



# CONNECTOR TRENDS FOR INFOTAINMENT AND DRIVER-ASSIST APPLICATIONS



AUTOMOTIVE INDUSTRY

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Molex HS Auto Link connector

Traditional wiring approaches for automotive electronics can be unwieldy, driving up vehicle weight, costs, and complexity, without commensurately driving up value. Molex explains the five levels of interconnect technology advancement in the era of digital.

Electronics make nearly every vehicle feature a reality. Popular automotive infotainment, integrated smart phone connectivity, turn-by-turn navigation, and driver-assist applications are pushing in-vehicle bandwidth and connectivity to new heights.

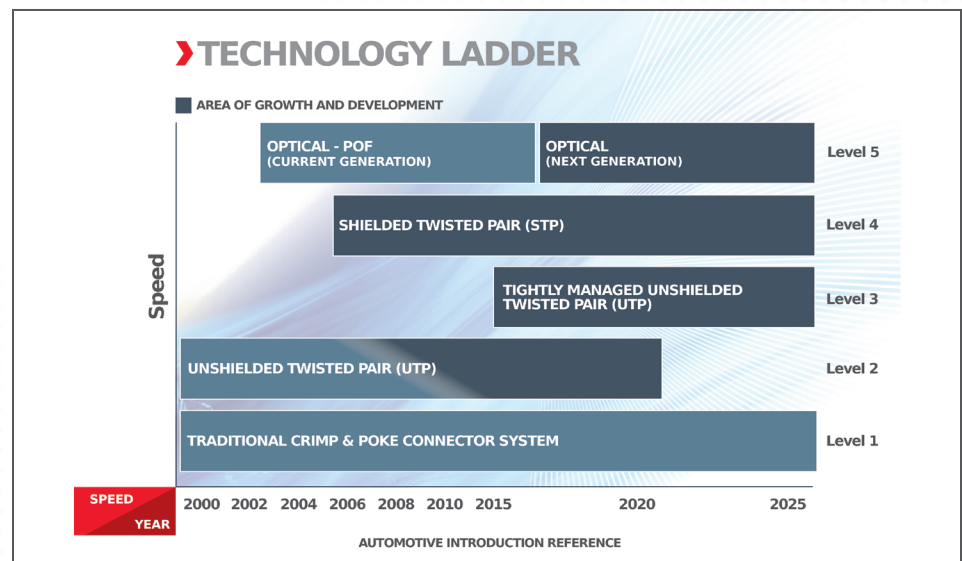
A decade ago, the average cost for automotive electronics represented about 20% of total manufacturing costs. Today that figure has jumped to 30% – 35% or higher. Automakers understand the value of using electronics to differentiate their models: Increasingly, car buyers expect high-end infotainment, safety, and other features to come standard in new vehicles. A recent study in Consumer Reports found that drivers were less brand-loyal, as they gravitate to models equipped with standard “luxury” in-dash electronics. However, equipment reliability and design complexity matter. Overly complicated infotainment equipment was the most troublesome

feature cited by 2014 vehicle owners.

Traditional wiring approaches such as terminals, wire, crimp, poke, seals, and wire harnessing assembly boards can become unwieldy, driving up vehicle weight, cost, and complexity, without commensurately driving up value. Exciting developments in automotive connectors and cables are helping simplify designs in this era of digital cars. Automotive connector technologies can save space in and lower overall cost of vehicles’ sophisticated electronic systems.

are designed to meet OEM preferences and application demands. Plastic features provide keying, terminal position assurance (TPA), and connector position assurance (CPA) with secondary latching innovations for secure mating.

Bandwidth demands brought CAN, FlexRay, MOST Bus, and other technologies into vehicle applications. Twisted pair wires introduced new complexities for connector and wiring harness investment and infrastructure. The automotive industry improved



The automotive world has five distinct levels of connector trends, as seen in the graphic above. Each brings different challenges and disruptions to the more traditional automotive connector systems of generations past.

The traditional “crimp-and-poke” approach represents the first level. Sealed and unsealed connector solutions support signal or power, where a range of terminals with post sizes 2.8mm, 1.5mm, 1.2mm, 0.64mm, and 0.50mm

processes from the early days of simply twisting post-terminated wires; flash forward to highly automated equipment delivering precise twisting and placement of splice connections along a cable run. While significant improvements in twisted-pair technology were realized, the approach only advanced connectivity performance by one level. Twisted-pair wire technologies essentially blended the same cable and connector systems from the first level.



The introduction of shielded cables helped to meet some of the challenges of the fourth level. Initially introduced for AM/FM antenna applications, co-ax cable is most notable in the fourth level. More recently, the challenge of shielded differential twisted-pair wire played a more prominent role with the introduction of USB, which moved beyond charging devices to become an important gateway for electronic devices to interact with vehicles. USB enabled the data paths to deliver stored digital music, audio books, and other forms of mobile entertainment to drivers and passengers. Representing the fastest data bus yet for vehicles, USB delivered 480Mb/s of data and demanded shielding that traditional first-level connectors could not deliver.

While USB made an infotainment splash, SerDes (serializer/deserializer) burst onto the automotive scene. Commonly deployed in PC and consumer applications, the RGB (red-green-blue) wire consolidation brought enhanced console displays for built-in GPS mapping plus enhanced video entertainment for rear-seat passengers.

The shielded twisted-pair connection system enabled higher resolution stack displays, back-up cameras, digital instrument clusters, head-up displays, and expanded customer convenience port (CCP) access through digital media hubs for state-of-the-art audio and video. The lanes of shielded twisted pairs can be increased for higher-circuit-count automotive connectors. For example, featuring better shielding and additional pin count, Molex's sturdy five-pin shielded HSAutoLink components meet stringent automotive mechanical requirements. The USCAR-30-compliant system supports USB 2.0 requirements for OEM system certification.

There comes a point where copper and shielding costs become an impediment in traditional wire harness assemblies. Transitioning to level-five optical fiber cabling systems is a technological step taken cautiously. Some within the industry favor using plastic optical fiber (POF), which boosts cost and complexity but bridges the technological divide between traditional copper products and fiber optics. Future technologies may build off POF and other advancements, offering new paths for optical fiber and transceivers.

Automotive digital content shows no sign of tapering off or decreasing. An undefined third level shows industry in a state of technological flux. Highly managed twisted pairs suggest prior methods are insufficient to meet higher-performing link segments. Post-twisted wires introduce inconsistent twists that cannot be tolerated in level-two systems. Inherent improvements to pre-twisted wires with cable shielding can potentially drive up costs and complexity for automotive connection systems. An end-to-end solution, including silicon, cable, and connectors, is feasible to eliminate costly shielding but requires balance to meet physical and electrical requirements. The IEEE and others within the industry are engaged in driving Ethernet standards that may clarify the best paths forward.