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Enhancing Interconnection Strategies for Next-Generation Vehicles

By Ralph Semmeling, Product Portfolio Director for Customized Connectors at ENNOVI (formerly known as Interplex)

The automotive industry is witnessing a rapid evolution in vehicle design, characterised by the integration of advanced functionalities aimed at enhancing comfort, performance, and safety. This includes a significant increase in the incorporation of sensors and imaging devices, not limited to luxury vehicles, but extending to mid-range and economy models.

Simultaneously, there's a paradigm shift in automobile designs driven by the imperative to reduce weight and extend the range of electric vehicles (EVs). This shift entails a transition from traditional mechanical systems to electronically based x-by-wire systems.

However, these trends bring forth a significant challenge; the exponential increase in data generation and transmission by modern vehicles. Analyst firm McKinsey estimates that cars already produce around 25GB of data per hour, a figure set to rise with the proliferation of cameras and emerging 3D imaging technologies like LiDAR, time-of-flight (ToF), and ultrasound. Further, it should be noted that this is only going to increase as higher levels of vehicle autonomy start to be introduced.



Figure 1. ENNOVI's ENNOVI-NET technology offers high repeatability while avoiding quality problems associated with solder

The evolving needs of automotive-grade interconnects

To address these unprecedented data demands, interconnect solutions must evolve while complying with stringent international automotive standards such as the EU's LV214 and the SAE's USCAR2.

First and foremost, they must be able to withstand exposure to shocks and vibration. Then there's the issue of high-temperature exposure, though this will become less problematic as the industry migrates to EVs.

If electromagnetic interference (EMI) sources are present and not reduced, the signal integrity of the data being carried may suffer. To combat this, shielding must be included in modules. Tin whiskers can have a major impact on interconnect dependability over time, increasing the possibility of short circuits and system faults.

Furthermore, due to space constraints in vehicle design, automotive-grade interconnects must be extremely tiny. Often, high-density solutions will be required. In some circumstances, they may have to mix power and data transfer. Moreover, the integration of interconnects into automotive systems poses challenges for Tier 1 suppliers producing electronic control units (ECUs) and sensor modules. Any disruptions to high-volume assembly processes can impact throughput and efficiency.

Introducing press-fit alternatives

Because of these issues, press-fit interconnect technology is emerging as a promising solution, streamlining assembly processes and enhancing reliability compared to soldered connections. Press-fit contacts provide a reliable yet simple interface. By using them, assembly work can be made much more efficient.

Another big benefit is that soldering is no longer required. Press-fit connections have greater tolerance than solder, which is totally rigid and, thus, prone to fracture when subjected to shocks and vibration. As a result, modules with press-fit contacts will have a longer operating life than those with soldered pins.

ENNOVI's ENNOVI-NET contacts, coupled with IndiCoat plating technology, have gained widespread acceptance among Tier 1 suppliers, offering reliable operation, mechanical robustness, and thermal efficiency. The innovative plating technology overcomes challenges like tin whisker formation, ensuring long-term reliability.

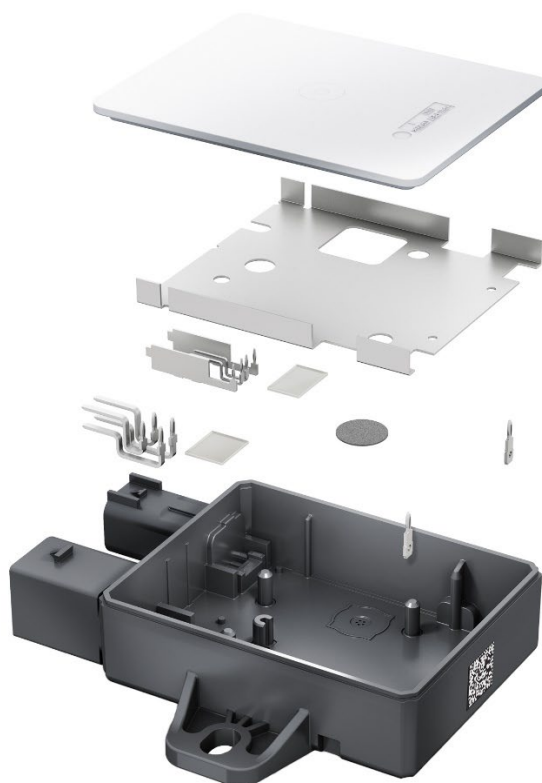


Figure 2. An exploded render of a radar module produced by ENNOVI

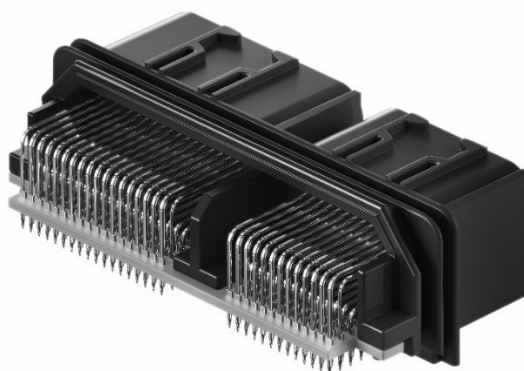


Figure 3. An ENNOVI-developed airbag ECU

A substantial number of carmakers are trying to outsource their ECU and sensor module design work. Rather than performing this in-house or through their Tier 1 suppliers, many businesses increasingly rely on ENNOVI to handle these tasks. This enables such organisations to concentrate their engineering efforts where they can obtain the most differentiation.

OEMs can benefit from ENNOVI's industry-leading expertise in high-precision mechanical engineering and coating technology. The company has designed and built a variety of modules for automotive deployment, including the radar unit and airbag ECU illustrated in Figures 2 and 3, respectively.

About the Author

Ralph Semmeling is a Product Portfolio Director at ENNOVI (formerly known as Interplex), a provider of interconnect solutions. He has over 25 years of experience in the automotive industry with extensive knowledge of High-Tech Electromechanical Industry. Ralph has great command in fine mechanical product designs and holds 12 patents. www.linkedin.com/in/ajay-bhargava

He has a Bachelor of Applied Science (B.A. Sc.) in Mechanical Master of Science (M.Sc.) degree in Mechanical Engineering with specialization in Mechatronics from Technical University Twente, The Netherlands.