10BASE-FB Transceiver Installation Guide

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Model Numbers: 5101T-FB-SMA
5101T-FB-ST
5101T-FB-FC

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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Class A prescrites dans le norme sur le materièl brouilleur : “Appareils Numériques”, NMB-003 édictée par le ministrè des Communications.

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled “Digital Apparatus”, ICES-003 of the Department of Communications.

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This is to certify that the (5101T-FB) is shielded against radio interference in accordance with the provisions of Vfg 243/1991.

The German Postal Services have been advised that this device is being put on the market and that they have been given the right to inspect the series for compliance with the regulations.

CAUTION

Do not install in air ducts or plenums. For installation in other environmental air handling spaces, use only with cable classified by Underwriters Laboratories as to fire and smoke characteristics in accordance with Section 770-2(b) and Section 725- 2(b) of the National Electrical Code.

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Table of Contents

Preface

This guide describes the features, DIP switch, installation steps, operation verification, and problem diagnosis for the 3Com 10BASE-FB Transceiver.

Intended Audience

This guide is intended for use by installers, users, and network managers. It does not include detailed service information. This product must be serviced by personnel at, or approved by, 3Com Corporation or the warranty is voided.

Before you use the 10BASE-FB Transceiver, read this guide to familiarize yourself with the product. Also read the reference manual for the product to which you are connecting the 10BASE-FB Transceiver.

This guide is divided into five sections:

- Transceiver Overview - Describes the transceiver controls and indicators.
- Installation - Describes how to unpack, power up, and verify transceiver operation.
- Troubleshooting - Provides help in isolating problems that can occur during installation and provides procedures for correcting them through use of the extensive diagnostic features built into the product set.
- AUI Cables and Pinouts - Describes common problems with IEEE 802.3 and Ethernet Transceiver (AUI) cables. Cable pinouts as well as rules for proper cabling are described.
- Specifications - Describes the transceiver optical specifications and AUI specifications.

Transceiver Overview

This section provides descriptions of the AUI connector, fiber optic ports, indicators, and DIP switch on the transceiver front, rear, and top panel (respectively). 3Com recommends that you become familiar with these features prior to installation.

Note: Do not under any circumstances attempt to open the transceiver enclosure.

Transceiver Top Panel

The top panel of the Transceiver contains a label briefly describing:

- LED blink sequences
- Functions of the DIP switch

The DIP switch has four switches for configuring transceiver operation.

Figure 1 illustrates the top panel of the 3Com 10BASE-FB Transceiver. Table 1 provides a description of the DIP switches.

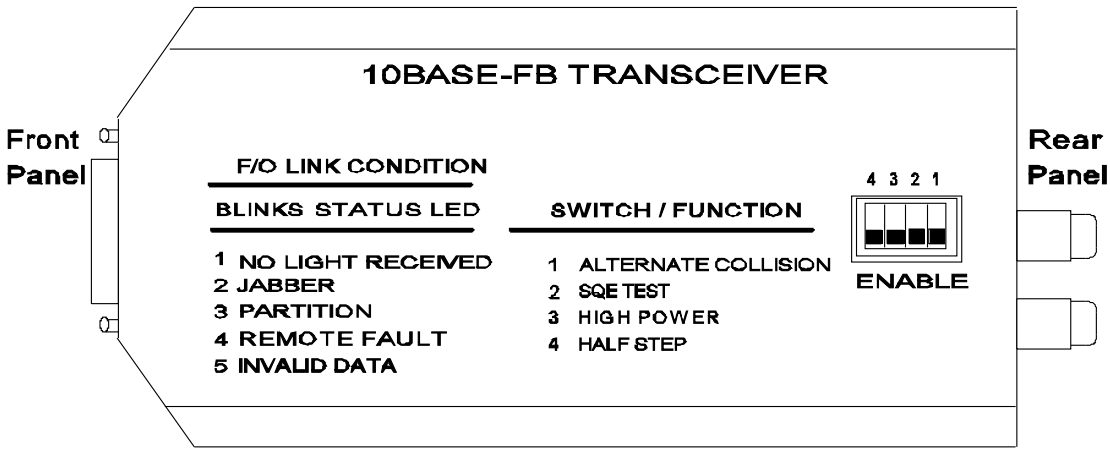

Figure 1. Transceiver Top Panel

Table 1. Transceiver DIP Switch Settings

Switch	Setting	Description
1	Alternate Collision	Enables or disables Alternate collision Presence Signaling mode.
2	SQE Test	Enables or disables SQE Test.
3	High Power	Enables High Power. Disable setting invokes Normal Power.
4	Half Step	Enables Half Step Signaling on AUI Receive (DI) Pair. Disable setting invokes Full Step Signaling.

Transceiver Front Panel

The Transceiver front panel contains the 15-pin AUI (Attachment Unit Interface) connector. The AUI 15-pin D subminiature male connector conforms to IEEE 802.3 and Ethernet Version 2.0 requirements. The shell of the connector is not insulated from the transceiver case, thereby providing optimal shielding and minimizing radiation.

Figure 2 shows the AUI connector on the Transceiver front panel.

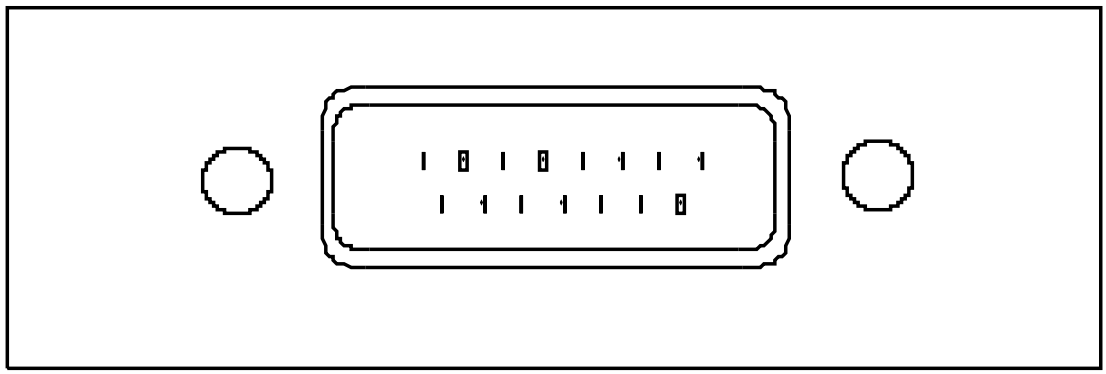

Figure 2. Transceiver Front Panel

Transceiver Rear Panel

The Transceiver rear panel contains the Fiber Optic (SMA, ST, or FC) connectors and four indicators (LEDs). The LEDs provide status for:

- Fiber link (transmit and receive)
- SQE Test
- Ports

The LEDs can be On, Off, or Blinking. The number of consecutive blinks before a longer pause on the STA (status) LED indicates the type of failure detected on the link. For ease of interpretation, a table is printed on the top panel of the transceiver to briefly describe the type of failure. This table is also repeated in greater detail in the Troubleshooting section later in this manual.

Refer to the Troubleshooting section later in this manual for a description of the LED blink sequences.

Figure 3 shows the rear panel on the 10BASE-FB Transceiver. Table 2 provides a description of the LEDs.

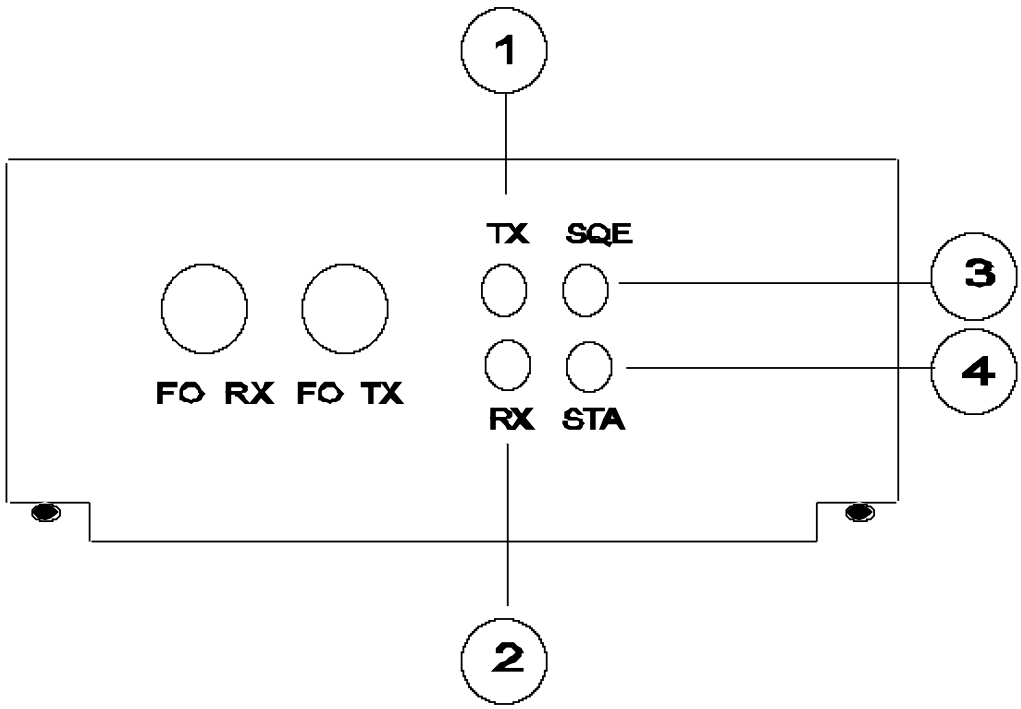

Figure 3. Transceiver Rear Panel

Table 2. Transceiver LED Descriptions

Switch	Setting	Description
1	TX	Transmit Port
2	RX	Receive Port
3	SQE	Squelch Test
4	STA	Status Indicator

Alternate Collision Mode

When enabled, the timing and duration of the collision presence signal (CI) at the AUI is altered to facilitate operation with certain controller chips. The default setting is enabled. When disabled, collisions are signaled to the AUI for as long as they last on the medium.

SQE Test

When enabled, the collision detection capability of the transceiver is tested after each transmission. If the test is successful, the SQE test (Signal Quality Error test, or heartbeat) signal is sent on the AUI to the attached controller. The default setting is enabled.

When disabled, this test is not performed and no SQE test signal is sent to the AUI. Always disable this function when connecting to an IEEE 802.3 repeater.

High Power (PWR)

When enabled, the optical power output on the main link is in the High range. The default setting is disabled, which invokes the optical power output on the main link in the Normal range.

Half Step Mode

When enabled, half step is signaled at the beginning of packets, as required in IEEE 802.3 and Ethernet Version 2.0. The default setting is enabled.

When disabled, the signaling on the AUI receive pair (DI) is the same as defined in Ethernet Version 1.0. This is a full step waveform at the beginning of a packet.

Installation

This section describes the following considerations for the 10BASE-FB Transceiver:

- Site Preparation and Placement
- Unpacking Procedures

Site Preparation and Placement

The 10BASE-FB Transceiver can be placed in the following locations:

- On top of the device to which it is attached
- On top of a desk
- Attached directly to the AUI connection on the DTE

To avoid damage to the Fiber Optic cable and prevent accidental disconnection from the AUI cable, secure the transceiver and cables connections.

3Com offers a velcro mount kit (part # 9300-TM3) to secure your transceivers. To order this kit, contact your supplier or call 3Com Technical Support.

Unpacking Procedures

To unpack the transceiver:

1. Remove the unit from the shipping carton.
2. Inspect the unit closely for damage.

   If the unit appears to be damaged, return it to the shipping carton and contact your local supplier.
3. Verify that the transceiver is the correct model by matching the model number listed on the side of the shipping carton to the model number you ordered (5101T-FB-SMA, 5101T-FB-ST, or5101T-FB-FC).

   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’.

Verifying Transceiver Switch Settings

Factory-set default settings for the transceiver are defined in Table 3.

Table 3. Transceiver DIP Switch Default Settings

Switch	Function	Default Setting
1	Alternate Collision	Enabled
2	SQE Test	Enabled
3	High Power	Disabled
4	Half Step	Enabled

These switch settings typically work with any Ethernet Version 2.0 or IEEE 802.3 controller device. You may change the Half Step switch and Collision Mode switch to optimize operational parameters for a particular controller type.

To make these optimizations, you must know the following two facts about your Ethernet controller:

1. Is the controller Ethernet V2.0 or IEEE 802.3?

   Most new products today are based on the IEEE 802.3 AUI interface standard. Some controllers are still based on Ethernet V2.0. Differences exist between the two standards in AUI pinouts and signaling characteristics. If you are in doubt, keep the Half Step switch enabled.

2. Does the controller use the AMD LANCE or Intel 82586 controller chip?

   The Transceiver can accommodate certain operational characteristics of these two widely used controller chips. The optimizations made by the Transceiver to more suitably support these chips during collision recovery are not detrimental to operation with other Ethernet controllers. If there is any doubt about the type of controller chip used by your equipment, leave the Alternate Collision Mode switch enabled.

Connecting to Ethernet V2.0 and IEEE 802.3 Controllers

Refer to Table 4 for the settings to use for connecting the transceiver to Ethernet Version 2.0 and IEEE 802.3 controller devices.

Table 4. DIP Switch Settings for Ethernet V2.0 and IEEE 802.3 Controllers

	Ethernet V2.0 Controllers	IEEE 802.3 Controllers
SQE Test	Enabled	Enabled
Alternate Collision Mode	Enabled *	Enabled *
Half Step Mode	Enabled	May be Disabled

* May be Disabled for IEEE compliance.

Connecting to Ethernet V2.0 and IEEE 802.3 Repeaters

Refer to Table 5 for the settings to use for connecting the transceiver to Ethernet Version 2.0 and IEEE 802.3 repeaters. The transceiver DIP switches must be changed for connection to IEEE 802.3 Repeaters.

Table 5. DIP Switch Settings for Ethernet V2.0 and IEEE 802.3 Repeaters

	Ethernet V2.0 Repeaters	IEEE 802.3 Repeaters
SQE Test	Disabled *	Disabled
Alternate Collision Mode	Disabled *	Disabled
Half Step Mode	Disabled *	Disabled

* Functional differences exist whereby Ethernet V2.0 repeaters are not supported by the 10BASE-FB Transceiver. If you are in doubt about the type of your repeater, contact your 3Com supplier for more information.

Connecting Fiber Cables

To connect fiber cables to the transceiver:

1. Remove the plastic protection caps from the fiber optic port only when ready to install cables. Transceiver ports that are not in use should remain capped.
2. Ensure that transmit and receive cables are clearly marked or color coded and are connected to the appropriate ports on the Transceiver.
3. Ensure the cables have been properly cleaned with an appropriate fiber optic cleaning solution before installation.

4. Connect the remote end of the fiber optic cables to the 10BASE-FB Star Coupler, ONline Ethernet 10BASE-FB Module, or ONcore Ethernet 10BASE-FB Module ports. Ensure the transmit fiber at one end connects to a receive port at the other end.

Connecting the AUI Cable

Apply power to the transceiver by connecting it to:

- AUI transceiver cables
- Directly to AUI connectors coming from active IEEE 802.3/Ethernet nodes

Upon powerup, the transceiver status indicator and the port status indicator on the other unit (Star or Ethernet 10BASE-FB Module port) stops blinking and turns on solid.

Connect the 10BASE-FB Transceiver to an Ethernet device using proper AUI (transceiver) cables.

There are differences between IEEE 802.3 and Ethernet Version 2.0 AUI cables. While the 10BASE-FB Transceiver is compatible with both, ensure that the AUI cable being used is appropriate for the device being connected. Refer to the section, AUI Cables and Pinouts, later in this manual for cable specifications.

Note: The AUI cable can not exceed 50 meters in length.

Verifying Physical Link Operation

To verify physical link operation:

1. Verify that every transceiver on the network has its status indicator ON and not blinking.
2. Verify that each 3Com 10BASE-FB Sta Coupler or Ethernet 10BASE-FB Module port status indicator is ON and not blinking.

If after completing Steps 1 and 2 you find no blinking Status indicators, you can now use your network nodes and verify data connectivity.

If after completing Steps 1 and 2 you find blinking Status indicators on connected and enabled modules or devices, refer to the Troubleshooting section in this manual.

Troubleshooting

This section explains how to use the diagnostic features of the 10BASE-FB Transceiver for fault isolation. This section describes:

- Status LED
- Troubleshooting Fiber Links
- System Problems

Status LED

The 10BASE-FB Transceiver provides a diagnostic status LED that indicates link status. The normal state for this indicator is the steady ON state. If the LED is OFF, this usually indicates lack of power.

A blinking status indicator is always a sign of a detected problem.

The status of the 10BASE-FB Transceiver can be easily and quickly determined by scanning for a blinking LED. Interpretation of the blinking sequences is provided in Table 6 and is also printed on the Transceiver top panel.

Table 6 lists the most common causes of link failures and the steps that should be taken to correct them. If the indicator remains off or none of the possible problems listed in Table 6 apply, try another port on the connecting device or replace the Transceiver.

Table 6. Troubleshooting Using the Status LEDs

LED Status	Indicates	Possible Problem	Possible Solution
Off	No power	Computer not powered	Turn on the computer
		Disconnected AUI cable	Check AUI connection
		Broken AUI cable	Replace AUI cable
		Bad controller	Follow vendor's instructions

Table 6. Troubleshooting Using the Status LEDs

LED Status	Indicates	Possible Problem	Possible Solution
1 Blink	No light received	Bad fiber connections	Clean RX fiber on both ends
		Broken fiber	Check and fix RX fiber link
		Bad port on other end	Try another port or replace unit
2 Blinks	Jabber	Jabbering controller	Follow vendor's instructions
		Noisy AUI cable	Replace AUI cable
3 Blinks	Partition	Bad port on other end	Try another port or replace unit

Table 6. Troubleshooting Using the Status LEDs

LED Status	Indicates	Possible Problem	Possible Solution
4 Blinks	Remote fault	Bad fiber connections	Clean TX fiber on both ends
		Bad port on other end	Try another port or replace unit
		Broken fiber	Check and fix TX fiber link
5 Blinks	Invalid data	Bad fiber connections	Clean RX fiber on both ends

Table 6. Troubleshooting Using the Status LEDs

LED Status	Indicates	Possible Problem	Possible Solution
5 Blinks (con't)	Invalid data	Broken or degraded fiber	Check and fix RX fiber link
		Bad or degraded port on other end	Try another port or replace unit

Troubleshooting Link Problems

Each full duplex fiber link is monitored at both ends. The 10BASE-FB Star Coupler and the 3Com Ethernet 10BASE-FB Modules contain status indicators (one for each port). The Transceiver contains a single status indicator. In addition to signifying link problems, the Transceiver indicator also indicates a local or remote jabber condition.

All link problems cause the link to be inoperable. If a link problem is indicated, check the indicators at both sides of the link, and then consult Table 6.

Troubleshooting System Problems

This section addresses some of the system problems that can be corrected using the options on the 10BASE-FB Transceiver. If problems occur, always check the diagnostics indicators on the Transceiver.

Excessive Collisions

Collisions can be caused by loops in the 10BASE-FB network. Such loops cause every packet to collide with itself. If you cannot locate the loop, try segmenting your network (by disconnecting Star Couplers, or ONline and ONcore Hubs one at a time) until the loop is located.

If you have IEEE 802.3 repeaters in your network, ensure that the SQE Mode and Alternate Collision Mode switches are disabled for 10BASE-FB Transceivers connected to these repeaters.

Late Collisions and Failure to Defer

Late collisions can be caused by exceeding the distance rules of Ethernet, or by controllers that do not fully comply 100% with the IEEE standard.

To verify that your network satisfies the distance rules, refer to the configuration rules in:

- *10BASE-FB Star Coupler Installation and Operation Guide,* Chapter 6
- ONline or ONcore Ethernet 10BASE-FB Module Installation Guide, Chapter 2

Activating the Alternate Collision Mode on the Transceiver may solve this problem in many cases.

Also, ensure that you have accounted for the distance reduction caused by external baseband repeaters that were added and by baseband segments connected to those repeaters.

Miscellaneous Errors

Many types of physical layer errors can occur if the controller AUI interface is Ethernet Version 1.0 or not fully compliant with Version 2.0 and IEEE 802.3.

If errors occur:

1. Try switching between the Full Step and Half Step options on the 10BASE-FB Transceiver.
2. Verify that an IEEE 802.3 AUI cable is being used with 802.3 controllers
3. Verify that Ethernet V2.0 cables are being used with Ethernet V2.0 controllers.

Refer to the next section for more information on AUI cables.

Transceiver Cables

This section explains the signal differences among the various types of AUI transceiver cables. It also explains wire sizes and the proper pinouts for Ethernet Version 2.0 and IEEE 802.3 AUI cables.

Signal Differences

Signal differences occur between different types of transceiver cables because there are three Ethernet standards:

- V1.0
- V2.0
- IEEE 802.3

These three standards also affect the shielding and grounding of the cables and the size of the wires used in the cables.

The most significant difference among AUI

cables occurs in the shielding and grounding of the individual signal and power pairs. IEEE 802.3 and Ethernet V2.0 specify a requirement for signal isolation due to AC-coupling of the AUI connection. The V1.0 standard does not contain this requirement.

The three standards specify different techniques for shielding and grounding.

EEE 802.3

All shields of the individual signal and power pairs are connected to pin 4. The overall AUI cable shield is connected to the AUI connector shell to provide a cable ground. Pin 1 is not used.

Version 2.0

All shields are connected to pin 1 and the AUI connector shell. Pin 4 is not used. Most Ethernet cables are built this way.

Version 1.0

Shielding of individual signal or power pairs is not required because most V1.0 controllers and transceivers are DC-coupled. The overall AUI cable shield provides for shielding and grounding and is connected to pin 1 and the AUI connector shell.

In practice, most Ethernet V1.0 equipment uses version 2.0 cables due to cross-talk problems caused by the lack of individual shielding of the pairs in Version 1.0 cables.

Wire Sizes

The three versions of AUI cables also use different wire sizes for the signal and power pairs. Table 7 describes the wiring that each type of transceiver cable uses.

Table 7. Transceiver Cable Wire Sizes

Cable Type	Signal Pair	Power Pair
V1.0	AWG # 22	AWG # 20
V2.0 and IEEE 802.3	AWG # 20	AWG # 20
Non-standard "office" cable *	AWG # 24 *	AWG #24 *

* More flexible, but is limited to 5.0 meters in length.

Signal deterioration along the signal pairs is most likely to happen as the AUI cable reaches the maximum length of 50 meters. Signal deterioration is due to the filtering action of the cable. IEEE 802.3 AUI cables are designed to reduce this effect.

Because 802.3 AUI cables provide a ground shield isolated from the signal and power pair shields, the cables provide additional noise immunity in noisy operating environments.

Cable Pinouts

Table 8 shows the proper pinouts for Ethernet Version 2.0 and IEEE 802.3 AUI cables.

Table 8. AUI Cable Pinout Chart

Pin	802.3	V2.0, V1.0
1	CI-S	Shield
2	CI-A	Collision Presence +
3	DO-A	Transmit +
4	DI-S	Reserved
5	DI-A	Receive +
6	V	Power Return

Table 8. AUI Cable Pinout Chart

Pin	802.3	V2.0, V1.0
7	CO-A	Reserved
8	CO-S	Reserved
9	CI-B	Collision Presence -
10	DO-B	Transmit -

802.3 - All signal and power pair shields can be connected to pin 4. The braided AUI cable shield connects to the AUI shell and not to pin 1.

V2.0 - All shields (external and internal) connect to pin 1 and to the connector shell.

V1.0 - Braided AUI cable shield connects to connector shield and pin 1.

Troubleshooting Transceiver Cables

This section describes some of the common problems you may have with transceiver cables and provides possible solutions to the problems.

Symptoms of Faulty Transceiver Cables

The following list describes symptoms of faulty transceiver cables:

- False or excessive collisions.
- Jabber condition on transceiver.
- Receive Errors (CRC and Alignment).
- Severe degradation of system performance

Causes of Fault Transceiver Cables

The following list describes causes of faulty transceiver cables:

- Improper Grounding (pin 1 vs. pin 4).
- Bad ground:
  - Shell connector not crimped onto AUI cable braid.
  - Ribbon cables in computers not shielded or improperly mounted.
- Broken pair wires or unseated AUI connector pin.
- Improper pairing - Verify that signal and power wires are paired (for example, Transmit + paired with Transmit -)
- Individual pairs not individually shielded (for example, Ethernet V1.0 type cable).

Cable Recommendations

The 10BASE-FB Transceiver is fully compatible with IEEE 802.3 and Ethernet V2.0. The use of Ethernet V1.0 AUI cables and controllers is not recommended.

The 10BASE-FB Transceiver accepts either 802.3 or V2.0 AUI cables. Use the proper AUI cable for the appropriate controller being used. For example, if you use an 802.3 controller, then use an 802.3 AUI cable.

Specifications

This section lists the following specifications for the 10BASE-FB Transceiver:

- General
- Optical Interface
- Transmit Power
- Fiber Optic Cable Compatibility

- Attachment Unit Interface

General Specifications

Table 9. General Specifications

Specification	Value
Dimensions	4.8" x 2.4" x 0.9" (122mm x 61mm x 23mm)
Weight	4 oz. (115 g)
Operating Temperature	32° to 104° F (0° to 40° C)
Operating Humidity	Less than 95% non-condensing
Power	5 Watts

Optical Interface Specifications

Table 10. Optical Interface Specifications

Specification	Value
Data Rate	10 Million bits per second
Encoding	Compliant with 10BASE-FB synchronous signaling standard
Connectors	SMA, ST, and FC
Connectors spacing	0.8 inch
Transmit Source Type	GaAlAs LED
Transmit Wavelength	820 ± 20nm
Receiver Detector Type	Silicon PIN photodiode
Receive Power for better than 10^{-9} bit error rate (minimal guaranteed dynamic range)	-29.5 dBm peak to -9 dBm peak

Transmit Power Specifications

Table 11. Transmit Power

Cable Size (micron)	Normal Power (dBm Peak)	High Power (dBm Peak)
50/125 NA 0.20	-21.3 ± 2.5	-13.8 ± 1.5
62.5/125 NA 0.275	-17.5 ± 2.5	-10.5 ± 1.5
100/140 NA 0.30	-12.0 ± 2.5	-5.0 ± 1.5

Fiber Optic Cables Compatibility

Table 12. Fiber Optic Cable Specifications

Specification	Value
Cable size	50/125, 62.5/125, 100/140 micron diameter
Cable bandwidth	40 MHzKm minimum
Jabber protection	30 ± 3 msec (Non-Latching)

Attachment Unit Interface Specifications

Table 13. AUI Specifications

Specification	Value
Connector	Standard male 15-pin D-subminiature
Standards conformance	IEEE 802.3, Ethernet V2.0
DC Power requirements	12-15 Volts ± 10% applied at AUI (pins 13, 6)
DC line current consumption	200 mA min @ 16.5 V, 77° F (25° C) 300 mA typ @ 12.0 V, 77° F (25° C) 500 mA max @ 10.8 V, 77° F (25° C)