

Miniature connector design for severe applications

Bob Stanton, Director of Technology, Omnetics Connector Corp.

Electronic equipment in today's defense industry is being driven forward with highly capable advanced technologies.

New electronics, resulting from modern sensor and detector devices to fully coordinated satellite internet controls are employed in battlefield complex management systems. GPS III enabled applications control UAS platforms from a distance and fly at hypersonic speeds. Highly portable modules support our soldier borne sensors, (SBS), on the battlefield in extremely rugged and evolving situations. Unmanned drones and ground based UMVs are used for advanced recognizance to provide pre-engagement data that can offer more than one solution to the battlefield strategy. These integrated electronic systems must provide signal reliability in extreme environmental situations. Those sensors, data processors, information transmitters must continue to perform at their best. Connectors and cable are used for providing connectivity to many portions of each module and support the core of the system's performance. Selecting the right connector and cable is critical. As circuit miniaturization and rugged mobility have evolved simultaneously, sensors have moved from inside the box to



out on the arm of robots. Image processors are now on the visors of helmets and hypersonic guidance is riding inside the munition in flight. Miniaturized defense connector and cable designs have developed a great history for use in military applications. As new requirements and electronics evolve, ruggedized connectors are readily available in many standard military specification levels. Additionally customized designs that achieve or exceed the military performance standards are rapidly adapted to meet the ruggedized needs today.



Water-Tight Micro-D

The hunt for a miniaturized connector that fits your needs

A great way to start your connector search begins with thoroughly knowing and understanding your application, where and how it will be used! (We all know someone that went to the auto dealership to "see what's new.") Selecting the right connectors for military applications is much more complicated. We can readily see the need for size, low weight and various shape requirements, but what temperature, pressures, exposures to salt, gas, or constant vibrations are critical. It's also important to remember that some most serious conditions are when we encounter two or more environmental exposures simultaneously; like temperature and salt exposure. In space we can see high temperatures and high atmospheric pressure at the same time. I like to make a list of key requirements of design criteria based on use.

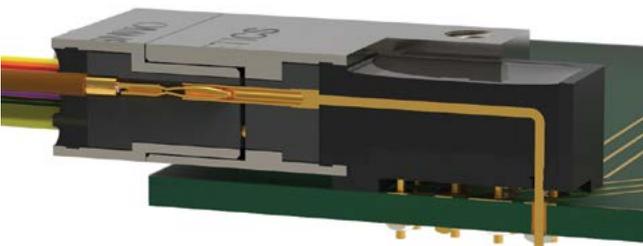


Shielded Power plus signal

Knowing and defining your Use and Environmental Application

- Mechanical:** What size and weight is needed in your instrument.
Define wiring format; as Wire to wire and or to panel mount.
Is it, deep inside an instrument, is there access.
How flexible does the cable need to be
Physical application and environment
- Environmental:** Exposures – as Temp., Chem. Radiation, and Pressure
Water sprayed or immersed
Salt exposure
Dust and dirt
- Use and fit:** High rate of connect and disconnects
Hand mated with or without gloves
- Electrical:** Signal type, analog, digital, amplitude modulated
Signal speeds, impedance match to circuit,
Crosstalk, EMI, Shielding requirements
"When the list has been completed, selecting connectors is easier!"

Military quality Micro and Nano connectors: There are two good resources to insure rugged performance of miniature connectors. Micro-d connector standards begin by specifying pin to pin spacing at .050", (1.27mm). The Mil. Specification 83513 lists connector size, shape and inter-mate specifications. More importantly, however, there is a list of key performance levels for ruggedized use, such as shock and vibration levels, the minimum number of mating cycles and even, electrical specifications such as resistance and mating force. One can also study the IPC, (printed circuit society), documents listed for standardized circuit board to connector pin configurations. Similarly, Nano-miniature connectors with pins spaced at .025", (.635mm) are thoroughly defined in Mil. Specification, 32135. Both standards have sets of well-defined physical, electrical and rugged performance expectations. With the rapidly increasing demand for small connector



Nano-D Cross Section

and cable in highly mobile defense electronics, second sourcing is quite important but not always be available. Key requirements like, signal type, signal speed, circuit density, EMI or crosstalk concerns are beginning to challenge the use of standard mil. Specifications exclusively. Highly mobile defense circuits often operate on high-speed digital signals using quite low voltages and currents. The new signals often need better shielding. Cable must be formatted for both



Soldier Borne Communications

reliability and high signal integrity. System designers can consider at least two options for making a connector selection that matches their application. The methods are based upon working with military qualified suppliers that use subparts and elements that have passed QPL within their standard military connectors.

Option 1.

- A. Visit your connector supplier websites and or sales team to review current standards that meet or are close to your physical needs. Collect the specifications of those standard and what rugged test data is available.
- B. List electrical signal specifications and discuss signal performance with EE at Connector supplier office.
- C. Chat with connector designer and get solid model and dimensions of standards to insure fit and function of standard device.
- D. Compare above list to the standard parts first. Ask for a sample.

Option 2.

- Variations for ruggedness, size and shape can be navigated easily. They can also include hybrid or mixed-signal connectors that reduce the number of cable within a system by adding power-plus signals within one interconnect unit.
- A. Define variations that you need from the mil. Standard connectors available.
 - B. Begin modifications, if needed, on-line with supplier to build solid models.
 - C. When ready – build a 3-D model of customized connector
 - D. When 3-d model looks good review planned specs.
 - E. Request a first article, specify additional testing to insure performance.

Finally; the system designer should specify any specific forms of Testing and Q.A., (Quality Assurance) that can assure the interconnection systems will sustain high reliability in the rugged and unique environmental conditions of your application. ■

**For more information, visit: www.omnetics.com
Email: bstanton@omnetics.com**