SLIDES ONLY

NO SCRIPT PROVIDED

KITCO fiber optics

KITCO History

- KITCO Fiber Optics is a leading provider of fiber optic connectorization products and consulting services to the military and commercial communications industry.

- We specialize in the design and fabrication of fiber optic tools, tool kits and custom cable assemblies; producing private label kits for a number of major connector manufacturers and selling our own broad line of products. Other services include:
  - Field Services providing on-site termination
  - Splicing (including fusion splicing)
  - Troubleshooting and testing support
  - Hands-on training and certification programs

- We are recognized by the defense industry as fiber optic connectivity experts, and for over 27 years have customized our products and services to meet strict military standards. We work with and support major defense contractors and government agencies.

KITCO fiber optics

Training

Our training department was created to share our broad industry knowledge; and our hands-on training and advanced certification program have become the hallmarks of our superior reputation. Our trainers have strong credentials including advanced industry certifications, substantial field experience and have trained thousands of students worldwide on terminating, splicing and testing fiber systems.

Our main training facility is located at our headquarters in Norfolk, Virginia, and a San Diego presence serves the West Coast and the surrounding area. Additionally, with our established mobile training services, we have the ability to train at your desired location—anywhere in the world—customizing and tailoring our courses to meet your training requirements.

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- **The advantages of fiber optics and their units of measure**

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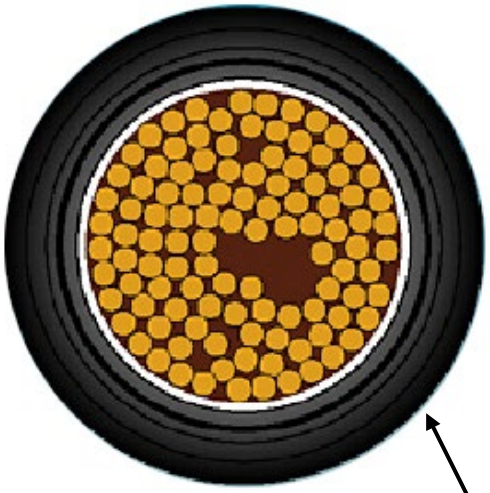
ADVANTAGES OF FIBER OPTICS

- Information Carrying Capacity
- Low Loss
- Electromagnetic/ Radio Frequency Immunity
- Light Weight
- Small Size
- Safety
- Security
- Upgradability

KITCO fiber optics

CABLE COMPARISON



	FIBER OPTIC CABLE	***COPPER CABLE***
DESIGN	144 Fibers	900 Pair Screened Pulp
SIZE	0.50 Inch Diameter	2.86 Inch Diameter
WEIGHT	80 lbs/1000 ft	4800 lbs/1000 ft
TRANSMISSION RATE	3.84 Tbps per fiber pair	1.54 Mbps per pair
PHONE CALLS	6,000,000 per fiber pair	24 per pair
REGENERATOR SPACING	60-70 miles	1.25 miles

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TRANSMISSION COMPARISION

Document	56.6kbps	128kbps	1.54Mbps	10 Gbps	3.28 Tbps (sec)
Page	.34 sec	.15 sec	.01 sec	0.00000192 sec	0.000000006
Report (30 pages)	10.29 sec	4.5 sec	.37 sec	0.0000576 sec	0.000000176
Book (200 pages)	1.14 min	30 sec	2.49 sec	0.000384 sec	0.000001173
Dictionary	11.43 min	5 min	41.5 sec	0.00384 sec	0.000012
Encyclopedia	2.48 hrs	1.08 hrs	5.38 min	0.04992 sec	0.000152
Local Library	79 days	34.7 days	2.89 days	38.4 sec	0.117
College Library	3.75 years	1.64 years	49 days	663 sec	2.021
Library of Congress	81.5 years	35.62 years	2.95 years	4 hrs	43.90

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- **The Main parts of a fiber link and the layers of an optical fiber.**

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MAIN PARTS OF A FIBER LINK

TRANSMITTER	Converts Electrical Signal into a Light Signal (**LED, VCSEL** or a **LASER**)
RECEIVER	Accepts the Light, (**Photodiode: PIN or APD**) and Converts it back into an Electrical Signal
FIBER OPTIC CABLE	Transmission Medium for Carrying Light
CONNECTORS	Connects Fibers to the Source, Detector, and Other Fibers

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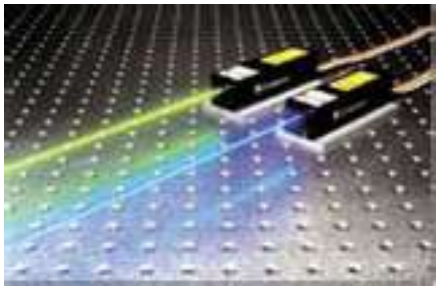
TRANSMITTER SOURCES

- **Light Emitting Diode (LED)**
  Wide emission pattern (spectral width), slow data transmission, low cost (MM)

- **Vertical Cavity Surface-Emitting Laser (VCSEL)**
  Narrower emission pattern than an LED, faster data transmission, low cost (MM), used w/ 50um MM LASER optimized fiber

- **LASER Diode (LD)**
  Extremely narrow emission pattern, fastest data transmissions, high cost (SM)



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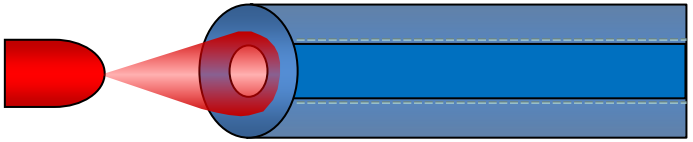
TRANSMITTER SOURCES

Mode Field Diameter: LASER vs LED

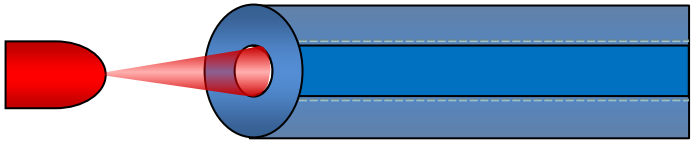
LED ≥ 100µm



62.5um core

Image of an LED with a wide or higher output pattern.

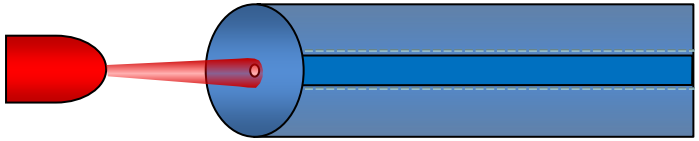
VCSEL ≤ 40µm



50um core

Spot diameter is not overfilled

LASER Diode



8.3um core

80% Core, 20% Cladding

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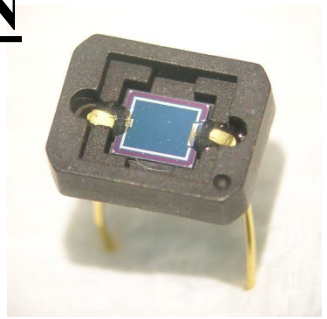
RECEIVERS/DETECTORS

- **Photodiodes**
  - **PIN (Positive-Intrinsic-Negative) –** Requires signal amplifiers, no gain, low cost, low data rates. Photon to Electron ratio is one to one.
  - **APD (Avalanche Photodiode)** – Requires additional electronics because high internal gain (noise filtering), more costly, better for high data rates

APD

PIN



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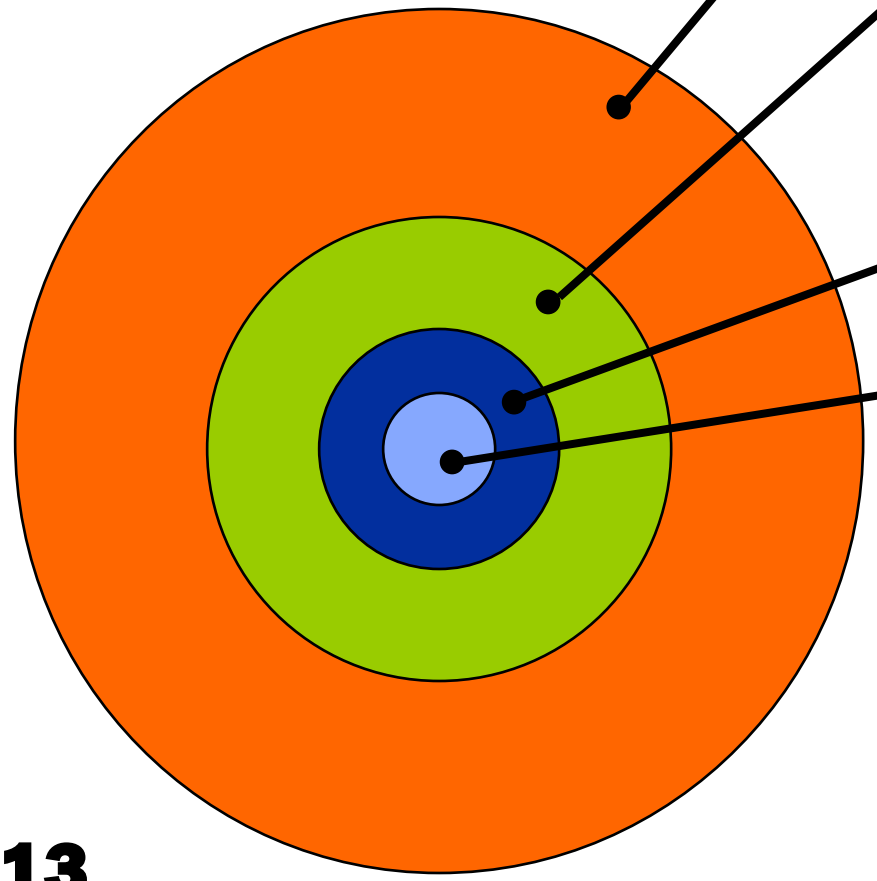
AEROSPACE OPTICAL FIBER PARAMETERS



Secondary Buffer (900µm)

Primary Buffer

Polyimide (140/155/172µm)

Acrylate (250µm) **Silicone** (500µm)

Cladding (125µm)

Core: **Multimode**	**Singlemode**
50µm	4.6µm
62.5µm	5.8µm
100µm	7.5µm
200µm	8.3µm

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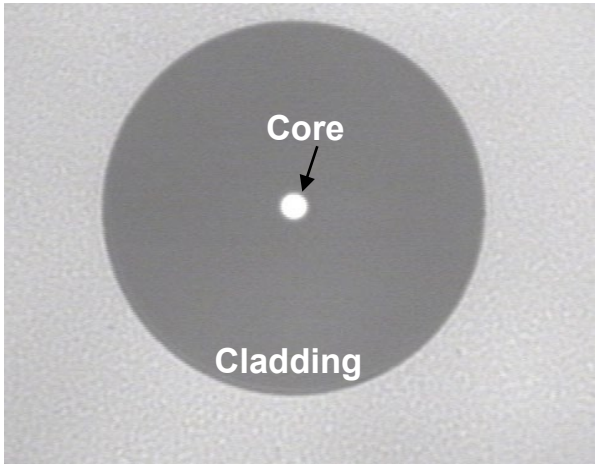
OPTICAL FIBER TYPES

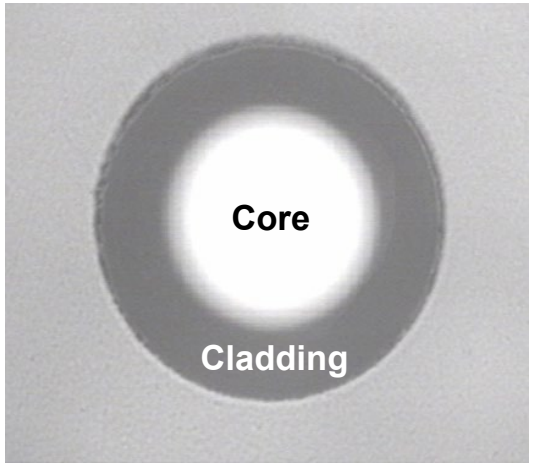
Singlemode



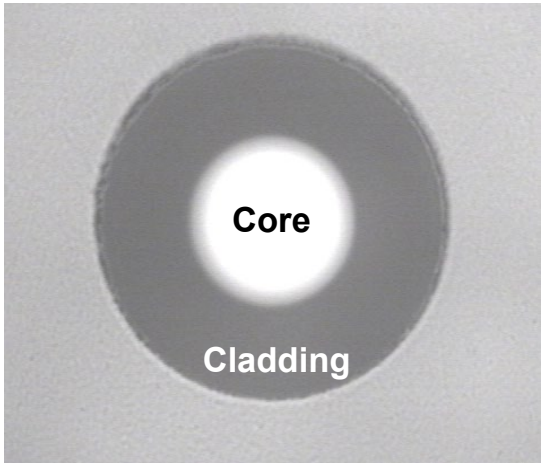
9/125 µm

- Lower attenuation
- Small core relative to diameter of the cladding
- Access/medium/long-haul networks (≥200 km)
- Unlimited bandwidth

Multimode



62.5/125 µm



50/125 µm

- Higher attenuation
- Large core relative to diameter of the cladding
- Local networks (≤2 km)
- Limited bandwidth

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- **The cause and effects of light propagation and attenuation in an optical fiber.**

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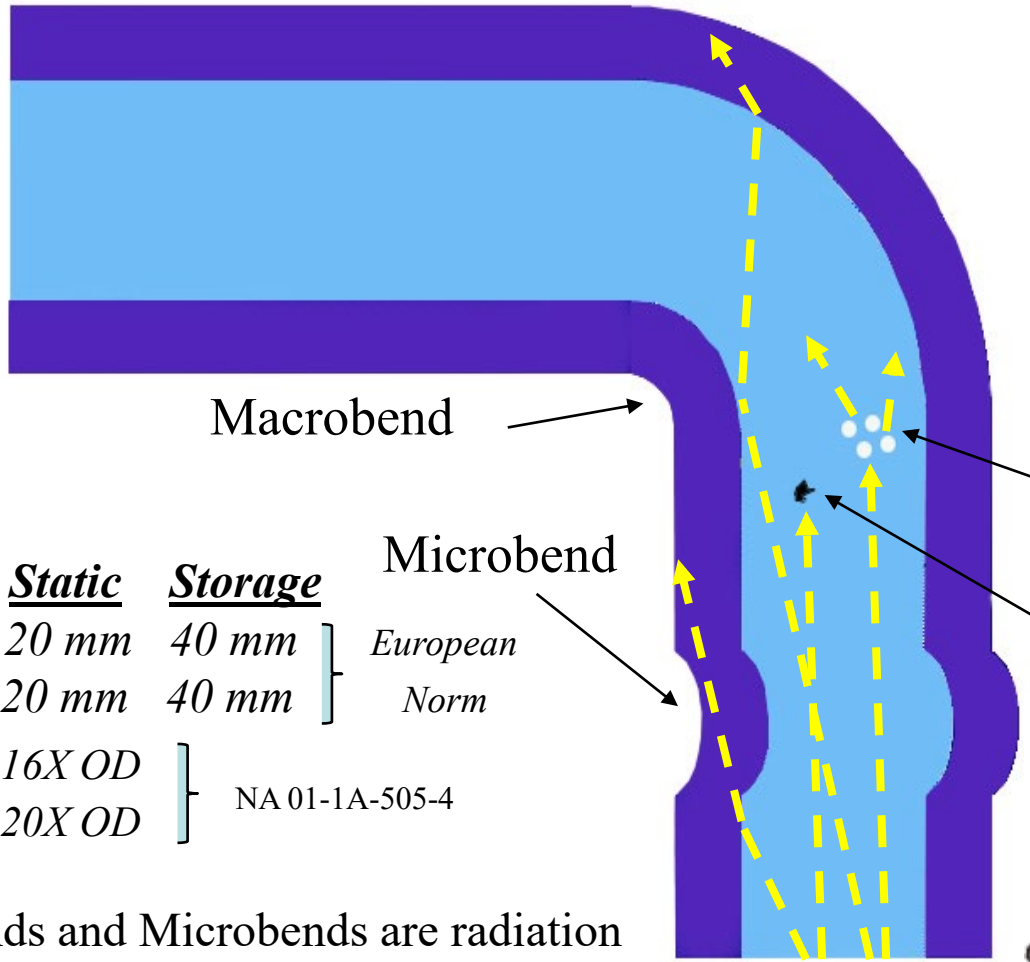
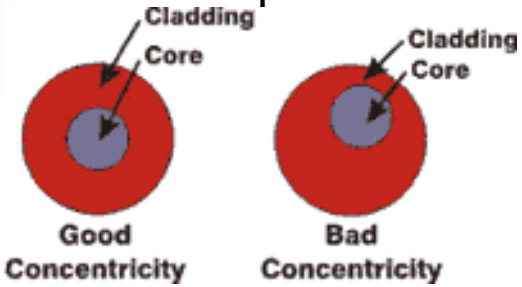
CAUSES OF ATTENUATION

Extrinsic loss examples: connector end face contamination/defects, macrobends, microbends (external forces), core misalignment, and angular separations.

Intrinsic loss examples: absorption, density changes, core ovality, and concentricity



	Installation	***Static***	***Storage***	
Tight	*20 mm*	*20 mm*	*40 mm*	*European*
Loose	*20 mm*	*20 mm*	*40 mm*	*Norm*
Tight	*8X OD*	*16X OD*		NA 01-1A-505-4
Loose	*20X OD*	*20X OD*		



Note: Macrobends and Microbends are radiation losses and are considered Extrinsic losses.

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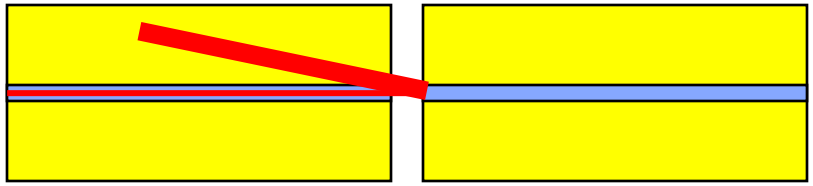
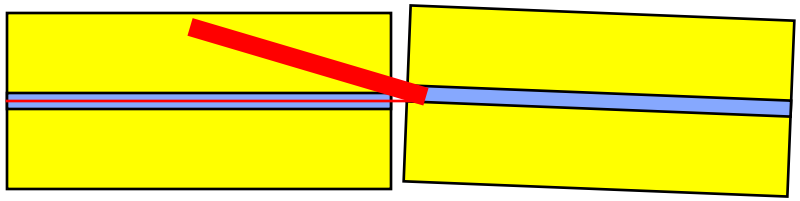
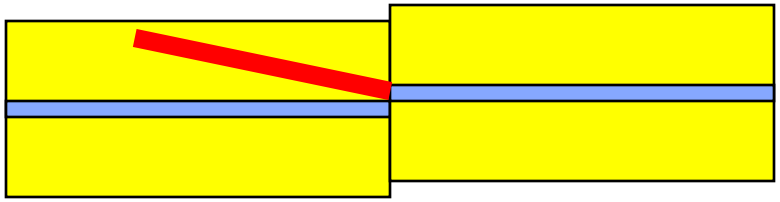
EXTRINSIC LOSS



End Face Separation



Angular Separation



Core Misalignment

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CABLE BEND DIAMETERS

MANUFACTURER	FIBER TYPE	SHORT TERM	LONG TERM & STORAGE
ARINC 802 & SAE 50881D Standards			
Carlisle (Tensolite)	Liteflight (900um)	4mm	9mm
	Netflight EP (Semi Loose-Structure)	6mm	9mm
General Cable	Flight-Light (Simplex)	10 times jacket OD	
OFS	FlightGuide (GI Polyimide)	8mm	25mm
	FlightLink (GI Silicone)	8mm	25mm
EN (4641 series) & NA-01-1A-505-4 Standards			
Nexans	**EN4641-100** (Tight-Structure 62.5/125um GI Simplex)	20mm	20mm
	EN4641-102 (Semi-Loose Structure 62.5/125um GI Simplex)	20mm	20mm
NA-01-1A-505-4	Loose-Structure Tight-Structure	20X OD 8X OD	20X OD 16X OD

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- **Common Military Connectors**

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ST CONNECTOR

Straight Tip (ST)

Ferrule	Straight -Single, 2.5 mm Diameter Zirconia Ceramic, Physical Contact
Latch	Bayonet Style, Key Alignment, Push and Turn, Typically 3-5 lb Spring

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LC CONNECTOR

Lucent Connector (LC)

Ferrule	Straight -Single, 1.25 mm Diameter Zirconia Ceramic, Physical Contact
Latch	Key Alignment, Push and Click, Typically 2-3 lb Spring
Usage	High Density Application for WRA/LRM/LRU interface

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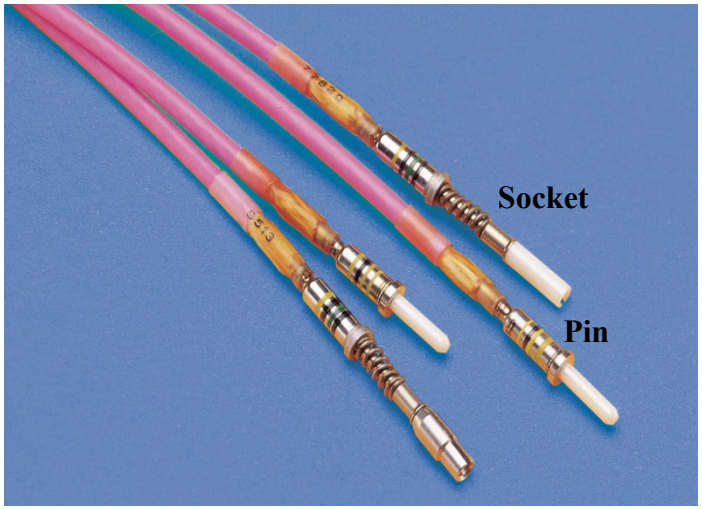
M29504 Termini Socket & Pin



Termini M29504/5 socket and M29504/4 Pin, Zirconia Ceramic, 0.0625" (1.6mm) Ferrule, Physical Contact (PC), Style 1, Based on 16 AWG Stainless Steel Ferrule. With stainless-steel, ruby-jewel insert, style 2.

Alignment Sleeve Threaded protective metal sleeve over a single split ceramic sleeve.

Latch Rear Insertion & Rear Release.

Usage M38999, ARINC 600, and ARINC 404 Connectors

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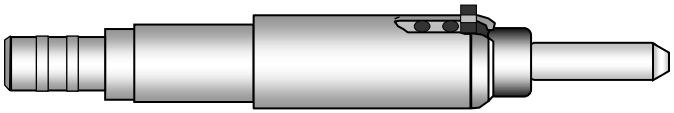
ARINC 801 TERMINI



Terminus ARINC 801, Zirconia Ceramic,1.25mm Ferrule, Physical Contact, Based on 16 AWG

Types

LM: Loose Structure Cable, Multimode
LS: Loose Structure Cable, Singlemode
LSA: Loose Structure Cable, Singlemode APC
TM: Tight Structure Cable, Multimode
TS: Tight Structure Cable, Singlemode
TSA: Tight Structure Cable, Singlemode APC

Latch Rear Insertion & Rear Release.

Usage Installed into Radiall 38999, EPX, and ARINC 600 Connectors

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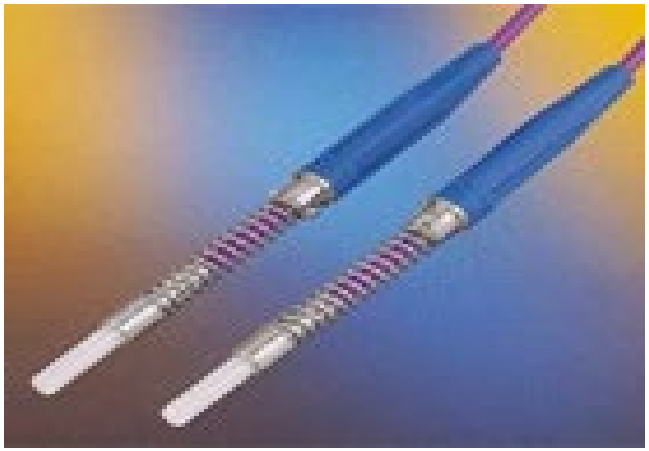
EN 4531 TERMINI



Termini EN 4531 Elio, Zirconia Ceramic, 2.50mm Ferrule, Physical Contact (PC), no crimp required.

Latch Rear Insertion & Rear Release.

Usage Housed in ARINC 600 and 38999 style multi-terminus connectors. Primary European Norm (EN) FO termini employed onboard the Airbus platforms

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MTP/MPO (ARRAY) CONNECTOR

Mechanical Transfer Push-On (MTP/MPO)

Ferrule	Flat Rectangular MT, Typically 4, 8, 12 Ribbon Fibers, Plastic, Physical Contact
Latch	Key Alignment, Push and Click, Typically 2-3 lb Spring
Usage	High Density Application, up to 72 fibers in a small footprint, for WRA/LRM/LRU assemblies

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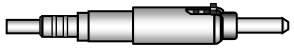
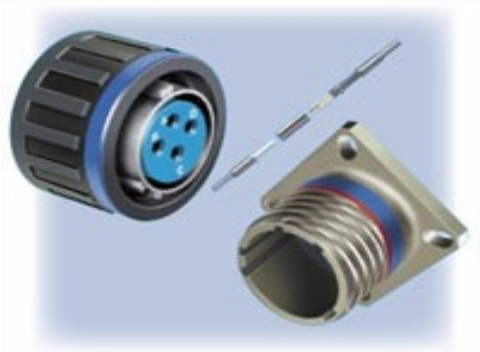
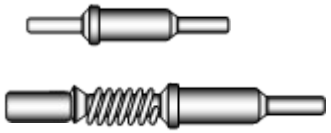
M38999 CONNECTOR

ARINC 801Plug



M29504/4 & M29504/5





EN4531 ELIO Receptacle

Termini Zirconia Ceramic (ZC) or Stainless-Steel end face, Physical Contact (PC) or Non-Contact (NC). M29504/4 & /5, ARINC 801, EN4531 ELIO, MPO/MTP

Connector Shell Sizes: Souriau size 25 (19 Elio), Radiall size 25 (32 ARINC 801), Glenair size 37 (39 M29504/4 & /5) Color- coded connector: Blue line indicates rear release, yellow line indicates FO connector, & red line indicates fully mated

Usage Bulkhead, Aircraft avionic rack, LRU/WRA, & feed thru.

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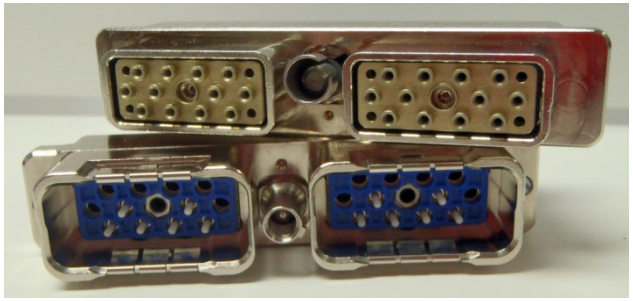
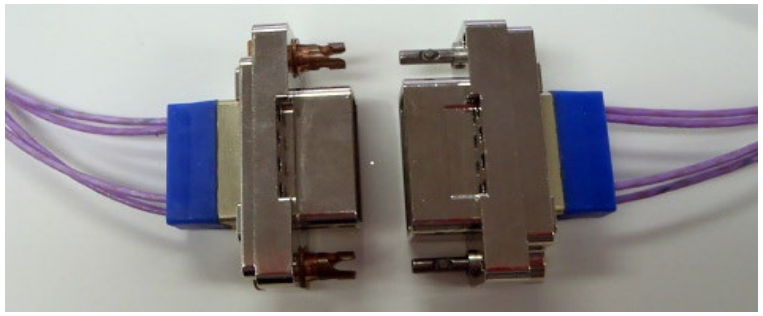
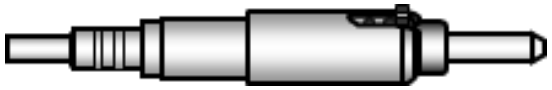
EPX CONNECTOR







Termini ARINC 801 genderless. 1.25mm, Zirconia Ceramic ferrule, physical contact

Connector 12 Channel or 24 Channel, Key A Insert and Key B Insert. Alignment sleeve pack configuration

Usage High density, cable-to-cable, modular station disconnect applications

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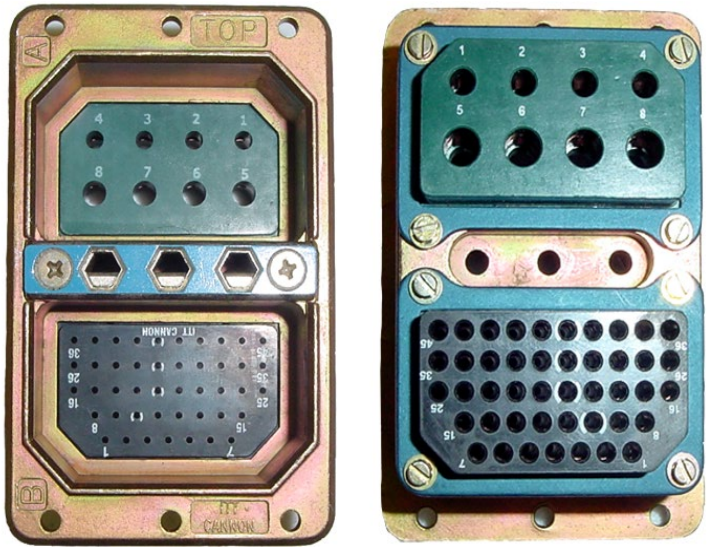
ARINC 404 Connector



Termini	Based on 16 AWG size M29504/4/5/6 & /7
Connector	4 different sizes available to house up to 26 termini
Usage	Rack & panel avionics connector. Predecessor to ARINC 600. Military aircraft, military, commercial flight simulators, and radar systems.

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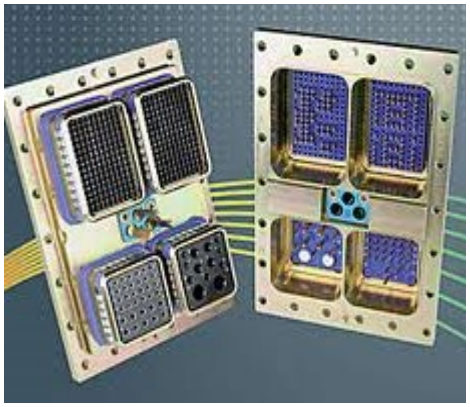
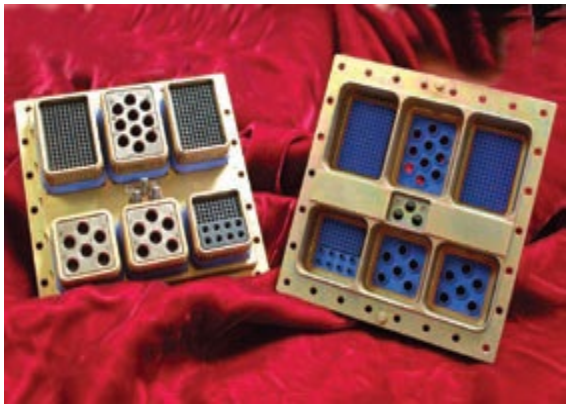
MIL-C-83527

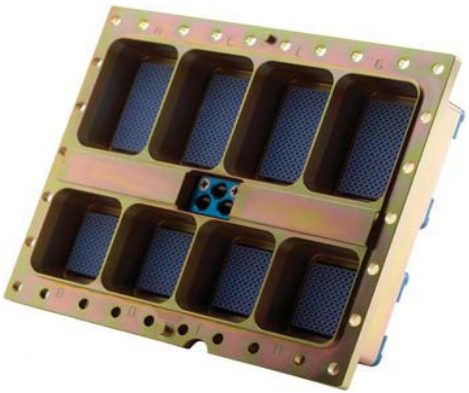
Shell Size 2
(Amphenol)



Shell Size 3



Shell Size 4



Shell Size 6

Termini Based on 16 AWG M29504/4/5/6 & /7

Connector Four different shell sizes and multiple different size insert cavities available (A-F). Up to 36 M29504 termini/insert

Usage Rack and panel avionics equipment. Intended for use in Military aircraft

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ARINC 600 CONNECTOR

Cable Side (Size 1)

Cable Side (Size 2) LRU Side

Termini Based on 16 AWG size:

- ARINC 801 max of 36 (**Radial** insert # 36F36),
- EN 4531 max of 16 (**Souriau** insert 11Q2),
- EN 4531 max of 11 #8 AWG (Quadrax Adapters)
- M29504 max of 5 (**Amphenol** insert #121)

Connector 3 different sizes: Size 1, Size 2 & Size 3

Usage Extreme levels of shock, vibration and humidity in Boeing BACC66 series, Airbus ASNE0161 / ASNE0162 / ASNE0163 series and McDonnell Douglas 067401, 068134, 068135 series

KITCO fiber optics

Our team of experts has over 100 years of combined experience with commercial and military fiber optics allowing us to provide any part of, or a total solution to your fiber optic requirements!

We are the fiber optic connectivity experts to the defense industry and for over 27 years have customized our products and services to meet strict military standards.

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