

# HARSH ENVIRONMENT

HIGH PERFORMANCE FIBER-OPTIC INTERCONNECT SOLUTIONS





## DIAMOND COMPANY PORTRAIT

DIAMOND is a leading global supplier of high-precision fiber-optic solutions and has been successfully supplying a wide range of markets for over 30 years now. Diamond is also recognised as a dynamic and innovative company that knows how to manufacture reliable and customised components and devices in order to satisfy the ever-increasing demands of clients. In addition to the company headquarters, which was founded in Switzerland in 1958, Diamond boasts a global distribution network with 5 subsidiaries and over 20 representatives.



## HARSH ENVIRONMENTS

The worldwide market for harsh-environment fiber optics (HEFOs) is experiencing steady growth, due to the rapid advances made in fiber-optic technology, as well as the increasing demand for fiber-optic components for demanding applications. As a result, DIAMOND has responded to this growing demand by developing a wide range of strong, reliable, and customisable indoor/outdoor field optical connectors and accessories with superior optical performances. These products must be able to withstand adverse temperatures and weather conditions, shocks, vibrations, tensile stress, external pressure, corrosive surroundings, etc., which are much harsher than the environmental conditions typically endured by standard commercial connectors and cable assemblies. Typical applications are: energy plants, coal mines, offshore oil platforms, cement factories, refineries etc., as well as field-deployable communications, mobile diagnostic units, avionics and space travel, security systems, machine controls, industrial machine networks.





1 Antenna

2 Avionic/Space

3 Mining

4 Solar plant

5 Industry

6 Wind farm



7 Oil platform

8 Container terminal

9 Military

10 Transportation

## NEW DIAMOND MULTIPURPOSE (DM) INSERT BASED ON CROCODILE ALBERINO

Diamond has developed the new factory-terminated and measured fiber-optic Crocodile **Alberino HE** (Harsh Environment) to allow customers to assemble precision-engineered **termini** to ensure low data loss and reliable, repeatable performances over long distances in many applications.

This can be performed with the Zeus D50 HE fusion splicer from Diamond.

In addition to the optical termini, Diamond also developed the electrical termini with the same dimensions, and both parts form the base of the new Diamond Multi-purpose (DM) insert that is the core of our **HE-2000™**, **MIL-38999 style** and **X-BEAM connectors**.

### Optical – Electrical Termini

NEW



### Features of termini

- Compatible with several fiber types such as HCS, MM, SM, PM and small-core fibers
- Available in PC and APC versions
- Steady and repeatable low IL and high return loss (when APC is polished)
- High and steady ER when terminated with PM fibers
- Compatible with tight cable construction and semi-loose cable/fiber construction
- Field repair and termination available with the Diamond *Fusion Crocodile Alberino*
- Electrical pins 20 AWG
- Titanium ferrule front face

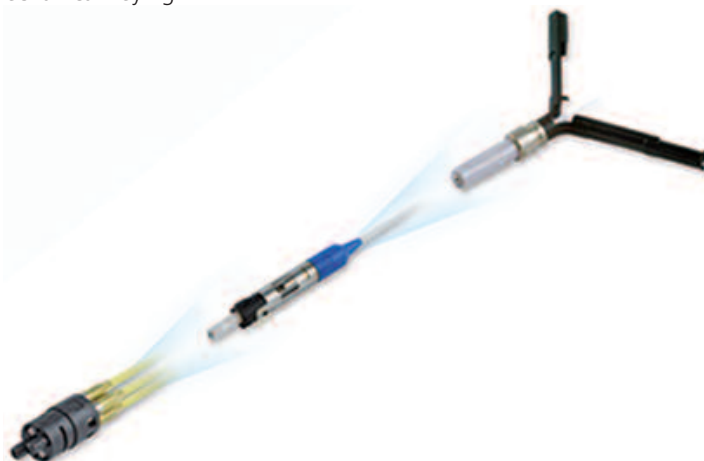
### Characteristics of DM insert

- Based on standard 2.5-mm Alberinos with integrated springs to prevent termini separation
- Up to 4 channels
- Hybrid, FO - Electrical
- Genderless mating and self-aligning design
- Easy front-face ferrule access for cleaning & inspection
- Easy termini insertion and removal for field termination and repair



### Specially designed for optical applications and housing electrical contacts

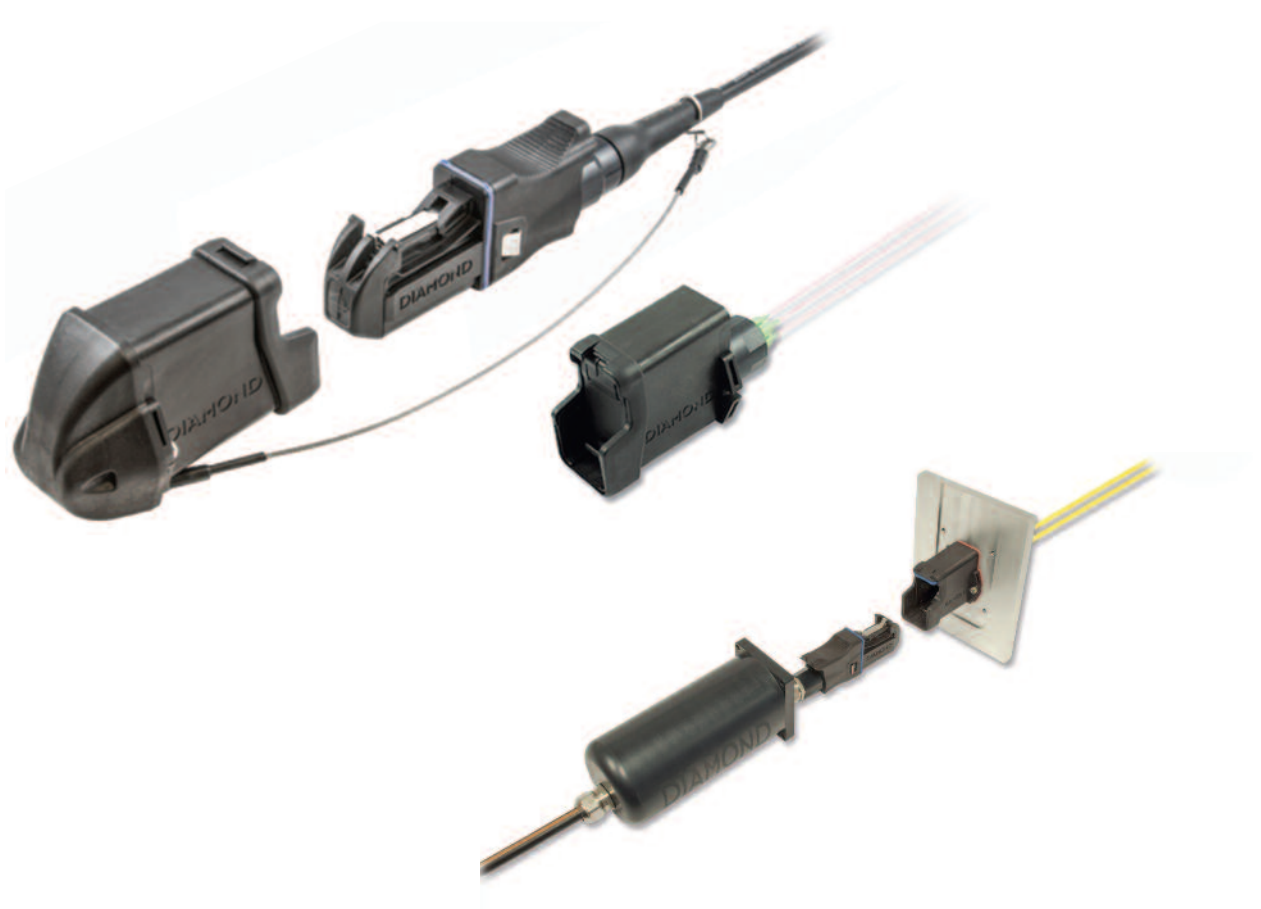
- Precise and repeatable pre-alignment, thanks to the ideal dimensions of the hollow pins
- Interacting, space-saving pre-alignment hollow pins
- Durable alignment sleeve protected in the hollow pre-alignment pins
- Alignment sleeves can be removed individually for easy cleaning
- Optical elements provided with complete protection against all external influences, such as twisting, bending and/or lateral stress
- Possibility of mechanical keying



### HE-2000™ Connector

The new push-pull four-channel HE-2000™ connector, which includes the DM insert, has the following features:

- Automatic protection shutter on connector (manual on bulkhead)
- Harsh-environment plastic shell, made from nylon with 25% fiber-glass reinforcement
- IP class: IP67
- Easy front-face ferrule access for cleaning & inspection
- Push-pull mechanism for easy handling
- Mechanical and colour-coding upon request
- Electrical pins 20 AWG
- Available on cable reels up to 500 metres in length





## OUTDOOR, INDUSTRIAL

### revos E-2000

- Rugged IP 65 rated metal enclosure (*Dust tight and spray proof*)
- Integrated caps and shutters  
*Laser eye safety*
- E-2000™ connector with Active Core Alignment  
*Exceptional optical performance*
- Easy lever locking
- Available on cable reel up to 500 meters length



### OPTELCON MEDIA CONVERTER

The DIAMOND optelcon® is a mediaconverter for optoelectronic media designed for flexible use in harsh environments.

- Variable mounting in cabinet walls as thick as 4 mm
- Compact, robust design
- M50 cutout sealed to IP65
- Robust revos E-2000 bulkhead with dust cap and IP65 protection
- Direct optical-electrical connection through the bulkhead
- Plug and play
- CE approved
- RoHS compliant

NEW



### OD3

- Rugged IP 67 rated anodised metal enclosure  
*Dust-tight and waterproof*
- F-3000™ (LC compatible) SFF connector system  
*Exceptional optical performance in a high-density LC standard compliant connector. Integrated caps on the connectors and shutters in the couplers provide both laser eye safety and end face protection during mating/demating*
- Exceptional optical performance
- Available on cable reel up to 500 meters length



### F-3000™ ODVA

- Robust IP 67 rated plastic enclosure
- F-3000™ (LC) PC/APC connector system terminated with Diamond's Active Core Alignment  
*Exceptional optical performance in a high density LC standard compliant connector. Integrated caps on the connectors and shutters in the couplers provide both laser eye safety and end face protection during mating/demating*
- Bayonet-style self-aligning, keyed housing  
*Ease of use in all mating situations*
- Available on cable reel up to 500 meters length



## SOLUTIONS FOR MIL, AVIONICS AND SPACE

### MIL-38999 style Connector

- Based on DM insert
- Size 13 shells (according to MIL std 38999 serie III)
- Low Insertion Loss and high reliability  
Typ. IL 0.2dB
- Easy field termination and repair
- Available on cable reel up to 500 meters length



### X-BEAM Connector

- Available with the new DM insert, or with integrated expanded beam lens system to protect the fiber end-face
- Rugged construction for high reliability
- IP 67 rated enclosure, IEC 60529 compliant
- Hermetic coupling (EN 1779 / DIN EN 13185)
- Low loss connection and high repeatability
- Genderless design to Simplifies mating
- Field repair and termination available with the Diamond *Fusion Crocodile Alberino*
- Available as high power version
- Electric Interlock mechanism upon request
- Mechanical coding
- Available on cable reel up to 500 meters length
- Loopback bulkheads available



Diamond has been supplying the renowned AVIM connector for ruggedized applications for over 20 years. Upon completion of qualification under ECSS specifications for the European Space Agency, the AVIM and Mini-AVIM products will be the first fiber optic connectors qualified for space applications.

**AVIM Connector**

AVIM are multipurpose, Commercial Off-The-Shelf fiber optic connectors offering high optical performance and capable in dynamic environments of mobile platforms, including avionics and especially space flight.

These connectors are compatible with the widest range of optical fibers, including singlemode (SM), multimode (MM), polarization maintaining (PM) and other fibers of different core/cladding sizes.



- Low IL thanks to Active Core Alignment (A.C.A.)
- High return loss thanks to Diamond polishing technique
- High performing polarization extinction ratio (PER), when terminated with PM fibers
- Miniaturized MIL-style ratchet system with high vibration/shock resistance
- Unique AVIM 2-piece cleanable adapter for easy cleaning and maintenance access
- Right angle boot available for facilitating unique installation and routing requirements



**Mini-AVIM Connector**

The Mini-AVIM connector has been developed after market request of a smaller and lighter version of our acclaimed AVIM connector, especially for space applications.

The Mini-AVIM combines two leading edge technologies: the AVIM MIL-style ratchet system and the base construction of Diamond Micro Interface (DMI) connector.

Applications will range from Space to underwater, applying to mobile, avionics, shipboard, oil downhole, etc.



- Compact, small and lightweight
- Low loss thanks to Diamond Active Core Alignment (A.C.A.)
- High return loss thanks to Diamond polishing technique
- High performing polarization extinction ratio (PER), when terminated with PM fibers
- Miniaturized MIL-style ratchet system with high vibration/shock resistance
- All Titanium – ZrO2 material for ultra low CTE mismatch



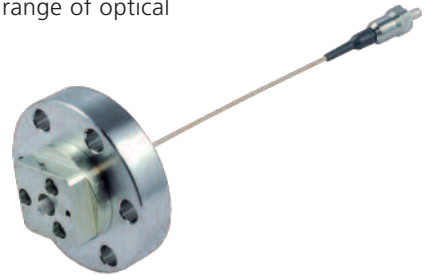
### Vacuum feedthrough

Diamond proposes vacuum feedthrough **V-FT** solutions, for a large range of optical fiber and adapters, using an epoxy sealing technology.

**V-FT** integrates a standard 2.5mm ferrule permanently sealed in a standard CF flange with a variety of adapters.

The obtained feedthrough benefits from a very low leak rate. It can be ordered for many types of fiber, including SM, MM, PM, PS, large core MM and others.

Multi-channels systems are also available using standard CF building block elements.



- Compact, robust, stable
- Low loss due to Diamond Active Core Alignment
- High return loss due to Diamond polishing technique
- Low leakage due to Diamond sealing technology
- Easy installation on a wide range of flanges

### Crocodile Repair Set

Diamond's Crocodile repair set provides a simple way to repair or add cable extensions to existing cable installations.

Its light weight and robust construction permits to use it in harsh environments and under high mechanical stress. It is available for SM and MM service, for secondary coated fiber and fiber cables (1.6mm – 3.1 mm).

Being part of the Crocodile technology, it is the completion of this versatile and modular field installation system which covers indoor, outdoor and harsh environments assemblies.

- Simple, fast and reliable field repair, even in severe conditions
- Integrated, small and robust splice protection and cable boots
- Compact, light weight
- Resistant to high cable tensions



The Crocodile repair set is then field terminated via a low loss fusion splice based on DIAMOND's ZEUS Fusion Field Termination Kit and provides all the tools and instructions required to easily repair existing fiber optic installations.



## FIELD INSTALLATION AND SERVICES

Diamond has developed the Crocodile Alberino fusions technology to allow customers to assemble factory-terminated and measured Splice On Connectors (SOC) on the field for termination and repair purposes.

This can be performed with the Zeus D50 HE fusion splicer from Diamond.

### Features and benefits of the Zeus D50 HE kit

- Complete set of all tools required for whole termination process starting from cable preparation to connector assembly (including cleaver and automatic stripper with heated jaws for tough secondary coating 900 µm)
- Suitable for use with 3-8mm military and outdoor cables
- Special cable clamps on bearing slides for secure, and easy cable handling
- Removable work plate – compatible with stand
- Hard protective case for harsh environments, IP65; 15 Kg
- Total weight: 15 kg



## Launch fibers

Diamond offers two types of launch fiber boxes for outdoor connectors: one for the revos E-2000 and the other for the HE-2000™.

## Cleaning and Inspection

In addition to the termination tools, Diamond offers a high quality cleaning kit and inspection equipment which are easy-to-use, lightweight, robust and field-proven.

### Cleaning Kit with hand microscope

After repeated matings, or when degraded performance is observed, it may become necessary to clean the individual ferrules and mating sleeve.

DIAMOND's Cleaning Kit contains all necessary tools for proper cleaning and inspection procedures to help ensure optimal connector performance.

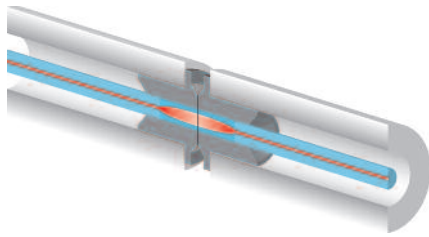


### Video Microscope Kit with cleaning tools

DIAMOND's Video Microscope Kit contains all necessary tools for proper inspection and cleaning of the connector's front-faces to help ensure optimal connector performance. The Microscope offers a zoom feature with up to 400x magnification, integrated endface illumination for inspection of 2.5 mm or 1.25 mm (PC and APC) ferrules, for both, unmated connector, and in-adapter connectors with the inspection probe. The inspection probe can also be used as stand-alone device and be directly connected via USB to laptops or PCs, without the need for an external power supply.

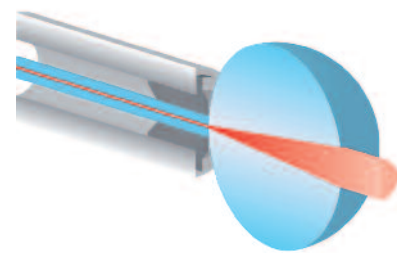


## POWER SOLUTION



### PS collimated (contact)

DIAMOND offers the Power Solution optical interface which expands the MFD of a SM fiber by splicing a GRIN lens at the extremity. The MFD at the end of the connector is thus expanded by a factor of 4 to 5, increasing the contact surface by a factor of about 15. As a result the heat issues decrease but cleanliness of the connectors and mating adapters is still important.



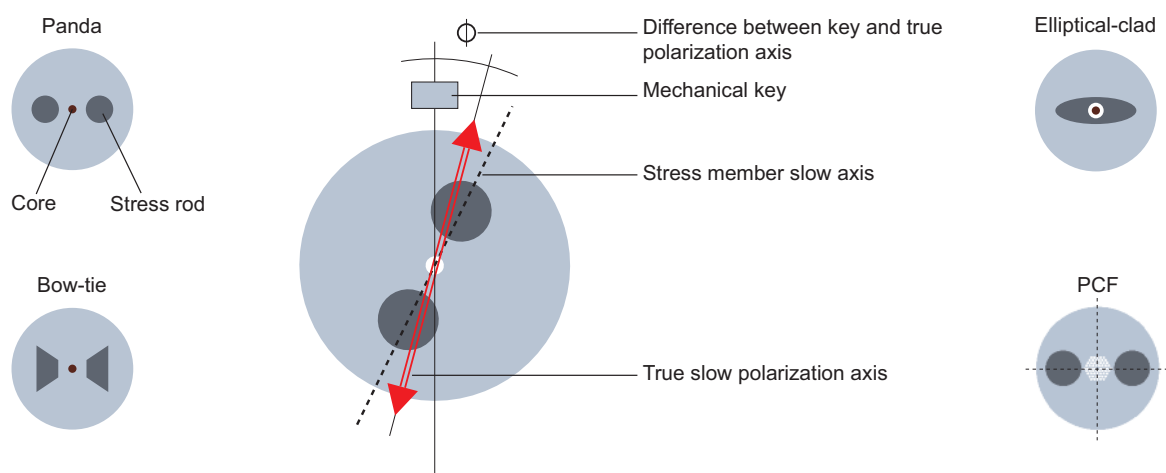
### PSb ball lens (X-BEAM)

A ferrule is placed behind a ball lens which is glued into a housing. This technology expands and collimates the transmission signal and reduces the impact of both misalignment as well as endface contamination.

Depending on the concentricity, the expanded beam exits the lens at a certain angle. To minimize this exit angle, Diamond uses the ACA process.

## POLARIZATION ORIENTATION (PO)

Polarization plays an important role in the industrial photonics market. Sensors and communication systems have been designed using Polarization Maintaining or Polarizing fibers. Special connectors are required for such fibers, because their connection must be made with a certain orientation. Only connectors with an orientation key are capable of properly terminating these fibers.



The connector key for a Polarization Maintaining connector can be aligned to the stress members (Passive Polarization Orientation, PPO) or to the true optical axis (Active Polarization Orientation, APO).

### ADVANTAGES

→ Ultra low Insertion Loss    → High Extinction Ratio    → High Return Loss

## Product overview

Product	Configuration			Performances				Technology				
	Max nr. of channels	DM insert (hybrid)	IP or leakage	IL (dB) SM	RL (dB) SM APC	Operating temperature (°C)	Fusion (Field assembly & repair)	SM/MM	PS	PM	Crimp & Cleave	
HE-2000™	4	✓	67	typ. 0.15 max. 0.45	min. 75	-55° / +85°	✓	✓	✓	✓	-	
MIL-38999 style	4	✓	67	typ. 0.2 max. 0.5	min. 75	-55° / +85°	✓	✓	Upon request	✓	-	
X-BEAM	4	✓	67	typ. 0.9 max. 1.6	typ. 30	-55° / +85°	✓	✓	Upon request	-	-	
revos E-2000	2	-	65	typ. 0.1 max. 0.25	min. 75	-40° / +85°	✓	✓	Upon request	✓	✓	
OD3	2	-	67	typ. 0.2 max. 0.5	min. 80	-55° / +85°	✓	✓	Upon request	✓	-	
F-3000™ ODVA	2	-	67	typ. 0.2 max. 0.4	min. 75	-40° / +85°	✓	✓	Upon request	✓	-	
AVIM	1	-	10 <sup>-4</sup> mbar . l/s	typ. 0.2 max. 0.4	min. 75	-55° / +85°	-	✓	✓	✓	-	
Mini-AVIM	1	-	-	typ. 0.2 max. 0.4	min. 75	-55° / +85°	-	✓	✓	✓	-	
Vacuum feedthrough	1	-	10 <sup>-8</sup> mbar . l/s	typ. 0.3 max. 0.6	min. 75	-40° / +85°	-	✓	✓	✓	-	
Crocodile Repair Set	1	-	-	typ. 0.15	min. 95	-60° / +150°	✓	✓	-	-	-	

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