

MASS TRANSIT

Electrical Wire and Cable Interconnect Technologies

SIGNAL · POWER · HIGH-SPEED ETHERNET · HARSH ENVIRONMENT

OCTOBER 2017



Complete Vertical Integration: From Design Engineering to Component Part Manufacture and Assembly

Connector shells, plating, inserts, contacts, environmental seals, assembly and test all controlled in-house



Glenair Series ITS reverse-bayonet power and signal connectors



- Largest connector engineering team and CNC metal turning operation in the high-rel interconnect industry
- Vertically integrated factories in Glendale, California; Bologna, Italy; and Mansfield, England



Glenair is ISO 9001:2008 and AS9100:2009 Rev. C certified and registered in North America; IRIS (International Railway Industry Standard), AS9100 SAE Aerospace and ISO 9001 certified and registered in Italy, and AS9100 certified and registered in the U.K.



Glenair: Total Vertical Integration





Our Commitment to Quality

Management System Certifications for Quality



- **ISO 9001:** the worldwide recognized manufacturing quality system. All Glenair facilities are ISO 9001 certified.
- **IRIS:** this system is based on ISO 9001 with additional requirements for the railway sector. Glenair's Italian operation, located in Bologna, is certified to the IRIS standard for mass transit market interconnect technologies.
- **EN 9100:** also based on ISO 9001, this standard incorporates additional Aviation, Space and Defense industry language and requirements. Glenair UK and Glenair Italy's ISO 9001 quality systems are augmented by additional certification to EN9100.
- **EN 9120:** another system based on ISO 9001 with specific requirements on Aviation, Space and Defence industries. It covers all Glenair operations in relation to these three sectors.





- **VG 95234, VG 95328, VG 95351, VG 96929, VG 96934:** these are certifications for five product families. They certify that our family of products guarantee the minimum performance requirements laid down by the relevant standard. They are issued by an institution of the German Ministry of Defense (BAAINBw) and are recognized by military entities in all NATO countries.
- **UL:** Upon request, some connectors from the ITS Series can be marked as a "UL Recognized Component."
- **ATEX/IECEX:** Glenair is a qualified manufacturer of connectors for potential explosive zone use according to IEC/EN 60079.



- **ISO / IEC 17025:** this Test Lab certification has been attained by Glenair's in-house test laboratory for a broad range of electrical and optical testing, including high voltage and high vib/shock





Rugged Power and Signal Connectors for Mass Transit

High current/high voltage electrical connectors for traction motor, lighting, data communications and more.

The interconnection of power transmission cables in traction motors is a critical application. Conventional systems may employ bulky and inefficiently-sealed junction boxes for cable interconnection. Glenair offers a number of different special-purpose designs for traction motors and other power requirements on transit cars. Features such as integral mounting, robust environmental sealing, screw and/or lever-action mating, as well as compliance to transit industry standards such as IRIS, FST, and RoHS make Glenair the natural design partner and supplier to the worldwide mass transit / rail industry. The following pages present an overview of our most popular power and signal connector series, principally manufactured, tested, and qualified in our Bologna, Italy factory. Glenair delivers worldwide application engineering and support to the mass transit / rail industry with support teams located in every major market.



Winged
ITS 901 Series
connectors



- Innovative screw and lever mated power connectors for mass transit / rail applications
- Proven performance and qualification credentials in hundreds of installations
- IRIS International Railway Industry Standard certified (Rev. 02, May 2009)

RUGGED

Power and Signal Connectors for mass transit applications



IRT Rectangular Multipole Connectors

SERIES IRT RECTANGULAR MULTIPOLE HIGH VOLTAGE TRACTION MOTOR CONNECTORS



Plug Connector



Receptacle Connector

The Glenair IRT series is a rectangular power connector for harsh environmental conditions.

Available with three, four and six contacts, typical for traction motor applications. Suitable for single cables AWG 4 – 373MCM (35 to 185 mmq).

Working voltage up to 3000 Vcc.

Two mating systems offered:

- Screws, for light weight and reduced dimensions
- Lever system with secondary lock, easy-to-use in difficult positions.

The IRT Series is suitable for separated power cables, with or without shielding, ground body available with a copper plait.

Available with three different cable back-end styles:

- Metallic gland
- Clamp with strain relief
- EMC shield and gland

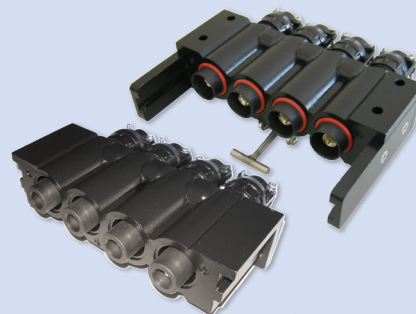
Series IRT Connector Selection Guide



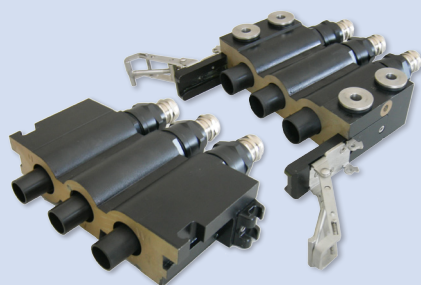
Size 01
3 contacts, Screw Mating



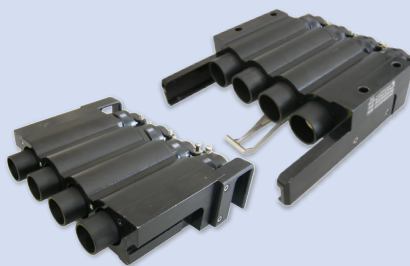
Size 02
4 contacts, Screw Mating



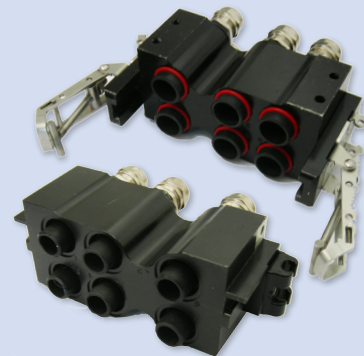
Size 03
3 contacts, Lever Mating



Size 04
3 contacts, Double-Lever Mating



Size 05
4 contacts, Lever Mating



Size 06
6 contacts, Stacked, Lever Mating

RUGGED

Power and Signal Connectors for mass transit applications



UJ Series Power Joint Connector System

UJ SERIES UNIPOLE POWER JOINT CONNECTOR SYSTEM



3-position
configuration

The Glenair UJ Power Joint system allows connection of medium and high power cables without the need for bulky junction boxes. The UJ Power Joint System offers the same environmental protection with substantial size and weight savings and better temperature tolerance than junction boxes.



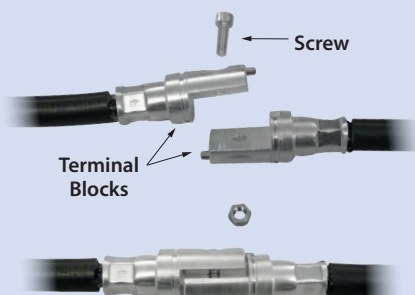
Head-to-head size comparison: UJ connector vs. junction box



2-position
configuration

| | UJ Series | Junction Box |
|------------------------|-----------|---------------|
| Dimensions | Small | Regular / Big |
| Weight | Light | Heavy |
| Protective Varnish | No | Yes |
| Modularity | Yes | No |
| Environmental | Yes | Yes |
| Electrical Performance | Yes | Yes |
| Cost Reduction | Yes | No |
| Temperature Range | High | Standard |

Easy 4-step mating



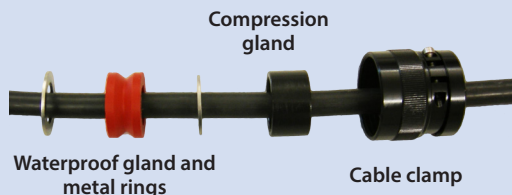
Mating by screw

Step 1: mate terminal blocks with screw



Plastic Body

Step 2: slide protective positioner into place to maintain correct terminal block positioning in plastic body



Compression
gland

Waterproof gland and
metal rings

Cable clamp

Step 3: slide the waterproof gland with metal rings and compression gland into position behind the terminal block. Tighten the cable clamp.



Step 4: repeat steps 2-3 for the other side. The assembly is complete.

RUGGED

Power and Signal Connectors for mass transit applications

ITS 901 · ITS 500 · ITZ



ITS 901 SERIES REVERSE BAYONET MULTI-POLE MEDIUM VOLTAGE JUMPER CONNECTORS



Plug Connector



Receptacle
Connector

ITS 901 Series is the extension of the ITS Reverse Bayonet connector family, for power cables over AWG 1/0. Suitable for harsh environmental conditions, 901 Series Connectors accept cable from AWG 4 to 262 MCM (35 - 120 mmq), for current up to 450 Amps. Working voltage is from 800 - 1000 VAC. Available for single wires and multipole jacketed cables, with cable clamp or conduit.

Male contacts offer Finger Test Protection, Load Side (Receptacle or Plug). Long bayonet ramps, three polarization keys and rubber recovered coupling facilitate mating and unmating operations.

901 Series meet the most important rail requirements and specifications:

- Salt Spray Test Corrosion: 500 hours;
- 500 Mating Cycles;
- Shock and Vibrations for Under-Car and Car-To-Car Applications;
- IP67 Sealing (Coupled Connectors);
- Fire Resistant and RoHS Compliant Materials.

ITS 500 SERIES REVERSE BAYONET SINGLE-POLE HIGH VOLTAGE JUMPER CONNECTORS



Plug
Connector



Receptacle
Connector

ITS 500 Series derives from the VG96929 Military Specification for Power Connectors. Suitable for harsh environmental conditions, ITS 500 accepts cable gauges AWG 3/0 to 444MCM (95-240 mmq), for current up to 750 Amps. Special insulator drawing allows high working voltage, up to 3000 Vcc. Suitable for jacketed cables, with or without conduit protection. Receptacle with finger protection (Load side).

ITS 500 meets the most important rail requirements and specifications:

- 500 Mating Cycles
- Salt Spray Test Corrosion: 500 hours
- Shock and Vibrations for Under-Car and Car-To-Car Applications
- IP67 Sealing (Coupled Connectors)
- Fire Resistant and RoHS Compliant Materials

ITZ SERIES WITH RAPID-ADVANCE THREADED COUPLING



The ITZ connector series provides the same electrical characteristics as the IT and ITS families, but utilizes rapid-advance threaded coupling in place of bayonet coupling. Originally designed to be used on special amphibious military vehicles, the series evolved into a versatile railway and industrial connector, used where threaded coupling is desired. The ITZ connector series uses solder and crimp contacts in accordance with MIL-C-5015 and a trapezoidal threaded coupling system with rubber O-ring environmental seals.

- Aluminum alloy construction with electrodeposited (cataphoresis) black coating (F6)
- Copper alloy contacts, silver plated
- Oil-resistant synthetic rubber insulators and O-rings
- Temperature tolerance -55° to +125°C

RUGGED Power and Signal Connectors for mass transit applications



FR ITS · ITH · ITK

FR ITS SERIES



FR ITS is the fire-resistant ITS connector series, designed with Flame, Smoke, and Toxicity-compliant insulating materials. FRITS is broadly utilized for environmental and non-environmental rail applications. More than 230 insert arrangements are available, from 1 to 150 contacts. FRITS connectors are RoHS-compliant, and IP67 environmentally sealed. Available FRITS - STR backshells provide versatile locking of cables or wires into the connector, providing IP67 sealing and EMI/RFI termination.



FR-ITS STR backshell for EMI shielding and IP67 sealing

ITH SERIES



The ITH connector series is based on the MIL-C-5015 standard, but with improved reverse bayonet coupling. Rigid inserts and crimp contacts provide better electrical insulation and reduced assembly time. The 3-point, positive-locking reverse bayonet coupling mechanism provides easier mating in awkward positions, reliable resistance to vibration and shock, and prevents de-coupling. ITH connectors conform to the VG95234 standard, French (NFF 61030) electrical standards, as well as EEC compliance directives for electromagnetic compatibility. EMI shield termination accessories are available for both overall as well as individual wire shields.

- Design IAW MIL-C-5015 and VG95234
- Temperature range -40°C to +100°C (conductive plating) or -55°C to +125°C (non-conductive plating)
- RoHS compliant
- Low fire hazard inserts, UL94V0 and NFF 16-102 compliant
- Halogen-free silicone rubber gaskets per NFF 16-102

ITK SERIES



Standard plug and receptacle

The high-temperature tolerant ITK series is a rugged reverse-bayonet mating connector that utilizes stainless steel connector shells and special high-temperature ceramic inserts. Compliant to EN 45545 standards, ITK connectors are capable of operation at +700°C for 15 minutes without electrical discontinuity.

- Ultra high-temperature tolerant ceramic inserts
- Stainless-steel construction
- EN 45545 compliant
- Operates at +700°C for 15 minutes, with no electrical discontinuity

ITK "piccolo"
2-pin plug and receptacle

RUGGED

Power and Signal Connectors for mass transit applications



Micro-Switch · One Cable - Two Contacts · ERTMS

MICRO-SWITCH CONNECTOR

Receptacle connector with micro-switch sensing contact



The Glenair Micro-Switch connector is a rugged, reverse-bayonet connector for enhanced-safety mating in rail applications. The connector is supplied with 3 #4/0 power contacts and a specially-designed sensing contact that allows current to flow only when the connector pair is fully mated.

- 3 #4/0 contacts and 1 sensing contact
- Thermoplastic resin insert (UL94 V0)
- IP67 environmental sealing
- Sensing contact is suitable for standard cavity
- 4 Amps current rating
- Operating Temp: -30°C to +75°C
- Solder lug termination

ONE CABLE - TWO CONTACTS



The “One Cable - Two Contacts” system is a rugged, RFI-shielded connector design that divides the source power in a 70 mmq cable into two contacts of 35 mmq each, enabling the plug connector to divide and deliver RFI shielded power via two separate cables. Designs for additional contact gages and power requirements are available. Mated pairs are sealed to IP67.

ERTMS INTERCONNECTION SYSTEM



Specially designed for utilization on the European Rail Traffic Management System, the ERTMS connector family offers plug connectors with integrated RFI shield termination backshells for complete electromagnetic compatibility when mated. Mated pairs offer IP67 environmental sealing.

“STINGER” SYSTEM



The Stinger System connector is equipped with integrated short circuit contacts which will cut power should the single-pole power circuit be unmated under load. The push-pull connector incorporates a fully insulated (rubber covered) coupling nut for additional user safety. Three backshell/rear fitting options accommodate conduit, PG gland, or rubber-covered backshell.



SERIES ITS & DERIVATIVES

Ruggedized circular power and signal connectors for high-speed, high-heat, and high-voltage mass transit applications

Circular Reverse-Bayonet and Threaded Coupling Connectors

Series ITS - Reverse-Bayonet Power and Signal

Series ITS-RG - RadGrip™ Rubber Coupling Nut Circular

Series FRITS - Flame-Resistant Insert for Rail Applications

Series IT - Threaded Coupling Power and Signal

Series ITH - Rigid Insert / Mechanical Contact Retention

Series ITK - High-Temperature Ceramic

Series ITZ - Triple-Start Thread Power and Signal

Series IFO - Reverse-Bayonet Fiber Optic

Series IGE - High Current, Low Voltage Single Pole

Series 901 - High Current Medium Voltage Circular

Series 500 - Reverse-Bayonet Single-Pole High Voltage

Series IPT - Standard Bayonet Power and Signal

Series IPT-SE - Standard Bayonet Crimp Contact

- Dozens of proven connector technologies for harsh application environments
- Hundreds of power and signal contact arrangements (crimp and solder)
- Threaded, reverse bayonet, and innovative latch-and-lock coupling technologies
- Flame-resistant, caustic substance-free material choices for RoHS and other compliance standards



Series IT, ITS and derivative connector families are available with three plug coupling nut designs: Standard, Heavy-Duty/Arctic, and rubber-covered RadGrip™

INDUSTRY STANDARD AND GLENAIR INNOVATIONS

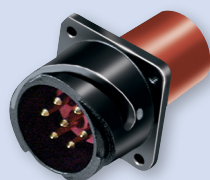
Industrial/Rail Power and Signal Connectors



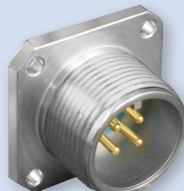
Circular Industrial/Rail Power and Signal Connectors: 5015 Type Derivatives



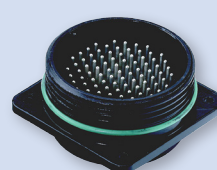
Series ITS
Reverse-Bayonet



Series ITH
Rigid Insert



Series IT
Threaded Coupling



Series ITZ
Trapezoidal Threaded
Coupling System



Series ITK
High-Temperature Ceramic
Insert



Seacrow
Marine Bronze



Series 901
Multi-Pin High Voltage with
Integrated Micro-Switch



Series 500
Single-Pole High Voltage



Series IGE
Single-Pole Low Voltage

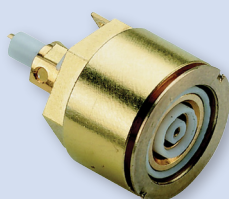


Winged
ITS 901 Series

High-Speed / Ruggedized Connectors for Industrial and Rail Applications



SuperSeal™
with RJ45 Ethernet



Series CX
High-Speed Coaxial



Octobyte™
Ethernet Contact



Series IFO
High-Speed Fiber Optic

Series ITS-RG RadGrip™ Reinforced Rubber Coupling Nut Connectors



ITS-RG
(Basic Black)



ITS-RG
(Semper Tan)



ITS-RG
(Fiber Optic Blue)



ITS-RG
(Safety Red)



ITS-RG
(Safety Orange)



ETHERNET-READY

Octobyte™

The faster ruggedized 4/8 pole interconnect system for Ethernet data applications

Glenair series ITH connectors with Ethernet-ready Octobyte™ contacts are available for harsh-environment mass transit applications that depend on sealed environmental (IP67) connector performance. Octobyte contacts, packaged in ruggedized ITH reverse-bayonet connectors, deliver both dedicated Ethernet datalink as well as mixed serial databus and power for high-speed data applications.

Octobyte™ contacts are vibration resistant and designed to work with Ethernet cables from CAT 5 to CAT 7A, MVB-WTB, and RG58 Coax. Reverse-bayonet ITH series connectors with Octobyte™ contacts are easy and fast to assemble and deliver reliable locking performance in severe vibration and shock applications.



- **For harsh-environment transit, industrial, or marine/subsea applications**
- **RF Coax applications (RG58 and RG59U cables)**
- **High-speed interconnect solution for audio, video, and digital displays**
- **Qualified for use in safety systems, sensors, detection devices, and control panels**
- **Tested in accordance with:**
 - ISO F0 STP: CAT 7A**
 - EN50173-1 F600-STP: CAT 7**
 - EN50173-1 D STP: CAT 5E**



Tested for compliance IAW EN50173-1 standards for CAT5E and CAT7.
Proven performance in numerous rail applications (consult factory for references)

OCTOBYTE™

The faster ruggedized Ethernet interconnect solution



OCTOBYTE CONTACTS FOR ETHERNET CAT 5 • CAT 6 • CAT 7 • COAX • MVB-WBT

| How To Order Octobyte contacts | |
|--------------------------------------|--|
| Sample Part Number | Q 0 8 P -A B1 -XXX -7A |
| Product Series | Octobyte contacts |
| Contact Size | 0 = contact size 0 |
| Number of Contacts | 8 = 8 poles 4 = 4 poles CX = Coax |
| Contact Gender | P = Male S = Female |
| Cable O.D. Range/ Coax Cable Type | A = O.D. 6-7 B = O.D. 7-8 C = O.D. 8-9 RG58 = 50 Ohm RG59U = 75 Ohm [Coax only] |
| Plating | B1 = gold plating |
| Alternative Color (Cat 7A only) | G14 = Black G14GN = Green G14GY = Grey G14R = Red G14Y = Yellow Omit for standard |
| Ethernet | 7A = Cat 7A AD = Ethernet MVB - WBT Contacts Omit for Cat 5 |



SERIES ITH CONNECTORS FOR OCTOBYTE CONTACTS

Reverse bayonet-lock connectors

Rugged environmental performance — the perfect Octobyte packaging solution



Dozens of contact arrangements available including hybrid Octobyte, power, and signal.

Ethernet-ready Octobyte solutions for rail and transit applications are available as discrete contacts, packaged in rugged reverse-bayonet ITH series connectors, or as turnkey inside-the-box or environmental cable assemblies, tested and ready for immediate use.



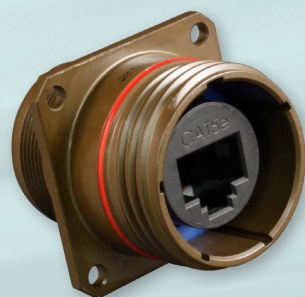
- Rugged MIL-DTL-5015 type design with fast reverse bayonet coupling
- Rigid dielectric inserts with contact retention clips
- Positive lock technology provides reliable vibration and shock resistance
- Proven performance in even the most rugged applications
- Conforms to the European VG 95234 standard, French (NFF 61030) and British (BS 6853) electrical standards and EEC compliance directives
- Threaded coupling version available, contact factory for ordering information

SUPERSEAL RJ45/USB

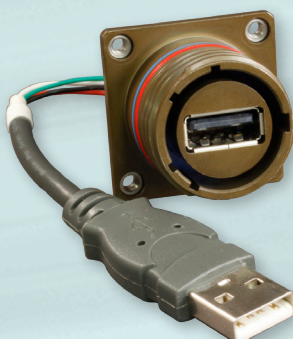
Ruggedized RJ45 and USB connectors for sealed environmental Ethernet performance

IP67 sealed connectors, robust insert-to-shell grounding, with a complete range of wire, cable, and circuit board terminations

- Superior sealing—IP67 unmated—for complete system protection against water, sand and dust
- Highly durable RJ45 design, including enhanced operating temperature, increased life-cycle, and rugged vibration and shock performance
- Shielded/grounded coupler designs in both receptacle and plug connectors
- Crimp, solder-cup, PC tail, and Quadrax contact/wire termination options
- RJ45 plug and/or jack interface options available in Cat 5e or Cat 6a
- MIL-DTL-38999 type versions intermateable with other RJ45 field-duty connectors



MIL-DTL-38999 Series III with sealed RJ45



MIL-DTL-38999 Series III with USB jack and jumper

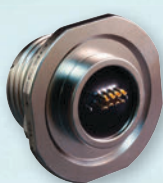


High-capacity, high-speed USB data stick

SUPERSEAL Field RJ45 and USB Connectors



AVAILABLE TERMINATION OPTIONS



Solder Cup



PC tail



Crimp



Jack-to-Jack



EMI Filtered



Quadrax



MIL-STD-1560
Arrangements

SUPERSEAL™ CONNECTOR FAMILIES



SuperSeal™ MIL-DTL-38999 Series III Type
RJ45 Connectors and Cordsets plus NEW
Transient Voltage Suppression Solutions



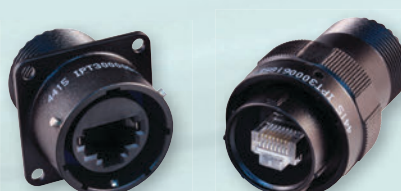
SuperSeal™ MIL-DTL-38999 Series III Type
USB 2.0 Connectors and Cordsets



ITS SuperSeal™
(5015 Intermountable) Reverse-Bayonet
RJ45 Connectors



NEW: ITS SuperSeal™ (5015
Intermountable) Reverse-Bayonet USB
2.0 Connectors



NEW: IPT SuperSeal™ MIL-DTL-26482 Type
Bayonet RJ45 Connectors



NEW: IPT SuperSeal™ MIL-DTL-26482 Type
Bayonet USB Connectors



SuperSeal™ MIL-DTL-28840 Type
RJ12/RJ45 and USB
Shipboard Connectors



SuperSeal™ Series 801, 804
and 805 Mighty Mouse
Micro USB 2.0 Connectors



SuperSeal™ Series 801, 804
and 805 Mighty Mouse
RJ45 Connectors



SuperSeal™ Series 801, 804
and 805 Mighty Mouse
Standard USB 2.0 Connectors



RADGRIP™ COUPLING NUTS

**For fast, easy mating of ITS Series bayonet connectors
plus improved coupling nut mechanical protection**



Better grip, improved durability

Glenair ITS-RG Series connector plugs with RadGrip™ rubber coupling nut covers was developed for harsh environmental field applications. RadGrip™ covers feature wide, easy-to-grip castellations as well as a raised thumb tab. Built for maximum durability and mechanical protection of plug coupling nuts, RadGrip™ is the perfect solution for advanced protection against shock and other forms of mechanical damage. In addition, RadGrip™ facilitates rapid mating and demating of connectors, even when surfaces are contaminated with oil, dust, water and other fluids. The highly durable rubber compound may be specified in seven different colors for improved connector and cable identification.

Colors available: Black, Yellow, Red, Blue, Light Green, Orange and Grey.

RadGrip™ material specifications

IAW UNI-CEI 11170 - AFNOR NF-F 16101 - BSS 7239 - ASTM E - 162, ASTM E-662
RadGrip™ covers adhere easily to Aluminum alloy, Stainless steel and Marine bronze.

- Fast, easy 1/4 turn bayonet coupling
- Ergonomically designed for use with gloves
- High Shock and Vibration Resistant
- Compatible with all Series ITS 5015 type connector shell sizes
- Durable chemical-resistant material
- Colored materials facilitate connector and cable identification and/or connector phases

SERIES ITS-RG

RadGrip™ Easy-Mate Rubber Covered Coupling Nut Connectors

Straight and 90° Plugs

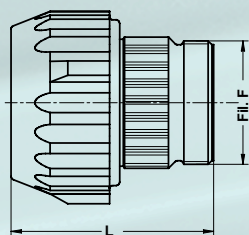


90° right-angle plug with
cable gland

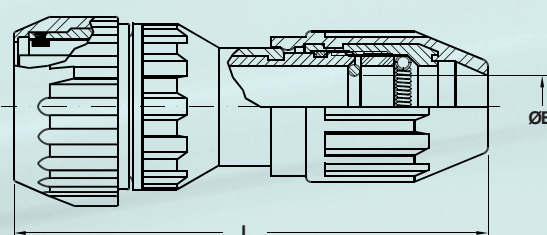
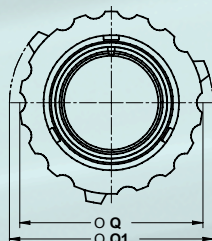


Straight plug with optional strain relief
clamp. Consult factory for additional
backshell options in the ITS-RG series

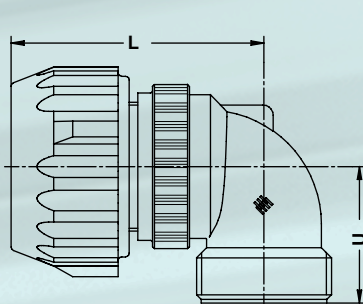
| How To Order | | | | | | | | | |
|----------------------------------|---|--|--|--|--|--|--|--|--|
| Sample Part Number | ITS | | | | | | | | |
| Product Series | Reverse-Bayonet Coupling Connector | | | | | | | | |
| Grounding Fingers | G = Grounding Fingers Omit for Standard | | | | | | | | |
| Contact Type | 31 = Solder 41 = Crimp | | | | | | | | |
| Shell Style | 06 = Straight Plug with Accessory Threads 08 = Plug with 90° Backshell | | | | | | | | |
| Connector/Backshell Class | RGG = Plug, environmental with rubber-covered coupling nut and cable gland RRG = Plug, environmental with rubber-covered coupling nut and rubber-covered EMI/RFI cable sealing backshell | | | | | | | | |
| Shell Size/Insert Arrangement | See Catalog | | | | | | | | |
| Contact Gender | P = Pin S = Socket | | | | | | | | |
| Alternate Insert Rotation | Omit for Normal | | | | | | | | |
| Color Code | BK = Black RD = Red YL = Yellow BL = Blue OR = Orange LG = Light Green GY = Grey | | | | | | | | |



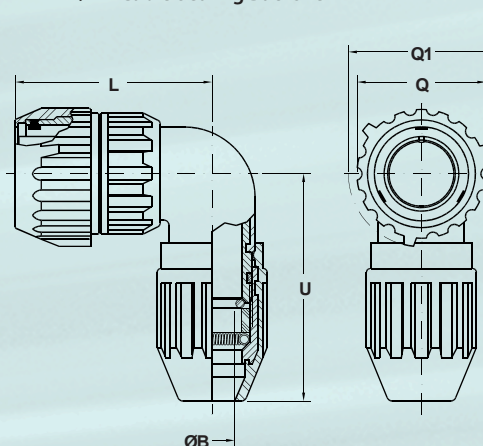
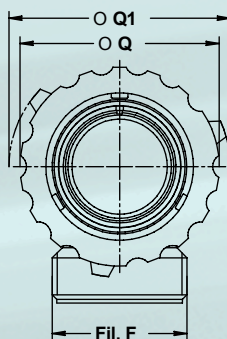
ITS-RGG (06) Straight Plug



ITS-RRG (06) Straight Plug with
EMI/RFI Cable Sealing Backshell



ITS-RGG (08) 90° Right-Angle Plug



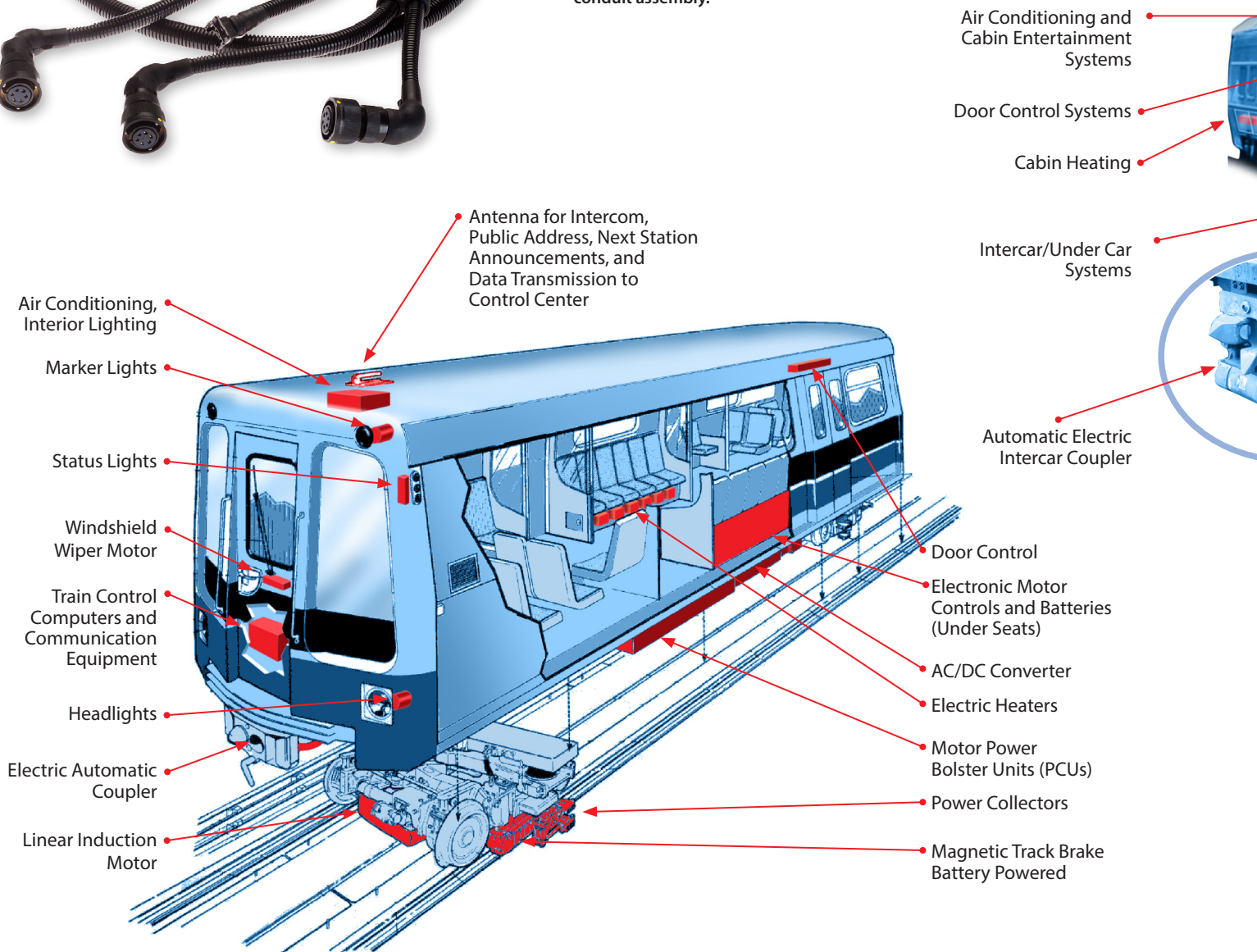
ITS-RRG (08) 90° Right-Angle Plug with
EMI/RFI Cable Sealing Backshell

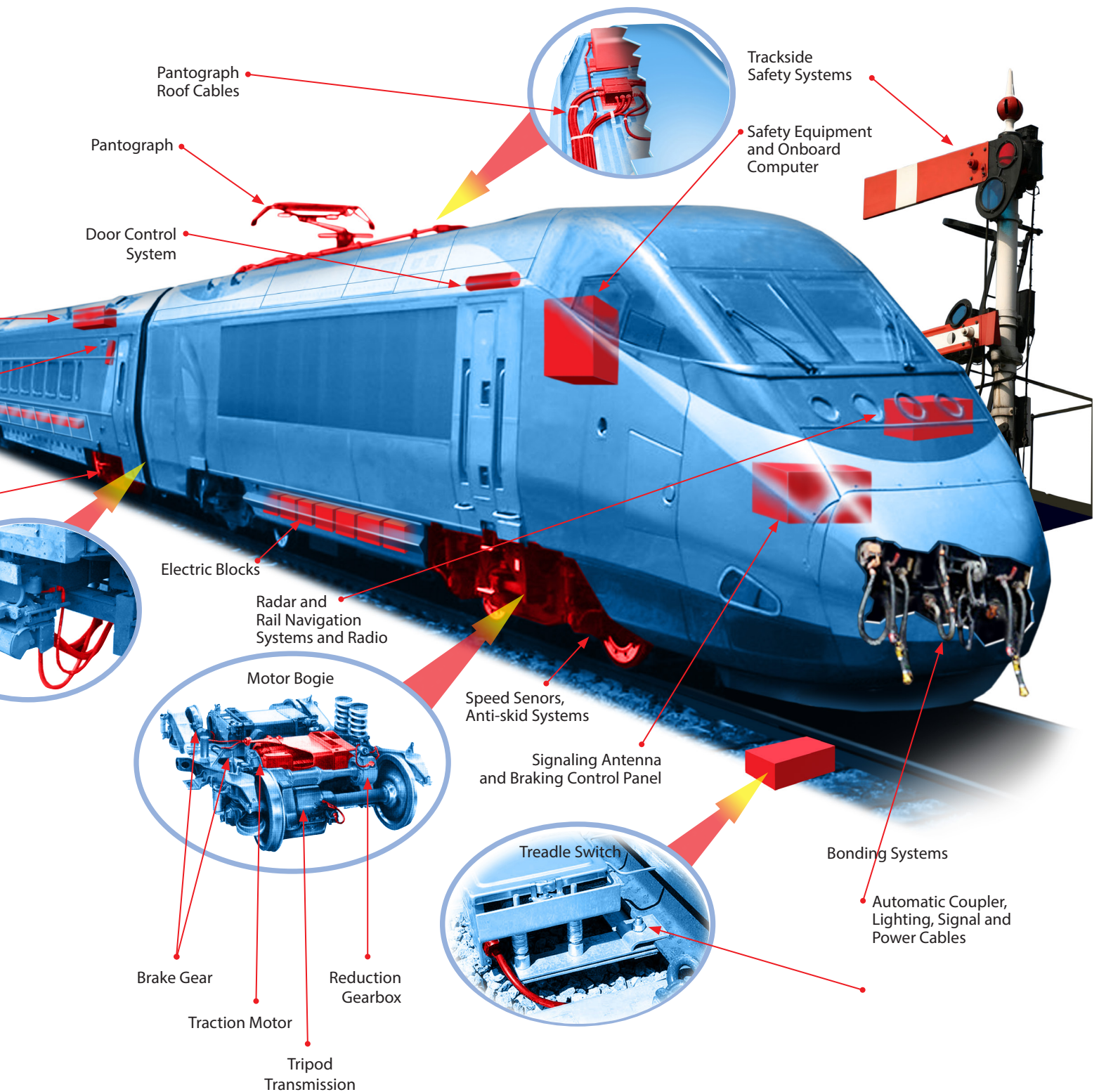
Rail Application Guide



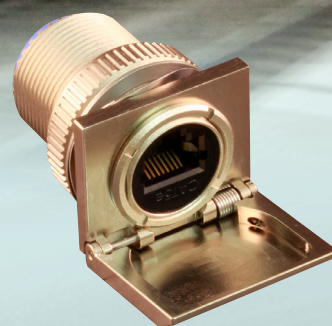
Glenair industrial/rail interconnect solutions are at home in a broad range of harsh-environment mass transit applications

Glenair is the world's only supplier of 5015 type (Series ITS reverse-bayonet) connectors that also manufactures a complete range of wire and cable protection systems such as this engine compartment conduit assembly.





Innovative Strain Relief Backshell Cable Clamps, Protective Covers and Adapters



SuperSeal RJ45 connector with
environmental flap-lid cover

STANDARD AND SPECIAL DESIGN BACKSHELLS AND ACCESSORIES FOR RAIL CONNECTORS

IT and ITS Series backshells
are available for every wire
and connector protection
requirement



Integral 90° backshell
configurations and resilient
rubber coupling nut covers



Integrated
clamping system
for UJ connectors
eliminates the
need for bulky
junction boxes



Protective covers for plugs and
receptacles, and spring-loaded
stainless steel receptacle covers



Special strain-relief backshell
invented by Glenair for use
on the French TGV rail system.
This backshell design resolved
complex intercar vibration and
shock problems which resulted
in destructive cable damage.

COMPOSITE BACKSHELL DESIGNS



Band-in-a-Can
composite backshell



Split-shell low profile
composite banding
backshells



All-in-one booted
"Piggyback" backshell



Isolated conductive
ground path

COMMERCIAL CABLE CLAMP DESIGNS



Broader range of plating
options available



Composite Swing-Arm with
keyed drop-in banding insert



Open-frame composite
strain relief



Composite
strain relief backshell

INNOVATIVE PROTECTIVE COVER DESIGNS



Bean Rubber
USB dustcaps



Self-locking,
anti-decoupling protective
covers



Mil-grade RF protective
covers and accessories

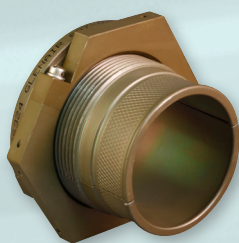


Spring-loaded "flop-lid"
protective cover

STANDARD AND PRESSURE BOUNDARY FEED-THRU



High-performance,
weight saving
composite feed-thrus



EMI/RFI split-shell metal
feed-thru

- High-grade engineering thermoplastic or machined metal
- Six pressure-boundary feed-thru layouts with accommodation for 1 – 6 cables
- Split-shell jam nut versions with EMI/RFI shield termination porch
- O-ring sealed panel and box mounting interface
- Conductive and non-conductive finish options



Glenair®

SERIES 77

Mechanical and environmental protection/strain relief for connector-to-cable transitions



- Standard, short, long and 90° lipped and lipless boots
- Choice of six boot materials and a complete range of high-performance adhesive types
- A wide range of colors including desert tan
- The industry's largest selection of metal and composite shrink boot adapters
- All popular part numbers in stock and ready for same-day shipment



Standard Lipped
or Lipless Boots



Transitions



Convoluted
Boots

SERIES 77

Heat-shrink boots

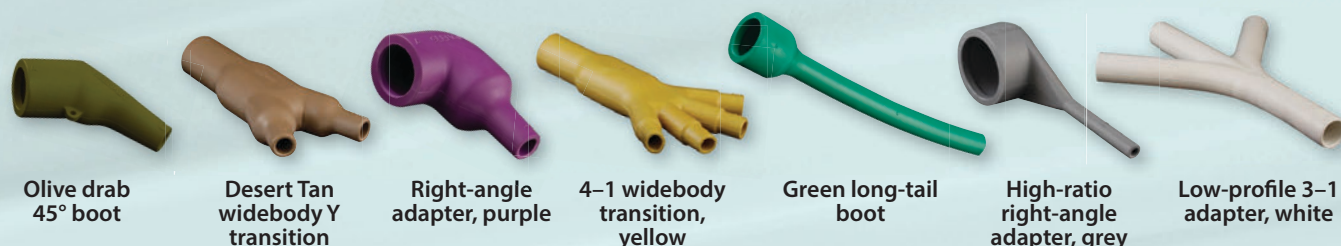
for environmental sealing and strain relief



HOT AND COLD SHRINK BOOTS AND TUBING FOR RUGGED ENVIRONMENTAL APPLICATIONS



SELECTED ENVIRONMENTAL SHRINK BOOT COLOR OPTIONS



PIGGYBACK SHRINK BOOT ADAPTERS



HEAT SHRINK TERMINATION (HST) SLEEVES AND IN-LINE SINGLE-CIRCUIT SPLICE KITS





turboflex

THE ULTRA FLEXIBLE RUGGED POWER CABLE

TurboFlex™ power distribution cables are constructed from highly flexible conductors and high-performance insulation to produce cables ideally suited for applications where flexibility, durability, and weight reduction are required. Amazingly durable and flexible—especially in cold weather—the 16 AWG to 450 MCM TurboFlex cable features high strand count rope lay inner conductors made with tin-, nickel- and silver-plated copper. TurboFlex is jacketed with Glenair's unique Duraelectric™ compound that provides outstanding flexibility and resistance to environmental and chemical exposure. Duraelectric is also low smoke, zero halogen.

Long life and performance are critical in power distribution applications. TurboFlex, with its flexible conductors and durable jacket delivers both.



Ultra flexible rope lay construction



Available in a broad range of gages, 16 AWG to 450 MCM



◀ Duraelectric™ is the high-performance TurboFlex™ jacketing material perfectly suited for immersion, chemical or caustic fluid exposure, temperature extremes, UV radiation and more—available in a broad range of colors including safety orange



Many sizes In-stock and available for immediate, same-day shipment. No minimums!

SERIES 96

TurboFlex® ultra-flexible power distribution cable

How to Order • Applications •

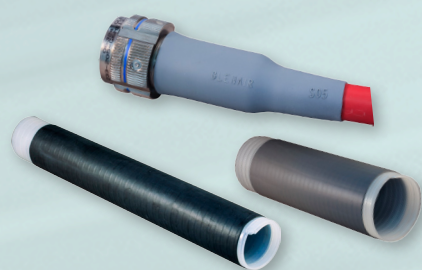
Duraelectric™ jacketing specifications and colors



Bulk jacketed Duraelectric® cable for harsh-environment power applications

| How to Order TurboFlex® | | | | | |
|---------------------------|---|-----|------|----|----|
| Sample Part Number | | 961 | -001 | -T | -G |
| Basic No. | TurboFlex with Duraelectric Jacket | | | | |
| Wall Thickness | -001 = .125" -002 = .093" -003 = .062" -004 = .032" | | | | |
| Conductor Material | -T = Tin/Copper (-60 -150°C) -S = Silver/Copper (-60 -200°C) -N = Nickel/Copper (-60 -260°C) | | | | |
| Wire Size | 16 – 450 MCM AWG, consult factory | | | | |
| Duraelectric Jacket Color | 0 = Black 1 = Desert Tan 2 = Red 3 = Orange 4 = Yellow 5 = Green 6 = Blue 7 = Violet 8 = Gray 9 = White | | | | |

TURBOFLEX® - DURALECTRIC® APPLICATION SHOWCASE



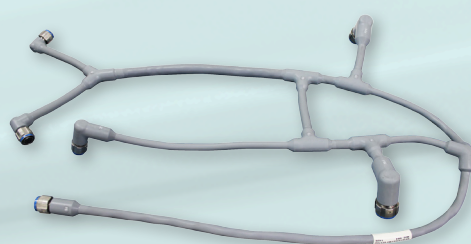
Duraelectric® AutoShrink™ employed in environmental boots and sleeves



Shipboard application with Duraelectric® jacketing and overmolding



Duraelectric jacketing employed as conduit covering in topside naval applications



Aerospace overmolded cable assembly with rugged Duraelectric® jacketing



TurboFlex® power pylon cable assembly with Duraelectric® jacketing



TurboFlex® with Duraelectric® jacketing ideally suited for equipment grounding

DURALECTRIC™ HIGH-TEMP, HALOGEN-FREE, CHEMICALLY RESISTANT JACKETING

Duraelectric® is high-performance elastomeric material for use as wire insulation, cable jacketing, conduit jacketing, cable/conduit overmolding, and molded boots. Perfectly suited for immersion, chemical or caustic fluid exposure, temperature extremes, UV radiation and more.

- Service temperature range: -65°C to 225°C (Duraelectric K: -110° to 225°C)
- Fire-resistant, Low Smoke-Zero Halogen (LSZH)
- Mil-aero and industrial fluid-resistant

- Accelerated UV/sunlight resistant, 53 year equivalent exposure
- Ozone resistant IAW ASTM D518
- Moldable and extrudable



POLYMER AND METAL-CORE

Conduit wire protection for bus and transit applications



Turnkey connectorized factory conduit assembly for power charging application

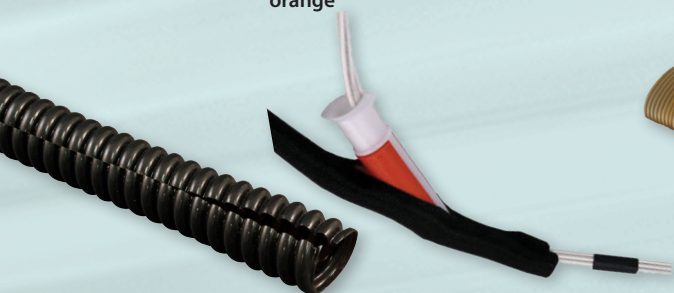
SERIES 72 ANNULAR CONVOLUTED BULK TUBING



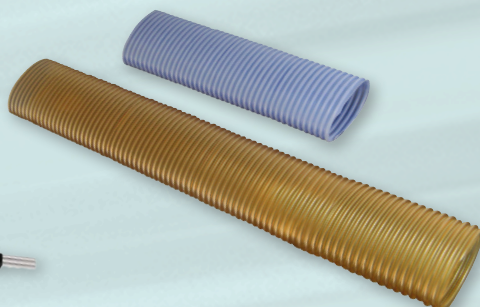
Conduit colors include standard black, natural, blue, yellow, red, desert tan, and orange

| Conduit Tubing Material Choices | |
|---------------------------------|--|
| Kynar® | Flexible, thermally stabilized, resistant to harsh chemicals and radiation. UV resistant, self-extinguishing, nontoxic and resistant to low-temperatures. 166° C temp. rating. |
| PVDF | Flexible and chemical/radiation resistant. Available in 4 colors plus standard black and natural. 150° C temperature rating. |
| G-FLEX Siltem | Lightweight, halogen-free, low toxicity, low smoke. 175° temperature rating. Ideal for harsh environment applications. Exceptional flexibility and crush resistance. |

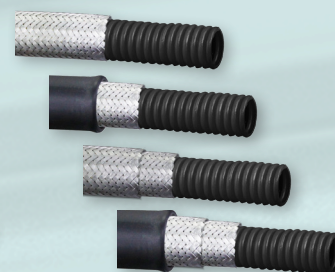
- Lightweight, flexible polymer-core materials and easy to install fittings, transitions and adapters
- A wide range of colors including safety orange and desert tan
- Internal and external braided shielding provides outstanding EMI/RFI, environmental, chemical and rodent protection
- User-installable or turnkey, factory-terminated assemblies



Any of Glenair's annular polymer-core tubings can be provided slit, for on-site installation or addition of wires in open wire loom applications. Use the Wire Loom Tool for easy wire insertion



In-house manufacturing allows Glenair to design and fabricate non-standard shapes such as oval profile for specialized wire routing applications

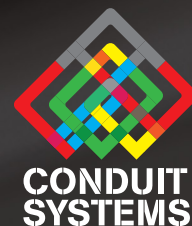


Braid and jacketing options for EMI, chemical, environmental and rodent protection

SERIES 72 · 74 · 75

Polymer-core and metal-core wire protection conduit systems

user-installable and factory-terminated



GUARDIAN SERIES LIGHTWEIGHT COMPOSITE EASY-TO-INSTALL CONDUIT SYSTEM



- Economical and easy to install. *It's a snap!*
- General duty, all-purpose wire protection
- O-ring equipped environmental sealing (splash-proof)
- Self-locking coupling nuts
- Band and shrink-boot ready
- Metal and composite thermoplastic materials



composite thermoplastic feed-thru fitting



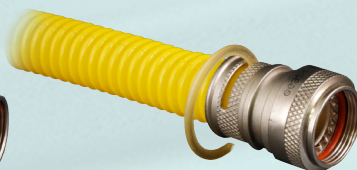
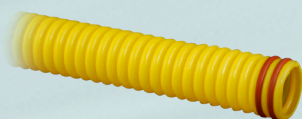
metal conduit-to-connector adapter



composite thermoplastic conduit-to-connector adapter



Direct-attach multibranch transitions



Easy installation:

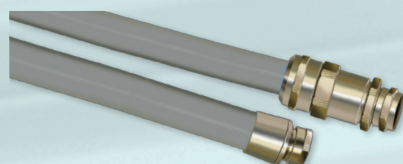
1. Install pair of provided O-rings on the two forwardmost tubing convolutes
2. Insert tubing into fitting
3. Run provided retaining clip into slot, aligned with the third convolution of conduit, behind the 2 O-rings.

SERIES 74 HELICAL CONVOLUTED POLYMER-CORE TUBING AND FITTINGS



- Lightweight, flexible helical polymer-core materials and easy to install fittings, transitions and adapters
- Choice of five materials: ETFE, FEP, PFA, PTFE, and low-smoke, halogen-free PEEK
- Factory-terminated assemblies or user-installable configurations
- All popular part numbers in stock and ready for same-day shipment

SERIES 75 METAL-CORE CONDUIT AND FITTINGS



- Choice of three materials: Brass, Stainless Steel, and Nickel Iron Alloy
- Turnkey, factory-terminated assemblies for harsh environments
- All materials deliver superior EMC performance as well as crush resistance and environmental sealing

TURNKEY FACTORY-TERMINATED POINT-TO-POINT AND MULTIBRANCH CONDUIT ASSEMBLIES

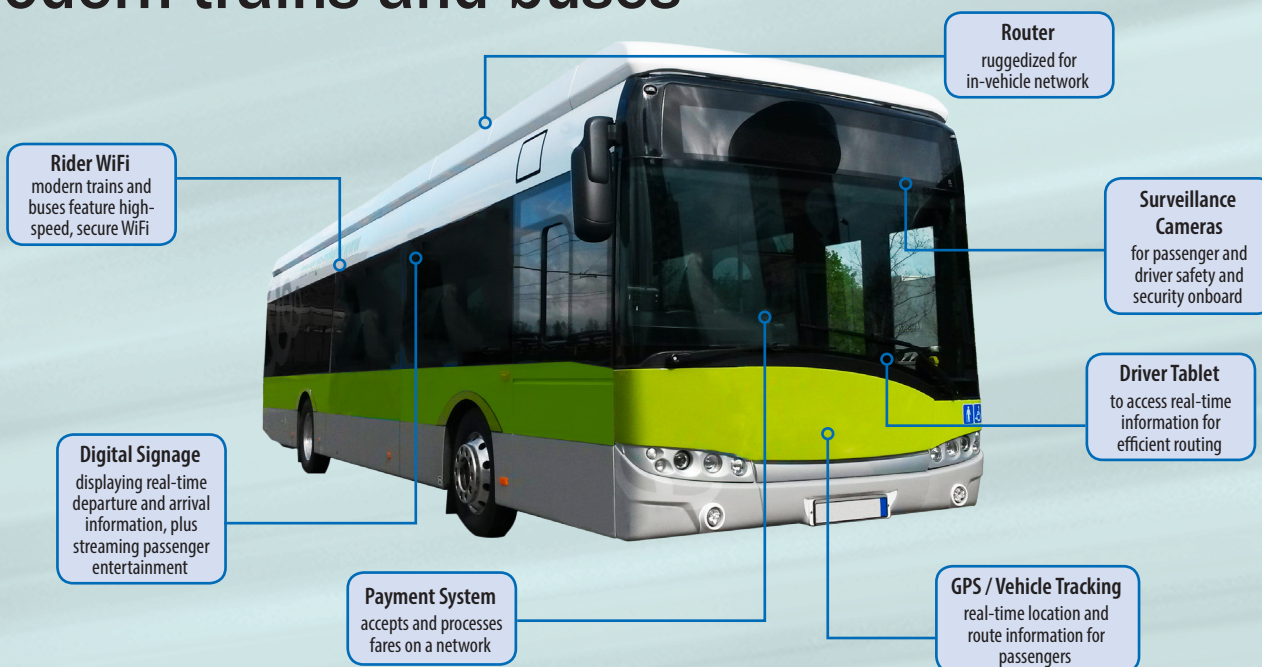
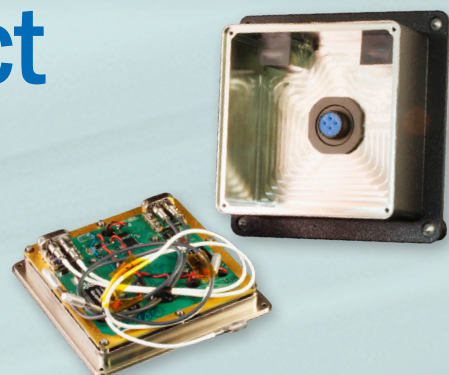




COSTSAVER

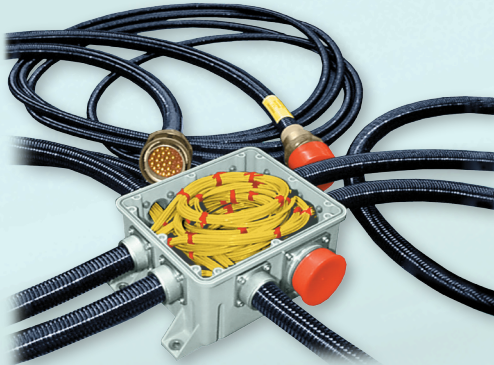
Composite Interconnect Junction Boxes

Sealed, corrosion-free housings for IT and WiFi applications on modern trains and buses



CostSaver Composite Junction Boxes

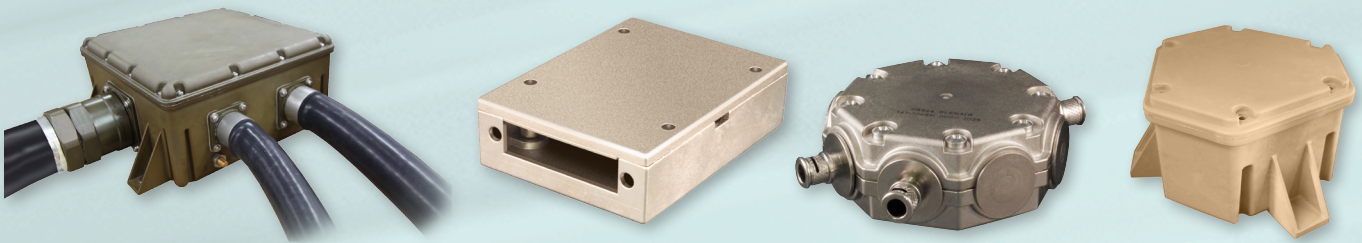
Lightweight, corrosion-free housings for WiFi and other IT applications



- Over a dozen different tooled sizes and shapes.
- Made-to-order configurations available—just ask.
- Extremely durable, corrosion-free, high temperature engineering composite thermoplastic
- Tested and qualified to U.S. Navy, UK MOD, transit, aircraft and marine applications

Glenair EMI/RFI CostSaver Composite Junction Box application—protecting and storing fiber optic media service loops

Install it and forget it: Glenair corrosion-free EMI/RFI shielded composite junction boxes



Ultra-Lightweight and Corrosion-Free

Series 316 stainless steel hardware provides long-term durability

IP67 rated seals and gaskets protect equipment from moisture and dust

Unlimited corrosion resistance compared to metal junction boxes reduces repair and maintenance costs.

Glass-reinforced composite thermoplastic material is strong and durable and yet extremely lightweight.

Low harmonic resonance and inherent attenuating properties reduce loosening and decoupling of feed-through fittings and accessories.



GROUNDING AND SHIELDING TECHNOLOGIES

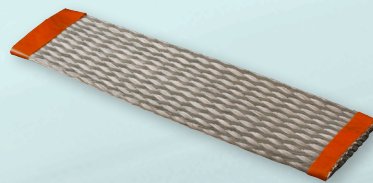
EMI/RFI braided shielding, ground straps, and earth bond tooling



- Complete range of QQ-B-575B/A-A and ASTM B conductive braided shielding solutions
- High performance tubular fabric braided sleeving for every mechanical and wire-protection application requirement
- Broad range of lightweight as well as heavy-duty ground strap/bonding technologies
- Rail industry qualified earth bond tooling and ground studs

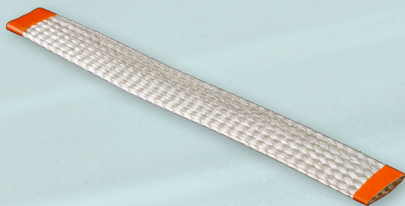
World's largest selection of metal and fabric cable shields, ground straps, and tools

100-001 TUBULAR METAL BRAID QQ-B-575B/A-A-59569 ASTM B298 TIN COATED COPPER



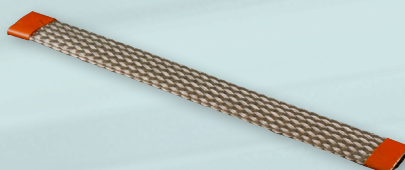
| How To Order | | | | |
|--------------------|---|---|-----|---|
| Sample Part Number | 100-001 | A | 203 | L |
| Basic No. | Tin/Copper Braid | | | |
| Wire Gage Code | A = 36 AWG D = 30 AWG B = 34 AWG E = 38 AWG C = 32 AWG F = 28 AWG (consult factory) | | | |
| Braid Diameter No. | consult factory | | | |
| Lanyard Option | L = with lanyard Omit = no lanyard | | | |

100-002 TUBULAR METAL BRAID QQ-B-575B/A-A-59569 ASTM B298 SILVER COATED COPPER



| How To Order | | | | |
|--------------------|--|---|-----|---|
| Sample Part Number | 100-002 | A | 203 | L |
| Basic No. | Silver/Copper Braid | | | |
| Wire Gage Code | A = 36 AWG B = 34 AWG (consult factory) D = 30 AWG (consult factory) E = 38 AWG (consult factory) | | | |
| Braid Diameter No. | consult factory | | | |
| Lanyard Option | L = with lanyard Omit = no lanyard | | | |

100-003 TUBULAR METAL BRAID ASTM B355 CLASS 4 OFHC NICKEL PLATED COPPER



| How To Order | | | | |
|--------------------|--|---|-----|---|
| Sample Part Number | 100-003 | A | 203 | L |
| Basic No. | Nickel/Copper Braid | | | |
| Wire Gage Code | A = 36 AWG B = 34 AWG C = 32 AWG (consult factory) D = 30 AWG (consult factory) | | | |
| Braid Diameter No. | consult factory | | | |
| Lanyard Option | L = with lanyard Omit = no lanyard | | | |

GROUNDING AND SHIELDING TECHNOLOGIES

EMI/RFI braided shielding, ground straps, and earth bond tooling

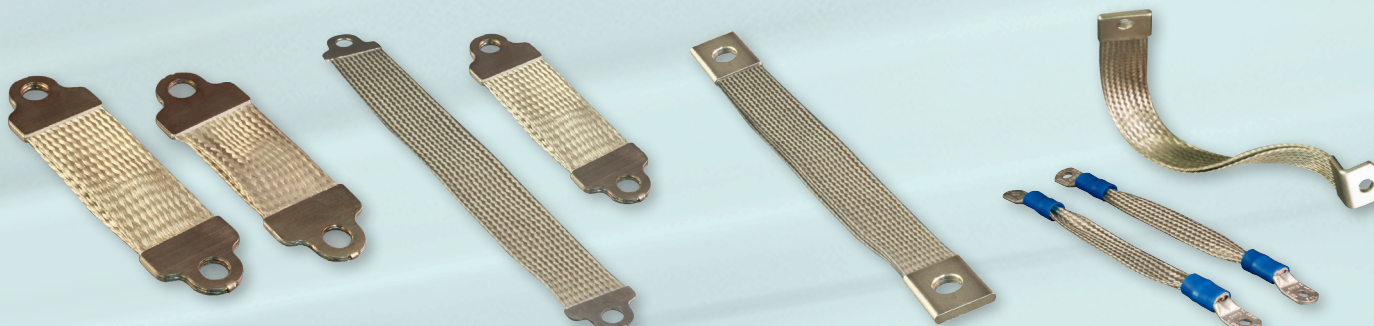


FABRIC BRAIDED SLEEVING FOR NON-ENVIRONMENTAL WIRE AND CABLE PROTECTION



| Non-Environmental Fabric Braided Sleeve Types | |
|---|---|
| Series No. | Type |
| 100-022 | PTFE glass tubular braided sleeving |
| 102-001 and -002 | Polyethelene expandable fabric tubular braided sleeving; black, green, red, white, and yellow |
| 102-020, -021, -022 and -023 | Halar expandable fabric tubular braided sleeving, white or black, with and without tracers |
| 102-073 | Dacron tubular braid, black |
| 103-013 | Nomex tubular braid; black, white, red, green, gray, and desert tan |
| 102-051 | PEEK tubular braid, black |
| 102-061 | Teflon tubular braid, clear and natural |
| 102-071 | Kevlar tubular braid, natural |
| 102-072 | Nylon tubular braid, black |

BRAIDED GROUND STRAPS



Lightweight ArmorLite™ microfilament ground straps

General duty, configurable ground straps

Heavy-duty 3-layer configuration

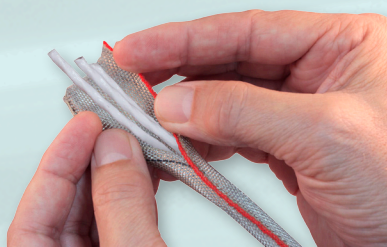
Special application materials, jacketing, and lug configurations

GroundControl™ EARTH BOND SYSTEM



One-hand operation and ram retract mechanism actuated by release trigger

MasterWrap™



Flexible, field-installable/repairable side-entry EMI/RFI shielding with ArmorLite™ technology



Spot-coverage mesh tape in lightweight ArmorLite™ or Nomex braid material

Band-Master ATS®

EMI/RFI Shield Termination System

Quick, easy, cost-effective and highly reliable termination of braided metallic shielding or fabric braid to connectors and backshells

Band-Master ATS® is the advanced termination system for interconnect cable shielding. The unique low profile and smooth inside diameter of the one-piece type 304 austenitic stainless steel clamping band virtually eliminates RFI/EMI/EMP leakage paths. The lock maintains constant tension under extreme environmental conditions. Band-Master ATS® bands have passed severe shock, vibration and thermal cycle testing with negligible deterioration of shell conductivity.

- Precision hand-held tool and bands deliver reliable, repeatable performance
- Integrated digital counter aids in identifying calibration intervals
- Single-piece stainless steel bands in various sizes and lengths
- Clamp both small and large diameters easily and reliably
- Qualified for both military and commercial programs

BAND-MASTER ATS® ADVANCED TERMINATION SYSTEM



Easy-to-use manual tools with built-in calibration counter



High-volume pneumatic tool for bench use



Save time and tool maintenance costs with the Glenair band tool calibration system

BAND-MASTER ATS® EMI/RFI Shield Termination System

Band-Master ATS®

The advanced termination system
for interconnect cable shielding

Band-Master ATS® Manual Tool Selection



601-100 Hand Tool for Standard Bands

The 601-100 Standard Band-Master ATS® Tool weighs 1.18 lbs., and is designed for standard .24" width clamping bands in a tension range from 100 to 180 lbs. Calibrate at 150 lbs. \pm 5 lbs. for most shield terminations. Tool and band should never be lubricated.



601-101 Hand Tool for Micro Bands

The 601-101 Micro Band-Master ATS® Tool weighs 1.18 lbs., and is designed for micro .120" width clamping bands in a tension range from 50 to 85 lbs. Calibrate at 80 lbs \pm 5 lbs. for most shield terminations. Tool and band should never be lubricated.



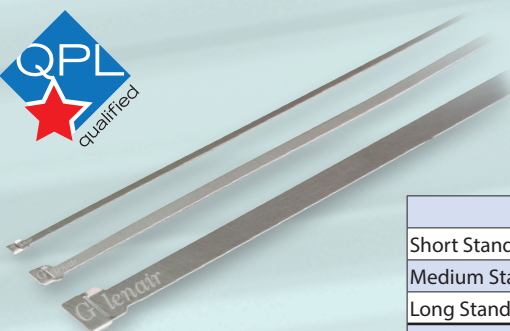
601-108 Hand Tool for Nano Bands

The 601-108 Nano Band-Master ATS® Tool weighs 1.18 lbs., and is designed for nano .075" width clamping bands in a tension range from 20 to 50 lbs. Calibrate at 50 lbs. \pm 3 lbs. for most shield terminations. Tool and band should never be lubricated.



601-109 Hand Tool for Slim Standard Bands

The 601-109 Slim Standard Band-Master ATS® Tool weighs 1.2 lbs., and is designed for slim standard .24" width clamping bands in a tension range from 50 to 100 lbs. Calibrate at 100 lbs. \pm 5 lbs. for most shield terminations. Tool and band should never be lubricated.



3 lengths and 3 widths of EMI braid termination bands plus new slim standard bands for size and weight savings—50% lighter and lower-profile than standard bands.

Band-Master ATS® Band Selection

| Bands | Length | | Part Number | | Fits Diameter | |
|---------------------------|--------|-------|-------------|------------|---------------|------|
| | in. | mm. | Flat | Pre-Coiled | in. | mm. |
| Short Standard Band | 9.0 | 228.6 | 601-005 | 601-006 | 1.0 | 25.4 |
| Medium Standard Band | 14.0 | 355.6 | 601-040 | 601-041 | 1.8 | 47.8 |
| Long Standard Band | 18.0 | 457.2 | 601-049 | 601-050 | 2.5 | 63.5 |
| Short Micro Band | 5.0 | 127.0 | 601-024 | 601-025 | 0.5 | 12.7 |
| Medium Micro Band | 8.0 | 203.2 | 601-060 | 601-061 | .88 | 22.4 |
| Long Micro Band | 14.0 | 355.6 | 601-064 | 601-065 | 1.8 | 47.8 |
| Short Nano Band | 6.0 | 152.4 | 601-500 | 601-501 | .60 | 15.2 |
| Medium Nano Band | 9.0 | 228.6 | 601-504 | 601-505 | .94 | 23.9 |
| Long Nano Band | 14.0 | 355.6 | 601-508 | 601-509 | 1.8 | 47.8 |
| Short Slim Standard Band | 9.0 | 228.6 | 601-570 | 601-571 | 1.0 | 25.4 |
| Medium Slim Standard Band | 14.25 | 362.0 | 601-572 | 601-573 | 1.8 | 47.8 |

SERIES 921 Super ITS™

Ultra-high performance
reverse-bayonet power connectors



Super ITS™

Reverse-bayonet derivatives of MIL-DTL-5015 (VG95234) connectors have long been preferred for their rapid mating and rugged resistance to vibration and shock in harsh environment applications such as mass transit, rail, and military vehicles. Now Glenair introduces an ultra high-performance version of the reverse-bayonet 5015 power connector called the Super ITS. This series is designed for high-ampacity applications where low insertion force LouverBand type contacts, mechanical contact retention, broad temperature tolerance, and superior connector and wire sealing is required. Super ITS is an extremely durable and environmentally-sealed connector, designed in accordance with legacy MIL-C-5015, EN50124, and VDE 0110-1 requirements. Unlike conventional 5015-type connectors designed for industrial and rail applications, the Super ITS offers uncompromising electrical, mechanical, and environmental performance—including 2000 mating cycles. Designed for extreme harsh environments such as are found in heavy industries, mining, military vehicles, offshore and shipboard applications, the Super ITS delivers contact and wire support from #16 to 2/0 and 1 mmq – 70 mmq respectively. With ampacity up to 350 amps, and a max working voltage of 2450 VCC / 1750 VCA, the Super ITS represents the ultimate in industrial power interconnection.

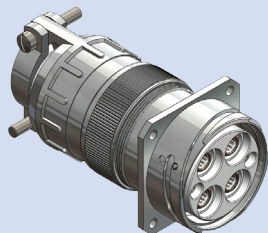
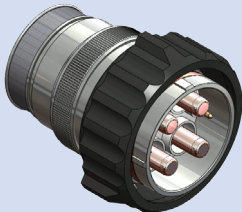
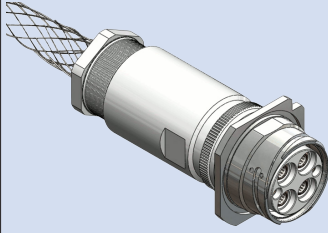
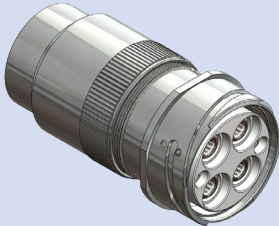


- Low insertion force, high-ampacity front-release contacts
- Rigid insulator with internal retention clip
- Aluminum, stainless steel or marine bronze shells with polarization keys
- Connector O-ring and individual wire sealing grommets
- High temperature range: -55° to +180°C
- 2000 mating cycles



| Performance Comparison: ITS vs. Series 921 Super ITS | | |
|--|--------------|--|
| | ITS | Series 921 Super ITS |
| Mating Cycles | 500 | 2000 |
| Mating Face Sealing | FRONT O-RING | SEALING O-RING |
| Polarization Key | NO | YES |
| Power Contacts | COPPER ALLOY | LOUVER BAND, HIGHER AMPACITY, L.I.F. |
| Insert | RUBBER | HIGH TEMP/RIGID INSERT + INTERNAL CLIP |
| Grommet | RUBBER | INDIVIDUAL CONTACT SEAL (Silicon) |
| Hard Anodization | NO | YES |
| Temperature Range | -55 / +125°C | -55 / +180°C |
| Working Voltage | MIL-C-5015 | MIL-C-5015, EN50124, VDE 0110-1 |

PRODUCT SELECTION GUIDE

| | | | |
|---|---|--|---|
|  |  |  |  |
| Wall Mount Receptacle Connector | Straight Plug connector | Jam Nut Receptacle Connector | In-Line Receptacle Connector |

SERIES 970 PowerTrip®

The power connector for extreme environments



**POWER
TRIP®**



Lightweight plug with ratcheting coupling nut and LouverBand contacts

Keyed receptacle with superior sealing and EMI shielding



PowerTrip®

- Fast, easy mating with triple-start ACME thread: 360° turn for full mating
- Reduced size and weight compared to 5015/VG95234 solutions
- LouverBand sockets for improved current ratings and longer life, up to 2000 mating cycles
- Splined backshell interface for improved backshell attachment and EMI shielding
- Ratcheting coupling nut for secure mating
- Operating temperature -65° C to +200° C
- Hermetic and filter options available

The Series 970 PowerTrip® offers improved performance compared to standard 5015 type power connectors: higher density and lighter weight packaging, rapid mating and demating triple-start threaded coupling, and extremely rugged splined and threaded backshell attachment interface

SERIES 970 POWERTRIP® CONNECTOR STYLES



Plug
970-001



Square Flange
Receptacles
970-003



Jam Nut Receptacles
970-004



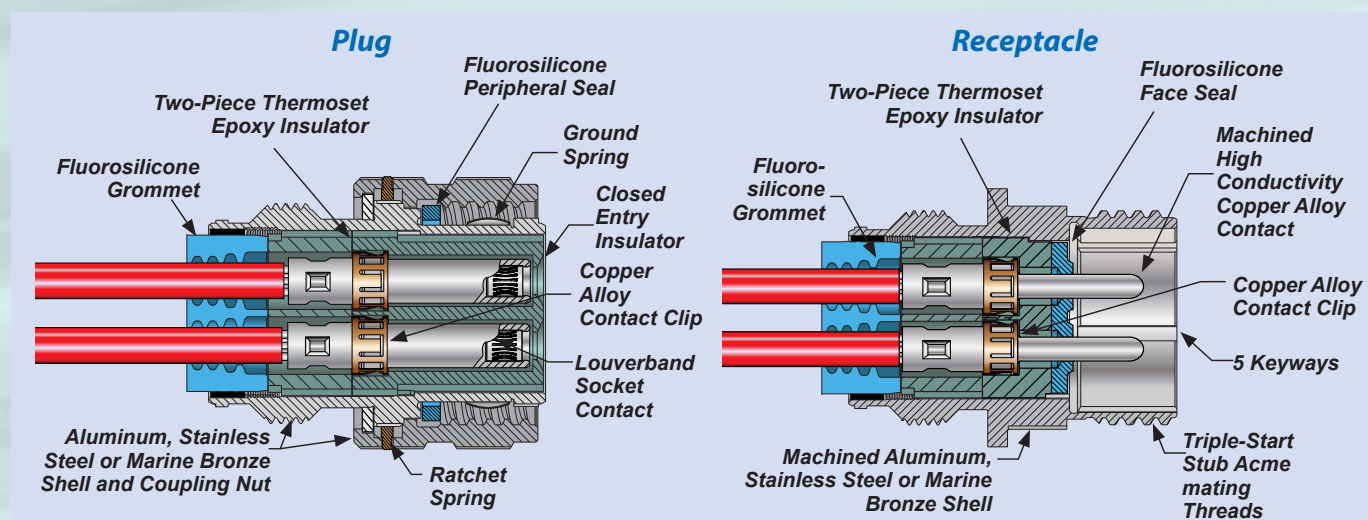
Cable Receptacles
970-005



Feed-Thru Bulkhead
970-006



Hermetic Feed-Thru
Bulkhead
970-007



Signal and Lighting Systems for mass transit

- Buttons
- Light Information Panels
- Communication Systems
- Operating Consoles
- LED Displays
- Signal Lights
- Touch Screen Monitors
- Test Equipment



LED LIGHTS AND LIGHT SIGNALING SYSTEMS

LED devices are designed to be installed in all compartments, from coaches to locomotives. Case and electronic components can be customized.

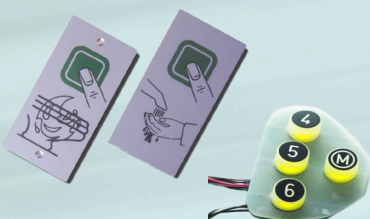
- Case: Aluminum
- Source: 18-36Vdc
- Working Temperature: -25/+70°C
- Standards: EN50155; UNI CEI 11170



LIGHT BUTTONS

Circular and rectangular devices, timed or not, with writing in relief for blind persons. Pictographs and case can be customized. Programmable, with LED light source.

- Case: Aluminum
- Source: 18-36Vdc
- Working Temperature: -25/+70°C
- Standards: EN50155; UNI CEI 11170

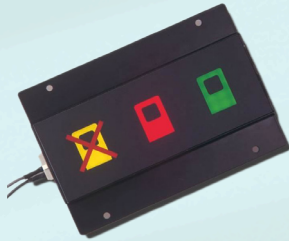


SPECIAL-USE BUTTONS

Circular and rectangular devices, timed or not, with writing in relief for blind persons. Pictographs and case can be customized. Programmable, with LED light source.

- Case: Aluminum
- Source: 18-36Vdc
- Working Temperature: -25/+70°C
- Standards: EN50155; UNI CEI 11170

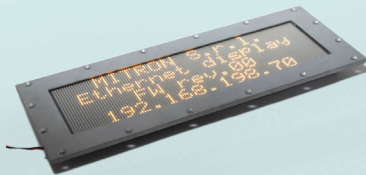
HIGH RELIABILITY Signal and Lighting Systems for mass transit



WARNING LED LIGHT PANELS

Panels are designed with LED lights. Number of lights, case and pictographs can be customized.

- Case: Aluminum
- Source: 18-36Vdc
- Working Temperature: -25/+70°C
- Standards: EN50155; UNI CEI 11170



LED LIGHT INFORMATION PANELS

Number of lights, case and pictographs can be customized.

- Case: Aluminum
- Source: 18-36Vdc
- Working Temperature: -25/+70°C
- Standards: EN50155; UNI CEI 11170



INTERCOM SYSTEMS

Customizable intercom units designed as communication system between coaches and between coaches and locomotives.

- Case: Aluminum
- Painting: Epoxy paint
- Source: 18-36Vdc
- Working Temperature: -25/+70°C
- Standards: EN50155; UNI CEI 11170



SIGNAL DEVICES

Signaling units designed for heavy duty conditions, when long life and high reliability are required. LED light source. The Ground Signal Device is available with fixed lights.

- Ground Signal; Modular High Signal; Permissive and Directional Signals
- Case: Fiberglass
- Color: Black
- Source: 150Vac
- Working Temperature: -25/+80°C
- Mechanical Degree Protection: IP54
- Standards: EN50155; UNI CEI 11170

CONTROL PANELS



SENSORS



TEST EQUIPMENT





MISSION-CRITICAL INTERCONNECT SOLUTIONS

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