



# **Built to Last: The Connected Commercial Vehicle**

There is an ever growing array of connected electrical systems in all sectors of the commercial vehicle market. [\*According to a recent report published by Deloitte\*](#), manufacturers are equipping commercial vehicles with a wide range of systems and devices to increase operational efficiency. Examples include sophisticated cargo (or passenger) monitoring infrastructure and advanced semi-autonomous ADAS capabilities, such as automatic braking and acceleration, collision warning, and even remote truck control and parking. These systems generate a continuous stream of real-time information, such as data about the condition of the vehicle, traffic updates, loading capacity, and cargo (or passenger) status.

With petabytes of information flowing through connected commercial vehicles, in-vehicle networks require reliable and ruggedized connectors and cables that support high data transfer rates. However, system interconnects and electronic components installed in commercial vehicles must deliver a high-level of performance and reliability in even the harshest conditions. This why system interconnects for commercial vehicles are housed in denser packages -- to protect them from vibration, fluid ingress, and electromagnetic interference (EMI).

Let's take a look at some of these in-vehicle system interconnects and components.

### Ethernet Switches & Connectors

Commercial vehicle systems and devices are linked together by automotive interconnect systems (cables, headers and connectors) that feed into Ethernet network switches. To withstand harsh conditions, [\*5-port and 8-port Ethernet switches\*](#) installed in commercial vehicles should be encased in Lexan-plastic or aluminium and carry an IP67/NEMA6 rating. Indeed, drivers of commercial vehicles may encounter temperatures in excess of 50°C or below freezing, high relative humidity, moisture and liquids, dust or dirt that can infiltrate electronic enclosures, high vibration, and electromagnetic interference.



It is also important for [Ethernet connectors](#) to produce a tight seal when mated and provide easier system maintenance, without requiring skilled labor. Additional key technical Ethernet specs should include dual power connections (to allow 24V power supply redundancy), as well as auto-sensing, auto-crossing, and auto-negotiation (for 10/100 MBaud).

### Automotive Interconnect Systems & CAT6A

Commercial vehicle ADAS and cargo (or passenger) monitoring systems utilize multiple cameras to capture high-resolution imagery to assist with lane departure, pedestrian warning, night vision, parking and loading/unloading operations. In addition, commercial vehicles are often equipped with head-up displays (HUD) and sophisticated dashboards that display information generated by multiple electronic systems and devices.

Ruggedized [commercial vehicle interconnect systems](#) must therefore support high bandwidth data transfers. As an example, [CAT6A sealed connector systems](#) (rated IP65-IP67) can achieve data transmission rates up to 10Gbps, even in harsh environments that may be subject to vibration. Key interconnect system features should include support for multiple cable variants, along with a wide range of media protocols such as USB 2.0, USB 3.0, LVDS, Ethernet AVB (Audio Visual Bridging), modified HDMI, DVI, and DisplayPort.

The increasing sophistication of commercial vehicle telematic systems has also prompted automotive manufacturers to pack more electronics in the same space (package). This is because [smaller interconnects](#) -- in contrast to traditional USCAR 0.64mm connectors -- allow circuits to be packaged in tighter space by utilizing smaller pin and terminal sizes. Smaller interconnects are a perfect fit for a range of commercial vehicle applications such as navigation, electrohydraulic steering systems, radios (FM/AM/SW/CB), cameras, cargo sensors, lighting, and smart mirrors.



### SMB Connector Systems

[\*SMB connector systems\*](#) also play a major role in enabling a new generation of commercial vehicle systems such as ADAS and in-vehicle infotainment. More specifically, SMB connector systems support devices and applications with external antennas. These include Satellite Digital Audio Radio Service (SDARS), cellular, GPS navigation, tire pressure monitors, parking sensors, and keyless entry. SMB connector systems features should include DC to 6 GHz (frequency), a impedance of 50 Ohms, a 360° rotation, and a secondary locking latch to deliver easy cable routing between antennas and multi-media units. Ruggedized SMB connector systems for commercial vehicles should also provide a mechanical key feature, along with visual color codes to differentiate between applications.

### Wire/Cable Harness

A typical [\*commercial vehicle harness\*](#) can pack up to 50 low-circuit-count connectors. All require securely sealed connections that can withstand high temperatures, chemicals, liquids, and harsh environments. Moreover, the connectors must be capable of minimizing electrical failures. As such, commercial vehicle wire harnesses should carry an IP68 rating to support aggressive wire routings and external exposure. Additional technical specs should include a maximum current of 13.0A, a maximum voltage

of 500V, and a contact resistance of 30mΩ. Moreover, commercial vehicle wire harnesses should offer insulation resistance of 20MΩ (min), a mating force of 135N (max), and a minimum durability of 100 cycles.

### Media Modules & Chargers

Commercial vehicle infotainment systems are becoming increasingly sophisticated to support a wide range of devices. These include Wi-Fi hotspots, BLE, keyboards, advanced smartphone syncing platforms, touchscreen tablet displays (for video and audio) and hands-free input for voice assistants such as Siri Eyes Free. [\*In-vehicle media modules\*](#) can help enable the easy integration of multiple I/O port connection types such as USB, HDMI, Ethernet, SD memory cards, auxiliary jack inputs and more. These media modules should be ruggedized and provide full end-to-end I/O module solutions to meet end-system requirements in either active or passive designs.

Looking beyond media modules, commercial vehicle manufacturers have begun installing more efficient in-vehicles charging capabilities. Indeed, most drivers carry or wear a number of personal devices such as smartphones, smartwatches, laptops and tablets. Commercial vehicles may also be equipped with portable emergency devices that can be charged via USB, such

as flashlights, radios and GPS units. These devices may need to be charged quickly and frequently, so it is important for manufacturers to equip commercial vehicles with [smart charge modules](#). Smart charging modules should support up to 2.4 amps of output current, USB connectors rated for 10,000 mating cycles, backlit lettering, and halo lighting around the ports to make finding and connecting to chargers easier in the dark.

To sum up, modern commercial vehicle networks routinely support sophisticated cargo monitoring infrastructure, advanced semi-autonomous ADAS capabilities and high-quality infotainment systems. With petabytes of information flowing through commercial vehicles, electronic systems require ruggedized Ethernet switches, high-speed connectors and cables that support high data transfer rates, capable of operating reliably in even the harshest conditions.

