


# QwikConnect

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**DEEP DIVE:**  
**Glenair Subsea  
Interconnect Technologies**

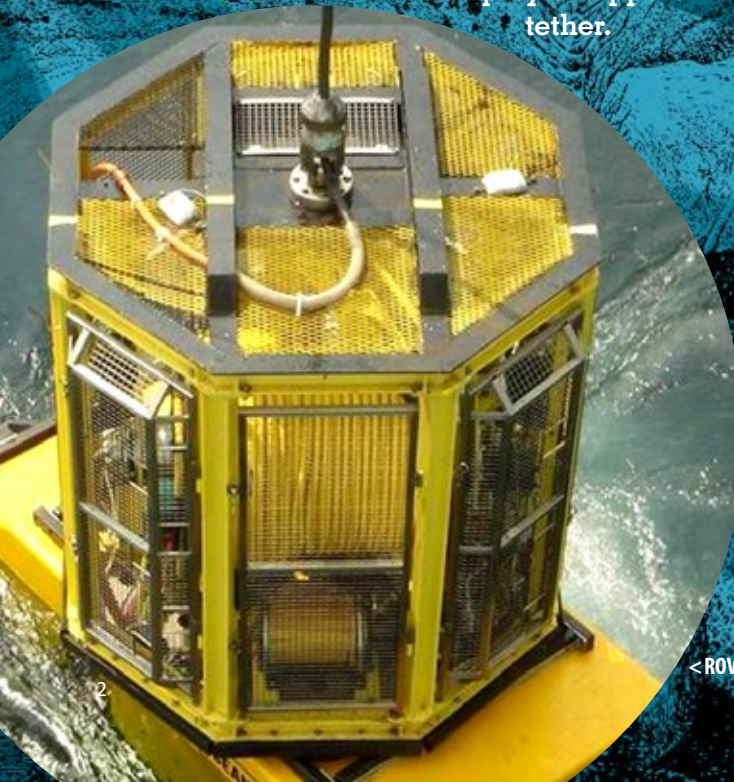
**G**lenair®



# DEEP DIVE: Glenair Subsea Interconnect Technologies

## ROVs: The Workhorse of Subsea Science and Exploration

Small unmanned submersibles called “marine remotely operated vehicles” or ROVs are deployed throughout the oil & gas industry—and in other industries such as scientific research, fisheries and aquaculture, oceanography, underwater archaeology, ocean exploration, and military/defense—to perform inspection, repair, and maintenance functions in water too deep or too dangerous for divers. ROVs service sea floor drilling and processing operations with capabilities as diverse as trenching and drill support. The various classes of ROVs are distinguished by their size, maneuverability, methods of propulsion. Regardless of class, all ROVs are cable connected (tethered) to their support platform. In addition, ROVs share two key characteristics: a subsea-to-topside visual feed (typically an HD/SD TV which provides real-time or slow-scan viewing) and the ability to rise or submerge subsea. Autonomous underwater vehicles (AUVs) are a far different class of submersible, and do not employ a support tether.



QwikConnect

### ROV classes

- Observation
- Observation with payload
- Work class
- Bottom crawling

Typical work-class ROV systems provide power levels ranging from 100 to 200 horsepower, and even as high as 330 HP. Trenching vehicles are equipped with 1500 HP electrical power for impressive thrust in either vertical or horizontal directions. In the past, ROVs have operated at 120V, but due to growing power requirements the industry is now adopting 270 and 240 VDC full wave rectification of 120/208 three phase AC for manned submersibles. Small inspection-class ROVs continue to operate in the 100–130 VAC range.



During operation ROVs are linked to a host ship by a neutrally buoyant tether or, when working in rough conditions or in deeper water, a load-carrying umbilical cable is used along with a tether management system (TMS). The TMS is either a garage-like device which contains the ROV during lowering through the splash zone or, in the case of larger work-class

ROVs, a separate assembly which sits on top of the ROV. The purpose of the TMS is to lengthen and shorten the tether as needed so that the cable drag effect of underwater currents is minimized. The umbilical is an armored cable that contains a group of electrical conductors and fiber optics that carry electric power, video, and data signals between the operator and the TMS. Some umbilical tethers are equipped with pneumatics to power work-class ROV equipment. Where used, the TMS then relays the signals and power for the ROV down the tether cable to power sonars, magnetometers, still cameras, manipulators, water samplers, cutting arms, or scientific instruments that measure water clarity, temperature, density, sound velocity, and light penetration.

< ROV with tether management system

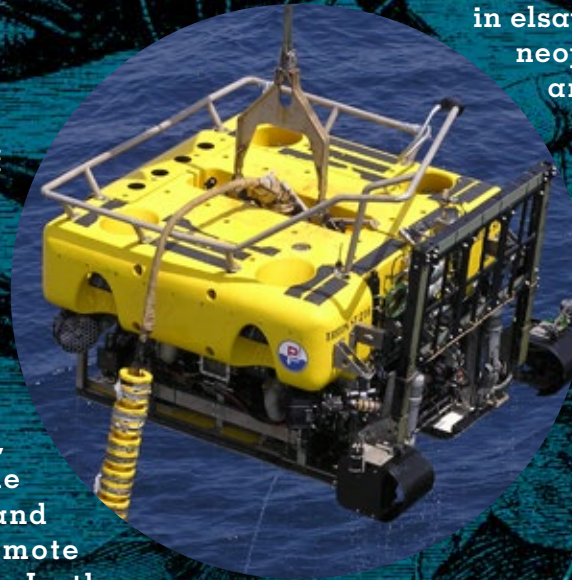


## Interconnect Technology for ROVs

ROVs are the backbone of all deepwater offshore operations: From installing assets and bringing wells online, to the complex business of decommissioning end-of-life fields, ROV equipment sets are pressure resistant, making it possible for the submersible to function and operate in harsh and remote depths up to 10,000 feet. In the demanding deep-water operations environment, electrical engineers specifying interconnect technology must consider extremes in temperature, pressure, and corrosion when choosing appropriate cables and connector sets to bring power and data to equipment and tools. Connectors must be evaluated for mating durability and wire-to-connector termination durability by considering working conditions including cathodic delamination, corrosion due to dissimilar metals, and mechanical stress due to cable routing and wave action.

Pressure resistant connectors are required on all ROVs for electrical and optical circuits interconnecting payload components and/or for umbilical connectivity topside. 10k psi is the standard for ROV connectors. Connectors typically employ front-end sealing technology that allows for wet underwater mating (not currently supplied by Glenair) and/or open-face exposure of connector halves to subsea pressures (a major Glenair strength—see our revolutionary SeaKing connector series later in this special edition of *QwikConnect*).

Back-end sealing technology protects the termination zone for both cable and contact, and is often a weak point in connector and cable sealing. Glenair brings over 60 years of mission-critical sealing expertise to our subsea interconnect designs, including deep materials science fluency

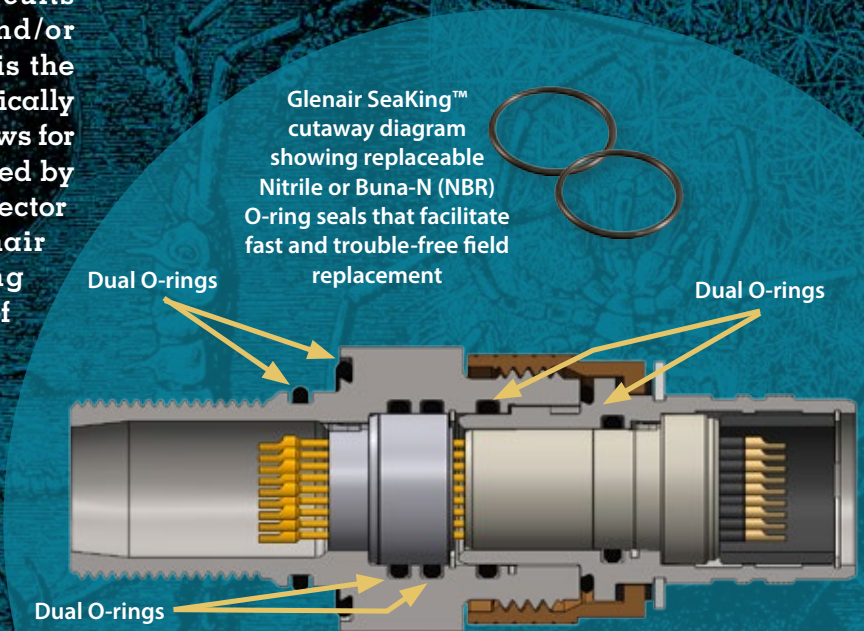


in elastomers such as polyurethane and neoprene. Various other techniques and materials are available for front-end and back-end-to-cable sealing in subsea interconnects including:

### Connector Sealing Technologies

- Glass-to-Metal
- Welding/Brazing
- Metal-to-Metal Seals
- Rubber-molded connectors
- Needle valves
- Tapered threads
- Potting/Adhesives/Sealants
- O-rings

O-rings are the unsung hero of sealing, and when properly applied can yield reliable, high pressure sealing results. O-rings are small, cheap, suitable for high-mating cycle applications, easy to inspect, easily serviced and, as mentioned, extremely effective when proper attention is applied to engineering best-practices. These practices focus on gland design (or the relative advantages and disadvantages of axial face seals compared to radial piston or rod seals), as well as careful attention to metal-to-metal extrusion gaps, and O-ring groove widths.





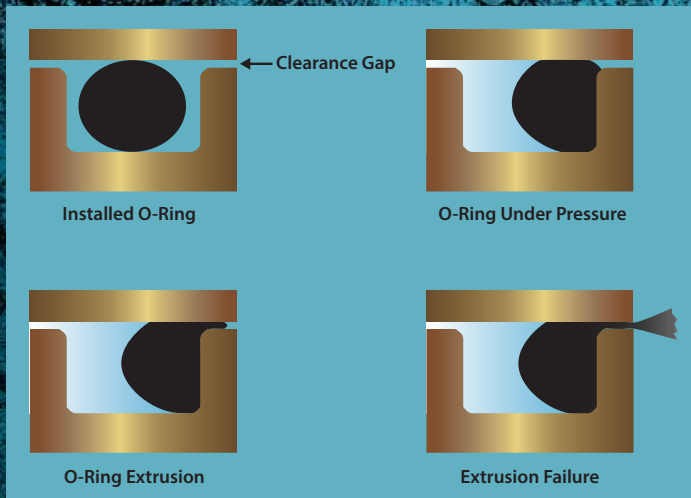
connector series were originally designed for shallower, lower pressure applications with shorter deployments. But today's requirements for 10k psi high-pressure performance and deployments measured in weeks, not hours, call for both better mechanical design and harder 90 Shore-rated seals.

Many subsea applications utilize electrical and optical Pressure Balanced Oil Filled (PBOF) cables. PBOF cables use a compensating fluid-filled elastomeric tube as a conduit for the electrical and fiber optic lines. The elastomeric conduit allows the ocean pressure to transfer

to the compensating fluid, equalizing the pressure differential. PBOF

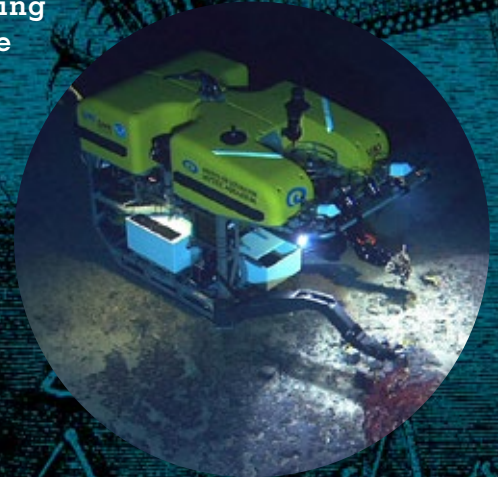
technology has been widely utilized in ocean science exploration, drilling systems, production control systems, towed sonar arrays, and most importantly, for the interconnection of subsea floor structures and equipment. Special PBOF connectors are employed to enable the ROV to connect and disconnect flying lead PBOF cables for maintenance or equipment replacement.

Glenair has developed a superior PBOF technology design that allows for faster, easier assembly and ease-of-repair in the field, and the utilization of both straight and sweeping, non-constricting 45° and 90° elbows. These improvements and a host of others are now available in Glenair SeaKing high-pressure connectors and coming soon in our revolutionary SuperG55 series. The SubSea/Marine Team at Glenair invites you to enjoy the rest of this special edition of QwikConnect and to contact the factory for applications and design-in support.

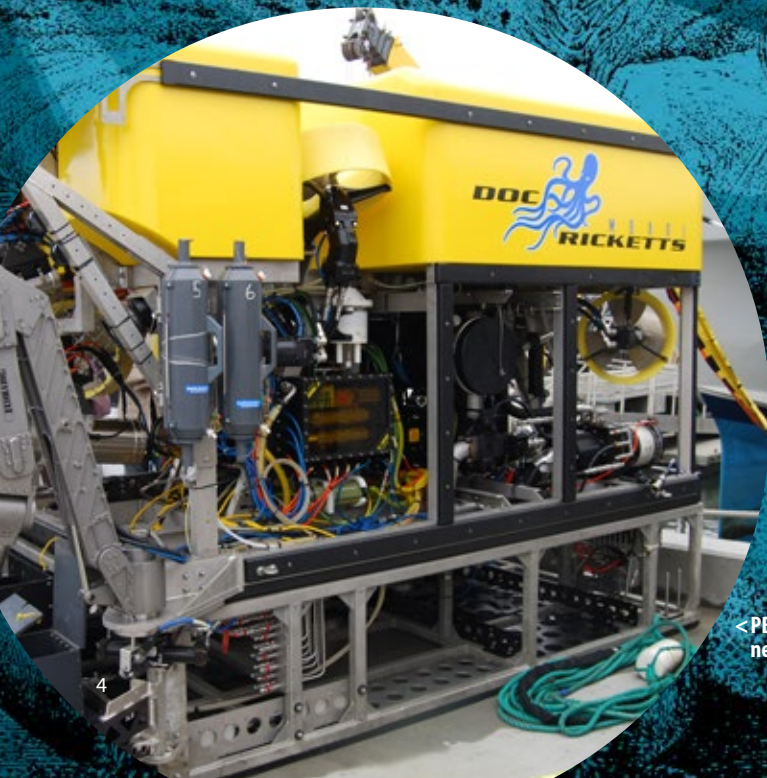


^ O-rings with proper shore hardness can prevent the extrusion problems shown in this diagram.

Next to mechanical design, the proper application of materials science has the greatest impact on high-pressure sealing. Metallic and non-metallic materials must be evaluated for temperature extremes, fluid compatibility, abrasion resistance, gas decompression, and conductivity. Shore hardness is a particularly critical material selection criterion in high-pressure sealing applications as it directly impacts material performance under pressure. Extrusion gaps in the designed-for clearance between metal sub-assemblies, for example, can be problematic for O-rings with Shore hardness ratings under 90. Many legacy subsea

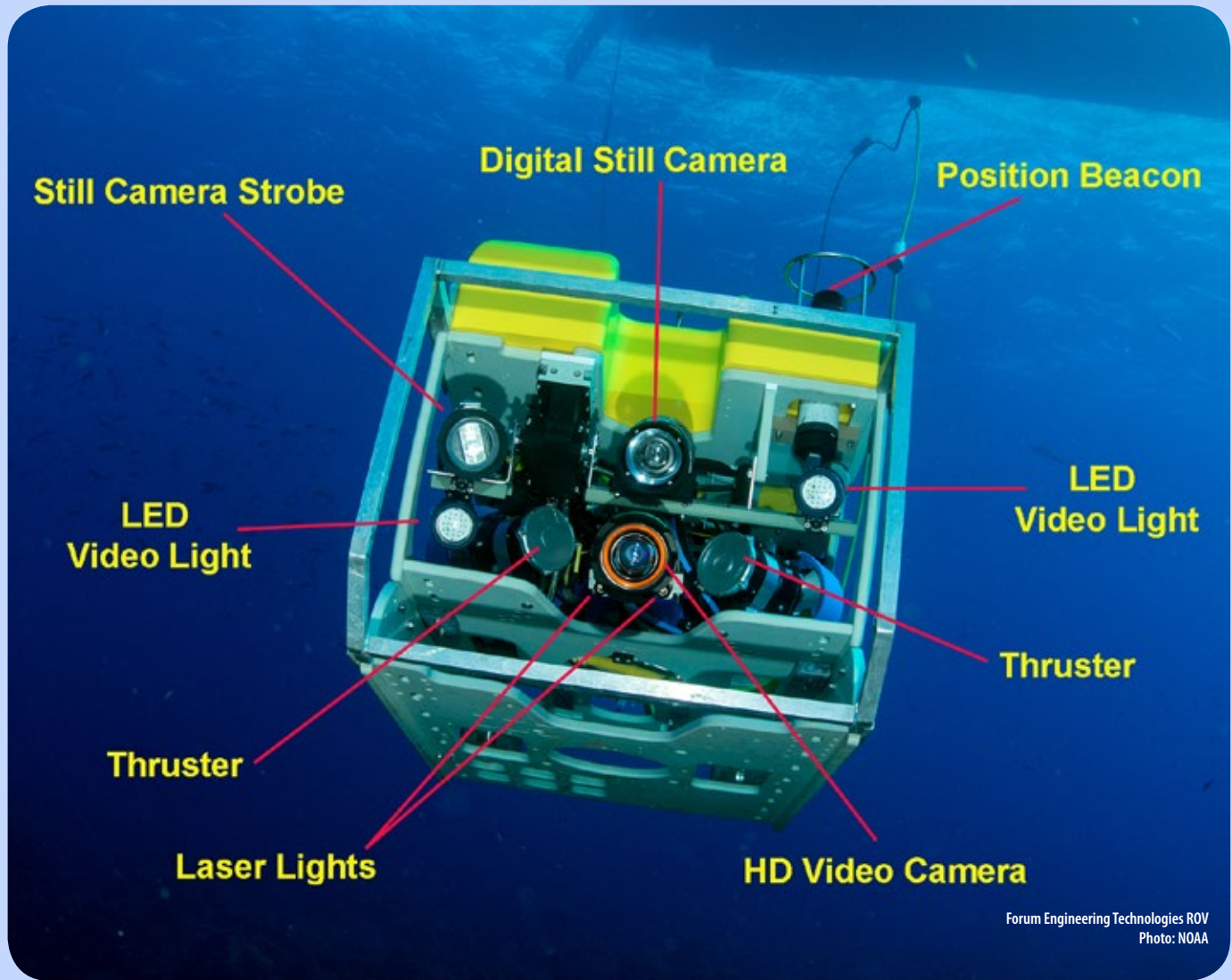


^ NOAA's Hercules ROV recovers a basalt recruitment block experiment from the sea floor



< PBOF cables on Monterey Bay Aquarium Research Institute's next-generation Doc Ricketts ROV. Photo: Bill Abbott/Flickr





## ROV Payloads

The equipment that ROVs use to perform their underwater work is known as the "payload." An ROV's payload could include sonar, lights, video cameras, gyroscopes, navigation systems, thrusters, manipulators (robotic arms) and occasionally, still cameras and strobes. All of these devices require interconnection to power supplies, communication systems and controllers. Subsea equipment engineers must consider extremes in temperature, pressure, and corrosion when choosing subsea connectors. The ROV's size and duty range can also influence connector choice. Glenair's dedicated subsea engineers can work directly with ROV payload designers to select the best interconnect for the application.





# Hydrostatic test lab

The Glenair marine/subsea technology team is unique in the industry having the ability to design, produce, validate, and test its complete range of subsea interconnect technologies using 100% in-house resources. Glenair's hydrostatic lab is a dual-mode pressure test facility equipped with both large form-factor pressure vessels for testing complete cable assemblies, mated cable connectors, and even customer sub-assemblies. In addition, a small pressure vessel cell provides qualification and validation testing on discrete connector inserts and bulkhead connectors. Both the large pressure vessel and small pressure vessel systems can validate and test up to 16.5K psi, or 1 1/2 times Glenair's standard 10,000 psi subsea connector rating.



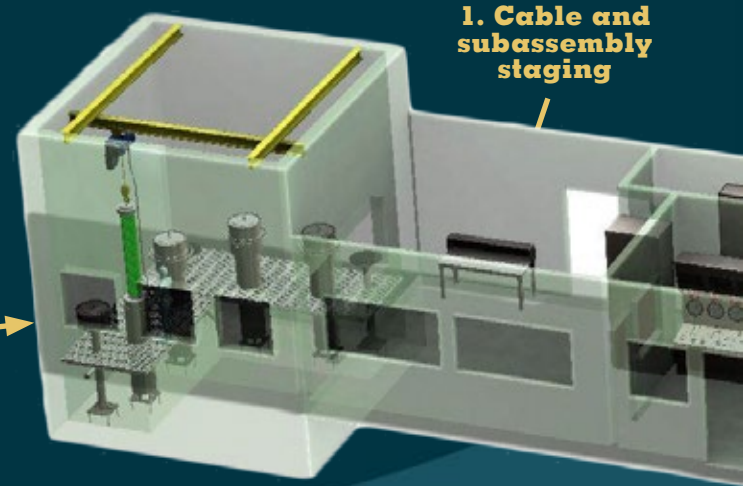
**DISCRETE CONNECTOR TESTING:** All Glenair subsea interconnects are subjected to 100% inspection and test



**LARGE PRESSURE VESSELS:** Built to accommodate complete cable assemblies, mated connectors, and customer-supplied sub-assemblies. Each unit contains a 12" diameter X 72" depth test chamber accommodating specimen weights up to 1500 lbs.



*Welcome to the lab, my friends! Lemme show you around.*



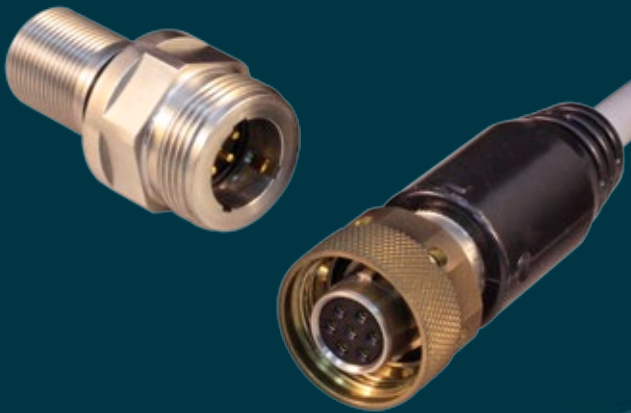
**1. Cable and subassembly staging**

**2. Large cable and subassembly pressure test bunker**



**TECHNICAL STAFF:** Knowledgeable and trained subsea specialists perform both in-house product qualification testing, as well as customer subassemblies.

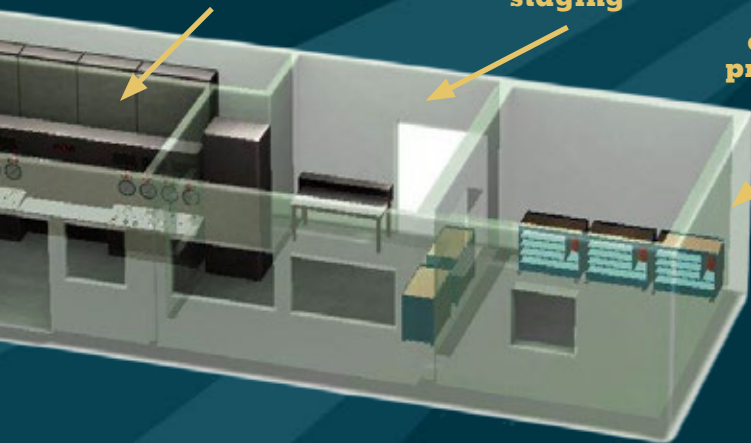
**CONTROL ROOM:** The modular consoles in the control room provide for up to 8 pressure circuits, operating in Manual mode or Automated. Each circuit is capable of a maximum of 16.5K psi. Monitors display: Automated Test Profiles, Data Acquisition, remote viewing of Test rooms and more. System is network connected for access to Profiles and distribution of test reports.



**3. Hydrostatic test lab control room**

**4. Production connector staging**

**5. Small connector pressure test bunker**



**SeaKing™ and SuperG55™ QUALIFICATION TESTING:** Both Glenair Series 70 SeaKing and SuperG55 rugged dry-mate subsea connectors have been tested and qualified to their 10K psi pressure rating—open-face and mated—in Glenair’s state-of-the-art hydrostatic test lab. Additional testing included mating cycles, salt spray, and electrical continuity



Glenair Hydrostatic Test Lab Technical Specifications and Pressure Test Standards	
Pressure test profiles	Automated or manual
Maximum test pressure	16.5K psi
Data acquisition types	Pressure, time, temperature, and electrical performance
Performance monitoring under pressure	I/R, continuity, insertion loss, and backreflection (optical)
Industry profiles	All major oil & gas standards
Custom profiles	Yes, including customer-supplied subassemblies
Capacity (large pressure vessels)	Working volume = 12" diameter x 72" depth; Test specimen weight up to 1500 lbs.





QwikConnect

# Marine/Subsea Interconnect Solutions from Glennair

- High-pressure subsea
- Ruggedized serial and high-speed electrical connectors
- Glass-sealed high-pressure bulkhead feed-thrus
- Fiber optic and opto-electronic solutions
- Hazardous zone ATEX explosion-proof
- Commercial Oil & Gas and defense industry solutions



DOWN HOLE



SUB SEA



TOP SIDE



EXPLOSION PROOF

High-performance, mission-critical interconnect technologies with proven shipboard and subsea performance



<Crew aboard the M/V Independence prepare to launch a Remotely Operated Vehicle (ROV).





SeaKing 10K PSI high-density subsea connectors and cables



SNEAK PEEK: SuperG55 dry-mate 10K PSI underwater electrical connectors



Series 80 AquaMouse subsea and hermetic connectors



SNEAK PEEK: Marine Molded dry mate submersion-zone connectors



Glass-sealed high-pressure to 30K PSI hermetic bulkhead connector feed-thrus and HTHP



Series 22 GeoMarine® 5K PSI transition-zone and subsea connectors and cables



ITS-Ex ATEEx-qualified and approved explosive zone connectors



MIL-DTL-28876 qualified Navy fiber optic connectors, termini, and backshells



Harsh environment opto-electronic (photonic) transceivers and media converters





## SeaKing

- High density, small form-factor connector
- Redundant dual O-ring seals ensure high-pressure performance
- Signal, power, RF Coax, and optical contact arrangements
- Five shell sizes with 4–109 contacts (#16, #20, and #22)
- Stainless steel construction with anti-galling marine bronze engaging nut
- Full-mate inspection ports
- Easy O-ring replacement
- Key and keyway polarization

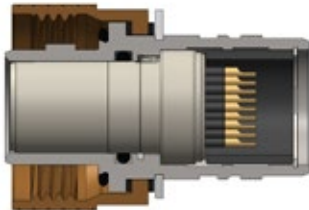
# SERIES 70 SeaKing™

10K PSI / 700 Bar / 7000m open-face or mated, dual O-ring equipped, high-density, high-voltage, fiber optic and hybrid electrical/optical subsea connectors

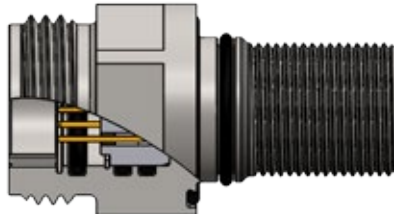
SeaKing is an innovative new connector series that eliminates a broad range of mechanical design weaknesses found in many of today's high-pressure subsea connector families. From its double O-ring seals and retractable engaging nut, to its multi-keyed mating interface, the SeaKing represents a bold new approach to subsea power and signal connectivity.

Ideally suited for offshore oil & gas, military/defense, oceanographic research, and other harsh-environment subsea applications, the dry-mate connector series is built for optimal durability and reliability. Tested to 15,000 PSI (open face and mated), and equipped with integrated dual O-ring seals, marine bronze coupling nuts, corrosion-resistant stainless steel shells and high-pressure contact inserts with gold-plated signal contacts, special RF and fiber optic solutions, the Series 70 SeaKing is today's most advanced high-density signal and standard-density power subsea connector available.

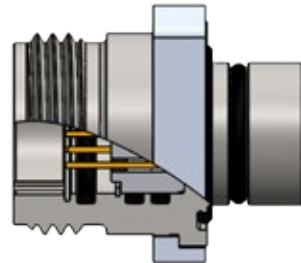
### STANDARD CONFIGURATIONS



Cable Connector Plug (CCP)



Bulkhead Connector Receptacle (BCR)



Flange Connector Receptacle (FCR)



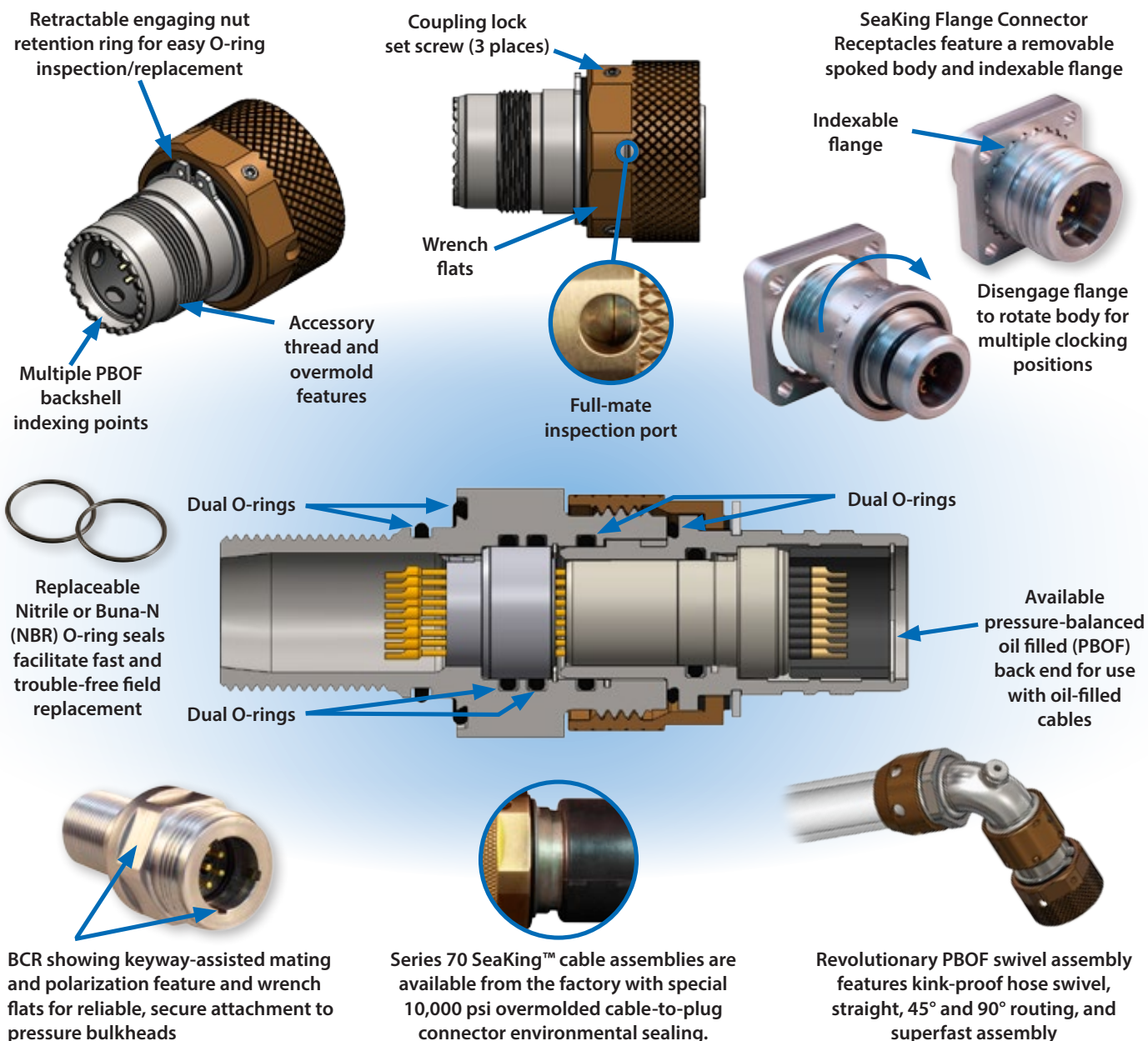
# SeaKing high-density subsea connectors and cable assemblies

## Key mechanical and environmental features

**Sealing:** The Series 70 SeaKing is the best sealed subsea connector on the market. All critical interfaces, including bulkhead seals, glass-to-metal insert seals, mating interface bore seals, and face seals are fully redundant ensuring 10K PSI protection, even in the event of a single-seal failure.

**Mating:** SeaKing utilizes a modified UNC (coarse) mating interface with added clearance to reduce bio-fouling and facilitate rapid-advance mating. The marine bronze coupler on the plug is equipped with thread flats as well as knurling and is less susceptible to galling than standard steel engaging nuts. Polarized keys and keyways prevent both thread damage and mismatching.

**Ease-of-Use:** Multiple PBOF backshell indexing points, indexable flange FCRs, full-mate inspection ports, retractable engaging nuts, and other features make SeaKing the most user-friendly subsea connector on the market.





SERIES 70 HIGH-PRESSURE 10K PSI / 700 BAR / 7000 M

# SeaKing high-density subsea connectors and cable assemblies



Available connectors and cable assemblies

## SeaKing™ CONNECTOR SERIES OVERVIEW

700-001

SeaKing™ Cable Connector Plug (CCP),  
10,000 psi rated (mated condition), subsea environment,  
solder termination



700-006

SeaKing™ Flange Connector Receptacle (FCR),  
10,000 psi rated (open face and mated), subsea  
environment, solder termination, indexable flange

700-007

SeaKing™ Bulkhead Connector Receptacle (BCR),  
10,000 psi rated (open face and mated), subsea  
environment, solder termination



## TURNKEY OVERMOLDED AND REPAIRABLE CABLE ASSEMBLIES AND SPECIAL CONFIGURATIONS



Transparent overmold test sample demonstrates Glenair's harsh-environment, high-pressure cable overmolding and cable termination expertise (no voids, 360° material adhesion and cosmetic perfection)



10K psi overmolded CCP assembly



10K psi overmolded 75 Ohm Coax hybrid assembly



Repairable wire mesh grip-equipped topside CCP cable



Cabled bulkhead connector receptacle (BCR) assembly



FCR assembly with flange mounting points and indexed flange



Special Oil & Gas industry NE 606 overmolded cable





# SERIES 70 HIGH-PRESSURE 10K PSI / 700 BAR / 7000 M

## SeaKing high-density subsea connectors and cable assemblies

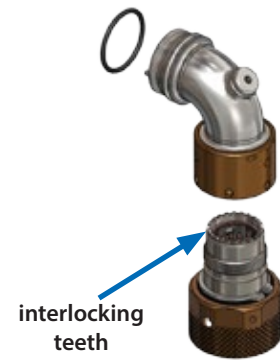
### PBOF cable attachment accessories



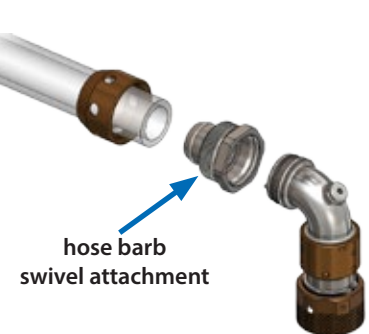
#### REVOLUTIONARY PBOF SWIVEL HOSE ATTACHMENT ACCESSORIES

Hose barb fittings for PBOF cable assemblies are the perennial weak link in subsea oil & gas applications. Kinked and twisted hoses, leaky fittings, corroded hose clamps, and general poor performance characterize most existing solutions. The Glenair PBOF swivel hose attachment for SeaKing connectors solves these problems and more. Designed from the sea floor up to perform flawlessly and reliably, this revolutionary attachment puts an end to the long list of field maintenance problems associated with oil-filled cable applications.

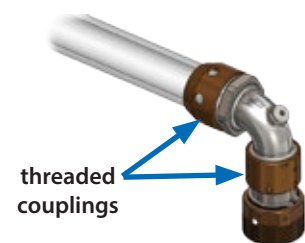
- Straight, 45°, and 90° “full radius” angle and profile hose routing
- Hose angle adjustment feature eliminates risk of oil leakage
- Corrosion-resistant materials used throughout
- Threaded couplers with safety set-screws for fail-safe leak and decoupling protection—no special tools required for assembly
- Compact PBOF compression fitting with 340° hose swivel action
- Support for the broad range of hose diameters and wall thicknesses



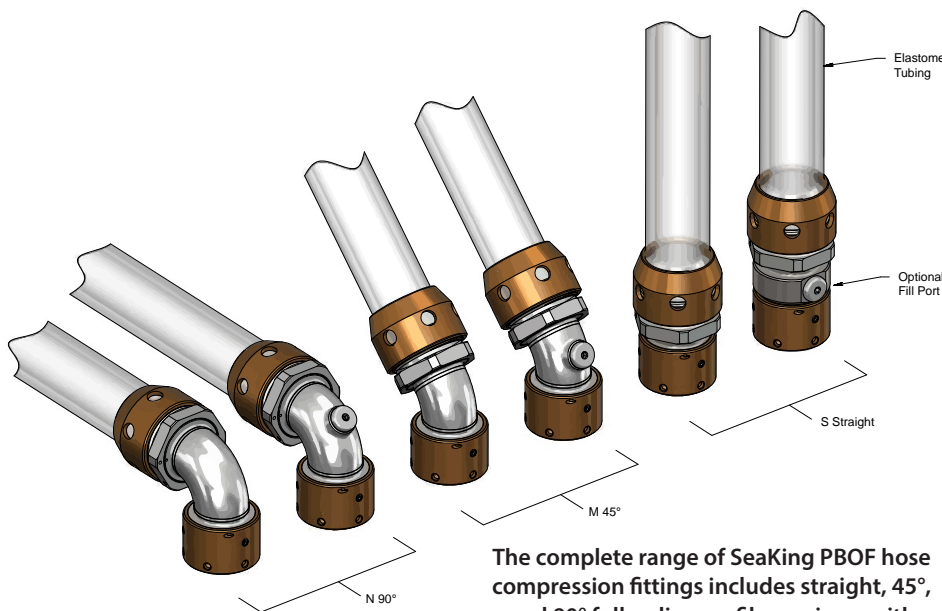
Interlocking teeth on SeaKing plug connectors interface with corresponding teeth on the PBOF swivel hose attachment to facilitate easy indexing and routing of hose assemblies



Revolutionary swivel hose barb compression attachment eliminates twisting and damage in PBOF assemblies



Threaded PBOF compression nut and connector coupling nut (with additional safety set screw) provide for fast and easy assembly and prevent leaks and assembly decoupling



The complete range of SeaKing PBOF hose compression fittings includes straight, 45°, and 90° full radius profile versions; with and without integrated oil fill ports

SeaKing Performance Specifications		
Pressure Rating	Plug: 10,000 psi, mated condition Receptacles: 10,000 psi mated and open face	per ISO 13628-6
Electrical	600 V typical 5 GOhm insulation resistance at 500 VDC	per MIL-STD-202, Method 301 per MIL-STD-202, Method 302
Materials	Salt Spray (corrosion) Humidity (steady state) Thermal Cycle	MIL-STD-202, Method 101 MIL-STD-202, Method 103 ISO 13628-6
Shock	30G Mechanical Shock	per ISO 13628-6
Vibration	5G Vibration	per ISO 13628-6





Photo: NOAA

# RUGGED UNDERWATER DRY MATE ELECTRICAL SuperG55

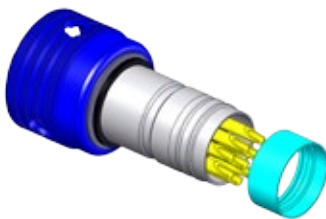
The SuperG55 family of dry-mate underwater connectors is a revolutionary new design of the popular industry-standard marine interconnect used in countless ROV, underwater camera, diver communications, lights, pan and tilts, and other subsea applications.

Available in 3 shell sizes, the SuperG55 is manufactured from 316L Stainless Steel with insert molded contact assemblies designed for pressure-sealed applications up to 10K psi mated and unmated. Intermateable and intermountable with other "55" series connectors, the Glenair solution introduces a long list of product innovations designed



To facilitate 360° indexing of the bulkhead keyway, SuperG55 FCR designs are now equipped with removable, spoked-body and indexable flange—a proven innovation borrowed from Glenair Series 70 SeaKing

To improve assembly speed and electrical performance, the SuperG55 CCP is equipped with extended-length solder cups and an auxiliary potting cap for post-soldering wire-to-contact sealing



to improve performance and durability. Our PBOF versions, for example, utilize easy-to-assemble threaded fittings which deliver both superior sealing performance while reducing installation time. Other innovations include full-mate inspection windows, improved solder cup contact design, improved potting and sealing, and more. Cable plugs and receptacles are available in attachable (user-terminatable) versions or factory overmolded single-ended whips.

Factory-terminated overmolded Cable Connector Plug (CCP)



Bulkhead Connector Receptacle (BCR)



Flange Connector Receptacle (FCR)

- 10,000 psi mated/unmated (approx. 22,500ft/7,000m)
- Recessed plug socket contacts for safety
- Intermateable and intermountable with other "55" series connectors
- 3 shell sizes — 15, 20 and 24, with 3 to 21 contacts
- PBOF versions available
- 600 VDC, 5 to 18 Amps (dependent on conductor and cable size and make-up)
- Retractable, anti-galling coupling nuts prevent mismatching and improve durability

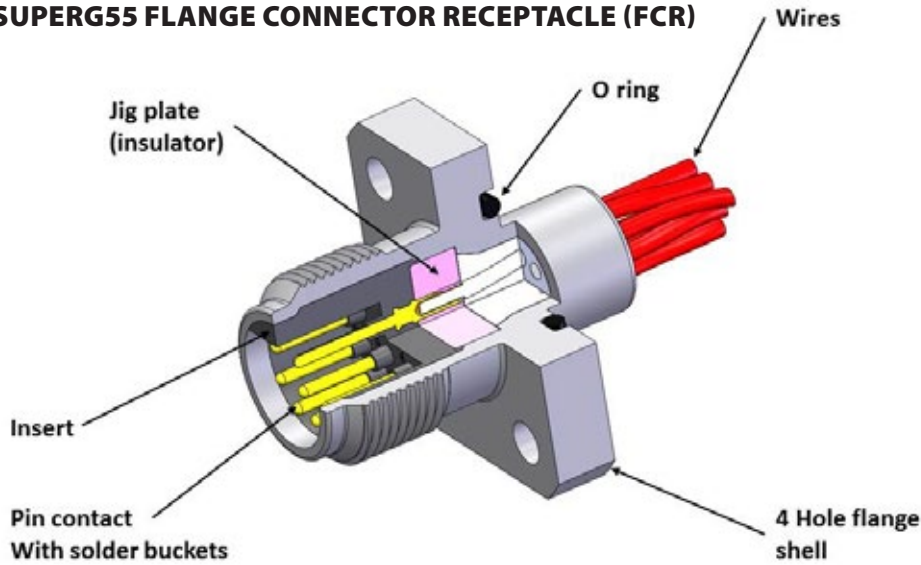


# RUGGED UNDERWATER DRY-MATE ELECTRICAL SuperG55



Tested and qualified for intermateability with popular “55” type interconnects

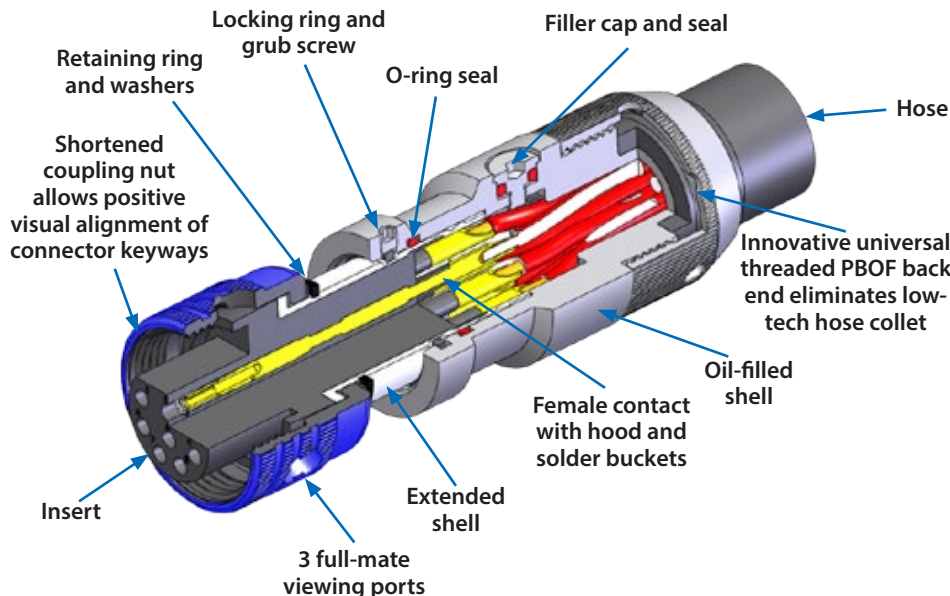
## SUPERG55 FLANGE CONNECTOR RECEPTACLE (FCR)



SuperG55 Performance Specifications	
Mating Cycles	500
Operating Temperature	-20°C to +90°C
Voltage Rating	600 VDC / 440 VAC
Current (max.)	5 to 18 Amps (dependant on contact and cable conductor sizes)

SuperG55 Material/Finish	
Shells	316L Stainless Steel/ Passivated
Insulator	PEEK
Insert	Neoprene
Contacts	Copper alloy, gold plated
O-rings	Nitrile
Overmold and Cable	Polyurethane or Neoprene

## UNIVERSAL CCP SUPERG55 FOR EITHER MOLDED OR PRESSURE-BALANCED OIL-FILLED CABLE CONFIGURATIONS



**NON-STANDARD MATERIALS:** Other material options are available as part of our non-catalog offerings including Anodized aluminium, Titanium, and Aluminium Bronze. Glenair is also able to supply SuperG55 interconnects in composite thermoplastic (PEEK) to meet application requirements for reduced cathodic corrosion as well as weight reduction without affecting connector performance.

**HIGH-SPEED ETHERNET:** The SuperG55 Ethernet option is available in the 1508, 2013 and 2021 contact configurations and provides both high speed (Up to 1GB) and power (600Volts) in a full subsea environment (10,000PSI). Gigabit speed data transfer up to a distance of 75mtrs.

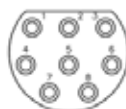
## AVAILABLE CONTACT ARRANGEMENTS



1503  
3 #12



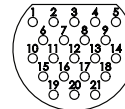
1508  
8 #16



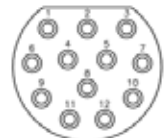
2008  
8 #12



2013  
13 #16



2021  
21 #16



2412  
12 #12



# Songs of the Sea

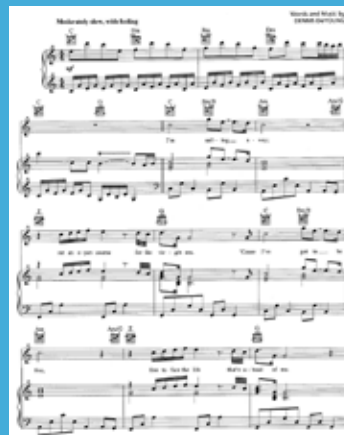
Fill in the randomly numbered blanks to solve this sea song puzzle

1.    th       C
2.                 's   a
3.    k                 r
4.    W
- d                         d
5. (                 '         )
- o                         y
6. W                         s/
- gg
7.                 o   t
8.                         b
- a                         m
9. O                         n
10.   l                         b
11.                 t         a
12. A
13.                 k
- r
14.                 y   e
- s
15.   a                 ,   a
16.         e   i   w
17.   o   o
18.   e
19.   h   r                         i
20.   m         S

Solution posted November 15<sup>th</sup>  
[www.glenair.com/qwikconnect](http://www.glenair.com/qwikconnect)



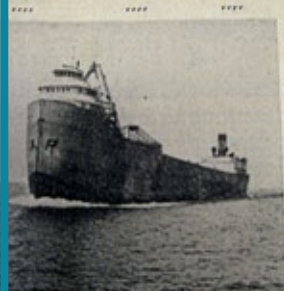
Bridge:  
 E C#m7 A  
 It's far,  
 B7 E C#m7  
 beyond a star,  
 A  
 It's near,  
 B7 E C#m7 Gdim  
 D7  
 beyond the moon;  
 G Em Am7  
 I know  
 D7 G Em  
 beyond a doubt  
 Am7 D7  
 My heart  
 G Gdim Edim G7  
 will lead me there soon.







# LAKE SHIP DISASTER



## Fear 33 Died As Freighter Split, Sank

### 18 Bodies Found as Search Of Lake Michigan Goes On

FOR SURVIVORS OF CARGO SHIP (RIGHT)

Still Hunting Six

CHARLEVOIX, Mich., Nov. 13 (AP)—Two men found alive today in empty waters of Lake Michigan which it was feared had claimed lives of 33 after the freighter Carl D. Bradley sank here last week in the cold, storm-tossed lake late yesterday.

Official fatalities numbers reported are even two had survived overnight in 16-degree below-zero winds that paid no attention to the Great Lakes. The air temperature was 20 below zero.

Some survivors reported an even two had survived overnight in 16-degree below-zero winds that paid no attention to the Great Lakes. The air temperature was 20 below zero.

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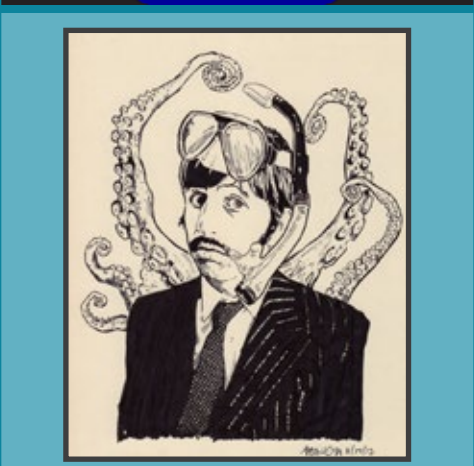






Photo: Subsea production systems  
by jasonwoodhead23

SERIES 802

# AquaMouse

## Ultraminiature high-pressure

Originally developed for petroleum pipeline inspection equipment, Series 802 connectors are available in ten sizes from 1 to 130 contacts and equipped with Viton® O-rings to withstand exposure to corrosive chemicals and high temperature environments. These connectors feature high density crimp Mighty Mouse inserts, 316 stainless steel or marine bronze shells and a piston O-ring for hydrostatic sealing. Series 802 insulated wire, panel mount receptacles can be ordered as square flange, in-line or jam-nut versions. Choose integral shield termination platform or accessory thread for use with a variety of strain relief options. Crimp style gold-plated crimp contacts accept #12–30 wire. Connectors are backfilled with epoxy potting compound. Hermetic glass-sealed connectors come with solder cup contacts (non-removable) or PC tails. 100% tested to meet  $1 \times 10^{-7}$  cc/sec helium leakage. Open face pressure rating 3500 PSI.

- 3500 psi pressure rated
- High-temperature and corrosive chemical-resistant Viton® or Nitrile O-rings
- Ultraminiature #23 contacts
- Size #20, #20HD, #16, #12, #8 signal, power, fiber optic and shielded contacts
- Discrete connectors and turnkey cable assemblies

Tooled Contact Arrangements →  
Contact Legend

#23° #20HD° #20● #16◐ #12⊕

### AQUAMOUSE CONNECTOR CONFIGURATIONS AND CLASSES



Series 802 Plugs



Series 802 BCR



Series 802 FCR

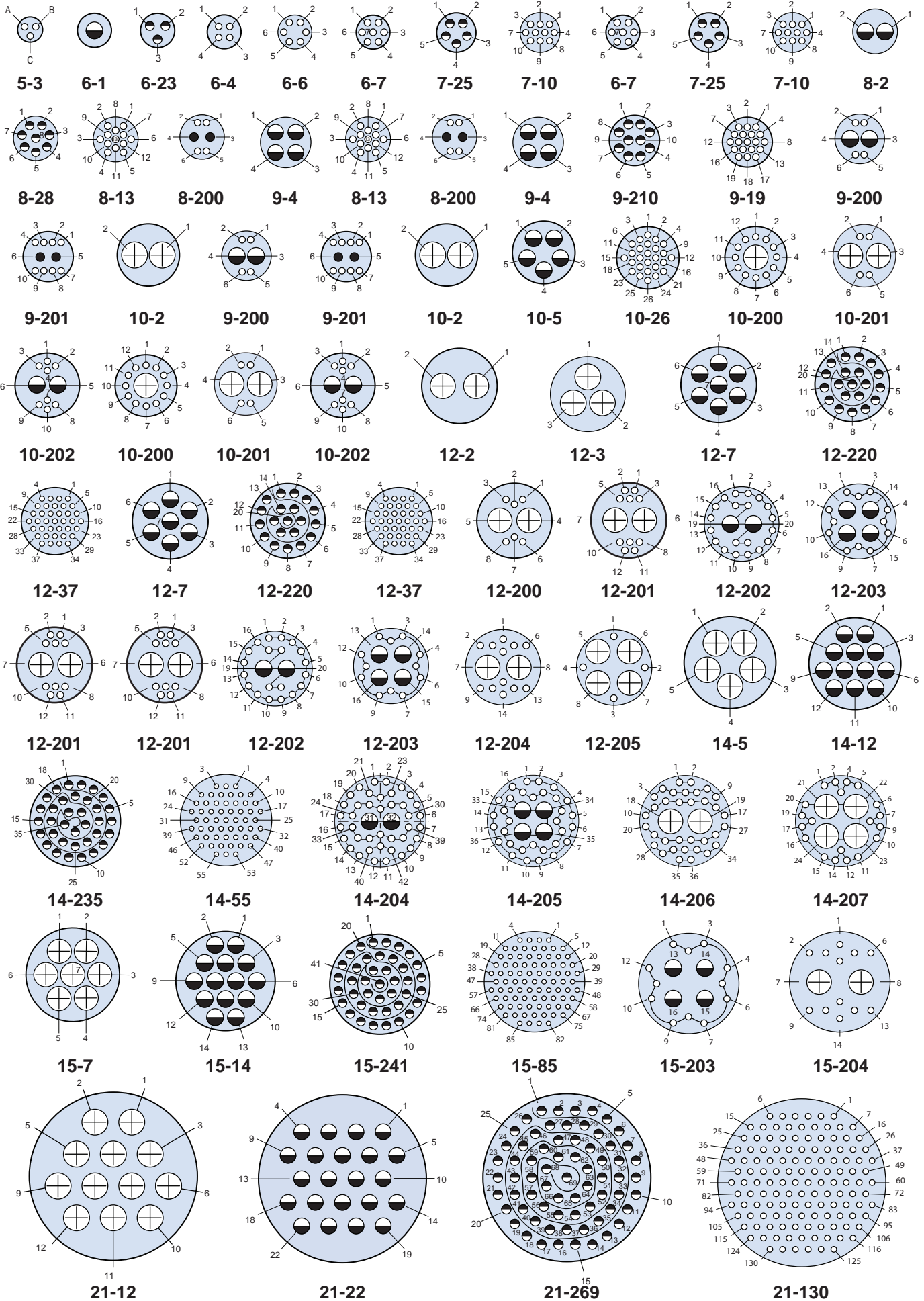


Series 802  
Hermetic BCR



Series 802 Hermetic  
Bulkhead Feed-Thru







**IN  
DEVELOPMENT**

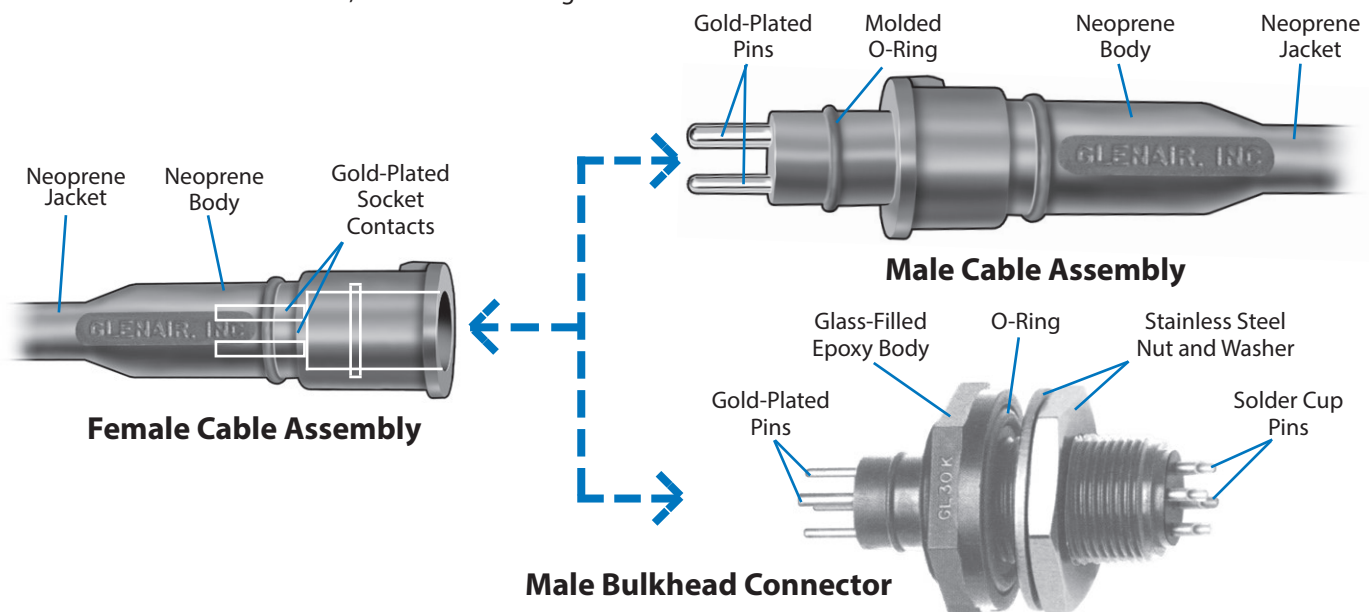


## SERIES GLA 20

# Marine Molded Underwater Interconnect Assemblies

**G**lenair Marine Molded series connectors are used in remotely operated vehicles, underwater lighting systems, underwater video monitoring systems and other subsea applications. Available in both rubber molded cable and inline versions, as well as glass-filled epoxy bulkhead versions, the Marine Molded series is a reliable and cost-effective interconnect technology for high-pressure subsea applications up to 10K psi mated condition. Available in a wide range of high-pressure insert molded contact arrangements, with size #16 to size #0 contacts, and from two to eight circuits.

- 10,000 psi (mated) pressure rating
- 7.5 Amps to 200 Amps
- Two to eight contacts
- Catalog and custom cable options
- Chemically resistant





SERIES GLA20

# Marine Molded Underwater Interconnect Assemblies

Specifications, contact arrangements and accessories



Male Bulkhead Connector

Specifications	
Contacts	Copper Alloy, Gold-Plated
O-Rings	Nitrile
Nut, Washer	Stainless Steel
Cable	Neoprene insulation, Stranded Copper Conductor
Bulkhead Connector Body	Glass-Filled Epoxy
Voltage Rating	600 VDC
Current Rating	See Contact Arrangements
Temperature Rating	-55°C to +105°C

Contact Arrangements and Current Rating		
<p><b>2 contacts</b></p> <p>1 #10 Contact 1 #12 Contact 10 Amps <b>G2</b></p>	<p><b>3 contacts</b></p> <p>1 #10 Contact 2 #12 Contact 10 Amps <b>G3</b></p>	<p><b>4 contacts</b></p> <p>1 #12 Contact 3 #16 Contacts 7.5 Amps <b>G4</b></p>
<p><b>5 contacts</b></p> <p>1 #10 Contact 4 #16 Contacts 7.5 Amps <b>K5</b></p>	<p><b>6 contacts</b></p> <p>1 #10 Contact 5 #16 Contacts 7.5 Amps <b>K5</b></p>	<p><b>8 contacts</b></p> <p>1 #10 Contact 7 #16 Contacts 6 Amps <b>K8</b></p>

## ACCESSORIES

### Locking Sleeves

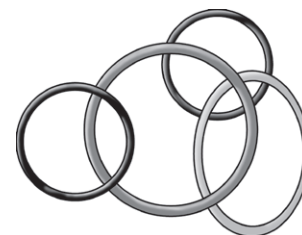
Locking Sleeves enable a mated pair of cable assemblies to be locked together, preventing accidental unmating. Material: Delrin.



Cable Part No.	Type	Sleeve Part No.
GL20G*P	Male	GL20G401
GL20K*P	Male	GL20K403
GL20G*S	Female	GL20G402
GL20K*S	Female	GL20K404

### O-Rings

Replacement O-Rings for bulkhead connectors. Material: Nitrile



Cable Part No.	O-Ring
GL30G	2-213
GL30K	2-217





**VITREOUS GLASS TECHNOLOGY ADVANTAGES**

- Superior pressure resistance to 32,000+ PSI
- Hundreds of designs, including long-length bulkhead feed-thrus and penetrators
- Higher resistance to extreme operating temperatures to 260°+ C
- Superior mechanical strength
- No material breakdown or aging over time
- Helium leak rate <math> < 1 \times 10^{-7}</math> cc/sec to <math> 1 \times 10^{-10}</math>

*HIGH-RELIABILITY*  
**Glass-sealed Hermetic Connectors**



Resolve gas, moisture and particle ingress problems with advanced-performance glass-sealed hermetic connectors

**CIRCULAR GLASS-SEALED HERMETIC CONNECTORS AVAILABLE WITH ACCELERATED LEAD TIMES**



MIL-DTL-26482



MIL-DTL-83723



MIL-DTL-38999 (QPL)



MIL-DTL-5015



Series 80 Mighty Mouse



# MIL-DTL-38999 AND OTHER Glass-Sealed Hermetic Connectors



## GEOPHYSICAL AND OFFSHORE CONFIGURATIONS



GeoMarine® double-start hermetic connector



Hermetic power connector



Single-way tool joint hermetic connector



Hermetic probe connector



Hermetic bulkhead penetrator

## HIGH-SPEED/SHIELDED DESIGNS



Triax hermetic



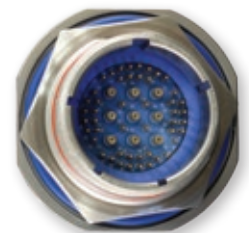
Hybrid coax/signal hermetic



Quadrax hermetic



MT ribbon fiber optic hermetic



Hybrid coax/signal hermetic

## RECTANGULAR PACKAGES



MIL-DTL-24308 QPL hermetic



Series 79 Micro-Crimp hermetic



MIL-DTL-83513 type micro-D hermetics



Sealed panel-mount micro-D hermetic



ALSO AVAILABLE:

Well-Master™ 260° high-temperature Micro-D

## MIL-DTL-38999 QPL PIN AND SOCKET HERMETICS



Series I Scoop-proof 3 Point Bayonet Coupling



Series II Low-profile 3 Point Bayonet Coupling



Series III Scoop-proof Triple Start, Self-Locking



Series IV Scoop-proof Breech Lock





## SERIES 22

# Geo-Marine®

**High-pressure harsh-environment connectors and overmolded cables for towed array and other high-pressure/submersible applications**

**D**esigned for use in oceanographic, geophysical and other severe industrial environments, Glenair Series 22 Geo-Marine® Connectors and Cables are the ultimate harsh-environment power and signal connector solution. Built to withstand hydrostatic pressures up to 5,000 PSI and exposure to extreme temperatures and corrosives, the Series 22 Geo-Marine® is ideally suited for applications such as US Navy towed array sonar systems, military land vehicles, submersibles and ROV's, offshore-oil drilling equipment, seabed exploration, pipeline inspection systems, well monitoring equipment, and digital seismic streamers.



Geo-Marine® plugs are equipped with arctic coupling nuts—made from marine-grade naval bronze—with easy-to-grip castellated knurling and a powerful ratcheted anti-decoupling mechanism which guarantees reliable mating and demating performance in even the harshest environments. Supplied as discrete connectors—or more typically in build-to-print overmolded cable assemblies.



## Geo-Marine®

- 5000 psi pressure rated
- Marine Grade 316 stainless steel machined shells and Naval Bronze coupling rings
- High-pressure environmental and hermetically sealed receptacles for field applications
- Power and signal contact arrangements from 2 to 128 contacts
- Anti-vibration ratcheted coupling nuts with castellated knurling
- Available Viton® overmolded cable assemblies



SERIES 22

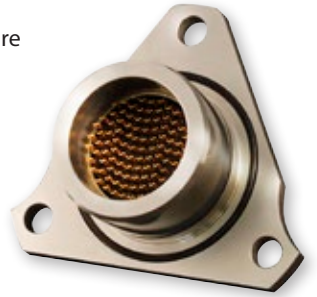
# Geo-Marine® Connectors

High-pressure environmental and hermetic connectors



## Range of Offerings

Series 22 Geo-Marine® connectors are supplied with either fused-glass ("H" hermetic class) or high grade thermoplastic ("E" environmental class) insulators. Both classes of connectors are supplied with rugged, corrosion-resistant materials. Low-profile and scoop-proof cable plugs and receptacles, as well as bulkhead feed-thrus are available. Specially-designed cable sealing backshells as well as EMI/RFI shield termination backshells and environmentally-sealed protective covers complete the range of discrete product offerings. 35 insert arrangements (contact sizes #12, #16, #20 and #22) are tooled and fully available.



## WIDE RANGE OF PLUG CONFIGURATIONS WITH ANTI-GALLING ARCTIC COUPLING NUTS



Cable plug with accessory threads



Cable plug with overmold adapter



Panel-mounted plug



Factory overmolded plug

## HIGH-PRESSURE ENVIRONMENTAL AND HERMETIC RECEPTACLE CONFIGURATIONS



Jam Nut



In-Line



Square Flange



Solder-Mount



Bulkhead Feed-Through

## RUGGEDIZED STAINLESS STEEL BACKSHELLS AND OTHER CONNECTOR ACCESSORIES



Environmental strain relief backshell



Overmolding adapter



Right-angle strain relief backshell



Environmentally sealed protective covers





## SERIES ITS-Ex

# Industrial-strength power and signal connector series qualified for use in hazardous zone interconnect applications

**D**esigned for safe operation in petrochemical refineries, oil & gas drilling platforms, and other explosion zone applications, the Glenair ITS-Ex series connector is optimized for life-of-system durability and reliability. Qualified by the globally-recognized IEC and IECEx standards bodies, the connector series is suitable for use in application areas where flammable gases and vapors are present as a normal condition of operation (group IIC) and with temperature classes T6 and T5, zones 1 and 2; and for applications where potentially flammable dust is present as a normal condition of operation (group IIIC) and with temperature classes T80°C and T95°C in zone 21 and 22.

Series ITS-Ex is designed for easy and repeatable termination of armored and unarmored cables built to IEEE 45, IEC, BS, DIN, and JIC standards. A full range of power and signal contacts, from size #16 to size #0 in over 40 insert arrangements are available to address all common voltage, wire size and connector service class ratings.

Special Ex design attributes of the series include an integral labyrinth flame path cooling zone, 2-part epoxy potting well, fixed in-line receptacles for attachment of cables to cable management brackets and trays, set screw (grub screw) secured protective safety covers, and durable life-of-system Ex marking labels.



- Utilizes all standard features of 5015 inserts, contacts, tools, etc.
- Grub nuts (set screw) to lock coupling nut
- Long plug barrels provide cooling zone
- Labyrinth gas exit port/pathway augments cooling
- Accessory accommodation for potted glands
- Increased wall thickness
- Stainless steel and Marine Bronze available



# SERIES ITS-EX IECEx/ATEX Qualified Explosive Zone Connectors

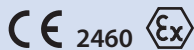


## RANGE OF APPLICATIONS

- Automotive refuelling or petrol stations
- Oil & gas extraction
- Oil refineries
- Gas pipelines and distribution
- Chemical processing plants
- Aircraft refuelling and hangars
- Transportation
- Pharmaceuticals
- Food processing
- Metal surface grinding
- Sugar refineries
- Grain handling and storage
- Coal mining



### ATEX Marking



II 2 G Ex db IIC T6, T5 Gb  
II 2 D Ex tb IIIC T80°C, T95°C Db IP68  
-40°C ≤ Tamb ≤ +40°C (T6, T80°C) or +55°C (T5, T95°C)

### IECEx Marking

Ex db IIC T6, T5 Gb  
Ex tb IIIC T80°C, T95°C Db IP68  
-40°C ≤ Tamb ≤ +40°C (T6, T80°C) or +55°C (T5, T95°C)

Glenair ITS-Ex series encompasses both in-line cable plugs and receptacles as well as fixed bulkhead-mountable designs





# QPL AND COMMERCIAL MIL-PRF-28876 Fiber optic connection system

Qualified MIL-PRF-28876 fiber optic connectors and MIL-PRF-29504 termini—Navy approved, in stock, and ready for immediate shipment

- Connectors qualified to the complete requirements of MIL-PRF-28876 including plugs, wall-mount receptacles, jam-nut mount receptacles and in-line receptacles
- Multiple shell sizes and insert arrangements, including 2, 4, 6, 8, 18 and 31 channel layouts
- Backshells in straight, 45° and 90° configurations
- Corrosion-resistant and environmentally sealed
- Qualified MIL-PRF-29504/14 and /15 pin and socket termini and /3 dummy terminus
- Connectors, backshells and protective covers available for immediate, same-day shipment



M28876/11 jam nut receptacle



M28876/7 plug with backshell



M28876/2 receptacle with backshell



## Fiber optic connection system

Connector/Backshell Types			
Connector Type	Backshell Type	MIL-Spec	Commercial Connector Type Code
Wall Mount Receptacle	None	M28876/1	03
	Straight	M28876/2	13
	45°	M28876/3	23
	90°	M28876/4	33
In-Line Receptacle	Straight	M28876/5	15
Plug	None	M28876/6	06
	Straight	M28876/7	16
	45°	M28876/8	26
	90°	M28876/9	36
Jam Nut Receptacle	None	M28876/11	04
	Straight	M28876/12	14
	45°	M28876/13	24
	90°	M28876/14	34



Qualified QPL-29504 pin and socket terminus

Test Description	Performance Requirements/Specifications
Optical Insertion Loss, Multimode	-0.3 dB Typical (62.5/125)
Optical Insertion Loss, Singlemode	-0.3 dB Typical (9/125)
Optical Back Reflection, Singlemode	Better than -40 dB - PC Polish • Better than -50 dB - Enhanced PC Polish
Operating Temperature	-28°C to +65°C (MIL-Spec Epoxy and Cable) -55°C to +125°C (alternative Epoxy and Cable)
Temperature (Thermal) Shock	-40°C to +70°C, 5 Cycles
Temperature Cycling	-28°C to +65°C, 5 Cycles
Temperature/Humidity Cycling	-10°C to +65°C, 10 Cycles, 240 hours, 98% RH
Temperature Life Aging	+110°C, 240 hours, Dry Air
Mating Durability	500 cycles
Vibration - Sinusoidal	10 g Peak, 5-500 Hz sin./ 10.2 g RMS, 50-2000 Hz random
Impact	8 Drops from 8 feet
Crush Resistance	281 lbs, 7 Cycles
Cable Pull Out Force - Termini	Termini: 22 lbs min for 1 minute Connector: 162 lbs min for 10 minutes
Fluid Immersion	Turbine Fuel, Isopropyl Alcohol, Hydraulic Fluid, Lubricating Oil, Coolant, Tap- and seawater, 24 hrs
Water Pressure	32 feet for 48 hours at +10°C to +35°C
Mechanical Shock (High Impact)	MIL-S-901, Grade A, Type B, Class I
Corrosion Resistance (Salt Spray)	500 hours
Sand and Dust	12 hours
Flammability	0.75 inch flame for 10 sec. mated, 1.50 inch flame for 60 sec. unmated

\*Performance Specifications/Requirements based on the use of MIL-PRF-24792 Epoxy and MIL-PRF-85045 Simplex and Breakout Shipboard Optical Fiber.

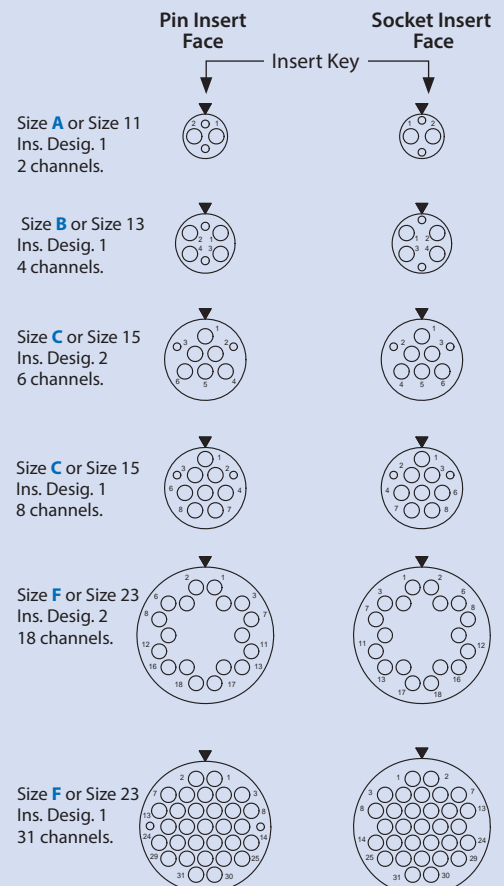
Qualified Fiber Optic Termini			
Type	Military Part Number	A Dia (Microns)	Typical Fiber Type
Pin Termini	M29504/14-4131C	126.0	Multi Mode
	M29504/14-4132C	127.0	Multi Mode
	M29504/14-4135C	142.0	Multi Mode
Socket Termini	M29504/15-4171C	126.0	Multi Mode
	M29504/15-4172C	127.0	Multi Mode
	M29504/15-4175C	142.0	Multi Mode
Dummy Terminus	M29504/3-4038		

Crimp sleeve is supplied with terminus assembly and may be ordered separately (see Table II). For terminus less crimp sleeve, omit C from end of part number. Consult factory for additional sizes.

Terminated and tested MIL-PRF-28876 fiber optic cable assembly



### Insert Arrangements







HARSH-ENVIRONMENT

# Fiber Optic Interconnect Solutions

Unlock the huge bandwidth of fiber optic connectors, cables, and ruggedized transceiver technologies

Glenair harsh-environment fiber optic connectors and board-level transceiver technologies are designed for harsh land, air, sea, and space environments and will operate reliably over very wide temperature ranges and high shock and vibration conditions. These proven technologies have been optimized to minimize size, weight and power and offer electrical-to-fiber conversion for Ethernet, video, signal aggregation and high-speed digital signals. Glenair also offers integration of electronics or opto-electronics into rugged connector packages and cable assemblies per specific customer requirements. We offer rapid response in-house electrical/PCB design, and mechanical connector/backshell engineering from our vertically integrated factory.



In-line fiber optic to copper media converter

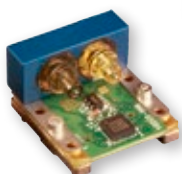


Photonic contacts and connectors



## GLENAIR FIBER OPTICS

- Reduced size, weight, and power consumption
- Total EMI immunity, network security, increased transmission distance and ultra-high bandwidth
- High shock and vibration to support mission critical applications
- Wide operating temperature range: -40°C to +85°C and beyond
- Qualified, proven opto-electronic and fiber optic interconnect technologies for both commercial oil & gas and naval/defense applications.



Small form-factor transceiver



Signal aggregation media converter



7-port Ethernet switch



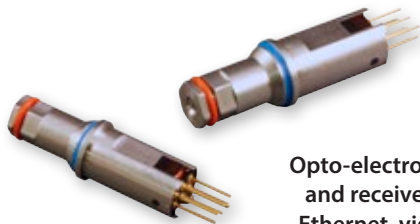
DVI video media converter



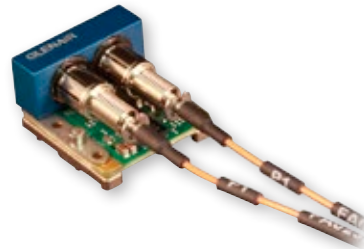
**FIBER OPTICS AND OPTO-ELECTRONICS**  
**Harsh-Environment, Small Form-Factor**  
**Optical Interconnect Solutions**  
**for Ethernet, video, and high-speed data**



**HARSH ENVIRONMENT FIBER OPTIC CONNECTORS AND OPTO-ELECTRONIC TRANSCEIVERS**



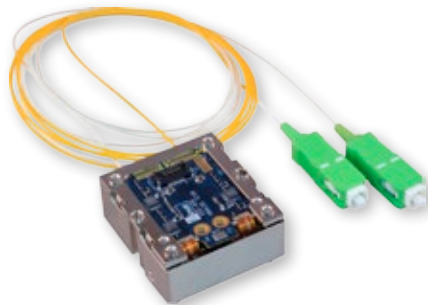
Opto-electronic transmitter and receiver contacts for Ethernet, video, and high-speed data



High vibration and shock board-mount transmitters and receivers with Samtec surface-mount connectors



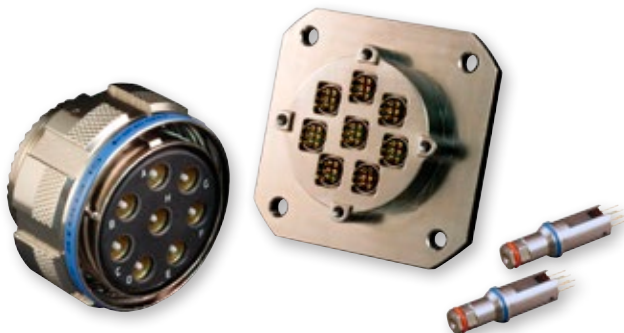
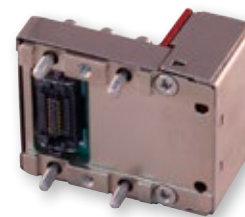
EMI shielded PCB transceiver showing Samtec surface-mount connector and Glenair GC F/O interconnects



RF-over-fiber board-mount transceiver



High vibration and shock Bi-directional transceiver



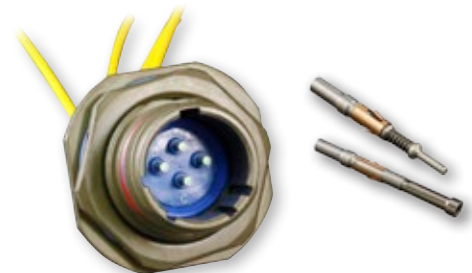
Harsh-environment opto-electronic connectors for Ethernet, video, and high-speed data



MIL-PRF-28876 US Navy qualified fiber optic connectors and termini



Eye-Beam® GMA Expanded-Beam IAW M83526



Eye-Beam® GLT Expanded Beam Fiber Optic



## Good Ideas



The founder of the Dayton Engineering Laboratories Company, the outfit that was to become Delco, was a man by the name of Charles Kettering. That's his picture there on the cover of Time magazine. Kettering was an American inventor, engineer, businessman, and the holder of 186 patents. In addition to his work at Delco, he was head of research at General Motors from 1920 to 1947. Kettering was renowned for the practicality of his inventions. As he said, "I didn't hang around much with...the executive fellows. I lived with the sales gang. They had some real notion of what people wanted."

Early automobiles required a hand crank for starting. Occasionally, when the spark lever was not properly set, the hand crank kicked back, causing serious injury: a broken wrist, arm, or shoulder. On a winter night in 1908, the result was much worse. Byron Carter, founder of Cartercar, came across a stalled motorist on Belle Isle in the middle of the Detroit River. He gallantly offered to crank the car for the stranded driver. When she forgot to retard the spark, the crank kicked and broke Carter's jaw. Complications developed, and Carter later died of pneumonia. When Cadillac chief, Henry M. Leland, heard the news, he was distraught. Byron Carter was a friend and the car that kicked back was a Cadillac. "The Cadillac car will kill no more men if we can help it," he told his staff.

He called Charles Kettering. The engineers at Delco worked around the clock to solve the problem. Leland approved their revolutionary electric starter and generator for his 1912 model and placed an order for 12,000 units. The same basic technology is still used today in modern automobiles.

Good ideas can come from any number of places. The end-user of a technology is invaluable when it comes to what does or doesn't work. Sales and marketing types in the field are classic sources for this "voice of the customer" feedback. Knowledgeable engineers are equally valuable sources of good ideas—especially when it comes to clever ways to solve a problem. Often, a good idea can come from someone outside a system or industry, as folks "inside a bubble" can tend to be influenced by ingrained taboos and traditions.

I have noticed here at Glenair that many of our best ideas originate with team members who are just plain not afraid to suggest a new way to tackle an old problem—regardless of what role they play in the organization. I absolutely cherish this behavior (what some folks call "acting like an owner"). Linus Pauling said "the best way to have a good idea is to have lots of ideas." That sounds about right to me.

*Chris Toomey*

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