Fiber-optic Rotary Joints

The fiber-optic rotary joint optically connects the fiber-optic tips within the fiber receptacle on the fixed side and on the rotating side of the joint. It consists of high precision bearings and a lens system which allow a rotation-insensitive optical power transfer between the fiber tips. In some optogenetics experiments, the optical fiber is connected to the mouse head and when the mouse moves inside confined space, the rotary joint releases the twisting of the optical fiber.

1x1 Fiber-optic Rotary Joint

Basic, most popular type of the rotary joint. It consists of a body, two bearings, two collimating lenses and of an FC/PC receptacle on each side. When connectors are inserted in receptacles the fiber tips are in the focal planes of the respective collimating lenses. Between the lenses the beam is parallel. Typically used with optical fibers with core diameter of 200µm and NA of up to 0.48.

1x1 fiber-optic rotary joint FC output

ORDERING CODE : FRJ_□□□-□□□

Intput Receptacle Code
FC, SMA, M3

Output Receptacle Code
FC, SMA, M3

1x2 Fiber-optic Rotary Joints

1x2 fiber-optic rotary joints have a single fiber receptacle on the fixed side and two fiber receptacles on the rotating side. These rotary joints are used to send light coming from a single optical fiber to two points on the moving target via separate optical fibers.

There are two distinct versions of this product, one for the intensity division and the other for the wavelength division of light. Each version can be further customized if needed.

Intensity division

The intensity division rotary joints send half of the input light into each of the two output receptacles. The input receptacle is typically the FC type while output receptacles can be any of M3, SMA or FC types.

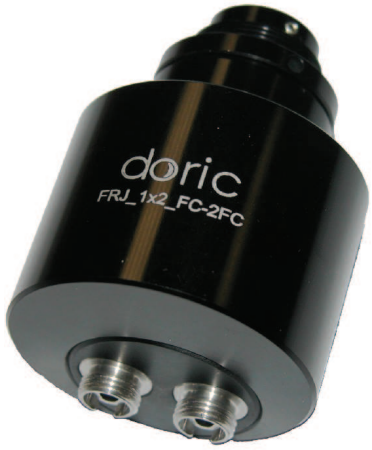
The rotary joint with FC receptacle on input side and M3 receptacles on the rotating side is small and compact and meets the low rotation torque requirements of some optogenetics experiments. The rotary joint with FC output connectors is somewhat larger. The fiber patch cords with corresponding connectors should be used to connect to rotary joints. On the output side, the loose ends of the fibers can be terminated with the M3 connectors, magnetic connectors or with a fiber ferrule that connect to fiber-optic cannula. For more information on the matching patch cords for rotary joints, see patch cord section.

1x2 fiber-optic rotary joint
Intensity division
M3 outputs

ORDERING CODE: FRJ_1x2i_□□□-2□□□

Input Receptacle Code
FC, SMA, M3

Output Receptacle Code (same for both fibers)
FC, SMA, M3



1x2 fiber-optic rotary joint
Intensity Division
FC outputs

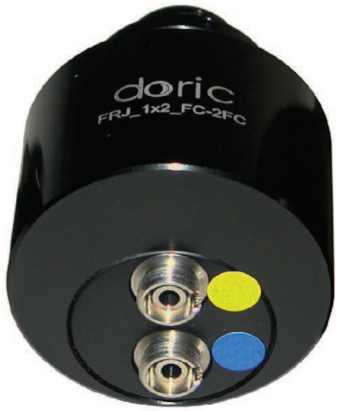
Wavelength division

The wavelength division rotary joints split the spectral band originating from the input receptacle and send each band to the corresponding rotating fiber receptacles. In some optogenetics experiments, they can be used for example to separate the 473-488 nm blue light (ON signal) and the 590 nm orange light (OFF signal).

1x2 fiber-optic rotary joint
Wavelength division
M3 outputs

The rotary joint with FC receptacle on input side and M3 receptacles on the rotating side is small and compact and meets the low rotation torque requirements of some optogenetics experiments. The rotary joint with FC output receptacles is somewhat larger. The fiber patch cords with corresponding connectors should be used to connect to rotary joints. On the output side, the loose ends of the fibers can be terminated with the M3 connectors, magnetic connectors or with a fiber ferrule that connect to the fiber-optic cannula. For more information on the matching patch cords for rotary joints, see patch cord section.

In opposite direction, a 1x2 wavelength division rotary joint with the appropriate filters can be used as a rotating fluorescence cube. For more information on the matching patch cords for 1x2 fiber-optic rotary joint, see patch cord section.



1x2 fiber-optic rotary joint
Wavelength division
FC outputs

ORDERING CODE: FRJ_1x2w_□□□/□□□_□□□-2□□□

Wavelength 1 (nm)
Wavelength 2 (nm)

Input Receptacle Code
FC, SMA, M3
Output Receptacle Code (same for both fibers)
FC, SMA, M3

1x4 Fiber-optic Rotary Joints

These joints are used to send the light coming from a single optical fiber to 4 points on the moving target via separate optical fibers.

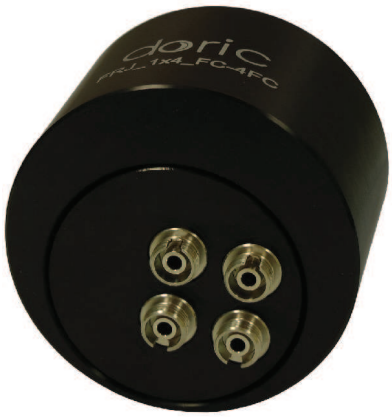
There are two distinct versions of this product, one featuring the intensity division and the other the intensity and wavelength division of light. Each version can be further customized if needed.

Intensity division

The purely intensity division rotary joint sends one quarter of the input light into each of four output receptacles. Its input receptacle is typically FC or SMA, while the output receptacles can be any of M3, SMA or FC types. However, due to the torque limitations in some optogenetics experiments, we strongly recommend the use of M3 version, although FC and SMA versions also exist. Indeed, FC or SMA connectors are much larger in size and consequently the joints are bulkier as well. However, some customers need them because of the compatibility issues with existing patch cords.

1x4 fiber-optic rotary joint
Intensity division
M3 outputs

The fiber patch cords with corresponding connectors should be used to connect to rotary joints. On the output side, the loose ends of the fibers can be terminated with the M3 connectors, magnetic connectors or with a fiber ferrule that connect to fiber-optic cannula. For more information on the matching patch cords for 1x4 fiber-optic rotary joint see patch cord section.



1x4 fiber-optic rotary joint
Intensity division
FC outputs

ORDERING CODE : FRJ_1x4i_□□□-4□□□

Input Receptacle Code:
FC, SMA, M3

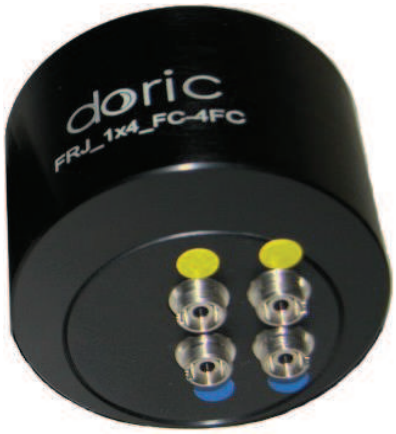
Output Receptacle Code: (same for all four)
FC, SMA, M3

Intensity and Wavelength division

In intensity and wavelength division rotary joint, the light is first spectrally divided and subsequently each wavelength band is intensity split into two. In optogenetics experiments, they can be used to separate 473-488nm blue light (ON signal) and 593nm orange light (OFF signal). The net result is that two receptacles will carry the ON signal and the other two will carry the OFF signal.

1x4 fiber-optic rotary joint
Wavelength division
M3 outputs

This fiber-optic rotary joint has an FC or an SMA receptacle on the input side and four FC, SMA or M3 receptacles on the rotating side. The fiber patch cords with corresponding connectors should be used to connect to rotary joints. On the output side, the loose ends of the fibers can be terminated with the M3 connectors, magnetic connectors or with a fiber ferrule that connect to fiber-optic cannula. For more information on the matching patch cords for 1x4 fiber-optic rotary joint see patch cord section.



1x4 fiber-optic rotary joint
Wavelength division
FC outputs

ORDERING CODE: FRJ_1x4w_□□□/□□□_□□□-4□□□

Wavelength 1 (nm)

Wavelength 2 (nm)

Input Receptacle Code
FC, SMA, M3

Output Receptacle Code (same for all four)
FC, SMA, M3

Technical specifications of fiber-optic rotary joints

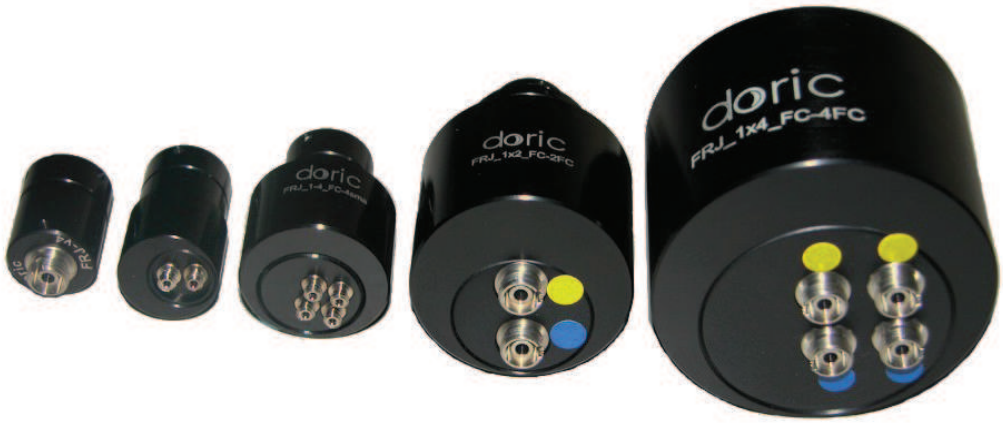
The principal motivation behind the development of our fiber-optic rotary joints is to provide optogenetics research labs with simple and inexpensive passive tools for connecting light sources with freely moving laboratory animals via optical fibers. Consequently, the main parameter to consider is the torque needed to move the joint or the resistance to the rotation of the joint. Typically smaller devices will have smaller torque.

The numerical aperture of the connecting fibers can affect the overall transmission of the joints and we recommend that appropriate fibers be used if the best transmission results are to be obtained. Additionally, the transmission and its variation during rotation are influenced by the fiber diameter. The specs shown below relate to 200µm diameter fibers.

FRJ	Torque	NA	Weight	OD_{max}	Length	Transmission (T)
FRJ_FC-FC	7µN.m	0.48	18g	17mm	30mm	> 80%
FRJ_1x2i/w_FC-2M3	9µN.m	0.22	22g	19mm	36mm	> 2x35% *
FRJ_1x4i/w_FC-4M3	16µN.m	0.22	38g	28mm	40mm	~ 4x16% *
FRJ_1x2i/w_FC-2FC	14µN.m	0.22	117g	40mm	60mm	> 2x35% *
FRJ_1x4i/w_FC-4FC	30µN.m	0.22	275g	60mm	70mm	~ 4x15% *

* : valid for intensity division

For all fiber-optic rotary joints, the variation of the power with the angular position of the joint is lower than 5% per channel.



1 2 3 4 5

Fiber-optic rotary joints that perform wavelength division are marked with color stickers, in order to identify the channels. For example, FRJs 4 and 5 on the picture perform wavelength division.

2x2 Fiber-optic Rotary Joint

These rotary joints are used to send the light coming from two different light sources to two points on the moving target via separate optical fibers. The 2x2 fiber-optic rotary joint provides two completely separate optical routes over which the light travels. The light signals do not share the optical fiber nor any other optical components. There are two fiber receptacles on the fixed side and two fiber receptacles on the rotating side of the joint. This device can be particularly useful for some fluorescence measurements where the signals are very weak.

ORDERING CODE: FRJ_2x2_□□□/□□□_2□□□-2□□□

wavelength 1 (nm)
wavelength 2 (nm)

Input Receptacles Code (same for both fibers)
FC, SMA, M3

Output Receptacles Code (same for both fibers)
FC, SMA, M3

Hybrid Rotary Joints (optical, liquid and electrical)

This all-inclusive rotary joint integrates the functions of the fiber-optic, electrical and liquid rotary joints within one joint. We recommend the use of hybrid cables to deliver light, fluid and electricity across the joint.

ORDERING CODE : HRJ-□□□_□□□-□□□_□□_□

Type:
OL= optic + liquid; **OE**=optic + electric;
OLE= optic + liquid + electric;

Optical Channel Input Receptacle Code :
FC, SMA, M3

Optical Channel Output Receptacle Code :
FC, 2FC, SMA, 2SMA, M3, 2M3

Liquid swivel gauge (ga) (optional)
20, 22, 25

# of electrical channels (optional)
0, 1, 2, 4, 8