

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

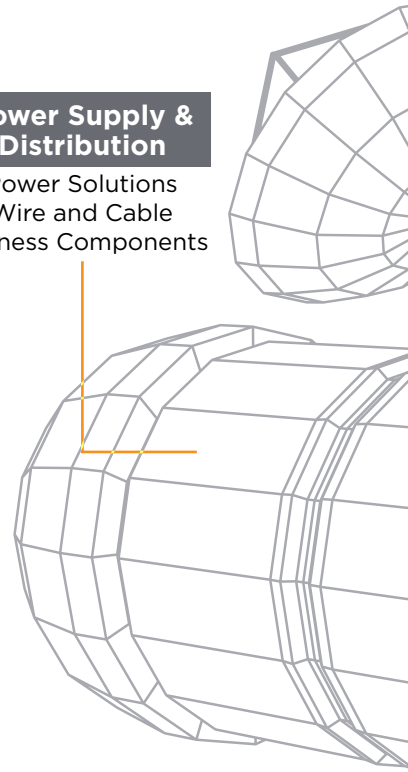
Today, the frontier of low-earth-orbit satellite networks is rapidly expanding. A vast constellation of cross-linked satellite platforms promises access to the Internet and mobile-phone voice and data across the entire planet. These opportunities have launched a new era in aerospace engineering, inspiring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

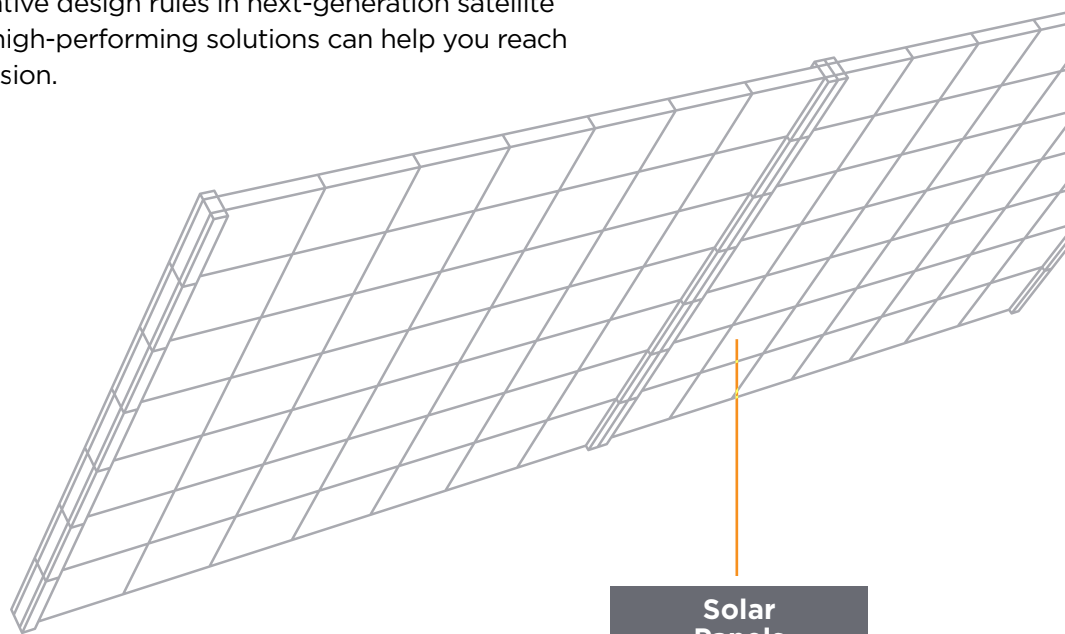
Power Supply & Distribution

Power Solutions
Wire and Cable
Harness Components



Solar Panels

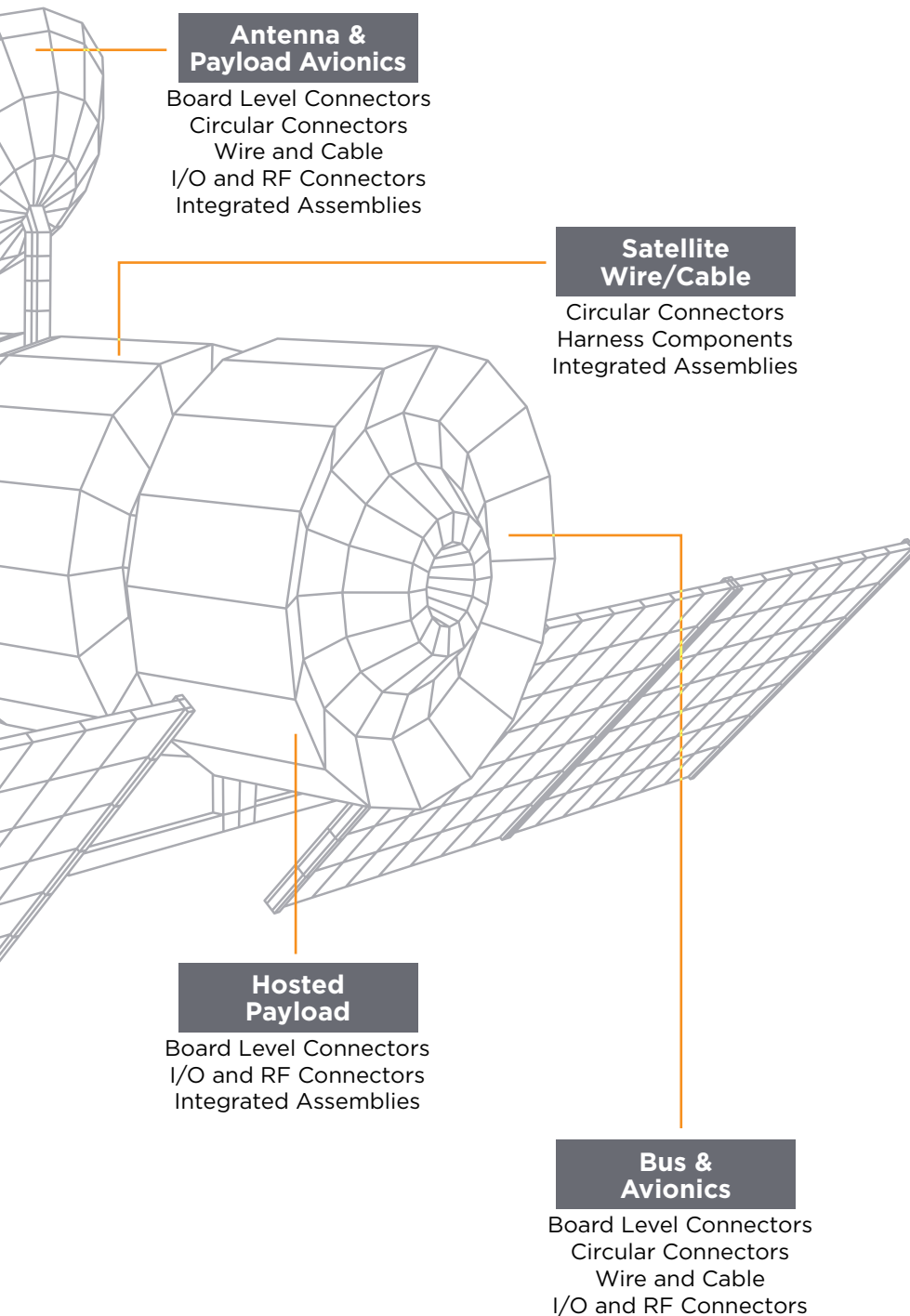
Wire and Cable
Power Solutions



TE Components . . . TE Technology . . . TE Know-how . . .

AMP | AGASTAT | CII | HARTMAN | KILOVAC | MICRODOT | NANONICS | POLAMCO | Raychem
SEACON | Rochester | DEUTSCH

Empower Engineers to Solve Problems, Moving the World Forward.



Antenna & Payload Avionics

Board Level Connectors
Circular Connectors
Wire and Cable
I/O and RF Connectors
Integrated Assemblies

Satellite Wire/Cable

Circular Connectors
Harness Components
Integrated Assemblies

Hosted Payload

Board Level Connectors
I/O and RF Connectors
Integrated Assemblies

Bus & Avionics

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BOARD-LEVEL CONNECTORS



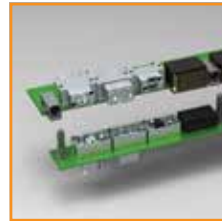
STRADA Whisper High Speed Backplane Connectors

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 66 Fiber-Optic Modules

Full Range of Choices

- ARINC 801, expanded beam or MT termini
- **MT:** extreme density with up to 48 fibers/module
- **ARINC 801:** excellent single-mode performance
- **Expanded beam:** noncontacting interface for frequent matings/unmatings
- VITA 67 RF modules support four or eight blindmate SMPM contacts



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-3 AND MULTIGIG RT 2-5 Connectors

Speed

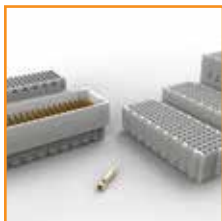
- Data transfer rates to 25+ Gb/s

Rugged

- Ruggedized multipoint contact system meets VITA vibration standards

Capable

- Modular design with backward interoperability



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 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

SPACE VPX



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

Rugged

- Configurations support VITA 78 SpaceUM (utility/management) modules
- Supports +125°C temp life
- Space-compatible materials



CIRCULAR CONNECTORS



DEUTSCH Wildcat 38999 Connectors

Space and Weight Savings

- Almost double the contact density of MIL-DTL-38999 connectors
- Lightweight materials

Rugged

- Threaded anti-vibration coupling
- Scoop-proof interface
- Aggressive fluid resistance and dust ingress prevention



DEUTSCH 014 Series Connectors

High Reliability

- Pyrotechnic connectors offer reliability under harshest high-temperature conditions
- Meets ESA/SCC 3401 grade requirements
- Bayonet coupling for fast connections



DEUTSCH ACT Composite Connectors

Light Weight

- Composite shell
- Up to 40% lighter than DTS

Durable

- 2000 hrs salt spray for corrosion resistant
- Shell is resilient to impact



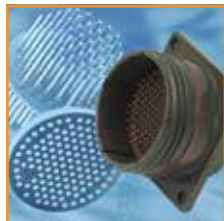
DTS 38999 Series III

Capable

- Lightweight
- Triple-start, self-locking threaded coupling

Space Qualified

- Class G qualified



DEUTSCH Filtered Connectors

Customizable

- Broad range of standard and custom options
- Rugged ceramic capacitors and inductors are used for the filtering
- Matched to application requirements



MIL-DTL-38999 Series IV

High Performance

- Optimized for SWAMP area applications
- Visual, audible and tactile full-mate indicators
- Quick-disconnect breech coupling mechanism

Space Qualified

- Class G qualified



DEUTSCH Hermetic Connectors

High Performance

- Maintains a pressure differential between the two sections
- Gastight glass-to-metal sealing
- Withstand high pressures, extreme temperatures and high vibration

Versatile

- Wide range of connector types and styles



DEUTSCH DBAS 9 Series Connectors

High Reliability

- Easy and secure locking with circular push/pull coupling ring for 100% mating
- -55°C to +200°C
- Scoop-proof shell

Standardized

- Insert arrangements and contacts are MIL-DTL-38999 Series III compatible



DEUTSCH DBAS 7 Series Connectors

High Reliability

- Easy and secure locking with circular push/pull coupling ring for 100% mating -55°C to +200°C

Versatile

- Hermetic, rackable, lanyard, dead-face, cryogenic, and custom configurations
- Meets ESA SCC 3401, Ariane 5, and Vega requirements

Versatile

- Hermetic, rackable, lanyard, and custom configurations



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 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 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 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



RECTANGULAR I/O AND RF



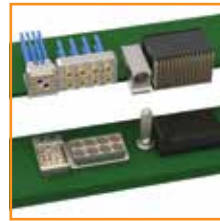
NanoRF VITA 67.3 Modules

Performance

- High frequency 70 GHz contacts

Offering

- Nanominature 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 EN4165/ARINC 809 Connectors

Save Weight, Control EMI

- Wide range of modules for signal and power
- Excellent EMI performance
- Robust composite shell saves weight



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 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 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



Microminiature Connectors

Rugged Reliability

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



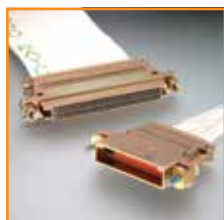
AMPLIMITE ULTRA-LITE Subminiature-D Connectors

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



MTC Connectors

Space-Saving Design

- Low profile for space and weight savings
- High density packaging
- Environmental sealing
- EMI protection
- Signal and power contacts



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



HARNES COMPONENTS



Raychem High-Temperature Terminations

Versatile

- Crimp and controlled-solder splices and shield terminations

High Temperature

- Rated to +200°C or +260°C

Environmentally Sealed

- Heat-shrinkable insulation sleeve for sealing and strain relief



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

- Space-grade versions for low outgassing
- 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



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



KILOVAC Hermetic Relays

High Reliability

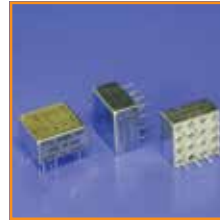
- 270 VDC max contact voltage
- Operating temperature range: -55°C to +125°C



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



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



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

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



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



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



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



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 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



Rugged Optical Interconnects

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



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



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



SENSOR SOLUTIONS



- Linear Variable Differential Transformer (LVDT)**
- Stainless steel, high stroke to length ratio
 - Excellent choice for applications with size restrictions or harsh operating environments
 - Excellent temperature coefficient



- Pressure Transducers and Transmitters**
- Pressures from 1 to 100,000 PSI
 - Analog and digital output signals
 - 1% total error band (-20°C to +85°C)
 - Solid state reliability
 - Survives high vibration and immersion



- Thermopile Infrared (IR) Sensors**
- Measures temperature from a distance by detecting an object's IR energy
 - Sensing element absorbs the energy and produces 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



- Piezoelectric Accelerometer Plug and Play**
- Integral strain relief
 - Case isolated, internally shielded
 - Noise monitoring
 - Available in custom and standard packages



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

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

LET'S CONNECT

We make it easy to connect with our experts and are ready to provide all the support you need. Just call your local support number or visit www.te.com/industrial to chat with a Product Information Specialist.

Technical Support

te.com/support-center

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Balancing Reliability, Cost, and Time with High-Performing
COTS and Space-Qualified Solutions



te.com/space

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Consult TE for the latest dimensions and design specifications.

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