

# RAILWAY

## APPLICATIONS GUIDE

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POWER | PROTECT | CONNECT

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# OVERVIEW

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The importance of efficient mass transport has always been framed by the needs of society. Any country's transport system is a crucial and a strategically important long-term investment that must be capable of adapting to the changes in demands from commuters and commerce. Rolling stock and rail infrastructure are evolving at different rates; the former is free to adopt the latest technologies as long as it continues to conform to the physical dimensions of the latter. From steam to diesel through to electrification, rolling stock continues to evolve, delivering higher passenger comfort and convenience, from liberally distributed AC sockets and 5V DC smart device charging points, to ubiquitous high-speed WiFi.

Trains have become complex systems, comprising multiple sub-systems that must communicate efficiently and reliably with each other and the wider network. Operating in a harsh environment, rolling stock must endure prolonged exposure to extremes in temperature, humidity and vibration. As more stock becomes electrified, the electrical environment is also become extreme. Multiple power conversion stages support widely distributed busses that must comply with strict electro-magnetic emission and interference regulation. Cabling and interconnections are also exposed to these extremes while having to withstand the transient and surge voltages they carry.

Safety has become paramount in all forms of mass transit and in rail this takes the form of multiple interconnected systems that must work flawlessly. This includes conventional functions such as windshield wipers and defrosters, braking systems and traction control, to door control, climate control and collision warning. The use of more sophisticated sensors such as cameras and GPS positioning are also now fully integrated into safety systems, imposing a new level of reliability on to the supply chain.

Bel understands this environment and provides a wide range of products designed specifically to meet international standards for a global rail industry, for both rolling stock and trackside systems. As the pervading standard adopted by the rail industry, EN-50155 certification is a must-have for any solution targeting rolling stock, wayside and trackside applications.

In addition, national standards such as AREMA, RIA12, STM-E-001 and GOST must also be observed. Meeting the increasingly stringent requirements of the rail industry means suppliers must be committed to quality assurance at every stage of design, test and manufactures.



# PRODUCT OFFERINGS BY RAIL APPLICATIONS

	Accessibility	Driving Aid	Passenger Convenience	Power Electronics / Auxiliary Converters	Safety	Wayside
0RQB Series - Board Mount Power Rugged Converters	•	•	•	•	•	
RQB Series - Board Mount Power Rugged Converters	•	•	•	•	•	
RCM Series - Melcher Chassis Mount Converters	•	•	•	•	•	
Q Series - Melcher Cassettes	•		•		•	•
IMX Series - Melcher DC-DC Converters	•	•	•	•	•	•
PSx Series - Switching Regulators		•				
HP Series - Melcher DC-DC Cassettes		•	•	•	•	•
LBC Series - Enclosed High-Power Battery Chargers				•		
LR Series - Melcher AC-DC Converters						•
DIN-Rail (AC-DC or DC-DC)						•
Custom Power Supplies		•	•	•		•
SealJack™ IP67 USB Connector			•	•		
M12X Code Cable Assemblies					•	
MagJack® Integrated Connector Modules						•
DU Series - Power Transformers				•		•
PLC Communication (PLC) Modules					•	
PQDE6W-Q110, PRF20, VHB150R Series - Isolated DC-DC Converters	•	•	•	•	•	•

# ACCESSIBILITY

Designing rolling stock for passengers comes with requirements to include safe ways to embark and disembark that covers all abilities. Conventional door control systems have evolved from simple mechanical latches to complex pneumatic systems and, now, an almost complete adoption of electric drive. For less able passengers it is now necessary to include wheelchair lifts that can lift weights of around 400 kg, covering heights of 1 m or more.

Other aspects of accessibility extend to automated passenger count systems, which are now used for both safety and surveyance. Similarly, ticketing systems are moving towards more complex, contactless and wireless systems.



*Wheelchair Lift*



*Door Control*



*Ticket System*

## PRODUCTS USED

- Board Mount Power Rugged Converters
- Chassis Mount Converters
- Rugged Enclosure Systems



## DRIVING AID

Rail stock is benefiting greatly from advances in technology. This is clear from the addition of the driver systems that are now automated or improved. This includes the addition of rear-view cameras with monitors for the driver, but more recently the introduction of forward-looking systems that are able to detect potential hazards or obstacles, before the driver has seen them.

The demand for power in the driver's cab is increasing as more effective solutions to perennial problems are introduced.

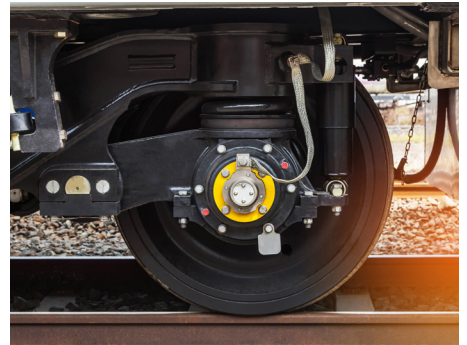
The driver's environment is also becoming more sophisticated, as more controls are added for features to help keep the rails in optimal condition. All of these systems require dependable power supplies.



*Headlights*



*Rearview Camera*



*Brakes*

Other Applications: Windshield Defroster, Windshield Wiper, Lubrication System, Sanding System, Driver Desk

## PRODUCTS USED

- Board Mount Power Rugged Converters
- Rugged Enclosure Systems
- DC-DC Chassis Mount Converters
- Switching Regulators
- SMT Resttable PTC Fuses  
(Chip Size: 1812, 1206, 1210, 2920, 2016)
- Surface Mount Fuses (Case Size: 1206, 0603)
- Radial Lead PTC Fuse (16 - 30 V, Slow burn)
- Glass Ceramic Fuse (5 x 15 mm)



# PASSENGER CONVENIENCE

Rail operators are now required to put passenger safety and convenience at the forefront of their efforts. This includes improving accessibility using moving ramps and platforms, offering barrier-free entrances and exits, and ensuring that passengers with limited mobility are not presented with challenging routes.

On-board, the changes continue. The use of passenger information displays is increasing, while our dependence on electronic devices and their need for power is also being acknowledge, through the introduction of customer power outlets. Passengers now also expect to have constant connectivity, typically through wireless access, which introduces further demands on operators.

This inevitably puts pressure on the systems that provide these passenger services. Meeting this demand requires the high reliability that comes with a trusted supplier.



*USB*



*Toilet System*

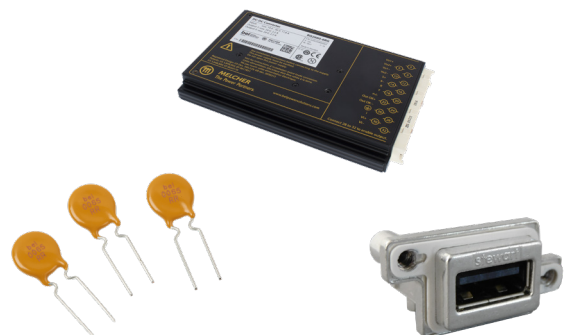


*Infotainment*

Other Applications: Onboard Bistro/Vending, Interior Illumination, Onboard WLAN, HVAC Systems, UMTS/LTE Repeater

## PRODUCTS USED

- IP67 SealJack USB Connector
- DC-DC Chassis Mount Converters
- Board Mount Power Rugged Converters
- Rugged Enclosure Systems
- SMT Resttable PTC Fuses  
(Chip Size: 1812, 1206, 1210, 2920, 2016)
- Surface Mount Fuses (Case Size: 1206, 0603)
- Radial Lead PTC Fuse (16 - 30 V, Slow burn)
- Glass Ceramic Fuse (5 x 15 mm)
- Custom Chokes



# POWER ELECTRONICS / AUXILIARY CONVERTERS

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Most electronic systems on a train are powered by an on-board battery, typically with a DC voltage of 110 V. This delivers a more reliable source of power that isn't dependent on the infrastructure or on-board generation.

These batteries will typically be charged at trackside or wayside using step-down conversion, as a result the solution chosen needs to be able to deliver the power and efficiency required by all rolling stock that it services.



*Pantograph*



*Battery Charging*



*Propulsion*

Other Applications: Propulsion, Auxiliary Converter, Pantograph, Main Switch

## PRODUCTS USED

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- Enclose High-Power Battery Charger
- DC-DC Chassis Mount Converters
- Board Mount Power Rugged Converters
- Rugged Enclosure Systems
- Power Fuses (500, 600, 1000 V, Fast blow)
- Power Transformers



# SAFETY

Safety is fundamental to any rail network. Today, the safety systems in place are highly sophisticated. Not only do they need to work passively, to keep passengers safe, but they need to function actively, to alert the driver if danger is present. These systems must also form part of the solution to address that danger. Increasingly, legislation requires these events to be recorded and analysed, in order to prevent recurrence. Ideally, some form of preventative measures will also be in place, to avoid the dangerous condition ever taking place.

Electronic systems provide these safety measures and are now commonplace in rail stock and infrastructure.



*Cab Radio*



*Fire Safety*



*Train Control*

Other Applications: Event Recorder, Collision Warning System, CCTV/Emergency System

## PRODUCTS USED

- Board Mount Power Rugged Converters
- DC-DC Chassis Mount Converters
- Rugged Enclosure Systems
- DC-DC Melcher® Rugged Cassettes
- IP67 Rated Connectors and Cable Assemblies
- Powerline Communication Modules





# WAYSIDE

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Rail waysides are evolving. They no longer simply provide support for rolling stock, they are increasingly responsible for monitoring the safety of the infrastructure and stock. The introduction of ubiquitous connectivity allows wayside equipment to now be monitorable from anywhere, leading to more responsive service. But this comes with its own demands, as the equipment involved now needs to be more reliable, as it takes on more responsibility for passenger safety.

As rail systems no regularly cross-country borders, there is also some pressure to make these systems more uniform and regulated. The development of preventative maintenance, enabled by pervasive internet connectivity, is also a force for change here.



*Level Crossing*



*Point Machine*



*Rail Signal*

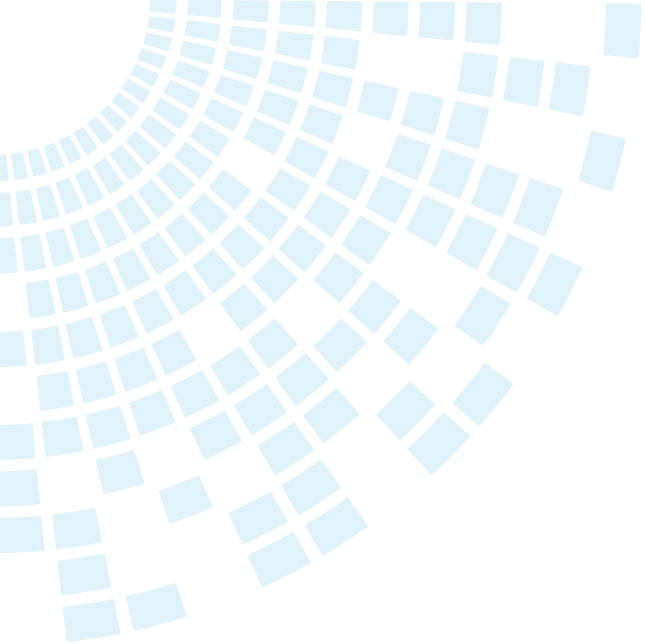
Other Applications: LTE Network, Level Crossing Barriers, Axle Counting, Balise, Computer Rooms

## PRODUCTS USED

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- AC-DC DIN Rail Power Supplies
- AC-DC / DC-DC Melcher® Rugged Cassettes Enclosed High-Power
- Board Mount Power Rugged Converters
- Power Shelves & Racks
- Powerline Modules
- Power Isolation Transformers
- MagJack® Integrated Connector Modules





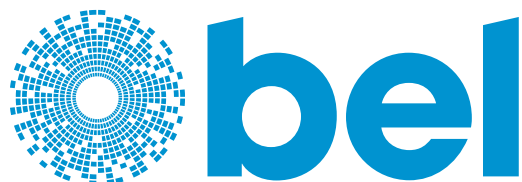
## About Bel

Bel and its groups are primarily engaged in the design, manufacture, and sale of products used in networking, telecommunications, high-speed data transmission, commercial aerospace, military, transportation, and consumer electronics.

Founded in 1949, Bel designs, manufactures and markets a broad array of products that power, protect and connect electronic circuits.

With over 65 years in the electronics industry, Bel has reliably demonstrated the ability to succeed in a variety of product areas across multiple industries. The company has a strong track record of technical innovation working with the engineering teams of market leaders.

Bel has consistently proven to be a valuable supplier to the foremost companies in its chosen industries by developing cost effective solutions for the challenges of new product development. By combining our strength in product design with our own specially designed manufacturing facilities, Bel has established itself as a formidable competitor on a global basis.



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**For more information,  
please contact us:**

**Bel Fuse Inc.**  
206 Van Vorst Street,  
Jersey City, NJ USA 07302

**Phone:**  
+1 201 432 0463  
[techhelp@belf.com](mailto:techhelp@belf.com)

[belfuse.com](http://belfuse.com)

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