JumboSwitch®

Multi-Service Ethernet/IP Platform

JumboSwitch Product Brochure

Overview

TC Communications has been designing and manufacturing industrial hardened data and voice communications equipment for more than 20 years.

Its flagship product, the JumboSwitch Multi-Service Ethernet/IP Platform, was introduced in 2007. An integrated communications system that currently supports 25 different data and voice interfaces, the JumboSwitch is a modern, lower cost alternative to aging voice-centric SONET/SDH backbone communications systems.

JumboSwitch networks have been successfully deployed in a wide variety of critical network applications worldwide including the United States, Canada, Australia, Saudi Arabia, Jamaica, Mexico, Paraguay, Indonesia, Singapore, China, Belize, Guatemala, Taiwan, etc.

JumboSwitch Application Examples:
- SCADA communications backbone
  » Power plants/transmission/distribution
  » Oil & Gas pipe lines, water pipe lines/treatment plants
- Power protection relay communications
- Railway signal communications
- Highway/freeway signal and camera communications
- Business campus data communications backbone
- Airport ATC communications backbone
- Military base communications backbone
- Bank ATM communications network

"Often TC's response is not a single engineer to work with, but a team of engineers all fully engaged and listening to your issue; this is quite rare in today's business world! I recommend partnering with TC without any reservation."

- John Brunson, Chief Engineer & Coordinator of Videoconferencing, Troy University

"We have 23 of the TC3840 JSW installed within our network. Within this network, 19 of the JSW are in a ring topology with 4 of the JSW as spur hops off the ring network... We supply Ethernet connectivity to our major substations and connect to PTZ security cameras, guest network internet, relaying, SCADA, interchange metering, and AMI/AMR."

- Keith J. Schiltz, MDT Services Manager, Noth Iowa Power Cooperative

"[The support] has been excellent and in our experience with them [TC Communications], they have been very service oriented…I have been satisfied with this product because it works well in our railroad environment."

- Jerone Hurst, METROLINK - Southern California Regional Rail Authority

- Teleprotection-over-Ethernet/IP
- Ethernet/IP-over-T1/E1 or T3/E3
- T1/E1 or T3/E3-over-Ethernet/IP
- Serial (RS-232, RS-422, RS-485)
- Copper GB Ethernet/IP

The JumboSwitch at a Glance

JumboSwitch Highlights:

- Integrates Ethernet, Voice & Data onto one rugged GigE platform
- Runs over existing infrastructure (fiber, T1/E1, T3/E3, microwave or SONET/SDH)
- Comprehensive network management System (TCView)
- 25 modular, hot-swappable interface cards
- 6 Chassis options to optimize scalability
- Exceeds all pertinent Industry & Environmental Standards including IEC 61850-3

Modular in design, the JumboSwitch currently offers 6 different chassis types and 25 legacy interface cards including RS-232/RS-422, FXS/FXO, T1/E1, T3/E3, G.703, 600 Ω analog and more (see back cover for complete list).

The JumboSwitch is based on advanced Ethernet, TDM-over-IP/Ethernet and VoIP technology and supports all popular legacy termination devices including RTUs, AMRs, PLCs traffic controllers, telephones, modems, FAX machines, bank ATM machines, data modems, power protection relays, etc.

Why JumboSwitch is Cost Effective:

Because of its multi-service capability, the JumboSwitch frequently is the most economical solution for integrating diverse applications onto one network. Examples include:

- Provides controlled, economical TDM/SONET to IP migration
- Preserves legacy assets

- Uses existing infrastructure (fiber, T1/E1, T3/E3, microwave & SONET) to minimize network build-out costs
- Centralizes network management and minimizes hardware device requirements

Benefits of JumboSwitch vs. SONET/SDH

Until multi-service platforms like the JumboSwitch came along, SONET/SDH was the backbone system of choice for most Power Utilities and similar entities. Today, the perceived advantage of SONET/SDH has disappeared.

SONET/SDH, though reliable and well-understood, is less flexible, difficult to scale, not optimized for packet data transmission and increasingly becoming harder to find replacement components.

Most important, the cost of ownership is much less for a JumboSwitch system. Deploying, configuring and maintaining a SONET/SDH system is complicated.

In comparison, JumboSwitch networks can be deployed and reconfigured by technicians with minimal training. JumboSwitch advantages over SONET/SDH include:

- Requires far less personnel training for operation & maintenance
- Much easier to deploy and reconfigure
- Guaranteed availability of Ethernet/IP components & support
- Dynamic bandwidth allocation
- Mesh or ring topology

- SFP GB Ethernet/IP
- Dry Contact
- RoIP
- MoIP
- VoIP

Features & Benefits

Rugged Design

Operates in harsh industrial environments from -40°C to +80°C with no moving parts or fans.

Modular Design

More than 25 different interface cards and 6 chassis types to choose from.

Hot-Swappable Interface Cards

All cards can be plugged/unplugged into chassis slots WITHOUT shutting power down.

Multiple Chassis Sizes

Choose between 4U, 2U, 1U, 2S, 1S or DIN Rail (see FIG 1-5) to fit your installation needs.

- 4U: A 4U high, 19" rack mount chassis with seven interface card slots

- 2U: A 2U high, 19" rack mount chassis with two interface card slots

- 1U: A 1U high, 19" rack mount chassis with one interface card slot (optional: 2 interface card slots)

- 2S: A 2U high standalone chassis with one interface card slot for wall mount installation

- 1S: A 1U high standalone chassis with one interface card slot for wall mount installation

- DIN Rail: Smallest chassis of the series. Easily installed into standard DIN Rail systems

Scalability

All interface cards are interchangeable between 4U, 2U, 1U, 1S, and 2S chassis models.

Topologies

The JumboSwitch supports all popular topologies including bus, ring, double ring (coupled ring), counter-rotating ring (self-healing ring), or mesh networks.

Minimize Network Downtime

Monitors critical parameters to prevent problems and avoid network downtime.

- Monitors entire units or each interface card's operating voltage and current consumption

- Monitors optical launch and receive power on aggregation

- Monitors chassis temperature

Low Latency

As low as 1.5msec, port-to-port communication, for many critical legacy signals including protection relays.

Remote Management

- Remote configuration
- Remote status monitoring
- Remote power cycling

User-Friendly Web GUI Interface

Intuitive and easy to learn.

JumboSwitch Chassis - DIN Rail (DR)

- Compact DIN Rail Chassis with full management
- Base unit with 2x GigE SFP ports and 6x 10/100Base-T
- Three Expansion Options:
  » 6 x 100FX SFP ports
  » 4 x RS-232/RS-422 ports (serial server)
  » 6 x 100 FX SFP ports

JumboSwitch Chassis - 1U, 2U, & 4U

- Industry Standard 19" Wide
- Rugged design for Harsh Environments
- Supports hot-swappable cards
- Extreme temperature (-40°C to +80°C) optional
- Power supplies managed via web, SNMP, serial console or telnet
- All popular AC & DC power ranges
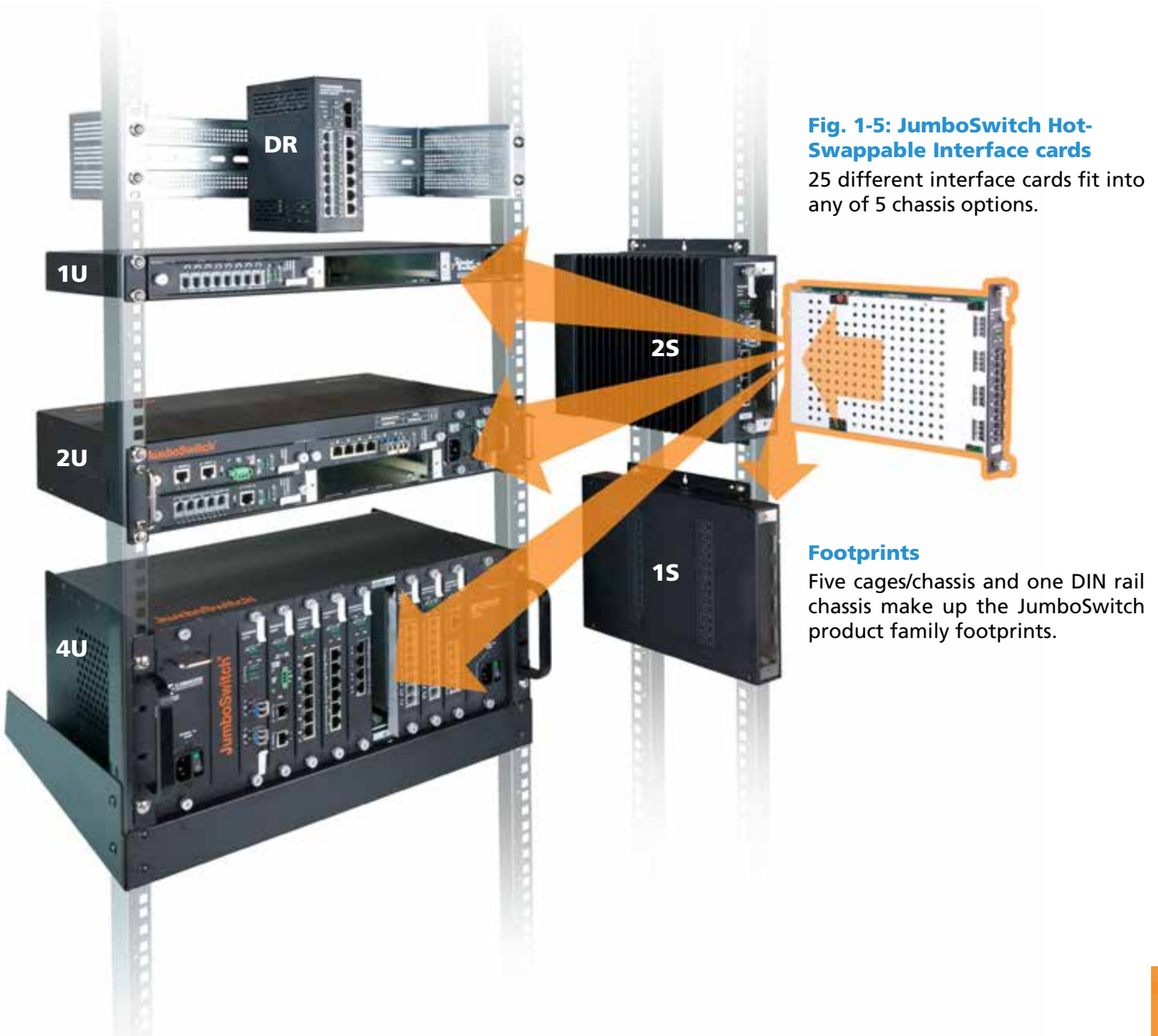- Built-in power redundancy

JumboSwitch Chassis - 1S & 2S

- Standalone/Wallmount (TCSD11-1/2)
- Ruggedized design for harsh environments
- Extreme temperature (-40°C to +80°C) optional
- Power supply managed via web, SNMP, serial console or Telnet (2S only)
- All popular AC & DC power ranges
- Built-in power redundancy
- Hot-Swappable Interface Cards

Ethernet Standards Compliance

- IEEE 802. 1x
- IEEE 802.1w
- IEEE 802.1s
- IEEE 802. 3x
- IEEE 802. 1D
- IEEE 802.1p
- IEEE 802.1Q
- IEEE 802. 3
- IEEE 802. 3u
- IEEE 802. 3z
- IEEE 802. 3ab
- IEEE 802. 3ad
- IEEE 802. 3ah
- 10/100/1000Base-T
- 100Base-FX
- 1000Base-SX/LX

The JumboSwitch comes in 6 different chassis options to fit various and changing networking needs. Users can mix or match any of the 25 hot-swappable JumboSwitch cards in all JumboSwitch chassis types except the DIN rail chassis. Hot-swappability is a critical feature for enabling users to change cards without incurring employee overtime, having to power down a system or replace entire units.

Power Options	DR	1U	2U	4U	1S	2S
12VDC	✔	✔	✔	✔	✔	✔
24VDC	✔	✔	✔	✔	✔	✔
-48VDC	✔	✔	✔	✔	✔	✔
125VDC		✔	✔	✔		
115-240VAC		✔	✔	✔		
115-240VAC Adapter	✔				✔	✔

Fig. 1-5: JumboSwitch Hot-Swappable Interface cards

25 different interface cards fit into any of 5 chassis options.

Footprints

Five cages/chassis and one DIN rail chassis make up the JumboSwitch product family footprints.

Network Management Made Simple

TCView is a Multi-User web-based SNMP Network Manager. It is based on the ITU-T Telecommunications Management Network (TMN) model with advanced FCAPS (Fault, Configuration, Asset, Performance, & Security) capabilities.

Equipped with a graphic user interface (GUI), it simplifies configuring, administrating, monitoring, troubleshooting and servicing JumboSwitch networks. TCView has the ability to monitor every plug-in interface card's temperature, operating voltage, and current. It also monitors optical and receive power to insure optical signal health.

Supported Software:

- Windows 7 Professional
- Windows 8 Professional or later
- Microsoft Windows 2008 Server or later
- Microsoft SQL Server 2008 or later

Browser:

Microsoft Internet Explorer version 6.0 or later.

One Platform, Many Benefits

TCView is an invaluable Operations, Administration & Management (OA&M) tool for minimizing your operating expenses. It offers multi-user support for network operations, maintains a centralized database, and provides remote access via an IP network. It can also receive traps from approved third party SNMP-enabled devices.

Monitoring each module's operation voltage and current consumption can detect potential component failures

JumboSwitch® TCView® Network Management System

Distinguishing Features

TCView offers more than typical Network Management Systems. Distinguishing features include:

- To ensure overall network performance, the JumboSwitch monitors **REAL TIME** key parameters including bandwidth usage, device temperature, power consumption, optical Tx launch and Rx Receiving power.
- Automatically alerts remote users via e-mail when temperature, voltage, current or optical power exceeds set thresholds
- Remotely downloads or upgrades software/firmware and re-boots units or individual cards
- Backs up & restores snapshots of the entire configuration for each unit
- Remotely manages JumboSwitch configurations such as VLAN and QoS
- Notifies users via e-mail, remote dry contact alarms of fault conditions
- Offers extensive asset management capabilities including:
  » Continuous collection of system part/serial numbers
  » Records version numbers & upgrade dates for precise inventory management
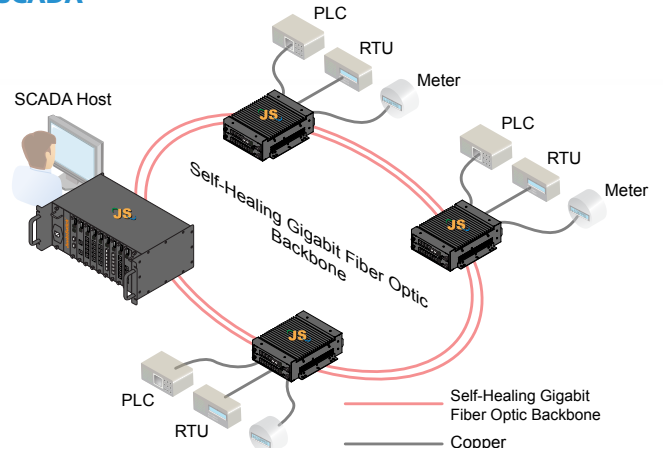
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Applications

Power and Utilities

A Comprehensive solution for Smart Grid Migration, Teleprotection, Substation Automation, SCADA systems and similar applications that connect devices including RTUs, PLCs, IEDs, Protective Relays and Surveillance Cameras.

Teleprotection

SCADA Host
Relays
Relays
Self-Healing Gigabit Fiber Optic Backbone
RTUs

——— C37.94
——— Mirrored Bits®*
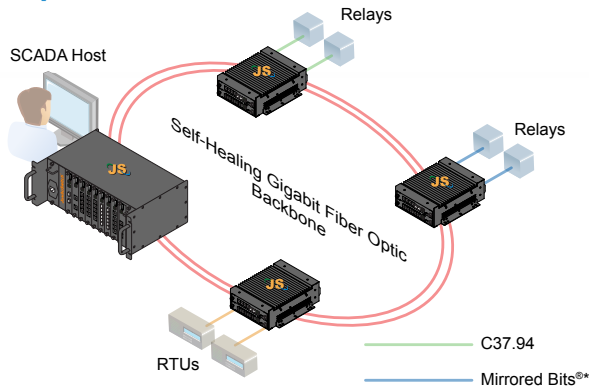
*Mirrored Bits® is a trademark of SEL®

SCADA

PLC
RTU
Meter
PLC
RTU
Meter
SCADA Host
Self-Healing Gigabit Fiber Optic Backbone
PLC
RTU

——— Self-Healing Gigabit Fiber Optic Backbone
——— Copper

Oil, Gas & Pipelines

The JumboSwitch is a logical choice for SCADA, PAGA, PBX/ Telephony, CCTV, Instrusion Detection systems and similar applications that connect devices including RTUs, PBXs/ Telephones, IP Cameras, Access Panels, Etc. It provides the security, redundancy and industrial hardened capability that is so often critical to oil and gas applications.

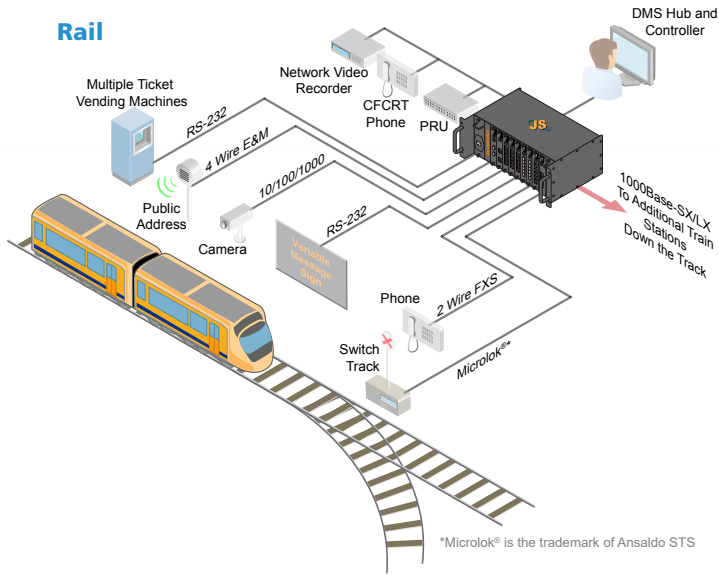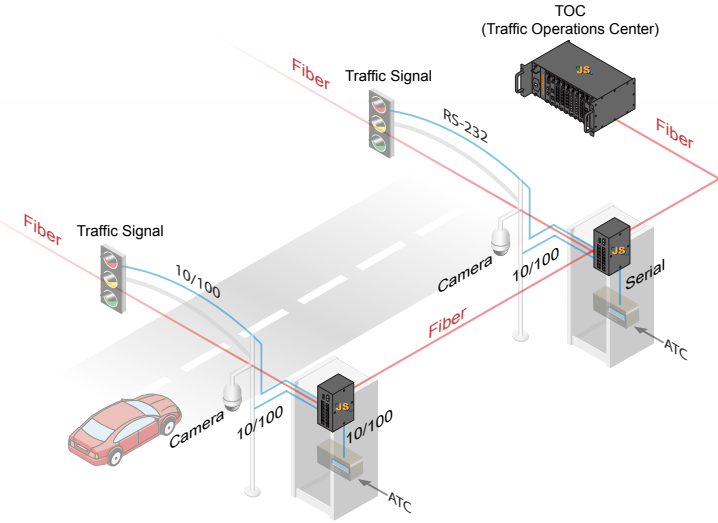### Onshore/Offshore SCADA, PAGA, CCTV, Telephony Communications Networks
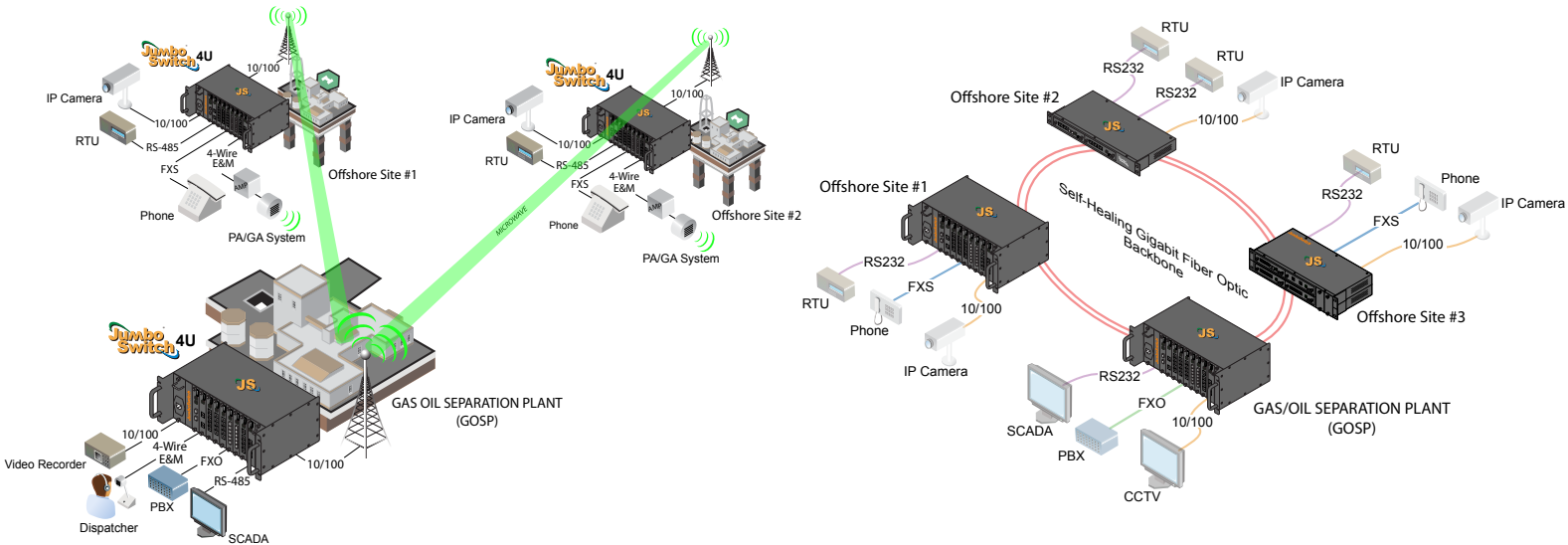
Transportation

An efficient transportation and traffic control network solution, either as a multi-featured high capacity Switch or integrated Ethernet, Voice and Data Multi-Service Access Platform (MSAP).

Rail
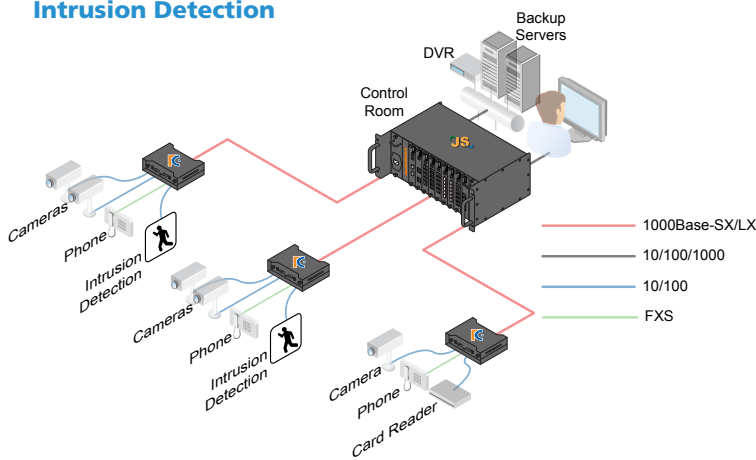

*Microlok® is the trademark of Ansaldo STS

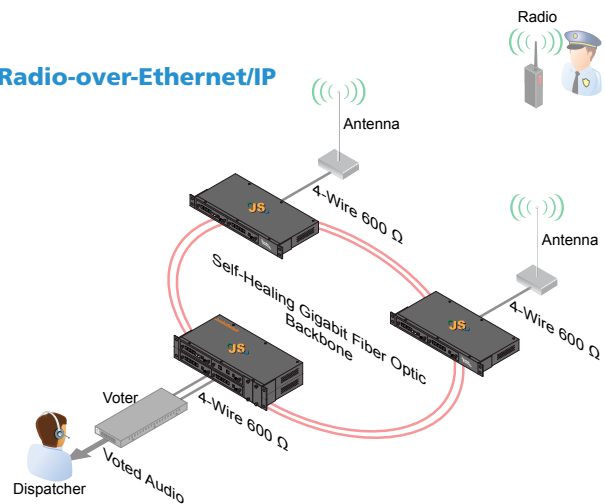## ITS

Public Safety & Security

Often used for phone & radio backhaul and video surveillance applications for emergency networks, the JumboSwitch is scalable, easily capable of high bandwidth demands and industrial hardened for harsh environments.

Intrusion Detection

——	1000Base-SX/LX
——	10/100/1000
——	10/100
——	FXS

Radio-over-Ethernet/IP

Iowa Utility Deploys JumboSwitch To Increase Data & Voice Connectivity Options

In 2006 NIPCO made a decision about the direction of its communication networks that will resonate for years to come: it opted to deploy a 650-mile multi-service Gigabit Ethernet backbone network using the JumboSwitch.

Upgrading to the JumboSwitch Multi-Service Ethernet Platform provided NIPCO with several immediate benefits including the ability to:

- Move AMR, Teleprotection and telecommunications over to IP
- Simplify maintenance, monitoring and repair
- Simplify Ethernet rate limiting to customers
- Quickly provision and configure core T1 links
- Quickly build out new Ethernet links for new customers

JumboSwitch 4U Chassis

NIPCO uses the JumboSwitch network for several applications including SCADA, Teleprotection, Automatic Meter Reading (AMR) and office LAN traffic. These applications are differentiated by core Utility VLANs such as "SCADA VLAN" and "substation VLAN." In addition, NIPCO created individual "Guest VLANs" for several of its Ethernet data link service customers.

"The JumboSwitch makes it easy to provision or configure the Ethernet and T1 circuits that we use," said Keith Schiltz, NIPCO's Metering, Digital SCADA and Telecommunications Services Manager.

"Because the JSW is less demanding for building out Ethernet circuits it is therefore quicker to establish new customer traffic."

In terms of network performance, the JumboSwitch has satisfied all of NIPCO's real time, synchronization and data traffic prioritization requirements. According to Keith, "everything on the JumboSwitch network is running fine, including SCADA and substation VLANs."

"One of the biggest benefits has been how easy it now is to 'plug and play' out in the field," said Keith. "Today, a tech can call up any site from his desk. No more 2 ½ hour drives out to J8 [substation]."

Keith is excited about future possibilities of NIPCO's JumboSwitch multi-service Ethernet network. "I expect the JumboSwitch platform will provide communications for NIPCO's core utility business and additional services, like T1 [T3, Internet service, RoIP], to customers for many years to come," he said.

NIPCO Technicians only require a laptop to perform JumboSwitch network health/alarm checks and reconfigurations.

See Full Case Study
http://www.tccomm.com/nipco

Specs & Standards

Quality Control
JumboSwitch Quality and Standard Compliance:

TC Communication is an ISO 2001 company. The JumboSwitch is 100% designed and manufactured in the USA with stringent quality control processes.

Complies with Industry & Environmental Standards:

IEC 61850-3 (Electrical Utility Substations)

Standard refers to communications networks and systems in substations, covering all aspects of communications between devices in the substations and related systems. IEC 61850-3 refers to IEC 870-2-2, "Tele-control equipment and systems - part 2: Operating conditions - section 2: Environmental conditions (climatic mechanical and other non-electrical influences)." Ethernet products must meet or exceed IEC 61850 specifications.

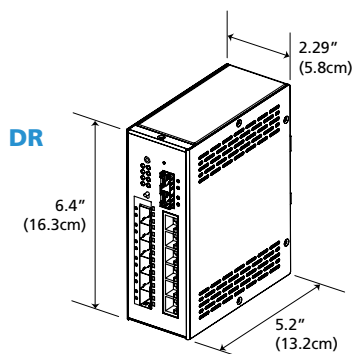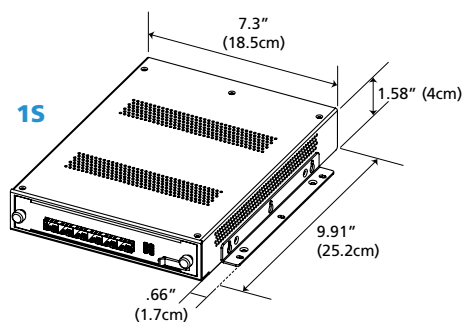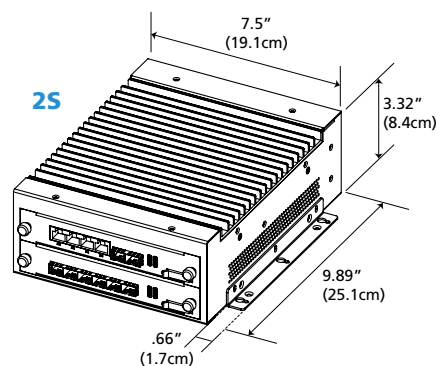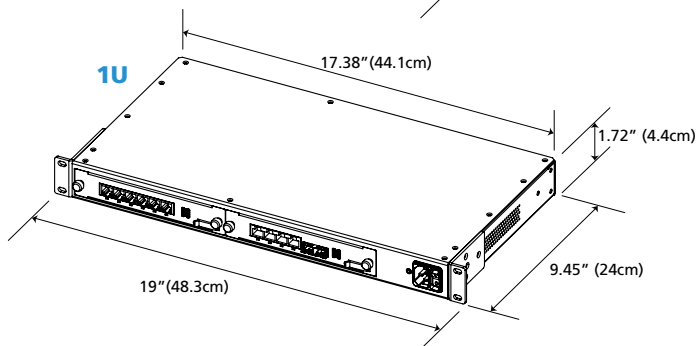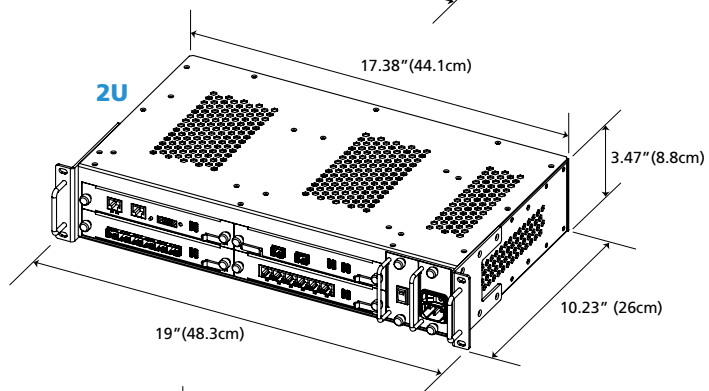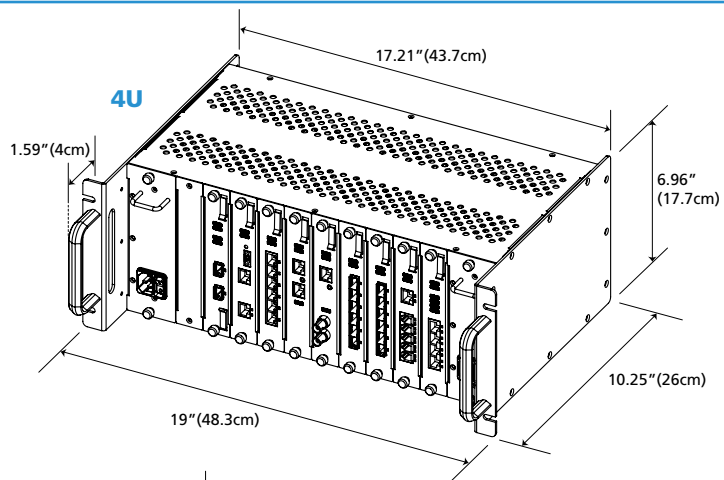### IEEE 1613 (Electrical Utility Substations)

The IEEE1613 standard defines environmental conditions in electric power substations and provides a foundation for designing and evaluating communications networking devices.

NERC CIP (Security for Electrical Utilities)

or New and emerging North American Electric Reliability Corporation (NERC) cyber security standards is designed to enhance cyber security and protect critical cyber assets for North American Electrical Utilities. NERC standards consist of eight different Critical Infrastructure Protection (CIP) sections to handle different cyber security aspects.

NEMA TS-2 (Transportation)

The National Electrical Manufacturer's Association certification for Traffic Control Equipment.

4U — 17.21"(43.7cm), 1.59"(4cm), 6.96" (17.7cm), 10.25"(26cm), 19"(48.3cm)

2U — 17.38"(44.1cm), 3.47"(8.8cm), 10.23" (26cm), 19"(48.3cm)

1U — 17.38"(44.1cm), 1.72" (4.4cm), 9.45" (24cm), 19"(48.3cm)

2S — 7.5" (19.1cm), 3.32" (8.4cm), 9.89" (25.1cm), .66" (1.7cm)

DR — 2.29" (5.8cm), 6.4" (16.3cm), 5.2" (13.2cm)

1S — 7.3" (18.5cm), 1.58" (4cm), 9.91" (25.2cm), .66" (1.7cm)

Cages & Chassis:

Description	Part #	Description	Part #
4U High 19" Rackmount Card Cage	TCRM197	1U High 19" Rackmount Card Cage (2 Interfaces)	TCRM199I
2U High 19" Rackmount Card Cage	TCRM198	2S, 2-Card Standalone Chassis	TCSD11-2
1U High 19" Rackmount Card Cage	TCRM199	1S, 1-Card Standalone Chassis	TCSD11-1

Main & Management Cards:

Description	Part #	Description	Part #
JumboSwitch Main Card (4U Chassis Only)	TC3840-1	JumboSwitch MGMT Card (2U & 4U Chassis Only)	TC3840-2
JumboSwitch Main 4-Port 10/100/1000 Card (2U Chassis Only)	TC3840-4	JumboSwitch Main/MGMT "Combo" Card (2S & 1U Chassis Only)	TC3840-3

Interface Cards:

Description	Part #	Description	Part #
6-Port 1000Base-SX/LX SFP	TC3842-1	4-Port 600 Ω analog and 4-Port dry contact over IP	TC3846-6
3-Port 1000Base-SX/LX SFP, 3-Port 100Base FX SFP	TC3842-2	4-Port RS-232/RS-422/RS-485 Async over IP, optional Microlok	TC3847-1
6-Port 100Base FX SFP	TC3842-3	4-Port Turbo Async RS-232/RS-422/RS-485 over IP with low latency	TC3847-3
Ethernet-over-T1/E1	TC3844-1	2-Port RS-530 Sync over IP	TC3847-4
Ethernet-over-T3/E3	TC3844-3	2-Port RS-422/RS-485 Async with handshake	TC3847-4H
Ethernet-over-OC3 (STM-1)	TC3844-5	8-Port Dry Contact (Digital) I/O over IP	TC3847-5
T1/E1-over-Ethernet	TC3845-1	8-Port Alarm relay monitoring Digital I/O managed by TCView	TC3847-6
T3/E3-over-Ethernet	TC3845-3	4-Port FXS and 1-Port of FXO, with virtual PBX VoIP	TC3848-1
2-Port G.703/64K Co-Directional over IP	TC3846-1	5-Port FXO VoIP with PBX VoIP	TC2848-2
2-Port C37.94 850nm MM over IP	TC3846-2M	4-Port FXS Modem/Fax over IP	TC3848-3
2-Port C37.94 1300nm SM over IP	TC3846-2S	4-Port FXO Modem/Fax over IP	TC3848-4

DIN Rail Configurations:

Description	Part #	Description	Part #
6 RJ45 10/100T and 2 SFP of 1000Base-SX/LX	TC3840DR	4 Ch RS-232/RS-422/RS-485 Async, expansion for TC3840DR	TC3847-1DR
6 RJ45 10/100T, expansion for TC3840DR	TC3841-2DR	4 Ch RS-232/RS-422/RS-485 Microlok, expansion for TC3840DR	TC3847-1MLDR
6 SFP 100FX, expansion for TC3840DR	TC3842-3DR		

TC Communications currently offers more than 60 different networking and data communication products. Together or singly, these products combine to provide reliable, efficient solutions for most fiber communication networks and connectivity applications including integrated Ethernet, Data and Voice solutions.

Examples of product applications include: communications backbones; legacy communications over IP networks; public safety; railroad signaling; power utilities; microwave terminations; intelligent transportation systems (ITS); oil & water pipelines; airports; and, commercial & military campuses.

All R&D, design, manufacturing, and support is done in the USA

For more detailed information
www.jumboswitch.com