

Amphenol
Turkey&MiddleEast



FIBER OPTICS

Amphenol Military & Aerospace Fiber Optic Products

AMAO FIBER OPTIC PRODUCTS OVERVIEW

Amphenol Military and Aerospace Operations (AMAO) designs and manufactures reliable and innovative harsh environment fiber optic interconnect solutions for all military and aerospace applications. AMAO is a global leader in fiber optic interconnect components and systems, including both physical contact and expanded beam connectors, fiber optic cable assemblies, and copper-to-fiber media converters. Our fiber optic interconnect solutions are based on high-performance optical termini, innovative design, and high quality, well-proven connector technology.

AMAO fiber optic interconnect solutions are tailor-made to meet the demanding requirements for customers manufacturing mission critical and safety-related equipment. Accordingly, we develop long-term commitments and customer partnerships to provide maintenance, repair, training and technical support on demand. Rigorous internal quality assurance systems exceed the ISO 9001 and AS9100 requirements and ensure consistent quality products regardless of manufacturing location.

Why Choose Fiber Optics?

Fiber optic interconnect solutions are ideally suited for high speed, high reliability, EMI/RFI immune, digital data transmission in harsh environment applications such as airborne avionics and computers, battlefield communications, and weapon systems.

A large amount of data, voice, and video has to be securely transmitted in these applications, sometimes over long distances. Fiber optic links, with a large bandwidth and a small diameter, provide a fast, reliable, lightweight, and simple method to transmit a huge amount of information between various systems. Fiber optic links only carry light pulses making them immune to electromagnetic or RF interferences, which are a threat to the integrity of the transmitted information.

Fiber optic links suit battlefield communication systems exceedingly well where secrecy and data integrity are paramount. Light pulses from fiber optic links can't be detected or hacked, making the link virtually invisible.

5 Advantages to Choosing Fiber Optics:

1. **Lower loss:** Optical fiber has lower attenuation than copper conductors, allowing longer cable runs and fewer repeaters.
2. **Increased bandwidth:** The high signal bandwidth of optical fiber provides significantly greater information-carrying capacity. Typical bandwidths for multi-mode fibers are between 200 and 600 MHz•km, and > 10 GHz•km for single mode fibers. Typical values for electrical conductors are 10 to 25 MHz•km.
3. **Immunity to interference and detection:** Optical fibers are immune to electromagnetic interference and emit no radiation.
4. **Electrical isolation:** Fiber optics allows transmission between two points without regard to the electrical potential between them.
5. **Decreased cost, size and weight:** Compared to copper conductors of equivalent signal-carrying capacity, fiber optic cables are easier to install, require less duct space, weigh 10 to 15 times less, and cost less than copper.

Certifications:

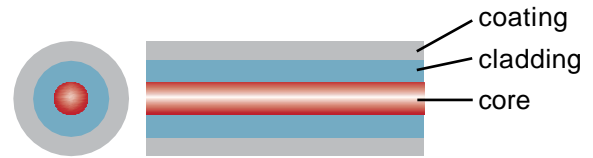
- ISO 9001:2000
- AS9100
- MIL-STD-790
- EN9100:2003
- AQAP 2110
- ISO 14001
- Electronics Technicians Association (ETA) to train and administer the Fiber Optics Installer (FOI) and the Fiber Optics Technician (FOT) certifications.

UNDERSTANDING FIBER OPTICS

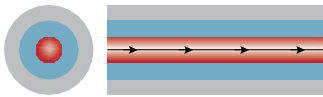
What is an optical fiber?

An optical fiber is made up of 3 concentric layers:

- **Core:** The central section, made of silica, is the light-transmitting region of the fiber.
- **Cladding:** The first layer around the core, also made of silica, that creates an optical waveguide which confines the light in the core by total internal reflection at the core-cladding interface.
- **Coating:** Non-optical layer around the cladding. It typically consists of one or more layers of polymer that protects the silica structure against physical or environmental damage.

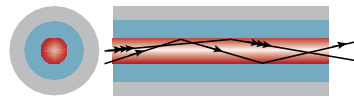


Single Mode Fiber:



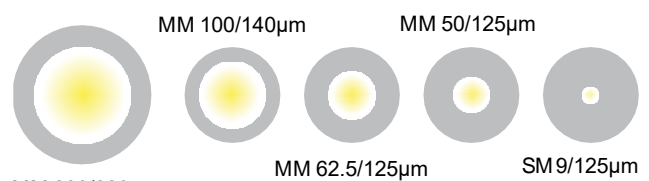
Only one mode is propagated. Light travels "straight" through the fiber. The core diameter is typically 9 microns.

Multi-Mode Fiber:



Light travels through fiber following different paths called "modes".

Fiber Sizes:



First number is Core diameter in microns.
Second number is Cladding diameter in microns.

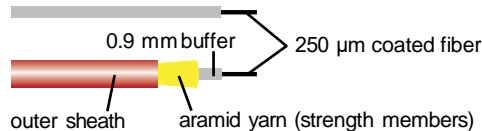
Fiber Optic Cables:

The coated fiber typically has an external diameter of 250 microns and is fragile. It is usually necessary to build cable to reinforce the fibers and make them more durable and easier to handle. There are many different cable constructions.

Single Fiber Cables:

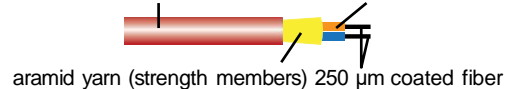
0.9 mm outer diameter

2.0 mm outer diameter



Multi Fiber Cables:

5.8 mm outer diameter 0.9 mm buffer



Fiber Optic Connectors:

A connector terminates the optical fiber inside a ceramic ferrule using epoxy to hold the fiber in place. The connectors can be mated and unmated at any time. There are two types of connectors:

Physical Contact:

Direct contact of polished fibers within two ceramic ferrules. The ferrules are aligned using a ceramic alignment sleeve.



Advantages:

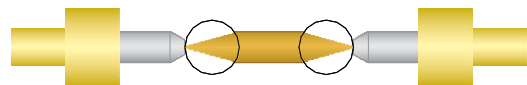
- Most common type of connection: rugged, cost-effective
- Typically low (0.3dB) insertion loss
- Generally less sensitive to liquid contaminants (water, oil)

Limitations:

- Signal loss is a function of alignment accuracy and polish quality

Expanded Beam Technology:

A lens is placed at the exit of each fiber widening and collimating the light, which is then captured and re-focused in the receiving fiber.



Advantages:

- Easy to clean
- Less susceptible to particle contaminants (dust and dirt)

Limitations:

- Performance impacted by liquid/film on lenses
- Mechanical interface between connectors must be precise

FIBER OPTICS MARKET APPLICATIONS



Harsh Environments:

Amphenol is the world leader in harsh environment fiber optic solutions. From the battlefield to the operating room, our products are specifically designed to provide reliable, durable connectivity in the most demanding applications.



Mobility:

A robust connector design is paramount whenever mobility is required. Amphenol's fiber optic connectors are specifically designed for fiber optic applications (not just repurposed from copper connectors) to ensure data reliability in dynamic environments.



Weight & Cost Savings:

Fiber optic cable is 10-15 times lighter than equivalent copper solutions (and costs less as well). When weight and cost savings are a priority, fiber optics offer engineers a lighter, more cost-effective alternative for data transmission.



Security:

In the presence of an ever increasing cyber threat, fiber optics afford a greater degree of security over copper. Amphenol's fiber optic solutions are fielded in some of the most sensitive applications, from missile defense systems to homeland security.



High Bandwidth:

In the data-rich world we inhabit, applications like 4K video are continuing to drive demand for increased bandwidth. Fiber optics offer increased bandwidth (significantly greater information carrying capacity) over copper cabling. Typical bandwidths for multi-mode fibers are between 200 and 600 MHz•km, and > 10 GHz•km for single mode fibers. Typical values for electrical conductors are 10 to 25 MHz•km.



EMI:

Because fiber optics are immune to electromagnetic interference (EMI) and emit no radiation, our fiber optic solutions are ideal for electrically "noisy" environments. Whether it be electromagnetic systems or flight-critical applications, Amphenol has the right fiber optic solution to ensure data integrity is maintained.



Distance:

Because optical fiber has lower attenuation than copper conductors, it is ideal for applications where loss due to long transmission distances would otherwise be prohibitive. This allows for longer cable runs and fewer repeaters. As an example, the distance limitation for 1G over copper is approximately 100m, whereas 1G can be transmitted up to 100km over fiber.

FIBER OPTICS PRODUCTS OVERVIEW



Fiber Optic Connectors:

Expanded Beam (pg. 8-9) and Physical Contact (pg. 10-27)

Circular and rectangular connectors

Ranges from 1 to 92 channels

Multi-mode and Single mode

Operating temperature range from

-55 deg C to 165 deg C

Up to 10,000 mating cycles

IP68 sealing on most connectors

Hybrid (copper and fiber) connector designs

Fiber Optic Cable Assemblies:

Single Mode and multi-mode cable assemblies

Custom design or build-to-print

Application-specific cable types
(radiation hardened, NBC, hybrids, QFCl)

Simplex jumpers to multi-fiber cable assemblies

Access to Amphenol complementary products
(cable reels, cable management)



Media Converters:

Copper to fiber and fiber to copper converters

Stand-alone and embedded solutions

Electro-optic contacts

Data concentrators, Ethernet protocols

Rugged environments

Based on MIL-DTL-38999

MIL-STD-461E, MIL-STD-810F GM

Fiber Optic Termini:

Expanded Beam Termini

MIL-PRF-29504 Termini

MT Ferrule Termini

ARINC 801 Termini

M28876 MPC Termini

LUX-Beam®

TFOCA-II® Termini

Lumière Termini

NGCON Termini



MEDIA CONVERTERS

Amphenol Military and Aerospace Operations offers fiber to copper media conversion, data concentration, protocol conversion, and other electronic solutions to solve system challenges with a wide area of both protocol agnostic and protocol specific solutions. We are constantly developing new products to meet new customer needs. Below is a sample of our products, but many more exist and are underwork. Please contact us with your requirements.



RES-GMC-1S-RJF-TACBEAM:

Military Rugged Gigabit Media Converter

MIL-STD-461E, MIL-STD-810F GM

1 Port RJF 10/100/1000TX with protective cap

1 port TACBEAM 1000Base-LX10 SINGLEMODE with protective cap



Stand-Alone Fiber Conversion:

Integrated, standalone, natural convection cooled, and rugged fiber conversion units. Parts can be configured for up to 4X bi-directional channels for either protocol agnostic interfaces or 10/100/1000-Base-T and 10G-Base-T. Fiber optic wavelengths are configurable for single mode & multi-mode interfaces.



Quadrax Based Fiber Conversion:

Media converter modules in a slim profile for up to eight fiber optic channels. ARINC-801 fiber optic pins, within quadrax pin contacts, for the fiber interface and Samtec HQDP for the high speed copper. Support for balanced protocols as well as pathological (3G/HD/SDI).



VPX Based Fiber Conversion:

Media converter modules in a 6U VPX profile for conduction cooled environments. Units are built with I2C and MDIO interfaces for diagnostics. System interfaces are launched from top side of the board for seamless delivery to front panel through Octonet contacts and connectors.



Ethernet Protocol Conversion:

Media converter modules in various form factors for integrated conversion of Ethernet backplane interfaces to Ethernet system interfaces. All options contain Samtec HQDP interfaces to the backplane for optimal high speed signal integrity.



Data Concentration & Conversion:

These media converters are built to receive and concentrate various signals and convert the concentrated communication over fiber optics in either multi-mode or single mode configurations. RS-422, VGA, DVI, Ethernet, Canbus, and other interfaces are supported for concentration.

FIBER OPTIC CABLE ASSEMBLIES

Amphenol offers complete fiber optic interconnect solutions, from connectors and termini to cable assemblies, harnesses, and turnkey systems. Our solutions incorporate popular harsh environment connectors such as TFOCA-II®, M28876, D38999, ARINC 801, expanded beam (CTOS, TACBeam®) and others. For applications demanding reliability, traceability and the highest level of quality, a complete plug-and-play cable assembly directly from the manufacturer offers the highest degree of confidence. Amphenol cable assemblies are manufactured by expert technicians in our state-of-the-art facilities.



D38999 Cable Assemblies:

Amphenol offers a comprehensive line of single mode and multi-mode cable assemblies in a variety of cable configurations using D38999 Series III connectors.



LimeLight SMPTE Compliant Assemblies:

Amphenol's SMPTE 304M compliant (110 Series) fiber optic connectors and 311M compliant cable assemblies provide rugged and superior performance for broadcast applications.



MediaTAC Cable Assemblies:

Amphenol offers MediaTac harsh environment fiber optic active cable assemblies for military applications. Supports bi-directional operation and provides full duplex transport of 10/100 Base T Ethernet over single or multi-mode fiber.



Multi-Channel Fiber Optic Cable Assemblies:

Amphenol builds custom cable assemblies for virtually any application using TFOCA, TFOCA-II®, TFOCA-III®, M28876, and many other connector standards.



NAVSEA-Approved MQJs:

Amphenol is fully certified to provide NAVSEA Measurement Quality Jumpers (MQJs) which are designed to interface with all M22876 products.



Cable Assembly Accessories:



Amphenol manufactures a full line of cable assembly accessories including reels, transit cases and backpack reels.

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|----------------------------|--|---|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| EXPANDED BEAM | | | | | | | | | | | | | | | | | | | | | |
| AXOS-E | | Dedicated to battlefield communications, AXOS-E is a robust optical connector for rapid deployment | • | | | • | | • | | | | | | | • | | • | • | | • | |
| CTOL | | CTOL : 8xFO expanded Beam with protective windows, the world's strongest tactical fiber optic connector | • | • | | • | | • | | | • | | • | • | • | | • | • | | • | |
| CTOS | | CTOS : 4xFO expanded Beam with protective windows, the world's strongest tactical fiber optic connector | • | • | | • | | • | | | • | | • | • | • | | • | • | | • | |
| LUX-BEAM® #12 | | LUX-BEAM® #12, expanded beam termini for 38999 cavity #12 and compatible with Std ARINC 801 | • | | • | • | | • | • | • | • | • | | • | • | | • | • | • | • | |
| LUX-BEAM® #16 | | LUX-BEAM® #16, expanded beam termini for 38999 cavity #16. Contactless technology for less maintenance | • | | • | • | | • | • | • | • | • | | • | • | | • | • | • | • | |
| TACBeam® | | Hermaphroditic expanded beam connector for harsh environment military & industrial applications | • | • | | • | | • | | | | | | | • | | • | • | | • | |
| TFOCA - XBT ⁴ ™ | | Expanded beam technology in the world's most popular harsh environment fiber optic connector | • | • | | • | | • | | | | | • | • | • | | • | • | | • | |

| Channels | | | | | | | | | | | Multi-Mode IL (dB) | | Single Mode IL (dB) | | Typical Return Loss (dB) | Operating Temp (deg C) | | | | | | |
|----------|----------------|---|---|---|---|---|---|----|----|----|--------------------|---------|---------------------|---------|--------------------------|------------------------|-----|-----|---------------|---------|-------------|-------------|
| Hybrid? | Hemaphroditic? | 1 | 2 | 4 | 5 | 6 | 8 | 12 | 24 | 48 | Other (specified) | Typical | Max | Typical | UPC: -50 APC: -85 | APC (Y/N) PC: -40 | Min | Max | Mating Cycles | Sealing | Pull rating | Submersible |
| | • | | • | • | | | | | | | | 1.5 | 2 | NA | NA | N | -40 | 85 | 2.5k | IP68 | 495lbs | 20m |
| | • | | • | • | | • | • | | | | | 1.5 | 2.5 | 1.8 | 2.5 | N | -40 | 85 | 10k | IP68 | 495lbs | 20m |
| | • | | • | • | | | | | | | | 1.5 | 2 | 1.8 | 2.5 | N | -40 | 85 | 10k | IP68 | 495lbs | 20m |
| • | | • | • | • | • | • | • | • | • | • | | 1.5 | 2 | 1.5 | 2 | N | -40 | 85 | 500 | IP68 | N/A | N/A |
| • | | • | • | • | • | • | • | • | • | • | | 1.5 | 2 | 1.5 | 2 | N | -40 | 85 | 500 | IP68 | N/A | N/A |
| | • | | • | • | | | | | | | | 0.7 | 2 | 1 | 2.5 | N | -46 | 71 | 3k | IP68 | 400lbs | 15m |
| • | • | | • | • | | | | | | | | 0.7 | 1.5 | 1 | 2.5 | N | -46 | 71 | 3k | IP68 | 400lbs | 50m |

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|-----------------------|---|--|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| PHYSICAL CONTACT | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| 109 Series | | Hermaphroditic connector for demanding broadcast applications | • | • | • | • | | | | | | | | | • | | • | • | • | • | • |
| 110 Series SMPTE 304M | | Hybrid connector conforming to SMPTE 304M standard for high definition broadcast applications | • | • | • | • | | | | | | | | | • | | | • | • | • | |
| 1900Elio | | Derived from the legacy EN3545 connectors. Composite rectangular connectors offering 36 keying positions, it comes with 7 EN4531 / Elio® Optical termini | • | | | | | | • | • | • | | | | | | • | | • | | • |
| AARC 2 Fiber |  | This interconnect system provides superior optical performance in outdoor environments using LC style 1.25mm ceramic ferrules | • | • | • | • | | | | | | | | | | | • | • | | • | |
| AARC 4 Fiber |  | This interconnect system provides superior optical performance in outdoor environments using LC style 1.25mm ceramic ferrules | • | • | • | • | | | | | | | | | | | • | • | | • | |
| AquaLink | | Cost-effective, dry-mate submersible connection for underwater applications up to 3,000m deep | • | • | | • | | | • | | | | | • | | | • | • | | • | |
| ARINC 801 | | Based on D38999, connector for commercial airframe, avionics and other aerospace applications. Tested to BACC specifications | • | • | • | • | | • | • | • | | | | | | | | • | | • | • |

| Channels | | | | | | | | | | | Multi-Mode IL (dB) | | Single Mode IL (dB) | | Typical Return Loss (dB) | Operating Temp (deg C) | | | | | | |
|----------|-----------------|---|---|---|---|---|---|----|----|----|--------------------|---------|---------------------|---------|--------------------------|------------------------|-----|-----|---------------|---------|-------------|-------------|
| Hybrid? | Hermaphroditic? | 1 | 2 | 4 | 5 | 6 | 8 | 12 | 24 | 48 | Other (specified) | Typical | Max | Typical | UPC-M85 APC-M85 | APC (Y/N) PC-- 40 | Min | Max | Mating Cycles | Sealing | Pull rating | Submersible |
| | • | | • | • | | | | | | | | 0.3 | 0.75 | 0.4 | 0.75 | N | -46 | 71 | 500 | IP68 | 125lbs | 15m |
| | • | | • | | | | | | | | | 0.3 | 0.5 | 0.5 | 0.5 | N | -20 | 60 | 5k | IP67 | 157lbs | No |
| | | | | • | | | | | | | | 0.3 | 0.7 | NA | NA | N | -65 | 125 | 500 | N/A | N/A | N/A |
| | | | • | | | | | | | | | 0.35 | 0.75 | 0.35 | 0.75 | N | -40 | 85 | 50 | IP67 | 300N | N/A |
| | | | | • | | | | | | | | 0.35 | 0.75 | 0.35 | 0.75 | N | -40 | 85 | 50 | IP67 | 300N | N/A |
| | | | | • | | | | | | | | 0.3 | 0.75 | 0.3 | 0.75 | N | -46 | 71 | 500 | IP68 | NA | 3000m |
| | | | • | • | • | | | • | • | | 16, 32 | 0.3 | 0.5 | 0.3 | 0.5 | Y | -55 | 70 | 500 | IP68 | NA | NA |

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|--|--|---|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| PHYSICAL CONTACT | | | | | | | | | | | | | | | | | | | | | |
| ARINC 801 bulkhead feedthrough | | Sealed fiber optic feedthrough used with ARINC 801 circular connectors | • | • | • | • | | • | • | • | | | | | | | | • | | • | |
| BDC | | Bayonet Coupling Low cost, overmoulded Plug - Based on 62GB / Pattern 105 #10 | • | • | • | • | | • | • | | • | • | | | • | | • | • | | • | |
| CF38999 | | Fiber optic version of D38999 Series III connectors. Many hybrid fiber/copper configurations available. | • | • | • | • | | • | | • | • | | | | | | • | • | | • | • |
| CF38999 bulkhead feedthrough | | Sealed fiber optic feedthrough used with CF38999 circular connectors | • | • | • | • | | • | | • | • | | | | | | • | • | | • | |
| DeepSight® | | Designed for high pressures, temperatures and corrosive fluids found in downhole environments | • | • | | • | | | | | | | | • | | | | • | | • | |
| EN4165 - SIM*O 04EL PN &SN (EN4701) insert | | EN4165 insert module to accept four EN 4531 Termini | • | | • | • | | | • | • | • | | | | | | • | | • | | • |
| EN4165 - SIM*O 06LU PN &SN (EN4830) insert | | EN4165 insert accepting up to six ARINC801 termini | • | • | • | • | | | • | • | • | | | | | | • | | • | | • |


| Channels | | | | | | | | | | | Multi-Mode IL (dB) | | Single Mode IL (dB) | | Typical Return Loss (dB) | Operating Temp (deg C) | | | | | | |
|----------|---------------|---|---|---|---|---|---|----|----|----|--------------------|---------|---------------------|---------|--------------------------|------------------------|-----|-----|---------------|---------|-------------|-------------|
| Hybrid? | Hemaphrodite? | 1 | 2 | 4 | 5 | 6 | 8 | 12 | 24 | 48 | Other (specified) | Typical | Max | Typical | UPC -50 APC Max | APC (Y/N) PC -40 | Min | Max | Mating Cycles | Sealing | Pull rating | Submersible |
| | | | • | | | | | | | | | 0.5 | 0.75 | N/A | N/A | N | -40 | 85 | 100 | IP68 | NA | N/A |
| | | | • | | | | | | | | | 0.3 | 0.75 | 0.2 | 0.75 | N | -55 | 85 | 500 | IP67 | 400lbs | N/A |
| • | | | • | • | • | • | • | | | | 11,16,21,29,37 | 0.5 | 1.25 | 0.75 | 1.5 | N | -55 | 125 | 500 | IP68 | NA | N/A |
| | | | • | • | • | • | • | | | | 16 | 0.5 | 1.25 | N/A | N/A | N | -40 | 85 | 500 | IP68 | NA | N/A |
| | | • | • | | | | | | | | | 0.3 | 0.75 | 0.4 | 0.75 | Y | -55 | 175 | NA | IP68 | NA | 25000 psi |
| | | | • | | | | | | | | | 0.3 | 0.7 | NA | NA | Y | -65 | 125 | 500 | IP68 | N/A | N/A |
| | | | | | • | | | | | | | 0.1 | 0.7 | 0.2 | 0.7 | Y | -65 | 125 | 500 | IP68 | N/A | N/A |

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|--|---|--|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| PHYSICAL CONTACT | | | | | | | | | | | | | | | | | | | | | |
| EN4165 - SIM*O MPO PN & SN insert | | EN 4165 insert module to accept standard MTP and MPO fiber connectors | • | • | • | • | | | • | • | • | | | | | | • | | • | | • |
| EN4165 - SIMTac01 insert | | EN 4165 accepting a standard MT ferrule and mounting clip | • | • | • | • | | | • | • | • | | | | | | • | | • | | • |
| EN4165 - SIMTac02 insert | | EN 4165 accepting a standard MT ferrule and toolless mounting clip | • | • | • | • | | | • | • | • | | | | | | • | | • | | • |
| F-143 | | One of the most durable, versatile harsh environment circular connectors in the industry | • | • | | • | | | • | | | | • | • | | | • | • | | • | |
| FB-00BLMA-TL700x |  | Field installable, waterproof LC plug connector | | • | • | • | | • | | | • | • | • | • | • | | • | • | | | • |
| FB-00BSMA-TL7001 |  | Field installable, waterproof SC plug connector | | • | • | • | | • | | | • | • | • | • | • | | • | • | | | • |
| FB-00RLFJ-TC7001 |  | Rear-fastened, waterproof LC receptacle connector | | • | • | • | | • | | | • | • | • | • | • | | • | • | | | • |

| Channels | | | | | | | | | | | Multi-Mode IL (dB) | | Single Mode IL (dB) | | Typical Return Loss (dB) | Operating Temp (deg C) | | | | | | |
|----------|----------------|---|---|---|---|---|---|----|----|----|--------------------|---------|---------------------|---------|--------------------------|------------------------|-----|-----|---------------|---------|-------------|-------------|
| Hybrid? | Hemaphroditic? | 1 | 2 | 4 | 5 | 6 | 8 | 12 | 24 | 48 | Other (specified) | Typical | Max | Typical | UPC -50 APC Max | APC (Y/N) PC -40 | Min | Max | Mating Cycles | Sealing | Pull rating | Submersible |
| | | | | | | | | • | • | • | | 0.2 | 0.6 | 0.25 | 0.75 | Y | -65 | 125 | 100 | N/A | N/A | N/A |
| | • | | | | | | | • | • | | | 0.2 | 0.6 | 0.25 | 0.75 | Y | -55 | 85 | 100 | N/A | N/A | N/A |
| | • | | | | | | | • | • | | | 0.2 | 0.6 | 0.25 | 0.75 | Y | -55 | 85 | 100 | N/A | N/A | N/A |
| | | | | • | | • | • | | | | 18, 31 | 0.4 | 0.75 | 0.3 | 0.75 | N | -54 | 65 | 1k | IP68 | 162lbs | 15m |
| | | | • | | | | | | | | | N/A | N/A | N/A | N/A | N/A | -40 | 105 | N/A | IP67 | N/A | N/A |
| | | | • | | | | | | | | | N/A | N/A | N/A | N/A | N/A | -40 | 105 | N/A | IP67 | N/A | N/A |
| | | | • | | | | | | | | | N/A | N/A | N/A | N/A | N/A | -40 | 105 | N/A | IP67 | N/A | N/A |

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|------------------|---|---|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| PHYSICAL CONTACT | | | | | | | | | | | | | | | | | | | | | |
| FB-SMRSFJ-TC7001 | | Rear-fastened, waterproof, single mode SC receptacle connector | | • | • | • | | • | | | • | • | • | • | • | | • | • | | | • |
| FS12 Pierside | | 12-Channel, hermaphroditic connector ideal for pierside and broadcast applications | • | • | | • | | | • | | | | | | • | | • | • | | • | |
| FTTA | | Hybrid fiber/copper connector for commercial outdoor environments | • | • | | • | | | | | | | | | | | • | • | | • | • |
| GoldRush® | | The only MSHA-certified fiber optic connector for use in underground mines | • | • | | • | | | | | | | • | • | | | • | • | | • | |
| H-Connector |  | A single fiber FTTH (Fiber to the Home) interconnect assembly designed to be used in direct burial or aerial connection to the Network Interface Device | • | • | • | • | | | | | | | | | | | • | • | | | • |
| HDM | | Small, rugged, hermaphroditic 2ch connector; receptacles can be dismantled, cleaned from outside equipment | • | • | | • | | • | | | | | | | • | | • | • | | • | |
| HiLinX | | The HiLinX range provides a unique choice of solutions by allowing a mix of contact types: signal, power, fiber optics and coaxial lines. | • | • | • | | | • | • | • | | | | | | | | | • | | • |


| Channels | | | | | | | | | | | Multi-Mode IL (dB) | | Single Mode IL (dB) | | Typical Return Loss (dB) | Operating Temp (deg C) | | Mating Cycles | Sealing | Pull rating | Submersible | |
|----------|-----------------|---|---|---|---|---|---|----|----|----|--------------------|---------|---------------------|---------|--------------------------|------------------------|-----|---------------|---------|-------------|-------------|-----|
| Hybrid? | Hermaphroditic? | 1 | 2 | 4 | 5 | 6 | 8 | 12 | 24 | 48 | Other (specified) | Typical | Max | Typical | UPC -50 APC Max | APC (Y/N) PC -40 | Min | | | | | Max |
| | | | • | | | | | | | | | N/A | N/A | N/A | N/A | N/A | -40 | 105 | N/A | IP67 | N/A | N/A |
| | • | | | | | | | • | | | | 0.35 | 0.75 | 0.35 | 0.75 | Y | -28 | 65 | 500 | IP68 | 400lbs | 15m |
| • | | | | | | | | | | | 4 fiber / 2 copper | 0.3 | 0.8 | N/A | N/A | Y | -40 | 85 | * | IP68 | NA | N/A |
| | • | | | • | | | | | | | | 0.3 | 0.75 | 0.4 | 0.75 | N | -46 | 71 | 2k | IP68 | 400lbs | 1m |
| | | • | | | | | | | | | | N/A | N/A | 0.15 | 0.3 | Y | -40 | 85 | 50 | IP67 | 150N | N/A |
| | • | | • | | | | | | | | | 0.3 | 0.75 | 0.2 | 0.75 | N | -55 | 85 | 500 | IP67 | 400lbs | N/A |
| • | | • | • | • | • | • | • | • | | | | 0.3 | 0.75 | 0.3 | 0.75 | N | -65 | 125 | 500 | N/A | N/A | N/A |

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|------------------|---|--|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| PHYSICAL CONTACT | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| IP-FX |  | A compact outdoor housing that is designed to provides an IP67 water and dust seal over LC Duplex, RJ45 and other connector types | • | • | • | • | | | | | | | | | | | • | • | • | | |
| J-Connector |  | Designed for optical connectivity to outdoor installed electronics. Uses 'Direct Connect' topology, to accept SFP or SFP+ pluggable transceivers | • | • | • | • | | | | | | | | | | | • | • | | • | |
| LC Field | | Upgrade your LC to LC Field for rugged environment. No cabling operation | • | • | • | • | | | | | • | | | | | | | • | | • | |
| LightConex |  | A-VPX integrates a 40 Gbps optical transceiver into the module connector saving board space | • | | • | | | | | • | | | | | | | | | • | • | |
| LowPro | | Ideal for edge-card connections and other applications requiring minimal connector profiles | • | • | | • | • | • | • | • | | | | | | | | | • | • | |
| M28876 | | Global leader in production of M28876 connectors for US and allied navies | • | • | • | • | | • | • | • | | | • | • | • | • | • | • | | • | |
| M83522 MIL-ST | | Rugged ST with higher spring force than commercial ST's for superior environmental performance | • | • | | • | | • | • | | | | • | • | | | • | • | | • | |

| Channels | | | | | | | | | | | Multi-Mode IL (dB) | | Single Mode IL (dB) | | Typical Return Loss (dB) | Operating Temp (deg C) | | | | | |
|----------|---------------|---|---|---|---|---|---|----|----|----|--------------------|---------|---------------------|--------------------------------------|--------------------------|------------------------|---------------|---------|-------------|-------------|-----|
| Hybrid? | Hemaphrodite? | 1 | 2 | 4 | 5 | 6 | 8 | 12 | 24 | 48 | Other (specified) | Typical | Max | APC (Y/N) PC -- 40 UPC -- 50 APC Max | Min | Max | Mating Cycles | Sealing | Pull rating | Submersible | |
| | | | • | | | | | | | | | N/A | N/A | N/A | N/A | -40 | 85 | 50 | IP67 | 150N | N/A |
| | | | • | | | | | | | | | N/A | N/A | N/A | N/A | -40 | 85 | 50 | IP67 | 300N | N/A |
| | | | • | | | | | | | | | 0.3 | 0.5 | 0.3 | 0.5 | -40 | 85 | 500 | IP68 | N/A | |
| | | | | | | | | • | | | | N/A | N/A | N/A | N/A | -40 | 85 | 500 | N/A | NA | N/A |
| | | | • | | | | | | | | * | 0.35 | 0.75 | 0.35 | 0.75 | -28 | 65 | 500 | IP67 | 22lbs | No |
| | | | | • | | • | • | | | | 18, 31 | 0.35 | 0.75 | 0.35 | 0.75 | -28 | 65 | 500 | IP68 | 162lbs | 15m |
| | | • | | | | | | | | | | 0.3 | 0.75 | 0.2 | 0.75 | -55 | 71 | 500 | IP66 | >50 | No |

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|------------------|---|---|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| PHYSICAL CONTACT | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| MFM | | Ruggedised Simplex, Anti-vibration coupling, non corrosive | • | • | • | • | | | • | • | • | • | | | | • | • | • | | • | |
| MT38999 | | Very high density fiber interconnect solution for avionics and imaging/ sensor applications | • | • | • | • | | • | | • | | | | | | | | • | | • | • |
| mTACH | | Dual-channel, hermaphroditic, rugged connector for tight spaces | • | • | | • | | • | | | | | • | • | • | | • | • | | • | |
| NGCON | | MIL-PRF-64266 compliant, "next generation connector" for naval and avionics applications | • | • | • | • | | | • | • | | | | | | | | • | | • | |
| Optron | | Precision-machined, hybrid fiber optic/ electrical connector for various harsh environment applications | • | • | | • | | • | • | | | | • | • | • | • | • | • | | • | |
| PROMI | | Promi is a miniature optical cable adaptor for reduced space. Easy installation & maintenance. | • | • | • | | | | • | • | | | | | | | | • | | • | |
| PT/LC |  | Leverages MIL spec 26482 connector system to provide an environmental seal & mechanical protection for 2 fiber duplex LC style connections. | • | • | • | • | | | | | | | | | | | • | • | | • | |

| Channels | | | | | | | | | | | Multi-Mode IL (dB) | | Single Mode IL (dB) | | Typical Return Loss (dB) | Operating Temp (deg C) | | | | | | |
|----------|-----------------|---|---|---|---|---|---|----|----|----|------------------------|---------|---------------------|---------|--------------------------|------------------------|-----|-----|---------------|---------|-------------|-------------|
| Hybrid? | Hermaphroditic? | 1 | 2 | 4 | 5 | 6 | 8 | 12 | 24 | 48 | Other (specified) | Typical | Max | Typical | UPC, -50 APC Max | APC (Y/N) PC, -40 | Min | Max | Mating Cycles | Sealing | Pull rating | Submersible |
| | | • | | | | | | | | | | 0.3 | 0.75 | 0.2 | 0.75 | Y | -55 | 155 | 1k | IP68 | 200lbs | N/A |
| | | | | | | | | | | | 4X48 | 0.4 | 0.8 | 0.5 | 0.95 | Y | -40 | 85 | 100 | IP68 | NA | N/A |
| | • | | • | | | | | | | | | 0.3 | 0.75 | 0.4 | 0.75 | N | -46 | 71 | 2k | IP68 | 400lbs | 1m |
| | | | • | | | • | | | | | 10, 36 | 0.4 | 0.75 | 0.3 | 0.75 | Y | -55 | 165 | 500 | IP68 | 165lbs | 15m |
| • | | | | • | | • | • | | | | 18, 31, 12 FO & 4 elec | 0.35 | 0.75 | 0.35 | 0.75 | Y | -28 | 65 | 500 | IP68 | 162 lbs | 15m |
| | | • | | | | | | | | | | 0.3 | 0.5 | 0.3 | 0.5 | Y | -55 | 70 | 500 | N/A | N/A | N/A |
| | | | • | | | | | | | | | 0.35 | 0.5 | 0.15 | 0.3 | N | -40 | 85 | 50 | IP67 | 300N | N/A |

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|--------------------|---|--|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| PHYSICAL CONTACT | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| PT/MPO |  | Provides an environmental seal and mechanical protection for a multi-fiber MPO style connector | • | • | • | • | | | | | | | | | | | • | • | • | | |
| R2CT |  | Designed as a cost effective means of providing a removable interface for applications requiring protection from wet or dirty environments | • | • | • | • | | | | | | | | | | | • | • | | • | |
| RNJOP |  | RNJOP is Rackable connector with standard Optical termini (Ø 2.5 mm) : high reliability performance | • | • | • | • | | • | | • | | | | | | | | • | | • | |
| SMASH |  | Offers high robustness where signal integrity is required. SMASH can house up to 450 contacts | • | • | • | | | • | • | • | | | | | | | | | • | • | |
| Space ST Connector |  | M83522 style connector specifically designed for space-based platforms and launch vehicles | • | • | | • | | | | • | | | | | | • | | • | | • | |
| StapleMate® |  | Revolutionary connector improves safety by providing real-time data on longwall shields | • | • | | • | | | | | | | • | | | | | • | | • | |
| Star-Line EX™ |  | The geophysical industry standard for hazardous area power and control | • | • | | • | • | | | | • | | • | • | | | • | • | | • | |


| Channels | | | | | | | | | | | Multi-Mode IL (dB) | | Single Mode IL (dB) | | Typical Return Loss (dB) | Operating Temp (deg C) | | | | | | |
|----------|----------------|---|---|---|---|---|---|----|----|----|--------------------|---------|---------------------|---------|--------------------------|------------------------|-----|-----|---------------|---------|-------------|-------------|
| Hybrid? | Hemaphroditic? | 1 | 2 | 4 | 5 | 6 | 8 | 12 | 24 | 48 | Other (specified) | Typical | Max | Typical | UPC, -50 APC Max | APC (Y/N) PC, -40 | Min | Max | Mating Cycles | Sealing | Pull rating | Submersible |
| | | | | • | • | • | • | • | • | | | 0.25 | 0.75 | 0.4 | 0.75 | Y | -40 | 85 | 200 | IP67 | 300N | N/A |
| | | | • | | | | | | | | | N/A | N/A | N/A | N/A | N/A | -40 | 85 | 100 | IP65 | 200N | N/A |
| | | | • | • | | | • | | | | | 0.5 | 0.8 | 0.7 | 1 | N | -40 | 85 | 500 | N/A | N/A | N/A |
| • | | • | • | • | • | • | • | • | • | | | 0.2 | 0.6 | .025 | 0.75 | Y | -65 | 125 | 500 | N/A | N/A | N/A |
| | | • | | | | | | | | | | 0.3 | 0.75 | 0.2 | 0.75 | N | -55 | 125 | 500 | IP66 | >50 | No |
| • | | • | • | • | • | • | • | | | | ≤8 F/O channels | 0.35 | 0.75 | 0.35 | 0.75 | Y | -28 | 65 | 500 | IP66 | NA | NA |
| • | | | | | | | • | | | | 4 to 11 elec | 0.3 | 0.75 | 0.4 | 0.75 | N | -55 | 71 | 500 | IP68 | 400lbs | No |

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|------------------------------|--|--|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| PHYSICAL CONTACT | | | | | | | | | | | | | | | | | | | | | |
| Startup | | Startup is a 38999 shell with Optical termini POM #16 (Ø 1,6 mm) : high reliability performance | • | | • | • | | • | • | • | | | | | | | | • | | • | |
| TFOCA | | Tactical Fiber Optic Cable Assembly (TFOCA); CECOM approved and meets MIL-C-83526 | • | | | • | | • | | | | | | | | | | • | | • | |
| TFOCA-II® | | AFSI patented this now standard connector for harsh environment deployable network applications | • | • | | • | | • | | | • | | • | • | • | | • | • | | • | |
| TFOCA-II® 12-Channel RigLinQ | | Hybrid connector engineered for superior performance and minimal maintenance in the oilfield | • | • | | • | | | | | | | | • | | | | • | | • | |
| TFOCA-II® EX | | Dedicated fiber optic, ATEX-rated connector based on field-proven TFOCA-II® technology | • | • | | • | • | | | | | | • | • | | | • | • | | • | |
| TFOCA-III® | | Next generation TFOCA connector using latest technology in fiber optic connectivity | • | • | | • | | • | • | | | | • | • | • | | • | • | | • | |
| THD Series | | Tactical high density connectors for high bandwidth battlefield and commercial/industrial communications | • | • | | • | | • | | | | | | • | | | • | • | | • | |

| Channels | | | | | | | | | | | Multi-Mode IL (dB) | | Single Mode IL (dB) | | Typical Return Loss (dB) | Operating Temp (deg C) | | | | | | |
|----------|----------------|---|---|---|---|---|---|----|----|----|--------------------|---------|---------------------|---------|--------------------------|------------------------|-----|-----|---------------|---------|--------------|-------------|
| Hybrid? | Hemaphroditic? | 1 | 2 | 4 | 5 | 6 | 8 | 12 | 24 | 48 | Other (specified) | Typical | Max | Typical | UPC -50 APC Max | APC (Y/N) PC -40 | Min | Max | Mating Cycles | Sealing | Pull rating | Submersible |
| | • | • | | | • | | | | | | | 0.8 | 1 | NA | NA | N | -40 | 85 | 500 | IP68 | 180lbs /80kg | 5m |
| | • | | • | | | | | | | | | 0.75 | 1.5 | 0.75 | 1.5 | N | -46 | 71 | 2k | IP68 | 400lbs | 1m |
| | • | | | • | | | | • | | | | 0.3 | 0.75 | 0.4 | 0.75 | N | -55 | 71 | 2k | IP68 | 400lbs | 1m |
| • | • | | | | | | | • | | | | 0.3 | 0.75 | 0.4 | 0.75 | N | -46 | 71 | 2k | IP68 | 400lbs | 1m |
| | • | | | • | | | | | | | | 0.3 | 0.75 | 0.4 | 0.75 | N | -46 | 71 | 2k | IP67 | 400lbs | No |
| | • | | | | • | | | | • | | | 0.3 | 0.75 | 0.4 | 0.75 | N | -55 | 71 | 2k | IP68 | 400lbs | 1m |
| | | | | | | | | | | • | 64, 72 | 0.3 | 0.75 | 0.4 | 0.75 | N | -55 | 71 | 500 | IP68 | 400lbs | 1m |

FIBER OPTICS PRODUCT GUIDE

| | | | Fiber | | Applications | | | | | | | | | | | | | | Shell | Material | |
|------------------|--|--|------------|------------|--------------|---------|------|---------------|------|-----------|----------------|----------|--------|-----------|---------------|---------|------------------|----------|-------------|----------|---------|
| | | | Multi Mode | Singlemode | Indoor | Outdoor | ATEX | Land Tactical | Navy | Aerospace | Transportation | Robotics | Mining | Oil & Gas | Entertainment | Medical | Other Industrial | Circular | Rectangular | Metal | Plastic |
| PHYSICAL CONTACT | | | | | | | | | | | | | | | | | | | | | |
| THDM | | High density, modular connector supporting 24 - 192 channels using standard MT ferrules | • | • | | • | | • | • | • | | | | • | • | | • | | | • | |
| TVOP | | TVOP is 38999 with standard Optical termini (Ø 2.5 mm) : high reliability performance | • | • | • | • | | • | • | • | | | | | | | | • | | • | |
| TxRx |  | Designed to provide direct connection of an outdoor sealed connector to a board mounted device within a sealed enclosure | • | • | • | • | | | | | | | | | | | • | • | | | • |
| VITA 66.1 | | VITA 66.1 - compliant board level interconnect using MT ferrules; available with 1mm | • | | • | | | | | • | | | | | | | | | • | • | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |

[illegible]

THE AMPHENOL ADVANTAGE



Amphenol Military & Aerospace Operations (AMAO) offers unique advantages that no other interconnect manufacturer can:

Global footprint, local support:

With 21 divisions in North America, Europe, and Asia, we can provide a local, regional presence to design and build any interconnect solution.

Cost-effective partnerships:

AMAO utilizes a vertically integrated supply chain to flow down the most competitive costs to our customers, even on the most complex solutions.

Manufacturing versatility:

Many AMAO interconnect solutions have dual-production locations and off-set options which means our customers benefit from low-cost options without the fear of a single-source position.

Technology proliferation from other Amphenol divisions:

As the 2nd largest interconnect company in the world, we're highly diversified and can provide our proven COTS technology from the antennas, sensors, industrial, and automotive markets to the military and aerospace world.

Amphenol Military & Aerospace Operations is perfectly aligned to provide the latest technologies, cost-effective manufacturing and supply chain management, and local support to solve any military and aerospace interconnect need.

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