Time-Triggered Ethernet Switch Unit (TSU)

Rugged Modular Switch Unit with up to 24 GbE + 24 x 100Base TX

Overview

The TTE Switch Unit is a modular system supporting configurations with 1 to 4 TTE switch boards.

The TSU is a rugged TTE switch system optimized for demanding Size, Weight and Power (SWaP) constraints of embedded space computer network systems and avionics for critical control applications.

The TTE Switch Unit has a modular design allowing independent in-orbit replacement of the Power Supply Board, and Switch Modules.

Each TTE switch board is installed in a dedicated slot and operates independently.

Each TTE Switch Board provides:

- 6x 1000 BASE-T (triple speed) Gigabit Ethernet + 6x 100 BASE-TX Fast Ethernet ports, 16 Gbps total switching performance
- Safe partitioning between IEEE 802.3, rate-constrained and time-triggered Ethernet traffic (SAE AS6802)
- Switch IP for up to 4,096 virtual links, up to 8 priorities
- Fault-tolerant high-speed communication with high bandwidth (COM/MON Safety Mechanism)

Power Supply Board provides each Switch Board with independently switchable power input, i.e. each Switch Board may be switched on/off individually via HV-HPC interface. Switch Board input power status is reported via binary status monitoring interface.

The unit can interface Ethernet via a large offering of space qualified connectors. Integrated filtering is designed to meet power input voltage, spikes, surges, transients and EMI/EMC requirements of typical space deployments (including Deep Space Gateway). The TSU enables deterministic Local Area Network (LAN) switching and time synchronization across extended operating temperature ranges, shock/vibration and radiation conditions.

The TSU features up to 24x 1000 BASE-T and 24x 100 BASE-TX ports and combines layer-2 managed network switch functions with remote management capabilities for optimizing communications and prioritizing critical traffic according to the AS6802 and ARINC664p7 standards.

Applications

The TSU is a reliable and flexible building block for mission critical real-time avionics networks and an elegant solution for connecting many IP-enabled devices, including cameras, sensors, payload, command-and-control equipment and other avionics deployed in space transportation system platforms and orbital infrastructures.

APPLICATIONS

- **Space:** Space Stations, Space transportation systems, orbital infrastructures. Deep Space Gateway Lunar I-Hab & Lunar View
- **Aerospace:** Military and civil spacecraft
- **Defence:** Battlefield communication, rugged networks, combat vehicles
- **Others:** Radiation exposed environment (Medical devices, Nuclear Power Plant, Nuclear Research facilities)

SERVICES AVAILABLE

- Unit customization

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ABOUT SPACE APPLICATIONS SERVICES

Space Applications Services NV/SA is an independent Belgian company founded in 1987. Aerospace Applications North America is our Partner company in Houston, USA.

Our aim is to research and develop innovative systems, solutions and products and provide services to the aerospace and security markets and related industries. Our activities cover manned and unmanned spacecraft, launch/re-entry vehicles, control centres, robotics and a wide range of information systems.

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Specification Summary

Architecture

- Independent operation of up to 4 TTE Switch Boards.

Ports

- 24x 1000 BASE-T (Triple speed) Gigabit Ethernet + 24x 100 BASE-TX Fast Ethernet ports.
- UART/DSU management console (per switch board).

Layer 3 (routing)

- Functionality can be implemented on demand.

Layer 2 (switching)

- Port control: port-speed, duplex mode, flow control, port frame size (jumbo frames), port state, port status (link monitoring), port statistics (MIB counters).
- Quality of Service (QoS) traffic prioritization and queuing: 4096 Virtual Links, bandwidth allocation gaps of 0.5 ms to 1600 ms.
- ICMP, TFPT, SNMP protocol support.
- IEEE 802.1Q VLAN support
- In-band Ethernet TTE switch management via Simple Network Management Protocol (SNMPv1).
- In-orbit software and configuration update via TFTP.
- UART/DSU for on-ground tracing.
- Built-In Test (BIT) functionality to detect system faults.

Power

- Power Input: dual-redundant 120 VDC nominal steady state.
- Survivability to abnormal steady state voltage, ripple, surges, spikes and transients.
- Power consumption: Max 75 Watt depending on configuration.

Physical

- Connectors: Circular MIL-DTL-38999, Micro-D, MicroMach or customer specified.
- Cooling: passive thermal management; conductive cooling
- Enclosure/finish: corrosion resistant, aluminium alloy, chromated or painted.

- **Mass:** Max 8.6 kg / 19 lbs depending on configuration.
- **Dimensions:** 294 x 292 x 140 mm / 11.6 x 11.5 x 5.5 in.

Environmental

- Operational Temperature Range: -35°C to +65°C / -31°F to +149°F (vacuum)

EMI/EMC

- Designed to Meet MIL-STD-461F & RTCA/DO-160G section 22.

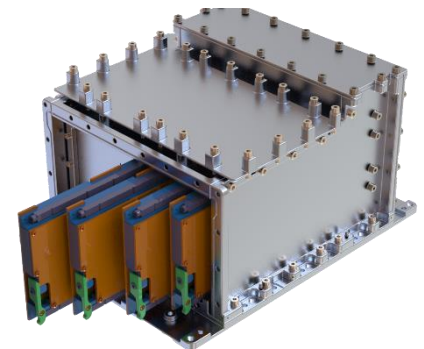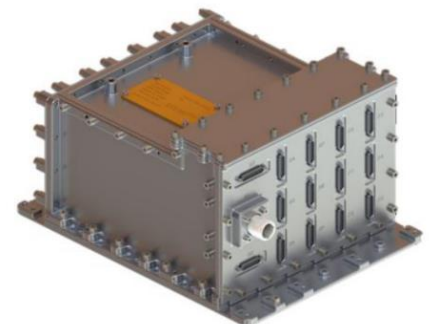## Export jurisdiction

- ITAR-free.

Quality

- Designed for human rated safety critical missions.

TSU with up to 4 TTE switch boards