



Enhanced Interconnect for Industrial Ethernet applications

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Ethernet technology has expanded from the home and office into the industrial environment and is now commonly used on the factory floor. Industrial Ethernet offers cost, data volume, and transmission speed improvements over many other technologies, including fieldbus. Industrial Ethernet can also handle harsh environments, data collisions, factory noise, and factory process needs. The continued development and expansion of more sophisticated industrial automation environments, such as Industry 4.0, now require higher performance networks with higher density connectivity. Bandwidth and dense connector solutions once unique to networking and datacom applications are becoming familiar performance requirements in the smart factory of today.

The standards around Ethernet have greatly influenced the networking and datacom application segments. Internet Protocol and IEEE 802 standardizations are widely accepted and have created a natural networking infrastructure for industrial applications. So too are standardized interfaces, such as the Modular Jack I/O solution that dominated the traditional networking segments. But in the industrial world, and more specifically on the factory floor, these Modular Jack connection points may not be ideal as they are prone to damage during handling and installation. Today there is an increasing number of intelligent field devices configured with local I/Os and connected to the switch cabinet via a fieldbus or industrial network such as EtherNet/IP. As a result, Ethernet technology has become more prominent in the modern industrial network. A priority of designers is to extend connectivity and sub-networks to perform at a more local level without compromising the integrity of the data transmission within the network.

The requirements to support application challenges related to Industry 4.0 and IoT can prove an obstacle unless the designer is aware of interconnect solutions that may be otherwise outside his/her normal prevue. This includes new I/O challenges and less traditional design requirements that are inside the system or enclosure. A designer's requisites are choices that support a more diverse set of mechanical and electrical solutions while balancing the tradeoffs that are continually being scrutinized. Paramount is implementing a well-designed network of industrial devices that are responsible for directing complex operations and storing sensitive data at increased speeds of at least 1GBps. This includes the reality that most industrial applications feature harsh environmental conditions of some kind — signal and data interference, dust and moisture contaminants, extreme temperatures, or shock and vibration — connectors must be ruggedized for the applications in which they are employed while

minimizing effects caused by increased data rates and inherent noise within the industrial environment.

Balancing Density and Reliability

It wasn't that long ago when standard connectors often found in more commercial hardware applications could also be employed in industrial process and automation equipment. However modern industrial hardware has increased I/O requirements, higher data rates, mechanical robustness and smaller packaging. These requirements are discovered in various connectivity points throughout the network; including passive I/O boxes, sensors, actuators and drives. Design challenges can include higher pincount requirements or improved shielding that can support more demanding electrical transmissions such as in GbE applications while continuing to support harsh environments in a mechanically proven and sealed (IP65/IP67) interface

In the past, M8 and M12 connector variations were used primarily as machine sensor connectors. These sensors and actuators in the field are frequently connected to a passive I/O box that can support various protocols and applications to include Ethernet. The harsh influences of the environment on these boxes make proven, tightly sealed (IP65/IP67) connectors a necessity. As such, the M8/M12 connector systems perform very well in such applications, proven and established in the field of sensor technology. Mechanically, the M12 connector continues to support various protocols via coding built into the male/female mating connectors. This includes keying schemes for devices (sensors/actuators) and fieldbus applications, such as Profibus and EtherNetIP.



A migration towards density is expected, but without compromising the mechanical performance that is required in industrial designs. New variations in the M12 series are supporting Industrial Ethernet and this connector platforms continues to evolve in the process. Open-pinfield connector options extending up to 17 positions are one way of optimizing your networking design requirements. When GbE applications are required, look for maximum shielding between differential pairs as well as improved conductivity between the panel and the board ground plane. A proper connector design and integrated components will mitigate

your signal integrity concerns while supporting reliability that is inherent is this defacto-standard interface.

Finally, another way to achieve maximum density and electrical performance is in innovative SMT termination designs with strain relief features to support the most demanding of rugged applications. These SMT termination options prove beneficial not only in optimizing signal integrity and mitigating stub effects associated with traditional through-hole terminals, but they are preferred in manufacturing of the host boards or passive boxes that employ a M8/M12 connector system. Proven signal and shield terminations will enhance the design and provide the confidence that is required over the life of the product installed in a factory environment.



Conclusion

The defacto-standard M8/M12 connector series has long been used in industrial environments. The evolution of this connector series includes coding features to service specific industrial communications applications. Newer and timely additions include density and higher pincount options. Finally, achieving longer transmission lengths even at increased data rates can now be realized with improved shielding designs and a focus on maintaining signal integrity. Industrial Ethernet applications are growing, so too should your connector choices and options.

For more information, visit

<https://www.erni.com/en/products-and-solutions/electronic-connectors/m8-and-m12-connectors/>