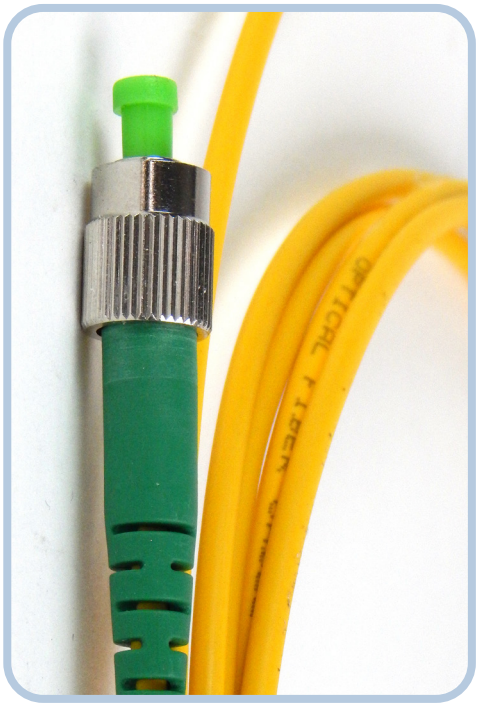
Level:
BASE

FIBRE OPTIC ROTARY JOINTS

3 Common Fibre Optic Connectors & Terminations

The ideal type of connector can vary depending on the application. BGB has a range of FORJs that come in both “pig-tailed” and connectorised formats. The pig-tailed versions can be adapted at customer request to almost any fibre length, connector type or for mechanically or chemically harsh environments. Our connectorised range is designed to suit a bayonet spring-loaded connector type (ST) allowing the customer to define their own cable arrangement without the need for a bulkhead adapter.



“Temporary” mechanical connections are commonly employed in fibre-optic products where field serviceability and assembly are important. Other types of connection, including permanent splicing and expander beam connectors may be employed depending on the application. However, for the vast majority of applications the types of connectors discussed here are more than adequate.

To manufacture a connector, the fibre optic core of the cable is fed through a cylindrical “ferrule” commonly made from a ceramic material, Zirconia. The end of the fibre that protrudes out the other end is cleaved and polished back. The butt connection is made by aligning the two ferrules axially and pressing them together tip-to-tip. The high level of precision that can be achieved with the manufacturing process of Zirconia lends itself to this application. Highly accurate alignment of Zirconia ferrules can be achieved with alignment sleeves and tubes.

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(CONTINUED..)

Specification of the type of connector required is normally denoted as follows: <type of connector>/<end-face type>, e.g. ST/PC. Nowadays, the insertion loss achieved varies between connectors but, with the exception of SMA, is routinely below 1 dB [1]. A summary of commonly used connectors is shown in Table 1 below:

Name	Stands for	Ferrule diameter (mm)	Standard	Description
FC	Field Connector	2.5	IEC 61754-13	Fixed ferrule with a screw down collar. Ideal for high vibration/shock environments.
LC	Little Connector	1.25	IEC 61754-20	Most common in SFPs. Small space envelope. Snap in connector, easy to plug and unplug.
SC	Subscriber or Square Connector	2.5	IEC 61754-4	Similar to LC but larger. Snap in connector, easy to plug and unplug.
ST	Straight Tip	2.5	IEC 61754-2	Sprung ferrule connector. Bayonet connector, easy to plug and unplug.

Table 1. Commonly used connectors [1].

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Level:
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(CONTINUED..)

As well as connector type, there are a variety of end-face types for fibre connectors. The end-face type refers to the geometry and polish of the fibre/ferrule. A summary table of the types of end-face is shown below in Table 2. PC (Physical Contact) is appropriate and most commonly used for multimode applications. Although UPC (Ultra-Physical Contact) has slightly better return loss characteristics it has a slightly reduced lifetime (in terms of number of number connections [2]). PC/UPC finishes are suitable for single mode applications, but for optimal optical performance APC is more commonly used to cut down the reflections at connector joints. An APC connection achieves this by use of, typically, an 8° angle on the end face causing the majority of reflected light to be angled directly into the cladding close to the connector and not back along the fibre core.

Name	Stands for	Typical Insertion Loss (dB)	Typical Return Loss (dB)
PC	Physical Contact	0.2	>35
UPC	Ultra-Physical Contact	0.2	>50
APC	Angled Physical Contact	0.2	>60

Table 2. End-face types for fibre optic connectors [1].

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References:
[1] B. Lee and T. Mamiya, "Optical Fiber Connector Handbook," Senko, 2017.
[2] J. M. Senior, "Optical Fiber Communications Principles and Practice," Pearson Prentice Hall, 2009.

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