

## Beam Launchers for Quantum

Customized beam shaping and combination



Representative product images. Individual product images are found on the individual product pages.

### FEATURES

Schäfter+Kirchhoff offers customized beam launchers especially for quantum optics. These beam launchers are customized optical systems for collimation and combination of fiber-guided radiation from multiple laser systems. They are compact, modular and long-term stable, are ideal for launching tailored laser beams to the desired target and can be conveniently flanged to the chamber.

Following functionalities can be integrated:

- Superposition: multiple input ports / dichroic beam combination
- Beam expansion
- Beam shaping: beams with elliptical cross-sections
- Polarization control: quarter and half-wave plates
- Polarization definition: post polarizer
- Power monitor
- Electromagnetic shutter
- Focus generation: attachment optics for refocusing

## DESCRIPTION

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Properties:

- Choice of different focal length for the individual wavelengths (e.g. for choosing different collimated beam diameters, or for compensating different fiber NAs)
- Spectral range 400 nm - 1000 nm
- Gaussian intensity profiles with excellent wave fronts
- Easy integration into existing systems: compatible with the multicube™ and cage system
- Rugged and compact design, excellent long-term pointing stability

Options:

- Amagnetic design

Specialized designs according to customer specifications. Fully assembled and adjusted by Schäfter+ Kirchhoff. As customer specifications vary significantly, we can only display example configurations here. For a configuration tailored to your demands, please contact us.

## TECHNOTES

- [Article - Specialized fiber collimators](#)  
[Cooling and trapping atoms using specially developed fiber collimators](#)
- [Article - Fiber Optics for Quantum](#)  
[How to get light into quantum computers](#)

## FAQ

### Fiber Receptacle

#### FC PC and FC APC

**What type of receptacle does my collimator with receptacle type FC have? Narrow key or wide key?**

All our fiber collimators and couplers with a receptacle type FC have a so called wide key receptacle (2.14 mm).

These are suitable for connecting fibers with connector type FC (wide key) but also with those of type narrow key! You can find the details in the FAQs below.

### **How do I attach a fiber cable?**

To prevent damage to the sensitive fiber end-face, always insert the fiber connector's ferrule at an angle, with the connector key properly aligned to the receptacle notch.

When the ferrule tip is safely located in the inner cylinder of the receptacle, align the connector to the receptacle axis and carefully introduce the connector into the fiber coupler.

Then, orient the connector key in a way that it is pressed gently onto the right-hand side of the receptacle notch ("right-hand orientation rule").

Gently screw on the connector cap nut onto the receptacle until it is finger-tight.

Gently tighten the fiber grub screw to reduce the free play of the ferrule in the receptacle.

### **What is the "right-hand orientation rule"?**

When the ferrule tip is safely located in the inner cylinder of the receptacle, align the connector to the receptacle axis and carefully introduce the connector into the fiber coupler.

Then, orient the connector key in a way that it is pressed gently onto the right-hand side of the receptacle notch.

The tightened grub screw and the "right-hand orientation rule" for the connector, ensure a high reproducibility in mode field position and angle, which is especially important for attaching and reattaching polarization-maintaining fibers reproducibly.

### **Can I attach a narrow key fiber cable to a fiber coupler with a wide key receptacle?**

Yes, you can- without any problem. Simply adhere to the "right-hand orientation rule".

Generally, with any FC PC or FC APC type connector there is a freeplay when inserting the fiber into the fiber coupler. The free play in between the connector ferrule and receptacle is only a few microns, but necessary for inserting the ferrule without force. There is a difference between the receptable and key width for wide key (2.14 mm) and narrow key (2.0 mm) fibers. If you follow the so-called "right-hand orientation rule" you can reproducibly attach and reattach even PM fibers with narrow key receptacle to fiber couplers with wide key receptacle without difficulty.

"Right-hand orientation rule":

When the ferrule tip is safely located in the inner cylinder of the receptacle, align the connector to the receptacle axis and carefully introduce the connector into the fiber coupler. Then, orient the connector key in a way that it is pressed gently onto the right-hand side of the receptacle notch. The tightened grub screw and the "right-hand orientation rule" for the connector, ensure a high reproducibility in mode field position and angle, which is especially important for attaching and reattaching polarization-maintaining fibers reproducibly.

## **Troubleshooting**

### **I can't collimate the radiation out of a coupler. Why?**

**Have you loosened the grub screws?**

The clamp screws have to be loosened before changing the focus setting, Please refer to the adjustment instructions of the individual couplers for more details.

**Have you checked, if the fiber is correctly placed within the fiber receptacle of the coupler?**

The fiber connector might not be placed correctly within the receptacle of the coupler/collimator. In particular, please check the small grub screw holding the connector's ferrule (e.g. for FC PC and FC APC type couplers). It might be in the way. Please refer to the adjustment instructions of the individual couplers/collimators for more details.

**Have you tried another eccentric key?**

Please check, if the eccentric key is damaged or broken.

Please also check, if you are using the appropriate eccentric key. The eccentric key type 60EX-5 has a larger stroke compared to the key type 60EX-4. The 60EX-5 is used for couplers/collimators with focal length  $\geq 12$  mm. The 60EX-4 is used for focal lengths  $< 12$  mm.

In some very rare cases (e.g. shorter wavelengths and end cap fibers) the stroke of the original eccentric key may be too small for the coupler in your application. (See FAQ "Difference between 60EX-4 and 60EX-5"). Try using the 60EX-5 in this case.

**Have you checked the eccentric key for damage?**

The eccentric key might be damaged or broken. If that is the case, try another eccentric key of the same type and (or) contact Schäfter+Kirchhoff for replacement.

**Are you using a fiber with an end cap?**

Collimating/coupling with an end cap fiber cable is no different than with a standard fiber cable. However, the focus position might vary a little ( $< 200 \mu\text{m}$ ) when swapping a standard fiber cable for a fiber cable with end cap.

The eccentric key 60EX-4 is used to adjust the focus position. In some cases the stroke is not large enough.

This includes working with very small wavelengths or very large wavelengths. Please try using the eccentric key 60EX-5 with a larger stroke instead.

**It says my coupler/collimator was "precollimated" but the collimation setting seems to not be alright. What might be the problem?**

**Are you using the same wavelength as the adjustment wavelength?**

Schäfter+ Kirchhoff ships all collimators/couplers prealigned and collimated/preadjusted for either a specific wavelength defined by the customer or a typical wavelength. The prealigned is performed using professional collimating telescopes.

The adjustment wavelength is given on the label for each collimator/coupler. If you are using another wavelength you need to change the focus setting. Please refer to the manual for more details.

**Are you using the same fiber type as in the adjustment procedure?**

The fibers used in the standard adjustment procedure are all equipped with an [end cap](#) when aligning for wavelengths  $\leq 520$  nm. The adjustment wavelength is given on the label for each collimator/coupler. If a fiber with end cap was used it is marked by "EC".

If you are not using a fiber with an end cap but the preadjustment at Schäfter+Kirchhoff was done using an end cap ("EC") or you are using a fiber with an end cap and the preadjustment at Schäfter+Kirchhoff was done without, you might need to change the focus setting. Please refer to the manual for more details.

## ACCESSORIES

ADJUSTMENT TOOLS  
FIBER OPTICS

## RELATED PRODUCTS

<b>FIBER COLLIMATOR SERIES 60FC-E</b>	Fiber Collimator series 60FC-E for an elliptical beam cross-section
<b>FIBER COLLIMATOR 60FC-Q</b>	Fiber Collimator for collimating large beam diameters and with integrated quarter-wave plate
<b>FIBER COLLIMATOR SERIES 60FC-BC</b>	with two fiber input ports and a dichroic beam combiner
<b>FIBER CABLES PMC</b>	Polarization-maintaining fiber cables

## OVERVIEW

This is a printout of the page <https://sukhamburg.com/products/fiberoptics/fibercoupler/series/beamlauncher.html> from 11/4/2024

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