DEUTSCH

Fibre Optics

Innovative Interconnection Solutions

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Introduction to Deutsch

For over 40-years Deutsch has provided interconnection solutions for harsh environments across a wide range of defence, aerospace, industrial and autosport applications. Deutsch is renowned worldwide for the design, development and manufacture of high quality connectors.

Deutsch's product range includes:

- Power and signal connectors
- Modules
- Power, signal and databus contacts
- Accessories
- HF and coil cable assemblies
- Filtered connectors
- Optical connectors and harnesses

Right from the beginning, Deutsch has been manufacturing high performance, single and multiway Fibre Optic connectors and cable assemblies for harsh environments. Applications range from sub-sea systems through to ground and sea based platforms to leading edge aerospace technology.

A knowledgeable and experienced team of experts, backed up by considerable investment in research and supported by an international distribution network, ensures Deutsch continues to meet the evolving needs of its customers with the most technologically advanced and market leading solutions available.

Capability Overview

Deutsch does not just supply connectors, but listens closely to customers and offers advice that is relevant to their application. The company's specialists will discuss architecture and system-level design issues at the start of a project, pinpointing the exact requirements thus saving time and effort. From the commissioning and prototyping stages right through to fitting and installation, clients can be confident of receiving an unparalleled level of support and service, backed up by a level of expertise that is unique in the industry.

Design

Deutsch's experienced engineers use the very latest in CAD systems and 3-D modelling techniques to produce innovative, cost effective designs in the shortest possible time.

Consultation and Project Management

Deutsch works with its customers' engineers to arrive at Fibre Optic solutions that ensure the optimal combination of factors like performance and low system cost. Suppliers commonly talk of their willingness to "go the extra mile" for customers. However Deutsch actually has a dedicated, in-house project management team that liaises between customers and internal teams to ensure that each project is successfully completed within the required timescale and budget.

Management System and Quality Approvals

- BS EN IS09001:2000 (BSI)
- BS/EN 9100:2003 (BSI)
- AS9100 Rev B (BSI)
- AS9120:2002 (BSI)
- EASA Part 21 Subpart G (CAA)
- BS9000 (BSI)
- Underwriters Laboratories (UL)
- Military Spec Approvals 38999 (DSCC)

Environmental Management

- BS EN 14001:2004 (BSI)

Manufacturing

Equipped to carry out optical connector and cable harness production to the highest quality standards, Deutsch is a vertically integrated company with the capability of manufacturing connectors from raw material right through to finished products.

To highlight a few key capabilities:

Moulding - Deutsch has its own screw inject moulding department producing components from a number of different materials. These include fluorosilicone elastomers, and both thermoplastic as well as thermoset composites.

Toolroom - To support the mould shop, Deutsch also has its own tool room with state of the art Electro Discharge Machining (EDM), conventional turning and milling, and surface and cylindrical grinding capabilities.

Machining - Deutsch's machine shop has a number of advanced CNC multi axis turning centres for the manufacture of both connector bodies and contacts. Machining materials supported include stainless steel, aluminium, leaded nickel copper and arcap. The machines can produce the components in a single operation.

Surface Finishing - Deutsch's surface-finishing department can produce a number of different finishes, including, cadmium, nickel, gold, tin, zinc, and many more. The surface finishing department is NADCAP approved. It also has BS EN ISO14001;2004 accreditation and operate under a PPC permit.

Assembly Areas - Deutsch produces a number of different connector styles including Environmental, Hermetic, Filter, and Fibre Optics. It has both video jet and laser marking capabilities and each area has its own automatic electrical testing facility.

Summary - Deutsch is a lean manufacturing company that has over the past five years invested in its people and customer service, through an intensive lean program. The whole company has undergone a number of changes to improve the working environment for its employees, as well as customer satisfaction.

Test and Qualification

With an extensive in-house testing facility for Fibre Optics, qualified to military and civil standards for a variety of applications, Deutsch is able to qualify customers' assemblies.

Our capabilities include:

- Temperature cycling
- Hot or cold long term immersion
- Vibration sinusoidal, random and random on random and temperature cycling
- Salt fog
- Humidity
- Immersion
- Altitude
- Bubble test
- Electrical IR and DWV
- Optical to requirement
- Attenuation
- Calibration
- Plus fixtures and tooling as designed by the lab

Support and Training

Deutsch offers a range of Fibre Optic training, including courses on the termination and handling of connectors and cable systems. Courses can be tailored to match customer-specific needs and can be held either on-site at Deutsch's extensive facilities located around the world, or at the customer's premises.

In addition, the company can supply Fibre Optic termination equipment to its customers to help with their processes.

The services available include:

- Termination inspection tooling
- Test equipment installation
- Termination support

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The Markets We Serve

Deutsch Fibre Optic products have a track record of providing optical interconnection solutions that function reliably in harsh environments. These have been deployed in sectors such as:

- Defence Aerospace
- Defence and Naval communications
- Civil Aerospace
- Transportation

Defence, Aerospace and Naval Communications

Deutsch offers robust Fibre Optic harnesses and connectors for communication, navigation and high bandwidth systems used in defence, aerospace and naval applications. These products are used in fighting vehicles, surface ships, submarines, satellites, aircraft, missiles, space vehicles, radar installations and communications equipment, to name a few.

Deutsch's optical connectors and harnesses are built to meet the industry specifications and their design takes into account the need to protect the connection from harsh environmental factors.

Defence, Aerospace and Naval applications include:

- Communications harnesses
- Defensive aid sub systems
- Remote-operated vehicles
- Avionics-box applications

Civil Aerospace

For more than 50 years, Deutsch has been one of the leading manufacturers of connectors for the aerospace sector. A combination of electronic and mechanical sciences enable us to develop technologies that help to keep aircraft operating at peak performance.

Deutsch's Fibre Optic connectors have been used in aerospace applications since 1976 and the company has a world-renowned reputation for supplying top quality products.

As a leading designer and manufacturer of custom and off-the-shelf interconnected products for both wide-body and corporate jet programmes, Deutsch offers solutions for the majority of platforms in use today. Typical application areas include airframes, avionics and in-flight entertainment, as well as specialist aero engine connector solutions.

Civil Aerospace applications include:

- In flight entertainment
- Camera systems
- Nose wheel speed sensors
- Landing gear systems

Transportation

Deutsch can source and provide speciality Fibre Optic solutions for trains, automobiles, airplanes and ocean going vessels.

Due to its recognised presence in the railway industry, Deutsch has established itself as a key partner since the dawn of high-speed trains in 1975. The company is now able to offer innovative Fibre Optic solutions in order to meet today's specific demands imposed by this industry.

Transportation applications include:

- Low smoke zero halogen environments
- High temperature transport systems
- In cabin communications and sensing functions.

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Why use Fibre Optics?

Fibre Optics technology will play a vital part in the future of interconnection systems in the Defence, Aerospace and Transportation markets. It's ability to carry vast amounts of data through very harsh environments makes it suitable for a variety of applications.

Typical areas of deployment include:

- Communications systems
- Sensor systems (in camera's etc)
- Structural health monitoring (in strain gauges and systems that monitor for vital changes in temperature and pressure)
- Defensive-aid sub systems (for example, for detecting and deploying missiles to intercept enemy incoming signals)
- Databuses and missions systems

Advantages of Fibre Optics over Copper are:

- **Higher bandwidth over longer distances:** A Fibre Optic system may have very high bandwidth, sometimes operating at data rates of 10Gb/s, equivalent to more than 120,000 standard telephone calls over one pair of optical fibres (one transmitting and one receiving)
- **Transmission security:** Light signals, such as those used in Fibre Optics, are impossible to intercept or monitor
- **Low loss:** Fibre optic cables are made from high quality materials. For example, if a candle was lit on one side of a one mile thick wall of the glass material used in Fibre Optics, the light would still be clearly visible from the other side
- **Immunity to Electromagnetic Interference:** Fibre Optic media uses light to transmit signals so it is not subject to Electromagnetic Interference, radio frequency interference or voltage surges, which can all affect copper
- **Lightweight and miniature:** Fibre is significantly lighter than copper and the reduction in size makes it possible to design-in complete redundancy for mission critical systems
- **Non-Conductive:** Fibre Optics are a safer, spark-free media suitable for use in hazardous environments and are immune to damage due to lightning strike
- **Future-Proof:** With existing installations, Fibre Optic systems only use a very small fraction of the potential information carrying capacity of the fibre. As demand for communications capacity increases, it will be possible to upgrade the transmission equipment

Why Deutsch Products?

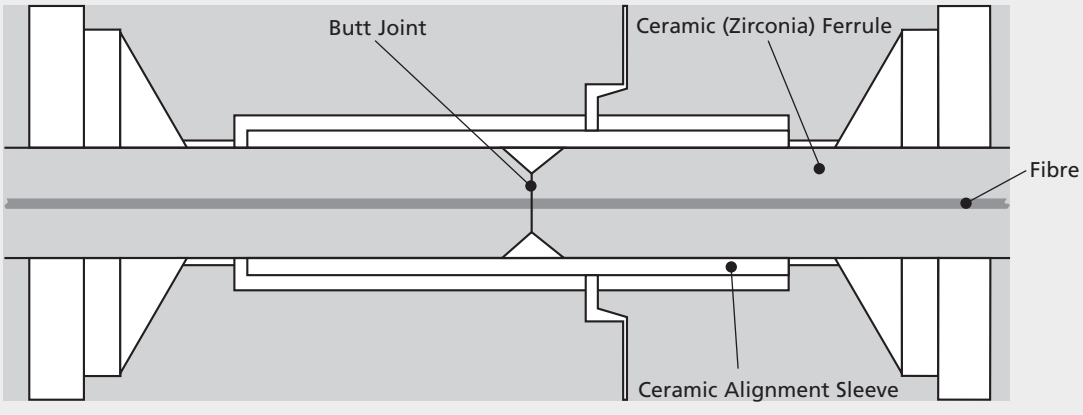
What is different about them?

Deutsch is a recognised and trusted supplier in the interconnect field, with four decades experience of providing top quality, high performance Fibre Optic connector solutions that are also easy to maintain in the field. Its products are designed to operate reliably in harsh and challenging environments, and the company's technical specialists have an in-depth understanding of a broad range of applications.

Butt Joint Technology

Deutsch focuses primarily on the use of butt joint technology in Fibre Optic connectors and contacts. The physical contact method provides the following benefits:

- Lower insertion loss
- Less reflection (better return loss measurements)
- Lower cost
- Smaller and lighter



Typical Deutsch Connector

Due to increased data rates and the need for real time data transmission, many new and non-traditional areas, such as in-flight entertainment, flight control and structural health monitoring, have now adopted fibre optic technology.

Deutsch's Fibre Optic connectors are available in a number of different types; circular, rectangular and modular; and come in variety of materials and finishes, including Aluminium, Composite and Aluminium Bronze.

Designed to be compatible with singlemode and multimode fibres, the connectors are available in both circular and ribbon cable types. They include features, such as rear insertable/removable optical contacts and a removable alignment sleeve, enabling simple, effective cleaning and maintenance.

Deutsch prides itself on offering products that meet the demands of today's technologies and standards, as well as maintaining the customised solutions for niche applications.

The company's team of specialists work to provide the best technical and commercial solution for each application, without compromising on quality or performance.

To further enhance its product range, Deutsch also offers optical termination tooling and training packages, along with qualification testing to suit the individual needs of customers.

Key Features:

- Dowel pin alignment
- Cleanable optical faces
- Environmental sealing
- High performance optical contacts used throughout the fibre connector range

Fibre Optics Range Overview

Deutsch manufacture singleway and multiway connectors for singlemode and multimode applications.

The extensive product range includes:

- RSC and RSC-V ruggedised singleway connectors
- HA singleway connector airframe fit (JN1055 connector)
- MIL-T-29504 style optical contact for D38999 connectors
- MC3 multiway connector series 3 - circular, metallic, single fibre termini
- MC5 multiway connector series 5 - circular, composite single fibre termini
- MC5 inserts for EN4165/ARINC 809 and DMC-M modular connectors
- MC6 multiway connector series 6 - circular or modular, composite or metallic, multi-fibre termini
- MC6 Insert for EN4165/ARINC 809 and DMC-M modular connectors
- Arinc 600 avionics box modular, hybrid interconnects
- Arinc 809 - 4 way optical module for ARINC 801 contact
- Composites and embedded fibre systems
- EMPIRE technology, for connecting embedded fibre to external equipment
- Custom Fibre Optic cable assemblies and harnesses
- Custom designs / specials.

Deutsch Connector Common Features									
Key Features	Connector Type								
	RSC/ RSC-V	HA	MC3	MC5	MC6	Arinc 600	DMC-M Mono	DMC-M Multi	38999
Composite Shell	×	×	×	✓	✓	×	✓	✓	×
Common Plug and Receptacle Contact	✓	×	✓	✓	✓	✓^	✓^	✓^	✓
Coupling Ring Grip	✓	✓	✓	✓	✓	×	✓	×	✓
Keying	✓	✓	✓	✓	✓	✓	✓	✓	✓
Receptacle Flange Mount Options	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cavity Identification	×	×	✓	✓	✓	✓	✓	✓	✓
Cable Gland Triple Seal	×	×	✓	✓	✓	×	✓	✓	✓
Backfitting Thread	×	×	✓	✓	✓	×	×	×	✓
Scoop Proofing	✓	✓	✓	✓	✓	×	✓	✓	✓
Tri-start Thread	×	×	✓	✓	✓	×	×	×	✓
EMI Bracelet	×	×	×	✓	✓	✓	✓	✓	✓
Anti-Vibration Coupling Mechanism	✓	✓	✓	✓	✓	×	✓	✓	✓
Dowel Pin Alignment	×	×	✓	✓	✓	✓	✓	✓	×
Cleanable Optical Faces	✓	✓	✓	✓	✓	✓	✓	✓	×
Environmental Sealing	✓	✓	✓	✓	✓	✓	✓	✓	✓
Visual Mating Indication	×	×	✓	✓	✓	×	✓	×	✓

✓ Connector does have this feature × Connector does not have this feature ^ Indicates connector is suitable for both MC5 and MC6 (MT) contacts

Fibre Optics Range Overview continued

Ruggedised Singleway Connector (RSC)

The RSC range of high performance Fibre Optic connectors is manufactured from Arcap, providing corrosion resistance. It has an anti-vibration coupling mechanism which is incorporated in the design. The range has been designed and adopted as an aerospace standard. Suitable for both singlemode and multimode applications, the RSC range has easily accessible fibre faces for cleaning purposes.

Key Features:

- Manufactured from Arcap for corrosion resistance
- Anti-vibration coupling mechanism
- Common ferrule carriers for the plug and receptacle

RSC-v

APC version of the ever popular RSC connector range. The RSC-V is available with either an angled polish (APC) or a tuneable physical contact (PC) variant.

Key Features:

- Suitable for singlemode applications
- Good return loss measurements
- Tuneable PC variant for optimum performance

HA Connector (JN1055)

A high performance singleway connector suitable for aerospace environments. This connector is manufactured to comply with the Eurofighter JN standard and is compatible with the Deutsch RSC connector.

Key Features:

- Manufactured to comply with Eurofighter specification JN1055 (J62.710)
- High performance optical contacts
- Rugged construction for high reliability

MIL-T-29504 Style Optical Connector Range

The Deutsch range of MIL-T style optical contacts is designed specifically for use with the MIL-DTL-38999 Series III connectors within the standard size 16 cavity.

Key Features:

- Manufactured to meet the requirements of MIL-T-29504/4 and 5
- Proven in both rotary and fixed-wing aerospace applications
- Sprung loaded socket contacts ensure consistent pressure and performance levels

MC3 MKII - Multiway Connector Range

The MC3 multiway Fibre Optic range provides high performance, maintainable optical interconnection in the harshest of environments.

Key Features:

- Insert-to-insert keying assists precision alignment
- Individually rear insertable/removable optical contacts enable easy assembly
- Backshells and adaptors available for most single and multifibre cable types

MC5 - Multiway Connector Range

The MC5 high density range is the very latest advance in high performance multi channel Fibre Optic connectors, capable of sustained performance over a wide range of environmental conditions.

Key Features:

- Compact 1.25mm precision zirconia ceramic ferrules
- Extensive range including 1,2,4,6,8,10 and 30 way connectors
- Simple termination process and tooling

Optical Inserts for EN4165 and Arinc 809

Deutsch has designed a comprehensive range of Fibre ptic inserts to further enhance our EN4165 connector range. To date the modular inserts can accommodate MC5, MC6 ribbon, Arinc 801 and EN4531 optical contacts.

Key Features:

- Interchangeable modular inserts
- Easy use insertion / extraction tool
- Easy access to optical contacts for cleaning maintenance
- Compliments DMC-M multiway modular connector range

Fibre Optical Insert for DMC-M

An optical insert is available for the popular DMC-M connector which enables six standard MC5 contact to be incorporated into a single insert package or 12 way MC6 or 4 way Arinc 801 contacts.

Key Features:

- Light weight composite
- Colour coded
- Modularity
- Screw coupling

Fibre Optics Range Overview continued

MC6 - Fibre Optic Ribbon Cable Connector

This high density Fibre Optic connector series is the next generation of optical interconnection solutions with the option for industry standard MT Ferrule inserts. The insert accommodates 2 to 72 channels and can be supplied pre-terminated if required. The Deutsch MC6 connector can also be incorporated into the DMC-M shell.

Key Features:

- Rear release contact using size 8 extraction tools
- Retrofit triple rear seal available
- Common contact single or multimode MT ferrules
- MIL-C-38999 Series III anti-vibration coupling with tri-start thread
- Interchangeable with MIL-C-38999 Series III

Arinc 600 Standard Avionics Box Applications

The MC5 Insert Package for Arinc 600 hybrid connector with dedicated Fibre Optic insert that houses up to 36 standard 1.25mm MC5 contacts (as qualified for EFA).

Key Features:

- Provides hybrid capability in a modular system
- Dedicated Fibre Optic insert housing up to 36 standard 1.25mm MC5 contacts
- Easily removable front insert allows cleaning of the optical faces and replacement of damaged alignment sleeves

Composites and Embedded Fibre Systems

This technology allows designers to reliably connect embedded optical fibres to external monitoring equipment, eliminating the problems of fixed 'flying lead' connections to the structure. Connection to embedded fibres with Deutsch connectors enables real-time 'health monitoring' of structures. This can be undertaken from the initial cure cycle right through to final service, even in harshest of environments.

Key Features:

- Reduces risk of fibre damage during manufacture
- Structural health monitoring capability
- Retro-fittable for non composite applications

38999

Military circular connector qualified to MIL-DTL-38999, Series III for fibre optic MIL-T-29504 style termini. Rugged design offers maximum performance for shock and vibration, environmental, moisture and corrosion resistance and provides effective EMI shielding.

Key Features:

- 100% Scoop Proof
- High strength Aluminium shells
- Superior flourosilicone seals provide maximum tear resistance and sealing memory
- Threaded coupling with self locking for anti-vibration integrity

EMPIRE

A unique, patent pending Fibre Optic connector technology that allows designers to reliably connect embedded optical fibres to external monitoring equipment, eliminating the problems of fixed 'flying lead' connections to the structure.

Key Features:

- Facilitates the implementation of fibre sensors within composites
- Protection of fibre at composite entry/exit point
- Receptacle connector physically embedded within composite material
- Available as panel edge or surface mount configuration

Fibre Optic Cable Assemblies and Harnesses

Deutsch also has dedicated design and manufacturing resources available to provide rugged and reliable Fibre optic harnesses for Aerospace, Military communications, Railways, Autosport and Industrial equipment.

Key Features:

- Custom designs available
- Custom lengths for harnessing
- Dedicated Fibre Optic harness facility
- Capability to work closely with customer to fully define requirements

Special Products

In addition to the standard product ranges, Deutsch can also produce application-specific interconnect solutions tailored to a particular customer's requirements, drawing on extensive experience in both Fibre Optics and in developing reliable connectors for harsh environments.

These range from mild adaptations of existing standard products to entirely new product concepts. In either case, Deutsch's expert team will work with customers to pinpoint exactly what they need.

Glossary

8/125	A type of singlemode fibre. The numbers state the core and cladding dimensions in microns
50/125	A type of multimode fibre. The numbers state the core and cladding dimensions in microns
62.5/125	A type of multimode fibre. The numbers state the core and cladding dimensions in microns
100/140	A type of multimode fibre. The numbers state the core and cladding dimensions in microns
200/280	A type of multimode fibre. The numbers state the core and cladding dimensions in microns
ARCAP	A corrosion-resistant, high nickel content alloy
Attenuation	The loss in the power of a signal that occurs as it travels through a transmission medium such as optical fibre or copper wire. It is sometimes measured in decibels per kilometre and varies with the type of fibre and - in the case of light - the wavelength
Bandwidth	Bandwidth is a measure of the information-carrying capacity of a communications system. A high-bandwidth fibre can carry more information in a given period of time
Cladding	The cladding surrounds the core of an optical fibre and cannot be separated from it. It has a lower refractive index than the core
Contact-fibre	A component used to terminate a fibre with another connector or piece of terminal equipment
Core	The core is the central section of an optical fibre – the part that carries the light. The refractive index of the core is higher than that of the cladding
dB/km	Decibels per kilometre. A unit of measurement of the attenuation coefficient of a communications medium. This will vary with the wavelength of the carrier
dBm	A unit of measurement of absolute power level. 0dBm = 1mW of power
Decibel	A logarithmic unit of measurement used for quantifying power ratios, e.g. when quantifying the loss across a fibre splice. One tenth of a Bel
Duplex Cable	A cable containing two fibres. Usually one fibre is used to transmit and the other to receive
Environmentally Sealed	A term applied to parts or assemblies equipped to keep out moisture, dirt, air or dust which might otherwise compromise performance. Sealing is achieved with gaskets, seals, grommets, potting or other means
Ferrule	The high precision part of a Fibre Optic contact used for accurate alignment of the fibre. Usually made from ceramic materials such as Zirconia
Fibre Optic	Adjective used to distinguish Fibre Optic components from their copper equivalents. E.g. Fibre Optic cable
Fibre Optics	A generic term applied to anything to do with optical fibres
Hermaphroditic Connector	A connector design that employs pin and socket contacts in a balanced arrangement such that both mating connectors are identical
Hermaphroditic Contact	A contact design which is neither pin nor socket and which mates with other contacts of the same design
Infrared	Electromagnetic radiation with wavelength exceeding 780nm. It is invisible to the human eye and is used in most optical-fibre communication systems
Insertion Loss	A measure of the optical loss of a component or system. Obtained by comparing the optical input power with the received power through that component or system
ISO	International Standards Organisation
Laser	The light source used for singlemode Fibre Optic systems. High powered, monochromatic and capable of very fast modulation. The word derives from Light Amplification by the Stimulated Emission of Radiation
Launch Power	A measure of how much power a transmitter puts into a certain type of fibre. It is measured in dBm
LED	Light-Emitting Diode. The light source used for most multimode fibre systems
Loss	A term often used in association with attenuation, but mostly in relation to the performance of components or systems such as connectors
Loss Budget	The total power loss of a cabling link, comprising both fibre losses and connector losses. It should be less than the power budget of the transmission equipment operating over the cabling link. Measured in decibels
Macro Bending	A term used in relation to the losses due to the whole fibre bending. Whenever fibre is bent some of the light is lost
Mega	Prefix meaning one million

MHz.km	Megahertz kilometre. The unit of measurement in which the bandwidth of a multimode fibre is expressed. Note that this is a frequency multiplied by a distance
Micro Bending	Very small bends in the fibre over short distance (<3mm). normally caused by the manufacturing process
Micron	A micrometer or one thousandth of a millimetre
Minimum Bend	The tightest bend that a Fibre Optic cable may suffer without degradation of performance
Mode	As in "multimode" or "singlemode"; refers to the different paths rays of light can follow along a fibre
Multimode Fibre	A multimode fibre has a core which is large enough for light to travel down the fibre following a number of different paths or modes
Nanometre	A thousandth of a micron, a billionth of a metre
Optical Fibre	The thin rod of silica along which the light travels in Fibre Optic systems. Comprises "core" and "cladding" elements
Pin Contact	A contact having an engagement end that enters the socket contact
Plug Connector	An optical fitting with pin, socket or pin-and-socket contacts, constructed to be affixed to the end of an optical cable and mated with a receptacle connector
Power Budget	The difference between the amount of power that a piece of transmission equipment launches into a fibre and the amount of power that the detector requires to operate satisfactorily. Measured in decibels. Should be greater than the loss budget
Primary Coating	The primary coating is applied to an optical fibre during manufacture. Normally a diameter of 250 microns
Radius	Modal Dispersion Distortion caused by the difference in time taken for light travelling along different modes or paths to travel along the same length of multimode fibre
Receptacle	An optical fitting with pin, socket or pin-and-socket contacts, constructed to be affixed to the connector end of an optical cable and mated with a plug connector
Refractive Index	Refractive Index is a measure of the optical density of a material. Defined as the ratio of the speed of light in a vacuum to the speed of light in material. Glass has a refractive index of around 1.5
Return Loss	In a transmission medium such as optical fibre, this is the amount of power which is reflected back to the source
Ruggedised	A cable construction used for fibre cables, comprising a secondary-coated fibre surrounded with Kevlar then an outer sheath
Secondary Coated Fibre	A fibre that has had an additional layer of material applied on top of the primary coating to bring it up to about 1mm diameter. Suitable for fitting contacts to
Scoop Proof	Recessed fibre contacts minimize potential contact damage in 100% scoop-proof connectors. In blind-mating applications, the mating shells cannot scoop the fibre contacts and cause contamination
Silica	Silica, or silicon dioxide, is the main constituent of ordinary glass. High quality optical fibres are made from a very pure form of silica
Simplex Cable	A cable containing fibre sufficient for one direction of communication, which might be as little as one filament of fibre
Singlemode Fibre	Singlemode fibre has a very small core, usually less than 10 microns and all the light travelling down the fibre follows exactly the same path or mode
Splitter	An optical component that splits the signal on one input fibre down two or more output fibres
Step Index Fibres	A step index fibre has a uniform refractive index throughout the core which means that all the rays of light travel at the same speed. Singlemode fibres are usually step index
Total Internal Reflection (TIR)	TIR takes place when the light in the core of a fibre strikes the cladding at an angle greater than the critical angle. It is this phenomenon that keeps the light within the fibre
Wavelength	The length of a wave as measured from one point to the identical point along the waveform (peak to peak)
Zirconia	A ceramic material used for the ferrules of fibre-optic contacts

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