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# TELEMATICS IN COMMERCIAL FLEET OPERATIONS

NUMEROUS ADVANTAGES FOR COMMERCIAL FLEET OPERATORS.

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Telematics is an interdisciplinary field that involves data collection in a mobile environment. A basic telematics system contains a GPS device, a data logger, a wireless connection such as a cellular modem, and perhaps a backup battery and a storage device such as a SIM card. A vehicle application will include an engine interface.

An advanced telematics system can include additional hardware or software capabilities. Hardware options include Bluetooth and Wi-Fi to enable data access through a smartphone app or in-vehicle modem; additional interfaces such as seat belt monitoring; cameras; or actuators such as electronic cargo locks. Software options include electronic logging; trip history logging; driver monitoring; engine operation tracking, and location tracking. A telematics communication system is bidirectional and the fixed-based module at headquarters can send information to the vehicle or driver. Examples include real-time traffic information, changes in vehicle routing, or detailed "last mile" instructions to help drivers find the best entrance or locate the correct loading dock in a large freight depot.

Many telematics functions have a cloud-based component. Fleet operators can send the information gathered from multiple units to the cloud as inputs to long-term programs such as business planning, predictive maintenance, and cost analysis.

### HOW DOES TELEMATICS BENEFIT Commercial fleet operators?

Telematics helps commercial fleet operators stay on the road and maximize the efficiency of their operations. A telematics system helps with regulatory compliance, vehicle health alerts, scheduling of routine maintenance, recall alerts, driver behavior analysis, and more. The white paper will review the features required for a telematics system designed for commercial fleet operation and the environmental and electrical requirements for connectors used in this application. Telematics is now an essential management tool for many commercial and government fleets and is being adopted in many non-transport industries.

Telematics offers many advantages for vehicle fleet operators:

#### **Maintenance Tracking**

A telematics system can provide data on engine operation, and issue real-time alerts about warning lights, scheduled maintenance, or even product recalls. Even when the ignition is off, the telematics system can unlock doors or initiate battery heating in cold conditions.

#### **Fuel Consumption Analysis**

Telematics can provide 24/7 monitoring of fuel consumption and fuel level to analyze fuel consumption, monitor idling time, detect theft or unauthorized use, and more. For EV/HEV fleets, telematics can offer the same capabilities by tracking energy use. Fleet operators can combine fuel and GPS location data to save time and resources through route optimization.

#### **Driver Monitoring**

Telematics can monitor driver habits such as seat belt use or speeding. A dash-mounted camera can monitor drivers for distracted or drowsy behavior and provide appropriate alerts.

#### **Environmental Monitoring**

Many cargoes are extremely sensitive to changes in their environment. Vaccines, for example, can become ineffective if temperature exceeds the safe value for even a short time. A telematics system can track and log conditions inside a temperature-controlled trailer to ensure the integrity of the cold chain, or provide alerts if humidity exceeds allowed levels.

### **Regulatory Compliance**

Federal safety regulations place limits on how commercial drivers spend their time, including stipulations for time on duty, time at the wheel, and break periods. The ELD Mandate that came into effect in 2017 requires commercial motor vehicle drivers to track their Record of Duty Status (RODS) electronically using a compliant Electronic Logging Device (ELD) that replaces paper logbooks. The ELD automatically records data on location, engine hours and vehicle miles and must remain mounted in a fixed position visible to the driver. The information must be available to officials during roadside inspections and safety audits.

#### **Theft Prevention**

Preventing the theft of vehicles and cargo is a primary concern of commercial fleet operators. Cargo theft is estimated to cost from \$15 billion to \$35 billion annually in the US, and telematics can be a powerful tool. Vehicle tracking via GPS is widely used, but telematics allows other options. Geofencing can create a virtual geographic boundary and trigger an alert when the vehicle enters or leaves a particular area. A vehicle access control system can send an alert when a vehicle door is opened or closed or only allow door operation at the warehouse or drop-off location; a concealed panic button can allow the driver to alert authorities; or the telematics system can immobilize the vehicle remotely once the thief has stopped the vehicle and turned off the ignition.



### **CONNECTOR REQUIREMENTS FOR TELEMATICS APPLICATIONS**

An OEM installation may be integrated into the vehicle wiring harness or use the existing vehicle network and built-in modem and have few, if any, connectors, but only newer-model vehicles offer modems with telematics capability. An aftermarket installation or standalone module will require an enclosure, cabling and connectors. A telematics system must be available 24/7 to collect and transmit real-time data. Connectors for telematics applications play an important role in system reliability. They must maintain a secure, reliable connection while operating in a harsh environment that includes extreme temperatures, shock, vibration, and the presence of liquids. In a fleet application, connectors can interface with the vehicle through its onboard diagnostics (OBDII) port or via another in-vehicle port such as Controller Area Network (CAN) bus. If the fleet uses older vehicles the telematics installation can use custom connectors or wire harnesses.

Inside the telematics system itself, there will be a printed circuit board (PCB) with multiple connectors to provide data and power connections to the internal systems within a vehicle. Connectors may be PCB mounted or chassis mounted and will connect to the PCB with a short cable. The connectors form an interface with the external environment, so rugged telematics connectors may be needed if environmental exposure poses a danger to system operation.





### **ENVIRONMENTAL STRESSES**

Telematics environments can impose severe operating stresses on equipment and are classified as harsh environment applications. Stresses may include one or more of the following: extreme hot or cold temperatures; shock and vibration; corrosion; dust or moisture intrusion, and more.

IP-rated connectors are highly recommended for telematics applications. Ingress Protection (IP) ratings are industry-standard classifications that signify the level of protection against solids and liquids.

The IP rating is defined by IEC standard 60529; the standard rates the resistance of enclosures, including connectors, against the intrusion of dust and liquids. The corresponding European Union (EU) standard is EN 60529. An IP rating has 2 digits after the IP: IP68, for example. The first digit refers to protection against intrusion from solids and the second digit refers to protection against intrusion from liquids.

Solid intrusion ratings range from 0 (no protection against intrusion) to 6 (complete protection against dust ingress). Liquid intrusion ratings range from 0 (no protection against intrusion) to 8 (protection against long-term immersion to a specific pressure).

Norcomp connectors for telematics applications have IP rating of IP67 or IP68. These connectors are sealed against dust intrusion, plus proception from heavy spray or short-term submersion.

## **ELECTRICAL STRESSES**

In-vehicle telematics applications must withstand the harsh automotive electrical environment. Electrical stresses include electrical noise, voltage spikes, and supply voltage variations, but most of these are the responsibility of the interface circuit design, using such components as input filters and galvanic isolation, and techniques to protect against overvoltage, reverse battery connection, and so on.

The primary protection afforded by the connector is EMI/RF shielding if this is a concern.



## **RECOMMENDED CONNECTORS**

There are no standardized connector requirements for telematics systems, but certain capabilities are often specified.

- Harsh environments are common.
- Depending on where a telematics system is deployed, the connector may need to accommodate both data and power connections in a single shell.
- A compact form factor is an advantage since many telematics systems must be installed in space-constrained locations such as under the hood of a vehicle.
- If vibration or shock are present, a robust coupling mechanism is a must for a connector to maintain connectivity in all conditions.

### **VULCON<sup>TM</sup> METRIC CIRCULAR CONNECTORS**



Figure 2: A selection of VULCON™ metric circular connectors (Source: NorComp)

The VULCON<sup>™</sup> connector family conforms to the long-established industry-standard form factor for circular connectors with a screw fitting. The VULCON<sup>™</sup> M-series connectors are IP67/ IP68 rated.

The VULCON<sup>™</sup> M12 circular connector has become a leader in telematics applications. VULCON<sup>™</sup> M12 connectors are now available in stainless-steel versions; these connectors provide upgraded corrosion resistance for the most rugged applications. M12 connectors are available in 3-pin, 4-pin, 5-pin, 6-pin, 8-pin, and 12-pin configurations with A, B, D,L, S, and X key coding options.

VULCON<sup>™</sup> M8 and M5 circular connectors are smaller more compact versions of the M12. M8 connectors are available in 3-pin, 4-pin, 5-pin, and 6-pin configurations with A or B key coding options. M5 connectors are recommended for telematics applications that require the most compact connector solution. M5 connectors are available in 2-pin, 3-pin, or 5-pin configurations.

## SEAL-D<sup>®</sup> WATERPROOF D-SUB CONNECTORS

The d-sub form factor is a versatile and popular choice in numerous industries. Norcomp offers two families of d-sub connectors with IP ratings for telematic and harsh-environment applications. SEAL-D<sup>®</sup> connectors are designed for telematics applications that require both the d-sub form factor plus IP67/IP68-rated protection.

The SEAL-D<sup>®</sup> family are drop-in replacements for standard unsealed connectors; this

eliminates the need to change PCB and sheet metal designs when upgrading to an IP-rated solution. They maintain the same footprint as the standard d-sub product offering but are sealed internally. NorComp's proprietary sealing technology allows any existing d-sub product to be manufactured in an IP-rated version.

SEAL-D<sup>®</sup> connectors are available in vertical and right-angle board mount types as well as solder cup for panel mount cable applications.

## NANOOK FLANGED WATERPROOF D-SUB CONNECTORS

NANOOK flanged waterproof d-sub connectors (figure 3) provide IP67-rated performance for telematics modules in standard, high-density, and mixed layout (Power-D) configurations. Standard density connectors can have up to 37 pins; high-density versions are offered with up to 62 pins. NANOOK connectors are reliable, cost effective, and operate over a -25°C to +85°C temperature range.

Figure 3: Standard density, high density, and Power-D Nanook connectors (Source: Norcomp)













### **POWER-D & COMBO-D MIXED D-SUB CONNECTORS**

Power D SEAL-D® connectors are designed for harsh environment telematics applications where both power & signal are required from a single connector. Featuring "Solid-Pin" machined contacts, these connectors offer high reliability performance for the most challenging design applications. The diverse product family features up to 12 industry-standard contact configurations. Features include:

- Signal/low power in 6 standard sizes (standard 9, 15, 24; high density 15, 26.44)
- Combo-D/high power in a variety of configurations (3W3, 5W1, 7W2, 9W4, 11W1, 13W3, 13W6, 17W2, 21W1, 21W4)
- Solder up, vertical mount, & right-angle board mount option
- High-reliability screw machined contacts
- 3 amp, 5 amp, 20 amp, and 40 amp power options
- -55 °C to +105 °C operating temperature range



### **QUIK-LOQ™ PUSH-PULL CONNECTORS**

Figure 4: QUIK-LOQ<sup>™</sup> push-pull connectors (Source: Norcomp)



(a) 820k



QUIK-LOQ<sup>™</sup> Circular Push-Pull Connector systems are rugged, sealed connectors ideal for telematics applications where quick connect / disconnect capability is required, such as cargo monitoring where the telematics equipment must be moved from one application to another. There are several families of QUIK-LOQ<sup>™</sup> connectors. Metal shell connectors are available with both IP67/IP68 ratings for harsh environments including telematics. Metal shell connectors feature 360° shielding for full EMI / RFI protection. Plastic shell connectors are also available.

### **CUSTOM HARNESS DESIGN FOR TELEMATIC SYSTEMS**

Telematics systems can be very diverse. To shorten the design cycle, suppliers now offer pre-made modules for sensors, cellular modems, actuators, and more. Using premade hardware blocks allows design engineers to focus on the telematics tasks that need to be accomplished. System designers can assemble a custom telematics solution from a wide range of standard modules.

This design methodology Is changing the market for connector suppliers. Once the designer has selected the modules for the application, the connector supplier provides the interconnects between the various modules, using appropriate wiring harnesses and mating connectors. The connectors must handle signal, data & power depending on application. The new approach raises the demands on suppliers in this market. They must now develop expertise in wiring, wiring harness manufacturing, and subsystem assembly in addition to their knowledge of connector design. The Norcomp engineering team has the expertise to develop custom wiring harnesses that provide connectivity solutions for a wide range of telematics configurations. Most of the connectors are designed for harsh environments and feature IP67/68 ratings.

#### **Recommended Resources**

The NorComp <u>website</u> has several resources for those wishing to learn more about the various types of connectors and recommendations for their use. Resources include: <u>Product Catalog</u> <u>Telematics Product Page</u> Telematics Capabilities Brochure

#### Conclusion

The telematics market is very diverse and offers numerous advantages for commercial fleet operators. The team at Norcomp has several connector families that are ideal for telematics applications due to their robust construction, mixed power and signal pin configurations, and IP67/68 ratings. Norcomp can also design custom wiring harnesses to meet the needs of the telematics market.





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