

Fibre Optic Feedthroughs

FC-PC Feedthroughs



FC-APC Feedthroughs



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Introduction

Fibre optic feedthroughs

The use of fibre optics provides new possibilities for an increasing number of fields of application.

Fibre optic feedthroughs are the simplest method to insert a glass fibre into vacuum. It is possible to use different cables on both sides of the feedthrough so that the feedthrough has not to be replaced in case a cable is damaged. This advantage causes a slightly higher loss.

Fibre optic feedthroughs enable to create a fibre optic link from the atmosphere to the vacuum side of an apparatus by a hermetic connection. Thus it is possible to achieve that without the in some cases elaborate input and output optics necessary for other technologies to inject a light signal from a vacuum system into a fibre.

Optical fibres are cables consisting of wave guides for light transmittance.

The refractive index is altered in a way (by a slight doping of the fibre core) that an electromagnetic wave can be guided in the fibre over several hundreds of kilometres.

The fibres consist of a core with high refractive index and a cladding with low refractive index. The alteration in the refractive index can proceed in steps or gradually, one speaks about step-index or gradient-index fibres accordingly.

Due to the different refractive index between core and cladding the light can only be injected into the fibre under a limited angle. This angle determines the so called numerical aperture. Fibre type, optical spectrum and numerical aperture have to be matched in order to minimise transmission losses.

Multimode fibres have a big core. They can be described reasonably well by means of geometric optics and enable a broad transmission spectrum.

Singlemode fibres have a small core (typ. $<10 \mu\text{m}$). Light propagation is described by means of wave optics. These fibres have a limited transmission range with very low loss.

Connectors

Fibre optic cables can be coupled with different connectors:

The optical fibre is guided in a ferrule.

FC/PC connectors: The ferrule is flat with flat fibre end faces or has a rounded finish, that the fibres are in contact only at their cores (physical contact = PC).

APC connectors: The ferrules are polished to an 8° angle in order to reduce losses from light being reflected on the face surface of the fibre (angled physical contact = APC).

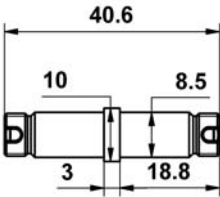
Different connectors with the same contact principle can be used at one cable. VACOM provides UHV feedthroughs with FC/PC and FC/APC couplings on both sides.

VACOM fibre optic feedthroughs are completely assembled with single- or multimode fibres for UHV applications down to $5.0\text{E-}11$ mbar.

VACOM fibre optic feedthroughs are characterised by a low He leak rate $< 1.5\text{E-}10$ mbar l/s and low insertion loss. The fibre optic feedthroughs are bakeable to 180°C . They are available with different flanges or as weld feedthroughs. Special fibres, cables or flanges can be offered on request.

Singlemode couplings and connectors

Singlemode couplings



- Fibre optic UHV feedthrough with FC-PC connector
- Assembled singlemode fibre 9/125 µm
- Coupling on both sides
- UHV compatible to 5.0E-11 mbar

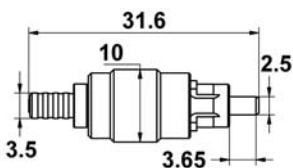
Technical data

- Fibre type F-E9/125 0.36F3.5/0.22H18
- Housing material stainless steel 304
- Ferrule 2.5 mm Zirconia ceramics
- Typical insertion loss (IL)
 - at room temperature ≤ 0.3 dB
 - above operating range ≤ 0.5 dB
- Typical return loss (RL)
 - at room temperature > 50 dB
 - beyond operating temperature range > 50 dB
- Operating temperature -25 °C to 75 °C
- Bakeout temperature ≤ 180 °C
- Max. temperature gradient at feedthrough 3 K/min
- Helium leak rate < 1.5E-10 mbar l/s
- Coupling length 41 mm

Order code	Flange	Number of couplings
W-FCPC-09-1-DE-ZR	-	1
CF16-FCPC-09-1-DE-ZR	DN16CF	1
CF40-FCPC-09-1-DE-ZR	DN40CF	1
CF40-FCPC-09-2-DE-ZR	DN40CF	2
CF40-FCPC-09-3-DE-ZR	DN40CF	3
CF63-FCPC-09-1-DE-ZR	DN63CF	1
CF63-FCPC-09-2-DE-ZR	DN63CF	2
CF63-FCPC-09-3-DE-ZR	DN63CF	3
CF63-FCPC-09-4-DE-ZR	DN63CF	4
CF63-FCPC-09-5-DE-ZR	DN63CF	5

- Metal ferrules, cables, other dimensions and flanges on request.

Connectors for singlemode couplings



Technical data

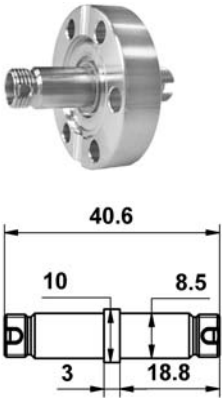
- Ferrule material zirconia
- Ferrule bore diameter 126 µm
- Operating temperature -25 °C to 75 °C
- Strain relief* ≥ 150 N
- Locking thread with anti-twist protection
- Mating cycles 1000

Order code	Contact side	Material
CONN-FCPC-09-A-ZR	atmosphere	zinc die casting
CONN-FCPC-09-V-ZR	vacuum	stainless steel

- * depending on cable used

Multimode couplings and connectors

Multimode couplings



- Fibre optic UHV feedthrough with FC-PC connector
- Assembled multimode fibre 50/125 µm
- Coupling on both sides
- UHV compatible to 5.0E-11 mbar

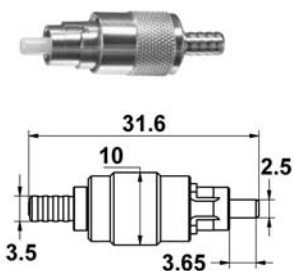
Technical data

- | | |
|---|--------------------------------|
| ■ Fibre type | F-G50/125 2.7B600/0.7F1200 OM2 |
| ■ Housing material | stainless steel 304 |
| ■ Ferrule | 2.5 mm zirconia ceramics |
| ■ Typical insertion loss (IL) | |
| • at room temperature range | ≤ 0.5 dB |
| • beyond operating temperature range | ≤ 0.5 dB |
| ■ Operating temperature | -25 °C to 75 °C |
| ■ Bakeout temperature | ≤ 180 °C |
| ■ Max. temperature gradient along feedthrough | 3 K/min |
| ■ Helium leak rate | < 1.5E-10 mbar l/s |
| ■ Coupling length | 41 mm |

Order code	Flange	Number of couplings
W-FCPC-50-1-DE-ZR	-	1
CF16-FCPC-50-1-DE-ZR	DN16CF	1
CF40-FCPC-50-1-DE-ZR	DN40CF	1
CF40-FCPC-50-2-DE-ZR	DN40CF	2
CF40-FCPC-50-3-DE-ZR	DN40CF	3
CF63-FCPC-50-1-DE-ZR	DN63CF	1
CF63-FCPC-50-2-DE-ZR	DN63CF	2
CF63-FCPC-50-3-DE-ZR	DN63CF	3
CF63-FCPC-50-4-DE-ZR	DN63CF	4
CF63-FCPC-50-5-DE-ZR	DN63CF	5

- Metal ferrules, cables, other dimensions and flanges on request

Connectors for multimode couplings



Technical data

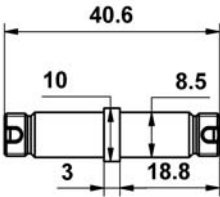
- | | |
|-------------------------|-----------------------------------|
| ■ Ferrule material | zirconia |
| ■ Ferrule bore diameter | 127/128 µm |
| ■ Operating temperature | -25 °C to 75 °C |
| ■ Strain relief* | ≥ 150 N |
| ■ Locking | thread with anti-twist protection |
| ■ Mating cycles | 1000 |

Order code	Contact side	Material
CONN-FCPC-50-A-ZR	atmosphere	zinc die casting
CONN-FCPC-50-V-ZR	vacuum	stainless steel

- * depending on cable used

Singlemode couplings and connectors

Singlemode couplings



- Fibre optic UHV feedthrough with FC-APC connector
- Assembled multimode 9/125 µm
- Coupling on both sides
- UHV compatible to 5.0E-11 mbar

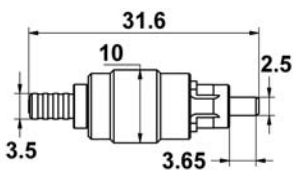
Technical data

■ Fibre type	F-E9/125 0.36F3.5/0.22H18
■ Housing material	stainless steel 304
■ Ferrule	2.5 mm zirconia ceramics
■ Ferrule angle	8°
■ Typical insertion loss (IL)	
• at room temperature	≤ 0.5 dB
• beyond operating temperature range	≤ 0.5 dB
■ Typical return loss (RL)	
• at room temperature	> 50 dB
• beyond operating temperature range	> 50 dB
■ Operating temperature	-25 °C to 75 °C
■ Bakeout temperature	≤ 180 °C
■ Max. temperature gradient at feedthrough	3 K/min
■ Helium leak rate	< 1.5E-10 mbar l/s
■ Coupling length	41 mm

Order code	Flange	Number of couplings
W-FCAPC-09-1-DE-ZR	-	1
CF16-FCAPC-09-1-DE-ZR	DN16CF	1
CF40-FCAPC-09-1-DE-ZR	DN40CF	1
CF40-FCAPC-09-2-DE-ZR	DN40CF	2
CF40-FCAPC-09-3-DE-ZR	DN40CF	3
CF63-FCAPC-09-1-DE-ZR	DN63CF	1
CF63-FCAPC-09-2-DE-ZR	DN63CF	2
CF63-FCAPC-09-3-DE-ZR	DN63CF	3
CF63-FCAPC-09-4-DE-ZR	DN63CF	4
CF63-FCAPC-09-5-DE-ZR	DN63CF	5

- Metal ferrules, cables, other dimensions and flanges on request

Connectors for singlemode couplings



Technical data

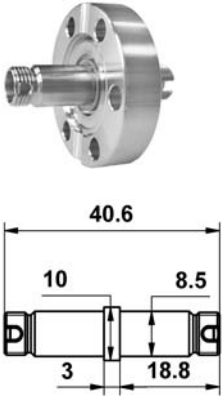
■ Ferrule material	zirconia
■ Ferrule angle	8°
■ Ferrule bore diameter	126 µm
■ Operating temperature	-25 °C to 75 °C
■ Strain relief*	≥ 150 N
■ Locking	thread with anti-twist protection
■ Mating cycles	1000

Order code	Contact side	Material
CONN-FCAPC-09-A-ZR	atmosphere	zinc die casting
CONN-FCAPC-09-V-ZR	vacuum	stainless steel

- * depending on cable used

Multimode couplings and connectors

Multimode couplings



- Fibre optic UHV feedthrough with FC-APC connector
- Assembled multimode fibre 50/125 µm
- Coupling on both sides
- UHV compatible to bis 5.0E-11 mbar

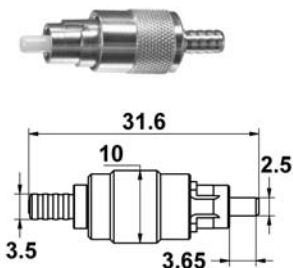
Technical data

■ Fibre type	F-G50/125 2.7B600/0.7F1200 OM2
■ Housing material	stainless steel 304
■ Ferrule	2.5 mm zirconia ceramics
■ Ferrule angle	8°
■ typical insertion loss (IL)	
• at room temperature	≤ 0.5 dB
• beyond operating temperature range	≤ 0.5 dB
■ Operating temperature	-25 °C to 75 °C
■ Bakeout temperature	≤ 180 °C
■ Max. temperature gradient at feedthrough	3 K/min
■ Helium leak rate	< 1.5E-10 mbar l/s
■ Ferrule length	41 mm

Order code	Flange	Number of couplings
W-FCAPC-50-1-DE-ZR	-	1
CF16-FCAPC-50-1-DE-ZR	DN16CF	1
CF40-FCAPC-50-1-DE-ZR	DN40CF	1
CF40-FCAPC-50-2-DE-ZR	DN40CF	2
CF40-FCAPC-50-3-DE-ZR	DN40CF	3
CF63-FCAPC-50-1-DE-ZR	DN63CF	1
CF63-FCAPC-50-2-DE-ZR	DN63CF	2
CF63-FCAPC-50-3-DE-ZR	DN63CF	3
CF63-FCAPC-50-4-DE-ZR	DN63CF	4
CF63-FCAPC-50-5-DE-ZR	DN63CF	5

- Metal ferrules, cables, other dimensions and flanges on request.

Connectors for multimode couplings



Technical data

■ Ferrule material	zirconia
■ Ferrule angle	8°
■ Ferrule hole	127/128 µm
■ Operating temperature	-25 °C to 75 °C
■ Strain relief*	≥ 150 N
■ Locking	thread with anti-twist protection
■ Mating cycles	1000

Order code	Contact side	Material
CONN-FCAPC-50-A-ZR	atmosphere	zinc die casting
CONN-FCAPC-50-V-ZR	vacuum	stainless steel

- * depending on cable used