

# **TC8616**

## **2-Channel C37.94-over-T1/E1 Multiplexer**

**User Manual**  
**MNL-86160-01-05**



TC Communications, Inc. 17881 Cartwright Road - Irvine, CA 92614

Tel: (949) 852-1972 Fax: (949) 852-1948 Web Site: [www.tccomm.com](http://www.tccomm.com) Email: [sales@tccomm.com](mailto:sales@tccomm.com)

---

All Rights Reserved

Copyright © 2019 by TC Communications. Products described in this publication are protected by one or more U.S. and foreign patents.

## Trademarks

The TC Communications® logo is a registered trademark.

JumboSwitch® is a registered trademark of TC Communications.

Other product and brand names may be trademarks or registered trademarks of their respective owners.

## Documentation Disclaimer

This document is provided “as-is” and is to be used only as a general guide. TC Communications disclaims all warranties, express or implied, regarding the accuracy of the information. TC Communications shall not be liable for any indirect, special, incidental, or consequential damages (including damages for loss of business, loss of profits, loss of business information, business interruption or other pecuniary loss) arising out of errors in this document.

The information given in this document is reviewed regularly and any necessary corrections will be included in subsequent editions. We appreciate any suggested improvements. We reserve the right to make technical improvements without notice.

Dissemination or reproduction of this document, or evaluation and communication of its contents, is not authorized except where expressly permitted. Violations are liable for damages. All rights reserved, particularly for the purposes of patent application or trademark registration. This document contains proprietary information, which is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced or translated to another language without the prior written consent of TC Communications.

# Record of Revisions





Revision	Date	Description of Changes
1.0	02/06/17	Initial Release of TC8616.
1.1	02/15/17	2 Channel T1/E1 combined information.
1.2	01/25/18	Updated rear panel LED definition, dip switch image, rear panel pin assignment image.
1.3	02/21/18	Updated descriptions and specifications. Update product photos. Updated LED definitions. Added Appendix C “R2 Button & LED Functions”
1.4	12/06/2018	Added Appendix C.3 CSU Loop Operation.
1.5	11/18/2019	Updated LED definitions. Updated product images.

TC Communications  
17881 Cartwright Road  
Irvine, California U.S.A. 92614  
Tel. (949) 852-1972  
Fax (949) 852-1948  
E-Mail: [sales@tccomm.com](mailto:sales@tccomm.com)  
Website: [tccomm.com](http://tccomm.com)

---

## 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

---

<b>1</b>	<b>Introduction</b>	
1.1	General Information . . . . .	1-1
1.2	Product Description . . . . .	1-1
1.2.1	Features . . . . .	1-4
1.2.2	Applications. . . . .	1-5
1.3	Specifications . . . . .	1-7
<b>2</b>	<b>Installation</b>	
2.1	Unpacking . . . . .	2-1
2.2	Equipment Location . . . . .	2-1
2.3	Power Supply . . . . .	2-1
2.4	Dry Contact Alarm Relay (DCAR) . . . . .	2-2
2.5	System Start Up . . . . .	2-2
2.6	System Configuration . . . . .	2-3
2.6.1	TC8616 Front Panel - C37.94 over TDM . . . . .	2-3
2.6.2	TC8616 Rear Panel - C37.94 over TDM. . . . .	2-4
2.6.3	Front Panel (C37.94 Connectors). . . . .	2-6
2.6.4	T1/E1 RJ-48F Connector & Pin Assignments. . . . .	2-7
<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 . . . . .	4-1
4.3	Remote Unit Status Monitoring and Remote Unit Alarm Reset . . . . .	4-2
4.4	T1/E1 Local Loopback Test . . . . .	4-3
<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
C.1.1	R2 (“Reset Too”) Push Button Functions . . . . .	C-1
C.2	LED Functions . . . . .	C-2
C.3	CSU Loop Operation . . . . .	C-2

# TABLE OF CONTENTS

---

## Appendix D Return Policy

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

## 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 TC8616 C37.94-over-T1/E1 multiplexer.

## 1.2 Product Description

The TC8616 is a one or two channel C37.94-over-T1/E1 multiplexer. For T1 Channel 1 supports N=1 to 12 and Channel 2 support N=1 to 8. For E1 both channels support N=1 to 12. This allows network managers the flexibility to leverage existing T1/E1 circuits by adding teleprotection relays. It is economical, simple to install and comes standard with builtin power redundancy.

The TC8616 is available in two configurations:

- Multimode
- Single-mode

Diagnostics are extensive and 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, Remote Unit Status, and RX/TX for the C37.94 channels.

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 TC8616 is compatible with standard T1 and 75Ω / 120Ω E1. The T1/E1 uses a RJ48 connector. (Optional BNC adapter cable is available for 75 Ohm E1.) The C37.94 uses either multimode or single-mode connectors. Power is 12VDC standard or optional 24VDC, -48VDC, 125VDC, or 115/230VAC with an external power cube. High temperature (-20°C to 70°C) and extreme temperature versions (-40°C to 80°C) are also available.



Figure 1-1 TC8616 Front Panel

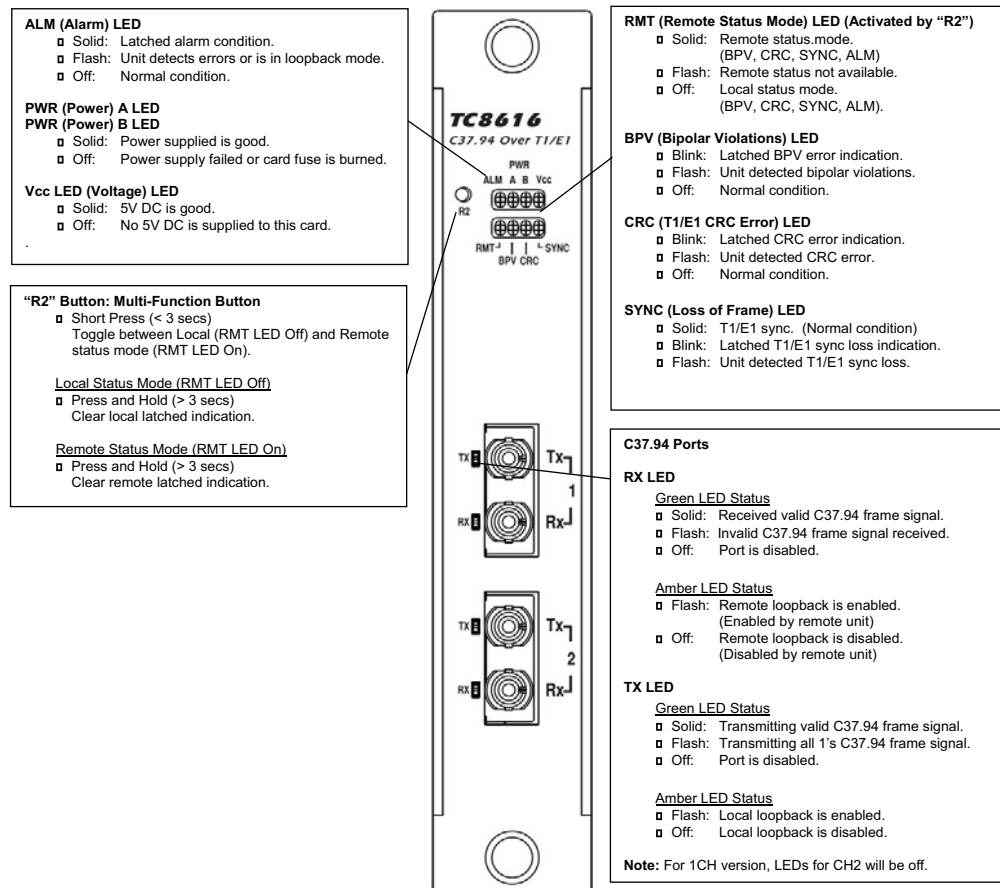


Figure 1-2 TC8616 Front Panel LED Definitions



Figure 1-3 TC8616 Rear Panel

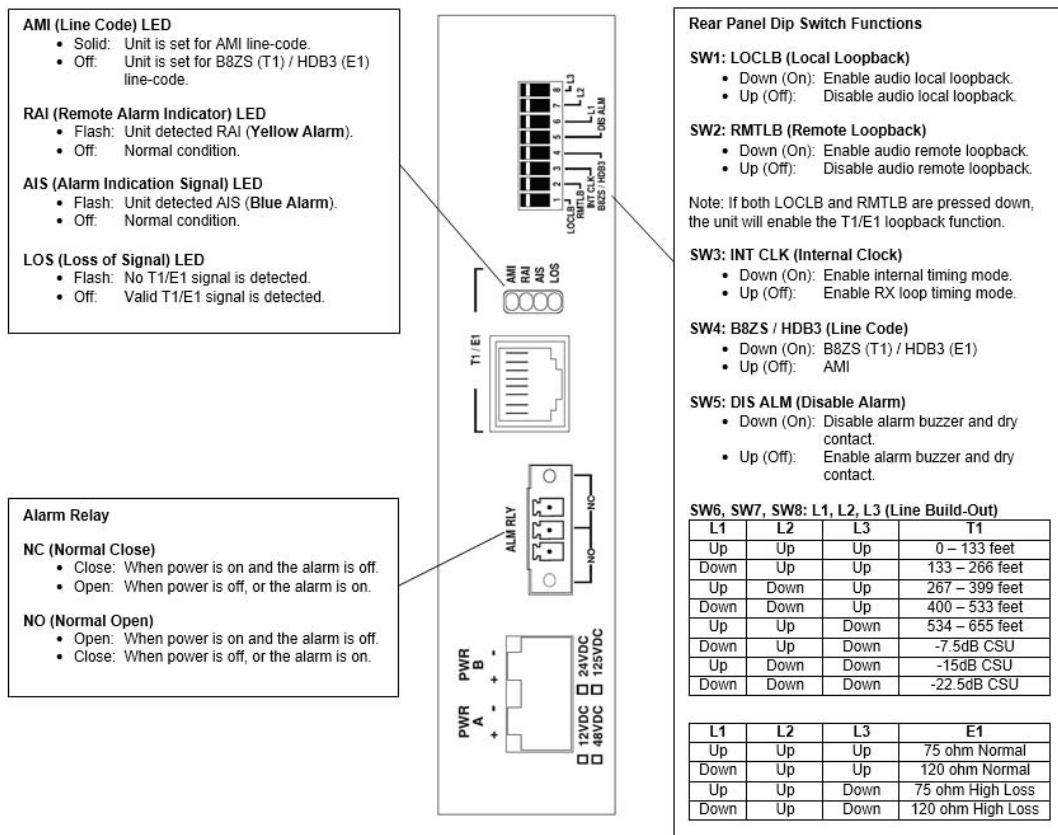


Figure 1-4 TC8616 Rear Panel LED Definitions

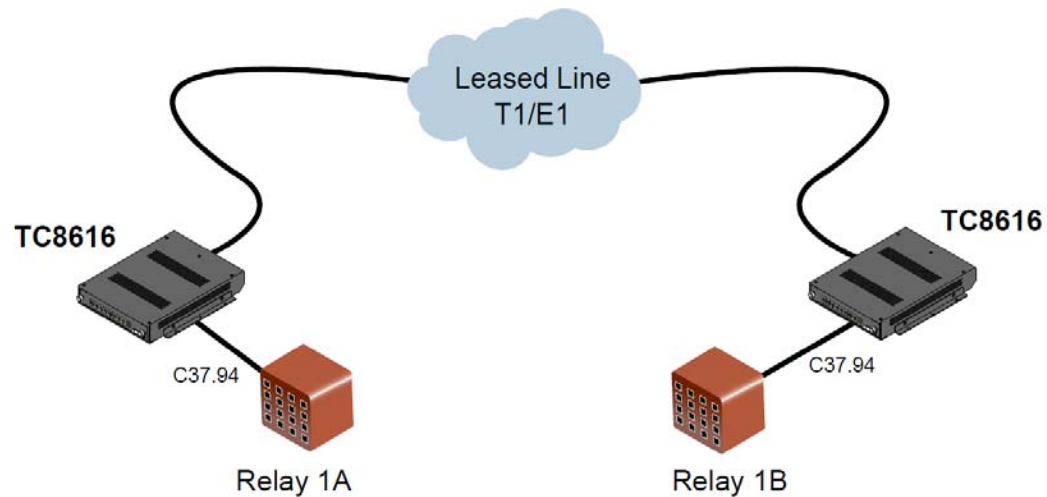


## 1.2.1 Features

- Extends IEEE C37.94 interfaces over T1/E1
- For T1:
  - Channel 1 supports N=1 to 12
  - Channel 2 supports N=1 to 8
- For E1:
  - Both channels support N=1 to 12
- ESF Framing Support for T1
- PCM31C Framing Support for E1
- Very Low Latency
- 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)
- RMT LED to indicate remote unit monitoring
- Built-in Power Redundancy
- Diagnostic DIP Switches for Local Loopback and Remote Loopback Tests & more.
- Rack Mount or Stand Alone

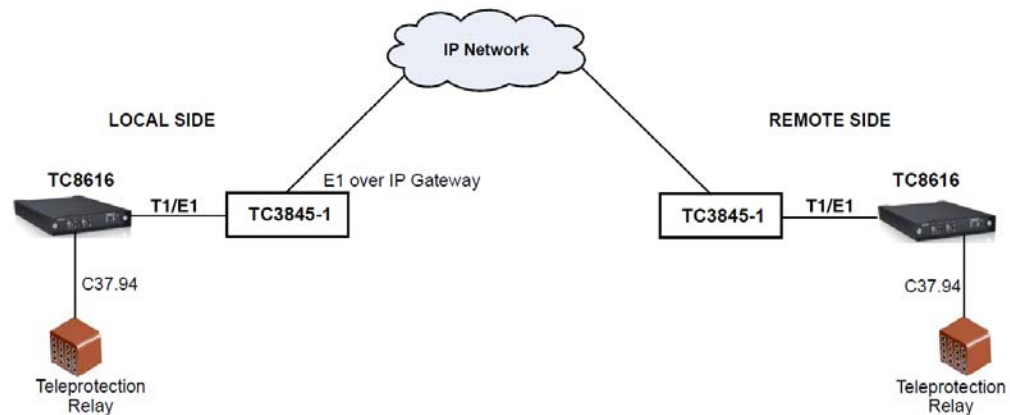
## 1.2.2 Applications

The TC8616 C37.94-over-T1/E1 Multiplexer is a low cost and immediate solution, typically used to link or extend C37.94 Teleprotection relays over existing T1/E1 links.



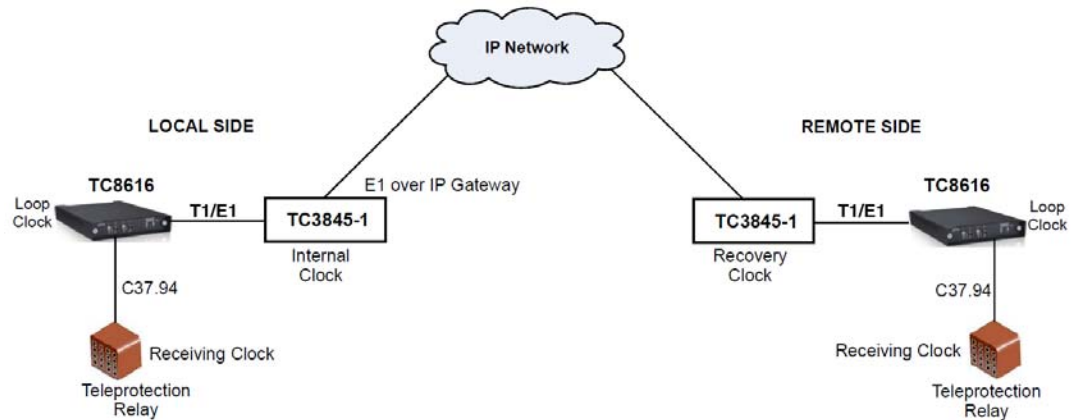
**Figure 1-5 Typical Application using the TC8616**

Figure 1-6 shows a simple application connections by using a pair of TC3845-1 (T1/E1-over-IP Gateway) JumboSwitch® devices and a pair of TC8616 devices over an IP Network to link communication between two teleprotection relays. Please make sure that all the connections such as T1/E1 and C37.94 are properly connected.



**Figure 1-6 TC8616 Over IP Application**

Figure 1-7 below, shows the same application diagram as above but now emphasizes on the setup of the main clock signal. The main clock signal is provided by the TC3845-1 unit situated on the local side as referenced on the diagram. This is the clock source that will be utilized by the application and there must only be one clock source. After all proper connections have been verified, the communication between the teleprotection relays should be established. Verify that your relays are synchronized if not make sure to check the integrity of all connections.



**Figure 1-7 TC8616 Over IP Application (with clock signal)**

## 1.3 Specifications

<b>Connection Capacity</b>	
C37.94	
For T1	Channel 1 N=1 to 12 Channel 2 N=1 to 8
For E1	Channel 1 N=1 to 12 Channel 2 N=1 to 12

<b>Electrical</b>	
T1/E1 Connector	RJ-48F

<b>Optical Interface Specification (C37.94)</b>	
Transmitter	LED/ELED
Receiver	PIN Diode
Wavelength	850nm MM 1300/1550nm SM
Fiber Optic Connector	ST
Loss Budget* - 850/1300/1550nm	(*Contact factory for higher requirements)
Multimode @ 62.5/125µm	15dB
Single Mode @ 9/125µm	20dB

<b>System</b>	
Bit Error Rate	1 in 10 <sup>9</sup> or better
Visual Indicators	PWR A, PWR B, Vcc, ALM, RMT, RAI, AIS, CRC, SYNC, AMI, BPV, LOS, RX/TX (each C37.94 ports)
Diagnostic Functions	Local Loopback, Remote Loopback

<b>Power Source</b>	
Standard	12VDC @300mA
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	(907g) 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"
Depth	(22.86 cm) 9"
Weight	(1.86 Kg) 4.1 lbs.

## 2.1 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

### 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.

## 2.2 Equipment Location

The TC8616 should be located in an area that provides adequate light, work space and ventilation.

### IMPORTANT

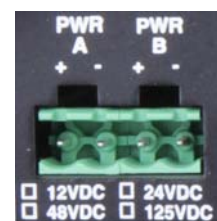


Avoid locating it next to any equipment that may produce electrical interference or strong magnetic fields, such as elevator shafts or heavy duty power supplies.

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

## 2.3 Power Supply

The TC8616 can be powered by an external DC power adapter rated 12 VDC @300mA. There are two terminal block connectors labeled "PWR A" and "PWR B" only one is required to power up the unit. Since each TC8616 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.

## 2.4 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.

## 2.5 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**

TC8616 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 T1/E1 connection has not been established.

## 2.6 System Configuration

The TC8616 has been pre-tested and switches have been set per factory specifications.

### 2.6.1 TC8616 Front Panel - C37.94 over TDM

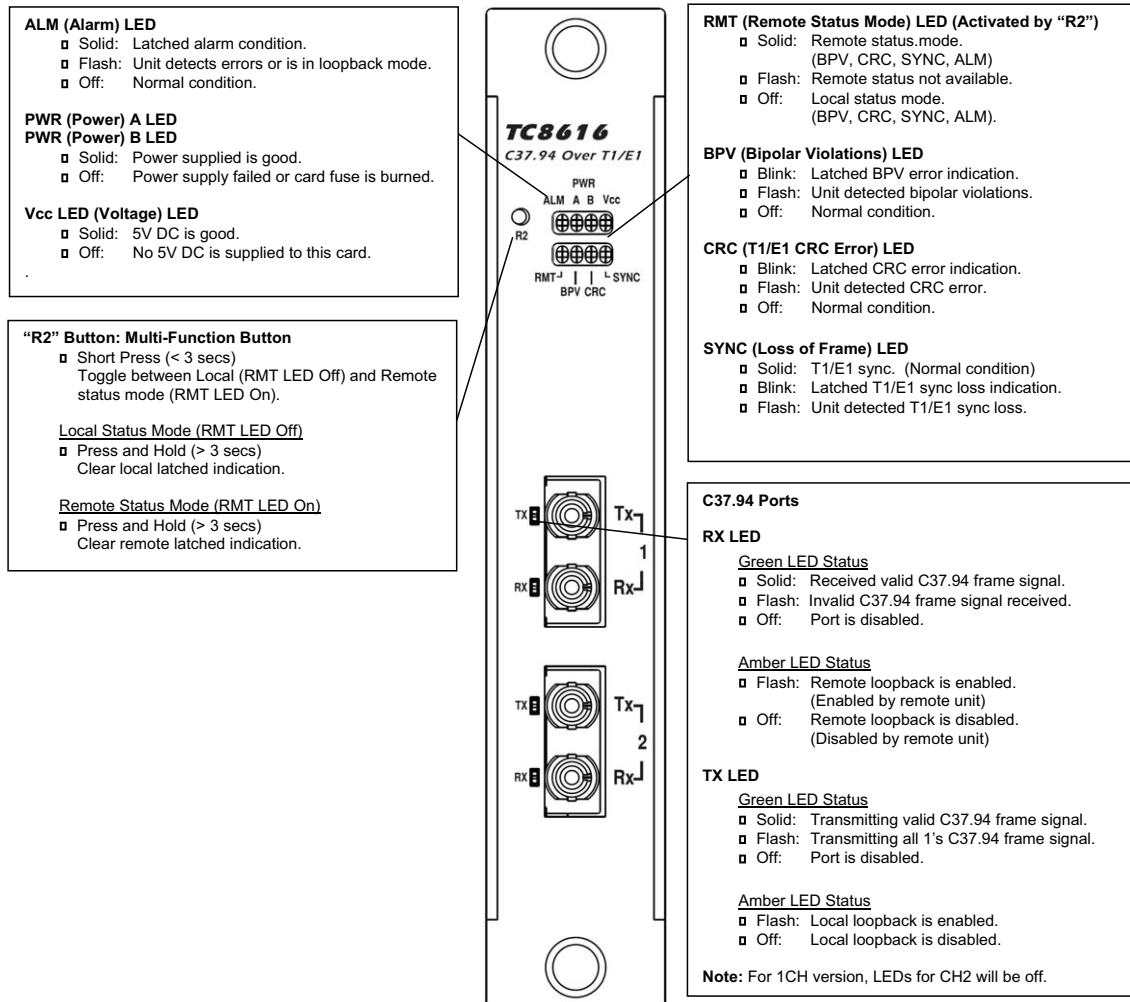


Figure 2-1 TC8616 Front Panel - C37.94 over TDM



## 2.6.2 TC8616 Rear Panel - C37.94 over TDM

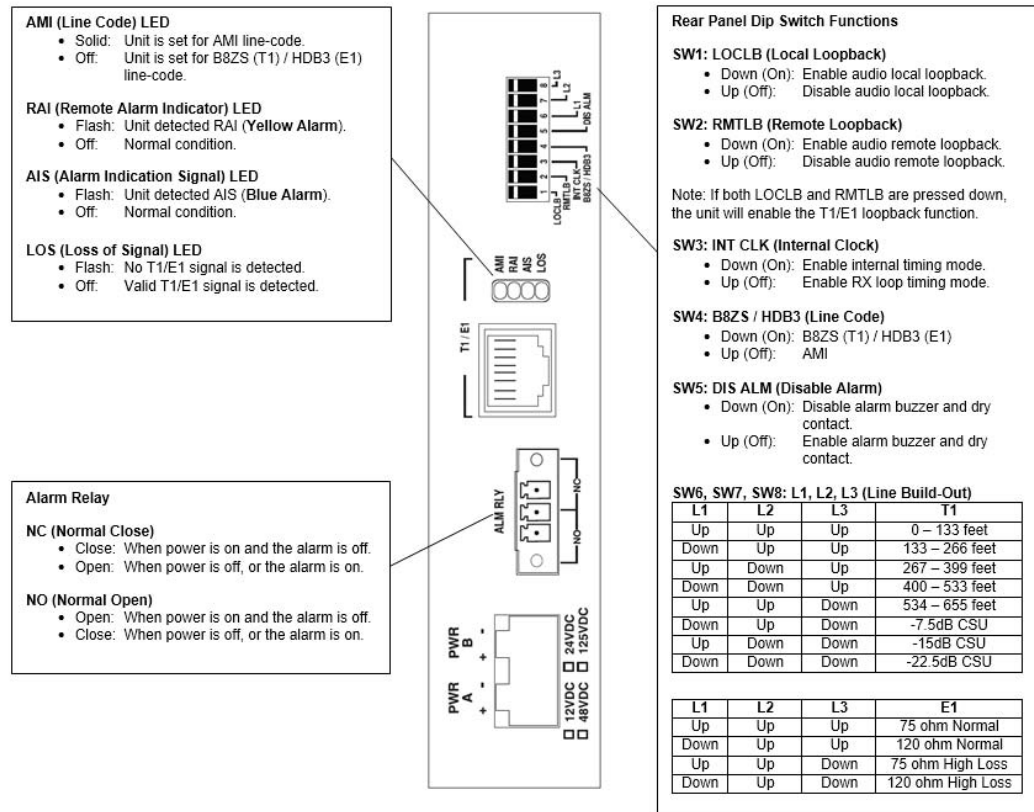
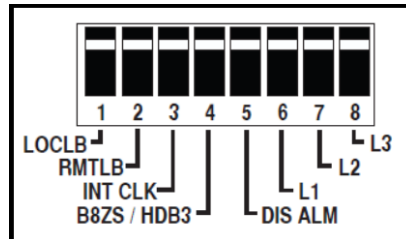


Figure 2-2 TC8616 Rear Panel - C37.94 over TDM

### 2.6.2.1 Rear Panel DIP Switch Functions



**Figure 2-3 Rear Panel Dip Switches TC8616**

The DIP Switch functions on the TC8616 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 voice signals received are looped back 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 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 crossconnect distance (copper line build-out/impedance).

For example, in a T1/E1 application, this is the length of twisted pair cable connecting the TC8616 to the user's equipment, which may be a CSU or DSU. See Table 2-1 and Table 2-2 on the next page.

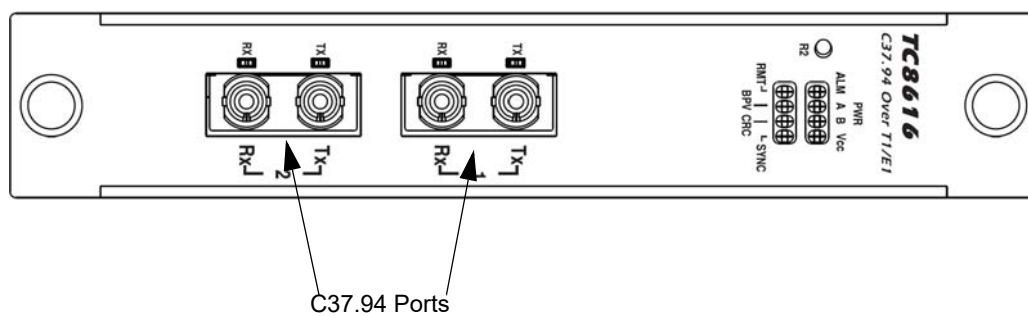
**Table 2-1: Copper Line Length Setup Table**

T1 Settings			
L1	L2	L3	Application Line Length
Up	Up	Up	DSX-1 (0 to 133 feet) / 0 dB CSU
Down	Up	Up	DSX-1 (134 to 266 feet)
Up	Down	Up	DSX-1 (267 to 399 feet)
Down	Down	Up	DSX-1 (400 to 533 feet)
Up	Up	Down	DSX-1 (534 to 655 feet)
Down	Up	Down	-7.5 dB CSU
Up	Down	Down	-15 dB CSU
Down	Down	Down	-22.5 dB CSU

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

E1 Settings			
L1	L2	L3	Application Termination
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

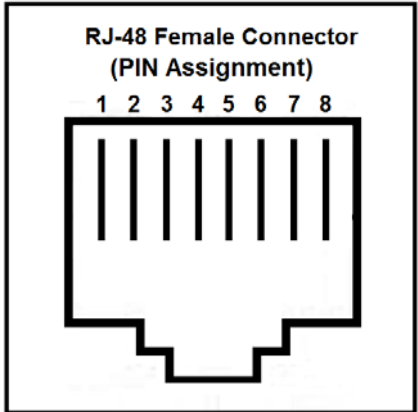
### 2.6.3 Front Panel (C37.94 Connectors)

**Figure 2-4 TC8616 Front Panel Connectors**

## 2.6.4 T1/E1 RJ-48F Connector & Pin Assignments

The left pair (Pin # 1 & 2) of the RJ-48F connector are used for receiving T1/E1 signal, while the right pair (Pin # 4 & 5) of the RJ-48F connector are used for transmitting T1/E1 signal.

**Table 2-3: RJ-48F T1/E1 connections**

T1/E1 interface connector & Pin Assignment	
1 - Rx+	
2 - Rx-	
3 - N/A	
4 - Tx+	
5 - Tx-	
6 - N/A	
7 - N/A	
8 - N/A	

**NOTE**

1. The T1/E1 signal use the same pin connections on the RJ-48 female connector.
2. The T1/E1 signal is bipolar, independent of the polarity.

## 3.1 Introduction

The TC8616 is designed for quick and easy installation. First, configure the unit for your specific application by setting the Line Code and Line Length. Once configured, you can connect the C37.94, T1/E1 signal source and power.

## 3.2 Setup

1. Select the appropriate Line Code for your application with the rear panel dip switch SW4.
2. For T1 applications, set the Copper Line Length with the rear panel SW6, SW7, & SW8. Generally, it will be factory set to "0-133 feet." (Refer to [Copper Line Length Setup Table](#), on page 2-6)
3. For E1 applications, set the proper impedance for your application with the rear panel SW6, SW7, & SW8. ([E1 Termination Setup Table](#), on page 2-6)
4. Connect the C37.94 end device to the C37.94 fiber port at the front of TC8616. Make sure Tx link of the end device connects to the Rx port of TC8616 and the Rx link of end device connects to the Tx port of TC8616.
5. TC8616 C37.94 will provide a signal to the end device for synchronization so the end device must be set to use loop clock instead of internal clock. The port status can be verified by each ports' corresponding LED status as described on [TC8616 Front Panel LED Definitions](#), on page 1-2.

## 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 TC8616 in a controlled environment. Knowledge of these functions and features will ease installation and troubleshooting efforts later on.

Loopback tests assist troubleshooting by helping pinpoint the source of errors. The TC8616 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 the "SYNC" LED blinks twice, it indicates that there were two "T1/E1 sync loss" after the last alarm reset.

To reset the alarm, press and hold the "R2" 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,

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

TC8616 is capable of monitoring the remote unit status and resetting the remote unit alarm condition.

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

"RMT" LED Off: Displaying Local Status

"RMT" LED On: Displaying Remote Status

To monitor remote unit status:

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. 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.

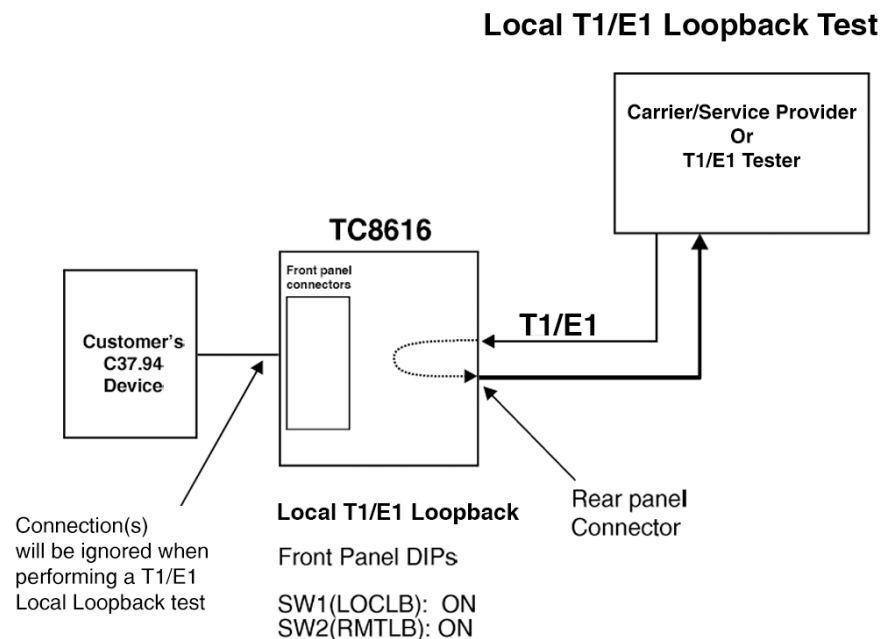
To reset remote unit alarm condition:

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 T1/E1 Local Loopback Test

A T1/E1 Local loopback is used to test T1/E1 wiring and T1/E1 transceiver functionality. For TC8616, 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 TC8616 is not receiving a valid T1/E1 or the T1/E1 cable is in question. Please reference Figure 2-1, *TC8616 Front Panel - C37.94 over TDM*, on page 2-3 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.
4. Upon successful completion of this test, please return DIP Switches SW1(LOCLB) and SW2(RMTLB) to the “Off”(Up) position for normal operation of the TC8616 unit(s).



**Figure 4-1 Local T1/E1 Loopback Test Diagram**



## 5.1 General

Alarm conditions occur whenever a T1/E1 sync "fault" condition is detected by the TC8616. 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

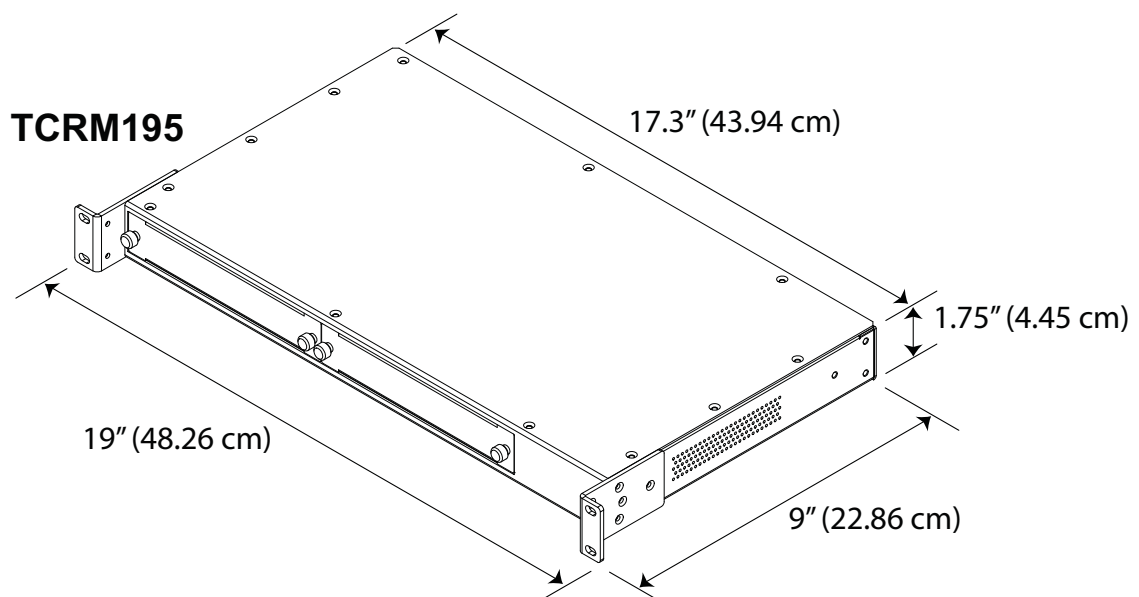
The TCRM195 "Pizza Box" Rack Mount Card Cages hold up to 2 single multiplexer type cards.

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).

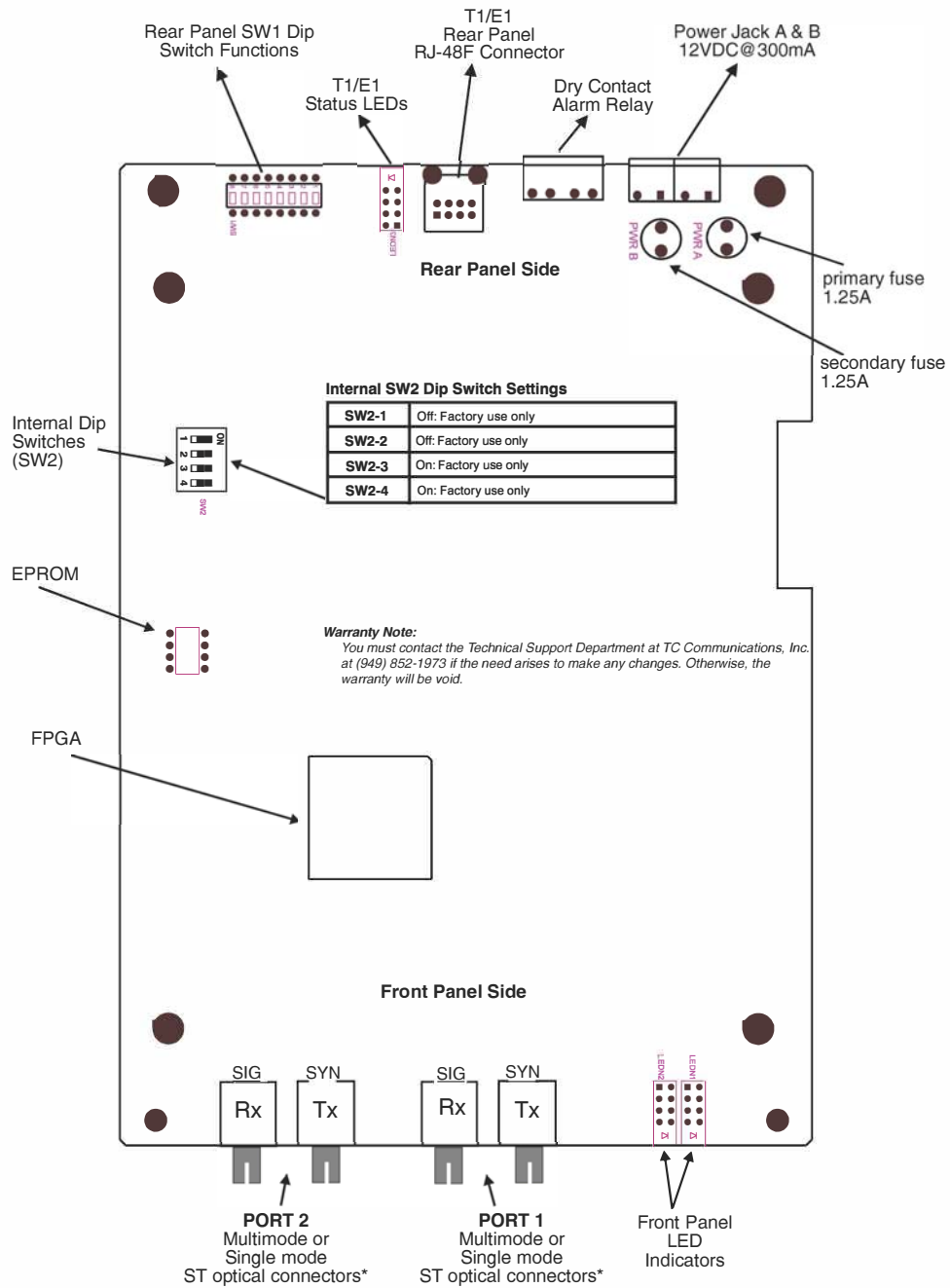
The rack assemblies are 19" wide by 1.75" high. The TCRM195 is 9" deep.

## 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.



## B.1 Overview



\*MM or SM optics are factory installed depending customer's order.

**Figure B-1 TC8616 PCB Layout**

# Appendix C R2 Button & LED Functions

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

The recent enhancements implemented on the TC8616 (C37.94 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.



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 ESF frame and E1 built-in CRC)

**SYNC:** displays frame locking for T1 (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.

The 600Ω Analog Tx and Rx LEDs are tied to a volume threshold level of -31dBm; when the volume is greater than -31dBm, the LED(s) will turn on.

## 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 T C 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 T C Communications, Inc. by purchaser for the goods from which the claim arose, in no event shall T C COMMUNICATIONS, INC. be responsible for indirect and consequential damages.
2. In no event shall liability attached to T C COMMUNICATIONS, INC. unless notice in writing is given to T C COMMUNICATIONS, INC. within ten days of the occurrence of the event giving rise to such claim.
3. T C 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 T C COMMUNICATIONS, INC.
4. T C 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

---

## C

cabling, 2-3

## D

DCAR, 2-2

## E

electrical, 5-1

environmental  
requirements, 2-1

## F

front panel, 2-1

## M

mechanical  
installation, 2-1

## P

power  
unit, 2-2

power-up LED verification sequence, 4-3

## S

specifications, 1-7

## T

troubleshooting, 4-1, 5-1

## U

unpacking, 2-1

## W

web  
interface, 1-7