MORNSUN Railway Power Supply Solutions

Every year, countries across the world are investing billions of dollars in high-speed railways. These evolving railways require power solutions that push the limits of technological innovation while still meeting railway standards. One example of the challenges and solutions found in railway power lies in the operation of sliding plug doors, an indispensable component in railroad and subway cars. However, power solutions are necessary for almost every facet of a railway system.

Challenges of Modern Railway Power

As Figure 1 illustrates, there are a wide array of systems in the rolling stock of a train that requires efficient, robust power components. From rather obvious applications, such as the integrated communication systems, to users that even regular riders might not be aware of, such as the axle temperature alarm system, a modern train cannot simply operate without power supply components that can handle aggressive environments, come in a wide range of input voltages, and are designed in such a way to promote the safety of both the electronic systems that interact together and the passengers that ride these trains daily.

TRAIN APPLICATION DISPLAY

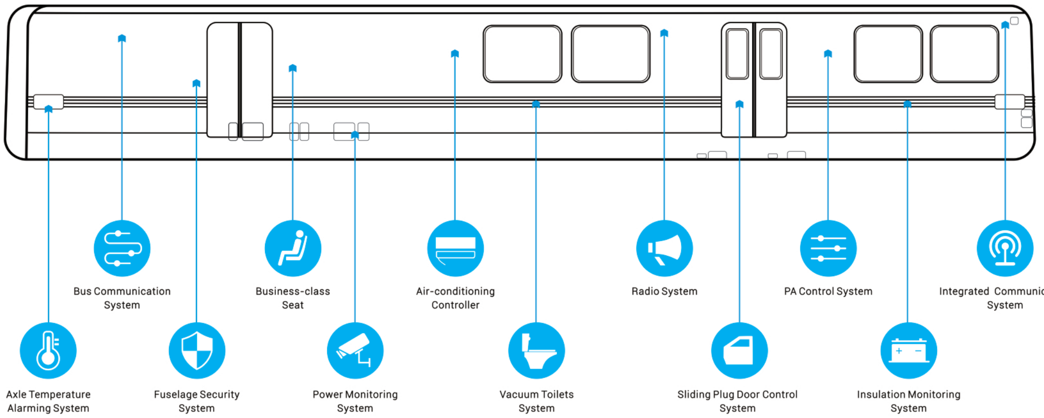
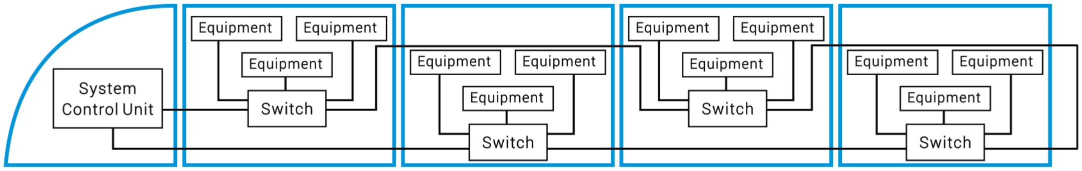


Figure 1.
Examples of train systems and applications that require EN50155 power components.

The EN50155 (Railway Applications - Electronic equipment used on rolling stock) is the industry performance standard within Europe and TB/T3021 covers the requirements for train-borne electronic systems in China. According to these standards, there are five critical design challenges of railway power that any solution must deal with: a wide input voltage range, electromagnetic compatibility (EMC), mechanical shock and vibration, temperature and humidity, and electrical isolation.

The input voltages must be compatible with different train-borne traction batteries: 24V, 28V, 36V, 48V, 72V, 96V, and 110V. EMC is critical because it involves potential electromagnetic interference between electrical and electronic systems, such as traction power and signalling. Any railway power solutions must also be able to perform an aggressive environment that involves vibration and sudden shock due to the motion of the train as well as extreme temperatures (on the order of -30°C to +60°C) and exposure to humidity (from an average of 75% to potential exposure to water). Isolation voltage helps to prevent damage to other components of an electrical system when one portion is under fault conditions. Figure 2 illustrates why such measures as isolation are necessary for the safe operation of the train.

Figure 2.
Simplified block diagram showing how the various systems and equipment are interrelated on a train.



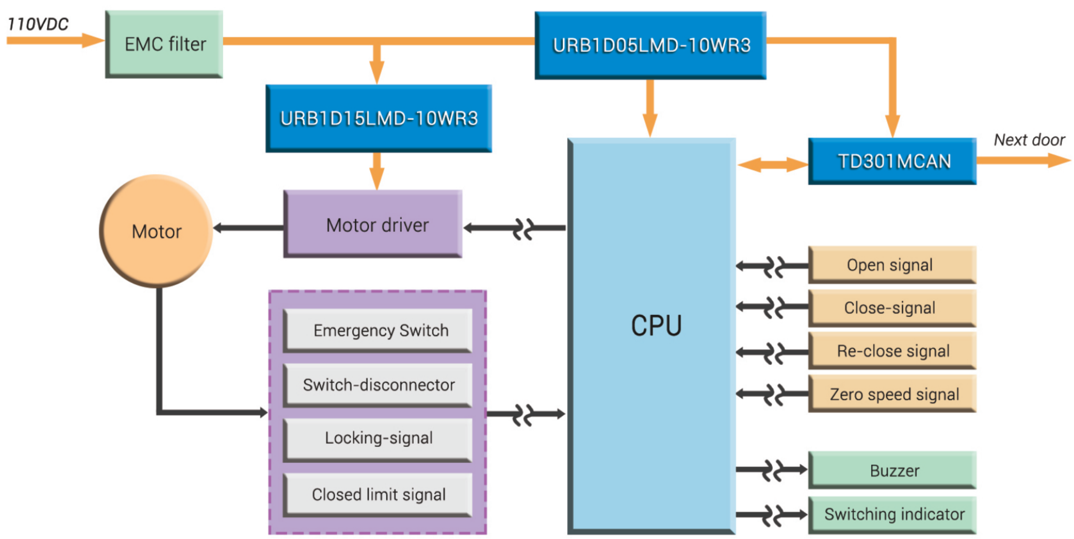
Sliding Plug Doors

An excellent case study involving the design challenges and solutions for railroad system power would be one that most railroad users are familiar with: the sliding plug door. Sliding plug doors have the panels parallel to and outside of the railroad car body when the door is in the open position. When the door is closed, the panels slide so that they remain parallel to the railroad car body. These door panels essentially seal (or plug) the doorway opening by taking advantage of the difference in pressure on opposite sides of the panel. The door panels on sliding plug doors are powered by an electric motor and gearbox and are controlled by a door control unit (or DCU).

Figure 3.
Typical sliding plug door on a railroad car.

DCUs are responsible for sending information about the status of the door (including safety monitoring data, emergency switch position, and other pertinent parameters) to the control cab. The control cab is responsible for issuing commands related to the opening and closing of sliding plug doors to the CPU of the DCU.

Figure 4.
Block diagram of a typical DCU (door control unit) for use with sliding plug doors on railroad cars.

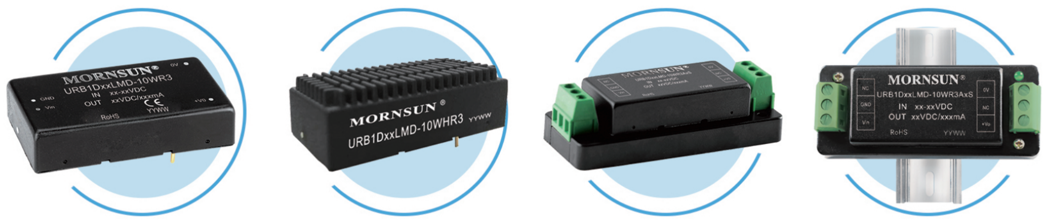


In Figure 4, the power supply for vehicle electronic equipment is 110VDC passing through an EMC filter. That 110VDC, in turn, must be supplied to the motor driver and the CPU while maintaining isolation between the CPU and the motor to ensure the electrical safety and common-mode interference protection capabilities. Therefore, the use of two DC-DC power converters is recommended. Figure 2 also shows the use of MORNSUN 10W railway power converters: the URB1D05LMD-10WR3 5VDC can be used to power the CPU and URB1D15LMD-10WR3 15VDC can be used to power the motor driver chip.

The URB1DxxLMD-10WR3 series of DC-DC converters is a 3rd-generation solution developed especially for the challenges of railway implementation, including shock and vibration, temperature extremes, high humidity, and other environmental limitations.

URB1DxxLMD-10WR3 DC-DC converters are an excellent choice for railroad power applications because they have been carefully designed in accordance to European standard EN50155, are suitable for 72V/96V/110V railway vehicle electronic equipment, meet the special requirement for isolation, and offer high efficiency (up to 85%). The converters in this series have 2250VDC isolation (with reinforced insulation) and 40-160VDC (4:1) ultra-wide input voltage.

These converters also offer multiple protections, including input under-voltage and output short-circuit, over-current, and over-voltage protection. The URB1DxxLMD-10WR3 series also has low ripple and noise.



Heat sink mounting | Chassis mounting | DIN-Rail mounting

Figure 5.
The MORNSUN URB1DxxLMD-10WR3 series of high-efficiency DC-DC converters.

These 10W isolated DC-DC converters come in an enclosed metal package with industry-standard pinouts. All MORNSUN DC-DC converters are fully potted with an insulating epoxy resin, which provides excellent immunity against the stresses found on all rolling stock in railway applications. They also offer excellent thermal performance and are extremely versatile in terms of what areas on a train they can be used, in part because of their operating temperature range of -40℃ to +85℃. This temperature range means MORNSUN's DC-DC converters can be used for anything from passenger cabs to external technical cabinets where they are exposed to outdoor temperatures and environmental challenges.

MORNSUN Provides Reliable Railway Power Solutions

At MORNSUN, we offer a large portfolio of products specifically designed to meet your railroad power needs, including applications as varied as powering PA systems, air conditioning controllers, business-class seat controllers, integrated communication systems, and monitoring systems. In addition, many of our products can be customized for your designs. Contact us today to find out what type of top-class solutions we can offer you.

