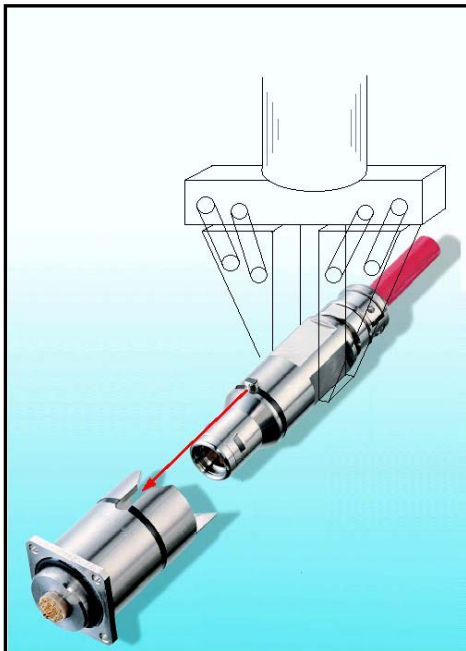


REFERENCE GUIDE

SELECTING A LEMO REMOTE HANDLING CONNECTOR ●



INTRODUCTION

A remote handling connector is a connector that can be remotely operated (connected or disconnected) by a robot or manipulator. LEMO has several connector series with remote handling capabilities. Robots or telemanipulators are typically used in environments that are harsh or dangerous for humans. This document focuses on gamma radiation environments in the nuclear industry; however, LEMO's remote handling connectors are suitable for many other harsh environment applications.

COVERAGE

- Types of telemanipulators and associated requirements
- Telemanipulator jaw-to-connector-interface
- Connector materials for radiation environments

BASIC FUNCTION

The operator controls the manipulator from a safe location and observes the movement and control of the manipulator on a closed circuit monitor or through a special leaded glass window.

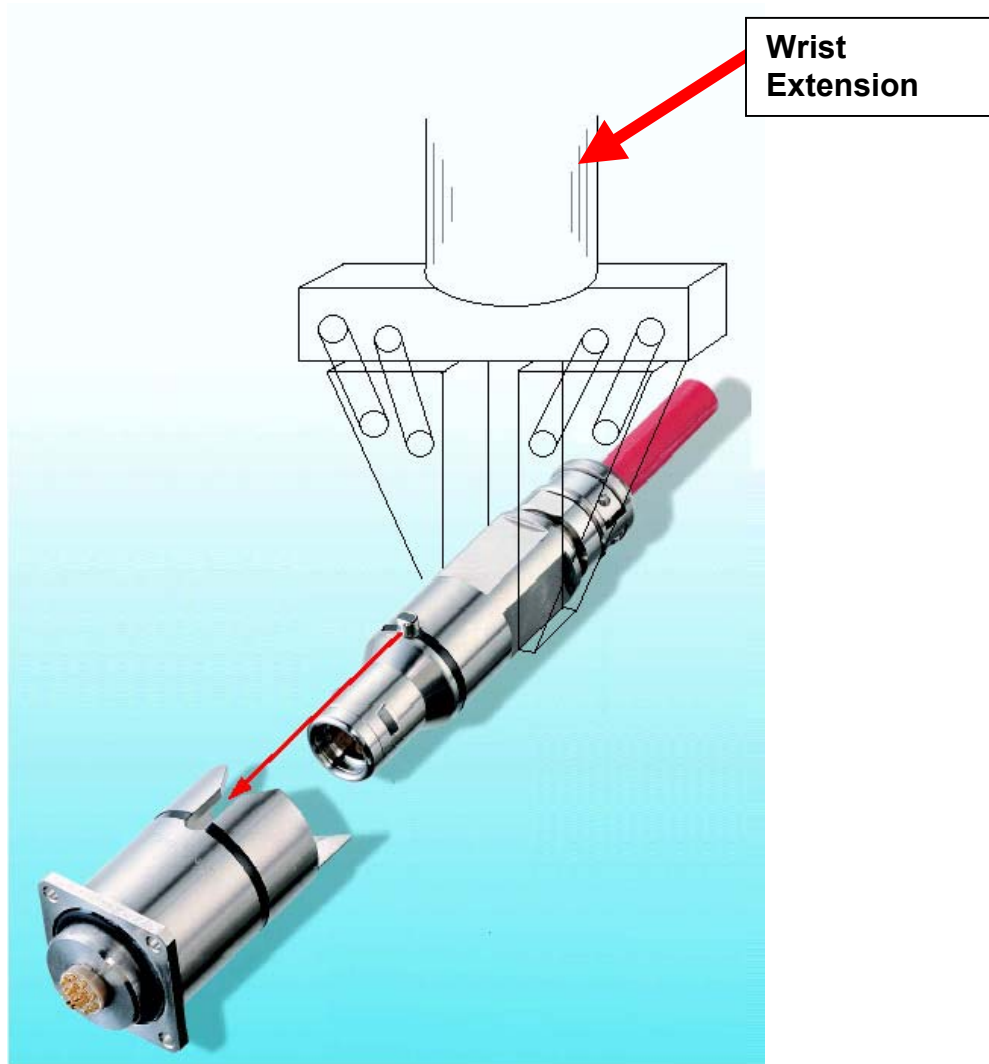
TYPES OF TELEMANIPULATORS

The type and range of telemanipulator and power of the telemanipulator will dictate the type and size of remote handling connector that it can handle.

- MSM's (Master Slave Manipulators) are manipulators that have physical feedback in the controls for the operator. The controls send physical signals to the operator so they can feel resistance such as when a connector is not properly aligned for mating. With this feedback the operator can adjust the alignment of the connector for insertion of the plug into the receptacle. MSM's typically have less power or force for inserting and withdrawing a connector.
- Power Manipulators are more powerful than MSM's, but they lack the physical feedback to the operator. Power Manipulators rely on additional features to assist with the guiding and mating of the connector pair.



The wrist-extension force specification of the manipulator is the typical parameter to review to determine limits for connector insertion force. The LEMO latching characteristics are in the front of most LEMO catalogs. The engaging force (F_v) is specified in (N) Newton. 1 Newton is equal to about 0.225 lbf (pound-force)¹.



	MSM	Low Power Manipulator	Power Manipulator
Power	Low	Low	High
Operator Feedback	Yes	No	No
Suggested LEMO Series	B Series S Series ² E Series ³	N Series Lever model (Y Type)	N Series Non-lever model (G Type)

¹ Typical equivalent value, not a hard spec.




² This series not recommended for new designs

The following connectors represent a sample of LEMO's remote handling connectors.

LEMO B SERIES
APPLICATION: MASTER SLAVE MANIPULATORS

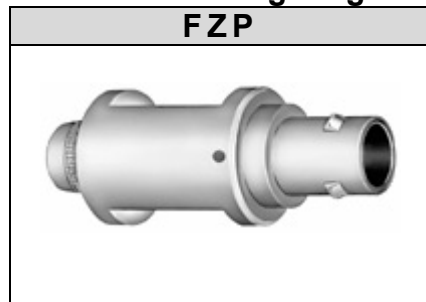
The B Series is best suggested for Master Slave Manipulators. The use of a manipulator with operator force feedback allows for the mating alignment.

B SERIES
Remote Handling Plugs

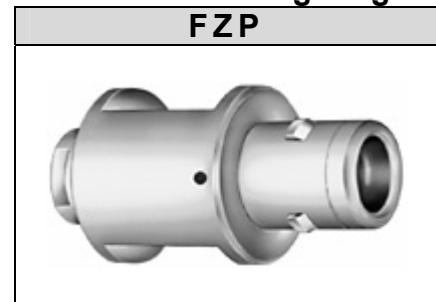
FZG	FIG	FKG
		

S AND E SERIES ONLY SHOWN FOR REFERENCE

S SERIES
Remote Handling Plug



E SERIES
Remote Handling Plug



³ This series not recommended for new designs.



LEMO N SERIES
APPLICATION: POWER MANIPULATORS

The **LEMO N Series** is suggested for power manipulators without operator feedback. The N Series has a landing tray on the receptacle to aid mating action. The plug and receptacle have self-aligning features for use with power manipulators. The lever version, Y-Type, has a 3:1 mechanical advantage for lower power manipulators. The keyed version, U-Type, has up to 32 customer configurable keying options*.

N SERIES NON-LEVER (G TYPE)




FZG PLUG	FMG ELBOW PLUG
	
EDG RECEPTACLE	
	

N SERIES W/LEVER (Y TYPE)

FZY PLUG	HSY RECEPTACLE
	

* Patent Pending

N SERIES W/KEYING (U TYPE)

FZU PLUG	FHU ELBOW PLUG
	
EDU RECEPTACLE	
	

REMOTE HANDLING CHECK LIST

- ❑ Determine manipulator power, or wrist-extension power available to insert the connector.
- ❑ Determine manipulator wrist-extension distance. Can the manipulator move the connector shell the full distance to land the insert the connector.
- ❑ Determine the manipulator lifting power. What is the weight lifting capability of the manipulator? Compare the estimated weight of the connector and cable.
- ❑ Manipulator controls - Does the unit have operator feedback? Are the alignment features of the N Series necessary for this manipulator?
- ❑ Determine the manipulator jaw face dimensions. Compare with the grip surface and size of the connector.

CONNECTOR INSERTION AND WITHDRAWAL FORCES

Mechanical latching characteristics for the B series are shown in the LEMO catalogs.

	2 B	3 B	4 B	5 B
AVERAGE LATCHING FORCE	15 N	17 N	39 N	48 N
AVERAGE UNMATING FORCE	12 N	14 N	38 N	38 N

The characteristic forces shown are for connector shells without contacts. For estimating purposes add an additional Newton per contact. Larger contacts will have a higher force.

The LEMO N series is very similar to the LEMO K series; use the LEMO K series values for initial estimating.

	2 K / 2 N	3 K / 3 N	4 K / 4 N	5 K / 5 N
AVERAGE LATCHING FORCE	20 N	32 N	65 N	85 N
AVERAGE UNMATING FORCE	13 N	25 N	40 N	60 N

The characteristic forces shown are for connector shells without contacts. For estimating purposes add an additional Newton per contact. Larger contacts will have a higher force.

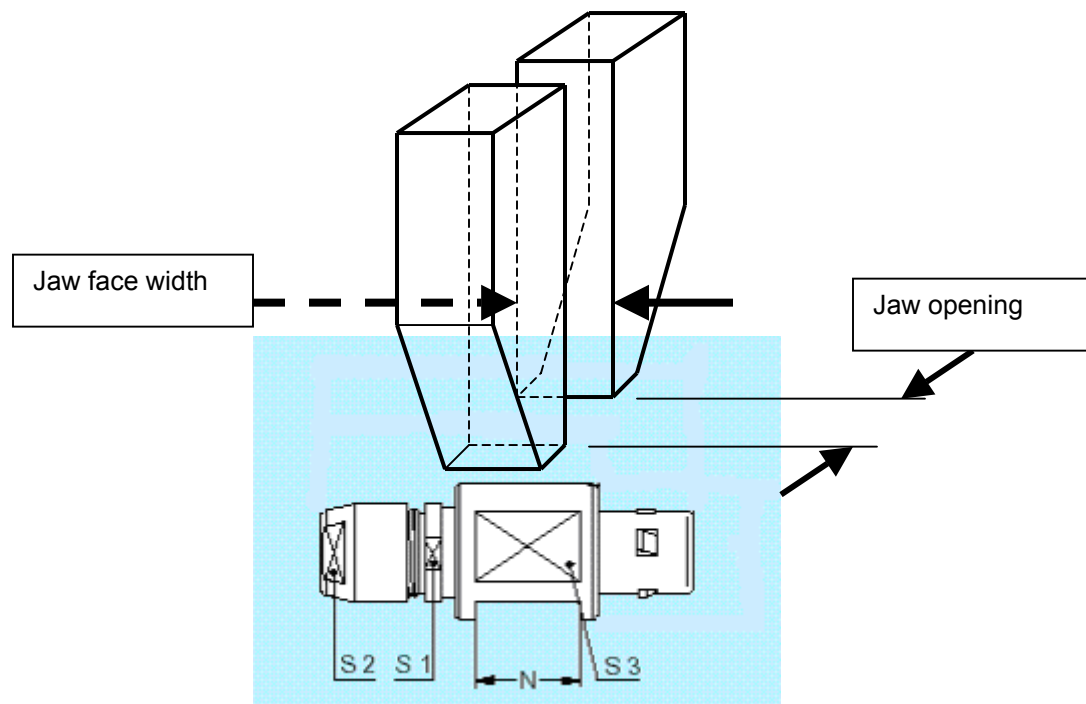
TELEMANIPULATOR JAW TO CONNECTOR INTERFACE

The jaws of the manipulator are the physical interface between the manipulator and the connector. The physical width of the jaw is needed to confirm if the grip face on the connector is large enough for the manipulator.

The interfaces on LEMO remote handling connectors are designed for parallel jaws. LEMO connectors offer flat sides for parallel jaws.

The jaws need to open wide enough to grip the connector.

The jaw face width needs to be narrow enough to fit into the flat sides of the connector.



For example, a manipulator with jaws that will open to 3 inches, and has a jaw face width of $\frac{3}{4}$ inch (19.05mm), can grasp a LEMO B Series connector - size 4B, style FZG. The "N" dimension (face width) is 25mm. The size 3B FZG would have an "N" dimension of 18mm, which is too small for the jaws of that manipulator. In this case the alternate FIG plug in size 3B would also be a candidate since the "N" dimension is 21.5mm.

A LEMO remote handling connector ensures a safe and secure latching with our QUICK-LOK™ push-pull, self-latching system. The connector is unlatched by pulling on the flat sides of the connector shell, or if it is a model with a lanyard, the lanyard can be



pulled to unlatch the connector. The lanyard allows the manipulator to retain a hold on the connector / cable assembly, without requiring a precise jaw grip.

TELEMANIPULATOR JAW CHECK LIST

- ❑ Verify jaw opening - Does the jaw open wide enough to grasp the connector?
- ❑ Check the jaw face width - Does the width of the jaw face fit within the flat space on the sides of the connector?
- ❑ Check clearances - If the N Series lever version is to be used, will the jaws clear all adjacent areas when the lever is in the up position and the down position?
- ❑ Will a lanyard be used to disconnect and retain the connector / cable?

CONNECTOR MATERIALS FOR RADIATION ENVIRONMENTS

Wet or Dry Application

LEMO connectors are rated to the IEC 60529 standard for ingress protection. The B Series and S Series are IP50 rated; these are dust-sealed connections when mated. The E Series and N Series are IP 66 rated; this is a rating for dust tight and watertight.

B Series	S Series	E Series	N Series
IP 50	IP 50	IP 66/68	IP 66
Dry environment	Dry environment	Wet environment	Wet environment

Outershell Material

The standard shell material for the B, S, and E Series is chrome-plated brass, other material options are:

- “S” letter code for external shell pieces in stainless steel.
- “T” letter code for external shell and latch sleeve in stainless steel
- “U” letter code for external shell, latch sleeve and internal metal pieces in stainless steel

The standard shell material for the N Series is stainless steel. The letter codes used for shell and internal mechanical metal parts are the same as above.

Grades of Stainless Steel Shell Material

B Series	S Series	E Series	N Series
AISI 303 w/o passivation	AISI 303 w/o passivation	AISI 303 w/o passivation	AISI 304 <i>AISI 304L special order</i>

AISI 303 stainless steel is available on the non-watertight series (B Series and S Series). AISI 303 does not have the same degree of corrosion resistance as AISI 304 stainless steel. The N Series is the primary series used for conditions where water will be present or Nitric Acid wash-down is necessary for radiation decontamination. AISI 304 stainless steel is standard material for the N Series.

Seal (Gland) Material

The standard seal material on the E Series is silicone. Changing to EPDM seals is possible as a special order. The B Series and S Series are IP 50 rated, non-watertight connectors; typically there are no seals.

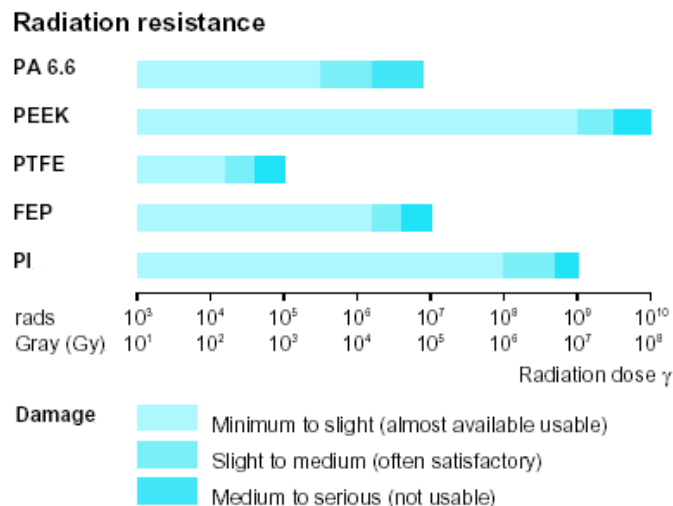
The standard seal material on the N Series is EPDM. EPDM is a radiation resistant material.

B Series	S Series	E Series	N Series
N.A. no seal	N.A. no seal	*Silicone	EPDM

* Special order, EPDM or Viton

Insert Material

The standard insert material for LEMO multi-pin connectors is PEEK (Polyether Etherketone). PEEK has excellent resistance to gamma radiation



Note: Technical data in this chapter provide general information on plastics used by LEMO as electrical insulators. LEMO reserves the right to propose new materials with better technical characteristics, and to withdraw, without notice, any material mentioned in the present catalog or any other publications edited by LEMO S.A. and/or its subsidiaries. LEMO SA and its subsidiaries use only plastic granules, powder or bars supplied by specialized companies, and thus cannot in any case take responsibility with regard to this material.

B Series multi-pin	S Series multi-pin	E Series multi-pin	N Series multi-pin
PEEK	PEEK	PEEK	PEEK

Coax contacts or hybrid inserts with low voltage contacts and coax contacts have Teflon insert material for the coax contact(s). Most coax inserts can be alternatively made in PEEK, but this would be a special order item. Hybrid connectors use PEEK inserts to hold the Teflon-coax contact.

B Series Hybrid	S Series Hybrid	S Series Coax	E Series Hybrid	E Series Coax	N Series Hybrid
PEEK/Teflon	PEEK/Teflon	Teflon	PEEK/Teflon	Teflon	PEEK/Teflon
Special order PEEK/PEEK	Special order PEEK/PEEK		Special order PEEK/PEEK		Special order PEEK/PEEK

Contact Material

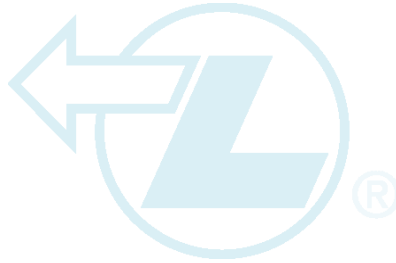
Contact material is brass with copper, nickel, gold plating for male contact and bronze with copper, nickel, gold plating for female contacts. Crimp contacts are typically used. This avoids lead based solders. Lead may be a restricted material.

The retaining clip on the crimp contacts is BeCu (Beryllium Copper). Beryllium may be a restricted material in loose or free powered form. In most cases a alloy configuration is acceptable. Please check your specific project requirements.

CONNECTOR / MATERIAL CHECK LIST

- Dry, Gamma Radiation environment? Use B Series, S Series with Stainless Steel options, or the N Series
- Wet Gamma Radiation environment, with possible Nitric Acid decontamination wash-down? Use N Series or stainless steel E Series with optional EPDM seals and optional AISI 304 Stainless Steel shell.
- Determine the required level of stainless steel
 - Shell only (S code)
 - Shell & Latch Sleeve (T code)
 - Shell, Latch Sleeve, and internal metal pieces (U code)
- Is Lead a restricted material? Use crimp contacts instead of solder contacts
- Are coax contacts required? Consider replacing Teflon insert material with PEEK insert material, if available, for the Coax Contact Pin assembly.

If you need technical assistance, please contact our Customer Service Department by phone at 1-800-444-5366 or via email at info@lemousa.com .



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