


## TTE Switch Lab Space

Deterministic Ethernet switch based on the TTE Switch Controller HiRel ASIC



### Key Benefits

- ✓ 19 x 100 Mbit/s full-duplex Ethernet
- ✓ 6 x 100/1,000 Mbit/s full-duplex Ethernet
- ✓ 4,096 virtual links with up to 8 priorities
- ✓ Switching features 100% identical to those of the corresponding space flight Ethernet switch
- ✓ Copper and optical physical layer available
- ✓ Partitioning between three traffic classes (standard Ethernet traffic, rate-constrained and Time-Triggered Ethernet traffic)

The TTE Switch Lab Space supports laboratory testing efforts of Time-Triggered Ethernet applications; user development costs can be reduced by using the internal TTE Switch Controller HiRel ASIC that is also used in flight equipment. With advanced features like speeds of up to 1 Gbit/s, flexible physical layer configuration and three supported traffic classes, it is the optimal switching solution for a large variety of application areas. TTEthernet is a fault-tolerant, real-time communication protocol for safety-relevant systems integrating Ethernet and TTEthernet data flows onto one physical infrastructure.

### Switching function

The TTE Switch Lab Space is a Deterministic Ethernet switch enabling the implementation of critical network-centric applications. Based on the flight TTE Switch Controller HiRel, it is especially useful as a launching platform for customers planning to work with or build a space-grade switch equipment box in the future, as the TTE Switch Controller HiRel can be reused for space flight missions.

The high-performance switch enables packet processing on all 25 ports with full line speeds. The TTEthernet technology of the TTE Switch Lab Space allows for convenient configuration of deterministic processing of critical and non-critical Ethernet traffic. It supports best-effort Ethernet (IEEE 802.3), ARINC 664 part 7 and time-triggered (SAE AS 6802) traffic flows. The TTE Switch Lab Space offers built-in mechanisms for traffic policing and fault isolation.

### Virtual links and protocol support

The TTE Switch Lab Space allows the configuration of up to 4,096 virtual links (VLs). Virtual links can be configured with eight priorities and a bandwidth allocation gap (BAG) of 0.5 ms to 1,600 ms. The configuration of the network is stored in the switch's non-volatile memory (256 Mbit). As an option, IEEE 802.1Q VLANs can be configured. Profiled IP/UDP, redundancy management, and traffic shaping are implemented in hardware. The internal LEON2 CPU is used for management and higher-layer protocol functions.

### Data loading and diagnostics

The built-in management module runs transparently and allows for data loading as well as for querying the network status via SNMP. Data loading is done according to TFTP.



### Application Fields

- Laboratory development
- Space

Connectors	<p>6 x 100/1,000 Mbit/s full-duplex Ethernet (1000Base-T/100BASE-TX via RJ45 or 1000BASE-X via SFP)                  19 x 100 Mbit/s Ethernet (100BASE-TX via RJ45)                  Optional support of optical SFPs                  USB interface for CPU debugging / UART1                  SpaceWire interface                  RS422/485 interface (can be used for debugging)                  Support advanced functions with GPIOs                  Monitoring faulty/healthy switch state through SNMP</p>
Time-Triggered (SAE AS 6802) Implementation	<p>8 sub-schedules                  8 clock sync masters                  4,096 virtual links                  Store-and-forward switch architecture</p>
ARINC 664 part 7 Implementation	<p>Policing, filtering, switching engine for bandwidth control and traffic prioritizing                  Integrity and error checking of frames                  4,096 virtual links with up to 8 priorities with restrictions of their associated ports                  4,096 shared bandwidth allocation gaps (BAGs)                  BAGs freely configurable from 0.5 to 1,600 ms                  BAG configuration granularity 100 µs                  Jitter &amp; BAG resolution of 8 ns                  SNMP v1 &amp; ICMP fully supported                  TFTP data-loading</p>
Key Features	<p>6 x 100/1,000 Mbit/s full-duplex Ethernet                  19 x 100 Mbit/s full-duplex Ethernet                  Ethernet link/activity LED per port                  Support of copper and optical physical layer                  Full line speed switching capability                  Switching engine core identical to corresponding TTEthernet flight switch                  Up to 1 Mbyte of frame memory                  256 Mbit Flash memory for storing switch configurations                  Internal LEON2 CPU for management functions                  Built-in tests (BITs) for health monitoring</p>
Standards Compliance	<p>IEEE 802.3-2005 (switching, flow control), IEEE 802.1Q (VLAN core capabilities),                  ARINC 664 part 7, SAE AS6802</p>
Environmental Operating Ranges	<p>Operational temperature: -40 °C to +70 °C                  Storage temperature: -55 °C to +85 °C                  Operating/non-operating humidity: humidity level from 25 to 90%</p>
Power Supply	<p>AC voltage: 100 to 240 V, 60 to 50 Hz, 2A max. thermal control 260 W AC power supply with PFC</p>
Dimensions	<p>Size: 44 x 483 x 356 (in mm), weight: 4.7 kg</p>
Form Factor	<p>19" rack housing 1 height unit</p>
Order Number	<p>13523: TTESwitch Lab Space – Package → TTESwitch Controller HiRel ASIC rev. 'B'                  (available until Q1/2021)                  13970: TTESwitch Lab Space – Package (rev. 'C') → TTESwitch Controller HiRel ASIC rev. 'C'                  (available from Q1/2021)</p>

