

# Link Precision T1000

## Digital substation switch

The T1000 is a fully flexible Ethernet switch for digital substations. It provides highly-accurate time synchronisation using IEEE1588 PTP and Gigabit Ethernet.



### Sub-microsecond PTP accuracy

### Gigabit Ethernet | Full Flexibility

The T1000 switch provides all the elements needed for the IEC 61850 digital substation network. It provides connections between IEDs that are flexible, reliable and robust, including those that are Precision Time Protocol (PTP) aware according to the IEEE 1588 v2 standard.

A flexible, modular design allows the T1000 to support a wide range of different network architectures. Up to 12 interfaces can be included, each using either copper or fibre connections. It also allows speeds of up to 1 Gbps, as required in high-end process bus applications. The interfaces can be hot-swapped without reconfiguration.

IEDs can be time synchronised over the Ethernet network to an accuracy of less than 1µs using PTP protocol. The switch can be set to operate as either a Transparent Clock or Boundary Clock. Also the internal NTP server provides a time reference to non-PTP aware IEDs.

Packet switching is implemented completely in hardware to ensure reliability and accuracy. This applies even when using a mixture of different copper and fibre interfaces.

The T1000 can be configured and managed cyber-securely using an SSH command line interface or an HTTPS graphical interface. The T1000 supports RADIUS and TACACS+ remote authentication technology. Statistical management information can be accessed using SNMP v2/v3.

#### CUSTOMER BENEFITS

- High performance time synchronisation using IEEE 1588 PTP
- Cyber-secure configuration and management
- Fully flexible, hot-swap interface modules
- Hardened for substation applications
- Uses include GOOSE, MMS, process bus, PMU, WAMS



## T1000 FEATURES

### Modules

- Up to 6 custom, hot swappable modules, each with 2 interface ports.
- Optical fibre interface modules: 100baseFX (ST connector, multimode fibre) or 1000baseFX (LC connector, single mode fibre).
- Copper interface modules: 10/100/1000baseTX, auto-negotiation and automatic crossover detection/configuration (HP Auto-MDIX).
- Special ring module with two optical 2.5 Gbps ports and LC connectors for single mode fibre.

### Time synchronisation

- Compliant to IEEE 1588 v2 with hardware-based time-stamping on all ports.
- Settable as a Boundary Clock (BC) or Transparent Clock (TC).
- Supports 2 master ports and up to 11 PTP slave ports when set as a Boundary Clock.
- Internal oscillator with thermal compensation (TCXO) and Stratum 3 precision.
- Internal NTP server synchronised by IEEE 1588 reference.

### Hardening and reliability

- High immunity to external electrical interferences (EMI) typically found in substation environments.
- Field upgradable with modules that are automatically recognised and reconfigured.
- Redundant power supply with load burden balancing across two sources.
- Extended temperature range from -40° to +85° C.
- Natural convection cooling – no moving parts
- Compliant to international standards: IEC 61850-3, IEEE 1613, IEC 61000-4, IEC 60255-5, IEC 60068-2

### Switching

- Packet switching is performed entirely in hardware with switching fabric in excess of 48 Gbps and 32 Mbits of internal packet buffer memory.
- Automatic learning with automatic negotiation and detection/correction of polarity inversion on copper ports.
- Automatic detection and control for rings using RSTP and MSTP.
- Forwards only verified packets using store and forward capability.

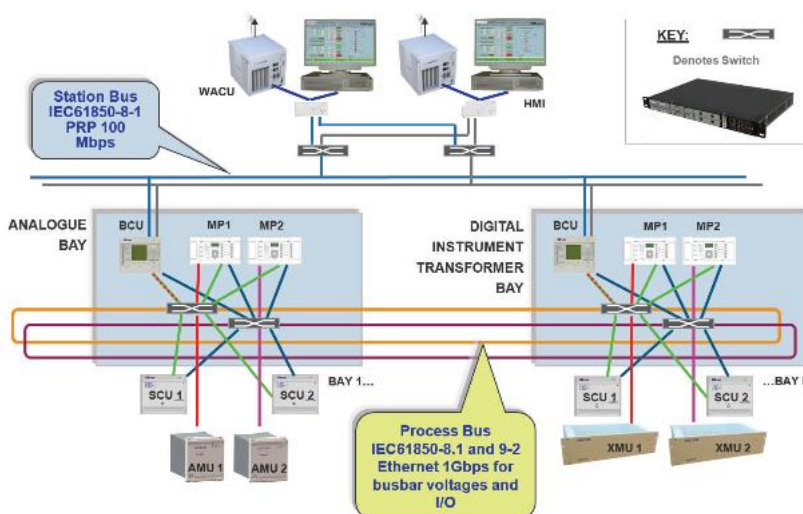
- VLAN (IEEE 802.1Q) support with independent (ISL) or shared (SVL) learning in hardware for up to 4K VLANs and 32K MAC addresses.
- Quality of service (QoS) with 512 entries and 8 priority queues per port.
- IPv4 and IPv6 support for broadcast, multicast and unicast.
- IGMP v2/v3 and MLD v1/v2 support.
- Automatic detection and control for broadcast, multicast and unicast flood storms.

### Management

- Secure native or remote access authentication via RADIUS/ TACACS+.
- Command line or web style configuration interface using secure SSH or SSL encryption.
- Remote monitoring (RMON).
- Dedicated USB 2.0 interface port for configuration.
- Usage statistics monitoring with SNMP v3.
- Provision of signalling alarm dry contact binary output.

### Physical

- Removable bracket for 19" standard rack (1U).
- Removable bracket for DIN rails.
- Front and rear interface options.



Typical digital substation topology

## PRODUCT SPECIFICATION

### Alarm relay output

- Dry contact NO and NC
- Max voltage: 250 Vac / 125 Vdc
- Max current: 2 A @ 250 Vac

### Wide temperature range

- From -40° to +85° C using natural convection (no fan)

### Interfaces

- Ethernet copper –10/100/1000baseTX with RJ45 Cat5e connector
- Single mode optical fibre– 1000baseFX with LC connector (SFP)
- Multi mode optical fibre – 100baseFX with ST or LC connector

### Modularity

- Up to 6 modules with 2 ports each (copper or fibre)
- Optical interface module for pair of fibres at 100 Mbps (100baseFX, ST or LC connector, multi mode fibre)
- Optical interface module for pair of fibres at 1 Gbps (1000baseFX, LC connector, single mode fibre)
- Optical interface module for single fibres at 1 Gbps (1000baseFX, LC connector, single mode, WDM)
- Copper interface module for Cat5e cables at 10/100/1000 Mbps with autonegotiation and automatic crossover detection and correction
- Optical interface module to build a ring at 2.5 Gbps (LC connector, single mode)

### Mounting options

- 19" standard rack mounting
- DIN rail support
- Front / rear interfaces

### Power supply

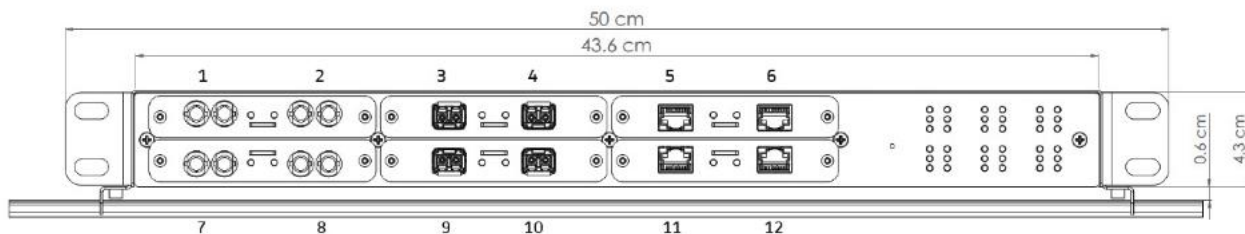
- Universal supply range
- Dual power supplies (redundancy)



## HIGHLIGHTS – UNIQUE FEATURES

- All modules can be removed / inserted / exchanged in the field by the end user, ready for future reconfiguration or changes in system topology.
- Unique 2.5Gbps optical interface for building high bandwidth redundancy rings between switches and bays.

## MECHANICAL DRAWING



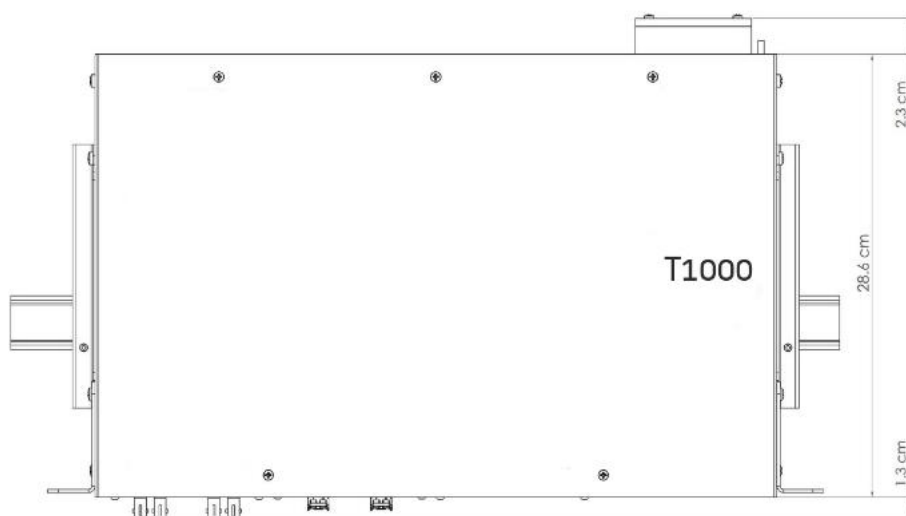
Front view including port designations



Rear view

## PRODUCT IDENTIFICATION

T1000	Example	P	-	RN2	-	AARGGG	-	E
	PTP							
	P = with PTP support							
	N = without PTP support							
	Mount	DIN rail support		Power supply				
	F = Front	D = with DIN rail support		1 = One power supply				
	R = Rear	N = no DIN rail support		2 = Redundant power supply				
	Modules							
	A = copper interface, 10/100/1000 Mbps, RJ45 connector, Cat5e							
	B = single mode 1 Gbps optical fibre interface, LC connector, no transceivers							
	C = single mode 1 Gbps optical fibre interface, LC connector, with transceivers for 2 km							
	D = single mode 1 Gbps optical fibre interface, LC connector, with transceivers for 10 km							
	E = single mode 1 Gbps optical fibre interface, LC connector, with transceivers for 20 km							
	F = single mode 1 Gbps optical fibre interface, LC connector, with transceivers for 80 km							
	G = multi mode 100 Mbps optical fibre interface, ST connector, with transceivers for 2 km							
	H = multi mode 100 Mbps optical fibre interface, LC connector, with transceivers for 2 km							
	R * = 2.5 Gbps, single mode, LC connector, 2 km, 2 transceivers							
	N = dummy module							
	Software and documents language							
	P = Portuguese							
	E = English							



Top view

<b>T1000</b>	MOD1	MOD2	MOD3
	MOD4	MOD5	MOD6

\* Note: Module option R in the above table is only available in MOD3

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