

Fiber Optics Applications Within Harsh Environments

Interconnect Solutions and Technologies



Typical Applications Within Harsh Environments



Avionics

2

Antenna

1

Space

2

3

Mining

Solar Plants

4

Industries

5

Military /
Defense

9

Transportation

10

Wind Farm

6

Oil & Gas

7

Container Terminal

8

Challenges / Requested Properties For HE Applications



The products must be able to withstand:

- Adverse temperatures and weather conditions
- Shocks, vibrations, tensile stress
- External pressure, corrosive surroundings, etc.
- Dirt and humidity

Polarization Maintaining PM

High Power Technology PS

Field repairable

SM/MM

IP65 – IP68

APC / PC

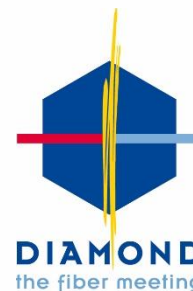
Unparalleled high Return Loss (RL)

Customizable



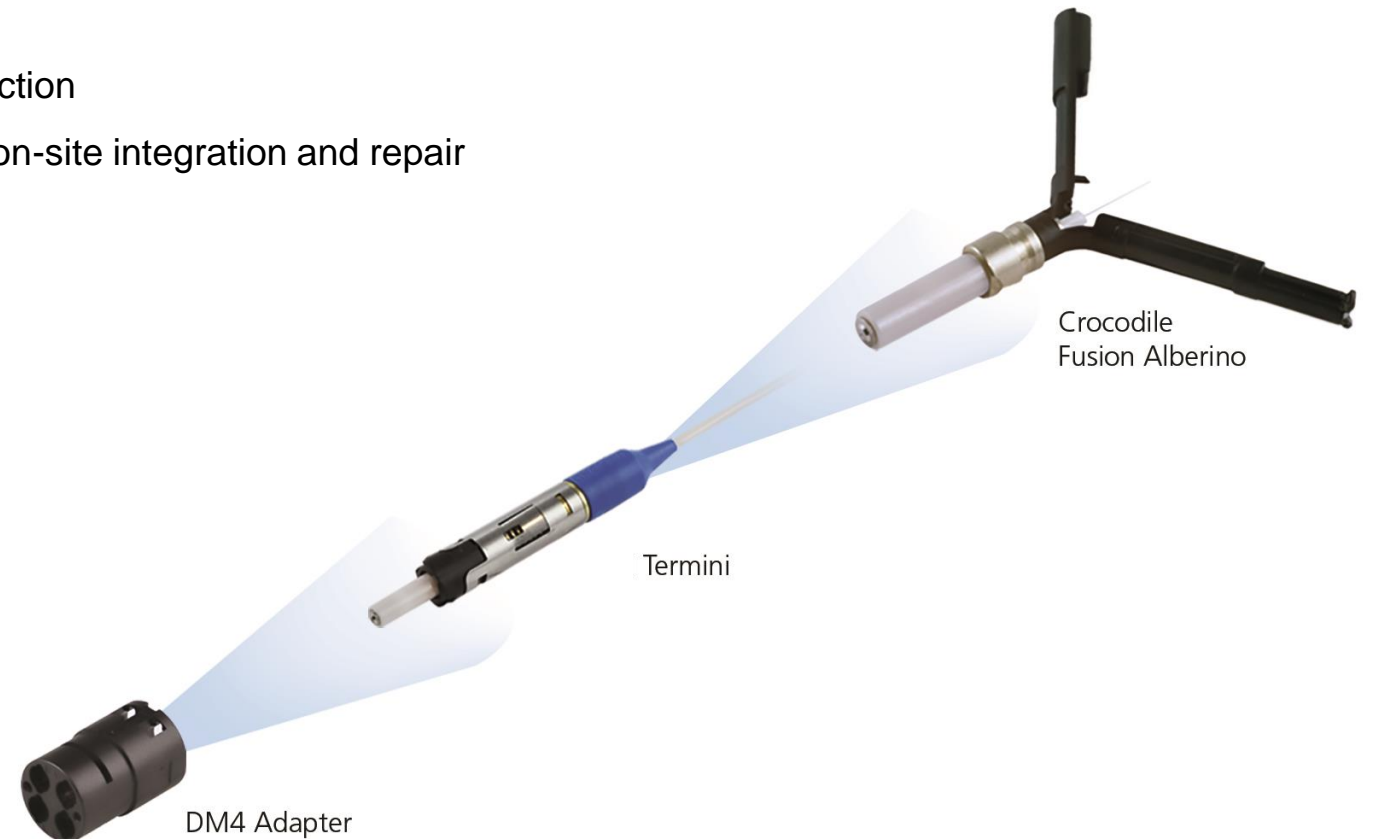
DM4 – Compact & Modular Solution

HE-2000®, MIL-38999 DM4 Family, MIL-83526DM4 Compact DM4



DM4 (Multipurpose Termini) - Main Features

- Based on 2.5-mm Fusion Alberinos with integrated springs to prevent termini separation
- Up to 4 optical and / or electrical channels
- Genderless mating and self-aligning design
- Easy front-face ferrule access for cleaning & inspection
- Simple assembly and disassembly of contacts for on-site integration and repair



Features Of Optical & Electrical DM4 Termini

- Compatible with several fiber types such as HCS, MM, SM, PM, Power Solution and small-core fibers
- Available in PC and APC versions
- Steady and repeatable low Insertion Loss (IL) and high Return Loss (RL)
- High and steady Extinction-Ratio (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 and Diamond ZEUS
- D50 HE fusion splicer
- Titanium ferrule front face
- Electrical pin: 20 AWG
- Lensed ferrule available



Optical And Electrical Specifications

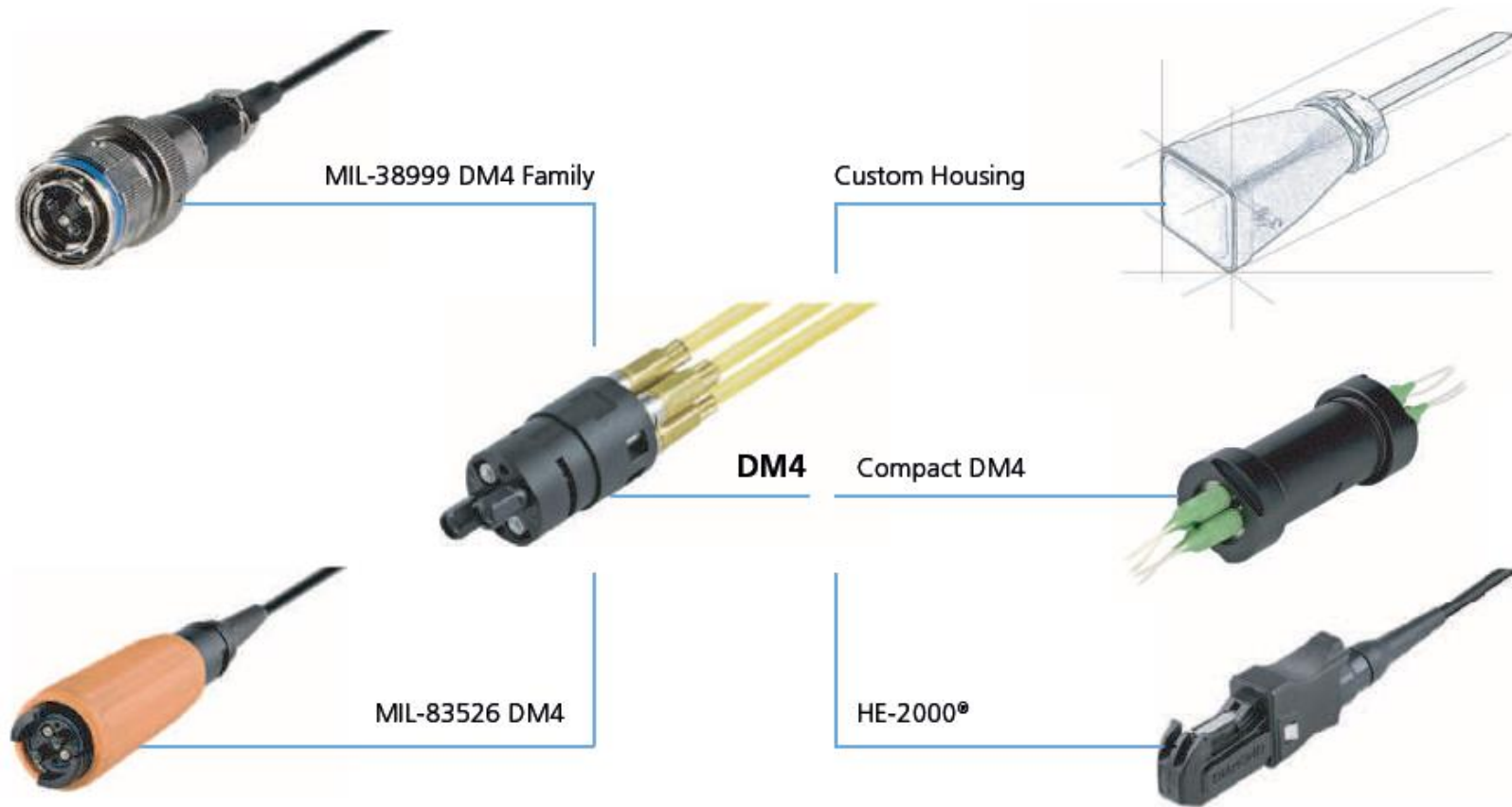
Optical Performances

MEASUREMENT/TEST	MULTIMODE	SINGLE MODE PC/APC	STANDARDS
Insertion loss (std. version)	typ. 0.20 dB max. 0.50 dB	typ. 0.15 dB max. 0.45 dB	IEC 61300-3-4 (λ =1310 / 1550 nm)
Insertion loss (fusion version)	typ. 0.20 dB max. 0.50 dB	typ. 0.25 dB max. 0.45 dB	IEC 61300-3-4 (λ =1310 / 1550 nm)
Insertion loss (PM) version)	-	typ. 0.25 dB max. 0.45 dB	IEC 61300-3-4 (λ =1310 / 1550 nm)
Return loss	min. 40 dB	min. 75 dB (APC) min. 50 (PC)	IEC 61300-3-6 (λ = 1550 nm)
Extinction Ratio	-	typ. 23 dB min. 20 dB	Diamond validated cross polarizers method (λ = 1550 nm)

Electrical Tests

Insulation resistant test	Resistance >200 M Ω	IEC 60512-3-1: 2002 (500V / 60 s)
Voltage Proof test	PASS	IEC 60512-4-1: 2003 (2500V / 60 s / 50 Hz)

DM4 (Multipurpose Termini) Modularity





2.5mm ferrule



Hybrid optical
and electrical
option



1.7mm XB lensed-ferrule

Add
up to 4 functions *

- ▶ Singlemode (SM)
- ▶ Multimode (MM)
- ▶ Power Solution (PS)
- ▶ Polarization Maintaining (PM)
- ▶ PM/PS

Add
polishing *

- ▶ PC
- ▶ APC 8
- ▶ APC 4

- ▶ 20 AWG
- ▶ Interlock (2 ch)

- ▶ Expanded Beam
Singlemode

DM4



Choose
housing

HE-2000™



MIL-38999 DM4 Family



MIL-83526 DM4



Custom Housing

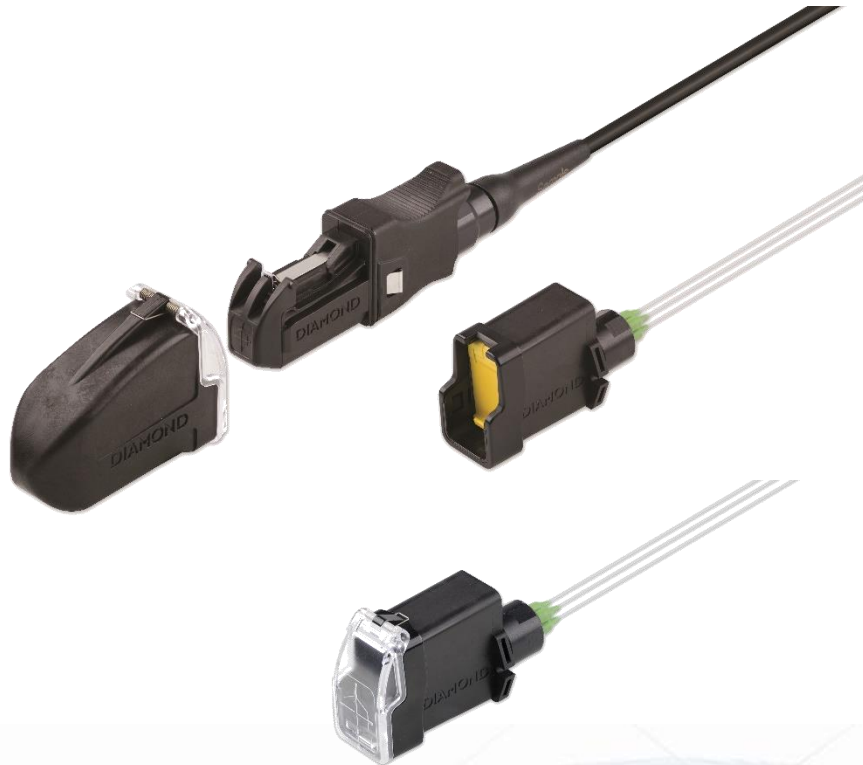


Compact DM4



* Standard add-ons, custom configurations available upon request.

HE-2000® - Main Features



- Automatic protection shutter on connector IP 65
- Bulkhead IP67 (manual shutter) or IP54 (automatic shutter)
- Harsh-environment plastic shell, made from nylon with 25% fiber-glass reinforcement
- Easy front-face ferrule access for cleaning & inspection
- Push-pull mechanism for easy handling

PUSH-PULL PROTECTIVE CAP



LENSED



IP 67

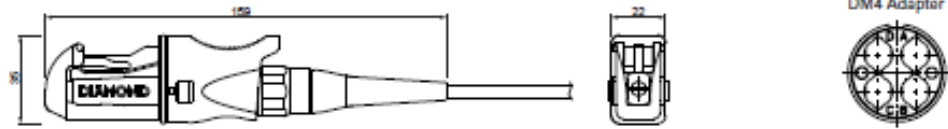


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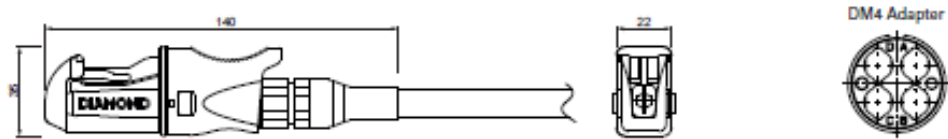


HE-2000® Connector Configuration

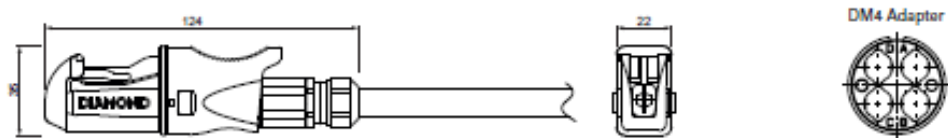
Type C/1 Connector with mini-break cable (ø 5.0 mm or ø 5.5 mm)



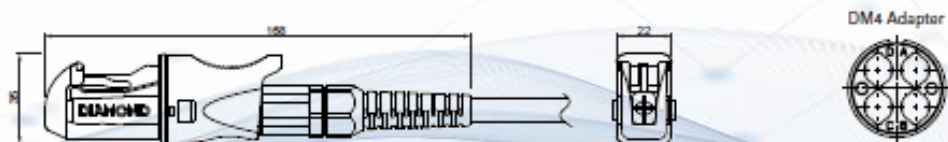
Type C/2 Connector with protection tube for fiber 900µm max.



Type C/3 Connector with fan-out cable (ø 8200µm)

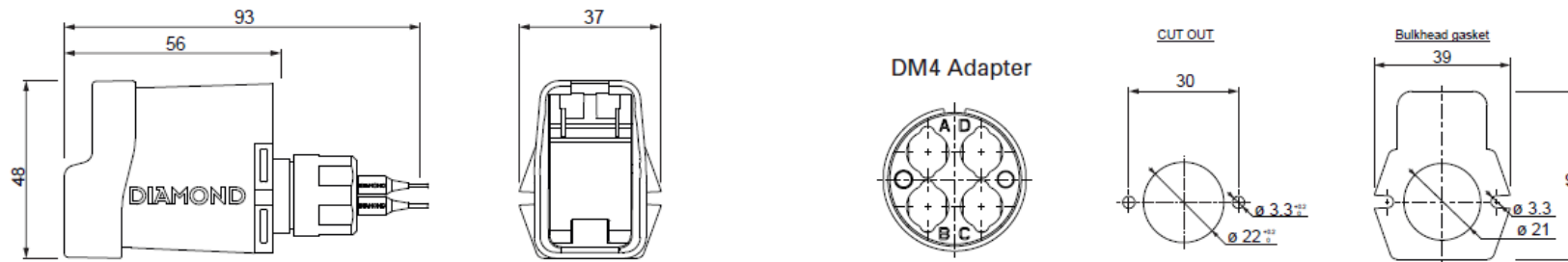


Type C/4 Connector with break-out cable (ø 6500µm - 7700µm)

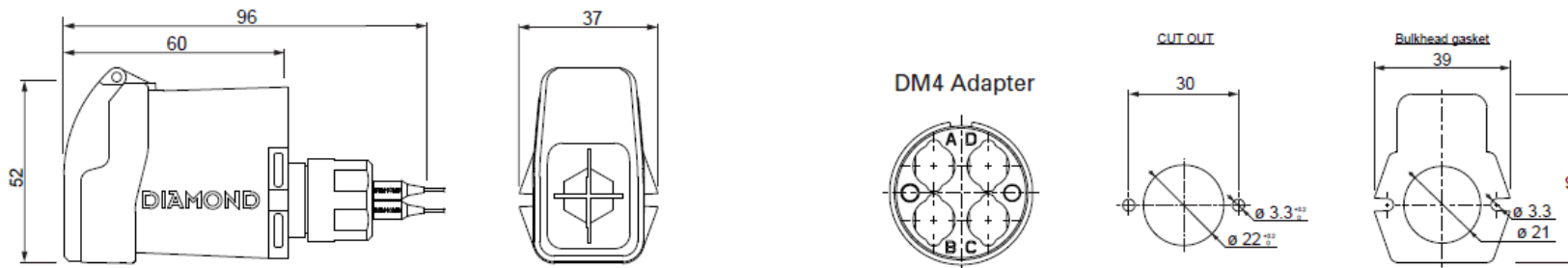


HE-2000® Bulkhead Configuration

Type B/1 Bulkhead IP 67 for simplex cable (ø 1.6 - 3.0 mm) or fiber 900µm max.



Type B/2 Bulkhead IP 54 for simplex cable (ø 1.6 - 3.0 mm) or fiber 900µm max.



Mechanical Specifications

Change of temperature	-55 / + 85 °C	IEC 61300-2-22 (λ =1310 / 1550 nm)
Low temperature	-55 °C (96h)	MIL-STD-810G (λ =1310 / 1550 nm)
High temperature	+85 °C (96h)	MIL-STD-810G (λ =1310 / 1550 nm)
Humidity	95% r.h. / 10 cycles	MIL-STD-810G (λ =1310 / 1550 nm)
Temperature shock	-55 / + 85 °C	MIL-STD-810G (λ =1310 / 1550 nm)
Low pressure / altitude	110 mbar /15240 m	MIL-STD-810G (λ =1310 / 1550 nm)
Vibration	10/2000 Hz (3h)	MIL-STD-202G (λ =1310 / 1550 nm)
Mating durability	500 cycles	IEC 61300-2-2 (λ =1310 / 1550 nm)
Cable torsion	+/-180° / 25 cycles	IEC 61300-2-5 (λ =1310 / 1550 nm)
Flexing of strain relief	+/-90° / 25 cycles	IEC 61300-2-44 (λ =1310 / 1550 nm)
Static side load	2N/90° (5min.)	IEC 61300-2-42 (λ =1310 / 1550 nm)
Cable retention on connector side	800N on multi-fiber cable	IEC 61300-2-4 (λ =1310 / 1550 nm)
Cable retention on bulkhead side	70N on simplex cable	IEC 61300-2-4 (λ =1310 / 1550 nm)
Fibre retention	5N	IEC 61300-2-4 (λ =1310 / 1550 nm)
Shock	1.2m / 26 drops	MIL-STD-810G (λ =1310 / 1550 nm)

MIL-38999 DM4 Size 13 - Main Features



- Compatible with tight cable construction, semi loose cable/fibre construction
- IP67 rated enclosures (connector and bulkhead)
- Easy front-face ferrule access for cleaning & inspection

LENSED



HYBRID

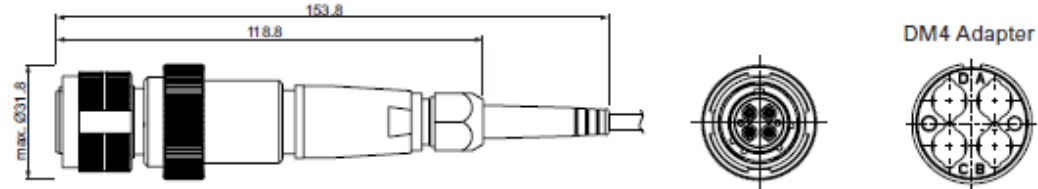


IP 67

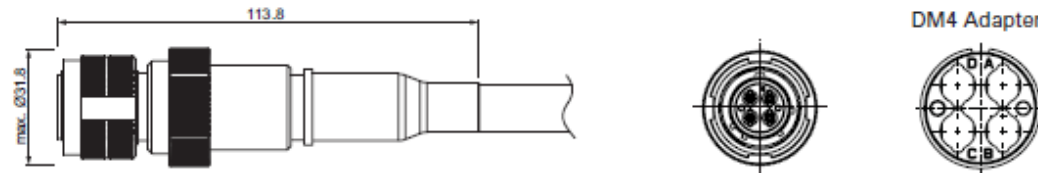


MIL-38999 DM4 Size 13 Connector Configuration

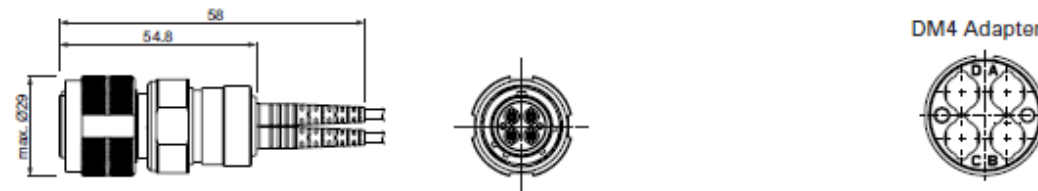
Type C13/1 Connector with mini-break cable (5mm or 5.5mm)



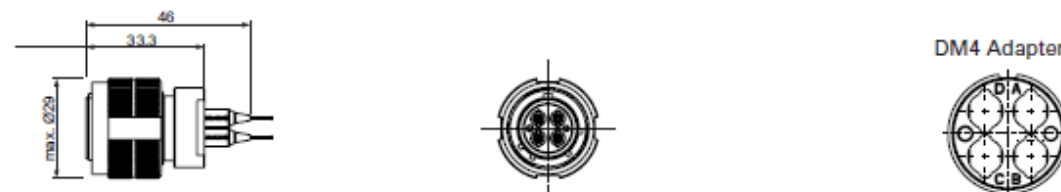
Type C13/2 Connector with protection tube for fiber 900um max.



Type C13/3 Connector for simplex cable version (1.6 - 2mm, 2.5 - 3mm) with IP protection

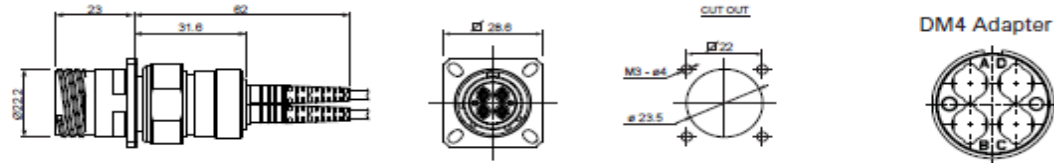


Type C13/4 Connector for simplex cable (1.6-3mm) or fiber 900um max. without IP protection

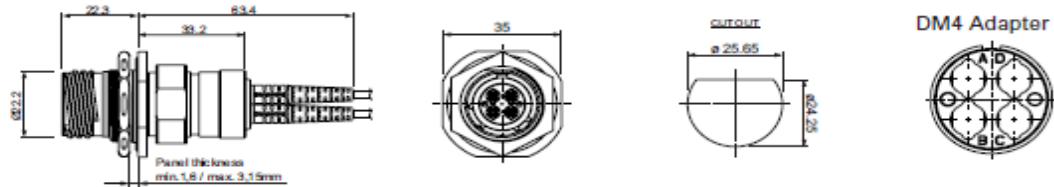


MIL-38999 DM4 Size 13 Bulkhead Configuration

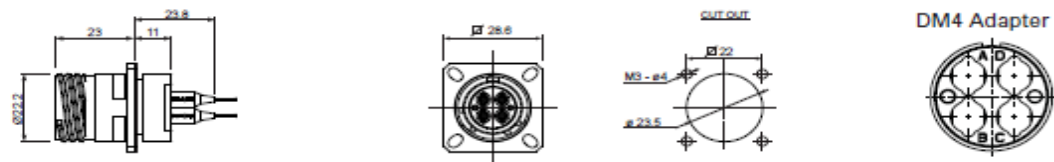
Type B13/1S Bulkhead for simplex cable (1.6 - 2mm, 2.5 - 3mm) with IP protection



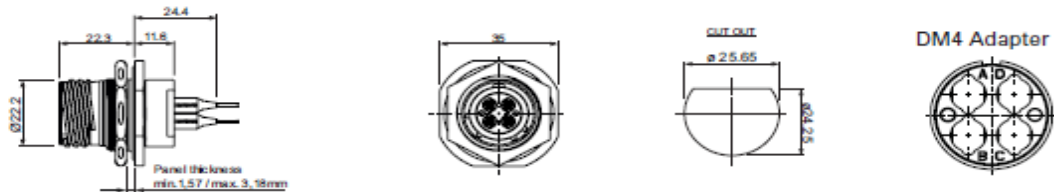
Type B13/1R Bulkhead for simplex cable (1.6 - 2mm, 2.5 - 3mm) with IP protection



Type B13/2S Bulkhead for simplex cable (1.6 - 3mm) or fiber 900um max. without IP protection



Type B13/2R Bulkhead for simplex cable (1.6 - 3mm) or fiber 900um max. without IP protection



MIL-38999 DM4 Size 25 - Main Features



- All features of the DM4 (3 x DM4) 12 channel
- Compatible with tight cable construction, semi loose cable / fiber construction
- IP67 rated enclosures (connector and bulkhead)
- Easy front-face ferrule access for cleaning and inspection

LENSED



HYBRID

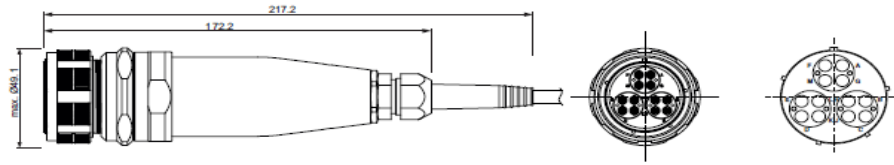


IP67

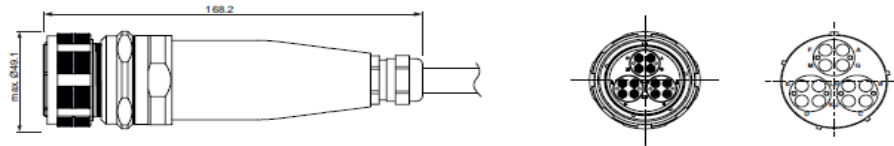


MIL-38999 DM4 Size 25 Configurations

Type C25/1 Connector with mini-break cable (6mm - 8.8mm)



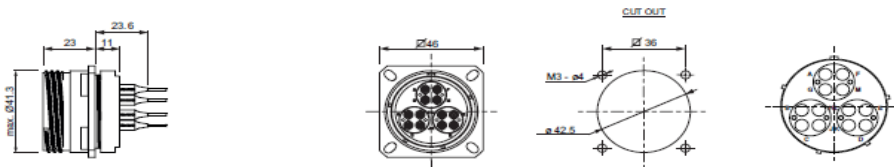
Type C25/2 Connector with protection tube for fiber 900um max.



Type C25/3 Connector for simplex cable version (1.6 - 3mm) or fiber 900um max. without IP protection



Type B25/1S Bulkhead for simplex cable (1.6 - 3mm) or fiber 900um max. without IP protection



Mechanical Specifications

Change of temperature	-55 / + 85 °C	IEC 61300-2-22 (λ =1310 / 1550 nm)
Low temperature	-55 °C (96h)	MIL-STD-810G (λ =1310 / 1550 nm)
High temperature	+85 °C (96h)	MIL-STD-810G (λ =1310 / 1550 nm)
Humidity	95% r.h. / 10 cycles	MIL-STD-810G (λ =1310 / 1550 nm)
Temperature shock	-55 / + 85 °C	MIL-STD-810G (λ =1310 / 1550 nm)
Low pressure / altitude	110 mbar /15240 m	MIL-STD-810G (λ =1310 / 1550 nm)
Vibration	10/2000 Hz (3h)	MIL-STD-202G (λ =1310 / 1550 nm)
Mating durability	500 cycles	IEC 61300-2-2 (λ =1310 / 1550 nm)
Cable torsion	+/-180° / 25 cycles	IEC 61300-2-5 (λ =1310 / 1550 nm)
Flexing of strain relief	+/-90° / 25 cycles	IEC 61300-2-44 (λ =1310 / 1550 nm)
Static side load	2N/90° (5min.)	IEC 61300-2-42 (λ =1310 / 1550 nm)
Cable retention on connector side	800N on multi-fiber cable	IEC 61300-2-4 (λ =1310 / 1550 nm)
Cable retention on bulkhead side	70N on simplex cable	IEC 61300-2-4 (λ =1310 / 1550 nm)
Fibre retention	5N	IEC 61300-2-4 (λ =1310 / 1550 nm)
Shock	1.2m / 26 drops	MIL-STD-810G (λ =1310 / 1550 nm)

MIL-83526 DM4 - Main Features

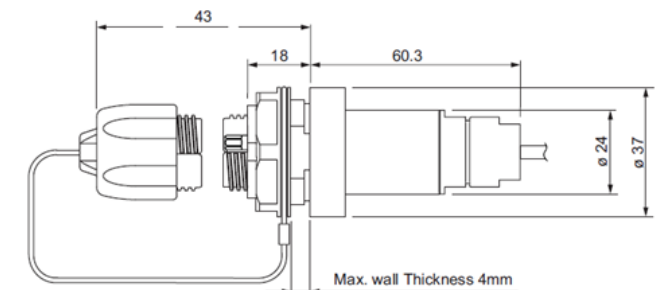
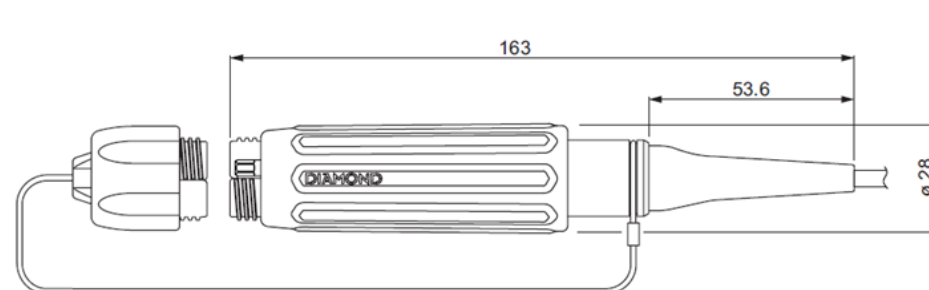


- Rugged construction for highly reliable optical connections
- IP class IP68
- Easy ferrule front-face access for cleaning and inspection
- Keyed, self aligning, connector housing aides in “blind mating” applications
- Shell aluminum and hard eloxate, rubber handle
- Easy termini insertion and removal for field termination and repair

LENSED

IP68

HYBRID



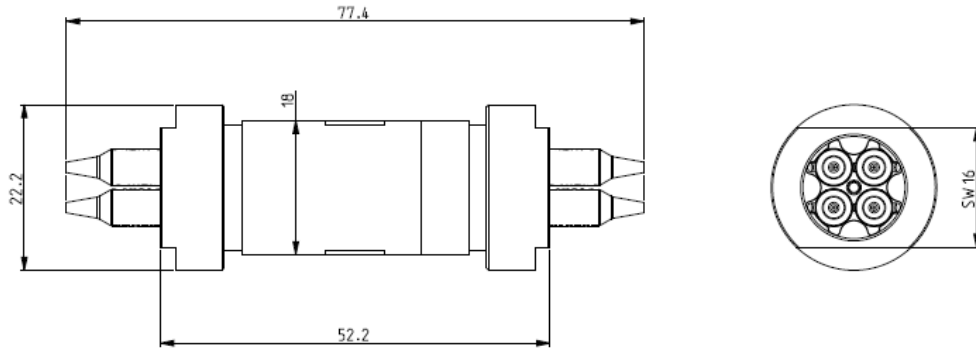
Mechanical specifications

Mechanical and environmental conditions

Change of temperature	-55 / + 85 °C	IEC 61300-2-22 (λ =1310 / 1550 nm)
Low temperature	-55 °C (96h)	MIL-STD-810G (λ =1310 / 1550 nm)
High temperature	+85 °C (96h)	MIL-STD-810G (λ =1310 / 1550 nm)
Humidity	95% r.h. / 10 cycles	MIL-STD-810G (λ =1310 / 1550 nm)
Temperature shock	-55 / + 85 °C	MIL-STD-810G (λ =1310 / 1550 nm)
Low pressure / altitude	110 mbar /15240 m	MIL-STD-810G (λ =1310 / 1550 nm)
Vibration	10/2000 Hz (3h)	MIL-STD-202G (λ =1310 / 1550 nm)
Mating durability	500 cycles	IEC 61300-2-2 (λ =1310 / 1550 nm)
Cable torsion	+/-180° / 25 cycles	IEC 61300-2-5 (λ =1310 / 1550 nm)
Flexing of strain relief	+/-90° / 25 cycles	IEC 61300-2-44 (λ =1310 / 1550 nm)
Cable retention on connector side	600N on multi-fiber cable	IEC 61300-2-4 (λ =1310 / 1550 nm)
Shock	1.2m / 26 drops	MIL-STD-810G (λ =1310 / 1550 nm)
Tensile strength of coupling mechanism	200 N	IEC 61300-2-6 (λ =1310 / 1550 nm)

Compact DM4 - Main Features

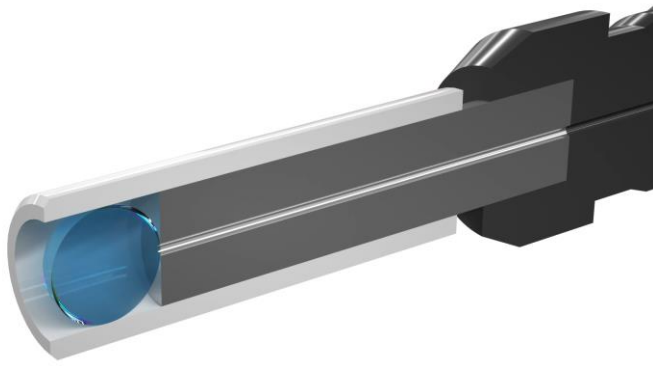
- Easy ferrule front-face access for cleaning & inspection
- Aluminum shell and hard eloxate
- Easy termini insertion and removal for field termination and repair
- No IP protection



Mechanical specifications

Mechanical and environmental conditions

Change of temperature	-40 / + 85 °C	IEC 61300-2-22 (λ =1310 / 1550 nm)
Low temperature	-40 °C (96h)	IEC 61300-2-17 (λ =1310 / 1550 nm)
High temperature	+85 °C (96h)	IEC 61300-2-18 (λ =1310 / 1550 nm)
Vibration	10/2000 Hz (3h)	MIL-STD-202G (λ =1310 / 1550 nm)
Mating durability	500 cycles	IEC 61300-2-2 (λ =1310 / 1550 nm)



Expanded Beam Interconnects

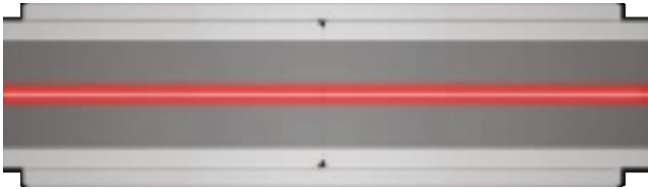
Robust. Versatile. Easy-To-Use.



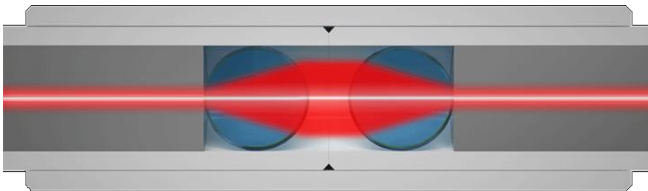
Expanded Beam Technology



Butt-joint connection

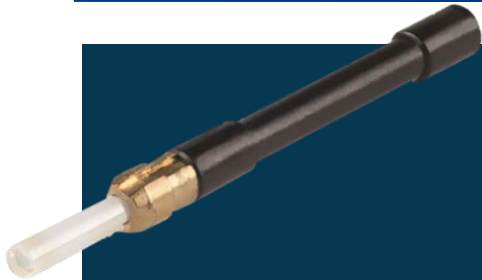


Expanded Beam connection



- Non-contact connection
- State-of-the-art optical performance
- High rate of mating cycles
- Insensitive to dirt and debris
- Low risk of damage
- High data rate capacity
- Easy cleaning process
- 150 x larger beam area

A Modular Approach : «Lens» Your Connection



XB LENSED-FERRULE

E-2000® XB

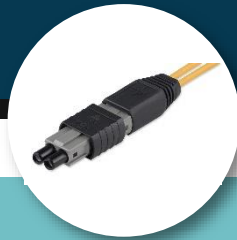
Channels: 1



New applications, Power Solution, fiber sensors, RFoF

XB2

Channels: 2



Avionics, lidars, new applications, Power over fiber, fiber sensors, RFoF

DM4 XB Size 13

Channels: 4



Avionics, Military tactical, outside broadcast, petrochemical plant, mining, offshore systems, RFoF, Fiber sensors, Power over Fiber

DM4 XB Size 25

Channels: 12



Military tactical, outside broadcast, petrochemical plant, mining, offshore systems, RFoF, fiber optic sensors, Power over fiber

revos E-2000®



Robust IP65-rated enclosure

- Dust-tight and protects against water jets

Integrated caps and shutters for Laser eye safety

E-2000® connector with Active Core Alignment

- Exceptional optical performance

Easy lever locking

Available for MM, SM (PC/APC), PM and small core fibers

Available as terminated connector or fusion set for field assembly

SPECIFICATIONS

	MULTIMODE 0° PC	SINGLE MODE 0° PC	SINGLE MODE 8° APC	UNITS	TEST CONDITIONS
Insertion Loss (IL) Standard	typ. 0.1 max 0.25	typ. 0.1 max. 0.25	typ. 0.1 max. 0.25	dB	IEC 61300-3-4; $\lambda = 1300/1550\text{nm}$
Insertion Loss (IL) Fusion	typ. 0.25 max 0.5	typ. 0.25 max 0.5	typ. 0.25 max 0.5	dB	IEC 61300-3-4; $\lambda = 1300/1550\text{nm}$
Return Loss (RL)	typ. 40	min. 50	min. 75*	dB	IEC 61300-3-6; $\lambda = 1300/1550\text{nm}$
Repeatability of IL	max. ± 0.1			dB	Over service life
Service life	500 mate/demate cycles				
Operating temperature	-40/+85**			°C	

* Measured with high precision reflectometer

** May be further limited by cable specifications



