



TTE Switching Unit (TSU)

Space-grade TTEthernet® Switching Unit with four TTESwitch Space 3U cPCI cards



Key Benefits

- ✔ Supports three Ethernet traffic classes: best effort, rate-constrained and time-triggered Ethernet
- ✔ 48 switched Ethernet ports (up to 24 Gigabit ports) in a compact unit
- ✔ Customizable to customer needs due to modular front panel and backplane design
- ✔ Two separate power compartments for increased reliability
- ✔ Currently under qualification for the Artemis Lunar Gateway

The TTESwitching Unit is based upon a robust 3U cPCI chassis hosting four TTESwitch Space 3U cPCI cards. It was designed to meet the challenges of harsh space environments like Gateway's lunar orbit. It provides core networking functionality for the design of complex distributed control systems.

TTESwitching Unit

The TTESwitching Unit is a powerful avionics system integrating four independent TTESwitch Space 3U cPCI cards building a reliable 48-ports Ethernet switching unit (TSU). A total of up to 24 gigabit ports are available.

Innovation meets Heritage

Based on TTTech's core technology, this product is manufactured and qualified by Beyond Gravity, leveraging on an extensive heritage of successful space products.

Dual DC/DC Power Supply

The TTESwitching Unit is equipped with a dual DC/DC power supply (each PS supplies two card slots) that safely transforms a spacecraft bus voltage of 96-136 V to the 3.3 V supply voltage (PICMG 2.0 R3.0)

required on the cPCI backplane. Each power supply forms an electrically independent power compartment confining failure propagation. A discrete power commanding interface is available for each compartment. Telemetry interfaces for hot spot temperature telemetry and status are available.

TTESwitch Space 3U cPCI

The on-board TTESwitch Space 3U cPCI cards form the core of a TTEthernet® network. The cards are built in a compact cPCI 3U form factor as an off-the-shelf product. TTEthernet® permits the use of synchronized and non-synchronized functions of distributed systems in the same Ethernet network. System-critical hard real-time functions enjoy reserved bandwidth, full determinism and a jitter below 1 μs. Thanks to a combination of SAE AS6802 time-triggered Ethernet, ARINC 664-part 7 compatible rate-constrained Ethernet and IEEE 802.3 Ethernet,



Application Fields

- Human space flight
- Telecommunication
- Earth observation
- Reconnaissance

high transfer rates for non-critical data can be achieved at the same time, without impacting critical traffic. Each switch has an internal frame memory of 512 kB supporting the storage of lower priority traffic while higher priority traffic is processed.

Device and network management

Each TTESwitch Space 3U cPCI features an integrated management CPU to perform loading and diagnostic services. These internal monitoring functions allow the user to continuously assess the system health state over the network via SNMP. Monitored parameters include synchronization state, supply voltage, board temperatures, dropped/rejected frames and the results of various built-in self-tests. Both switch firmware and network traffic schedule (configuration files) can be updated safely via the TFTP network protocol without interruption of the network service. Configuration files for all traffic classes can be created with our TTE-Tools (see related products).

Flexible backplane connectors

EDU products are offered with either a commercial cPCI connector backplane (at a lower price) or with a flight-grade Hypertac cPCI connector (-H) backplane for maximum representativeness to the proto and flight models. Proto and flight models are always with Hypertac connectors.

Available Models

EDU: Functionally-representative with commercial parts for laboratory use only.

PROTO: Built for unit/system-level qualification (lower parts grade).

FLIGHT: Qualified according to ECSS and acceptance-tested. Flight-grade model for safety-critical space applications. Built with level-1 grade ceramic parts.

Applicable Documents

PICMG 2.0 R3 – compact PCI® specification

S-311-P-822 – NASA specification, connectors, PWB, 2 mm cPCI™ Style

ECSS-Q-ST-60C Rev.2 – ECSS, electrical, electronic and electromechanical (EEE) components

Related Products

- TTESwitch Space 3U cPCI
- TTEEnd System Space 3U cPCI
- TTETools

Ordering Codes

13252	TSU (4x TTESwitch Space 3U cPCI (EDU))
14132	TSU (4x TTESwitch Space 3U cPCI (EDU – H))
14998	TSU (4x TTESwitch Space 3U cPCI (PROTO))
13251	TSU (4x TTESwitch Space 3U cPCI (FLIGHT))

13251/13735 – TTESwitching Unit (FLIGHT)	Lifetime	15 years
	Environmental	<p>Vibration (random, all axes, to be confirmed): 20 Hz: 0.036 g²/Hz (+3 db/oct), 40 Hz: 0.2 g²/Hz, 800 Hz: 0.2 g²/Hz, 2000 Hz: 0.032 g²/Hz</p> <p>Shock, all axes (to be confirmed): 20 Hz: 20 g, 1000 Hz: 2000 g, 2000 Hz: 3000 g, 10000 Hz: 3000 g</p> <p>Temperatures (qualification test levels): Operational range: -35 °C to +66 °C, storage range: -40 °C to +85 °C</p> <p>Radiation: TID for 15 years GEO missions, all components SEL free up to 60 MeV/cm²/mg & SEE tested up to 60 MeV/cm²/mg</p> <p>EMC: Compliance to MIL-STD-461F CS101, CS114 (Space), CE101-4, CE102 (for 115 V)</p>
	Power supply	Supply voltage: 96 – 136 V Provides internally: 3.3 V (according to PICMG 2.0 R3) Power consumption EoL 13251: 54.8 W average, 70.4 W peak
	Dimensions	291.1 x 200.7 x 115.1 mm
	Mass	4x Switch TSU configuration: 6.6 kg



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