

TTU01/V35

DS1/V.35 Interface

TTU01/X21

DS1/X.21 Interface

TTU01/449

DS1/RS449 (V.36) Interface

TTU01/530

DS1/RS530 Interface



USER'S MANUAL

DS1 CSU/DSU Unit

DS1/E1 Standalone rack mountable series

CTC
union Technologies Co.,Ltd.

Table of Contents

Chapter 1. Introduction	1
1.1 Functional Description	1
1.2 Typical System Application	3
1.3 Technical Specifications	10
Chapter 2. Installation	15
2.1 General	15
2.2 Site Preparation	15
2.3 Mechanical Assembly	15
2.4 Electrical Installation	15
2.5 Dip Switches and Jumper Settings	19
Chapter 3. Operation	21
3.1 General	21
3.2 Controls and Indicators	21
3.3 Operating Procedure	24
Chapter 4. Tests And Diagnostics	25
4.1 General	25
4.2 Loopback Tests	25
4.3 Bit Error Rate Tester	25
4.4 Local Analog Loopback	26
4.5 Local Digital Loopback	27
4.6 Remote Loopback	28

Table of Contents

Appendix A. Dip Switch Setting Summary	29
A.1 All Dip Switching Functional Description	29
A.2 Dip Sw1 Time Slot 0 To 7 Setting	30
A.3 Dip Sw2 Time Slot 8 To 15 Setting	31
A.4 Dip Sw3 Time Slot 16 To 23 Setting	32
A.5 Dip Sw4 Line Build Out Setting	33
A.6 Dip Sw5 Parameter Group 1 Setting	34
A.7 Dip Sw6 Parameter Group 2 Setting	35
A.8 Dip Sw7 Line Impedance Setting	35
A.9 Clock Mode Description	36
Appendix B. Interface Specification	37
B.1 DS1 Line Connector	37
B.2 X.21 User Data Channel Connector	39
B.3 V.35 User Data Channel Connector	40
B.4 RS-530 User Data Channel Connector	41
B.5 RS-530 To RS-449 Adapter Cable	42
Appendix C. Rack Mounting Instructions	43
Appendix D. ETU/TTU ET10/100 Interface Module .	45

Chapter 1. Introduction

1-1. Functional Description

The **TTU-01** is a single port access unit for DS1, Fractional DS1 or Fractional cascade DS1 service.

The **TTU-01** data channels support user-selectable transmission rates, which are integer multiples of 56 or 64kbps, up to a maximum 1.536Mbps (64K x 24), 1544Mbps for unframed, for a line attenuation of up to 36 dB on twisted pair.

The **TTU-01** packs the data channels into DS1 link time slots in user-selected time slots, The unused time slots can insert IDLE code (In frame mode) or insert the receive side time slots data (In cascade mode).

The **TTU-01** has three types of user-replaceable data channel modules, which provide the desired interface: V.35, X.21 or RS-530. RS-449 is supported by means of RS-530 to RS-449 adapter cable.

The **TTU-01** fully meets all of the DS1 specifications including ITU G.703, G.704, G.706, G.823, and ANSI T1.403-1995.

The **TTU-01** features V.54 diagnostic capabilities for performing local loopback and remote digital loopback. The operator at either end of the line may test both the **TTU-01** and the line in the digital loopback mode. The loopback is controlled by either a manual switch or by the DTE interface for V.35 and RS-530.

Chapter 1. Introduction

A front panel switch generates an internal 511 bit pseudo random test pattern, according to CCITT, for direct end-to-end integrity testing. The Err indicator flashes for each bit error detected.

Multiple clock source selection provides maximum flexibility in connecting both the DS1 and user interface. The DS1 link may be clocked from the recovered receive clock, from user data port, or from the internal oscillator.

The **TTU-01** user interface has five clocking modes:

Mode 0 (DCE 1): DCE interface. The **TTU-01** provides the transmit and receive clocks (Recovered timing) to the equipment connected to the data channel.

Mode 1 (DCE 2): DCE interface. The **TTU-01** provides the transmit and receive clocks (Internal oscillator timing) to the equipment connected to the data channel.

Mode 2 (DTE 1): DTE interface. The **TTU-01** data channel accepts the user transmit clock and provides a receive clock (Recovered timing) to the equipment connected to the data channel.

Mode 3 (DTE 2): DTE interface. The **TTU-01** data channel accepts the user transmit clock (from ETC pin) and receive clock (from ERC pin) provided by the equipment connector to the data channel.

Mode 4 (DTE 3): DTE interface. The **TTU-01** data channel accepts the user transmit and receive clock (All from ETC pin) provided by the equipment connector to the data channel.

Chapter 1. Introduction

The **TTU-01** operates from 115VAC, 230VAC or -48VDC. The unit is built in a compact case that can be placed on desk tops or shelves or installed, by means of an optional adapter, in a 19" rack.

1-2. Typical System Applications

General

In a typical application (Figure 1-1), the **TTU-01** is used to connect the synchronous user data channel to the serving central office over a DS1 line.



Figure 1-1 Point-to-Point Application

The fractional DS1 data service is based on the assumption that the user data rate is a fraction of the available DS1 bandwidth, in multiples of 56K or 64K.

DS1 signal structure

The DS1 line operates at a nominal rate of 1.544Mbps. The data transferred over the DS1 line is organized into frames, with each DS1 frame containing 193 bits. The 193 bits consist of 24 time slots of eight bits each, that carry the data payload, and one F-bit.

Chapter 1. Introduction

DS1 transmission utilizes two main types of framing: **Super Frame (SF)(D4)** and **Extended Super Frame (ESF)**. Framing is necessary in order for equipment receiving the DS1 signal to be able to identify and extract the individual channels.

Superframe format (SF) (D4)

A super frame consists of twelve consecutive frames. The SF format is a structure in which the F bits are used for framing only. In the SF format, the F bits are divided into two groups:

Terminal Framing (Ft) bits that are used to identify frame boundaries.

Signaling Frame (Fs) bits that are used to identify super frame boundaries. When the 192-digit time-slots are DS0-channelized, the Fs bits are also used to identify the signaling frames.

Extended superframe format (ESF)

An extended super frame consists of twenty-four frames. The ESF used the F bits for the following functions:

A 2-kbit/s frame pattern sequence (FPS): The FPS is used to identify the frame and the extended super frame boundaries. When the 192-information-digit time-slots are channelized, the FPS is used to identify the signaling frames.

A 4-kbit/s data link (DL): The ESF DL is for carrying performance information and control signals.

A 2-kbit/s cyclic redundancy check (CRC) channel: This channel carries a CRC-6 code.

Chapter 1. Introduction

DS1 line signal

The basic DS1 line signal is coded using the **Alternate Mark Inversion** (AMI) or **B8ZS** rule.

In the AMI format, “ones” are alternately transmitted as positive and negative pulses, whereas “zeros” are transmitted as a zero voltage level. AMI is not used in most 1.544 Mbps transmissions because of synchronization loss occurs during long strings of data zeros.

In the B8ZS format, a string of eight consecutive zeros is replaced with a substitute string of pulses containing an intentional bipolar violation. The B8ZS code substitutions provide high pulse density so that the receiving equipment is able to maintain synchronization with the received signal.

TTU-01 Capabilities

DS1 link line coding

The **TTU-01** supports two DS1 line codes:

AMI coding.

B8ZS coding.

DS1 framing formats

The **TTU-01** supports three frame formats:

Unframed format.

SF (D4) format.

ESF format.

Chapter 1. Introduction

User data channel rates

The **TTU-01** supports user data channel rates which are a multiple of 56 or 64kbps. For maximum flexibility, the **TTU-01** supports data rates up to 1.544Mbps. The **TTU-01** supports flexible time slot assignment, allowing the user to freely specify the selection of time slots.

User data channel interface

The **TTU-01** has three types of user data channel modules: V.35, X.21 and RS-530. The **TTU-01** also supports RS-449 data channel via an interface adapter cable attached to the RS-530 channel module. The desired interface is achieved by installing the appropriate type of channel module in the **TTU-01**. For maximum flexibility, the **TTU-01** supports data rates in multiples of 56Kbps or 64Kbps up to 1.544Mbps. The **TTU-01** supports flexible time slot assignment, allowing the user to specify the selection of time slots used.

System Timing Considerations

The **TTU-01** has the flexibility to meet the timing requirements of various system configurations. The timing mode for the DS1 link and for the user channels are selected by the setting of DIP switches.

Chapter 1. Introduction

DS1 link timing

The **TTU-01** DS1 link receive path always operates on the receive clock. The **TTU-01** recovers the receive clock from the received DS1 link data signal. The source of the **TTU-01** DS1 link transmit clock can be selected by the user. The following DS1 link transmit timing modes are available, and application examples are shown in Figure 1-5:

Recovery timing:

The **TTU-01** DS1 link transmit clock is locked to the recovered receive clock. This is usually the timing mode selected for network operation.

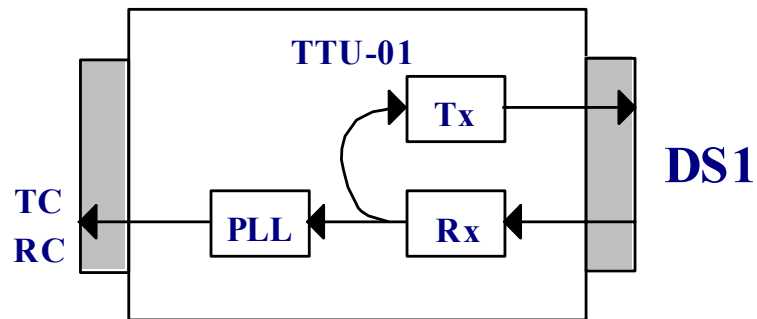


Figure 1-2 Recovery Timing

Chapter 1. Introduction

Internal timing:

The **TTU-01** DS1 link transmit clock is derived from the internal clock oscillator. This timing mode is necessary in point-to-point applications over leased line. In this case, one **TTU-01** must use the internal oscillator, and the others must operate from the recovered clock.

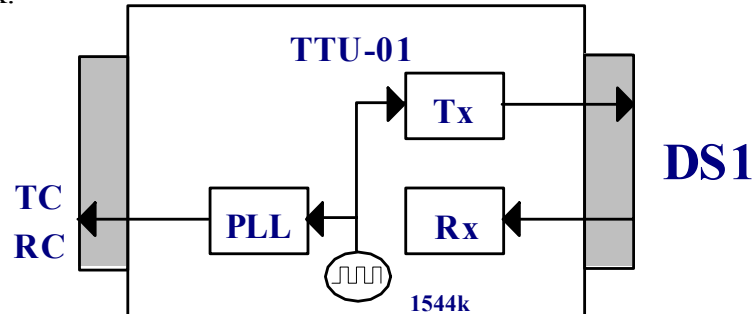


Figure 1-3 Internal Timing

External timing:

The **TTU-01** DS1 link transmit clock is locked to the clock signal provided by the user DCE connected to the data channel. When the data channel is used as the clock source, the data channel must use clock timing mode 3 (DTE2) or 4 (DTE3).

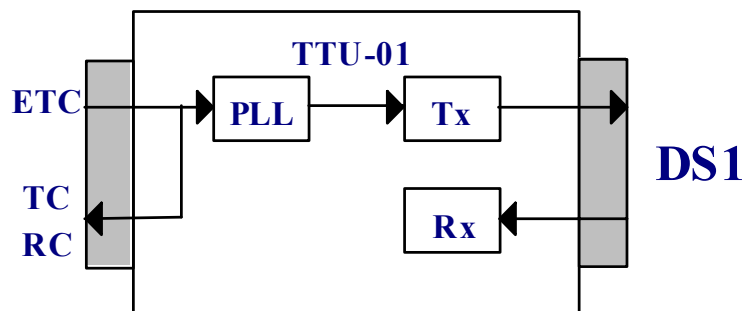
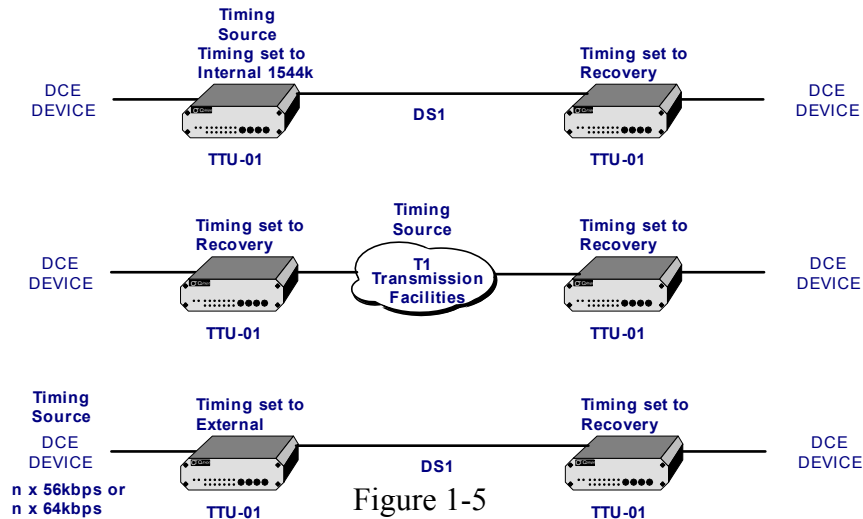


Figure 1-4 External Timing

Chapter 1. Introduction

Timing Application Examples



User data channel timing

The **TTU-01** has five user clocking modes:

Clock mode 0 (DCE 1):

The **TTU-01** data channel operates as a DCE and provides both transmit and receive clocks (recovered timing) to the data terminal equipment connected to the user channel. The clocks are locked to the recovered timing.

Clock mode 1 (DCE 2):

The **TTU-01** data channel operates as a DCE and provides the transmit and receive clocks (internal oscillator timing) to the data terminal equipment connected to the user channel. The clocks are locked to the oscillator timing.

Chapter 1. Introduction

Clock mode 2 (DTE 1):

The **TTU-01** data channel supplies the receive clock to the synchronous DCE, and accepts a transmit clock from the DCE (from the ETC pin). The DCE must transmit data at the rate of the clock signal supplied by the **TTU-01**.

Clock mode 3 (DTE 2):

The **TTU-01** data channel operates as a DTE and accepts both transmit clock (from the ETC pin) and receive clock (from the ERC pin) from the user equipment. **NOTE:** The X.21 data channel cannot be operated in clock timing mode 3 (DTE2).

Clock mode 4 (DTE 3):

The **TTU-01** data channel operates as a DTE and accepts both transmit clock and receive clock (both from the ETC pin) from the user equipment.

Chapter 1. Introduction

1-3. TECHNICAL SPECIFICATIONS

DS1 link

Framing	-Unframed/Framed -SF (D4) / ESF
Bit Rate	1.544 Mbps
Line Code	-AMI -B8ZS
Line Impedance	-100 ohms -Bridge (high Z)
Relative Receive Level	0 to -36dB
“Pulse” Amplitude	Nominal 3.00V±20%
“Zero” Amplitude	±0.15V
Transmit Frequency Tracking	
Internal Timing	±30 ppm
Loopback Timing	±50 ppm
External Timing	±100 ppm
Jitter Performance	According to CCITT G.823
Complies With	CCITT G.703, G.704, G.706, G.823 and ANSI T1.403
Interface Connectors	-15-pin, D-type Female -BNC -Bantam

Chapter 1. Introduction

User Data Channels

Interfaces Type	-V.35 -X.21 -V.35 -RS-449(via adapter cable)
Interface Connectors	
V.35 Interface	34 pin, Female
X.21 Interface	15 pin, D-type Female
RS-530 Interface	25 pin, D-type Female
RS-449 Interface	37 pin, D-type Male(via adapter cable)
Line Code	NRZ
Data Rate	Unframe: 1.544 Mbps Frame: $n \times 56$ kbps or $n \times 64$ kbps where n equal 1 to 24
Clock Modes	
Clock Mode 0 (DCE1)	Receive and transmit clock (recovered) to the synchronous DTE
Clock Mode 1 (DCE2)	Receive and transmit clock (internal oscillator) to the synchronous DTE
Clock Mode 2 (DTE1)	Receive clock to the synchronous, and transmit clock from the synchronous device
Clock Mode 3 (DTE2)	Receive and transmit clock from the synchronous DCE (from ETC and ERC pin)
Clock Mode 4 (DTE3)	Receive and transmit clock from the synchronous DCE (all form ETC pin).
Control Signals	-CTS constantly ON -DSR constantly ON, except during test loops -DCD constantly ON, except during signal loss
Time slot allocation	User defined

Chapter 1. Introduction

Diagnostics

Test Switches/Diagnostics

- Digital local loopback
- Analog local loopback
- Digital remote loopback
- Test pattern

LED indicators

PWR	Green	Power
TD	Yellow	Transmit data
RD	Yellow	Receive data
RTS	Yellow	Request to sent
DCD	Yellow	Data carrier detect
Tx CLK	Red	Transmit clock loss
Loss		
Red Alarm	Red	DS1 link signal loss
Sync Loss	Red	DS1 link sync loss
Yel Alarm	Red	DS1 link yellow alarm
Err	Red	Bit errors
Test	Red	Loopback and pattern test

Physical

Height:	45 mm
Width:	195 mm
Depth:	255 mm
Weight:	1.5 kg

Chapter 1. Introduction

Power supply

Voltage	115 or 230 VAC \pm 10% -48VDC (-42 to -54VDC)
Frequency	47 to 63 Hz for AC power
Power consumption	20 Watts
Fuse	0.1A slow blow for 230 VAC 0.2A slow blow for 115 VAC 0.5A slow blow for -48 VDC

Environment

Temperature	0-50C / 32-122F
Humidity	0 to 90% non-condensing

Chapter 2. Installation

2-1. GENERAL

This chapter provides detailed instructions for mechanical installation of the **TTU-01**. Following the completion of installation, please refer to Chapter 3 for operating information.

2-2. SITE PREPARATION

Install the **TTU-01** within reach of an easily accessible grounded AC outlet. The outlet should be capable of furnishing 115 VAC or 230 VAC (depending on rated voltage of unit). Allow at least 10 cm (4 inches) clearance at the rear of the **TTU-01** for signal lines and interface cables.

2-3. MECHANICAL ASSEMBLY

The **TTU-01** is designed for tabletop or bench installation, and is delivered completely assembled. No provisions are made for bolting the **TTU-01** to the tabletop. The unit may also be mounted singularly or in pairs within an EIA 19 inch rack via an optional rack mounting kit.

2-4. ELECTRICAL INSTALLATION

2-4-1. Power connection

AC power is supplied to the **TTU-01** through a standard IEC receptacle. (Refer to Figure 2-1) The **TTU-01** should always be grounded through the protective earth lead of the power cable.

The line fuse is located in an integral-type fuse holder on the rear panel. Make sure that only fuses of the required rating are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. **Always disconnect the power cable before removing or replacing the fuse.**

Chapter 2. Installation

2-4-2. Rear panel connectors:

The digital interface connectors located on the rear panel of the **TTU-01** (Refer to Figure 2-1) consist of a DB15pin connector for X.21, DB25pin connector for RS-530 or 34-pin V.35 connector for V.35. The DS1 line connectors incorporate a single DB15pin connector, two BNC Coax connectors and two Bantam connectors. (Appendix B provides detailed information on the various interface connectors).

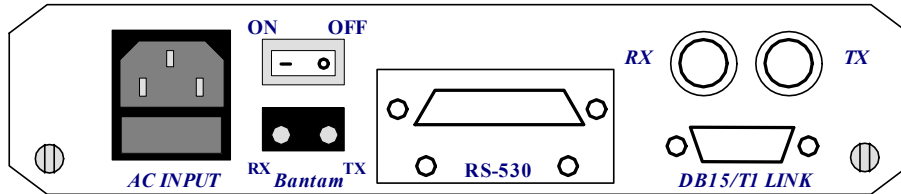


Figure 2-1 **TTU-01** rear panel, Option: DTE (RS-530)

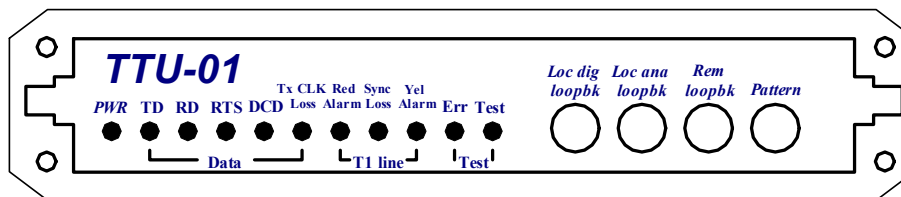


Figure 2-2 **TTU-01** front panel

Chapter 2. Installation

DS1 Line side

DB-15 Connector

The pin assignments for the DB-15 connector are as follows:

Pin:	Function:
1	TTIP (Transmit data out)
9	TRING (Transmit data out)
3	RTIP (Receive data in)
11	RRING (Receive data in)

BNC coax connector

Two BNC coax connectors marked RX and TX serve the same function as the DS1 line DB15 connector.

Bantam connector

Two BANTAM connectors marked RX and TX serve the same function as the DS1 line DB15 connector.

NOTE: Only one set of the above DS1 link connectors may be used at a time.

Data port side

V.35 interface connector

The V.35 connector utilizes standard pin-out. The three test pins have been chosen for loops and test. For applications using an V.35 interface, clock mode is selected DTE2, connect the ERC input clock to pins Z(A) and BB(B).

Chapter 2. Installation

X.21 interface connector

For applications using an X.21 interface external clock (Clock mode select DTE1 or DTE3), connect the input clock to pins 7(A) and 14(B) of the 15-pin connector.

RS-530 interface connector

The RS-530 connector utilizes standard pin-out. The three test pins have been chosen for loops and test. For applications using an RS-530 interface, clock mode is selected DTE2, connect the ERC input clock to pins 20(A) and 23(B).

RS-449 interface connector

Appendix B-5 describes the cabling connection between the RS-530 interface and the RS-449.

Cable and Termination

Use a shielded twisted pair cable between the **TTU-01** and the DTE device. The receivers on the **TTU-01** are 100 Ohm terminated (For X.21 and RS-530). If problems are encountered with the connection to the DTE interface, make sure that the DTE interface is terminated correctly.

Chapter 2. Installation

2-5. Dip Switches and Jumper Settings

2-5-1. Caution

To avoid accidental electric shock, be sure to disconnect the **TTU-01** power cord before opening the cover. Access inside the equipment is only permitted only to authorized and qualified service personnel.

2-5-2. Procedure

- a. Turn power OFF, Disconnect the power cord from the AC outlet.
- b. Loosen the screws at the left/right of the rear panel.
- c. Remove the PCB.
- d. Adjust the DIP switches and jumpers as required, according to table 2-1. (Appendix A describes the DIP switch functions).
- e. Carefully replace the PCB and tighten the screws.

Chapter 2. Installation

Table 2-1

Item	Function	Possible Settings	Set Place	Factory Setting
1	Set the active timeslot	TS0 to TS23 random setting	DIPSW1-1 to DIPSW3-8	TS0 to TS3
2	Set the line build out	0-155 to 533-655 feet,-7.5,-15,-22.5db	DIPSW4-1 to DIPSW4-3	0-155 feet
3	Set the timing mode	M0 (MODE0) to M4 (MODE4)	DIPSW5-1 to DIPSW5-3	MODE0 (DCE1)
4	Set the DS1 line code	B8ZS or AMI	DIPSW5-4	B8ZS
5	Set the DS1 frame format	SF (D4) or ESF	DIPSW5-5	SF (D4)
6	Set the DS1 line idle code	FF (0xFF) or 7E (0x7E)	DIPSW5-7	0xFF
7	Select the N64K or N56K	N64 or N56	DIPSW5-8	N64
8	Set the DS1 jitter	DIS (disable) or ENA (enable)	DIPSW6-1	Enable
9	Set the DS1 jitter place	RX or TX side	DIPSW6-2	RX side
10	Set the DS1 jitter length	32 or 128 bits	DIPSW6-3	32 bits
11	Set multiplex (cascade) function	DIS (disable) or ENA (enable)	DIPSW6-4	Disable
12	Set in multiplex signaling passthrough	MM1 (nonpass) or MM2 (passthrough)	DIPSW6-5	Nonpass
13	Set data port loopback test function	DIS (disable) or ENA (enable)	DIPSW6-7	Disable
14	Set front panel switch function	DIS (disable) or ENA (enable)	DIPSW6-8	Enable
15	Set the DS1 line impedance	100 Ohm or Bridge	DIPSW7-1 to DIPSW7-5	100 Ohm
16	Set main board chassis ground	DIS (disconnect) or CON (Connect)	JP1	Connect
17	Set extern board chassis ground	DIS (disconnect) or CON (Connect)	JP1(On small PCB)	Connect

Note: If the DTE does not provide the test pins for loopback test, the data port loopback test function must be always set to DIS (disable).

Chapter 3. Operation

3-1. General

This chapter describes the **TTU-01**'s controls and indicators, explains the operating procedures, and supplies instructions for field strapping changes. Installation procedures (in Chapter 2) must be completed and checked before attempting to operate the **TTU-01**.

3-2. Controls and Indicators

All controls (pushbutton switches) and LED indicators are located on the **TTU-01** front panel. Depress a push-button to activate (turn ON) the corresponding control. Release the push-button to deactivate (turn OFF) the control.

The function of each pushbutton and indicator is described in Table 3-1 and Table 3-2 respectively.

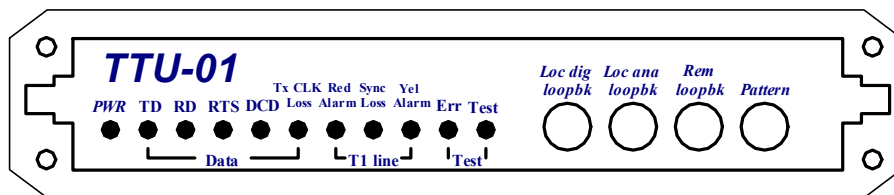


Figure 3-1 **TTU-01** Front Panel

Table 3-1 Control Functions

Item	Control Switch	Function
1	<i>Loc dig loopbk</i>	The local digital loopback switch causes the local <i>TTU-01</i> to loop received data to its transmitter.
2	<i>Loc ana loopbk</i>	The local analog loopback switch causes the local <i>TTU-01</i> to loop transmitter output back to its receiver and send all "1" signal to DS1 link during local analog loopback activated. This loopback may also be activated from the DTE when the data port loopback test function is set to ENA (enable).
3	<i>Rem loopbk</i>	The remote loopback switch causes the remote <i>TTU-01</i> to loop received data to its transmitter. This loopback may also be activated from the DTE when the data port loopback test function is set to ENA (enable).
4	<i>Pattern</i>	The pattern switch causes the <i>TTU-01</i> to send and receive a 511 test pattern. If errors are encountered, the Err LED indicator lights.

Chapter 3. Operation

Table 3-2 LED indicators

Item	Indicator	Color	Function
1	PWR	Green	ON when unit power is on.
2	TD	Yellow	ON when SPACE is being transmitted. Flashing when data is transmitted.
3	RD	Yellow	ON when SPACE is being received. Flashing when data is received.
4	RTS	Yellow	ON when terminal activates Request To Sent.
5	DCD	Yellow	ON when a valid receive signal is present.
6	Tx CLK Loss	Red	ON when transmitted clock is lost.
7	Red Alarm	Red	ON when received signal is lost.
8	Sync Loss	Red	ON when received frame sync is lost.
9	Yel Alarm	Red	ON when the DS1 link receives a yellow alarm.
10	Err	Red	ON when the <i>Pattern</i> switch is activated and has bit errors.
11	Test	Red	ON when the <i>TTU-01</i> is in any loopback mode or <i>Pattern</i> is depressed.

Chapter 3. Operation

3-3. Operating Procedure

The **TTU-01** requires no operator attention once installed, except for occasional monitoring of the front panel indicators. Intervention is only required when:

- (1) The **TTU-01** has to be adapted to a new operational requirement.
- (2) Diagnostic loops are required.

The **TTU-01** is turned on when its AC power cord is connected to an AC power outlet and the power switch is turned to the ON position. The PWR indicator lights, indicating that the **TTU-01** is on. Verify the **TTU-01** is in operation by checking that the front panel LEDs match the following indicator conditions:

PWR:	ON
TD:	ON, OFF or Flashing
RD:	ON, OFF or Flashing
RTS:	ON
DCD:	ON
Tx CLK Loss:	OFF
Red Alarm:	OFF
Sync Loss:	OFF
Yel Alarm:	OFF
Err:	OFF
Test:	OFF

Chapter 4. Tests And Diagnostics

4-1. General

This chapter contains procedures for performing system diagnostic tests.

4-2. Loopback Tests

The loop back test buttons (Loc dig loopbk, Loc ana loopbk and Rem loopbk) and the LED indicators built into the **TTU-01** allow for rapid checking of the data terminal, **TTU-01** and the DS1 line. Before testing the operation of the data system equipment and their line circuits, ensure that all units are turned on and are configured correctly.

4-3. Bit Error Rate Test

When depressing the **Pattern** push-button switch, the Bit Error Rate Test (BERT) can be activated in any diagnostics test in which the test pattern transmitted is received by another **TTU-01** (see Figure 4-1). When used opposite another **TTU-01**, either with the Pattern push-button switch depressed or with an external BERT transmitting the same pattern (V.52 511-bit), the complete link can be tested. If errors are encountered, the Err indicator LED will blink (for intermittent errors) or remain on continuously (for continuous errors).

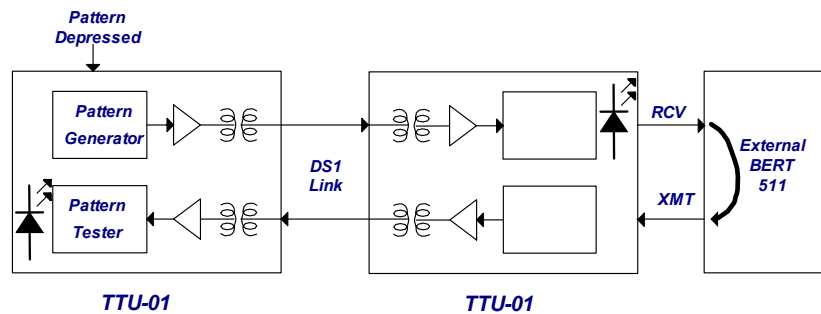


Figure 4-1 BERT operation, with external BERT

Chapter 4. Tests And Diagnostics

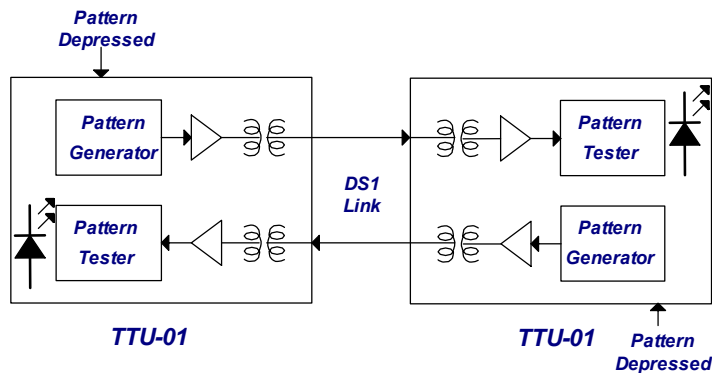


Figure 4-2 BERT operation, without external BERT

4-4. Local Analog Loopback

The local analog loop back test is activated by depressing the “Loc ana loopbk” pushbutton. This test checks the performance of the **TTU-01**, the local data terminal, and the connections between them. It is performed separately at the local and the remote sites (see Figure 4-3). In local analog loopback, the transmit sends an all “1” signal to DS1 line.

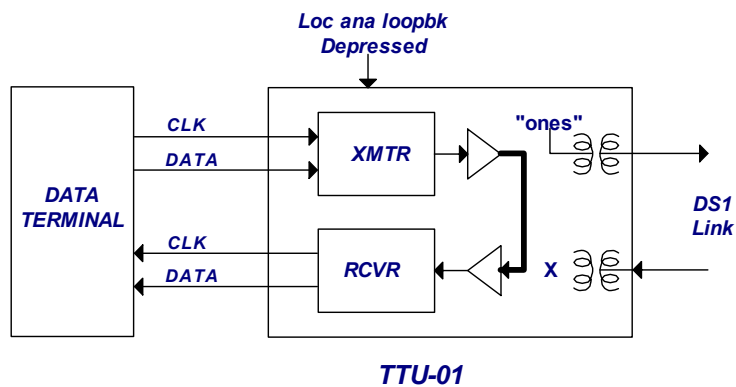


Figure 4-3 Local analog loop back

Chapter 4. Tests And Diagnostics

4-5. Local Digital Loopback

The local digital loop back test is activated by depressing the “Loc dig loopbk” pushbutton. This test consists of looping the received DS1 data to the remote **TTU-01**. The test checks the performance of the local **TTU-01**, the remote **TTU-01** and the connections between them (see Figure 4-4).

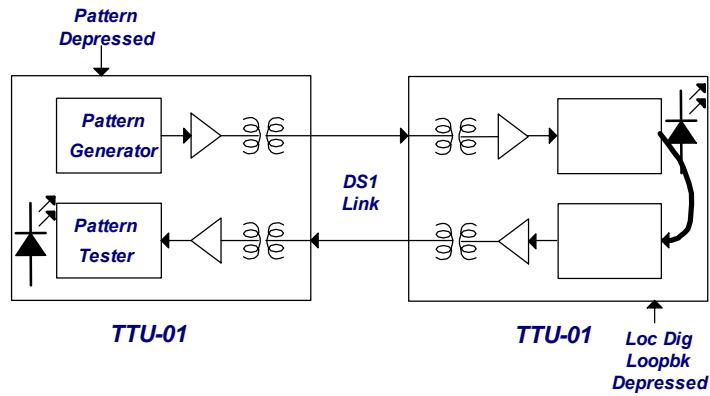


Figure 4-4 Local digital loop back

Chapter 4. Tests And Diagnostics

4-6. Remote Loopback

The remote loop back test is activated by depressing the “Rem loopbk” pushbutton. This test determines the performance both of the local and the remote **TTU-01** units, as well as their interconnecting lines. The remote loopback test provides a loopback at the remote **TTU-01** (see Figure 4-5).

In SF (D4) frame format, the remote line loop back uses the in-band control signal. The in-band control signals for remote line loopback are as follows:

Loop up code (Loopback ON): 10000.

Loop down code (Loopback OFF): 100.

In ESF frame format, the remote line loop back is controlled by the ESF Data link messages. The control signals for remote line loopback are as follows:

Loop up code (Loopback ON): 0000111011111111.

Loop down code (Loopback OFF): 0011100011111111.

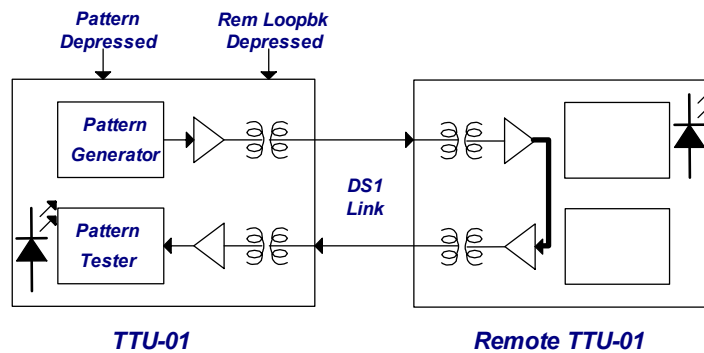


Figure 4-5 Remote loop back

Appendix A. DIP SW. Setting Summary

A-1 All DIP SW. Function Description

DIP SW	FUNCTION	COMMAND
1	Time slot 1 to 8 setting	See Table A-2
2	Time slot 9 to 16 setting	See Table A-3
3	Time slot 17 to 24 setting	See Table A-4
4	Line build out setting	See Table A-5
5	Parameter group 1 setting	See Table A-6
6	Parameter group 2 setting	See Table A-7
7	Line impedance setting	See Table A-8

Table A-1 All DIP Switches, Function Description

Note 1: DIP SW1 to DIP SW3 all off is unframed mode.

Note 2: In frame mode, the user data rate is $n \times 56K$ or $n \times 64K$,
where n = number of time slots, 1 to 24.

Appendix A. DIP SW. Setting Summary

A-2 DIP SW1 Time Slot 0 To 7 Setting

DIP SW1	STATE	FUNCTION	COMMAND
-1	OFF	Time slot 1 disable	
	ON	Time slot 1 enable	
-2	OFF	Time slot 2 disable	
	ON	Time slot 2 enable	
-3	OFF	Time slot 3 disable	
	ON	Time slot 3 enable	
-4	OFF	Time slot 4 disable	
	ON	Time slot 4 enable	
-5	OFF	Time slot 5 disable	
	ON	Time slot 5 enable	
-6	OFF	Time slot 6 disable	
	ON	Time slot 6 enable	
-7	OFF	Time slot 7 disable	
	ON	Time slot 7 enable	
-8	OFF	Time slot 8 disable	
	ON	Time slot 8 enable	

Table A-2 DIP SW1 Time Slot 0 To 7 Setting

Appendix A. DIP SW. Setting Summary

A-3 DIP SW2 Time Slot 8 To 15 Setting

DIP SW2	STATE	FUNCTION	COMMAND
-1	OFF	Time slot 9 disable	
	ON	Time slot 9 enable	
-2	OFF	Time slot 10 disable	
	ON	Time slot 10 enable	
-3	OFF	Time slot 11 disable	
	ON	Time slot 11 enable	
-4	OFF	Time slot 12 disable	
	ON	Time slot 12 enable	
-5	OFF	Time slot 13 disable	
	ON	Time slot 13 enable	
-6	OFF	Time slot 14 disable	
	ON	Time slot 14 enable	
-7	OFF	Time slot 15 disable	
	ON	Time slot 15 enable	
-8	OFF	Time slot 16 disable	
	ON	Time slot 16 enable	

Table A-3 DIP SW2 Time Slot 8 To 15 Setting

Appendix A. DIP SW. Setting Summary

A-4 DIP SW3 Time Slot 16 To 23 Setting

DIP SW3	STATE	FUNCTION	COMMAND
-1	OFF	Time slot 17 disable	
	ON	Time slot 17 enable	Note 1
-2	OFF	Time slot 18 disable	
	ON	Time slot 18 enable	
-3	OFF	Time slot 19 disable	
	ON	Time slot 19 enable	
-4	OFF	Time slot 20 disable	
	ON	Time slot 20 enable	
-5	OFF	Time slot 21 disable	
	ON	Time slot 21 enable	
-6	OFF	Time slot 22 disable	
	ON	Time slot 22 enable	
-7	OFF	Time slot 23 disable	
	ON	Time slot 23 enable	
-8	OFF	Time slot 24 disable	
	ON	Time slot 24 enable	

Table A-4 DIP SW3 Time Slot 16 To 23 Setting

Note 1: In CAS mode, DIP SW3-1 must not be set to ON.

Appendix A. DIP SW. Setting Summary

A-5 DIP SW4 Line Build Out Setting

DIP SW4	STATE			FUNCTION	COMMAND
-1,-2,-3	OFF	OFF	OFF	0 to 133 feet / 0dB	
	ON	OFF	OFF	133 to 266 feet	
	OFF	ON	OFF	266 to 399 feet	
	ON	ON	OFF	399 to 533 feet	
	OFF	OFF	ON	533 to 655 feet	
	ON	OFF	ON	-7.5 dB	
	OFF	ON	ON	-15 dB	
	ON	ON	ON	-22.5 dB	
-4	OFF			Reserved	
	ON			Reserved	
-5	OFF			Reserved	
	ON			Reserved	
-6	OFF			Reserved	
	ON			Reserved	
-7	OFF			Reserved	
	ON			Reserved	
-8	OFF			Reserved	
	ON			Reserved	

Table A-5 DIP SW4 Line Build Out Setting

Appendix A. DIP SW. Setting Summary

A-6 DIP SW5 Parameter Group 1 Setting

DIP SW5	STATE			FUNCTION	COMMAND
-1,-2,-3	OFF	OFF	OFF	Clock mode 0 (DCE1)	See Table A-9
	ON	OFF	OFF	Clock mode 1 (DCE2)	
	OFF	ON	OFF	Clock mode 2 (DTE1)	
	ON	ON	OFF	Clock mode 3 (DTE2)	
	OFF	OFF	ON	Clock mode 4 (DTE3)	
	ON	OFF	ON	Reserved	
	OFF	ON	ON	Reserved	
	ON	ON	ON	Reserved	
-4	OFF			Line code: B8ZS	
	ON			Line code: AMI	
-5	OFF			Frame mode: SF (D4)	
	ON			Frame mode: ESF	
-6	OFF			Reserved	
	ON			Reserved	
-7	OFF			Idle code: Mark (0xFF)	
	ON			Idle code: Flag (0x7E)	
-8	OFF			Data channel rate: nx64	
	ON			Data channel rate: nx56	

Table A-6 DIP SW5 Parameter Group 1 Setting

Appendix A. DIP SW. Setting Summary

A-7 DIP SW6 Parameter Group 2 Setting

DIP SW6	STATE	FUNCTION	COMMAND
-1	OFF	Jitter attenuator: Disable	
	ON	Jitter attenuator: Enable	
-2	OFF	Jitter place in: Received side	
	ON	Jitter place in: Transmitted side	
-3	OFF	Jitter buffer depth: 32 bits	
	ON	Jitter buffer depth: 128 bits	
-4	OFF	Multiplex (cascade): Disable	
	ON	Multiplex (cascade): Enable	
-5	OFF	Signaling: Non pass through	
	ON	Signaling: Pass through	
-6	OFF	Reserved	
	ON	Reserved	
-7	OFF	Data port loop back: Disable	
	ON	Data port loop back: Enable	
-8	OFF	Front panel loop back: Disable	
	ON	Front panel loop back: Enable	

Table A-7 DIP SW6 Parameter Group 2 Setting

A-8 DIP SW7 Line Impedance Setting

DIP SW7	STATE	FUNCTION	COMMAND
ALL	OFF,OFF,ON,ON,OFF	100 ohm	
1,2,3,4,5	OFF,OFF,OFF,OFF,OFF	Bridge	

Table A-8 DIP SW7 Line Impedance Setting

Appendix A. DIP SW. Setting Summary

A-9 Clock Mode Description

CLOCK MODE	DIPSW 5 STATE			DS1 LINE TRANSMIT CLOCK	USER DATA PORT	
	-1	-2	-3		RECEIVE CLOCK	TRANSMIT CLOCK
0 (DCE1)	OFF	OFF	OFF	RECOVERY*	RECOVERY Output to RC pin	RECOVERY Output to TC pin
1 (DCE2)	ON	OFF	OFF	INTERNAL OSCILLATOR	INTERNAL Output to RC pin	INTERNAL Output to TC pin
2 (DTE1)	OFF	ON	OFF	EXTERNAL Locked at ETC pin	RECOVERY Output to RC pin	EXTERNAL Input from ETC pin
3 (DTE2)	ON	ON	OFF	EXTERNAL Locked at ETC pin	EXTERNAL Input from ERC pin	EXTERNAL Input from ETC pin
4 (DTE3)	OFF	OFF	ON	EXTERNAL Locked at ETC pin	EXTERNAL Input from ETC pin	EXTERNAL Input from ETC pin

Table A-9 Clock Mode Description

*Recovery timing is synonymous with loopback timing.

Appendix B. Interface Specifications

B-1. DS1 Line Connectors

B-1.1 D-15 connector:

The DS1 link D-15 connector conforms to AT&T Pub 62411. The physical interface is a 15-pin female D-type connector.

Pin	Designation	Direction	Function
1	TTIP	From <i>TTU-01</i>	Transmit data
2	FG	↔	Frame ground
3	RTIP	To <i>TTU-01</i>	Receive data
4	FG	↔	Frame ground
5	--	--	--
6	--	--	--
7	--	--	--
8	--	--	--
9	TRING	From <i>TTU-01</i>	Transmit data
10	--	--	--
11	RRING	To <i>TTU-01</i>	Receive data
12	--	--	--
13	--	--	--
14	--	--	--
15	--	--	--

Table B-1 DS1 D-15 connector pin assignment

Appendix B. Interface Specifications

B-1.2 BNC connectors:

Conn.	Pin	Designation	Direction	Function
TX	Center	TTIP	From <i>TTU-01</i>	Transmit data
	Sleeve	TRING	↔	Signal return
RX	Center	RTIP	To <i>TTU-01</i>	Receive data
	Sleeve	RRING	↔	Signal return

Table B-2 DS1 BNC connector pin assignment

B-1.3 Bantam connectors:

Conn.	Pin	Designation	Direction	Function
TX	Tip	TTIP	From <i>TTU-01</i>	Transmit data
	Ring	TRING	↔	Signal return
	Sleeve	FG	↔	Frame ground
RX	Tip	RTIP	To <i>TTU-01</i>	Receive data
	Ring	RRING	↔	Signal return
	Sleeve	FG	↔	Frame ground

Table B-3 DS1 Bantam connector pin assignment

Appendix B. Interface Specifications

B-2. X.21 User Data Channel Connector

When the **TTU-01** is ordered with an X.21 interface, the physical interface is a 15-pin female D-type connector wired in accordance with Table B-4.

SIGNAL FUNCTION	PIN	CIRCUIT	DIRECTION	DESCRIPTION
Protective Ground	1	Shield	↔	Chassis ground. May be isolated from Signal Ground.
Signal Ground	8	G	↔	Common signal ground.
Transmitted Data	2 9	T(A) T(B)	To TTU-01	Serial digital data from DTE.
Received Data	4 11	R(A) R(B)	Fm TTU-01	Serial digital data at the output of the TTU-01 receiver.
Request to Sent	3 10	C(A) C(B)	To TTU-01	An ON signal to the TTU-01 when data transmission is desired.
Data Carrier Detect	5 12	I(A) I(B)	Fm TTU-01	Constantly ON, except when a loss of the received carrier signal is detected.
Signal Timing	6 13	S(A) S(B)	Fm TTU-01	A transmit data rate clock for use by an external data source.
External Transmit clock	7 14	B(A) B(B)	To TTU-01	A serial data rate clock input from the data source.
--	15	--	--	--

Table B-4 X.21 user data channel connector pin assignment

Appendix B. Interface Specifications

B-3. V.35 User Data Channel Connector

When the **TTU-01** is ordered with a V.35 interface, the physical interface is a 34-pin female M-type connector wired in accordance with Table B-5.

SIGNAL FUNCTION	PIN	CIRCUIT	DIRECTION	DESCRIPTION
Protective Ground	A	Frame	↔	Chassis ground. May be isolated from signal ground.
Signal Ground	B	Signal Ground	↔	Common signal ground.
Transmitted Data	P S	TD(A) TD(B)	To TTU-01	Serial digital data from DTE.
Received Data	R T	RD(A) RD(B)	From TTU-01	Serial digital data at the output of the TTU-01 receiver.
Request to Sent	C	RTS	To TTU-01	A ON signal to the TTU-01 when data transmission is desired.
Clear to Sent	D	CTS	From TTU-01	Constantly ON.
Data Set Ready	E	DSR	From TTU-01	Constantly ON, except during test loops.
Data Terminal Ready	H	DTR	To TTU-01	Not used.
Data Carrier Detect	F	DCD	From TTU-01	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit clock	U W	ETC(A) ETC(B)	To TTU-01	A transmitted data rate clock input from the data source.
Transmit Clock	Y AA	TC(A) TC(B)	From TTU-01	A transmitted data rate clock for use by an external data source.
Receive Clock	V X	RC(A) RC(B)	From TTU-01	A received data rate clock for use by an external data source.
External Receive clock	Z BB	ERC(A) ERC(B)	To TTU-01	A received serial data rate clock input from the DTE.
Remote Loop back	HH	RL	To TTU-01	When on, commands TTU-01 into remote loop back, can disable by DIPSW.
Local Loop back	JJ	LL	To TTU-01	When on, commands TTU-01 into local loop back, can disable by DIPSW.
Test Indicator	KK	TM	From TTU-01	ON during any test mode

Table B-5 V.35 user data channel connector pin assignment

Appendix B. Interface Specifications

B-4. RS-530 User Data Channel Connector

When the **TTU-01** is ordered with an RS-530 interface, the physical interface is a 25-pin female D-type connector wired in accordance with Table B-6.

SIGNAL FUNCTION	PIN	CIRCUIT	DIRECTION	DESCRIPTION
Protective Ground	1	Frame	↔	Chassis ground. May be isolated from signal ground.
Signal Ground	7	AB	↔	Common signal ground.
Transmitted Data	2 14	BA(A) BA(B)	To TTU-01	Serial digital data from DTE.
Received Data	3 16	BB(A) BB(B)	From TTU-01	Serial digital data at the output of the TTU-01 receiver.
Request to Sent	4 19	CA(A) CA(B)	To TTU-01	A ON signal to the TTU-01 when data transmission is desired.
Clear to Sent	5 13	CB(A) CB(B)	From TTU-01	Constantly ON.
Data Set Ready	6 22	CC(A) CC(B)	From TTU-01	Constantly ON, Except during test loops.
Data Terminal Ready	20 23	CD(A) CD(B)	To TTU-01	DTR not used, used for a received serial data rate clock input from the DTE.
Data Carrier Detect	8 10	CF(A) CF(B)	From TTU-01	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit clock	24 11	DA(A) DA(B)	To TTU-01	A transmitted data rate clock input from the data source.
Transmit Clock	15 12	DB(A) DB(B)	From TTU-01	A transmitted data rate clock for use by an external data source.
Receive Clock	17 9	DD(A) DD(B)	From TTU-01	A received data rate clock for use by an external data source.
Remote Loop back	21	RL	To TTU-01	When on, commands TTU-01 into remote loop back, can disable by DIPSW.
Local Loop back	18	LL	To TTU-01	When on, commands TTU-01 into local loop back, can disable by DIPSW.
Test Indicator	25	TM	From TTU-01	ON during any test mode

Table B-6 RS-530 user data channel connector pin assignment

Appendix B. Interface Specifications

B-5. RS-530 To RS-449 Adapter Cable

When the **TTU-01** is ordered with a RS-449 interface, the physical interface is a 37-pin male D-type connector wired in accordance with Table B-7.

SIGNAL FUNCTION	RS-530 PIN	RS-449 PIN	RS-449 CIRCUIT	DESCRIPTION
Protective Ground	1	1	Frame	Chassis ground. May be isolated from signal ground.
Signal Ground	7	19,20,37	SG,RC,SC	Common signal ground.
Transmitted Data	2 14	4 22	SD(A) SD(B)	Serial digital data from DTE.
Received Data	3 16	6 24	RD(A) RD(B)	Serial digital data at the output of the TTU-01 receiver.
Request to Sent	4 19	7 25	RS(A) RS(B)	A ON signal to the TTU-01 when data transmission is desired.
Clear to Sent	5 13	9 27	CS(A) CS(B)	Constantly ON.
Data Set Ready	6 22	11 29	DM(A) DM(B)	Constantly ON, Except during test loops.
Data Terminal Ready	20 23	12 30	TR(A) TR(B)	DTR not used, used for a received serial data rate clock input from the DTE.
Data Carrier Detect	8 10	13 31	RR(A) RR(B)	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit clock	24 11	17 35	TT(A) TT(B)	A transmitted data rate clock input from the data source.
Transmit Clock	15 12	5 23	ST(A) ST(B)	A transmitted data rate clock for use by an external data source.
Receive Clock	17 9	8 26	RT(A) RT(B)	A received data rate clock for use by an external data source.
Remote Loop back	21	14	RL	When on, sets TTU-01 into remote loop back, can disable by DIPSW.
Local Loop back	18	10	LL	When on, sets TTU-01 into local loop back, can disable by DIPSW.
Test Indicator	25	18	TM	ON during any test mode

Table B-7 RS-530 to RS-449 pin assignment

Appendix C. Rack Mounting Instructions

Optional Rack Mounting Kits

All rack mount series units may be placed in a stand EIA 19 inch rack occupying one unit space by means of the optional rack mounting adapter kit. Units may be mounted singularly or in pairs side-by-side.

Single unit mounting kit:

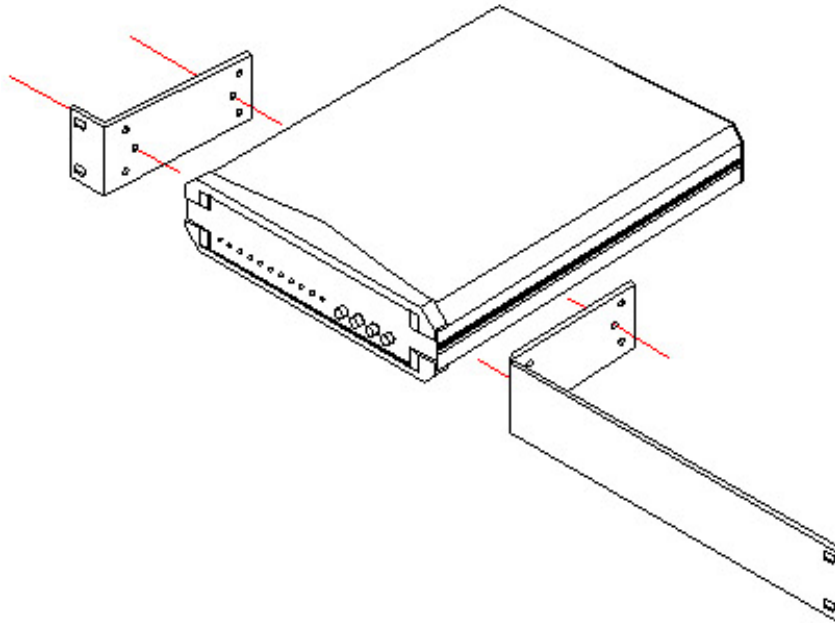


Figure C-1. Single Unit Rack Mount

Using the four (4) supplied self-tapping sheet metal screws, attach the brackets to the main unit. The unit may be mounted on the left side (as shown) or on the right side at your discretion.

Appendix C. Rack Mounting Instructions

Dual Unit Mounting Kit:

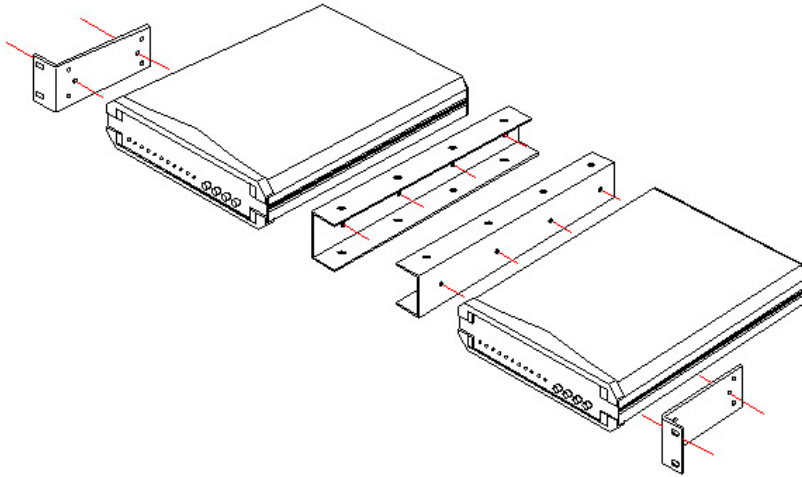


Figure C-2. Dual Unit Rack Mount

Attach the brackets as shown with the supplied self-tapping sheet metal screws. Refer to the drawing below for unit connection.

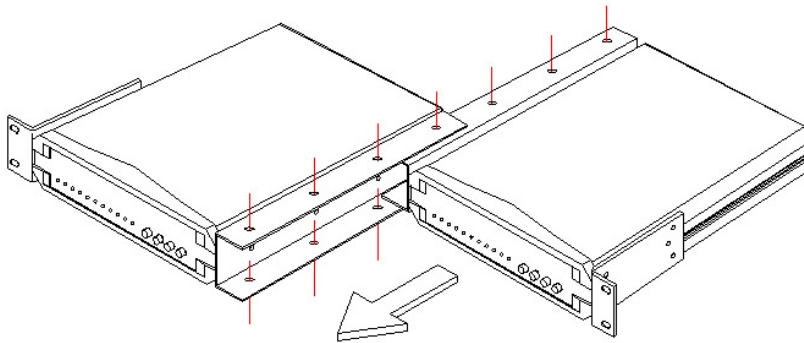


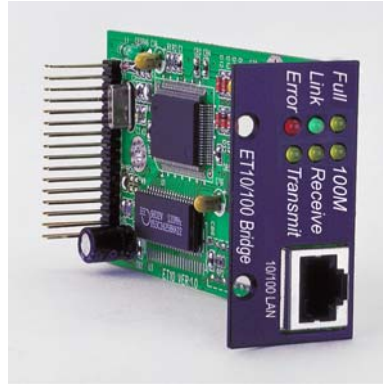
Figure C-3. Dual Unit Detail

Slide the units together as shown above and attach the screws. Mount the assembly in a rack as usual, using the rack supplied mounting screws.

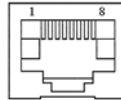
Appendix D. Interface Module

ET10/100 10/100BASE-TX Ethernet Interface

When the **ETU-01** is ordered with an **ET10/100 Interface**, the unit is not only an access unit for E1, but also becomes a high performance WAN bridge for 10Base-T or 100Base-TX Ethernet extension. The physical interface is a RJ-45 connector, with the pin assignment as follows:



MDI	MDI-X
1. Tx +	1. Rx +
2. Tx -	2. Rx -
3. Rx +	3. Tx +
6. Rx -	6. Tx -



DIP Switch Settings

DIP	STATE	FUNCTION	
1	ON*	Enable MAC filtering	
	OFF	Disable Filtering	
2	ON	Enable 802.3x flow control	
	OFF*	Disable 802.3x flow control	
3	ON	NO Auto-negotiation	
	OFF*	Auto-negotiation	
4	ON	Half Duplex ¹	
	OFF*	Full Duplex ¹	
5	ON	10BASE-T LAN speed ¹	
	OFF*	100BASE-TX LAN speed ¹	
6	ON*	Enable Auto MDIX	
	OFF	MDI (1:1 to HUB)	
7 8	OFF	OFF	Memory configuration #1
	ON	OFF	Memory configuration #2
	OFF	ON	Memory configuration #3
	ON	ON	Reserved

* factory default settings

¹ no effect when sw3 is off (auto-negotiation is on)

² Note : Some LAN card modules have the feature of "Power Manager". The Tx Side won't transmit data when the "Link" status is not on. Under this circumstance the switch#6 needs to be on the "ON" position then the normal function should be remained.

LED Indicators

Designation	Indication
Full (yel)	ON=Full Duplex
Link (grn)	ON=LAN Link
Error (red)	ON=LAN Error
100M (yel)	ON=Fast Ethernet
Receive (yel)	ON=LAN Rx data
Transmit(yel)	ON=LAN Tx data

Memory configuration detail

#1 LAN to WAN 308 packets, WAN to LAN 32 packets
 #2 LAN to WAN 170 packets, WAN to LAN 170 packets
 #3 LAN to WAN 32 packets, WAN to LAN 308 packets

Notes:

Notes:

Notes:
