

## POTS 2-Wire to Fiber Converter TE160A, TE161A, TE162A TE163A, TE164A, TE165A User's Guide



The Black Box POTS 2-Wire to Fiber Converter (P/N TE16xA) connects central-office voice-grade signals to distant POTS (Plain Old Telephone Service) equipment using standard telephone signaling.

The TE16xA media converter provides audio transmission, caller ID, ringing at the distant end and automatic ring-down. Two units are required to implement an end-to-end system.

The TE16xA can extend, over fiber, the distance between two voice path communication devices by up to 40 km using either singlemode or multimode fiber cable.

An RJ-11 female connector provides the electrical interface between the media converter and the telephone device.

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### Unit A - TE160A, TE162A, TE164A

Unit A connects to a Central Office (CO) telephone line or a PBX (Private Branch Exchange). It mimics a telephone device (Line-Side FXS) and has the ability to detect ringing voltages. The available models are:

Product Number	Port One - Copper	Port Two - Fiber-Optic
TE160A	RJ-11C Connector Twisted-Pair 5 km (3.1 miles)*	ST Connector 1300 nm <b>multimode</b> 2 km (1.2 miles)*
TE162A	RJ-11C Connector Twisted-Pair 5 km (3.1 miles)*	SC Connector 1300 nm <b>multimode</b> 2 km (1.2 miles)*
TE164A	RJ-11C Connector Twisted-Pair 5 km (3.1 miles)*	SC Connector 1310 nm <b>singlemode</b> 20 km (12.4 miles)*

\* Typical maximum cable distance. Actual distance is dependent upon the physical characteristics of the network installation.

### Unit B - TE161A, TE163A, TE165A

Unit B, the reciprocal unit, connects to a telephone device and mimics a Central Office (Customer-Side FXO). The available models are:

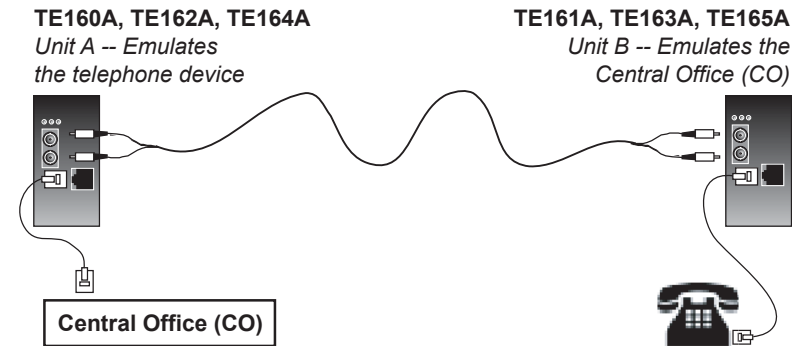
Product Number	Port One - Copper	Port Two - Fiber-Optic
TE161A	RJ-11C Connector Twisted-Pair 5 km (3.1 miles)*	ST Connector 1300 nm <b>multimode</b> 2 km (1.2 miles)*
TE163A	RJ-11C Connector Twisted-Pair 5 km (3.1 miles)*	SC Connector 1300 nm <b>multimode</b> 2 km (1.2 miles)*
TE165A	RJ-11C Connector Twisted-Pair 5 km (3.1 miles)*	SC Connector 1310 nm <b>singlemode</b> 20 km (12.4 miles)*

\* Typical maximum cable distance. Actual distance is dependent upon the physical characteristics of the network installation.

## TE16xA in the Network

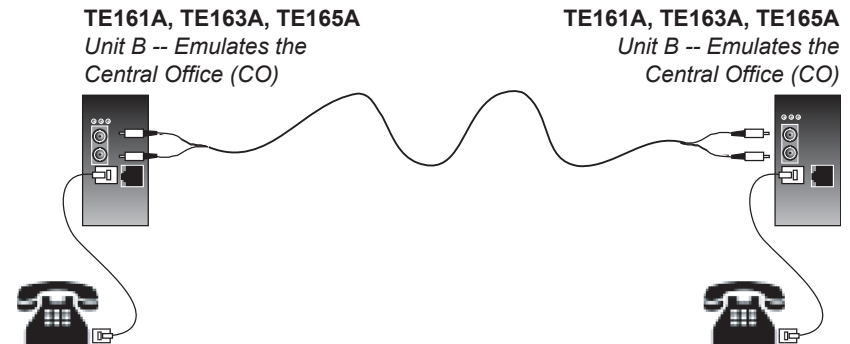
### Standard Configuration

One Unit A device and one Unit B device is required for the standard configuration. The Unit A device is connected to the Central Office (CO) while the Unit B device is connected to a telephone device.



### Automatic Ring-Down Configuration

Automatic Ring Down (ARD) is a dedicated, point-to-point voice system. When one telephone is taken off-hook, the other telephone rings, without the need to dial. Two Unit B devices, connected via the fiber ports, are required for this mode of operation; with a telephone device at each end.



## Installation

**CAUTION:** Wear a grounding device and observe electrostatic discharge precautions when setting the jumpers. Failure to observe this caution could result in damage to, and subsequent failure of, the media converter.

### Setting the Jumpers

- Using a small screwdriver, remove the screws that secure the cover to the media converter and carefully remove the cover.
- Locate the jumpers on the circuit board.
- Using small needle-nosed pliers or similar device, move the jumper to the desired position. (Refer to the drawings below.)
- Carefully replace the cover on the media converter and replace the screws to secure the cover.

### Standard / Automatic Ring-Down

The jumper labeled "JP1" is used to switch between the Standard or Automatic Ring-Down configuration and is located on the **top** circuit board of **Unit B**.

The drawing below illustrates the jumper settings.

- Set jumper JP1 on the Unit B device to the **Standard** setting when using the Standard configuration (described on page 3).
- Set jumper JP1 on **both** Unit B devices to the **Automatic Ring-Down** setting when using the Automatic Ring-Down configuration (described on page 3).



### US / EU Telephone Regulation

The jumper labeled "US EU" is used to switch between the US or EU telephone configuration and is located on the **top** circuit board of **Unit A**. This feature is required to comply with the EU TBR21 telephone regulation. The jumper has been set at the factory to the US setting as the default.

The drawing below illustrates the jumper settings.

- Set jumper "US EU" on the Unit A device to the **US** setting if the device is to be used with US-based telephone systems.
- Set jumper "US EU" on the Unit A device to the **EU** setting if the device is to be used with European-based telephone systems.



## Installation -- Continued

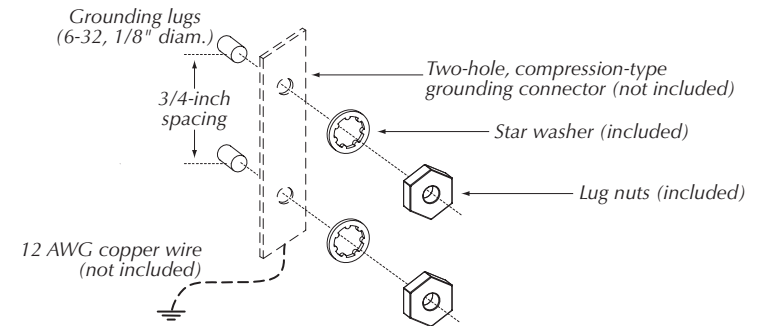
### Grounding the Media Converter

The TE16xA comes equipped with grounding lugs located on the back panel. They require a grounding conductor wire terminated with a **two-hole, compression-type, grounding connector**. The grounding wire -- which must be a copper conductor -- is not included with the media converter and **must be provided by the customer/installer**.

The electrical conducting path from the TE16xA must:

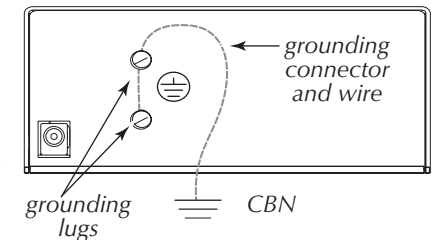
- Flow via the grounding lugs to the common bonding network (CBN) (a requirement for telecom installations),
- Be of sufficiently low impedance to conduct fault currents likely to be imposed on the media converter, and
- Enable proper operation of any over-current protection devices.

The conductor must be fastened to the grounding lugs with the enclosed anti-rotation star-washers and lug-nut fasteners. The applied torque required to the connector lug-nut fasteners is specified by the connector's manufacturer.



### To properly ground the TE16xA media converter:

- Obtain one (1) grounding conductor (12 AWG copper wire gauge or larger) with a two-hole, compression-type, grounding connector.
- Attach the grounding conductor to the converter by placing the two-hole connector onto the grounding lugs and fasten with the enclosed lock-washers / lug-nuts at the proper torque (per the manufacturer's specification).
- Attach the opposite end of the grounding conductor to the common bonding network (CBN).



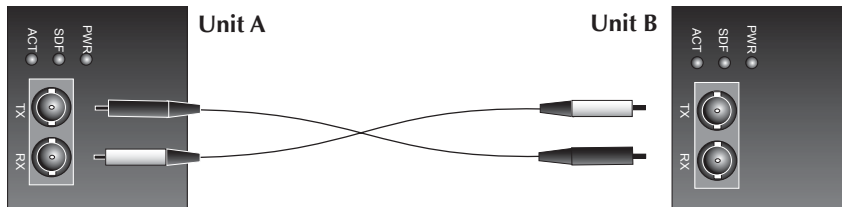
## Installation -- Continued

### Installing the Cable -- Standard Configuration

**NOTE:** Unit B must be configured for Standard Configuration (see page 4).

#### Fiber

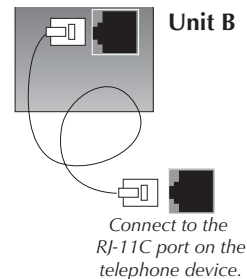
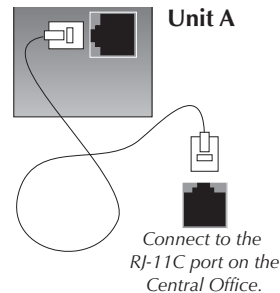
1. Locate or build fiber cable with male, two-stranded TX to RX connectors installed at both ends.
2. Connect the fiber cables to **Unit A** as described:
  - Connect the male **TX** cable connector to the female **TX** port.
  - Connect the male **RX** cable connector to the female **RX** port.



3. Connect the fiber cables to **Unit B** as described:
  - Connect the male **TX** cable connector to the female **RX** port.
  - Connect the male **RX** cable connector to the female **TX** port.

#### Copper

1. Locate or build copper cables with male, RJ-11C connectors installed at both ends.
2. Connect the copper cables to **Unit A** as described:
  - Connect the RJ-11C connector at one end of the cable to the RJ-11C port **on Unit A**.
  - Connect the RJ-11C connector at the other end of the cable to the RJ-11C port **on the Central Office**.
3. Connect the copper cables to **Unit B** as described:
  - Connect the RJ-11C connector at one end of the cable to the RJ-11C port **on Unit B**.
  - Connect the RJ-11C connector at the other end of the cable to the RJ-11C port **on the telephone device**.



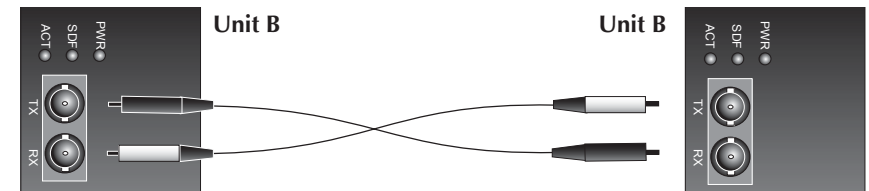
## Installation -- Continued

### Installing the Cable -- Automatic Ring-Down Configuration

**NOTE:** Both Unit B's must be configured for Automatic Ring-Down (see page 4).

#### Fiber

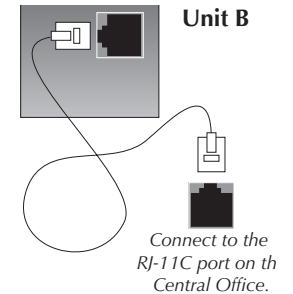
1. Locate or build fiber cable with male, two-stranded TX to RX connectors installed at both ends.
2. Connect the fiber cables to the **first Unit B** as described:
  - Connect the male **TX** cable connector to the female **TX** port.
  - Connect the male **RX** cable connector to the female **RX** port.



3. Connect the fiber cables to the **second Unit B** as described:
  - Connect the male **TX** cable connector to the female **RX** port.
  - Connect the male **RX** cable connector to the female **TX** port.

#### Copper

1. Locate or build copper cables with male, RJ-11C connectors installed at both ends.
2. Connect the copper cables to the **first Unit B** as described:
  - Connect the RJ-11C connector at one end of the cable to the RJ-11C port on the **first Unit B**.
  - Connect the RJ-11C connector at the other end of the cable to the RJ-11C port **on the telephone device**.
3. Connect the copper cables to the **second Unit B** as described in step 2.



## Operation

### Power the Media Converter

1. Install the power adapter cord to the back of the media converter.
2. Connect the power adapter plug to AC power.
3. Verify that the media converter is powered by observing the illuminated LED power indicator light.

### Using Status LEDs

Use the status LEDs to monitor the TE16xA media converter operation in the network.

#### PWR (Power)

On = The media converter is connected to external power.

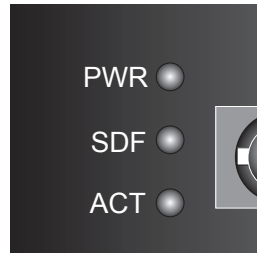
#### SDF (Signal Detect Fiber Link)

On = The fiber link is active.

#### ACT (Activity)

On = The telephone device is in use (off-hook).

Flashing = The telephone device is ringing or pulse-dialing.



## Operation - Continued

### Loop-Start Operation

Loop-Start Service -- commonly known as "Plain Old Telephone Service" (POTS) -- is the primary analog signaling method used between telephone switches such as the Central Office (CO) and a telephone device. Loop-Start provides a way to indicate on-hook and off-hook conditions, which facilitates outgoing and incoming calls in a voice network.

When a customer wants to make an **outgoing** call, he or she takes a telephone device off-hook. This action completes the loop, which signals the CO that a customer desires to use the telephone line. To signal the customer of an **incoming** call, the CO applies a ring voltage to alert the customer.

The three states of the Loop-Start signaling protocol are described below:

#### Idle State (On-Hook)

1. The CO applies a battery voltage to the ring lead and monitors the tip-ring current for closure of the tip-ring.
2. The telephone device draws less than 10  $\mu$ A of from the line while waiting for the superimposition of the ringing voltage over the ring lead.

#### Telephone In-Use (Off-Hook)

1. The customer takes the telephone device off-hook, drawing a minimum of 20 to 30 mA of current.
2. The CO senses the tip-ring current and issues a dial tone on the line.
3. Communication can now begin.

#### Central Office (CO) Rings the Telephone

1. The CO superimposes the ringing voltage over the ring lead battery.
2. The telephone device uses the ring voltage to operate the ringer, which alerts the customer of an incoming telephone call.
3. The customer takes the phone off-hook, which closes the tip-ring connection and allows the tip-ring current to flow.
4. The CO senses the DC current from the telephone device and connects the call to the telephone line.
5. Communication can now begin.

## Cable Specifications

The physical characteristics must meet or exceed FCC part 68 specifications.

### Copper Cable -- Category 1

Either shielded twisted-pair (STP) or unshielded twisted-pair (UTP) is acceptable.

Gauge:	24 to 22 AWG
Maximum # Nodes:	2
Maximum Cable Length:	5 meters (16.4 ft) (Unit A and CO) 5 km (3.1 mi) (Unit B and telephone)

### Fiber Cable

Bit error rate:	≤10 <sup>-9</sup>
Singlemode fiber (recommended):	9 μm
Multimode fiber (recommended):	62.5/125 μm
Multimode fiber (optional):	100/140, 85/140, 50/125 μm

#### TE160A (Unit A)

<b>TE161A (Unit B)</b>	1300 nm multimode	
Fiber Optic Transmitter Power:	min: -19.0 dBm	max: -14.0 dBm
Fiber Optic Receiver Sensitivity:	min: -30.0 dBm	max: -14.0 dBm
Link Budget:	11.0 dB	

#### TE162A (Unit A)

<b>TE163A (Unit B)</b>	1300 nm multimode	
Fiber Optic Transmitter Power:	min: -19.0 dBm	max: -14.0 dBm
Fiber Optic Receiver Sensitivity:	min: -30.0 dBm	max: -14.0 dBm
Link Budget:	11.0 dB	

#### TE164A (Unit A)

<b>TE165A (Unit B)</b>	1310 nm singlemode	
Fiber Optic Transmitter Power:	min: -15.0 dBm	max: -8.0 dBm
Fiber Optic Receiver Sensitivity:	min: -31.0 dBm	max: -8.0 dBm
Link Budget:	16.0 dB	

**The fiber optic transmitters on this device meet Class I Laser safety requirements per IEC-825/CDRH standards and complies with 21 CFR1040.10 and 21CFR1040.11.**

Product is certified by the manufacturer to comply with DHHS Rule 21/CFR, Subchapter J applicable at the date of manufacture.

**CAUTION:** Visible and Invisible Laser Radiation When Open. Do Not Stare Into Beam Or View Directly With Optical Instruments.

**CAUTION:** Use of controls, adjustments or the performance of procedures other than those specified herein may result in hazardous radiation exposure.

## RJ-11C Connector Specification

### Unit A (Telephone Emulation)

#### TE160A, TE162A, TE164A

Connector:	RJ-11C
Impedance:	600 Ω
REN:	0.4 B
Loop Current:	10 to 100 mA
Insertion Loss:	0.0 ± 1.0 dB at 1000 Hz (When both ports are terminated at 600 Ω.)

### Unit B (Central Office Emulation)

#### TE161A, TE163A, TE165A

Connector:	RJ-11C
Impedance:	600 Ω
Battery Source:	48 VDC +/- 5V
Ringing Supply:	90 Vp-p
Ring Frequency:	15-30 Hz (Reproduces the frequency detected by Unit A.)
Ring Cadence:	Reproduces the cadence detected by Unit A.
Insertion Loss:	0.0 ± 1.0 dB at 1000 Hz (When both ports are terminated at 600 Ω.)

## Technical Specification

For use with Black Box Model TE16xA or equivalent

<b>Standards</b>	FCC Part 68, TBR21
<b>Dimensions</b>	3.7" x 4.8" x 1.84" (91 mm x 122 mm x 47 mm)
<b>Weight</b>	1 lb. (0.45 kg) (approximate)
<b>Power Consumption</b>	7.0 watts
<b>Power Supply</b>	12VDC, 0.8 Amp (minimum)
<b>DC Output</b>	minimum output regulation: 5% Connector: 2.1mm barrel, center pin positive
<b>MTBF</b>	47,790 hours (MIL217F2 V5.0) (MIL-HDBK-217F) 115,873 hours (Bellcore7 V5.0)
<b>Environment</b>	Tmra*: 0° to 50°C (32° to 122° F) Storage Temp: -15° to 65°C (-4° to 122° F) Humidity: 5 to 95%, non condensing Altitude: 0 to 10,000 feet
<b>Warranty</b>	Lifetime

\*Manufacturer's rated ambient temperature.

## Troubleshooting

### 1. Is the PWR (power) LED illuminated?

#### NO

- Is the power adapter the proper type of voltage and cycle frequency for the AC outlet? (See “Power Supply DC Output” on page 11.)
- Is the power adapter properly installed in the media converter and in the outlet?
- Does the external power source provide power?
- Contact Technical Support: 1-724-746-5500.

#### YES

- Proceed to step 2.

### 2. Is the SDF (signal detect fiber Link) LED illuminated?

#### NO

- Check the fiber cables for proper connection.
- Verify that the TX and RX cables on the first media converter are connected to the RX and TX ports, respectively, on the second media converter.
- Contact Technical Support: 1-724-746-5500.

#### YES

- Proceed to step 3.

### 3. Is the ACT (active) LED illuminated?

#### NO

- Ensure that the local unit is off-hook.
- Contact Technical Support: 1-724-746-5500 .

#### YES

- Contact Technical Support: 1-724-746-5500.

## Consumer Information

### ACTA Compliance

This equipment complies with Part 68 of the FCC rules and the requirements adopted by the Administrative Council for Terminal Attachments (ACTA). On the back of this equipment is a label that contains, among other information, a product identifier in the format US:AAAEQ##TXXXX. If requested, this number must be provided to the telephone company.

### Plug and Jack

A plug and jack used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA. A compliant telephone cord and modular plug is provided with this product. It is designed to be connected to a compatible modular jack that is also compliant. See installation instructions for details.

### Ringer Equivalence Number

The Ringer Equivalence Number (REN) (listed on the label on the front of the device) is used to determine the number of devices that may be connected to a telephone line. Excessive RENs on a telephone line may result in the devices not ringing in response to an incoming call. In most but not all areas, the sum of the RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company.

### Harm to the Telephone Network

If the **TE16xA** causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

### Changes to the Telephone Company's Network

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the **TE16xA**. If this happens the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

### Problems with the Equipment

If trouble is experienced with the **TE16xA**, for repair or warranty information, please contact Technical Support at 1-724-746-5500. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

### Repairs to the Equipment

Aside from the jumper settings (described on page 3), the **TE16xA** is not intended to be serviced by the user. If the equipment requires repair, contact Technical Support at 1-724-746-5500.

### Party Lines

Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission, or corporation commission for information.

### Alarm Dialing Equipment

If your home has specially wired alarm equipment connected to the telephone line, ensure the installation of the **TE16xA** does not disable your alarm equipment. If you have questions about what will disable alarm equipment, consult your telephone company or a qualified installer.

## Compliance Information

### UL Listed

C-UL Listed (Canada)

CISPR22/EN55022 Class A

CE Mark

### FCC Regulations

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 the user's own expense.

### Canadian Regulations

This digital apparatus does not exceed the Class A limits for radio noise for digital apparatus set out on the radio interference regulations of the Canadian Department of Communications. Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la Class A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

### European Regulations

#### Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

#### Achtung !

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in weichen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

#### Attention !

Ceci est un produit de Classe A. Dans un environnement domestique, ce produit risque de créer des interférences radioélectriques, il appartiendra alors à l'utilisateur de prendre les mesures spécifiques appropriées.

### VCCI Class 1 Compliance

This equipment is in the 1st Class category (information equipment to be used in commercial/industrial areas) and conforms to standards set by the Voluntary Control Council For Interference by Data Processing Equipment and Electronic Office Machines aimed at preventing radio interference in commercial/ industrial areas. When used in a residential area or in an adjacent area thereto, may cause interference to radio and TV receivers, etc. Read instructions for correct handling.

この装置は、第一種情報装置（商工業地域において使用されるべき情報装置）で商工業地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会（VCCI）基準に適合しております。  
従って、住宅地域またはその隣接した地域で使用すると、ラジオ、テレビジョン受信機等に受信障害を与えることがあります。  
取扱説明書に従って正しい取り扱いをして下さい。



**Black Box Corporation**  
The World's Source for Connectivity™

### Declaration of Conformity

Name of Mfg: **Black Box Corporation**  
1000 Park Dr., Lawrence, PA 15505, USA  
Model: **TE16xA Series Media Converters**  
Part Number(s): **TE160A, TE161A, TE162A, TE163A, TE164A, TE165A**  
Regulation: **EMC Directive 89/336/EEC**

Purpose: To declare that the **TE16xA** to which this declaration refers is in conformity with the following standards.  
EN 55022:1998+A1:2000 Class A; 55024:1998; FCC Part 15 Subpart B; UL 1950; TBR 21:1998; CS 03; TIA-968; 21 CFR Subpart J

**I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).**

  
Stephen Anderson, Vice-President of Engineering

February 17, 2003  
Date



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