BLACK BOX®
NETWORK SERVICES

JULY 2003

MT1100A MT1100A-DC

MT1100C MT1101A

MT1101A-DC MT1102A

MT1102A-DC MT1102C

E1/T1 Rate Converters

CUSTOMER SUPPORT INFORMATION

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Contents

List of Figures

List of Tables

Chapter 1
Introduction

1.1 Overview

MT1100A, MT1100A-DC, MT1100C, MT1101A, MT1101A-DC, MT1102A, MT1102A-DC, MT1102C are interface converters. They convert unframed HDB3, AMI or B8ZS data of ITU G.703 E1/T1 balanced or unbalanced interface into a V.35 or RS-530 DTE interface.

The units operate at 1544 kbps or 2048 kbps. It extracts data and the clock from the G.703 interface via a jitter attenuator to meet ITU G.823 requirements.

RIC-E1 acts as a line transceiver. It provides protection from over-voltage and over-current stress caused by lightning, power crosses and other noise sources.

Versions

The following versions of the converters are available:

- MT1100A – standalone T1 to V.35 converter, AC power supply
- MT1100A-DC – standalone T1 to V.35 converter, DC (-48 VDC) power supply
- MT1100C – converter card for Rack Nest 2/14 modem nest, T1 to V.35
- MT1102A – standalone T1 to RS-530 converter, AC power supply
- MT1102A-DC – standalone T1 to RS-530 converter, DC (-48 VDC) power supply
- MT1102C – converter card for Rack Nest 2/14 modem nest, T1 to RS-530
- MT1101A – standalone E1 to V.35 converter, AC power supply
- MT1101A-DC – standalone E1 to V.35 converter, DC (-48 VDC) power supply.

Application

Converters are typically used to connect between a G.703 network and a DTE. The DTE can be a multiplexer, a bridge, a router etc. *Figure 1-1* illustrates a typical application.

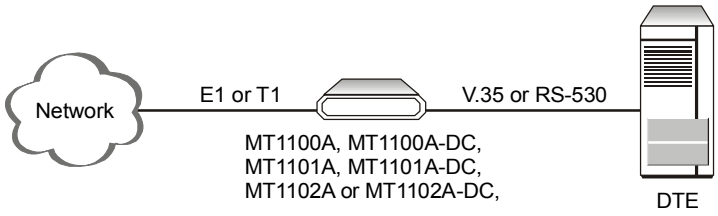

Figure 1-1. Typical Application

1.2 Functional Description

Functional Block Diagram

Figure 1-2 shows the functional block diagram of MT1101A and MT1101A-DC.

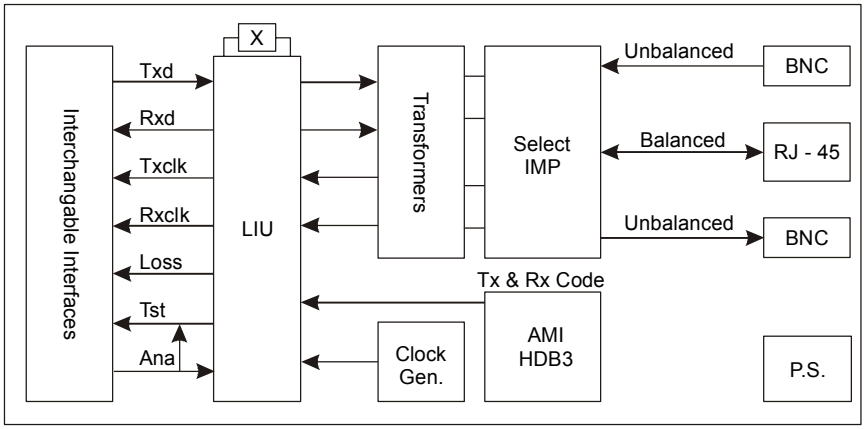

Figure 1-2. Block Diagram, E1 Converter

Figure 1-2 shows the functional block diagram of MT1100A, MT1100A-DC, MT1100C, MT1102A, MT1102A-DC, and MT1102C.

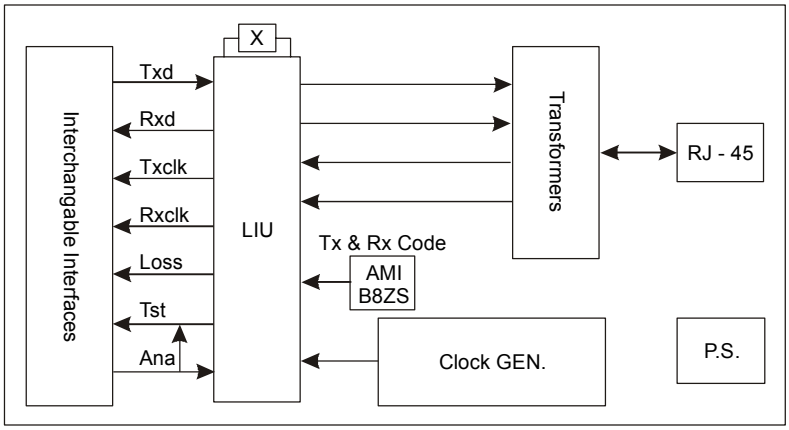

Figure 1-3. Block Diagram, T1 Converter

Timing Reference

Converters support three clock modes:

- Internal, derived from its internal oscillator
- External, supplied by the attached DTE
- Receive, recovered from the received line signal.

Diagnostics

Converters support a V.54 (loop 3) local loopback activated by the internal jumper of the standalone unit, front panel pushbutton of the rack card or via corresponding pin of the DTE interface connector. For more information, refer to *Chapter 4*.

1.3 Technical Specifications

E1 Interface	*Coding*	HDB3 or AMI
	Framing	Unframed
	Bit Rate	2.048 Mbps
	Impedance	120Ω, balanced 75Ω, unbalanced
	RCV Signal Level	0 to -10 dB
	XMT Signal Level	3V (±10%), balanced 2.37V (±10%), unbalanced
	Connectors	RJ-45, 8-pin, balanced Two BNC coaxial, unbalanced
	Return Loss	Better than 15 dB
T1 Interface	*Coding*	B8ZS, AMI
	Framing	Unframed
	Bit Rate	1.544 Mbps
	Impedance	100Ω, balanced
	RCV Signal Level	0 to -10 dB
	XMT Signal Level	3V (±10%), balanced
	Connector	RJ-45, 8-pin, balanced
	Return Loss	Better than 15 dB
DTE Interface	*Type*	• V.35: 34-pin, female • RS-530: 25-pin, D-type female
	Control Signals	• CTS follows RTS • DCD follows E1 state • DSR is constantly ON
Timing		Derived from three alternative sources: • Internal oscillator • External, from the attached DTE • Receive, derived from the received signal
Indicators	*PWR (green)*	On – Power on
	TXD (yellow)	On – Data is being transmitted to the link
	RXD (yellow)	On – Data is being received from the link
	LOS (red)	On – No E1/T1 data is received from the link
	TST (red)	On – The local loopback is active

Diagnostics		Complies with ITU V.54 (loop 3)
	Local Loopback	Activated by: • Internal jumper (standalone unit) • Front panel pushbutton (rack card) • DTE circuit 141
Power	*AC Source*	100 to 240 VAC (± 10%), 50 or 60 Hz
	DC Source	-48 VDC (-42 to -60 VDC)
	Power Consumption	• Standalone: 3W, max • Card: 5.2W
	Fuses	Standalone: 250 mA 250V slowblow Card: 500 mA 250V slowblow
Physical	***Standalone***	
	Height	39.5 mm / 1.5 in
	Width	190 mm / 7.4 in
	Depth	160 mm / 6.2 in
	Weight	0.6 kg / 1.3 lb
	Card	Fits one slot in the Rack Nest 2/14
Environment	*Temperature*	0–50°C (32–122°F)
	Humidity	Up to 90%, non-condensing

Chapter 2

Installation and Setup

This chapter explains how to configure and install MT1100A, MT1100A-DC, MT1101A, MT1101A-DC, MT1102A, and MT1102A-DC converters.

After the installation is complete, refer to *Chapter 3* for information about operating standalone units.

Refer to *Chapter 4* for troubleshooting and diagnostics information.

2.1 Site Requirements and Prerequisites

MT1100A, MT1101A, MT1102A units should be installed within 1.5m (5 ft) of an easily-accessible grounded AC outlet capable of furnishing the required supply voltage, in the range of 100 to 240 VAC.

MT1100A-DC, MT1101A-DC and MT1102A-DC units require a -48 VDC power source, which must be adequately isolated from the mains supply. In order to prevent a fire hazard, a suitable fuse must be installed in the live DC line.

Allow at least 90 cm (36 in) of frontal clearance for operator access and at least 10 cm (4 in) clearance at the rear of the unit for interface cable connections.

The ambient operating temperature should be 0 to 50°C (32 to 122°F), at a relative humidity of up to 90%, non-condensing.

2.2 Package Contents

The package includes the following items:

- Standalone unit or rack card
- The AC power cord or DC power supply connector kit for standalone unit
- Installation and operation manual on a CD

- Rack installation kit (if ordered).

2.3 Configuring Standalone Unit

This section provides information on the functions and locations of internal jumpers. Use this information to select the correct setting for your particular application.

➤ **To install a standalone unit:**

1. Determine the required configuration, according to your application, and set the internal jumpers accordingly. For more information, refer to *Setting the Jumpers* on page 2-2.
2. Connect the DTE and G.703 link interfaces, as explained in *Connecting the Interfaces* on page 2-5.
3. Connect the power to the unit. For more information, refer to *Connecting the Power* on page 2-5.

Setting the Jumpers

This section explains how to set the internal jumpers according to your requirements. *Figure 2-1* and *Figure 2-2* show the jumper locations.

Warning

Avoid adjusting, maintaining or repairing unit while it is connected to the power source.
Adjusting, maintaining and repairing unit, while connected to power supply should only be done by a skilled technician aware of the hazards involved.
Capacitors inside the instrument may still be charged even after the instrument has been disconnected from its source of supply.

➤ **To set the jumpers:**

1. Disconnect the power cable from the mains outlet.
2. Slide the blue side panel forward to detach it from the case.
3. Unscrew the two screws located on the bottom panel at the rear end of the unit.
4. Separate the two halves of the case by lifting the top cover at the end of the unit and sliding it forward.
5. Adjust the internal jumpers, as described in *Table 2-1* and *Table 2-2*. *Figure 2-1* and *Figure 2-2* show the jumper locations.
6. Reinstall the cover and tighten the screws.

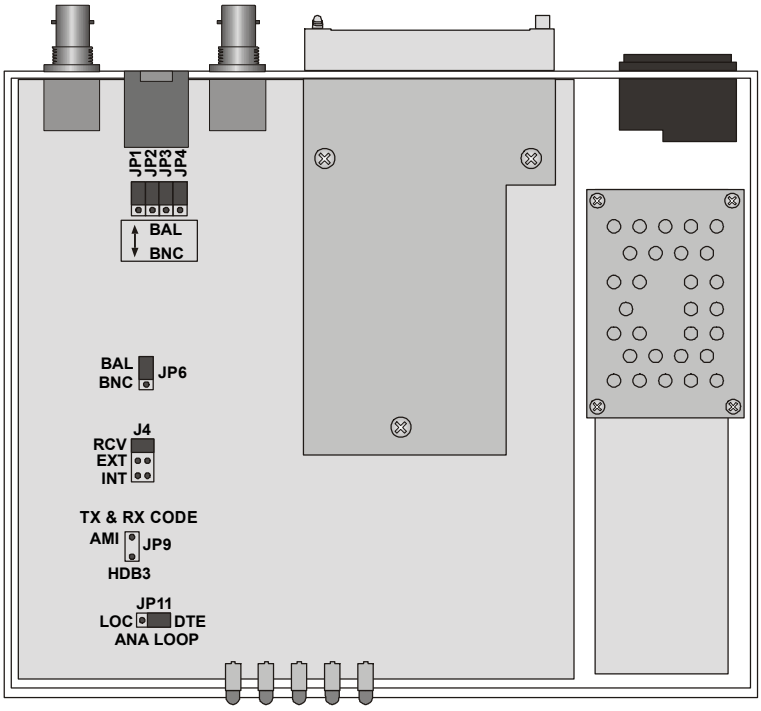

Figure 2-1. Jumper Locations, E1 Converter

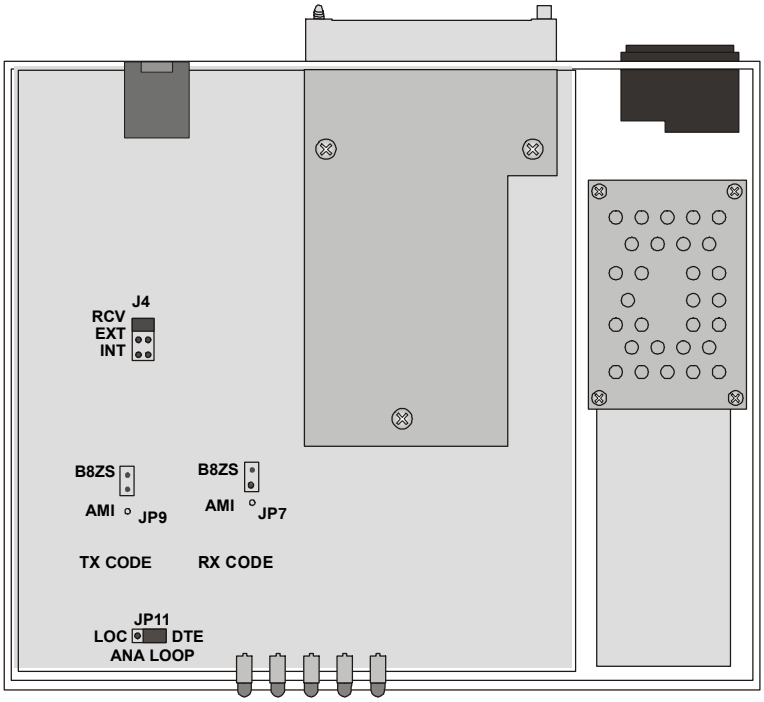

Figure 2-2. Jumper Locations, T1 Converter

Table 2-1. Jumper Settings, E1 Converter

Jumper	Description	Values	Default Setting
JP1, JP2, JP3, JP4, JP6	Select the E1 interface type	**BAL** – Balanced interface (RJ-45 connector)	BAL
		BNC – Unbalanced interface (BNC coax connectors)	
TX & RX CODE, JP9	Selects the transmit and receive coding	**AMI –** Jumper plug is installed	
		HDB3 – Jumper plug is not installed	HDB3
TIMING, J4	Selects the clock reference	**RCV (pin 4)** – Receive clock	RCV
		EXT (pin 5) – External clock	
		INT (pin 6) – Internal clock	
ANA LOOP, JP11	Controls the local analog loopback activation	**LOC** – Activates the local analog loopback	
		DTE – Allows the activation of the local analog loopback via DTE	DTE

Table 2-2. Jumper Settings, T1 Converter

Jumper	Description	Values	Default Setting
TX & RX CODE, JP9 & JP7	Selects the transmit and receive coding	**AMI –** Jumper plug is installed	
		B8ZS – Jumper plug is not installed	B8ZS
TIMING, J4	Selects the clock reference	**RCV (pin 4)** – Receive clock	RCV
		EXT (pin 5) – External clock	
		INT (pin 6) – Internal clock	
ANA LOOP, JP11	Controls the local analog loopback activation	**LOC** – Activates the local analog loopback	
		DTE – Allows the activation of the local analog loopback via DTE	DTE

Selecting the E1 Impedance

When using the balanced interface:

- Terminate the impedance of G.703 link to 120Ω.
- Use only the RJ-45 connector to transmit full duplex data to the G.703 network over UTP or STP cable.

When using the unbalanced interface:

- Terminate the impedance of G.703 link to 75Ω.
- Use only the coaxial BNC connectors to transmit to the G.703 network via two coaxial cables.

Closing the Case

After completing the internal settings, close the unit case.

➤ **To close the case:**

1. Position the lower half of the case on the flat surface.
2. Install the top cover making sure the top cover guides enter the corresponding recesses at the end of the unit.
3. Secure the two screws located at the end of the unit.
4. Fit the inside tabs of the blue side panel into the unit case grooves, and slide the side panel until snaps into place.

Connecting the Interfaces

Connecting the E1 Line

E1 link interface terminates in balanced and unbalanced connectors, marked LINK.

➤ **To connect the balanced interface:**

- Use RJ-45 male connector and connect it to the RJ-45 port of converter. *Appendix A* lists the balanced connector pin assignment.

➤ **To connect the unbalanced interface:**

1. Connect the receive line to the back panel connector designated TX.
2. Connect the transmit line to the back panel connector designated RX.

Warning

Do not connect both balanced and unbalanced connectors.

Connecting the T1 Line

T1 link interface terminates in balanced RJ-45 connector, marked LINK.

➤ **To connect the balanced interface:**

- Use RJ-45 male connector and connect it to the RJ-45 port of converter. *Appendix A* lists the balanced connector pin assignment.

Connecting the DTE

Converters support V.35 and RS-530 data channel interfaces. The DTE equipment can be connected directly to the RIC-E1 DTE port. Connector pin allocations and cable wiring data appear in *Appendix A*.

Connecting the Power

Refer to the appropriate section below depending on the unit's version – AC or DC.

Connecting the AC Power

AC power should be supplied to the MT1100A, MT1101A, MT1102A units through the 1.5m (5 ft) standard power cable terminated with a standard 3-prong plug. The cable is provided with the unit.

Warning

Before connecting power to the unit, verify that the socket outlet is provided with a protective ground contact. If you are using an extension cord (power cable) make sure it is grounded as well

Interrupting the protective (grounding) conductor (inside or outside the unit), or disconnecting the protective ground terminal can make this unit dangerous.

Make sure that only fuses of the required rating (0.250A, 250V) are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the mains cable before removing or replacing the fuse. If there is a chance that the fuse protection has been damaged, make the unit inoperative.

➤ **To connect AC power:**

1. Connect the power cable to the power connector on the rear panel.
2. Plug the power cable to the mains outlet.

   The unit turns on automatically upon connection to the mains.

Connecting the DC Power

➤ **To connect DC power:**

- Refer to the DC power supply connection supplement.

Chapter 3

Operation

This chapter describes how to operate converters. Installation procedures explained in *Chapter 2* must be completed and checked before attempting to operate the unit.

3.1 Front Panel Indicators

Figure 3-1 and *Figure 3-2* show front panels of the E1 and T1converters, respectively. The front panel indicators are described in *Table 3-1*.

Figure 3-1. E1 Converter Front Panel

Figure 3-2. T1 Converter Front Panel

Table 3-1. Front Panel LED Indicators

Designation	Color	Function
PWR	Green	ON – The unis is powered up
TXD	Yellow	ON – Data is being transmitted to the link
RXD	Yellow	ON – Data is being received from the link
LOS	Red	ON – No E1/T1 data is received from the link
TST	Red	ON – The local loopback is active

3.2 Operating Instructions

Turning On

The unit starts operating as soon as AC or DC power is connected. Always connect the power cable to the power connector first and then to the mains outlet.

The PWR LED lights when power is connected.

Operating the Unit

Converters operate entirely unattended except when performing system tests.

Turning Off

To turn the unit off, disconnect the power cable from the mains outlet.

Chapter 4

Troubleshooting and Diagnostics

4.1 Performing Local Analog Loopback

E1/T1 rate converters support activation of a V.54 diagnostic (loop 3) local loopback.

This loopback checks the communication and connection between the unit and the attached DTE, as shown in *Figure 4-1*. When converter performs a local loopback, the data received from the local transmitter is both transmitted on the line and looped back to the local receiver at the digital level. This checks the operation of all local digital circuitry.

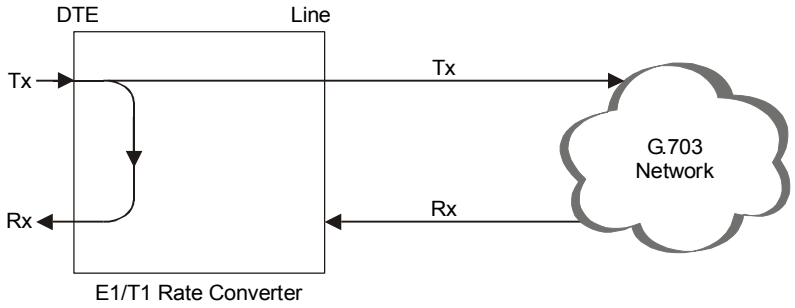

Figure 4-1. Running Local Loopback

Activating Local Analog Loopback

You can activate the local analog loopback via DTE interface circuit 141.

Note *When activating the local analog loopback via interface of the DTE connected to the rack card, make sure to set the ALB DTE jumper (JP4) to EN.*

Alternatively, you can initiate the loopback via internal jumper of the standalone unit or by pressing the ANA pushbutton on the rack card panel.

Warning

Do not touch any components other than ANA LOOP (JP11) jumper plug while activating the local loopback from the standalone unit, in order to avoid electrical shock.

➤ **To activate the local analog loopback from the standalone unit:**

1. Open the unit's case, as described in *Chapter 2*.
2. Set the JP11 jumper to LOC.

   The analog loopback is activated and the TST indicator on the front panel turns on.

➤ **To activate the local analog loopback from rack card:**

- Press the ANA pushbutton on the card's front panel.
  Make sure that the PNL SW jumper (JP5) on the card's board is set to EN.

  The TST indicator on the front panel turns on.

Deactivating Local Analog Loopback

➤ **To deactivate the local analog loopback from the DTE:**

- Lower the circuit 141 pins of the DTE interface.

➤ **To deactivate the local analog loopback from the standalone unit:**

- Set the JP11 jumper to DTE.

  The TST indicator on the front panel turns off.

➤ **To deactivate the local analog loopback from the rack card:**

- Press the ANA pushbutton again to return it to the previous position.

4.2 Troubleshooting

Table 4-1 contains troubleshooting information to help you identify and correct problems.

Table 4-1. Troubleshooting

Trouble Symptoms	Probable Cause	Corrective Measures
All front panel indicators are OFF	1. No power	Check that both ends of the power cable are properly connected.
	2. Blown fuse	Disconnect power cable from both ends and replace the fuse with another fuse of proper rating.
LOS indicator is ON	1. Receive line fuses are blown	Disconnect power cable from both ends and replace the fuses with new fuses of proper rating.
	2. Line cables are not properly connected	Check and adjust both ends of the line cables.
	3. Unbalanced BNC connectors are reversed	Switch the two BNC connectors.
	4. The transformer is damaged	Replace the unit.

Chapter 5

MT1100C, MT1102C Cards

This chapter describes the card version of the T1 converter, designed for installation in the Rack Nest 2/14 card cage. The chapter contains the following sections:

- The Rack Nest 2/14 card cage
- MT1100C, MT1102C cards
- Power supply to the cards
- Installing the cards.

5.1 Rack Nest 2/14 Card Cage

The Rack Nest 2/14 card cage contains one or two power supplies and up to 14 plug-in cards.

For each of the 14 cards, the rear panel contains a male connector for the terminal block and a DB-25 connector. A protection cover protects the terminal block connectors.

Line Connector

The line is to be attached to the rear panel terminal block connectors. It contains screws for connecting the transmit and receive pairs and ground, if present.

The Rack Nest 2/14 is also available with BNC coaxial unbalanced or RJ-45 balanced line connectors.

DTE Connector

The 25-pin D-type female interface connector provides all interface signals for the digital interfaces. Units with V.35 interface require an external mechanical adapter.

5.2 Power Supply

Power is supplied to the converter cards from the Rack Nest 2/14 power supply via the chassis. Each converter card has two fuses (F5 and F6), which protect the entire system against power failure resulting from a short circuit in one card. The rating of the fuses is 500 mA, 250V, slowblow (see *Figure 5-3*).

The Rack Nest 2/14 card cage can accept both AC or DC power supplies. LED indicators located on the Rack Nest 2/14 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 Rack Nest 2/14 is 100, 115, or 230 VAC, ±10%, 47 to 63 Hz.

Optional 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 with 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.*

5.3 Front Panel

Figure 5-1 shows the card front panel. The LEDs of the card version with serial DTE interface are identical in their functionality to those of the standalone device, except for the ANA pushbutton. The ANA pushbutton serves for activation of the local analog loopback, see *Chapter 4* for the details.

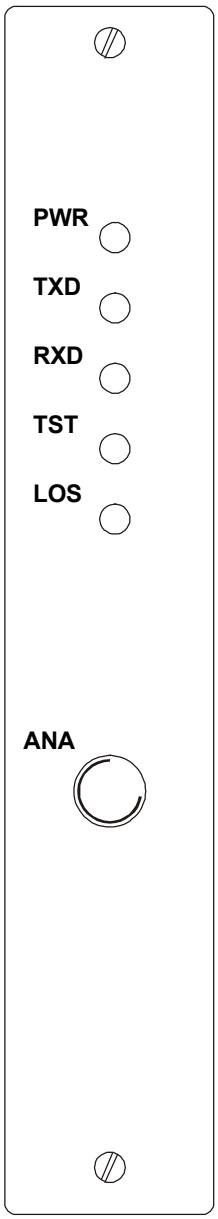

Figure 5-1. MT1100C, MT1102C Front Panels

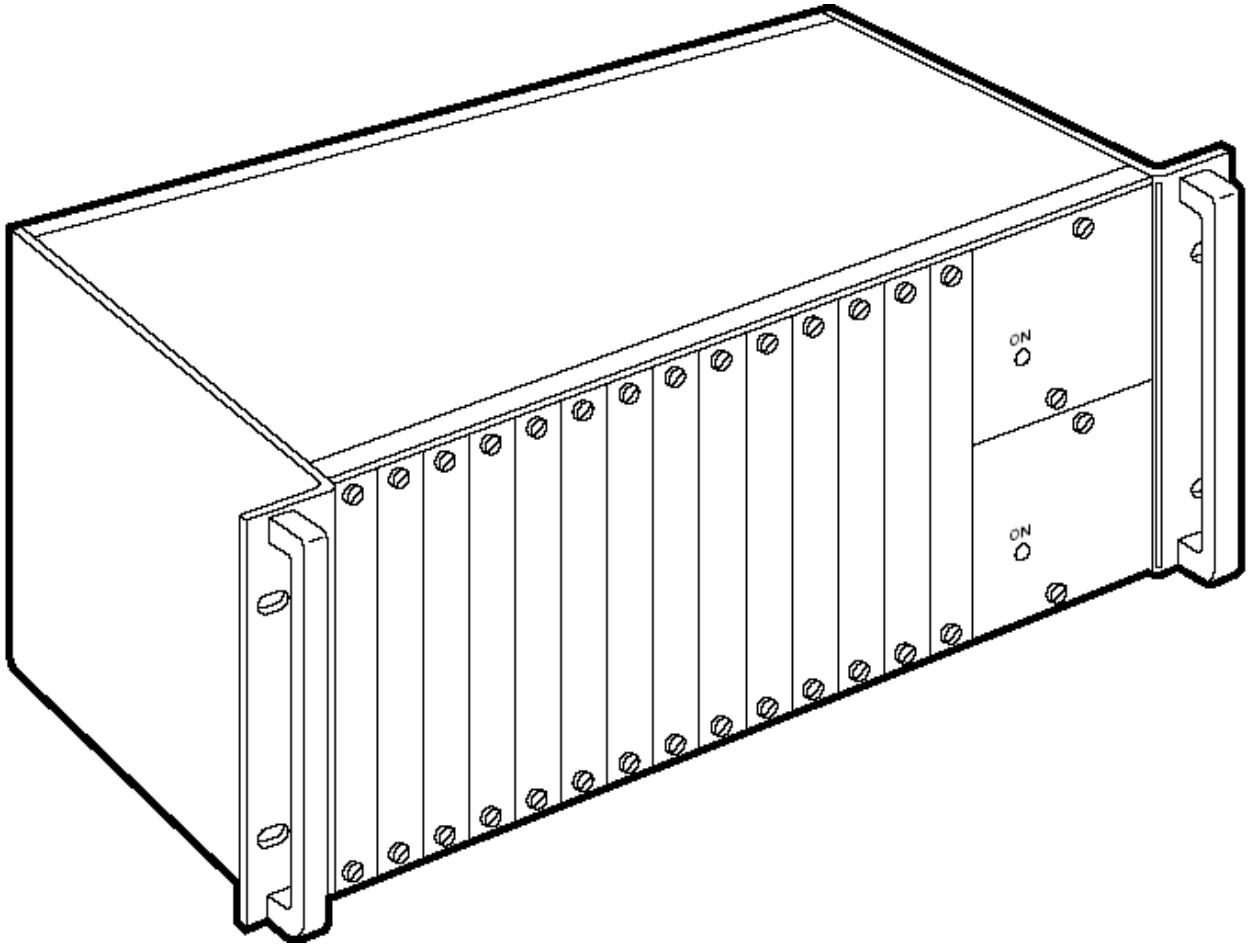

Figure 5-2. Rack Nest 2/14 Front Panel

5.4 Installing MT1100C, MT1102C

Setting Internal Jumpers and Switches

Figure 5-3 illustrates location of the internal jumpers on the PCB.

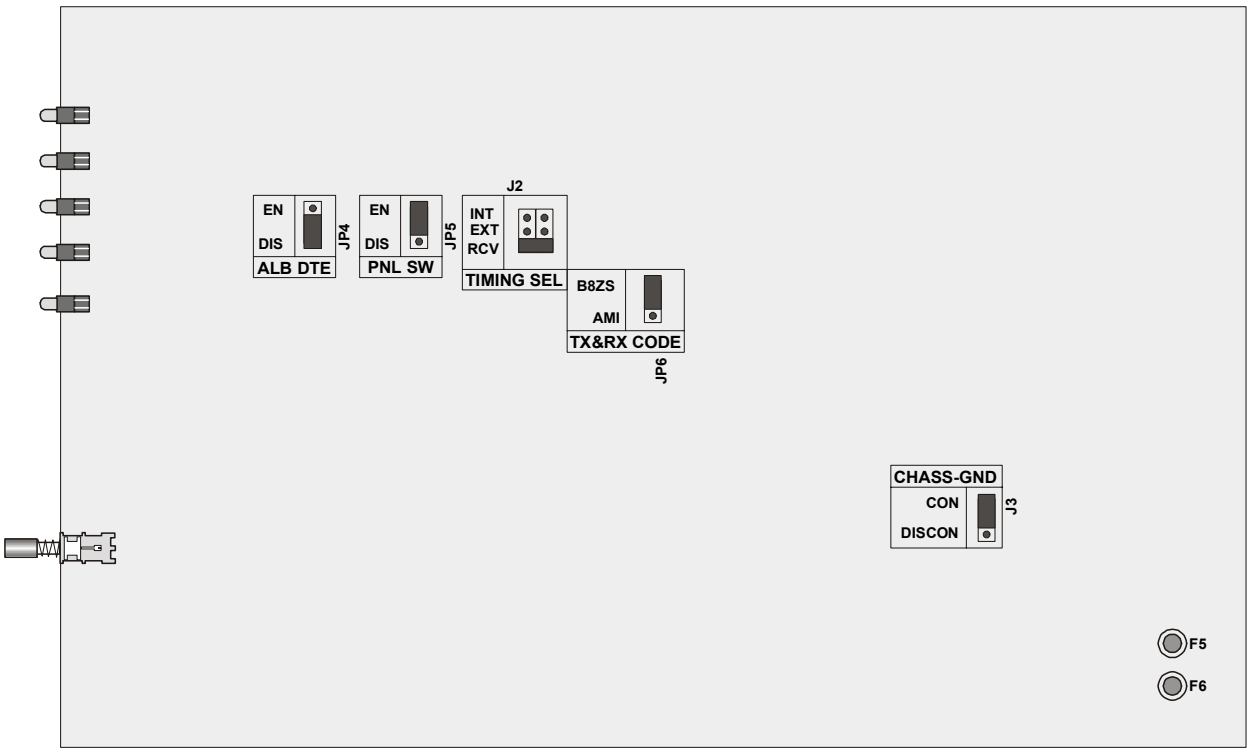

Figure 5-3. PCB Layout

Table 5-1. Jumper Settings

Jumper	Description	Values	Default Setting
ALB DTE, JP4	Enables local analog loopback activation from the DTE (via pin 18 for RS-530 or via pin "JJ" for V.35)	**EN** – The local analog loopback activation from the DTE is enabled	
		DIS – The local analog loopback activation from the DTE is disabled	DIS
PNL SW, JP5	Enables activation of the local analog loopback via the front panel pushbutton	**EN** – The LLB can be activated via the front panel	EN
		DIS – The LLB cannot be activated via the front panel	
TX&RX CODE, JP6	Selects the data receive and transmit coding	**B8ZS**	B8ZS
		AMI	

Table 5-1. Jumper Settings (Cont.)

Jumper	Description	Values	Default Setting
TIMING SEL, J2	Selects the clock reference	**RCV** – Receive clock **EXT** – External clock **INT** – Internal clock	RCV
CHASS GND, J3	Controls the connection between the signal ground of the card and the frame (chassis) ground	**CON** – Signal ground is connected to the frame ground **DISCON** – Signal ground is disconnected from the frame ground	CON

Installing MT1100C, MT1102C into the Rack Nest 2/14 Card Cage

➤ **To install MT1100C, MT1102C card into the Rack Nest 2/14 card cage:**

1. Install the Rack Nest 2/14 card cage in the 19-inch rack.
2. Insert the MT1100C or MT1102C card into one of the Rack Nest 2/14 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 front panel of the modem card.

Connecting the Interfaces

MT1100C and MT1102C use the Rack Nest 2/14 rear panel terminal block ports for the line connections. The 25-pin D-type female connector serves as a DTE port.

1. Remove the protection cover from the terminal block connectors.
2. Connect the terminal block to the Rack Nest 2/14 terminal block connector.
3. Connect the line to the terminal block as follows: connect transmit pair to the terminals marked XMT, the receive pair to the terminals marked RCV, and the fifth screw to ground (optional).
4. If required, attach the appropriate interface adapter to the DB-25 connector on the card cage rear panel.
5. Connect the DTE cable to the DB-25 connector or other side of the interface adapter (depending on your version of the card interface).
6. Connect power to the Rack Nest 2/14 card cage:
   - To connect AC power, connect the power cable to the mains supply.
   - To connect DC power, refer to DC power supply connection supplement of the Rack Nest 2/14 installation and operation manual.

Warning

The Rack Nest 2/14 card cage has no power switch. Operation starts when the power is applied to the rear panel POWER connector. When applying power, first connect the plug of the power cord to the Rack Nest 2/14 POWER connector and then to the mains power source (outlet).

Appendix A
Interface Connector Wiring

A.1 V.35 and RS-530 Interface Connectors

Table A-1 lists the pin assignments of the V.35 and RS-530 interface connectors.

Table A-1. V.35 and RS-530 Interfaces, Pin Assignments

Signal Function	V.35, 34-Pin			RS-530, DB-25		
	Pin		Circuit	Pin		Circuit
Protective Ground	A	Frame	101	1		101
Signal Ground	B	Signal GND	102	7	AB	102
Transmitted Data	P S	TD(A) TD(B)	103 103	2 14	BA(A) BA(B)	103 103
Received Data	R T	RD(A) RD(B)	104 104	3 16	BB(A) BB(B)	104 104
Request to Send	C	RTS	105	4 19	CA(A) CA(B)	105
Clear to Send	D	CTS	106	5 13	CB(A) CB(B)	106
Data Set Ready	E	DSR	107	6 22	CC(A) CC(B)	107
Data Terminal Ready	H	DTR	108	20 23	CD(A) CD(B)	108
Carrier Detect	F	DCD	109	8 10	CF(A) CF(B)	109
External Transmit Clock	U W	SCTE(A) SCTE(B)	113 113	24 11	DA(A) DA(B)	113 113
Transmit Clock	Y AA	SCT(A) SCT(B)	114 114	15 12	DB(A) DB(B)	114 114
Receive Clock	V X	SCR(A) SCR(B)	115 115	17 9	DD(A) DD(B)	115 115
Local Analog Loop	jj	LLB	141	18	LL	141
Test Indicator	kk	TM	142	25	TM	142

A.2 Line Interface Connector

The E1/T1 line interface terminates in 8-pin balanced RJ-45 connector, wired in accordance with *Table A-2*.

Table A-2. Balanced RJ-45 Line Interface Connector, Pin Assignment

Pin	Function
1, 2	Transmit
4, 5	Receive
3, 6	GND