

Designing Durable Connectors for Commercial Trucks

by Caroline Hayes on May 5, 2020

Heavy-duty trucks log long miles on rough roads in all conditions to bring essential goods and materials to businesses and consumers. The connectors these vehicles depend on must be exceptionally reliable and rugged.

Even when the rest of the world shuts down, commercial transport vehicles keep on trucking. These heavy-duty vehicles operate for long hours in all climates and weather conditions. Even at rest, climate control, communications, and infotainment systems remain in operation to keep drivers comfortable and cargo secure. These vehicles endure much heavier use and rougher conditions than a passenger vehicle and depend on connectivity systems that can go the extra mile.



Designing for Vibration Resistance

Designing a connector that resists the effects of vibration is a challenge. A vehicle is a dynamic, moving object, says Shawn D’Gama, field applications engineer for the automotive tactical team at [ERNI](#). Cross-country trucking routes traverse a variety of road conditions, so vehicle connectors are subject to significant vibration.

The company designed its [MicroBridge](#) 1.27mm-pitch cable-to-board connector to perform in transportation applications. The single-row connector includes ERNI’s solder clips, located at the sides of the connector. They absorb mechanical stress and resist high shock and vibration loads.

“All the vibration dissipation is focused on the mechanical clips rather than the electrical pins,” said D’Gama. “The functionality of the pins is to pass signal and power.” This is not a unique design, he said, but the mechanical pegs are placed along the side of the connector in such a way that the header has a

very low center of gravity. This enables the operator to apply more force or insert the connector at a less-than-optimum angle without affecting performance. “We have polarization abilities, but the location of the clips also helps,” said D’Gama.

The MicroBridge design uses Koshiri security to protect against damage caused by insertion. With this connector, says D’Gama, ERNI has enhanced connector position assurance by adding tongues on the female connector and grooves on the male connector to pre-align the connector housings and ensure that alignment is correct, avoiding damage to the contact pins that could be caused by improper mating. A [shortened test pin](#) on the male connector can be used to test the contact security between the male and female connectors. This can be tested even during the mating process. The result is a connector that is uniquely well suited to the rigors of commercial transport.



ERNI’s MicroBridge is available in straight and angled surface mount versions. The female connectors are available as insulation displacement connectors (IDCs). They are available with a 90° cable outlet. Pin counts are from two to 20. The connector conforms to US Council for Automotive Research (USCAR) and LV214 and also known as VW75174.

Designing for Temperature Extremes

Commercial trucks must be outfitted with components that can endure rugged conditions for extended periods of time. “Temperature is another big factor,” said D’Gama. The closer the connector is to the engine, which is the source of heat and vibration, the more important it is for the design to be able to withstand harsh conditions and temperature extremes. The location can also influence the choice of materials used for housing.

“On the chassis, the temperature profile does not exceed 150°C (302°F), so nylon-based materials can be used. A connector that goes on the engine has to be a high-profile Ethylene Propylene Diene Monomer (EPDM) rubber-based component — this is very expensive,” D’Gama says. “As soon as you move away from the engine, it becomes a less expensive product,” he adds. Nylon-based products can be used for the header and the receptacle has to flex to accommodate the clips, so a slightly less rigid material is used on the receptacle.

Another differentiating feature for connectors intended for transportation vehicles is that 80% of them are sealed. The nature of long-distance commercial transport means that electronic systems are subjected to high levels of ingress.

“Ingress protection could be IP67, because commercial trucks are designed to last for more than 10 years, so the parts have to be interchangeable,” said D’Gama. The sealed parts can be disconnected and re-connected more than conventional connectors. “Generally, we design a connector for 10 mating cycles, but these could be, maybe 20 mating cycles.”

Keeping Track

Commercial transport vehicles maintain constant connectivity even when travelling long distances. Electronic systems are used for fleet management communications, driver safety, and security. Some

edge routers are designed for vehicular use. An example is the Skyus Industrial IoT gigabit edge router, released by Inseego.



Skyus edge routers from Inseego feature an array of ruggedized connectors.

The company ruggedized this router for the harsh conditions of commercial transport vehicles. “We have tested it for shock and vibration to military standards,” says Ashish Sharma, president, IoT & mobile solutions for Inseego. The unit includes integral GPS and an accelerometer for vehicle and load tracking.

“There is also the ability, depending on where the router is located, to run cables with external antennas. These can be mounted on the top or side of the vehicle to get a clean signal to the carrier infrastructure and tower,” he explained.

The routers are powered from the vehicle’s battery or engine. This requires selective connector specification. The unit features standard and reverse polarity SMA coaxial connectors, USB 2.0, an eight-pin locking connector for power input, RJ45 connectors, and a SIM card connection. Each must be selected for ruggedness. “We don’t just put in the regular barrel connector that you see on consumer devices,” he said. “We use a specific, industrialized connector that has the same mechanism, whether the router is powered by the battery or the engine. We use an industrial connector with a wire on one side, which can be connected directly to the battery or the engine.”

A ruggedized SMA connector is used to connect the gateway to the antenna. The connector choice allows the company to use omnidirectional or directional antennas, depending on the use case, to connect cables so that the antenna can be positioned in the optimal site on the vehicle to afford it a clear line of sight to base stations.

As commercial trucks continue to integrate connected technologies, every system, from communications equipment to the drivetrain, needs to include connectors that are ruggedized for the realities of the road.

About ERNI

With global headquarters in Switzerland and locations in over 40 countries, privately held E RNI Electronics is a leading global manufacturer and supplier of quality electronic connectors and cable assemblies for the automotive, industrial, medical, and communications fields, among others. Locally, [ERNI Americas](#) headquarters are in Midlothian, VA, from which the group provides customer support, administration and fulfillment services for local and global customers. For more information about the company, please visit www.erni.com.

Contact information:

ERNI Americas
2400 ERNI Way
Midlothian, VA 23112
Main Line 804-228-4100
Email: <mailto:Marketing.Americas@ERNI.com>