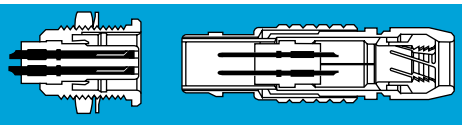
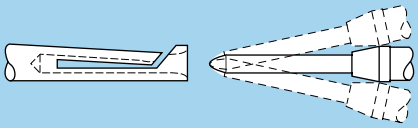


Electrical contact

Technical description

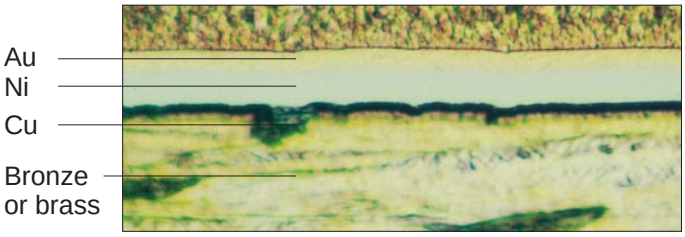
The secure reliable electromechanical connection achieved with LEMO female cylindrical contacts is mainly due to two important design features :

1. *Prod proof entry* on the mating side which ensures perfect concentric mating even with carelessly handled connectors.
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 bronze 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.

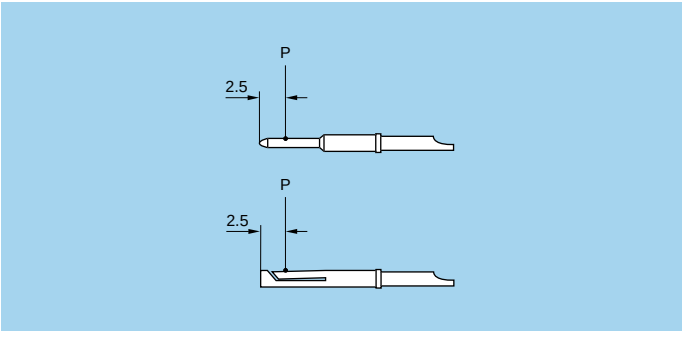


LEMO male solder and print contacts are made of brass (UNS C 38500). Male crimp contacts are made of brass (UNS C 34500) or annealed brass (UNS C 38500) with optimum hardness (HV) for crimping onto the wire.

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 print	Brass (UNS C 38500)			
Female crimp	Bronze (UNS C 54400) Cu-Be (FS QQ-C-530)	0.5	3	1.5
Female print				
Clips	Cu-Be (FS QQ-C-530)	–	–	–
	Stainless steel			
Wire[2)]	Brass	–	3[3)]	–

Notes: the standard surface treatment are as follows:
– nickel: FS QQ-N-290A or MIL-C-26074C
– gold: ISO 4523.
[1)] minimum value
[2)] for elbow print contacts
[3)] treatment completed by 6 µm Sn (lead free) tin-plating

Thickness comparison between the outside and the inside of female contacts



Note: P = inspection point

Contact ø A (mm)	Gold thickness		
	male (µm)	female	
		outside (µm)	inside (%)
0.5	1.0	1.5	65
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
3.0	1.0	1.5	75
4.0	1.0	1.5	75
5.0	1.0	1.5	75
6.0	1.0	1.5	75
8.0	1.0	1.5	75
12.0[1)]	–	–	–

Notes: [1)] contacts are silver plated

Contact resistance with relation to the number of mating cyles

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

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

A ø (mm)	Contact resistance (mΩ)			A ø (mm)	Contact resistance (mΩ)		
	1000 cycles	3000 cycles	5000 cycles		1000 cycles	3000 cycles	5000 cycles
0.5	7.5	8.3	8.7	3.0	2.0	2.2	3.1
0.7	5.6	5.7	6.1	4.0	1.6	2.0	2.8
0.9	4.1	4.2	4.8	5.0	1.4	–	–
1.3	2.8	2.9	3.6	6.0	1.2	–	–
1.6	2.6	2.7	3.5	8.0	0.8	–	–
2.0	2.9	3.1	3.3	12.0	0.7	–	–

Insulation resistance between the contacts and contact/shell

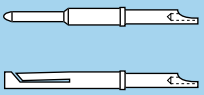
(measured according to IEC 60512-2 test 3a)

Insulating material	Multipole	Unipole
	PEEK	PTFE
new	> 10^{12} Ω	> 10^{12} Ω
after humidity test[1)]	> 10^{10} Ω	> 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.
See page 7 for the range of cable dimensions that can be soldered.



Crimp contacts

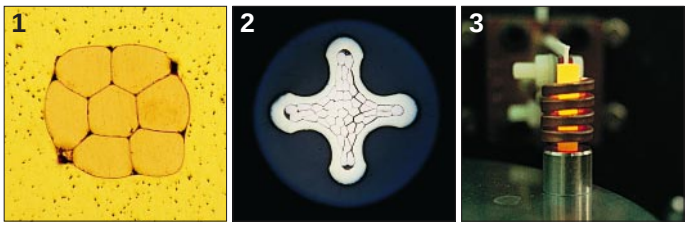
The square form crimp method is used (MIL-C-22520F, class I, type 2) photo 1 for unipole contacts.

For multipole contacts the standard four identer crimp method is used, MIL-C-22520F, class I, type 1), photo 2.
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 of bronze or brass contacts they 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 (see photo 3).

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

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



Crimp contacts

The crimp contacts can be with two forms: a standard crimp barrel for large conductors (see fig. 1) or with a reduced crimp barrel for smaller conductors (see fig. 2).

The range of cable dimensions that can be crimped into our contacts are indicated on the table on page 7.

Fig. 1

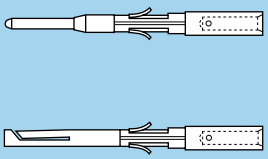
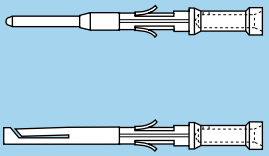


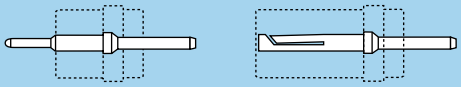
Fig. 2



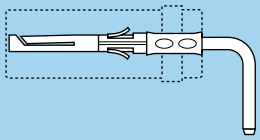
Print contacts

Print contacts are available in straight or elbow versions for certain connector types, mostly for straight and elbow socket models. Connection is made on flexible or rigid printed circuits by soldering.
Straight print contacts are gold-plated which guarantees optimum soldering, even after long-term storage. However for wave soldering, we recommend removal the gold-plating from the contact end on the printed circuit side before soldering according to the assembly procedures.
Print elbow contacts include a tinned lead free brass wire crimped into a crimp contact.

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 1 minute.

This test has been carried out with a mated plug and socket, 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.
They correspond with values measured at sea level. They 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.
It means also that test voltage has to be divided by this coefficient.

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

Rated current

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

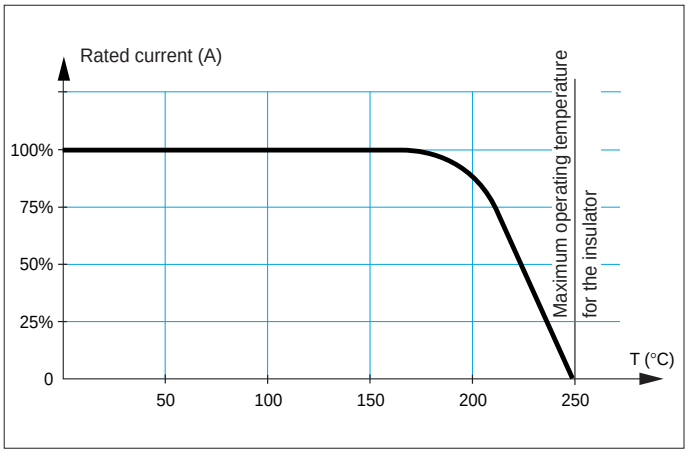
The specified rated current can be applied simultaneously to all the contacts.
It corresponds with an average temperature rise of 40°C of the connector.

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 case the current depend on the conductor dimension (see table on page 183) or on the printed circuit dimension.

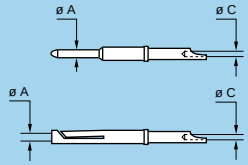
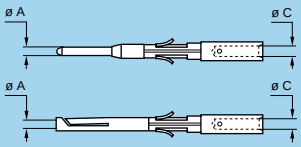
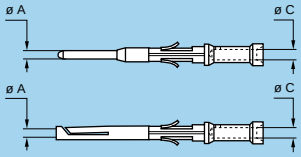
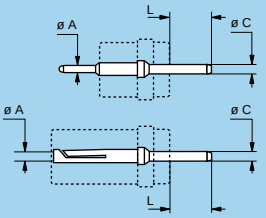
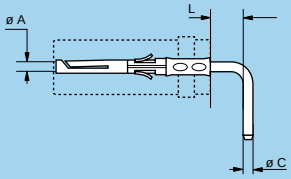
Caution:
In general, connectors should not be unmated while live.

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



Verify the fitting to your wire

Verify if the selected contact diameter (ø A) of the LEMO connector fits to your cable wire diameter (AWG number or max. available section).

Contact type	Contact			Conductor						F_r [1] (N)	Note
				Solid		Stranded					
						AWG		Section (mm²)			
	ø A (mm)	ø C (mm)	Form per fig.	AWG max.	Section max. (mm²)	min.	max.	min.	max.		
Solder 	0.5[2]	0.40[2]	–	28	0.09	–	30	–	0.05	–	●
	0.5	0.45	–	28	0.09	–	28	–	0.09	–	
	0.7[3]	0.60[3]	–	24	0.25	–	26	–	0.14	–	
	0.7	0.80	–	22	0.34	–	22[4]	–	0.34	–	
	0.9	0.80	–	22	0.34	–	22[4]	–	0.34	–	
	1.3	1.00	–	20	0.50	–	20[4]	–	0.50	–	
	1.6	1.40	–	16	1.00	–	18	–	1.00	–	
	2.0	1.80	–	14	1.50	–	16	–	1.50	–	
	3.0	2.70	–	10	4.00	–	12	–	4.00	–	
	4.0	3.70	–	10	6.00	–	10	–	6.00	–	
	5.0	5.20	–	–	–	–	8	–	10.00	–	
	6.0	5.20	–	–	–	–	8	–	10.00	–	
	8.0	7.00	–	–	–	–	4	–	16.00	–	
	12.0	11.50	–	–	–	–	0	–	50.00	–	
Crimp fig. 1 	0.5[5]	0.45	1	–	–	32	28	0.035	0.09	12	●
	0.7	0.80	1	–	–	26	22[4]	0.140	0.34	22	●
		0.45	2	–	–	32	28	0.035	0.09		○
	0.9	1.10	1	–	–	24	20	0.250	0.50	30	●
		0.80	2	–	–	26	22[4]	0.140	0.34		○
		0.45	2	–	–	32	28	0.035	0.09		○
	1.3	1.40	1	–	–	20	18	0.500	1.00	40	●
		1.10	2	–	–	24	20	0.250	0.50		○
		0.80	2	–	–	26	22[4]	0.140	0.34		○
fig. 2 	1.6	1.90	1	–	–	18	14[4]	1.000	1.50	50	●
		1.40	2	–	–	22	18	0.340	1.00		○
	2.0	2.40	1	–	–	16	12[4]	1.500	2.50	65	●
		1.90	2	–	–	18	14	1.000	1.50		○
	3.0	2.90	1	–	–	14	10[4]	2.500	4.00	75	●
	4.0	4.00	1	–	–	12	10	4.000	6.00	90	●
Print 	L dimensions and C are detailed in the section on PCB drilling pattern. See page 156 and 159.										●
Print (elbow) 	L dimensions and C are detailed in the section on PCB drilling pattern. See page 157 and 160.										●

Note:
1) contact retention force in the insulator (according to IEC 60512-8 test 15 a).
2) for 00 multipole series.
3) for S, E, 2C, 2G and 1D series.
4) 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.
5) for 00 multipole series or for 0B and 1B series with male contacts.