



November 2004

MT650A-ST-R3 MT651A-ST-R2

MT653A-ST-D48-R2

MT650C-R2

MT651C

T1/E1 Fiber Optic Line Drivers

CUSTOMER
SUPPORT
INFORMATION

Order **toll-free** in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)
FREE technical support 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mailing address: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: www.blackbox.com • E-mail: info@blackbox.com

Quick Start Guide

Installation of T1/E1 FOLD units should be carried out only by an experienced technician. If you are familiar with T1/E1 FOLDS, use this quick start guide to set it up for operation.

This guide describes the standalone version of the modem.

Perform the installation procedures for both the local and the remote units.

1. Installing T1/E1 FOLD

Configuring T1/E1 FOLD

1. Disconnect all the cables connected to T1/E1 FOLD.
2. Locate the DIP switch on the T1/E1 FOLD rear panel.
3. Select the electrical interface type (E1 or T1) by setting the E1/T1 section of the rear panel DIP switch to appropriate position.
4. For E1 interface, select its type (balanced or unbalanced) by setting the BAL/UNBAL section of the rear panel DIP switch to appropriate position.

Table below provides details on the functions of the DIP switch, and its default settings.

Jumper/Switch	Function	Possible Settings	Factory Setting
SW1, LOOP ENABLE	Enables or disables LLB or RLB activation	ON – LLB or RLB is activated OFF – LLB or RLB is activated	OFF
SW2, RLB/LLB	Selects local loopback (LLB) or remote loopback (RLB) to be activated from T1/E1 FOLD	ON – RLB is selected OFF – LLB is selected	OFF
SW3, E1/T1	Selects electrical interface type (E1 or T1)	ON – E1 OFF – T1	ON
SW4, BAL/UNBAL	Selects the E1 interface type (balanced or unbalanced)	ON – Balanced E1 (120Ω) OFF – Unbalanced E1 (75Ω)	ON
SW5, AIS	When a major alarm is detected, AIS is transmitted to the electrical or optical interface.	ON – Transmit AIS OFF – Do not transmit AIS	ON

Connecting the Cables

► **To connect cables:**

1. Connect the T1/E1 electrical interface.
2. Connect the fiber optic interface.
3. Connect the power cable (first to the modem, then to the mains).
Operation starts when the power is applied to the rear panel power connector.

2. Operating T1/E1 FOLD

1. Check that SW1 of the DIP switch is set to OFF.
2. Verify LED status. All the LED indicators should be OFF, except for the PWR indicator.
3. If there is an indication of a malfunction or fault, run a diagnostic test.

Contents

Chapter 1. Introduction

1.1 Overview.....	1-1
Versions.....	1-1
Application.....	1-2
Features.....	1-2
1.2 Functional Description.....	1-3
Signal Conversion	1-4
Data/Clock Recovery	1-4
Data Transfer.....	1-4
1.3 Technical Specifications.....	1-4

Chapter 2. Installation and Setup

2.1 Site Requirements and Prerequisites	2-1
2.2 Package Contents	2-1
2.3 Installation and Setup	2-2
Configuring T1/E1 FOLD.....	2-2
Connecting the Interfaces	2-3
Connecting the Power	2-4

Chapter 3. Operations

3.1 Front Panel Controls and Indicators	3-1
3.2 Operating Instructions	3-2
Turning On.....	3-2
Normal Operating Instructions	3-2
Turning Off.....	3-2

Chapter 4. Testing and Diagnostics

4.1 Status Indicators and Alarm Relays.....	4-1
Front Panel LEDs	4-1
Alarm Relays.....	4-1
4.2 Diagnostic Tests.....	4-2
Local Loopback (LLB).....	4-2
Remote Loopback (RLB)	4-2
4.3 Troubleshooting Instructions	4-3
4.4 Frequently Asked Questions	4-4

Chapter 5. T1/E1 FOLD Card Version

5.1 RM110A and RM110AE Rack Nests.....	5-1
5.2 Power Supply	5-2
AC Supply	5-2
DC Supply.....	5-3
Power Supply Redundancy	5-3
5.3 T1/E1 FOLD Card Front Panel	5-4

5.4	Installing a T1/E1 FOLD Card.....	5-5
	Setting Internal Jumpers and Switches	5-5
	Installing T1/E1 FOLD cards into the RM110A or RM110AE	5-6
	Connecting the Interfaces	5-6

Appendix A. Interface Connector Specifications

List of Figures

1-1	T1/E1 FOLD Application	1-2
1-2	T1/E1 FOLD Block Diagram	1-3
2-1	Rear Panel DIP Switch	2-2
2-2	T1/E1 FOLD Rear Panel	2-3
3-1.	T1/E1 FOLD Front Panel	3-1
4-1.	Local Analog Loopback	4-2
4-2.	Remote Loopback	4-2
5-1	RM110A or RM110AE Rear Panel	5-2
5-2	RM110A or RM110AE Front Panel	5-3
5-3	T1/E1 FOLD card Front Panel.....	5-4
5-4	T1/E1 FOLDcard PCB Layout	5-5

List of Tables

1-1.	Fiber Optic Interface Types	1-2
2-1	T1/E1 FOLD DIP Switch Settings	2-3
3-1.	T1/E1 FOLD Front Panel Controls and Indicators.....	3-1
4-1.	Troubleshooting Chart	4-3
5-1.	T1/E1 FOLD card Internal Jumpers and Switches.....	5-6

Chapter 1

Introduction

1.1 Overview

This manual provides information on the technical characteristics, installation and operation of the T1/E1 Fiber Optic Line Drivers (T1/E1 FOLDS) as standalone units, and as rack-mount cards for the RM110A and/or RM110AE.

T1/E1 FOLDS are fiber optic modems for transmission of E1 (2.048 Mbps) or T1 (1.544 Mbps) over multimode or single-mode fiber optic media. The communication equipment is connected to the T1/E1 FOLDS according to the ITU G.703 standard. The modems are designed to operate with several types of fiber optic cables and connectors. The electrical signals are connected through an RJ-45 connector or BNC connectors. LED indicators on the front panel show the operational status of the modem. Alarms indicating faults in modem operation are relayed via a dedicated port. Local and remote loopback tests are available for diagnostics.

The RM110A and/or RM110AE are 19-inch rack, which holds up to 14 cards (see [Chapter 5](#) for the description).

Versions

The following versions of the T1/E1 FOLDS are available.

Standalone units:

- MT650A-ST-R3
- MT651A-ST-R2
- MT653A-ST-D48-R3

Card Versions:

- MT650C
- MT651C

Application

In the application illustrated, each T1/E1 FOLD receives E1 or T1 signals that are equalized to overcome electrical link distortion. The unit then converts the E1 or T1 signals into an optical signal.

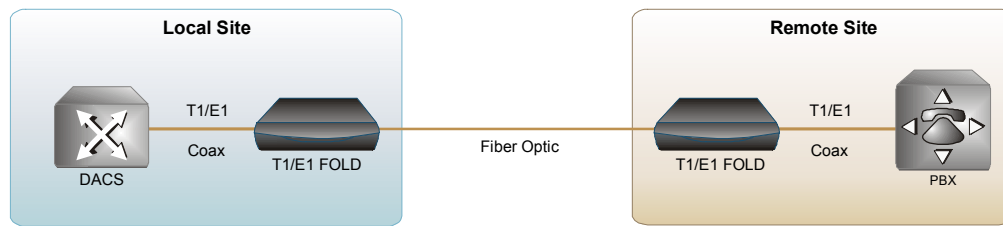


Figure 1-1 T1/E1 FOLD Application

Features

Fiber Optic Interface

Table 1-1 provides information on the characteristics of the fiber optic interface types supported by the T1/E1 FOLDS, including the maximum range of a typical fiber optic cable. The maximum range values given assume a margin of 3dB.

Table 1-1. Fiber Optic Interface Types

Wavelength [nm]	Fiber Type [μm]	Transmitter Type	Typical Power [dBm]	Receiver Sensitivity [dBm]	Connector	Typical Max. Range	
						[km]	[miles]
850	62.5/125 multimode	VCSEL/LED VCSEL	-18 (T1/E1 FOLD card versions)	-38 (T1/E1 FOLD card versions)	ST	4.8	3
			-7 (T1/E1 FOLD)	-35 (T1/E1 FOLD)		7	4.3
1310*	62.5/125 multimode	LED	-18	-39	ST	5	3
1310	9/125 single mode	Laser	-12	-40	ST	50	31
1310*	9/125 single mode	Laser (long haul)	-2	-40	ST	70	43.4

Note Fiber optic interfaces that are marked with an asterisk (*) are for standalone versions only.

Typical attenuation for the fiber optic interface units is as follows:

- 3.5 dB/km for 62.5/125 μm multimode fibers
- 0.5 dB/km for 9/125 μm single mode at 1310 nm

E1/T1 Interface

- The electrical interface meets requirements of ITU G.703 standard for E1 and T1.
- T1/E1 FOLDS support both balanced and unbalanced interfaces.

When T1/E1 FOLDS detect electrical interface levels below G.703 electrical levels, the modem transmits an “All 1 signal” (AIS) to the optical interface.

Test and Diagnostics Capabilities

- T1/E1 FOLDS support local and remote loopback activation.
- T1/E1 FOLDS feature a dry contact alarm port (DB-9) for attaching an external alert device.
- When an AIS is detected at the optical or electrical interface, the modem transparently converts the signal and alerts the user via front panel LEDs.

1.2 Functional Description

This section describes the functional circuitry of the T1/E1 FOLD. T1/E1 FOLDS are used for transmission of E1 (2.048 Mbps) and T1 (1.544 Mbps) over multimode or single-mode fiber optic media. The unit is transparent to framing and can transmit data using any framing pattern with HDB3 or B8ZS coded signals.

Figure 1-2 illustrates the T1/E1 FOLD block diagram.

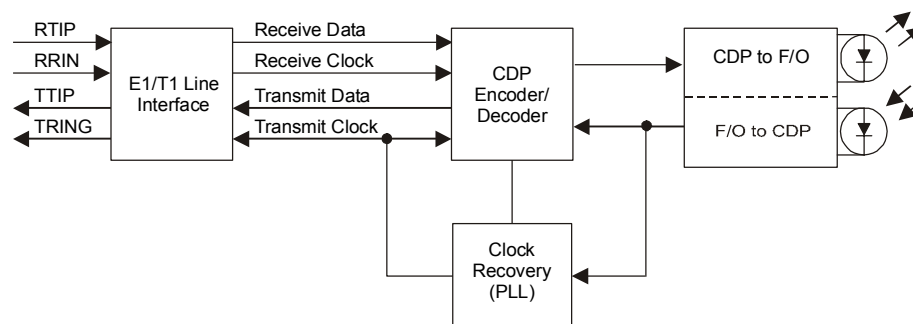


Figure 1-2 T1/E1 FOLD Block Diagram

T1/E1 FOLDS comprise the following signal processing stages:

- Signal conversion
- Data/clock recovery
- Data transfer.

Signal Conversion

Conversion of the electrical signal into an optical signal takes place by using an infrared light-emitting diode or laser transmitter. At the opposite end of the fiber, the optical signal is converted back into an electrical signal and amplified to the required level.

Data/Clock Recovery

To recover data and clock from the signal, a Phase Locked Loop (PLL) circuit is utilized. T1/E1 FOLDS provide internal selection for the E1/T1 electrical interfaces.

Data Transfer

The optical signal is linked to the fiber-optic media and transmitted via the optical link to the remote unit. A high sensitivity pre-amplifier and an AGC (Automatic Gain Control) circuit enable the remote unit to receive the optical signal. The output of the receiver is applied to the clock recovery circuit and the data regeneration circuit, which in turn apply it to the electrical interface driving circuit.

1.3 Technical Specifications

E1/T1 Interface	<i>Transmission Rates</i>	E1: 2.048 Mbps T1: 1.544 Mbps
	<i>Interface</i>	User-selectable: <ul style="list-style-type: none"> • E1: 120Ω balanced or 75Ω unbalanced • T1: 100Ω balanced
	<i>Line Code</i>	E1: HDB3, B8ZS or AMI
	<i>Connectors</i>	Balanced: RJ-45 Unbalanced: two BNC coax
Optical Interface	<i>Technical Specifications</i>	See Table 1-1
Alarm Relay	<i>Type</i>	Dry contacts
	<i>Operation</i>	Normally Open and Normally Closed, using different pins
	<i>Maximum Ratings</i>	1A, 60 VDC, 30 VAC
	<i>Connector</i>	9-pin, D-type, female
Indicators	<i>POWER</i>	ON – The unit is powered up
	<i>LLB</i>	ON – The unit is in local loopback mode
	<i>RLB</i>	ON – The unit is in remote loopback mode
	<i>ELEC LOSS</i>	ON – The electrical interface input is below G.703 electrical levels

	<i>ELEC AIS</i>	ON – An “All 1s” string is received at the electrical interface
	<i>OPTICAL LOSS</i>	ON – Bit error rate of the received signal from the optical interface is 10^{-6} or worse
	<i>OPTICAL AIS</i>	ON – An “All 1s” string is received at the optical interface
Physical	<i>Height</i>	43.7 mm / 1.7 in
	<i>Width</i>	240 mm / 9.4 in
	<i>Depth</i>	170.5 mm / 6.7 in
	<i>Weight</i>	0.5 kg / 1.1 lb
Power	<i>Wide Range Voltage</i>	100–240 VAC, 8 VA or 40 to 72 VDC, 3W
	<i>DC Voltage</i>	20 to 60 VDC, 4W
	<i>Fuses</i>	MT650C, MT651C: 1A 250V and 50 mA 250V
Environment	<i>Temperature</i>	-5°–55°C / 23°–131°F
	<i>Humidity</i>	Up to 90%, non-condensing

Chapter 2

Installation and Setup

This chapter describes installation and setup procedures for the standalone T1/E1 FOLD.

T1/E1 FOLD is delivered assembled. It is designed for tabletop installation.

After installing the unit, refer to [Chapter 3](#) to assure normal operation.

In case a problem is encountered, refer to [Chapter 4](#) for test instructions.

2.1 Site Requirements and Prerequisites

AC-powered T1/E1 FOLD units should be installed within 1.5m (5 ft) of an easily-accessible grounded AC outlet capable of furnishing the voltage in accordance with T1/E1 FOLD nominal supply voltage.

DC-powered T1/E1 FOLD units require a 24 VDC or -48 VDC power source, which must be adequately isolated from the main supply.

Allow at least 90 cm (36 in) of frontal clearance for operating and maintenance accessibility. Allow at least 10 cm (4 in) clearance at the rear of the unit for signal lines and interface cables.

The ambient operating temperature of T1/E1 FOLD is 0° to 50°C (32° to 122°F) at relative humidity of 90%, non-condensing.

2.2 Package Contents

The package includes:

- One T1/E1 FOLD standalone unit
- Technical documentation CD
- Power cord
- DC adapter connector (for MT653-ST-D48-R3)

2.3 Installation and Setup

T1/E1 FOLD is a standalone device intended for tabletop or bench installation. It is delivered completely assembled. No provision is made for bolting the unit on the tabletop.

► **To install T1/E1 FOLD:**

1. Determine the required configuration of T1/E1 FOLD and set the rear panel DIP switch (see [Configuring T1/E1 FOLD](#), below).
2. Connect the line (see [Connecting the Fiber Optic Interface](#) below).
3. Connect the DTE (see [Connecting the T1/E1 Interface](#) below).
4. Connect power to the unit (see [Connecting the Power](#) below).

Configuring T1/E1 FOLD

This section describes how to configure T1/E1 FOLD for a typical application. [Figure 2-1](#) illustrates the rear panel DIP switch. [Table 2-1](#) provides details on the functions of the DIP switch, and its default settings.

► **To configure T1/E1 FOLD:**

1. Disconnect all the cables connected to T1/E1 FOLD.
2. Select the electrical interface type (T1 or E1) by setting the T1/E1 section of the rear panel DIP switch to appropriate position.
3. For E1 interface, select its type (balanced or unbalanced) by setting the BAL/UNBAL section of the rear panel DIP switch to appropriate position.

Now you can proceed with the line, DTE and power connections as described below.

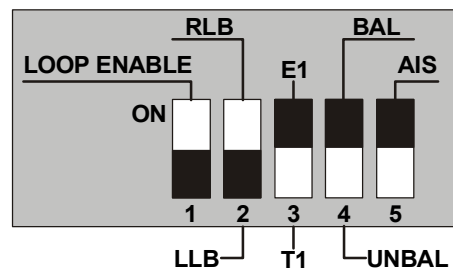


Figure 2-1 Rear Panel DIP Switch

Table 2-1 T1/E1 FOLD DIP Switch Settings

Jumper/Switch	Function	Possible Settings	Factory Setting
SW1, LOOP ENABLE	Enables or disables LLB or RLB activation	ON – LLB or RLB is activated OFF – LLB or RLB is activated	OFF
SW2, RLB/LLB	Selects local loopback (LLB) or remote loopback (RLB) to be activated from T1/E1 FOLD	ON – RLB is selected OFF – LLB is selected	OFF
SW3, T1/E1	Selects electrical interface type (E1 or T1)	ON – E1 OFF – T1	ON
SW4, BAL/UNBAL	Selects the E1 interface type (balanced or unbalanced)	ON – Balanced E1 (120Ω) OFF – Unbalanced E1 (75Ω)	ON
SW5, AIS	When a major alarm is detected, AIS is transmitted to the electrical or optical interface.	ON – Transmit AIS OFF – Do not transmit AIS	ON

Connecting the Interfaces

Figure 2-2 illustrates a rear panel of a typical T1/E1 FOLD unit.

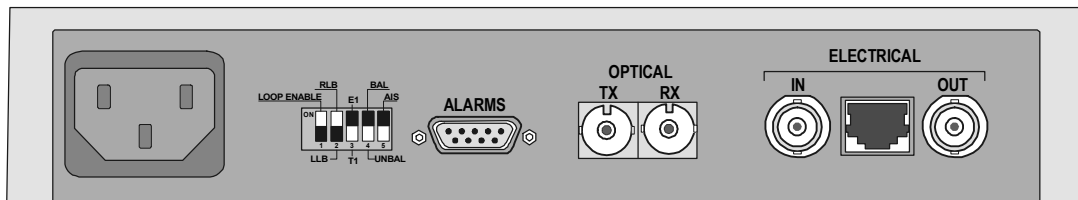


Figure 2-2 T1/E1 FOLD Rear Panel

Connecting the Fiber Optic Interface

Two fiber optic ST, SC or FC connectors are located on the rear panel and marked OPTICAL TX and OPTICAL RX.

► To connect the fiber optic cables

1. Remove the protective caps from the connectors and store them in a safe place for later use.
2. Connect the transmit fiber to the connector marked TX and the receive fiber to the connector marked RX.
3. At the remote unit connect the transmit fiber to RX and the receive fiber to TX.

Connecting the T1/E1 Interface

The rear-panel T1/E1 connector provides interface for data input/output, clock reference and control signal exchange between T1/E1 FOLD and T1/E1 equipment.

Balanced T1/E1 interface terminates in RJ-45 connector (see [Appendix A](#) for the connector pinout).

Unbalanced E1 interface terminates in two coaxial BNC connectors, designated as IN and OUT. IN refers to the T1/E1 FOLD input signal. OUT refers to a signal transmitted from T1/E1 FOLD to the attached equipment.



Warning

The T1 and E1 ports should be connected to SELV (Safety Extra Low Voltage) links only.

Connecting the Power



Warning

Before connecting this unit to a power outlet and connecting or disconnecting any other cable, the protective earth terminals of this unit must be connected to the protective ground conductor of the mains (AC or DC) power cord. If you are using an extension cord (power cable) make sure it is grounded as well. Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting of the protective earth terminal can make this unit dangerous. Intentional interruption is prohibited.

Connecting AC Power

AC power is supplied to the T1/E1 FOLD modem through a standard 3-prong connector.

AC power should be supplied through the 1.5m (5 ft) standard power cable terminated by a standard 3-prong connector. A cable is provided with the unit.

➤ **To connect AC power:**

1. Connect the power cable to the power connector on the T1/E1 FOLD rear panel.
2. Connect the power cable to the mains outlet.

The unit will be turned on automatically upon connection to the mains.

Connecting DC Power

A special IEC 60320 adapter for -48/-60 VDC power connection is supplied with the unit. 24 VDC T1/E1 FOLD units have a terminal block DC inlet and adapter supplied with the unit.

➤ **To connect DC power:**

- Refer to the DC power supply connection supplements for instructions how to wire the DC adapters.

Chapter 3

Operations

This chapter provides the following information for the T1/E1 FOLD standalone modem:

- T1/E1 FOLD front-panel indicators and controls
- Operating procedures (turn-on, front-panel indications, performance monitoring and turn-off).
- Installation procedures given in [Chapter 2](#) must be completed and checked before attempting to operate T1/E1 FOLD.

3.1 Front Panel Controls and Indicators

[Figure 3-1](#) shows the T1/E1 FOLD front panel. [Table 3-1](#) lists the T1/E1 FOLD controls and indicators.

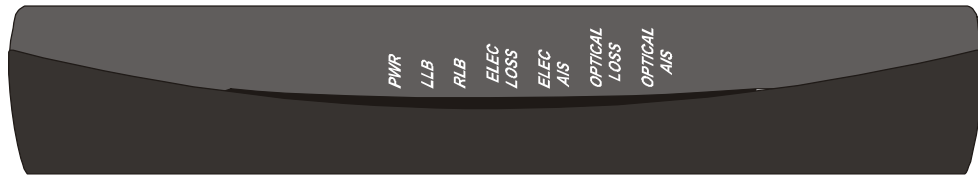


Figure 3-1. T1/E1 FOLD Front Panel

Table 3-1. T1/E1 FOLD Front Panel Controls and Indicators

Name	Type	Function
PWR	Green LED	ON – T1/E1 FOLD is powered up
LOC	Yellow LED	ON – A local loopback is active
REM	Yellow LED	ON – A remote loopback is active
ELEC LOSS	Red LED	ON – T1/E1 electrical input is below G.703 level
ELEC AIS	Yellow LED	ON – T1/E1 electrical interface received "All 1s" string
OPTICAL LOSS	Red LED	ON – Bit error rate of the signal received from the optical interface is 10^{-6} or worse
OPTICAL AIS	Yellow LED	ON – Fiber optic interface received "All 1s" string

3.2 Operating Instructions

Turning On

T1/E1 FOLD starts operating as soon as it is connected to the power source. The PWR LED turns ON and remains lit as long as the units are connected to the mains.

Normal Operating Instructions

During normal operation all indicators should be OFF, except for the PWR indicator.

Note

Some of LEDs may turn on upon the T1/E1 FOLD power-up, indicating that other communication equipment is not functioning properly.

Turning Off

Turn T1/E1 FOLD off by disconnecting the power cord from the mains.

Chapter 4

Testing and Diagnostics

This chapter describes the T1/E1 FOLD diagnostics functions, which include:

- Front panel LED indicators
- Alarm relays
- Diagnostic loopbacks.

In addition, this chapter provides some tips on troubleshooting and frequently asked questions.

4.1 Status Indicators and Alarm Relays

Front Panel LEDs

The front panel LED indicators indicate the status of the T1/E1 FOLD. For description of LED indicators and their functions, refer to [Chapter 3](#).

Alarm Relays

T1/E1 FOLD has a dry contact alarm relays. The following fault conditions trigger the major and minor alarm relays:

- Major alarms are initiated when T1/E1 electrical input becomes lower than G.703 electrical levels, or bit error rate at the fiber optic interface is 10^{-6} or worse.
- Minor alarms occur when an Alarm Indication Signal (AIS) is received at the T1/E1 electrical or fiber optic interfaces.

The DB-9 connector pins used for the alarm relays are described in [Appendix A](#), table A-2.

Note *When connecting an external alarm-monitoring device, do not exceed the maximum rating of the alarm relay contacts (1A, 60 VDC, 30 VAC).*

4.2 Diagnostic Tests

Local Loopback (LLB)

T1/E1 FOLD supports activation of a local loopback, which tests the performance of the T1/E1 electrical interface of the local unit and equipment attached to it.

The data received at the T1/E1 electrical interface is looped back to the equipment attached to it. In addition, if the switch AIS is set to on, the AIS is sent to the remote unit (see [Figure 4-1](#)).

Note T1/E1 FOLD/R does not transmit AIS to the remote unit, when the LLB is initiated.

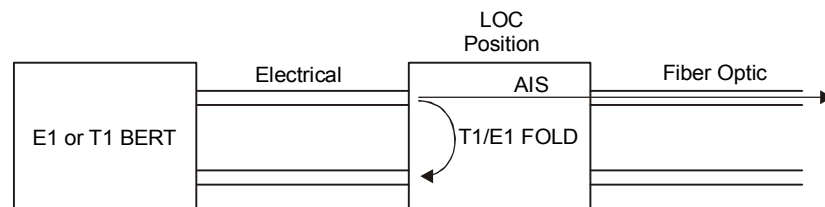


Figure 4-1. Local Analog Loopback

► **To activate local loopback:**

1. Set SW2 (RLB/LLB) of the rear panel DIP switch to the OFF (LLB) position.
2. Set SW1 of the rear panel DIP switch to the ON (LOOP ENABLE) position.

The TEST LOC indicator lights up and remains lit as long as the local loopback is active.

Remote Loopback (RLB)

T1/E1 FOLD supports activation of a remote loopback, which tests the performance of the local unit's T1/E1 electrical and optical interfaces and the remote unit's optical interface.

The data received at the optical interface of the remote unit is looped back to the local unit. In addition, if the switch AIS is set to on, the AIS is sent to the remote electrical interface (see [Figure 4-2](#)).

Note T1/E1 FOLD/R does not transmit AIS to the electrical interface, when the RLB is initiated.

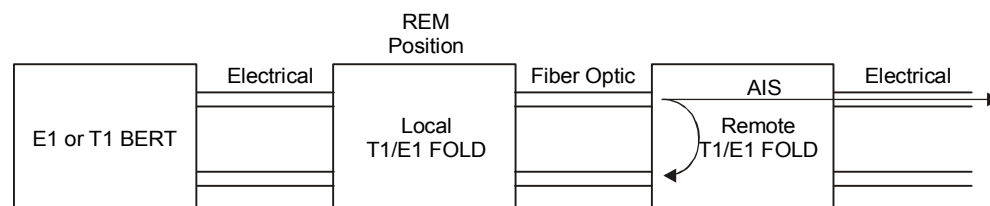


Figure 4-2. Remote Loopback

► **To activate remote loopback:**

1. Set SW2 (RLB/LLB) of the rear panel DIP switch to the ON (RLB) position.
2. Set SW1 of the rear panel DIP switch to the ON (LOOP ENABLE) position.
The TEST REM indicator lights up and remains lit as long as the remote loopback is active.

4.3 Troubleshooting Instructions

Table 4-1 provides troubleshooting details. Perform the actions listed under *Corrective Measures* in the order given in the table, until the problem is corrected.

Table 4-1. Troubleshooting Chart

Symptom	Probable Cause(s)	Corrective Measures
PWR LED is OFF	No AC power	Verify that the power outlet is providing the required power. Ensure that both ends of the AC power cord are connected properly.
ELECTRICAL LOW LED is ON	T1/E1 cable is disconnected from the RJ-45 ELECTRICAL connector	Ensure that the T1/E1 cable is connected properly to the RJ-45 connector.
	One of coaxial cables is disconnected or defective	Ensure that both ends of the coaxial cables are connected properly and that the cables operate properly.
	The attached equipment outputs are not according to G.703 electrical levels	Check that the output levels of equipment attached to T1/E1 FOLD comply with G.703 electrical levels.
	The SW3, SW4 switches are set incorrectly	Verify that the SW3, SW4 switch positions correspond to the T1/E1 interface type.
ELECTRICAL AIS LED is ON	The attached equipment is transmitting "All 1s" string	Ensure that the equipment attached to the T1/E1 FOLD transmits real data (not "All 1s").
OPTICAL LOSS LED is ON	No optical connection.	Ensure that both transmit and receive fiber connections on the local and remote units are connected properly.
	Optical budget is too low	Measure the optical loss over the fiber link and verify that it meets the product specifications.
OPTICAL AIS LED is ON	The equipment attached to the remote unit is transmitting "All 1s" string	Check the remote attached equipment transmission.
	The remote unit detected Electrical Low alert	Check the remote unit and the remote attached equipment for possible fault.

4.4 Frequently Asked Questions

Q: Can I connect T1/E1 FOLD with a balanced interface to T1/E1 FOLD with an unbalanced interface?

A: Yes

Q: What is the maximal distance between T1/E1 FOLD and end equipment (E1 link)?

A: The T1/E1 FOLD output conforms to the G.703 standard: the coding is bipolar $\pm 3V$ with the maximum attenuation of -12 dB for E1 and -7 dB for T1.

Chapter 5

T1/E1 FOLD Card Version

This chapter describes the card versions of T1/E1 FOLD, MT650C and MT651C. It discusses the following topics:

- Rack Nests RM110A and RM110AE
- T1/E1 FOLD plug-in cards for the RM110A and RM110AE
- Rack nest and card power supply
- Installation of the rack nest and card.

5.1 RM110A and RM110AE Rack Nests

The RM110A and RM110AE contain one or two power supplies and up to 14 plug-in cards. The card types can be T1/E1 FOLD MT650C, MT651C or other rack version modems/converters – any combination of up to 14 plug-in cards.

For each of the 14 cards, the rear panel (see [Figure 5-1](#)) contains a male connector for the terminal block and a DB-25 connector. A protection cover protects the terminal block connectors.

The terminal block contains screws for connecting the transmit and receive pairs and ground, for the balanced E1/T1 interface. The transmit pair is connected to the terminals marked XMT, the receive pair – to the terminals marked RCV, while the fifth screw is a terminal for optional ground connection. When operating T1/E1 FOLD MT650C, MT651C with unbalanced E1 interface, use an interface adapter, which converts the terminal block connector into two coaxial BNC connectors.

The 25-pin D-type female connector serves as an alarm relay port (see [Appendix A](#) for the connector pinout).

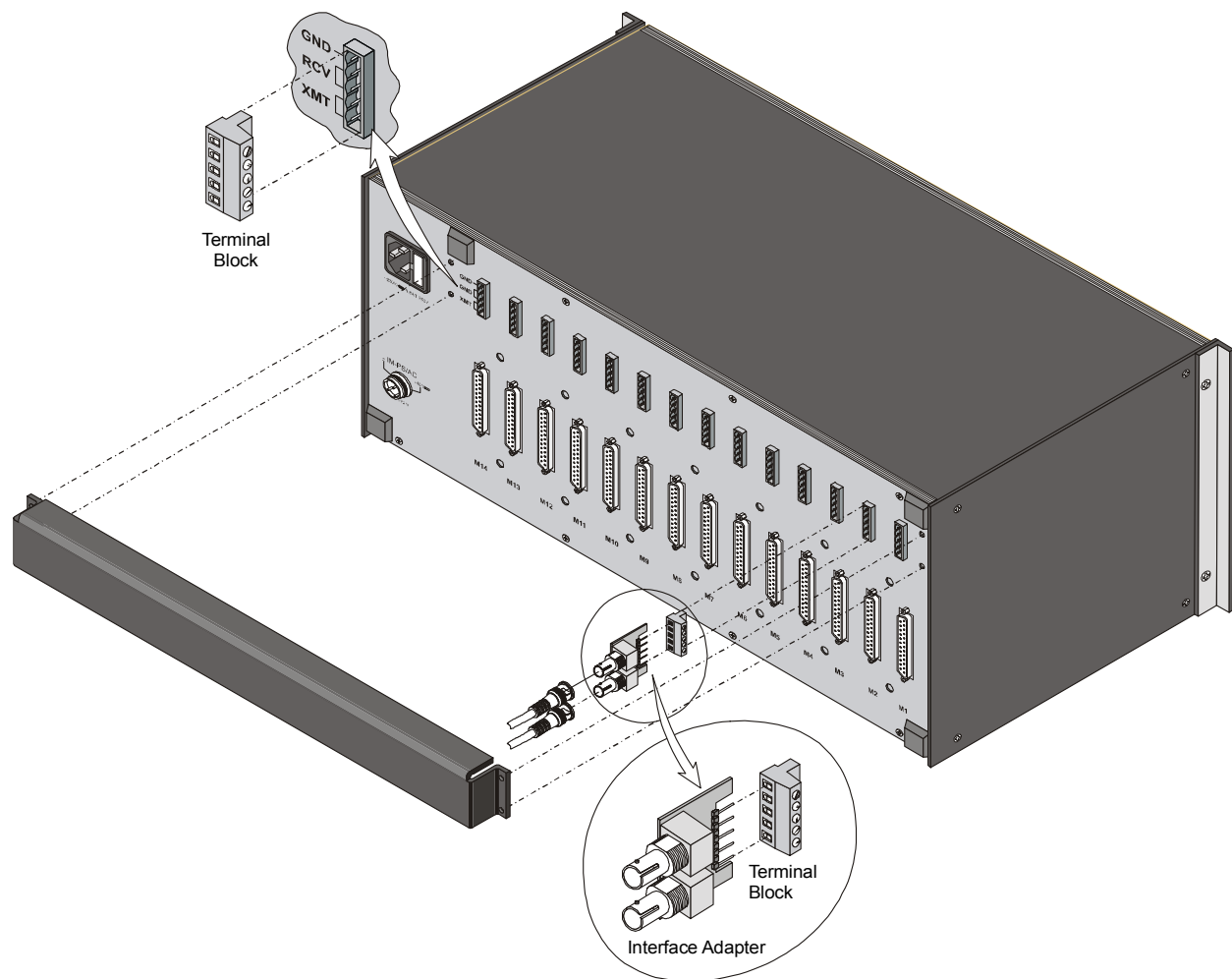


Figure 5-1 RM110A or RM110AE Rear Panel

5.2 Power Supply

The T1/E1 FOLD MT650C, MT651C cards are powered from the RM110A or RM110AE power supply via its chassis. Each T1/E1 FOLD card has two fuses that protect the entire system against power failure due to a short circuit in one card (see [Figure 5-4](#)). The ratings of the fuses are 1A, 250V and 50 mA 250V.

The RM110A and RM110AE can accept both AC and DC power supplies. LED indicators located on the RM110A and RM110AE front panel (see [Figure 5-2](#)) show activity when the power supply is connected to the mains plug. The power supply supports the full card cage with any combination of cards.

AC Supply

The AC power supply of the RM110A is 100, 115 VAC $\pm 10\%$, 47 to 63 Hz. RM110AE is 230 VAC $\pm 10\%$ 47 to 63 Hz.

DC Supply

The DC power supply is -48 VDC (-36 to -72 VDC) or 24 VDC (18 to 32 VDC). It uses a DC/DC converter module to provide the power required for the cards.

Power Supply Redundancy

This special ordering option is equipped with two separate power supplies, operating together and sharing the load of the whole card cage. If either of the power supplies fails, the other one will continue to supply power to the full card cage.

Two LED indicators show activity of each power supply. They should both light when mains power is provided.

Note *It is possible to combine AC and DC power supplies in the same cage.*



Figure 5-2 RM110A or RM110AE Front Panel

5.3 T1/E1 FOLD Card Front Panel

Figure 5-3 shows the T1/E1 FOLD card front panel. The front panel of T1/E1 FOLD card includes fiber optic connectors, loopback initiation switch and LED indicators. The front panel LEDs of the card versions are identical in their functionality to those of the standalone device. For this information, refer to the *Front Panel and Indicators* section in *Chapter 3*.

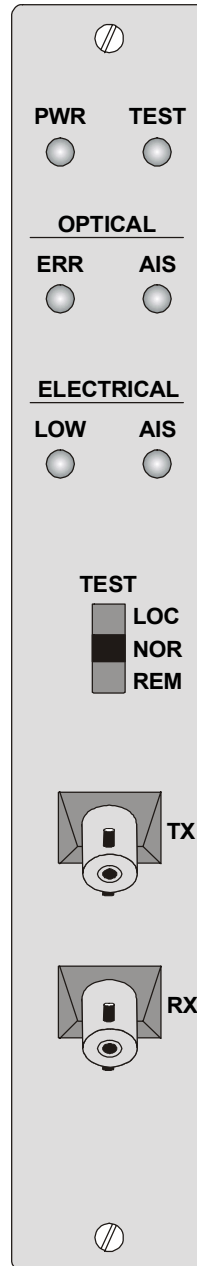


Figure 5-3 T1/E1 FOLD card Front Panel

5.4 Installing a T1/E1 FOLD Card

Setting Internal Jumpers and Switches

The MT650C and MT651C internal jumpers and switches are detailed [Table 5-1](#).

[Figure 5-4](#) illustrates the PCB layout.

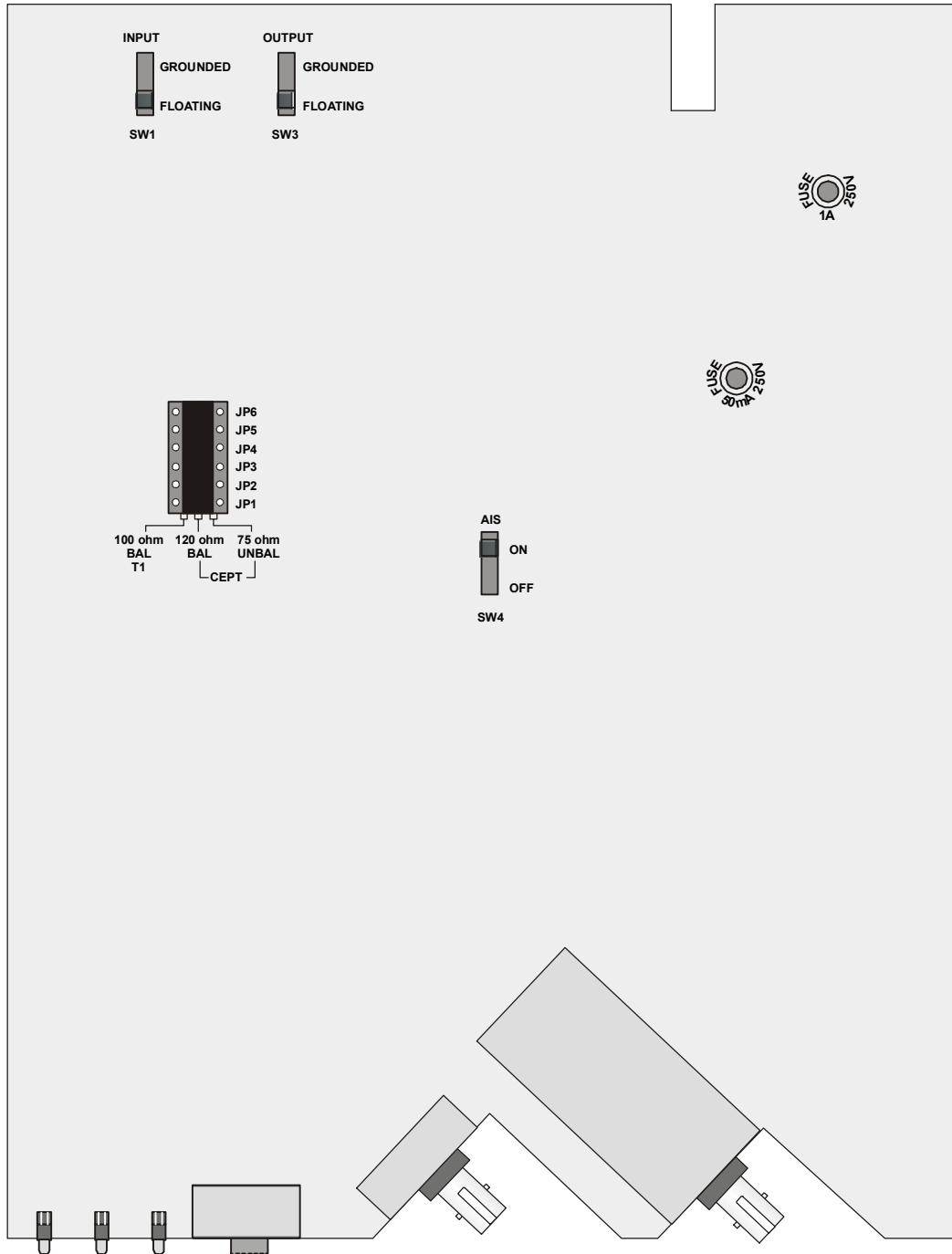


Figure 5-4 T1/E1 FOLDcard PCB Layout

Table 5-1. T1/E1 FOLD card Internal Jumpers and Switches

Jumper/Switch	Function	Possible Settings	Factory Setting
SW4, AIS	When a major alarm is detected, AIS is transmitted to either the electrical or optical interface.	ON – Transmit AIS OFF – Do not transmit AIS	ON
SW1, INPUT Ground SW3, OUTPUT Ground	Controls connection of the BNC shield to the chassis ground	CONNECTED – BNC shield is connected to the chassis ground (for E1 unbalanced) FLOATING – BNC shield is disconnected from the chassis ground (for E1/T1 balanced)	FLOATING
JP1, JP2, JP3, JP4, JP5, JP6	Selects the E1/T1 electrical interface	100 ohm BAL T1 – T1 100Ω balanced 120 ohm BAL CEPT – E1 120Ω balanced 75 ohm UNBAL CEPT – E1 75Ω unbalanced	120 ohm BAL CEPT

Installing T1/E1 FOLD cards into the RM110A or RM110AE

- **To install T1/E1 FOLD cards into RM110A or RM110AE:**
 1. Install the RM110A or RM110AE in the 19-inch rack.
 2. Insert the T1/E1 FOLD card into one of the RM110A or RM110AE slots.
 3. Push the card into the cage until it is fully inserted into the edge connector inside the rack.
 4. Tighten the screws on the front panel of the card.

Connecting the Interfaces

MT650C and MT651C use the RM110A or RM110AE rear panel terminal block ports for the E1/T1 connections. The 25-pin D-type female connector serves as an alarm relay port.

Balanced E1/T1

The two TX screws of the terminal block serve as the E1/T1 electrical signal outputs of the modem. The RX screws serve of the terminal block as the electrical signal inputs to the modem.

Unbalanced E1

When operating T1/E1 FOLD cards with an unbalanced E1 interface, use the interface adapter, which converts the terminal block connector into two coaxial BNC connectors.

Fiber Optic

The ST, SC or FC fiber optic connectors are located on the front panel of the modem card.

Alarm Relay

The RM110A or RM110AE DB-25 connector serves as an alarm relay port (see [Appendix A](#) for the connector pinout).

Appendix A

Interface Connector Specifications

A.1 Standalone T1/E1 FOLD

Balanced RJ-45 Connector

Balanced E1/T1 interface terminates in a balanced RJ-45 connector. [Table A-1](#) describes the RJ-45 connector pinout.

Table A-1. RJ-45 Connector Pinout

Pin	Designation	Function
1	Send Data (TTIP)	Transmit Data, A-wire (T1/E1 FOLD output)
2	Send Data (TRING)	Transmit Data, B-wire (T1/E1 FOLD output)
4	Receive Path (RTIP)	Receive Data, A-wire (T1/E1 FOLD input)
5	Receive Path (RRING)	Receive Data, B-wire (T1/E1 FOLD input)

DB-9 Alarm Relay Connector

The rear panel 9-pin D-type female connector serves for the major and minor alarm relay. [Table A-2](#) describes the DB-9 connector pinout.

Table A-2. DB-9 Connector Pinout

Pin	Contact	Alarm Type
2, 6	Normally Closed	Minor
1, 6	Normally Open	
5, 9	Normally Closed	Major
4, 9	Normally Open	

The relay positions are shown in the non-energized (alarm active) state.

A.2 T1/E1 FOLD Card Version

The 25-pin D-type female connector located on the rear panel of the Rack Nest 2/14 modem rack serves as an alarm relay port. [Table A-3](#) lists the functions of the DB-25 pins.

Table A-3 Rack Nest 2/14, DB-25 Pin Assignment

Pin	Contact	Alarm Type
10, 22	Normally Closed	Minor
10, 21	Normally Open	
13, 25	Normally Closed	Major
13, 24	Normally Open	

The relay positions are shown in the non-energized (alarm active) state.