

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 (0.75×10^{-1} Torr).

At pressures over 10^{-1} mbar (0.75×10^{-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:

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

Current Feedthroughs

Technical Data

FE 16 / 9S

FE 16 / 9

| | | | |
|---|------------|--|-----------|
| Vacuum connection | DN | 16 ISO-KF | |
| Number of feedthroughs | | 9 | |
| Voltage per pole ¹⁾ | V | 50 | |
| Current per pole ¹⁾ | 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 ⁻⁹ | |
| Pressure (absolute) | | 1 x 10 ⁻⁸ mbar to 2.5 bar (0.75 x 10 ⁻⁸ 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 | |

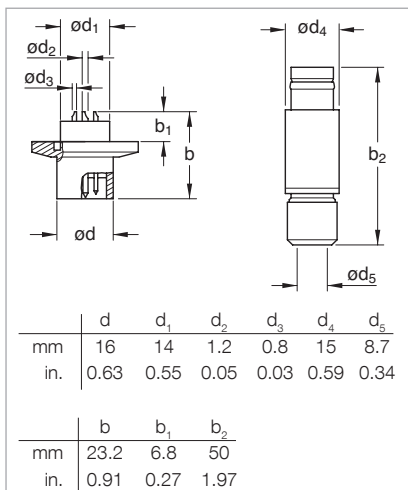
Ordering Information

FE 16 / 9S

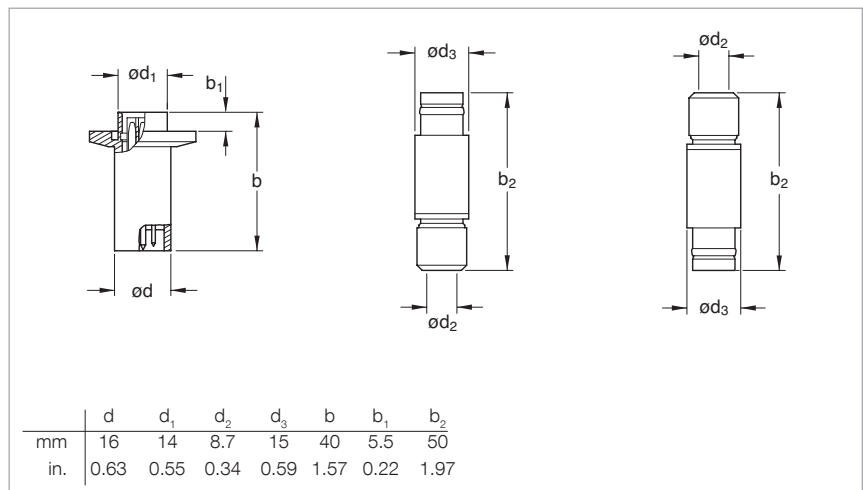
FE 16 / 9

| | Part No. | Part No. |
|------------------------|----------------|----------------|
| Current feedthroughs | 210 302 | 210 304 |
| Connector: vacuum side | - | 210 305 |
| Connector: air side | 210 303 | 210 303 |

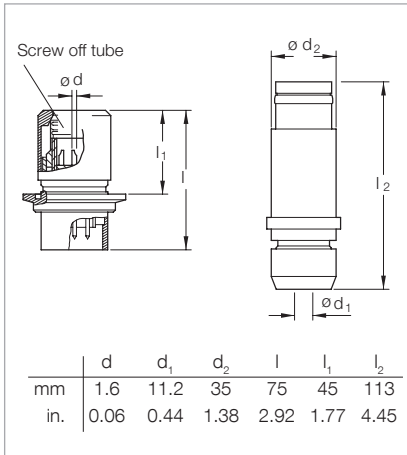
¹⁾ Local regulations concerning use must be followed



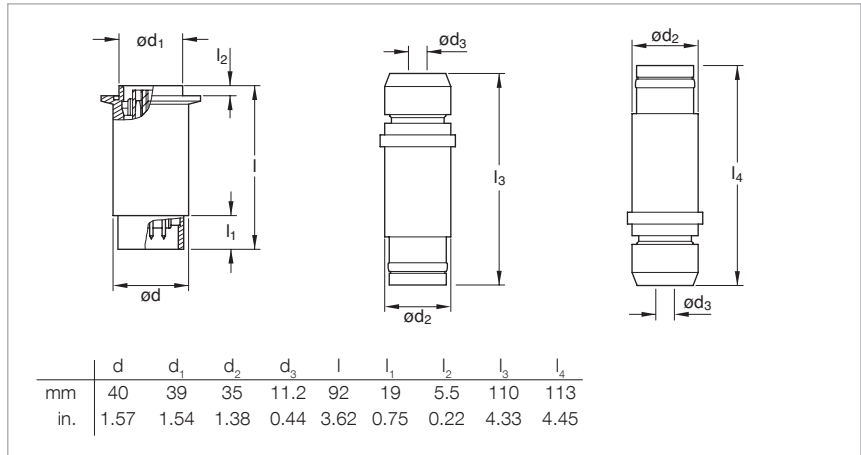
Dimensional drawing for the feedthrough FE 16/9S (left) and the connector for air side (right)



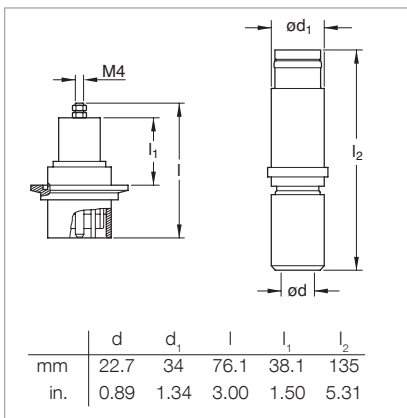
Dimensional drawing for the feedthrough FE 16/9 (left), the connector for vacuum side (middle) and the connector for air side (right)



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**

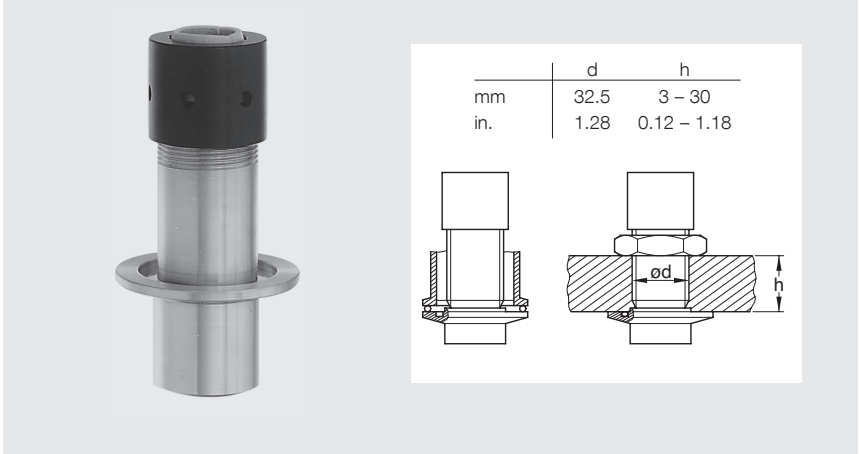
| | | | | |
|---|------------|--|-----------------------------|---------------------|
| Vacuum connection | DN | 40 ISO-KF | | |
| Number of feedthroughs | | 7 | 7 | 1 |
| Voltage per pole ¹⁾ | V | 380 | 380 | 6000 |
| Current per pole ¹⁾ | A | 16 | 16 | 25 |
| Connection | | | | |
| Vacuum side | | 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 ⁻⁹ | | |
| Pressure (absolute) | | 1 x 10 ⁻⁸ 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**

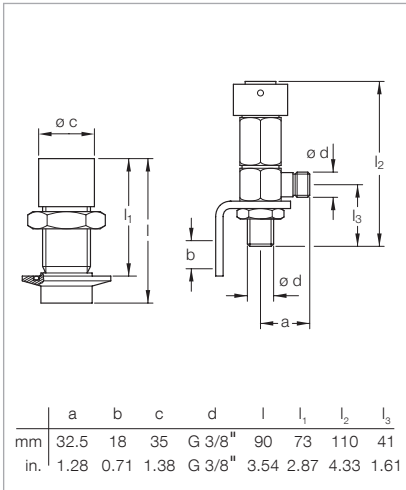
| | Part No. | Part No. | Part No. |
|------------------------|-----------------|-----------------|-----------------|
| Current feedthroughs | 210 325 | 210 326 | 210 350 |
| Connector: vacuum side | – | 210 328 | – |
| Connector: air side | 210 327 | 210 327 | 210 351 |

¹⁾ Local regulations concerning use must be followed

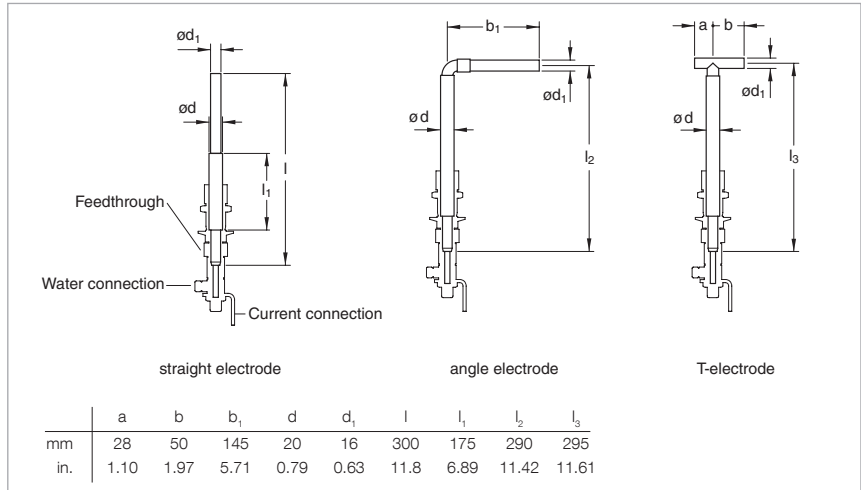
High Current Feedthroughs



- 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 ⁻⁹ |
| Pressure (absolute) | | 1 x 10 ⁻⁸ 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**

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

¹⁾ 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 ¹⁾ | 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 ⁻⁹ | |
| Pressure (absolute) | | 1 x 10 ⁻⁹ 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

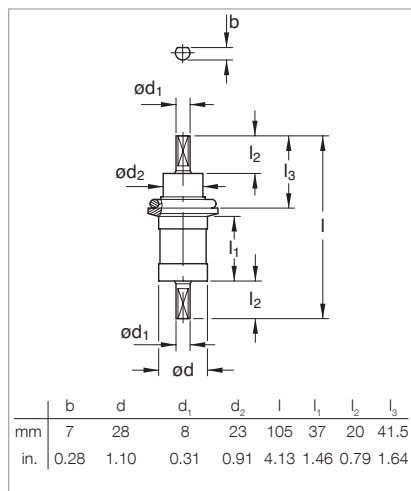
FR 25/50 N

FR 63/100 N

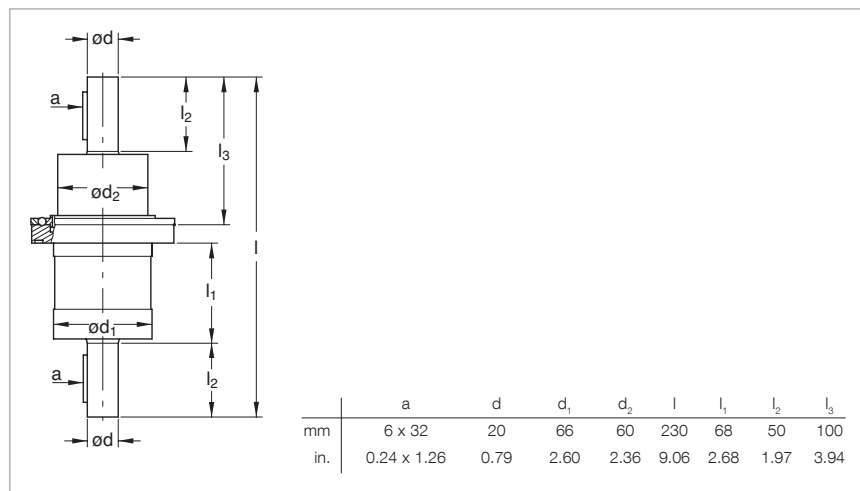
| | Part No. | Part No. |
|--------------------|----------------|------------------------------|
| Rotary feedthrough | 210 151 | 210 153 ²⁾ |

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

²⁾ 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 H₂O and LN₂
- Thermally insulated
- Especially suited for very hot and very cold applications

Technical Data

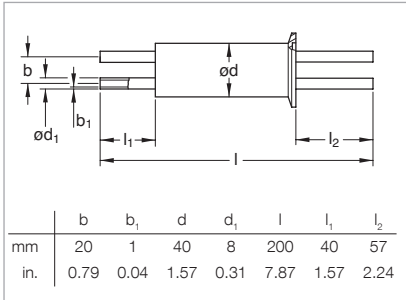
FL 40K/2

| | | |
|---------------------|------------|---|
| 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 ⁻⁹ |
| Pressure (absolute) | | 1 x 10 ⁻⁹ 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

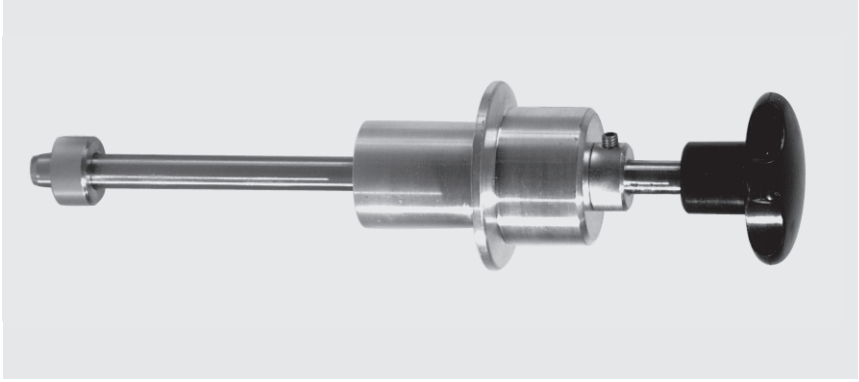
FL 40K/2

| | Part No. |
|--------------------|----------|
| Liquid feedthrough | 210 275 |

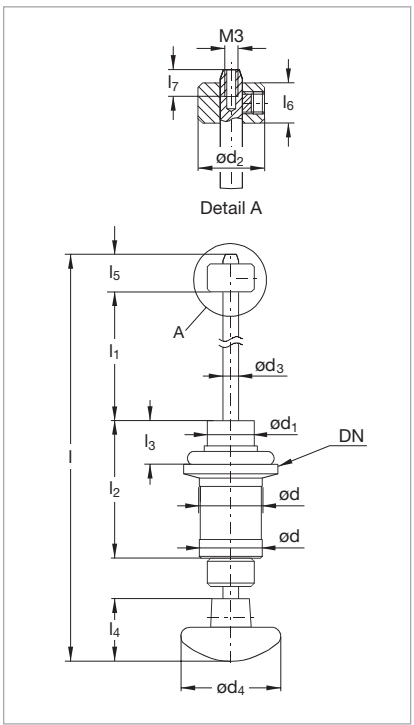


Dimensional drawing for the liquid feedthrough
FL 40K/2

Rotary / Linear Motion Feedthroughs



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



Dimension Table

| Feedthroughs | DN | d | d ₁ | d ₂ | d ₃ | |
|--------------|-----|----------------|----------------|---------------------|----------------|----------------|
| 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 ₄ | l | l ₁ max. | l ₂ | l ₃ |
| 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 ₄ | l ₅ | l ₆ | l ₇ | |
| 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 | |

Dimensional drawing for the feedthroughs FNRL

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 ⁻⁹ | |
| Operating pressure range (absolute) | | 1 x 10 ⁻⁹ 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**

| | Part No. | Part No. |
|-----------------------------|-----------------|-----------------|
| Rotary / linear feedthrough | 210 200 | 210 201 |

CF Feedthroughs

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

- Linear motion mechanical feedthroughs
- Rotary motion mechanical feedthroughs

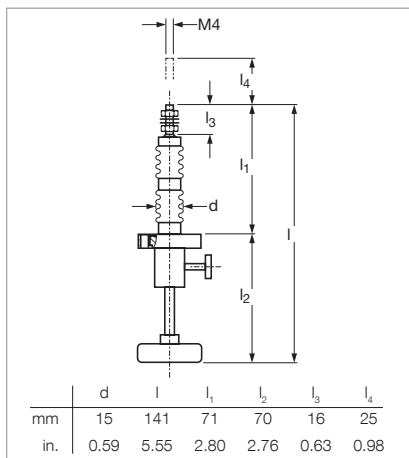
A stainless steel bellows is used to seal off the CF linear and rotary feedthroughs against the atmosphere.

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

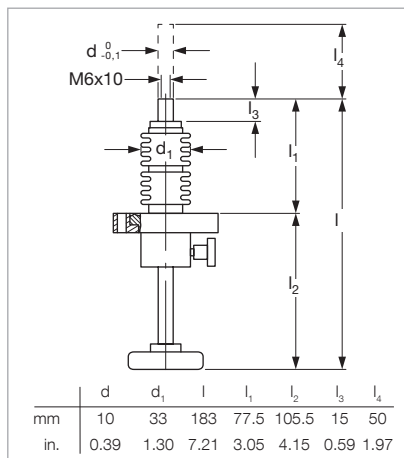
Abbreviations used in connection with feedthroughs:

- 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, ∅ 10 (M 6 x 0.39, ∅ 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 ⁻¹¹ | |
| Pressure (absolute) | | 1 x 10 ⁻¹⁰ 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) |

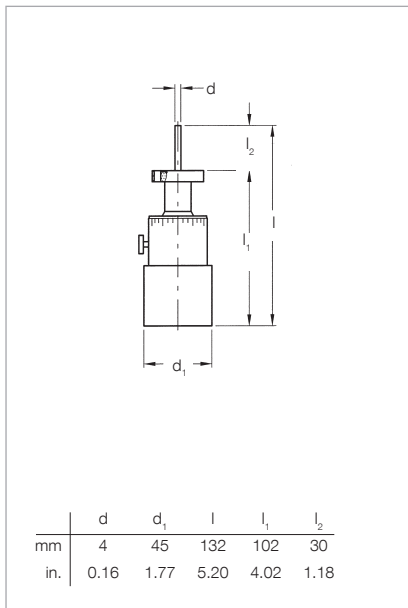
Ordering Information

FNL 16/25

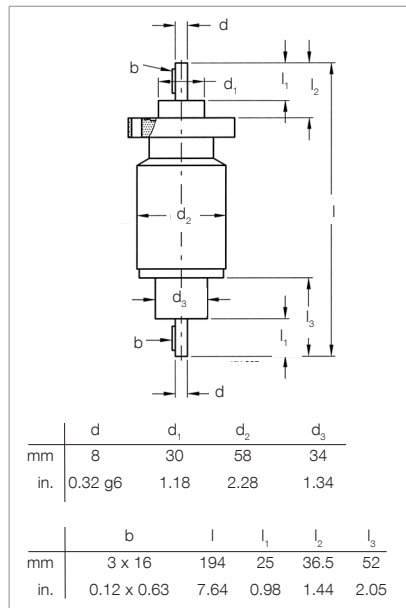
FNL 40/50

| | 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 ⁻¹¹ | |
| Pressure (absolute) | | 1 · x 10 ⁻¹⁰ 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) |

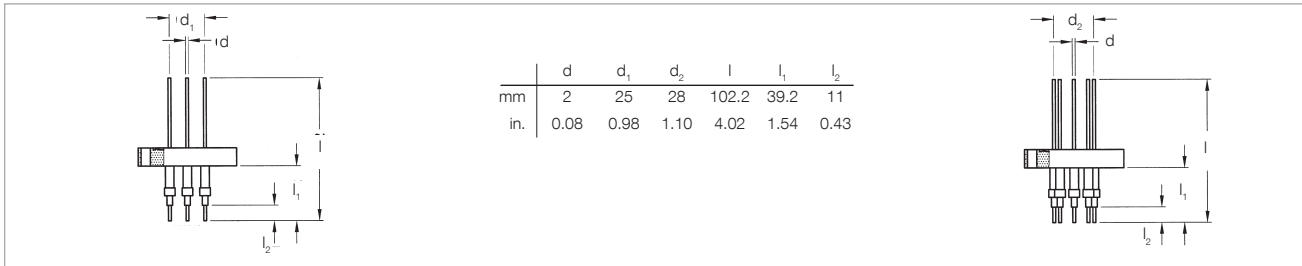
Ordering Information

FPR 16/5 N

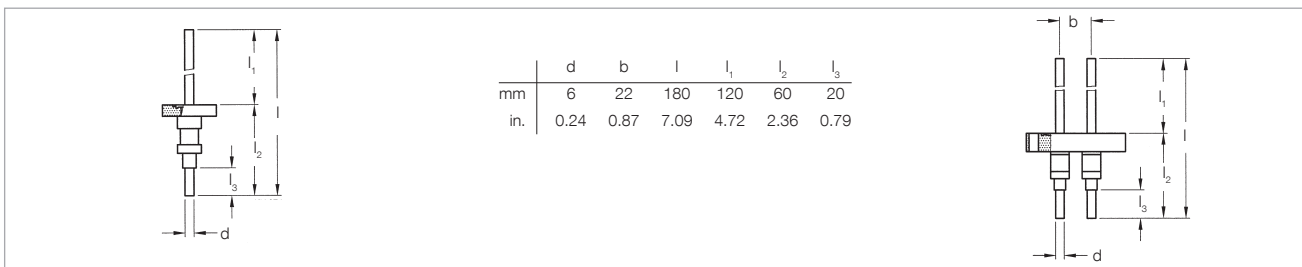
FNR 40/20 N

| | Part No. | Part No. |
|--------------------|----------------|----------------|
| Rotary feedthrough | 210 154 | 210 155 |

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 ¹⁾ | kV | 1 | 1 | 4 | 4 |
| Current per pole ¹⁾ | 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 ⁻¹¹ | | | |
| Pressure (absolute) | | 1 x 10 ⁻¹⁰ mbar to 2 bar | | | |
| Flange | | Stainless steel | | | |
| Conductor | | Stainless steel | Stainless steel | Copper | Copper |
| Insulator | | Al ₂ O ₃ | | | |
| Weight | kg (lbs) | 0.3 (0.66) | 0.4 (0.88) | 0.15 (0.33) | 0.45 (0.91) |

Ordering Information

FE 40/4

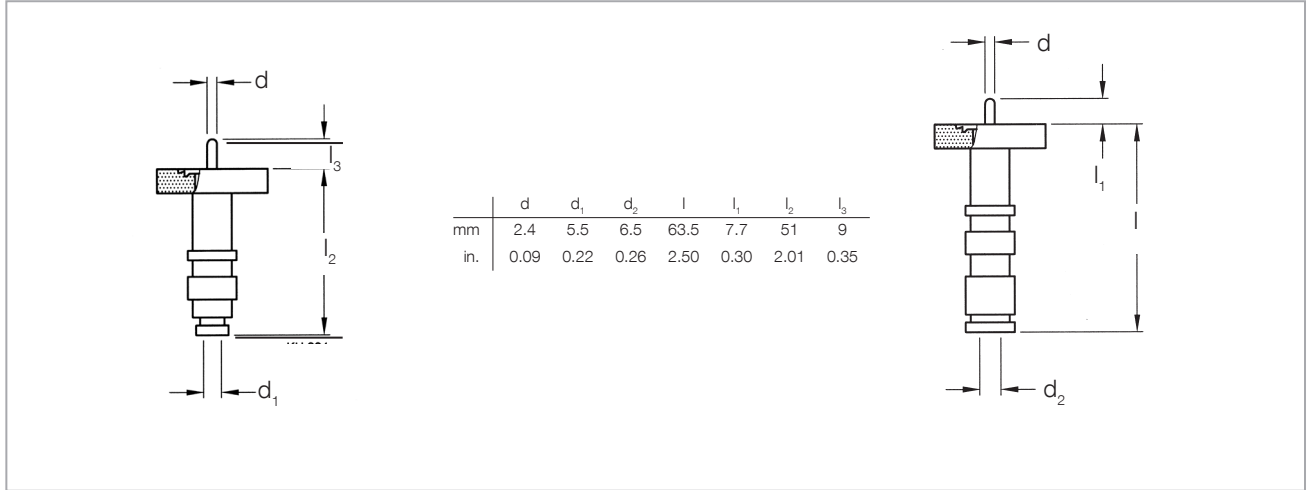
FE 40/9

FEHC 16/1

FEHC 40/2

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

¹⁾ 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 ⁺¹⁰ | |
| Bakeout temperature | | | |
| with connector | °C (°F) | 50 (122) | |
| without connector | °C (°F) | 400 (572) ¹⁾ | |
| Tightness | mbar x l/s | 1 x 10 ⁻¹⁰ | |
| Pressure (absolute) ²⁾ | | 1 x 10 ⁻¹⁰ mbar to 2,5 bar | |
| Housing, flange, conductor | | Stainless steel | |
| Feedthrough, seal | | Al ₂ O ₃ | |
| Weight | kg (lbs) | 0.14 (0.31) | 0.14 (0.31) |

Ordering Information

FEF 16/1

FEHV 16/1

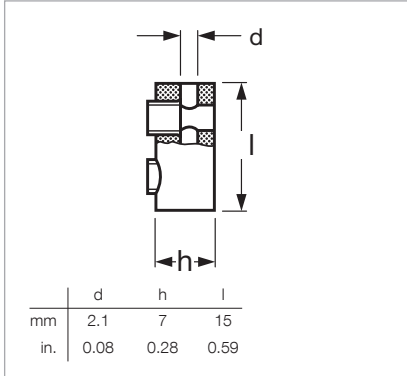
| | Part No. | Part No. |
|-------------------------------------|------------------------|-------------------------|
| Current feedthrough | 210 404 | 210 402 |
| Outside plug (included in delivery) | BNC UG 88/U | MHV UG 932/U |
| Cable | RG 58/U | RG 59/U |

¹⁾ With elastomer seal up to 150 °C (302 °F)

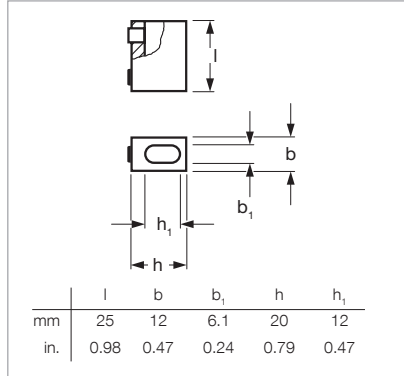
²⁾ Pressure at 400 °C (572 °F) reduced to 2 bar

Accessories for Feedthroughs

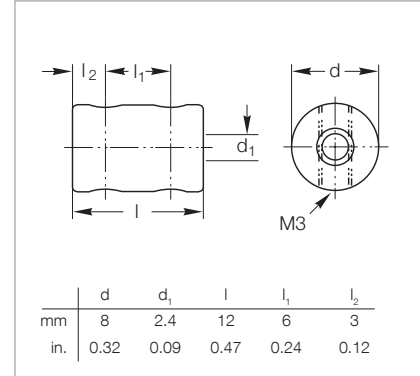
Connectors, vacuum side



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

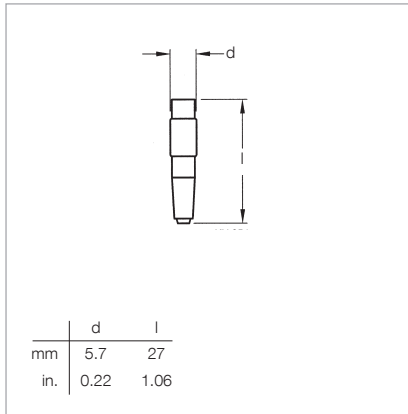
| Connector for feedthrough | | FE 40/4 / FE 40/9 | FEHC 40/2 / FEHC 16/1 | FEHV 16/1 / FEHV 40/3 FEF 16/1 |
|---------------------------|---------|-------------------|-----------------------|-----------------------------------|
| Current max. | A | 12 | 90 | 3 |
| Bakeout temperature | °C (°F) | 400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

Ordering Information

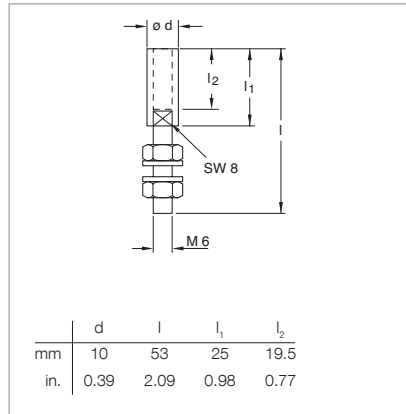
Connectors Vacuum Side

| | Part No. | Part No. | |
|-----------------------------------|----------------|----------------|---------------|
| Connector: vacuum side | - | - | 846 47 |
| Connector: vacuum side (Set of 5) | 210 312 | - | - |
| Connector: vacuum side (Set of 5) | - | 210 337 | - |

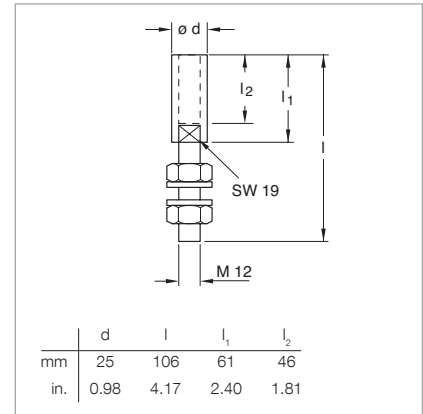
Connectors, atmospheric side



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. | A | 12 | 90 | 250 |
| Not insulated, for use up to | V | 50 | | |
| Bakeout temperature | °C (°F) | 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 | - | - | 210 339 |
| Connector, atmospheric side (Set of 5) | 210 3112 | - | - |
| Connector, atmospheric side (Set of 2) | - | 210 336 | - |

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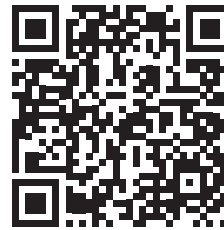
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