

# Feedthroughs

ISO-KF, ISO-K, CF



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## Feedthroughs

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# Products

## Feedthroughs

### Current Feedthroughs

#### General

Current feedthroughs for vacuum applications, as well as their corresponding connectors, comply with the German VDE Regulations 0100, 0660 and 0110 Section 1. The latter refers to air gaps and leakage paths.

- All current feedthroughs are tested according to VDE Regulations

#### Important

The special regional safety regulations must be observed! These may differ from the regulations which apply in Germany! The voltages stated on the following pages apply to atmospheric pressure and the right connector from Leybold. The voltage specifications apply also to that part of the feedthrough which is exposed to the vacuum, provided the pressure in these areas is less than  $10^{-1}$  mbar ( $0.75 \times 10^{-1}$  Torr).

At pressures over  $10^{-1}$  mbar ( $0.75 \times 10^{-1}$  Torr) voltage breakdowns may occur depending on the distance between the electrodes, the type of rarefied gas, the type of contamination, the distribution of the electric field, etc.

Operators are advised to check each application individually or to get in touch with Leybold for advice.

In applications where VDE regulations need not be applied, higher operating voltages are permissible. Please contact us for further information regarding your particular application.

The test and operating voltages refer to a vacuum pressure of  $< 1 \times 10^{-4}$  mbar ( $< 0.75 \times 10^{-4}$  mbar) and when using the connectors recommended by Leybold. Electrical power may only be applied via the external plugs.

#### Abbreviations used in connection with feedthroughs:

<b>F</b>	Feedthrough
<b>E</b>	Current
<b>L</b>	Liquid
<b>N</b>	Normal
<b>P</b>	Precision
<b>F</b>	Frequency
<b>HC</b>	Current
<b>HV</b>	Voltage
<b>L</b>	Linear
<b>R</b>	Rotary

# Current Feedthroughs

## Technical Data

## FE 16 / 9S

## FE 16 / 9

Vacuum connection	DN	16 ISO-KF	
Number of feedthroughs		9	
Voltage per pole <sup>1)</sup>	V	50	
Current per pole <sup>1)</sup>	A	2	
Connection			
Vacuum side		solder connection	connector
Air side		connector	connector
Diameter of connecting wire	mm (in.)	0.8 (0.03) / 1.2 (0.05)	
Tightness	mbar x l/s	1 x 10 <sup>-9</sup>	
Pressure (absolute)		1 x 10 <sup>-8</sup> mbar to 2.5 bar (0.75 x 10 <sup>-8</sup> Torr to 1875 Torr)	
Bakeout temperature (feedthrough, connector)	°C (°F)	130 (266)	
Housing		Stainless steel	
Insulator		PEEK / Araldit	
Seal		FPM (FKM)	
Contact (feedthrough, connector)		gold-plated brass	

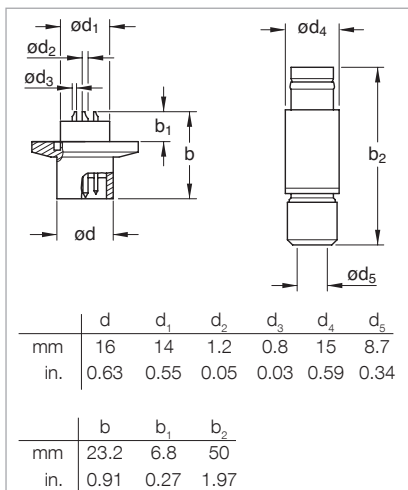
## Ordering Information

## FE 16 / 9S

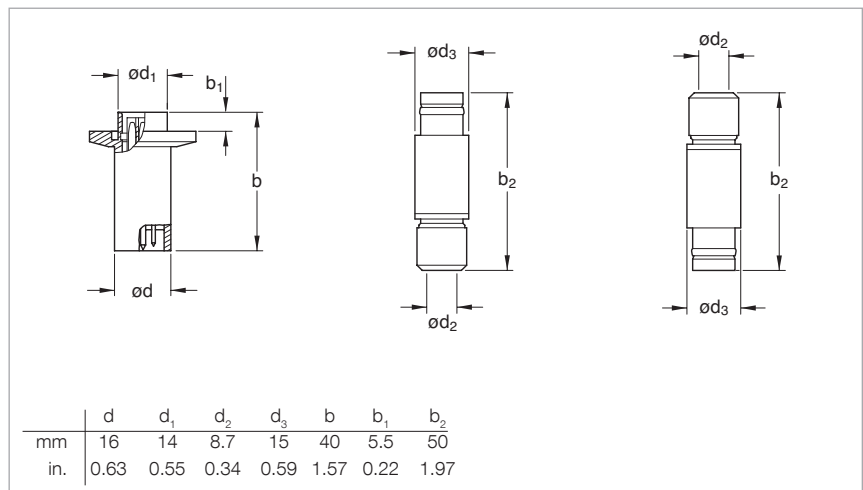
## FE 16 / 9

	Part No.	Part No.
Current feedthroughs	<b>210 302</b>	<b>210 304</b>
Connector: vacuum side	-	<b>210 305</b>
Connector: air side	<b>210 303</b>	<b>210 303</b>

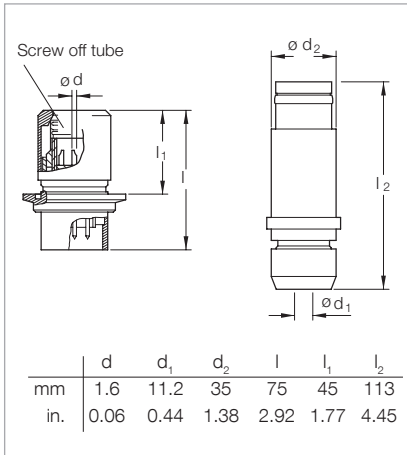
<sup>1)</sup> Local regulations concerning use must be followed



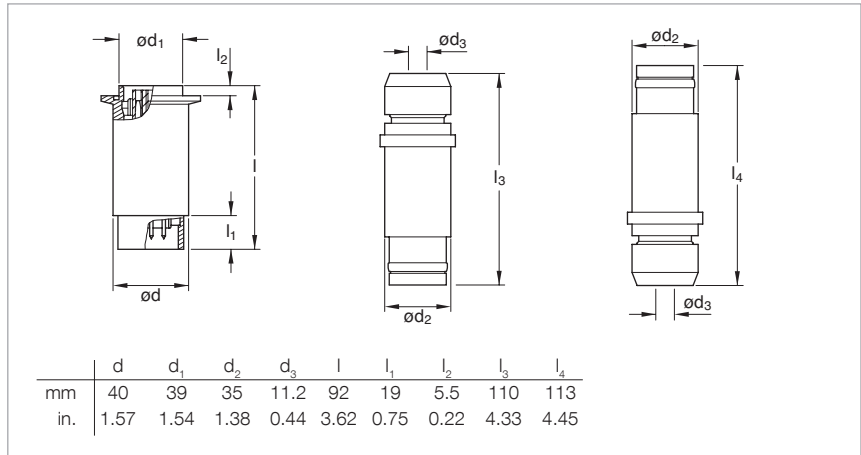
Dimensional drawing for the feedthrough FE 16/9S (left) and the connector for air side (right)



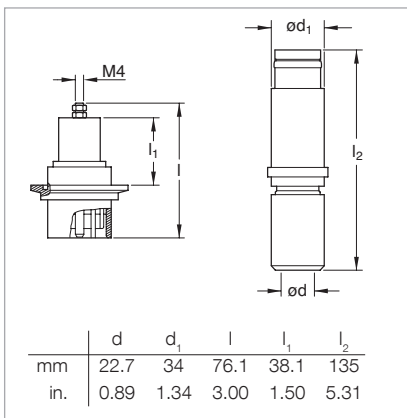
Dimensional drawing for the feedthrough FE 16/9 (left), the connector for vacuum side (middle) and the connector for air side (right)



Dimensional drawing for the feedthrough FE 40/7S (left) and the connector for air side (right)



Dimensional drawing for the feedthrough FE 40/7 (left), the connector for vacuum side (middle) and the connector for air side (right)



Dimensional drawing for the feedthrough FEHV 40/1 (left) and the connector for air side (right)



**Technical Data****FE 40 / 7S****FE 40 / 7****FEHV 40 / 1**

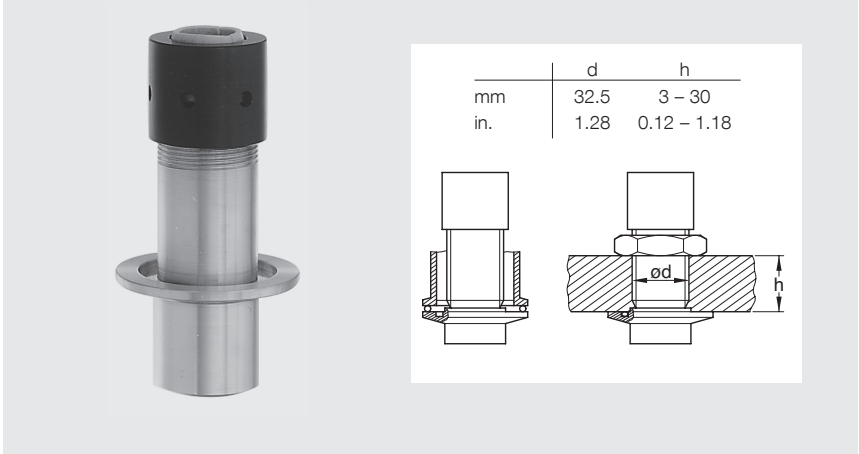
Vacuum connection	DN	40 ISO-KF		
Number of feedthroughs		7	7	1
Voltage per pole <sup>1)</sup>	V	380	380	6000
Current per pole <sup>1)</sup>	A	16	16	25
Connection				
Vacuum side		solder connection	connector	screw coupling
Air side		connector	connector	connector
Diameter of connecting wire	mm (in.)	1.8	–	–
Test voltage	kV / Hz	–	–	15 / 50
Tightness	mbar x l/s	1 x 10 <sup>-9</sup>		
Pressure (absolute)		1 x 10 <sup>-8</sup> mbar x l/s to 2.5 bar		
Bakeout temperature (feedthrough, connector)	°C (°F)	130 (266)		
Housing		chrom-plated steel		
Insulator		PTFE / Araldit	PTFE / Araldit	PTFE
Seal		FPM (FKM)		
Contact (feedthrough, connector)		gold-plated stainless steel	gold-plated stainless steel	nickel-plated brass

**Ordering Information****FE 40 / 7S****FE 40 / 7****FEHV 40 / 1**

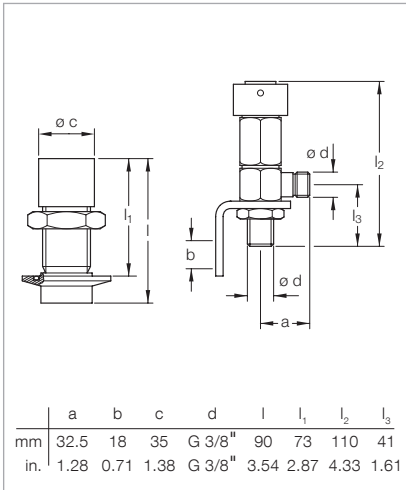
	<b>Part No.</b>	<b>Part No.</b>	<b>Part No.</b>
Current feedthroughs	<b>210 325</b>	<b>210 326</b>	<b>210 350</b>
Connector: vacuum side	–	<b>210 328</b>	–
Connector: air side	<b>210 327</b>	<b>210 327</b>	<b>210 351</b>

<sup>1)</sup> Local regulations concerning use must be followed

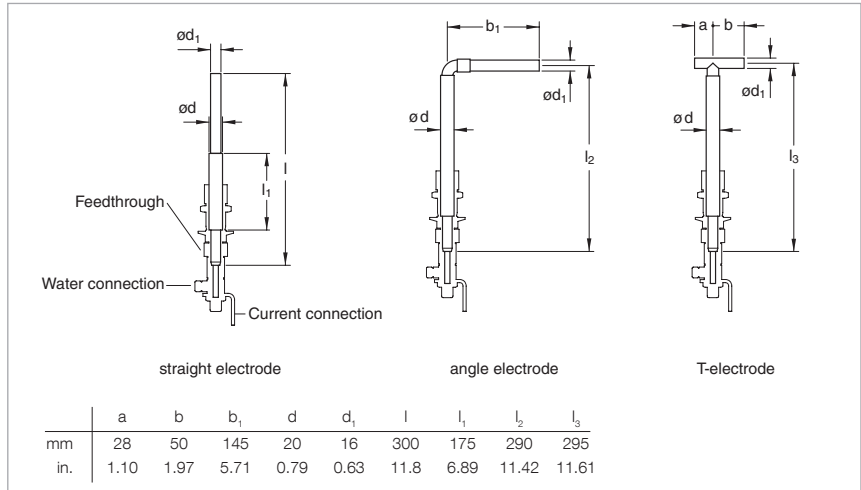
# High Current Feedthroughs



- Selection of electrodes
- Slide into mounted feedthrough
- Current connection with water cooling



Dimensional drawing for the feedthrough FEHC 40/1 (left) and current connection with water cooling (right)



Dimensional drawings for the copper electrodes for the feedthrough FEHC 40/1



**Technical Data****FEHC 40/1**

Vacuum connection	DN	40 ISO-KF
Number of feedthroughs		1
Voltage	V	50
Current	A	250
with water cooling	A	1500
Tightness	mbar x l/s	1 x 10 <sup>-9</sup>
Pressure (absolute)		1 x 10 <sup>-8</sup> mbar to 2.5 bar (max. 10 bar with external centering ring)
Bakeout temperature	°C (°F)	110 (230)
Housing		aluminum
Insulator		thermoplast and thermoset
Seal		FPM (FKM)

**Ordering Information****FEHC 40/1**

	<b>Part No.</b>
High current feedthroughs	<b>210 352</b>
Current connection with water cooling <sup>1)</sup>	<b>210 356</b>
Straight electrode	<b>210 353</b>
Angle electrode	<b>210 354</b>
T-electrode	<b>210 355</b>

<sup>1)</sup> Not insulated

# Rotary Feedthroughs

- ISO-KF / ISO-K
- For transmitting high torque
- With FPM (FKM) shaft seal and ball bearings

## Technical Data

### FR 25/50 N

### FR 63/100 N

Vacuum connection	DN	25 ISO-KF	63 ISO-K
Feedthrough / Seal		FPM (FKM)	
Shaft Connection	mm (in.)	dia. 8 (0.31)	dia. 20 (0.79)
Transferable torque	Nm	6	100
Rotational speed <sup>1)</sup>	1/min	1000	500
Shaft load			
Radial	N	150	500
Axial	N	50	100
Service life (revolutions)		20 000 000	10 000 000
Tightness, static	mbar x l/s	1 x 10 <sup>-9</sup>	
Pressure (absolute)		1 x 10 <sup>-9</sup> mbar to 1 bar	
Operating temperature, max.	°C (°F)	50 (122)	
Bakeout temperature	°C (°F)	110 (230)	
Materials exposed to process media		Stainless steel, aluminum, FPM (FKM)	
Weight	kg (lbs)	0.2 (0.44)	2 (4.42)

## Ordering Information

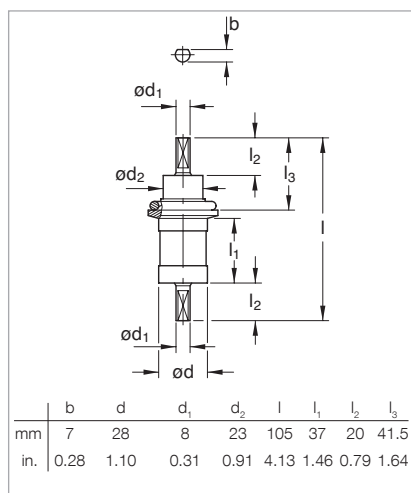
### FR 25/50 N

### FR 63/100 N

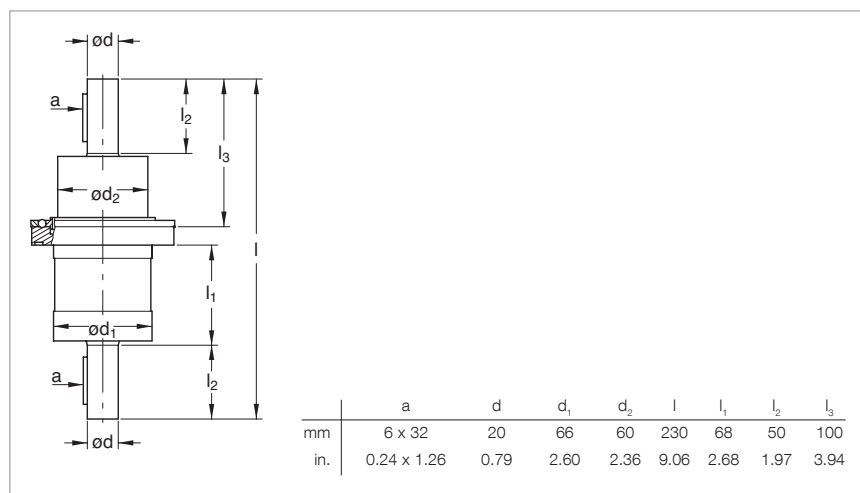
	Part No.	Part No.
Rotary feedthrough	<b>210 151</b>	<b>210 153 <sup>2)</sup></b>

<sup>1)</sup> When a reduced service life is acceptable, the rotational speed can be increased by up to a factor of two

<sup>2)</sup> Centering ring, CR/aluminum Part No. 268 05, FPM (FKM)/stainless steel Part No. 887 03



Dimensional drawing for the feedthrough FR 25/50 N



Dimensional drawing for the feedthrough FR 63/100 N

# Liquid Feedthroughs

- For H<sub>2</sub>O and LN<sub>2</sub>
- Thermally insulated
- Especially suited for very hot and very cold applications

## Technical Data

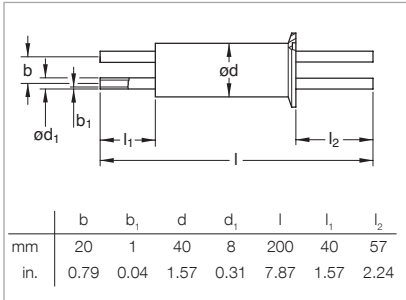
## FL 40K/2

Vacuum connection	DN	40 ISO-KF
Feedthrough / seal		welded
Connection	mm (in.)	dia. 8 x 1 (0.31 x 0.04)
Number of tubes		2
Tightness	mbar x l/s	1 x 10 <sup>-9</sup>
Pressure (absolute)		1 x 10 <sup>-9</sup> mbar to 2.5 bar (max. 10 bar with external centering ring)
Temperature range	°C (°F)	-200 to +150 (-328 to +302)
Material		Stainless steel
Weight	kg (lbs)	0.3 (0.66)

## Ordering Information

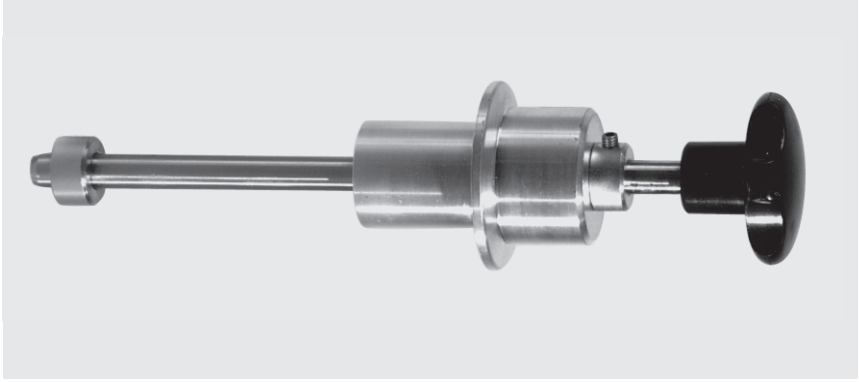
## FL 40K/2

	Part No.
Liquid feedthrough	<b>210 275</b>

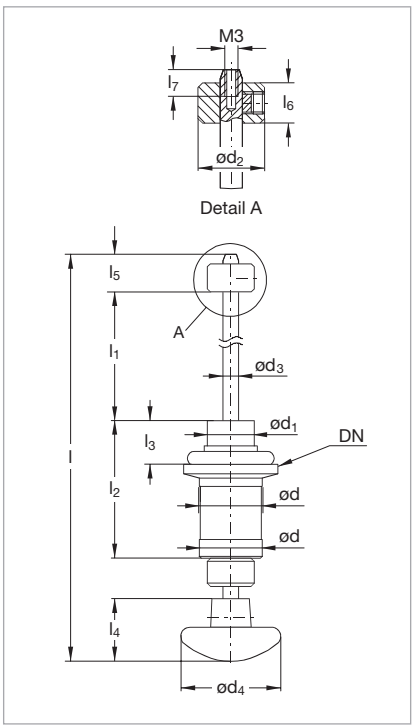


Dimensional drawing for the liquid feedthrough  
FL 40K/2

# Rotary / Linear Motion Feedthroughs



- Two FPM (FKM) shaft seals
- Direct push/pull and rotary actuation
- With locking ring



Dimensional drawing for the feedthroughs FNRL

### Dimension Table

Feedthroughs	DN	d	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	
FNRL 16/50	16					
	mm	20	15	15	5	
	in.	0.79	0.59	0.59	0.20	
FNRL 25/100	25					
	mm	25	23	22	8	
	in.	0.98	0.91	0.87	0.31	
		d <sub>4</sub>	l	l <sub>1</sub> max.	l <sub>2</sub>	l <sub>3</sub>
FNRL 16/50	mm	32	134	50	44	14
	in.	1.26	5.28	1.97	1.73	0.55
FNRL 25/100	mm	50	210	100	58	24
	in.	1.97	8.27	3.94	2.28	0.94
		l <sub>4</sub>	l <sub>5</sub>	l <sub>6</sub>	l <sub>7</sub>	
FNRL 16/50	mm	20	10.5	8	6	
	in.	0.79	0.41	0.31	0.24	
FNRL 25/100	mm	32	11	9	8	
	in.	1.26	0.43	0.35	0.31	

**Technical Data****FNRL 16/50****FNRL 25/100**

Vacuum connection	DN	16 ISO-KF	25 ISO-KF
Feedthrough / seal		FPM (FKM)	
Shaft Connection	mm (in.)	M 3 x 6 / dia. 5 (M 3 x 0.24 / dia. 0.20)	M 4 x 8 / dia. 8 (M 4 x 0.31 / dia. 0.31)
Stroke	mm (in.)	50.0 (1.97)	100.0 (3.94)
Shaft load			
Radial, at max. displacement	N	10	15
Torsion	Nm	2	8
Tightness, static	mbar x l/s	1 x 10 <sup>-9</sup>	
Operating pressure range (absolute)		1 x 10 <sup>-9</sup> mbar to 1 bar	
Operating temperature, max.	°C (°F)	50 (122)	
Bakeout temperature	°C (°F)	110 (230)	
Materials exposed to process media		Stainless steel, aluminum, FPM (FKM)	
Weight	kg (lbs)	0.1 (0.22)	0.2 (0.44)

**Ordering Information****FNRL 16/50****FNRL 25/100**

	<b>Part No.</b>	<b>Part No.</b>
Rotary / linear feedthrough	<b>210 200</b>	<b>210 201</b>

# CF Feedthroughs

CF feedthroughs are available in a variety of field-proven designs, specifically:

- Linear motion mechanical feedthroughs
- Rotary motion mechanical feedthroughs

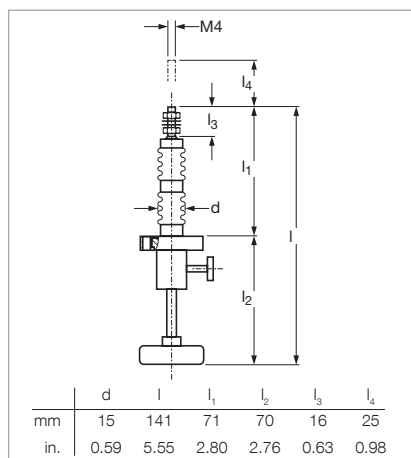
A stainless steel bellows is used to seal off the CF linear and rotary feedthroughs against the atmosphere.

All feedthroughs can be installed in the vacuum systems in any orientation.

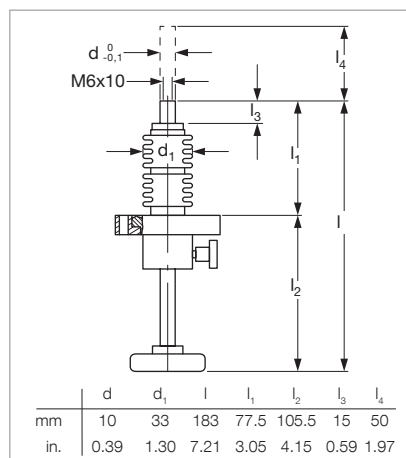
## Abbreviations used in connection with feedthroughs:

- F Feedthrough
- E Electric
- L Liquid
- N Normal
- P Precision
- F Frequency
- HC Current
- HV Voltage
- L Linear
- R Rotary

## Linear Motion Mechanical Feedthroughs



Dimensional drawing for the FNL 16/25 linear motion feedthrough



Dimensional drawing for the FNL 40/50 linear motion feedthrough

### Technical Data

### FNL 16/25

### FNL 40/50

Nominal width	DN	16 CF-R	40 CF-R
Shaft connection	mm (in.)	M 4 x 16 (M 4 x 0.63)	M 6 x 10, Ø 10 (M 6 x 0.39, Ø 0.39)
Feedthrough / seal		bellows	
Actuator		manually	
stroke	mm (in.)	25.0 (0.98)	50.0 (1.97)
Scale division	mm (in.)	5.0 (0.20)	10.0 (0.39)
Shaft load			
Radial at max. displacement	N	20	100
Axial, against vacuum	N	85	140
Axial, against atmosphere	N	100	200
Torsion	Nm (lbf-in)	0.2 (1.77)	0.5 (4.43)
Tightness	mbar x l/s	5 x 10 <sup>-11</sup>	
Pressure (absolute)		1 x 10 <sup>-10</sup> mbar to 2 bar	
Bakeout temperature	°C (°F)	300 (572)	
Materials exposed to process media		Stainless steel	
Weight	kg (lbs)	0.15 (0.33)	0.75 (1.66)

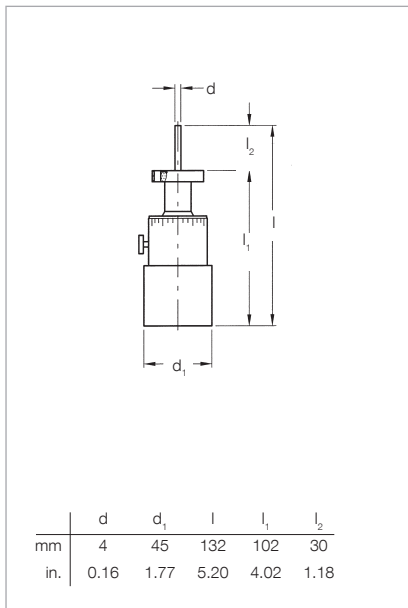
### Ordering Information

### FNL 16/25

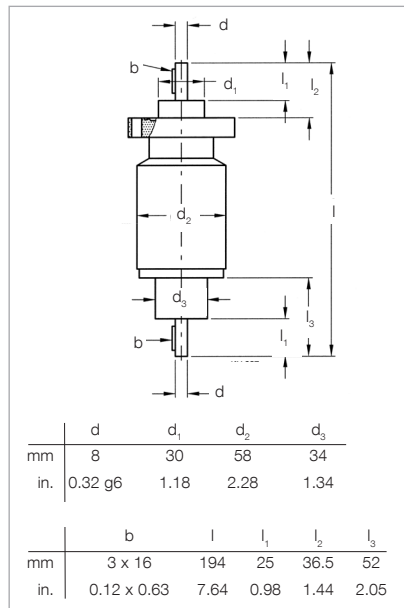
### FNL 40/50

	Part No.	Part No.
Linear motion feedthrough	210 250	210 251

# Linear Motion Mechanical Feedthroughs



Dimensional drawing for the FPR 16/5 N rotary feedthrough



Dimensional drawing for the FNR 40/20 N rotary feedthrough

The rotation of the drive knob is translated via a gearless drive system to the shaft on the vacuum side. This shaft runs on ball bearings which do not require any maintenance during the entire service life.

## Technical Data

### FPR 16/5 N

### FNR 40/20 N

Nominal width	DN	16 CF-F	40 CF-F
Shaft connection	mm (in.)	dia. 4 (0.16)	dia. 8 (0.32)
Feedthrough / seal		bellow	
Transferable torque			
Dynamic	Nm (lbf-in)	0.4 (3.54)	4.0 (35.40)
Dynamic, at 300 °C (572 °F)	Nm (lbf-in)	0.2 (1.77)	2.0 (17.70)
Static	Nm (lbf-in)	0.2 (1.77)	3.0 (26.55)
Rotational speed	rpm	200	1000
at max. torque	rpm	–	500
Scale division	mm	10°	–
Shaft load			
Radial	N	10	60
Axial	N	5	20
Tightness	mbar x l/s	5 x 10 <sup>-11</sup>	
Pressure (absolute)		1 · x 10 <sup>-10</sup> mbar to 2 bar	
Bakeout temperature	°C (°F)	300 (572)	
Materials exposed to process media		Stainless steel	
Weight	kg (lbs)	0.3 (0.66)	1.5 (3.31)

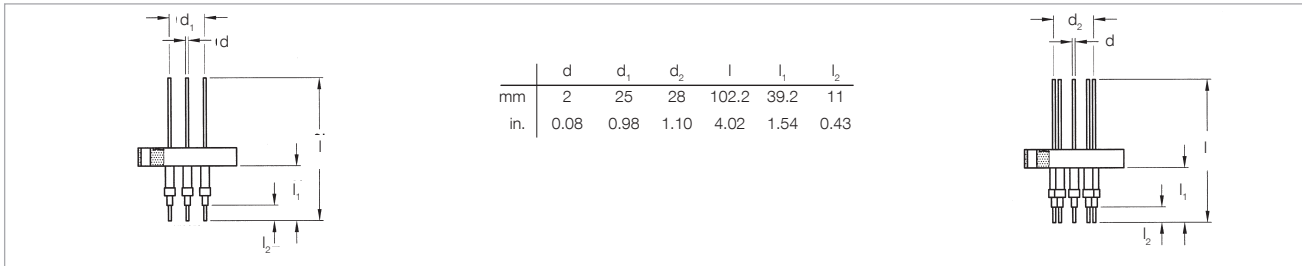
## Ordering Information

### FPR 16/5 N

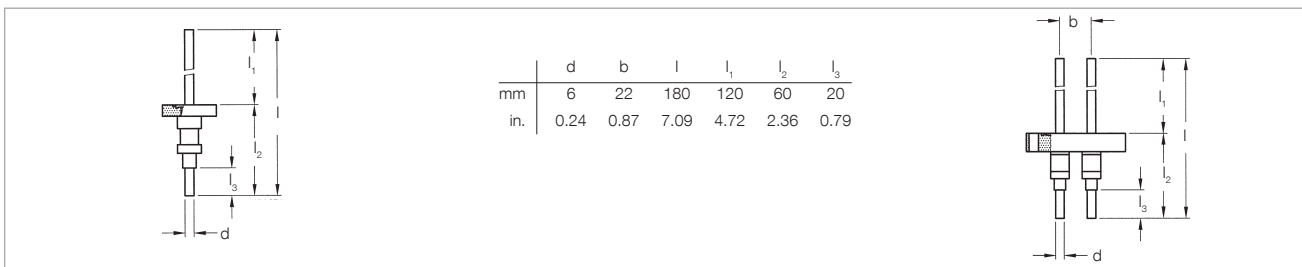
### FNR 40/20 N

	Part No.	Part No.
Rotary feedthrough	<b>210 154</b>	<b>210 155</b>

# Current Feedthroughs



Dimensional drawing for the current feedthrough FE 40/4 (left) and FE 40/9 (right)



Dimensional drawing for the current feedthrough FEHC 16/1 (left) and FEHC 40/2 (right)

## Technical Data

### FE 40/4

### FE 40/9

### FEHC 16/1

### FEHC 40/2

	DN	CF 40-F	CF 40-F	CF 16-F	CF 40-F
Nominal width	DN	CF 40-F	CF 40-F	CF 16-F	CF 40-F
Number of feedthroughs		4	9	1	2
Number of connection pieces					
vacuum side (set)		5	2 x 5	2	2
atmospheric side (set)		5	2 x 5	2	2
Voltage per pole <sup>1)</sup>	kV	1	1	4	4
Current per pole <sup>1)</sup>	A	8	8	150	150
Bakeout temperature ΔT	°C (°F)	400 (752)			
Temperature rise at max. current ΔT	°C/min	40	40	50	50
Tightness	mbar x l/s	5 x 10 <sup>-11</sup>			
Pressure (absolute)		1 x 10 <sup>-10</sup> mbar to 2 bar			
Flange		Stainless steel			
Conductor		Stainless steel	Stainless steel	Copper	Copper
Insulator		Al <sub>2</sub> O <sub>3</sub>			
Weight	kg (lbs)	0.3 (0.66)	0.4 (0.88)	0.15 (0.33)	0.45 (0.91)

## Ordering Information

### FE 40/4

### FE 40/9

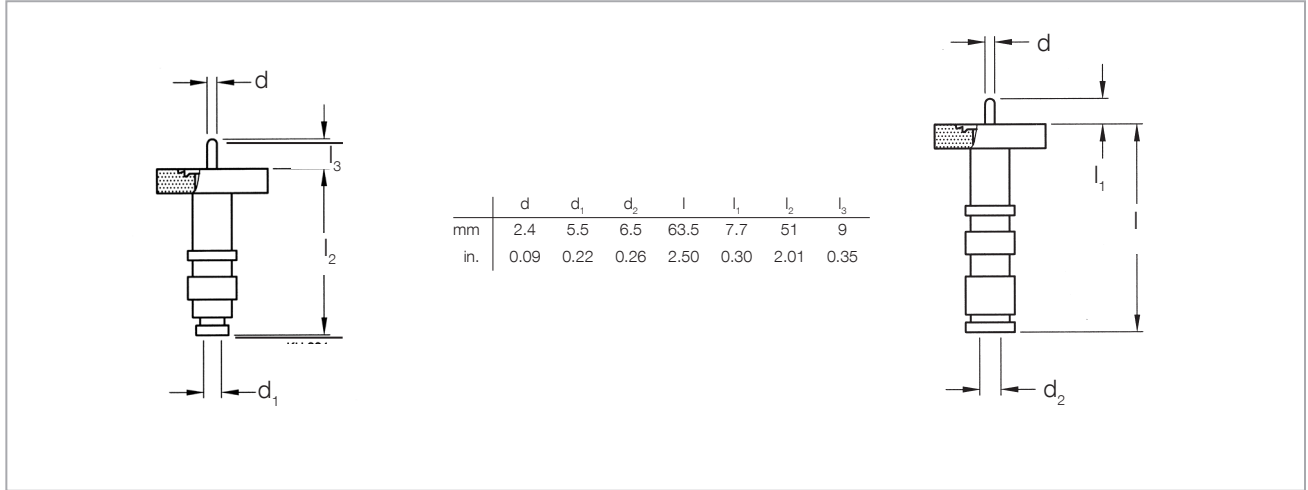
### FEHC 16/1

### FEHC 40/2

	Part No.	Part No.	Part No.	Part No.
Current feedthrough	<b>210 310</b>	<b>210 313</b>	<b>210 335</b>	<b>210 342</b>
Connection piece, vacuum side (set)	<b>210 312</b>	<b>2x 210 312</b>	<b>210 337</b>	<b>210 337</b>
Connector, atmospheric side (set)	<b>210 311</b>	<b>2x 210 311</b>	<b>210 336</b>	<b>210 336</b>

<sup>1)</sup> Local safety regulations must be met





Dimensional drawing for the current feedthrough FEF 16/1 (left) and FEHV 16/1 (right)

## Technical Data

### FEF 16/1

### FEHV 16/1

Nominal width	DN	CF 16-F	CF 16-F
Number of feedthroughs		1	1
Voltage			
AC, 50 Hz	kV	0.35	3.5
DC	kV	0.5	5.0
Current	A	3	
Frequency	MHz	150	–
Impedance	Ω	50 - 60	–
Insulation resistance at 20 °C (68 °F)	Ω	10 <sup>+10</sup>	
Bakeout temperature			
with connector	°C (°F)	50 (122)	
without connector	°C (°F)	400 (572) <sup>1)</sup>	
Tightness	mbar x l/s	1 x 10 <sup>-10</sup>	
Pressure (absolute) <sup>2)</sup>		1 x 10 <sup>-10</sup> mbar to 2,5 bar	
Housing, flange, conductor		Stainless steel	
Feedthrough, seal		Al <sub>2</sub> O <sub>3</sub>	
Weight	kg (lbs)	0.14 (0.31)	0.14 (0.31)

## Ordering Information

### FEF 16/1

### FEHV 16/1

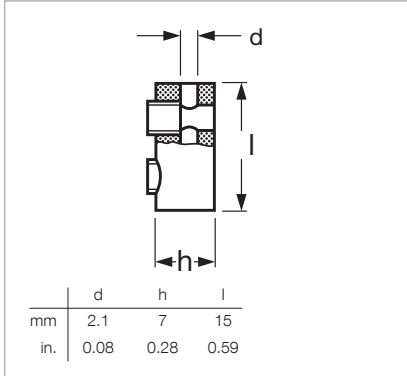
	Part No.	Part No.
Current feedthrough	<b>210 404</b>	<b>210 402</b>
Outside plug (included in delivery)	<b>BNC UG 88/U</b>	<b>MHV UG 932/U</b>
Cable	<b>RG 58/U</b>	<b>RG 59/U</b>

<sup>1)</sup> With elastomer seal up to 150 °C (302 °F)

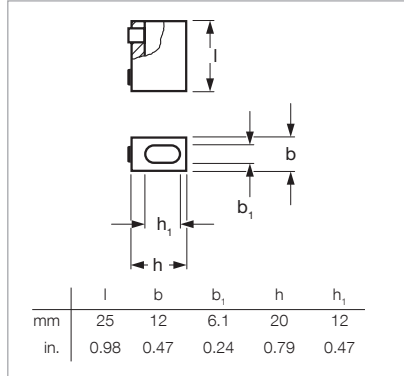
<sup>2)</sup> Pressure at 400 °C (572 °F) reduced to 2 bar

# Accessories for Feedthroughs

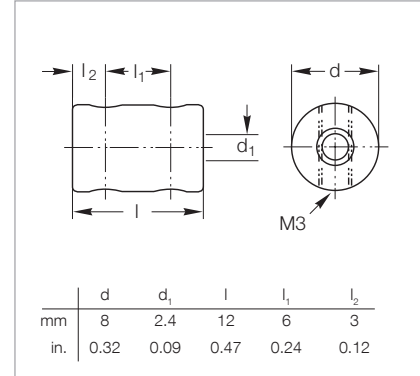
## Connectors, vacuum side



Dimensional drawing for the connector used on FE 40/4 / FE 40/9



Dimensional drawing for the connector used on FE 16/1, FEHC 40/2 and FEHC 16/1



Dimensional drawing for the connector used on FEHV 16/1, FEHV 40/3 and FEF 16/1

### Technical Data

### Connectors Vacuum Side

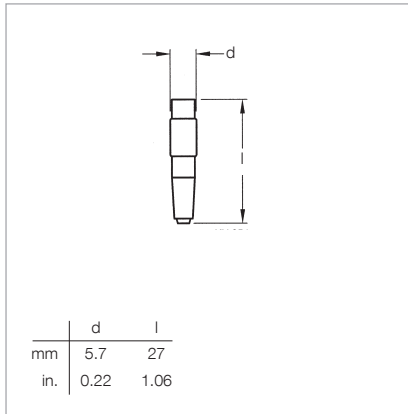
Connector for feedthrough		FE 40/4 / FE 40/9	FEHC 40/2 / FEHC 16/1	FEHV 16/1 / FEHV 40/3 FEF 16/1
Current max.	A	12	90	3
Bakeout temperature	°C (°F)	400 (752)	400 (752)	350 (662)
Material		Stainless steel	Stainless steel	Copper

### Ordering Information

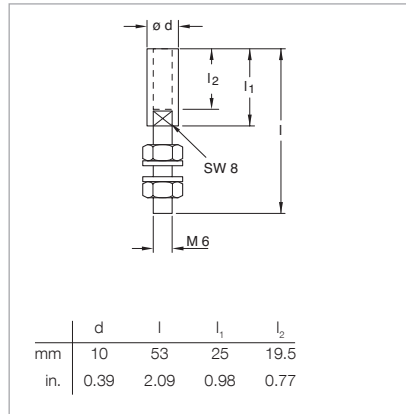
### Connectors Vacuum Side

	Part No.	Part No.	
Connector: vacuum side	-	-	<b>846 47</b>
Connector: vacuum side (Set of 5)	<b>210 312</b>	-	-
Connector: vacuum side (Set of 5)	-	<b>210 337</b>	-

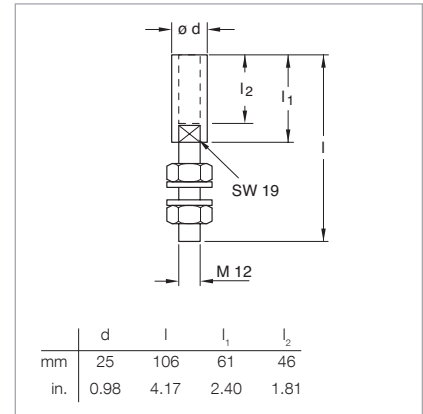
# Connectors, atmospheric side



Dimensional drawing for the outside plug used on FE 40 /4 and FE 40/9



Dimensional drawing for the outside plug used on FE 16/1, FEHC 40/2 and FEHC 16/1



Dimensional drawing for the outside plug used on FEHC 40/1

## Technical Data

## Connectors Atmospheric Side

Connector for feedthrough		FE 40/4 / FE 40/9	FEHC 40/2 / FEHC 16/1	FEHC 40/1
Current max.	<b>A</b>	12	90	250
Not insulated, for use up to	<b>V</b>	50		
Bakeout temperature	<b>°C (°F)</b>	50 (122)	150 (302)	150 (302)
Material		gold-plated brass	silver-plated brass	silver-plated brass

## Ordering Information

## Connectors Atmospheric Side

	Part No.	Part No.	
Connector, atmospheric side	-	-	<b>210 339</b>
Connector, atmospheric side (Set of 5)	<b>210 3112</b>	-	-
Connector, atmospheric side (Set of 2 )	-	<b>210 336</b>	-









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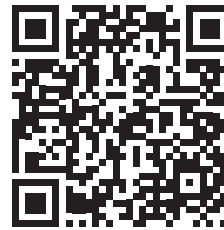
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