TC3301

1000Base-T Ethernet Fiber Optic Converter
User's Manual

1. Features

p **1000Mbps for twisted pair, and 1000Mbps for fiber**

p **Local Dry Contact Alarm Relay**

p **Multimode (850nm) and Single Mode (1310nm/1550nm)**

p **Optional Hi-Temp -20°C to 70°C**

p **1000Mbps Full duplex, 1000Base-T, 1000Base-SX/LX**

p **Distances up to 100km**

p **Optional Two-way Single Fiber Communication**

p **Built-In Power Redundancy**

p **Fits Category 5E or 6 Ethernet Cable**

p **Standalone or Rackmount**

2. Standards

IEEE 802.3ab 1000Base-T, IEEE 802.3z 1000Base-SX/LX and TIA/EIA-785

3. Description

Featuring an "Industrial-Hardened" version for extreme environments, the TC3301 Gigabit Ethernet Fiber Optic Converter supports distances up to 100km and is available with a 2-way single fiber option.

The TC3301 is IEEE802.3z/AB complaint. It converts or connects 1000Base-TX unshielded twisted-pair devices (e.g. network bridges, switches, or workstation cards) to single mode (1300/1550nm) or multimode (850nm) fiber optics.

Completely transparent to the network, the TC3301R/S is ideal for integrating UTP and fiber optics in any Gigabit Ethernet network. It is designed with modern Field Programmable Gate Array (FPGA) technology and operates efficiently even during high-demand traffic loads.

It is available in two temperature versions: 0°C to 50°C; -20°C to 70°C; The Industrial-Hardened version exceeds all pertinent Utility and Traffic Control environmental and temperature specifications.

Diagnostics include 8 LEDs for Ethernet settings and Ethernet/Power status. Dry contact alarms are provided for connection to remote network management systems. It is available standalone or rack mount. The TC3301S is the standalone/wallmount unit. The TC3301R rackmount version fits into the Model TCRM192 or 19" rackmount card cages.

Fiber optic connectors are ST, SC and FC. The UTP connector is RJ-45 female. Power is 12VDC @ 600mA (standard); optional power sources include 24VDC, -48VDC, 125VDC, or 115/230VAC with an external power cube.

TC COMMUNICATIONS
FIBER OPTIC CONNECTIVITY

4. Optical Specifications

Multimode 850nm, 275/550 Meter Option

Transmitter:	FP LASER; typical Launch Power:	-10.0 dBm @850nm
Receiver:	PIN Diode; typical Sensitivity:	-18.0 dBm @850nm
	Optic saturation level:	0 dBm @850nm
Loss Budget:	Multimode (50/125µm)@850nm:	8 dB
	Multimode (62.5/125µm)@850nm:	8 dB
Distance:	Multimode (50/125µm)@850nm:	up to 550 Meter distance*
	Multimode (62.5/125µm)@850nm:	up to 275 Meter distance*
Wavelength:	Multimode 850nm:	
Connector*:	ST	
	FC	
	SC	

Multimode 1310nm, 2km Option

Transmitter:	FP LASER; typical Launch Power:	-6.0 dBm @1310nm
Receiver:	PIN Diode; typical Sensitivity:	-16.0 dBm @1310nm
	Optic saturation level:	0 dBm @1310nm
Loss Budget:	Multimode (50 or 62.5/125µm)@1310nm:	10 dB
Distance:	Multimode (50 or 62.5/125µm)@1310nm:	up to 2km distance*
Wavelength:	Multimode 1310nm:	
Connector*:	ST	
	FC	
	SC	

Single Mode 1310nm, 20km Option

Transmitter:	FP Laser; typical Launch Power:	-10 dBm @1310nm
Receiver:	PIN Diode; typical Sensitivity:	-20.0 dBm @1310nm
	Optic saturation level:	-3 dBm @1310nm
Loss Budget:	Single Mode (9/125µm)@1310nm:	10 dB
Distance:	Single Mode (9/125µm)@1310nm:	up to 20 km distance*
Wavelength:	Single Mode 1310nm (LASER):	
Connector*:	ST	
	FC	
	SC	

Single Mode 1550nm, 50km Option

Transmitter:	FP Laser; typical Launch Power:	-4dBm @1310nm
Receiver:	PIN Diode; typical Sensitivity:	-23.0 dBm @1310nm
	Optic saturation level:	-3 dBm @1310nm
Loss Budget:	Single Mode (9/125µm)@1310nm:	19dB
Distance:	Single Mode (9/125µm)@1310nm:	up to 50km distance*
Wavelength:	Single Mode 1310nm (LASER)	
Connector*:	ST	
	FC	
	SC	

Launch power, sensitivity and distance are listed for reference only. These numbers may vary. Contact factory for higher loss budgets and ST & FC fiber connector types (SC fiber connectors are standard).

Single Mode 1550nm, 80km Option

Transmitter:	**Typical Launch Power:**	**0 dBm @1550nm**
Receiver:	**PIN Diode; typical Sensitivity:**	**-24.0 dBm @1550nm**
	Optic saturation level:	**0 dBm @1550nm**
Loss Budget:	**Single Mode (9/125µm)@1550nm:**	**24 dB**
Distance:	**Single Mode (9/125µm)@1550nm:**	**up to 80km distance***
Wavelength:	**Single Mode 1550nm :**	
Connector*:	**ST**	
	FC*	
	SC	

Single Mode 1550nm, 120km Option

Transmitter:	**DFB Laser; typical Launch Power:**	**0dBm @1550nm**
Receiver:	**PIN Diode; typical Sensitivity:**	**-32.0 dBm @1550nm**
	Optic saturation level:	**-9dBm @1550nm**
Loss Budget:	**Single Mode (9/125µm)@1550nm:**	**32dB**
Distance:	**Single Mode (9/125µm)@1550nm:**	**up to 120km distance***
Wavelength:	**Single Mode 1550nm (LASER)**	
Connector*:	**ST**	
	FC	
	SC	

Single (One) Fiber, 40km Model

Transmitter:	**Typical Launch Power**	**-3 to + 2 dBm* (1310nm/1550nm, @9/125µm)**
Receiver:	**PIN Diode; typical Sensitivity**	**-23 dBm* (1310nm/1550nm, @9/125µm)**
	Optic saturation level	**-3 dBm***
Loss Budget:	**1310nm/1550nm Single Mode, @9/125µm**	**20 dB**
Distance:	**1310nm/1550nm Single Mode, @9/125µm**	**up to 40km distance***
Wavelength:	**1310nm/1550nm Single Mode**	
Connector:	**SC** **Only***	

Launch power, sensitivity and distance are listed for reference only. These numbers may vary. Contact factory for higher loss budgets and ST & FC fiber connector types (SC fiber connectors are standard).

5. Optic Cable Types

Conventionally, fiber optic cable with **yellow-colored** insulation is used for Single Mode applications; **gray or orange-colored** insulated cable is for Multimode use. If Multimode cable is used in a Single Mode application, the test results could be erroneous and confusing.

6. Calculating the Loss on the Fiber

The fiber optic link and/or connectors are frequently the source of various problems. Check out the connectors and the integrity of the link first. Ideally, the link should be calibrated for total loss after the installation has been completed. This will accomplish two things: (1) it will verify that the total loss of the link is within the loss budget of the device and (2) it will provide a benchmark for future testing. For example, a system that has been tested as having 6dB total loss when installed and suddenly tests out as having a loss of 10dB probably has a connector or link problem.

These are the reference values we use to calculate the loss on the fiber:

Multimode 850nm	:	**3 dB loss per km on 62.5/125µm cable***
Multimode 1310nm	:	**2 dB loss per km on 62.5/125µm cable***
Single Mode 1310nm	:	**0.5 dB loss per km on 9/125µm cable***
Single Mode 1550nm	:	**0.25 dB loss per km on 9/125µm cable***

These numbers are listed for reference only. We recommend an OTDR reading be used to determine actual link loss.
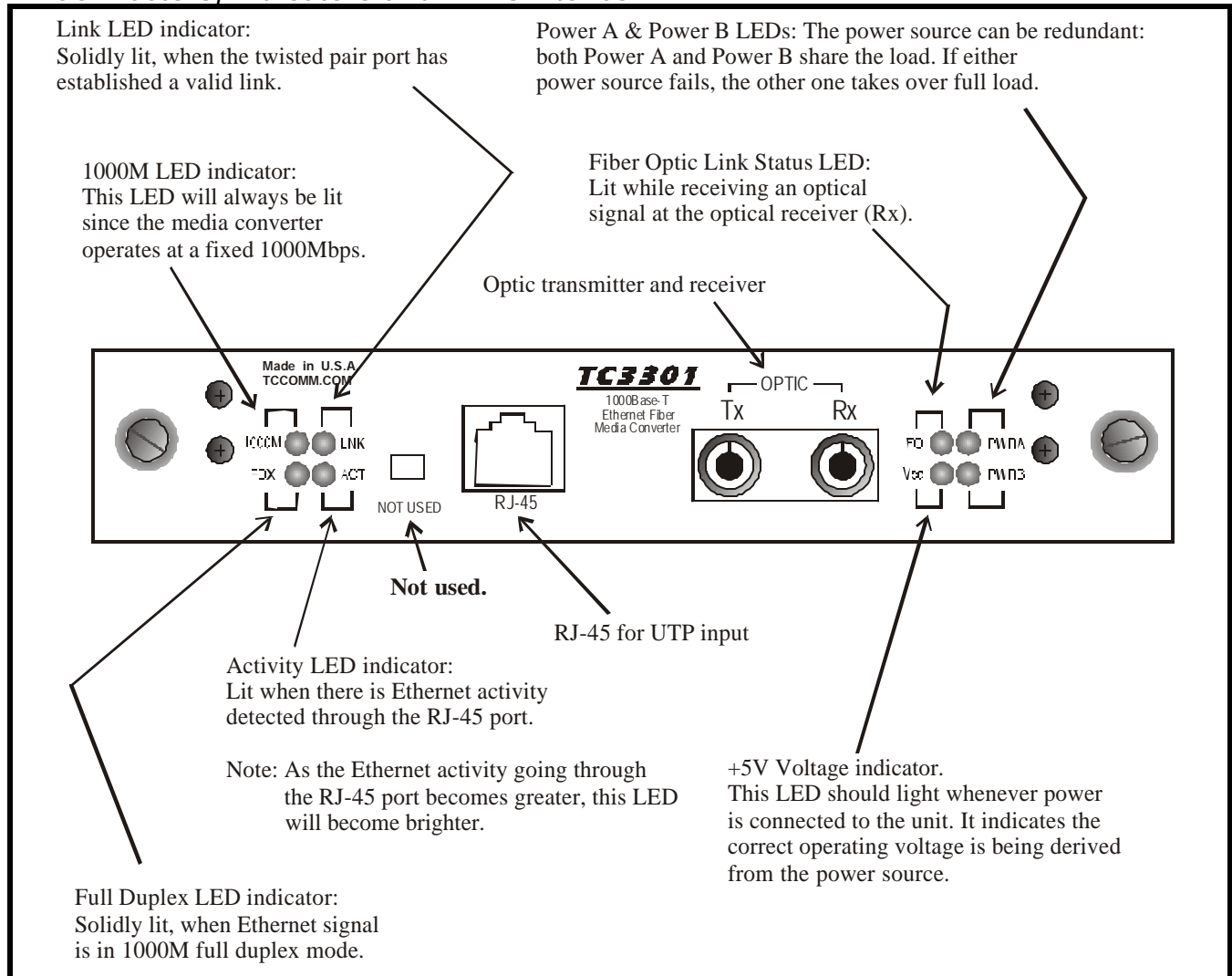
7. Connectors, Indicators and DIP Switches

Link LED indicator:
Solidly lit, when the twisted pair port has established a valid link.

Power A & Power B LEDs: The power source can be redundant: both Power A and Power B share the load. If either power source fails, the other one takes over full load.

1000M LED indicator:
This LED will always be lit since the media converter operates at a fixed 1000Mbps.

Fiber Optic Link Status LED:
Lit while receiving an optical signal at the optical receiver (Rx).

Optic transmitter and receiver

Made in U.S.A
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TC3301
1000Base-T
Ethernet Fiber
Media Converter

OPTIC
Tx   Rx

1000M   LNK
FDX   ACT

NOT USED

RJ-45

FO   PWRA
Vcc   PWRB

Not used.

RJ-45 for UTP input

Activity LED indicator:
Lit when there is Ethernet activity detected through the RJ-45 port.

Note: As the Ethernet activity going through the RJ-45 port becomes greater, this LED will become brighter.

+5V Voltage indicator.
This LED should light whenever power is connected to the unit. It indicates the correct operating voltage is being derived from the power source.

Full Duplex LED indicator:
Solidly lit, when Ethernet signal is in 1000M full duplex mode.

Figure 1. TC3301's Front Panel

8. Power Requirements

A. Standard input power to the TC3301's is 12VDC @600mA.

B. The TC3301's power connectors are two terminal blocks located on the rear panel of the unit. Polarity is indicated under each connector block (see Figure 2).

C. Should an external power adapter need to be replaced, use one with the following specifications: 12VDC @600mA. You may order it directly from TC Communications.

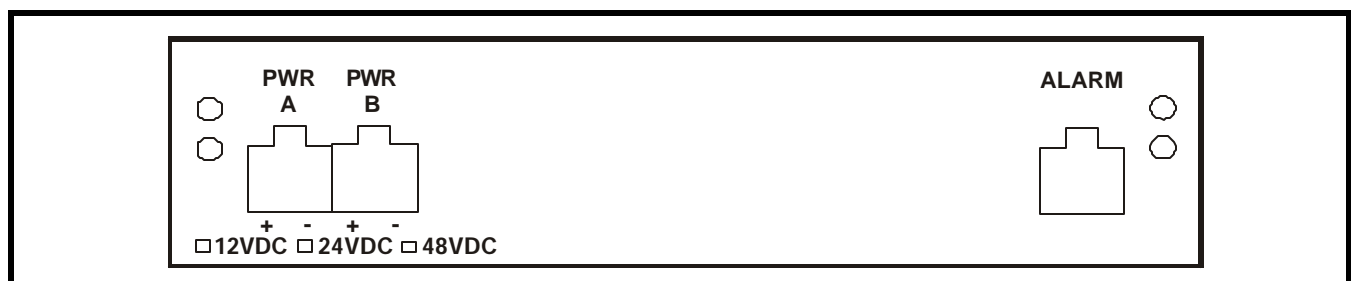**D.** The TC3301 can also be ordered with an optional 24VDC, 48VDC, 125VDC or 115/230VAC with an external power cube.

PWR   PWR
A   B

ALARM

+ - + -
☐ **12VDC** ☐ **24VDC** ☐ **48VDC**

Figure 2. TC3301's Rear Panels

9. Installation

A. Connect the standard 12VDC power supply to the TC3301 (24VDC, 48 VDC, 125VDC or 115/230VAC with an external power cube are optional).

B. The "PWRA," and/or "PWRB," "1000M," "Vcc," LEDs should be lit.

C. Use CAT 5E or 6 UTP cable to connect the TC3301 RJ-45 port to the 1000Base-T Port of your network device. The "FDX," and "LNK," LEDs will be lit. If the LEDs are "Off," please verify the cable connection and the power of the network device.

D. Connect the optic cables according to the example diagrams shown on page 7. For example, on diagram C; the local TC3301's optic "Tx" should be connected to the remote network device's optic "Rx" and vice-versa.

E. After step "D," the "FO" LED should light to indicate that the optical idle signal is being received.

F. Create some activity on the Ethernet, the "ACT" LED should be lit.

Note: As the Ethernet activity going through the RJ-45 port becomes greater, this LED will become brighter.

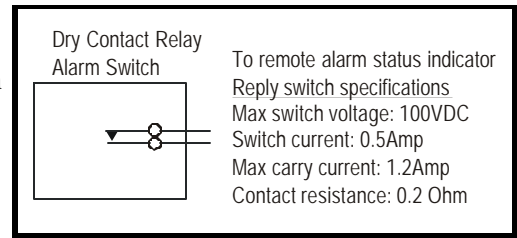**G.** Double-check all LEDs according to the following:

The "PWRA," and/or "PWRB," "Vcc," "FO," "1000M," "FDX," "LNK," and "ACT" LEDs should be lit.

The "FO" LED will be lit when the optic side has activity and/or fiber optic cables are connected.

The "ACT" LED will be lit when the UTP side has activity.

10. Dry Contact Relay Alarm

A terminal block connector on the rear panel (labeled "ALARM") provides for the dry contact relay alarm (see Figure 2). Normally in the OPEN position, any loss of optical signal will trigger an alarm condition and force the switch to the CLOSED position. This relay can be used in conjunction with an external device to monitor the condition of the fiber optic links.

Dry Contact Relay Alarm Switch

To remote alarm status indicator
Reply switch specifications
Max switch voltage: 100VDC
Switch current: 0.5Amp
Max carry current: 1.2Amp
Contact resistance: 0.2 Ohm

11. Electrical Specifications

Data Rates: 1000Mbps
Connector: RJ-45 Female

12. Temperature

Operating .... 0ºC to 50ºC

.... Hi-Temp (Optional) -20ºC to 70ºC

Humidity .... 95% non-condensing

13. Physical Characteristics

Height: 1.4" (3.5 cm)   Depth: 6.5" (16.5 cm)
Width: 7.1" (18 cm)   Weight: 1.1 lbs. (501 gm)

14. Troubleshooting

After installation is complete, only the "PWRA," and/or "PWRB," "Vcc," "LNK," "FO," "1000M," and "FDX" LEDs should be lit. If not, please check the following:

Power Problem:

No LEDs are lit:

A. "PWRA" and/or "PWRB" LEDs should be on when power is connected. If both are "Off," then no DC power is reaching the unit. Check the power supply, source, and polarity.

B. If "PWRA," and/or "PWRB," "Vcc," or "1000M" LEDs are "On" but all other LEDs are "Off", and the Alarm switch is not closed, it indicates an internal problem with the unit. For assistance, please contact the Technical Support Department at TC Communications @ (949) 852-1973.

Electrical Problem:

If the LNK or FDX LEDs are Off:

It means that there is no Ethernet electrical signal detected by the TC3301. Check the electrical connections on the Cat 5E or 6 cable. Make sure that there's Ethernet signal being provided and that the signal is 1000M. Also, check that the Ethernet cable is good.

Optical Problem:

The "FO" LED should be lit at all times to indicate good optic transmit and receive conditions and good cable connections.

If the FO LED is OFF:

A. Optic power received by "Rx" is lower than the typical sensitivity.

B. Optic "Tx" is connected to another TC3301's "Tx." Check the optic cable connection; the local unit's optic "Tx" should be connected to the remote unit's optic "Rx."

C. Optic cable type is incorrect. Typically, fiber optic cable with yellow-colored insulation is designated for Single Mode use @8.2μm or 9μm; orange or gray-colored cable is for Multimode use @50μm or 62μm. If the wrong cable type is used, the unit will not function properly.

15. Typical Application Examples:

Three installation examples for the TC3301 units are shown on the diagrams below. Make the proper copper and fiber optical connections as shown on the diagrams.
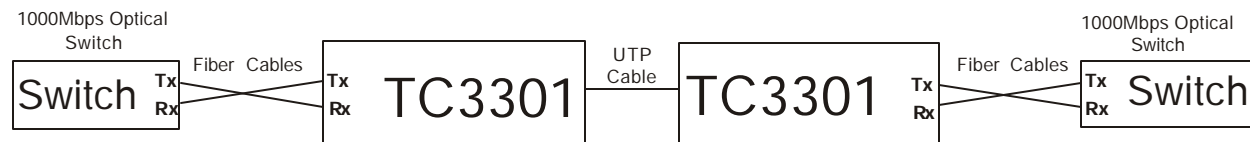
A. *Copper to Copper over Fiber:*

Make sure you connect the local TC3301's "Tx" to the remote TC3301's "Rx" and vice-versa.
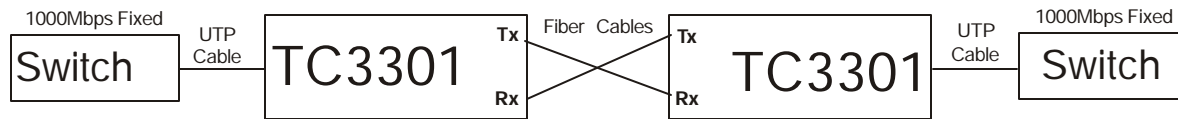
B. *Fiber to Fiber over Copper:*

Connect your optical switches "Tx" to the "Rx" of the TC3301 and vice-versa on both ends.

C. *Copper to Fiber:*

Connect the optical cables according to the diagram below, the local TC3301's optic "Tx" should be connected to the remote network device's optic "Rx" and vice-versa.

16. Return Policy & Warranty
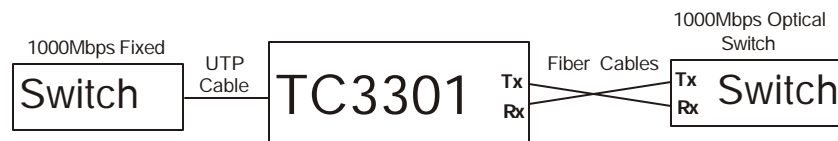
Return Policy

To return a product, you must first obtain a Return Material Authorization number from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please provide a description of the problem and any results of diagnostic tests that have been conducted.

Warranty

Damages by lightning or power surges are not covered under this warranty.

All products manufactured by TC Communications, Inc. come with a five year (beginning 1-1-02) warranty. TC Communications, Inc. warrants to the Buyer that all goods sold will perform in accordance with the applicable data sheets, drawings or written specifications. It also warrants that, at the time of sale, the goods will be free from defects in material or workmanship. This warranty shall apply for a period of five years from the date of shipment, unless goods have been subject to misuse, neglect, altered or destroyed serial number labels, accidents (damages caused in whole or in part to accident, lightning, power surge, floods, fires, earthquakes, natural disasters, or Acts of God.), improper installation or maintenance, or alteration or repair by anyone other than Seller or its authorized representative.

Buyer should notify TC Communications, Inc. promptly in writing of any claim based upon warranty, and TC Communications, Inc., at its option, may first inspect such goods at the premises of the Buyer, or may give written authorization to Buyer to return the goods to TC Communications, Inc., transportation charges prepaid, for examination by TC Communications, Inc. Buyer shall bear the risk of loss until all goods authorized to be returned are delivered to TC Communications, Inc. TC Communications, Inc. shall not be liable for any inspection, packing or labor costs in connection with the return of goods.

In the event that TC Communications, Inc. breaches its obligation of warranty, the sole and exclusive remedy of the Buyer is limited to replacement, repair or credit of the purchase price, at TC Communications, Inc.'s option.

To return a product, you must first obtain a Return Material Authorization (RMA) number and RMA form from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please fill out RMA form provided with a description of the problem(s) and any results of diagnostic tests that have been conducted. The shipping expense to TC Communications should be prepaid. The product should be properly packaged and insured. After the product is repaired, TC Communications will ship the product back to the shipper at TC's cost to U.S. domestic destinations. (Foreign customers are responsible for all shipping costs, duties and taxes [both ways]. We will reject any packages with airway bill indicating TC communications is responsible for Duties and Taxes. To avoid Customs Duties and Taxes, please include proper documents indicating the product(s) are returned for repair/retest).