual FDDI devices may occupy that location in the network map.
- The **ringmap** command will map the local FDDI ring only. It will not map stations that are located on the other side of a bridge, switch, router, or gateway.
- The **ringmap** command will display up to 96 stations on an individual FDDI ring.

## Output:

When you build and display a new ring map, you will see something like the following output:

```
Building new ringmap
.....
Ringmap complete. 7 MACs responded and 1 MAC inferred.

                =[Iphase 00:20:50]= (W)      NPI 01:b0:20
[Iphase 00:20:70]                               3Com 2c:01:33
Cres 02:2c:18 (L)                               Madge 03:47:9c (F)
                S&K 00:1e:24 (?)              =[Iphase 00:20:b0]= (W)
```

There is a great deal of information in this map display:

- **Station Order.** MAC addresses are displayed **clockwise**, in token order. If you start with Interphase 00:20:50, then the NPI MAC is the next MAC downstream, followed by the 3Com station, followed by the Madge station, etc.
- **First Station.** The left-most station listed on the first line of the map is always the Interphase concentrator/FDDI Monitor station that constructed the ring map.
- **Brackets.** An item that is enclosed by brackets (for example, [Iphase 00:20:70]) is a concen-

trator. An item without brackets is something other than a concentrator (e.g., an adapter card, a bridge, a router, a management station, etc.).

- **Equal Signs.** An item that is enclosed by equal signs (e.g., =[Iphase 00:20:b0]=) is on the dual ring. It is either 1) a dual-attached device with an A or B port active in a peer connection or 2) a single-attached device whose S port is active in a peer connection.
- **Error Flags.** The ring map will automatically identify problems or potential problems with stations on the local FDDI ring. It does this by displaying error flags in parentheses and to the right of map entries. There are six error conditions that the map will report:
  - ? Unknown station. This flag is set when the station with the MAC address did not respond to the map network query and when there is sufficient information for the mapping algorithm to infer that the station exists in a specific map location.
  - D Duplicate MAC address. This flag is set when the MAC address is duplicated on the local FDDI ring. You may or may not see the duplicate in the ring map.
  - F Frame error condition. This flag is set when there is an increase in Frame Lost Count or Frame Error Count for a given device during map construction.
  - L LER Condition. This flag is set when the reported link error rate (LER) estimate is less than or equal to PortLER-Cutoff for any port on a device.
  - T Twisted ring. This flag is set when an active A-to-A and/or B-to-B connection is present on a device. A twisted ring condition may cause a loss of connectivity between stations on your local FDDI ring.
  - W Peer wrap condition. This flag is set only when a station is on the dual ring and is also wrapped. It indicates that your dual ring is wrapped. This flag will not be set for devices connected to the ring directly through a concentrator.
- Many of these flags will also appear on the relevant portions of the **view** command output.
- **Unknown station.** When the ring mapping algorithm encounters a hole in the network map that cannot be filled from the available data, it will create a place holder map entry. This entry will have a MAC address composed entirely of question marks (e.g., "?:?:?:?:?:?:?"). It indicates that zero or more FDDI devices occupy that portion of the network map.

When you use the -o option, you will also receive an indication of how long ago the ring map was generated:

```
The ringmap was generated 2 hours ago.
      =[Iphase 00:20:50]= (W)      NPI 01:b0:20
      [Iphase 00:20:70]          3Com 2c:01:33
      Cres 02:2c:18 (L)        Madge 03:47:9c (F)
      S&K 00:1e:24 (?)         =[Iphase 00:20:b0]= (W)
```

## Examples:

In order to generate a new ring map, use the following command:

```
ringmap
```

In order to view the previously generated ring map, use the following command:

```
ringmap -o
```

In order to generate new ring maps continuously and to have the mapping algorithm report all inconsistencies generated, use the following command:

```
ringmap -c -v
```

**See Also:**

**monitor**  
**status**  
**view**

# route

## Description:

Display or modify the internet protocol (IP) routing table.

## Syntax:

```
route [ -d ] [ ip_address ]
```

```
route ip_address gateway mask metric
```

where:

- d indicates that some portion of the routing table should be deleted. If you provide an IP address with the -d option, then only the associated entry in the routing table will be deleted. If you use the -d option without arguments, the entire routing table will be deleted.
- ip\_address is an IP address associated with a specific network or host. This is a standard, 32-bit address, represented in dotted decimal notation, of the form a.b.c.d, where each component is an integer between 0 and 255.
- gateway is the IP address of the device that acts as the gateway between the current network and the specified network or host. This is a standard 32-bit address mask, represented in dotted decimal notation, of the form a.b.c.d, where each component is an integer between 0 and 255.
- mask is the network mask associated with the destination. This is a standard 32-bit address mask, represented in dotted decimal notation, of the form a.b.c.d, where each component is an integer between 0 and 255.
- metric is an integer value representing the “cost” associated with using the associated network gateway. The metric argument indicates the number of hops to the destination. It must be zero if the destination is on a directly-attached network, and non-zero if the route utilizes one or more gateways.

## Notes:

- The **route** command is used to manipulate the IP routing table. You need to set up the routing table only if you want to manage the M400 FDDI concentrator from a different IP network (i.e., there is an IP router between the concentrator and the network management station) using SNMP. Make sure the IP address has been initialized.

**Note:** Generally, you should not modify the IP routing table unless you are the network administrator and are familiar with the operation of IP protocols.

- The **route** command does three things. You can use it to:
  - Display the current routing table,
  - Delete an entry from the current routing table,
  - Add an entry to the current routing table.
- When used without any arguments, the **route** command displays the entire routing table. If you specify an IP address, you will see only the applicable entry from the routing table.
- If you want to delete an entry from the routing table, use the -d option. When used with an IP address, this option causes the associated entry to be deleted from the routing table. When used without an IP address, the -d option causes all entries in the routing table to be deleted. If you have provided a mapping between the IP address and an alphanumeric identifier in the alias table, then you may use the identifier here instead of the IP address.

- If you want to add an entry to the routing table, specify the address of the host or network, the gateway used to reach the destination, the network mask, and the metric.
- If you create a routing table entry with an IP address of 0.0.0.0 (null), this will be used as the permanent default gateway route.

**Note:** During initialization, IP will add a local host entry to the routing table automatically. This will have IP address 127.0.0.1. You should not remove this table entry.

**Note:** When you specify an IP address for the concentrator or when one is assigned by BOOTP or an RARP server, several entries will be created in the routing table automatically. These are permanent entries relating to the local host, local subnetwork, and local broadcast. They should not be deleted.

- Routing table entries are stored in non-volatile RAM and are preserved across interruptions in concentrator service. However, there is no default value for the routing table. Therefore, if you return the concentrator to its factory default settings, your routing table entries will be deleted.

### Output:

When you use the **route** command to display the entire routing table, you will see something like the following output:

Address	Gateway	Mask	Metric	TTL	RefCt	UseCt
127.0.0.1	127.0.0.1	255.255.255.255	0	-	1	0
local_all	m400	255.255.255.255	0	-	1	0
193.0.0.0	m400	255.255.255.255	0	-	1	0
m400	m400	255.255.255.255	0	-	1	52
193.0.0.0	m400	255.255.255.0	0	-	1	1106
0.0.0.0	193.12.0.4	255.255.255.0	0	-	1	0

where:

- The first column represents a target host or network address.
- The second column is the IP address of the gateway to be used to reach the specified host or network.
- The third column is the network mask for the associated entry.
- The fourth column describes the cost in hops of using the specified gateway.
- The fifth column is the time to live for the associated routing table entry as measured in seconds. For routing table entries that are permanent, this field will display a “-”. The default time to live for non-permanent fields is 180 seconds (3 minutes).
- The sixth column number of routing processes currently using this entry.
- The last column lists the number of packets that have been sent along this route.

In addition, the entry with the null IP address (0.0.0.0) represents the permanent default gateway route.

## Examples:

- In order to display the routing table entry associated with network 193.12.0.4, use the following command:

```
route 193.12.0.4
```

- In order to delete the entire routing table, use the following command:

```
route -d
```

- In order to add routing information for a new, adjacent subnetwork through a known gateway (“europa”, from the alias table), use the following command:

```
route 193.10.0.0 europa 255.255.255.0 1
```

## See Also:

**alias**

**arp**

**ifconfig**

**ping**

## set

### Description:

Change a value in the FDDI SMT MIB.

### Syntax:

```
set { parameter_id | parameter_name } [ index ] new_value
```

where:

parameter\_id

is the two-octet SMT parameter identifier for a specific MIB attribute. A list of these is provided in *Appendix C: MIB Reference* on page 114. The SMT identifier is usually entered in hexadecimal format, preceded by a '0x'.

parameter\_name

is an alternative to the numeric parameter\_id. You may enter the name of the MIB variable instead. A list of parameter names is provided in *Appendix C: MIB Reference* on page 114. Remember that names may be entered in upper or lower case.

index

is the index of the associated object, where appropriate.

There are four objects in the SMT MIB: SMT, MAC, Path, and Port. When you change the value of one of these objects, the parser must be able to determine which instance of the object applies. The M400 FDDI concentrator has one (1) SMT instance, one (1) MAC instance, two (2) Path instances, and either four (4) or eight (8) Port instances. Therefore, you must omit the index argument for the SMT and MAC objects and you must provide the index argument for the Path and Port objects.

new\_value

is the new value that the attribute should take. See the MIB reference in *Appendix C: MIB Reference* on page 114 for a description of the encodings and semantics of each MIB attribute.

### Notes:

- You should use the **set** command when you want to change specific concentrator behavior. Only attributes whose access is listed in *Appendix C: MIB Reference* on page 114 as read-write may be changed using the **set** command.
- Actions, specifically SMTStationAction (0x103C) and PORTAction (0x4046), are write-only MIB attributes. Setting these attributes to the values specified causes the concentrator to take the associated actions.
- SMT parameter identifiers are most easily entered in hexadecimal format and should be preceded by a '0x' to inform the parser that the value is hexadecimal.
- The new\_value parameter can have a variety of formats. See the "Encoded as" sections of the entries in *Appendix C: MIB Reference* on page 114 for more information about the data format that SMT expects. Generally, you must enter the new value as the SMT MIB would expect to receive it. For example,
  - Bitmaps must be entered as the integer equivalent of the value.
  - Flags must be entered as 1 (true) or 0 (false).
  - Timer values (such as PATHMaxT-Req and SMTTrace-MaxExpiration) may be entered in decimal format and measured in nanoseconds, milliseconds, or seconds. Simply enter the desired numeric value followed by ns., ms., or s.

- Strings need not be enclosed by single or double quotes. However, if you want to enter a null string, you must use double quotes (i.e., "").
- Many of the writable attributes in the MIB have ranges of valid values. See the “Description” sections of the entries in *Appendix C: MIB Reference* on page 114 for more information about valid attribute ranges.
- When you provide a parameter name as the first argument to the **set** command, the command parser will use its partial match capability to find the argument that best matches the fragment provided. Therefore,
 

```
set ler-cutoff 2 6
```
- will change the current value of PORTLER-Cutoff for port number 2 to be 6.
- The index argument is not used for attributes from the SMT object or attributes from the MAC object. However, the index argument must be provided for changes to Path and Port attributes. Failure to provide an index will result in an appropriate error message. Indices always start with one (1).

### Output:

If your set request is successful, you will see no output from the **set** command. The only output that the **set** command generates consists of error messages.

### Examples:

In order to change the value of T-Req for your concentrator to 80 ms., use the following command<sup>8</sup>:

```
set pathmaxt-req 1 80 ms.
```

In order to change the value of T-Notify so that SMT will transmit NIF frames every 10 seconds, use the following command:

```
set t-notify 10
```

In order to move your MAC to the secondary path, use the following command<sup>9</sup>:

```
set macrequestedpaths 0x03
```

In order to disable the status reporting protocol, use the following command:

```
set statrptpolicy 0
```

### See Also:

**configure**  
**get**  
**status**  
**walk**

Appendix C: MIB Reference

---

<sup>8</sup>. The T-Req parameter is not directly manipulable through the MIB. In order to change T-Req, you must lower its ceiling value of PATHMaxT-Req. This example assumes that your MAC is currently located on the primary path.

<sup>9</sup>. This will change the requested paths value such that the secondary path, rather than the primary path, is requested. SMT will note the change and move the MAC automatically. Note that, even though this attribute is a bitmap, an integer value is given. An easier way to do this is with the **configure** command.

# snmpconfig

## Description:

Configure the behavior of the SNMP frame services.

## Syntax:

```
snmpconfig [ -s { on | off } ] [ -c string ] [ -t ip_address ]
```

where:

- |            |  |
|------------|--|
| -s         | indicates that the acceptance of SNMP set requests should be changed.  |
| on         | indicates that SNMP set requests should now be accepted and parsed according to standard frame processing rules.   |
| off        | indicates that SNMP set requests should be unconditionally rejected.   |
| -c         | indicates that the SNMP community string should be changed.  |
| string     | is the new value to be used for the SNMP community string. This string must not contain any white spaces (e.g., spaces, tabs) and may be up to 20 characters long.   |
| -t         | indicates that the SNMP trap IP address should be changed.   |
| ip_address | is the new value for the IP address to which concentrator SNMP traps should be sent. This is a standard, 32-bit address, represented in dotted decimal notation, of the form a.b.c.d, where each component is an integer in the range 0 to 255. There is no restriction on the class or content of this address. |

## Notes:

- This command is used to do four things:
  - Display the current status of in-band SNMP set requests, the SNMP community string, and the SNMP trap address.
  - Enable and disable the acceptance of SNMP set requests.
  - Change the community string used by SNMP.
  - Change the IP address to which SNMP traps should be sent.
- The M400 FDDI concentrator is shipped with the following default settings:
  - SNMP set requests are unconditionally rejected.
  - The SNMP community string is “public”.
  - The SNMP trap IP address is not set (0.0.0.0).
- When used without arguments, the **snmpconfig** command will display the current status of in-band set requests, the current value of the SNMP community string, and the current SNMP trap IP address.
- Use the -s option to enable or disable SNMP set requests. When SNMP set requests are allowed, the concentrator will honor received set requests, provided that they are properly formatted and semantically correct. When SNMP set requests are disabled, the concentrator will unconditionally ignore all received set requests. You should disable SNMP set requests if you are concerned about security on your network or you want to prevent unauthorized changes to the concentrator MIB. This is the default setting for SNMP set requests.

**Note:** SNMP (as opposed to SNMPv2) provides no sophisticated authorization or authentication mechanisms for its get or set frames whatsoever. (The community string should not be used as an authorization password.) Therefore, when you allow the concentrator to honor SNMP set requests, you are giving network users that

understand SNMP frames and the SNMP MIB the capability to alter the behavior and configuration of the concentrator. If you are concerned about security, then it is prudent to deny SNMP set requests and restrict concentrator access to the local management interface.

- The frame configuration settings, SNMP community string, and SNMP trap address are stored in nonvolatile RAM and are saved across interruptions in concentrator service.

Note that any changes to the SNMP configuration settings will be erased if you use the system command to return the concentrator NVRAM to its factory default settings.

## Output:

When you use the **snmpconfig** command without arguments, you will see output similar to the following :

```
SNMP SETs are accepted, community string is [public].
The SNMP trap address is 193.12.0.22.
```

## Examples:

To cause the concentrator to reject SNMP set requests unconditionally, use the following command:

```
snmpconfig -s off
```

To cause the concentrator to accept SNMP set requests and to change the community string to be “accounting1”, use the following command:

```
snmpconfig -s on -c accounting1
```

To reset the SNMP community string to be “public”, use the following command:

```
snmpconfig -c public
```

To assign a null SNMP community string, use the following command:

```
snmpconfig -c ""
```

To set the SNMP trap address to 148.102.98.12, use the following command:

```
snmpconfig -t 148.102.98.12
```

To disable the transmission of SNMP traps, set the SNMP trap address to null by using the following command:

```
snmpconfig -t 0.0.0.0
```

## See Also:

**frconfig**  
**snmpset**

# snmpget

## Description:

Display a value from the resident SNMP MIBs.

## Syntax:

```
snmpget [ -c ] [ parameter.index ]
```

where:

- |           |   |
|-----------|---|
| -c        | indicates that the retrieval and display of the MIB value should be continuous. When you use the -c flag, the MIB value you requested will be displayed once per second until you stop the display. Pressing any key will pause the display. Pressing 'q' will stop the display when it is paused.  |
| parameter | is the alphanumeric name of an SNMP MIB object. See the "SNMP name" field of the entries in <i>Appendix C: MIB Reference</i> on page 114 for a list of SNMP object names. Remember that names may be entered in upper or lower case.  |
| index     | represents the index number(s) required to identify the specific object instance. This index number is appended to the parameter name with a period ("."). This argument is variable in size and may include more than one number. See the "SNMP name" field of the entries in <i>Appendix C: MIB Reference</i> on page 114 for a detailed description of SNMP object indexing. |

## Notes:

- You should use the **snmpget** command when you would like specific concentrator information that is unavailable through the **status** or **diagnostics** command.
- You may use the **snmpget** command to retrieve objects from the resident SNMP MIBs. The M400 FDDI concentrator supports the latest FDDI MIB (RFC 1512) and MIBII (RFC 1213). If you want to retrieve values from the SMT MIB, you should use the **get** or **walk** command.
- You may monitor the value of a MIB object by using the -c option. When you request continuous display, the value of the MIB object will be retrieved and displayed once per second until you press any key to pause the display. Once the display is paused, it may be terminated by pressing 'q'.
- The parameter argument includes the name of the SNMP object as well as its related instance number(s). You may enter the alphanumeric name of the object in upper or lower case. You may enter all or part of the name; the parser will use its partial match capability to locate the matching object. For example, the strings

```
fddimibPORTLerCutoff
portlercutoff
lercutoff
lercut
```

all refer to the same MIB object.

**Note:** There are textual differences between how SMT MIB attributes are named and how the corresponding SNMP MIB objects are named. Specifically, SNMP does not use hyphens (“-”) and its counter names end with “Cts” rather than “Ct”. See section *C.1. Differences Between SMT and SNMP* on page 114 for a detailed description of the differences between SMT and SNMP with regard to variable naming. For the purposes of this command, the SNMP naming conventions apply. You may also use the **snmpwalk** command to step through the MIB and see how the object instances are named.

- At least one number must be appended to the name of the object with a period (“.”). This represents the specific instance of the MIB object. The instance number part of the parameter argument is variable. See the “SNMP name” section of the entries in *Appendix C: MIB Reference* on page 114 for an explicit description of the name and index identification of SNMP MIB objects. As an example, the following command is used to access the value of PORTLerCutoff for the second port in the concentrator:

```
snmpget fddimibportlercutoff.1.2
```

- where the first number (.1) indicates that the first SMT instance should be used and the second number (.2) indicates that the value for the second port should be retrieved.
- Instance numbers always start with one. The lone exception is when an object can have one and only one instance. In this case, an index of zero is used. There are four of these objects in the FDDI SNMP MIB. They are listed in *Appendix C: MIB Reference* on page 114.
- In general:
  - SMT objects require that a “.1” be appended to the parameter name;
  - MAC objects require that a “.1.1” be appended to the parameter name;
  - Path objects have no standard form; and
  - Port objects require that a “.1.x” be appended to the parameter name, where x represents the number of the port.
- MAC addresses retrieved from the SNMP MIB via the **snmpget** command are always displayed in IEEE canonical format. The **address** command has no effect on the output of the **snmpget** command.
- When used without the parameter.index argument, the **snmpget** command will retrieve and display the last SNMP MIB object accessed.
- You may also use the **snmpwalk** command to step through the SMT MIB automatically.

## Output:

The information retrieved from the MIB has three component parts: the SNMP object name, the instance number, and the value. For example, in the following output:

```
fddimibPORTLerCutoff.1.2: 7
```

The first item, fddimibPORTLerCutoff, represents the full name of the MIB object.

The second item, .1.2, is the index of the object. The first digit (.1) indicates that the first (and only) SMT instance is being referenced and the second digit (.2) indicates that the object applies to the second port on the concentrator.

The final item, 7, is the requested value. See *Appendix C: MIB Reference* on page 114, for a discussion of the semantics of each variable in the MIB.

## Examples:

The following commands retrieve the same value from the SNMP MIB:

```
snmpget fddimibSMTStationId.1
snmpget fddimibsmststationid.1
```

```
snmpget stationid.1<Using the partial match capability.>
```

To display the current value of T-Neg continuously, use one of the following commands:

```
snmpget -c mactneg.1.1  
snmpget -c tneg.1.1
```

**See Also:**

**get**

**set**

**snmpgetnext**

**snmpset**

**snmpwalk**

**walk**

Appendix C: MIB Reference

RFC 1213 -- MIB-II

RFC 1512 -- FDDI Management Information Base

# snmpgetnext

## Description:

Display the value of the next lexicographically larger object in the resident SNMP MIB space.

## Syntax:

**snmpgetnext** [ -c ] [ parameter.index ]

where

- c indicates that the retrieval and display of MIB values should be continuous. When you use the -c flag, the MIB values will be displayed once per second until you stop the display. Pressing any key will pause the display. Pressing 'q' will stop the display when it is paused.
- parameter is the alphanumeric name of an SNMP MIB object. See the "SNMP name" field of the entries in *Appendix C: MIB Reference* on page 114 for a list of SNMP object names. Remember that names may be entered in upper or lower case.
- index represents the index number(s) required to identify the specific object instance. This index number is appended to the parameter name with a period ("."). This argument is variable in size and may include more than one number. See the "SNMP name" field of the entries in *Appendix C: MIB Reference* on page 114 for a detailed description of SNMP object indexing.

## Notes:

- This function is used to get the value of the "next" lexicographically larger object in the SNMP MIB space. All of the object identifiers in the MIB space are ordered by numeric object identifier. In the following example, each of the object identifiers is lexicographically larger than the one before it:  

```
1.3.6.1.2.1.10.15.73.1.2.1.25.1.1
1.3.6.1.2.1.10.15.73.2.1.0
1.3.6.1.2.1.10.15.73.5.1.0
1.3.6.1.2.1.10.15.73.5.2.1.4.1.1
1.3.6.1.2.1.10.15.73.5.2.1.4.1.2
```
- Since there can be gaps in the numbering of available MIB objects, the **snmpgetnext** command is provided so that you can retrieve the value of a MIB object without knowing its numeric identifier or its name.
- The **snmpgetnext** command is also useful if you want to obtain a value from the SNMP MIB but do not remember the exact parameter name or the specific index number. Simply enter as much of the name as you can and the **snmpgetnext** command will display the 'next' value in the MIB that applies, assuming that the command parser can resolve the name you provided.
- The **snmpgetnext** command will search the entire SNMP MIB space on the concentrator. This includes MIB-II (RFC 1213) and the FDDI MIB (RFC 1512).
- The **snmpgetnext** command retrieves the value of the next object in the MIB space. Therefore, it must have some reference point from which to begin its search.
  - If you specify an argument, the **snmpgetnext** command will use this object name as the point from which to begin its search. It will retrieve the value of the next object instance in the MIB.

- If you use **snmpgetnext** without an argument, the command will use the object instance from the most recent **snmpget** or **snmpgetnext** request and will retrieve the value of the next object.
- If you use **snmpgetnext** without an argument and you have not executed an **snmpget** or **snmpgetnext** command since the last reset of the concentrator, the command will retrieve the object that is lexicographically first in the MIB space.
- If you use the -c option, the **snmpgetnext** command will continue to get the next value in the MIB until the MIB space is exhausted. In other words, the -c option has the same effect as the **snmpwalk** command. When you request continuous display, the MIB objects will be retrieved and displayed once per second until you press any key to pause the display. Once the display is paused, it may be terminated by pressing 'q'.
- The parameter name argument includes the name of the SNMP object as well as its related instance number(s). You may enter the alphanumeric name of the object in upper or lower case. You may enter all or part of the name; the parser will use its partial match capability to locate the matching object. For example, the strings

```
fddimibPORTLerCutoff
portlercutoff
lercutoff
lercut
```

- all refer to the same MIB object.

**Note:** There are textual differences between how SMT MIB attributes are named and how the corresponding SNMP MIB objects are named. Specifically, SNMP does not use hyphens (“-”) and its counter names end with “Cts” rather than “Ct”. See section *C.1. Differences Between SMT and SNMP* on page 114 for a detailed description of the differences between SMT and SNMP with regard to variable naming. For the purposes of this command, the SNMP naming conventions apply. You may also use the **snmpwalk** command to step through the MIB and see how the object instances are named.

- The index number part of the parameter argument is variable and may be omitted for the **snmpgetnext** command. See the “SNMP name” section of the entries in *Appendix C: MIB Reference* on page 114 for an explicit description of the name and index identification of SNMP MIB objects. As an example, the following identifier refers to the value of PORTLer-Cutoff for the second port in the concentrator:

```
fddimibportlercutoff.1.2
```

- where the first number (.1) refers to the first SMT instance and the second number (.2) refers to the second port on the concentrator.
- Instance numbers always start with one. The lone exception is when an object can have one and only one instance. In this case, an index of zero is used. There are four of these objects in the FDDI SNMP MIB. They are listed in *Appendix C: MIB Reference* on page 114.
- In general:
  - SMT objects require that a “.1” be appended to the parameter name;
  - MAC objects require that a “.1.1” be appended to the parameter name;
  - Path objects have no standard form; and
  - Port objects require that a “.1.x” be appended to the parameter name, where x represents the number of the port.
- Note that, unlike the **snmpget** command, the arguments for the **snmpgetnext** command do not have to be fully qualified. It is enough that the command parser be able to resolve the alphanumeric parameter name. For example, the string:

fddimibPORT

- refers to a large section of the SNMP MIB space, one that includes many individual objects. If you use this string as an argument to the **snmpgetnext** command, the value of the lexicographically first object in this space, fddimibPORTNumber.0, will be displayed.
- MAC addresses retrieved from the SNMP MIB via the **snmpgetnext** command are always displayed in IEEE canonical format. The **address** command has no effect on the output of the **snmpgetnext** command.
- You may also use the **snmpwalk** command to step through the SMT MIB automatically.

### Output:

The information retrieved from the MIB has three component parts: the SNMP object name, the instance number, and the value. For example, in the following output:

```
fddimibPORTLerCutoff.1.2: 7
```

The first item, fddimibPORTLerCutoff, represents the full name of the MIB object.

The second item, .1.2, is the index of the object. The first digit (.1) indicates that the first (and only) SMT instance is being referenced and the second digit (.2) indicates that the object applies to the second port on the concentrator.

The final item, 7, is the value of the MIB object. See *Appendix C: MIB Reference* on page 114, for a discussion of the semantics of each variable in the MIB.

### Examples:

The following command retrieves the lexicographically first value in the FDDI MIB:

```
snmpgetnext fddimib
```

The following command retrieves the lexicographically first value in the entire MIB:

```
snmpgetnext
```

To step through the rest of the FDDI MIB, starting with the port objects, use one of the following commands

```
snmpgetnext -c fddimibport  
snmpgetnext -c port
```

### See Also:

**snmpget**

**snmpwalk**

Appendix C: MIB Reference

RFC 1213 -- MIB-II

RFC 1512 -- FDDI Management Information Base

## snmpset

Change a value in the resident SNMP MIB space.

### Syntax:

**snmpset** parameter.index new\_value

where:

- |           |   |
|-----------|---|
| parameter | is the alphanumeric name of an SNMP MIB object. See the “SNMP name” field of the entries in <i>Appendix C: MIB Reference</i> on page 114 for a list of SNMP object names. Remember that names may be entered in upper or lower case.  |
| index     | represents the index number(s) required to identify the specific object instance. This index number is appended to the parameter name with a period (“.”). This argument is variable in size and may include more than one number. See the “SNMP name” field of the entries in <i>Appendix C: MIB Reference</i> on page 114 for a detailed description of SNMP object indexing. |
| new_value | is the new value that the MIB object should take. See <i>Appendix C: MIB Reference</i> on page 114 for a description of the encodings and semantics of each FDDI MIB object. The MIB-II objects are described in RFC 1213.  |

### Notes:

- You should use the **snmpset** command when you want to change specific concentrator behavior. Only object whose access is listed in *Appendix C: MIB Reference* on page 114 and RFC 1213 as read-write may be changed using the **snmpset** command. If you want to change values in the SMT MIB, you should use the **set** command.
- The parameter identifier argument includes the name of the SNMP object as well as its related instance number(s). You may enter the alphanumeric name of the object in upper or lower case. You may enter all or part of the name; the parser will use its partial match capability to locate the matching object. For example, the strings

```
fddimibPORTLerCutoff
portlercutoff
lercutoff
lercut
```

- all refer to the same MIB object.

**Note:** There are textual differences between how SMT MIB attributes are named and how the corresponding SNMP MIB objects are named. Specifically, SNMP does not use hyphens (“-”) and its counter names end with “Cts” rather than “Ct”. See section *C.1. Differences Between SMT and SNMP* on page 114 for a detailed description of the differences between SMT and SNMP with regard to variable naming. For the purposes of this command, the SNMP naming conventions apply. You may also use the **snmpwalk** command to step through the MIB and see how the object instances are named.

- At least one number must be appended to the name of the object with a period (“.”). This represents the specific instance of the MIB object. The instance number part of the parameter argument is variable. See the “SNMP name” section of the entries in *Appendix C: MIB Reference* on page 114 for an explicit description of the name and index identification of SNMP MIB objects. As an example, the following command is used to access the value of PORTLerCutoff for the second port in the concentrator:

```
snmpget fddimibportlercutoff.1.2
```

- where the first number (.1) indicates that the first SMT instance should be used and the second number (.2) indicates that the value for the second port should be retrieved.
- Instance numbers always start with one. The lone exception is when an object can have one and only one instance. In this case, an index of zero is used. There are four of these objects in the FDDI SNMP MIB. They are listed in *Appendix C: MIB Reference* on page 114.
- In general:
  - SMT objects require that a “.1” be appended to the parameter name;
  - MAC objects require that a “.1.1” be appended to the parameter name;
  - Path objects have no standard form; and
  - Port objects require that a “.1.x” be appended to the parameter name, where x represents the number of the port.
- There are two actions defined in the FDDI SNMP MIB. These are `fddimibSMTStationAction` and `fddimibPORTAction`. Setting these objects to the values specified causes the concentrator to take the associated actions.
- The `new_value` parameter can have a variety of formats. Generally, you must enter the new value as the SNMP MIB would expect to receive it. For example,
  - Bitmaps must be entered as the integer equivalent of the value.
  - Flags must be entered as 1 (true) or 2 (false).
  - Timer values (such as `PATHMaxTReq` and `SMTTraceMaxExpiration`) are generally entered in decimal format and measured in seconds, milliseconds or nanoseconds.
  - Strings need not be enclosed by single or double quotes. However, if you want to enter a null string, you must use double quotes (i.e., “”).
- See the “Encoded as” sections of the entries in *Appendix C: MIB Reference* on page 114 for more information about the data format that SNMP expects.
- If a null string (i.e., “”) is entered for the following MIB objects:
  - `ipNetToMediaPhysAddress`
  - `atPhysAddress`
- a zero length OCTET STRING is generated. This invalidates the MIB entry.
- Note that you may enter a MAC address in MSB or IEEE canonical order. If you are entering a MAC address in MSB order, be sure to enter three groups of four hexadecimal digits. If you are entering a MAC address in IEEE canonical order, be sure to enter six pairs of hexadecimal digits separated by hyphens.
- Many of the writable objects in the MIB have ranges of valid values. See the “Description” sections of the entries in *Appendix C: MIB Reference* on page 114 for more information about valid object value ranges.
- You should use the **snmpget** or **snmpwalk** command to verify your MIB changes.

### Output:

If your set request is successful, the **snmpset** command will display the parameter name, the parameter index, and the new value. If your request is unsuccessful, the **snmpset** command will display a message telling you what is wrong.

### Examples:

In order to change the value of T-Notify so that SMT transmits NIF frames every 10 seconds, use the following command:

```
snmpset tnotify.1 10
```

In order to change the value of T\_Req for your concentrator to 80 ms., use the following command<sup>10</sup>:

```
snmpset pathmaxtreq.1.1 80000000
```

In order to move your MAC to the secondary path, use the following command<sup>11</sup>:

```
snmpset macrequestedpaths.1.1 0x03
```

In order to disable the status reporting protocol, use the following command:

```
snmpset statrptpolicy.1 2<Note that 2 indicates 'False' in SNMP>
```

### **See Also:**

**snmpget**

**snmpgetnext**

**snmpwalk**

Appendix C: MIB Reference

RFC 1213 -- MIB-II

RFC 1512 -- FDDI Management Information Base

---

<sup>10</sup>. The T-Req parameter is not directly manipulable through the MIB. In order to change T-Req, you must lower its ceiling value of PATHMaxTReq. This example assumes that your MAC is currently located on the primary path.

<sup>11</sup>. This will change the requested paths value such that the secondary path, rather than the primary path, is requested. SMT will note the change and move the MAC automatically. Note that, even though this attribute is a bitmap, an integer value is given.

# snmpwalk

## Description:

Undertake a depth-first display of the entire SNMP MIB space.

## Syntax:

**snmpwalk** [ -c ]

where:

-c               instructs the **snmpwalk** command to repeat its depth-first display continuously until terminated from the keyboard.

## Notes:

- The **snmpwalk** command is useful for examining the SNMP MIB space in detail and verifying changes to the MIB. If you are unfamiliar with the structure of the MIB or are unclear about how SNMP names and indexing works, this is a useful way to examine what information the MIB offers.
- This command will walk through the entire MIB space resident on the concentrator. This includes MIB-II (RFC 1213) as well as the FDDI MIB (RFC 1512).
- When used without the -c flag, the **snmpwalk** command will step through the SNMP MIB space one time. When used with the -c flag, the **snmpwalk** command will step through the SNMP MIB space continuously.
- You may pause the MIB display by pressing any key. When the display is paused, you may restart it by pressing any key or terminate it by pressing 'q'.
- The display of the MIB tree space is depth-first and in lexicographical order. All instances of a given attribute are displayed before the command moves on to the next attribute. For example, the current value of PORTLerCutoff is given for all ports on the concentrator before the next attribute is displayed.

## Output:

The information retrieved from the MIB has three component parts: the SNMP object name, the instance number, and the value. For example, in the following output:

```
fddimibPORTLerCutoff.1.2: 7
```

The first item, fddimibPORTLerCutoff, represents the full name of the MIB object.

The second item, .1.2, is the index of the object. The first digit (.1) indicates that the first (and only) SMT instance is being referenced and the second digit (.2) indicates that the object applies to the second port on the concentrator.

The final item, 7, is the requested value. See *Appendix C: MIB Reference* on page 114, for a discussion of the semantics of each variable in the MIB.

## See Also:

**snmpget**

**snmpgetnext**

**snmpset**

Appendix C: MIB Reference

RFC 1213 -- MIB-II

RFC 1512 -- FDDI Management Information Base

# status

## Description:

Display a brief summary of concentrator status.

## Syntax:

**status**

## Notes:

- Use the status command if you want a brief summary of the status of the concentrator. Use the **get** or **snmpget** command for more detailed information.

## Output:

The **status** command produces the following output:

```
UpTime: 012:02:19:03      RingOpCt: 7
DAC      ECM: In          RMT: Ring_Op           IP: 193.12.0.2
UNA: 0003 b900 2a01      MLA: 0003 b900 2a81    DNA: 0000 1f00 0000
```

```
Primary Path: Available      Secondary Path: Available
```

Port	State	Nbr	PC-Withhold	Ler	Lem-Ct	Lem-Reject-Ct	CurrentPath
1:A	Next	B	Not_Withheld	15	257	0	Thru
2:B	Active	A	Not_Withheld	15	0	0	Thru
3:M	Connect	?	Not_Withheld	15	0	0	Isolated
4:M	Active	B	Not_Withheld	15	551	0	Primary
5:M	Active	S	Not_Withheld	15	0	0	Primary
6:M	Next	M	M_to_M	15	0	0	Isolated
7:M	Active	S	Not_Withheld	15	0	0	Primary
8:M	Active	S	Not_Withheld	15	0	0	Primary

Each of these items is described here:

- UpTime** The amount of time since the last concentrator initialization. The units displayed here are:  
days : hours : minutes : seconds
- RingOpCt** This indicates the number of changes to the ring operational (Ring\_Op) flag on the resident MAC since the last time the concentrator was reset. An increase in this counter indicates that your ring has “bounced” (i.e., has become non-operational and then operational again). This is equivalent to the claim process and is normally caused by changes in ring configuration. This counter should not increase in a stable ring. If this counter increases steadily, it *may* indicate a problem on your FDDI network.
- DAC** The current configuration. This section of the status display will have a value of DAC, SAC, or NAC
- ECM** The current state of the ECM state machine.
- RMT** The current state of the RMT state machine.
- IP** The current internet protocol address of the concentrator.
- UNA** The MAC address of the station that is logically next upstream in the token flow. If the upstream neighbor has not yet been identified, then this will have the value of the SMT Unknown Address (0000 1f00 0000).
- MLA** The MAC address of the concentrator.
- DNA** The MAC address of the station that is logically next downstream in the token

flow. If the downstream neighbor has not yet been identified, then this will have the value of the SMT Unknown Address (0000 1f00 0000).

Although the MAC addresses shown in this example are displayed in MSB format, the MAC address information provided by this command may also be displayed in IEEE canonical format. See section *B.5. Format of MAC Address Values — Bit Order* on page 45 for more information.

**Primary Path**

The availability of the primary data path to the ports and MAC in the concentrator.

**Secondary path**

The availability of the secondary data path to the ports and MAC in the concentrator.

The next nine entries (one entry per port, plus a header line) describe the current status of each of the ports.

**Port** The index and type of the port. The index will match the numeric part of the port label on the front of the concentrator. The type of the port will be A, B, S, or M. For ports 1 and 2, the current configuration of the concentrator (i.e., DAC, SAC, NAC) determines the port type.

**State** The current status of the port's PCM state machine. If this port has been disabled by a diagnostics failure or by a path test failure, this field will have the value DISABLED.

**Nbr** The type of the neighboring port. This will have a value of A, B, S, M, or ?.

**PC-Withhold**

The current status of the connection between this port and the neighboring port. It will have one of the following values:

- Not\_Withheld
- Other
- M\_to\_M
- No\_Paths

**Ler** The current link error rate (LER) estimate for the port. This is the absolute value of the exponent. Therefore 15 indicates an LER estimate of  $10^{-15}$ . This value will range from 4 to 15 ( $10^{-4}$  to  $10^{-15}$ ).

**Lem-Ct** The current link error monitor error count for this port. It indicates the number of link errors detected.

**Lem-Reject-Ct**

The current link error monitor failure count. It indicates the number of times that the connection has been rejected due to excessive link errors.

**CurrentPath** The current path (or configuration state) of the port. This will have one of the following values:

- Concatenated
- Isolated
- Primary
- Secondary
- Thru

**See Also:**  
**address**  
**configure**

**get**

Appendix C: MIB Reference

# system

## Description:

Issue a system command to the concentrator.

## Syntax:

**system** { connect | disconnect | defaults | reset }

where:

- |            |   |
|------------|---|
| connect    | issues a connect request to the concentrator. A connect request causes the concentrator to begin operation. It initializes all of the ports so that they can begin the connection sequence. A connect request is issued automatically by the software after boot diagnostics.   |
| disconnect | issues a disconnect request to the concentrator. A disconnect request causes the concentrator to cease operation. A disconnect request is generally not necessary unless you plan to perform maintenance on the concentrator.   |
| defaults   | resets the nonvolatile storage on the concentrator to factory defaults. This option will reset <b>all</b> changeable attributes <i>except the current password</i> to their default values.<br><br>Note that this option will reset all MIB attributes to their default values. It will also reset the current IP address, the frame configuration settings, and the internal and external concentrator configuration settings. |
| reset      | issues a reset to all of the hardware and software on the concentrator, including the FDDI silicon, SMT, and the SNMP protocol stack. This will reboot the concentrator, execute initial diagnostics, and return all of the resources to their initial operational state. It will also reset all of the MIB attributes to their original states.  |

## Notes:

- Issuing a reset or returning to factory defaults require a re-initialization of the unit. All connections active at the time of the change will be terminated. After the restart, you must enter the current password in order to access the local interface commands.
- The **connect** option should be used when the station is not active on the network. If the LEDs on the front of the concentrator are flashing red, one port at a time, from left to right, it indicates that the concentrator is currently disconnected. Generally, a station becomes disconnected for one of the following reasons:
  - After failing a path test, or
  - After detecting that its MAC address is duplicated on the ring, or
  - Through local or remote interface management activity.
- If you find that your concentrator is disconnected and you or your network administrator did not disconnect the concentrator intentionally, verify that your concentrator is in full working order before issuing a connect request.
- Note that a connect request is not required when you turn on the concentrator. A connect request is issued automatically after the boot diagnostics have completed.
- The **disconnect** option should be used when you want to perform maintenance or when you want to change the network configuration in an orderly manner. Note that the disconnect is required before you can execute the **diagnostics** command. After you have finished your

maintenance or management activities, you should use the **connect** option to restart the unit.

- The **defaults** option is useful when you are not sure of the changes that have been made to the concentrator and you want to return it to a well-known state.

**Output:**

The **system** command produces no significant output.

**Examples:**

After you have made several changes to the state of the MIB (using the **set** or **snmpset** command) and are not sure that the current state is what you actually want, you may erase the changes and return the concentrator to a well-known state by entering the following command:

```
system defaults
```

**See Also:**

**diagnostics**

**set**

**snmpset**

# view

## Description:

Display configuration and performance data for a device on the local FDDI ring.

## Syntax:

```
view [ -c ] { macs | ports | station } { all | mac_address }
```

where:

- c indicates that the data should be gathered and displayed continuously until terminated from the keyboard.
- macs indicates that MAC-related data only should be gathered and displayed.
- ports indicates that port-related data only should be gathered and displayed.
- station indicates that MAC-related data, port-related data, and station configuration data should be gathered and displayed.
- all indicates that the specified data should be gathered and displayed for all manageable devices on the local FDDI ring.

mac\_address is the 48-bit MAC address of a device on your local FDDI ring. You may enter this address in most significant bit first (MSB) or IEEE canonical format. See section *B.5. Format of MAC Address Values — Bit Order* on page 45 for more information about MAC address formats.

## Notes:

- Use this command to display FDDI information about a manageable device on your local FDDI ring. You may display three different sets of information:
  - **MAC information** provides a view that focuses on MAC performance. It includes rates of frames transmitted, frames lost, frames in error, frames copied, and frames not copied. It also includes the T-Req value for each MAC.
  - **Port information** provides a focused view of port performance. It includes the link error rate (LER) estimate, the LER alarm value, the LER cutoff value, a count of the number of bit errors, a count of the number of times the link has been broken because of errors, and a count of elasticity buffer errors detected.
  - **Station information** provides a wider view of an entire FDDI device. It includes the MAC information and port information above, as well as configuration data about the device, including number of MACs, number of ports, MAC address, neighbor addresses, MAC timers, and station-specific error flags.
- This command uses SMT frames to gather the specified information. It is capable of gathering data from devices running various versions of SMT, from 5.1 through 7.3.

**Note:** Because SMT frames do not pass over bridge, switch, or router boundaries, you may use this command to display FDDI information about devices that are on the local FDDI ring only.

- When used without the -c flag, the **view** command will gather and display the specified data one time. When used with the -c flag, the **view** command will gather and display the specified data continuously until terminated from the keyboard.
- You may pause the display by pressing any key. When the display is paused, you may restart it by pressing any key or terminate it by pressing 'q'.

## Output:

The **view macs all** command produces output in the following format:

	MAC	Trans/s	Error/s	Lost/s	Copied/s	NotCop/s	T-Req	
Iphase 00:20:50	1	2	0	1	3	N/A	165.0	F
Cres 02:2c:18	1	0	0	0	0	0	15.0	
Iphase 00:20:70	1	1	0	0	1	N/A	165.0	
Iphase 00:20:b	1	1	0	0	1	N/A	165.0	

- The first column identifies the station from which the data was gathered. Note that some devices may have multiple MACs and will, therefore, have multiple entries in this table.
- The second column (“MAC”) identifies the index of the MAC within the target station to which this data applies.
- The third column (“Trans/s”) is the number of frames transmitted per second. This provides an indication of the current rate at which frames are being transmitted. A high number in this field indicates that this MAC is a heavy contributor to the current level of network traffic.
- The fourth column (“Error/s”) is the number of error frames detected per second. This provides an indication of the current rate at which error frames are detected. This field should always be zero. A nonzero number in this field indicates a problem with frame reception or with the bit error rate of the incoming link.
- The fifth column (“Lost/s”) is the number of lost frames detected per second. This data provides an indication of the current rate at which frames are lost. This field should always be zero. A nonzero number in this field indicates a possible problem with the device itself.
- The sixth column (“Copied/s”) is the number of frames per second copied by the MAC. This information provides an indication of how busy the device is. A large number in this field indicates that the device is the recipient of a large amount of network traffic.
- The seventh column (“NotCop/s”) is the number of frames per second addressed to the MAC, but not copied by the MAC. This field should always be zero. A nonzero number in this field indicates that the device may have internal resource limitations that prevent proper frame reception. The accounting of Frames Not Copied is optional for FDDI and this data may not be supported by some FDDI devices.

**Note:** The data presented by this command option is rate based, rather than value based. This provides an indication of how busy an FDDI device currently is regardless of how long it has been operating.

- The eighth column (“T-Req”) is the MAC’s current bid for target rotation time. This bidding takes place during the claim process and the lowest bid wins. This command provides a good way to identify the station that won the claim process.
- The ninth column lists any error flags that are associated with a MAC. An “F” will appear in the right-most column if, during any polling interval, Error/s or Lost/s is greater than zero.

The **view ports all** command produces output in the following format:

	Port	Estimate	Alarm	Cutoff	LEM-Ct	LEM-Rjct	EBErr-Ct		
00:20:50	1*	10e-15	10e-08	10e-07	0	0	N/A		
	2*	10e-15	10e-08	10e-07	0	0	N/A		
	3*	10e-8	10e-08	10e-07	32	0	N/A	L	
	4	10e-12	10e-08	10e-07	0	0	N/A		
Cres 02:2c:18	1*	10e-15	10e-08	10e-07	0	0	0		
	00:20:70	1*	10e-15	10e-08	10e-07	0	0	N/A	
		2*	10e-15	10e-08	10e-07	0	0	N/A	
		3	10e-12	10e-08	10e-07	0	0	N/A	
	4	10e-12	10e-08	10e-07	0	0	N/A		

	5	10e-12	10e-08	10e-07	0	0	N/A
	6	10e-12	10e-08	10e-07	0	0	N/A
	7	10e-12	10e-08	10e-07	0	0	N/A
	8	10e-12	10e-08	10e-07	0	0	N/A
00:20:b0	1*	10e-15	10e-08	10e-07	0	0	N/A
	2*	10e-15	10e-08	10e-07	0	0	N/A
	3	10e-12	10e-08	10e-07	0	0	N/A
	4	10e-12	10e-08	10e-07	0	0	N/A
	5	10e-12	10e-08	10e-07	0	0	N/A
	6	10e-12	10e-08	10e-07	0	0	N/A
	7	10e-12	10e-08	10e-07	0	0	N/A
	8	10e-12	10e-08	10e-07	0	0	N/A

- The first column identifies the station from which the data was gathered. Note that many devices will have multiple ports and will, therefore, have multiple entries in this table.
- The second column (“Port”) identifies the port within the target station to which this data applies. An asterisk (“\*”) in this column means that the port is currently active.
- The third column (“Estimate”) is the current link error rate (LER) estimate for the associated port. This value will range from  $10^{-15}$  (very good) to  $10^{-4}$  (very bad). Each port monitors the LER while the port is active. If the LER increases significantly, then a port connection may be terminated.
- The fourth column (“Alarm”) represents the LER at which a port connection will be deemed marginal. This value is  $10^{-8}$  by default, but may vary on individual ports.
- The fifth column (“Cutoff”) represents the LER at which a port connection will be terminated due to excessive errors. This value is  $10^{-7}$  by default, but may vary on individual ports. When the LER estimate is less than or equal to the Cutoff rate, a port connection will be terminated and the LEM rejection count will increment.
- The sixth column (“LEM-Ct”) shows the number of link errors detected on the port.
- The seventh column (“LEM-Rjct”) displays the number of times that a port connection has been terminated due to excessive link errors since the station was reset.
- The eighth column (“EBErr-Ct”) displays the number of elasticity buffer errors detected by the port since the station was reset. This field will normally be zero. A nonzero value in this field indicates a potential hardware problem with the station in question. Elasticity buffer error detection is an optional feature in FDDI and may not be supported by some devices.
- The ninth column displays error flags that are associated with a specific port. An “L” will appear in this column if, during any polling interval, the LER Estimate is less than or equal to the value of LER-Alarm.

The **view station** command will produce the following output:

Descrip: Interphase M400 FDDI Concentrator				Type: Concentrator								
Mfr: Interphase M400 [Rev. 2.1]				SMT: 7.3								
# Macs:	1	# M-Ports:	2	Wrap Status:	Y	SRF Reports:	Y					
Dup Mac:	N	# A/B/S-Ports:	2	Twisted Ring:	A-A	Synch Mode:	N					
=====												
UNA: Cres	02:2c:18	MLA:	00:20:50	DNA:	00:20:70							
T-Neg:	15.0 ms	T-Req:	165.0 ms	TVX:	2.5 ms							
Transmit-Ct		Error-Ct		Lost-Ct		Copied-Ct		NotCopied-Ct				
27		0		0		5		n/a				
Trans/sec		Error/sec		Lost/sec		Copied/sec		NotCopied/sec				
3		0		0		1		n/a				
=====												
Port#		LER-Est		LER_Alrm		LER_Cut		LEM-Ct		LEM-Rjct		EBErr-Ct
1*		10e-15		10e-8		10e-7		0		0		n/a
2		10e-15		10e-8		10e-7		0		0		n/a
3*		10e-15		10e-8		10e-7		0		0		n/a
4		10e-12		10e-8		10e-7		0		0		n/a

This display has three distinct sections:

1. The top part contains station configuration information.

- The **Description** field is the contents of the fddiSMTUserData MIB attribute. You can set this attribute on Interphase products with the **set** or **snmpset** command.
- The **Type** field will either be Station or Concentrator.
- The **Mfr** field contains the contents of the fddiSMTManufacturerData MIB attribute.
- The **SMT** field lists the version of SMT that the device is currently running. This will either be “7.3” or “pre-7.3”. A device running an SMT version labeled “pre-7.3” will probably be operating SMT version 5.1 or 6.2.
- The **# Macs** field lists the number of MACs supported by the device.
- The **# M-Ports** field lists the number of M ports supported by the device.
- The **Wrap Status** field indicates whether this device is wrapped in a peer connection or not. If so, then the “W” flag will appear in the right-most column.
- The **SRF Reports** field indicates whether the device is currently transmitting status report frames (SRFs) according to the SRF protocol or not.
- The **Dup Mac** field indicates whether this MAC is duplicated on the local FDDI ring or not. If so, then the “D” flag will appear in the right-most column.
- The **# A/B/S-Ports** field lists the number of A, B, or S ports supported by the device.
- The **Twisted Ring** field indicates whether a twisted ring condition exists on this device or not. A twisted ring condition is caused by an active A-to-A or B-to-B connection. This field will have a value of **None**, **A-A**, **B-B**, or **Both**. If the value of this field is something other than **None**, then the “T” flag will appear in the right-most column.
- The **Synch Mode** field indicates whether the station is currently using the synchronous mode of FDDI transmission or not.

2. The middle part contains MAC performance and connectivity information. Much of this data is the same as that offered by the **view macs** command option. However, the following pieces of data are also available:

- The **UNA** field contains the address of the MAC that is immediately upstream of this MAC in the token flow. This is a 48-bit MAC address. The current settings of the **address** command determine the display format of this field.
- The **MLA** field contains the MAC address of this station. For devices that support multiple MACs, this field will contain the address of the MAC that was used to gather this config-

uration information. This is a 48-bit MAC address. The current settings of the **address** command determine the display format of this field.

- The **DNA** field contains the address of the MAC that is immediately downstream of this MAC in the token flow. This is a 48-bit MAC address. The current settings of the **address** command determine the display format of this field.
  - The **T-Neg** field contains the current negotiated target token rotation time for the ring as a whole. This value is displayed in milliseconds.
  - The **T-Req** field contains the token rotation time that is bid by this MAC during the claim process. This value is displayed in milliseconds.
  - The **TVX** field contains the current TVX timer value used by this MAC. This value is displayed in milliseconds.
  - The **Transmit-Ct** field contains the total number of frames transmitted by the MAC since the MAC was last reset.
  - The **Error-Ct** field contains the total number of error frames detected by the MAC since the MAC was last reset.
  - The **Lost-Ct** field contains the total number of frames lost since the MAC was last reset.
  - The **Copied-Ct** field contains the total number of frames copied by this MAC since the MAC was last reset.
  - The **NotCopied-Ct** field contains the total number of frames that were addressed to the MAC, but that could not be copied by the MAC, since the MAC was last reset.
3. The bottom part contains port performance information. This data is the same as that offered by the **view ports** command option.

### Examples:

If you want to find the busiest stations on your FDDI ring or identify the station that won the claim process, use the following command:

```
view macs all
```

If you want to monitor the complete set of configuration and performance data for the station with MAC address 00:03:b9:00:20:e0, use the following command:

```
view -c station 00:03:b9:00:20:e0
```

### See Also:

**address**  
**status**

# walk

## Description:

Undertake a depth-first display of the entire SMT MIB space.

## Syntax:

**walk** [ -c ]

where:

- c           instructs the **walk** command to repeat its depth-first display continuously until terminated from the keyboard.

## Notes:

- The **walk** command is useful for examining the SMT MIB in detail and verifying changes to the MIB. If you are unfamiliar with the structure of the MIB, this is a useful way to examine what information the MIB offers.
- When used without the -c flag, the **walk** command will step through the SMT MIB one time. When used with the -c flag, the **walk** command will step through the SMT MIB continuously.
- You may pause the MIB display by pressing any key. When the display is paused, you may restart it by pressing any key or terminate it by pressing 'q'.
- The display of the MIB tree space is depth-first. All instances of a given attribute are displayed before the command moves on to the next attribute. For example, the current value of PORTLer-Cutoff is given for all ports on the concentrator before the next attribute is displayed.

## Output:

The information about each attribute retrieved from the MIB has four component parts: the SMT identifier, the name, the index, and the value. For example, in the following output:

```
0x403a PORTLer-Cutoff[2]: 7
```

The first item, 0x403a, is the two-octet SMT identifier.

The second item, PORTLer-Cutoff, is the name of the variable.

The third item, [2], indicates that this value is for the second port on your concentrator. For SMT and MAC attributes, this item will not appear in the output.

The final item, 7, is the requested value. See *Appendix C: MIB Reference* on page 114, for a discussion of the semantics of each variable in the MIB.

In some cases, additional output is provided. The following output shows the time value measured in milliseconds, as well as its MIB value. The value stored in the MIB is the unsigned two's complement format of the time as measured in 80-nanosecond units:

```
0x2033 MACT-Req: 165.007 milliseconds [0xffe08700]
```

Other variables have more sophisticated output. The following output shows the numeric value of the variable (0x7). However, since this attribute is encoded as a bitmap, it also shows the meaning of the bits that are set.

```
0x2020 MACRequestedPaths: [0x7]
    ='Local '
    ='Secondary-alternate'
    ='Primary-alternate'
```

**See Also:**

**get**

**set**

Appendix C: MIB Reference

## Appendix C: MIB Reference

This appendix describes all of the FDDI MIB variables supported by the M400 FDDI concentrator. There are two ways to access this MIB information remotely: via SMT protocols and via SNMP protocols. Therefore, this summary includes variables that are specific to SMT, those that are specific to SNMP, and those that are accessible by both protocols.

Each entry below provides the following information about the MIB variables:

<b>SMT name</b>	The alphanumeric parameter name for the SMT protocol. This information is used with the <b>get</b> and <b>set</b> commands.
<b>SMT identifier</b>	The numeric parameter_id for the SMT protocol. This value is presented in hexadecimal format.
<b>SNMP name</b>	The alphanumeric object name for the SNMP protocol. This information is used with the <b>snmpget</b> , <b>snmpgetnext</b> , and <b>snmpset</b> commands.
<b>SNMP identifier</b>	The numeric object identifier for the SNMP protocol. These values are presented in decimal format.
<b>Description</b>	The semantics of the variable: what the variable means, how it is used, what it tells you, etc.
<b>Encoded as</b>	How the variable is encoded. This often differs between SMT and SNMP (see below) and both encodings are given. This section also tells you what units the value is measured in, where appropriate.
<b>Access</b>	The read/write access of the variable.

### C.1. Differences Between SMT and SNMP

There are some differences between SMT and SNMP. These differences largely have to do with naming and encoding. They are described below.

- SMT uses an 'fddi' prefix on its variable names. SNMP uses an 'fddimib' prefix on its variable names.
- SMT makes use of the hyphen ("-") to break up its long variable names. However, hyphens are not used by SNMP. Therefore, although SMT attribute names are listed with hyphens below, these hyphens will not appear in the SNMP equivalent.
- SMT's counter names generally end with "Ct", whereas SNMP counter names generally end with "Cts". The counter names listed below are those for SMT.
- These MIB variables are presented in lexicographical order. That is, they are listed by order of the SMT and/or SNMP *numeric* identifiers. Please note that, in some cases, the lexicographical ordering of the variables is incompatible between SMT and SNMP. Where this happens, SMT prevails.
- Variables encoded as Flags below have the following values:

	<u>SMT</u>	<u>SNMP</u>
True	1	1
False	0	2

- For SNMP, Bitstring variable types are actually encoded as integers. However they are described as bit strings below and should be interpreted accordingly.

## C.2. MIB Variable Summary

### C.2.1. SMT Parameters

- SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibSMTNumber.0**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.0  
Description: The number of SMT implementations (regardless of their current state) on this device. The value for this variable must remain constant at least from one re-initialization of the entity's network management system to the next re-initialization.  
Encoded as: Integer (0..65535)  
Access: Read-only
- SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibSMTIndex.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.1.1  
Description: A unique value for each SMT. The value for each SMT must remain constant at least from one re-initialization of the entity's network management system to the next re-initialization.  
Encoded as: Integer (1..65535)  
Access: read-only
- SMT name: **fddiSMTStationId**  
SMT identifier: 0x100B  
SNMP name: **fddimibSMTStationId.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.2.1  
Description: Used to uniquely identify an FDDI station.  
Encoded as: 8-octet string. The two most significant octets are implementation-defined. The six least significant octets are the MAC address of the device.  
Access: Read-only
- SMT name: **fddiSMTOpVersionId**  
SMT identifier: 0x100D  
SNMP name: **fddimibSMTOpVersionId.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.3.1  
Description: The version of SMT frames that this station is using for its operation. The value of this attribute is 2 for SMT revision 7.3.  
Encoded as: Integer (1..65535)  
Access: Read-only
- SMT name: **fddiSMTHiVersionId**  
SMT identifier: 0x100E  
SNMP name: **fddimibSMTHiVersionId.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.4.1  
Description: The highest frame version of SMT that this station supports.  
Encoded as: Integer (1..65535)  
Access: Read-only
- SMT name: **fddiSMTLoVersionId**  
SMT identifier: 0x100F  
SNMP name: **fddimibSMTLoVersionId.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.5.1  
Description: The lowest frame version of SMT that this station supports.  
Encoded as: Integer (1..65535)  
Access: Read-only
- SMT name: **fddiSMTManufacturerData**  
SMT identifier: 0x1010  
SNMP name: <None. SMT attribute only.>  
SNMP identifier: <None. SMT attribute only.>

- Description: 32 octets of manufacturer data. The first component, manufacturerOUI, is the three octet Organizationally Unique Identifier (OUI) assigned by IEEE. The second component, manufacturerData, is the manufacturer's data (29 octets).
- Encoded as: 32-octet string.
- Access: Read-only
8. SMT name: **fddiSMTUserData**  
 SMT identifier: 0x1011  
 SNMP name: **fddimibSMTUserData.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.6.1.1  
 Description: This attribute contains 32 octets of user defined information. The information shall be an ASCII string.  
 Encoded as: 32-octet ASCII string.  
 Access: Read-write
9. SMT name: **fddiSMTMIBVersionId**  
 SMT identifier: 0x1012  
 SNMP name: **fddimibSMTMIBVersionId.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.7.1.1  
 Description: The version of the FDDI MIB of this station. The value of this attribute is 1 for SMT revision 7.3.  
 Encoded as: Integer (0..65535)  
 Access: Read-only
10. SMT name: **fddiSMTMac-Ct**  
 SMT identifier: 0x1015  
 SNMP name: **fddimibSMTMACCts.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.8.1.1  
 Description: The number of MACs in this concentrator.  
 Encoded as: Integer (0..255)  
 Access: Read-only
11. SMT name: **fddiSMTNonMaster-Ct**  
 SMT identifier: 0x1016  
 SNMP name: **fddimibSMTNonMasterCts.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.9.1.1  
 Description: The value of this attribute is the number of A, B, and S ports in this concentrator.  
 Encoded as: Integer (0..2)  
 Access: Read-only
12. SMT name: **fddiSMTMaster-Ct**  
 SMT identifier: 0x1017  
 SNMP name: **fddimibSMTMasterCts.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.10.1.1  
 Description: The number of M Ports in the concentrator.  
 Encoded as: Integer (0..255)  
 Access: Read-only
13. SMT name: **fddiSMTAvailablePaths**  
 SMT identifier: 0x1018  
 SNMP name: **fddimibSMTAvailablePaths.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.11.1.1  
 Description: A bit string that indicates the path types that are available in the station.  
 Encoded as: Bitstring (3), with the following values:

<u>Position</u>	<u>Meaning</u>
Bit 0	Primary available
Bit 1	Secondary available
Bit 2	Local available

Access: Read-only

14. SMT name: **fddiSMTConfigCapabilities**  
 SMT identifier: 0x1019  
 SNMP name: **fddimibSMTConfigCapabilities.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.12.1.1  
 Description: A bit string that indicates the configuration capabilities of a node. The 'Hold Available' bit indicates the support of the optional Hold Function, which is controlled by fddiSMTConfigPolicy. The 'CF-Wrap-AB' bit indicates that the station has the capability of performing a wrap\_ab.  
 Encoded as: Bitstring (2), with the following values:

<u>Position</u>	<u>Meaning</u>
Bit 0	Capable of Hold
Bit 1	Capable of Wrap_AB

Access: Read-only

15. SMT name: **fddiSMTConfigPolicy**  
 SMT identifier: 0x101A  
 SNMP name: **fddimibSMTConfigPolicy.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.13.1.1  
 Description: A bit string representing the configuration policies currently desired in a node. 'Hold' is one of the terms used for the Hold Flag.  
 Encoded as: Bitstring (1). The only value of this attribute indicates whether the Hold policy is currently supported by this device.  
 Access: Read-write

16. SMT name: **fddiSMTConnectionPolicy**  
 SMT identifier: 0x101B  
 SNMP name: **fddimibSMTConnectionPolicy.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.14.1.1  
 Description: A bit string representing the connection policies in effect in a node. A station sets the corresponding bit for each of the connection types that it rejects. The letter designations, X and Y, in the 'RejectX-Y' names have the following significance: X represents the PC-Type of the local PORT and Y represents the PC\_Type of the adjacent PORT (PC\_Neighbor). The evaluation of Connection-Policy (PC-Type, PC-Neighbor) is done to determine the setting of T-Val(3) in the PC-Signalling sequence. Note that Bit 15, (RejectM-M), is always set and cannot be cleared.  
 Encoded as: Integer (32768..65535). This attribute should be interpreted as a bit string, with the following values:

<u>Position</u>	<u>Meaning</u>
Bit 0	RejectA-A
Bit 1	RejectA-B
Bit 2	RejectA-S
Bit 3	RejectA-M
Bit 4	RejectB-A
Bit 5	RejectB-B
Bit 6	RejectB-S
Bit 7	RejectB-M
Bit 8	RejectS-A
Bit 9	RejectS-B
Bit 10	RejectS-S
Bit 11	RejectS-M
Bit 12	RejectM-A
Bit 13	RejectM-B
Bit 14	RejectM-S
Bit 15	RejectM-M

(Note: Always set)

Access: Read-write

17. SMT name: **fddiSMTT-Notify**  
 SMT identifier: 0x101D

- SNMP name: **fddimibSMTTNotify.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.15.1.1  
Description: The timer, expressed in seconds, used in the Neighbor Notification protocol. It has a range of 2 seconds to 30 seconds, and its default value is 30 seconds.  
Encoded as: Integer (2..30). This time value is measured in seconds.  
Access: Read-write
18. SMT name: **fddiSMTStatRptPolicy**  
SMT identifier: 0x101E  
SNMP name: **fddimibSMTStatRptPolicy.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.16.1.1  
Description: If true, indicates that the node will generate Status Reporting Frames for its implemented events and conditions. It has an initial value of true.  
Encoded as: Flag.  
Access: Read-write
19. SMT name: **fddiSMTTrace-MaxExpiration**  
SMT identifier: 0x101F  
SNMP name: **fddimibSMTTraceMaxExpiration.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.17.1.1  
Description: Trace\_Max is the maximum propagation time for a trace on the FDDI topology. This variable indicates how long a tracing station will wait for the trace signals to return before automatically leaving the ring and executing a path test. The default value is 7 seconds.  
Encoded as: SMT: Integer (0..4294967295) measuring time in 80-nanosecond units.  
SNMP: Integer (0..2147483647) measuring time in millisecond units.  
Access: Read-write
20. SMT name: **fddiSMTPORTIndexes**  
SMT identifier: 0x1020  
SNMP name: <None. SMT attribute only.>  
SNMP identifier: <None. SMT attribute only.>  
Description: This attribute is an array of indexes of all port objects within the station.  
Encoded as: A set of two-octet integers (0..65535) indicating the indexes of the ports currently present in the device.  
Access: Read-only
21. SMT name: **fddiSMTMACIndexes**  
SMT identifier: 0x1021  
SNMP name: <None. SMT attribute only.>  
SNMP identifier: <None. SMT attribute only.>  
Description: This attribute is an array of indexes of all MAC objects within the station.  
Encoded as: A set of two-octet integers (0..65535) indicating the indexes of the MACs currently present in the device.  
Access: Read-only
22. SMT name: **fddiSMTBypassPresent**  
SMT identifier: 0x1022  
SNMP name: **fddimibSMTBypassPresent.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.18.1.1  
Description: A flag indicating if the station has a bypass on its AB port pair.  
Encoded as: Flag  
Access: Read-only
23. SMT name: **fddiSMTECMState**  
SMT identifier: 0x1029  
SNMP name: **fddimibSMTECMState.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.19.1.1  
Description: Indicates the current state of the ECM State Machine.  
Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
--------------	------------	-------------

0	EC0:Out	--
1	EC1:In	EC0:Out
2	EC2:Trace	EC1:In
3	EC3:Leave	EC2:Trace
4	EC4:Path_Test	EC3:Leave
5	EC5:Insert	EC4:Path_Test
6	EC6:Check	EC5:Insert
7	EC7:Deinsert	EC6:Check
8	--	EC7:Deinsert

Access: Read-only

24. SMT name: **fddiSMTCF-State**  
 SMT identifier: 0x102A  
 SNMP name: **fddimibSMTCFState.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.20.1.1  
 Description: The CF\_State represents the attachment configuration for the station or concentrator.  
 Encoded as: An enumerated type with the following meanings

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	Isolated	--
1	Local_A	Isolated
2	Local_B	Local_A
3	Local_AB	Local_B
4	Local_S	Local_AB
5	Wrap_A	Local_S
6	Wrap_B	Wrap_A
7	Wrap_AB	Wrap_B
8	Wrap_S	Wrap_AB
9	C_Wrap_A	Wrap_S
10	C_Wrap_B	C_Wrap_A
11	C_Wrap_S	C_Wrap_B
12	Thru	C_Wrap_S
13	--	Thru

Access: Read-only

25. SMT name: **fddiSMTRemoteDisconnectFlag**  
 SMT identifier: 0x102C  
 SNMP name: **fddimibSMTRemoteDisconnectFlag.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.21.1.1  
 Description: A flag indicating that the station was remotely disconnected from the network as a result of receiving an fddiSMTAction(Disconnect) in a set request frame. A station requires a Connect Action to rejoin and clear the flag.  
 Encoded as: Flag  
 Access: Read-only

26. SMT name: **fddiSMTStationStatus**  
 SMT identifier: 0x102D  
 SNMP name: **fddimibSMTStationStatus.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.22.1.1  
 Description: The current status of the primary and secondary paths within this station.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	Concatenated	--
1	Separated	Concatenated
2	Thru	Separated
3	--	Thru

Access: Read-only

27. SMT name: **fddiSMTPeerWrapFlag**  
 SMT identifier: 0x102E  
 SNMP name: **fddimibSMTPeerWrapFlag.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.23.1.1  
 Description: This variable indicates whether the device is in a peer wrap state or not. A peer wrap state is in effect when an A, B, or S port is wrapped and in a peer configuration, indicating that the ring is wrapped unexpectedly.  
 Encoded as: Flag  
 Access: Read-only
28. SMT name: **fddiSMTimeStamp**  
 SMT identifier: 0x102F  
 SNMP name: **fddimibSMTimeStamp.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.24.1.1  
 Description: A time-stamp internal to the device used for registering the time that certain events occurred.  
 Encoded as: SMT: Integer (0..18446744073709551615) measuring time in 80 nanosecond units.  
 SNMP: Integer (0..2147483647) measuring time in milliseconds.  
 Access: Read-only
29. SMT name: **fddiSMTransitionTimeStamp**  
 SMT identifier: 0x1033  
 SNMP name: **fddimibSMTransitionTimeStamp.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.25.1.1  
 Description: A time-stamp internal to the device used for registering the time of the most recent occurrence reportable by the status report protocol.  
 Encoded as: SMT: Integer (0..18446744073709551615) measuring time in 80-nanosecond units.  
 SNMP: Integer (0..2147483647) measuring time in milliseconds.  
 Access: Read-only
30. SMT name: **fddiSMTSetCount**  
 SMT identifier: 0x1034  
 SNMP name: <None. SMT attribute only.>  
 SNMP identifier: <None. SMT attribute only.>  
 Description: This attribute is composed of a count incremented in response to a Set operation on the MIB, and the time of the change.  
 Encoded as: A complex data type formed by a 4-octet counter and an 8-octet time stamp.  
 Access: Read-only
31. SMT name: **fddiSMTLastSetStationId**  
 SMT identifier: 0x1035  
 SNMP name: <None. SMT attribute only.>  
 SNMP identifier: <None. SMT attribute only.>  
 Description: The Station ID of the station that effected the last change in the FDDI MIB.  
 Encoded as: 8-octet string.  
 Access: Read-only
32. SMT name: **fddiSMTStationAction**  
 SMT identifier: 0x103C  
 SNMP name: **fddimibSMTStationAction.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.1.2.1.26.1.1  
 Description: The behavior of setting this variable to each of the acceptable values is as follows:  
**Other:** Results in an appropriate error.  
**Connect:** Generates a Connect signal to ECM to begin a connection sequence.  
**Disconnect:** Generates a Disconnect signal to ECM.  
**Path-Test:** Initiates a station Path\_Test. The Path\_Test variable is set to 'Testing'. The results of this action are not specified.

- Self-Test:** Initiates a station Self\_Test. The results of this action are not specified.
- Disable-A:** Causes a PC\_Disable on the A port if the A port mode is peer.
- Disable-B:** Causes a PC\_Disable on the B port if the B port mode is peer.
- Disable-M:** Causes a PC\_Disable on all M ports.

Attempts to set this object to all other values results in an appropriate error. The result of setting this variable to Path-Test or Self-Test is implementation-specific. For SNMP, this object, when read, always returns a value of Other.

Encoded as: An enumerated type with the following meanings:

<u>Action</u>	<u>SMT</u>	<u>SNMP</u>
Other	--	1
Connect	0	2
Disconnect	1	3
Path-Test	2	4
Self-Test	3	5
Disable-A	4	6
Disable-B	5	7
Disable-M	6	8

Access: Write-only (SMT); Read-write (SNMP)

### C.2.2.MAC Parameters

33. SMT name: <None. SNMP object only.>  
 SMT identifier: <None. SNMP object only.>  
 SNMP name: **fddimibMACNumber.0**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.1.0  
 Description: The total number of MAC implementations (across all SMTs) on this device. The value for this variable must remain constant at least from one re-initialization of the entity's network management system to the next re-initialization.  
 Encoded as: Integer (0..65535)  
 Access: Read-only
  
34. SMT name: <None. SNMP object only.>  
 SMT identifier: <None. SNMP object only.>  
 SNMP name: **fddimibMACSMTIndex.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.1.1.1  
 Description: The value of the SMT index associated with this MAC.  
 Encoded as: Integer (1..65535)  
 Access: Read-only
  
35. SMT name: <None. SNMP object only.>  
 SMT identifier: <None. SNMP object only.>  
 SNMP name: **fddimibMACIfIndex.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.3.1.1  
 Description: The value of the MIB-II ifIndex corresponding to this MAC. If none is applicable, 0 is returned.  
 Encoded as: Integer (1..65535)  
 Access: Read-only
  
36. SMT name: **fddiMACFrameStatusFunctions**  
 SMT identifier: 0x200B  
 SNMP name: **fddimibMACFrameStatusFunctions.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.4.1.1  
 Description: Indicates the MAC's optional Frame Status processing functions.  
 Encoded as: Bitstring(3) with the following meanings:

<u>Position</u>	<u>Meaning</u>
Bit 0	FS-Repeating
Bit 1	FS-Setting

Access: Read-only

37. SMT name: **fddiMACT-MaxCapability**  
 SMT identifier: 0x200D  
 SNMP name: **fddimibMACTMaxCapability.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.5.1.1  
 Description: Indicates the maximum time value (minimum twos-complement numeric value) of fddiMACT-Max that this MAC can support.  
 Encoded as: SMT: A 4-octet integer indicating time in unsigned two's complement format and measured in 80-nanosecond units.  
 SNMP: Integer (0..2147483647) measuring time in nanoseconds.  
 Access: Read-only

38. SMT name: **fddiMACTVXCapability**  
 SMT identifier: 0x200E  
 SNMP name: **fddimibMACTVXCapability.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.6.1.1  
 Description: Indicates the maximum time value (minimum twos-complement numeric value) of fddiMACTvxValue that this MAC can support.  
 Encoded as: SMT: A 4-octet integer indicating time in unsigned two's complement format and measured in 80-nanosecond units.  
 SNMP: Integer (0..2147483647) measuring time in nanoseconds.  
 Access: Read-only

39. SMT name: **fddiMACAvailablePaths**  
 SMT identifier: 0x2016  
 SNMP name: **fddimibMACAvailablePaths.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.7.1.1  
 Description: Indicates the paths available for this MAC.  
 Encoded as: Bitstring (3) with the following meanings:

<u>Position</u>	<u>Meaning</u>
Bit 0	Primary available
Bit 1	Secondary available
Bit 2	Local available

Access: Read-only

40. SMT name: **fddiMACCurrentPath**  
 SMT identifier: 0x2017  
 SNMP name: **fddimibMACCurrentPath.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.8.1.1  
 Description: Indicates the path into which this MAC is currently inserted.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	Isolated	--
1	Local	Isolated
2	Secondary	Local
3	Primary	Secondary
4	Concatenated	Primary
5	Thru	Concatenated
6	--	Thru

Access: Read-only

41. SMT name: **fddiMACUpstreamNbr**  
 SMT identifier: 0x2018  
 SNMP name: **fddimibMACUpstreamNbr.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.9.1.1

Description: The MAC's upstream neighbor's long individual MAC address. It has an initial value of the SMT-Unknown-MAC Address and is only modified by the Neighbor Information Frame (NIF) protocol.  
 Encoded as: A 48-bit MAC address.  
 Access: Read-only

42. SMT name: **fddiMACDownstreamNbr**  
 SMT identifier: 0x2019  
 SNMP name: **fddimibMACDownstreamNbr.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.10.1.1  
 Description: The MAC's downstream neighbor's long individual MAC address. It has an initial value of the SMT-Unknown-MAC Address and is only modified by the Neighbor Information Frame (NIF) protocol.  
 Encoded as: A 48-bit MAC address.  
 Access: Read-only

43. SMT name: **fddiMACOldUpstreamNbr**  
 SMT identifier: 0x201A  
 SNMP name: **fddimibMACOldUpstreamNbr.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.11.1.1  
 Description: The previous value of the MAC's upstream neighbor's long individual MAC address. It has an initial value of the SMT-Unknown-MAC Address and is only modified by the Neighbor Information Frame (NIF) protocol.  
 Encoded as: A 48-bit MAC address.  
 Access: Read-only

44. SMT name: **fddiMACOldDownstreamNbr**  
 SMT identifier: 0x201B  
 SNMP name: **fddimibMACOldDownstreamNbr.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.12.1.1  
 Description: The previous value of the MAC's downstream neighbor's long individual MAC address. It has an initial value of the SMT-Unknown-MAC Address and is only modified by the Neighbor Information Frame (NIF) protocol.  
 Encoded as: A 48-bit MAC address.  
 Access: Read-only

45. SMT name: **fddiMACDupAddressTest**  
 SMT identifier: 0x201D  
 SNMP name: **fddimibMACDupAddressTest.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.13.1.1  
 Description: The current value of the duplicate address test flag. It indicates the results of the most recent duplicate address test.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	None	--
1	Pass	None
2	Fail	Pass
3	--	Fail

Access: Read-only

46. SMT name: **fddiMACRequestedPaths**  
 SMT identifier: 0x2020  
 SNMP name: **fddimibMACRequestedPaths.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.14.1.1  
 Description: List of permitted paths which specifies the path(s) into which the MAC may be inserted.  
 Encoded as: Bitstring (8) with the following meanings:

<u>Position</u>	<u>Meaning</u>
Bit 0	Local

Bit 1	Secondary alternate
Bit 2	Primary alternate
Bit 3	Concatenated alternate
Bit 4	Secondary preferred
Bit 5	Primary preferred
Bit 6	Concatenated preferred
Bit 7	Thru

Access: Read-write

47. SMT name: **fddiMACDownstreamPORTType**  
 SMT identifier: 0x2021  
 SNMP name: **fddimibMACDownstreamPORTType.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.15.1.1  
 Description: Indicates the type of the first port that is downstream of this MAC (i.e., the exit port of the MAC).  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	A	--
1	B	A
2	S	B
3	M	S
4	None	M
5	--	None

Access: Read-only

48. SMT name: **fddiMACIndex**  
 SMT identifier: 0x2022  
 SNMP name: **fddimibMACIndex.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.2.1.1  
 Description: Index attribute for uniquely identifying the MAC object instances.  
 Encoded as: Integer (0..65535)  
 Access: Read-only

49. SMT name: **fddiMACSMTAddress**  
 SMT identifier: 0x2029  
 SNMP name: **fddimibMACSMTAddress.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.16.1.1  
 Description: The 48-bit individual address of the MAC used for SMT frames.  
 Encoded as: A 48-bit MAC address.  
 Access: Read-only

50. SMT name: **fddiMACT-Req**  
 SMT identifier: 0x2033  
 SNMP name: **fddimibMACTReq.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.17.1.1  
 Description: This attribute is the requested token rotation timer passed to the MAC.  
 Encoded as: SMT: A 4-octet integer indicating time in unsigned two's complement format and measured in 80-nanosecond units.  
 SNMP: Integer (0..2147483647) measuring time in nanoseconds.  
 Access: Read-only

51. SMT name: **fddiMACT-Neg**  
 SMT identifier: 0x2034  
 SNMP name: **fddimibMACTNeg.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.18.1.1  
 Description: This variable is the negotiated token rotation timer value for the ring.  
 Encoded as: SMT: A 4-octet integer indicating time in unsigned two's complement format and measured in 80-nanosecond units.  
 SNMP: Integer (0..2147483647) measuring time in nanoseconds.

- Access: Read-only
52. SMT name: **fddiMACT-Max**  
SMT identifier: 0x2035  
SNMP name: **fddimibMACTMax.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.19.1.1  
Description: This attribute is the maximum T\_Req value currently supported by the MAC.  
Encoded as: SMT: A 4-octet integer indicating time in unsigned two's complement format and measured in 80-nanosecond units.  
SNMP: Integer (0..2147483647) measuring time in nanoseconds.  
Access: Read-only
53. SMT name: **fddiMACTvxValue**  
SMT identifier: 0x2036  
SNMP name: **fddimibMACTvxValue.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.20.1.1  
Description: This attribute is the valid token timer expiration passed to the MAC.  
Encoded as: SMT: A 4-octet integer indicating time in unsigned two's complement format and measured in 80-nanosecond units.  
SNMP: Integer (0..2147483647) measuring time in nanoseconds.  
Access: Read-only
54. SMT name: **fddiMACFrame-Ct**  
SMT identifier: 0x2047  
SNMP name: **fddimibMACFrameCts.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.21.1.1  
Description: A count of the number of frames received by this MAC.  
Encoded as: Integer (0..4294967295)  
Access: Read-only
55. SMT name: **fddiMACCopied-Ct**  
SMT identifier: 0x2048  
SNMP name: **fddimibMACCopiedCts.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.22.1.1  
Description: A count that should as closely as possible match the number of frames addressed to (A bit set) and successfully copied into the station's receive buffers (C bit set) by this MAC. Note that this count does not include MAC frames.  
Encoded as: Integer (0..4294967295)  
Access: Read-only
56. SMT name: **fddiMACTransmit-Ct**  
SMT identifier: 0x2049  
SNMP name: **fddimibMACTransmitCts.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.23.1.1  
Description: A count that should as closely as possible match the number of frames transmitted by this MAC. Note that this count does not include MAC frames.  
Encoded as: Integer (0..4294967295)  
Access: Read-only
57. SMT name: **fddiMACError-Ct**  
SMT identifier: 0x2051  
SNMP name: **fddimibMACErrorCts.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.24.1.1  
Description: A count of the number of frames that were detected in error by this MAC that had not been detected in error by another MAC.  
Encoded as: Integer (0..4294967295)  
Access: Read-only
58. SMT name: **fddiMACLost-Ct**  
SMT identifier: 0x2052  
SNMP name: **fddimibMACLostCts.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.25.1.1

Description: A count of the number of instances that this MAC detected a format error during frame reception such that the frame was stripped.  
 Encoded as: Integer (0..4294967295)  
 Access: Read-only

59. SMT name: **fddiMACFrameErrorThreshold**  
 SMT identifier: 0x205F  
 SNMP name: **fddimibMACFrameErrorThreshold.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.26.1.1  
 Description: A threshold for determining when a MAC frame error condition report shall be generated.  
 Encoded as: Integer (0..65535)  
 Access: Read-write

60. SMT name: **fddiMACFrameErrorRatio**  
 SMT identifier: 0x2060  
 SNMP name: **fddimibMACFrameErrorRatio.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.27.1.1  
 Description: This attribute is the value of the ratio,  

$$F(\text{fddiMACLost-Ct} + \text{fddiMACError-Ct}, \text{fddiMACFrame-Ct} + \text{fddiMACLost-Ct})$$
  
 over an implementation-specific period of time.  
 Encoded as: Integer (0..65535)  
 Access: Read-only

61. SMT name: **fddiMACRMTState**  
 SMT identifier: 0x206F  
 SNMP name: **fddimibMACRMTState.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.28.1.1  
 Description: Indicates the current state of the RMT State Machine.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	RM0:Isolated	--
1	RM1:Non_Op	RM0:Isolated
2	RM2:Ring_Op	RM1:Non_Op
3	RM3:Detect	RM2:Ring_Op
4	RM4:Non_Op_Dup	RM3:Detect
5	RM5:Ring_Op_Dup	RM4:Non_Op_Dup
6	RM6:Directed	RM5:Ring_Op_Dup
7	RM7:Trace	RM6:Directed
8	--	RM7:Trace

Access: Read-only

62. SMT name: **fddiMACDA-Flag**  
 SMT identifier: 0x2070  
 SNMP name: **fddimibMACDaFlag.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.29.1.1  
 Description: The RMT duplicate address flag.  
 Encoded as: Flag.  
 Access: Read-only

63. SMT name: **fddiMACUNDA-Flag**  
 SMT identifier: 0x2071  
 SNMP name: **fddimibMACUnaDaFlag.1.1**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.30.1.1  
 Description: A flag that is set when the upstream neighbor reports a duplicate address condition. This information is reported by this station in the event that the upstream neighbor's frames are unable to reach the network management station due to the duplicate address condition.

- Encoded as: Flag.  
Access: Read-only
64. SMT name: **fddiMACFrameErrorFlag**  
SMT identifier: 0x2072  
SNMP name: **fddimibMACFrameErrorFlag.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.31.1.1  
Description: Indicates the MAC frame error condition is present when set. Cleared when the condition clears and on station initialization.  
Encoded as: Flag.  
Access: Read-only
65. SMT name: **fddiMACMA-UnitdataAvailable**  
SMT identifier: 0x2074  
SNMP name: **fddimibMACMAUnitdataAvailable.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.32.1.1  
Description: A flag indicating that the specified MAC is available for the transmission and reception of higher-layer protocol frames. This flag is controlled by SMT and is used to suspend higher-layer protocol function temporarily in certain network fault situations.  
Encoded as: Flag.  
Access: Read-only
66. SMT name: **fddiMACHardwarePresent**  
SMT identifier: 0x2075  
SNMP name: **fddimibMACHardwarePresent.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.33.1.1  
Description: This attribute indicates that the underlying hardware for this MAC object is actually present.  
Encoded as: Flag.  
Access: Read-only
67. SMT name: **fddiMACMA-UnitdataEnable**  
SMT identifier: 0x2076  
SNMP name: **fddimibMACMAUnitdataEnable.1.1**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.2.2.1.34.1.1  
Description: This attribute determines the value of the MA\_UNITDATA\_Enable flag in RMT. The default and initial value of this flag is set. It allows a network manager to suspend higher-layer protocol functions temporarily in certain network fault situations.  
Encoded as: Flag.  
Access: Read-write

### *C.2.3.Path Parameters*

68. SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibPATHNumber.0**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.1.0  
Description: The total number of PATHs possible (across all SMTs) on this network management application entity. The value for this variable must remain constant at least from one re-initialization of the device to the next re-initialization.  
Encoded as: Integer (0..65535)  
Access: Read-only
69. SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibPATHSMTIndex.1.x(x = index of the path)**  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.2.1.1.1.x(x = index of the path)  
Description: The value of the SMT index associated with this PATH.  
Encoded as: Integer (1..65535)  
Access: Read-only.

70. SMT name: **fddiPATHIndex**  
SMT identifier: 0x320B  
SNMP name: **fddimibPATHIndex.1.x**(x = index of the path)  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.2.1.2.1.x(x = index of the path)  
Description: Index attribute for uniquely identifying the primary, secondary and local PATH object instances. The index for the primary path is 1; the index for the secondary path is 2. Local path object instances are represented with integer values 3 to 255.  
Encoded as: Integer (0..255)  
Access: Read-only
71. SMT name: **fddiPATHConfiguration**  
SMT identifier: 0x3212  
SNMP name: <None. SMT attribute only.>  
SNMP identifier: <None. SMT attribute only.>  
Description: A circular list of resources on the path where each entry in the list consists of a resource type identifier (MAC or PORT), an index, and its CurrentPath. If the path is available to a resource in the node (as indicated by fddiPORTAvailablePaths or fddiMACAvailablePaths) then that resource shall be included in the list. If the path is not available to a resource or the underlying hardware is not present, then that resource shall not be included in the list. Resources currently inserted in the Path shall appear in the list once in token order. Resources not currently inserted in the Path shall appear once in any position supported by the implementation.  
Encoded as: A complex data type consisting of a set of descriptors. Each descriptor indicates whether the unit being described is a MAC (0x02) or a Port (0x04), its index, and its current path. The current path enumerations are the same as those for fddiMACCurrentPath and fddiPORTCurrentPath.  
Access: Read-only
72. SMT name: **fddiPATHTVXLowerBound**  
SMT identifier: 0x3215  
SNMP name: **fddimibPATHTVXLowerBound.1.x**(x = index of the path)  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.2.1.3.1.x(x = index of the path)  
Description: Specifies the minimum time value of fddiMACTvxValue that shall be used by any MAC that is configured in this path. The initial value of fddiPATHTVXLowerBound is 2.500 msec.  
Encoded as: SMT: A 4-octet integer indicating time in unsigned two's complement format and measured in 80-nanosecond units.  
SNMP: Integer (0..2147483647) measuring time in nanoseconds.  
Access: Read-write
73. SMT name: **fddiPATHT-MaxLowerBound**  
SMT identifier: 0x3216  
SNMP name: **fddimibPATHTMaxLowerBound.1.x**(x = index of the path)  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.2.1.4.1.x(x = index of the path)  
Description: Specifies the minimum time value of fddiMACT-Max that shall be used by any MAC that is configured in this path. The initial value of fddiPATHT-MaxLowerBound is 165 msec.  
Encoded as: SMT: A 4-octet integer indicating time in unsigned two's complement format and measured in 80-nanosecond units.  
SNMP: Integer (0..2147483647) measuring time in nanoseconds.  
Access: Read-write
74. SMT name: **fddiPATHMaxT-Req**  
SMT identifier: 0x3217  
SNMP name: **fddimibPATHMaxTReq.1.x**(x = index of the path)  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.2.1.5.1.x(x = index of the path)  
Description: Specifies the maximum time value of fddiMACT-Req that shall be used by any MAC that is configured in this path. The default value of fddiPATHMaxT-Req is 165 msec.  
Encoded as: SMT: A 4-octet integer indicating time in unsigned two's complement format and measured in 80-nanosecond units.

- Access: SNMP: Integer (0..2147483647) measuring time in nanoseconds.  
Read-write
75. SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibPATHConfigSMTIndex.1.p.n**(p = path index;  
n = n<sup>th</sup> item in token flow.)  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.3.1.1.p.n(p = path index;  
n = n<sup>th</sup> item in token flow.)  
Description: The value of the SMT index associated with this configuration entry.  
Encoded as: Integer (1..65535)  
Access: Read-only
76. SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibPATHConfigIndex.1.p.n**(p = path index;  
n = n<sup>th</sup> item in token flow.)  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.3.1.2.1.p.n(p = path index;  
n = n<sup>th</sup> item in token flow.)  
Description: The value of the PATH resource index associated with this configuration entry.  
Encoded as: Integer (1..65535)  
Access: Read-only
77. SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibPATHConfigTokenOrder.1.p.n**(p = path index;  
n = n<sup>th</sup> item in token flow.)  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.3.1.3.1.p.n(p = path index;  
n = n<sup>th</sup> item in token flow.)  
Description: An object associated with Token order for this entry. Thus if the token passes re-  
sources a, b, c and d, in that order, then the value of this object for these resources  
would be 1, 2, 3 and 4 respectively.  
Encoded as: Integer (1..65535)  
Access: Read-only
78. SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibPATHConfigResourceType.1.p.n**(p = path index;  
n = n<sup>th</sup> item in token flow.)  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.3.1.4.1.p.n(p = path index;  
n = n<sup>th</sup> item in token flow.)  
Description: The type of resource associated with this configuration entry.  
Encoded as: Integer { mac(2), port(4) }  
Access: Read-only
79. SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibPATHConfigResourceIndex.1.p.n**(p = path index;  
n = n<sup>th</sup> item in token flow.)  
SNMP identifier: 1.3.6.1.2.1.10.15.73.4.3.1.5.1.p.n(p = path index;  
n = n<sup>th</sup> item in token flow.)  
Description: The value of the SMT resource index used to refer to the instance of this MAC or  
port resource.  
Encoded as: Integer (1..65535)  
Access: Read-only
80. SMT name: <None. SNMP object only.>  
SMT identifier: <None. SNMP object only.>  
SNMP name: **fddimibPATHConfigCurrentPath.1.p.n**(p = path index;

SNMP identifier: 1.3.6.1.2.1.10.15.73.4.3.1.6.1.p.n (p = path index; n = n<sup>th</sup> item in token flow.)  
 Description: The current insertion status for this resource on this Path.  
 Encoded as: Integer {isolated(1), local(2), secondary(3), primary(4), concatenated(5), thru(6)}  
 Access: Read-only

### C.2.4.Port Parameters

81. SMT name: <None. SNMP object only.>  
 SMT identifier: <None. SNMP object only.>  
 SNMP name: **fddimibPORTNumber.0**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.1.0  
 Description: The total number of port implementations (across all SMTs) on this network management application entity. The value for this variable must remain constant at least from one re-initialization of the device to the next re-initialization.  
 Encoded as: Integer (0..65535)  
 Access: Read-only

82. SMT name: <None. SNMP object only.>  
 SMT identifier: <None. SNMP object only.>  
 SNMP name: **fddimibPORTSMTIndex.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.1.1.x(x = index of the port)  
 Description: The value of the SMT index associated with this port.  
 Encoded as: INTEGER (1..65535)  
 Access: Read-only

83. SMT name: **fddiPORTMy-Type**  
 SMT identifier: 0x400C  
 SNMP name: **fddimibPORTMyType.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.3.1.x(x = index of the port)  
 Description: The type of the port (PC\_Type).  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	A	--
1	B	A
2	S	B
3	M	S
4	None	M
5	--	None

Access: Read-only

84. SMT name: **fddiPORTNeighborType**  
 SMT identifier: 0x400D  
 SNMP name: **fddimibPORTNeighborType.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.4.1.x(x = index of the port)  
 Description: The type of the neighboring port as determined by PCM. This attribute has an initial value of none.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	A	--
1	B	A
2	S	B
3	M	S
4	None	M
5	--	None

Access: Read-only

85. SMT name: **fddiPORTConnectionPolicies**  
 SMT identifier: 0x400E  
 SNMP name: **fddimibPORTConnectionPolicies.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.5.1.x(x = index of the port)  
 Description: A bit string representing the port's connection policies desired in the node.  
 Encoded as: Bitstring (2) with the following meanings:

<u>Position</u>	<u>Meaning</u>
Bit 0	MAC on LCT desired
Bit 1	MAC on Local Loop desired

Access: Read-write

86. SMT name: **fddiPORTMACIndicated**  
 SMT identifier: 0x400F  
 SNMP name: **fddimibPORTMACIndicated.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.6.1.x(x = index of the port)  
 Description: The indications of this port and the neighbor port of the intent to place a MAC in the output token path to a port.  
 Encoded as: For SMT, this attribute is encoded as a pair of Flags, the first of which indicates the intent of this port to place a MAC in the output token path of the connection (T-Val9); the second of which indicates the intent of the neighbor port to place a MAC in the output token path of the connection (R-Val9).

For SNMP, the following enumerated meanings apply:

<u>Value</u>	<u>Meaning</u>
1	T-Val9 False, R-Val9 False
2	T-Val9 False, R-Val9 True
3	T-Val9 True, R-Val9 False
4	T-Val9 True, R-Val9 True

Access: Read-only

87. SMT name: **fddiPORTCurrentPath**  
 SMT identifier: 0x4010  
 SNMP name: **fddimibPORTCurrentPath.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.7.1.x(x = index of the port)  
 Description: Indicates the path(s) into which this port is currently inserted.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	Isolated	--
1	Local	Isolated
2	Secondary	Local
3	Primary	Secondary
4	Concatenated	Primary
5	Thru	Concatenated
6	--	Thru

Access: Read-only

88. SMT name: **fddiPORTRequestedPaths**  
 SMT identifier: 0x4011  
 SNMP name: **fddimibPORTRequestedPaths.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.8.1.x(x = index of the port)  
 Description: This attribute is a list of permitted paths where each list element defines the port's permitted paths.  
 Encoded as: An array of three Bitstring (8) 's with the following meanings:

<u>Position</u>	<u>Meaning</u>
Bit 0	Local

Bit 1	Secondary alternate
Bit 2	Primary alternate
Bit 3	Concatenated alternate
Bit 4	Secondary preferred
Bit 5	Primary preferred
Bit 6	Concatenated preferred
Bit 7	Thru

The specific set of bit string values used is determined by the current connection type of the port. The first set in the array is used when the port is unconnected; the second set is used when the port is in a Tree configuration; the third set is used when the port is in a Peer configuration.

Access: Read-write

89. SMT name: **fddiPORTMACPlacement**  
 SMT identifier: 0x4012  
 SNMP name: **fddimibPORTMACPlacement.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.9.1.x(x = index of the port)  
 Description: Indicates the MAC, if any, whose transmit path exits the station via this port. The value shall be zero if there is no MAC associated with the port. Otherwise, the MACIndex of the MAC will be the value of the attribute.  
 Encoded as: Integer (0..65535)  
 Access: Read-only

90. SMT name: **fddiPORTAvailablePaths**  
 SMT identifier: 0x4013  
 SNMP name: **fddimibPORTAvailablePaths.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.10.1.x(x = index of the port)  
 Description: Indicates the paths which are available to this port. In the absence of faults, the A and B Ports will always have both the primary and secondary paths available.  
 Encoded as: Bitstring (3) with the following meanings:

<u>Position</u>	<u>Meaning</u>
Bit 0	Primary available
Bit 1	Secondary available
Bit 2	Local available

Access: Read-only

91. SMT name: **fddiPORTPMDClass**  
 SMT identifier: 0x4016  
 SNMP name: **fddimibPORTPMDClass.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.11.1.x(x = index of the port)  
 Description: This attribute indicates the type of PMD entity associated with this port.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	Multimode Fiber	--
1	Single Mode 1	Multimode Fiber
2	Single Mode 2	Single Mode 1
3	SONET	Single Mode 2
4	Low-cost Fiber	SONET
5	Twisted Pair	Low-cost Fiber
6	Unknown	Twisted Pair
7	Unspecified	Unknown
8	--	Unspecified

Access: Read-only

92. SMT name: **fddiPORTConnectionCapabilities**  
 SMT identifier: 0x4017  
 SNMP name: **fddimibPORTConnectionCapabilities.1.x**(x = index of the port)

SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.12.1.x(x = index of the port)  
 Description: A bit string that indicates the connection capabilities of the port.  
 Encoded as: Bitstring (2) with the following meanings:

<u>Position</u>	<u>Meaning</u>
Bit 0	MAC on LCT possible
Bit 1	MAC on Local Loop possible

Access: Read-only

93. SMT name: **fddiPORTIndex**  
 SMT identifier: 0x401D  
 SNMP name: **fddimibPORTIndex.1.x** (x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.2.1.x(x = index of the port)  
 Description: Index attribute for uniquely identifying the port object instances.  
 Encoded as: Integer (0..65535)  
 Access: Read-only
94. SMT name: **fddiPORTBS-Flag**  
 SMT identifier: 0x4021  
 SNMP name: **fddimibPORTBSFlag.1.x** (x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.13.1.x(x = index of the port)  
 Description: A flag indicating that the specified port is stuck in the break state and cannot initialize the connection to its neighbor.  
 Encoded as: Flag.  
 Access: Read-only
95. SMT name: **fddiPORTLCTFail-Ct**  
 SMT identifier: 0x402A  
 SNMP name: **fddimibPORTLCTFailCts.1.x** (x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.14.1.x(x = index of the port)  
 Description: The count of the consecutive times the link confidence test (LCT) has failed during connection management.  
 Encoded as: 4-octet integer counter.  
 Access: Read-only
96. SMT name: **fddiPORTLer-Estimate**  
 SMT identifier: 0x4033  
 SNMP name: **fddimibPORTLerEstimate.1.x** (x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.15.1.x(x = index of the port)  
 Description: A long term average link error rate. It ranges from  $10^{-4}$  to  $10^{-15}$  and is reported as the absolute value of the base 10 logarithm.  
 Encoded as: Integer (4..15)  
 Access: Read-only
97. SMT name: **fddiPORTLem-Reject-Ct**  
 SMT identifier: 0x4034  
 SNMP name: **fddimibPORTLerRejectCts.1.x** (x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.16.1.x(x = index of the port)  
 Description: A link error monitoring count of the times that a link has been rejected.  
 Encoded as: 4-octet integer counter.  
 Access: Read-only
98. SMT name: **fddiPORTLem-Ct**  
 SMT identifier: 0x4035  
 SNMP name: **fddimibPORTLemCts.1.x** (x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.17.1.x(x = index of the port)  
 Description: The aggregate link error monitor error count, set to zero only on station initialization.  
 Encoded as: 4-octet integer counter.  
 Access: Read-only

99. SMT name: **fddiPORTLer-Cutoff**  
 SMT identifier: 0x403A  
 SNMP name: **fddimibPORTLerCutoff.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.18.1.x(x = index of the port)  
 Description: The link error rate estimate at which a link connection will be broken. It ranges from  $10^{-4}$  to  $10^{-15}$  and is reported as the absolute value of the base 10 logarithm. The default value is 7.  
 Encoded as: Integer (4..15)  
 Access: Read-write

100. SMT name: **fddiPORTLer-Alarm**  
 SMT identifier: 0x403B  
 SNMP name: **fddimibPORTLerAlarm.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.19.1.x(x = index of the port)  
 Description: The link error rate estimate at which a link connection will generate an alarm. It ranges from  $10^{-4}$  to  $10^{-15}$  and is reported as the absolute value of the base 10 logarithm of the estimate. The default value is 8.  
 Encoded as: Integer (4..15)  
 Access: Read-write

101. SMT name: **fddiPORTConnectState**  
 SMT identifier: 0x403D  
 SNMP name: **fddimibPORTConnectState.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.20.1.x(x = index of the port)  
 Description: An indication of the connect state of this port.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	Disabled	--
1	Connecting	Disabled
2	Standby	Connecting
3	Active	Standby
4	--	Active

Access: Read-only

102. SMT name: **fddiPORTPCMState**  
 SMT identifier: 0x403E  
 SNMP name: **fddimibPORTPCMState.1.x**(x = index of the port)  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.21.1.x(x = index of the port)  
 Description: The state of this port's PCM state machine.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	PC0:Off	--
1	PC1:Break	PC0:Off
2	PC2:Trace	PC1:Break
3	PC3:Connect	PC2:Trace
4	PC4:Next	PC3:Connect
5	PC5:Signal	PC4:Next
6	PC6:Join	PC5:Signal
7	PC7:Verify	PC6:Join
8	PC8:Active	PC7:Verify
9	PC9:Maint	PC8:Active
10	--	PC9:Maint

Access: Read-only

103. SMT name: **fddiPORTPC-Withhold**  
 SMT identifier: 0x403F  
 SNMP name: **fddimibPORTPCWithhold.1.x**(x = index of the port)

SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.22.1.x(x = index of the port)  
 Description: An enumerated type indicating the reason that this port's connection was withheld, if any.  
 Encoded as: An enumerated type with the following meanings:

<u>Value</u>	<u>SMT</u>	<u>SNMP</u>
0	None	--
1	M to M	None
2	Other	M to M
3	Path not available	Other
4	--	Path not available

Access: Read-only

104. SMT name: **fddiPORTLerFlag**  
 SMT identifier: 0x4040  
 SNMP name: **fddimibPORTLerFlag.1.x(x = index of the port)**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.23.1.x(x = index of the port)  
 Description: This flag is set to true whenever fddiPORTLerEstimate is less than or equal to fddiPORTLerAlarm, indicating a marginal link.  
 Encoded as: Flag  
 Access: Read-only

105. SMT name: **fddiPORTHardwarePresent**  
 SMT identifier: 0x4041  
 SNMP name: **fddimibPORTHardwarePresent.1.x(x = index of the port)**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.24.1.x(x = index of the port)  
 Description: This attribute indicates that the underlying hardware for this port object is actually present.  
 Encoded as: Flag  
 Access: Read-only

106. SMT name: **fddiPORTAction**  
 SMT identifier: 0x4046  
 SNMP name: **fddimibPORTAction.1.x(x = index of the port)**  
 SNMP identifier: 1.3.6.1.2.1.10.15.73.5.2.1.25.1.x(x = index of the port)  
 Description: Causes one of the following control signals to be sent to the specified port: (PC\_Maint, PC\_Enable, PC\_Disable, PC\_Start, PC\_Stop). For SNMP, this object, when read, will return a value of Other.  
 Encoded as: An enumerated type with one of the following values:

<u>Action</u>	<u>SMT</u>	<u>SNMP</u>
Other	--	1
MaintPORT	0	2
EnablePORT	1	3
DisablePORT	2	4
StartPORT	3	5
StopPORT	4	6

Access: Write-only (SMT); Read-write (SNMP)



## **4B/5B**

The physical layer coding scheme for multimode (FDDI) and single mode (10km) fiber media, respectively.

## **802.1 IEEE**

A set of standards for governing the OSI Data Link layer and the OSI physical layer. For example, 802.1d is the standard for bridging between the LAN standards.

## **802.2 IEEE**

Standards that govern the Logical Link Control (LLC) within the Data Link layer of the OSI model. LLC frames carry user information between the nodes on a network and define the transmission of a frame between two stations. These standards are common across the various lower level standards within the Data Link and the Physical layers.

## **adapter**

A device, usually in the form of a user interface card, that physically connects an endstation to the network medium; for example, twisted pair, coaxial, fiber.

## **ANSI (American National Standards Institute)**

Organization which coordinates, develops, and publishes standards used in the United States.

## **Application layer**

The seventh layer in the OSI model for data communications. It defines protocols for user or application programs.

## **ARP (Address Resolution Protocol)**

A TCP/IP protocol used to dynamically translate the IP address of a network host to its LAN hardware (MAC) address. This action is limited to LANs that support hardware broadcasts.

## **asynchronous transmission**

In FDDI networks, it is the transmission of data according to token-holding rules. Data transmission is initiated by the token holder if the token holding timer has not expired.

## **backbone**

A network configuration that connects LANs into an integrated network.

**bandwidth**

Bandwidth typically indicates the data transmission capacity of a network through a given circuit. Generally, the greater the bandwidth, the more information can be sent through a circuit during a given amount of time.

**baud**

Measurement of signaling speed indicating line changes per second, where line changes can represent one or more bits. The baud is equal to bits-per-second only for line changes representing a single bit.

**beacon**

A special frame used by media access control to announce to the other stations that the ring is broken. The resulting action attempts to restructure the network to account for the probable fault.

**bridge**

An internetworking device used to connect two or more computer networks and to forward packets among the networks. Bridges operate at the Link layer of the OSI model.

**bypass**

The ability of a station to be optically or electronically isolated from the network while maintaining the integrity of the ring.

**CFM (Configuration Management)**

That portion of the Connection Management (CMT) within the Station Management (SMT) function of an FDDI station that provides for the configuration of PHY and MAC entities within a node.

**claim process**

A technique used to determine which station will initialize the FDDI ring.

**CMT (Connection Management)**

That portion of the Station Management (SMT) function within an FDDI station that controls the insertion, removal, and connection of the PHY and MAC entities within that station.

**concentrator**

An FDDI node that provides attachment points (through M ports) for stations that are not connected directly to the dual ring. The concentrator is the focal point of the dual ring of trees topology.

**counter-rotating ring**

An arrangement where two signal paths, whose directions are opposite, exist in a ring topology.

**CPU (Central Processing Unit)**

A computer's main microprocessor chip.

**CRC (Cyclic Redundancy Check)**

An error checking procedure in which bytes at the end of a frame are used by the receiving node to detect a transmission problem.

**DAC (Dual Attachment Concentrator)**

A concentrator that offers two connections to the FDDI network capable of accommodating the FDDI dual (counter-rotating) ring, and additional ports for the connection of other concentrators or FDDI stations.

**DAS (Dual Attachment Station)**

An FDDI station that offers two connections to the FDDI dual counter-rotating ring.

**Differential Manchester encoding**

A signaling method that encodes clock and data information into bit symbols. Each bit symbol is divided into two halves, where the second half is the inverse of the first half. A zero is represented by a polarity change at the start of the bit time; a one is represented by no polarity change at the start of the bit time.

**DMA (Direct Memory Access)**

A fast method of moving data between two processor subsystems without processor intervention.

**downstream**

A term that refers to the relative position of two stations in a ring. A station is downstream of its neighbor if it receives the token after its neighbor receives the token.

**dual homing**

A method of cabling concentrators and stations that permits an alternate or backup path to the dual ring in case the primary connection fails. Can be used in a tree or dual ring of trees configuration.

**dual ring**

An FDDI network topology that uses two redundant rings to overcome fiber-optic failures between two nodes.

**dual ring of trees**

A topology of concentrators and nodes that cascade from concentrators on a dual ring.

### **ECM (Entity Coordination Management)**

That portion of the Connection Management (CMT) within the Station Management (SMT) function of an FDDI station that provides for controlling bypass relays, signaling to PCM (Physical Connection Management) that the medium is available, and coordinating trace functions.

### **encapsulating bridge**

A proprietary hardware device that encapsulates packets into specialized frames, usually by adding a header and a trailer to the frame.

### **encode**

The act of changing data into a series of electrical or optical pulses that can travel efficiently over a medium.

### **extended LAN**

A collection of local area networks (similar or dissimilar) interconnected with a bridge.

### **FDDI (Fiber Distributed Data Interface)**

An ANSI standard (X3T9.5) for 100 Mbps LANs based on the token-passing access method. It is often used to bridge several Ethernet segments at high speed.

### **fiber optic cable**

A transmission medium designed to transmit digital signals in the form of pulses of light.

### **fiber optics**

The technique of using fiber optic transmitters, receivers, and cables for the transmission of data.

### **fragmentation**

A process in which large frames from one network are broken up into smaller frames that are compatible with the frame size requirements of the network to which they will be forwarded.

### **fragment**

In FDDI, pieces of a frame left on the ring; caused by a station stripping a frame from the ring.

### **frame**

A Protocol Data Unit (PDU) transmitted between cooperating MAC entities on an FDDI ring, consisting of a variable number of bytes and control symbols.

**graded index**

A characteristic of fiber optic cable in which the core refraction index is varied so that it is high at the center and matches the refractive index of the cladding at the core-cladding boundary.

**header**

Control information added at the data source to allow data to reach its destination. At the destination, layers corresponding to those at the source that created the header read and remove it, so that only the data reaches the final destination.

**host**

Generally, any computer on a network.

**host name**

A unique name that identifies each host machine on a network.

**ICMP (Internet Control Message Protocol)**

An integral part of the Internet Protocol (IP) that handles error and control messages. Specifically, gateways and hosts use ICMP to send reports of problems with datagrams back to the original source of the datagram. ICMP includes an echo request/reply used to test whether a destination is reachable or responding.

**IEEE (Institute of Electrical and Electronic Engineers)**

An information exchange organization. As part of its various functions, it coordinates, develops, and publishes network standards for use in the United States, following ANSI rules.

**Inter-frame gap**

The interval between frames on the network media. It is defined by FDDI standards to prevent one frame from becoming confused with the next.

**IP (Internet Protocol)**

A network layer protocol that contains addressing and control information to allow packets to be routed over dissimilar networks.

**ISO (International Standards Organization)**

An international body that creates networking standards, including the Open Systems Interconnection (OSI) model.

**KB**

Kilobytes. 1024 bytes.

### **LAN (Local Area Network)**

A data communications network that spans a limited geographical area. The network provides high bandwidth communication over coaxial cable, twisted pair, fiber, or microwave media. It is usually owned by the user.

### **local**

Local refers to files and devices, such as disk drives, that are attached to or on your machine.

### **logical ring**

The circular path a token follows in an FDDI network made up of all the connected MAC sublayers. The physical topology can be a dual ring of trees, a tree, or a ring.

### **MAC (Media Access Control)**

The Data Link layer in the ISO model that describes how devices share access to a network. Ethernet, token-ring, and FDDI are MAC layer specifications. Wiring hubs deal primarily with MAC layer equipment.

### **Manchester encoding**

A signaling method by which clock and data bit information can be combined into a single, self-synchronizable data stream. A transition takes place in the middle of each bit time. A low-to-high transition represents a one; a high-to-low transition represents a zero.

### **Mbps**

Megabits (1,048,576 bits) per second.

### **MIB (Management Information Base)**

A set of variables that describe how data is stored, monitored, and managed. MIB-I and MIB-II are revisions of the database used in a TCP/IP network. The original MIB was renamed to MIB-I when the MIB-II was defined.

### **MIC (Media Interface Connector)**

An optical fiber connector pair that links the fiber media to the FDDI node or another cable. The MIC consists of two halves. The MIC plug terminates an optical fiber cable. The MIC receptacle is associated with the FDDI node.

### **multicast**

A technique that allows copies of a single packet or cell to be passed to a selected subset of all possible destinations.

### **multimode**

A large-core (62.5 micron) optical fiber through which multiple modes will propagate.

**network**

An interconnection of multiple stations or systems that are able to send messages to or receive messages from one another.

**Network layer**

Layer 3 in the OSI model; permits communications between network nodes in an open network.

**NIF (Neighborhood Information Frame)**

Special frames used by the SMT Frame Services within the Station Management (SMT) function of an FDDI station that periodically announce their addresses to downstream neighbors. Each station in the ring makes such an announcement every 30 seconds by sending a NIF that uses Next Station Addressing (NSA), a special addressing mode that permits a station to send a frame to the next station on the token path without knowing the address of that station. This information can be used to create a logical ring map for the order in which each station appears within the ring.

**NMS (Network Management Station)**

The system responsible for managing a network or a portion of a network. The NMS communicates to network management agents which reside in the managed node using a network management protocol.

**node**

A device, such as a station or concentrator, connected to a network.

**NRZ (Nonreturn to Zero)**

A data transmission technique where a polarity level, high or low, represents a logical 1 or 0.

**NRZI (Nonreturn to Zero Invert on Ones)**

A data transmission technique where a polarity transition from low to high, or high to low, represents a logical 1. The absence of a polarity transition represents a 0.

**NSA (Next Station Addressing)**

A special addressing mode in FDDI networks that permits a station to send a frame to the next station on the token path without knowing that station's address.

**optical receiver**

An opto-electronic circuit that converts an incoming optical signal to an electrical signal, typically a photodetector.

**optical transmitter**

An opto-electronic circuit that converts an electrical signal to an optical signal, typically a light emitting diode or a laser diode.

### **OSI Model (Open Systems Interconnection)**

The 7-layer protocol model defined by the International Standards Organization (ISO) for data communications.

### **packet**

Data information that is grouped and transmitted together, such as messages, commands, and control codes.

### **PCM (Physical Connection Management)**

That portion of the Connection Management (CMT) within the Station Management (SMT) function of an FDDI station that manages the physical connect between adjacent PHYs. This includes the signaling of the connection type, link confidence testing, and the enforcement of connection rules.

### **peer-to-peer**

Assigning of communications tasks so that data transmission between logical groups or layers in a network architecture is accomplished between entities in the same sublayer of the OSI model.

### **PDU (Protocol Data Unit)**

The unit of data transfer between peer layer entities. It may contain control information, address information, and/or data (for example, a Service Data Unit from a higher layer entity). A valid PDU is at least 24 bits in length. The FDDI MAC PDUs are tokens and frames.

### **PHY (Physical Layer Protocol)**

A standard protocol that defines symbols, line states, clocking requirements, and the encoding of data for transmission.

### **Physical layer**

Layer 1 in the OSI model; defines and handles the electrical and physical connections between systems. The physical layer can also encode data into a form that is compatible with the medium (coaxial, twisted pair, fiber, and so on).

### **PING (Packet Internet Groper)**

A TCP/IP protocol facility used to test the reachability of destinations by sending an ICMP (Internet Control Message Protocol) echo request and waiting for a reply.

### **PMD (Physical Layer Medium Dependent)**

A standard that defines the medium and protocols to transfer symbols between PHYs.

### **point-to-point**

Transmission of data between two nodes where one node is the sender and the other node is the receiver.

**Presentation layer**

Layer 6 in the OSI model; details protocols governing data formats and conversions.

**propagation delay**

The time it takes for a signal to travel across the network.

**protocol**

A set of rules and conventions that govern the exchange of information between communicating parties on a network.

**reconfiguration**

The operation by which a station determines the location of a fault and isolates it by utilizing the redundancy of the dual FDDI ring.

**repeat frame**

The operation of repeating a group of symbols on the network in exactly the same manner they were received by the station.

**repeater**

A level 1 hardware device that performs the basic actions of restoring signal amplitude, waveform, and timing of signals, before transmission onto another network segment.

**ring**

Connections between two or more stations that form a circular topology.

**RMT (Ring Management)**

That portion of the Station Management (SMT) function within an FDDI station that receives status information from the Media Access Control (MAC) and the Connection Management (CMT). The RMT then reports this status to the SMT and higher-level processes.

**router**

A level 3 hardware device that uses layer 3 protocols to control network communication between stations and forwards messages to endstations or other routers.

**SAC (Single Attachment Concentrator)**

A concentrator that offers one S port for attachment to the FDDI network and M ports for the attachment of stations or other concentrators.

**SAS (Single Attachment Station)**

An FDDI station that offers one S port for attachment to the FDDI ring.

### **services**

A set of functions proved by one OSI/ISO layer or sublayer entity, for use by a higher layer or sublayer entity or by management entities.

### **Session layer**

Layer 5 in the OSI model; defines protocols governing communications between applications.

### **SIF (Station Information Frame)**

Special frames used by the SMT Frame Services within the Station Management (SMT) function of an FDDI station that contain more information about the station's configuration and characteristics than the associated Neighborhood Information Frame (NIF). This information can be used to create a physical ring map that shows the position of each station in both the token path and the network topology.

### **single mode**

A small-core (9 micron) optical fiber through which only one mode can propagate.

### **SMT (Station Management)**

An entity within a network station on an FDDI ring that monitors station activity and exercises control over station activity. The standard defines how to manage the Physical Layer Medium Dependent (PMD), the Physical Layer Protocol (PHY), and the Media Access Control (MAC) portions of FDDI.

### **SMT Frame Services**

That portion of Station Management (SMT) that provides the means to control and observe the FDDI network. The service uses Neighborhood Information Frames (NIF) and Station Information Frames (SIF) to pass an announcement, a request, and the response to a request.

### **SNMP (Simple Network Management Protocol)**

A high level standards-based protocol for network management, usually used in TCP/IP networks. An SNMP monitor controls and measures the activities of SNMP agents that are embedded in nodes and network devices on the network. SNMP relies on Management Information Bases (MIBs) embedded in the network resources to monitor and control the network's topology.

### **spanning tree**

A method of creating a loop-free logical topology on an extended LAN. Formation of a spanning tree topology for transmission of messages across bridges is based on the industry standard spanning tree algorithm defined in IEEE 802.1d.

**station**

An addressable node on the network capable of transmitting and receiving data. In an FDDI ring, the station can repeat data. A station has at least one instance of SMT, at least one instance of PHY and PMD, and an optional MAC entity.

**stuck beacon**

The condition where a station is locked into sending continuous beacon frames.

**TCP/IP (Transmission Control Protocol/Internet Protocol)**

A set of communications protocols that define how different types of computers talk to each other. It is the standard architecture for internetworking multiple organizations, and the common link that ties the huge Internet together.

**token**

A bit pattern consisting of a unique symbol sequence that circulates around the ring following a data transmission. The token grants stations the right to transmit.

**token holding timer**

A timer that controls the amount of time a station may hold the token in order to transmit asynchronous frames.

**token passing**

A method where each node, in turn, receives and passes on the right to use the channel. The nodes are usually configured in a logical ring.

**Token Ring**

A network topology utilizing a token-passing media access protocol in a ring topology. 100 Mbps FDDI and ANSI 802.5 4- and 16-Mbps Token Ring are token ring technologies.

**trace**

A diagnostic process to recover from a stuck-beacon condition. The fault is localized to the beaconing MAC and its upstream neighbor MAC.

**Transport layer**

Layer 4 in the OSI model; defines protocols governing message structure and some error checking.

**TRT (Token Rotation Timer)**

A clock that times the period between the receipt of tokens.

**TTP (Timed-Token Protocol)**

The rules defining how the target token rotation time is set, the length of time a station can hold the token, and how the ring is initialized.

**TTRT (Target Token Rotation Time)**

The value used by the MAC receiver to time the operations of the MAC layer. The TTRT value varies, depending on whether or not the ring is operational.

**TVX (Valid Transmission Timer)**

A timer that times the period between valid transmissions on the ring; used to detect excessive ring noise, token loss, and other faults.

**upstream**

A term that refers to the relative position of two stations in a ring. A station is upstream of its neighbor if it receives the token before its neighbor receives the token.

**UTP (Unshielded Twisted Pair)**

Type 3 cable with one or more twisted pairs where the wiring is not protected from electromagnetic and radio frequency, but covered with plastic or PVC.

**WAN (Wide Area Network)**

A network spanning a large geographical area that provides communications among devices on a regional, national or international basis.

**workgroup**

A network configuration characterized by a small number of attached devices spread over a limited geographical area.

**workstation**

A networked computer typically reserved for end-user applications.

**X3T9.5 ANSI**

The standard specification for an FDDI network operating at 100 Mbps in a ring topology that can extend to hundreds of stations over tens of kilometers without degrading the system.

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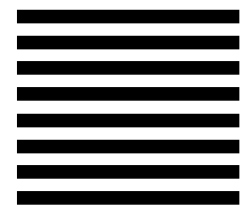
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