

# SOLUTIONS FOR SPACE

MISSION-CRITICAL RELIABILITY

Withstand the Extreme Environments of Space with High-Reliability Solutions That Save Weight and Space

# LAUNCHING RELIABILITY, ENSURING MISSION SUCCESS

## Space Proven, Agency Approved

To meet the need of today's space applications, we are continually innovating products that are smaller, lighter, and more capable—giving you the reliability you require in packages that enable you to create better systems.

TE Connectivity's (TE) space solutions have been approved by the major space agencies:

- ESA (European Space Agency)
- ISRO (Indian Space Research Organization)
- JAXA (Japan Aerospace Exploration Agency)
- NASA (National Aeronautics and Space Administration)

## Boosting Performance

TE traces its heritage in space exploration back to the days of the Explorer 1 satellite and Project Mercury manned flights. Today we work globally with space agencies, agency contractors, and commercial space companies to create the next generation of solutions for launch vehicles, satellites, manned missions, and deep space explorers.

Our high-performance solutions give you the features you need in every space mission:

### Reliability

- Very wide temperature ranges
- Low outgassing
- Radiation resistance

### Reduced SWaP

- Smaller size
- Lighter weight

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

AMP | Agastat | CII | Hartman | Kilovac | Microdot | Nanonics | Polamco | Raychem | Rochester | DEUTSCH  
SEACON Phoenix | L.L. Rowe | Phoenix Optix | SEACON

Get your product to market faster with a smarter, better solution.

### DEUTSCH DBAS SERIES CONNECTORS

The rugged DBAS series offers easy and secure locking with a push/pull coupling ring for 100% mating. They are rated from -55°C to +200°C, and available in environmentally or hermetically sealed, rack-mountable, and lanyard release versions



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### MICRODOT HIGH-DENSITY CONNECTORS

Our nanominiature and microminiature connectors offer interconnect solutions for a broad range of space applications. For exceptional savings in weight and space, we have the nano and microminiature connectors in rectangular and circular configurations





## Solutions for Avionics

### Standard Connectors and Accessories

- COTS Products
- Mil Spec PCB Connectors
- Mil Spec RF Connectors
- Circular Connectors
- Rectangular Connectors

### Space-Saving Connectors

- Microminiature Connectors
- Nanominiature Connectors
- Rugged Optics

### Relays

- Low Signal Relays
- Solid-State Relays

### Wire and Cable

- ElectroLoss FilterLine Cable
- Controlled Electrical Cables

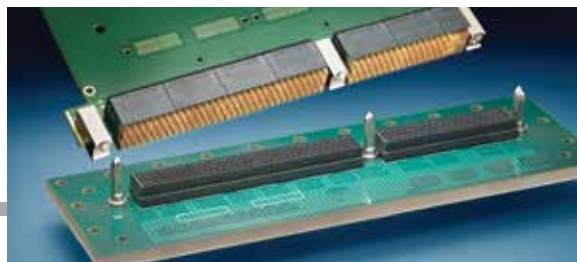
### DEUTSCH CUSTOM DESIGNS AND UMBILICALS

We can custom design to your specific requirements, including deadface connectors, umbilical harnesses, and a range of standard connector styles



### MULTIGIG RT 2-R CONNECTORS

Chosen as the backplane connector for SpaceVPX, our ultra-rugged, lightweight, high-speed VPX board-to-board interconnect is compliant to VITA 46 standards. This system is designed for high shock and vibration levels, featuring modularity and flexibility with a pinless wafer design in place of pin contacts



### COAXIAL CABLE AND CONNECTORS

We provide a wide range of coaxial cable and connectors for flight applications, including space-qualified SMA, SSMA, SMP, SMPM small-form-factor connectors supporting frequencies to 40 GHz



# RELIABILITY IS THE ONLY OPTION

## Bring Performance Home

Reliability is mission critical. The overriding requirement of every component and system is meeting the demands of space. Our long experience in space, aerospace, and military applications means we know how to create products for maximum reliability.

## SpaceVPX: Designing for Ultra-Rugged Reliability

Space VPX defines an embedded computing system for space—combining mission-critical reliability with the ability to withstand the extreme vibrations of liftoff and the extreme temperatures, background radiation, and other harsh conditions of extraterrestrial travel.

Our MULTIGIG RT 2-R connector was chosen for the SpaceVPX backplane based on its extreme ruggedness, light weight, low outgassing, and absence of tin whisker growth.

## Reducing SWaP

Manned or unmanned, space flight requires extreme reliability combined with smaller, lighter components, subsystems, and systems. Every ounce saved means lighter payloads at liftoff and more efficiency during the mission.

### LIGHTWEIGHT AMPLIMITE CONNECTORS

Our extensive line of subminiature-D connectors includes ultra-lightweight versions meeting NASA 311P and featuring one-piece aluminum shells. Weight savings are up to 20%, with enhanced EMI protection. The line includes both standard-density and high-density inserts



### DEUTSCH 9305 AND DCS SERIES CONNECTORS

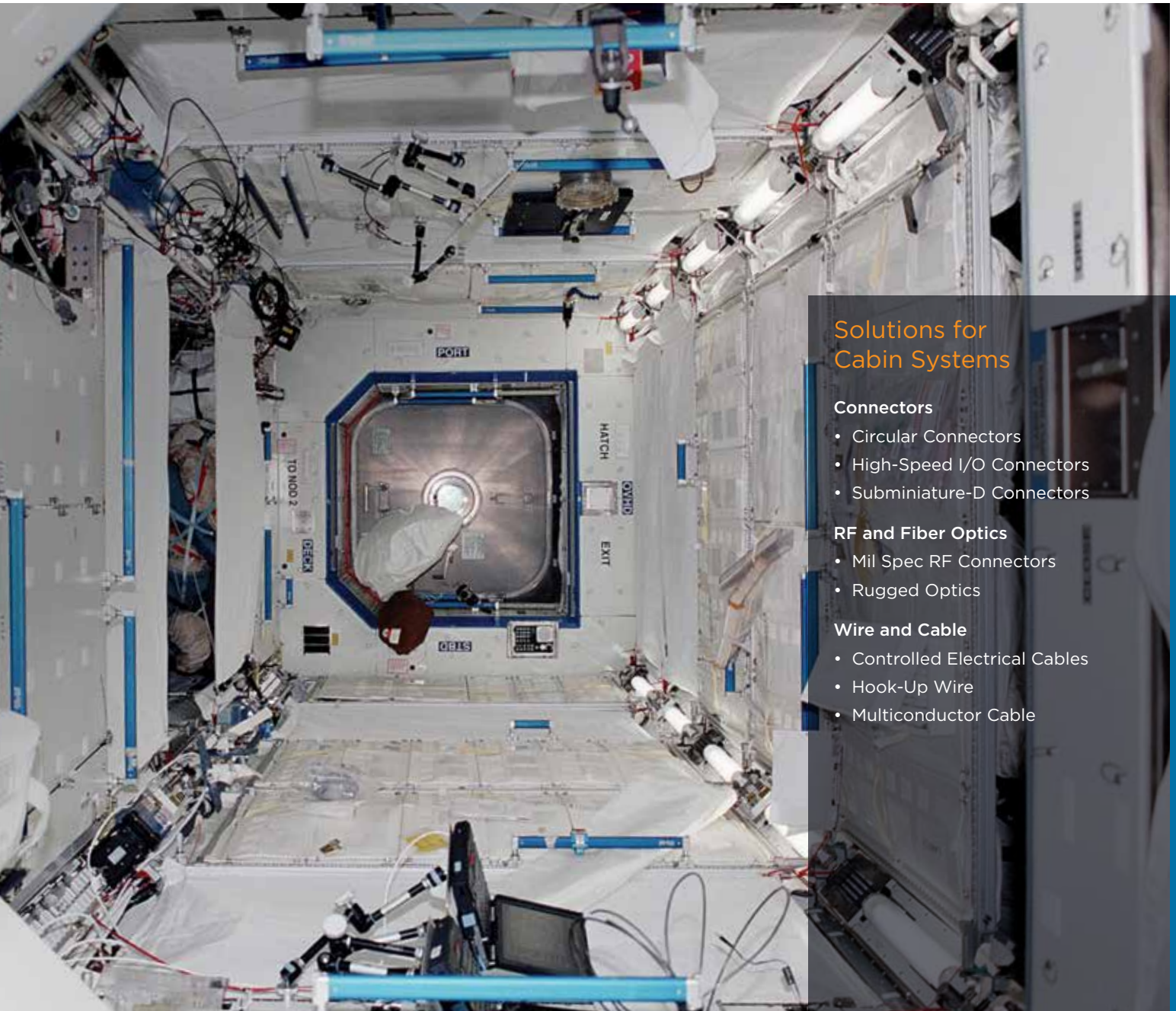
Available in 4 positions for 9305 Series, and 4 and 7 positions for DCS Series, these threaded subminiature circular connectors are environmentally sealed, hermetically sealed, or EMI shielded, with a temperature range from -55°C to +200°C



### RAYCHEM MULTICORE CABLE

Get high-performance custom cable designs with different conductor sizes, counts, and cabling to achieve application specific needs. Multicore cables use our SPEC 44 and SPEC 55 technology for light weight and wide environmental performance





## Solutions for Cabin Systems

### Connectors

- Circular Connectors
- High-Speed I/O Connectors
- Subminiature-D Connectors

### RF and Fiber Optics

- Mil Spec RF Connectors
- Rugged Optics

### Wire and Cable

- Controlled Electrical Cables
- Hook-Up Wire
- Multiconductor Cable

### RECTANGULAR CONNECTORS

A full line of rack-and-panel connectors support power, signals, RF, and optics in modular high-density rectangular connectors for easier “black-box” installation and removal of LRUs and similar equipment



### RAYCHEM TUBING AND MOLDED PARTS

Space-grade heat-shrink tubing and molded parts give wide temperature ranges, low outgassing, and radiation resistance. Thin-wall designs, available with or without adhesive lining, save weight and space and enable you to protect, strain relieve, identify, and organize



# ADVANCED DEVELOPMENT FOR EXTREME ENVIRONMENTS

## Expertise in Material Science Yields Innovative Options

As the demand for bandwidth increases, so does the need to achieve improved SWaP by reducing the size, weight, and power consumption of components and systems. TE has pioneered such advances with thin-wall wire and cable, composite connectors, and miniaturization.

We are also actively researching next-generation solutions through advanced materials.

- Advanced composite polymers with optimized strength, chemical, thermal, and electrical performance
- Nanotechnologies, from carbon nanotube conductors and shielding to nanocrystalline metals
- Materials for chemical sensors, electrical components for fault location, and other sensors
- High-band-gap semiconductors for high-performance relays

Applying new materials and processes, or even using existing ones in new and novel ways, will allow future generations of products.

### RAYCHEM HEXASHIELD BACKSHELLS

HexaShield adapters represent a significant improvement over pigtail termination methods, providing 360-degree shielding on the termination area of each cable. They are simple to install, easy to maintain, and dependably resistant to mechanical and environmental stresses



### COMPOSITE ENCLOSURES

Engineered polymers, micro-encapsulates, molded-in antennas, selective traces, EMI, and thermal management are crucial in any enclosure. We have the capability to design rugged, lightweight enclosures with our expertise in materials, manufacturing, engineering, and modeling



### RAYCHEM SPEC 55 SPACE WIRE

Cross-linked ETFE insulation with low corrosive characteristics achieve insulation walls as thin as 4 mm. Low-outgassing SPEC 55 wire and cable are capable of continuous operation from -65°C to 200°C, and reduce the effects of high-frequency EMI





## Solutions for Interconnection Harnesses

### Connectors

- Circular Connectors
- Nanominiature Connectors
- Rack and Panel Connectors
- Subminiature-D Connectors
- Microminiature Connectors

### Networking

- Mil-Std-1553B Data Bus Components

### Harnessing

- Molded Parts
- Rugged Optics
- Connector Accessories
- Tubing
- Shield Terminations
- Terminals and Splices

### DEUTSCH 014 SERIES CONNECTORS

These pyrotechnic connectors offer high reliability under the harshest high-temperature conditions. Meeting ESA/SCC 3401 grade requirements, the 014 Series uses a bayonet coupling for fast connecting



### CARBON NANOTUBE WIRE AND CABLE

TE is at the forefront of commercializing CNT wire and cable to provide weight savings of at least 50% over copper. We are constantly improving performance of CNT shields and conductors, while optimizing them for crimp or solder termination



# POWERFUL SOLUTIONS FROM ARRAY TO DEVICE

## Manage Power End to End

We make power distribution efficient and manageable. TE offers relays and contactors with make/break current ratings up to 2000 A, current ratings up to 1000 A at 28 Vdc and 500 A at 900 Vdc, and hermetic sealing for reliability. Our relays offer an industry-leading combination of high-current switching in compact, lightweight packages.

Power cables and connectors are designed to carry power efficiently, with lower resistance and less bulk. Our power solutions include thin-wall insulation for smaller diameter, lighter weight, and more flexibility for easier routing.



### HARTMAN SPACE-QUALIFIED RELAYS

Hartman relays feature lightweight construction in hermetically sealed enclosures for panel mounting, a variety of switching configurations, an efficient magnetic latching design with self-deenergizing coil, and main contact ratings of 100 A at 28 Vdc or 35 Vdc



### CONTACTORS

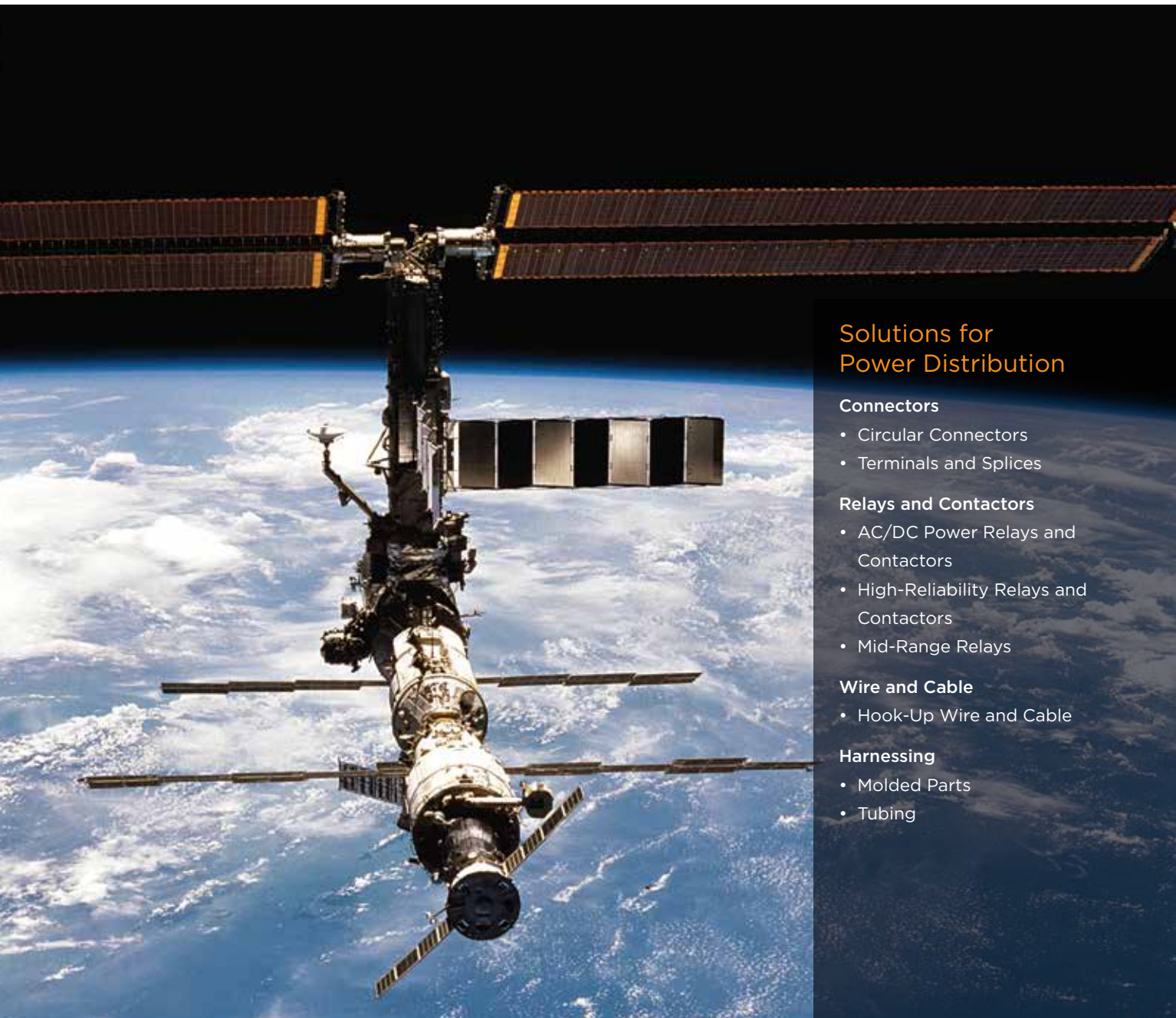
Our lightweight contactors handle high-power DC or high-voltage DC needs. They are available hermetically sealed, with a variety of electrical configurations, power ratings, voltage ratings, and mounting styles to make your electrical system more reliable and capable



### RAYCHEM HOOK-UP WIRE AND CABLE

Find the right wire and cable for your needs. We offer a wide range of options to meet needs for low outgassing, radiation and chemical/fuel resistance, and extreme temperatures. Our cables also help save weight and provide flexibility for easier routing





## Solutions for Power Distribution

### Connectors

- Circular Connectors
- Terminals and Splices

### Relays and Contactors

- AC/DC Power Relays and Contactors
- High-Reliability Relays and Contactors
- Mid-Range Relays

### Wire and Cable

- Hook-Up Wire and Cable

### Harnessing

- Molded Parts
- Tubing

### MID-RANGE RELAYS

Our MIL-PRF-6106 and MIL-PRF-83536 qualified hermetically sealed mid-range relays handle up to 50 A using a balanced force design with permanent magnet drive for long-life operation. Terminal styles include socket pins and hook solder terminals



### DEUTSCH DS/ADS SERIES CONNECTORS

These connectors support Size 8 contacts capable of carrying 46 A—or up to 500 A in a fully loaded connector. A variety of insert configurations support both power and signals



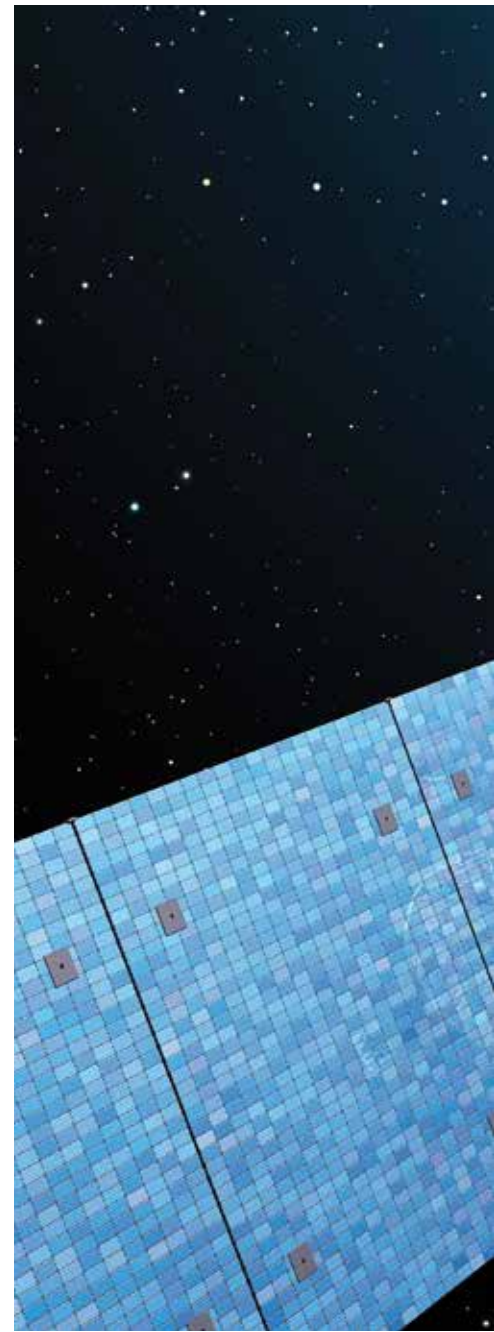
# PUTTING HIGH PERFORMANCE TO WORK

## Connecting Sensor to Actuator with Space-Proven Reliability

We help keep things moving, from positioning of solar arrays to operation of robotic arms and other equipment. Space-qualified, high-reliability components work steadfastly in the harsh environment of space, helping maintain precise motion control.

We offer end-to-end solutions, from sensor to actuator, with MIL-STD-1553B flight control data bus connectivity, and a range of relays and contactors to switch power efficiently.

We can help create application-specific sensors—including sensor elements, processing, packaging, and I/O connectors—to deliver accuracy and robustness in the harsh environment of space, and form factors to save weight and increase reliability. Capabilities include custom packaging and sealing, shielding, and wireless telemetry—in addition to a wide range of sensing technologies.



### RAYCHEM HIGH-TEMPERATURE DEVICES

Shield termination devices provide environmentally protected shield termination on cables that are designed for applications requiring a maximum temperature rating of +200°C. SolderSleeve terminations insulate, strain relieve, and protect terminations from environmental damage



### RAYCHEM MIL-STD-1553B DATA BUS COMPONENTS

Our space-grade data bus products offer reduced weight, low outgassing, enhanced temperature ranges, and radiation resistance. We offer custom assemblies for high-performance networking of sophisticated subsystems to conserve space, weight, and power consumption





## Solutions for Actuation and Motion Control

### Connectors

- Low-Magnetism Connectors
- Solar Array Connectors
- Terminals and Splices

### Relays and Contactors

- Lightweight AC/DC Relays and Contactors
- Custom Solenoids

### Wire and Cable

- Hook-Up Wire and Cable

### Sensors

- Industrial-Grade Sensors
- Military-Grade Sensors

### Harnessing

- Molded Parts
- Tubing

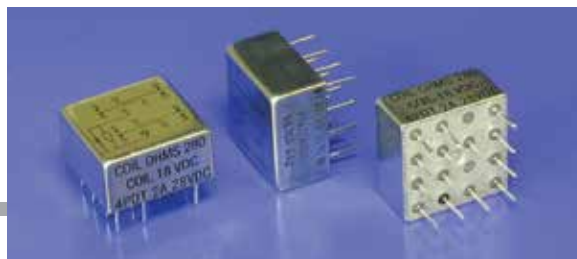
### DEUTSCH UR AND RE SERIES CONNECTORS

Low general magnetism and outgassing in a lightweight, high-density connector make the UR series well suited to satellite applications. A companion RE series is intermateable and recommended for nonflight applications



### NASA APPROVED LATCHING RELAYS

TE high-reliability, space-qualified relays use lightweight low-outgassing materials, hermetic sealing, and inert gas backfilling to create rugged, high-performance, compact products. They are available in the smallest and most reliable high-current, high-voltage, midrange, and low signal configurations



### DEUTSCH D-PASO SERIES CONNECTORS

Designed for solar arrays, compact, ultra-flat D-PASO connectors offer an extreme temperature range of -170°C to +150°C, with mated connectors weighing under 50 g. Standard size 20 contacts allow current handling up to 7.5 A



# THE PERFORMANCE TO KEEP IN TOUCH

## Reach for the Stars with Better Signal Integrity

Signal integrity in high-speed digital applications is critical, both on board spacecraft and in ground-based mission control and communications. TE is a leader in supporting higher speeds, both in commercial applications and in military/aerospace applications where increased ruggedness is required to withstand vibration, shock, and temperature extremes.

From uplinks/downlinks to control centers, we support microwave applications with RF connectors and cable, high-speed links at gigabit speeds over fiber, and high-performance processing with high-speed backplane and I/O connectors.



### RUGGED OPTICAL INTERCONNECTS

For high-density applications, the MTC family uses a rectangular geometry to save space compared to circular connectors, and accepts standard ARINC 801 optical termini in a compact, lightweight design. We also offer ruggedized assemblies and expanded-beam connectors



### DEUTSCH RSM/ARSM SERIES CONNECTORS

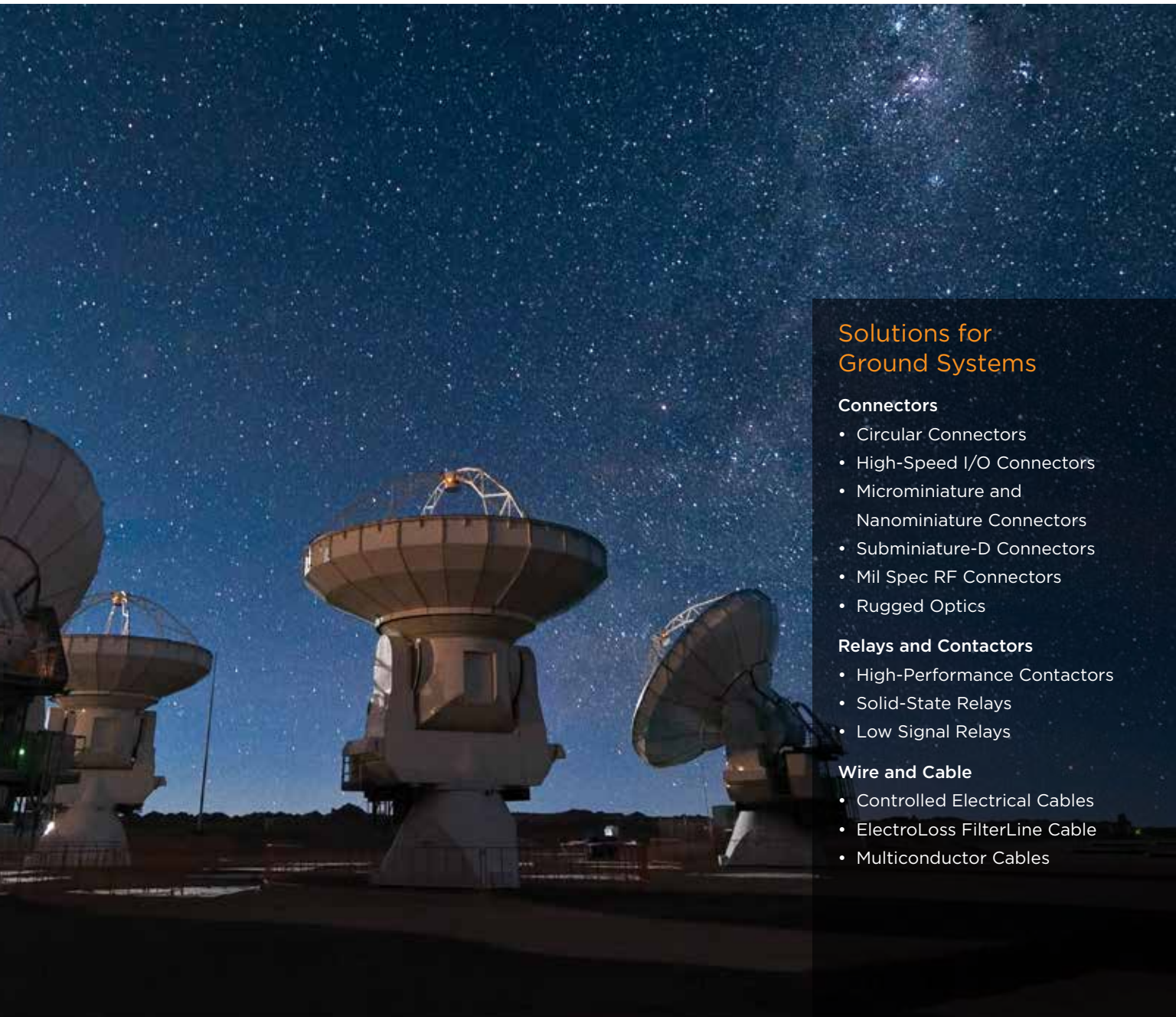
These subminiature MIL-C-26482 connectors combine high contact density in a push-pull interface with an operating temperature from -55°C to +150°C and a choice of environmental or hermetic sealing



### FORTIS ZD BACKPLANE CONNECTORS

Fortis Zd connectors withstand the vibration and other mechanical stresses of military applications. Supporting data rates of 10+ Gb/s, the modular system builds on established technology to achieve rugged reliability and high-speed processing





## Solutions for Ground Systems

### Connectors

- Circular Connectors
- High-Speed I/O Connectors
- Microminiature and Nanominiature Connectors
- Subminiature-D Connectors
- Mil Spec RF Connectors
- Rugged Optics

### Relays and Contactors

- High-Performance Contactors
- Solid-State Relays
- Low Signal Relays

### Wire and Cable

- Controlled Electrical Cables
- ElectroLoss FilterLine Cable
- Multiconductor Cables

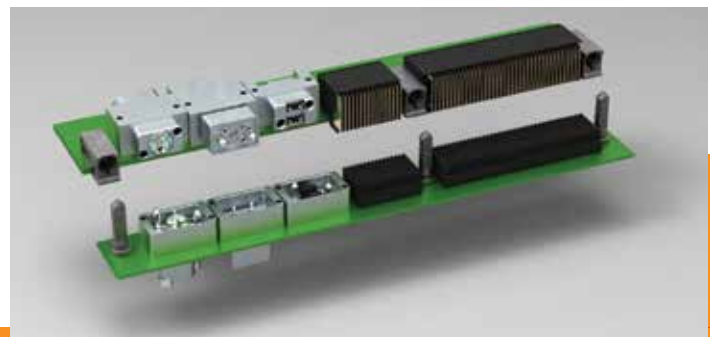
### CEELOK FAS-X CONNECTORS

CeeLok FAS-X connectors with industry-proven AS39029 contacts are designed for rugged environments and provide reliable, consistent high-speed performance, supporting 10G Ethernet and beyond



### VITA 66/67 OPTICAL AND RF MODULES

Our optical and RF modules allow LRUs and LRMs to be disconnected at the VPX backplane. Optical modules for VITA 66 support MT, ARINC 801, and expanded beam contacts, while VITA 67 RF modules support four or eight blindmate SMPM contacts



# MAKE THE TE CONNECTION

## Design Smarter and Faster

Begin solving your tough interconnection challenges by talking to TE. By involving us early in your design cycle, we can help you find the best solution—one that lowers costs, boosts performance, and meets demanding SWaP requirements. Our range of space-qualified, agency-approved products is extensive, and we work closely with customers on next-generation solutions and custom application-specific assemblies.

Count on our R&D programs and TE AD&M's Advanced Development Group for the innovations that come from expertise in materials science, advanced processes, packaging, signal transmission, and other disciplines. When you are ready to launch your next mission, you will be glad that TE is on board.



### POLAMCO BACKSHELLS

Our newest line offers a complete range of high-performance backshells for unshielded, shielded, and rugged conduit systems. Supporting one of the widest variety of Mil-Spec and COTS connectors, we have the solution for rugged, lightweight, and specialized needs



### RAYCHEM HARNESSING COMPONENTS

An array of space-qualified, low-outgassing cable, tubing, adhesives, molded parts, and backshells makes it easy to build high-performance harness assemblies. They feature low outgassing characteristics and provide environmental and mechanical robustness





## Solutions for Subassemblies and Design

- Custom Harness Assemblies
- High-Speed Digital Cable Assemblies
- Harness Design Software

### RF and Optics

- RF Cable Assemblies
- Rugged Optics

### Packaging

- Composite Enclosures
- Antennas
- Power Distribution Units

### GOLD-PLATED TERMINALS

Increase the reliability of wire connections with TE's gold-plated terminals. Available in multiple configurations, the nonmagnetic crimp terminals provide mechanical reliability, excellent corrosion protection, and low contact resistance required for space applications



### DEUTSCH DFE SERIES CONNECTORS

Rugged bayonet-coupling connectors meeting MIL-C-26482G Series 2, the DFE Series comes in various shell sizes to accommodate signal, power, and coaxial contacts. They offer 500-mating-cycle durability and a temperature range from -65°C to +200°C. Options include hermetic sealing



### RAYCHEM CONTROLLED ELECTRICAL CABLE

Cheminax cables bring tightly controlled electrical characteristics to miniature coaxial cable—offering electrical performance exceeding standard RG cables in a smaller, lighter design that saves weight and space while providing lower attenuation and capacitance



## For More Information

### TE Technical Support Center

North America	+1 800 522 6752
Asia Pacific	+86 0 400 820 6015
Austria	+43 1 905 601 228
Baltic Regions	+46 8 5072 5000
Benelux	+31 73 6246 999
Czech Republic	+420 800 701 462
France	+33 1 34 20 86 86
Germany	+49 6251 133 1999
Hungary	+36 809 874 04
Italy	+39 011 401 2632

Nordic	+46 8 5072 5000
Poland	+48 800 702 309
Russia	+7495 790 790 2
Spain/Portugal	+34 93 2910366
Switzerland	+41 52 633 66 26
United Kingdom	+44 800 267 666

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Polamco

+44 (0)1225 322500

Email: sales@polamco.com

WITHSTAND THE EXTREME ENVIRONMENTS OF SPACE WITH HIGH-RELIABILITY SOLUTIONS THAT SAVE WEIGHT AND SPACE



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Consult TE for the latest dimensions and design specifications.