

# OMNETICS

## NEWSLETTER COLLECTION

- SPRING 2014 -

Volume 1, Issue 9

## A SENSE OF RELIABILITY AT 260°C

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In North America alone, the oil and gas drilling industry has increased 214 percent over the last decade. These numbers have been influenced considerably by directional drilling opportunities which have seen an even larger spike of approximately 1,165 percent in horizontal wells. While the strides we have made domestically are not going without notice, they are creating a whole new set of problems for the modern day design engineer.

### How Omnetics Can Help?

Omnetics Connector Corporation has extensive expertise in developing high reliability Micro and Nano miniature connectors. For over 30 years these connector families have provided our customers with high levels of shock and vibrational resistance across a number of markets, many of which are set in extreme temperature environments. One, in particular, is down-hole related applications and electronics. Oil, gas and other geothermal based applications have a tendency of exposing electronic equipment to some of the world's harshest conditions, with temperatures often soaring well past 200°C. As we have grown to know in the interconnect world, this temperature range clearly exceeds the recommended operating temperature of standard MIL-DTL-83513 Micro-D™ Connectors (125°C), making reliability a question amongst standard Micro-D™ manufacturers and users. That is, until now....

### Introducing Omnetics 260° Micro-D connectors

These high reliability Micro-D™ connectors are now available in an ultra-high temperature rating of 260°C (500°F). These connectors are ideal for down-hole related applications and come standard; pre-wired, soldercup as well as terminated with PCB tails. At .050" pitch, Omnetics 260°C high temp Micro-D™ connectors accept #24 to #30 gauge wire utilizing Omnetics' unique flex pin contact system. Omnetics' gold plated flex pin contacts are recessed into the high temp liquid crystal polymer (LCP) insulator to protect and prevent damage. Meanwhile, a special nickel alloy is also added to the contact to resist softening as well as corrosion in high temperature situations. The contacts themselves are factory-installed and potted with a special high temp epoxy to ensure the performance you expect. Pin counts mirror that of standard MIL-DTL- 83513 configurations and range from 9 contacts up to 51.



This ultra-high temp Micro-D™ provides continuous operations in temperatures upwards of 260° C for as long as 600 hours continuous. Key features include, but are not limited to; three standardized housing material types, jack screws and/or "Tool-Free" latching hardware, a high temperature LCP insulator, capped off with Omnetics reliable flex pin technology. Components are potted into place utilizing a special epoxy allowing these connectors to survive in some of the most demanding high-temperature environments.

### A Growing Need for High Temp Solutions

Besides the oil and gas industries, other applications, such as Avionics, are also emerging for high-temperature connectors as well. The aviation industry has a growing movement towards more of an "Electric" engine. In the past these "traditional" or "legacy" control systems required large, bulky (heavy wire) harnesses consisting of hundreds of conductors and multiple connector interfaces, all drawing massive amounts of power. However, advances in circuit technology have helped pave the way for a more distributed control scheme. Essentially by placing the physical engine controls closer to the engine itself, not only increases the reliability, but also reduces the complexity of the interconnection systems used. Now if designed correctly utilizing components such as Omnetics High Temperature Micro-D™, designers are able to miniaturize their interconnection scheme, and allow the aircraft itself to reduce size and weight by simply eliminating hundreds of pounds in interconnect related weight.



Pre-Wired/Cable  
Pin counts: 9 - 51 pos.  
26 AWG



Surface Mount  
Pin counts: 9 - 51 pos.  
Avail. Horiz & Vertical



Solder Cup  
Pin counts: 9 - 51 pos.



Card Edge  
Pin counts: 9-85 pos.



Thru Hole  
Pin counts: 9 - 51 pos.



Aluminum  
w/ Ni Plating



Aluminum  
w/ Cadmium Plating



Stainless Steel

### SHELL OPTIONS:

#### Aluminum with Nickel Plating:

#### Aluminum with Cadmium Plating:

#### Stainless Steel:

Alloy 6061 per SAE AMS-QQ-A-200/8, Nickel per SAE -AMS-2404

Alloy 6061 per SAE AMS-QQ-A-200/8, Cadmium With Yellow Chromate Conversion per SAE-AMS-QQ-P-416, Type II, Class 3  
Over Nickel Underplate

300 Series, Passivated per SAE AMS-2700

*\*Unique/Custom housing designs are available upon request to fit tight spaces*

# High Temp Micro D Continued.....

## MATERIAL SPECIFICATIONS:

|                        |  |
|------------------------|--|
| <b>Contact:</b>        | Nickel Alloy   |
| <b>Contact Finish:</b> | Gold per ASTM B488, Type II, Class 1.27, Code C Over Nickel Underplate |
| <b>Insulator:</b>      | High Temp LCP  |
| <b>Hardware:</b>       | Stainless Steel, 300 Series, Passivated per SAE AMS-2700               |
| <b>Insulated Wire:</b> | Nickel-Coated Copper, PTFE Insulation per M22759/87                    |

## ELECTRICAL-MECHANICAL SPECIFICATIONS:

|                                      |  |
|--------------------------------------|--|
| <b>Operating Temperature:</b>        | -55°C to 260°C                                 |
| <b>Dielectric Withstand Voltage:</b> | 600 VAC RMS @sea level                         |
| <b>Contact Resistance:</b>           | 26 milliohms(65 mV) Max @2.5 AMPS              |
| <b>Current Rating:</b>               | 3 AMPS per contact                             |
| <b>Durability:</b>                   | 500 Mating Cycles min                          |
| <b>Insulation Resistance:</b>        | 5,000 megohms @ 500 VDC                        |
| <b>Shock:</b>                        | 50 g's with no discontinuities > 1 microsecond |
| <b>Vibration:</b>                    | 20 g's with no discontinuities > 1 microsecond |
| <b>Thermal Vacuum Outgassing:</b>    | 1.0% max TML, 0.1% max VCM                     |
| <b>Mating/Unmating Force:</b>        | 10 oz (0.283 kg) max per contact               |

For more information please go to: <http://www.omnetics.com/capabilities/>



## OMNETICS PZN LINE EXPANDS TO 24

Omnetics Connector Corporation has just expanded one of its fastest growing connector families.

Omnetics Polarized Nano Series (PZN™) has just doubled its allowable contacts up from 12 to now allow users as many as 24 contacts. The PZN™ series is an ideal solution for designers who are tight for space, yet demand rugged reliability. Omnetics Polarized Nano Series is a hermaphroditic connector solution encompassing both male and female contacts within the same insulator arrangement. Benefits from this connector configuration include the fact the connector itself is polarized, thus eliminating the need for excess weight caused by guide pins or other polarizing features. Meanwhile, at .025" (.64 mm) spacing and mil quality, gold plated contacts, makes the PZN™ series one of, if not the smallest Hi-Rel connector on the market today. Like all of Omnetics ruggedized solutions, the PZN series utilizes Omnetics very own Flex pin contact system, allowing users the ability to push as much as 1 AMP through each contact; making Omnetics Polarized Nanos a great complement to those tasked with getting from an I/O panel down to an ultra-small PC board footprint.

The Polarized Nano Series is available in 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24 position sizes. Termination options include: Pre-wired, Cabled, Straight and Right Angle Thru-Hole, as well as Horizontal and Vertical Surface Mount.

Custom harnesses are also available. Please consult your local Omnetics representative or inside sales contact today!

For more info go to: <http://www.omnetics.com/polarized-nano/>

*“Benefits from this connector configuration include the fact the connector itself is polarized, thus eliminating the need for excess weight caused by guide pins or other polarizing features.”*



Spring 2014

# From the Engineer's Desk

Written by Ryan Satrom – [rsatrom@omnetics.com](mailto:rsatrom@omnetics.com)

## High-Speed Digital Connector Design

(Part I - Introduction)

High-speed digital connectors have the same requirements as any other rugged connector. For example, they must meet specifications for shock, force, insertions, and vibration. There are, however, additional requirements that must be addressed in order to ensure proper performance for high-speed digital applications. With gigabit data rates through connectors now commonplace, the parameters that impact high-speed performance must be understood by both connector manufacturers and connector users. This is the first in a series of articles that are aimed at helping readers better understand the critical concepts and parameters that must be considered for high-speed connector design.

### Breakdown of the Old Order

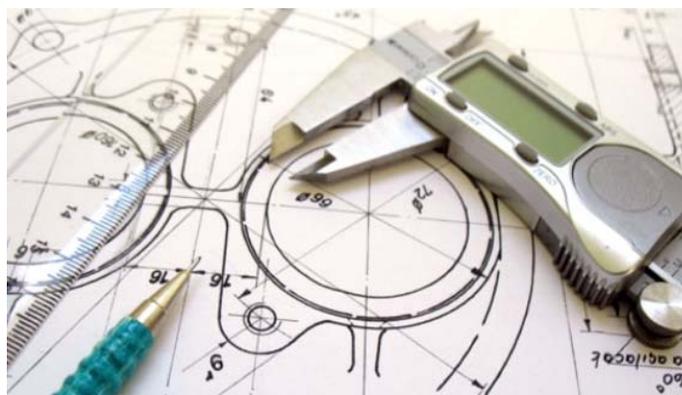
For low-speed signals, the connector and cable can be adequately modeled as a small resistor. This resistor will accurately represent the loss that is created due to the length and diameter of the path. As speeds approach the high-speed regime (generally 100 Mbps+), a small resistor will no longer accurately model the electrical performance. Being able to understand and accurately predict the performance will require a paradigm shift in how electrical signals are viewed.

### Paradigm Shift

Electrical signals are actually electromagnetic waves that traverse down a signal path. At low-speed, the electromagnetic waves can be simplified by using circuit theory – the wave can be modeled as a voltage-across/current-through the path, with an instantaneous transfer rate. This is modeled with the simple resistor discussed above. This model, however, breaks down at high-speed, and understanding this requires a new way of thinking about electrical signals.

### Fluid Flow Analogy

High-speed signals must be viewed as waves. A simplified understanding of this signal-as-a-wave concept can be obtained by using a fluid flow analogy. As a wave travels through a pipe, a portion of the wave will reflect back every time the pipe diameter changes. Thus, optimal fluid flow is achieved with a pipe that has a constant diameter (See [Figure 1a to the right](#)). If the pipe diameter is constantly changing (See [Figure 1b to the right](#)), large portions of the wave will reflect and the efficiency of the pipe will decrease.



The performance of the pipe is analogous to the performance of a high-speed signal path in a cable/connector assembly, with the critical parameter in a signal path being impedance instead of diameter.

### What is Impedance?

In its most basic definition, impedance is the ratio of the voltage to the current of a signal path. Like the diameter of the pipe in the fluid flow analogy above, the impedance of a signal path is defined by the cross-sectional geometry at any point along the path. This is an important point that bears repeating – impedance is specific to each point along a signal path. An ideal signal path maintains a constant impedance – like a constant diameter of a pipe – throughout the path. The optimal impedance is defined by each specific application, but the most common impedance is 100Ω.

### High-Speed Connectors

In the installments that follow, we will discuss many helpful parameters and concepts for understanding high-speed connectors. We will also describe the challenges that must be addressed to achieve an optimal design. The goal is to provide the reader with an understanding of the important concepts that pertain to high-speed connectors and give engineers the ability to select the correct high-speed connector with confidence.

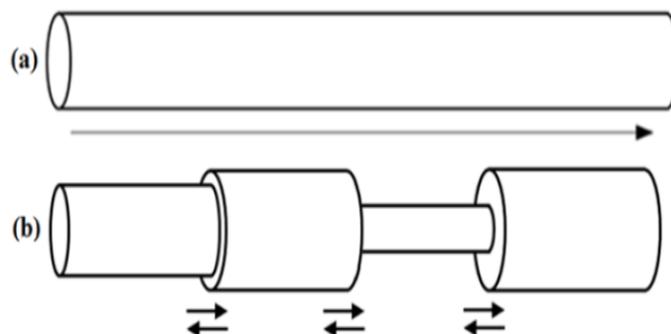


Figure 1



# APPLICATION SPOTLIGHT

## MINIATURE CONNECTORS FOR DOWN HOLE

Written w/ contributions from Matt Steele – [msteele@omnetics.com](mailto:msteele@omnetics.com)

The down-hole drilling industry continues to push the limits of technology as it relates to new and innovative methods for extracting oil and gas. Through the development of smaller, more versatile down-hole tools, many of these often dreamt about extraction methods have quickly become an ultra-effective reality. These new down-hole tools are packed with an array of sensors and electronics that must be small in size, yet rugged and reliable enough to withstand some of the toughest environments the world has to offer. In fact, within each new tool design, it is vital that every component, even connectors, must be able to withstand the harsh shock and vibration generally associated with these types of tools.

Mil-Spec connectors such as the Omnetics Connector Corporation's Bi-Lobe® and Nano 360™ Circular Series have found their way onto a number of these new tools, as each product family offers their users just that; a small, durable interconnect solution. These High-Rel Mil Spec connectors allow for easy mating and de-mating, while offering users the ability to stay mated under extreme shock (100 G's > 10 nanoseconds) and vibration (20 G's > 10 nanoseconds). At .025" (.64mm) on center, Omnetics nano-miniature connectors are some of the smallest connectors on the market today. These connectors and cable assemblies are specifically designed and engineered to perform and thrive in temperatures ranging anywhere from -55°C (-67°F) to 200°C (392°F).

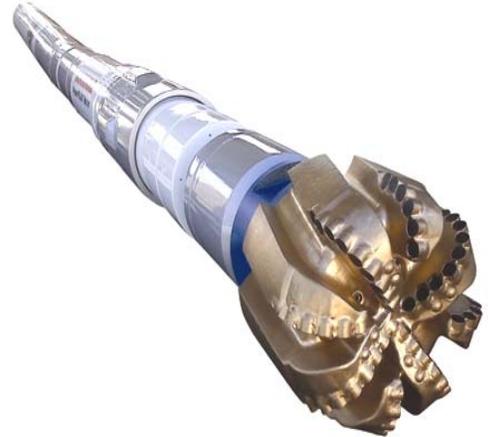


Photo Courtesy of: [www.upsideenergy.com](http://www.upsideenergy.com)

Whether it's milling or pumping, these Omnetics connector solutions are opening the door for the down-hole industry to transfer real-time data at a record rate while monitoring pressure and flow. With this ability to see real-time data, well service engineers are able to make adjustments on the fly to accommodate the ever changing well conditions.

For more information go to: <http://www.omnetics.com/capabilities/application-space/>

## On the Road with Omnetics

- May 5-9<sup>th</sup>:** SPIE Defense & Sensing – Baltimore, MD
- May 12-15<sup>th</sup>:** AUVSI – Orlando, FL
- May 20-22<sup>nd</sup>:** SOFIC – Tampa, FL
- June 10-12<sup>th</sup>:** Global Petroleum – Calgary, Canada
- June 17-21<sup>st</sup>:** Eurosatory – Paris, France



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## About Omnetics

Omnetics was founded in 1984 to deliver rugged, reliable interconnect solutions for the most demanding industries. The company has a fully integrated design and manufacturing plant in Minneapolis, Minnesota USA, where it produces micro and nano miniature interconnect products, featuring COTS, Standards and Custom connectors for industries such as Medical, Military, Aerospace, Defense and other technology oriented OEMs.

## Twitter Trivia

The average number of people flying over the US at any given time is?

- A) 61,000
- B) 125,000
- C) 35,000
- D) 375,000.

**Answer:**

Please follow us on (@Omnetics) for the answer [#OmneticsTrivia](https://twitter.com/Omnetics)

