SOLUTIONS FOR LOW-EARTH-ORBIT SATELLITE BUSES AND PAYLOADS

BALANCING RELIABILITY, COST, AND TIME WITH HIGH-PERFORMING COTS AND SPACE-QUALIFIED SOLUTIONS
Providing Broad Options for the Optimum Balance

Today, the frontier of low-earth-orbit satellite networks is rapidly expanding. A vast constellation of cross-linked satellite platforms promises access to the Internet and mobile-phone voice and data across the entire planet. These opportunities have launched a new era in aerospace engineering, inspiring unprecedented innovation in low earth orbit (LEO) satellite design.

That’s why TE Connectivity (TE) offers both space-qualified and commercial-off-the-shelf (COTS) components to meet novel bus and payload needs. Space-qualified solutions comply with demanding vibration, offgassing, electrostatic-discharge, tin-whisker-mitigation, temperature, radiation, and size-weight-and-power (SWAP) requirements. TE also accommodates new mission profiles where the performance, economy, and ready availability of COTS and COTS+ solutions are suited to LEO satellites with limited life cycles.

Our broad portfolio helps designers reach the optimum balance between performance, cost, and time to market. With a heritage in satellites beginning with Explorer 1, TE has been at the forefront in developing space-qualified SpaceVPX, VITA, and MIL-SPEC compliant products. That expertise extends to offering “up-ruggedized” COTS+ products commonly used in military, avionics, automotive, and other qualified applications. And benefitting from world-class-manufacturing, our COTS products are being applied under conservative design rules in next-generation satellite platforms. Discover how our high-performing solutions can help you reach the right balance for your mission.
Solutions for Low-Earth-Orbit Satellite Buses and Payloads

**Propulsion**
- Relays and Contactors
- Wire and Cable
- Harness Components
- Sensor Solutions

**System Interconnect**
- Circular Connectors
- Wire and Cable
- I/O and RF Connectors
- Backshells

**Data and Payload**
- Board Level Connectors
- I/O and RF Connectors
- Fiber Optics
- Harness Components
- Wire and Cable

**Communications**
- Circular Connectors
- Wire and Cable
- I/O and RF Connectors
- Fiber Optics

**Solar Panels**
- Wire and Cable
- Circular Connectors
- Sensor Solutions
- Relays and Contactors
Solutions for Low-Earth-Orbit Satellite Buses and Payloads

BOARD-LEVEL CONNECTORS

STRADA Whisper High Speed Backplane Connectors

High Speed
- Transfers data at speeds of 25 Gbps and offers unparalleled scalability up to 112 Gbps

Reliability
- Industry leading crosstalk performance
- Robust signal pins and ground shields
- Simple upgrade path

VITA 46 MULTIGIG RT-3 AND MULTIGIG RT 2-S Connectors

Speed
- Data transfer rates to 25+ Gb/s

Rugged
- Ruggedized multipoint contact system meets VITA vibration standards

Capable
- Modular design with backward interoperability

Fortis Zd Ruggedized Connectors

High Speed
- Data transfer rate 10+ Gb/s
- 2 and 3 pairs modules
- 3-bay metal shield modules

High Performance
- Extreme mechanical and electrical performance
- 4-points of contact per M55302
- Modular design allows for user configurability
- Space-compatible materials

VITA 46 MULTIGIG RT 2-R Connectors

Ultra-Rugged
- Withstand high shock and vibration levels
- Redundant 4-point contact interface

Optimized Performance
- Supports data rates to 10+ Gb/s
- Compliant to VITA 46 standards
- Modularity and flexibility with a pinless wafer design
- Lightest weight VPX solution on the market

Mezalok Mezzanine Connectors-
VITA 61 and VITA 48.8

Compatible
- Data transfer rate of 16+ Gb/s
- 114-position, compatible with XMC 2.0 VPX structure 10 mm to 18 mm stack heights availability
- 17 mm stack height compliant to VITA 48.8
- 60 and 320-position, 10 and 12 mm stack heights

Robust
- 4-points of contact per M55302
- Highly reliable, compliant with VITA 47 and 72 HALT
- Designed for excellent thermal stability and durability

VITA 62 MULTIBEAM XLE Power Connectors

Offering
- Standard connectors for 20 A and 50 A with signals. Connectors for 270 VDC up to 70K altitude
- 3-phase connectors
- 50 and 30 micron Au interface
- Hot plug capable

SPACE VPX

Space VPX

Rugged
- Configurations support VITA 78 SpaceUM (utility/management) modules
- Supports +125°C temp life
- Space-compatible materials
<table>
<thead>
<tr>
<th>Connector Type</th>
<th>Features</th>
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<tbody>
<tr>
<td>DEUTSCH Wildcat 38999 Connectors</td>
<td><strong>Space and Weight Savings</strong>&lt;br&gt;• Almost double the contact density of MIL-DTL-38999 connectors&lt;br&gt;• Lightweight materials&lt;br&gt;<strong>Rugged</strong>&lt;br&gt;• Threaded anti-vibration coupling&lt;br&gt;• Scoop-proof interface&lt;br&gt;• Aggressive fluid resistance and dust ingress prevention</td>
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<tr>
<td>DEUTSCH ACT Composite Connectors</td>
<td><strong>Light Weight</strong>&lt;br&gt;• Composite shell&lt;br&gt;• Up to 40% lighter than DTS&lt;br&gt;<strong>Durable</strong>&lt;br&gt;• 2000 hrs salt spray for corrosion resistant&lt;br&gt;• Shell is resilient to impact</td>
</tr>
<tr>
<td>DEUTSCH Filtered Connectors</td>
<td><strong>Customizable</strong>&lt;br&gt;• Broad range of standard and custom options&lt;br&gt;• Rugged ceramic capacitors and inductors are used for the filtering&lt;br&gt;• Matched to application requirements</td>
</tr>
<tr>
<td>DEUTSCH Hermetic Connectors</td>
<td><strong>High Performance</strong>&lt;br&gt;• Maintains a pressure differential between the two sections&lt;br&gt;• Gastight glass-to-metal sealing&lt;br&gt;• Withstand high pressures, extreme temperatures and high vibration&lt;br&gt;<strong>Versatile</strong>&lt;br&gt;• Wide range of connector types and styles</td>
</tr>
<tr>
<td>DEUTSCH DBAS 7 Series Connectors</td>
<td><strong>High Reliability</strong>&lt;br&gt;• Easy and secure locking with circular push/pull coupling ring for 100% mating -55°C to +200°C&lt;br&gt;<strong>Versatile</strong>&lt;br&gt;• Hermetic, rackable, lanyard, dead-face, cryogenic, and custom configurations&lt;br&gt;• Meets ESA SCC 3401, Ariane 5, and Vega requirements</td>
</tr>
<tr>
<td>DEUTSCH 014 Series Connectors</td>
<td><strong>High Reliability</strong>&lt;br&gt;• Pyrotechnic connectors offer reliability under harshest high-temperature conditions&lt;br&gt;• Meets ESA/SCC 3401 grade requirements&lt;br&gt;• Bayonet coupling for fast connections</td>
</tr>
<tr>
<td>DTS 38999 Series III</td>
<td><strong>Capable</strong>&lt;br&gt;• Lightweight&lt;br&gt;• Triple-start, self-locking threaded coupling&lt;br&gt;<strong>Space Qualified</strong>&lt;br&gt;• Class G qualified</td>
</tr>
<tr>
<td>MIL-DTL-38999 Series IV</td>
<td><strong>High Performance</strong>&lt;br&gt;• Optimized for SWAMP area applications&lt;br&gt;• Visual, audible and tactile full-mate indicators&lt;br&gt;• Quick-disconnect breech coupling mechanism&lt;br&gt;<strong>Space Qualified</strong>&lt;br&gt;• Class G qualified</td>
</tr>
<tr>
<td>DEUTSCH DBAS 9 Series Connectors</td>
<td><strong>High Reliability</strong>&lt;br&gt;• Easy and secure locking with circular push/pull coupling ring for 100% mating&lt;br&gt;• -55°C to +200°C&lt;br&gt;• Scoop-proof shell&lt;br&gt;<strong>Standardized</strong>&lt;br&gt;• Insert arrangements and contacts are MIL-DTL-38999 Series III compatible&lt;br&gt;<strong>Versatile</strong>&lt;br&gt;• Hermetic, rackable, lanyard, and custom configurations</td>
</tr>
</tbody>
</table>
Solutions for Low-Earth-Orbit Satellite Buses and Payloads

WIRE AND CABLE

Raychem Hi-FLEX Power Cable
Spec 80 FlexLine
- Operating temperature range: -65°C to +200°C
- Single and dual wall constructions
- Optional high strand count for increased flexibility

SHF-260
- Operating temperature range: -65°C to +260°C (10k hours)
- Tight routing bends without jacket wrinkling or cracking
- Conductors available in nickel coated copper

Raychem SPEC 55 Signal and Power Radiation XL-ETFE Space Wire
Performance
- Excellent abrasion and cut-through resistance
- Excellent flexibility
- Low-fluoride and Electroloss filtering options
- Smallest and lightest performance wire
- Mechanically tough, low outgassing
- Meets ESA requirements ESCC 3901/012, /020 and /022
- Mil Spec version available

Raychem High-Speed Copper Cable
Rugged Choices
- Reduced size and weight
- Harness component system compatibility
- Custom constructions available

High-Speed Protocols
- Cat 5e, Cat 6a, 100Base-T, CANbus, IEEE 1394, USB 2.0/3.0, DVI, Fiber

Raychem Cheminax Controlled Electrical Cable
High Performance
- 25-40% smaller and lighter than RG cables
- Improved electrical performance over RG cables
- Custom constructions available
- Operating temperature range: -65°C to +200°C

Adaptable
- Small size, lightweight
- Coax, twinax, triax, balanced line, data bus available
NanoRF VITA 67.3 Modules

**Performance**
- High frequency 70 GHz contacts

**Offering**
- Nanominiature coax contacts with packaging designed for harsh environments
- 0.110 pitch compared to 0.240 SMPM pitch
- Precise alignment due to floating plate design
- RF-Optical hybrid modules
- Full range of contacts and tools

VITA 67.1 and VITA 67.2 Modules

**Performance**
- High frequency up to 40 GHz

**Offering**
- Full range of SMPM RF modules
- SMPM blind mate as well as special OSMM threaded mates
- Space and weight savings with aluminum modules
- Full range of contacts and tools

DEUTSCH UR and RE Series Connectors

**High Reliability**
- Low general magnetism and outgassing

**Extreme Weight and Space Savings**
- Lightweight, high-density connector
- Companion RE series is intermateable and recommended for nonflight applications

DEUTSCH EN4165/ARINC 809 Connectors

**Save Weight, Control EMI**
- Wide range of modules for signal and power
- Excellent EMI performance
- Robust composite shell saves weight

DEUTSCH D-PASO Series Connectors

**Capable**
- Compact, ultra-flat designed for solar arrays
- Size 20 contacts: 7.5 A current rating

**Robust**
- High reliability, high density
- Extreme temperature range of -175°C to +130°C

369 Space Series Connectors

**Rugged and Reliable**
- Small form factor with simple push pull mating
- Lightweight at 2.9 g per mated pair
- Integrated tie down reduces installation complexity
- Meets outgassing spec per ASTM 595

Microminiature Connectors

**Rugged Reliability**
- High shock and vibration ratings
- Wide temperature range: -200°C to +200°C
- Lightweight and space-proven
- Low outgassing

AMPLIMITE ULTRA-LITE Subminiature-D Connectors

**Weight-Saving Design**
- Ultra-lite connector features up to 20% weight savings
- Designed for input/output and product break harnessing

**Capable**
- Improved EMI performance
- NASA qualified designs

RF Connectors, Cable and Cable Assemblies

**More Choice, More Performance**
- Standard, subminiature, and microminiature interfaces and frequencies
- Flexible and semi-rigid cable
- Qualified to MIL-PRF-39012, Mil-DTL-83517, MIL-PRF-55339

DEUTSCH D-PASO Series Connectors

**Capable**
- Compact, ultra-flat designed for solar arrays
- Size 20 contacts: 7.5 A current rating

**Robust**
- High reliability, high density
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AMPLIMITE ULTRA-LITE Subminiature-D Connectors

**Weight-Saving Design**
- Ultra-lite connector features up to 20% weight savings
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**Capable**
- Improved EMI performance
- NASA qualified designs
Raychem High-Temperature Devices

Reliable
• Heat shrinkable technology for one-step shield
• Transparent insulation sleeve saves time during installation
• Provides strain relief with ratings of up to 150°C
• Minimal tools required to achieve connection, insulation and protection
• Inhouse design and quality controlled process offers reliability and traceability

P-Clamps

Mechanically Tough
• Primary clamp installation mechanism decoupled from clamp closure mechanism for harness installation
• Captive locking pin
• Self-aligning ratcheting teeth
• Pinchless hinge
• Butterfly mounting capable (allows for stacked clamps)
• Weight and time savings

Raychem Tubing and Molded Parts

More Choice
• Available to fit TE backshell adapters

Capable
• Provides excellent strain relief at connector cable terminations
• Save weight and space

Raychem INSTALITE Molded Parts

Weight Savings
• 20-30% lighter than TE's -25 part

Time Savings
• Optimized interior geometry speeds installation time
• Faster recovery

Rugged
• Resists most common aviation fuels, oils and greases
• Abrasion resistant

Gold-Plated Terminals

Reliable
• Non-magnetic crimp terminals provide mechanical reliability, excellent corrosion protection, and low contact resistance required for space applications

Raychem INSTALITE Lightweight Braid

Weight Savings
• Up to 50% lighter than traditional braid

Excellent Shielding
• Covers wide frequency range
• Better low-frequency performance than expensive plated fibers or microfilaments

COPALUM Terminals and Splices

Efficient
• Terminate to aluminum or copper wire
• Aluminum wire: 8 AWG to 4/0 AWG
• Up to 300 amps
• Dry Crimp – no inhibitor agent
• Copper and aluminum terminal bodies

POLAMCO Backshells

Full Range
• Unshielded, shielded, and rugged conduit systems
• Rectangular and circular configurations
• Straight, 45, or 90-degree options

Rugged
• Versions to match any harsh environment
### POWER SOLUTIONS

**HARTMAN Space Qualified Relays**

**Space and Weight Savings**
- Lightweight, hermetically sealed enclosures

**Robust and Versatile**
- Variety of switching configurations
- Efficient magnetic latching decision
- Self de-energizing coil
- Main contact ratings of 100 A at 28 VDC or 35 VDC

**CII High Reliability Hermetic Relays**

**High Reliability**
- Lightweight, low-outgassing materials
- Hermetic sealing
- Inert gas backfilling
- 28 VDC max contact voltage
- Operating temperature range: -65°C to +125°C

**Wide Range of Sizes**
- Available in the smallest and most reliable high-current, high-voltage, midrange and low signal configurations

**KILOVAC Contactors**

**Rugged Reliability**
- Lightweight high power DC or high-voltage DC
- Hermetically sealed, available with a variety of electrical configurations, power ratings, voltage ratings, and mounting styles to make your electrical system more reliable and capable

**KILOVAC High Voltage Relays**

**High Reliability**
- Many configurations and form factors available
- Operating temperature range -55°C to +125°C

**HARTMAN N-Series Relays**

**High Reliability**
- Magnetic latch or side stable
- Stainless steel-welded construction
- Hermetically sealed

**Flexible Performance**
- Operating temperature range: -55°C to +125°C
- Multiple mounting and auxiliary contact configurations
- Main contact current ratings 30 to 125 A

**DRI Mid-Range Latching Relays**

**Versatile**
- 5A to 25A product
- Internal voltage suppression options
- Variety of mounting and termination styles

**Reliable**
- Qualified to M83536
- Hermetically sealed
- Magnetic latching assures improper switching

### FIBER OPTICS

**Optical Flex Circuits**

**Versatile**
- Symmetrical and asymmetrical designs
- Radiation hardened fiber
- Up to 10mm tight bend radii
- Very low insertion loss over a broad temperature range

**Highly Customizable**
- Up to 6 levels of fiber crossings in a single layer
- Up to 12 layers
- Range of packaging options for environmental conditions
- Qualified for space application

**Rugged Optical Interconnects**

**Space Saving Design**
- MTC connectors save space compared to circulars
- Accepts standard ARINC 801 optical termini

**DEUTSCH RSC Connectors**

**Rugged**
- Single-channel connectors
- Manufactured from ARCAP alloy for corrosion resistance
- Anti-vibration coupling mechanism

**Versatile**
- RSC: M29504/4 and /5 termini
- RSC EB: EB16 termini
- RSC-v: APC or tunable interface
Solutions for Low-Earth-Orbit Satellite Buses and Payloads

INTEGRATED ASSEMBLIES

HarnWare Harness Design Software
- Powerful
  - Speeds/simplifies harness design
- Comprehensive
  - Component selection
  - Layout and assembly drawings
  - Bills of material

Digital Cable Assemblies
- More Speed, Less Weight
  - Support for high-speed protocols
  - Compact, lightweight designs
  - Fully tested and characterized by TE

Composite Enclosures
- Weight-Saving Rugged Performance
  - Up to 50% lighter than aluminum
  - Rugged and corrosion resistant
- Customizable
  - Composites and plating options
  - Customizable with wire traces, antennas and connectors

Raychem MIL-STD-1553B Data Bus Components
- SWaP Reduction
  - Conserve space, weight, and power consumption
  - Tin/nickel-plated metallic parts
  - Baked silicone rubber components
- Optimum Performance
  - Cable with optimized single shield, double shield, or EMP hardened
  - Low-fluoride-outgassing cable

HIGH SPEED INTERCONNECTS

Quadrax Connectors, Contacts and Cable
- High Density, High Speed
  - Up to 10 Gb/s (over Cat 6A cable)
  - 2 differential pairs in a size 8 contact shell
- Compatible
  - Inserts for many popular aerospace connectors

Raychem HexaShield Backshells
- High Performance
  - 360° shield termination system for shielded wires and cables
  - Excellent mechanical and environmental resistance
- Versatile and Flexible
  - Aluminum, stainless steel and composite versions
  - Simple installation and re-entry

CeeLok FAS-T Nano Connectors
- Extreme Space and Weight Savings
  - .30” diameter
  - Push-pull or threaded coupling
- Fast
  - 10G Ethernet-capable
  - 8 position connector
  - Innovative T-Shaped contact pattern reduces crosstalk

CeeLok FAS-T Connectors
- Compact 10 GbE Performance
  - Compact Size 8 shell for space and weight savings
- Rugged
  - Excellent shock, vibration, temperature, and sealing performance
- Convenient
  - Field terminable, with integral backshell for low-cost, low-weight strain-relief, and EMI protection

STRADA Whisper High Speed Connectors and Assemblies
- High Speed
  - Transfers data at speeds of 25 Gbps and offers unparalleled scalability up to 112 Gbps
- Reliability
  - Industry leading performance
  - Robust signal pins and ground shields
  - Simple upgrade path
  - Best-in-class EMI performance
- Configuration
  - Traditional backplane
  - Direct plug orthogonal (DPO)
  - Cable backplane
## SENSOR SOLUTIONS

<table>
<thead>
<tr>
<th>Linear Variable Differential Transformer (LVDT)</th>
<th>Pressure Transducers and Transmitters</th>
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<tbody>
<tr>
<td>• Stainless steel, high stroke to length ratio</td>
<td>• Pressures from 1 to 100,000 PSI</td>
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<tr>
<td>• Excellent choice for applications with size restrictions or harsh operating environments</td>
<td>• Analog and digital output signals</td>
</tr>
<tr>
<td>• Excellent temperature coefficient</td>
<td>• 1% total error band (-20°C to +85°C)</td>
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<td></td>
<td>• Solid state reliability</td>
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<td></td>
<td>• Survives high vibration</td>
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<td>and immersion</td>
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<tr>
<th>Thermopile Infrared (IR) Sensors</th>
<th>Negative Temperature Coefficient (NTC) Thermistors</th>
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</thead>
<tbody>
<tr>
<td>• Measures temperature from a distance by detecting an object’s IR energy</td>
<td>• Rocket temperature</td>
</tr>
<tr>
<td>• Sensing element absorbs the energy and products an output signal</td>
<td>• Solar array panel temperature</td>
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<td></td>
<td>• Motor temperature</td>
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<td>• Battery temperature</td>
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<td></td>
<td>• Bearings temperature</td>
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<tr>
<td></td>
<td>• Atomic clock</td>
</tr>
<tr>
<td></td>
<td>• Optics temperature</td>
</tr>
<tr>
<td></td>
<td>• Reference space wheel</td>
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<tr>
<th>Piezoelectric Accelerometer Plug and Play</th>
<th>MEAS Space Qualified Sensor</th>
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<tbody>
<tr>
<td>• Integral strain relief</td>
<td>• Radial, bead and custom package types</td>
</tr>
<tr>
<td>• Case isolated, internally shielded</td>
<td>• ESA and NASA approved</td>
</tr>
<tr>
<td>• Noise monitoring</td>
<td>• High reliability and accuracy</td>
</tr>
<tr>
<td>• Available in custom and standard packages</td>
<td>• 1kΩ to 100kΩ resistance range</td>
</tr>
</tbody>
</table>

### Launch & Space Sensor Types
- Payload monitoring vibration sensors
- Thrust vectoring LVDT position sensors
- Electrical actuator position resolvers
- Booster separation potentiometers
- Cryogenic fuel pressure transducers
- Satellite temperature sensors
- Mirror/antenna position LVDT sensors

### Thermopile Infrared (IR) Sensors
- Measures temperature from a distance by detecting an object’s IR energy
- Sensing element absorbs the energy and products an output signal

### Negative Temperature Coefficient (NTC) Thermistors
- Rocket temperature
- Solar array panel temperature
- Motor temperature
- Battery temperature
- Bearings temperature
- Atomic clock
- Optics temperature
- Reference space wheel

### MEAS Space Qualified Sensor
- Radial, bead and custom package types
- ESA and NASA approved
- High reliability and accuracy
- 1kΩ to 100kΩ resistance range
CONNECT WITH US

We make it easy to connect with our experts and are ready to provide all the support you need. Visit te.com/support to chat with a Product Information Specialist.

QUALITY STARTS WITH THE RIGHT APPLICATION TOOLING

Creating a quality crimp connection is essential to delivering high performance and reliability in extreme environments. From low to high volume wire processing, TE has you covered with a full range of application tooling and a global field service team.

- View all application tooling
- Connect with our experts to find the right tool for your application

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TE Connectivity
Aerospace, Defense & Marine
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Middletown, PA 17057