ODI
Subsea Optical Interconnect

Hybrid and optical solutions for wet mate applications

ROLLING SEAL
HYBRID WET MATE
CONNECTOR

NAUTILUS™
ROLLING SEAL
HYBRID WET MATE
CONNECTOR

OPTICAL
PENETRATOR

TELEDYNE
MARINE
Everywhereyoulook™

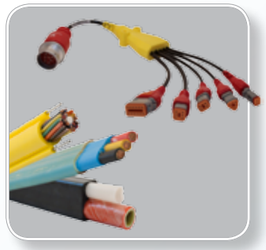
TELEDYNE OIL & GAS
Everywhere**you**look™

Complementary Teledyne Oil & Gas Product Lines

TELEDYNE AG GEOPHYSICAL PRODUCTS

Interconnect, transducers, firing cables, and hydrophones for extreme environments

TELEDYNE CABLE SOLUTIONS



Application-specific cable assemblies and harnesses for harsh environments

TELEDYNE CORMON

Erosion/corrosion monitoring, pressure and temperature sensing solutions

TELEDYNE DGO

High Pressure/High Temperature Electrical and Optical Interconnect Glass-to-Metal Seal Technology

TELEDYNE IMPULSE

Harsh environment electrical and optical interconnect

TELEDYNE ODI

Subsea interconnect and data networking

For the latest version of the catalog, visit www.teledyneoilandgas.com

Table of Contents:

Teledyne Oil & Gas:

RELIABLE POWER TRANSMISSION, DATA TRANSMISSION, NEW PRODUCT DEVELOPMENT AND SENSING SOLUTIONS FOR HARSH ENVIRONMENTS

Teledyne Oil & Gas is a market-focused group of Teledyne Marine companies focused on the performance requirements, industry specifications, performance life and high reliability expectations of on and offshore exploration, drilling and production. Our individual technologies can be combined to resolve a broader number of application challenges our customers face.

These industry-leading product lines designed specifically to meet the demanding requirements found in the oil and gas industry provide:

- Electrical and optical distribution systems
- Power and data transmission networking interconnection systems
- Wellhead feed-through systems
- Corrosion and erosion sensing and monitoring networks
- Turn-key sensor interconnect assembly solutions
- Subsea engineering
- Application-focused new product development with systems and material reliability expertise
- Ruggedized harsh environment cable assemblies
- High pressure, high temperature (HP/HT) penetrations and feed-throughs for differential pressure
- High power connection systems

Together the oil & gas market-focused elements of Teledyne Marine offer a *sea of solutions* with the continuity benefits of working with one supplier.

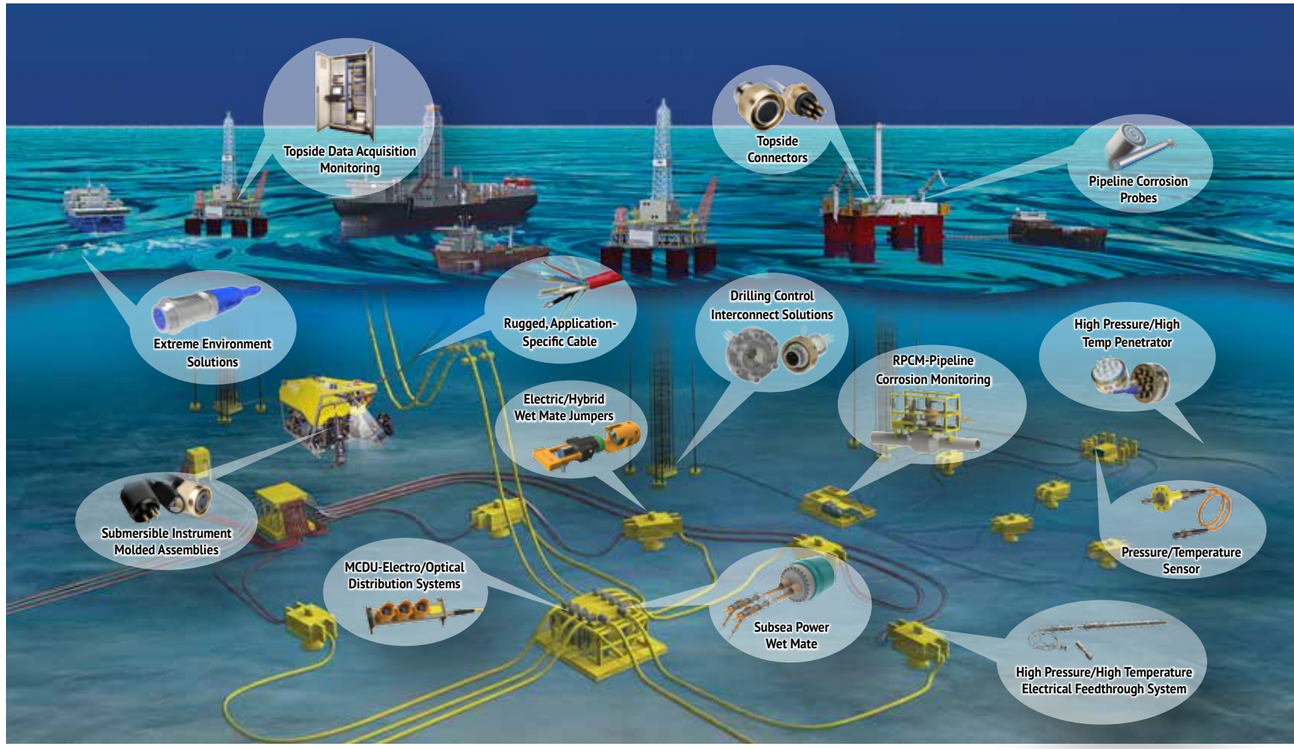
BENEFITS & VALUE

- Health, Safety & Environmental (HSE) culture
- Innovative engineered solutions
- Aerospace levels of reliability
- Materials science & certification expertise
- Instrumentation integration
- Global manufacturing centers
- Rapid response global field support
- Integrated team support: A single purchase order, set of terms & focused contact
- Security of supply

Teledyne ODI:

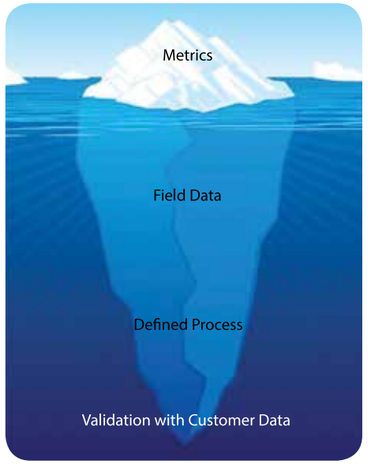
SUPPLYING MISSION CRITICAL SYSTEMS TO THE OIL & GAS PRODUCTION INDUSTRY

Teledyne ODI was formed in 1988 and created the original designs that enabled deep water wet mate interconnection of subsea modules. Today, with over 162,000 electrical and fiber optic interconnect packages deployed worldwide, ODI is a leader in innovation and subsea reliability around the globe with a dedicated team of engineers driving innovation to meet emerging technical challenges.



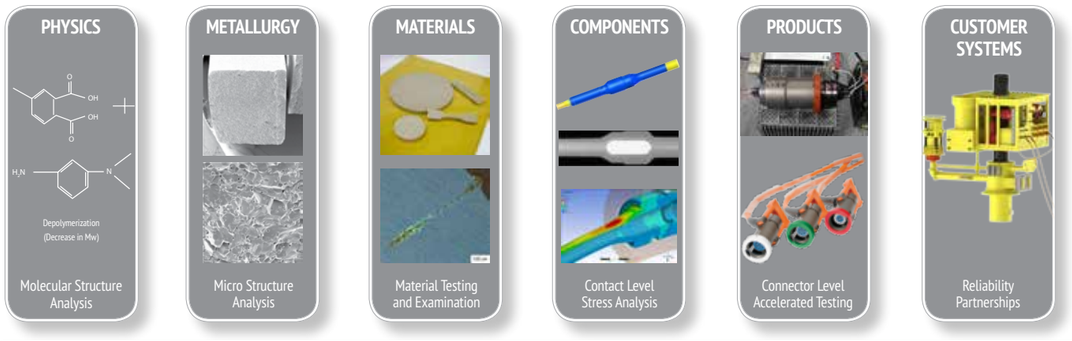
TOG Reliability:

RELIABILITY PROGRAM

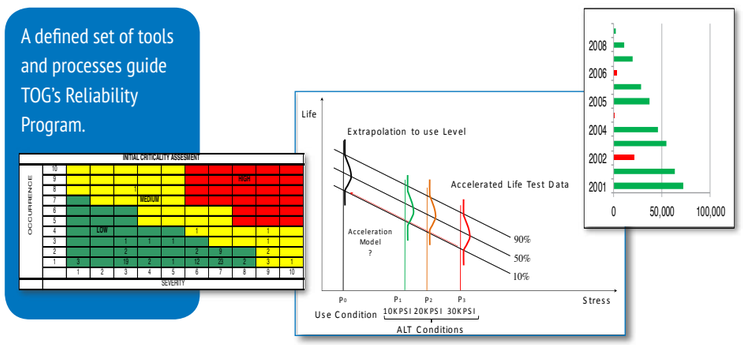


Teledyne Oil and Gas products operate in environments that are difficult or imposible to access. We understand that our customers want peace of mind knowing that the equipment they deploy in these harsh environments will not fail. Beginning with initial product development, through the first deployment, and continuing for the life of the product, reliability is a primary focus at Teledyne Oil and Gas.

Having internal metrics is just the tip of the iceberg. Dedicated Reliability Engineers at Teledyne Oil and Gas gather and analyze field data from customer deployments, and continuously validate the results. This process is what sets Teledyne Oil and Gas apart from the rest.



A defined set of tools and processes guide TOG's Reliability Program.



- Finite Element Analysis
- Operational Study
- FRACAS – Root Cause Analysis
- Design Validation Testing
- Qualification Testing
- Accelerated Aging
- Reliability Assurance Plan
- FMECA (D, P & O)
- Block Diagram Analysis
- Design of Experiments
- Fault Tree Analysis
- Weibull Analysis

TOG Quality:

TELEDYNE OIL & GAS IS COMMITTED TO SAFELY PROVIDING PRODUCTS AND SERVICES OF THE HIGHEST INTEGRITY AND RELIABILITY.

QUALITY ASSURANCE

Teledyne ODI has been certified by INTERTEK to the ISO 9001:2008 standard for the design, manufacture, test, and service of subsea or hostile environment electrical and optical interconnection systems.

QUALITY SYSTEM

TOG's Quality System includes the appraisal and assessment of component and part quality using sophisticated measurement systems. The product is manufactured, tested and inspected under the control of a high-level factory management system with full material and operational traceability.

FACTORY ACCEPTANCE TESTING

Final product acceptance testing includes functioning within a hyperbaric environment using computerized data acquisition of pressure profiles and circuit performance measurements. The data is maintained both electronically and on hard copy for availability upon customers' requests.

Optical and Hybrid Interconnect:

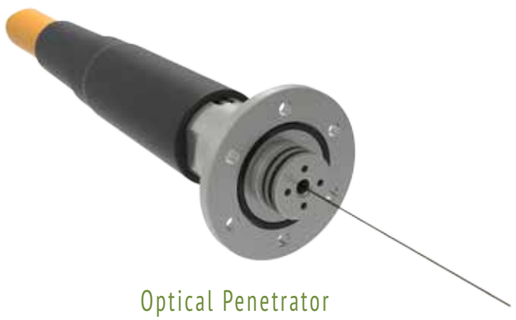
Teledyne ODI designs complex engineered solutions for subsea interconnect applications, meeting challenges brought on by high pressures and temperature extremes in turbid and saltwater environments. Teledyne ODI offers a comprehensive line of fiber optic and electro-optical hybrid wet mate interconnect products.

For “Mission Critical” Subsea Applications

- Subsea Control Modules
- Data Transmission Systems
- Umbilical Terminations
- Junction Boxes

Rolling Seal Hybrid (RSH)
Wet Mate Connector

Nautilus Rolling Seal Hybrid (NRH)
Wet Mate Connector



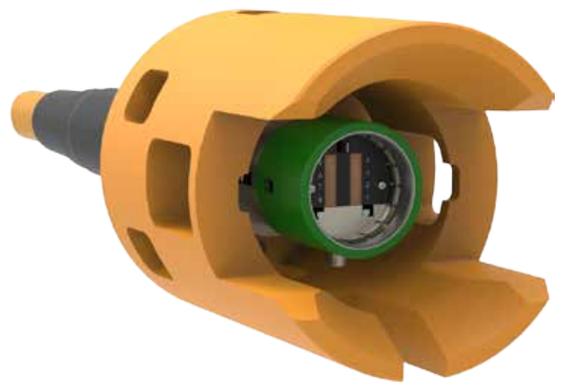
Optical Penetrator

This catalog will provide ordering information on recommended configurations for each product, however, variations are available upon request. Contact us to learn more.

Rolling Seal Hybrid Wet Mate:

Teledyne ODI’s Rolling Seal Hybrid (RSH) is the industry-standard, multi-channel, underwater optical connector for subsea field operations requiring high-speed data transmission via optical fiber.

The fully-qualified connector features 8 optical or electrical circuits in almost any combination, rated to 10,000 psi (pressure balanced).



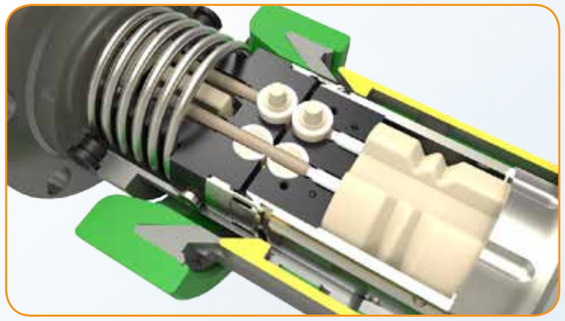
The Rolling Seal Hybrid can be configured as an Angled Physical Contact (APC) connector for lower return loss performance.

Rolling Seal Hybrid (RSH) Technology Overview

Introduced in 1995, over 6,400 Rolling Seal connectors are in service across the globe. Configurations include ROV mate, stab mate, and manual mate options.

Mating Operation

The patented Rolling Seal design functions by excluding water and shuttling silt away from the region where the optical ferrules are brought into contact; creating a clean, oil-filled conduit for the optical ferrules to connect. The result is a reliable low-loss optical throughput.



Mk III Enhancements

Introduced in 2013, the evolutionary RSH Mk III focuses on enhancing operational efficiencies and reducing risks during ROV intervention where and when circumstances provide for less than optimal mating/demating conditions. Teledyne developed these enhancements with customer feedback in mind. Critical Mk III design enhancements are field retro-fittable and backwards compatible with Mk II connectors.

Five Performance Enhancements

1. Guide funnel and latch indication ensures mating efficiency and eliminates potential for shell damage while offering positive latch indication.
2. Bulkhead center actuator material change offers increased margin against deformation, for overall field reliability.
3. Bulkhead main spring force increase assures manifold return even when mated at excessive angles.
4. Bulkhead bushing now reinforced and more robust for ROV handling.
5. Longer, contoured Cable End lead-in bushing enhances fine alignment of connector halves during the mating sequence.

Rolling Seal Hybrid Connector Specifications

GENERAL SPECIFICATIONS*

Operational Temperature:	**SEAWATER:** 23˚F to +104˚F (-5˚C to +40˚C) **AIR:** -4˚F to +122˚F (-18˚C to +50˚C)
Storage Temperature:	-22˚F to +140˚F (-30˚C to +60˚C)
Max Operational Pressure:	10,000 psi ambient 5,000 psi differential (bulkhead)
Mate/De-mate Cycles:	100 without refurbishment
Mating Force:	<120 lbs
De-mating Force:	<100 lbs
Configurations:	ROV, Stab & Manual-Mate
Material:	Titanium
Design Life:	30 Years

OPTICAL & ELECTRICAL SPECIFICATIONS

Number of Circuits:	8 max, optical or electrical
Insertion Loss:	≤ 0.5 dB @ 1310/1550/1625 nm
Return Loss:	≥ 30 dB @ 1310/1550/1625 nm
Max Operational Current:	7 Amps per circuit
Max Operational Voltage:	700 VAC/1 kVDC
Insulation Resistance:	>10 GΩ @ 1 kVDC
Contact Resistance:	< 30 mΩ per Contact

*For reference only, see FDS - IFS D/N 182480 for Official Values

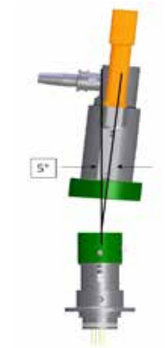
Wet mate hybrid connectors require no periodic maintenance and are maintenance-free for their intended life. If their mating cycle lifetime (100 mates) is exceeded, the connectors should be returned to Teledyne Oil & Gas for refurbishment. If damage occurs to the connector, then the entire connector must be returned to Teledyne Oil & Gas for repair or replacement.

Gross Alignment Funnel and Enhanced Latching Indicator (GAF-ELI) Technology Overview

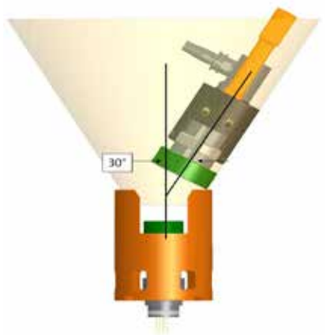
ROV intervention time due to operator variability and environmental conditions such as current and visibility can significantly increase costs. Teledyne ODI offers two wet mate connector enhancements designed to optimize ROV mating efficiency and reduce operator time, thus lowering total installed cost. The GAF and ELI are standard on the Rolling Seal Hybrid (RSH), the APC Rolling Seal, and the Nautilus™ Rolling Seal connectors.

Gross Alignment Funnel (GAF)

The Teledyne ODI Gross Alignment Funnel (GAF) is used in conjunction with the Enhanced Latching Indicator (ELI) System to overcome severe approach angles of ROV connectors during mating. Easily installed onto a Rolling Seal bulkhead mounted connector, the GAF significantly reduces ROV operator variability, ultimately resulting in faster mating/demating, and lower overall operator cost.



Without GAF: low misalignment tolerance at severe mating angle



With GAF: Higher tolerance for misalignment, reducing mating operation time

OPERATIONAL SPECIFICATIONS: GAF

Maximum side load tolerance as installed:	1,000 lbs
Maximum approach angle:	30°
Material:	Acetal

SPECIFICATIONS: ELI

Operational temperature:	23° F to 104° seawater (-5° C to +40° C) -22°F to +122°F air (-30°C to +50°C)
Storage temperature:	-4°F to +140°F (-20°C to +60°C)
Mating/demating force due to latching indicator:	< 10 lbs
Material:	Acetal and Titanium

Enhanced Latching Indicator (ELI)

In many cases, mating is further complicated when the bulkhead mounted connector end is shrouded by a protective bucket or mounting plate. The Enhanced Latching Indicator presents visual mating indication closer to the handle area of the ROV Nautilus™ or Rolling Seal connector. When unmated, four high-visibility yellow indicators rest inside the handle and when a successful mate occurs, the indicators extend out. The Enhanced Latching Indicator is easily retrofitted onto Rolling Seal Flying Lead Connectors already in the field. When used with the GAF, the ELI provides additional fine alignment registration.

Rolling Seal Hybrid Connector Attributes

STANDARD ATTRIBUTES

1. CONNECTOR TYPE

RSH - Designates the Rolling Seal Hybrid connector

2. OPTICAL CIRCUITS

Indicates the number of optical circuits xO where x is the number of desired optical circuits (Up to 8)

3. ELECTRICAL CIRCUITS

Indicates the number of electrical circuits xE where x is the number of desired electrical circuits (Up to 8 at 7A per circuit).

Note: if 1 or 2 electrical circuits are needed, it is recommended to use the Nautilus™ Rolling Seal Hybrid Connector (NRH), beginning on page 34.

4. MATE CONFIGURATION

Indicates the mating method used

ROV = ROV mate
MAN = Manual mate
STB = Stab plate

5. MOUNTING

Indicates type of mounting configuration

CE = Cable End (Flying)
BH = Front Mount Bulkhead (Fixed)

6. TERMINATION ARRANGEMENT

Indicates the exit angle of the PBOF hose

NA = None
00 = Straight
45 = 45°
60 = 60°
90 = 90°

Note: Straight or 45° are preferred configurations.

7. OPTICAL INTERFACE

UPC = Ultra Physical Contact Rolling Seal Hybrid Connector – a low amperage electro-optical hybrid connector

APC = Angled Physical Contact Rolling Seal Optical Connector – an optical connector that features a lower return loss due to an 8° angle polish on the fiber end face

Note: APC connectors are typically offered as ROV mate configurations.

OPTIONAL ATTRIBUTES

8. HANDLE

Indicates the handle type of the flying ROV mate connectors

STD= Standard
SVD=Standard V-Notch

NOTE: Standard UPC connector mating interface includes a single key. Optional APC connector mating interface includes dual keys. These unique features prevent cross-mate between configurations.

EXAMPLE:

Ordering description example for an ROV cable end connector with 4 electrical circuits, 4 optical circuits, and a 45° termination with standard handle:

1	2	3	4	5	6	7	8
RSH	4O	4E	ROV	CE	45	UPC	STD

Maximum of 8 circuits configured with electrical/optical or all optical circuits.

Connector Attributes - Detail

1. CONNECTOR TYPE

Rolling Seal Hybrid (RSH)
This is meant to differentiate the connector type from the Nautilus™ Rolling Seal (NRH) connector, which begins on page 33

2. OPTICAL CIRCUITS

Can be configured with electrical/optical or all optical up to a total of 8 circuits.

3. ELECTRICAL CIRCUITS

The Rolling Seal connector can accommodate electrical circuits up to 7A per circuit for hybrid applications where low voltage circuits are needed with optics.

Exception: The APC Rolling Seal connector cannot have any electrical circuits.

For configurations with 1 or 2 electrical circuits the Nautilus™ Rolling Seal Hybrid (NRH) connector is recommended.

4. MATE CONFIGURATIONS

ROV: Mating operation performed via Remotely Operated Vehicle

Manual Mate: mating operation performed via diver

Stab plate: mating operation performed when equipment is coupled. Alignment of connections is built into equipment and connectors are held in place with gravity with no mechanical locking mechanism.

5. MOUNTING

Bulkhead (fixed)
Plug

Cable End (Flying) Receptacle

Connector Attributes - Detail

RSH

6. TERMINATION ARRANGEMENT

CABLE END

45° Recommended Termination*

*60° and 90° cable end terminations available upon request

BULKHEAD

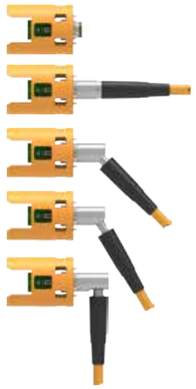
No Termination

0°

45°

60°

90°



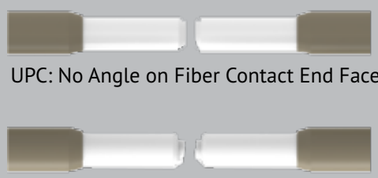
7. FIBER END FACE

Ultra Physical Contact (UPC)

Return loss of >30 dB @1310/1550/1625 nm

Angled Physical Contact (APC)

Return loss of >45 dB @ 1310/1550/1625 nm



UPC: No Angle on Fiber Contact End Face

APC: 8° Angle on Fiber Contact End Face

8. HANDLE

Indicates the handle type of the flying ROV mate connectors

Standard

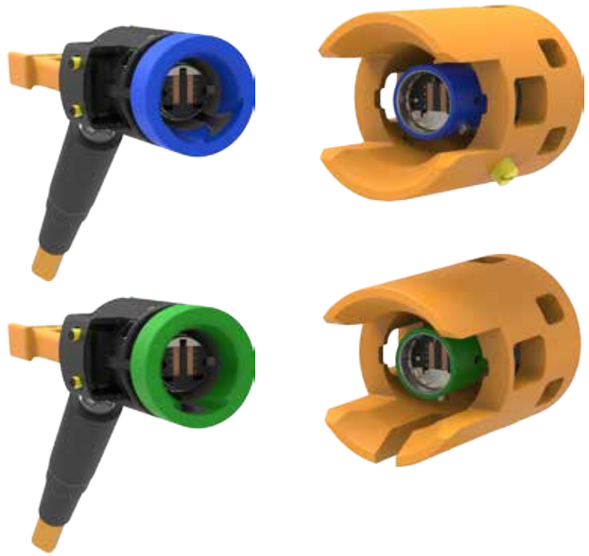
Standard V-Notch

Rolling Seal ROV Connectors

RSH

Rolling Seal ROV connectors are designed to be mated at full ocean depth with the use of Remotely Operated Vehicles. The shells of the ROV connectors are constructed from Titanium to allow the connectors to withstand the rugged handling of mating operations.

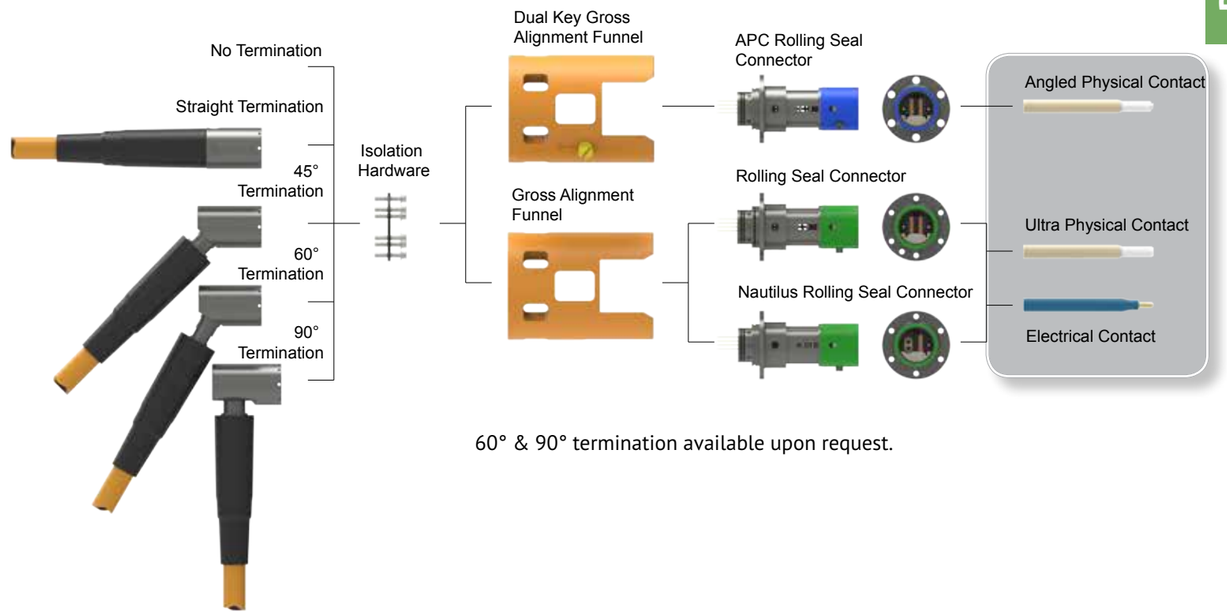
Mating and de-mating of connectors is performed only when the power is disconnected and all residual charge is drained. A variety of protective caps and parking positions are available for use when the connectors are in the unused state subsea.



Rolling Seal ROV Connectors
Common ROV Modular Diagram

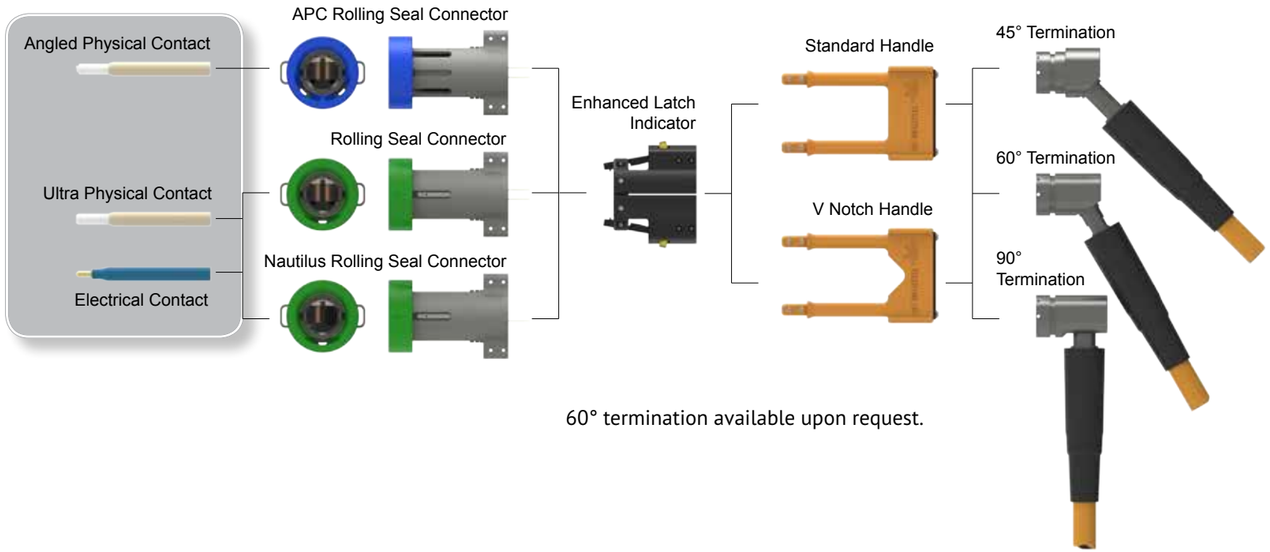
RSH

BULKHEAD



60° & 90° termination available upon request.

CABLE END

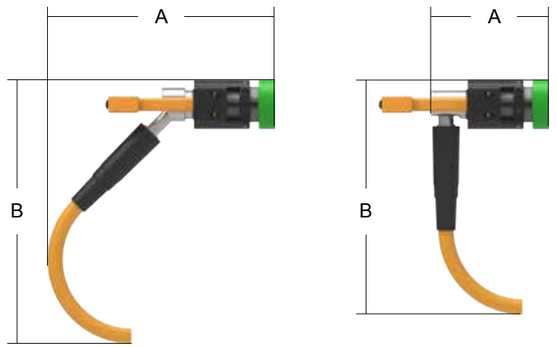


60° termination available upon request.

Rolling Seal Hybrid
ROV Cable End Receptacle

Ultra Physical Contact Configuration

45° 90°



ROV Cable End Optical Connector with UPC Configuration			
Termination	A Dim in [mm]	B Dim in [mm]	Ordering Description
45°	16.61[421.8]	19.28[489.6]	RSH-xO-xE-ROV-CE-45-UPC-STD
90°	8.62[218.9]	17.11[434.6]	RSH-xO-xE-ROV-CE-90-UPC-STD

60° Terminations available upon request.

EXAMPLE:

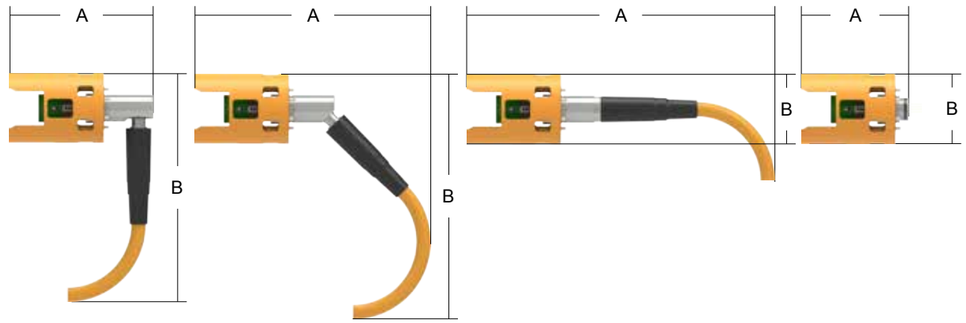
Ordering description example for an ROV cable end connector with 4 optical circuits, 4 electrical circuits, and a 45° termination with standard handle:

Type	Opt	Elec	Config	Mount	Term	Interface	Handle
RSH	4O	4E	ROV	CE	45	UPC	STD

Rolling Seal Hybrid
ROV Bulkhead Plug

Ultra Physical Contact Configuration

90° 45° Straight None



ROV Bulkhead Optical Connector with UPC Configuration			
Termination	A Dim in [mm]	B Dim in [mm]	Ordering Description
90°	11.01[279.5]	18.05[458.5]	RSH-xO-xE-ROV-BH-90-UPC
45°	18.61[472.8]	19.32 [490.7]	RSH-xO-xE-ROV-BH-45-UPC
Straight	24.05[610.9]	5.48[139.2]	RSH-xO-xE-ROV-BH-00-UPC
None	8.2[208.4]	5.48[139.2]	RSH-xO-xE-ROV-BH-NA-UPC

60° Terminations available upon request.

EXAMPLE:

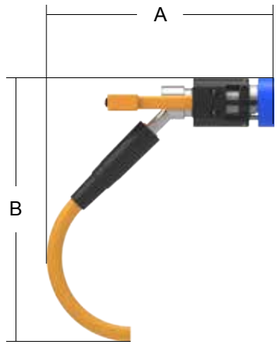
Ordering description example for an ROV bulkhead plug with 4 optical circuits, 4 electrical circuits, and a straight termination:

Type	Opt	Elec	Config	Mount	Term	Interface
RSH	4O	4E	ROV	BH	00	UPC

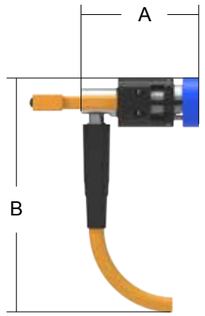
APC Rolling Seal Hybrid ROV Cable End Receptacle

Angled Physical Contact Configuration

45°



90°



ROV Cable End Optical Connector with APC Configuration			
Termination	A Dim in [mm]	B Dim in [mm]	Ordering Description
45°	16.61[421.8]	19.28[489.6]	RSH-xO-0E-ROV-CE-45-APC-STD
90°	8.62[218.9]	17.11[434.6]	RSH-xO-0E-ROV-CE-90-APC-STD

60° Terminations available upon request.

EXAMPLE:

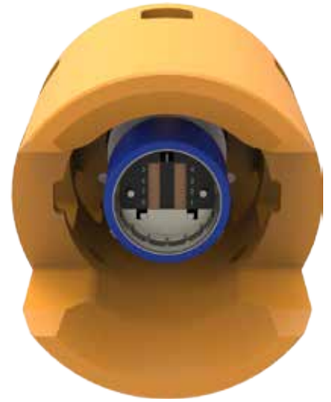
Ordering description example for an ROV cable end connector with 8 optical circuits, a 45° termination, and an APC configuration with standard handle:

Type	Opt	Elec	Config	Mount	Term	Interface	Handle
RSH	8O	0E	ROV	CE	45	APC	STD

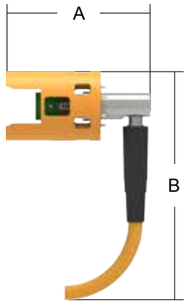
note: *not typically offered with electrical circuits

APC Rolling Seal Hybrid ROV Bulkhead Plug

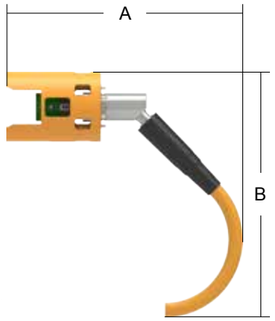
Angled Physical Contact Configuration



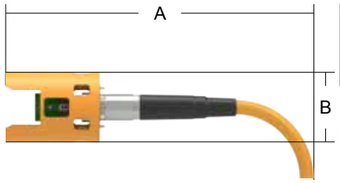
90°



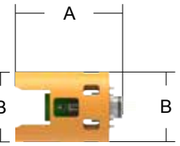
45°



Straight



None



ROV Bulkhead Optical Connector with UPC Configuration			
Termination	A Dim in [mm]	B Dim in [mm]	Ordering Description
90°	11.01[279.5]	18.05[458.5]	RSH-xO-0E-ROV-BH-90-APC
45°	18.61[472.8]	19.32 [490.7]	RSH-xO-OE-ROV-BH-45-APC
Straight	24.05[610.9]	5.48[139.2]	RSH-xO-0E-ROV-BH-00-APC
None	8.2[208.4]	5.48[139.2]	RSH-xO-0E-ROV-BH-NA-APC

60° Terminations available upon request.

EXAMPLE:

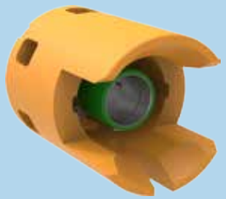
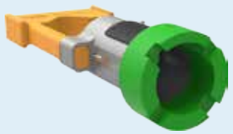
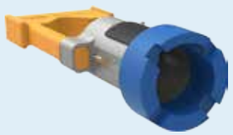
Ordering description example for an ROV bulkhead plug with 8 optical circuits, a straight termination, and an APC configuration:

Type	Opt	Elec	Config	Mount	Term	Interface
RSH	8O	0E	ROV	BH	00	APC

note: *not typically offered with electrical circuits

Dummy Protection Caps for ROV Rolling Seal Connectors

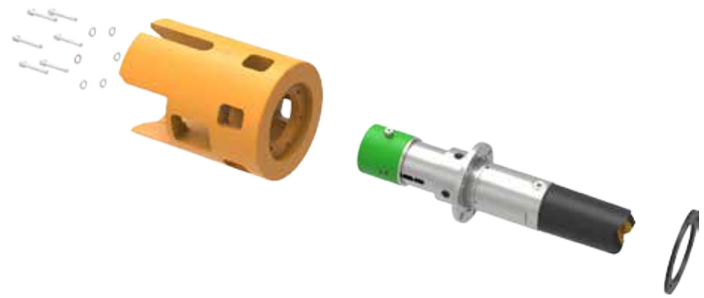
To ensure proper mechanical actuation after any length of time stored subsea, it is required that bulkhead connectors be stored mated with a dummy flying lead acting as the subsea protective cap. Retrievable protective caps are also recommended for flying lead connectors that will be idle subsea.

	ACCESSORY	ORDERING DESCRIPTION	MATING CONNECTOR
	Rolling Seal ROV Front Mount Bulkhead Fixed Plug Parking Position (No Inserts) with No Termination	RSH-PA-ROV-BH-00-UPC	Rolling Seal ROV Cable End
	Rolling Seal ROV Retrievable Dummy Protection Receptacle (No Inserts) with No Termination	RSH-DC-ROV-CE-00-UPC-STD	Rolling Seal ROV Bulkhead
	APC Rolling Seal ROV Front Mount Bulkhead Fixed Plug Parking Position (No Inserts) with No Termination	RSH-PA-ROV-BH-00-APC	APC Rolling Seal ROV Cable End
	APC Rolling Seal ROV Retrievable Dummy Protection Receptacle (No Inserts) with No Termination	RSH-DC-ROV-CE-00-APC-STD	APC Rolling Seal ROV Bulkhead

Bulkhead/GAF Mounting Options including Isolation Hardware

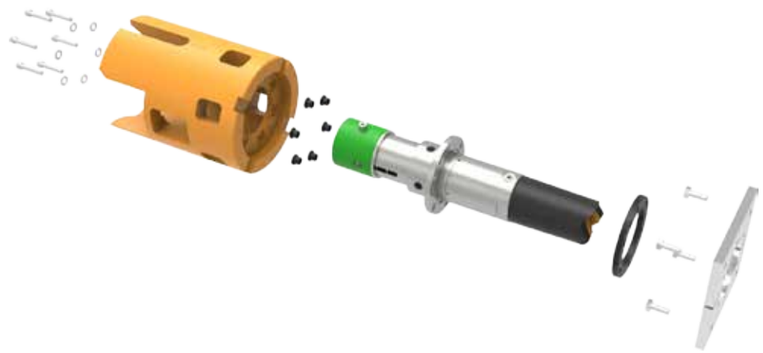
STANDARD ISOLATION HARDWARE

The ROV Bulkhead Connectors are typically installed directly to an end user vessel such as a Subsea Control Module, and are frequently outfitted with pigtails for splicing by the end user. The isolation hardware is provided to prevent galvanic corrosion resulting in accelerated metal degradation due to dissimilar metals.



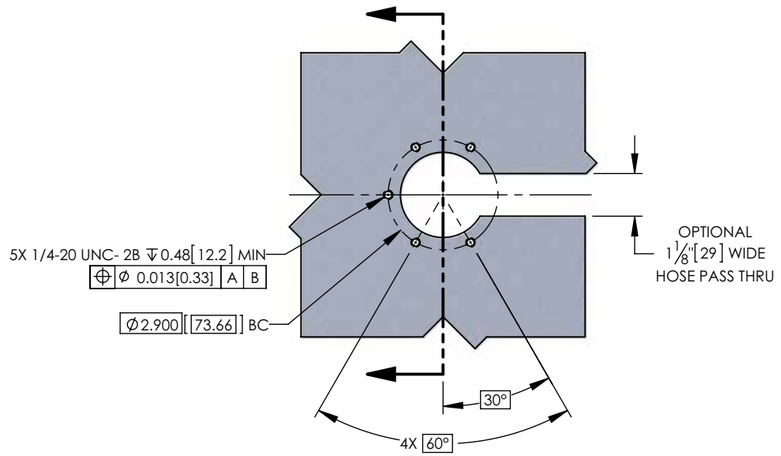
SPLIT PLATE ISOLATION HARDWARE

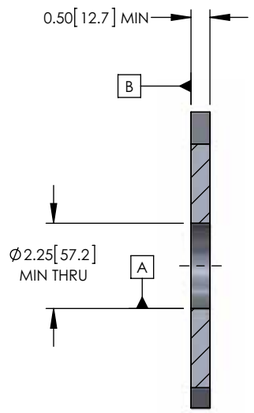
The split plate isolation hardware is provided for connectors with a termination and pressure balanced oil filled hose. The connector can then be passed through the rear of the bulkhead via a larger opening rather than having a hose pass through the channel.



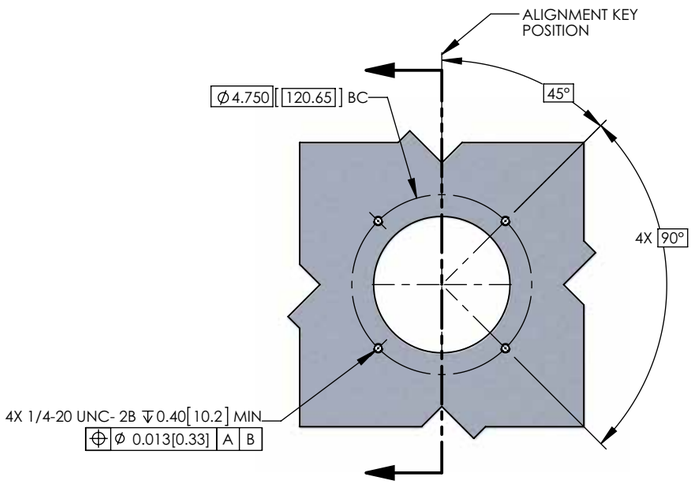
Rolling Seal Hybrid ROV Mate Outline Interface

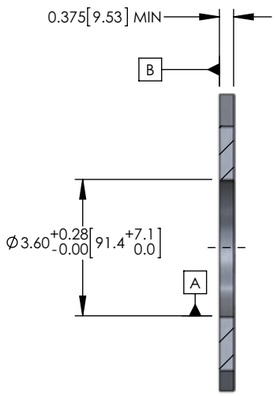
STANDARD O/I DRAWING





SPLIT PLATE O/I DRAWING



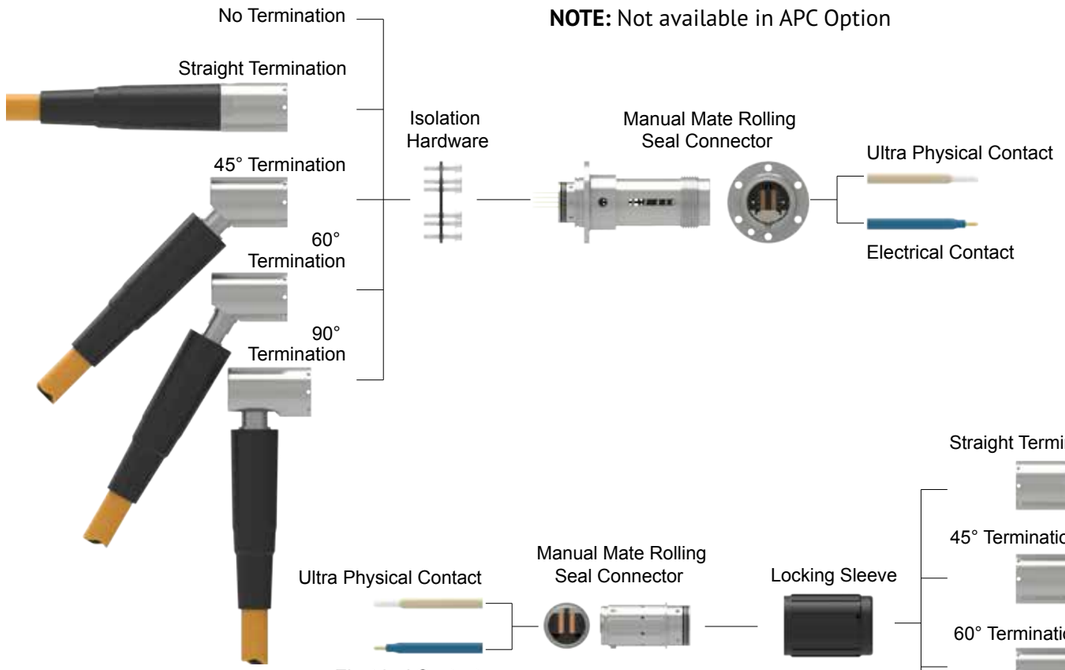


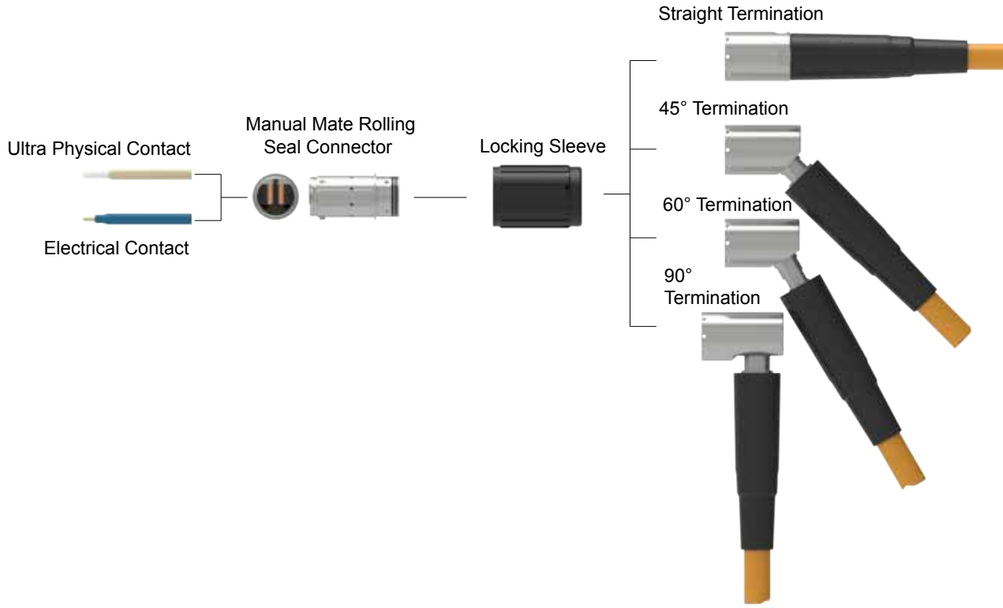
Rolling Seal Hybrid:

Manual Mate Rolling Seal Connectors, sometimes referred to as “Diver Mate”, feature a manually actuated threaded locking sleeve arrangement for mechanical coupling. Manual Mate connectors are constructed from Titanium with multiple material options for the locking sleeves.

These connectors are used in shallow water where the subsea wet mate coupling is achieved by divers rather than by ROV. Manual Mate Connectors are also used as highly reliable surface connectors that can be deployed in deep water applications.

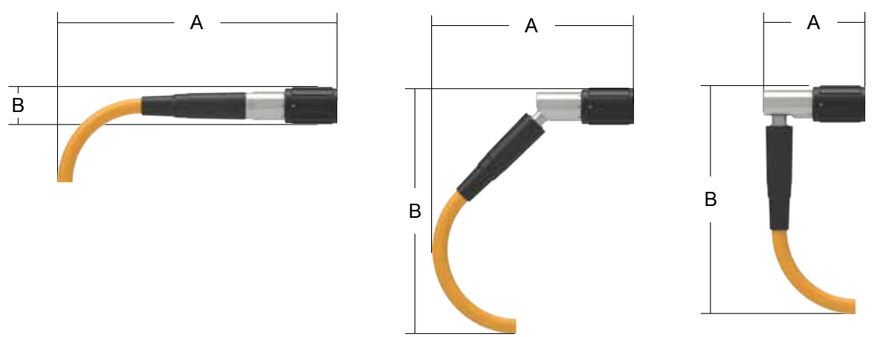
NOTE: Not available in APC Option





Rolling Seal Hybrid Manual Mate Cable End Receptacle

Straight | 45° | 90°



Manual Mate Cable End Optical Connector			
Termination	A Dim in [mm]	B Dim in [mm]	Ordering Description
Straight	20.44[519.2]	2.73[69.3]	RSH-xO-xE-MAN-CE-00-UPC
45°	16.6[421.5]	18.32[465.3]	RSH-xO-xE-MAN-CE-45-UPC
90°	7.39[187.8]	16.68[423.5]	RSH-xO-xE-MAN-CE-90-UPC

60° Terminations available upon request.

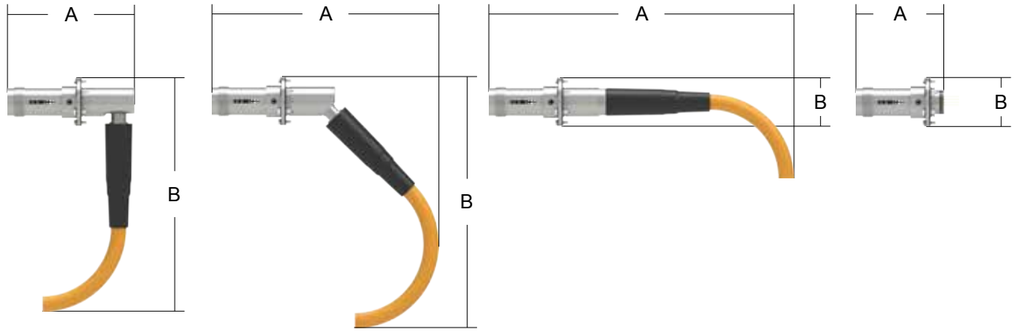
Ordering description example for a manual mate cable end connector with 4 optical circuits, 4 electrical circuits, and a straight termination :

EXAMPLE:

Type	Opt	Elec	Config	Mount	Term	Interface
RSH	4O	4E	MAN	CE	00	UPC

Rolling Seal Hybrid Manual Mate Bulkhead Plug

90° | 45° | Straight | None



Manual Mate Bulkhead Optical Connector			
Termination	A Dim in [mm]	B Dim in [mm]	Ordering Description
90°	9.28[235.6]	17.05[433.1]	RSH-xO-xE-MAN-BH-90-UPC
45°	18.61[472.8]	19.32[490.7]	RSH-xO-xE-MAN-BH-45-UPC
Straight	22.33[567.1]	3.48[88.4]	RSH-xO-xE-MAN-BH-00-UPC
None	6.43[163.3]	3.48[88.4]	RSH-xO-xE-MAN-BH-NA-UPC

60° Terminations available upon request.

Ordering description example for a manual mate bulkhead connector with 4 optical circuits, 4 electrical circuits, and a straight termination :

EXAMPLE:

Type	Opt	Elec	Config	Mount	Term	Interface
RSH	4O	4E	MAN	BH	00	UPC

Dummy Protective Caps for Manual Mate Connectors

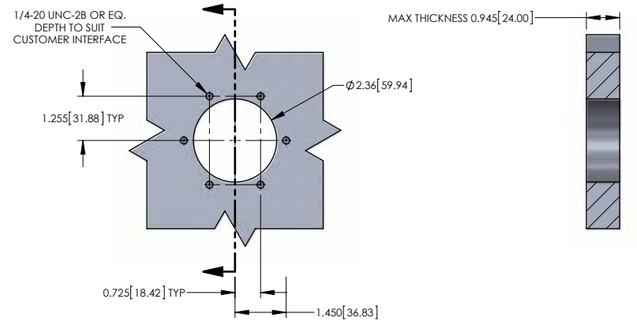
To ensure proper mechanical actuation after any length of time stored subsea, it is required that bulkhead connectors be stored mated with a dummy cable end connector acting as the subsea protective cap. Retrievable protective caps are also recommended for flying lead connectors that will be idle subsea.

	ACCESSORY	ORDERING DESCRIPTION	MATING CONNECTOR
	Manual Mate Parking Position (No Inserts)	RSH-PA-MAN-BH-00-UPC	Rolling Seal Manual Mate Cable End
	Manual Mate Long Term Loop Back Termination Cap	xO-xE*-RSH-DC-MAN-CE-00-UPC	Rolling Seal Manual Mate Bulkhead

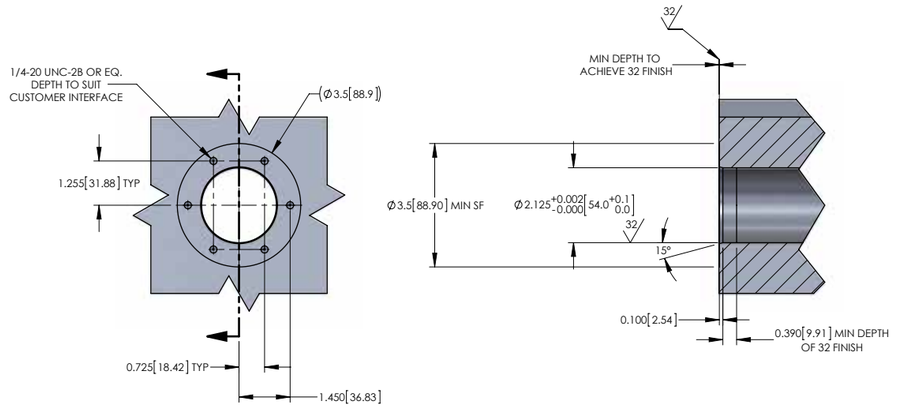
*Optical and Electrical count must match mating connector

Rolling Seal Hybrid Manual Mate Outline Interface

STANDARD REAR MOUNT O/I DRAWING



PRESSURE VESSEL FRONT MOUNT CONFIGURATION
INCLUDES FIBER PIGTAILS (NO PBOF HOSE)



Rolling Seal Hybrid Stab Mate Connectors

Stab Mate Rolling Seal Hybrid Connectors are used as fixed elements where two pieces of equipment are coupled and held in place through gravity with no mechanical locking mechanism. The alignment of the connections is built into the equipment. The customer's equipment must be designed to align and maintain the connectors in the proper mating condition. The connectors have defined tolerance allowances to accommodate slight misalignment.

STAB MATE CONFIGURATIONS

As with ROV optical connectors, any combination of 8 optical or electrical circuits are available.

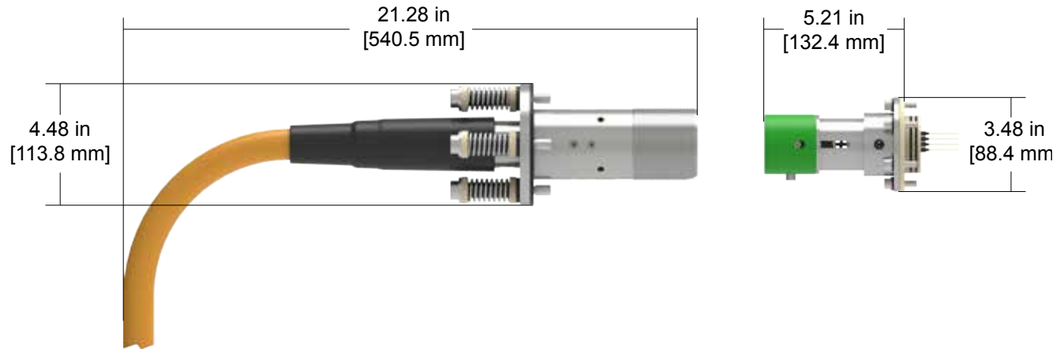
Often mounted onto retrievable control modules or pods, the floating connector half leverages corrosion-resistant springs, thereby offering an exceptional range of radial, rotational, angular, and axial compliance for stab mates. The fixed connector half is identical to an ROV bulkhead connector.

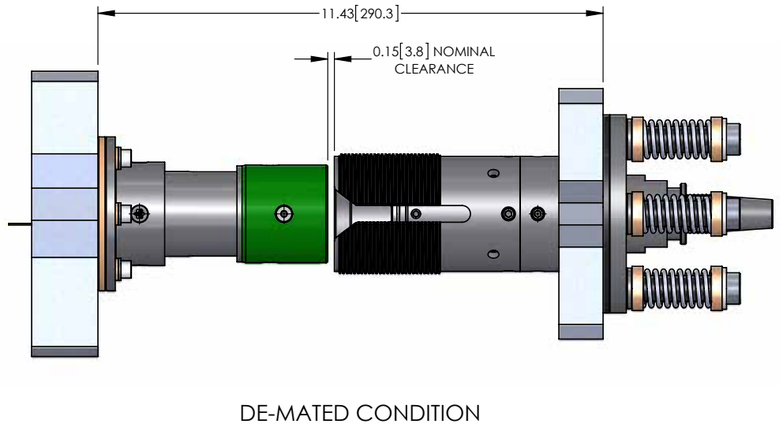
Topside test connectors which mate to the floating receptacle connector half are threaded in order to maintain the mated condition.

Rolling Seal Hybrid Stab Mate Connector	
Termination	Ordering Description
Fixed connector	RSH-xO-xE-STB-BH
Floating connector	RSH-xO-xE-STB-CE

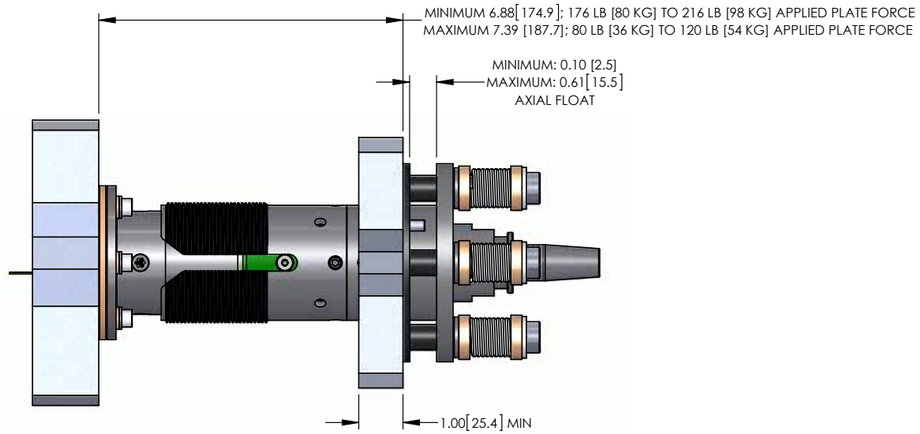
Rolling Seal Hybrid Stab Mate Connectors

RSH





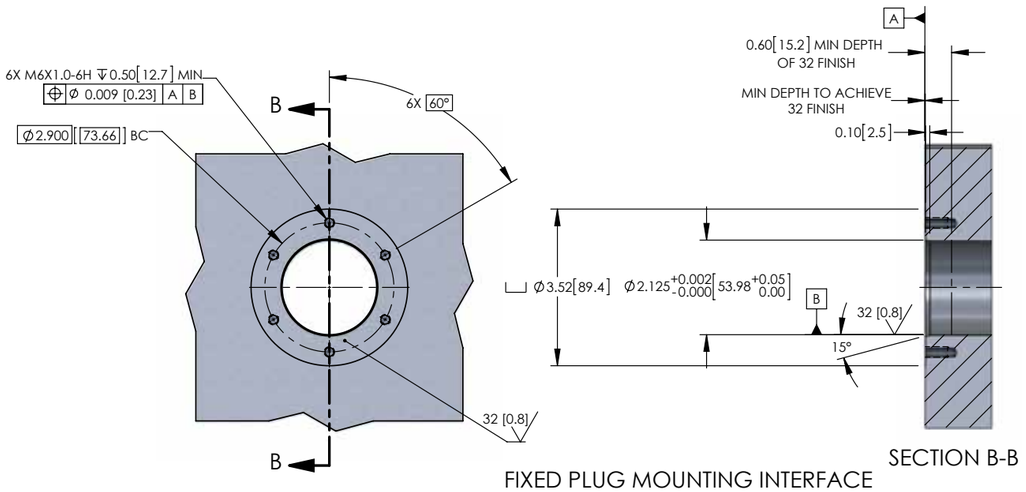
DE-MATED CONDITION



MATED CONDITION

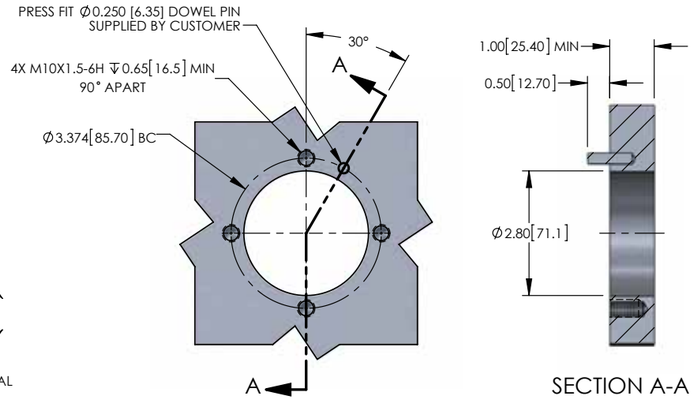
RSH

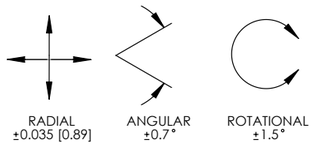
Rolling Seal Hybrid Stab Mate Outline Interface



FIXED PLUG MOUNTING INTERFACE

SECTION B-B





MISALIGNMENT CAPABILITY

SECTION A-A

RECEPTACLE MOUNTING INTERFACE

NRH

Nautilus™ Rolling Seal Hybrid Wet Mate

Teledyne ODI's Nautilus™ Rolling Seal Hybrid is an electro-optical wet mate connector designed to provide reliable power and high speed data transmission in subsea control modules and umbilical terminations.

The fully-qualified connector is rated to 10,000 psi (pressure balanced), and it features 2-way electrical circuits rated to 30 amps each and up to 4 optical circuits. Configurations include ROV or manual mate bodies, and can be configured with either pins or sockets on the flying lead connector half.

Reverse NRH

An alternate configuration of the NRH is available, reversing the position of the contacts so that the sockets are located in the flying lead. This alleviates any safety concerns with undetected live pins in the flying lead during set up or Site Integration Testing (SIT). The yellow bushings with ±40° keying on opposite side from standard optical designs prevent mating to standard NRH.

Available in Reverse configuration with sockets in the flying lead

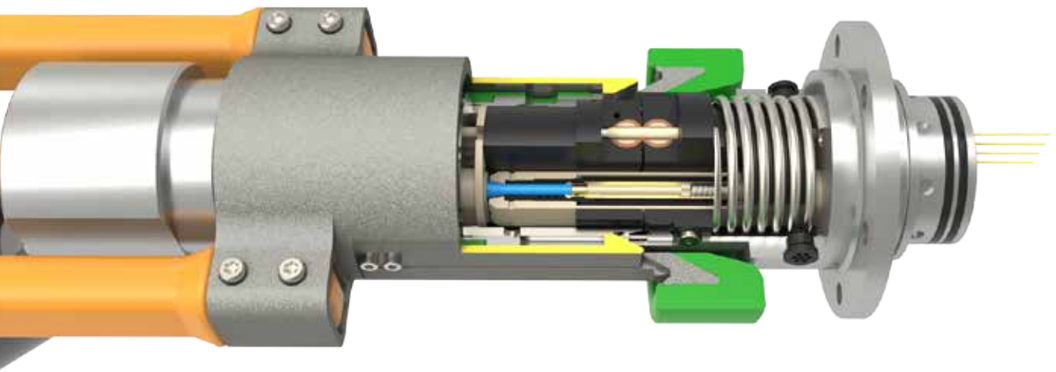
Nautilus™ Rolling Seal (NRH) Technology Overview

Subsea control modules and umbilical terminations often have need for both power and high-speed data transmission via optical fiber. Addressing this challenge, the Teledyne ODI Nautilus™ Rolling Seal Hybrid (NRH) Connector combines the reliability and electrical current capacity of the industry-standard Nautilus™ Connector with the flexibility and multi-channel optical capabilities of the Rolling Seal Connector.

Mating Operation

On one side of the connector, the patented Rolling Seal design excludes water and silt from the region where the optical ferrules are brought into contact, providing a clear oil-filled conduit for the ferrules to contact and create a low-loss optical path.

Featuring the Teledyne ODI "Dual Seal" technology, electrical elements of the connector incorporate the Nautilus™ design with two independent oil reservoirs, providing two completely separate barriers to the ingress of sea water. The patented design of the electrical contacts allows the pin to enter these reservoirs and to transfer sealing via a shuttle pin and dual wiper seal assembly.

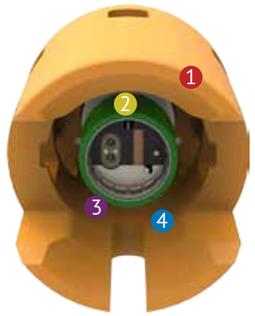


Nautilus™ Rolling Seal (NRH) Technology Overview

NRH

MK III ENHANCEMENTS

Introduced in 2013, the evolutionary NRH Mk III design focuses on enhancing operational efficiencies and reducing risks during ROV intervention where and when circumstances provide for less than optimal mating/demating conditions. Teledyne developed these enhancements with customer feedback in mind. Critical Mk III design enhancements are field retro-fittable and backwards compatible with Mk II connectors.



Five Performance Enhancements

1. Guide funnel and latch indicators provides for gross alignment before connector shell contact.
2. Center actuator material change offers increased margin against deformation, for overall increased connector field reliability.
3. Bulkhead main spring (not shown) force increase assures manifold return even when mated at excessive angles.
4. Bulkhead bushing now reinforced and more robust for ROV handling.
5. Longer, contoured lead-in bushing enhances fine alignment of connector halves during the mating sequence.

Nautilus™ Rolling Seal Optical Connector Specifications

GENERAL SPECIFICATIONS*

Operational Temperature:	**SEAWATER** 23˚F to +104˚F (-5˚C to +40˚C)	**AIR** -4˚F to +122˚F (-18˚C to +50˚C)
Storage Temperature:	-22˚F to +140˚F (-30˚C to +60˚C)	
Max Operational Pressure:	10,000 psi ambient 1,500 psi differential (bulkhead)	
Mate/De-mate Cycles:	100 without refurbishment	
Mating Force:	<120 lbs	
De-mating Force:	<100 lbs	
Configurations:	ROV Mate (Manual mate upon request)	
Material:	Titanium	
Design Life:	30 Years	

OPTICAL & ELECTRICAL SPECIFICATIONS

Number of Circuits:	2 electrical, up to 4 optical
Insertion Loss:	⩽ 0.5 dB @ 1310/1550/1625 nm
Return Loss:	⩾ 30 dB @ 1310/1550/1625 nm
Max Operational Current:	30 Amps per circuit
Max Operational AC Voltage:	1.0 kV Phase-to-Ground 1.7 kV Phase-to-Ground
Max Operational DC Voltage:	3.3 kV
Insulation Resistance:	>10 GΩ @ 1 kVDC
Contact Resistance:	< 30 mΩ per Contact

*For reference only, see FDS - IFS Should be D/N 213932 for Official Values

Nautilus™ Rolling Seal Connector Attributes

STANDARD ATTRIBUTES

1. CONNECTOR TYPE
Nautilus Rolling Seal Optical/Hybrid Connector - **NRH**. Differentiates the connector type from the Rolling Seal Hybrid (RSH) described on pages 9-32.

2. OPTICAL CIRCUITS
Indicates the number of optical circuits xO where x is the number of desired optical circuits (Up to 4)

3. ELECTRICAL CIRCUITS
Indicates the number of electrical circuits xE where x is the number of desired electrical circuits (Up to 2 at 30A per circuit).

4. MATE CONFIGURATION
Indicates the mating method used

ROV = ROV mate
MAN = Manual mate

5. MOUNTING
Indicates type of mounting configuration

CE = Cable End (Flying)
BH = Front Mount Bulkhead (Fixed)

6. TERMINATION ARRANGEMENT
Indicates the exit angle of the PBOF hose

NA = None
00 = Straight
45 = 45°
60 = 60°
90 = 90°

OPTIONAL ATTRIBUTES

7. HANDLE
Indicates the handle type of the flying ROV mate connectors

STD= Standard
SVD=Standard V-Notch

EXAMPLE:

Ordering description example of an ROV cable end (flying) connector with 4 optical circuits, 2 electrical circuits, and a 45° termination:

1	2	3	4	5	6	7
NRH	4O	2E	ROV	CE	45	STD

Connector Attributes - Detail

1. CONNECTOR TYPE

Nautilus Rolling Seal Hybrid (NRH).
The NRH is typically used in applications that require fiber and higher voltage electrical connections (up to 30A).

2. OPTICAL CIRCUITS

The NRH can have up to 4 optical circuits.
The NRH connector is only available as a UPC connector.

3. ELECTRICAL CIRCUITS

The NRH can have up to 2 electrical circuits. 30A per circuit.

4. MATE CONFIGURATION

ROV: Mating operation performed via Remotely Operated Vehicle
(Manual Mate upon request)

5. MOUNTING

Bulkhead (fixed)
Plug

Cable End (Flying)
Receptacle

Connector Attributes - Detail

NRH

6. TERMINATION ARRANGEMENT

Cable End
45° Recommended Termination*

*60° and 90° cable end terminations available upon request

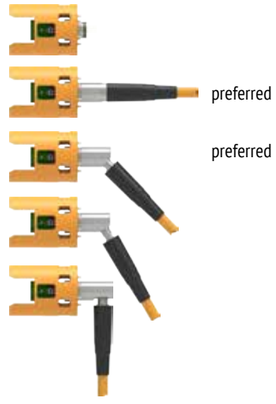
Bulkhead
No Termination

0° preferred

45° preferred

60°

90°



7. HANDLE

Indicates the handle type of the flying ROV mate connectors

Standard

Standard V-Notch

ADDITIONAL NOTES

MOUNTING

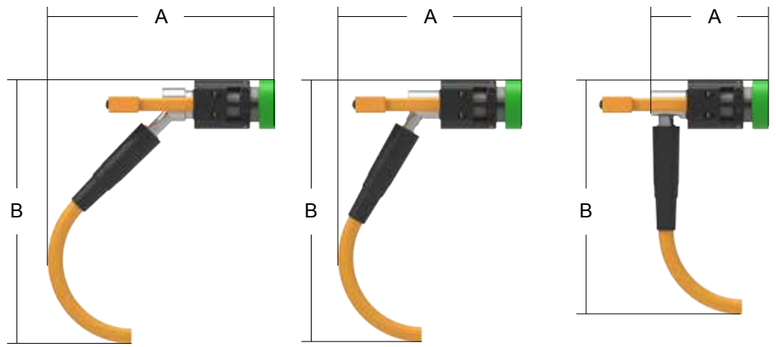
Note: NRH connectors are typically offered as ROV mate configurations, but an NRH manual mate is available upon request. No stab mate configuration is available for NRH connectors.

REVERSE CONFIGURATION

Contact Teledyne Oil & Gas for more information regarding the Reverse Configuration (sockets in the flying lead) oilandgas@teledyne.com

Nautilus™ Rolling Seal Hybrid ROV Cable End Receptacle

45° 60° 90°



ROV Cable End NRH Connector			
Termination	A Dim in [mm]	B Dim in [mm]	Ordering Description
45°	16.61[421.8]	19.28[489.6]	NRH-xO-xE-ROV-CE-45-STD
60°	13.43[341]	19.13[486]	NRH-xO-xE-ROV-CE-60-STD
90°	8.62[218.9]	17.11[434.6]	NRH-xO-xE-ROV-CE-90-STD

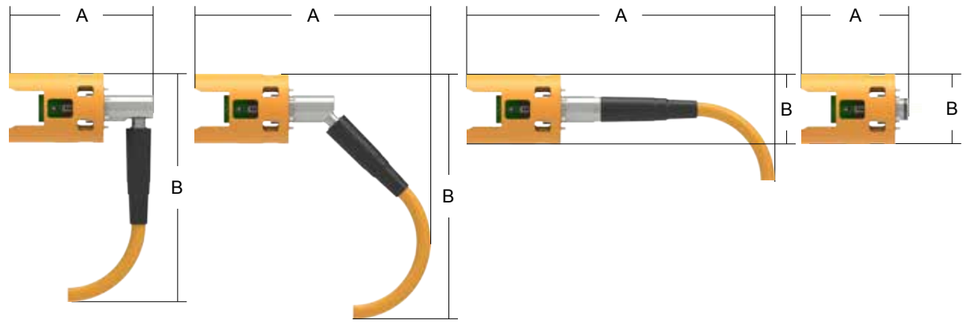
Ordering description example for an ROV cable end connector with 4 optical circuits, 2 electrical circuits, and a 45° termination with standard handle:

EXAMPLE:

Type	Opt	Elec	Config	Mount	Term	Handle
NRH	4O	2E	ROV	CE	45	STD

Nautilus™ Rolling Seal Hybrid ROV Bulkhead Plug

90° 45° Straight None



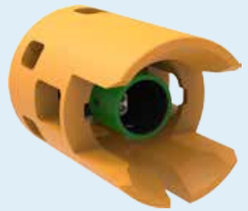
ROV Bulkhead NRH Connector			
Termination	A Dim in [mm]	B Dim in [mm]	Ordering Description
90°	11.01[279.5]	18.05[458.5]	NRH-xO-xE-ROV-BH-90
45°	18.61[472.8]	19.32 [490.7]	NRH-xO-xE-ROV-BH-45
Straight	24.05[610.9]	5.48[139.2]	NRH-xO-xE-ROV-BH-00
None	8.2[208.4]	5.48[139.2]	NRH-xO-xE-ROV-BH-NA

Ordering description example for an ROV bulkhead plug with 4 optical circuits, 2 electrical circuits, and a straight termination:

EXAMPLE:

Type	Opt	Elec	Config	Mount	Term
NRH	4O	2E	ROV	BH	00

Dummy Protection Caps for ROV NRH Connectors

	ACCESSORY	ORDERING DESCRIPTION	MATING CONNECTOR
	NRH ROV Front Mount Bulkhead Fixed Plug Parking Position With No Termination	NRH-PA-ROV-BH-00	NRH ROV Cable End
	Rolling Seal/NRH ROV Retrievable Dummy Protection Receptacle With No Termination	xO-xE*-NRH-DC-ROV-CE-00-STD	NRH ROV Bulkhead

*Optical and electrical count must match mating connector

Test Boxes

Whether testing in the laboratory, at the integration, site or on the deck of a ship immediately before deployment, test boxes are a crucial part of pre-deployment testing and system validation. Consisting of a functional wet mate connector, an un-filled hose, and a rugged metal box, connectivity is provided via telecomm-grade terrestrial connector types, such as FC/PC, FC/APC, ST, or LC. These terrestrial connectors often interface with matching 3.0 mm terrestrial jumpers or patch cables, eventually leading to the optical test equipment. All wet mate connectors are rated for 100 mate/demates before refurbishment.

Test Box

Test Box

The Teledyne Oil & Gas mating pedestal provides a stable base upon which a bulkhead connector test box assembly can be mounted prior to mating the subsea-deployable flying lead. Although Teledyne recommends a Gross Alignment Funnel and Enhanced Latch Indicator for topside operations, care should still be taken to mate and demate the connectors in a smooth and controlled motion. More details can be found in the Optical Installation / Operation Manual DN 10272-1.

Special test box configurations or box sizes may be available upon request.

Hand Mate Pedestal

Optical Penetrator

High-Pressure Hermetic Optical Penetrator developed to enable reliable fiber transmission through a bulkhead with up to 12 fibers.

The Teledyne ODI Optical Penetrator offers a reliable and flexible solution for the next generation of multi-channel fiber optic applications in subsea control arrays, downhole sensors, optical amplifiers, oceanographic monitoring, and defense equipment.

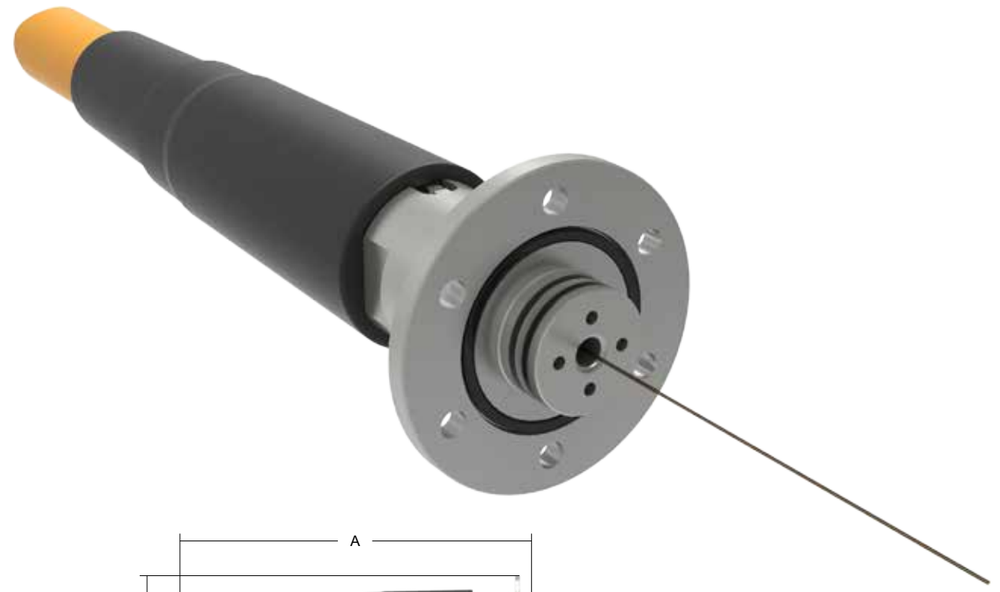
The Teledyne ODI Optical Penetrator resides at the wall or bulkhead of the vessel in which the equipment is located, providing a differential pressure barrier, fluid isolation and reliable optical feed-through. The penetrator is primarily installed into a customer's subsea atmospheric pressure vessel, although its adaptable design allows it to be integrated into Teledyne ODI Field Assembled Cable Terminations (FACT) and Modular Connectorized Distribution Units (MCDU). With a working pressure certification of 9,100 psi, the Teledyne ODI optical penetrator meets or exceeds industry standard applications.

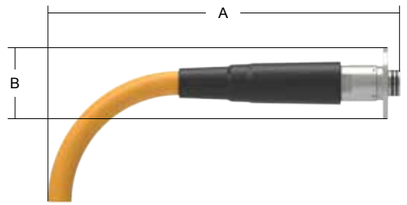
GENERAL SPECIFICATIONS*

Operational Temperature:	35˚F to 107˚F (0°C TO 50°C)
Storage Temperature:	-40˚F to 140˚F (-40˚C to +60˚C)
Rated Differential Pressure:	9,100 psi
Test Pressure:	10,000 psi
Material Compatibility:	Sea Water, DC200 Silicone Oil
Design Life:	30 Years
Hermeticity (He leak):	⩽ 10-7 STD cc/sec @ 1 atm Pressure Differential

OPTICAL & ELECTRICAL SPECIFICATIONS

Optical Fiber Type:	Corning 12-fiber ribbon, single mode (SMF-28E) or multimode (50 or 62.5 µm)
Insertion Loss:	≤0.25 dB per channel @ 1310/1550/1625 nm
Return Loss:	≥50 dB per channel @ 1310/1550/1625 nm





Optical Penetrator			
Termination	A Dim in [mm]	B Dim in [mm]	Ordering Description
Straight	16.54 [420.1]	3.35 [85.1]	xO-PEN

Ordering description example for penetrator with 4 optical fibers:

EXAMPLE:

Opt	Config
4O	PEN

Additional Solutions from Teledyne Marine

Dry Mate Submersible Interconnect

TELEDYNE AG GEOPHYSICAL

Waterproof, high shock resistant, electrical interconnect

TELEDYNE DGO

Highly reliable glass-to-metal sealed electrical and fiber optic interconnect for extremely high pressures and temperatures

TELEDYNE IMPULSE

Dry mate submersible electrical and fiber optic interconnect for deepwater applications and harsh environments

TELEDYNE ODI

Dry mate submersible electrical interconnect to complement wet mate applications

Additional Solutions from Teledyne Marine

ELECTRICAL OPTICAL FLYING LEAD

Fully qualified, wet mateable electrical Ethernet to optical flying lead

TOG's Electrical Optical Flying Lead (EOFL), the newest entrant to the Active Flying Lead product line, features a Nautilus™ Rolling Seal Hybrid connector on one side, and a 7- or 12 –way Nautilus electrical connector on the other, with a qualified integrated electro-optical converter within the pressure balanced oil-filled hose (PBOF).

The electro-optical components are housed in a 1 ATM enclosure, are protected on one side by glass to metal seal penetrators with a hermetic fiber penetrator on the other. The EOFL converts an electrical signal to a fiber optic signal, currently allowing up to 100 Mbit/sec data speed over 2 twisted pairs to be converted to one single fiber. The EOFL can run 1 Gigabit/sec over 4 twisted pairs if needed.

Including the EOFL into the subsea layout allows for greater field architecture flexibility, while at the same time increasing reliability.

GENERAL SPECIFICATIONS*

Max Operational Pressure:	4,000M (6,000 PSI)
Configurations:	23°F TO +104°F (-5°C TO +40°C) Seawater -4°F TO 122°F (-20°C TO +50°C) Air
Storage Temperature:	-22°F to 140°F (-30°C to +60°C)
Material:	Housing Titanium
Design Life:	30 Years (Assuming Operational Temperature of 4°C)
Communications Test:	RFC-2544 error rate < 1%
Ethernet Speed:	10/100 Mbit/sec
Power Wires (Pass Through):	Maximum Operational Current per Circuit: 3 amps Maximum Operational Voltage: 620 VAC Phase to Ground Insulation Resistance: ≥ 10 GΩ @ 1 KVDC
Power Wires (Required to run Converter):	Operating Power: 5 watts Operating Voltages: 24 Volts +12/-6 Volts Max In Rush Power: 10 watts
Power Wires (With Oil-Filled Hose):	Electrical side: 90 meters Total Length: 300 meters

Additional Solutions from Teledyne ODI

Subsea Junction Boxes:

Subsea Junction Boxes serve two main purposes:

1. To distribute input signals to multiple output signals where wire splicing typically occurs within the Junction Box to distribute the signals.

2. To marshal the input signals to multiple output connections, typically where no splicing is necessary inside of the Junction Box,

Teledyne ODI offers Junction Boxes integrated with wet mate connectors to provide a turn-key solution for reliable subsea distribution.

JUNCTION BOX APPLICATION CHECKLIST

Number of Electrical Circuits: _____

Input Circuit Count: _____

Output Circuit Count: _____

Number of Optical Circuits: _____

Input Circuit Count: _____

Output Circuit Count: _____

Wire gauge required: _____

Type of Wire: Single ❑ TP ❑ TSJP ❑

Operating Voltage: _____AC / DC

Operating Current: _____(A)

Water Depth or Operating Pressure: _____

Additional Solutions from Teledyne ODI

MCDU- Modular Connectorized Distribution Unit:

A modular family of subsea distribution units that provide oil-filled, pressure balanced junctions for flexible configurations.

The modular design and versatility of the Teledyne ODI's MCDU allows for a variety of configurations with wet mate connectors, including the industry standard Nautilus™ Electrical, Rolling Seal Optical, and Nautilus™ Rolling Seal Hybrid. Functioning as the hub of an expandable subsea network, the MCDU can provide input connectivity through a variety of sources.

MCDU APPLICATION CHECKLIST

of Optical Circuits: _____

# of Electrical Circuits: _____

Input Connectivity Source (select one):

___ Hose

___ Penetrator

___ Closed Circuit Assembly

Operating Voltage:

_____ AC / DC

Operating Current _____ (A)

Water Depth or Operating Pressure: _____

Frame Required? Y / N

Type (select one): _____

____ Retrievable

____ Fixed Mount

Housing Material (select one):

_____ SS _____ Titanium

Additional Solutions from Teledyne ODI

FACT – Field Assembled Cable Termination:

The standard FACT components allow Teledyne ODI to factory build and test the majority of the termination assembly. As a result, only cable breakout, soldering, and encapsulation are performed in the field, thus significantly reducing operator dependence, and termination time while significantly increasing reliability. By creating a reliable water barrier to protect dry components, risk of internal failures is reduced substantially.

General Specifications	Optical FACT	Hybrid FACT
Operational Temperature	50°F to +122°F (-10°C to +13°C)**	14°F to +122°F (-10°C to +50°C)*
Storage Temperature	-40°F to +140°F (-40°C to +60°C)**	-40°F to +140°F (-40°C to +60°C)**
Max Operational Pressure	6,600 psi **	6,600 psi **
Max Test Pressure	10,000 psi (689 bar)**	7,700 psi (531 bar)*
Min Cable Diameter	0.3 in (7.62 mm)	0.625 in (15.8 mm)
Max Cable Diameter	0.7 in (17.78 mm)	1.27 in (32.3 mm)
Number of Circuits	8 max	6 electrical, 12 optical
Material	316L Stainless Steel or Titanium Gr 2	316L Stainless Steel or Titanium Gr 2
Design Life	25 Years	30 Years

*Subject to Cable Performance For reference only, see FDS - D/N 213952 for Official Values

**Subject to Cable Performance For reference only, see FDS - D/N 336403 for Official Values

Optical FACT:

A combination of up to six optical FACT penetrators and/or jumper assemblies can be accommodated in the standard dielectric- filled pressure-balanced splice canister.

Hybrid FACT:

Electrical and optical cable termination assembly that adapts to a wide array of interfaces

FACT APPLICATION CHECKLIST

Provide manufacturers' cross sectional drawing.

# of Conductors: _____ AWG / mm^2 of Conductors: _____

Armor? Y / N Conductor Diameter: _____

No. of fibers:_____

Jacket Material Composition? _____

Cable OD: _____

Cable Inner Core OD (as applicable): _

Operating Voltage: ____Operating Current (A): _____

Water Depth/Operating Pressure: _____

Axial Load? _____

Mounting Required? Y / N_____

Termination onshore / offshore? _____

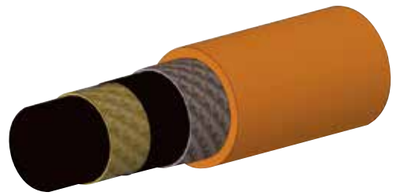
Flying Lead Connector output (4, 7, 12-Way): _____

Additional Solutions from Teledyne ODI

Pressure Balanced Oil Filled (PBOF) Hose:

Custom-Manufactured hose assembly system available in -6, -8 and -12 sizes designed specifically for subsea harnesses

Teledyne ODI has met the challenges of designing a cable specifically for the subsea environment. Teledyne ODI's Oil Filled Hose (jumper) assemblies are a proven reliable and economical means for passing electrical and/or optical circuits, while compensating its internal pressure as the external environmental pressure changes. The hose can be terminated into a variety of hose end fittings, which enables the ease of assembly to any combination of connectors or feed-throughs. These hose end fittings include the standard JIC and the Teledyne ODI integral hose termination.



FEATURE	-6 RATING	-8 RATING	-12 RATING (standard)
Minimum Bend Radius:	3" (76.2mm)	4" (101.6mm)	5" (127mm)
Axial Load / Max Working:	300 lbs	400 lbs	600 lbs
Axial Load / Min Failure:	450 lbs	600 lbs	1150 lbs
Max Axial Stretch:	2% @ 300 lbs	2% @ 400 lbs	2% @ 600 lbs
Internal Pressure Rating (Max Working):	225 psi		
Temperature Rating:	-4°F to 122°F (-20°C to +50°C)		

For additional information, see operation and installation manual (D/N 10397-1}

Request For Proposal Guide

Please use the following forms to guide your product selections. If you have a functional design specification, please provide it with your request for proposal submission.

For proposal assistance and/or current product specifications:

ODI_Marketing@teledyne.com

For email submission of Request for Proposals:

ODI_RFQs@Teledyne.com

Jumper Sketch Worksheet

Designer: _____ Company: _____

Contact Phone: _____ Contact Email: _____

System: _____ Project Name: _____

Sketch Name: _____

CONNECTOR A

HOSE LENGTH/ WIRE AWG

CONNECTOR B

N/A for BH Connector

Type	Opt	Elec	Config	Mount	Term	Interface	Handle
RSH	0	0	ROV	CE	NA	UPC	STD
NRH	1	1	MAN	BH	00	APC	SVD
	2	2	STB		45		
	3	3	PEN		60		
	4	4			90		
	5	5					
	6	6					
	7	7					
	8	8					

CONNECTOR A

example:

RSH - 4 O - 4 E - ROV - CE - 45 - UPC - STD

CONNECTOR B

example:

RSH - 4 O - 4 E - ROV - BH - 00 - UPC - N/A

PBOF Hose: _____ Length (M or ft): _____

Wires AWG: _____

Special Notes: _____

_____

Action Requested: Quote ❑ Yes or ❑ No Please Call ❑ Yes or ❑ No

APPLICATION CHECKLIST GENERAL:

Company: _____ Contact: _____

Location: _____ Title: _____ Email: _____

Project Name: _____ Phone: _____ Fax: _____

Installation Location: _____ Required Delivery Date: _____

GENERAL:

- Do you have a Functional Design Specification? ❑ Yes ❑ No
  If yes, please send to your local representative or to **ODI_RFQs@teledyne.com** with this inquiry.
- Please check the following application questions:

APPLICATION:

Electrical Options: ❑ High Power ❑ Standard Low Voltage (3.3kVDC/1.73kVAC)
❑ Optical (fiber optics) ❑ Hybrid (combination of fiber and electrical) ❑ Optical with >45dB Return Loss
❑ Combination

TOG PRODUCT REQUIREMENTS (CHECK ALL THAT APPLY):

❑ Point to Point Jumper ❑ Multi-Leg Harness ❑ Bulkhead Connector(s) ❑ Penetrator(s)
❑ Field Assembled Cable Termination (FACT) ❑ Molded Connector(s) and/or cable assembly
❑ Multiple Connector Distribution Unit (MCDU) ❑ Test Connector(s)

MATING CONFIGURATION REQUIREMENTS:

Wet mate Options: ❑ ROV ❑ Manual mate ❑ Stab mate / ❑ Dry mate (Submersible) ❑ Combination

- Project Description and Application (Brief Summary):

_____
_____
_____

ENVIRONMENTAL:

- Project operating depth? _____ Ft. or _____ Meters
- If using bulkhead mounted connectors, then identify the application:
  ❑ Free Flooded ❑ 1 ATM ❑ Pressure Balanced
  If pressure balanced, then identify the fluid that will be in contact with the terminated side of the connector:
  Fluid(s): _____
- Connectors are designed for seawater exposure.
  Identify other fluids, if any: _____
- Identify temperature requirements:
  Minimum _____°F or _____°C Maximum _____°F or _____°C

HARDWARE:

- Connector Material: ❑ 316 Stainless Steel ❑ Titanium ❑ S. Duplex ❑ Other* ❑ Combination
  *If "other" Please describe: _____
- ❑ Check if Fluid-Filled Hose (Point to Point Jumper): Maximum Length Required: _____ Ft. or _____ Meters
- ❑ Check if Molded Cable (Point to Point Jumper): Maximum Length Required: _____ Ft. or _____ Meters
- ❑ Check if Field Assembled Cable Termination (FACT) required: ❑ Electrical ❑ Optical ❑ Hybrid ❑ Combination

APPLICATION CHECKLIST GENERAL (con't):

CIRCUIT REQUIREMENTS:

- Identify continuous operating voltage: _____ ❑ kVAC or _____ ❑ kVDC
- Identify continuous operating current: _____ Amps
- Identify connector circuit configuration required: ❑ 4-Way ❑ 7-Way ❑ 12-Way ❑ Combination
- Wire construction preference: ❑ Single Conductor ❑ Twisted Pair ❑ Twisted Shielded Pair ❑ Combination
- Wire gauge preference: ❑ 14AWG (power applications) ❑ 16AWG (communication applications) ❑ Combination
- Identify wire gauge preference if any: _____ AWG or _____ mm^2
- Identify optical requirements: ❑ Single Mode ❑ Multi-Mode ❑ Combination ❑ Other: _____
- Identify optical operating wavelength: ❑ 850nm ❑ 1310nm ❑ 1550nm ❑ Combination ❑ Other: _____
- Required number of optical circuits per connector: _____ (max. 8 for standard connector)

CABLE TERMINATION:

- If utilizing a mechanical (FACT) cable termination, then please include a copy of the cable cross-section and specification details with this enquiry.

PROJECT REQUIREMENTS:

- Please identify unique project requirements such as Statoil, API, ISO if any: _____
- Please include a copy of project requirements with this enquiry if any.
- Please feel free to contact Teledyne Oil and Gas for technical assistance: **Don.Heinz@teledyne.com**

NOTES:

_____
_____
_____
_____
_____
_____
_____
_____
_____

Field Service / Aftermarket Service:

IN THE EVENT OF A FIELD SERVICE EMERGENCY, PLEASE CALL +1 386 236 0780 OR +1 800 234 6930

The Company maintains a staff of experienced technicians located in the USA, Europe, Malaysia and South America to service customers.

Teledyne ODI's technicians are certified to work in the most extreme environments such as offshore oil & gas facilities.

The Field Service Team maintains an around-the-clock service that includes representatives from Engineering for technical support and Operations for manufacturing/spare parts support of the field teams.

TO SCHEDULE ROUTINE FIELD SERVICE REQUESTS OR RETURN AN ODI PRODUCT, PLEASE VISIT
WWW.TELEDYNEOILANDGAS.COM
CALL +1 **386 236 0780 OR +1 800 234 6930**
EMAIL: **TOG_SERVICE@TELEDYNE.COM**

GLOBAL FIELD SERVICE LOCATIONS

Daytona Beach, FL
+1 386 236 0780

Houston, TX
+1 281 875 1717

Ellon, UK
+44 (0) 1358 729564

Johor Bahru, Malaysia
+607 509 9712/9923/9924

Rio de Janeiro, Brasil
+55 21 2714 6072

FIELD SERVICE CAPABILITIES

- Electrical and optical cable Terminations
- Factory Acceptance Tests (FATs)
- Dry fit-ups
- Installation support
- Test connector rentals
- Training
- Configure deployment frame rigging
- Maintenance and repair of wet mate connectors (oil fill and inspection)
- Project consulting
- Project-specific stand-by services (technician on-call)
- Topside support
- Site integration testing (SIT)
- Testing (Hyperbaric pressure tests, OTDR/Fiber testing, Ethernet testing)

Commonly Used Acronyms

Abbreviation:	Definition
AMP:	Ampere
APC:	Angled Physical Contact
API:	American Petroleum Institute
ATM:	Atmospheric
AWG:	American Wire Gauge
BH:	Bulkhead
CE:	Cable End
DWG:	Drawing
EHP:	Electrical Hull Penetrator
ELI:	Enhanced Latching Indicator
FACT:	Field Assembled Cable Termination
FITA:	Field Installed Termination Assembly
FMEA:	Failure Mode Effects Analysis
FMBH:	Front Mount Bulkhead
FXD:	Fixed
GAF:	Gross Alignment Funnel
GND:	Ground
GΩ:	Gigaohms
Hg:	Mercury
HP/HT:	High Pressure/High Temperature
HSE:	Health, Safety, Environmental
Hz:	Hertz
ISO:	International Organization for Standardization
KHz:	Kilohertz
Kohm:	Kilohms
kv:	Kilovolt
NRH:	Nautilus Rolling Seal
O/I:	Outline Interface
PBOF:	Pressure Balanced Oil Filled
RCPT:	Receptacle
RMBH:	Rear Mount Bulkhead
RSH:	Rolling Seal Hybrid Connector
UPC:	Ultra Physical Contact

Temperature Conversion Table (°F to °C)

° Farenheit	° Celsius	° Farenheit	° Celsius
-4	-20	311	155
5	-15	329	165
23	-5	347	175
41	5	365	185
59	15	374	190
77	25	383	195
95	35	392	200
113	45	401	205
131	55	410	210
149	65	419	215
167	75	428	220
185	85	437	225
203	95	446	230
221	105	455	235
239	115	464	240
257	125	473	245
275	135	482	250
293	145	491	255

DEPTH/PRESSURE CONVERSION TABLE

METERS	FEET	P.S.I.	BAR
100	328	161	11.1
500	1640	744	51.3
1000	3281	1473	101.5
1500	4921	2202	151.8
2000	6562	2930	202.1
3000	9843	4388	302.6
5000	16404	7304	503.6
10000	32808	15594	1006.2

TELEDYNE OIL & GAS
Everywhereyoulook™

FOR EMERGENCY FIELD SERVICE:
+1 386 236 0780 or +1 800 234 6930

DAYTONA BEACH
Teledyne ODI
tel: +1 386 236 0780
+1 888 506 2326

MALAYSIA
Teledyne Oil & Gas
tel: +603 7805 7712

BRASIL
Teledyne Oil & Gas
tel: +55 21 2714 6072

HOUSTON
Teledyne Oil & Gas
tel: +1 281 875 1717

EUROPE
Teledyne Cormon
tel: +44 (0) 1903 854800

SCOTLAND
Teledyne Oil & Gas
tel: +44 (0) 1358 729564

oilandgas@teledyne.com

Global Presence

Teledyne Oil & Gas is a global organization with manufacturing facilities and service and test centers around the world. A team of 30+ cross-trained, multi-lingual field service technicians remain ready 24/7 for routine and emergency deployments anywhere Teledyne products are being used.

TELEDYNE MARINE
Everywhereyoulook™

Teledyne Marine | Global Headquarters
1026 North Williamson Blvd. Daytona Beach, Florida 32114 USA
Tel. +1 386 236 0780 • Fax +1 508-563-6444 • E-mail: teledynemarine@teledyne.com

www.teledynemarine.com

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