



The Belden Onboard Multimedia and Telematics Subsystem (OMTS) Network

Belden's complete onboard network for passenger rail

Solution Brief



Modern passenger rail is no longer defined by what moves the train. It is defined by what moves through it: high-definition video from dozens of cameras, synchronized announcements across every car, real-time information for every passenger and a constant feed of telemetry from doors, HVAC units and onboard sensors. All of that depends on one network that must be high-throughput, highly available, secure and rugged enough to live on a moving railcar for decades.

That network is the digital nervous system inside the train, handling every important non-driving task: video surveillance, passenger information, public address, intercom and operational telemetry.



»» Every modern passenger railcar needs an onboard multimedia network. Belden builds the whole thing, from the switch to the connector.

Table of contents

The shift to digital passenger rail	2
What a complete OMTS network requires	3
How Belden delivers	4
How operators deploy it	7
Why Belden? / Get in touch	8

The IEC 62580 standard defines it formally as the Onboard Multimedia and Telematics Subsystem, or OMTS. The Belden OMTS Network Solution is a complete, single-vendor approach to building it: switches, cables, connectors, cybersecurity and management software, sourced and supported as one solution.

For rolling stock OEMs, retrofit systems integrators and passenger rail operators, that means one network architecture, one supply chain and one partner accountable for the whole stack.



The shift to digital passenger rail

Operators, rolling stock OEMs and retrofit systems integrators across mass transit are absorbing a step change in onboard data. A single car now supports dozens of high-definition cameras, multi-language passenger information displays, IP-based public address and intercom, and a growing layer of operational telemetry from non-vital subsystems. Each of those services has different network requirements, and they all have to coexist on the same infrastructure.

> The pressure points are the same, over and over again

The shift is hardest on the network underneath all of it. Legacy onboard architectures (mixed-media designs with fragmented hardware from multiple vendors) were never sized for this volume of traffic, this many endpoints or this level of cybersecurity scrutiny. The same pressure points come up time and time again:

- **Bandwidth bottlenecks.** Projects that required 1 Gbps a few years ago now ask for 10 Gbps backbones to carry the aggregate of HD CCTV and IoT telemetry, with headroom to grow.
- **Expanded attack surface.** Passenger-accessible endpoints in the cabin (screens, intercoms, exposed ports) are physically accessible and create new entry points into the broader network.
- **Weight and size constraints.** Heavy traditional cabling drives up vehicle weight and complicates installation, and onboard equipment has to fit in tight spaces (ceiling voids, under seats, behind bulkheads) especially on light rail and tram vehicles.
- **Operational risk.** Dropped video frames, garbled public address audio or stalled passenger information displays during a service incident erode rider trust and create real safety exposure. Industry expectation has tightened to sub-50 millisecond recovery from a single network failure, fast enough that passengers and drivers never notice.

>>> The usual response is a stack of point products from multiple vendors stitched together by the integrator.

That works, but it leaves the operator owning the integration risk and the OEM coordinating multiple supply chains, certifications and warranty paths.



What a complete OMTS network requires

Across mass transit projects, the same requirements show up again and again. Here are the seven most common ones.

> Multi-gigabit performance

A non-blocking 1/10 Gbps backbone sized for HD video, real-time audio and telemetry on a fully loaded car.

> Heavy-duty Power over Ethernet

Budgets to power cameras, access points and intercoms over the data cable, with per-port control and remote power cycling.

> Quality of Service and IGMP

Strict prioritization so voice is never starved by a video burst; IGMP snooping to manage multicast.

> Rail-grade ruggedization

EN 50155 for shock, vibration and temperature; EN 45545 for fire safety; connectors that won't vibrate loose.

> Self-healing redundancy

Sub-50 ms recovery from a single link failure.

> Active cybersecurity

VLAN segmentation, port security and alignment with IEC 62443 for exposed cabin endpoints.

> Long product lifecycle

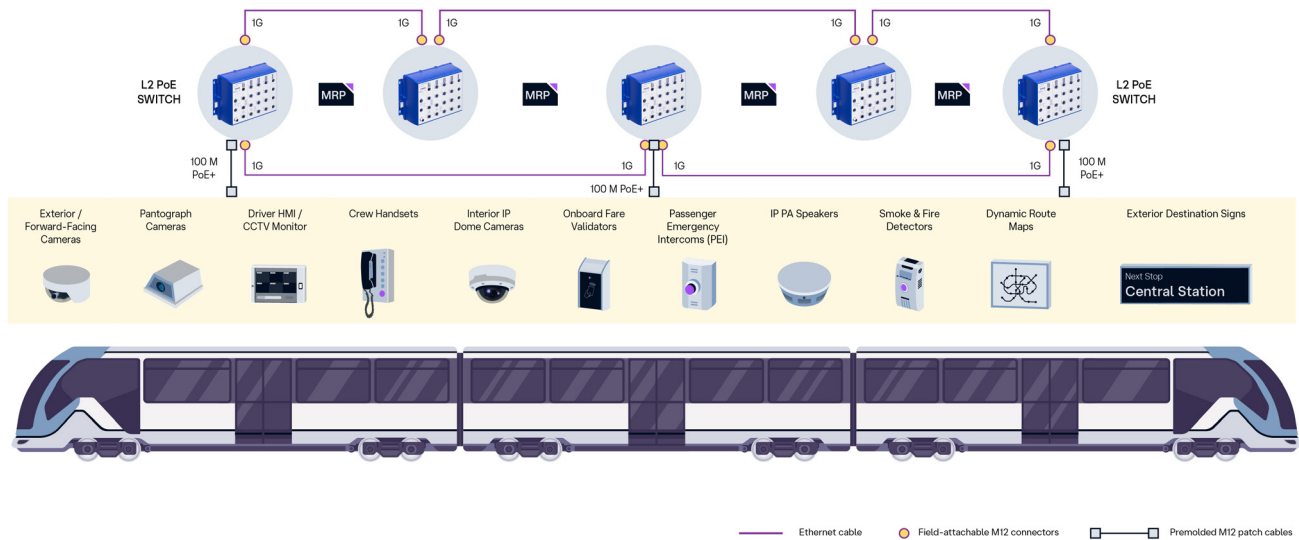
Availability, support and spares across the 20–30 year life of the vehicle.



How Belden delivers

The **Belden OMTS Network Solution** is built from three blocks: rugged managed switching, cabling and connectivity, and cybersecurity and management. Every component is built and certified for rail, and validated to work together.

> Every component is built and certified for rail



> Rugged managed switches

The right switch depends on where in the car it sits and what it has to power. Belden's onboard switch lineup covers three deployment patterns:

- **Belden OCTOPUS II** IP67-rated managed switches for compact, decentralized access. Mount directly to the chassis without a cabinet. Fast Ethernet to Gigabit at the edge for cameras, signs and sensors.
- **Belden OCTOPUS 3** full-Gigabit IP67 managed switches with PoE+, for cars where every edge port needs Gigabit throughput and onboard PoE.
- **Belden BXP** the rolling-stock workhorse for the 10 Gbps backbone, with high port density, PoE++ up to 120 W and seamless redundancy (HSR/PRP). Certified to **EN 50155**, **EN 50121** and **EN 45545**.

All three run Belden HiOS, the same managed-switch operating system across the family, so configuration, monitoring and security policies stay consistent end-to-end.



> Cabling and connectivity

This is where Belden's single-vendor story is strongest: Belden manufactures both the cable and the connector, which no other major networking vendor does.

Belden RailTuff™ Ethernet cables are engineered specifically for rolling stock, with cross-linked low-smoke zero-halogen jackets, electron-beam treatment for vibration and abrasion resistance, and variants from Cat 5e through Cat 7 to support every speed tier up to the 10 Gbps backbone.

Belden push-pull M12 connectors replace screw-types with a click-to-seal design that speeds installation and confirms an IP67-rated mate by feel.

Factory-assembled **molded M12 cordsets** are 100% factory-tested, sealed and strain-relieved, removing the variability of field termination and giving every connection the same day-one reliability. And with Belden's Reliable Connections in Motion solution, Belden works with your engineers during the design and production process to deliver bespoke, architecture-matched cables explicitly customized to the physical rolling stock layout.

> Cybersecurity and management

Belden HiOS managed-switch software and the **TBF-800V virtual firewall** work together to keep the OMTS network safe. HiOS provides VLAN segmentation, IEEE 802.1X port security and traffic prioritization across every switch in the lineup.

TBF-800V adds Layer 2 to Layer 4 protection with deep packet inspection for rail and industrial protocols, intrusion detection and prevention, and the policy enforcement needed to keep cabin-facing endpoints from becoming an entry point into the wider train network. **TBF-800V** is delivered as software and runs on the customer's choice of onboard compute platform.

Belden's enterprise NMS provides centralized network management for discovery, configuration, monitoring and diagnostics, both onboard and from the ground operations center.



How Belden delivers

For each common mass transit project requirement, Belden offers a practical approach and proven solutions to meet it.

> Belden OCTOPUS II, OCTOPUS 3 and BXP managed switches.

Rail-rated switches across the access layer (OCTOPUS II, OCTOPUS 3) and the 10 Gbps backbone (BXP).



> OCTOPUS 3 PoE+ and BXP PoE++

Intelligent power management, prioritization and remote power cycling reduce service calls.



> Belden HiOS managed switching

QoS, IGMP snooping and traffic shaping protect voice and control traffic from video bursts.



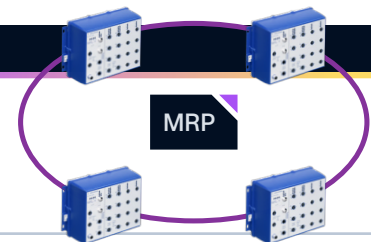
> RailTuff™ cables, push-pull M12 connectors and molded M12 cordsets

Certified to EN 50155, EN 45545 and IEC 61375 across the physical layer.



> Ring topology with MRP

Fast recovery, no single point of failure for the car network.



> TBF-800V virtual firewall and HiOS port security

Deep packet inspection, VLAN segmentation and IEEE 802.1X authentication.



> Belden rail portfolio and global support.

Long-lifecycle products backed by regional support teams.



How operators deploy it

There is no single right OMTS network architecture. The design depends on the vehicle, but the underlying building blocks are the same: rugged managed switches, RailTuff™ cables, push-pull M12 connectors and molded cordsets, HiOS managed-switch software and the TBF-800V virtual firewall. What changes is how those pieces come together. Three patterns cover most of the market.

> Light rail and trams



Space and weight are at a premium, with no room for large equipment racks.

The focus is exterior situational awareness, onboard ticketing and compact, decentralized switching mounted directly to the chassis. One European multi-operator consortium took this approach for a joint tram-vehicle procurement spanning multiple cities, each with different infrastructure requirements. By standardizing on a single Belden OMTS architecture across the fleet, the consortium replaced what would have been six separately engineered onboard networks with one, cutting custom engineering and approval overhead and giving every operator the same spare-parts inventory.

Each car runs **OCTOPUS managed switches** across the **OMTS layer**, and **ACA22-M12 autoconfiguration** adapters let technicians swap a switch in the field without specialized IT skills because the network identity moves with the cable. First vehicles entered service in late 2024.

> Metro and heavy rail



Dense urban service, often underground, shifts the focus to extreme security, high passenger density and video-centric traffic. These networks need high PoE budgets for dozens of interior cameras, resilient topologies so public address never fails during an underground incident, and the highest fire-safety ratings for enclosed tunnels. Belden **BCP switches** with **PoE++ budgets**, ring redundancy and **EN 45545-rated cabling** are sized for this profile.

> Mainline and high-speed rail



Long-distance service emphasizes long-term reliability and complex, multi-language passenger information synchronized across long consists. Belden's portfolio supports **high-budget PoE** for **advanced display controllers**, **crew intercoms across long trains** and the cabling and connectivity to keep it all certified and serviceable for the life of the vehicle.



Why Belden?

Belden is the one vendor that builds every layer of the OMTS network. The switches, the cables, the connectors, the cordsets, the management software and the security platform all come from the same supplier, validated to work together and certified to the same rail standards.

For rolling stock OEMs, that simplifies supply chain and certification. For retrofit systems integrators, it shortens design and approval cycles. For operators, it means one accountable partner across the 20 to 30 year life of the vehicle, with regional support that follows the program from architecture through commissioning and into service.

[Learn more](#) →



Get in touch

For the OMTS reference architecture, a sample bill of materials or an architecture consultation sized to a specific program, contact your Belden account manager or visit **belden.com**

»» Ready to address your specific needs,
requirements or pain points?

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