



TC Communications TC8619 4 Channel Ethernet over-T1/E1 Multiplexer User Manual

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TC Communications TC8619 4 Channel Ethernet over-T1/E1 Multiplexer



INTRODUCTION

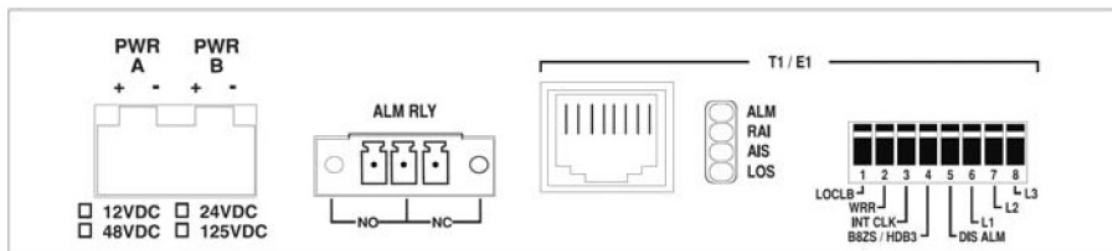
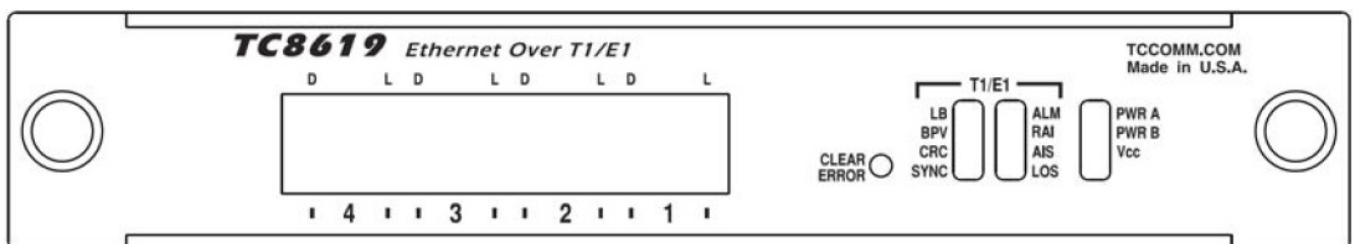
General Information

This manual is intended to describe the features and functionality in addition to aiding in the planning, configuring, commissioning and maintaining of the TC8619 Ethernet-over-T1/E1 multiplexer.

Product Description

The TC8619 is a 4 Channel Ethernet-over-T1/E1 multiplexer with built-in power redundancy.

TC8619 can support either T1 or E1 upon the order. Extensive diagnostics include DIP switches for T1/E1 Loopback and other application configuration switches. Each unit also provides multiple LEDs for Alarm, Power, Vcc, T1/E1 Status, and Link and Duplex 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 TC8619 is compatible with standard 100Ω T1 for copper line lengths up to 6000ft and up to 2.5km for 75Ω / 120Ω E1 (copper line length is the distance between the TC8619 and the T1/E1 cross-connect). The T1/E1 uses an RJ-48 connector and the Ethernet channels use RJ-48 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°C to 70°C) and extreme temperature version (-40°C to 80°C) are also available.



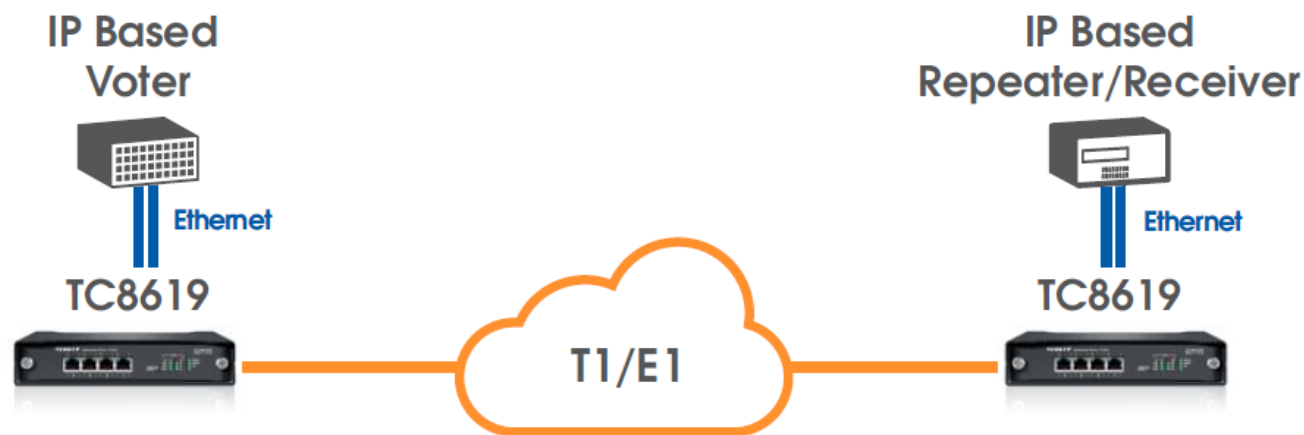
Features

- 10/100 Base-T Ethernet with IEEE 802.1p support
- T1 Features:
- ESF Framing
- Supports Line Length up to 3000ft (T1)*
- E1 Features:
- PCM31C Framing
- Supports Line Length up to 2.5km
- Very Low Latency ~ 600μs
- LEDs for Link (L) and Duplex (D) (to monitor Ethernet 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 T1/E1 Loopback test.
- Rack Mount or Stand Alone

Applications

The TC8619 offers an inexpensive, plug and play method for connecting Ethernet devices over existing T1/E1 links. Popular applications include:

- Bridging Ethernet LANs over Existing T1/E1 Telecom Network
- Extending Ethernet Networks by Utilizing TDM Telecom Infrastructure (i.e. T1/E1 Landline, or T1/E1s/PDH/SDH Microwave Carrying T1/E1)
- Demarcation Between the Carrier’s and Customer’s Networks
- Bonded Transparent LAN Service



Specifications

Ethernet Capacity	
Channels	4 ports – 10/100 Base-T Ethernet Channels

Electrical	
Ethernet Connectors	RJ-48F
T1/E1 Connector	RJ-48F

System	
Bit Error Rate	1 in 10 ⁹ or better
Unit Status Indicators	PWR A, PWR B, Vcc
T1/E1 Status Indicators	ALARM, SYNC, AMI, BPV, LOS, AIS, RAI, CRC, RMT
Ethernet Status Indicators	Link (L) and Duplex (D)
Diagnostic Functions	T1/E1 Loopback

Power Source	
Standard	12VDC @300mA
Optional	24VDC, -48VDC, 125VDC, or 115/230VAC with an external power cube

Temperature	
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

Physical (Standalone Unit)	
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.

Physical (Rack mount 1U “Pizza Box” with two cards)	
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.

Installation

General Information

The installation section describes how to:

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

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.

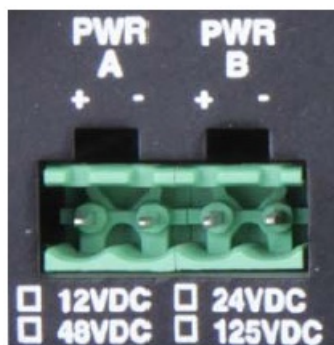
Equipment Location

The TC8619 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.

Power Supply

The TC8619 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 TC8619 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.

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.

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: TC8619 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 “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.

System Configuration

The TC8619 has been pre-tested and set per factory specifications.

- **Front Panel**

RJ48F connectors are provided on the front panel for Ethernet connections.

PWR (Power) A LED
PWR (Power) B LED

- On: Power supplied is good.
- Off: Power supply failed, or card fuse is burned.

Vcc LED (Voltage) LED

- On: 5V DC is good.
- Off: No 5V DC is supplied to this card.

CLEAR ERROR (T1/E1) Button

- Press and Hold (> 3 secs) to clear latched T1/E1 error.

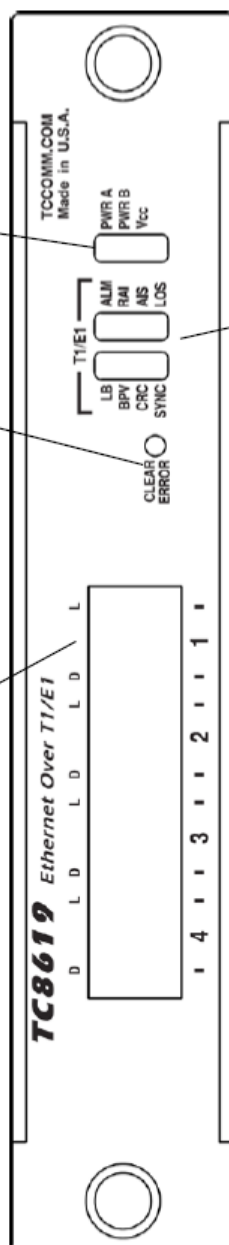
Ethernet Port Status

D (Duplex) LED

- On: Full Duplex.
- Off: Half Duplex.

L (Link / Activity) LED

- On: Link Up.
- Flash: Activity Detected
- Off: Link Down



T1/E1 Status

ALM (Alarm) LED

- Solid: Latched alarm condition.
- Flash: Unit detects errors or is in loopback mode.
- Off: Normal condition.

RAI (Remote Alarm Indicator) LED

- Blink: Latched RAI indication.
- Flash: Unit detected RAI (**Yellow Alarm**).
- Off: Normal condition.

AIS (Alarm Indication Signal) LED

- Blink: Latched AIS indication.
- Flash: Unit detected AIS (**Blue Alarm**).
- Off: Normal condition.

LOS (Loss of Signal) LED

- Solid: Valid T1/E1 signal is detected.
- Flash: No T1/E1 signal is detected.

LB (T1/E1 Loopback) LED

- Flash: Local loopback is enabled or received CSU loop-up code.
- Off: Normal condition.

BPV (Bipolar Violations) LED

- Blink: Latched BPV error indication.
- Flash: Unit detected bipolar violations.
- Off: Normal condition.

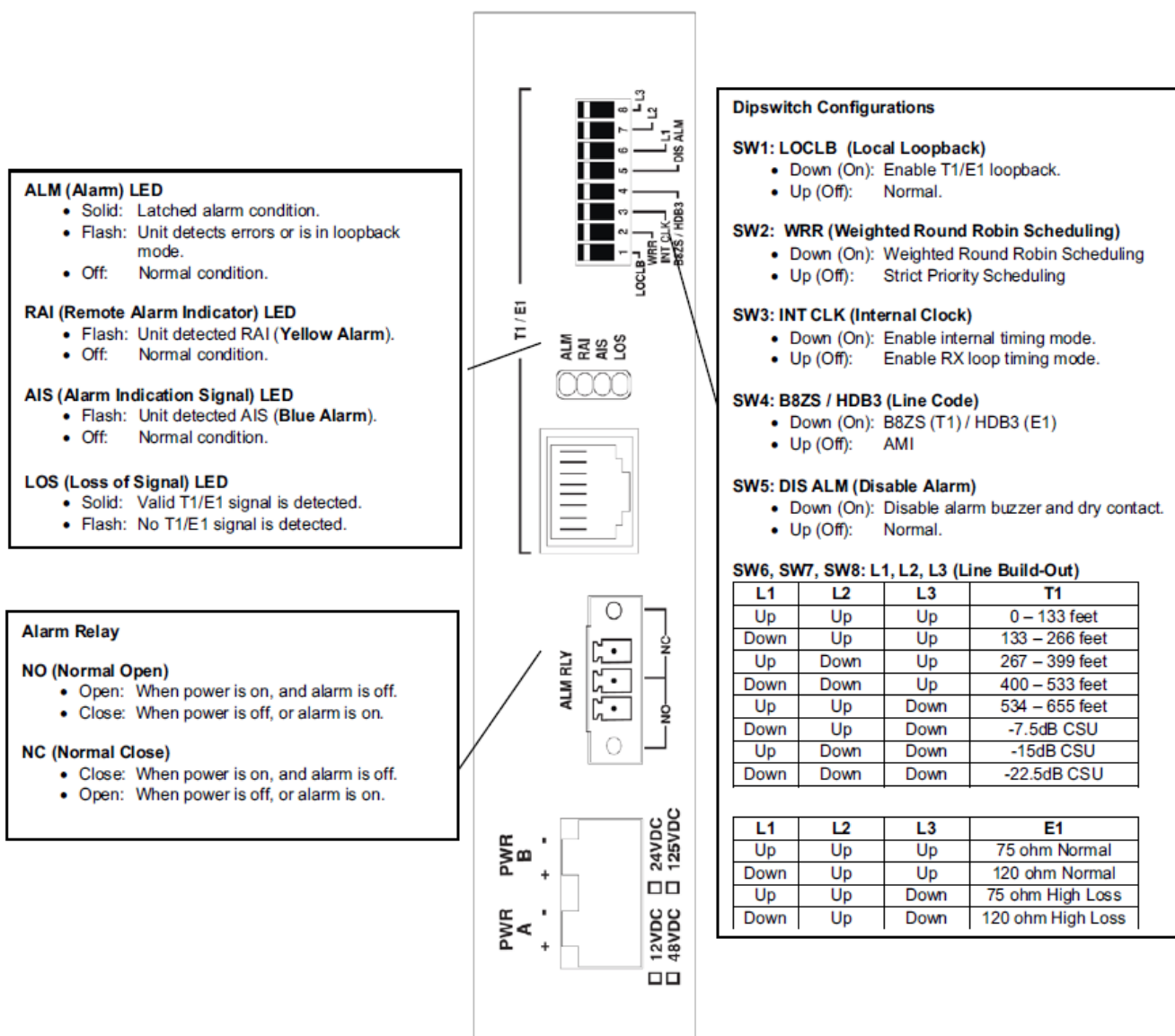
CRC (T1/E1 CRC Error) LED

- Blink: Latched CRC error indication.
- Flash: Unit detected CRC error.
- Off: Normal condition.

SYNC (Loss of Frame) LED

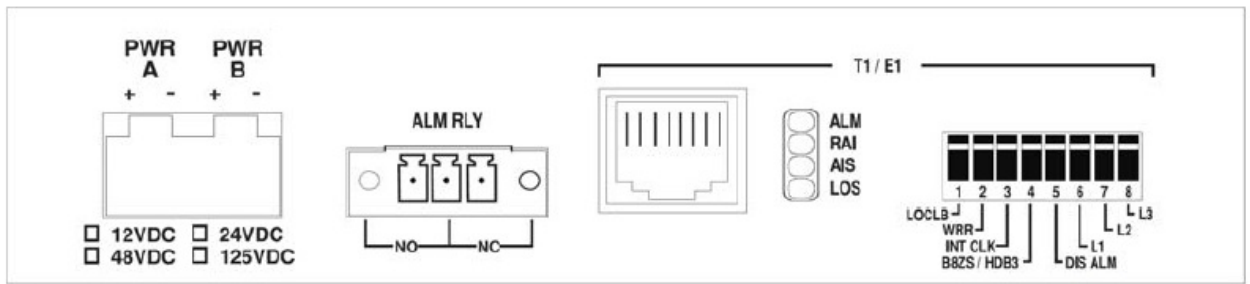
- Solid: T1/E1 sync. (Normal condition)
- Blink: Latched T1/E1 sync loss indication.
- Flash: Unit detected T1/E1 sync loss.

• Rear Panel



◦ 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 TC8619 (receive), while the right pair (Pin # 4 & 5) of the RJ-48F connector are for the transmit signal coming out of the unit.

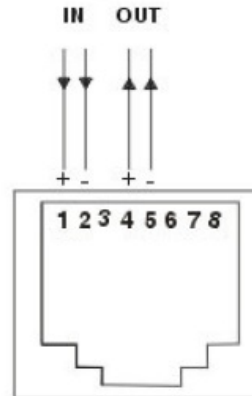


DRY CONTACT (ALARM)

NO - Normal Open/NC - Normal Closed

Rear Panel DIP Switches

Terminal Block Connectors
for Power A & B

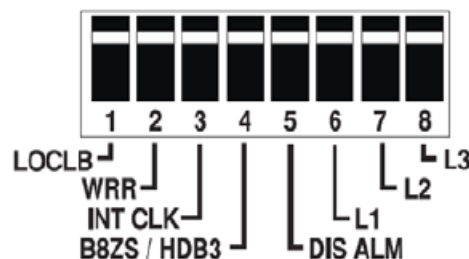


T1/E1 Signal Input, Output
RJ-48 Female Connector

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.

• Rear Panel DIP Switch Functions



The DIP switch functions on the TC8619 are described below. To activate the function, set the appropriate switch to the On (Down) position.

- **LOCLB:** Local T1/E1 Loopback. This switch (SW1) initiates the Local T1/E1 Loopback function.
- **WRR:** Weighted Round Robin Priority Scheduling. This switch (SW2) is used to configure the Ethernet priority scheduling mode. “On” for weighted round robin priority scheduling. “Off” for strict priority scheduling.
- **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 TC8619 to the user's equipment, which may be a CSU or DSU. See Table 2-1.

Table 2-1: Copper Line Length Setup Table

T1 Settings			
L3	L2	L1	Application Line Length
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)

T1 Settings			
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

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

Quick Start Guide

Introduction

The TC8619 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 Ethernet, T1/E1 signal source and power.

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 TC8619 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 Ethernet pin connections as well as the T1/E1 pin connections. After that, connect the two TC8619 units with a T1/E1 cable.
5. Connect the Ethernet signal source to the TC8619 Port 1 RJ-48 connector.
6. Verify the corresponding channel’s Ethernet Link LED is solidly lit to indicate that data is being received. If the Link LED does not light up solidly on a particular channel, it usually indicates incorrect connections at the Ethernet port.

Tutorial

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 TC8619 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 TC8619 is a sophisticated product designed with multiple advanced technologies. Loopback tests have been implemented to test independent components of it.

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 “CLEAR ERROR” button for 3 seconds until the “ALM”, “BPV”, “CRC”, and “SYNC” LEDs are flashing. The alarm will reset after the “CLEAR ERROR” 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)

Latched Alarm Clearing

Latched alarm is cleared automatically after 10 seconds by default. This default setting can be changed using

unit's internal dipswitch SW2-3 and SW2-4. *Please contact TC Communications technical support before opening the unit to access the internal dipswitch.

Table 4-1: Latched Alarm Clear Times

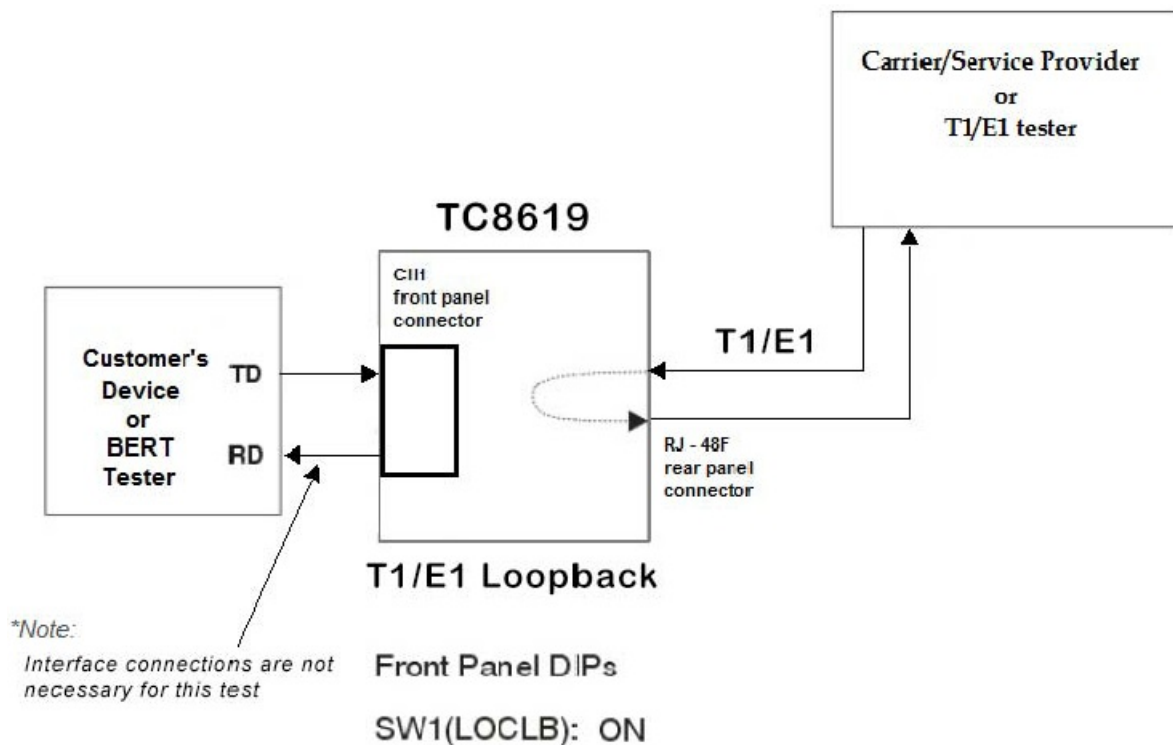
SW2-3	SW2-4	Latched Alarm Auto Clear Time	Usage
OFF	OFF	10 seconds (Default)	<p>Use for general T1/E1 line stability monitoring.</p> <p>Any specific T1/E1 error will be shown on the T1/E1 status LEDs: BPV, CRC, RAI, AIS, and SYNC.</p>
ON	OFF	1 hour	<p>This is useful for verifying T1/E1 line condition after initial setup or T1/E1 setting changes.</p> <p>User does not need to wait at the unit location and can check back within an hour to verify the T1/E1 line stability.</p>
OFF	ON	24 hours	<p>This is useful for verifying T1/E1 line condition during off office hours. (Example: Overnight)</p> <p>The unit will log T1/E1 errors for the past 24 hours.</p>
ON	ON	48 hours	<p>This is useful for verifying T1/E1 line condition during off office hours. (Example: Over the weekends)</p> <p>The unit will log T1/E1 errors for the past 48 hours.</p>

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 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 TC8619 is not receiving a valid T1/E1 or the T1/E1 cable is in question. Please reference Figure 2-3, TC8619 Rear Panel T1/E1 Connector & Pin Assignment, on page 2-5 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) to the Up (Off) position for normal operation of the TC8619 unit(s).

T1/E1 Loopback Test



Troubleshooting

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.

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.

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

Features

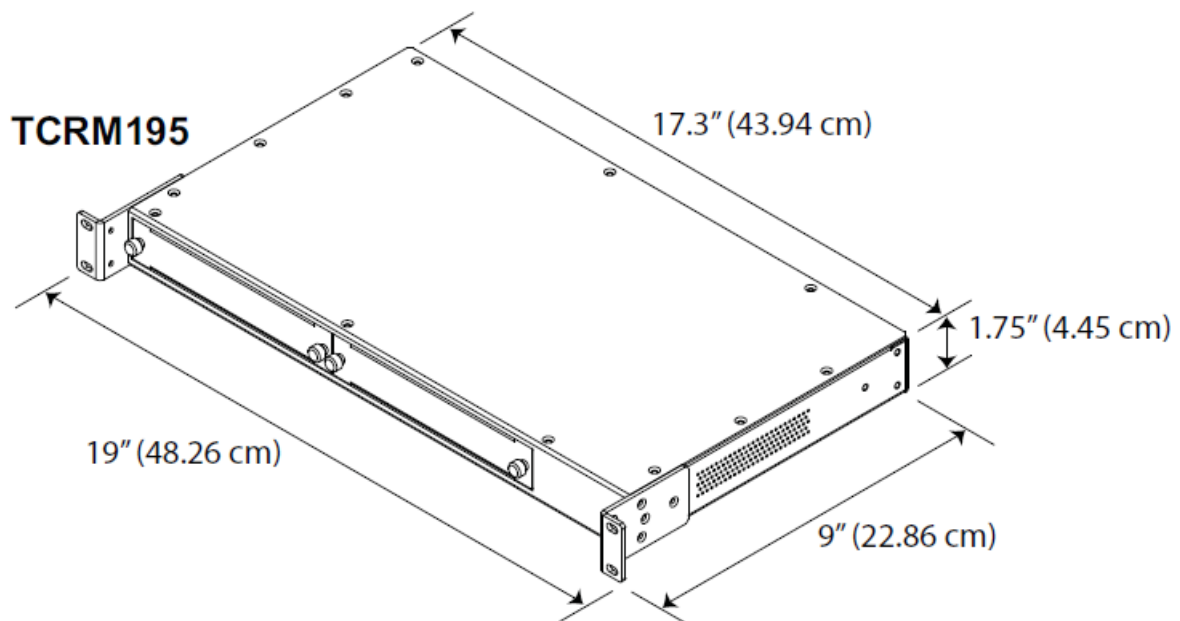
- 1U height (1.75")
- Universal Power Supply Accepts 90V to 264V AC and 47 to 63 Hz AC
- Standard Power Supply is 12VDC, Optional 24VDC, -48VDC, 125VDC, or AC Power Supply Available
- Over Load & Short Circuit Protection

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.

Chassis Ground

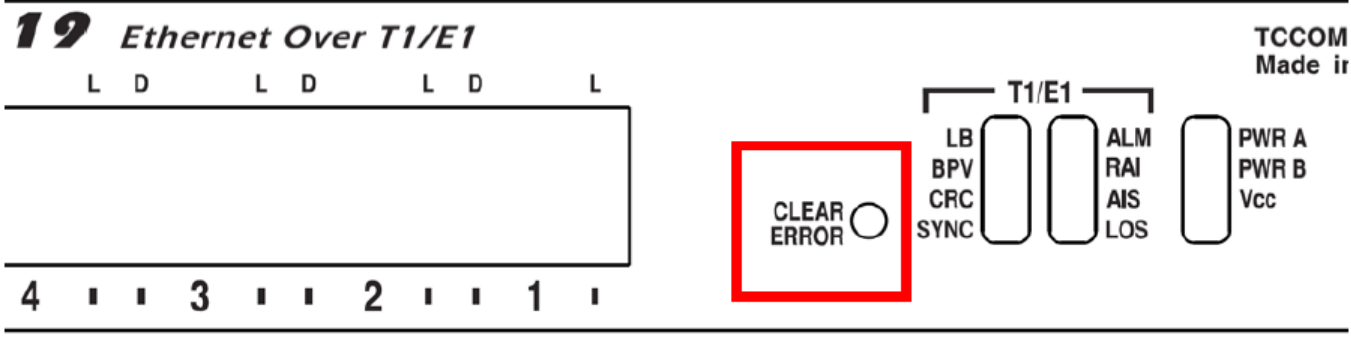
The Stand alone and Rack mount chassis provide a connection point for chassis ground with a dedicated chassis ground screw and lock washer. The chassis ground screw is located on the rear side of the chassis. This chassis ground connection point is available in case chassis ground is taken into design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



Push Button & LED Functions

CLEAR ERROR Button Description

The recent enhancements implemented on the TC8619 (Ethernet 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 CLEAR ERROR push button.



CLEAR ERROR Push Button Functions

1. To reset the local unit's alarm LEDs, hold down the "CLEAR ERROR" button for at least 3 seconds until you see the alarm LEDs flash in sequence.

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:

1. 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.

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.

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.

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).

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Record of Revisions

Revision	Date	Description of Changes
1.1	07/07/2022	Initial Release of TC8619.

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).

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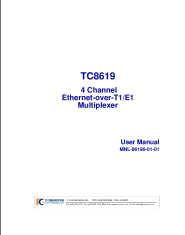
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Documents / Resources

	<p>TC Communications TC8619 4 Channel Ethernet over-T1/E1 Multiplexer [pdf] User Manual TC8619 4 Channel Ethernet-over-T1 E1 Multiplexer, TC8619, 4 Channel Ethernet-over-T1 E1 Multiplexer, Ethernet-over-T1 E1 Multiplexer, E1 Multiplexer</p>
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References

- [TC Communications - Fiber Optic Networks and Industrial Ethernet Solutions](#)