# Amphenol



### Interconnect solutions for Navy and Marine

# Amphenol

Amphenol Corporation is one of the world's largest interconnect manufacturers. Founded in 1932, Amphenol designs, manufactures, and markets electrical, electronic, and fiber optic connectors, interconnect systems, and coaxial and specialty cables.

Amphenol products are engineered and manufactured in Europe, the Americas, Asia, and Africa, and sold by a worldwide sales and marketing organization.

Learn how Amphenol interconnect solutions will enable your organization to succeed. Our entire organization is at your service.



Amphenol is an industry leader of harsh environment electronic interconnects servicing the Naval market. Whether powering vital control systems, initiating countermeasures, or transmitting critical communication data; Amphenol's broad product offerings and high reliability ensure a safe and successful mission.

Our deep expertise in technologies (high-speed, miniaturization and high power) and materials (marine bronze, stainless steel) allows us to understand your operational needs and respond to them.

### Key applications we support:

- Shipboard Ethernet Network
- Tactical computer
- Torpedos
- Very long range radio
- Console
- Perimeter security system
- HD video cameras
- Radars
- Missile tracking/launch systems
- Positioning systems
- Numerical periscopes

We take pride in supporting the Naval market and will continue to provide our highest level of technology, quality, and service to do so.



## ETHERNET NETWORK SOLUTIONS

Amphenol offers solutions for the evaluation and implementation of Ethernet on the battlefield.

Our robust and sustainable solutions give you the assurance of continuous data transmission securely between all your communication equipments in harsh environments.

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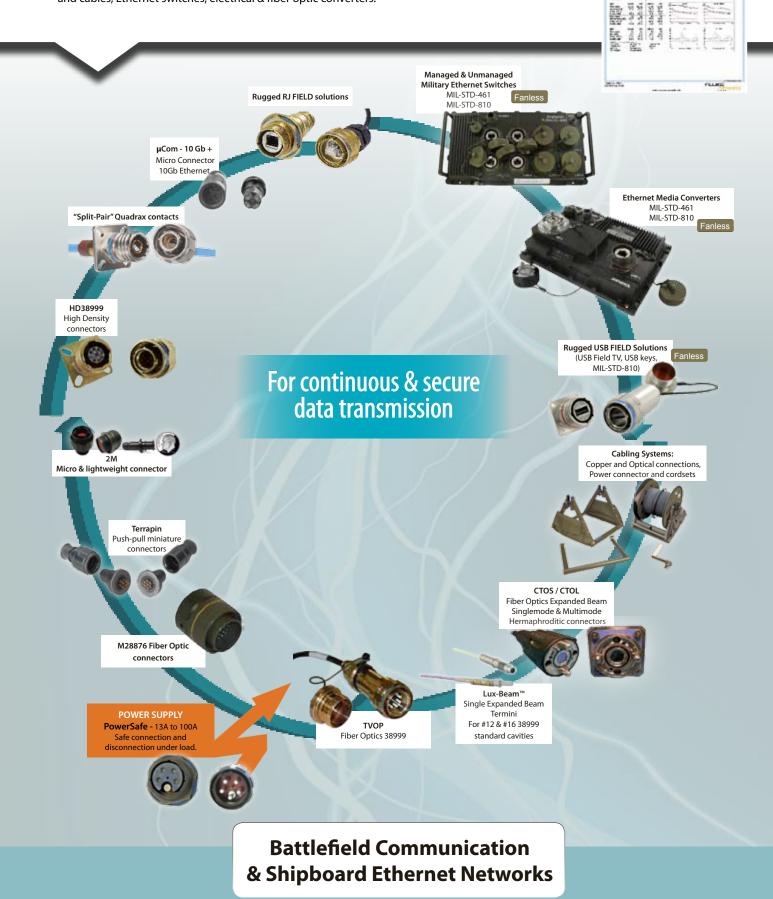
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We design Ethernet networks and supply interconnection products – electrical and fiber optic connectors and cables, Ethernet switches, electrical & fiber optic converters.



# HIGH-SPEED

### **Need for high-speed?**

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The size and the weight reduction of a system and the constant increase of data exchanges in the telecommunication networks have stimulated the need for high-speed electronics and passive components. Designing high-speed systems requires finding the right technology with the best data rate for each architecture levels (boards, contacts, connectors, cables) to increase the speed of communication and preserve the signal integrity.

Check out some of our products designed for high-speed applications.

### FIBER OPTICS



### TVOP

38999 series III

- ► 1/2/4/8 channels
- Singlemode & Multimode option
   Ethernet & RF compliant



#### M28876 Fiber Optic connectors

Precision-machined to MIL-PRF-28876, Rev. E specification
3 shell sizes: 13-4, 15-6, 15-8, 23-Six keying options
Inserts are interchangeable from

Inserts are interenting able from plug to receptacle
 Fully qualified M28876 connectors
 Qualified on singlemode or multimode M29504/14 and /15 termini



## FS12H Pierside 12-Channel Fiber Optic Connector

Hermaphroditic connector
 Rugged design: FS12 Pierside connector handles the rigors of deployment and harsh environment conditions for navy applications
 Environmentally sealed connector: ensures environmental integrity
 Qualified MIL-PRF-29504 /14 & /15 Termini : singlemode and multimode
 Removable insert cap

## PCB FLEX



• Routing in smaller area to get more dense system ▶ Blind and/or Buried-via's to create more density



### **Flex Circuits**

Cost-effective and lightweight solutions ► Amphenol's product offering includes type I through type V flex circuits Single-sided, double-sided & multi-layer options Military & IPC spec. qualified



▶ High performance materials for high speed digital applications Precisions back-drilling for high speed signal integrity Blind and/or Buried -via's to create

more density

### **TFOCA II® & singlemode**

design ▶ Meets the MIL-C-83526 performance criteria Easy field maintenance and cleaning



A CONTRACTOR OF THE OWNER OF THE

SIM / EN4165 Optical Modules for MT ferrule, Luxcis® contacts (EN4830)or Elio<sup>®</sup> contacts (EN4701)

▶ Metallic SIM MonoModule Push Pull Connector

optical termini

Modules also available for MPO/MTP connectors or Expanded beam optical





### Lux-Beam<sup>™</sup> Expanded beam termini

beam terminiCompatibility with multisources connectors (38999, EN4165,

► Hybrid solutions possible (mix with electrical contact)

**TACBEAM** 

Supports both multimode and

Hermaphroditic design
 Non-contacting interface allows

Meets the MIL-C-83526

► Monolithic insert design

thousands of mating cycles

single mode fiber

▶ Size 12 and 16

Design for gloved handling and blind mating in difficult conditions
 NATO/STANAG4290



### Media Converter

Gigabit Ethernet fiber converter





Protection windows for contactless

channe



CTOS or TACBeam TVOP Multimode or Singlemode



### Confirmed expertise with a wide range of high-speed solutions

Amphenol is leading the way when it comes to providing our customers with cutting-edge high speed solutions. We demonstrate our expertise in every high-speed development including modeling, simulation and testing solutions. Our capabilities include differential impedance measurement, propagation delay simulation, insertion & return loss modeling, near-end crosstalk (next) & far-end crosstalk (fext) characterization and eye diagram realization.

Amphenol has the right high-speed connector for every application and signals to be transmitted (rf, ethernet, optics, single-ended, diffy pairs,...).

Check out some of our products designed for high-speed applications.

### BOARD TO BOARD



### HDAS

Cost effective rugged connector for harsh environments
6-tines starclip contact technology
Robust and simple design
High-density staggered grid
High-performance to extreme conditions



### HiLinX<sup>1.905</sup> with Power contacts

Full modular PCB interconnect to meet all the market needs
 With 20A power contacts or 70A RADSOK high power contacts
 Fast design, fast delivery, fast integration for long-term programs



### μCom-10Gb+

- 15mm diam external dimension
   Miniature ruggedized connector
   Environmental protection similar to MIL-DTL-38999
- Thread and Push Pull mating mechanism



### Quadrax & Split Quadrax

ETHERNET

- Splitpair Quadrax suitable for 10GBASE-T
- Frequency range up to 3 GhZ
   Are 100Ω. 110 Ω and 150Ω matched
- impedance



### HiLinX cordset

- High-data rate board to cable interconnect solution
   Turn-key cordset equipped with Amphenol technologies
   Board-to-cable HiLinX connector, high data rate RJFTV



### Viper

High density, modular, high vibration, ESD shielded connectors
 Meet VITA4 46 or 48 specifications in 3U and 6U configurations
 Signal integrity to 10 Gbps



### **RJ Field TV**

- Rugged Gigabit ethernet solutions
   No tooling, fitted directly with standard cordset (RJ45 Cat5e, Cat6 ...)
   Environmental protection: IP68, dust...
   One piece compouned receptacles
   Pending VG 95319 certification
   Certé

- ► Cat6 NEW



Fanless

9 C

- Rugged ethernet switch
   From 2 to 28 different ports of vario types (Fast, Gigabit, Fiber)
   Managed and unmanaged versions
   Fully MIL-STD compliant



### USB Field - USB3.0

No hazardous on-field cabling and grounding
 IP68, improved EMI protection
 Dataspeed 10x higher than USB2.0
 Available with plug + cordset



20+ Gbps performance
 Linear density of 82 differential pairs per inch
 Meets the IEEE 802.3ap v3.2 10GBASE-KR standard

## **ROHS CORROSION RESISTANT MATERIALS**

The use of Cadmium, as well as hexavalent chromium, are key issues for many Military or Navy equipment manufacturers. Several substitutes are available on the market, with variable performances. Amphenol is deeply involved in the protection of the environment and offers a large range of ROHS compliant plating on its metallic shells such as Black Zinc Nickel, Electroless nickel, Black or Green Zinc cobalt, Durmalon (Nickel PTFE), ...

Amphenol is the first connector manufacturer being QPL MIL-DTL-38999 qualified for two cadmium substitutes with the class T (Durmalon Nickel PTFE) and the class Z (Black Zinc Nickel)!

When it comes to the connectors on the printed circuit board, Amphenol can offer numerous ROHS compliant contact tails finishes (lead free) to allow perfect board level integration.

Amphenol supports you in choosing the right ROHS compliant contacts, connectors, backshells... and to help you to keep in conformance with the REACH regulation. (REACH : does not contain SVHC > 0.1% weight, or hazardous substances included in Annex XIV and Annex XVII of the regulation)

Please note that the products listed are only a sampling of our product ranges.



## POWER

### High-current power interconnect solutions for every military application

The electrical integration of embedded equipments in military devices keeps increasing. This requires an important amount of upstream power. The multiplication of voltages and current levels in the systems requires a tremendous amount of upstream power.

When it comes to accessing electrical supply, wherever it can be, Amphenol is here to support the most demanding needs under the most stringent conditions. Amphenol enjoys a long experience in the field of electrical power, and thus benefits from a large array of competencies and technologies.

With high current rate contacts, high-voltage connectors, overmolding, but also technologies that tackle the side effects of increased power, like Thermal Clamps and so on, Amphenol provides a comprehensive range of capabilities which meet the next generation of electrical power challenges.

Check out some of our products designed for high-power applications.

### AT THE BOARD LEVEL



### 127/HE8 series

▶ 2.54 [.100] staggered grid (1.27 [.050] offset), 2.54 [.100] between rows • Proven, reliable and robust rectangular PCB connectors Numerous contact terminations and fittings Hybrid patterns with power or coax contacts



### **Thermal clamps**

 Chassis devices, which both help to dissipate components heating and block the daughter cards into the box slots grooves



### HiLinX<sup>1.905</sup> with **Power contacts**

 With 20A power contacts or 70A RADSOK high power contacts Fast design, fast delivery, fast integration for long-term

programs



**OUTSIDE THE BOX** 

38999 Power

 Derived from the MIL-DTL-38999 series
 Equipped with ruggedized power inserts ▶ Available in different shell types



### PowerSafe

Transmit high-power with voltages over 500V (EN61984, EN60664)
 Meet the most stringent requirements of the market regarding user safety
 Designed according to VG96944



### Smash

- High-density advanced SEM E modular connector
   Provide superior modules to backplane interconnects
   Flexible circuit terminations for a higher density



RHINO 38999 Up to 1000A power

IP2X finger protection on plugs and

► EMP filtered option

### ErgoN'

- ► Ergonomic, rugged & IP68 sealed plastic
- High current capabilities, up to 350A
   IP2X (user security) and 3000 mating cycles features
   Push Pull Mating
   Designed for full electric boats

#### Monoblock assembly 3240 series

 Available with individual or shunted terminals, from 1 to 12 terminals, in different diame Permanent current up to 250 Amps / Max current rating: 340 Amps

- ► For copper or aluminum cable connections ▶ Temperature up to 230°C
- ► Also available: cover Block for 230V applications



### **Aluminium Bus Bars**

- To be used between power generator boxes, terminal blocks, and small terminal block interconnects
   Many standard sizes and shapes
   High mechanical resistance
   Temperature up to 150°C



**Radsok**<sup>®</sup>

Solutions for high-current single-point connections to PCB ▶ Up to 120 Amps to the board Preserve surface area and provide more flexibility in board design

### SIHD series

 2.54 [.100] staggered grid (1.27 [.000 offset), 1.905 [.075] between rows
 Lateral displacement capability allowing the use of thermal clamps: ± 0.25 [±.010]
 Possibility to have a central ground string. Designed for severe mechanical environments
 Low weight

# **ACCESSORIES & CONTACTS**

Amphenol product offerings go beyond connectors with a large range of accessories designed to optimize deployment of communications systems in harsh environments.

Please note that the products listed are only a sampling of our product ranges.



Backshells for MIL-DTL-38999 series III or TV connectors
 EMI protection thanks to conical rings system
 Electrical continuity between the braid, the backshell and
the connector
 Free inner ring avoids twisting of the braid during screwing
 Nickel plating on aluminum (RoHS compliant)
 Sealing is ensured by a heat shrink molded piece (straight
 or right angled)

# **OTHER SOLUTIONS**

Amphenol provides also other interconnect systems for military harsh environment applications.

From military specification connectors to specific products, that are custom designed to perfectly match our customer expectations, we provide an unequalled array of competencies to serve our customers with Stereolothography modelling for rapid prototypes, we are able to provide fast initial feasibility study with technical evaluation and space modelling.





### Submariner

- For diving equipment, ROV's, submersible pumps, and underwater cameras
   Depth: > 6,000 meters (600 bar) ➤ Operating Temperature: -5°C to 65°C ► Max Operating Voltage: 600V ► Machine-molded Neoprene insulation material Options for 316 Stainless,
- Titanium, and Aluminum bulkhead material



### USB Memory sticks

DTL-38999
Memory capacity from 2GB to 128GB ► IP68 MIL-DTL-810F



### System Attachments, <u>Standoffs</u>

 High performance attachments to organize cable harnesses throughout a vehicle
 Accommodate wide range of maintenance



### Deep immersion Connectors

► Connectors for dry mate applications. Provides a high reliability with dry a mate sealing down to 200 meters immersion Screw coupling connector Marine brass material ▶ Signal, Coax contact



### Cable Clamp ABS 1339 series

 Lightweight composite, perfect protection from shocks & vibrations
 For cable harnesses fixing on structure
 8 sizes for cable harnesses diameter from 3 to 48 mm
 For general use or fuel zone environment temperature un environment, temperature up to 150°C

Also available in Lighter
 versions (ABS1339 Light series)



### Cable clamp CC5516 series

Composite clamps (weight saving up to 50% vs metallic NSA5516 clamps)
 For cable harnesses fixing on

- For cable namescontains of structure
   37 sizes for cable harnesses diameter from 3 to 60 mm
   Perfect protection from shocks & vibrations
   Use in high temperature
- environment (225°C)



### Eco Mate

Cable screw connection with clamping ring
 Strain relief and mounted gasket all in one component
 Ergonomically shaped handle for a better grip and safer handling
 Fastening for the protective caps on the receptacle housing
 One cable housing for all cable diameters (6 mm - 12,5 mm)



### Pipe Clamp ABS 1410 series

structure ▶ Available in 1 to 5 holes, various & mixed diameters (from 6.3 to

Lightweight composite, perfect protection from shocks & vibrations
 For general use or fuel zone

environment ▶Temperature up to 170°C



#### **164 Series Audio** Connectors

QPL under MIL-C-55116
Water resistant, five & six pin
Contact electrical connectors for use in low voltage audio frequency circuits & applications Extensively used in military communication



**NMEA 2000** 

Compact and rugged design available in IP67/IP68 unmated waterproof to withstand harsh marine environments



### PT/451/HE301B VG95328

- versions ▶ Wide range of backshells and inserts arrangements ► Available with plastic self closing cap option



### **Heavy Mate**

- Inserts for signal and power transmission
   Pole sizes from 3 up to 280 poles per connector
- ► Current ratings up to 250A per contacts and voltages up
- configure customized solution



# **SPACE & WEIGHT SAVINGS**

### Smaller, lighter, more efficient connectors

Thanks to constant evolution of technologies, every new generation of electronics systems is smaller than the previous one. That trend will continue and has an impact on the interconnect industry pushing to develop smaller, more efficient, higher density products.

### Amphenol's connector technology meets your miniaturization needs

Large investments in R&D and advanced technology have played a key role in providing light-weight solutions and composite materials to military and aircraft manufacturers' programs. Our array of competencies and technologies include thermoplastic, thermoset and silicone. All our connectors and interconnect systems are tested and measured to meet the actual light-weight demand and anticipate the need for both stronger and lighter composite solutions for all military and aerospace applications.

Check out some of our solutions dedicated to your miniaturization needs.

### MINIATURIZATION



2M

Small and lightweight connector



**SC39** 

series III requirements (lighter, smaller, better shock and vibration

disconnect, space constraints, quick installation



HD38999

- The only high density connector which meets or exceeds MIL-DTL-38999 series III performances





CT\

Lightweight High corrosion resistance
 Durability



### RNJ RNJLP

Rack & Panel solutions for harsh environment
 Very light weight vs ARINC 404 or 600
 Derivated from 38999 series
 Realignment capability on 3 axis
 38999 level sealing with the specific membrane hounting



### SIM/ EN4165 Composite

Lightweight composite & modular connector
 For sealed (IP66 / 68 & 69K) and EMC applications in harsh environment
 Modularity for customization: all technologies in one shell (signal, power, optics, Ethernet, Quadrax...)



Module 1750 series

 Wiring optimization for weight, space and cost savings

modules stackable on tracks (up to 36 cts size 22 per module) cts size 22 per module) For signal & low current distribution Lightweight modules & Sealed connection (IP66 / 68 & 69K)

### HD SIM / EN4165

 Removable high density modules
 30 contacts size 23 per module (50% more vs size 22 contacts) • Crimp our PCB contacts / EN3155 spec pending

# MILITARY HARNESSES

Amphenol is also offering electrical and optical harnessing tailored to your technical specifications.

Our experience in connectors for harsh environments has given us a real expertise in assembling Ethernet network Harnesses, power supply/ power cords and point to point harnesses. We have different activities dedicated to electrical harnesses manufacturing for military land and industrial applications.

Tell us about your wiring needs, our experts are at your disposal.



Assembly kit



### **Electrical Harness**

 Kitting preparation for on-site installation
 Heat-shrinking for harsh environment



Overmolded cable assembly • Overmolded harsh environment cable assembly • For both high and low-

temperature applications Impervious to high-vibration, high-abrasion, moisture, oil & corrosive elements



Ethernet C/A

USB & RJ Field cords
Quadrax Mil/Aero connectors
µCom connectors

(Global solutions with Amphenol Socapex switchs & media converters)



### Signal/Power C/A

Single way, multiway until
500 A
500 V connectors
Copper big section C/A

### Military Headset Cables

 Specific to various OEM radio platforms
 Utilizes overmold technology
 Shielded solutions to accommodate various length and connectors



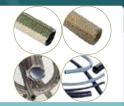
2M Overmold Cables

 Overmold to withstand harsh environments (IP67 environmental survivability) Dedicated routing for specific installation on navy ship Low profile designs to save space Bi-directional strain reliefs with robust encapsulations of transition areas 360° EMI shielding



### Fiber Optics Cables

 Wide range of tactical cables for deployable harsh environment optical links
 Available in a variety of applications, sizes, materials, accessories
 For various diameters and cable lengths



### All types of protection

Open textile sleeves
 Conduits
 Overbraiding
 Heat-shrinkable sleeves



### ESATA Cable Assembly

 For military communications, video, and computer storage
 Designed for harsh environments



### Deep immersion Harnesses

 Overmold to withstand deep immersion (up to 200m)
 Custom molding shape further customer request
 360° EMI SHIELDING

### **Amphenol Socapex**

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