ONline Ethernet 10BASE-T Module User's Guide

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Model Number: 5108M-TP

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Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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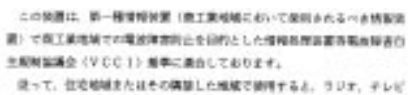

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How to Use This Guide

The *ONline™ Ethernet 10BASE-T Module User's Guide* describes the features, indicators, and installation procedures for the ONline Ethernet 10BASE-T Module. Information on troubleshooting and diagnostics is included for verifying operation. This guide also contains a configuration section which will be helpful when you plan your network configuration.

Audience

This guide is intended for the following people at your site:

- ❑ Network manager or administrator
- ❑ Hardware installer

Structure of This Guide

This guide contains the following chapters:

Chapter 1, Introduction –Introduces the principal features of the ONline Ethernet 10BASE-T Module and provides views and descriptions of the front panel and the dip switches on the module.

Chapter 2, Designing and Expanding the Network – Shows and explains examples of possible network configurations using the ONline System Concentrator and the ONline Ethernet 10BASE-T Module. These examples include both shielded and unshielded twisted pair configurations.

Chapter 3, Installing and Operating the Module – Provides illustrated procedures for installing the 10BASE-T Module into the ONline System Concentrator.

Chapter 4, Troubleshooting –Provides help in isolating and correcting problems that may arise during the installation process and during normal operation.

Appendix A, Specifications – Provides electrical, environmental, and mechanical specifications, as well as other information for the module.

Appendix B, Technical Support – Lists the various methods for contacting the 3Com technical support organization and for accessing other product support services.

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Document Conventions

The following document conventions are used in this manual:

Convention	Indicates	Example
Courier text	User input	In the Agent Information Form, enter `MIS` in the New Contact field.
	System output	After pressing the Apply button, the system displays the message `Transmitting data`.
Bold command string	Path names	Before you begin, read the readme.txt file located in **/usr/snm/agents**.
Italic text in braces	User-substituted identifiers	Use the following command to show port details: `SHOW PORT {`*`slot`*`.all} VERBOSE`
Capitalized text in plain brackets	Keyboard entry by the user	Type your password and press [ENTER].
Italics	Text emphasis, document titles	Ensure that you press the Apply button *after* you add the new search parameters.

Convention	Indicates	Example
Note:	A **Note**. The information is important	**Note:** Use STP lobe cables for your system.
 **Caution:**	A **Caution.** A condition may damage software or hardware	 **Caution:** Do not put your installation diskettes on a magnetic surface. This may damage the diskettes.
 **Warning:**	A **Warning.** A condition may threaten personal safety	 **Warning:** Wear eye protection when performing these maintenance procedures.

Related Documents

This section provides information on supporting documentation, including:

- 3Com Documents
- Reference Documents

3Com Documents

The following documents provide additional information on 3Com products:

17-Slot ONline System Concentrator Installation and Operation Guide – Explains how to install, operate, and manage the 3Com ONline 17-Slot System Concentrator (Models 5017C-LS and 5017C with load sharing).

6-Slot ONline System Concentrator Installation and Operation Guide – Explains how to install, operate, and manage the 3Com ONline 6-Slot System Concentrator.

ONline Ethernet Management Module Installation and Operation Guide – Describes how to install the ONline Ethernet Network Management Module in the ONline System Concentrator and explains the LEDs on the module faceplate. This guide also provides instructions for connecting a terminal to the module and describes the management commands necessary to perform management tasks on the concentrator and on remote devices.

ONline Management Commands Guide – Provides an alphabetized reference resource describing all ONline management commands.

For a complete list of 3Com documents, contact your 3Com representative.

Reference Documents

The following documents supply related background information:

Case, J., Fedor, M., Scoffstall, M., and J. Davin, *The Simple Network Management Protocol*, RFC 1157, University of Tennessee at Knoxville, Performance Systems International and the MIT Laboratory for Computer Science, May 1990.

Rose, M., and K. McCloghrie, *Structure and Identification of Management Information for TCP/IP-based Internets*, RFC 1155, Performance Systems International and Hughes LAN Systems, May 1990.

1 Introduction

This chapter describes the features, indicators, and dip switch settings on the ONline™ Ethernet 10BASE-T Module.

The ONline Ethernet 10BASE-T Module

The ONline™ Ethernet 10BASE-T Module is an eight-port IEEE 802.3 repeater module that complies with the 10BASE-T standard. This module works with the 3Com ONline System Concentrator using both unshielded and shielded twisted pair wiring. The ONline 10BASE-T Module provides the following features and benefits:

- ❑ supports up to 150 meter link distances on 22 gauge wire, up to 125 meters on 24 gauge wire, and up to 100 meters on 26 gauge wire
- ❑ supports up to 200 meter link distance on IBM Type 1 cabling
- ❑ complies fully with the 10BASE-T standard
- ❑ features "hot swap" capability so that you can install or remove the module without having to power down the concentrator

The 10BASE-T Module works with both unshielded and shielded twisted pair wire. A single module can support any mix of shielded and unshielded twisted pair connections. For example, ports 1, 2, and 6 can be unshielded

twisted pair connections while ports 3, 4, 5, and 7 are shielded twisted pair connections.

In addition to complying with the 10BASE-T standard, each port provides support for features that are beyond the scope of the 10BASE-T standard:

- ❑ supports shielded twisted pair cable
- ❑ allows Low Squelch level (which significantly increases achievable link distances)
- ❑ allows Link Integrity to be disabled (which allows connection to some equipment which does not conform to the 10BASE-T standard)

Before installing the Ethernet 10BASE-T Module, read the *ONline System Concentrator Installation and Operation Guide*.

Indicators

The 10BASE-T Module has eight Activity and eight Status LEDs on the front panel that indicate the state of each port on the module. Figure 1-1 shows the locations of these indicators and Table 1-1 describes how to read them.

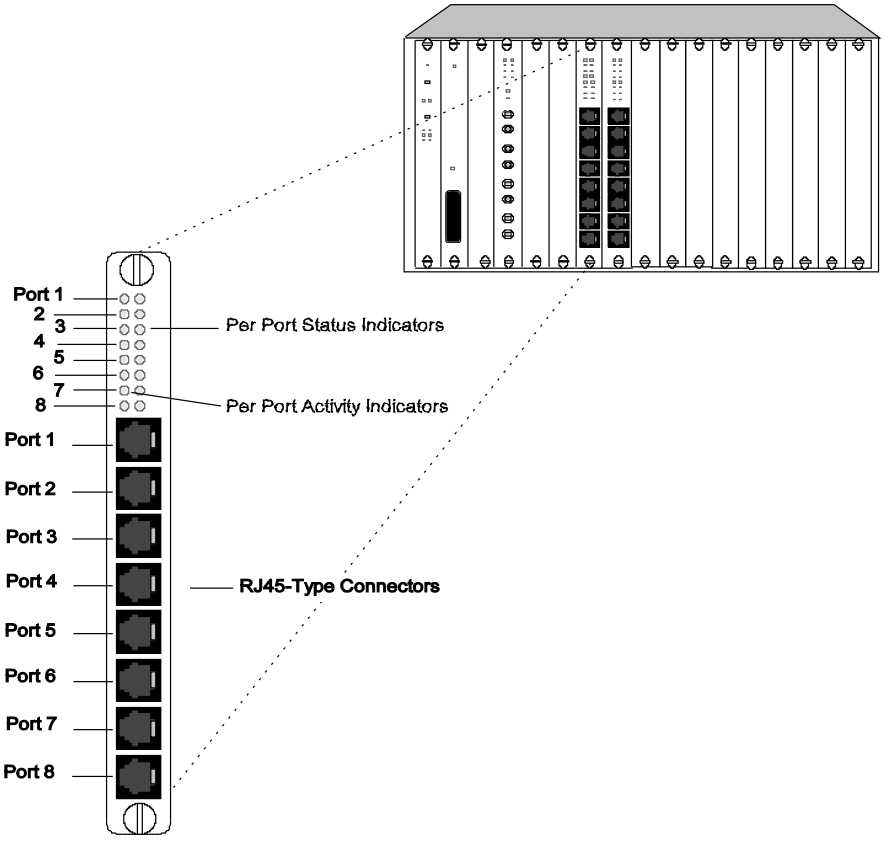

Figure 1-1. 10BASE-T Module Faceplate and ONline System Concentrator

Table 1-1. Interpretation of the 10BASE-T Module LEDs

LED Name	Color	State	Indicates
Activity (Ports 1-8)	yellow	Off	No packets are received on the segment.
		On	Constant activity on the segment.
		Blinking	Normal activity on the segment.
Status (Ports 1-8)	green	Off	Port disabled.
		On	Port enabled and Link Integrity is functional.
		1 blink	Link Integrity error.
		2 blinks	Jabber error or port partitioning.
		Timed blinks (LED is on for 10 seconds, blinks off for 400 msecs)	Link Integrity disabled for this active port.

Dip Switches

The 10BASE-T Module has three dip switches located on the module:

- ❑ 8-switch dip switch (SW1)
- ❑ 4-switch dip switch (SW3)
- ❑ 8-switch dip switch (SW6)

Configure the switches to the settings you want if different than the default values. (Refer to Table 1-2, Table 1-3, Table 1-4, and Table 1-5 for an explanation of the dip switch settings.) Figure 1-2 shows the location of the dip switches.

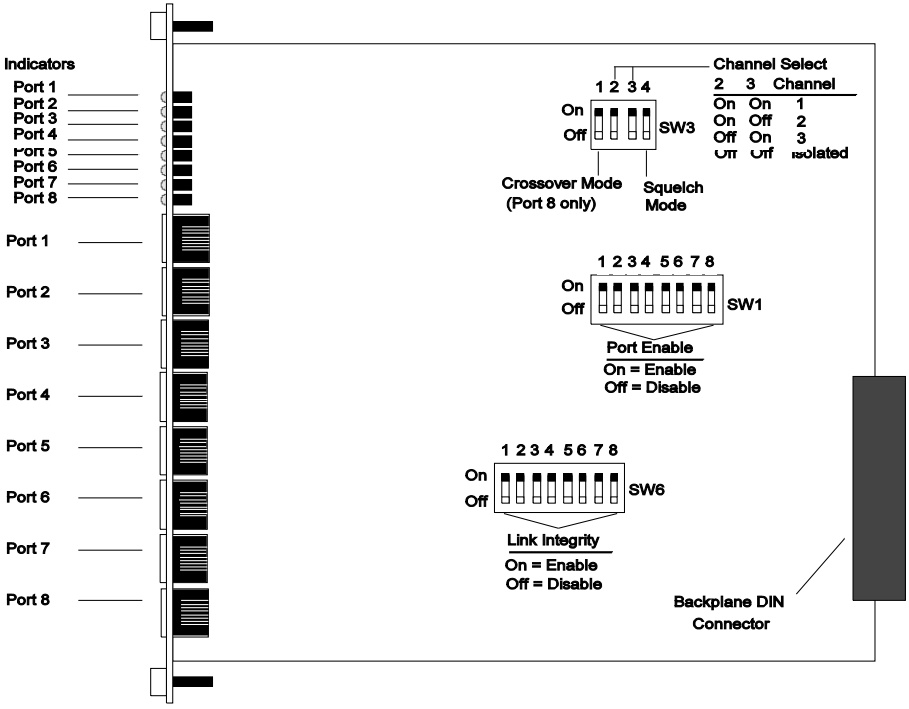

Figure 1-2. 10BASE-T Module and Dip Switch Locations

Dip Switch SW1 (Port Status)

The eight switches on dip switch SW1 allow you to enable or disable each of the eight ports. The switches are labeled 1 through 8 and correspond to the respective eight ports. The Off position disables the port and the On position enables the port. The switch settings are initially configured in the

On position, therefore, all ports are initially enabled. Table 1-2 describes the settings and functions for switches 1 through 8.

Table 1-2. Dip Switch SW1 Settings and Interpretations

Switch	Function	Factory Default	Switch Setting Off	On
1 - 8	Enable/disable port	enable	disable	enable

If you have an ONline Ethernet Network Management Module installed in your concentrator, you can remotely override these switch settings. Refer to the *ONline Ethernet Network Management Module Installation and Operation Guide* for information on remotely managing the ports.

Dip Switch SW3 (Crossover Mode, Channel Select, Squelch)

The four switches on dip switch SW3 allow you to:

- ❑ set port 8 to uncrossed mode
- ❑ select a channel for the module
- ❑ set the Squelch level to high (normal) or low (sensitive)

The switches are labeled 1 through 4 and the settings affect all eight ports. Switch 1 allows you to enable or disable crossover mode for port 8. The channel is initially configured for channel 1 (default) and Squelch level is initially configured for high (default). The following sections explain the crossover, channel selection, and Squelch mode.

If you have an ONline Ethernet Network Management Module installed in your concentrator, you can remotely override these switch settings.

Table 1-3 explains crossover mode and squelch mode switch settings and the sections following the table explain these features in more detail. The channel selection switches are discussed in Table 1-4.

Table 1-3. Dip Switch SW3 Settings for Switches 1 and 4

Switch	Function	Factory Default	Switch Setting Off	On
1	Enable/disable crossover mode for port 8 only	enable	disable (uncrossed)	enable (crossed)
4	Squelch mode	high	low	high

Crossover Mode Switch

All eight ports on the 10BASE-T Module are internally crossed over as per 10BASE-T standard. This enables the 10BASE-T Module to be connected to a 10BASE-T Transceiver. Port 8, however, can be uncrossed using the crossover mode switch to connect the 10BASE-T Module directly to another 10BASE-T Module without the need for an external crossover adapter. One port *must* be crossed over and the other port (port 8) *must* be uncrossed when connecting a 10BASE-T Module to another 10BASE-T Module. If both ports are crossed, you must use an external crossover adapter to provide a proper connection.

The Off position disables crossover mode (uncrosses) and the On position enables crossover mode (default), therefore, port eight is initially crossed over.

Squelch Mode Switch

The Squelch mode switch allows you to set the Squelch level to high (normal) or low (sensitive). The On position sets the Squelch level to high (default). The High Squelch level conforms to the proposed 10BASE-T standard. In general, 3Com recommends using High Squelch.

The Off position sets the Squelch level to low. When the Squelch level is set to low, the ports are able to receive weaker signals. Note that Low Squelch mode does not conform to the 10BASE-T standard. If you change the module's Squelch level to low, you must change the 10BASE-T Transceiver Squelch level to low also. Refer to the *ONline Ethernet 10BASE-T Transceiver Installation Guide* for information on setting the transceiver Squelch level.

On unshielded twisted pair cable, setting the Squelch level to low increases the achievable link distance by approximately 25% to 50%, but with the added risk of losing packets to impulse noise. Do not use Low Squelch mode if your network should experience too many illegally short packets (runts). This problem will occur if there is significant external noise around the link.

Setting the Squelch level to low in conjunction with shielded twisted pair wiring increases the achievable link distance *without* sacrificing noise immunity. Thus, there is no real drawback in using Low Squelch on shielded twisted pair.

To gain the extended link distance achieved by using Low Squelch mode, you must use *qualified* data grade shielded twisted pair cable or *qualified* high performance unshielded cable. IBM Type 1 shielded cable (with an appropriate RJ45 to Type 1 connector), among others, meets this requirement. If you are unsure of the grade of twisted pair cable to use, set the Squelch level to high, or call 3Com for a list of qualified cables to use in extended distance applications.

Channel Select Switch Settings

The ONline Ethernet 10BASE-T Module is equipped with the technology to work with the ONline System Concentrator's unique TriChannel™ architecture. This feature allows you to assign the module to any of three channels (or none) on the ONline System Concentrator backplane. Refer to Chapter 1 in the *ONline System Concentrator Installation and Operation Guide* for a complete discussion of ONline's TriChannel architecture.

The channel select switch settings (switches 2 and 3) on dip switch SW3 let you select a channel. Switches 2 and 3 are factory set to On, therefore, the

10BASE-T Module is initially configured to channel 1. To reconfigure the module to a different channel, refer to the information in Table 1-4.

Table 1-4. Dip Switch SW3 Settings and Interpretations for Switches 2 and 3

	Switch 2	Switch 3	Channel Selection
Switch Setting	On	On	1 (default)
	On	Off	2
	Off	On	3
	Off	Off	Isolated (module operates independent of any channel)

If you have an ONline Ethernet Network Management Module installed in your concentrator, you can remotely override these switch settings.

Dip Switch SW6 (Link Integrity)

The eight switches on dip switch SW6 allow you to enable or disable Link Integrity for each port. The switches are labeled 1 through 8 and correspond to the eight ports. The On position enables Link Integrity for each port (default) and the Off position disables Link Integrity for each port. The switch settings are initially configured in the On position, therefore, all eight ports have Link Integrity enabled, as per the 10BASE-T standard.

In general, you should enable Link Integrity. To conform to the 10BASE-T standard, for example, a connection requires Link Integrity to be enabled. You must disable Link Integrity to connect to older equipment which does not conform to the 10BASE-T standard. Link Integrity must either be enabled at both ends of the link or disabled at both ends or the module will report a Link Integrity error.

If you enable a port and disable Link Integrity, the Status LED is on for 10 seconds and blinks off for 400 msecs to indicate that Link Integrity is disabled.

Table 1-5 lists the settings and functions for switches 1 through 8.

Table 1-5. Dip Switch SW6 Settings and Interpretations

Switch	Function	Factory Default	Switch Setting Off	On
1 - 8	Enable/disable link integrity	enable	disable	enable

If you have an ONline Ethernet Network Management Module installed in your Concentrator, you can remotely override these switch settings.

Related Features

The following sections describe functions which allow you to:

- ❑ check the module's channel assignment and LED functionality
- ❑ remotely manage the 10BASE-T Module

LED and Channel Verification

The ONline Controller Module is equipped with an LED/Channel Check button on the front panel. The LED/Channel Check button has two functions: it causes all LEDs in all modules in the concentrator to light and it causes each module to identify the channel to which it is assigned. When you activate this button, it causes all module LEDs to light for approximately five seconds. Any LED that does not light is defective.

After the five seconds elapse, the diagnostic continues with a channel check of all modules. This channel check causes each module's Status LEDs to blink a number of times corresponding to the channel to which it is

assigned. The channel check sequence repeats five times. Table 1-6 explains the channel check codes.

Table 1-6. Channel Check Codes

LED State	Channel Configuration
1 Blink	Module is configured for channel 1
2 Blinks	Module is configured for channel 2
3 Blinks	Module is configured for channel 3
Off	Isolated (module operates independent of any channel)

The LED/Channel Check button and the Controller Module are explained in more detail in the *ONline Controller Module Installation Guide*.

The ONline Ethernet Network Management Module

The ONline Network Management Module provides remote network management capabilities for the ONline System Concentrator and its modules. The Management Module can also remotely override the following dip switch settings of the 10BASE-T Module:

- ❑ enable/disable each port
  (SET PORT 6.5 MODE ENABLE)
- ❑ enable/disable Link Integrity for each port
  (SET PORT 3.2 LINK_INTEGRITY ENABLE)
- ❑ set Squelch to high level or low level per port
  (SET PORT 5.1 SQUELCH LOW)
- ❑ enable/disable crossover mode for port 8
  (SET MODULE 5 CROSSOVER DISABLE)

- change channel selection (per module)

  (SET MODULE 4 CHANNEL 2)

The ONline Ethernet Management Module allows you to set redundancy between the ports. Refer to Redundant Links in Chapter 2 for an example of setting redundancy between concentrators using 10BASE-T Modules.

Refer to the *ONline Ethernet Network Management Module Installation and Operation Guide* for additional information on the Network Management features.

2 Designing and Expanding the Network

This appendix contains configuration information that will help you to design your network. Install all equipment using only approved cables for proper operation. Refer to Appendix A in the Twisted Pair Connectors and Cables section for information on twisted pair connector and cable requirements.

This appendix describes how to configure your network with the ONline System Concentrator and the ONline Ethernet 10BASE-T Module. It also provides examples of alternative network cabling structures and rules for configuring Ethernet networks. There are five sections:

- Network Diameter Calculations: General Rules
- Fiber Backbone, Twisted Pair To-The-Desk
- Twisted Pair Backbone, Twisted Pair To-The-Desk
- Redundant Links
- Patch Panels

Understanding the General Rules

As part of your network design, it is important to consider your network size. For instance, is the network (end-to-end) 100 meters, 1000 meters, 4000 meters, or more? What are your plans for expansion? Your answers play a role in how you configure your network. For example, once the network expands beyond a certain size, you need to add a bridge or other internetworking device.

This section describes general rules for configuring an Ethernet network using fiber as the backbone medium. It also provides rules to ensure that your network configuration conforms to distance limitations imposed by Ethernet and networking equipment.

This section includes:

- Basic Network Rules
- LAN Equivalence

Basic Network Rules

This section outlines the basic network rules and 3Com recommendations for these rules. For more hardware-specific information on the 10-Port module, refer to Appendix A.

Table 2-1 outlines the seven basic rules to keep in mind when you construct your network.

Table 2-1. Seven Basic Network Rules

Rule	Definition	Recommendations/Notes
1	If possible, use 10BASE-FB as the backbone medium.	Use 62.5 micron cable to conform with the IEEE 10BASE-F and upcoming ANSI FDDI standards.
		Use ST-type connectors.
2	Wire the backbone in a star topology to isolate faults.	Make sure to lay extra fiber cables. The extra cost is small and you will find you need them as your network grows.
		The star topology conforms to FDDI wiring as well -- just make sure to run at least two fiber strands to every backbone connection.
3	The maximum Fiber Ethernet network diameter is 4200 meters of fiber cable.	The 4200 meters is the maximum distance between any two transceivers on the network.
		The 4200 meters *does not include* the transceiver cable (that is, drop or patch cable) that connects a device with an external transceiver. Transceiver cables can extend up to 50 meters. Thus, total network diameter can be as much as 4300 meters (4200 m + 2 * 50 m) between any two nodes.

Table 2-1. Seven Basic Network Rules (Continued)

Rule	Definition	Recommendations/Notes
4	Certain LAN devices on the network shrink the maximum Fiber Ethernet network diameter to less than 4200 meters.	Many LAN products delay the signal that goes through them. This is known as *equivalent distance*. Every microsecond delay reduces the maximum link distance. In fact, every microsecond delay shrinks the network diameter by approximately 200 meters of fiber cable. Table 2-2 lists the Equivalent Distances for other 3Com products.
5	Assume that one meter of coaxial or twisted pair is equal to one meter of fiber cable.	This is a conservative rule of thumb. For example, the actual equivalence is about 1.1 meters of coaxial for every meter of fiber. For simplicity, assume one meter.

Table 2-1. Seven Basic Network Rules (Continued)

Rule	Definition	Recommendations/Notes
6	The fiber link distances must not exceed the limits imposed by the optical power budget.	In general, on 62.5 micron cable, you can go up to 4000 meters point-to-point using the ONcore or ONline Fiber Modules. If you have poor quality cable or cross many patch panels, you may have to sacrifice some distance.
		Some older Ethernet fiber optic products are less powerful than ONcore Fiber Module optics. So when connecting to these products, remember that the least powerful device determines the maximum point-to-point distance.
7	When in doubt, use a bridge.	If you are not certain if you have exceeded allowable network distances, use a bridge to extend the network.

LAN Equivalence

LAN equivalence is the sum of both the incoming and outgoing module port signals. Different modules, however, have different equivalent distances. Table 2-2 lists the LAN product equivalent distances.

Table 2-2. LAN Product Equivalent Distances

LAN Product	Equivalent Distance (meters)
ONcore Ethernet 10-Port 10BASE-FB Module	190
Incoming signal to fiber port	140
Outgoing signal from fiber port	50
ONcore Ethernet 10BASE-T Module	585
Incoming signal to TP port	420
Outgoing signal from TP port	165
ONline Ethernet 10BASE-T Modules	585
Incoming signal to TP port	420
Outgoing signal from TP port	165
ONline Ethernet Fiber or 10BASE-FB Modules	190
Incoming signal to fiber port	140
Outgoing signal from fiber port	50
ONline Ethernet FOIRL Module	560
Incoming signal to fiber port	330
Outgoing signal from fiber port	230
ONline Ethernet Transceiver Module	0
10BASE-FB Star Coupler (8 or 14 port) 26	180

Table 2-2. LAN Product Equivalent Distances (Continued)

LAN Product	Equivalent Distance (meters)
ONline Ethernet BNC Module	900
Incoming signal to BNC port	450
Outgoing signal from BNC port	450
ONline Ethernet Repeater Module	800
Incoming signal to AUI port	600
Outgoing signal from AUI port	200
IEEE Repeater	800

Fiber Backbone, Twisted Pair To-The-Desk

When you configure a network with unshielded or shielded twisted pair cabling to-the-desk and fiber for the backbone, there are only three additional rules you need to be aware of:

- There can be no more than eight 10BASE-T Modules (5108M-TP) in the path between any two transceivers due to Ethernet's four-repeater rule (each 10BASE-T Module counts as a 1/2 repeater). You must add a bridge if you have more than eight 10BASE-T Modules serially connected.
- There is an equivalent fiber distance for the ONline Fiber Modules (see Rule 4). The equivalent is:
  - 140 meters for signals that externally enter a Fiber Module port
  - 50 meters for signals that internally enter a Fiber Module via the ONline Concentrator backplane

- There is an equivalent fiber distance for the 10BASE-T Modules (see Rule 4). The equivalence is:
  - 420 meters for signals that externally enter a 10BASE-T Module port
  - 165 meters for signals that internally enter a 10BASE-T Module via the ONline Concentrator backplane

Thus, for every pair of 10BASE-T Modules that a signal goes through, there is a fiber equivalent distance of 585 meters (420 m + 165 m = 585 m). This is also true if a signal makes a roundtrip through a single 10BASE-T Module, i.e., enters a 10BASE-T port externally and exits through another port on the same 10BASE-T Module. This counts as 585 meters of fiber equivalent distance, and as a full repeater.

Fiber Backbone, Twisted Pair To-The-Desk Example

In the sample configuration shown in Figure 2-1, we determine if the transceivers are within legal Ethernet limits. This example is applicable to both unshielded and shielded twisted pair cables. Note that 22 gauge unshielded twisted pair cable is used to connect 10BASE-T Transceivers to the 10BASE-T Modules in the concentrators.

The first step is to identify the two transceivers that are likely to be the greatest fiber equivalent distance apart. In this case, they are 10BASE-T Transceivers A and B.

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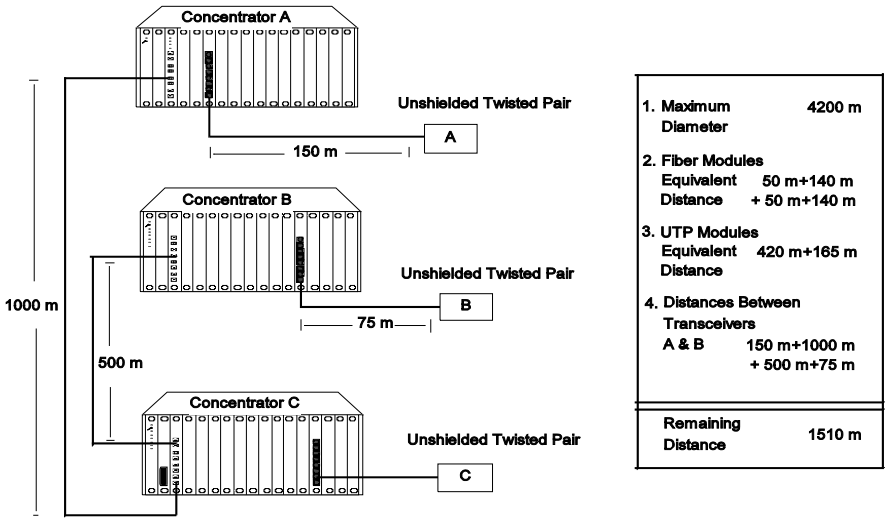

Figure 2-1. Sample Configuration Distance Calculation

Use the following steps to determine whether your network configuration is legal:

1. Begin with 4.2 km (4200 m) since this is the maximum network diameter for a pure fiber network (Rule 3).

2. Subtract 100 m for the signal exiting the Fiber Modules in concentrators A and C (2 * 50) and 280 m for the signal entering the Fiber Modules in concentrators C and B (2 * 140) as explained in Rule 4 and defined in Table 2-2.

3. Subtract 420 m of fiber equivalent distance for the signal entering the 10BASE-T Module in concentrator A and 165 m for the signal exiting the 10BASE-T Module in concentrator B (Rule 4).

4. Subtract all cable lengths between the two transceivers and if the result is greater than zero, the configuration is within legal Ethernet limits (Rule 5).

For the configuration shown in Figure 2-1 to work, the fiber equivalent distance between transceiver A and transceiver B must be less than 4200 meters. As you can see in the calculation, there are still 1510 meters left for expansion in this configuration.

Be aware that the link from a 10BASE-T Module to a 10BASE-T Transceiver should not exceed the distances as defined in Table 2-3. In this example, the link cannot exceed 150 meters, using the 10BASE-T standard High Squelch mode and 22 gauge wire.

Table 2-3. Maximum Link Distance on Twisted Pair

Cable Gauge	Supports Link Distances Up To:	
Unshielded Twisted Pair: 10BASE-T	***High Squelch***	***Low Squelch***
22 (.6mm)	150m	200m
24 (.5mm)	125m	150m
Shielded Twisted Pair: IBM Type 1	***High Squelch***	***Low Squelch***
22 (.6mm)	200m	300m

In areas of low noise, the Squelch level can be lowered to accept weaker signals. (Low Squelch does not conform to the 10BASE-T standard.) This allows the acceptable link distance to increase to 200 meters. The 10BASE-T standard limits link distance to approximately 200 meters (equivalent to 1 µsec of delay) on unshielded twisted pair.

10BASE-T signaling can also be used on shielded twisted pair even though the standard does not include shielded twisted pair in its specification. Since external noise does not affect signals on shielded twisted pair, there is no restriction in using the Low Squelch level. Using Low Squelch on shielded twisted pair allows link distances of up to 300 meters. Nevertheless, 3Com recommends that you always use the High Squelch setting except in situations where the link distance exceeds 200 meters.

Twisted Pair Backbone, Twisted Pair To-The-Desk

In constructing a twisted pair backbone, one additional configuration rule must be considered:

- There can be no more than eight 10BASE-T Modules in the path between any two transceivers due to the Ethernet four-repeater rule (each 10BASE-T Module counts as a 1/2 repeater). You must add a bridge if you have more than eight 10BASE-T Modules serially connected.

The configuration in Figure 2-2 illustrates a possible unshielded twisted pair network using 22 gauge cable.

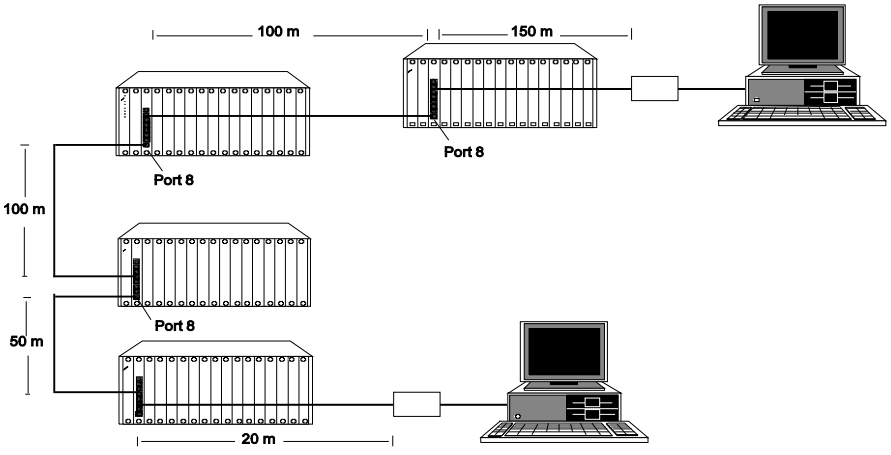

Figure 2-2. Unshielded Twisted Pair Network

Note that when connecting two concentrators with twisted pair cable, use port 8 on one of the 10BASE-T Modules and disable crossover mode for that port. This allows a direct connection to another 10BASE-T Module without the need for an intervening adapter. (Refer to Dip Switch SW3 (Crossover Mode, Channel Select, Squelch) in Chapter 1 for information on crossover mode and the crossover mode switch setting.)

While there is no fiber in this configuration, the fiber equivalent distance can be calculated as follows:

Total link distance: 150 m + 100 m + 100 m + 50 m + 20 m = 420 m

Total equivalent distance of 10BASE-T Modules:
4 * 420 m + 4 * 165 m = 2340 m
(signal externally enters four 10BASE-T Modules: 4 * 420 m)
(signal enters four 10BASE-T Modules from the backplane: 4 * 165 m)

Total equivalent distance: 420 m + 2340 m = 2760 m

Since the total equivalent distance (2760 m) is less than 4200 meters, this is a legitimate configuration.

Note that if shielded twisted pair cabling is used, each link in the network could run up to 300 meters using Low Squelch (refer to Dip Switch SW3 (Crossover Mode, Channel Select, Squelch) in Chapter 1 for information on Squelch levels and the Squelch dip switch setting). Low Squelch is acceptable for all shielded twisted pair applications since external noise is not a problem.

Redundant Links

You can implement twisted pair link redundancy between ONline System Concentrators using Network Management. Figure 2-3 below shows an example of a redundant configuration between concentrators using 10BASE-T Modules.

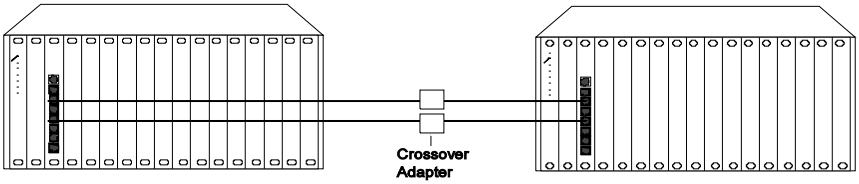

Figure 2-3. Redundant Twisted Pair Configuration

To set redundancy between two 10BASE-T Modules, connect two links between the modules. The redundant link must be connected to a port on the same 10BASE-T Module as the primary link. Use a crossover adapter between each link unless you choose to uncross port 8 on one of the modules to make the connection. Refer to Chapter 1 for information on using crossover mode. Then use the SET PORT <slot.port> MODE REDUNDANT <slot.port> command to specify which port is the primary link and which is the backup link.

Note: If the 10BASE-T Modules are powered down, and then brought back up without the Ethernet Management Module present, a network loop could occur. To prevent a potential failure, 3Com advises that you disable the Port Enable dip switch setting for the backup port on one of the 10BASE-T Modules.

Once redundancy is configured, a switchover will occur under three conditions: a link failure; port partition; or a jabber condition. The switchover occurs when the primary link fails. (Note that in the unlikely event of a partial break in the link, a switchover may not occur. In this situation, use Network Management to manually switch over the ports.)

Once the switchover occurs, and the primary link becomes operational, a switch-over back to the primary link happens automatically if the cause of the original switchover was a link failure. If a jabber condition causes the switchover, the link will not automatically switch back to the primary once the problem is resolved. In this case, use Network Management to manually switch back to the primary link.

Refer to the *ONline Ethernet Network Management Module Installation and Operation Guide* for information on setting redundancy between 10BASE-T Module ports.

Patch Panels

Patch panels weaken signals, thereby reducing achievable link distances. 3Com includes the use of one patch panel in the 150 meter link distance calculation. However, each additional patch panel in the link reduces the 150 meter link distance by approximately 10 meters.

In the example in Figure 2-2, if two patch panels were used between the top right PC and the top right concentrator, the link distance of 150 meters would have to be shortened to 140 meters. This is because the maximum allowable link distance on 22 gauge wire using 10BASE-T signaling with two intervening patch panels is 150 meters minus approximately 10 meters.

Note that a patch panel installed between the bottom right PC and the bottom left concentrator would not affect the link since it is only 20 meters.

3 Installing and Operating the Module

This chapter describes the precautionary, unpacking, and installation procedures for the Ethernet 10BASE-T Module.

Precautionary Procedures

Electrostatic discharge (ESD) can damage static-sensitive devices on circuit boards. Follow these precautions when you handle the 10BASE-T Module.

- ❑ Do not remove the board from its anti-static shielding bag until you are ready to inspect it.
- ❑ Handle the board by the faceplate.

Use proper grounding techniques when you install the 10BASE-T Module. These techniques include using a foot strap and grounded mat or wearing a grounded static discharge wrist strap. An alternate method is to touch the grounded rack or other source of ground just before you handle the module.

Unpacking Procedures

Use the following procedure when unpacking your 10BASE-T Module.

1. Verify that the 10BASE-T Module is the correct model by matching the model number listed on the side of the shipping carton to the model number you ordered (5108M-TP).

   Note that the product model number printed on the shipping box differs from the model number on the product. The model number on the shipping box contains the prefix '3C9'.

2. Remove the 10BASE-T Module from the shipping carton.

3. Remove the module from the anti-static shielding bag and inspect it for damage. Always handle the 10BASE-T Module by the faceplate being careful not to touch the components.

   If the module appears to be damaged, replace it in the anti-static shielding bag, return it to the shipping carton, and contact your local supplier.

3Com suggests you keep the shipping carton and anti-static shielding bag in which your module was shipped in case you later want to repackage the module for storage or shipment.

We also suggest that you record the serial number of your 10BASE-T Module. We have provided a log for this and other information specific to your modules under the Slot Usage Chart in Appendix B of the *ONline System Concentrator Installation and Operation Guide*.

Installation Procedures

You do not need to power down the ONline System Concentrator to install the 10BASE-T Module. You can insert the module while the concentrator is operating (called a *hot insertion*). Follow the steps below to install the 10BASE-T Module.

1. Set the dip switches on the board to the settings you want, if different than the default values. (Refer to Table 1-2, Table 1-3, Table 1-4, and Table 1-5 for an explanation of the dip switch settings.)

2. Locate a blank slot in the concentrator. If there is no blank slot, you must remove a blank panel on the concentrator to expose a slot for the 10BASE-T Module.

3. Insert the module into the board guides at the top and bottom of the slot and slide it into the concentrator. Makesure the connector is well seated into the backplane of the concentrator.

   Figure 3-1 shows the installation of the 10BASE-T Module.

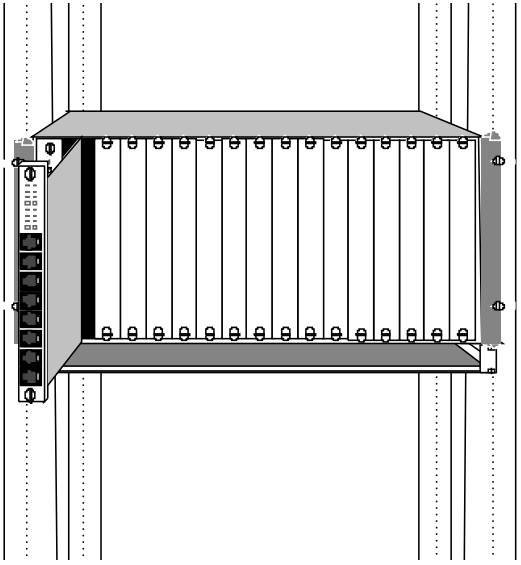

Figure 3-1. Installing a 10BASE-T Module

4. Fasten the spring-loaded screws on the front of the 10BASE-T Module face-plate to the concentrator with your fingers (do not overtighten).

5. Attach the twisted pair cable to the port on the front of the 10BASE-T Module as shown in Figure 3-2. Then attach the other end of the cable to another 10BASE-T Module, a 10BASE-T Transceiver, or a 10BASE-T Adapter Card.

   Figure 3-2 shows a cable attached to the 10BASE-T Module.

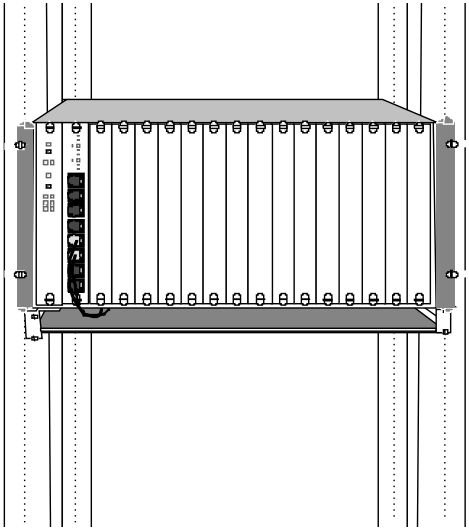

Figure 3-2. 10BASE-T Module Cable Connection

4 Troubleshooting

This chapter describes troubleshooting procedures for the ONline Ethernet 10BASE-T Module. Information on troubleshooting will assist you in verifying operation. Typical fault conditions are addressed in this chapter.

Troubleshooting

Diagnostic features are covered in Table 1-1 on page 1-4. Table 4-1 and Table 4-2 in this chapter cover fault conditions and troubleshooting suggestions for the 10BASE-T Module. This chapter is divided into the following parts:

- Troubleshooting With the Port Status LEDs
- Troubleshooting With the Activity LEDs
- Technical Assistance

Troubleshooting With the Status LEDs

A blinking Port Status indicator may be a sign that the port detects a potential problem. Once a port detects a problem, you can further analyze the problem by counting the number of blinks. Table 4-1 provides troubleshooting suggestions for each of the blinking sequences.

Table 4-1. Troubleshooting With the Port Status LEDs

LED State	Indication	Possible Problem	Troubleshooting Suggestions
Off	Port Disabled	Port disabled	Enable port.
		10BASE-T Module not powered	Check the Controller Module Power LEDs.
		Broken LED	Press the LED/Channel Check button on the Controller Module.
		Bad 10BASE-T Module	Replace module.

Table 4-1. Troubleshooting With the Port Status LEDs (Continued)

LED State	Indication	Possible Problem	Troubleshooting Suggestions
1 Blink	Link Integrity Error	Cable not connected	Connect cable.
		Cable broken	Check cable with cable tester. Repair or replace cable.
		Cable too long	Try a shorter cable.
		Remote connection has Link Integrity disabled	Enable Link Integrity at remote connection or if the remote link does not have Link Integrity, disable Link Integrity at local connection.
		Weak or no signal - link distance too long	Change Squelch level from high to low (low setting does not conform to the 10BASE-T standard).
		Bad port	Try another port.
		Device attached to transceiver at other end is not powered on	This is not a problem.

Table 4-1. Troubleshooting With the Port Status LEDs (Continued)

LED State	Indication	Possible Problem	Troubleshooting Suggestions
2 Blinks	Port Partitioning	Faulty cable	Check cable with cable tester. Repair or replace cable.
		Network overloaded	Reassign users to another channel to balance the load.
	Jabber condition	Transceiver attached to the port is jabbering or has DTE jabber	Try another port or replace module.
Timed Blinks (LED is on for 10 seconds, blinks off for 400 msecs)	Link Integrity Disabled	None	This is not a problem. You may want Link Integrity disabled.

Troubleshooting With the Activity LEDs

There may be situations where a port's Activity LED may not light. Use the troubleshooting suggestions in Table 4-2 to help isolate why this has occurred.

Table 4-2. Troubleshooting With the Port Activity LEDs

LED Name	LED State	Possible Problem	Troubleshooting Solutions
Activity (Ports 1 - 8)	Off	There is no traffic received from the segment (normal)	None.
		The port is disabled	Check the port enable dip switch setting.
		The power is off	Check the Controller Module Power LEDs.
		The Activity LED has burnt out	Press the LED/Channel Check button on the Controller Module.
		The 10BASE-T Module port is faulty	Connect the cable to a different port.
		The module connection to the backplane is bad	Reinsert the 10BASE-T Module. If this fails, try another concentrator slot.
		The 10BASE-T Module is faulty	Try a different 10BASE-T Module.

Technical Assistance

You can receive assistance for installing and troubleshooting the 10BASE-T Module by calling either your 3Com reseller or 3Com Technical Support. Be prepared to supply a representative with the following information:

- ❑ Description of the problem
- ❑ Steps you have taken to try and correct the problem
- ❑ Type and software version of the ONline network management module being used
- ❑ Version of software installed on your 10BASE-T Module
- ❑ Status of the front panel LEDs
- ❑ Configuration of your concentrator

  (you may find it helpful to refer to the Slot Usage Chart in Appendix B of the *ONline System Concentrator Installation and Operation Guide* for a record of this information)

Reber to Appendix B for instructions on contacting Technical Support for your product.

A Specifications

ONline Ethernet 10BASE-T Module Specifications

This appendix lists specifications for the 10BASE-T Module. There are five subsections:

- Electrical Specifications
- Environmental Specifications
- Mechanical Specifications
- General Specifications
- Twisted Pair Connectors and Cables

Electrical Specifications

Backplane Interface: 96-pin edge connector, compatible with the 3Com ONline System Concentrators.

Power Requirements: 1.75 A for 5V
Fuse: 4.0 Amps Fast blow
Watts: 8.75

Environmental Specifications

Operating Temperature: 0° to 50° C (32° to 122° F)

Storage Temperature: -30° to 65° C (-22° to 149° F)

Humidity: less than 95%, non-condensing

BTU/hr: 30

Mechanical Specifications

Dimensions: 1.0" W x 10.25" L x 8.5" H
(2.54 cm x 26.04 cm x 21.6 cm)

Weight: 1.25 lb. (0.57 kg.)

General Specifications

Data Rate: 10 Mbps (million bits per second)

Data modulation: Manchester

Diagnostic modulation: Link Integrity pulse

Collision detection: 100% deterministic

Maximum number of nodes: 1024

Configuration rules: supports IEEE 802.3 controllers and IEEE 802.3 repeaters

Jabber Protection: 6.5 milliseconds

Port Connectors: Shielded 8-pin modular telephone jack, compatible with an unshielded connector

Cabling: 22, 24, or 26 AWG unshielded or shielded twisted pair cable

Cable differential impedance: 85 ohms to 150 ohms over 1 to 16 MHz band

Cable propagation velocity: >.585c

Host Interface: 3Com ONline System Concentrator bus interface standard

Installation Attachment: Two thumbscrews on the mounting bracket

Twisted Pair Connectors and Cables

There are many types of cables and connectors that you can use to link your 10BASE-T Module to your network. These cables and connectors are explained in the following sections. Use this information to ensure that the cables and connecting hardware meet requirements. For proper operation, use only approved cables when you install all equipment. This section is divided into the following parts:

- Twisted Pair Connectors
- Twisted Pair Cables

Twisted Pair Connectors

The IEEE 802.3 10BASE-T standard for pin-outs must be used. The following cable standard *must* be used. 10BASE-T uses 2 pairs of wire: pins 1 & 2 and pins 3 & 6. If the pairs are not configured this way, the connection will not work properly. Datagrade cable should have the following pin pairings:

- pins 4 and 5 are pair 1
- pins 3 and 6 are pair 2
- pins 1 and 2 are pair 3
- pins 7 and 8 are pair 4

Refer to Figure A-1 for an example of this connector and the cable pin-outs.

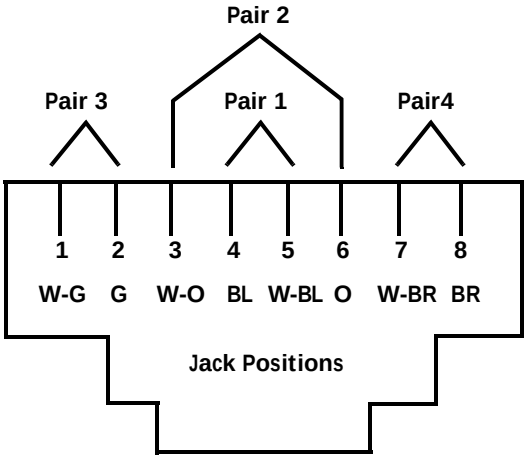

Figure A-1. RJ45 Connector Pin-outs

Some installations may have 50-pin Telco connectors at the wiring closet. We recommend using a patch panel that converts from 50-pin to RJ45-type connectors. This allows direct connection to the ONline Ethernet 10BASE-T Module in your ONline System Concentrator.

Twisted Pair Cables

The cables that are supported must meet the following qualifications:

- ❑ 22, 24, or 26 gauge twisted pair cable
- ❑ 80 to 150 ohm impedance
- ❑ minimum of 2 pairs

Usually, a pair on a twisted pair cable is designated by a solid color wire twisted with a striped wire with the same color.

Connecting Twisted Pair Cables

We recommend that you connect cables first at the active concentrator location, and connect transceivers second. Refer to the *ONline System Concentrator Installation and Operation Guide* for more information about the ONline System Concentrator connections.

B Technical Support

3Com provides easy access to technical support information through a variety of services. This appendix describes the following services:

- On-line Technical Support
- Support from Your Network Supplier
- Support from 3Com
- Returning Products for Repair
- Accessing the 3Com MIB
- 3Com Technical Publications

On-line Technical Support

3Com offers worldwide product support through the following on-line systems:

- Email Technical Service
- World Wide Web Site

Email Technical Support

You can contact the Integrated Systems Division (formerly Chipcom) on the Internet for technical support using the e-mail address techsupp@chipcom.com.

World Wide Web Site

You can access the latest networking information on the 3Com World Wide Web site by entering our URL into your Internet browser:

http://www.3Com.com/

This service features news and information about 3Com products, customer service and support, the 3Com latest news releases, selected articles from 3TECH™, the 3Com award-winning technical journal, and more.

You can contact the Integrated Systems Division on the World Wide Web by entering our URL into your Internet browser:

http://www.chipcom.com/

There are links between both WWW pages to view information from all 3Com divisions.

Support from Your Network Supplier

If additional assistance is required, contact your network supplier. Many suppliers are authorized 3Com service partners who are qualified to provide a variety of services, including network planning, installation, hardware maintenance, application training, and support services.

When you contact your network supplier for assistance, have the following information ready:

- Diagnostic error messages
- A list of system hardware and software, including revision levels
- Details about recent configuration changes, if applicable

If you are unable to contact your network supplier, see the following section on how to contact 3Com.

Support from 3Com

If you are unable to receive support from your network supplier, technical support contracts are available from 3Com.

For direct access to customer service for Integrated Systems Division products in:

- U.S.A. and Canada - call (800) 724-2447
- Asia Pacific - call (508) 787-5151
- Europe - Refer to the table below. For European countries not listed, call 31 30 60 299 00.

Country	Telephone Number
Belgium	0800 71429
Denmark	800 17309
Finland	0800 113153
France	05 917959
Germany	0130 821502
Ireland	1 800 553117
Italy	1678 79489

Country	Telephone Number
Netherlands	06 0227788
Norway	800 11376
Spain	900 983125
Sweden	020 795482
U.K.	0800 966197
U.S.	800 876-3266

For access to customer service for all 3Com products, call (800) 876-3266.

You can also contact the Integrated Systems Division (ISD) on the Internet by using the e-mail address techsupp@chipcom.com.

Returning Products for Repair

A product sent directly to 3Com for repair must first be assigned a Return Materials Authorization (RMA) number. A product sent to 3Com without an RMA number will be returned to the sender unopened, at the sender's expense.

To obtain an RMA number for Integrated Systems Division products (formerly Chipcom), use the following numbers.

Country	Telephone Number	Fax Number
U.S. and Canada	(800) 724-2447	(508) 787-3400
Europe	(44) (1442) 275860	No Fax
Asia Pacific	(508) 787-5296	(508) 787-3400

Accessing the 3Com MIB

The 3Com Management Information Base (MIB) for the Integrated Systems Division describes commands that enable you to manage 3Com SNMP-based products. The MIB is available over the Internet on an anonymous FTP server. Updates to these MIBs are released as new 3Com products are introduced.

To access Internet versions:

1. FTP to `ftp.chipcom.com` (151.104.9.65).
2. Enter the login name `anonymous`.

3. Enter your full Internet e-mail address as the password (for example, `jdoe@company.com`).

4. Change to the mib or schema directory using the `cd /pub/mibs` or `cd /pub/mibs/schemas` command.

5. To view the 3Com MIB, OID, or schema entries, enter the `dir` command.

   - ❑ To pause the display, press [CTRL-S].
   - ❑ To continue the display, press [CTRL-Q].

6. Copy the MIB, OID, or schema files to your current directory using the appropriate command (for example, `get chipcom.mib`).

7. To exit the FTP session, invoke the `quit` command.

3Com Technical Publications

If you have comments or questions on 3Com Integrated Systems Division Technical Publications documents, please contact the Technical Publications group by FAX (508) 229-1551.

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