

# **TC8610-1**

## **4 Channel Serial-over-T1/E1 Multiplexer**

**User Manual**  
**MNL-86101-01-05**



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# Record of Revisions

Revision	Date	Description of Changes
1.1	08/09/2017	Initial Release of TC8610-1.
1.2	07/05/2018	Added DCE RS-232 cable information. Updated part number information.
1.3	09/26/2018	Updated data rates table.
1.4	12/06/2018	Added Appendix C.3 CSU Loop Operation
1.5	08/16/2019	Updated Pin Assignment diagrams.

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## Guide to Alert Symbols

These alert symbols are used in Caution, Warning, and Danger notes.

Symbol	Meaning
	Pinching or crushing hazard
	Electrical hazard.
	Equipment alert: be careful of damage from static electricity
	General alert: used for all other hazardous conditions (referring to people, not equipment).

# TABLE OF CONTENTS

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<b>1</b>	<b>Introduction</b>	
1.1	General Information . . . . .	1-1
1.2	Product Description . . . . .	1-1
1.2.1	Features . . . . .	1-3
1.2.2	Applications. . . . .	1-4
1.3	Specifications . . . . .	1-5
<b>2</b>	<b>Installation</b>	
2.1	General Information . . . . .	2-1
2.2	Unpacking . . . . .	2-1
2.3	Equipment Location . . . . .	2-1
2.4	Power Supply . . . . .	2-2
2.5	Dry Contact Alarm Relay (DCAR) . . . . .	2-2
2.6	System Start Up . . . . .	2-2
2.7	System Configuration . . . . .	2-3
2.7.1	Front Panel RJ Connectors. . . . .	2-3
2.7.2	Cabling . . . . .	2-4
2.7.3	RJ-11 to DB9 DTE Adapter Cable Pin Assignments . . . . .	2-6
2.7.4	RJ-11 to DB9 DCE Adapter Cable Pin Assignments . . . . .	2-8
2.7.5	Rear Panel . . . . .	2-12
<b>3</b>	<b>Quick Start Guide</b>	
3.1	Introduction. . . . .	3-1
3.2	Setup . . . . .	3-1
<b>4</b>	<b>Tutorial</b>	
4.1	Introduction. . . . .	4-1
4.2	Latched Alarm . . . . .	4-2
4.3	Remote Unit Status Monitoring and Remote Unit Alarm Reset . . . . .	4-3
4.4	Local Loopback Test . . . . .	4-4
4.5	Remote Loopback Test . . . . .	4-4
4.6	T1/E1 Local Loopback Test . . . . .	4-5
<b>5</b>	<b>Troubleshooting</b>	
5.1	General. . . . .	5-1
5.2	All LEDs are OFF . . . . .	5-1
5.3	Alarm LED . . . . .	5-1
<b>Appendix A 19” Rack Mount Card Cage</b>		
A.1	Features . . . . .	A-1
A.2	Description . . . . .	A-1
A.3	Chassis Ground . . . . .	A-1
<b>Appendix B Components Placement</b>		
B.1	Overview . . . . .	B-1
<b>Appendix C R2 Button &amp; LED Functions</b>		
C.1	R2 (“Reset Too”) Button Description . . . . .	C-1

# TABLE OF CONTENTS

---

- C.1.1 R2 (“Reset Too”) Push Button Functions . . . . . C-1
- C.2 LED Functions . . . . . C-2
- C.3 CSU Loop Operation . . . . . C-2

## Appendix D Return Policy

- D.1 Return Policy . . . . . D-1
  - D.1.1 Warranty . . . . . D-1
  - D.1.2 Limitation of Liability . . . . . D-2

## In this chapter:

- *Product Description*, on page 1-1
- *Specifications*, on page 1-5

## 1.1 General Information

This manual is intended to describe the features and functionality in addition to aiding in the planning, configuring, commissioning and maintaining of the TC8610-1 Serial-over-T1/E1 multiplexer.

## 1.2 Product Description

The TC8610-1 is a 4 Channel Serial-over-T1/E1 multiplexer with built-in power redundancy.

TC8610-1 can support either T1 or E1 upon the order. For serial input, four options are available:

- TC8610-1-1: 4-Channel RS-232
- TC8610-1-3: 4-Channel RS-422
- TC8610-1-4: 4-Channel RS-485, 4-wire
- TC8610-1-5: 4-Channel RS-485, 2-wire\*

Extensive diagnostics include DIP switches for Local & Remote Loopback and other application configuration switches. Each unit also provides multiple LEDs for Alarm, Power, Vcc, T1/E1 Status, and Tx & Rx LEDs for each channel.

The built-in sync mechanism verifies both device and T1/E1 link operation. No other test equipment is required for link and device verification.

The TC8610-1 is compatible with standard 100 $\Omega$  T1 for copper line lengths up to 6000ft and up to 2.5km for 75 $\Omega$  / 120 $\Omega$  E1 (copper line length is the distance between the TC8610 and the T1/E1 cross-connect). The T1/E1 uses an RJ-48 connector and the serial channels use RJ-11 connectors. Optional BNC adapter cable is available for 75 Ohm E1. Power is 12VDC standard or optional 24VDC, -48VDC, 125VDC, or 115/230VAC with an external power cube. Optionally, a high temperature version (-20 $^{\circ}$ C to 70 $^{\circ}$ C) and extreme temperature version (-40 $^{\circ}$ C to 80 $^{\circ}$ C) are also available.

*\*Note: Check factory for availability*



Figure 1-1 TC8610-1 Front and Rear Panel

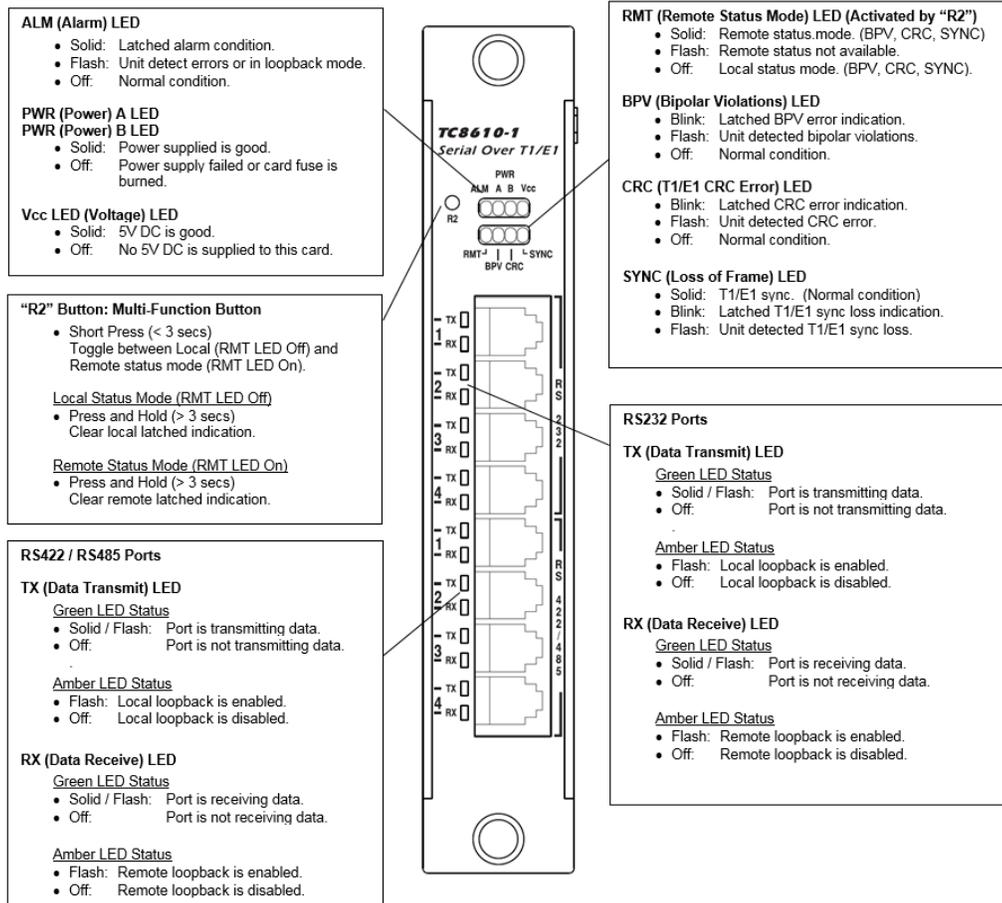


Figure 1-2 TC8610-1 Front Panel LED Definitions

## 1.2.1 Features

- Serial Configuration
- T1 Features:
  - ESF Framing Support (SF Framing, Optional)
  - Supports Line Length up to 3000ft (T1)\*
- E1 Features:
  - PCM31C Framing Support (PCM30, PCM30C, PCM31 Optional)
  - Supports Line Length up to 2.5km
- Very Low Latency ~ 600 $\mu$ s
- Individually Isolated Ground for Each Serial Port
- LEDs for "TX", "RX" (to monitor serial channel status)
- LEDs for "SYNC", "AMI", "BPV", "LOS", "AIS", "RAI", "CRC" (to monitor each T1/E1 channel status)
- LEDs for "PWR A," "PWR B," "Vcc," & "ALM" (to monitor each unit's power supply and alarm condition status)
- Built-in Power Redundancy
- Diagnostic DIP Switches for Local Loopback, Remote Loopback and T1/E1 Loopback tests.
- Rack Mount or Stand Alone

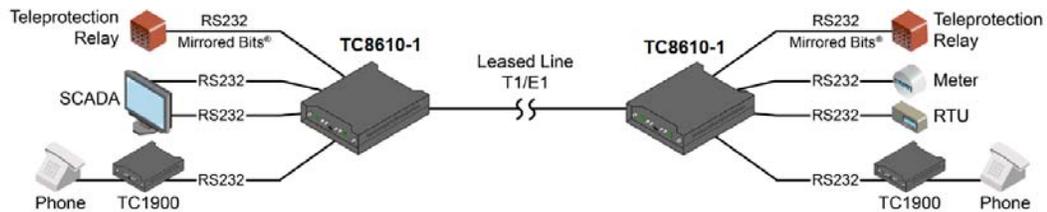
*\*Note: For line lengths beyond 655ft additional testing is required.*

## 1.2.2 Applications

The TC8610-1 offers an inexpensive, plug and play method for connecting up to four serial devices over existing T1/E1 links. Popular applications include:

- Transport of asynchronous RS-232/RS-422/RS-485
- Transport of SCADA communications
- Protocol-transparent
- Support for SEL Mirrored Bits®\*
- Connection for two Power Utility teleprotection relays
- Convert the RS-232 Async to RS-422/RS-485 signals running from the local side to the remote side or vice-versa.

\*Note: *Mirrored Bits®* is a registered trademark of Schweitzer Engineering Laboratories Inc.



**Figure 1-3 Serial Tunneling Application Using TC8610-1 Serial-over-T1/E1 Multiplexer**

## 1.3 Specifications

**Table 1-1 Unit Specifications**

<b>Data Rates</b>	
RS-232 Async w/ Control	Up to 64 Kbps
RS-422 Async	Up to 64 Kbps
RS-485 2 or 4-wire	4.8 Kbps, 9.6 Kbps, 19.2 Kbps, 38.4 Kbps
<i>*Contact factory for higher requirements</i>	

<b>Channel Capacity</b>	
Channels	4-Serial Channels

<b>Electrical</b>	
Serial Connectors	RJ-11
T1/E1 Connector	RJ-48F
Serial Interface	RS-232, RS-422, RS-485 2 or 4 wire

<b>System</b>	
Bit Error Rate	1 in 10 <sup>9</sup> or better
Unit Status Indicators	PWR A, PWR B, Vcc
T1/E1 Status Indicators	ALARM, SYNC, AMI, BPV, LOS, AIS, RAI, CRC, RMT
RS-422 Status Indicators	TX, RX
Diagnostic Functions	Local Loopback, Remote Loopback, and T1/E1 Loopback

<b>Power Source</b>	
Standard	12VDC @300mA

<b>Power Source</b>	
Optional	24VDC, -48VDC, 125VDC, or 115/230VAC with an external power cube

<b>Temperature</b>	
Operating	-10°C to 50°C
Optional Hi-Temp Version	-20°C to 70°C
Optional Extreme-Temp Version	-40°C to 80°C
Storage	-40°C to 90°C
Humidity	95% non-condensing

<b>Physical (Standalone Unit)</b>	
Height	(3.53 cm) 1.40"
Width	(18.14 cm) 7.20"
Depth	(24.89 cm) 9.80"
Weight	(0.9 Kg) 2.0 lbs.

<b>Physical (Rack mount 1U "Pizza Box" with two cards)</b>	
Height	(4.45 cm) 1.75"
Width	(48.26 cm) 19.0"
Depth	(22.86 cm) 9.0"
Weight	(1.86 Kg) 4.1 lbs.

## In this chapter:

- *Power Supply*, on page 2-2
- *System Configuration*, on page 2-3

## 2.1 General Information

The installation section describes how to:

- Unpack the unit
- Ensure an optimum site location
- Install the power supply and dry contact connection

## 2.2 Unpacking

Before unpacking any equipment:

- Inspect all shipping containers for evidence of external damage caused during transportation
- Inspect for damage after it is removed from the containers

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### IMPORTANT



Any claims concerning shipping damage should be made directly to the pertinent shipping agencies. Any discrepancies should be reported immediately to the Customer Service Department at TC Communications, Inc. at (949) 852-1973.

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## 2.3 Equipment Location

The TC8610-1 should be located in an area that provides adequate light, work space and ventilation.

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### Important

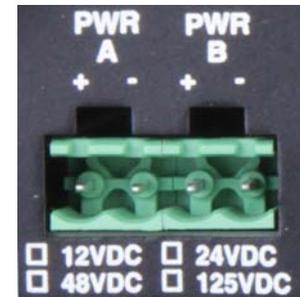
Avoid locating it next to any equipment that may produce electrical interference or strong magnetic fields, such as elevator shafts or heavy duty power supplies.

As with any electronic equipment, keep the unit from excessive moisture, heat, vibration and freezing temperatures.

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## 2.4 Power Supply

The TC8610-1 can be powered by external DC power. Available power options are 12 VDC, 24 VDC, -48 VDC, and 125 VDC. There are two terminal block connectors labeled "PWR A" and "PWR B" only one is required to power up the unit. Since each TC8610-1 card is equipped with a power redundancy capability, the power LEDs on the front panel will light according to which power jack (A or B) is connected. Both LEDs will light when power redundancy is utilized.



### Important

Read and only connect a supply voltage that corresponds to the type plate of your device. Make sure that the contact load capacity of the signal contact is not exceeded.

## 2.5 Dry Contact Alarm Relay (DCAR)

A terminal block connector at the rear panel provides for the Dry Contact Alarm Relay. This relay can be used in NO (Normal Open) or NC (Normal Close) configuration.

When used in NO (Normal Open) configuration, the relay will close if the unit loses power completely or the Alarm is on. The relay remains open during normal operation.

When used in NC (Normal Close) configuration, the relay will open if the unit loses power completely or the Alarm is on. The relay remains close during normal operation.

## 2.6 System Start Up

Apply the power by plugging the power plug into a power jack (both PWR A & PWR B for dual power units).

After power is applied, all LEDs (except PWR & VCC LEDs) will flash momentarily and the following LED status should be observed from the front and back panels:

1. The Power "A" and/or "B" and VCC LEDs should be lit.

*Note: TC8610-1 cards installed in the 1U rack chassis will not show the PWR A LED in the "On" lit state and will be Off. This is normal and the power to the card will be monitored by the VCC LED being "On" lit.*

2. The "AMI" LED on the rear panel will be Lit or Off depending on the setting of the rear panel DIP switch SW4. The LED will be Lit when SW4 is "Off" (Up) position, set for AMI. The LED will be Off when SW4 is "On" (Down) position, set for B8ZS (T1) or HDB3 (E1).

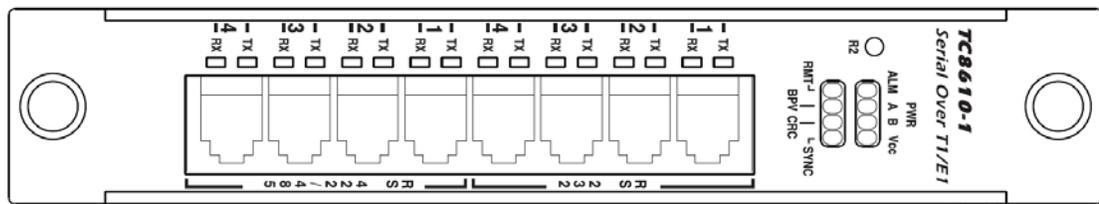
3. The "ALM" and "SYNC" LEDs on the front panel will be flashing indicating that the T1/E1 connection is not established. This is normal when the T1/E1 connection has not been established.

## 2.7 System Configuration

The TC8610-1 has been pre-tested and set per factory specifications.

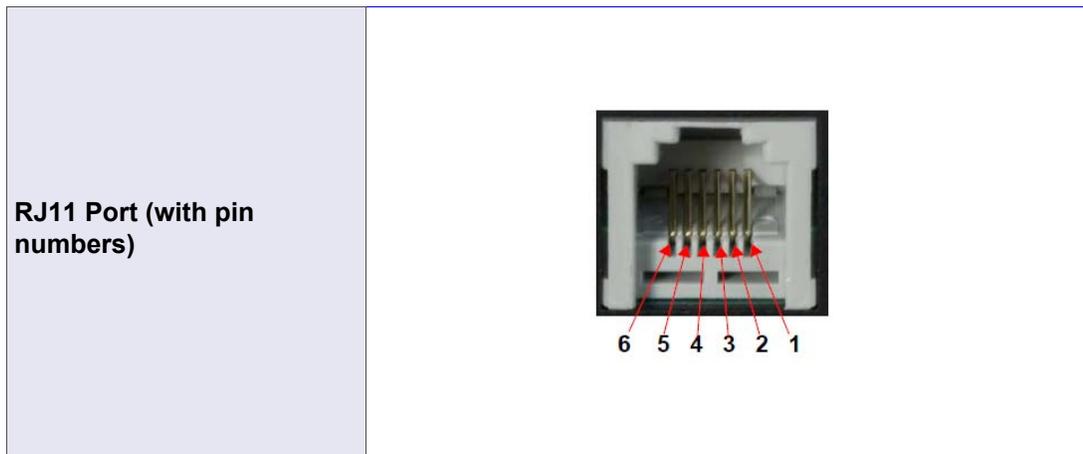
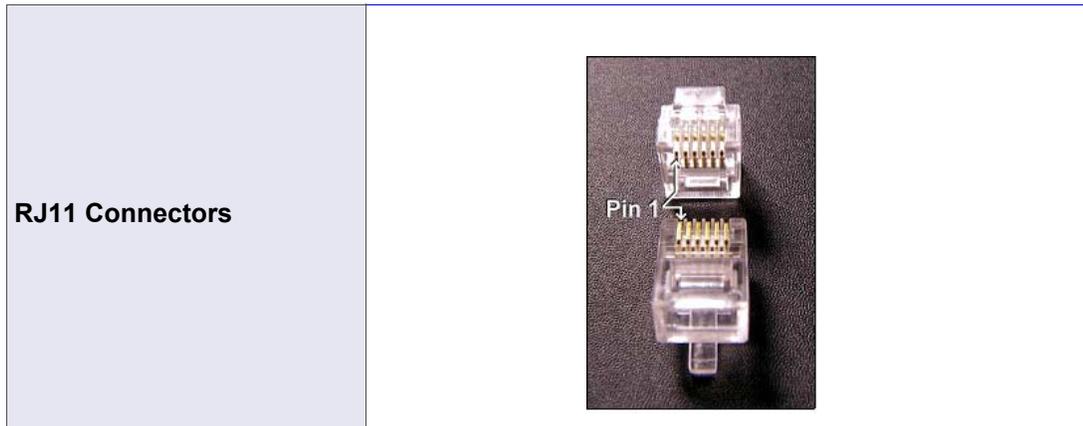
### 2.7.1 Front Panel RJ Connectors

RJ-11 connectors are provided on the front panel for RS-232 connection of the serial signal.



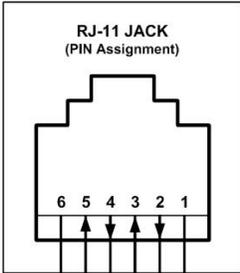
**Figure 2-1 TC8610-1 Front Panel RJ-11 Ports Pin Assignments**

## 2.7.2 Cabling

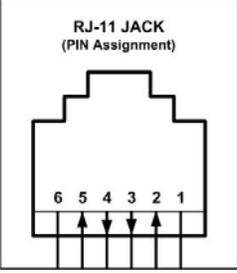


### 2.7.2.1 RJ11 Pin Assignments

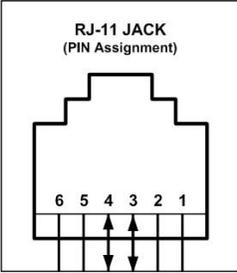
The serial ports located on the TC8610-1 front panel require RJ11 connectors. This section lists the pin assignments and signal names for these RJ11 ports for different serial interfaces.

Asynchronous w/ control RS-232 Serial Port RJ-11 Pin Assignment	
1 - Signal Ground (GND)	
2 - Control Out	
3 - Control In	
4 - Data Out	
5 - Data In	
6 - Signal Ground (GND)	

**Figure 2-2 RS-232 Async with Control Pin Assignment**

<b>4-Wire RS-422/485 Serial Port RJ-11 Pin Assignment</b>	
1 - Signal Ground (GND)	
2 - Data In (A)-	
3 - Data Out (A)-	
4 - Data Out (B)+	
5 - Data In (B)+	
6 - Signal Ground (GND)	

**Figure 2-3 4-Wire RS-422/485 Pin Assignment**

<b>2-Wire RS-485 Serial Port RJ-11 Pin Assignment</b>	
1 - Signal Ground (GND)	
2 - N/A	
3 - Data (A)-	
4 - Data (B)+	
5 - N/A	
6 - Signal Ground (GND)	

**Figure 2-4 2-Wire RS-485 Pin Assignment**

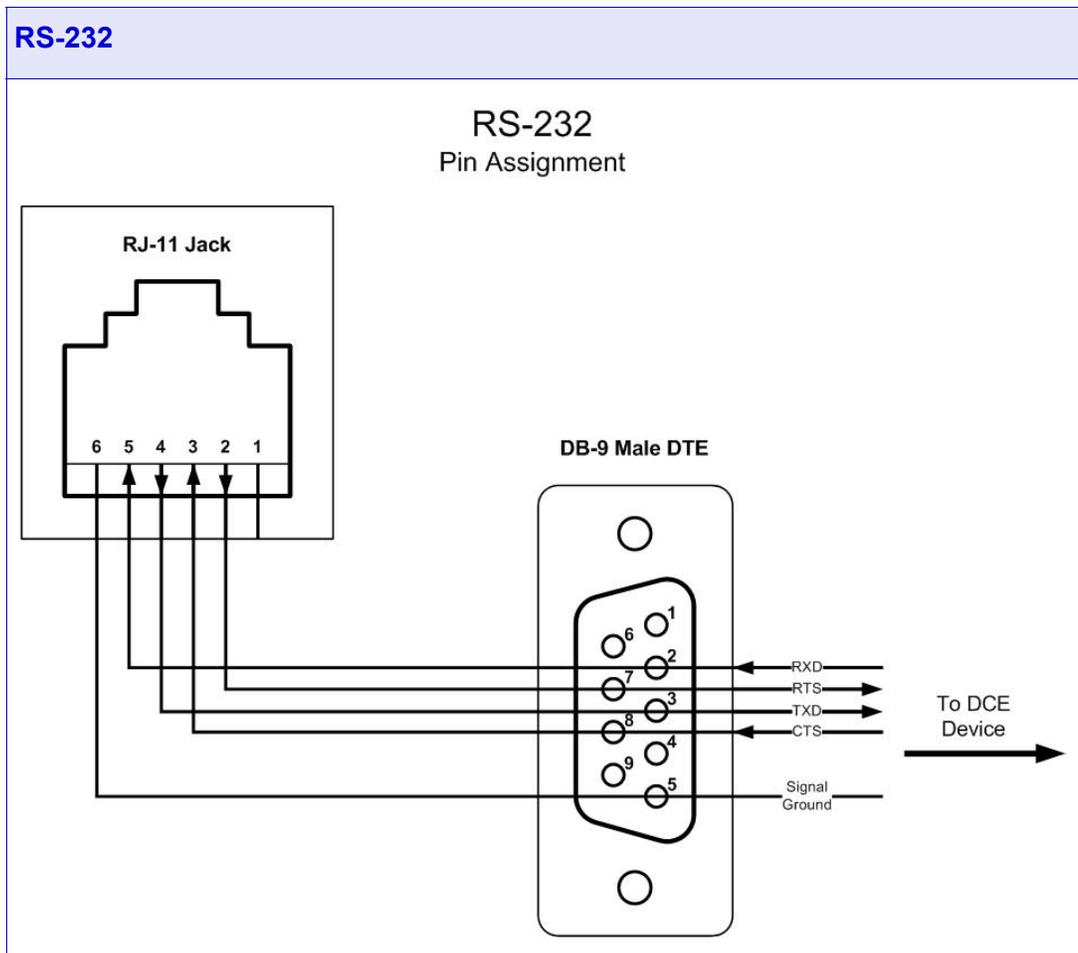
### 2.7.3 RJ-11 to DB9 DTE Adapter Cable Pin Assignments

TC Communications optionally provides four RJ-11 to DB9M DTE adapter cables (PN: 620-R1109-16) for each unit of TC8610-1. This section illustrates the pin connections from RJ-11 to DB9 for different serial interfaces.

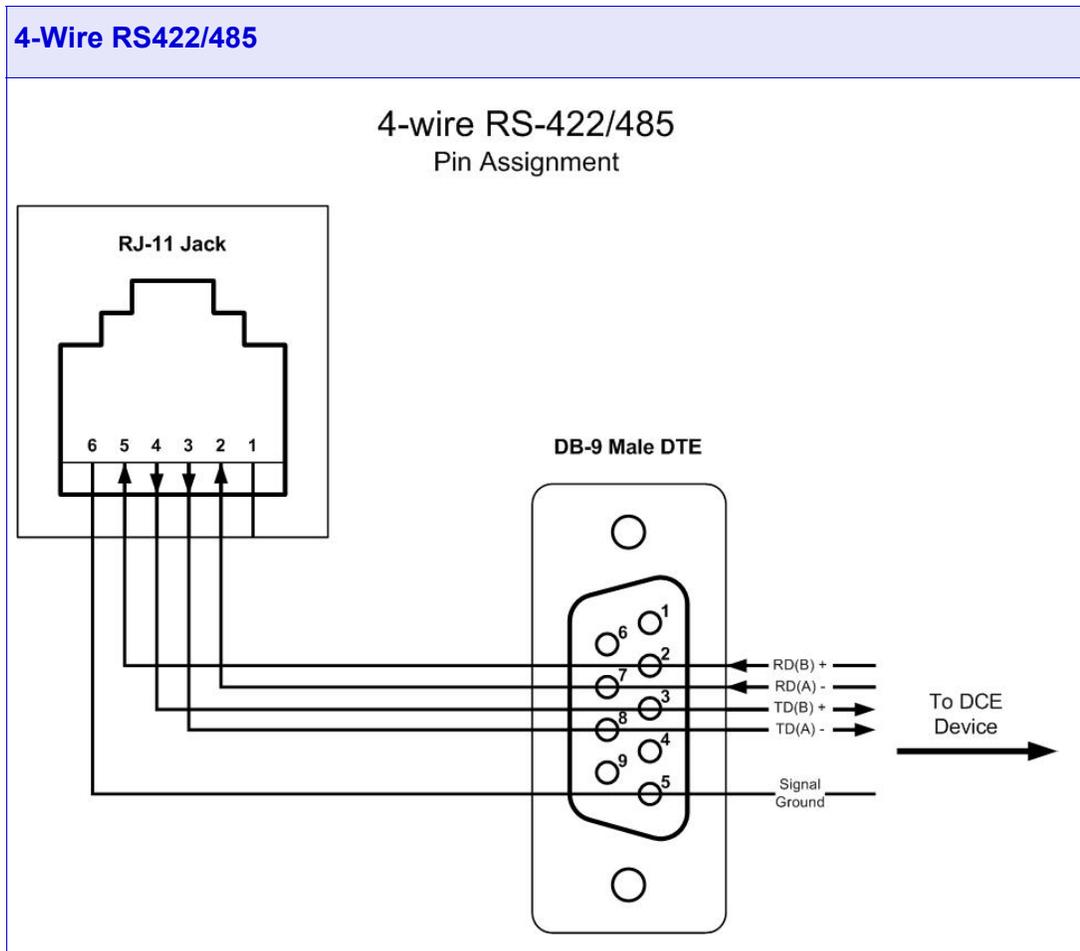


**RJ-11 to DB9M  
(DTE) Adapter  
Cable**  
TC P/N:  
620-R1109-16

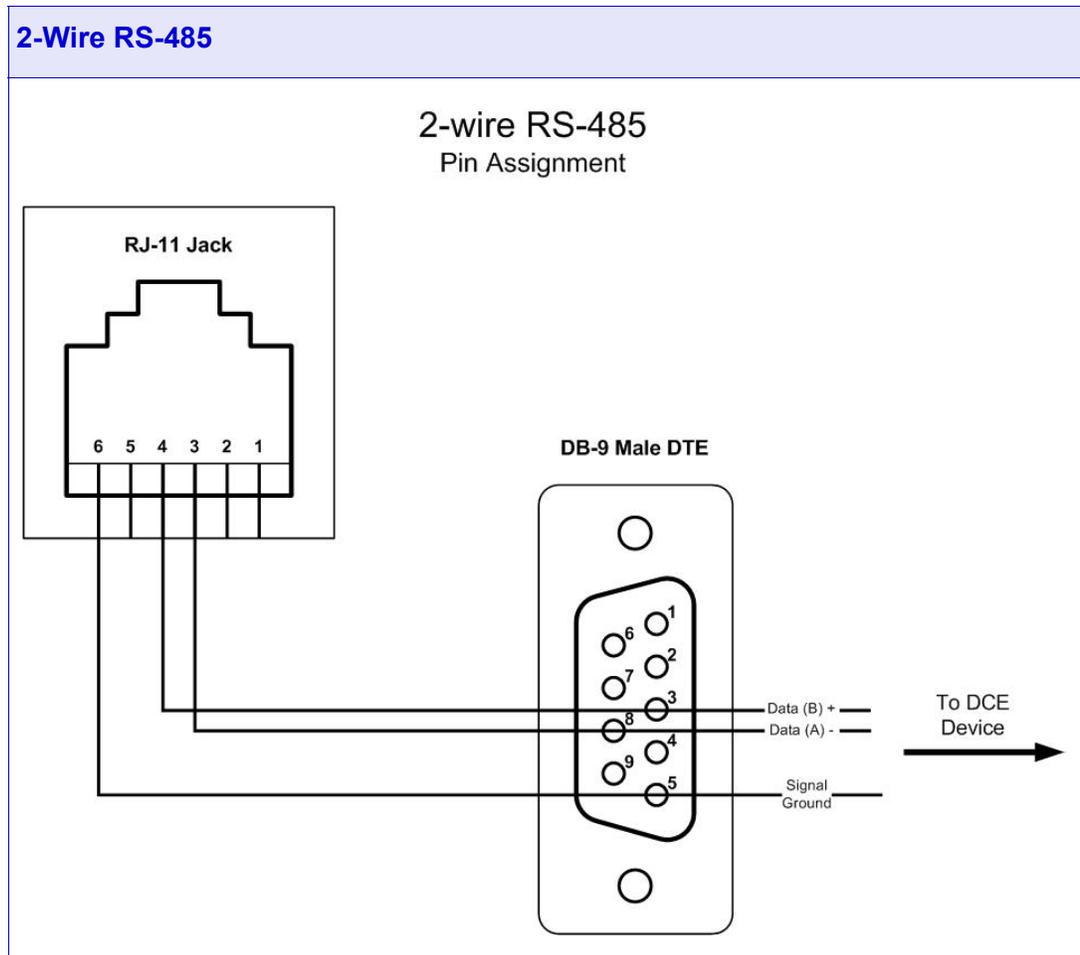
**Figure 2-5 RJ-11 to DB9 DTE Adapter Cable**



**Figure 2-6 RJ-11 to DB9 DTE Pin Assignment for RS-232 Async with Control**



**Figure 2-7 RJ-11 to DB9 DTE Pin Assignment for 4-Wire RS-422/485**



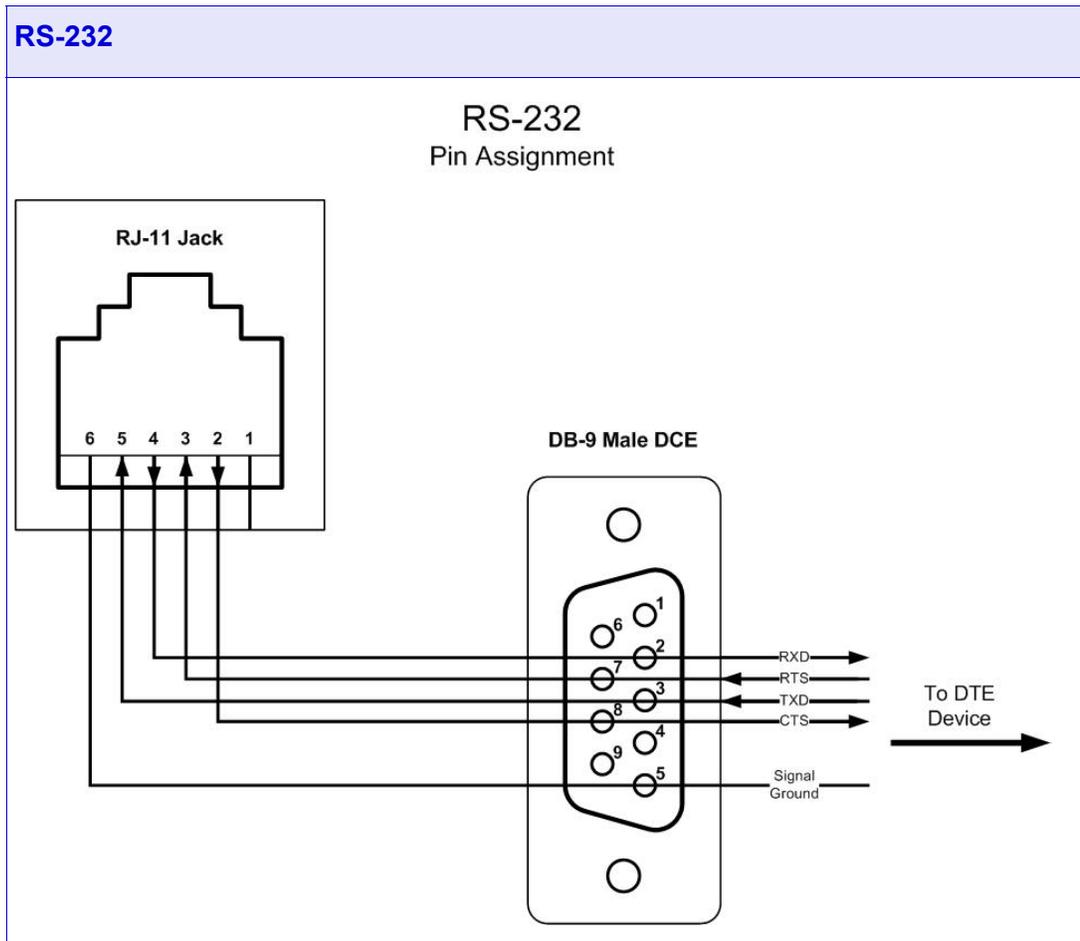
**Figure 2-8 RJ-11 to DB9 DTE Pin Assignment for 2-Wire RS-485**

## 2.7.4 RJ-11 to DB9 DCE Adapter Cable Pin Assignments

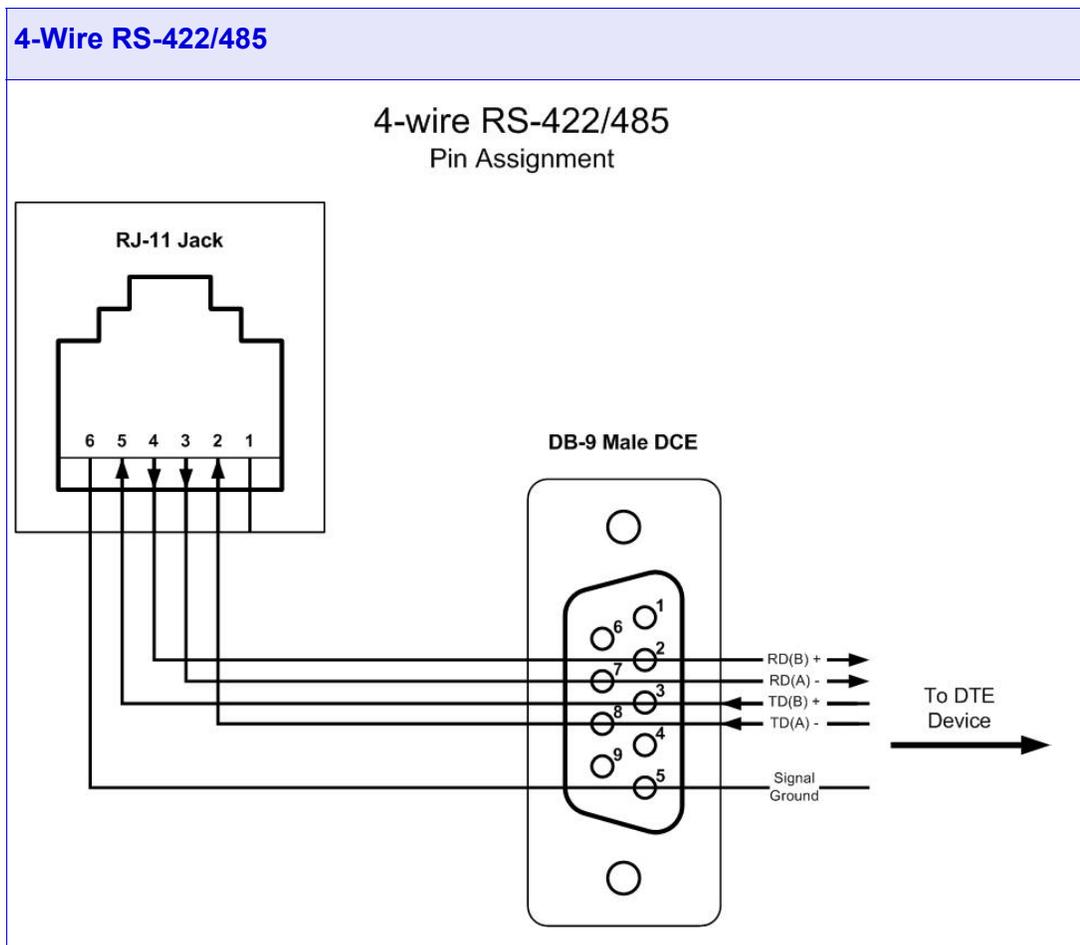
TC Communications optionally provides four RJ-11 to DB9 DCE adapter cables (PN: 620-R1109-06) for each unit of the TC8610-1. This section illustrates the pin connections from RJ-11 to DB9 for different serial interfaces.



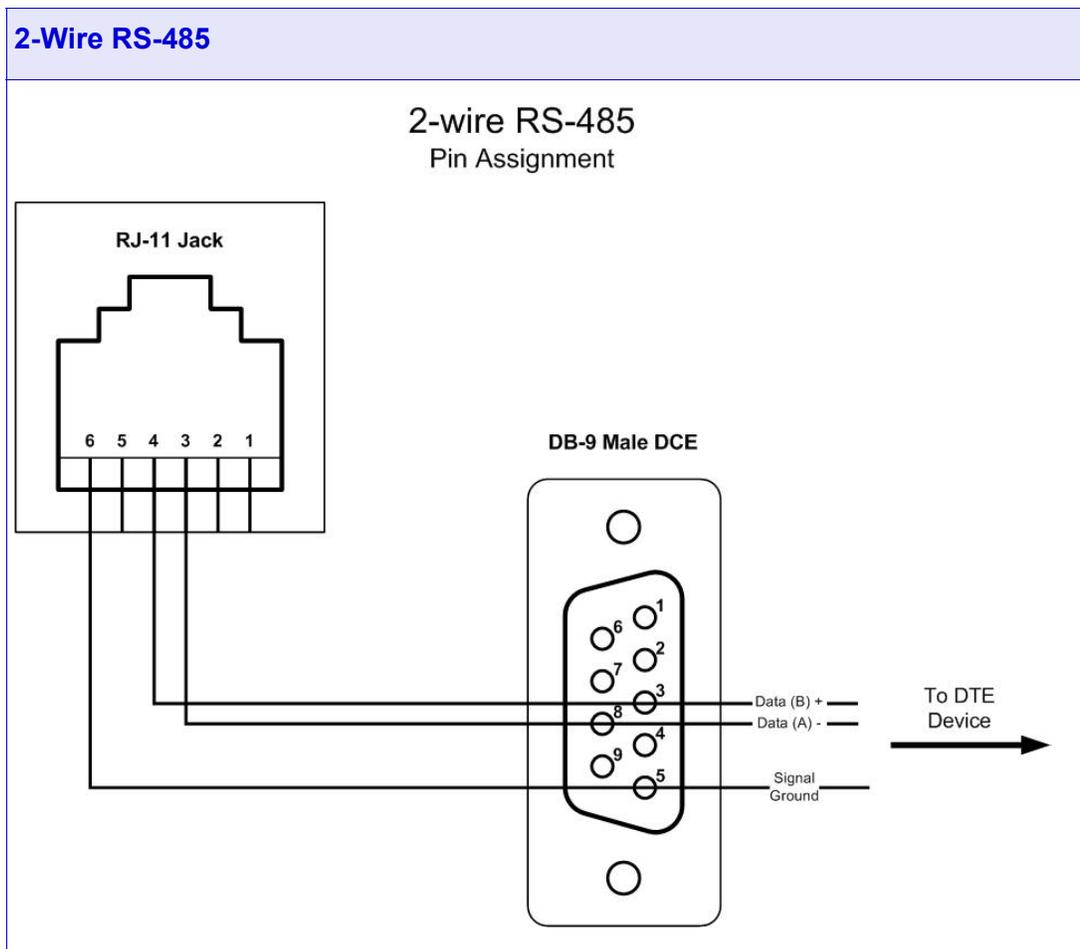
**Figure 2-9 RJ-11 to DB9 DCE Adapter Cable**



**Figure 2-10 RJ11 to DB9 DCE Pin assignments for RS-232 Async with Control**



**Figure 2-11 RJ11 to DB9 DCE Pin assignments for 4-Wire RS-422/485**



**Figure 2-12 RJ11 to DB9 DCE Pin assignments for 2-Wire RS-485**

## 2.7.5 Rear Panel

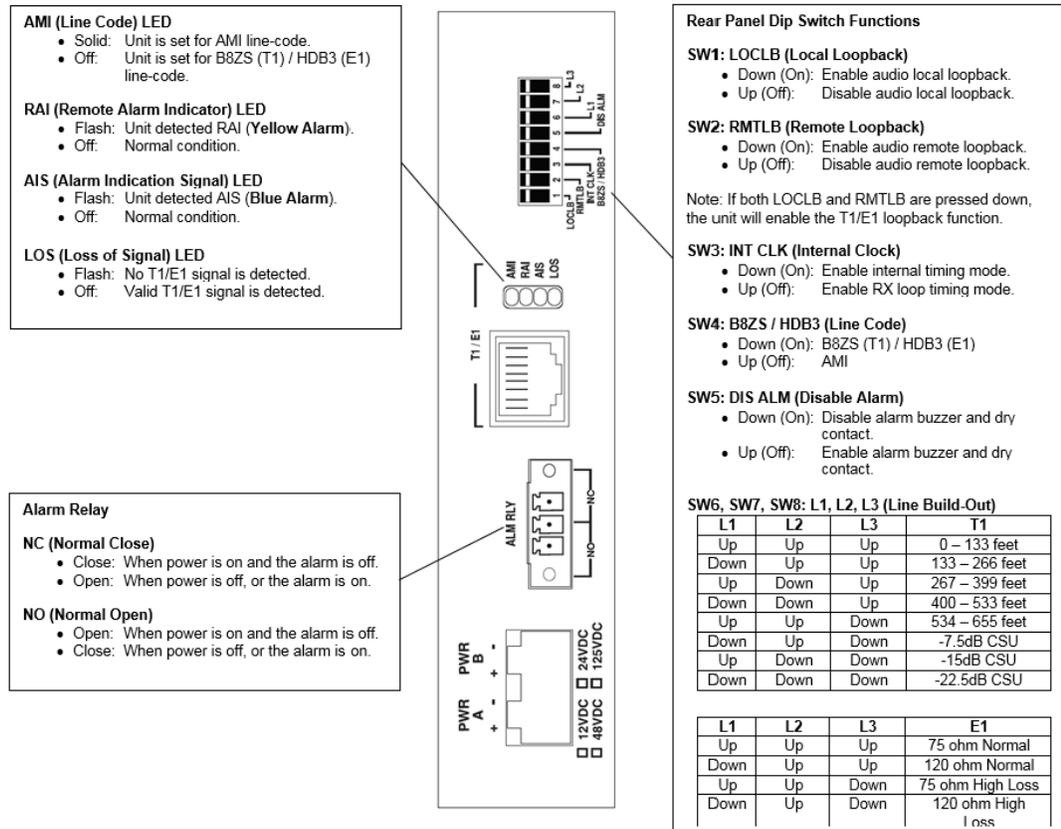
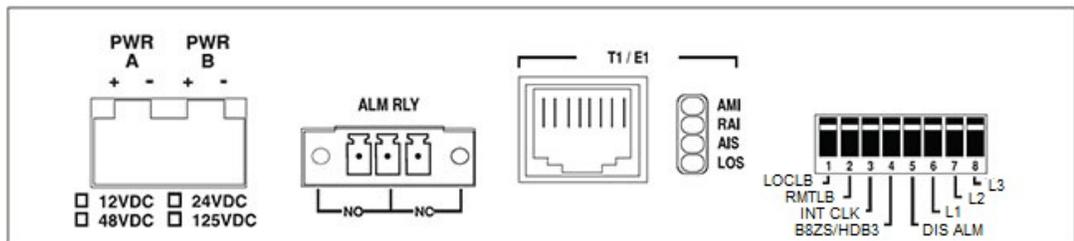


Figure 2-13 TC8610-1 Rear Panel Connectors, LEDs, & DIP Switches

### 2.7.5.1 Rear Panel (T1/E1 RJ-48F Connector & Pin Assignments)

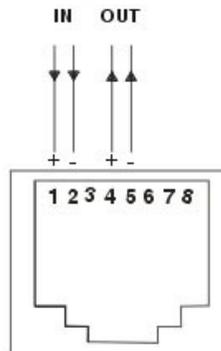
An RJ-48F female connector is provided on the rear panel for the connection of the T1/E1 wire pairs. When viewing the RJ-48F connector, the left pair (Pin # 1 & 2) of the RJ-48F connector are for T1/E1 signal going into the TC8610-1 (receive), while the right pair (Pin # 4 & 5) of the RJ-48F connector are for the transmit signal coming out of the unit.



DRY CONTACT (ALARM)  
 NO - Normal Open/NC - Normal Closed

Rear Panel DIP Switches

Terminal Block Connectors  
 for Power A & B

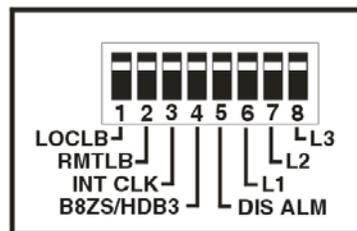


T1/E1 Signal Input, Output  
 RJ-48 Female Connector  
 T1 (100 Ω) or E1 (75 Ω or 120 Ω)

Note 1: The T1/E1 signal use the same pin connections on the RJ-48 female connector.

**Figure 2-14 TC8610-1 Rear Panel T1/E1 Connector & Pin Assignment**

### 2.7.5.2 Rear Panel DIP Switch Functions



**Figure 2-15 Rear Panel DIP Switch**

The DIP switch functions on the TC8610-1 are described below. To activate the function, set the appropriate switch to the On (Down) position.

- **LOCLB:** Local Loopback. This switch (SW1) initiates the Local Loopback function. The RS-422 signals are received on the “RX Data” pins and looped back to the ”TX Data” pins for diagnostic testing.

- **RMTLB:** Remote Loopback. This switch (SW2) initiates the Remote Loopback function. Enabling this switch on the local unit triggers the remote loopback function on the remote unit.
- **INT CLK:** Internal Clock. This switch (SW3) is used to setup the T1/E1 timing mode. "On" for internal timing mode. "Off " for Rx loop timing mode.
- **B8ZS/HDB3:** This switch (SW4) is used to setup the T1/E1 Line Code. "On" for B8ZS (T1) or HDB3 (E1). "Off" for AMI.
- **DIS ALM:** This switch (SW5) is used to disable the audio buzzer and dry contact alarm relay. "On" (down) position disables the buzzer and relay. "Off" enables the buzzer and relay. "DIS ALM" dip switch should be in "Off" under normal condition.
- **L1, L2, L3:** These switches (SW6, SW7, & SW8) are used to set the T1/E1 cross-connect distance (copper line build-out).

For example, in a T1/E1 application, this is the length of twisted pair cable connecting the TC8610-1 to the user's equipment, which may be a CSU or DSU. See Table 2-1.

**Table 2-1: Copper Line Length Setup Table**

<b>T1 Settings</b>			
<b>L3</b>	<b>L2</b>	<b>L1</b>	<b>Application Line Length</b>
Off	Off	Off	DSX-1 (0 to 133 feet) / 0 dB CSU
Off	Off	On	DSX-1 (133 to 266 feet)
Off	On	Off	DSX-1 (266 to 400 feet)
Off	On	On	DSX-1 (400 to 533 feet)
On	Off	Off	DSX-1 (533 to 655 feet)
On	Off	On	-7.5 dB CSU
On	On	Off	-15 dB CSU
On	On	On	-22.5 dB CSU

**Table 2-2: E1 Termination Setup Table**

<b>E1 Settings</b>			
<b>L1</b>	<b>L2</b>	<b>L3</b>	<b>Application Termination</b>
Up	Up	Up	75 Ohm Normal
Down	Up	Up	120 Ohm Normal
Up	Up	Down	75 Ohm High Loss
Down	Up	Down	120 Ohm High Loss

## 3.1 Introduction

The TC8610-1 is designed for quick and easy installation. First, configure the unit for your specific application by setting the Line Code, and Line Length DIP switches. Once configured, you can connect the Serial, T1/E1 signal source and power.

## 3.2 Setup

1. Set the appropriate Line Code for your application with the rear panel DIP switch SW4. "On" for B8ZS (T1) or HDB3 (E1). "Off" for AMI.
2. For T1/E1 applications, set the appropriate T1/E1 Line Length with the rear panel DIP switch SW6, SW7, & SW8. It is set to "0-133 feet" by default.
3. Set the appropriate T1/E1 timing mode with rear panel DIP switch SW3. There should be one and only one clock source throughout the entire T1/E1 network. If two TC8610-1 units are connected back to back, one unit should set to "Internal" timing mode, and the other unit should set to "RX Loop" timing mode.
4. Verify the serial pin connections as well as the T1/E1 pin connections. After that, connect the two TC8610-1 units with a T1/E1 cable.
5. Connect the serial signal source to the TC8610-1 Port 1 RJ-11 connector.
6. Verify the corresponding channel's "Rx" LED is solidly lit to indicate that data is being received. If the "Rx" LED does not light up solidly on a particular channel, it usually indicates incorrect connections at the RJ-11 input port (Please double-check your connections and verify them with the connection diagram see Figure 2-1, *TC8610-1 Front Panel RJ-11 Ports Pin Assignments*, on page 2-3.)
7. For RS-485, use internal dip switch SW2-1, SW2-2 to set the appropriate baud rate. ( Table 3-1 )

**Table 3-1 RS-485 Baud Rate**

SW 2-1	SW 2-2	
OFF	OFF	4.8 Kbps
ON	OFF	9.6 Kbps (Default)
OFF	ON	19.2 Kbps
ON	ON	38.4 Kbps

## In this chapter:

- *Local Loopback Test*, on page 4-4
- *Remote Loopback Test*, on page 4-4

## 4.1 Introduction

It is highly recommended to conduct bench tests before actual installation. Bench testing allows the user to become familiar with all the functions and features of the TC8610-1 in a controlled environment. Knowledge of these functions and features will ease installation and troubleshooting efforts later on.

Loopback tests assist troubleshooting by helping in pinpointing the source of errors. The TC8610-1 is a sophisticated product designed with multiple advanced technologies. Loopback tests have been implemented to test independent components of it.

## 4.2 Latched Alarm

The front panel "ALM", "BPV", "CRC" and "SYNC" LEDs can display both current and latched error conditions.

For example, if the "ALM" LED is on, and "SYNC" LED blinks twice, it indicates that there are two "T1/E1 sync loss" after the last alarm reset.

To reset the alarm, press and hold the "R2" ("Reset Too") button for 3 seconds until the "ALM", "BPV", "CRC", and "SYNC" LEDs are flashing. The alarm will reset after the "R2" button is released.

See the table below for latched alarm definitions,

**Table 4-1 Latched Alarm Definitions**

LED	Normal	Current Error	Latched Error	Note
ALM	Off	Flashing Continuously	On	
BPV	Off	Flashing Continuously	Blink	The number of blinks indicates the number of times the error condition happens. (Max. 3 Blinks)
CRC	Off	Flashing Continuously	Blink	The number of blinks indicates the number of times the error condition happens. (Max. 3 Blinks)
SYNC	On	Flashing Continuously	Blink	The number of blinks indicates the number of times the error condition happens. (Max. 3 Blinks)

## 4.3 Remote Unit Status Monitoring and Remote Unit Alarm Reset

TC8610-1 is capable of monitoring the remote unit status and resetting the remote unit alarm condition.

Short press (less than 3 seconds) the "R2" button will toggle between local and remote status display.

"RMT" LED Off: Display Local Status

"RMT" LED On: Display Remote Status

To monitor remote unit status:

1. Check if T1/E1 connection is established ("SYNC" LED is solidly lit).
2. Short press (< 3 secs) the "R2" button and the "RMT" LED should be lit to indicate it is displaying remote unit status.
3. When "RMT" LED is lit, "ALM", "BPV", "CRC", and "SYNC" LEDs will be displaying remote unit status.
4. The "RMT" LED will turn off automatically after 20 seconds and switch back to local status display.

To reset remote unit alarm condition:

1. Check if T1/E1 connection is synched ("SYNC" LED is solidly lit).
2. Short press (< 3 secs) the "R2" button and the "RMT" LED should be lit to indicate it is displaying remote unit status.
3. Press and hold the "R2" button for 3 seconds until the "ALM", "BPV", "CRC", and "SYNC" LEDs are flashing. The remote unit alarm will reset after the "R2" button is released.
4. The "RMT" LED will turn off automatically after 20 seconds and switch back to local status display.

## 4.4 Local Loopback Test

When the rear panel SW1 (LOCLB) in the On (Down) position the serial signals are received on the “RD” pins and looped back to the ”TD” pins on the TC8610-1.

1. The “TX” LED will be flashing amber for that particular channel being tested and the "ALM" alarm LED will flash to indicate that the unit is in local loopback mode. (Note, the TX LED will be lit green when TX activity is detected.)
2. Make sure that the serial device or BERT tester indicates a "SYNC" signal.
3. Upon successful completion of this test, please return DIP switch SW1(LOCLB) to the Up (Off) position.

### Local Loopback Test

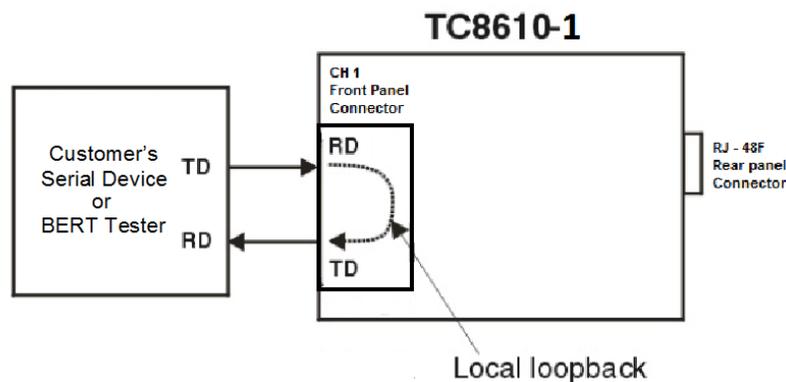
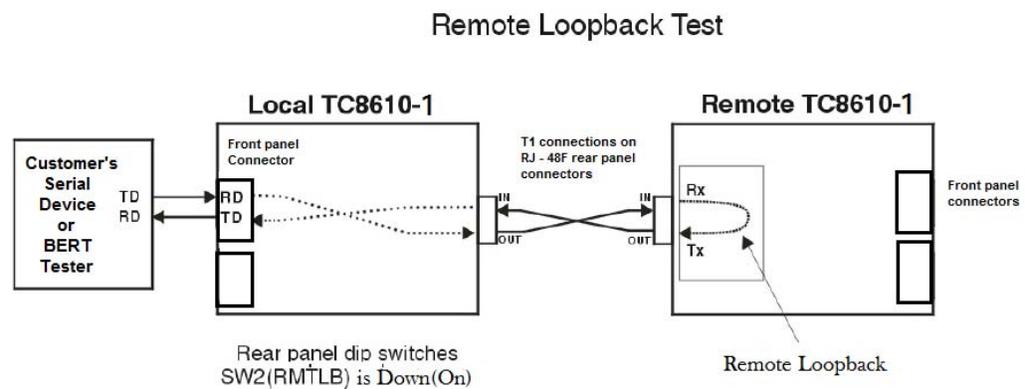


Figure 4-1 Local Loopback Test

## 4.5 Remote Loopback Test

1. Connect the local and remote TC8610-1 units as shown on the diagram below. (Note, testing for Port 1 will be shown, Port 2-4 can be tested with the same setup.)
2. Connect the T1/E1 connections as shown on the diagram below. Be sure to make the correct pin connections, refer to Figure 2-14, *TC8610-1 Rear Panel T1/E1 Connector & Pin Assignment*, on page 2-13 for pin assignments.
3. Verify that both TC8610-1 units have the same Line Code and Line Length settings.
4. The local unit should be set as "Internal" timing mode (SW3 down) and the remote unit as “RX Loop” timing mode (SW3 up). T1/E1 sync should be established and “SYNC” LED should be solidly lit on both units.

5. On the local TC8610-1, set DIP switch SW2 (Remote Loopback) to the Down (On) position. Observe that the "ALM" alarm LED will flash indicating that the unit is in (remote loopback) mode. The "RX" and "TX" LEDs on local unit Port 1 should be solidly lit indicating the serial signal is looped back as shown on diagram below.
6. On the remote TC8610-1, observe that the "ALM" alarm LED will flash indicating that the unit is in (remote loopback) mode. The "TX" LEDs will be solidly lit. The "RX" LED will be flashing amber.
7. Make sure the BERT tester indicates a "SYNC" signal.
8. Upon successful completion of this test, return SW2 on the local unit to the "Off" or up position.



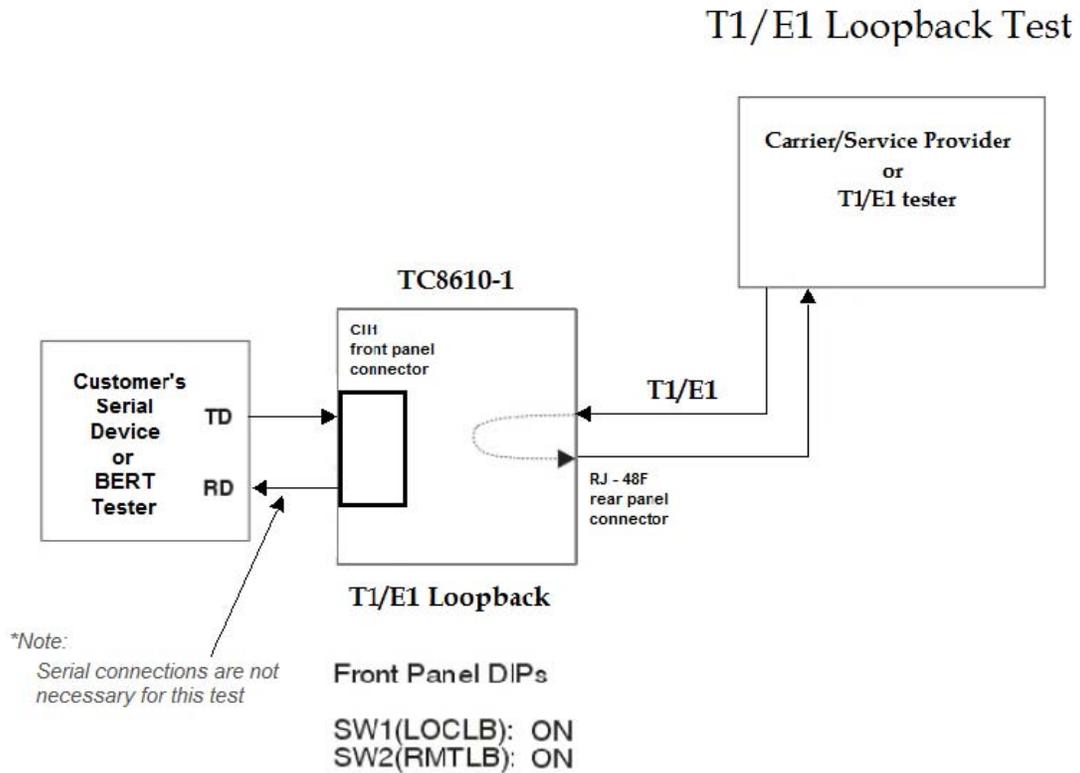
**Figure 4-2 Remote Loopback Test**

## 4.6 T1/E1 Local Loopback Test

A T1/E1 Local loopback is used to test T1/E1 wiring and T1/E1 transceiver functionality. It can be enabled by pushing both rear panel DIP switches SW1 & SW2 to the "On" (down) position. The diagram below shows the T1/E1 signal flow and related loopback path.

1. The "ALM" LED should be flashing indicating the unit is in T1/E1 Loopback mode.
2. The "LOS" LED should be off indicating that a valid T1/E1 signal is being received. If the "LOS" LED is flashing it means that the TC8610-1 is not receiving a valid T1/E1 or the T1/E1 cable is in question. Please reference Figure 2-14, *TC8610-1 Rear Panel T1/E1 Connector & Pin Assignment*, on page 2-13 for T1/E1 pinouts.
3. The T1/E1 signal should be looped back to the Carrier/Service Provider or T1/E1 tester. Please make sure a valid T1/E1 signal is being received.

- Upon successful completion of this test, please return dip switches SW1(LOCLB) and SW2(RMTLB) to the Up (Off) position for normal operation of the TC8610-1 unit(s).



**Figure 4-3 T1/E1 Loopback**

## 5.1 General

Alarm conditions occur whenever a T1/E1 sync "fault" condition is detected by the TC8610-1. Under normal operation, PWR, Vcc, and SYNC LEDs should be lit.

## 5.2 All LEDs are OFF

If no LEDs are lit on the unit, check the DC power supply, connector plug, and/or the power source. If the problem persists, contact the Technical Support Department at TC Communications, Inc. @ (949) 852-1973.

## 5.3 Alarm LED

The ALARM LED will flash when the unit detects any error, such as T1/E1 loss of frame (no SYNC) or T1/E1 loss of signal (LOS), or in any loopback modes. It will light solidly to indicate a latched alarm condition.(See 4.2 for Latched alarm)

# Appendix A 19" Rack Mount Card Cage

## A.1 Features

- 1U height (1.75")
- Universal Power Supply Accepts 90V to 264V AC and 47 to 63 Hz AC
- Standard Power Supply is 12VDC, Optional 24VDC, -48VDC, 125VDC, or AC Power Supply Available
- Over Load & Short Circuit Protection

## A.2 Description

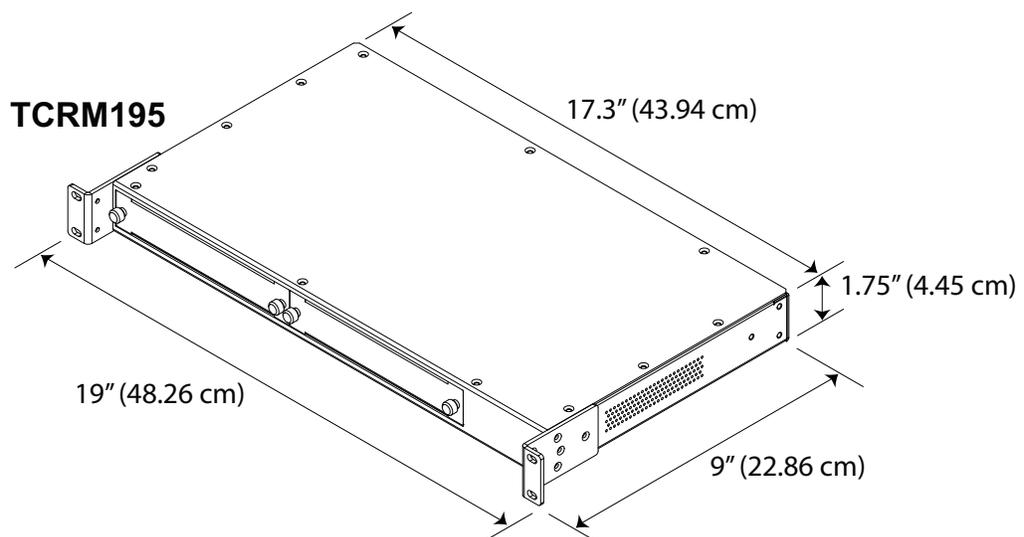
The TCRM195 "Pizza Box" Rack Mount Card Cages hold up to 2 single multiplexer type cards.

It operates with one power supply. The AC power supply automatically adjusts for 90V to 264V AC input and 47 to 63 Hz operation. The DC power supply accepts 24VDC, -48VDC, or 125VDC input (Optional).

The rack assemblies are 19" wide by 1.75" high. The TCRM195 is 9" deep.

## A.3 Chassis Ground

The Stand alone and Rack mount chassis provide a connection point for chassis ground with a dedicated chassis ground screw and lock washer. The chassis ground screw is located on the rear side of the chassis. This chassis ground connection point is available in case chassis ground is taken into design consideration by the end user.



**Figure A-1 Rack Mount Chassis (TCRM195) Dimensions**

# Appendix B

# Components Placement

## B.1 Overview

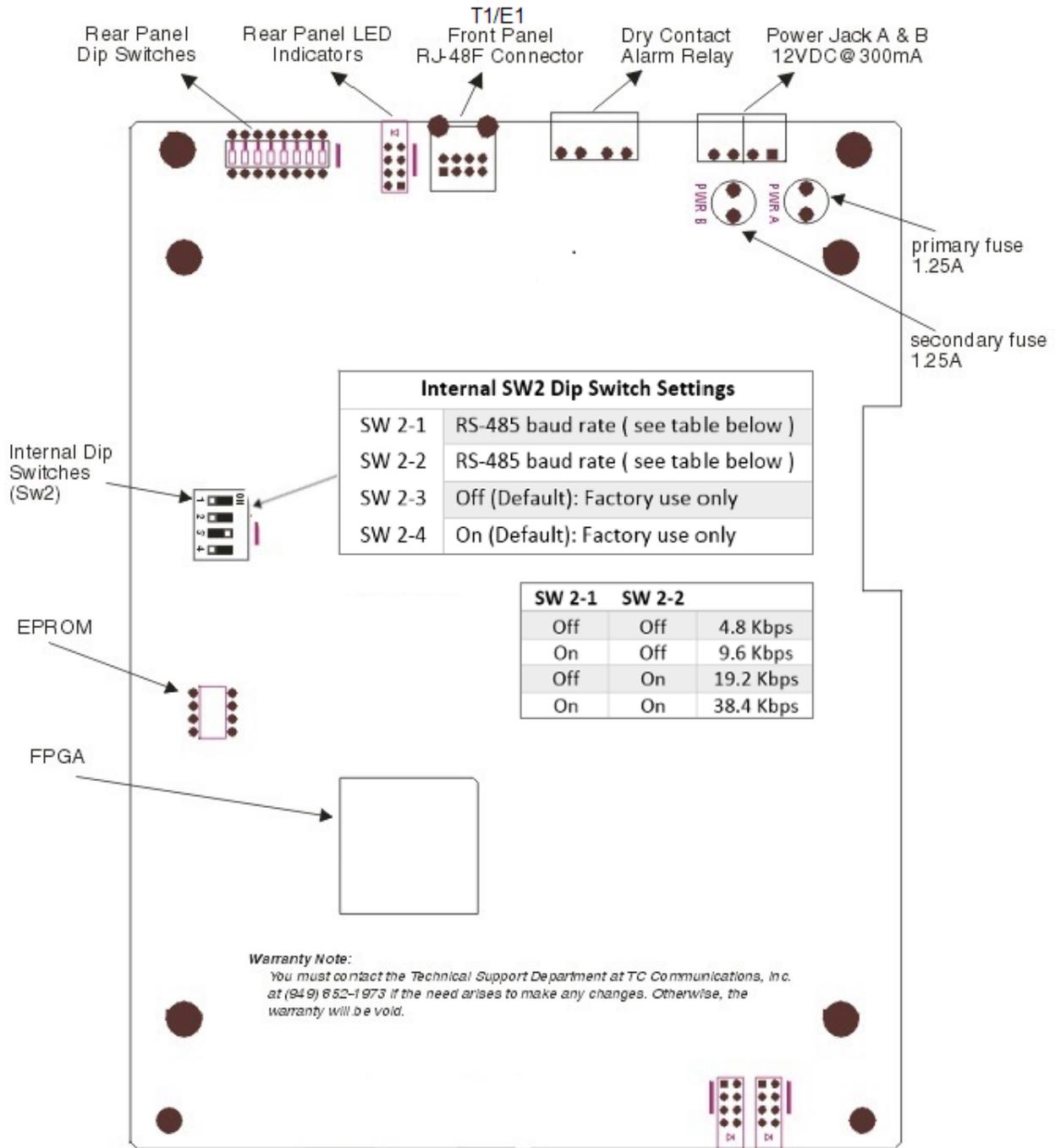


Figure B-1 TC8610-1 PCB Layout

# Appendix C R2 Button & LED Functions

## C.1 R2 (“Reset Too”) Button Description

The recent enhancements implemented on the TC8610-1 (RS-232 over T1/E1) will make troubleshooting a much easier process. The alarm LEDs - BPV, CRC, and SYNC - can now latch abnormal conditions until they are reset by the user. These functions are realized in part by the newly added "R2" ("Reset Too") push button.



**Figure C-1 Front Panel "R2" push Button**

The "R2" push button is for displaying remote unit LED status and to reset local or remote error and alarm LEDs.

### C.1.1 R2 (“Reset Too”) Push Button Functions

R2 push button:

1. To reset the local unit's alarm LEDs, hold down the R2 button for at least 3 seconds until you see the alarm LEDs flash in sequence.
2. To display the remote unit's alarm LEDs on the local unit, briefly press the R2 button on the local unit. The local unit's RMT LED will subsequently turn on and whatever alarm LEDs are being displayed on the remote unit will now be displayed on the local unit's alarm LEDs.
3. To reset the remote unit's alarm LEDs from the local unit, while the RMT LED is lit on the local unit, hold down the local unit's R2 button for at least 3 seconds until you see the alarm LEDs flash in sequence.

Automatic return to local alarm LED status:

Upon briefly pressing the R2 button on a local unit, the local unit will remain in remote alarm LED status (RMT LED is on) for 20 seconds, after which the local unit will automatically revert back to local alarm LED status.

## C.2 LED Functions

**RMT:** displays the remote unit's LED status on the local unit

**BPV:** displays bi-polar violation(s) for the ingress T1/E1 signal

**CRC:** displays error(s) in data integrity (only for T1/E1 ESF frame and E1 built-in CRC)

**SYNC:** displays frame locking for T1/E1 (ESF framing) or E1 (PCM31C framing)

The alarm LEDs - BPV, CRC and SYNC - all have a latching functionality to indicate the number of occurrences for each error. These LEDs will continuously flash at regular intervals until reset by the user. The behavior is noted here:

- When an LED blinks once, it indicates a single error has occurred once. When an LED blinks twice, it indicates the error has occurred twice. When the LED blinks 3 times, it indicates the error has occurred 3 or more times.

## C.3 CSU Loop Operation

When the ISP transmits the CSU Loop Up Code towards the unit, the unit will recognize the code and loop back the entire T1/E1 signal back towards the ISP.

Once the Loop Up condition is established, the unit alarm will be flashing and the ISP may perform BER testing and other tests on the looped link.

To cancel the loop, the ISP must transmit the CSU Loop Down Code towards the unit. Alternatively, disconnecting the T1/E1 cable will also cancel the loop.

## D.1 Return Policy

To return a product, you must first obtain a Return Material Authorization number from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please provide a description of the problem and any results of diagnostic tests that have been conducted.

### D.1.1 Warranty

Damages by lightning or power surges are not covered under this warranty.

All products manufactured by TC Communications, Inc. come with a five year (beginning 1-1-02) warranty. TC Communications, Inc. warrants to the buyer that all goods sold will perform in accordance with the applicable data sheets, drawings or written specifications. It also warrants that, at the time of sale, the goods will be free from defects in material or workmanship. This warranty shall apply for a period of five years from the date of shipment, unless goods have been subject to misuse, neglect, altered or destroyed serial number labels, accidents (damages caused in whole or in part to accident, lightning, power surge, floods, fires, earthquakes, natural disasters, or Acts of God.), improper installation or maintenance, or alteration or repair by anyone other than Seller or its authorized representative.

Buyer should notify TC Communications, Inc. promptly in writing of any claim based upon warranty, and TC Communications, Inc., at its option, may first inspect such goods at the premises of the Buyer, or may give written authorization to Buyer to return the goods to TC Communications, Inc., transportation charges prepaid, for examination by TC Communications, Inc. Buyer shall bear the risk of loss until all goods authorized to be returned are delivered to TC Communications, Inc. TC Communications, Inc. shall not be liable for any inspection, packing or labor costs in connection with the return of goods.

In the event that TC Communications, Inc. breaches its obligation of warranty, the sole and exclusive remedy of the Buyer is limited to replacement, repair or credit of the purchase price, at TC Communications, Inc.'s option.

To return a product, you must first obtain a Return Material Authorization (RMA) number and RMA form from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please fill out RMA form provided with a description of the problem(s) and any results of diagnostic tests that have been conducted. The shipping expense to TC Communications should be prepaid. The product should be properly packaged and insured. After the product is repaired, TC Communications will ship the product back to the shipper at TC's cost to U.S. domestic destinations. (Foreign customers are responsible for all shipping costs, duties and taxes [both ways]. We will reject any packages with airway bill indicating TC communications is responsible for Duties and Taxes. To avoid Customs Duties and Taxes, please include proper documents indicating the product(s) are returned for repair/retest).

### **D.1.2 Limitation of Liability**

1. In no event shall the total liability of TC COMMUNICATIONS, INC. to purchaser and/or end user for all damages including but not limited to compensatory, consequential and punitive damages, exceed the total amount paid to TC Communications, Inc. by purchaser for the goods from which the claim arose, in no event shall TC COMMUNICATIONS, INC. be responsible for indirect and consequential damages.
2. In no event shall liability attached to TC COMMUNICATIONS, INC. unless notice in writing is given to TC COMMUNICATIONS, INC. within ten days of the occurrence of the event giving rise to such claim.
3. TC COMMUNICATIONS, INC. shall not be responsible for delays or non-deliveries directly or indirectly resulting from or contributed to by foreign or domestic embargoes, seizure, fire, flood, explosion, strike, act of God, vandalism, insurrection, riot, war, or the adoption or enactment of any law, ordinances, regulation, or ruling or order or any other cause beyond the control of TC COMMUNICATIONS, INC.
4. TC COMMUNICATIONS, INC. shall not be responsible for loss or damage in transit and any claims for such loss or damage shall be filed by the purchaser with the carrier.

# Index

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## C

cabling, 2-3

## D

DCAR, 2-2

## E

electrical, 5-1

environmental  
requirements, 2-1

## F

front panel, 2-2

## L

latched alarm, 4-2

LED verification sequence  
power-up, 4-4

local loopback test, 4-4

## M

mechanical  
installation, 2-2

## P

power  
unit, 2-2

power-up LED verification sequence, 4-4

## R

R2 Button, C-1

remote loopback, 4-4

## T

T1/E1 local loopback test, 4-5

troubleshooting, 4-1, 5-1

## U

unpacking, 2-1

## W

web  
interface, 1-5