Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

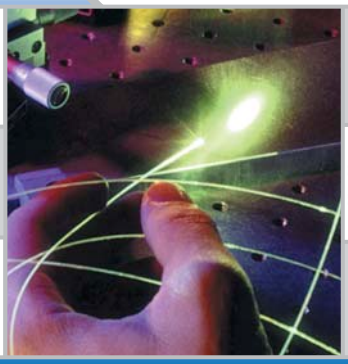
Contact us

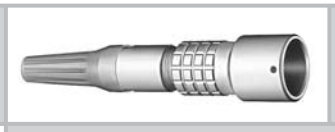
Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

LEMO's Fiber Optic Connectors

Single-mode, Multi-mode, and

Hybrid Fiber Optic Applications





2003

Expect Success. Spec LEMO®.

A Global Leader

Since its beginning in Switzerland in 1946, LEMO® has evolved into a worldwide leader in the design and manufacture of circular connectors, with products sold in more than 80 countries.

Today, LEMO offers a product line for almost any application, from medical equipment to test and measurement instrumentation.

LEMO Means "Quality"

The name LEMO has become synonymous with quality and customer service in the connector industry, setting standards that others strive to meet. Our connectors are designed in an ISO 9001 business environment, ensuring the highest quality products for our customers.

LEMO – We Deliver Reliability

Ask for LEMO connectors for any application where quality, safety and ruggedness are essential; where reliability is critical or where connectors are frequently engaged and disengaged, even in the toughest environments.

LEMO Connectors offer a unique combination of benefits:

Original QUICK-LOK™ push-pull, self-latching system saves space and time while ensuring durable connections.

Precision construction from machined brass, stainless steel or aluminum ensures safety and uniform mating.

Gold plated contacts assure excellent electrical performance.

Collet-type strain relief securely grips circumference of any round cable, protecting connection even under extreme stress.

Bend relief option offers additional cable protection, including color-coding for easy identification.

Custom Design

If we don't have it, we'll build it. Although we offer the most extensive product line in the industry, we understand that some application needs are unique. If we don't have exactly what you need, LEMO will design and build a connector that's just right for your application.

Cable Assembly

Expand the quality of the connector to the cable assembly with our one-stop shop value-added service. LEMO's skilled technicians build and test assemblies to your specifications.

Customer Support

Customer Support when you need it. Only LEMO offers extended customer service hours so you get technical support when you need it. LEMO's Customer Support Team includes in-house Product Specialists, plus a nationwide network of sales representatives and distributors.

LEMO®

Table of Contents

General Information

LEMO's Product Line 3
Characteristics of Primary Series 3
LEMO's Line of Series by Types 4
LEMO's Line of Fiber Optic Series 5
QUICK-LOK™ Push-Pull Self-Locking System 6

General Characteristics

Outer Shell, Technical Characteristics 7
Electrical Characteristics 8
Insulator, Technical Characteristics 9
Electrical Contact 10

00 Series Connectors

Introduction 17
Interconnections 18
Part Section Showing Internal Components 19
Part Number Example 20
Models 21
Fiber Types 22

0B Series Connectors

Introduction 25
Interconnections 26
Part Section Showing Internal Components 27
Part Number Example 28
Models 29
Fiber Types 30

0K Series Connectors

Introduction 33
Interconnections 34
Part Section Showing Internal Components 35
Part Number Example 36
Models 37
Fiber Types 37

2B to 5B Series Connectors

Introduction 39
Interconnections 40
Part Section Showing Internal Components 41
Part Number Example 42
Models 43
Types 56

2K to 5K Series Connectors

Introduction 39
Interconnections 49
Part Section Showing Internal Components 50
Part Number Example 51
Models 52
Types 56

3K.93C Series Connectors

Introduction 63
Interconnections 64
Part Section Showing Internal Components 65
Part Number Example 66
Models 67
Types 70

F1 Fiber Optic Contacts

Introduction 76
Part Section Showing Internal Components 76
Part Number Example 76
Models 77
Fiber Types 77

F2 Fiber Optic Contacts

Introduction 78
Part Section Showing Internal Components 78
Part Number Example 79
Models 79
Types 79

Insertion and Extraction of Fiber Optic contacts . . .81

Accessories

Insulators for Crimp Contacts 84
Crimp Contacts 85
Caps 86
Bend Relief 91
Washers and Nuts 93

Tooling

Wrenches and Assembly Tools 97
Crimping Tools for Crimp Contacts 100

Tooling for type C Coax contacts 102
Fiber Optic Tooling 103
Cable Fixing 107

Preferred Fiber Optic cable types 110
Technical Tables and Conversion 111
Terms and Conditions 113
Product Safety Notice 115
Forms 116

LEMO's Product Line

● Connectors, accessories and tools found in this catalog.

Connectors

Single contact from 2 to 150 Amps
Coaxial 50 and 75 Ω
Coaxial 50 Ω (NIM-CAMAC)
Coaxial 50 Ω for frequency → 12 GHz
Multicoaxial 50 and 75 Ω
Multicontact from 2 to 66 contacts
High Voltage 3, 5, 8, 10, 15, 30 and 50 kV cc
Multi High Voltage 3, 5, and 10 kV cc
Triaxial 50 and 75 Ω
Quadrax
Mixed: High Voltage (HV) + Low Voltage (LV)
Mixed: Coax + LV
Mixed: Triax + LV
Thermocouple
Multithermocouple
● Fiber optic singlemode
● Fiber optic multimode
● Mixed: fiber optic + LV
● Mixed: fiber optic + coax + LV
Fiber optic singlemode OPTABALL®
Fluidic
Multifluidic
Mixed: fluidic + LV
Subminiature
Miniature
Plastic
Printed circuit board
Remote handling
Watertight
Sealed (pressure and/or vacuum)
● With plastic outer shell
● With aluminum outer shell
● With stainless steel outer shell
With special radiation resistant insulator material
With screw thread coupling for very high pressure
With microswitch

Patch Panels

For audio-mono applications: triax
For audio-mono applications: 3 contacts
For audio-stereo applications: quadrax
For audio-stereo applications: 6 contacts
For video applications: coax 75 Ω

Patch Panels

For video HDTV applications: 3 coax 75 Ω + 2LV
For fiber optic applications

Adaptors

For BNC, C, UHF, N, CINCH, GEN-RADIO connectors
For TNC, SMA connectors

Accessories

● Insulator for crimp contacts
● Crimp contacts
● Coaxial contacts
Triaxial contacts
● Fiber optic contacts
● Fiber optic ferrules
● Caps and bend relief
● Heatshrink boot
● Insulating washers
● Double plastic panel washers
● Locking washers
● Tapered washers
● Hexagonal nuts
● Conical nuts
● Round nuts
● Notched nuts
● Grounding washers
Lead-through with cable collet

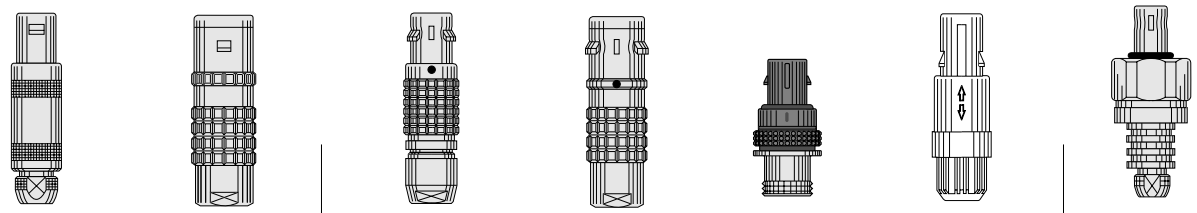
Tooling

● Wrenches
● Wrenches for assembling plug
● Assembly tool
● Pliers
● Tap
● Crimping tools
● Positioners
● Crimping dies
● Banding Tool
● Extractors
● Insertion testing tool for crimp contacts
● Fiber optic termination workstation
● Fiber optic polishing tools

On request

Filtered connectors
● Connectors with special alloy housing
Mixed special connectors
● Assembly onto cable

Characteristics of Primary Series



Series	STANDARD	WATERTIGHT	KEYED	KEYED WATERTIGHT		PLASTIC	SCREW
	01 (Minax)	0E to 6E	00 (multicontact)	0K to 5K	0F to 5F	REDEL® 1P	03
	00 (NIM-CAMAC)	3T	0B to 5B	2N to 5N		REDEL® 2P	0V to 5V
	00 (single contact)	4M	2G/5G			REDEL® 3P	0W to 5W
	05 / R0	REDEL® F					2U to 5U
	0S to 6S						
	0A / 4A						
	1D / 2C						
	1Y-3Y-6Y						
Latching	Push-Pull						Screw
Key	Stepped insert (Half-Moon)		Key (G) or other key-way code		Key (G) or other key-way code	Key (G) or other key-way code	Key (G) or stepped insert (Half-Moon)
Shell	Metal or plastic	Metal	Metal or plastic	Metal	Metal	Plastic	Metal
Insert	Hermaphroditic or cylindrical		Cylindrical				Hermaphroditic or cylindrical
Contact	Solder or printed circuit		Solder, crimp or printed circuit				Solder (crimp or PC)

• LEMO's Line of Series by Types

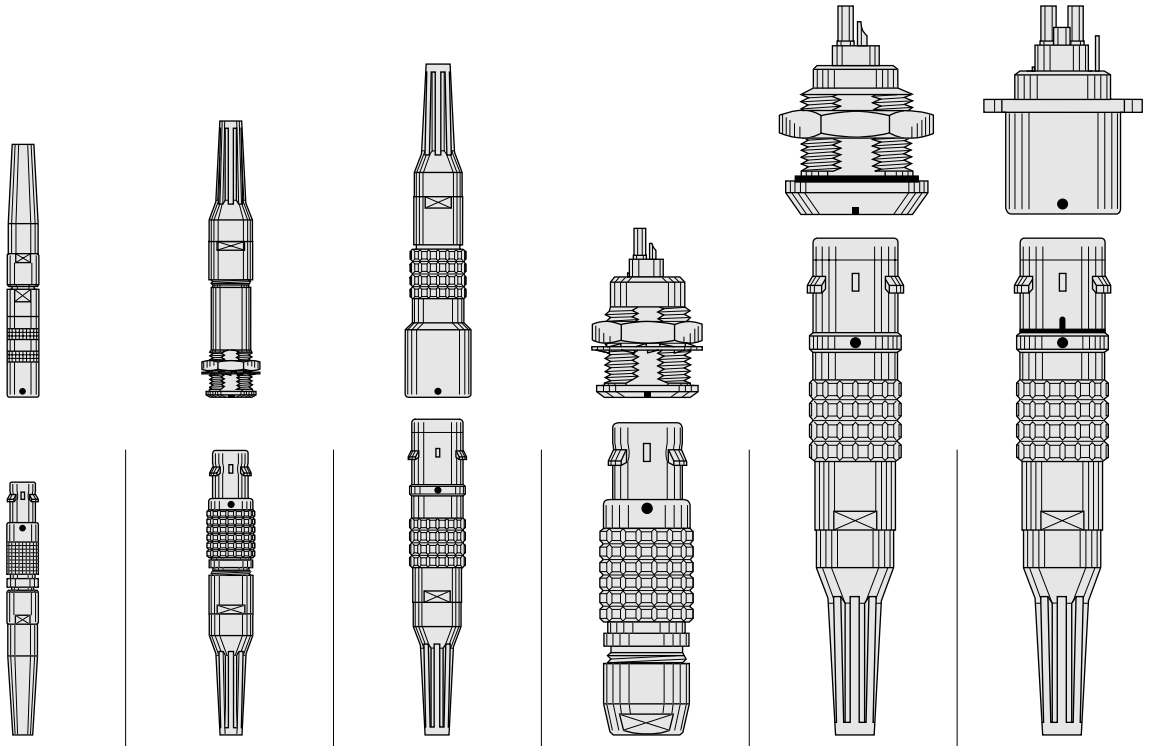
Note:

■ = included in this catalog
● = available but not included in this catalog.

	Series	Types																			
		Single contact	Coaxial 50 Ω	Coaxial 75 Ω	Multicontact	High Voltage	Triaxial 50 Ω	Triaxial 75 Ω	Quadrax	Multi HV	Multi Coaxial	Mixed HV+LV	Mixed Coax+LV	Mixed Triax+LV	Fiber Optic	Multi FO	Mixed FO+LV	Fluidic	Multi fluidic	Mixed fluidic+LV	Thermocouple
Hermaphroditic Keying	01		●																		
	00	●	●				●											●			
	05					●															
	R0		●																		
	0A		●	●																	
	0S	●	●		●	●	●														●
	1S	●	●	●	●	●	●														●
	2S	●	●	●	●	●	●	●				●									●
	3S	●	●	●	●	●	●	●		●		●	●								
	4S	●	●	●	●	●	●	●		●	●	●	●								
	5S	●	●	●	●					●	●	●	●								
	6S				●						●		●								
	1D								●												
	2C		●		●																
	4A							●													
	1Y-3Y-6Y					●															
Hermaphroditic Keying — Watertight	0E	●	●		●	●	●														●
	1E	●	●	●	●	●	●														●
	2E	●	●	●	●	●	●	●				●									●
	3E	●	●	●	●	●	●	●		●		●	●								
	4E	●	●	●	●		●	●				●	●								
	5E	●			●					●	●	●	●								
	6E				●						●		●								
	3T			●				●													
	4M						●	●													
Mechanical Keying	00				●										■						
	0B				●										■			●			●
	1B				●							●									●
	2B				●					●	●	●	●	●			■			●	●
	3B				●						●	●	●	●		■	■		●	●	
	4B				●					●	●	●	●	●		■	■		●	●	
	5B				●					●	●	●	●	●		■	■				
	2G				●																
	5G									●											
Mechanical Keying — Watertight	0K				●										■			●			●
	1K				●							●									●
	2K				●						●	●	●	●			■			●	●
	3K			●	●						●	●	●	●		■	■		●	●	
	4K				●					●	●	●	●	●		■	■		●	●	
	5K				●					●	●	●	●	●		■	■				
	0F to 5F				●																
	3N to 5N				●																
Plastic	1P to 3P				●								●	●				●			
Screw	03		●		●																
	0V	●	●		●		●													●	
	1V	●	●	●	●		●													●	
	2V	●	●	●	●		●	●				●								●	
	3V	●	●	●	●		●	●		●		●	●								
	4V	●	●	●	●		●	●				●	●								
	5V	●			●					●	●	●	●								
	0W to 5W				●						●	●	●	●			●			●	●
	2U to 5U				●										●	●	●				

Fiber Optic Connectors Product Line

The product line is divided into 12 series of connectors. Their main characteristics and applications are shown below.



Series	00	0B	0K	2B to 5B	2K to 5K	3K.93C
Latching	Self-latching Quick-Lok™					With «W» key-way
Shell	Metal			Metal or plastic	Metal	
Feature	Miniature		Watertight to IP68		Watertight to IP68	Watertight to IP68
Cable Construction	Single fiber			Multi fiber or Mixed optical/electrical		Mixed HDTV optical/electrical
Contact Type	**F4**	**F3**	**F2**	**F1**	**F2**	**F2**
Fiber Type	Single-mode or Multi-mode fibers ≤ 100/140µm	Multi-mode fibers ≥ 100/140µm	Single-mode or Multi-mode fibers ≤ 100/140µm	Multi-mode fibers ≥ 100/140µm	Single-mode or Multi-mode fibers ≤ 100/140µm	Single-mode or Multi-mode fibers ≤ 100/140µm
Mean insertion loss	0.10 dB (s/m) 0.25 dB (m/m)	1.13 dB	0.10 dB (s/m) 0.25 dB (m/m)	1.13 dB	0.10 dB (s/m) 0.25 dB (m/m)	0.10 dB (s/m) 0.25 dB (m/m)
Ferrule Material	Ceramic	Ceramic or metal	Ceramic	Ceramic or metal	Ceramic	Ceramic
Interface Type	Spherical with physical contact of the fiber end face (PC)	Spherical, non-contact with controlled gap of the fiber end face	Spherical with physical contact of the fiber end face (PC)	Spherical, non-contact with controlled gap of the fiber end face	Spherical with physical contact of the fiber end face (PC)	Spherical with physical contact of the fiber end face (PC)
Page	17 to 24	25 to 32	33 to 38	39 to 48	49 to 62	63 to 75

General Characteristics

Materials and Surface Treatment

Outer Shell

Brass

In most cases, LEMO connectors have a brass outer shell which is suitable for most general purpose applications, including civilian and military. The brass outer shells have a chrome nickel-plated surface which ensures very good protection against industrial atmosphere, salt air and most corrosive agents.

Alternative protective coatings are available to satisfy other specific environmental conditions:
– electrolytic nickel
– nickel-black chrome. After the black chrome treatment, the part is coated with a protective organic film.

Stainless steel

For applications where there are severe environmental conditions that may rapidly damage the surface finish, we recommend using stainless steel. The AISI 303 stainless steel is a material for general use adapted to most applications requiring a product made entirely of stainless metal.

For the broadcasting industry the heavy duty line with shell in stainless steel offers more resistance to heavy wear conditions.

Aluminum alloy

The aluminum alloy outer shells find numerous applications where light weight is a predominant factor, such as in the aeronautics and space industries, and for portable and mobile equipment.

These materials have high mechanical strength and excellent resistance to corrosion.

The shell surface is protected by anodizing which is available in six colors: blue, yellow, black, red, green, and natural.

Depending on the application, other surface finish is also available (electrolytic nickel-plating, black nickel plating).

Plastic materials

Some connector model shells of the 2B-4B series can be made of plastic. This solution offers optimum electrical insulating properties particularly suitable for medical applications. Grey or white polysulfone (PSU) and beige PEEK offer excellent mechanical properties and is suitable for gas or vapour sterilization.

Some models are also available with an outer shell of cream-colored polyphenylsulfone (PPSU). We recommend this material particularly for applications where products are to withstand hundreds of vapour sterilization cycles.

Other metallic components

In general, most metallic components are manufactured in brass. However, bronze or beryllium copper are used where good elasticity is required (for example: grounding crown). Depending on the application, these parts have electrolytic nickel or nickel-gold plating. These parts can also be manufactured in stainless steel (AISI 416).

Gasket and O-rings

In general, gaskets and O-rings are made of silicone rubber MQ/MVQ. However, for some products they are made of fluorosilicone rubber (FPM).

Materials and Treatments

Component	Material (Standard)	Surface treatment (µm)							Notes
		chrome			nickel		black chr.		
		Cu	Ni	Cr	Cu	Ni	Ni	Cr	
Outer shell, collet nut, conical nut or notched nut	Brass (UNS C 38500)	0.5	3	0.3	0.5	3	1	2	
	Stainless steel (AISI 303 or 304)	without treatment							
	Aluminum alloy (AA 6012)	anodized							
	PEEK, Polyether Etherketone, beige	–							1)
	PSU (Udel®), Polysulfone, grey or white	–							2)
	PPSU (Radel®), Polyphenylsulfone, cream	–							2)
Grounding crown	Bronze (UNS C 54400) or special brass	–	–	–	0.5	3	–	–	
	Stainless steel (AISI 416)	without treatment							3)
Latch sleeve	Special brass	0.5	3	0.3	0.5	3	–	–	
	Stainless steel (AISI 416)	without treatment							3)
Locking washer	Bronze (UNS C 52100)	–	–	–	0.5	3	–	–	
Hexagonal or round nut	Brass (UNS C 38500)								
	Stainless steel (AISI 303 or 304)	without treatment							4)
	Aluminum alloy (AA 6012)	anodized natural							4)
Other metallic components	Brass (UNS C 38500)	–	–	–	0.5	3	–	–	
	Stainless steel (AISI 303 or 304)	without treatment							
O-ring and gaskets	Silicone MQ/MVQ or FPM/FKM (Viton®)	–							

Notes:
standards for surface treatment are as follows:
Chrome-plated: FS QQ-C-320B;
Nickel-plated: FS QQ-N-290A, or MIL-C-26074C;
Gold-plated: ISO 4523; and
Black chrome: MIL-C-14538C with a minimum of 10 µm of lacquer protection.

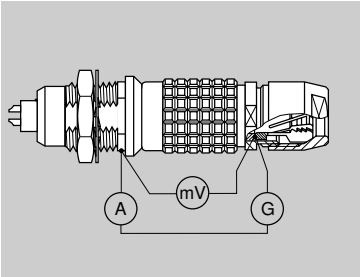
1) for FGG and ENG models of the 3B and 4B series
2) for the FGY and ENY models of the 2B, 3B and 4B series
3) AISI 416 steel is used with shells made of AISI 303 or 304
4) delivered with free and fixed receptacles with aluminum alloy or stainless steel shell

Electrical Characteristics

Shell electrical continuity: (measured according to IEC 60512-2 test 2f)

Test current: 1A
A = Ammeter
mV = Millivoltmeter
G = Generator

Keyed series



Series	R (mΩ)
2B	2.2
3B	2.2
4B	1.5
5B	1.5
2K	1.8
3K	1.6
4K	1.4
5K	1.4

R_1 Values with grounding crown and latch sleeve or inner-sleeve nickel-plated.

Electromagnetic compatibility (EMC) and shielding efficiency

The electromagnetic compatibility of a device can only be en-sured by meeting a number of basic rules with the design of the device and by carefully selecting components, cables and connectors.

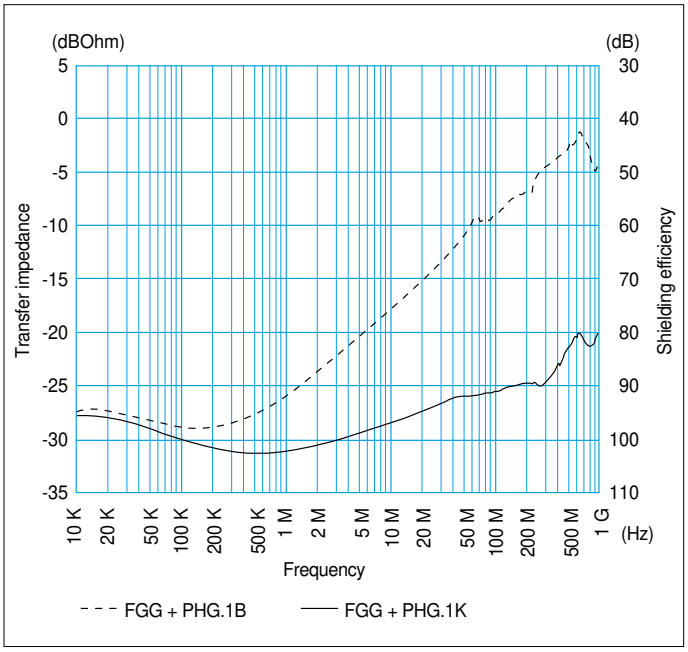
Electrical and electronic devices are to be designed to ensure the following:

a) Reduce the emission of generated electromagnetic interference to a level where radios and telecommunication and other devices can properly function;
b) Electromagnetic immunity against electromagnetic interference so that they can properly function.

When selecting a connector, screen or shielding efficiency and low resistance to electric continuity between the cable and the connector should be considered.

The design of LEMO connectors with metal shell and grounding crown guarantee optimum shielding efficiency in all applications where electromagnetic compatibility (EMC) is critical.

The performance of a connector is measured through shielding efficiency, a value that represents the ratio between the electromagnetic field on the outside and the inside of the shell. Our measurements are carried out according to the IEC 60169-1-3 standard.



The performance of B series connectors is comparable to the results of measurements carried out on a pair of FGG + PHG.1B connectors.

The performance of K series connectors is comparable to the results of measurements carried out on a pair of FGG + PHG.1K connectors.

Insulator

Plastic material used by LEMO for manufacturing insulators is selected according to the electric and thermal properties required for the various connector types. Characteristics examined for the two connector types are:

- Dielectric strength;
- Comparative tracking index;
- Surface and volume resistivity;
- Continuous service temperature;
- Water absorption;
- Radiation resistance;
- Flammability rating;
- Resistance to hydrocarbon.

Mechanical and Electrical Properties

LEMO uses PEEK (Polyether Etherketone) for the insulator material. The performance of this thermo-plastic material is enhanced by the addition of glass fibers in the resin to achieve very high mechanical strength, to increase dielectric strength and to reduce water absorption rate. The above features of PEEK, plus its excellent chemical and radiation resistance, make it ideal for most applications. Sealing grommets are molded from Viton®. Such polymer has inherently excellent electrical insulating properties which do not change when exposed to adverse environments.

Insulating resistance $>10^{12}\Omega$ (per MIL-STD-1344A method 3003.1).

Technical characteristics

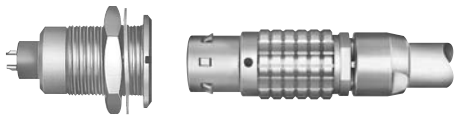
Type	Norme	Units	PEEK	PSU	PPSU	Silicone	FPM
Density	ASTM D 792	–	1.3-1.4	1.24	1.3	~1.2	~1.9
Tensile strength (at 73.4° F)	ASTM D 638/ ISO R527	MPa	92-142	70	70	> 9	> 12
Flexurale strength (at 73.4° F)	ASTM D 790/ ISO R178	MPA	170	106	91	–	–
Dielectric strength	ASTM D 149/IEC 60243	kV/mm	19-25	17-20	15	18-30	–
Volume resis. at 50% HR and 73.4° F	ASTM D 257/IEC 60093	$\Omega \bullet$ cm	10^{16}	$5x10^{16}$	–	10^{14}	–
Surface resistivity	ASTM D 257	Ω	10^{15}	–	–	–	–
Thermal conductivity	ASTM C 177	W/K • m	0.25	0.26	–	–	–
Comparative tracking index	IEC 60112	V	CTI 150	CTI 150	–	–	–
Maxi. continuous service temperature	UL 746	°F	482	284	356	392	392
Min. continuous service temperature	UL 746	°F	-67	-76	-58	-58	-4
Max. short-time service temperature	–	°F	572	320	392	> 482	572
Water absorption in 24h at 73.4° F	ASTM D 570/ISO R62A	%	0.12	0.3	0.37	–	–
Radiation resistance	–	Gy[1)]	10^7	10^5	–	10^5	$8x10^4$
Flammability rating	ASTM D 635/UL 94	–	V-0/3.2	V-0/4.4	V-0/1.6	–	–
Resistance to steam sterilization	–	–	excel.	good	excel.	good	good

ASTM = American Society for Testing & Materials
ISO = International Standards Organization
UL = Underwriters Laboratories
IEC = International Electrotechnical Commission

Note: [1)] 1 Gy (Gray) = 100 rad

Note: Values of insulation resistance between contacts are given on page 11.

QUICK-LOK™ Push-Pull Self-Latching System



LEMO's Original QUICK-LOK push-pull, self-latching system is renowned worldwide for its easy and quick mating and unmating features. It provides absolute security against vibration, shock or pull on the cable, and facilitates operation in a very limited space, and offers unique advantages for all applications:

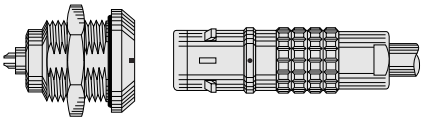
Speed – Engage connectors simply and quickly by pushing plugs axially into mating receptacles. Pull on outer shell to remove plug easily.

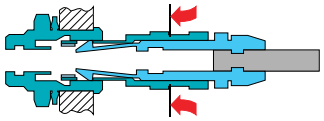
Space Savings – Just one finger clearance on two sides is needed to engage and disengage connectors, so there's no need to twist or turn a locking ring.

Reliability – Connections are reliable and assured when locking mechanism is engaged.

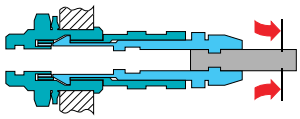
Ruggedness – Sturdy design, with sealed models to various IP levels.

How QUICK-LOK™ Works

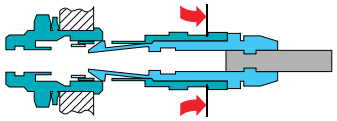




Engaging
QUICK-LOK allows the connector to be mated by simply pushing the plug straight into the receptacle.



Latched
Once firmly latched, connection cannot be broken by pulling on the cable or any other component part other than the outer release sleeve.



Disengaging
When required, the connector is disengaged by a single straight pull on the outer release sleeve. This first disengages the latches and then withdraws the plug from the receptacle.

Key:
Fv = average latching force.
Fd = average unmating force with axial pull on the outer release
Fa = average pull force with axial pull on the collet nut.

Latching Characteristics for 00, B and K Series Connectors

Force (N)	Series					
	00	0B	2B	3B	4B	5B
Fv	9	10	15	17	39	48
Fd	7	8	12	14	38	38
Fa	120	250	300	550	700	800

Force (N)	Series				
	0K	2K	3K	4K	5K
Fv	14	20	32	65	85
Fd	9	13	25	40	60
Fa	250	400	550	700	800

Notes: the forces were measured on outer shell not fitted with contacts. The mechanical endurance represents the number of cycles after which the latching system is still effective (1 cycle = 1 latching/unlatching – 300 cycles per hour).

Mechanical endurance: 5000 cycles.

The values were measured according to the standard MIL-STD-1344A method 2013.1.

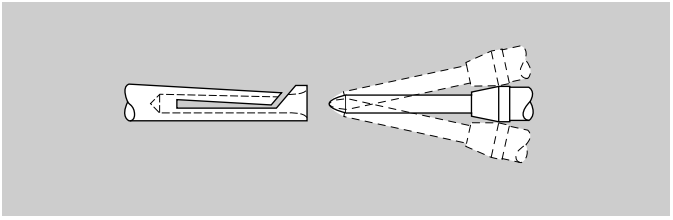
1N = 0.102kg.= 0.224 lbs

Electrical Contact

Technical Description

The secure reliable electromechanical connection achieved with LEMO female cylindrical contacts is mainly due to two important design features:

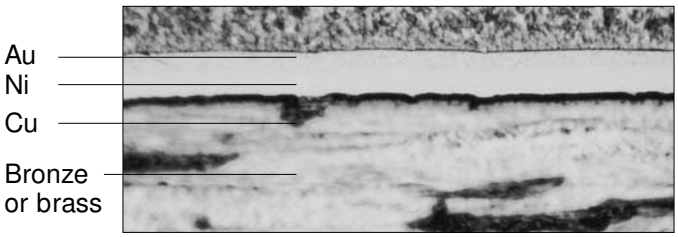
1. *Prod proof entry* on the mating side which ensures perfect concentric mating even with carelessly handled connectors; and
2. *The pressure spring*, with good elasticity, maintains a constant even force on the male contact when mated. The leading edge of the pressure spring preserves the surface treatment (gold-plated) and prevents undue wear.



Contact Material and Treatment

LEMO female contacts are made of copper beryllium (QQ-C-530) or bronze (UNS C 54400). These materials are chosen because of their high modulus of elasticity, their excellent electrical conductivity and a high mechanical strength.

LEMO male solder and printed circuit contacts are made of brass (UNS C 38500). Male crimp contacts are made of brass (UNS C 34500) or annealed brass (UNS C 38500) with optimum hardness (HV) for crimping onto the wire.

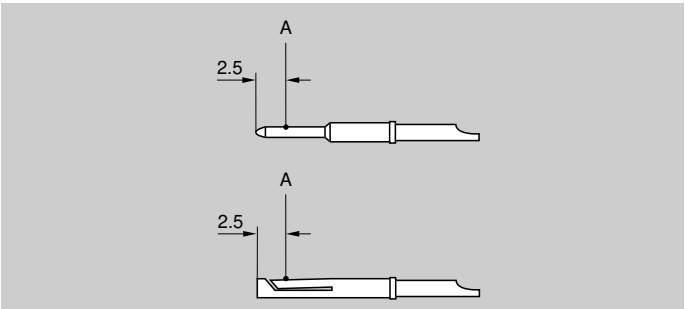


Notes: The standard surface treatment are as follows:
Nickel: FS QQ-N-290A or MIL-C-26074C; and
Gold: ISO 4523.
1) Minimum value 2) For elbow printed circuit contacts
3) Treatment completed by 6 µm Sn-Pb tin-plating

Type	Material (standard)	Surf. treatment (µm)		
		Cu	Ni	Au[1)]
Male crimp	Brass (UNS C 34500)	0.5	3	1.0
	Brass (UNS C 38500)			
Male solder	Brass (UNS C 38500)			
Female crimp	Bronze (UNS C 54400)	0.5	3	1.5
Female solder				
Clips	Cu-Be (FS QQ-C-530)	–	–	–
	Stainless steel			

Notes: The standard surface treatment are as follows:
Nickel: FS QQ-N-290A or MIL-C-26074C; and Gold: ISO 4523.
1) Minimum value.

Thickness comparison between the outside and the inside of female contacts



Contact ø A (mm)	Gold thickness		
	male (µm)	female	
		outside (µm)	inside (%)
0.7	1.0	1.5	70
0.9	1.0	1.5	75
1.3	1.0	1.5	75
1.6	1.0	1.5	75
2.0	1.0	1.5	75
4.0	1.0	1.5	75

Note: A = inspection point

Electrical Contact

Contact resistance with relation to the number of mating cyles

Maximum values measured after the mating cycles and the salt spray test according to IEC 60512-6 test 11f.

ø A (mm)	Contact resistance (mΩ)		
	1000 cycles	3000 cycles	5000 cycles
0.7	5.6	5.7	6.1
0.9	4.1	4.2	4.8
1.3	2.8	2.9	3.6

ø A (mm)	Contact resistance (mΩ)		
	1000 cycles	3000 cycles	5000 cycles
1.6	2.6	2.7	3.5
2.0	2.9	3.1	3.3
4.0	1.6	2.0	2.8

Insulation resistance between the contacts and contact/shell

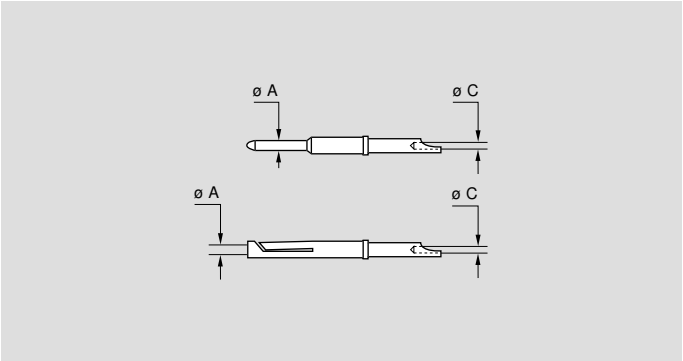
(measured according to IEC 60512-2 test 3a)

Insulating material	PEEK
new	> 10^{12} Ω
after humidity test[1)]	> 10^{10} Ω

Note: 1) 21 days at 95% RH according to IEC 60068-2-3.

Solder contacts

The conductor bucket of these contacts is machined at an angle to form a cup into which the solder can flow.



Contact		Conductor			
		Solid		Stranded	
ø A (mm)	ø C (mm)	AWG max.	Section max (mm^2)	AWG max.	Section max (mm^2)
0.7	0.80	22	0.34	22[1)]	0.34
0.9	0.80	22	0.34	22[1)]	0.34
1.3	1.00	20	0.50	20[1)]	0.50
2.0	1.80	14	1.50	16	1.50
4.0	3.70	10	6.00	10	6.00

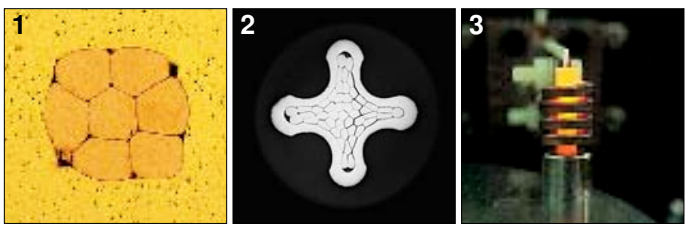
Note: 1) For a given AWG, the diameter of some stranded conductor designs is larger than the solder cup diameter. Make sure that the maximum conductor diameter is smaller than ø C.

Crimp contacts

For multipole or hybrid connectors the standard four-identer crimp method is used (MIL-C-22520F, class I, type 1).
The crimp method requires a controlled compression to obtain a symmetrical deformation of the conductor strand and of the contact material. The radial hole in the side of the contact makes it possible to check whether the conductor is correctly positioned within the contact. A good crimping is characterized by only slightly reduced conductor section and practically no gap.

For optimum crimping, the bronze or brass contacts are annealed to relieve internal stress and reduce material hardening during the crimping process.
Only the crimping zone is annealed with the help of an induction heating machine designed by the LEMO Research and Development Department (microphoto 3).

Crimp contacts are available in standard version (microphoto 1) for mounting maximum size conductors.
For some dimensions, these crimp contacts can be produced with reduced crimp barrels (microphoto 2) for mounting reduced size conductors.



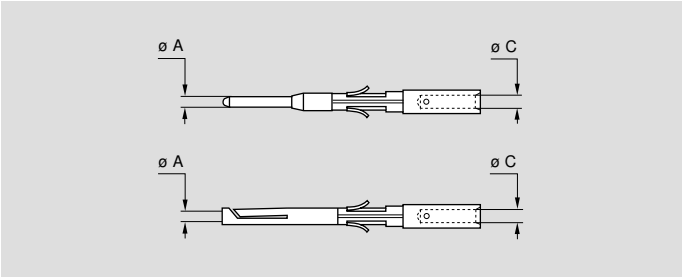
Advantages of crimping

- practical, quick contact fixing outside the insulator
- possible use at high temperature
- no risk of heating the insulator during the conductor-contact fixing
- high tensile strength

The range of cable dimensions that can be crimped into the contacts is indicated on the table on page 12.

Electrical Contact

The crimp contacts are designed to be crimped with the standard four-indent method according to MIL-C-22520F, class 1, type 1.



Contact		Conductor stranded				F_r (N)
ø A (mm)	ø C (mm)	AWG stranded		Section (mm^2)		
		min.	max.	min.	max.	
0.7	0.80	26	22 1)	0.140	0.34	22
0.9	1.10	24	20	0.250	0.50	30
1.3	1.40	20	18	0.500	1.00	40
	1.90 2)	18	14	1.000	1.50	
1.6	1.90	18	14 1)	1.000	1.50	50
2.0	2.40	16	12 1)	1.500	2.50	65

Note:
1) For a given AWG, the diameter of some stranded conductor designs is larger than the solder cup diameter. Make sure that the maximum conductor diameter is smaller than ø C.
2) These contacts are special with an oversized crimp bucket and can be used only with the series 3K.93C.

Note: Fr = mean contact retention force in the insulator (according to IEC 60512-8 test 15a).
Crimp contacts can also be supplied with a reduced crimp barrel. Please consult factory or our Unipole/Multipole catalog.

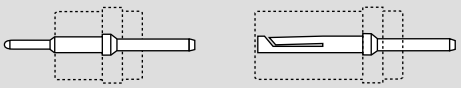
A detailed range of conductor dimensions that can be crimped into LEMO contacts is given in the table above. See also the section on tooling (pages 97 to 106).

Printed Circuit contacts

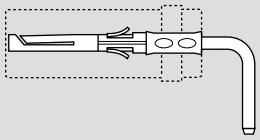
Printed circuit contacts are available in straight or elbow versions for certain connector types, mostly for straight and elbow receptacle models. Connection is made on flexible or rigid printed circuits by soldering.

Printed circuit contacts are gold-plated which guarantees optimum soldering, even after long-term storage. However for wave soldering, we recommend removal of the gold-plating from the contact end on the printed circuit side before soldering according to the assembly procedures.

straight



elbow



Test Voltage

Test voltage (Ue):
(measured according to the IEC 60512-2 test 4a standard).

It corresponds to 75% of the mean breakdown voltage. Test voltage is applied at 500 V/s and the test duration is one minute.

This test has been carried out with a mated plug and receptacle, with power supply only on the plug end.

Operating voltage (Us):
It is proposed according to the following ratio: $Us = \frac{Ue}{3}$

Caution:
For a number of applications, safety requirements for electrical appliances are more severe with regard to operating voltage.

In such cases operating voltage is defined according to creepage distance and air clearance) between live parts.

Please consult us for the choice of a connector by indicating the safety standard to be met by the product.
Voltage values are given in the table on insulator types for each series corresponding with values measured at sea level and are adapted to all applications up to an altitude of 2000 m.

In case a device is used at a higher altitude, air clearance between live parts has to be multiplied by the following coefficients:
(Test voltage also has to be divided by this coefficient).

altitude (m)	coefficient
2000	1.00
3000	1.14
4000	1.29
5000	1.48

Electrical Contact

Rated Current

(measured according to IEC 60512-3 test 5a).

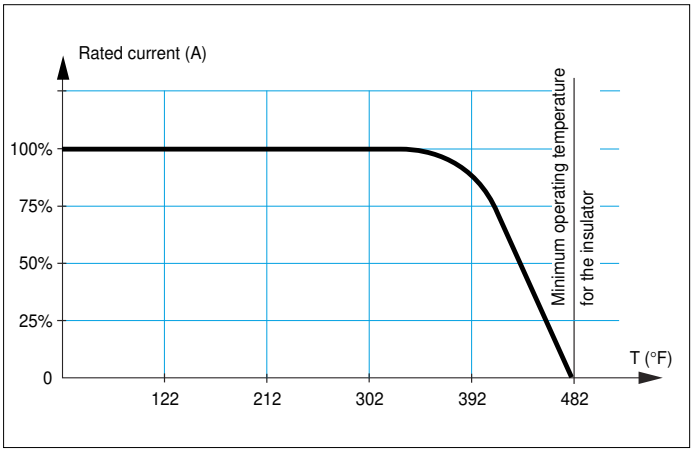
The specified rated current can be applied simultaneously to all the contacts, corresponding with an average temperature rise of 104° F of the connector.

The current values are indicated in the table of insulator types in each series. For use at higher temperatures, acceptable rated current will be lower. It tends towards zero as the material is used at the maximum operating temperature accepted for the insulator.

In most cases, the current depends on the conductor dimension, or on the printed circuit dimension.

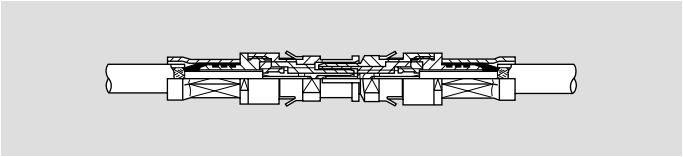
Caution:
In general, connectors should not be unmated while live.

For connectors with PEEK insulator, maximum admissible current will follow the curve below depending on the operating temperature T.



Coaxial contacts

The type C coaxial contact is removable and fixed in place by clips. Cable attachment is made by crimping. The square form is used to captivate center conductor and hexagonal crimping method for the cable shield.
A detailed range of coaxial cable that can be installed into our type C coaxial contact is given in the table below.



Group	Type
1	RG.174A/U, RG.188A/U, RG.316/U
2	RG.178B/U, RG.196A/U
3	RG.179B/U, RG.187A/U

Coaxial contacts type C

The cable fixing is achieved with hexagonal crimping (MIL-C-22520F, type 2). This method guarantees a good electrical continuity of the shield which improves greatly the shielding efficiency of the cable/connector link. The back end of the crimp nut which receives the shield braid, is milled to ensure a good retention of the shield once crimped.

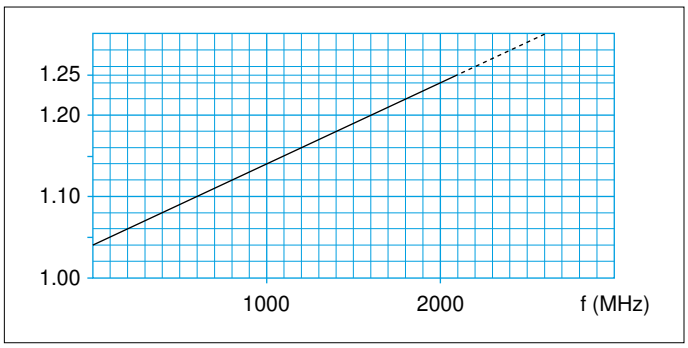
For the center contact, square form crimp method is used (MIL-C-22520F, type 2). The method requires a controlled compression to obtain a symmetrical deformation of the conductor strand and of the contact material. The radial hole in the side of the contact enables correct positioning of the conductor within the contact to be verified. A good crimping is characterized by a small conductor section reduction and by the quite closed free spaces.

The LEMO crimp contacts are factory annealed to relieve internal stresses, and reduce the risk of the material work hardening during the crimping process.

Technical characteristics

Characteristics	Unit	Value
Impedance	Ω	50
Operating voltage at 50 Hz	kV rms	0.5
Test voltage at 50 Hz	kV rms	1.6
Rated current	A	2
Insulation resistance	Ω	$>10^{12}$
Contact resistance	mΩ	5.8
Shell to shell resistance	mΩ	3.7
VSWR (f=GHz)		1.04 + 0.1f
Max. working frequency	GHz	2.1

Standing wave ratio

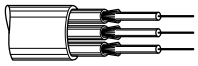
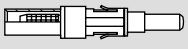
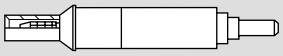


Selection of the LEMO Fiber Optic Contacts

In order to ensure the highest technical performance and to provide the optimum solution for a diversity of applications, LEMO has developed four types of fiber optic contacts; designated **F1**, **F2**, **F3**, and **F4**. These contacts are designed to operate with single fiber, multi fiber, and mixed fiber optical/electrical cable constructions and cater to single and multi-mode fibers from 9/125 to 1500 µm diameter.

The choice of fiber optic contacts depends upon the following criteria:
– Cable construction (single fiber, multi fiber, mixed optical/electrical)
– Fiber type (single-mode or multi-mode).

The table below shows the suitability of each contact type with different fibers and cables.
Note that the multi fiber cable can contain many types of optic fibers or a group of fibers and electrical cables leading to mixed optical/electrical connectors.

	Contact type	Cable Structure		Fiber Types and dimensions		
					 multi-mode	
		single fiber	multi fiber or mixed	single-mode	≤ 100/140µm	≥ 100/140µm
	**F1**					
	**F2**					
	**F3**					
	**F4**					

See inside back cover for full color color diagrams of F1, F2, F3 and F4 contacts

Available series and contact configurations

Single and Multi F.O.

Number of F.O. contacts	Series							
	00	0B	0K	2B-2K	3B-3K	4B-4K	5B-5K	3K.93C
1	●	●	●					
2					●			
4						●		
10							●	
14							●	

Mixed F.O. + L.V.

Number of F.O. contacts	Number of L.V. electrical contacts	Series							
		00	0B	0K	2B-2K	3B-3K	4B-4K	5B-5K	3K.93C
1	2, 4, 6 or 10				●				
1	22					●			
2	4, 6, 10 or 16					●			
2	6, 7, 12, 16 or 18						●		
3	6 or 12						●		
3	10							●	
4	5 or 9						●		
9	3							●	

Mixed F.O. + L.V. + H.V.

Number of F.O. contacts	Number of L.V. electrical contacts	Number of H.V. electrical contacts	Series							
			00	0B	0K	2B-2K	3B-3K	4B-4K	5B-5K	3K.93C
2	2	2								●
6	2	4							●	
12	1	2							●	

Mixed F.O. + L.V. + Coax

Number of F.O. contacts	Number of L.V. electrical contacts	Number of coax electrical contacts	Series							
			00	0B	0K	2B-2K	3B-3K	4B-4K	5B-5K	3K.93C
1	6	1					●			
1	16	1					●			
2	–	2						●		
2	6	1						●		

Optical Performance for F1, F2, F3, and F4 Type Contacts

The optical performance for the fiber optic contacts relates to the insertion and return losses measured at the junction of the fiber to fiber interface. These losses are caused mainly by minute geometrical effects of the critical alignment components and deviations in the fiber core and cladding dimensions.

The insertion loss results for multi-mode and single-mode fibers are given whereas the return loss values are provided for single-mode fibers only.

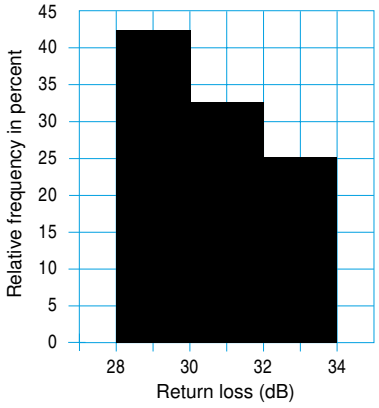
Insertion and return losses are expressed in decibels (dB). The data shown in the diagrams below correspond to numerous matings using various batches of optical fibers and connectors.

Measurements with Single-mode Fiber for F2 and F4 Contacts.

Insertion loss

Mean = 0.10 dB
Tested at 1300 nm
Tested according to the standard IEC 61300-03-04, Insertion Method B.
Fiber = 9/125 µm
Ferrule bore diameter = 125 µm

Return loss



Mean = 30.42 dB
Tested at 1300 nm
Tested according to the standard IEC 61300-03-06, Branching Device Method
Fiber = 9/125 µm, Hand Polishing

Note: It is possible to obtain return losses better than 45 dB with UPC polishing techniques.
Please consult LEMO for more detailed information.

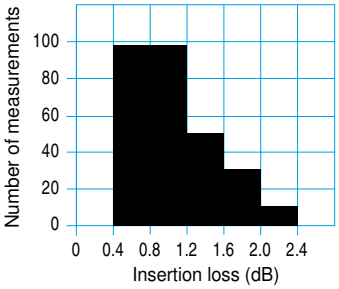
Measurements with Multi-mode Fiber for F2 and F4 Contacts

Insertion loss

Mean = 0.25 dB
Tested at 1300 nm
Tested according to the standard IEC 61300-03-04, Insertion Method B.
Fiber = 50/125 µm
Ferrule bore diameter = 126 µm

Measurements with Multi-mode Fiber for F1 and F3 Contacts

Insertion loss



Mean = 1.13 dB
Tested at 850 nm
Tested according to the standard IEC 61300-03-04, Insertion Method B.
Fiber = 200/230 µm
Ferrule bore diameter = 235 µm

Change in attenuation vs. environmental and mechanical conditions

Characteristic	Value	Standard	Change in attenuation [1]	
			F2-F4 Contacts	F1-F3 Contacts
High temperature	+ 176 °F	IEC 61300-02-18	< 0.20 dB	< 0.20 dB
Low temperature	- 40 °F	IEC 61300-02-17	< 0.20 dB	< 0.20 dB
Change of temperature (7 cycles)	Diagram 1 below	IEC 61300-02-22	< 0.20 dB	< 0.20 dB
Damp heat steady state	Up to 95 % RH, 140 °F	IEC 61300-02-19	< 0.20 dB	< 0.15 dB
Mating cycles (contact F1; F2; F3)	1000	IEC 61300-02-02	< 0.15 dB	< 0.15 dB
Mating cycles (contact F4)	500	IEC 61300-02-02	< 0.15 dB	–
Cable retention [2]	100 N	IEC 61300-02-04	< 0.10 dB	–
Impact (Method A)	1 m onto concrete floor	IEC 61300-02-12	< 0.10 dB	< 0.15 dB
Shock (3 cycles in 2 directions)	100 g, 10-50 ms; 20 g, 6-9 ms	IEC 61300-02-09	< 0.10 dB	< 0.20 dB
Vibration (7 cycles)	Diagram 2 below	IEC 61300-02-01	< 0.20 dB	< 0.25 dB

Note:
[1] The insertion loss variations were measured during the entire environmental and mechanical tests respectively.
[2] Value quoted is for 2.5 mm tight jacket cable. In practice the cable retention depends on many factors including the cable construction.

Diagram 1: Temperature cycles

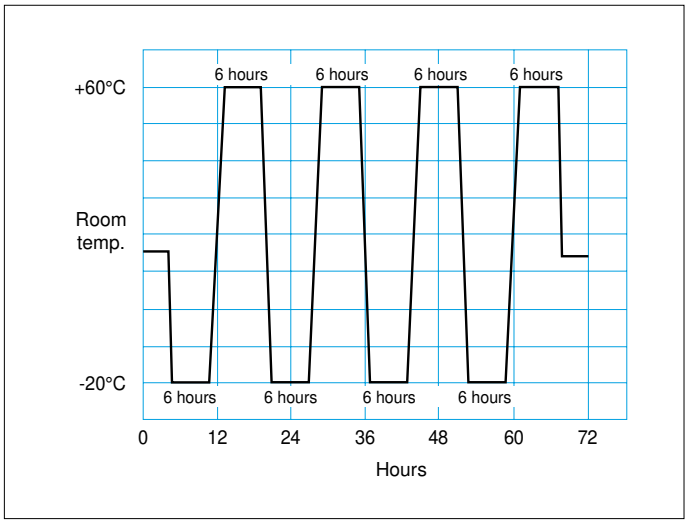
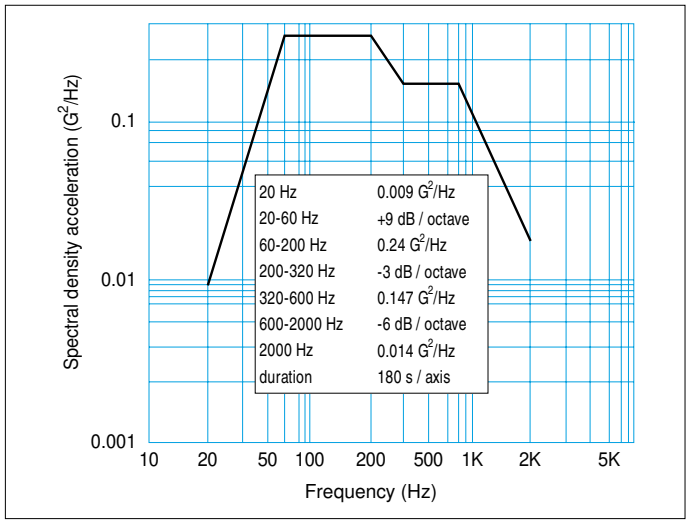
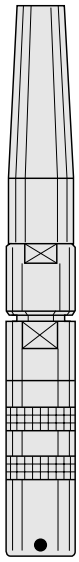
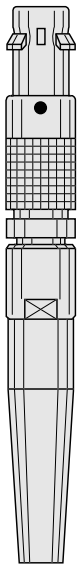


Diagram 2: Vibration





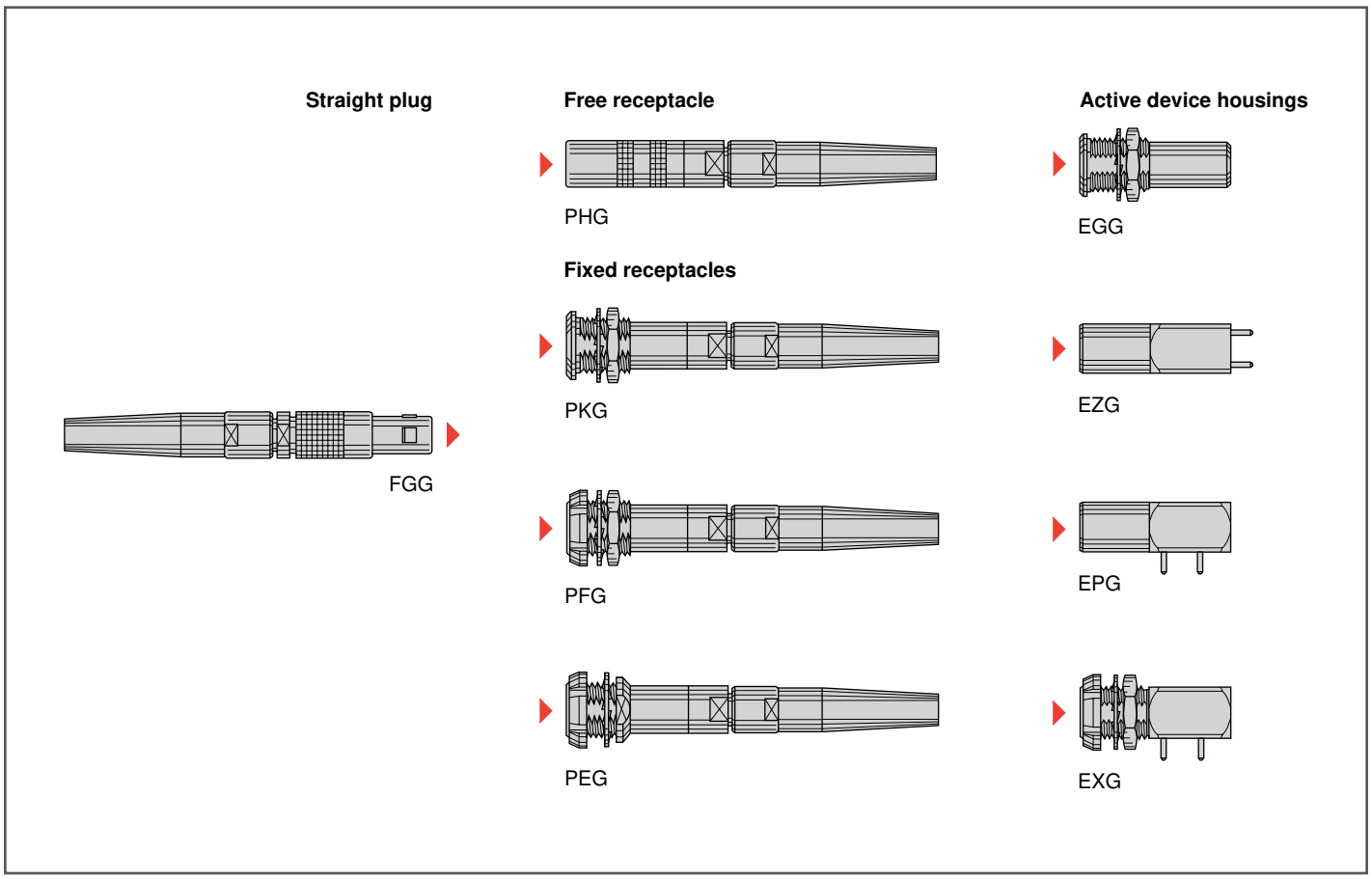
• 00 Series Connectors



00 Series Connectors

The 00 series connectors are fitted with LEMO **F4** type fiber optic contacts.
The main features of this series are as follows:
– Security of the LEMO self-latching Quick-Lok™ system
– Minimum mounting space requirement (high packing density)
– Protection against accidental contamination or damage to the fiber end face because the ferrules do not protrude outside of the connector shell
– The alignment key (G, B) ensures excellent repeatability of performance during frequent matings
– Assembly of the fiber optic contact uses a ceramic ferrule with spherical end face
– Simple and fast polishing ensuring the physical contact of the fiber end face
– The alignment tube can be easily removed in order to clean the fiber end face.
00 Series consists of nine connector models.
The active device housings are designed to accept emitting or receiving components such as LEDs or photodiodes in a TO-18 case.
The plugs and receptacles are suitable for use with single fiber cables fitted with single-mode or multi-mode fibers of the following dimensions; 9/125, 50/125, 62.5/125, 100/125 and 100/140 µm.

Interconnections



Model Description

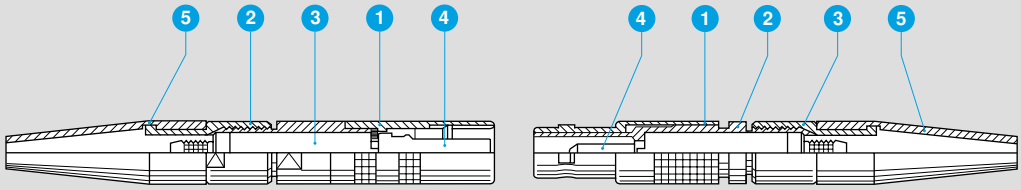
EGG Fixed active device housing, nut fixing, key (G) or key (B)
EPG Elbow active device housing (90°) for printed circuit, key (G) or key (B)
EXG Elbow active device housing (90°) for printed circuit, with two nuts, key (G) or key (B), (back panel mounting)
EZG Straight active device housing for printed circuit, key (G) or key (B)
FGG Straight plug, key (G) or key (B), with bend relief
PEG Fixed receptacle, nut fixing, key (G) or key (B), with bend relief, (back panel mounting)
PFG Fixed receptacle, with two nuts, key (G) or key (B), with bend relief, (back panel mounting)
PHG Free receptacle, key (G) or key (B), with bend relief
PKG Fixed receptacle, nut fixing, key (G) or key (B), with bend relief

Part Section Showing Internal Components

Connector

Free receptacle

1. outer shell
2. collet nut
3. F4 fiber optic contact
4. alignment tube
5. bend relief



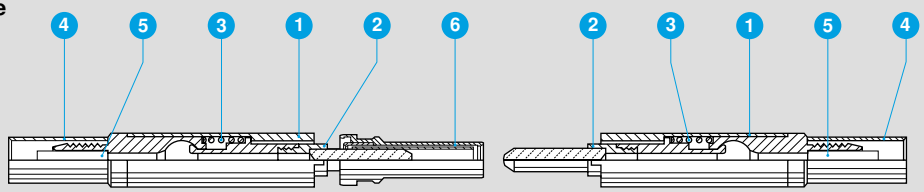
Straight plug

1. outer shell
2. latch sleeve
3. collet nut
4. F4 fiber optic contact
5. bend relief

F4 Contact

Contact with alignment tube

1. body with holder
2. ferrule with holder
3. spring
4. crimp ferrule
5. intermediary tube
6. alignment tube



Contact

1. body with holder
2. ferrule with holder
3. spring
4. crimp ferrule
5. intermediary tube

Technical Characteristics

Mechanical and Climatic

Characteristics	Value	Standard
Endurance	> 5000 cycles	IEC 61300-02-02
Humidity	up to 95 % at 140°F	IEC 61300-02-19
High temperature[1) 2)]	+176° F	IEC 61300-02-18
Low temperature	-40° F	IEC 61300-02-17
Protection index (mated)	IP 50	IEC 60529
Cable retention	100 N	IEC 61300-02-04

Optical

Characteristic	Value	Standard	Method
Average insertion loss fiber 9/125 µm	0.10 dB	IEC 61300-03-04	Insertion Method B
Average insertion loss fiber 50/125 µm	0.25 dB	IEC 61300-03-04	Insertion Method B
Return loss fiber 9/125 µm (UPC)	≥45 dB	IEC 61300-03-06	Branching Device Met.
Return loss fiber 9/125 µm (Hand polish)	~30 dB	IEC 61300-03-06	Branching Device Met.

Note: Detailed characteristics are presented on inside back cover and pages 15-16.

Alignment Key and Polarized Keying Systems

Front view of a receptacle

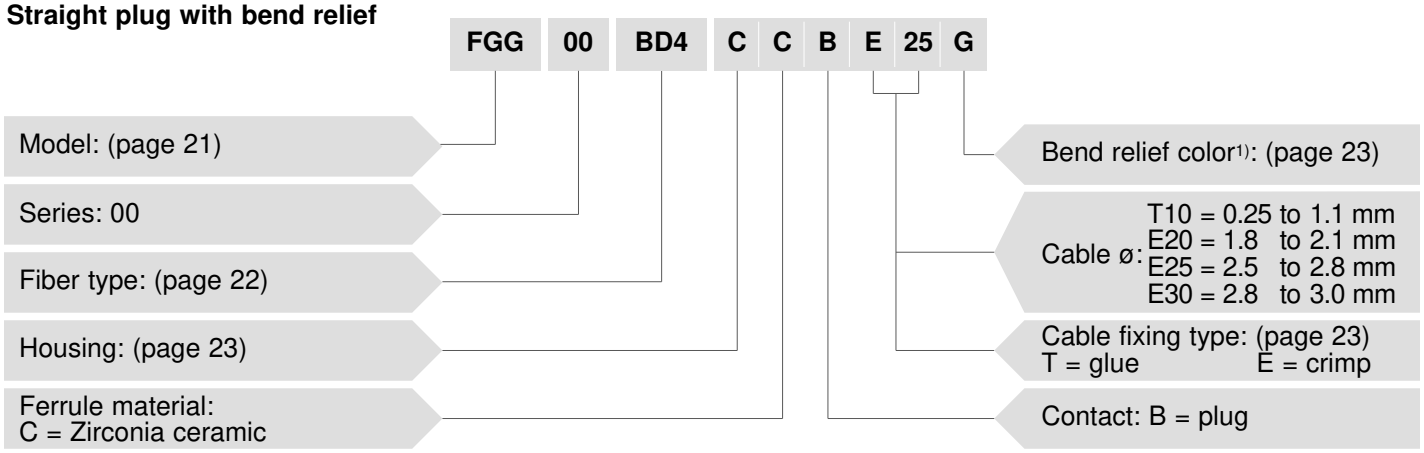
Model	No of keys	Angle		Note
●●G	1	α	0°	■
●●B	2		60°	□

■ First choice alternative □ Special order alternative

Part Number Example

A different part number is applicable for each of the following product type:
– Plugs or receptacles for assembly onto cables
– Active device housings

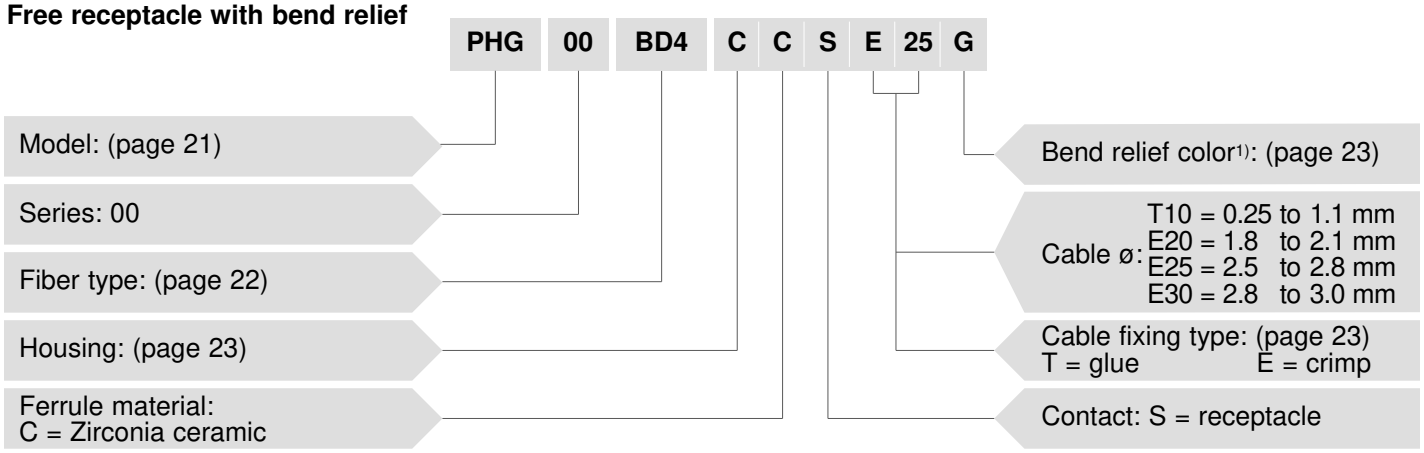
Straight plug with bend relief



FGG.00.BD4.CCBE25G = Straight plug with key (G), 00 series for single-mode or multi-mode fibers, F4 fiber optic contact, ferrule hole diameter 128 µm, chrome-plated brass housing, zirconia ceramic ferrule, plug type contact, crimp type cable fixing for 2.5 to 2.8 mm diameter cable, and gray bend relief.

Note: 1) The bend relief sleeve is necessary to the proper function of the connector thus the connector can only be ordered with the appropriate sleeve.

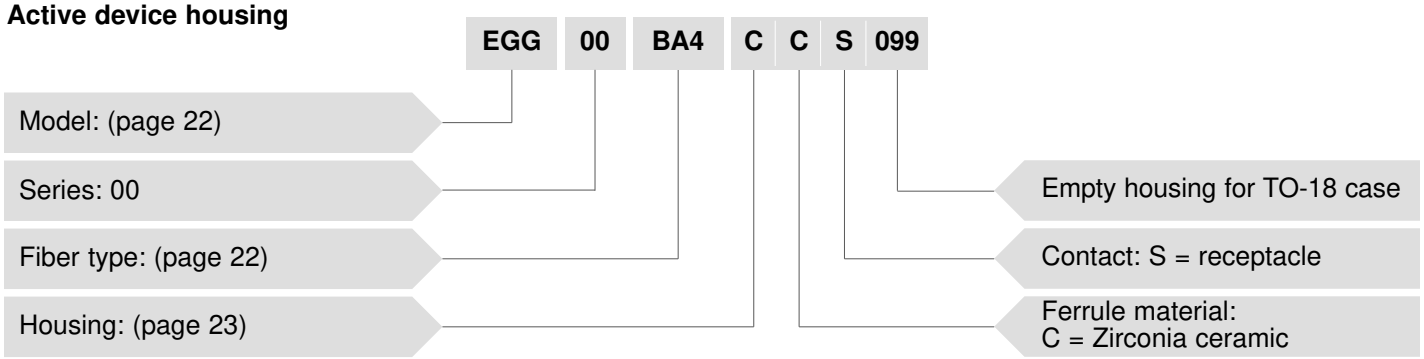
Free receptacle with bend relief



PHG.00.BD4.CCSE25G = Free receptacle with key (G), 00 series for single-mode or multi-mode fibers, F4 fiber optic contact, ferrule hole diameter 128 µm, chrome-plated brass housing, zirconia ceramic ferrule, receptacle type contact, crimp type cable fixing for 2.5 to 2.8 mm diameter cable, and gray bend relief.

Note: 1) The bend relief sleeve is necessary to the proper function of the connector thus the connector can only be ordered with the appropriate sleeve.

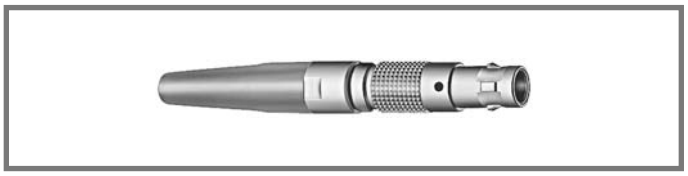
Active device housing

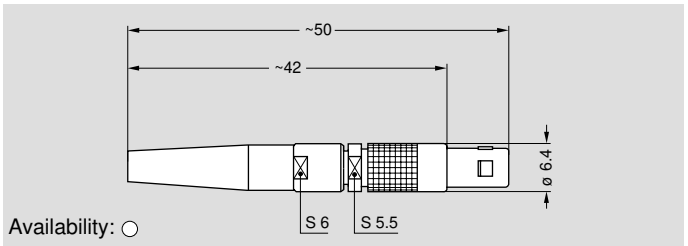


EGG.00.BA4.CCS099 = Straight active device housing, nut fixing with key (G), 00 series, with ferrule for F4 fiber optic contact, assembled with single-mode fiber ø 9/125, chrome-plated brass housing, zirconia ceramic ferrule, receptacle contact, empty housing for TO-18 case.

• Models

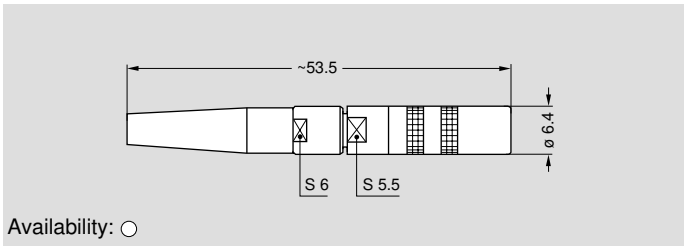
FGG.00 Straight plug, key (G) or key (B), with bend relief





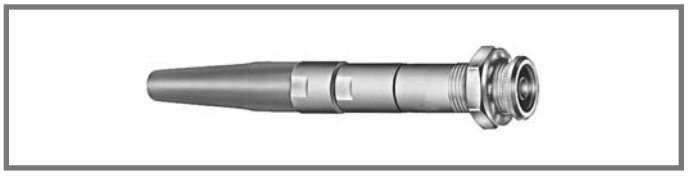
Availability: ○

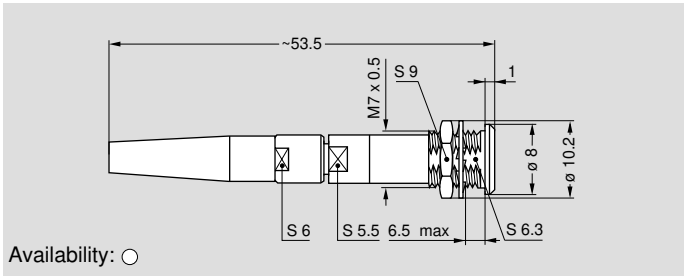
PHG.00 Free receptacle, key (G) or key (B), with bend relief



Availability: ○

PKG.00 Fixed receptacle, nut fixing, key (G) or key (B), with bend relief

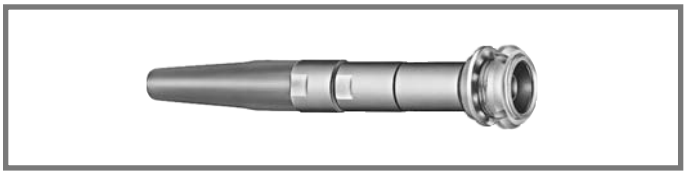


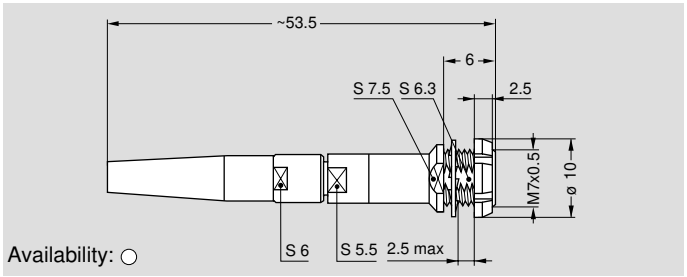


Availability: ○

Panel cut-out (page 23)

PEG.00 Fixed receptacle, nut fixing, key (G) or key (B), with bend relief (back panel mounting)

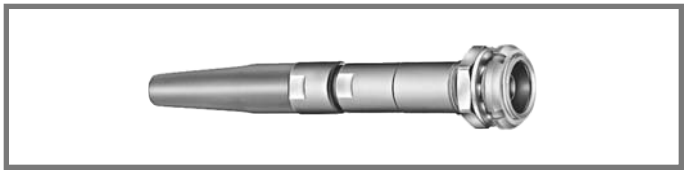


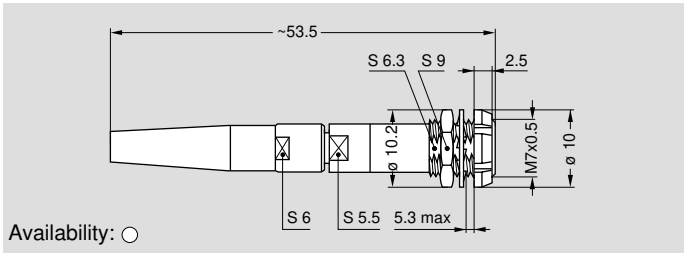


Availability: ○

Panel cut-out (page 23)

PFG.00 Fixed receptacle, with two nuts, key (G) or key (B), with bend relief (back panel mounting)

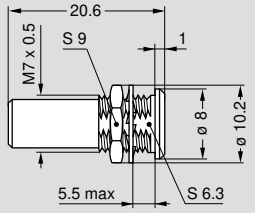




Availability: ○

● Standard, typically 0-6 weeks delivery for quantities of 250 or less.
○ Non-standard product, contact LEMO USA, typically 6-12 weeks delivery for quantities of 250 or less.
Non-standard product is defined as any product which contains one or more components which are not standard.

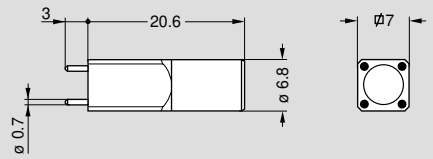
EGG.00 Fixed active device housing, nut fixing, key (G) or key (B)



Availability: ○

Panel cut-out (page 23)

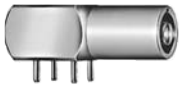
EZG.00 Straight active device housing for printed circuit, key (G) or key (B)

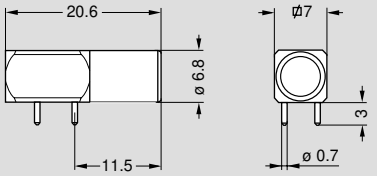


Availability: ○

Panel cut-out (page 23) PCB drilling pattern (page 23)

EPG.00 Elbow active device housing (90°) for printed circuit, key (G) or key (B)

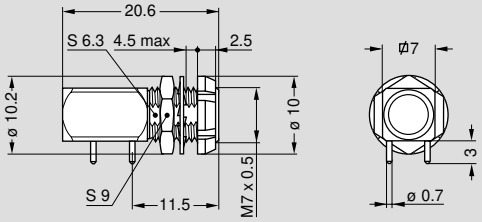




Availability: ○

Panel cut-out (page 23) PCB drilling pattern (page 23)

EXG.00 Elbow active device housing (90°) for printed circuit, with two nuts, key (G) or key (B), (back panel mounting)



Availability: ○

Panel cut-out (page 23) PCB drilling pattern (page 23)

Note: Upon request active device housing can be delivered with a specific device of your choice already fitted into. Please consult the factory.

● Fiber Type

The choice of the ferrule hole diameter is dependent upon the fiber core/cladding size. LEMO offers a range of ferrule hole diameters to suit the users' specific requirements.

Plug or receptacles

The type reference represents the ferrule hole diameter.

Reference	ø Core/Cladding (µm)	Ferrule hole diameter (µm)	Note [1]
BA4	9/125 50/125 62.5/125 100/125	125	■
BB4		126	■
BC4		127	□
BD4		128	□
FA4	100/140	140	□
FB4		144	■

Note: [1] The BA4 type (ferrule hole 125 µm) is recommended for single-mode fibers. The BB4 type (ferrule hole 126 µm) is commonly used with multi-mode fibers.

Active device housings

The type reference represents the type of fiber used.

Reference	ø Core/Cladding (µm)	Note
BA4	9/125	■
CA4	50/125	□
DA4	62.5/125	■
EA4	100/125	□
FA4	100/140	■

■ First choice alternative □ Special order alternative

● Standard, typically 0-6 weeks delivery for quantities of 250 or less.
○ Non-standard product, contact LEMO USA, typically 6-12 weeks delivery for quantities of 250 or less.
Non-standard product is defined as any product which contains one or more components which are not standard.

• Housing

Ref.	Material	Surface treatment		Note
		Outer shell and collet nut	Latch sleeve and grounding crown	
C	Brass	chrome	nickel	■
N	Brass	nickel	nickel	□
K	Brass	black chrome	nickel	□
T	Stainless steel	without treatment	stainless steel	□

■ First choice alternative □ Special order alternative

• Cable Fixing Type

Reference		Cable structure	Cable ø (mm)
Cable fixing Type	Reference ø (mm)		
T	10	Buffer coated fiber	0.25 to 1.1
E	20	Tight jacket cable	1.8 to 2.1
E	25		2.5 to 2.8
E	30		2.8 to 3.0

• Bend Relief

Models FGG, PHG, PKG, PEG and PFG are supplied with a bend relief. The reference for the color of the bend relief is chosen from the table below and it should be stated in the «bend relief» position of the connector part number.

Ref.	Color
A	blue
B	white

Ref.	Color
G	grey
J	yellow

Ref.	Color
M	brown
N	black

Ref.	Color
R	red
S	orange

Ref.	Color
V	green

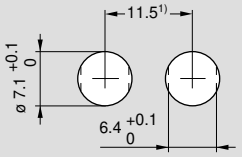
• Tooling

The full range of tools for terminating fiber optic F4 contacts for this 00 series is shown on pages 103 to 106.
Consult the factory for the termination instructions.

• Panel Cut-Outs

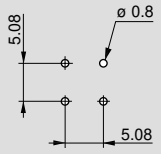
Panel cut-outs

PKG-PEG-PFG
EGG-EXG



PCB drilling pattern, for the fixing pins

EZG-EPG-EXG



Note: 1) Minimum distance between two neighboring components.
Mounting nut torque: **1 Nm**. The value shown above is the maximum torque for each connector type.
1N = 0.102 Kg