

## NEW FOR v3.1

- 0.05 mm Resolution CANbus Option
  - Larger Diameter Sensor Tube Options
  - SSI (Asynchronous Mode) Option
  - Up To 20 metre Stroke Now Available
  - High Speed Magnet Options
  - C - Calibratable Version
  - CANbus with Temperature Output Options
- 
- Compact
  - 20g vibration resistant
  - No external signal conditioning
  - Very robust solid state/zero wear design
  - Absolute signal

Subject to reasonable modifications due to technical advances

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# HISTORY OF ROTA LIMITED

Rota Limited (formerly known as Rota Engineering Limited) is based in Manchester, UK and was established in 1964. Linear Transducer production started in 1993. The company also specialises in the design and manufacture of patented tank level transducers, and also ultra robust electrical and fibre optic connectors for use in explosive atmospheres.

## IN-CYLINDER LINEAR TRANSDUCERS

Rota introduced In-Cylinder Linear Transducers into the hydraulic cylinder market in 2004. Incorporating well-protected solid state electronics in a high pressure tube, when installed in the piston rod the only moving part is the non-contact magnet moved by the piston.

An Intrinsically Safe version for explosive atmospheres followed shortly afterwards. The LK design is Rota's latest Intrinsically Safe linear transducer.

Our customers include the largest companies in hydraulics, construction equipment, trucks, farm machinery, forestry equipment, military, and mining equipment etc. Many of the applications have seen diverse combinations of shock, vibration, temperature, pressure spikes, EMC, etc.

## QUALITY

Designing and building Transducers and Connectors for use in explosive atmospheres requires an obsession with quality. Rota's quality systems were originally approved to British Standard 5750 back in 1986, and are now assessed by B.S.I to ISO 9001:2015. The QA system is also Audited by B.S.I and CSA for Ex certified transducers and connectors.

Rota's environmental management system has achieved ISO 14001:2015 certification.

## SENSOR RANGE

### Mobile:

- LA Swaged Aluminium 6082 T6 Transducer for Mobile Hydraulic Cylinders, 350 bar working pressure
- LB Swaged 304L Stainless Steel Transducer for Mobile Hydraulic Cylinders, 375 bar working pressure
- LM Welded 304L Stainless Steel Transducer for Mobile Hydraulic Cylinders, 375 bar working pressure
- LL Light Duty Aluminium 6082 T6 Independently Pin-Mounted Transducer

### Industrial:

- LJ Welded 316 Stainless Steel Transducer for Industrial Hydraulic Cylinders
- LJW Welded 316 Stainless Steel Subsea Transducer rated to 5000 m depth
- LF Welded 316 Stainless Steel High Pressure Transducer rated at 720 bar working pressure
- EL Externally Mounted Transducer for Hydraulic Cylinders up to 20 mm wall thickness
- ML Modular Transducers with very compact connection joint for up to 30 m stroke
- LV Verification Transducer with additional array of Hall-effect sensors for verifying the primary circuit
- ELV Externally Mounted Verification Transducer
- LR Dual Redundant Transducer housing two entirely separate sensing circuits
- LQ Triple Redundant Transducer housing three entirely separate sensing circuits
- LK Intrinsically Safe Transducer suitable for zones 0/1/2, Atex categories 1/2/3
- LD Explosive Atmosphere Transducer suitable for zones 1/2, Atex categories 2/3
- LZ Welded 316L SS Ex e mb Combined High Resolution Transducer & High Voltage Switching Device
- AC Externally Mounted Transducer for Carbon Steel Piston Accumulators up to 25 mm wall thickness
- AL Externally Mounted Transducer for Carbon Steel Pumps and certain Hydraulic Cylinders with limited crush load
- TL Tank Level Monitoring Transducer suitable for Diesel, Oils, Adblue, Agri Chemicals, etc.
- TLT Tank Level Transducer with Integrated Temperature Sensor
- TLH Tank Level Transducer for Harsher Applications
- LN Normal Duty 316L Stainless Steel Independently Pin-Mounted Transducer with Subsea Options
- LNKY Ex ia I.S LN Transducer
- LU Ultra-Heavy Duty 316L Stainless Steel Independently Pin-Mounted Transducer with Subsea Options
- LUR Dual Redundant LU Transducer with two entirely separate sensing circuits
- LUKY Ex ia I.S LU Transducer
- RT Radial Transducer with Low Resolution 90° Position Monitoring
- RJ Radial Transducer with High Resolution 290° Position Monitoring

## LJ TRANSDUCER

The LJ solid state linear transducers are designed for high pressure industrial hydraulic cylinders. With compact sensor heads and no external signal conditioning required, they fit easily into cylinders, without compromising their stroke to body length ratio.

Subject to reasonable modifications due to technical advances



# RELIABLE OPERATION TOUGH APPLICATION



## ADVANCED FEATURES

### 20G RMS VIBRATION RESISTANCE INCLUDING RESONANT FREQUENCIES

To assure an extended life for our products, Rota is one of only a few companies that exceed standard requirements during vibration testing. In particular, Rota sensors are tested at 20g (RMS) from 10-2000Hz (including resonant frequencies) and additionally held at 1g for one hour at resonant frequencies.

Rota's electronics comply, and in all cases, exceed the requirements of the following IEC standards:

- IEC 60068-2-64 (Vibration, Broadband Random & Guidance) at 20g 10-2000Hz (RMS) in all 3 axes
- IEC 60068-2-6 (Vibration, Sinusoidal) at 20g 10-2000Hz in all 3 axes
- IEC 60068-2-27 (Shock) Total of 6000 shocks at 50g over all 3 axes
- Resonant Frequency Search and Dwell Test - 10-2000Hz up to 7 found and each held @1g for 1 Hour

### OUTSTANDING EMC PERFORMANCE

Rota LJ transducers meet some of the highest EMC standards worldwide, enabling safe and secure operation in electromagnetic environments whilst ensuring superior and reliable performance. All Rota LJ sensors are designed to meet and exceed the compliance requirements in the standards listed below.

- EN 61000 - 6 - 1 : 2007 EN 61000 - 6 - 3 : 2007+A1 : 2011
- EN 61000 - 6 - 2 : 2005 EN 61000 - 6 - 4 : 2007+A1 : 2011
- EN61326-1:2013

### CALIBRATABLE OPTION

It's possible to order customer calibratable transducers, which will be delivered in calibration mode where the "end of stroke" signal positions must be set after the transducer has been installed in the cylinder/actuator.

Benefits:

- Signal positions can be tailored to the mechanical tolerances of cylinder/actuator
- One transducer model can cater for multiple stroke lengths
- Cost efficient - can bulk buy sensors with undetermined strokes

Available with voltage and current output as normal and reverse signal. Sensors come supplied with approximately 5 mm of extra stroke at each end to allow for tolerance stack up and mechanical wear.

### SELECTABLE OUTPUT

Rota now offer our transducers with a 'BU' signal output. The sensors come equipped with both a current output (4-20mA) and a voltage output (1.0-5.0V), allowing the cylinder manufacturer to decide signal output at a later stage. This enables the possibility for hydraulic cylinder manufacturers to build up stock and cut costs even when the output signal is unassigned at point of purchase.

### CANBUS WITH TEMPERATURE INDICATION

Rota's LJ series transducer can now be ordered with temperature indication, available with CANbus SAE J1939 and CANopen outputs. The inclusion of temperature indication allows the possibility of reduced overall cost, and can free up I/O ports, as one sensor can replace two (and sometimes three) sensors in a hydraulic cylinder.

Please contact Rota for more information



Subject to reasonable modifications due to technical advances



**RELIABLE OPERATION TOUGH APPLICATION**



# CABLE AND CONNECTOR OPTIONS

## CABLES & WIRES - For Analogue and CANbus outputs

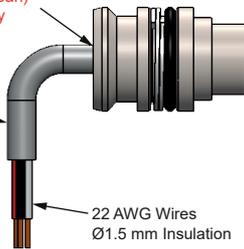
N and U cables, and individual wires have IP69K rated cable/wire entries (steam jet clean up to 150 bar at 99°C).

### N - PVC Cable

-55°C to +105°C (-67°F to +221°F)

IP69K (Steam Jet Clean)  
Rated Cable Entry

2 & 3 Wires Ø4.8 mm  
- for Analogue Outputs  
4 Wires Ø4.8 mm  
- for Digital Outputs  
Min fixed bending  
radius 25.4 mm at -40°C



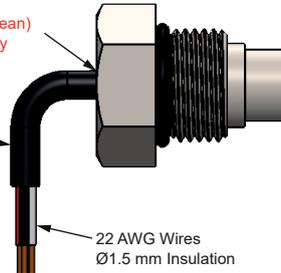
22 AWG Wires  
Ø1.5 mm Insulation

### U - PUR Cable

-40°C to +90°C (-40°F to +194°F)

IP69K (Steam Jet Clean)  
Rated Cable Entry

2 & 3 Wires Ø4.8 mm  
- for Analogue Outputs  
4 Wires Ø4.8 mm  
- for Digital Outputs  
Min fixed bending  
radius 24 mm at -40°C



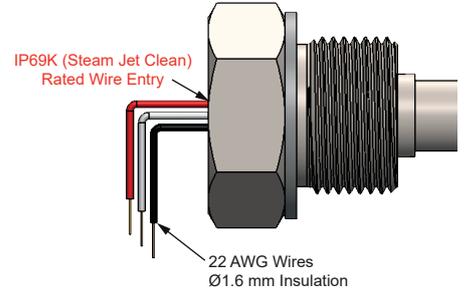
22 AWG Wires  
Ø1.5 mm Insulation

### W - Individual Wires

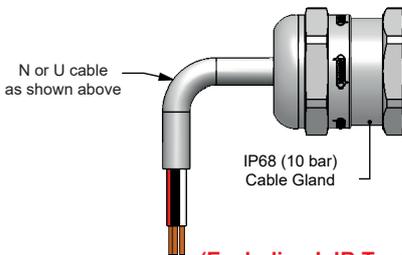
-40°C to +105°C (-40°F to +221°F)

IP69K (Steam Jet Clean)  
Rated Wire Entry

22 AWG Wires  
Ø1.6 mm Insulation

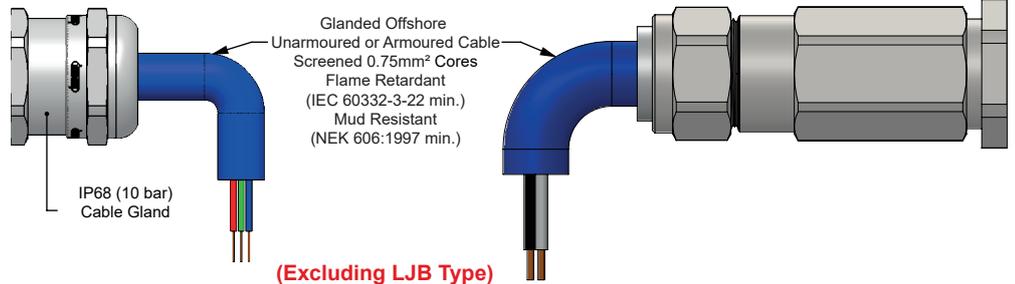


### (N or U) G - Glanded Cable\*



(Excluding LJB Type)

### \*\* G - Glanded Offshore Cable\*\*\*



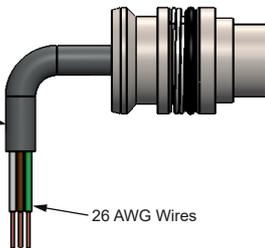
(Excluding LJB Type)

## CABLES & WIRES - For SSI Outputs

### N - PVC Cable

-40°C to +80°C (-40°F to +176°F)

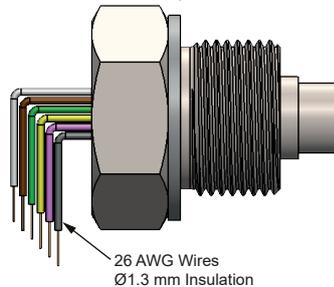
6 Wires Ø4.9 mm  
-for SSI (Asynchronous  
Mode) Outputs  
Min fixed bending  
radius 19.6 mm



26 AWG Wires

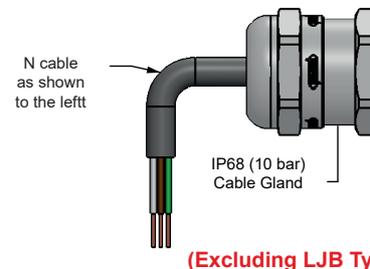
### W - Individual Wires

-40°C to +105°C (-40°F to +221°F)



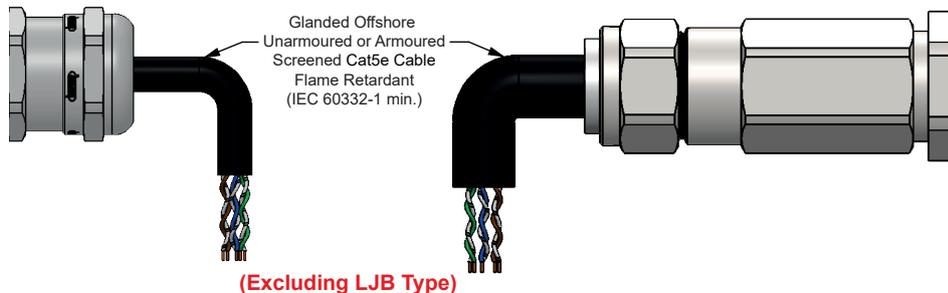
26 AWG Wires  
Ø1.3 mm Insulation

### (N) G - Glanded Cable\*



(Excluding LJB Type)

### \*\* G - Glanded Offshore Cable\*\*\*



(Excluding LJB Type)

\*Glanded N or U cables available for 12 mm tube diameter sensors only

\*\*See page 6 for offshore cable coding

\*\*\*Armoured offshore cables available for 16 mm and 19 mm tube diameter sensors only, excludes CANbus outputs

Subject to reasonable modifications due to technical advances



# RELIABLE OPERATION TOUGH APPLICATION

Rota Limited, Manchester UK

www.rota-ltd.com

LJ CAT V3.05.03



# OFFSHORE CABLE OPTIONS AND CONNECTOR TERMINATION OPTIONS

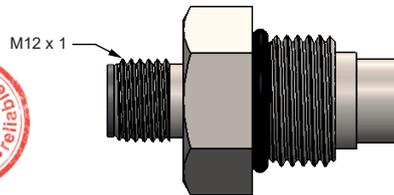
## M12 CONNECTORS - IP69K RATED

Steam Jet Clean  
Up to 150 bar (2180 psi)  
at 85°C (185°F)  
Open Face - even with  
cap/connector not fitted  
Independent UKAS Test  
(IAF MLA)

(Supplied with HDPE protective cap  
- not shown)



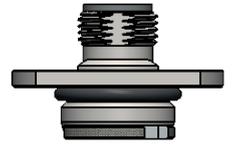
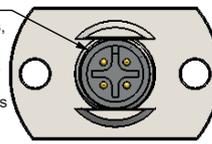
### J - M12 Integrated Connector



(LJE & LJM Types Only)

### K - M12 Connector

4 Pin for  
Analogue Outputs,  
5 Pin for  
CANbus Outputs,  
or 8 Pin for  
SSI (Asynchronous  
Mode) Output



(LJB Type Only)



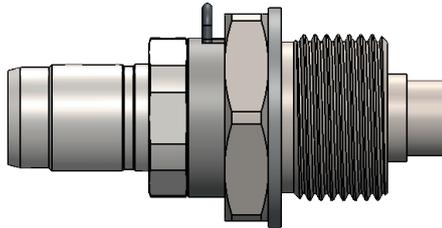
## ULTRA HEAVY DUTY B-SERIES CONNECTORS - IP69K RATED

### Rota B-Series Connector

IP68 3m, 7 day Open Face  
**IP69K Steam Jet Clean Open Face**  
up to 150 bar (2180 psi) at 85°C (185°F)  
- even with cap/connector not fitted  
Independent UKAS Test (IAF, MLA)

(Supplied with Stainless Steel 316  
Dust Cap - not shown)

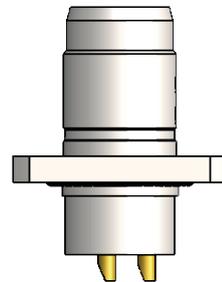
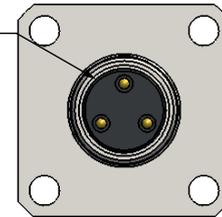
### B - Integrated B-Series Connector



(LJQ & LJR Types Only)

### Flanged B-Series Connector (must be ordered separately)

3 Pin for  
Analogue Outputs,  
4 Pin for  
CANbus Outputs,  
or 7 Pin for  
SSI (Asynchronous  
Mode) Output



3 Pin Rota p/n: QBC 1581  
4 Pin Rota p/n: QBC 3298  
7 Pin Rota p/n: QBC 2636

For subsea connectors please see LJW Catalogue

## OFFSHORE CABLES:

	Rota p/n	No. of Conductors	Conductor Size	Suitable Outputs	OD (mm)	40°C Flex	Fire Res.	Mud Res.	Min. bend radius (Fixed) (mm)	Temp. Rating
Armoured*	GJM Y1P	1 Pair	0.75 mm <sup>2</sup>	T	11.2/13.6	CSA	-	Yes	55	-40°C to +90°C
	GHM Y1T	1 Trip	0.75 mm <sup>2</sup>	A, B, C, F, G, H, L, R, T, V	11.5/13.5	-	Yes	Yes	78	-40°C to +80°C
	GJN Y2P	2 Pair	0.75 mm <sup>2</sup>	All Analogue	14.3/15.9	CSA	-	Yes	95	-40°C to +90°C
	GW5 C4P	4 Pair	Cat5e	Q	11.0/13.4	-	-	Yes	135	-40°C to +60°C
Unarmoured	UJM Y1P	1 Pair	0.75 mm <sup>2</sup>	T	7.0/8.0	CSA	-	Yes	32	-40°C to +90°C
	UHM Y1T	1 Trip	0.75 mm <sup>2</sup>	A, B, C, F, G, H, L, R, T, V	7.6/10.0	-	Yes	Yes	57	-40°C to +80°C
	UJM Y2P	2 Pair	0.75 mm <sup>2</sup>	All Analogue	11.0/13.0	CSA	-	Yes	48	-40°C to +80°C
	UV5 C4P	4 Pair	Cat5e	Q	6.2/6.8	-	-	-	35	-40°C to +80°C

The first two characters of the Rota p/n form the cable code in the transducer order code (see page 23).

These codes will be assigned by Rota by default, using the least possible number of conductors for a given signal output.

E.g. If a 2 metre long unarmoured offshore cable is requested with a T output, the cable UJM Y1P will be used by default. The order code in this case would be: "... 0.xT UJ2.0 G ..."

If a different cable is required, please contact Rota.

\*16 mm and 19 mm diameter sensor tubes only  
Not available for CANbus outputs.

Subject to reasonable modifications due to technical advances



**RELIABLE OPERATION TOUGH APPLICATION**

Rota Limited, Manchester UK

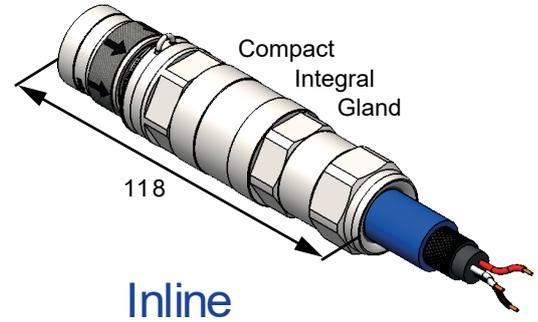
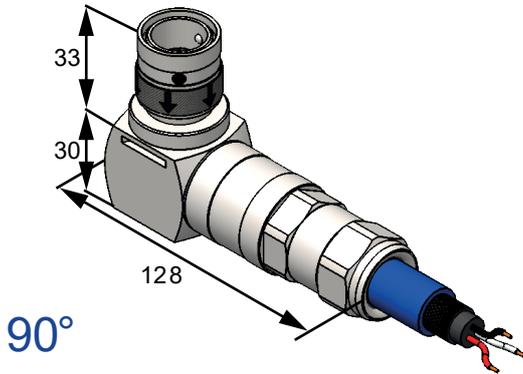
www.rota-ltd.com

LJ CAT V3.06.04

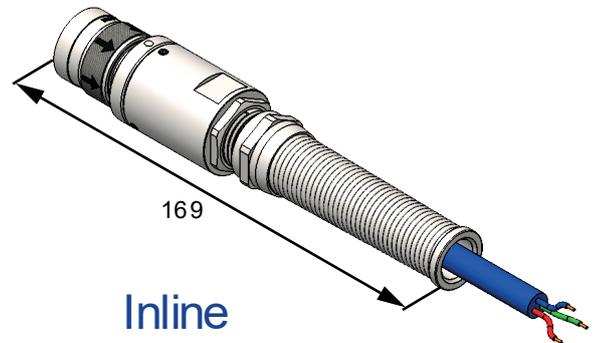
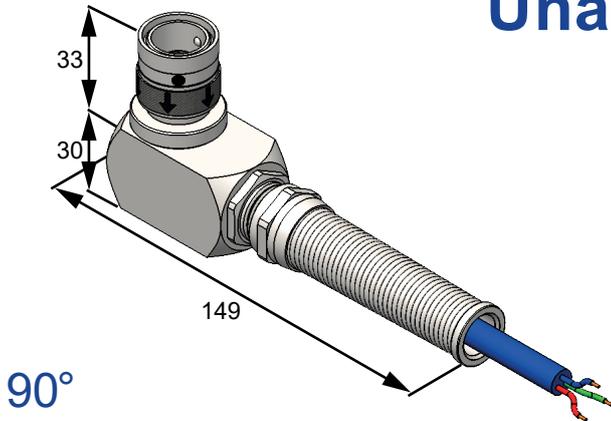


# MATING CONNECTOR ASSEMBLIES FOR LJ...B TRANSDUCERS

## Armoured



## Unarmoured



	Rota p/n	Orientation	Cable Rota p/n	Wires	OD (mm)	-40°C Flex	Fire Res.	Mud Res.	Min. bend radius (Fixed) (mm)	Temp. Rating
Armoured	QBC 2301 L-	90°	GHM Y1T	2 or 3	11.5/13.5	-	Yes	Yes	78	-40°C to +80°C
	QBC 2312 L-	Inline								
	QBC 2810 L-	90°	GJM Y1P	2	11.2/13.6	CSA	-	Yes	55	-40°C to +90°C
	QBC 2821 L-	Inline								
Unarmoured	QBC 2320 L-	90°	UHM Y1T	2 or 3	7.6/10.0	-	Yes	Yes	57	-40°C to +80°C
	QBC 1847 L-	Inline								
	QBC 2832 L-	90°	UJM Y1P	2	7.0/8.0	CSA	-	Yes	32	-40°C to +90°C
	QBC 2843 L-	Inline								

### Example Ordering Codes

1 metre Inline Armoured Cable  
12 metre 90° Unarmoured Cable

**QBC 2312 L01**  
**QBC 2320 L12**

B Series Connector

**IP68**  
3m, 7days

**IP69K**  
Steam Jet Clean up to 150bar (2180psi), +85°C (+185°F)  
Independent UKAS Test (IAF MLA)

Open Face Ratings  
i.e. even with cap/connector not fitted

All Cable Assemblies are supplied with Protective Caps and have a maximum length of 100 metres.

Subject to reasonable modifications due to technical advances



**RELIABLE OPERATION TOUGH APPLICATION**



# SENSOR TUBE DIAMETER OPTIONS

Rota LJ Series transducers are available in 3 different tube sizes. As standard, LJ Series transducers are manufactured with a 12 mm diameter tube, but larger diameter tubes (16 mm and 19 mm) are available for applications where tube bending is a concern, e.g., long stroke, horizontally mounted transducers.

Consideration should be given to the angle of cylinder mounting, cylinder speed, internal diameter of cylinder, and the viscosity of the hydraulic fluid used.

Mounted horizontally, a transducer with a 16 mm diameter tube will bend 43% less than a transducer of the same length with a 12 mm diameter tube. A transducer with a 19 mm diameter tube will bend 57% less than a transducer of the same length with a 12 mm diameter tube.



Transducer Tube Diameter (mm)	Relative Bending	Maximum Stroke (mm)
12	1	5800
16	0.57	15000
19	0.43	20000

To minimise the risk from transducer bending, a longer dead length at the end of the transducer may be required.

NB - Tube diameter is signified by the chosen magnet. E.g., an LJB with an FT magnet will have a 16 mm tube diameter. See Pages 14 - 16 for magnet details.

If a remote magnet is required, please specify the desired tube diameter. See page 16.

Subject to reasonable modifications due to technical advances

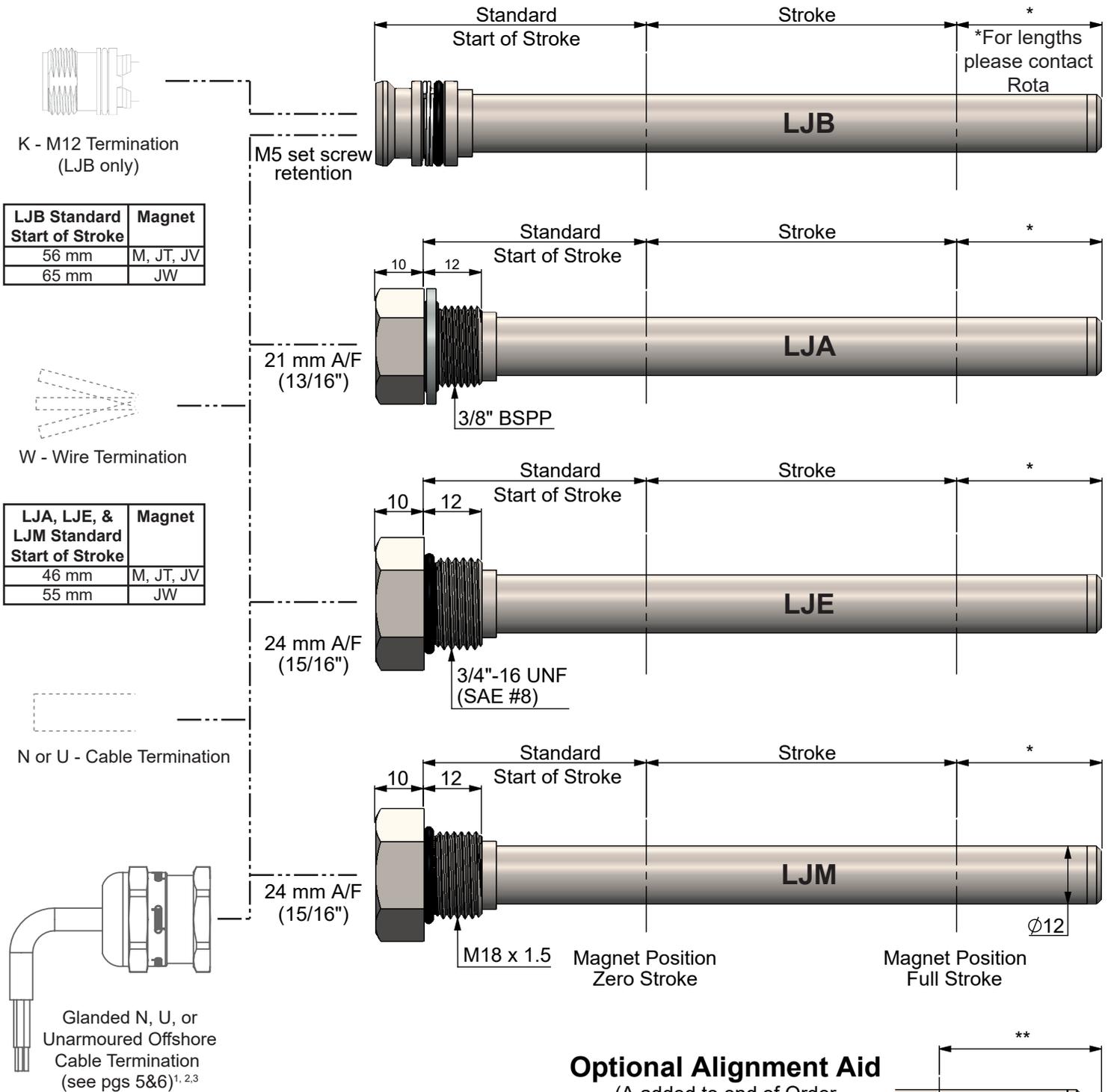


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# MOUNTING CONFIGURATIONS

## 12 mm TUBE DIAMETER SENSORS



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Rota Limited, Manchester UK

www.rota-ltd.com  
 LJ CAT V3.09.02



# MOUNTING CONFIGURATIONS

## 12 mm TUBE DIAMETER SENSORS

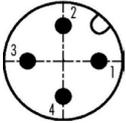
### M12 CONNECTOR

LJA Standard Start of Stroke	Magnet
43 mm	M, JV, JT
60 mm	JW

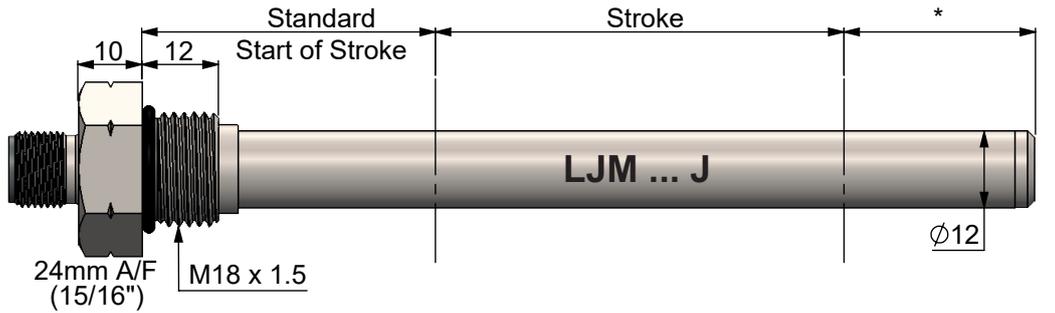
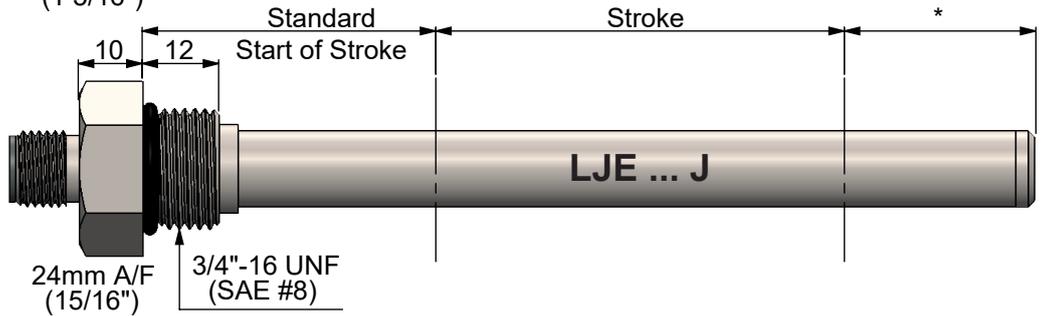
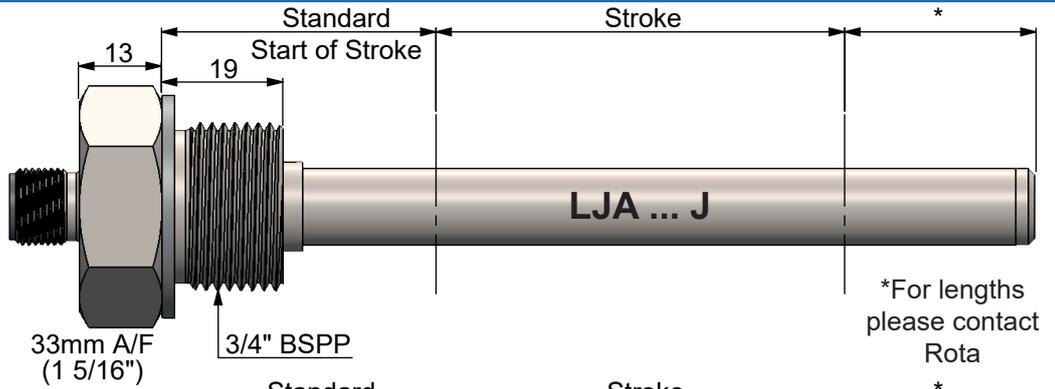


**IP69K**  
 Steam Jet Clean  
 Up to 150 bar (2180 psi)  
 at 85 °C (185 °F)  
 Open face - even with  
 cap/connector not fitted  
 Independent UKAS Test  
 (IAF, MLA)

LJE & LJM Standard Start of Stroke	Magnet
46 mm	M, JV, JT
55 mm	JW



Example Transducer Face View  
 J - Termination  
 M12 x 1 Male Pins  
 Termination is A Coding

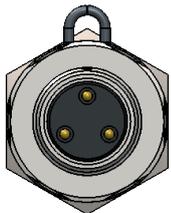


### ROTA B SERIES CONNECTOR

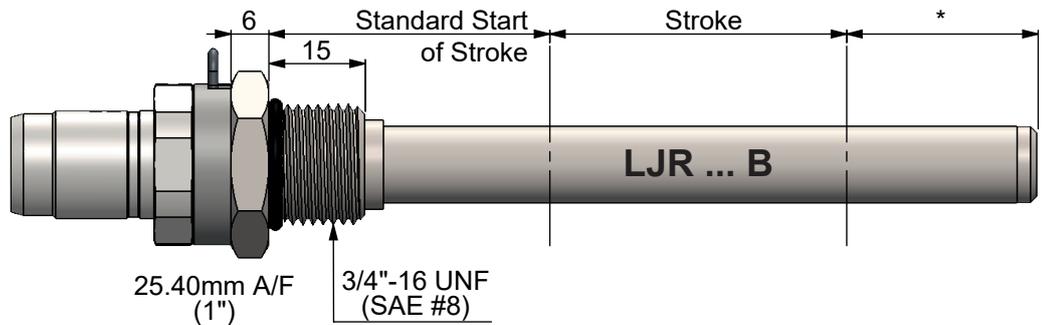
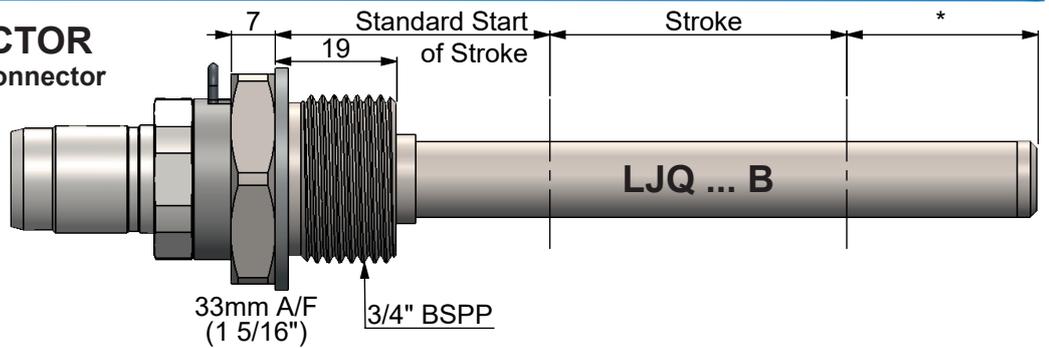
Ultra-Robust 316 Stainless Steel Connector

**IP68** 3m, 7 day Open Face  
**IP69K Steam Jet Clean** Open Face  
 up to 150 bar (2180 psi) at 85°C (185°F)  
 - even with cap/connector not fitted  
 Independent UKAS Test (IAF, MLA)  
 (Supplied with Stainless Steel Cap - not shown)

Standard Start of Stroke	Magnet
43 mm	M, JV
49 mm	JT
55 mm	JW



Example Transducer Face View  
 B - Termination



Subject to reasonable modifications due to technical advances

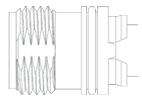


**RELIABLE OPERATION TOUGH APPLICATION**



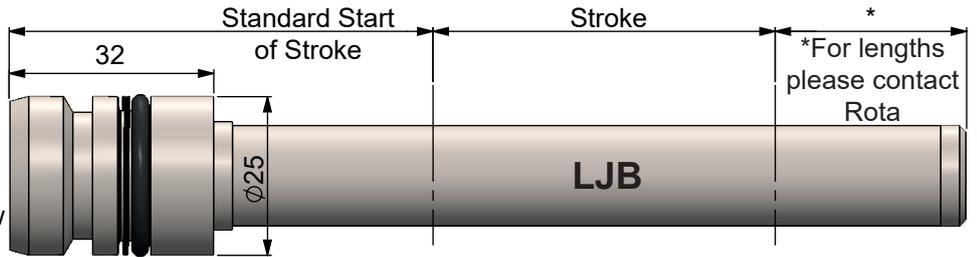
# MOUNTING CONFIGURATIONS

## 16 mm TUBE DIAMETER SENSORS

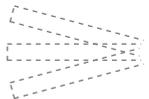


K - M12 Termination  
(LJB only)

M5 set screw retention



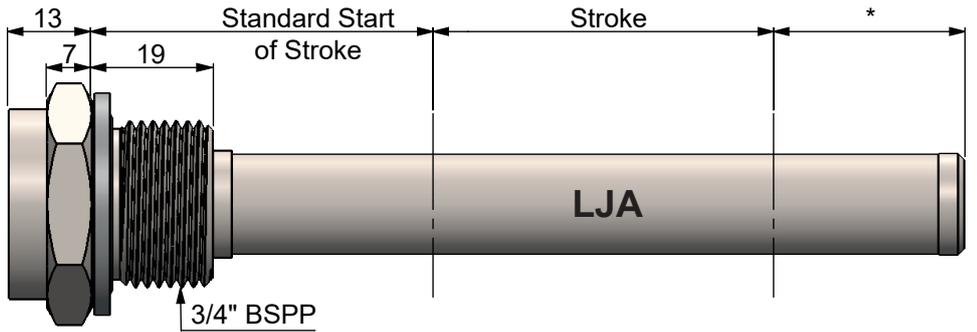
LJB Standard Start of Stroke	Magnet
56 mm	FV
57 mm	FT
85 mm	FW



W - Wire Termination<sup>1</sup>

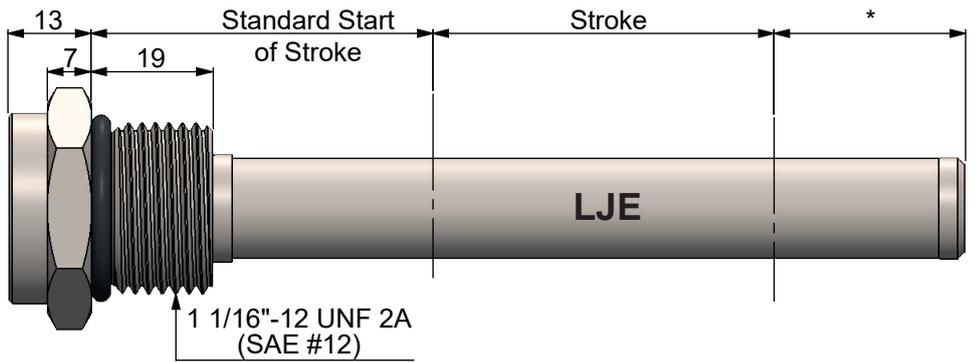
1. Due to handling and shipping requirements, Wires Termination is not recommended for 16mm or 19mm tube sensors

33mm A/F  
(1 5/16")



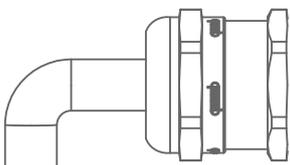
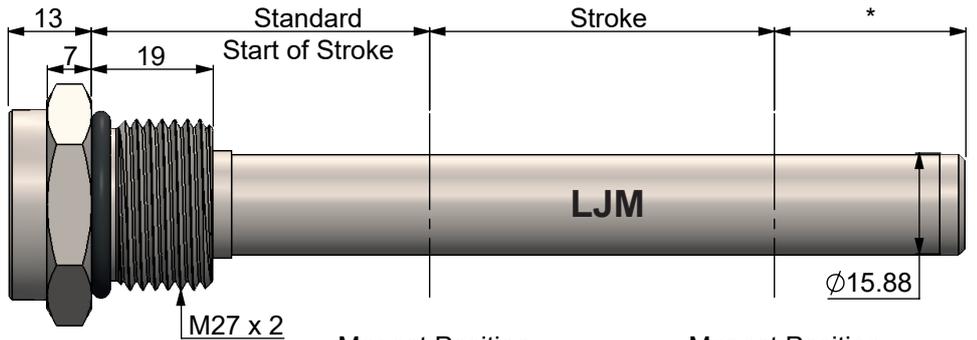
N or U - Cable Termination

33mm A/F  
(1 5/16")



LJA, LJE, & LJM Standard Start of Stroke	Magnet
52 mm	FV
59 mm	FT
62 mm	FW

33mm A/F  
(1 5/16")



Glanded Offshore Cable Termination  
(Armoured or Unarmoured options available - see pgs 5&6)<sup>2</sup>

2. Excludes LJB

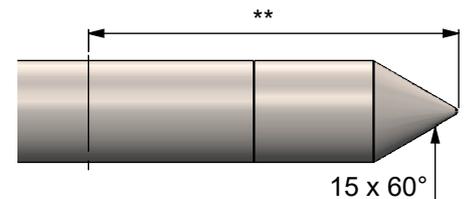
Magnet Position Zero Stroke

Magnet Position Full Stroke

### Optional Alignment Aid

(A added to end of Order Code - See Page 23)

\*\*Adds  $\geq 31$  mm to length, please contact Rota for this length.



Subject to reasonable modifications due to technical advances



**RELIABLE OPERATION TOUGH APPLICATION**

Rota Limited, Manchester UK

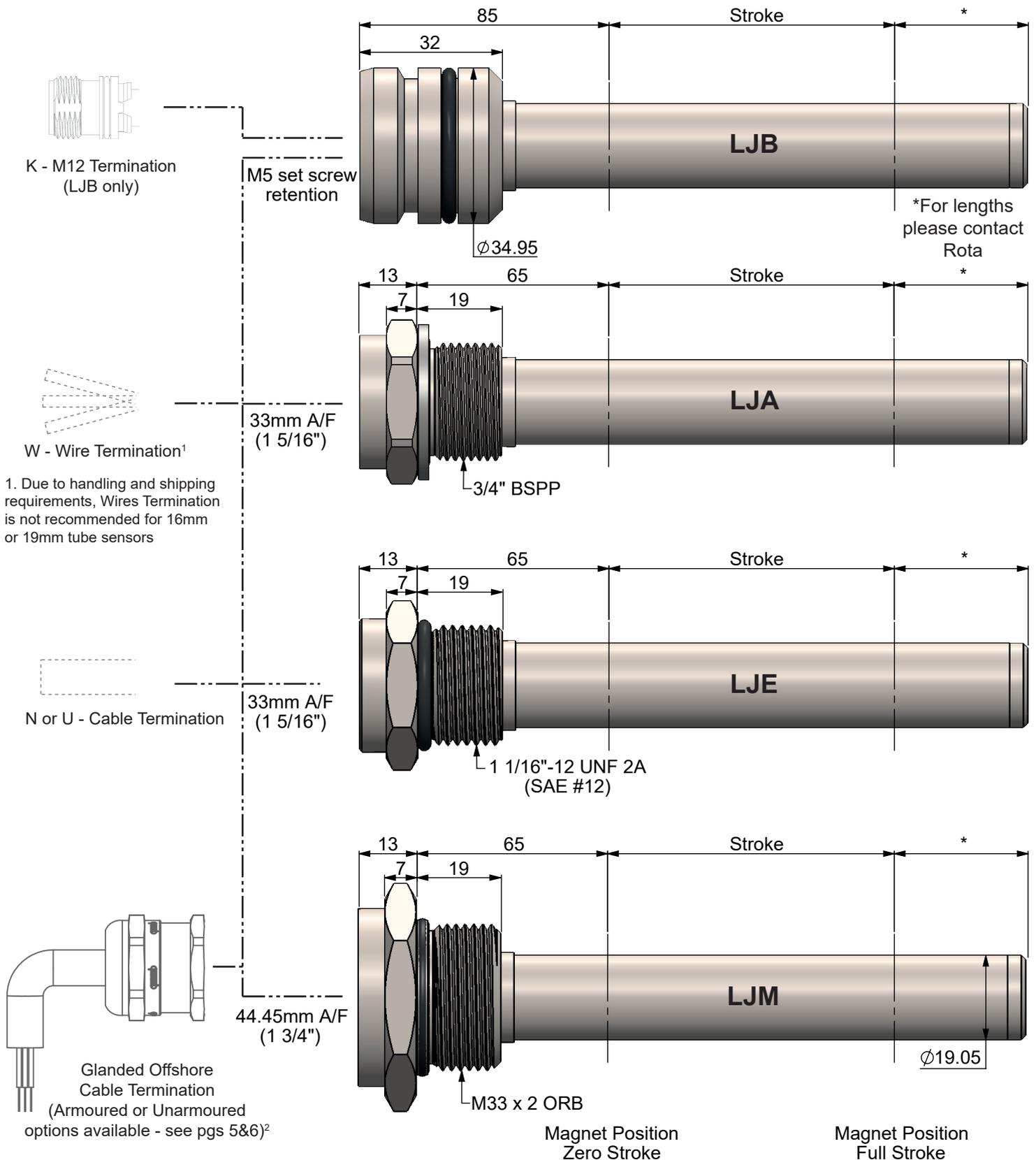
www.rota-ltd.com

LJ CAT V3.11.01



# MOUNTING CONFIGURATIONS

## 19 mm TUBE DIAMETER SENSORS



2. Excludes LJB

Subject to reasonable modifications due to technical advances



**RELIABLE OPERATION TOUGH APPLICATION**

Rota Limited, Manchester UK

www.rota-ltd.com

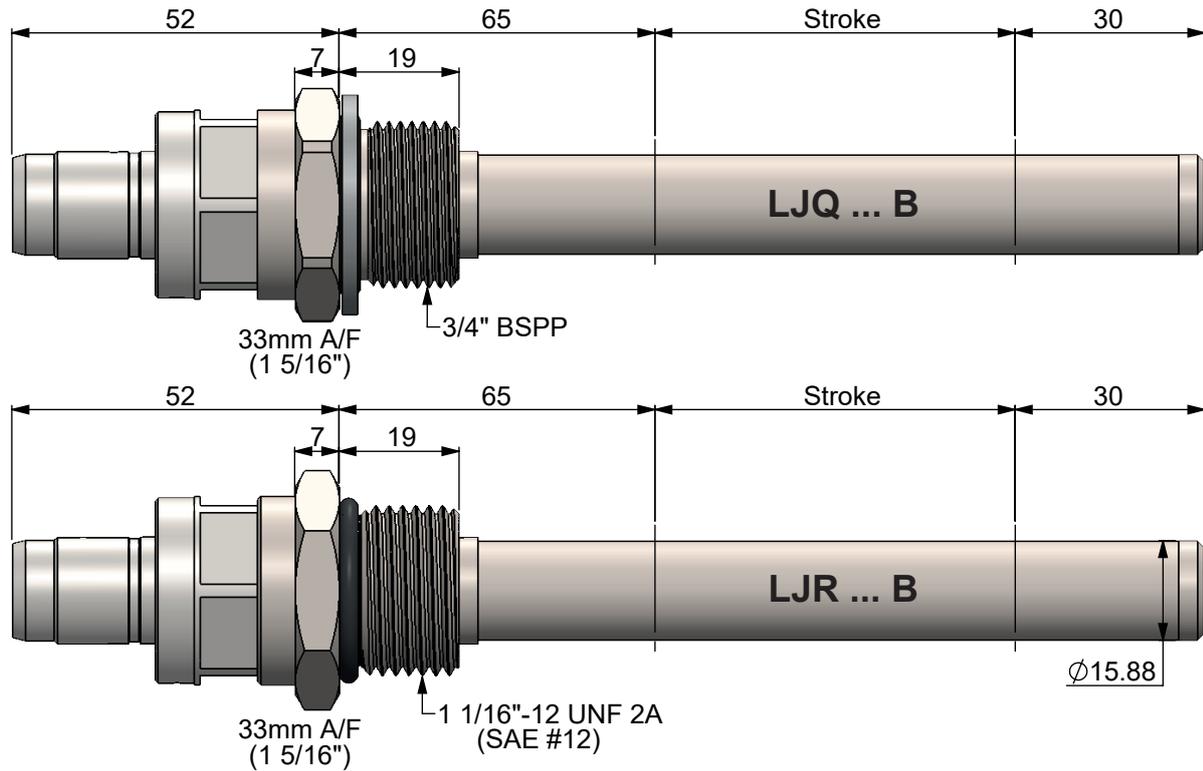
LJ CAT V3.12.01



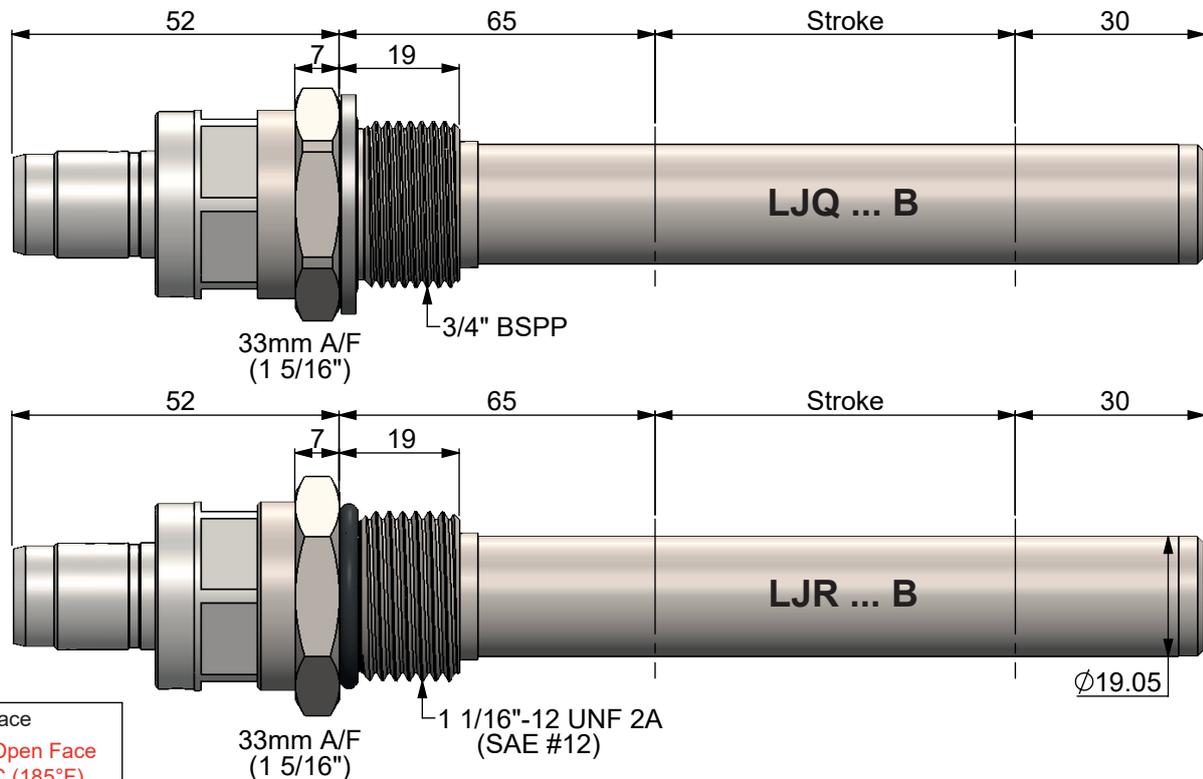
# B SERIES CONNECTOR TERMINATIONS

## 16 mm & 19 mm TUBE DIAMETER SENSORS

### 16 mm TUBE DIAMETER SENSORS



### 19 mm TUBE DIAMETER SENSORS



Example Transducer Face View  
B - Termination

IP68 3m, 7 day Open Face  
**IP69K Steam Jet Clean** Open Face  
 up to 150 bar (2180 psi) at 85°C (185°F)  
 - even with cap/connector not fitted  
 Independent UKAS Test (IAF, MLA)  
 (Supplied with Stainless Steel Cap - not shown)

Subject to reasonable modifications due to technical advances



**RELIABLE OPERATION TOUGH APPLICATION**



# INTERNAL MAGNET OPTIONS

## 12 mm TUBE DIAMETER SENSORS

Internal magnets must be housed in magnetic material - for housing in non-magnetic material please contact Rota. For machining details please see pages 18 - 19.

### Maximum Electronic Speed:

Output	Magnet	M, FV, JV	JT, FT	JW, FW, QW ***
Analogue**		2.5 m/s	5.5 m/s	8 m/s
J1939		2 m/s	3.5 m/s	8 m/s
CANopen		1.75 m/s	3.25 m/s	7 m/s

Electronics speed only, mechanical constraints may exist. For longer transducers, particularly when used with certain types of hydraulic oil or in sub-zero temperatures this velocity must be significantly reduced.

\*\*3-wire outputs only, 2-wire output is slower, please contact Rota.

\*\*\*For higher speeds please contact Rota.

### Circlip Design

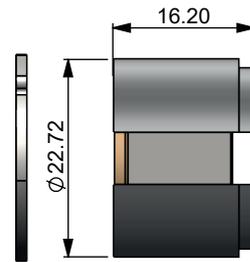
#### 'M' Magnet (Rota P/N LJ 1234)

<±0.5 mm Non-linearity

0.05 mm Resolution: - CANbus/SSI any length

0.1 mm Resolution: - Analogue ≤2 m stroke

0.2 mm Resolution: - Analogue >2 m stroke



### Clip-in Design

- Clips in by hand\*
- Easy & fast assembly
- No circlip needed
- Not easily removed

\*To aid installation, setting tools are recommended. See Page 20 for details.

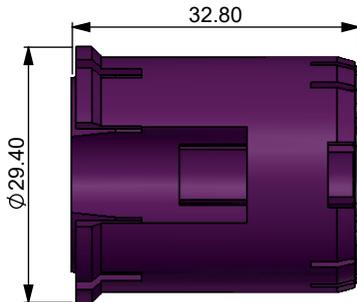
#### 'JT' Magnet (Rota P/N LJ 7123)

<±1.0 mm Non-linearity

0.2 mm Resolution: - CANbus/SSI any length

0.3 mm Resolution: - Analogue ≤4 m stroke

0.5 mm Resolution: - Analogue >4 m stroke



Patents  
CNZL201580063891.8  
EP 3198231  
KR10-1960719  
JP 6713457  
US 10,222,238

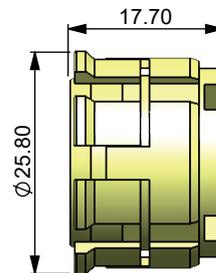
#### 'JV' Magnet (Rota P/N LJ 8234)

<±0.5 mm Non-linearity

0.05 mm Resolution: - CANbus/SSI any length

0.1 mm Resolution: - Analogue ≤2 m stroke

0.2 mm Resolution: - Analogue >2 m stroke



### Thread Mounted Design

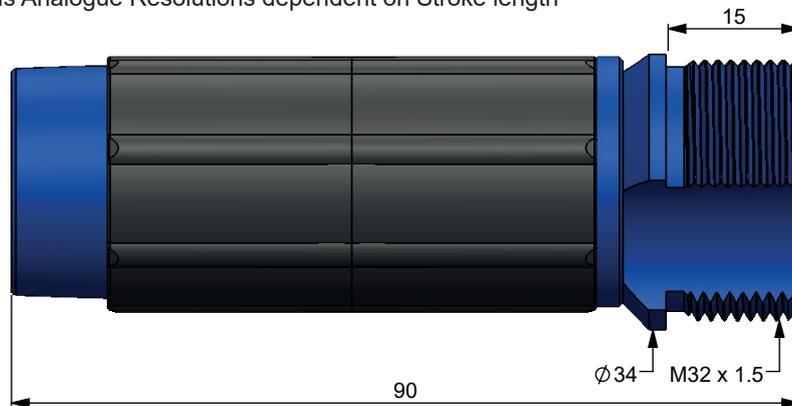
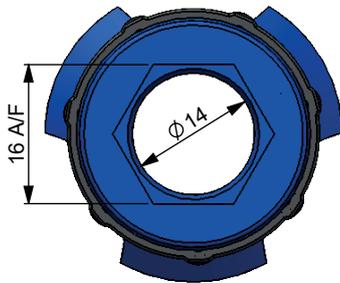
Ideal for long strokes and high speed applications.

#### 'JW' Magnet (Rota P/N LV 6311)

For approx. ≥ 60 mm I/D magnet cavity

0.2 mm (CANbus/SSI) or Various Analogue Resolutions dependent on Stroke length

<±2.0 mm Non-linearity



Patents  
CNZL201580063891.8  
EP 3198231  
KR10-1960719  
JP 6713457  
US 10,222,238

Subject to reasonable modifications due to technical advances



RELIABLE OPERATION TOUGH APPLICATION



# INTERNAL MAGNET OPTIONS

## 16 mm & 19 mm TUBE DIAMETER SENSORS

### 16 mm TUBE DIAMETER SENSORS

#### 'FT' Magnet (Rota P/N LJ 5882)

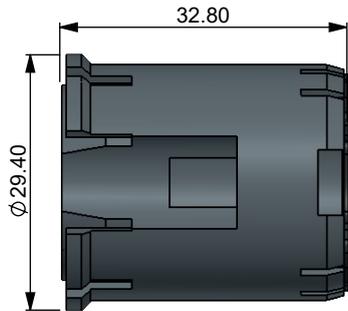
##### Clip-in Design

<±1.0 mm Non-linearity

0.2 mm Resolution: - CANbus/SSI any length

0.3 mm Resolution: - Analogue ≤4 m stroke

0.5 mm Resolution: - Analogue >4 m stroke



Patents  
CNZL201580063891.8  
EP 3198231  
KR10-1960719  
JP 6713457  
US 10,222,238

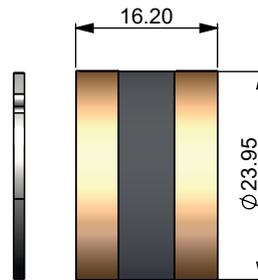
#### 'FV' Magnet (Rota P/N LJ 8456)

##### Circlip Design

<±1.0 mm Non-linearity

0.2 mm Resolution: - CANbus/SSI any length

0.3 mm Resolution: - Analogue any length



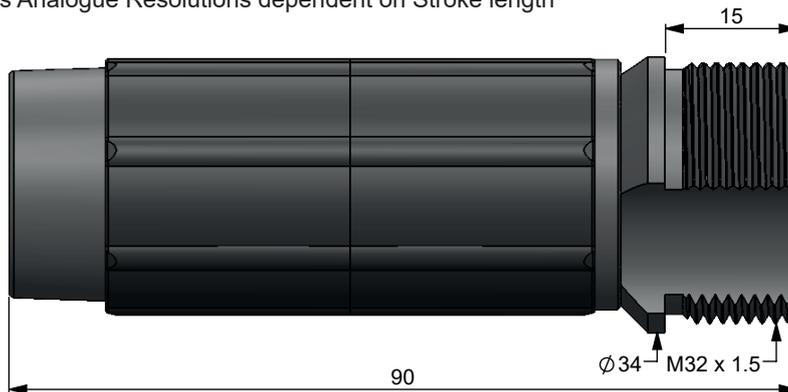
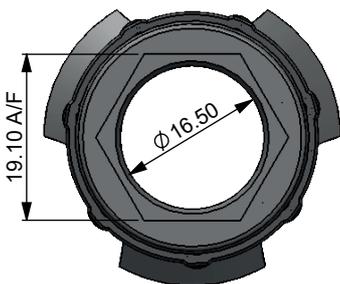
#### 'FW' Magnet (Rota P/N LJ 7991)

##### Thread-Mounted Design

For approx. ≥ 60 mm I/D magnet cavity

0.2 mm (CANbus/SSI) or Various Analogue Resolutions dependent on Stroke length

<±2.0 mm Non-linearity



Patents  
CNZL201580063891.8  
EP 3198231  
KR10-1960719  
JP 6713457  
US 10,222,238

### 19 mm TUBE DIAMETER SENSORS

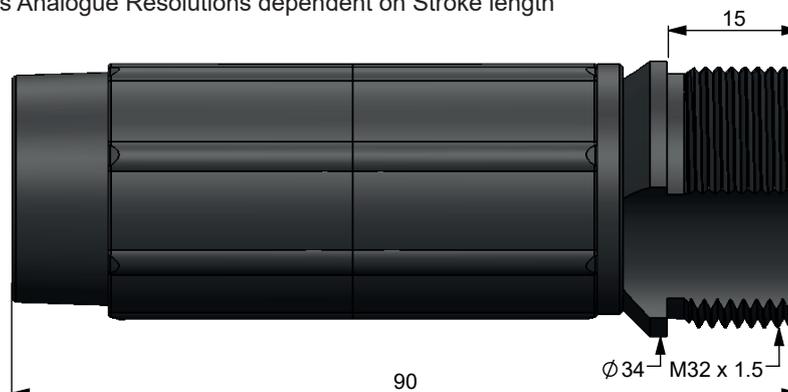
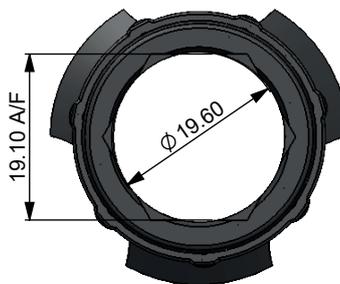
#### 'QW' Magnet (Rota P/N LJ 7992)

##### Thread-Mounted Design

For approx. ≥ 60 mm I/D magnet cavity

0.2 mm (CANbus/SSI) or Various Analogue Resolutions dependent on Stroke length

<±2.0 mm Non-linearity



Patents  
CNZL201580063891.8  
EP 3198231  
KR10-1960719  
JP 6713457  
US 10,222,238

Subject to reasonable modifications due to technical advances



**RELIABLE OPERATION TOUGH APPLICATION**

Rota Limited, Manchester UK

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LJ CAT V3.15.01



# REMOTE - 'R' MAGNETS

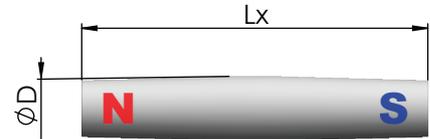
For mounting on any linear-moving structure where internal hydraulic cylinder mounting is not feasible. Strokes up to 20m possible, dependent on sensor tube diameter (see page 8).

	ØD (mm)	Lx (mm)	Resolution (mm)	Optimum distance from centre-line of Transducer (mm)**
R1	5	13	0.2	10 ±0.5***
R2	10	15	0.2*	22 ±3
R3	4.76	50.8	0.3*	19 ±3
R5	4.76	50.8	0.3*	15 ±3
R6	9.52	50.8	0.3*	26 ±4
R7	11.5	62	0.3*	45 ±4

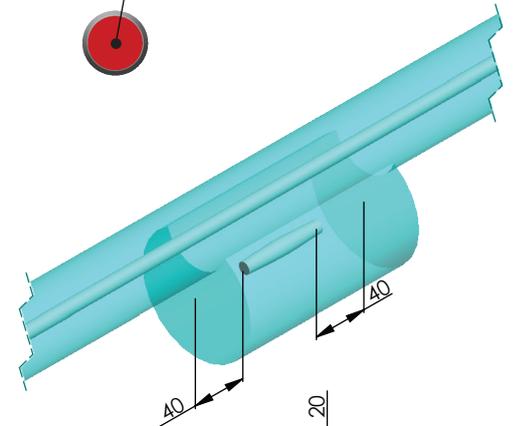
\*For analogue strokes over 2m: R2 = 0.3mm, R3-R7 = 0.5mm

\*\*For increased distances please contact Rota regarding 'E' magnets

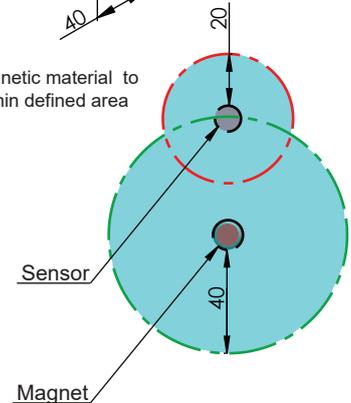
\*\*\*Due to small centre distance, R1 magnet is not suitable for 16mm or 19mm tube diameter sensors



Nickel-Copper-Nickel Plated Magnet  
Red mark indicates north pole



No magnetic material to be within defined area



## CODING

Please code the R magnet to indicate which sensor tube diameter is required, using 2RX for 12 mm tube diameter, 6RX for 16 mm tube diameter, and 9RX for 19 mm tube diameter.

E.g., a 6R3 magnet is an R3 magnet with a 16 mm sensor tube diameter.

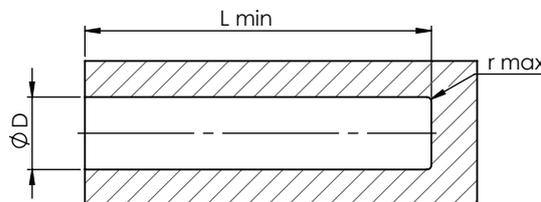
## NOTE

Correct magnet orientation is critical – North Pole of magnet (indicated with red mark) must be orientated towards connector/cable end of transducer. If the optimum distance between the magnet and the transducer is not maintained the signal will dropout.

To achieve the above figures, the 'R' magnets must be housed in non-magnetic material, and magnetic fields in close proximity to transducer must be avoided. In addition there must be no magnetic bracket, fixture or structure within 20mm of the stroke sensing zone or within 40mm of the magnet.

Magnet operating temperature: -40 to +70°C (-40 to +158°F)

## MAGNET CAVITY MACHINING DETAILS



### PRODUCTION NOTES

UNLESS OTHERWISE STATED

REMOVE ALL SHARP EDGES

MACHINED SURFACE TEXTURE TO BE  $\leq 1.6\mu\text{m Ra}$

TOLERANCE ON MACHINED DIMENSIONS  $\pm 0.25\text{ mm}$

TOLERANCE ON NON-MACHINED DIMENSIONS  $\pm 0.75\text{ mm}$

TOLERANCES ON ANGLES  $\pm 2\text{ DEGREES}$

ALL DIMENSIONS IN MILLIMETRES

	ØD (mm)	L (mm)	r (mm)
R1	5.1/5.2	13	0.40
R2	10.1/10.2	15	0.85
R3	4.85/4.95	50.8	0.60
R5	4.85/4.95	50.8	0.60
R6	9.6/9.7	50.8	0.60
R7	11.6/11.7	62	1.20

Subject to reasonable modifications due to technical advances



# RELIABLE OPERATION TOUGH APPLICATION

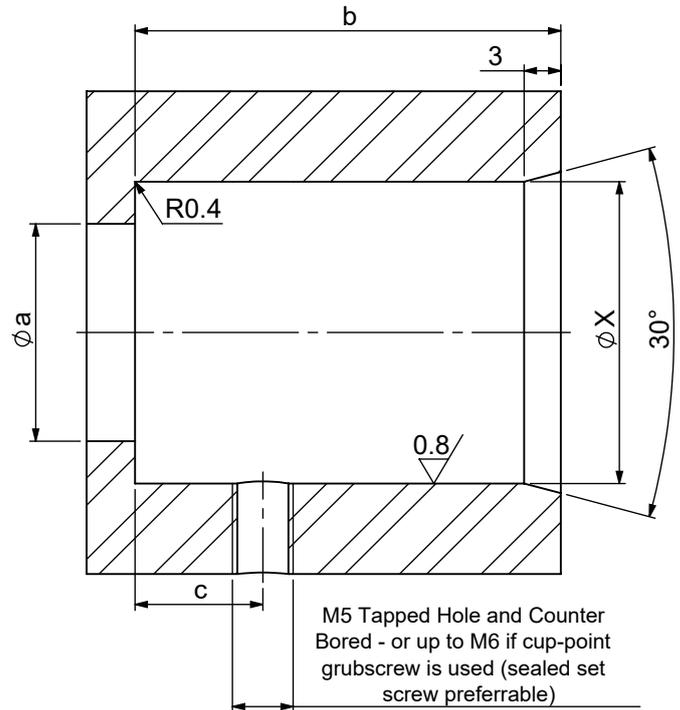
Rota Limited, Manchester UK

www.rota-ltd.com

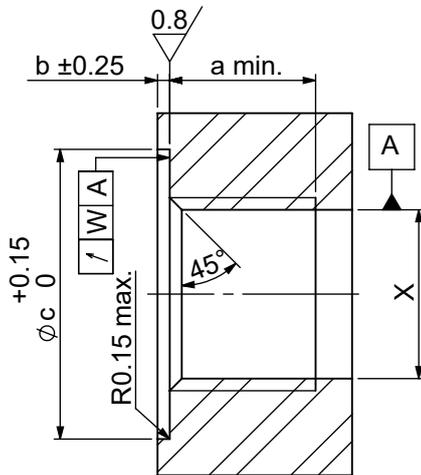
LJ CAT V3.16.01

## LJB

Tube Diameter	X	a	b	c
12	17.463/17.490	12.5	20	5
16	25.01/25.03	18	39	10.5
19	35.000/35.039	22		



## LJA/LJQ

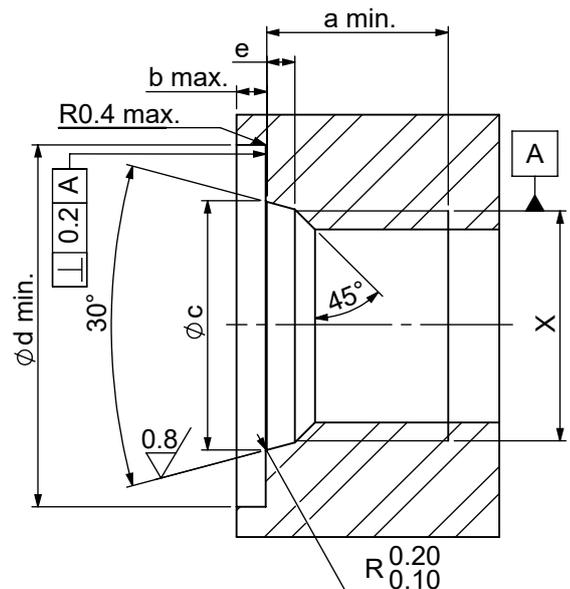


Tube Diameter	X	a	b	c
12*	3/8" BSPP	12	1	23.93
16 or 19	3/4" BSPP	19	1.17	35.06

\* 12 mm tube diameter LJQs, and LJAs with integrated M12 termination or cable gland have 3/4" BSPP thread

## LJE/LJR

Tube Diameter	X	a	b	c	d	e
12	3/4" - 16 UNF (SAE #8) - 2B	15	2.4	20.73/20.60	30	2.9/2.5
16 or 19	1 1/16" - 12 UNF (SAE #12) - 2B	20	2.4	29.33/29.20	41	3.7/3.3



## LJM

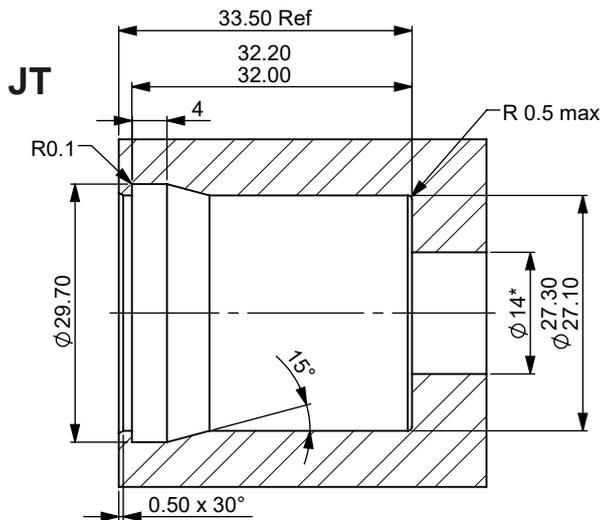
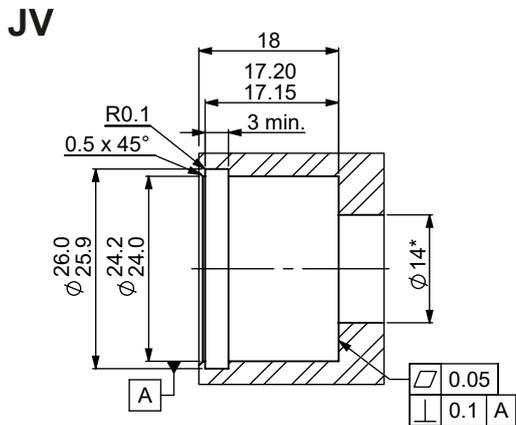
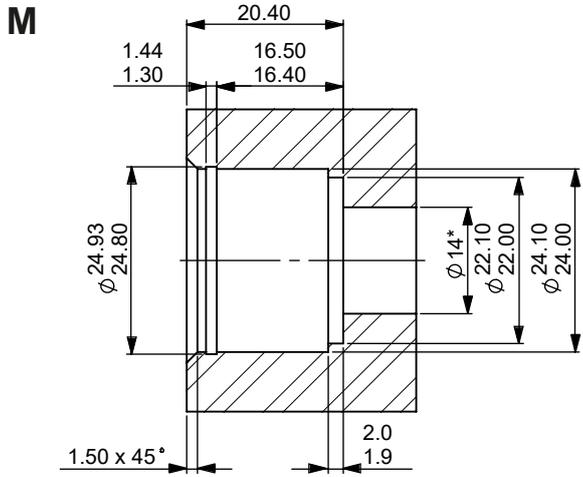
Tube Diameter	X	a	b	c	d	e
12	M18 x 1.5	15	2.0	19.90/19.80	30	2.8/2.4
16	M27 x 2	20		29.50/29.40	41	3.5/3.1
19	M33 x 2	19	2.5	35.50/35.40	54	

Subject to reasonable modifications due to technical advances

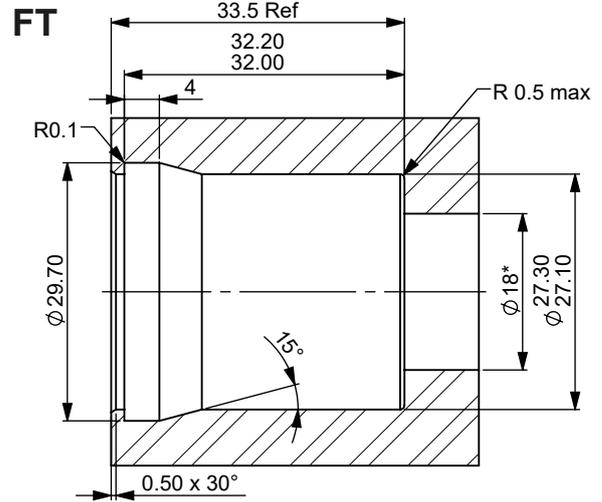
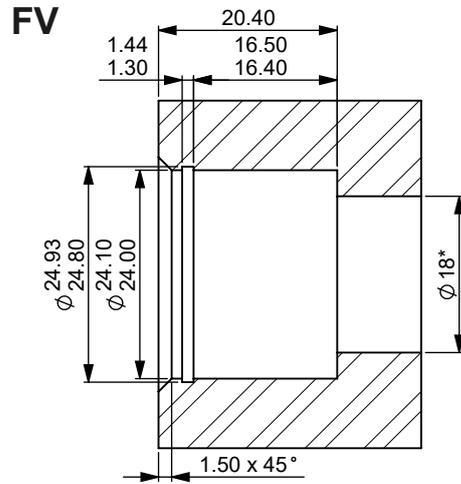


# MAGNET CAVITY MACHINING DETAILS

## 12 mm TUBE DIAMETER SENSORS



## 16 mm TUBE DIAMETER SENSORS



### PRODUCTION NOTES

UNLESS OTHERWISE STATED

REMOVE ALL SHARP EDGES

MACHINED SURFACE TEXTURE TO BE  $\leq 1.6\mu\text{m Ra}$

TOLERANCE ON MACHINED DIMENSIONS  $\pm 0.25\text{ mm}$

TOLERANCE ON NON-MACHINED DIMENSIONS  $\pm 0.75\text{ mm}$

TOLERANCES ON ANGLES  $\pm 2\text{ DEGREES}$

ALL DIMENSIONS IN MILLIMETRES

\*Gundrill hole diameter will affect oil flow, stated diameter is preferable to support the transducer. However, consideration must be given to the pressure created in the gundrilled hole at various stroke lengths, cylinder speeds, oil viscosities, and temperatures. Each magnet has a maximum gundrill hole size. Installation in hollow tubes can also be accommodated. Please contact Rota for more information.

Subject to reasonable modifications due to technical advances



# RELIABLE OPERATION TOUGH APPLICATION

Rota Limited, Manchester UK

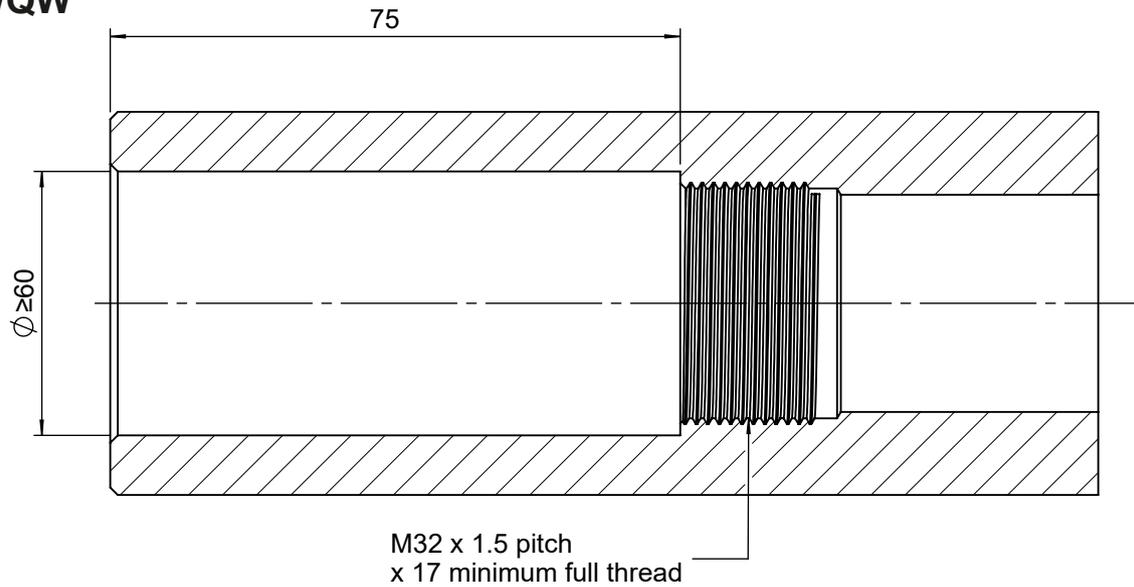
www.rota-ltd.com

LJ CAT V3.18.02



# MAGNET CAVITY MACHINING DETAILS AND K CONNECTOR CAVITY MACHINING DETAILS

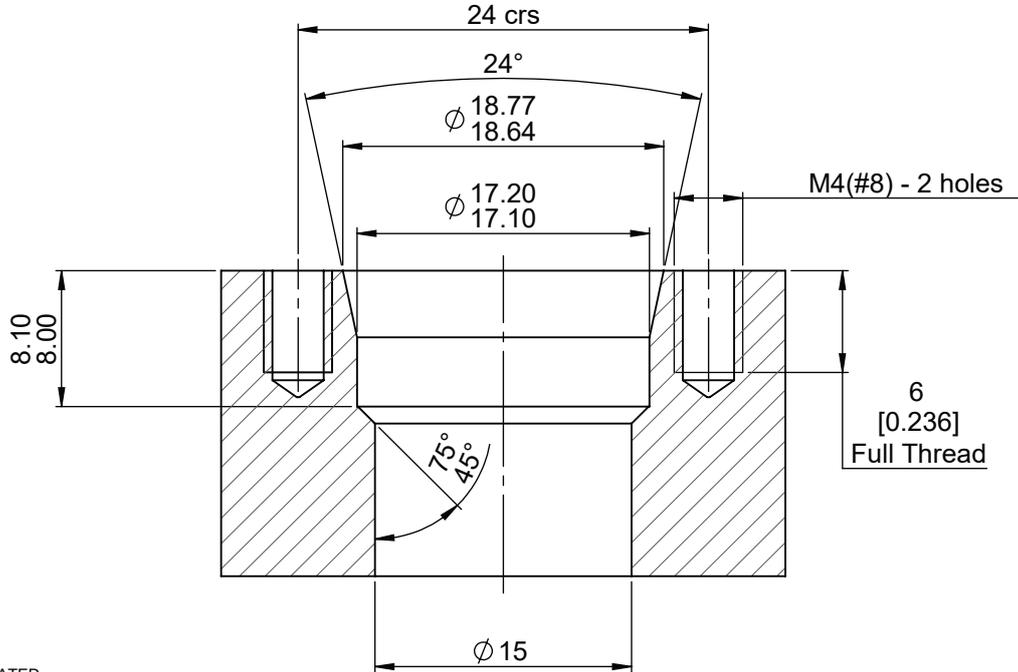
JW/FW/QW



## K Connector

2 Hole Flange

(Supplied with x2 M4x8 screws)



### PRODUCTION NOTES

UNLESS OTHERWISE STATED

REMOVE ALL SHARP EDGES

MACHINED SURFACE TEXTURE TO BE  $\leq 1.6 \mu\text{m Ra}$

TOLERANCE ON MACHINED DIMENSIONS  $\pm 0.25 \text{ mm}$

TOLERANCE ON NON-MACHINED DIMENSIONS  $\pm 0.75 \text{ mm}$

TOLERANCES ON ANGLES  $\pm 2 \text{ DEGREES}$

ALL DIMENSIONS IN MILLIMETRES

Subject to reasonable modifications due to technical advances



RELIABLE OPERATION TOUGH APPLICATION

Rota Limited, Manchester UK

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LJ CAT V3.19.01

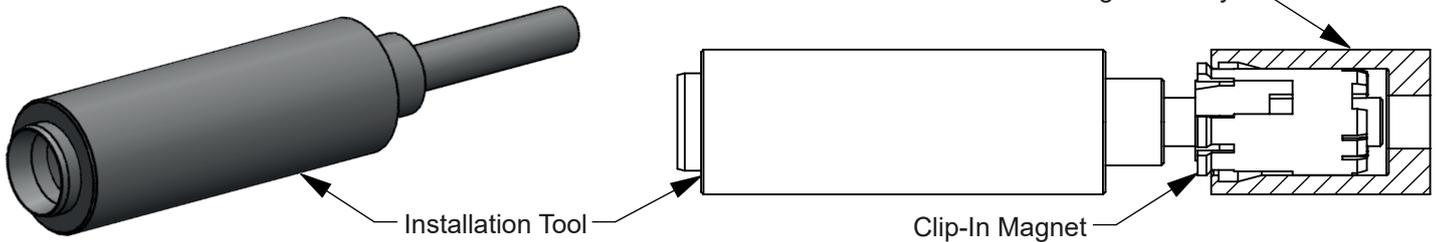


# CLIP-IN MAGNET INSTALLATION TOOLS AND CANBUS TEST KIT

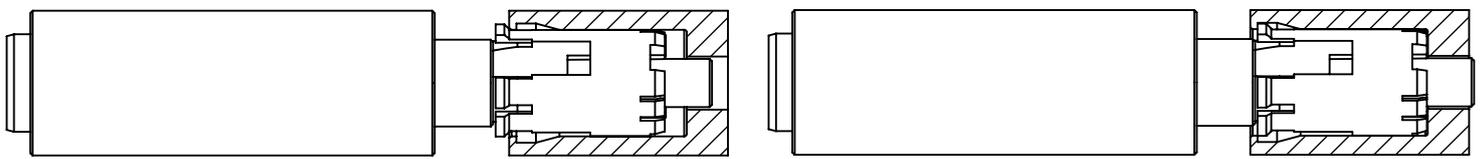
## INSTALLATION TOOLS FOR CLIP-IN MAGNETS

Installation tools are recommended for Rota's clip-in magnets. If the magnet cavity is machined to Rota specifications shown on page 18 these tools ensure the magnets are installed correctly, using a simple three step process.

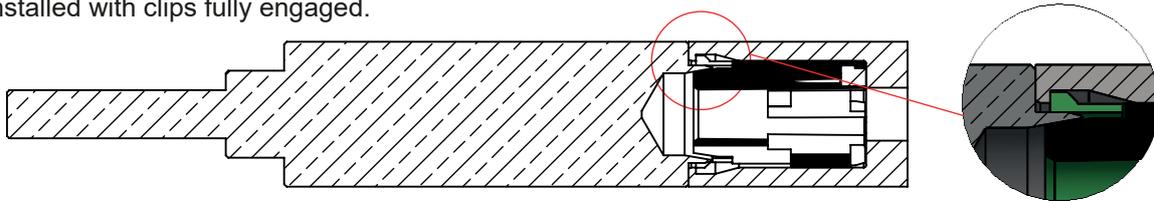
Step 1 - Insert tool through magnet assembly.



Step 2 - Use tool to push magnet assembly into piston cavity.



Step 3 - Insert other end of tool into magnet housing. If tool achieves contact with piston as shown below, magnet is correctly installed with clips fully engaged.



Please order magnet installation tools separately under the following part numbers:

JV Magnet Installation Tool p/n: 256687  
FT Magnet Installation Tool p/n: 255904

JT Magnet Installation Tool p/n: 256406

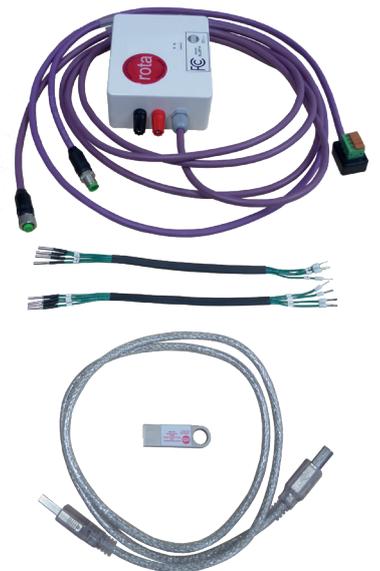
## CANBUS TEST KIT

Rota's CANbus test kit provides an easy way to test and modify the settings of Rota CANbus transducers, eliminating the need for PLC's.

The included Rota CANbus Linear Transducer Test Software enables real time connections with Rota CANbus Transducers via USB. The software translates the CANbus data into readable information and displays this information in a graphical format. To facilitate stocking of common types of Rota transducers for multiple applications, the software also enables the user to easily modify the features and settings of the transducer to suit the requirements of the particular application.

Please order the CANbus test kit under the part number LJ 2914. This includes:

- USB CANBUS Test Unit:
  - USB Cable for connection to PC or Laptop
  - M12 5-pin Connector (for direct connection to M12 type transducer)
  - M12 5-pin to 4 way adaptor (for connector to flying lead type transducer)
  - Loop-through power supply connection - provides power to transducer
- USB memory stick with Test Software and drivers
- User's guide (PDF format)



Subject to reasonable modifications due to technical advances



# RELIABLE OPERATION TOUGH APPLICATION



# LJ STANDARD PERFORMANCE DATA

Stroke	Up to 5.8 m for 12 mm O/D sensor rods, 15 m for 16 mm O/D, 20 m for 19 mm										
Resolution including ripple	Various resolutions available with different magnets - see pages 14 - 16 for further details										
Repeatability	See resolution										
Hysteresis	See resolution										
Non-linearity	See pages 14 - 16										
Operating and Storage Temperature	-40°C to +85°C (-40°F to +185°F)										
Surge Protection	Tranzorb Protection Diode (BS EN 61000-4-5 Compliant)					ISO 7637-2 & ISO 7637-3					
Short Circuit Protection	All types protected to maximum input voltage										
Electrical Protection	All types fully protected against incorrect connection (all wires) to maximum input voltage Supply Reverse polarity protection up to -36V DC										
<b>Analogue Outputs</b>											
Update Frequency	Update Frequency (3 Wire types) 900Hz - any length Update Frequency (2 wire 4-20mA) - 620Hz - any length										
Update Period	3 Wire Types	1.1 ms; any length - gives 1.1 mm (0.043 ") resolution at 1 metre/second magnet speed. 1.1 ms; any length - gives 0.55 mm (0.022 ") resolution at 0.5 metre/second magnet speed.									
	2 Wire 4-20mA	1.6 ms; any length - gives 1.6 mm (0.063 ") resolution at 1 metre/second magnet speed. 1.6 ms; any length - gives 0.80 mm (0.031 ") resolution at 0.5 metre/second magnet speed.									
Start-up Time	3 Wire Types	< 120 ms									
	2 Wire 4-20mA	< 200 ms									
Analogue Outputs (custom output on request)	0.5 - 3.5V	0.25 - 4.75V	0.5 - 4.5V	0.5 - 10V	0.5 - 4.5V	0.5 - 4.75V	0.5 - 5.0V	4 - 20mA		4 - 20mA	
Order Code	C	F	G	H	L	R	V	A <sup>1</sup>	B <sup>2</sup>	T <sup>3</sup>	BU <sup>4</sup>
Input Voltage	4 - 10V	9 - 32V	9 - 32V	13 - 32V	5 - 10V	9 - 32V	9 - 32V	13 - 32V	10 - 18V	11 - 28V	10 - 30V
Current Consumption (~)	8mA	8.5mA	8.5mA	8.5mA	8mA	8.5mA	8.5mA	9.5mA + Signal	9.5mA + Signal	4 - 20mA	9.5mA + Signal
Power Consumption	0.04W (5V)	0.2W (24V)	0.2W (24V)	0.2W (24V)	0.04W (5V)	0.2W (24V)	0.2W (24V)	0.7W (24V)	0.35W (12V)	0.48W (24V)	0.35W (12V)
Magnet Off-Stroke Output	~0.2V	~0.2V	~0.2V	~0.36V	~0.2V	~0.2V	~0.2V	0.7mA	0.7mA	3.8mA	0.7mA & 0.2V
1. Three wire current output signal type "A" designed for a 24V Input, 500Ohm load. For other input voltages and load resistances please inform Rota 2. Three wire current output signal type "B" designed for a 12V Input, 250Ohm load. For other input voltages and load resistances please inform Rota 3. Two wire current output signal type "T" designed for a 12V Input, 250Ohm load. For other input voltages and load resistances please inform Rota 4. Three wire current output signal type "BU" designed for a 12V Input, 250Ohm load. For other input voltages and load resistances please inform Rota											
<b>Digital Outputs<sup>5, 6</sup></b>											
Position Resolution	CAN	0.1 mm per bit - any length (Standard)					Higher bit resolution available on request to Rota				
Update Frequency	CAN	J1939 and CANopen - 1100 Hz - any length									
Update Period	J1939	0.9 ms; any length - gives 0.9 mm (0.035 ") resolution at 1 metre/second magnet speed									
Update Period	CANopen	0.6 ms; any length - gives 0.45 mm (0.018 ") resolution at 0.5 metre/second magnet speed									
Start-up Time	J1939	< 10 ms									
Start-up Time	CANopen	< 250 ms									
Digital Output	CANopen (CiA 301)			CANopen (CiA 301) with Temperature			SAE J1939	SAE J1939 with Temperature		SSI Asynchronous	
Order Code	O			OT			J	JT		Q	
Temperature Resolution	-			±1°C			-	±1°C		-	
Temperature Accuracy	-			±2°C			-	±2°C		-	
Magnet Off-Stroke Output	Stops transmitting TPDO Sends emergency message					Magnet Error Byte					-
Input Voltage	9 - 32V										5 - 28V
Temperature Co-Efficient (~)	±15ppm/°C (±0.0008%/°F) +0.002mm/°C										
Current Consumption (~)	20 mA										
Power Consumption (~)	0.48W (24V) or 0.24W (12V)										
NB! Repeatability, Hysteresis, and Non-linearity data does not apply to the remote 'R' magnet series. Contact Rota for details.											
5. Canbus test kit 'LJ 2914' available, see page 20											
6. You will be asked to complete a CAN order form with your desired parameters											

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## RELIABLE OPERATION TOUGH APPLICATION

Rota Limited, Manchester UK

www.rota-ltd.com

LJ CAT V3.21.01



# LJ STANDARD PERFORMANCE DATA

Termination Options					
Termination Description		M12 Connectors	Integrated B Series Connector	Cables or Wires	Offshore Cable
Code		J, K	B	N, U, W	See Page 6
Analogue (3 wire)					
Terminal Wiring Details	Input	1 (Red)	B (Red)	Red	Please contact Rota for wiring details
	Signal	2 (White)	F (White)	White	
	Common	3 (Black)	D (Black)	Black	
		4 (Not Connected)	N/A	N/A	
2 Wire 4-20mA					
Terminal Wiring Details	Input	1 (White)	B (White)	White	Please contact Rota for wiring details
	Common/Signal Return	2 (Black)	D (Black)	Black	
		3, 4 (Not Connected)	F (Not Connected)	N/A	
CAN bus					
Terminal Wiring Details		1 (Not Connected)	N/A	N/A	Please contact Rota for wiring details
	Input	2 (Red)	B (Red)	Red	
	Common	3 (Black)	C (Black)	Black	
	CAN_H	4 (White)	E (White)	White	
	CAN_L	5 (Green)	F (Green)	Green	
<b>Environmental Performance</b>					
<b>Sensor and Magnet</b>					
Pressure Rating    Maximum Operation = 500 Bar (7250 psi)					
<b>Sensor Materials</b>					
Enclosure    Stainless Steel 316L					
O-Ring Seals    Nitrile (NBR)					
Bonded Seals <sup>1</sup> Stainless Steel 316 / Nitrile (NBR)					
<b>Sensor Performance</b>					
Vibration Tests    Electronics tested to: IEC 60068-2-64 Random Vibration (including resonant frequencies) - 10-2000Hz @ 20g (all 3 axes) Resonant Frequency Search and Dwell Test - 10-2000Hz up to 7 found and each held @ 1g for 1 Hour					
<b>EMC</b> Tested and complies to: EN 61000 - 6 - 1 : 2007 EN 61000 - 6 - 3 : 2007+A1 : 2011 EN 61000 - 6 - 2 : 2005 EN 61000 - 6 - 4 : 2007+A1 : 2011 EN61326-1:2013					
					
<b>MTBF</b> Estimated 44 years for 1 metre (40") stroke length - any output - M, JV, FV, R1 magnet. Estimated 79 years for 1 metre (40") stroke length - any output - JT, FT, R2 magnet. Estimated 79 years for 0.5 metre (20") stroke length - any output - M, JV, FV, R1 magnet. Estimated 129 years for 0.5 metre (20") stroke length - any output - JT, FT, R2 magnet. Estimated 129 years for 1 metre (40") stroke length - any output - JW, FW, QW, R3, R5, R6, R7 magnet. Estimated 191 years for 0.5 metre (20") stroke length - any output - JW, FW, QW, R3, R5, R6, R7 magnet.					
<small>1. Stainless steel 316 / Viton (FKM) bonded seals are available, with an operating temperature range of -25°C to +85°C. Please contact Rota for more information</small>					

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**RELIABLE OPERATION TOUGH APPLICATION**



# HOW TO ORDER

LJ A 0950 JV 0.05 JT N 0.5 G A 1234

### LJ Series Linear Transducer

#### Mounting Configuration

- A = 3/8" BSPP
- B = M5 Grubscrew
- E = 3/4" - 16 UNF (SAE#8)
- M = M18 x 1.5
- Q = 3/4" BSPP
- R = 9/16" - 18 UNF (SAE#6)

#### Stroke

(millimetres) max. = 5800 mm for 12 mm O/D,  
15000 mm for 16 mm O/D, 20000 for 19 mm O/D Sensors

#### Magnet\*

- FT = from 0.2 mm res - for 16 mm O/D tube sensors
- FV = from 0.2 mm res - for 16 mm O/D tube sensors
- FW = from 0.2 mm res - for 16 mm O/D tube sensors
- JT = from 0.2 mm res - for 12 mm O/D tube sensors
- JV = from 0.05 mm res - for 12 mm O/D tube sensors
- JW = from 0.2 mm res - for 12 mm O/D tube sensors
- M = from 0.05 mm res - for 12 mm O/D tube sensors
- R = See page 16 for details
- QW = from 0.2 mm res - for 19 mm O/D tube sensors

\*For non-magnetic housing contact Rota

#### Signal Resolution\*\*

0.05, 0.1, 0.2, 0.3, 0.5, 2.0 mm

\*\*See pages 14-16 for magnet resolutions

#### Output Signal

- A = Current 4 to 20 mA (3 Wire) (13 - 32 V Input)
- B = Current 4 to 20 mA (3 Wire) (10 - 18 V Input)
- BU = Current 4 to 20 mA & Voltage 1.0 to 5.0 V (10 - 30 V Input)
- C = Voltage 0.5 to 3.5 V (4 - 10 V Input)
- F = Voltage 0.25 to 4.75 V (9 - 32 V Input)
- G = Voltage 0.5 to 4.5 V (9 - 32 V Input)
- H = Voltage 0.5 to 10.0 V (13 - 32 V Input)
- J = CANbus SAE J1939 (9 - 32 V Input)
- JT = CANbus SAE J1939 with temperature indicator (9 - 32 V Input)
- L = Voltage 0.5 to 4.5 V (5 - 10 V Input)
- O = CANopen (9 - 32 V Input)
- OT = CANopen with temperature indicator (9 - 32 V Input)
- Q = SSI Asynchronous (9 - 28 V Input)
- R = Voltage 0.5 to 4.75 V (9 - 32 V Input)
- T = Current 4 to 20 mA (2 Wire) (11 - 28 V Input)
- V = Voltage 0.5 to 5.0 V (9 - 32 V Input)

### Unique Transducer Calibration Number

#### Optional

A = Alignment aid - for easy fitting  
[12 mm and 16 mm O/D tube  
sensors only]

#### Optional

G = Cable Gland  
[LJA, LJE, LJM only]

#### Flying Lead Length (m)

\*\* , N, U & W Terminations  
preferred lengths: 0.15, 0.3, 0.5,  
1.0, 1.5, 2.0, 3.0, 4.0, 5.0, etc.

#### Electrical Termination

- B = Integrated Ultra Heavy Duty B-Series Connector  
[LJQ & LJR only]
- \*\* = Offshore Cable (Cable Gland Required)
- J = M12 Integral Connector [LJA, LJE & LJM only]
- K = M12 Connector (2 Holes Flange Mount,  
304 St Steel)[LJB only]
- N = PVC Cable
- U = PUR Cable
- W = Individual Wires

#### Optional

C = 'Confirmed calibration' - transducer delivered in  
calibration mode

#### Optional

R = Reversible Signal (analogue outputs only)

\*\*See page 6 for offshore cable coding

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Rota Limited, Manchester UK

www.rota-ltd.com

LJ CAT V3.23.04