Fiber Collimators Series 60FC-Q

This document provides assistance in installing the fiber collimators series 60FC-Q. It describes how a fiber cable is attached, the collimation setting is adjusted, and how the integrated quarter-wave plate is adjusted.

Before You Start

The fiber collimator is shipped with a protection cap for the fiber receptacle and with a front cap.

> **Notice:** Please remove all the protection caps first and do not use them as beam dumps (risk of photo contamination).

There is a two-part protection cap on the receptacle. Please perform the following steps in order to remove this cap:

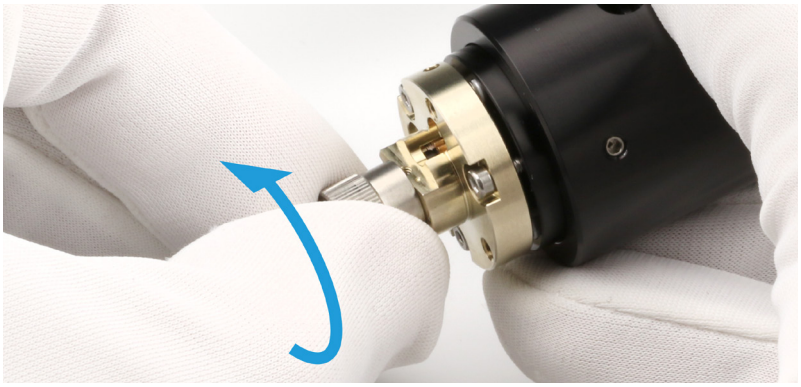

Figure 1:

First, remove the threaded cap from the fiber receptacle of the fiber collimator.

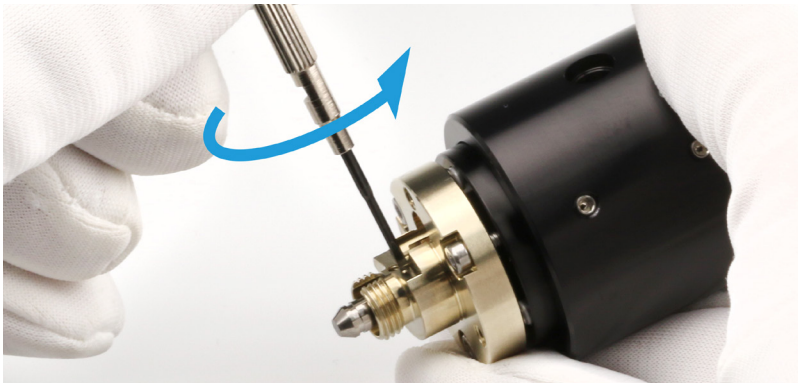

Figure 2:

Then, slightly loosen the small pin screw. Use the screwdriver 9D-12. Make sure to not loosen it too far, as it is small and easily lost.

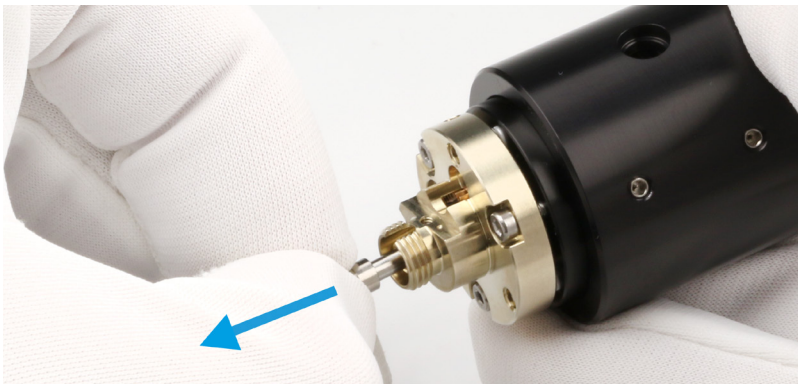

Figure 3:

Now, pull out the plug.

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Now, make sure that the connector of the fiber you want to attach matches the receptacle type of the fiber collimator:

- Use fibers with FC-APC (8°-polish) connectors for fiber collimators with an inclined coupling axis (60FC-Qxxx-4).
- Use fibers with FC-PC (0°-polish) connectors for fiber collimators with a coaxial axis (60FC-Qxxx-0).

The fiber collimators are compatible to all fiber connectors type FC, including fiber connectors with end caps.

Notice:
- Do not touch either the optical surface of the lens or the fiber end-face.
- If the coupler is not in use, reattach both rear and front protection caps.

Caution! **Refer to the laser instruction manual for all instructions regarding laser safety!**
- Do not stare directly into the laser beam (which can cause permanent damage to the eyes).
- Do not stare at the reflected beam from reflective objects.
- Do not point the laser beam to other individuals.

1. Attaching a Fiber Cable to the Fiber Collimators

For attaching a fiber cable to the fiber collimator perform the following steps:

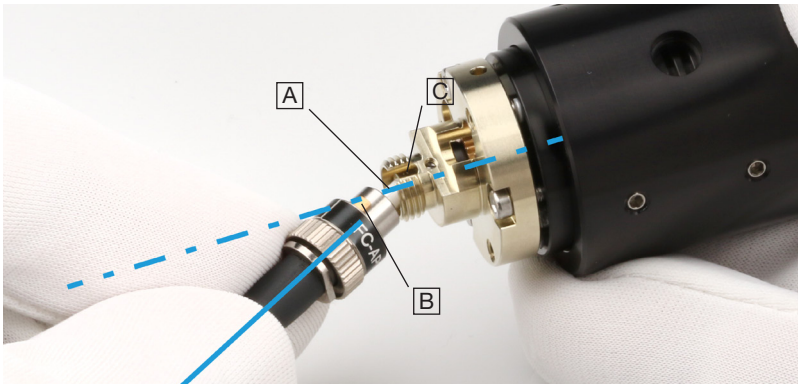

Figure 4:

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

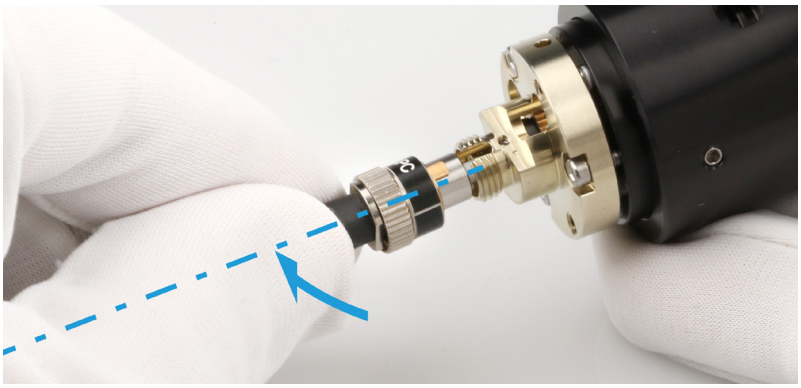

Figure 5:

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 collimator.

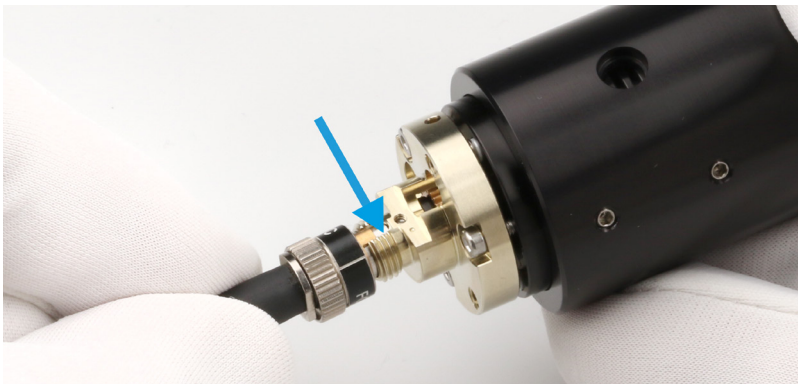

Figure 6:

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

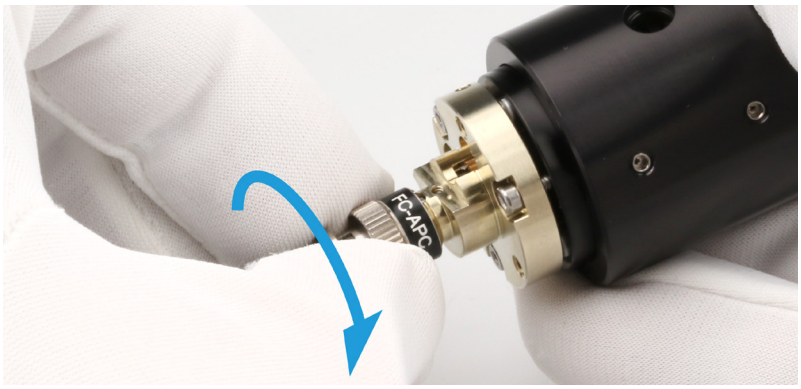

Figure 7:

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

Figure 8:

Finally, gently tighten the fiber grub screw to reduce the free play of the ferrule in the receptacle.

The free play in between the connector ferrule and receptacle is only a few microns, but necessary for inserting the ferrule without force.

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.

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2. Adjusting the Collimation Setting

Collimation adjustment (adjustment of the collimating lens in z-direction) is a demanding task and should be performed preferably using a collimating telescope.

Notice: The fiber collimator is shipped pre-adjusted for the given wavelength and, often, it is not necessary for the customer to readjust the lens position. This is why you can skip this step in most cases.

To check the collimation setting of the fiber collimator, couple a radiation source of appropriate wavelength into the fiber connected to the fiber collimator.

Caution! **Refer to the laser instruction manual for all instructions regarding laser safety!**

- Do not stare directly into the laser beam (which can cause permanent damage to the eyes).
- Do not stare at the reflected beam from reflective objects.
- Do not point the laser beam to other individuals.

There are two options for rating the collimation setting:

- For fiber collimators with a focal length f‘ > 30 mm it is best to use a shearing interferometer.
- For fiber collimators with a focal length f‘ ≤ 30 mm you can use the following procedure as an alternative:

  Direct the beam to a target about half a Rayleigh length z_R away:

$$\frac{z_R}{2} = \frac{\pi \cdot \varnothing^2_{beam}}{\lambda \cdot 8}$$

  Here λ is the optical wavelength and $Ø_{beam}$ the collimated beam diameter (1/e² level).

  When correctly collimated, the laser spot diameter on a target about $z_R/2$ away must have approximately the same diameter such as the beam directly behind the laser beam coupler. Additionally, make sure that there is no focused spot between the laser beam coupler and the target at $z_R/2$.

The lens position is adjusted by means of an eccentric key type 55EX-5.

For adjusting the lens position perform the following steps:

Figure 9:

Loosen the clamp screws fixing the lens position by means of a screwdriver type 50HD-15.

Notice: The number of clamp screws (two or four) depends on the individual type of fiber collimator. For the exact position of these clamp screws please refer to the technical drawing of the individual fiber collimator, respectively.

Figure 10:

Insert the eccentric key type 55EX-5 into the large hole.

Now, adjust the focus setting by rotating the eccentric key. Use the shearing interferometer or adjust the collimation by minimizing the size of the laser spot on the target about half the Rayleigh length z_R away.

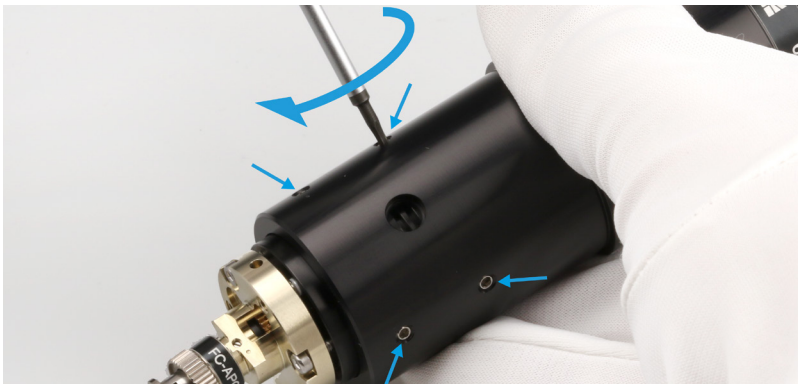

Figure 11:

Finally, fix the clamp screws in order to lock the collimation setting.

3. Tilt Adjustment

The fiber collimators of series 60FC-Q have an integrated tilt alignment mechanism.
With this mechanism you can adjust the optical axis to the mechanical axis of the fiber collimator.

Notice: This mechanism is not suitable for adjusting the beam pointing of the fiber collimator in your setup. If you want to adjust the beam pointing, use an external alignment device such as an adjustable mirror mount.

For adjusting the optical axis with respect to the mechanical axis perform the following steps:

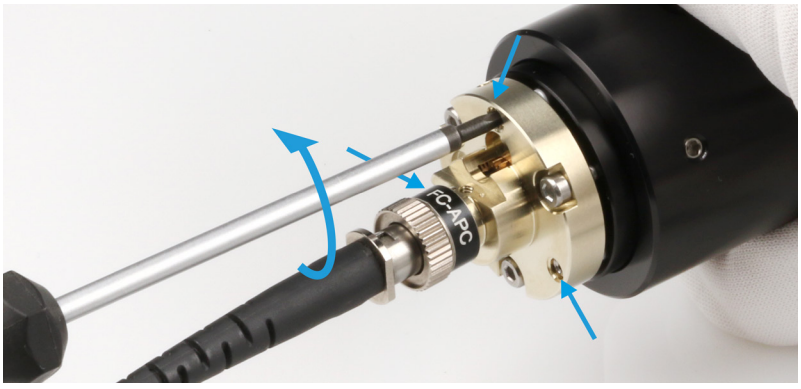

Figure 12:

Loosen the three locking screws (grub screws) by 2 - 3 turns. Use the hex screwdriver 50HD-15.

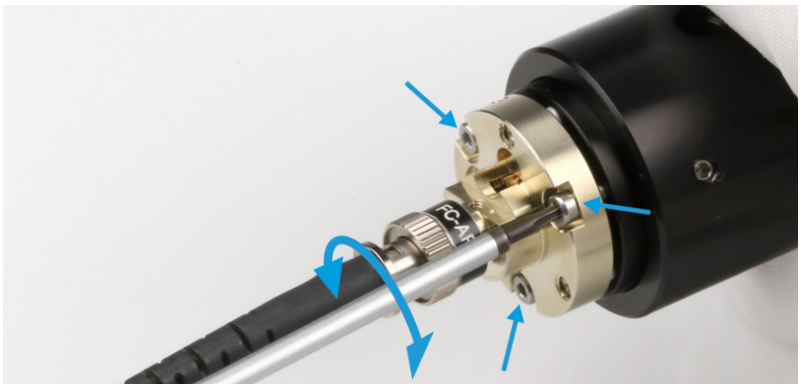

Figure 13:

Now, adjust the optical axis by means of the three adjustment screws (hex with head). Again, use the hex screwdriver 50HD-15.

Caution! **Refer to the laser instruction manual for all instructions regarding laser safety!**

- Do not stare directly into the laser beam (which can cause permanent damage to the eyes).
- Do not stare at the reflected beam from reflective objects.
- Do not point the laser beam to other individuals.

There are two options for rating the alignment:

- Observe the collimated radiation on a screen placed in a large distance from the fiber collimator. The distance that is most sensitive for this method again is about half the Rayleigh range z_R, see Chapter 2.
  Rotate the fiber collimator along its mechanical axis.
  The alignment of the optical axis is best when the position of the spot on the screen does not alter.
- A second option can be used only when the fiber collimator has a clear aperture that is small with respect to the fiber NA. Then the collimated beam is truncated by the aperture of the fiber collimator at a lower level of the Gaussian intensity distribution:
  Observe the collimated radiation on a screen placed in front of the fiber collimator (for laser safety or in case of invisible radiation use a camera for this purpose).
  The alignment of the optical axis is best when the beam truncation seen on the screen is axially symmetric.

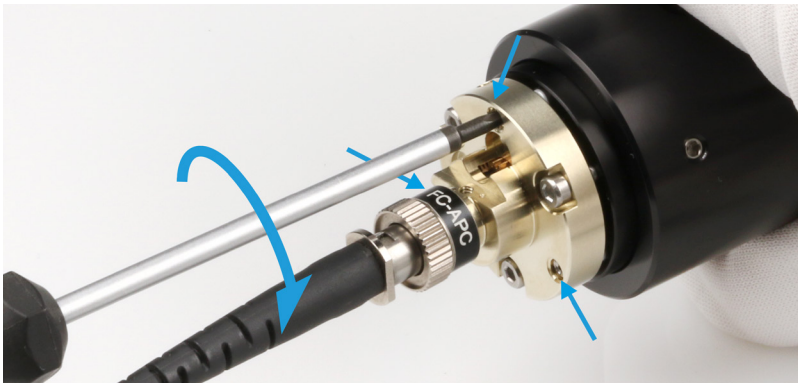

Figure 14:

Finally, lock the three grub screws. Use a torque of max. 40 Ncm.

4. Adjusting the Wave Plate

The axis of the wave plate integrated to the fiber collimators of series 60FC-Q can be adjusted. This is done using the special tool type 60Z-2803 based on a gear wheel. By rotating the wave plate you can adjust the state of polarization between circularly right-handed or left-handed (details see *www.sukhamburg.com/support/technotes/fiberoptics/SK010PA/applications.html*).

The state of polarization of the collimated beam exiting the fiber collimator is measured using a polarization analyzer, such as the SK010PA Polarization Analyzer from Schäfter+Kirchhoff.

Notice: The fiber collimators of series 60FC-Q should be used with polarization-maintaining fiber cables only.

Please perform the following steps:

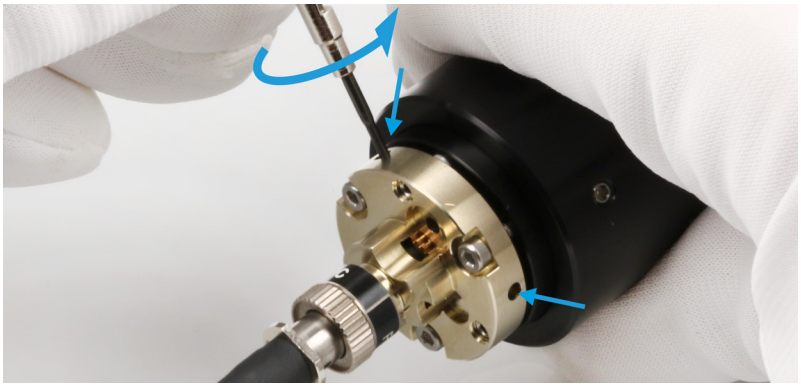

Figure 15:

Loosen the two radially arranged grub screws. Use the screwdriver type 9D-12.

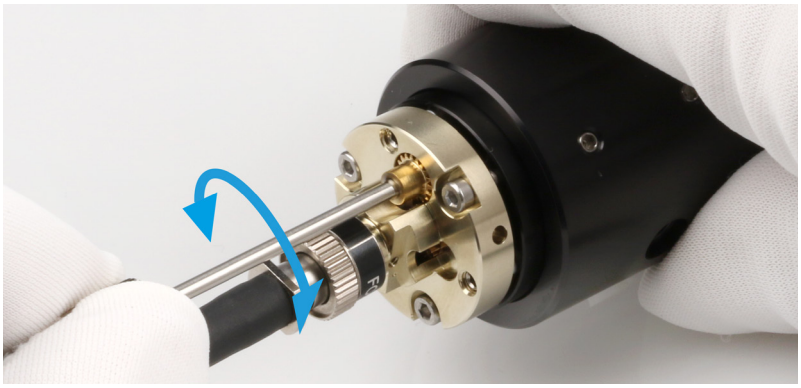

Figure 16:

Insert the tool type 60Z-2803 into the large aperture. Make sure that the teeth are interlocking. Now, you can rotate the wave plate.

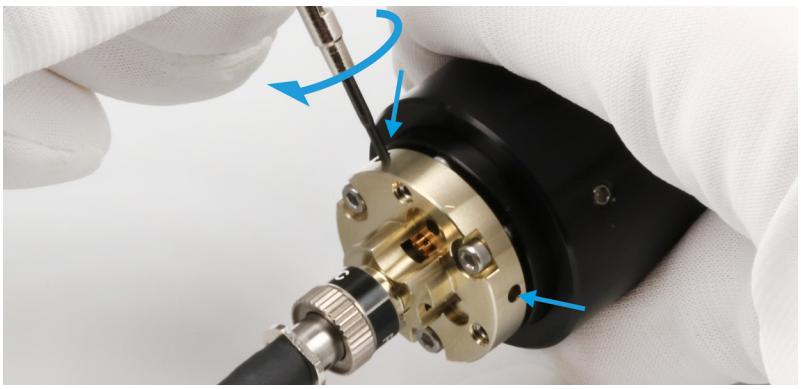

Figure 17:

Finally, fix the two radially arranged grub screws.

5. Adjustment Tools

For assembling and adjusting the fiber collimators series 60FC-Q you need the following tools:

Figure 18:

Screw driver type 9D-12, hex key 50HD-15, and eccentric key type 55EX-5.

Figure 19:

Tool type 60Z-2803 for rotating the wave plate

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Date of issue: 15.12.2020

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