Smart Grid Substation Automation Ethernet Switch - Official Technical Overview & Hardware Datasheet

SMART GRID SUBSTATION AUTOMATION ETHERNET SWITCH

OFFICIAL TECHNICAL OVERVIEW & HARDWARE DATASHEET

EXECUTIVE SUMMARY

The Smart Grid Substation Automation Ethernet Switch is a ruggedized, IEC 61850-3 and IEEE 1613 compliant networking appliance purpose-built for electric power substation environments. Designed to operate reliably under extreme electromagnetic interference, wide temperature ranges (-40°C to +85° C), and galvanic disturbances, this platform enables seamless integration of protection, control, measurement, and monitoring devices within digital substation architectures. The switch combines high-availability Layer 2 switching with deterministic traffic prioritization, redundant power inputs, and zero-packet-loss failover mechanisms essential for mission-critical protection applications (e.g., GOOSE, Sampled Values, MMS).



HARDWARE ARCHITECTURE & SILICON

The switch is built upon a fault-tolerant, fanless conduction-cooled chassis with an application-specific integrated circuit (ASIC) forwarding engine capable of line-rate wire-speed processing across all Ethernet ports. The hardware architecture separates the data plane from the management plane, ensuring that control traffic storms or CPU overloads do not interrupt protection message forwarding. Key silicon-level features include hardware-based IEEE 1588v2 Precision Time Protocol (PTP) with sub-microsecond timestamp accuracy, hardware-accelerated Quality of Service (QoS) queuing (8 priority queues per port), and ingress policing for GOOSE message storm suppression. The power supply subsystem supports dual-redundant wide-range DC inputs (24/48/110/125/220 VDC, with reverse polarity protection) or optional AC inputs (110/220 VAC), with automatic power source failover and failure alarm

relay output.

KEY FEATURES & ROUTING LOGIC

- IEC 61850-3 & IEEE 1613 Compliance: Certified for substation environmental and EMI requirements, including surge withstand, fast transients, electrostatic discharge, and radiated immunity.
- Deterministic GOOSE & SV Forwarding: Hardware-based multicast filtering and VLAN segregation ensure predictable latency (<4 microseconds per hop) for protection-critical messages.
- IEEE 1588v2 PTP (Power Profile): Transparent clock and boundary clock modes for synchronized merging units and intelligent electronic devices (IEDs) without GPS dependency.
- Redundant Network Protocols: Supports Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR) for zero-switchover-time substation ring topologies (IEC 62439-3).
- Substation Hardened Ports: Up to 18 x 100/1000BASE-X SFP fiber ports (multimode/singlemode) and 6 x 10/100/1000BASE-T copper ports, all with extended surge protection (4 kV common mode / 2 kV differential mode).
- Management & Cybersecurity: Role-based access control (RBAC), RADIUS/TACACS+ authentication, SNMPv3, syslog, port security, MAC address whitelisting, and Dying Gasp alarm for last-gasp power failure notification.

COMPLIANCE & STANDARDS

- Power Utility Standards: IEC 61850-3 (clause 6.5 for EMI), IEEE 1613 (environmental and EMI), IEC 62439-3 (PRP/HSR).
- Safety & EMC: IEC 61000-6-2 (industrial immunity), IEC 61000-6-4 (emissions), UL 61010-1 / CSA C22.2 No. 61010-1 (safety), CE, FCC Part 15 (Class A).
- Environmental: RoHS 3 (EU 2015/863), REACH, WEEE compliant. Fanless design for contaminant-free operation (no moving parts).
- Port & Interface Immunity: IEC 60255-27 (measuring relays and protection equipment), ANSI C37.90 (relay ports to switch).

TECHNICAL SPECIFICATIONS

- Switching Fabric Capacity: 12.8 Gbps non-blocking
- Forwarding Rate: 9.5 Mpps (64-byte packets)
- MAC Address Table: 8K entries
- Jumbo Frame Support: Up to 9,216 bytes
- VLANs: 4K active (802.1Q), Port-based, GVRP
- QoS: 8 hardware queues per port, strict priority/WRR, 802.1p, DSCP remarking
- Redundancy Protocols: PRP (RedBox), HSR (QuadBox), RSTP (802.1w), MSTP (802.1s)

- Management Interfaces: CLI (console serial), Web GUI (HTTP/HTTPS), SNMP v1/v2c/v3, RMON, Syslog

- MTBF (Telcordia SR-332): > 500,000 hours at 40°C ambient

- Operating Temperature: -40°C to +85°C (convection cooled, fanless)

- Storage Temperature: -45°C to +90°C

- Humidity: 5% to 95% non-condensing

- Altitude: Up to 4,000 m (operational)

- Enclosure: IP40 (dust-tight), DIN-rail or wall-mount, aluminum alloy chassis

- Dimensions (W x H x D): 74 mm x 152 mm x 123 mm (for 8-port models) ; expandable modular chassis available

- Power Consumption: 18W (typical) to 35W (maximum with all PoE+ ports active)

Parameter	**Specification**
Form Factor	DIN-rail / Wall-mount, fanless, IP40 (Compact models) or Modular Chassis
Switching Capacity	12.8 Gbps non-blocking (expandable with modular chassis up to 56 Gbps)
Power Supply	Dual hot-swappable redundant DC (24/48/110/125/220 VDC) or AC (110/220 VAC) with reverse polarity protection

Operating Temperature	-40 °C to +85 °C (fanless conduction cooling)
Redundancy Protocols	PRP (RedBox), HSR (QuadBox), RSTP, MSTP, G.8032 ERPS
IEEE 1588v2 Accuracy	Sub-microsecond timestamping (transparent/boundary clock)
MTBF	> 500,000 hours (Telcordia SR-332, 40° C ambient)

ORDERING SKU INFORMATION

Model Designation | Total Port Configuration | Power Input | Redundancy Protocol Support | PoE Capable

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SGS-6008T | 8 x 10/100/1000BASE-T | Dual 24-48 VDC | RSTP, PRP (via firmware) | No

SGS-6016M | 16 x 100/1000BASE-X SFP + 4 x Gigabit combo | Dual 110/125/220 VDC | HSR, PRP, RSTP | No

SGS-6024P | 24 x Gigabit combo (12 copper / 12 SFP) | Dual 24-48 VDC (PoE+ 30W per port) | RSTP, MSTP | Yes, 802.3at/af

SGS-6000R | Modular chassis (up to 28 ports) with PRP/HSR RedBox | Dual

AC/DC universal | HSR, PRP, RSTP, G.8032 | Optional



Note: Extended temperature (-40°C to +85°C) applies to all listed models. For industry-safety approvals (UL/IECEx/ATEX for hazardous locations), consult the factory for region-specific variants. All SKUs include 15-year minimum support lifecycle for utility asset planning.