



# Tucson Power Deploys Multiple Teleprotection-over-IP Links

## Case Study

### The Challenge: Merging Legacy Applications with a Backbone Network

As Power Utilities continue to integrate legacy applications into their Ethernet/IP substation communication backbone networks, they are increasingly using TDM over IP/Ethernet instead of traditional TDM-based solutions for latency sensitive applications such as teleprotection. TDM over IP/Ethernet is a reliable, proven solution for teleprotection communications that produces deterministic results.

Tucson Electric Power Co.'s (TEP) initial search for a suitable product for teleprotection-over-IP communications was lengthy. Its goal was to find a low-latency industrial hardened Ethernet serial server to connect protective relays using mirrored bits® between

substations over fiber and microwave. It soon discovered that Ethernet teleprotection products vary greatly between communication vendors.

### Solution: Low Latency Serial over IP Done Right

TEP has been successfully using multiple TDM over IP/Ethernet links for protective relay communications between substations over fiber and microwave communications since 2011.

TEP's teleprotection-over-IP links are based on a multi-service Ethernet platform, the JumboSwitch® from TC Communications, using a special "Turbo Serial" TDM over IP/Ethernet interface card to connect its protective relays with RS-232 (mirrored bits®) interfaces. (See diagram on page 2).

## Objective

Establish protective relay communications between substations over fiber and microwave communications via TDM over IP/Ethernet

## Products Used

- [JumboSwitch®](#)
- [TC3847-3: Turbo Serial over IP](#)

## Key Benefits

- Exceeded stringent latency requirements
- Solved connection issues when RTUs were not available.
- Satisfied power redundancy requirements



*We quickly learned to rely on our test results rather than vendor spec sheets. Many hardened serial servers are unsuitable for teleprotection applications. For example, one popular hardened serial server from a major industrial Ethernet switch manufacturer tested out at 250 msec. of delay. When testing the delay, you must also ensure the measurements are consistently taken round trip or relay to relay; TEP's standards are based on relay to relay.*

- Jon Otteman  
Communications Engineer for TEP

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Deployment of the JumboSwitch for TEP's teleprotection links, SCADA, and metering over IP and conventional TDM links are part of TEP's multi-service Fiber and Radio backbone for the Distributive Generation Projects. This frees up rack space and lowers the cost of deploying multiple boxes to provide the same function.

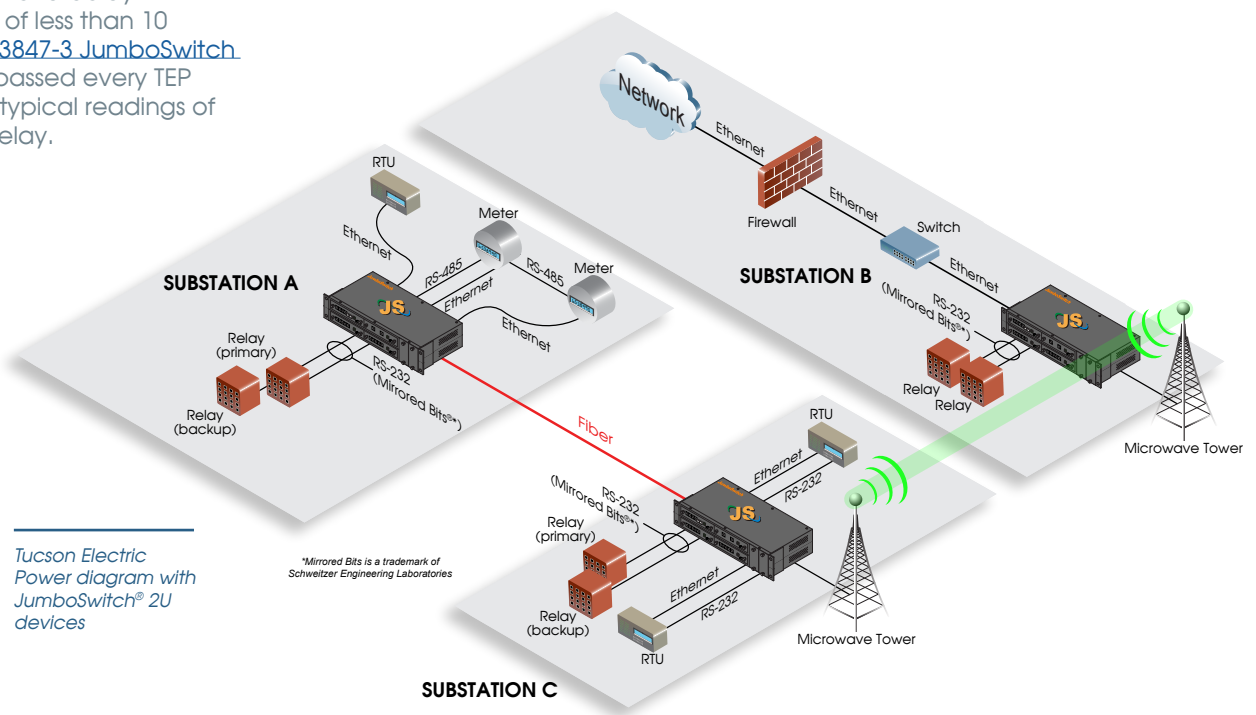
## Results: Exceeding Expectations at Every Turn

TEP's specs called for a delay (excluding relays) of less than 10 msec. and the [TC3847-3 JumboSwitch Turbo Serial card](#) passed every TEP latency tests with typical readings of around 3 msec. delay.

In addition to meeting TEP's stringent latency specifications for teleprotection, the JumboSwitch solved connection issues for RS-232, RS-485, Ethernet, and serial and dry contacts to monitor certain alarm points when an RTU is not available. It also provided a redundant power supply, required by TEP's standard. Changing from 48VDC, 125VDC to 115VAC can be easily accomplished by switching the power module.

The JumboSwitch offers [25 different interface cards](#), including all popular interfaces used for teleprotection-over-IP applications. The [G.703](#), [C37.94](#), [T1](#), and [Turbo-Serial \(RS-232, RS-422/485\)](#) teleprotection interface cards meet stringent real time requirements for protective relay communications in the Power Utility industry.

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



## About TC Communications

TC Communications specializes in TDM over IP network solutions including Analog Radio, Voice, Serial and T1 products. Applications include Leased Line Replacement, Voter Comparator over IP and Multi-Service communication networks. Focused on mission-critical applications, TC products are designed to help Public Safety networks transition to IP/Ethernet without replacing existing analog equipment. All services including engineering, manufacturing, and support located in Irvine, California, USA since 1991.



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