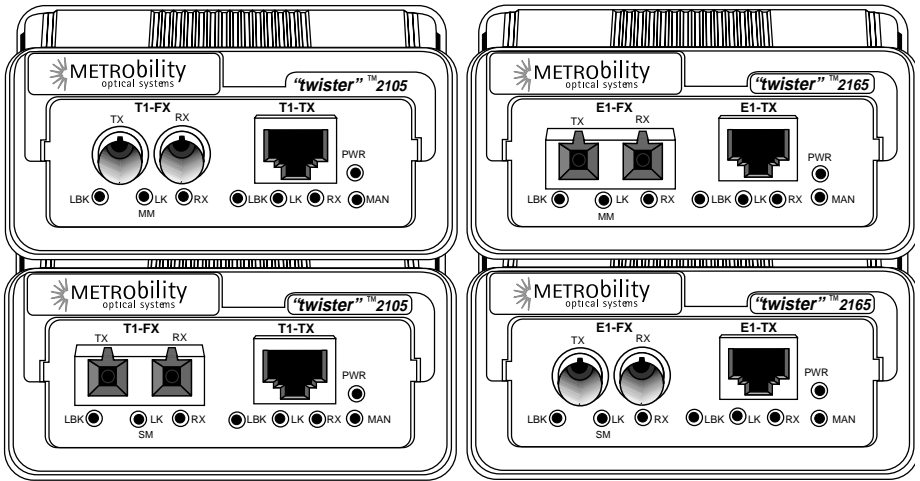


# T1/E1 “twister”



## *Installation & User Guide*

Models: 2105-13-01 / 2105-14-01 / 2105-15-01 / 2105-16-01 /  
2105-17-01 / 2105-1J-01 / 2165-13-01 / 2165-14-01 /  
2165-15-01 / 2165-16-01 / 2165-17-01 / 2165-1J-01

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## ***Metrobility T1/E1 Standalone Models***

### **T1 Copper to T1 Fiber:**

2105-13-01 \_\_\_\_\_ T1 RJ-45 to T1 multimode SC  
2105-14-01 \_\_\_\_\_ T1 RJ-45 to T1 singlemode SC  
2105-15-01 \_\_\_\_\_ T1 RJ-45 to T1 multimode ST  
2105-16-01 \_\_\_\_\_ T1 RJ-45 to T1 singlemode ST  
2105-17-01 \_\_\_\_\_ T1 RJ-45 to T1 singlemode SC (40km)  
2105-1J-01 \_\_\_\_\_ T1 RJ-45 to T1 singlemode SC (100km)

### **E1 Copper to E1 Fiber:**

2165-13-01 \_\_\_\_\_ E1 RJ-45 to E1 multimode SC  
2165-14-01 \_\_\_\_\_ E1 RJ-45 to E1 singlemode SC  
2165-15-01 \_\_\_\_\_ E1 RJ-45 to E1 multimode ST  
2165-16-01 \_\_\_\_\_ E1 RJ-45 to E1 singlemode ST  
2165-17-01 \_\_\_\_\_ E1 RJ-45 to E1 singlemode SC (40km)  
2165-1J-01 \_\_\_\_\_ E1 RJ-45 to E1 singlemode SC (100km)

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# Overview

## **Thank you for choosing the Metrobility T1/E1 media converter.**

The T1/E1 media converter from Metrobility Optical Systems provides high-speed integration and conversion of T1 (1.544Mbps) or E1 (2.048Mbps) serial copper telco communication lines to fiber transport environments. Regardless of the line codes or framing, the copper data stream is converted to optical signals for greater noise immunity and longer transmission. The T1/E1 model supports remote fiber optic links up to 2km over multimode and up to 100km over singlemode cable.

To optimize your T1/E1 network, this compact media converter operates seamlessly with a low bit delay. All signal activity is completely converted ensuring accurate communication within connected segments. The Metrobility T1/E1 converter is totally frame and data independent and features user-selectable line build out.

For testing a full-duplex fiber optic link, the T1/E1 model is designed with a built-in Bit Error Rate Test (BERT) and a dual-port loopback switch which, when enabled, returns the incoming copper and fiber data back to the sending devices. The T1/E1 model also includes eight LEDs on the front panel for visible status reporting.

The Metrobility T1/E1 media converter offers the following key features:

- AMI or B8ZS (T1) / HDB3 (E1) bipolar line code support on the copper interface.
- Eight LED indicators on the front panel for easy visual diagnostics.
- Built-in BERT 511.
- Dual-port loopback testing without the need for special equipment.
- Variable line length selection to set the proper T1/E1 pulse shape.
- MDI-II to MDI-X switch on the copper interface to eliminate the need for crossover cables.
- Copper to multimode conversion up to 2km, or copper to singlemode conversion up to 100km.
- Far End Fault notification of a loss on the remote unit's fiber optic receiver.
- Low jitter for maximum transmission quality.
- Low power consumption ( $\leq 3W$ ).

# Installation Guide

Follow the simple steps outlined in this section to install and start using your Metrobility T1/E1 media converter.

## 1 **Unpack the Media Converter and Accessories**

Check that the following components have been included with your order:

- Metrobility T1/E1 media converter
- Power supply
- Power cord
- Four (4) rubber feet
- Two (2) SC-to-ST adapters (2105-16-01 and 2165-16-01 only)

Your order has been provided with the safest possible packaging, but shipping damage does occasionally occur. Inspect your order carefully. If you discover any shipping damage, notify your carrier and follow their instructions for damage and claims. Save the original shipping carton in case return or storage of the unit is necessary.

## 2 **Choose an Appropriate Location**

The Metrobility media converter is intended for use in either office or industrial environments. The unit must be located within six (6) feet of the AC power source being used and placed as far away as possible from electrical noise generating equipment such as copiers, electrostatic printers and other motorized equipment. If exposed twisted-pair wiring is used nearby, the wiring should be routed as far away as possible from power cords and data cables to minimize interference.

The unit may be oriented in any manner which permits the user to make physical connection to the power supply and leaves a minimum of six (6) inches of space for proper ventilation.

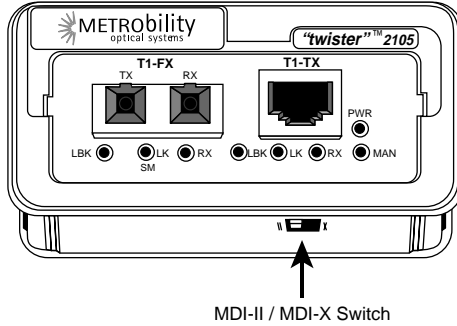
*TUV Compliance Note: For pluggable equipment, the socket outlet must be installed near the equipment and be easily accessible.*

*Bei Geräten mit Steckanschluß muß die Steckdose nahe dem Gerät angebracht und leicht zugänglich sein.*

# 3 Set the Switches

## MDI-II/MDI-X Switch

To eliminate the need for crossover cables, the T1/E1 converter features an MDI-II/MDI-X switch for the copper interface. The switch is located on the bottom of the unit directly below the RJ-45 connector.



Using a pointed object, simply slide the switch in the direction of the appropriate symbol to configure the port for either a straight-through or crossover connection.

- The parallel symbol (**||**) indicates a straight-through or parallel connection. (*default*)
- The cross symbol (**X**) indicates a crossover connection.

Use the following table as a guide.

A device that is wired straight through needs one crossover connection:	
If the cable is	the MDI-II to MDI-X switch setting should be
<b>straight through</b>	<b>X</b>
<b>crossover</b>	<b>  </b>

A device that is wired crossover needs a parallel connection:	
If the cable is	the MDI-II to MDI-X switch setting should be
<b>straight through</b>	<b>  </b>
<b>crossover</b>	<b>X</b>

## DIP Switches

A set of six DIP switches is located on the back of the unit. These switches allow you to select from several modes of operation as well as to set the transmitter's output pulse shape. Refer to the table below for the proper setting of the DIP switches.

**NOTE:** The switch is ON when it is in the DOWN position.  
The switch is OFF when it is in the UP position.

Switch No.	Switch Label	Position	Function
1	BR	ON	Bit Error Rate Test (BERT) is enabled.
		OFF ( <i>default</i> )	BERT is disabled; normal operation.
2	LB	ON	Loopback is enabled on the copper and fiber ports.
		OFF ( <i>default</i> )	Loopback is disabled; normal operation.
3	CD	ON	Alternate Mark Inversion (AMI) line coding is used for receiving and transmitting data.
		OFF ( <i>default</i> )	B8ZS (T1) or HDB3 (E1) line coding is used for receiving and transmitting data.
4	L2	ON	Line length bit 2 is 1.
		OFF ( <i>default</i> )	Line length bit 2 is 0.
5	L1	ON	Line length bit 1 is 1.
		OFF ( <i>default</i> )	Line length bit 1 is 0.
6	L0	ON ( <i>E1 default</i> )	Line length bit 0 is 1.
		OFF ( <i>T1 default</i> )	Line length bit 0 is 0.

### BR Switch

Use the Bit Error Rate Test switch to test the fiber optic connection between two T1/E1 units. If BERT 511 is enabled on the local unit, it will generate a 511 pattern on the data channel and request temporary loopback on the management channel. The remote unit will then put itself into loopback on the fiber port and return the BERT data back to the local unit. The default state of the BERT switch is disabled (OFF).

### LB Switch

The LB switch enables local loopback which isolates the copper side from the fiber side. This allows the incoming data on each side to loop back on their own media line and return to their sending devices. The default state of

the local loopback switch is disabled (OFF). For more information, refer to [Diagnostic Modes](#) in the User Guide section of this manual.

### CD Switch

The line code switch determines whether AMI or B8ZS / HDB3 coding is used for receiving and transmitting data. The default setting is B8ZS for a T1 model and HDB3 for an E1 model. These are the settings used in most applications. AMI (bipolar) coding is common in some legacy applications.

### L2, L1 and L0 Switches

These switches determine the shape of the transmitter's output pulse. The default is 0, 0, 0 for T1 and 0, 0, 1 for E1. (0 = OFF; 1 = ON)

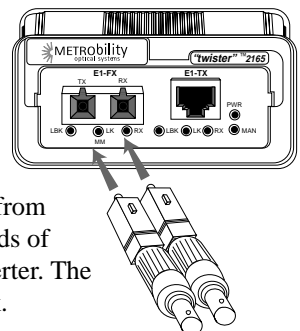
L2	L1	L0	T1 Line Build Out	E1 Line Build Out
0	0	0	DSX-1 (0-133 ft) / 0 dB CSU <i>(T1 default)</i>	
0	0	1	DSX-1 (133-266 ft)	120 ohms normal <i>(E1 default)</i>
0	1	0	DSX-1 (266-399 ft)	
0	1	1	DSX-1 (399-533 ft)	
1	0	0	DSX-1 (533-655 ft)	
1	0	1	-7.5 dB CSU	
1	1	0	-15 dB CSU	
1	1	1	-22.5 dB CSU	

## 4 Attach the Adapters

*(2105-16-01, 2165-16-01 Only)*

The fiber ports on these models are equipped with SC connectors and require two SC-to-ST adapters, which are included in your order.

To connect the adapters to the Metrobility T1/E1 converter, first remove the protective coverings from both ends of the adapters. Next, insert the SC ends of the adapters into the SC connectors on the converter. The unit is now ready to be connected to the network.





# 5 **Connect to the Network**

The Metrobility T1/E1 model offers the ease of plug-and-play installation. Once power is applied to the unit, correct connectivity can be verified via the link (LK) LED.

## ***Twisted-Pair Interface***

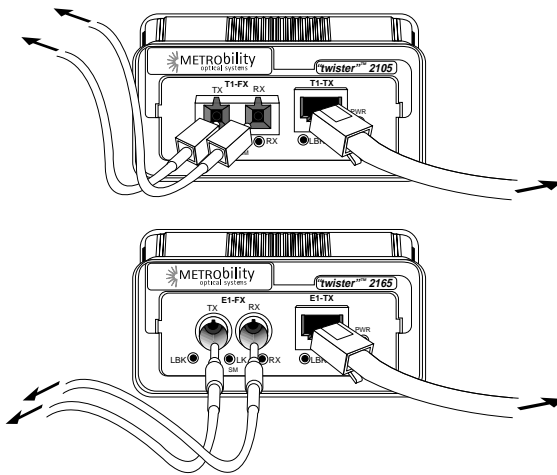
The twisted-pair port provides a shielded RJ-45 connector. It supports a maximum segment length of 1,310 feet for short haul or 4,500 feet (22 dBm) for long haul Channel Service Unit (CSU) operation.

## ***Fiber Optic Interface***

The fiber optic transmit (TX) port on the media converter is located to the left of the receive (RX) port. When making network connections, make sure that the receive port of the Metrobility unit connects to the transmit port of the connected device, and make sure that the receive port of the connected device connects to the transmit port of the Metrobility unit.

The fiber optic multimode (MM) interface supports a maximum segment length of 2km for remote links.

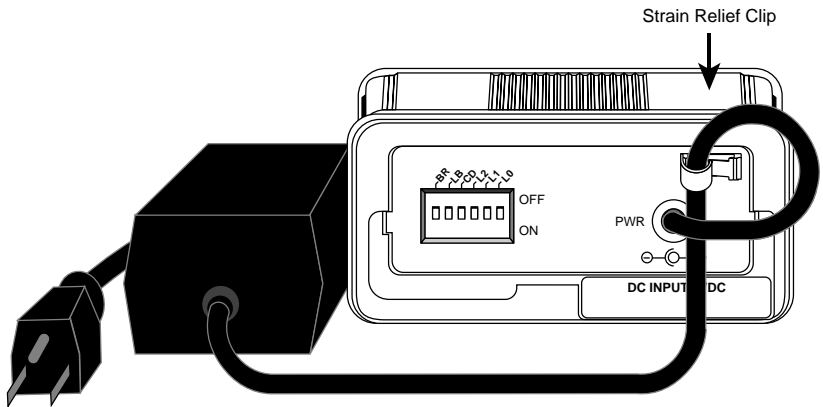
The standard singlemode (SM) connector supports a maximum segment length of 15km. The singlemode long haul interface (2105-17-01 and 2165-17-01) supports a maximum segment of 40km. The singlemode extended long haul interface (2105-1J-01 and 2165-1J-01) supports a maximum segment length of 100km.



## 6 Apply Power

Power is provided from the desktop power supply module. This power module is equipped with an S760 hollow-type plug for insertion into the DC jack located on the back of the unit and a standard IEC 320-type AC power receptacle.

When making power connections, it is recommended that the DC power cord be connected to the DC input jack located on the back of the media converter *before* making the AC connection to the outlet. Be sure to seat the power cord into the strain relief clip to ensure against accidental disconnection.



Upon receiving power, the media converter goes into normal operation mode and automatically provides the appropriate signal translation between the connected network segments.

Verify correct segment connectivity via the LK LEDs on the front of the unit.

If an additional extension cord is used to connect the power module to the power source, the following guidelines must be followed.

While one end of the AC power cord can be fitted with whatever plug is standard for the country of operation, the end that connects to the power supply module must have a female plug that fits this type of AC receptacle.

- AC 115V (North American): use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, type SVT or SJT three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15A, 125V.
- AC 230V (USA): use a UL-listed cord set consisting of a minimum No. 18 AWG, type SVT three-conductor cord, a maximum of 15 feet in length and a Tandem blade grounding-type attachment plug rated 15A, 250V.
- 240V (outside USA): use a cord set consisting of a minimum No. 18 AWG cord and grounding-type attachment plug rated 15A, 250V. The cord set should have the appropriate safety approvals for the country in which the unit is being installed and marked HAR.

# User Guide

*This section contains more detailed information regarding the operating features of the Metrobility T1/E1 media converter.*

## LED Indicators

The Metrobility T1/E1 media converter provides several system and port LEDs for the visible verification of unit status and proper functionality. These LEDs can aid in troubleshooting and overall network diagnosis and management.

### System LEDs

LED Label	Color (Status)	Indication
PWR	Green (steady)	Unit is receiving power.
	(off)	Unit is not receiving power or has failed.
MAN	Green (steady)	Unit is receiving good management frames. Management frames are sent only when Far End Fault is detected.
	(off)	No management frames are being received. Normal operation.

### Copper Port LEDs

LED Label	Color (Status)	Indication
RX	Green (steady)	Receiving carrier on inbound copper line. RX is normally ON and indicates that the incoming data and clock are within tolerance.
	(off)	The carrier is lost. (Red Alarm)
LK	Green (steady)	Normal operation. Copper link is up (no alarm condition).
	Green (blinking)	There is a bipolar violation (T1) or a code violation (E1). A bipolar violation (BPV) is two consecutive marks with the same polarity, unless it is part of a B8ZS sequence. A code violation is two consecutive BPVs with the same polarity.
	(off)	Alarm condition on the incoming stream. <ul style="list-style-type: none"><li>• If RX LED is OFF, the carrier is lost. (Red Alarm)</li><li>• If RX LED is ON, port is receiving AIS (unframed all 1s) from the sending device. (Blue Alarm)</li></ul>
LBK	Yellow (steady)	Copper port is in loopback mode. Inbound data on the copper pair is regenerated and sent back on the transmit copper pair.
	(off)	Normal operation. Loopback is disabled on the copper port.

### Fiber Optic Port LEDs

LED Label	Color (Status)	Indication
RX	Green (steady)	Receiving pulses on inbound fiber line. RX is normally ON and indicates that the inbound fiber line has a signal.
	Green (blinking)	Receiving BERT 511 sequence.
	(off)	The carrier is lost. (Red Alarm)
LK	Green (steady)	Normal operation. Fiber link is up (no alarm condition).
	Yellow (blinking)	Receiving BERT 511 sequence which contains occasional bit errors.
	Yellow (steady)	The remote T1/E1 unit is not detecting link on its inbound fiber port and is reporting Far End Fault via the management channel. (Yellow Alarm)
	(off)	Alarm condition on the incoming stream. <ul style="list-style-type: none"> <li>• If RX LED is OFF, the carrier is lost. (Red Alarm)</li> <li>• If RX LED is ON, port is receiving AIS (unframed all 1s) or bad pulses from the sending device. (Blue Alarm)</li> </ul>
LBK	Yellow (steady)	Fiber port is in loopback mode. Incoming data on the fiber port is sent back on the transmit fiber line.
	(off)	Normal operation. Loopback is disabled on the fiber port.

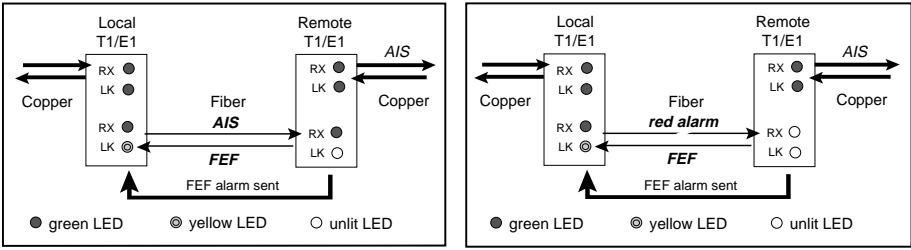
# Factory Settings

## Default Hardware Settings

MDI-II/MDI-X .....	Parallel (II)
RJ-48 Pin Out .....	1, 2 (TX Output)
.....	4, 5 (RX Input)
BERT 511 .....	Disabled
Local Loopback .....	Disabled
Line Code .....	B8ZS (T1)
.....	HDB3 (E1)
Line Length Bits (L2, L1, L0) .....	0, 0, 0 (T1)
.....	0, 0, 1 (E1)
Line Build Out .....	DSX-1 (0-133 ft) / 0 dB CSU (T1)
.....	120 Ω normal (E1)

## Far End Fault

The Metrobility T1/E1 media converter includes a Far End Fault (FEF) feature. FEF enables a local T1/E1 unit to detect a loss of link (red or blue alarm) on the remote unit's fiber port receiver. If the remote unit's fiber port receiver loses its carrier or receives AIS, the remote unit will send an unsolicited alarm to the local T1/E1 unit, thus turning the local unit's MAN LED green. The local unit will also report the condition with a yellow LK LED on its fiber port. FEF is not applicable to the copper port.



Because the fiber LK LED is used to display both FEF and blue alarm conditions, if both conditions occur at the same time, the blue alarm will take priority over FEF. Although both alarms will be transmitted, only the blue alarm will be displayed through the LEDs (i.e., fiber LK off and fiber RX on).



# ***Theory of Operation***

## ***Coding Scheme and Clocking***

T1/E1 data is carried over copper lines using either AMI or B8ZS (T1)/HDB3 (E1) coding, which encodes both the data and clock. AMI, B8ZS, and HDB3 require a transport medium that can carry both positive and negative pulses, as well as a zero level. This is not possible with fiber, in which transmitters are either off or on. To properly transport the information over fiber lines and simplify clock extraction, the Metrobility T1/E1 media converter uses a Pulse Width Modulation (PWM) scheme that converts the T1/E1 data to a format suitable for fiber optic communication. The fiber receiver on the remote T1/E1 unit then restores the signal back to its original format.

The PWM data provides a composite pulse for each incoming data bit, ensuring that the original timing information for each bit is transferred and recoverable. No synchronizing headers are necessary, resulting in faster recovery from lost signal errors and ensuring timing transparency and the accurate transfer of data.

## ***Data Transparency***

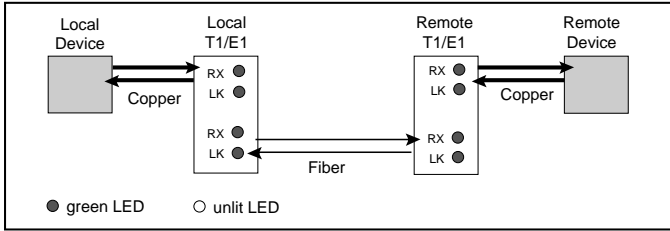
The Metrobility T1/E1 media converter offers full data transparency. Any codes or commands contained within the data stream are passed through to the remote device. The only commands executed by the Metrobility converter are those set through the DIP switches.

## Link Loss Indications

The following illustrations show the status of the RX and LK LEDs under various link conditions. Note that the T1/E1 converter only generates blue alarms (AIS) on the data channel. It never generates yellow alarms, although it does propagate them. The T1/E1 unit relies on the local and remote devices to convert blue alarms to yellow. (Loopback is disabled in these examples.)

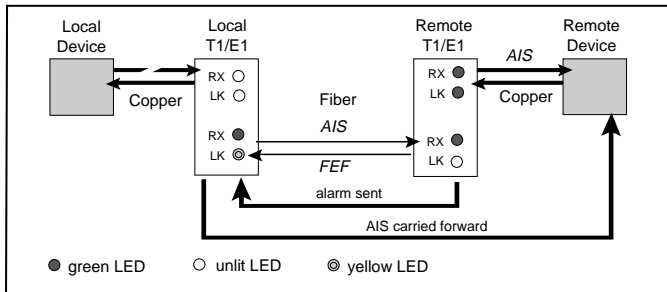
### Normal

The diagram below shows a typical configuration with good link status.



### Input Copper Link Loss

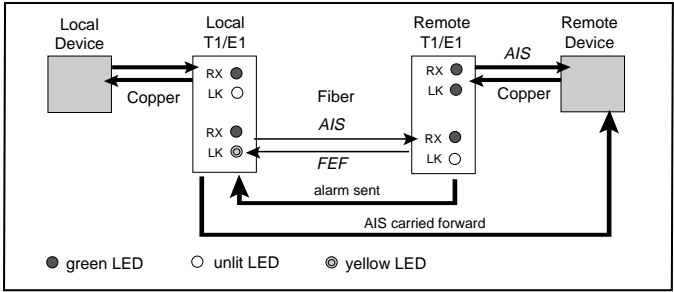
Loss of the copper input forces the T1/E1 unit to generate AIS, which is transmitted out the fiber port. For example, if the local unit's inbound copper line breaks, it will transmit AIS to the remote T1/E1 via the fiber cable. The remote unit will then carry the AIS forward via its copper cable to the remote device. Additionally, when the remote unit's fiber port receives the AIS, it will generate a Far End Fault (FEF) alarm which is returned to the local T1/E1. The local T1/E1 reports the condition with a yellow LK LED on its fiber port.



### Input Copper AIS

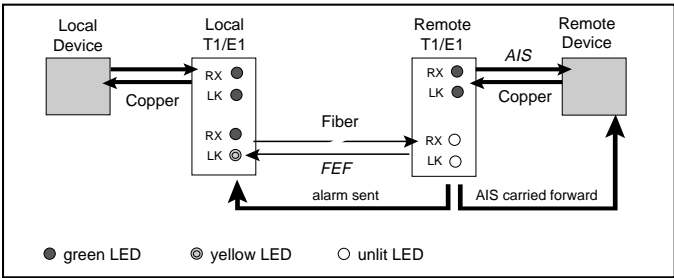
If the local T1/E1 converter's copper interface receives AIS, the unit will transmit the alarm to the remote unit, which then transmits it to the remote device. Notice that in this example, the copper RX LED on the local T1/E1 remains green since the cable is intact. Again, the FEF alarm is transmitted back from the remote to the local unit.





**Input Fiber Link Loss**

If a T1/E1 converter’s inbound fiber line breaks, the unit will generate AIS which is transmitted over its copper cable. It will also send an alarm to its T1/E1 partner. In the example below, the remote T1/E1 has lost its fiber input and is sending AIS to the remote device. Additionally, because of the Far End Fault feature, the unit transmits an unsolicited alarm to the local T1/E1 which reports the condition with a yellow LK LED on its fiber port.

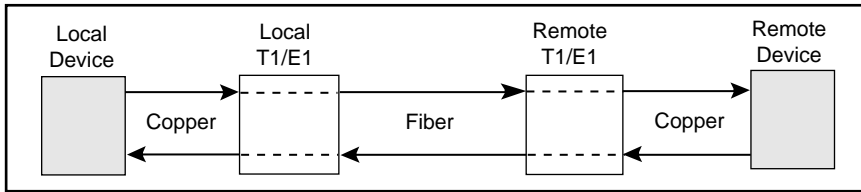


## Diagnostic Modes

The Metrobility T1/E1 media converter features BERT 511 and loopback testing to help verify correct installation and diagnose system problems.

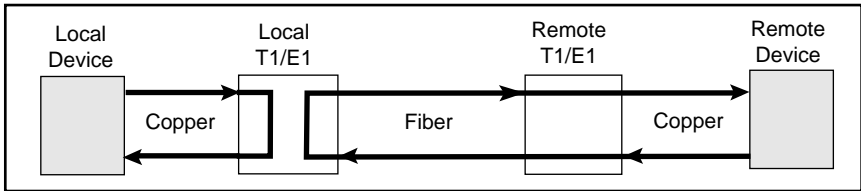
### Normal

During normal operation, data from the local device (CSU, PBX, etc.) enters the copper receiver of the local T1/E1, passes through the fiber cable between the two converters, then exits out the remote unit's copper transmitter to enter the remote equipment, and vice versa.



### Local Loopback

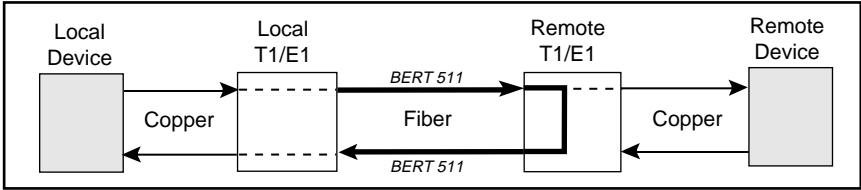
In this mode, data on both the copper and fiber lines are looped back to the sending devices. Loopback is set through Dip Switch 2 (LB). During local loopback, the LBK LEDs are yellow and the RX LEDs green. Once local loopback is enabled, the unit will remain in this mode until you reset the DIP switch.



### Bit Error Rate Test (BERT)

To test the fiber connection between two T1/E1 units, you can enable BERT 511 which generates a test sequence on the fiber line to verify proper looping. BERT is set through DIP Switch 1 (BR). It is not applicable to the copper port.

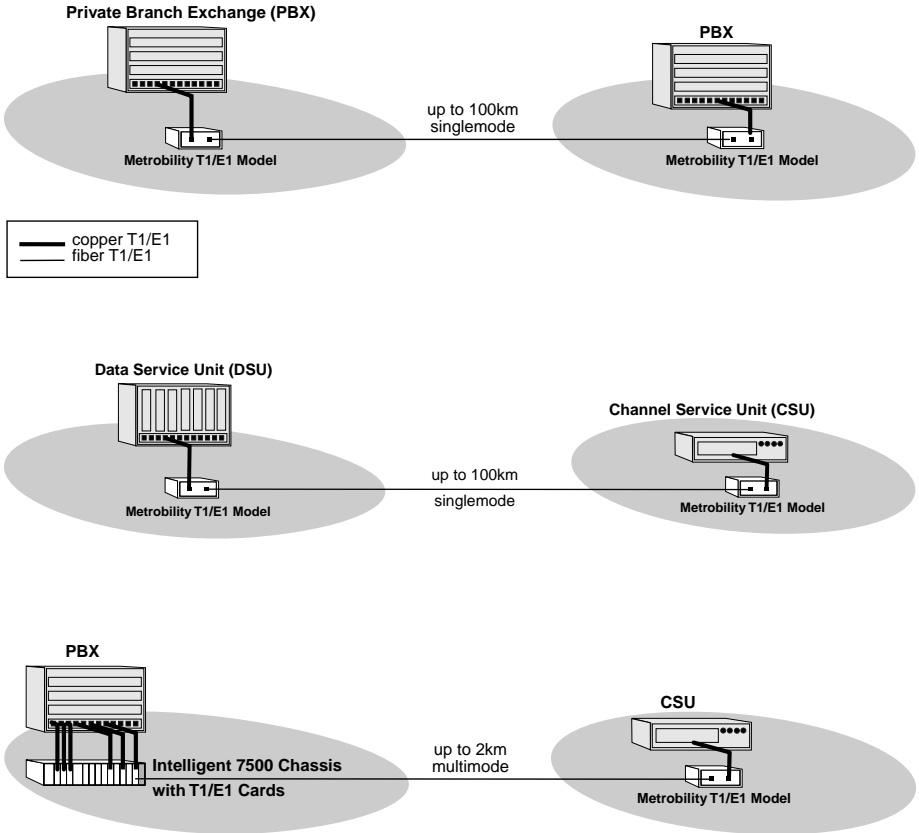
If BERT is enabled on the local T1/E1, it will generate a 511 pattern on its outbound fiber data channel and request temporary loopback from the remote unit. The remote T1/E1 then puts itself into loopback on the fiber port and sends the BERT data back to the local T1/E1. When the local unit receives the test data, its fiber RX LED blinks green. If there are any errors, the local unit's fiber LK LED will blink yellow. Once BERT is enabled, the unit will remain in this mode until you reset the DIP switch.



BERT 511 is a random sequence generated by the polynomial  $x^9 + x^5 + 1$ , which is repeated every 511 bits. It is implemented by a linear feedback shift register. BERT 511 is detected when there are one or fewer bad BERT 511 bits in 512 data bits.

# Topology Solutions

The Metrobility T1/E1 standalone model is a point-to-point media converter designed to extend the reach of copper T1/E1 segments and to provide protection from power surges and electromagnetic interference. Each T1/E1 model supports a single remote T1/E1 unit.



# Technical Specifications

## Network Connections

### Twisted-Pair Interface

Connector \_\_\_\_\_ Shielded RJ-45, 8-pin jack  
Impedance \_\_\_\_\_ 100 Ohms T1 (balanced pair)  
\_\_\_\_\_ 120 Ohms E1 (balanced pair)  
Supported Link Length \_\_\_\_\_ up to 1,310 feet (short haul)  
\_\_\_\_\_ up to 22.5 dBm or 4,500 feet (long haul CSU)  
Cable Type \_\_\_\_\_ Category 5 UTP

### Multimode Fiber Optic Interface

(2105-13, 2105-15, 2165-13, 2165-15)

Connector \_\_\_\_\_ ST or SC  
Wavelength \_\_\_\_\_ 1310 nm  
RX Input Sensitivity \_\_\_\_\_ -31 dBm typical  
Output Power \_\_\_\_\_ -20 dBm to -14 dBm (62.5/125  $\mu$ m)  
Supported Link Length \_\_\_\_\_ up to 2km full duplex  
Cable Type \_\_\_\_\_ 50/125, 62.5/125  $\mu$ m F/O

### Singlemode Fiber Optic Interface

(2105-14, 2105-16, 2165-14, 2165-16)

Connector \_\_\_\_\_ ST or SC  
Wavelength \_\_\_\_\_ 1310 nm  
RX Input Sensitivity \_\_\_\_\_ -31 dBm peak minimum  
Output Power \_\_\_\_\_ -15 dBm to -8 dBm (9/125  $\mu$ m)  
Supported Link Length \_\_\_\_\_ up to 15km full duplex  
Cable Type \_\_\_\_\_ 8.3/125, 8.7/125, 9/125, 10/125  $\mu$ m F/O

### Singlemode Fiber Optic Interface — long haul distance support

(2105-17, 2165-17)

Connector \_\_\_\_\_ SC  
Wavelength \_\_\_\_\_ 1310 nm  
RX Input Sensitivity \_\_\_\_\_ -35 dBm minimum  
Output Power \_\_\_\_\_ -5 dBm to 0 dBm (9/125  $\mu$ m)  
Supported Link Length \_\_\_\_\_ up to 40km full duplex  
Cable Type \_\_\_\_\_ 8.3/125, 8.7/125, 9/125, 10/125  $\mu$ m F/O

*Singlemode Fiber Optic Interface — extended long haul distance support*  
(2105-1J, 2165-1J)

Connector \_\_\_\_\_ SC  
Wavelength \_\_\_\_\_ 1550 nm  
RX Input Sensitivity \_\_\_\_\_ -37 dBm minimum  
Output Power \_\_\_\_\_ -3.0 dBm to 0 dBm (9/125  $\mu$ m)  
Supported Link Length \_\_\_\_\_ up to 100km full duplex  
Cable Type \_\_\_\_\_ 8.3/125, 8.7/125, 9/125, 10/125  $\mu$ m F/O

**Data Rate**

Data Rate \_\_\_\_\_ 1.544Mbps (T1); 2.048Mbps (E1)

**Power**

Input \_\_\_\_\_ +5.0VDC @ 0.6A, 3W average

**Environmental**

Operating Temperature \_\_\_\_\_ 0° to 55° C  
Storage Temperature \_\_\_\_\_ -30° to 70° C  
Relative Humidity \_\_\_\_\_ 5% to 95% non-condensing  
Physical Case \_\_\_\_\_ Fully enclosed metal construction  
Dimensions \_\_\_\_\_ 4.83"L x 3.26"W x 1.71"H  
\_\_\_\_\_ 12.3 cm x 8.3 cm x 4.3 cm  
Weight (including power supply) \_\_\_\_\_ 3 lb, 1.36 kg

## ***Acronyms and Abbreviations***

This list defines the acronyms and abbreviations used in this guide.

<b>AIS</b>	Alarm Indication Signal
<b>AMI</b>	Alternate Mark Inversion line coding for T1 and E1
<b>ANSI</b>	American National Standards Institute
<b>AWG</b>	American Wire Gauge
<b>B8ZS</b>	Bipolar Eight Zeroes Substitution line coding for T1
<b>BERT</b>	Bit Error Rate Test
<b>BPV</b>	Bipolar Violation
<b>BR</b>	Bit Error Rate Test
<b>CD</b>	Line code
<b>CSA</b>	Canadian Standards Association
<b>CSU</b>	Channel Service Unit
<b>DSU</b>	Data Service Unit
<b>DSX-1</b>	Digital Signal Cross-Connect; the T1 electrical interface specification
<b>E1</b>	2.048 Mbps communications standard
<b>FEF</b>	Far End Fault, an alarm indicating the remote unit's fiber receiver is lost
<b>F/O</b>	Fiber Optic
<b>FPGA</b>	Field-Programmable Gate Array
<b>HDB3</b>	High Density Bipolar Three Zeroes Substitution line coding for E1
<b>IEC</b>	International Electrotechnical Commission
<b>ITU</b>	International Telecommunication Union
<b>LB, LBK</b>	Loopback
<b>LK</b>	Link
<b>MAN</b>	Management frames
<b>Mbps</b>	Megabits per second
<b>MDI-II</b>	Media Dependent Interface—Parallel
<b>MDI-X</b>	Media Dependent Interface—Crossover
<b>MM</b>	Multimode
<b>NRZ</b>	Non-Return to Zero line coding
<b>PBX</b>	Private Branch Exchange
<b>PWM</b>	Pulse Width Modulation
<b>PWR</b>	Power
<b>RX</b>	Receive
<b>SM</b>	Singlemode
<b>T1</b>	1.544 Mbps communications standard
<b>TX</b>	Transmit
<b>UTP</b>	Unshielded Twisted Pair

## ***Product Safety, EMC and Compliance Statements***

This equipment complies with the following requirements:

- UL
- CSA
- EN60950 (safety)
- FCC Part 15, Class A
- EN55022 Class A (emissions)
- EN55024: 1998 (immunity)
- IEC 825-1 Classification
- DOC Class A (emissions)
- ITU-G.703
- G.704
- G.706
- G.824
- ANSI T1.403-1999
- ANSI T1.408
- Class 1 Laser Product

This product shall be handled, stored and disposed of in accordance with all governing and applicable safety and environmental regulatory agency requirements.

The following *FCC* and *Industry Canada* compliance information is applicable to North American customers only.

### ***USA FCC Radio Frequency Interference Statement***

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.

***Caution:*** *Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

### ***Canadian Radio Frequency Interference Statement***

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

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



## **Warranty and Servicing**

### **Three-Year Warranty for Metrobility T1/E1 Standalone Models**

Metrobility Optical Systems, Inc. warrants that every Metrobility T1/E1 standalone model will be free from defects in material and workmanship for a period of THREE YEARS. This warranty covers the original user only and is not transferable. Should the unit fail at any time during this warranty period, Metrobility will, at its sole discretion, replace, repair, or refund the purchase price of the product. This warranty is limited to defects in workmanship and materials and does not cover damage from accident, acts of God, neglect, contamination, misuse or abnormal conditions of operation or handling, including overvoltage failures caused by use outside of the product's specified rating, or normal wear and tear of mechanical components.

To establish original ownership and provide date of purchase, complete and return the registration card or register the product online at [www.metrobility.com](http://www.metrobility.com). If product was not purchased directly from Metrobility, please provide source, invoice number and date of purchase.

To return a defective product for warranty coverage, contact Metrobility Customer Service for a return materials authorization (RMA) number. Send the defective product postage and insurance prepaid to the address provided to you by the Metrobility Technical Support Representative. Failure to properly protect the product during shipping may void this warranty. The Metrobility RMA number must be clearly on the outside of the carton to ensure its acceptance.

Metrobility will pay return transportation for product repaired or replaced in-warranty. Before making any repair not covered by the warranty, Metrobility will estimate cost and obtain authorization, then invoice for repair and return transportation. Metrobility reserves the right to charge for all testing and shipping costs incurred, if test results determine that the unit is without defect.

This warranty constitutes the buyer's sole remedy. No other warranties, such as fitness for a particular purpose, are expressed or implied. Under no circumstances will Metrobility be liable for any damages incurred by the use of this product including, but not limited to, lost profits, lost savings, and incidental or consequential damages arising from the use of, or inability to use, this product. Authorized resellers are not authorized to extend any other warranty on Metrobility's behalf.

### **Product Manuals**

The most recent version of this manual is available online at

<http://www.metrobility.com/support/manuals.htm>

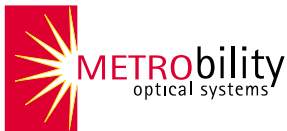
To obtain additional copies of this manual, contact your reseller, or call

1.877.526.2278 or 1.603.880.1833

### **Product Registration**

To register your product, go to

<http://www.metrobility.com/support/registration.cfm>



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