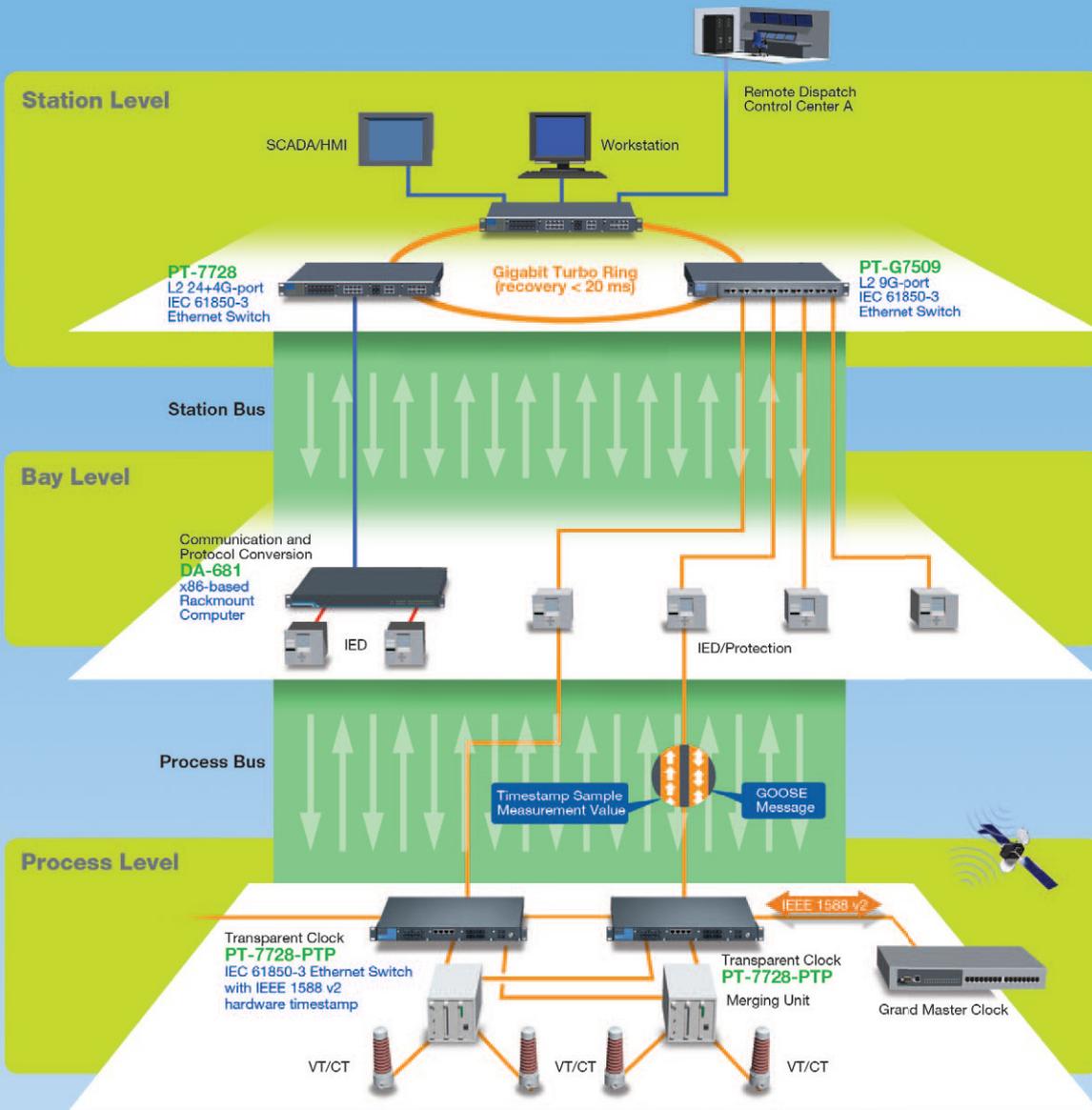


# Introduction to IEC 61850-3 Ethernet Switches

: Suitable for All Demanding Power Utility Applications

2

Industry-specific Ethernet Switches > Introduction to IEC 61850-3 Ethernet Switches



- Fiber Optic Cable (1000BaseSX/LX/LHX/ZX or 100BaseFX)
- Twisted Pair Cable (10/100BaseT(X))
- Serial

## IEC 61850-3 Ethernet Switches for Substation Automation

Industrial Ethernet is not only being used in a wide range of vertical markets, but is also finding uses in different facets of each market. For example, IEC 61850-3 industrial Ethernet networks are applied as the physical medium for power substation automation, which means that a host of legacy field buses must be connected to the Ethernet network. When used as a unified communication protocol in power automation, the IEC 61850 standard provides benefits that help power automation designers construct a complete, Ethernet-based communication system. These benefits include:

**Integrated Protocol:** The costs associated with setting up a monitoring system in a substation that uses different communication protocols

(e.g., DNP3.0, UCA, and IEC 870-5) can be prohibitive. The IEC 61850 protocol is preferred since programmers only need to use one protocol to develop the required monitoring applications.

**Maintenance and Implementation:** System designers find it easier to select components and controllers that have been designed specifically to meet the standard requirements of the IEC 61850 protocol, saving on both implementation and system maintenance.

**Time-to-Market:** The fact that leading manufacturers such as ABB, Siemens, and Schneider Electric are producing integrated IEC 61850-based products saves time, since system integrators can design systems with products right off the shelf.

## Enabling High Availability, Reliability, and Scalability of Power Transmission and Distribution Networks

### Rugged Design Suitable for Harsh Environments

#### Verified Overall Reliability and Zero Packet Loss under Harsh EMI Interference

The EMI stress in high-voltage substations may cause errors or equipment damage in electronic communications. Moxa's PowerTrans Ethernet switches are designed to withstand all of the EMI type tests required by IEC 61850-3 without experiencing any loss in communications. The full product line has passed IEC 61850-3 and IEEE1613 certification testing conducted by KEMA, a well respected testing laboratory in the energy and utility markets. Further tests, including GOOSE messaging, EMC tests, extreme temperature

tests, and mechanical tests for vibration and shock resistance, were conducted to verify the overall durability of the PowerTrans series.

#### Unaffected by extreme temperatures

To perform flawlessly in the exposed climate of utility substations and industrial environments, Moxa's IEC 61850-3 substation Ethernet switches are designed for completely fanless operations in a wide temperature range of -40 to 85°C.

### Redundancy for Higher Network Availability

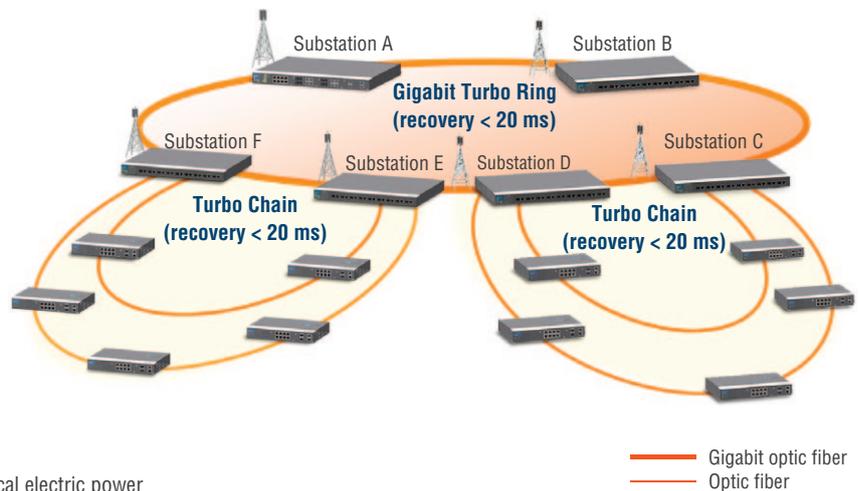
#### Media Redundancy

• **Turbo Ring™ for Ring Redundancy**  
Managed Ethernet switches come with the world's fastest Turbo Ring redundancy (20 ms @ 250 switches), and the standard STP/RSTP redundancy protocol. To reduce redundant network cabling and network planning costs, and to ensure high network reliability, three topology options are supported: ring coupling, dual-ring, and dual homing.

• **Turbo Chain™ Builds Complex Redundant Networks for Power Electricity Distribution**

Electric power distribution is the final stage in the delivery of electricity to end users. The distribution system carries electric power from the transmission system and delivers it to large numbers of consumers. Consequently, a typical electric power distribution system consists of a complex network that allows various connections by the power utilities.

Moxa's Turbo Chain™ is an innovative breakthrough that allows the creation of multiple redundant networks beyond the current limitations of redundant ring technology. Turbo Chain™ is easy to configure by linking two user-configured end ports within the same segment. Turbo Chain™ easily connects and extends existing redundant networks by enabling high network availability with its self-healing capability (recovery time < 20 ms). Moreover, compared with Turbo



Ring in power distribution systems, Turbo Chain is more flexible and cost-efficient and has the potential to save a significant amount on development costs, time, effort, cabling, and Ethernet ports.

### Isolated Power Input Redundancy

Non-stop operation is the key criterion for mission-critical applications. The PT-7828, PT-G7509, and PT-7728 support dual, isolated, redundant power supplies with different power sources (24/48 VDC or 110/220 VAC/VDC input voltage). For example, you can choose 110/200 VAC/VDC as your main power source, and 48 VDC from a battery as your back up power source.



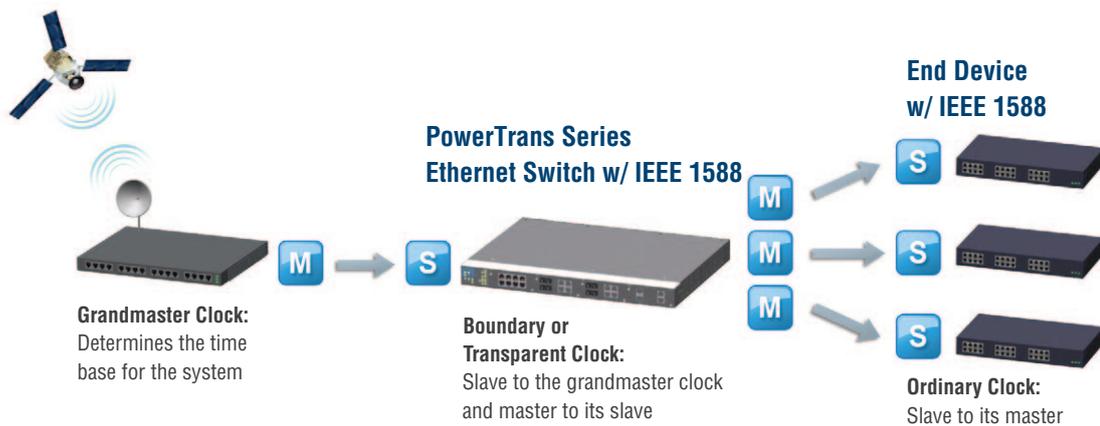
### Configuration Redundancy

The ABC-01 backup configuration tool can both save and load configurations automatically when connected to a Moxa managed Ethernet switch. This novel management tool helps reduce downtime, and can be used for fast configuration duplication of large-scale networks.

### IEEE 1588 Precision Time Protocol for the PowerTrans Series

Time synchronization can be accomplished using the IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems (IEEE 1588-2008) to synchronize real-time clocks incorporated within each component of the electrical power system in power automation applications. Moxa's PowerTrans

products are designed to operate in tough power substation environments and provide highly accurate time synchronization for each process utility. To ensure the best time synchronization network design for power automation, substation designers must consider the convenience of IEEE 1588 deployment for Ethernet switches.



### Scalable Network Infrastructure Capability

Substation and transportation automation networks can be extremely large and cover expansive territories. Moxa's PowerTrans Ethernet switches satisfy the scalable network requirements with long-haul fiber solutions from Layer 3 to Layer 2 Ethernet switches.

- The PT-7828 Layer 3 Ethernet switch can divide a large network into hierarchical subnets. Controlling network traffic on separate subnets can improve the performance of the entire network.

- The PT-7728 and PT-7710 are Layer 2 modular managed Ethernet switches that support advanced network management and control functions, including VLAN, QoS, IGMP snooping, LACP, and GMRP to optimize and prioritize network communications.
- The PT-G7509 is equipped with 9 combo Gigabit Ethernet ports, making it ideal for upgrading an existing network to Gigabit speeds and building a new full Gigabit backbone.

Note: Please check PowerTrans Ethernet Switch selection guide on page 2-3 for detailed features supported by each product model.

## Future-proof Flexibility

### Up to 9 Gigabit Ports for Backbone and Uplink

Demand is growing for applications in industrial networks that consist of multiple, interconnected Gigabit backbones among different network centers. Moxa offers a range of Gigabit managed Ethernet solutions that can be used to form a Gigabit backbone that connects to control centers, video-over-IP servers, Ethernet-enabled devices, or other Ethernet switches. These Gigabit Ethernet switches support fault-tolerant rings with fiber-optic ports, allowing operation in the toughest industrial environments.

Moxa's IEC 61850-3 Ethernet switches come with up to 9 Gigabit combo ports for the PT-G7509 series. Other modular Ethernet switches include the managed PT-7728/7828 Ethernet switches and the PT-7710 Ethernet switch, all of which support 2 or 4 Gigabit combo ports. Any combination of twisted pair and fiber optic ports can be chosen to form a redundant Gigabit Turbo Ring or for connecting to a Gigabit HMI/SCADA system in the control room.

### Media Configuration Flexibility

The PT series of modular Ethernet switches supports different numbers of Gigabit and fast Ethernet interface modules, which allow users to choose from a variety of copper/fiber media combinations. The modular design benefits users in three ways:

- Higher flexibility for system design and fast network changes
- Easy maintenance and lower cost of spare parts
- Reduced cost of future upgrades

### Cabling Flexibility

Moxa's rackmount Ethernet switches support two cabling options. Front cabling is ideal for maintenance, whereas rear cabling is neater and results in an arrangement that is safer in the event that a cable gets disconnected.

## Certifications to Ensure Reliable Operation

### Power Substation Certifications

#### IEC 61850-3

IEC 61850-3 specifically addresses immunity from certain environmental conditions and electromagnetic interference (EMI) for communication networks and systems in substations. The EMI immunity requirements are based on IEC 61000-6-5, which establishes performance criteria for key functions within the substation. To be compliant with the standard, critical functions, such as protection relay and control functions, on-line processing and regulation, as well as metering and network communication, must experience no delays or data loss when exposed to various EMI phenomena.

#### IEEE 1613

IEEE 1613 is another industry standard that establishes EMI immunity requirements for networking devices in electric power substations. Included in this standard are ratings, environmental performance requirements, and testing requirements for compliant communication devices.

According to the IEEE 1613 standard, compliant devices may not experience permanent damage under EMI stress. Two different classes of devices are defined in the standard according to how EMI stress affects performance.

#### Class 1

Compliant devices in this class may experience some data errors, losses, or delays under EMI stress conditions.

#### Class 2

Compliant devices in this class must not experience any data errors, delays, or losses under EMI stress conditions.

The PowerTrans PT series is compliant with IEC 61850-3 and IEEE 1613 certifications specifying a high level of EMC, shock, and vibration in power substations.

### Railway Industry Standards

#### EN 50155

All PowerTrans series switches are certified according to the EN 50155 standard, ensuring safe deployment for railway applications.

#### EN 50121-4

EN 50121-4 defines emission and immunity standards for signaling and telecommunication devices.