



## **Tackling the Challenges of Harsh Environment Interconnects**

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As communication technologies evolve, the need to provide interconnect solutions to a wider variety of applications increases. Exposure to dust, water and other corrosive elements presents challenges to the integrity and reliability of the connectors used in these applications. For industrial, medical or other outdoor applications, electronic system designers must consider ingress protection for their enclosures as well as shock and vibration performance for their systems. Selecting the right interconnect solution is critical in coming up with the best solution for these applications.

In the past, designers were limited to a small range of products which could withstand requirements for IP67 protection and above. In many cases, they were very expensive, bulky, provided limited signal integrity and power handling capabilities. Today, however, there are more solutions that exist to address the needs for faster speeds and to provide power for portable or peripheral equipment. These solutions will incorporate design features which extend the use of standard interfaces into harsh or rugged environment applications.

### **Modular Jack Connectors: Twisted pair Ethernet continues to expand its widespread use**



The Ethernet Alliance has published figures illustrating the ubiquitous presence of RJ45 Ethernet connectors in our wired world. Close to a billion ports are sold every year! The original form factor dates back to the 1970's but if one was to think the technology was standing still, you might be surprised. New standards for twisted pair copper wire have been recently released for 2.5GBASE-T, 5GBASE-T, 25GBASE-T and 40G BASE-T. This adds to the already popular 10/100 and 1000BASE-T, as well as the 10GBASE-T which is just starting to ramp up.

Modular Jacks are used in many industrial, military and medical applications where the need for IP67 protection is critical for performance reliability. One method to upgrade the performance of standard connectors for harsh environments is to provide a protective panel mount housing and pot epoxy or other sealant behind it. While this method can provide satisfactory results for many applications, sometimes, a higher level of protection is needed.

For situations where you may see extreme temperature cycling and exposure to shock or vibration, a different approach may be needed. The more advanced second generation harsh modular jack connectors utilize internal seals and gaskets as well as resin impregnated over moldings to provide a robust seal that improves thermal cycling performance. Amphenol ICC provides many second generation IP67 solutions to support needs for data rates up to 2.5GBASE-T with new versions on the way addressing 5GBASE-T and 10GBASE-T requirements.

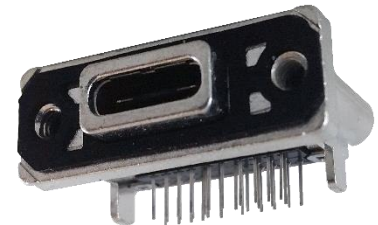
### **Universal Serial Bus (USB): Providing greater bandwidth and functionality to the field**

It has been a few years since the Universal Serial Bus (USB) Implementers Forum released specifications for an upgraded version of Enhanced SuperSpeed USB which takes performance far beyond the trusty USB 2.0. These upgraded connector interfaces have made their way into new computers and peripheral devices and are being adopted almost everywhere. Portable applications such as GPS's, fitness equipment, factory automation or vehicle mounted instrumentation have not been as quick to catch on to the increased bandwidth available but this is slowly changing.

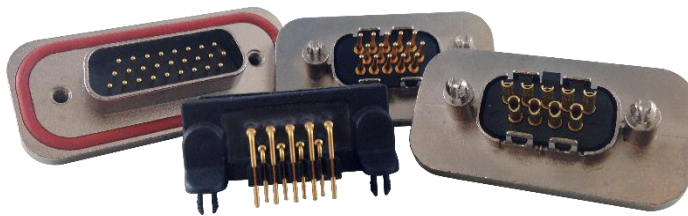


Amphenol ICC offers a new line of USB 3.0 Type A connectors which provide full compatibility with the legacy USB 2.0 cables and devices. The USB 3.1 specification refers to this class of products as USB 3.1 Gen 1. They are available in single port or stacked configurations with right angle or vertical PCB mounting orientations. These incorporate familiar features such as a rugged die cast panel mount construction for excellent strength and durability. Other optional features such as dust covers and conductive sealing gaskets for improved EMI performance are also available.

The parallel specification for a compatible "USB Type C" connector has sparked interest in using USB to handle not only data signals but audio, video and power. With the ability to carry up to 100watts of power as well as data rates of 5Gbps in a reversible connector interface. Amphenol ICC's IP67 Type C connectors offer the flexibility to upgrade communication ports in harsh environment applications. This rugged connector is available in right angle and vertical terminations and includes different thread and gasket options. A sealing boot kit is coming soon which will allow users to seal not only the enclosure but the mating cable assembly for permanent installations.



### **D-Subminiature Connectors: The workhorse of the industry**



Since its introduction more than 60 years ago, D-subminiature (D-sub) connectors have seen usage in everything from Ethernet networks, audio/video ports, medical equipment, military and other signal communications. They are generally considered to be too large for use in computers today but due to the reliability of the interface and the widespread availability, it is still a useful solution for many applications.

Through the use of screw machined contacts, internal gaskets and seals and die cast shells; rugged versions with IP67 ratings can provide robust solutions for environments where temperature extremes can vary from 40°C up to 105°C. D-subminiature connectors are well suited for situations where systems may be subjected to high levels of mechanical shock and vibration. Amphenol ICC is planning to introduce a new set of combo D-subminiature connectors in a 3W3 arrangement which can provide up to 40A per contact in a package that provides IP67 water and dust protection in both the mated and unmated condition. This unique solution also includes the flexibility to provide filtering options for a clean power source free of noise and transients.

### **HDMI Connectors: Providing water and dust proof solutions**



The ruggedization of the High Definition Multimedia Interface (HDMI) has provided designers with water and dust tight solutions for audio and video transmissions. With 4K video capability at 60 Hz, Amphenol ICC's standard HDMI version 2.0 Type A interface provides a great solution for broadcast equipment, security systems, outdoor audio visual equipment as well as portable ultrasound equipment. The product is available in right angle and vertical termination types with optional interposer boards for flexible mounting arrangements. Optional accessories include dust covers and sealing boot kits to provide IP67 protection for any standard mating cable assemblies.

### **The Path Forward: Greater speeds and more power**

As electronic system designers are pressured to provide greater functionality to their devices, this challenges connector manufacturers to provide greater bandwidth and more power in harsh or rugged environments. Greater temperature extremes, along with mechanical shock and vibration and the potential of prolonged water

makes choosing the right connector manufacturer and solution a critical factor when designing these types of applications.

Amphenol ICC takes things into consideration such as the robustness of the PCB terminations, gasket sealing methods and further developing resin impregnation techniques. All of these things help ensure that electronic system designers have plenty of options for maintaining reliable connections for end users in rugged environment applications.

Amphenol ICC offers a wide variety of interconnect solutions that pushes outside the safe confines of a computer room; allowing designers to build interfaces and applications that successfully and reliably perform in any environment.

