REALIZING SYSTEM SYNERGIES

Passenger Coaches

KNORR-BREMSE
They carry commuters into big cities, combine with other transport modes to open up entire regions, and link provincial train stations into the high-speed network. Regional trains have one of the most varied roles in the entire rail sector – and the demands made on their sub-systems are similarly diverse: They have to be compact, efficient and safe, but at the same time perfectly adapted to local conditions. With its decades of experience, carefully matched systems and service concepts that ensure optimum economy over the entire life cycle, Knorr-Bremse is the partner of choice.
**Passenger Coaches**

**Merak**
Our mission is to be the most respected partner for rail climate control solutions, through shared values, engineering experience, and global presence. Close customer cooperation, continuous improvement, and innovation have made Knorr-Bremse a world leader for heating, ventilation, and air conditioning (HVAC) systems, with >70,000 units in successful daily service.

**Microelettrica Scientifica**
Microelettrica Scientifica, based in Italy, has been developing and producing power switches, transducers and resistors dedicated to the most advanced applications of the rail vehicle industry and industrial applications for more than six decades. The company's high product quality results from continuous research, realized in close cooperation with its customers in order to precisely and punctually meet their needs.

**POWERTech**
Knorr-Bremse PowerTech is a specialist in advanced power supply systems for all types of rail vehicle. The brand’s mission is to ensure their availability and to use them as effectively as possible. Whether in rail vehicles, in industry or in research and development, its power supply systems operate efficiently and reliably and ensure that optimum use is made of energy.

**Selectron**
State-of-the-art rail vehicles can only be realized with advanced control technology. For many years, Selectron Systems AG has been successfully developing such solutions for the automation, networking, and control of rail vehicles. As Selectron is able to utilize the worldwide Knorr-Bremse sales and service network it can provide its customers with even better support at international level.

**The Perfect Combination of High-Quality Systems and Services**

**Knorr-Bremse**
Knorr-Bremse is the world’s leading manufacturer of braking systems for rail vehicles. The product portfolio also includes intelligent entrance systems, HVAC systems, auxiliary power supply systems, control components and windscreen wiper systems, platform screen doors, friction material, driver assistance systems, and control technology. As a technology leader through its products the company has been making a decisive contribution to greater efficiency, cost effectiveness and safety in the international rail business.

**IFE**
IFE is the leading manufacturer worldwide of automatic entrance systems for rail vehicles. The guiding principle “Success through Quality and Innovation” has marked the company’s development for more than 60 years. Today, external and internal doors, door control units and access devices are among the range of solutions offered. With the experience of an unparalleled 50,000,000 entrance systems delivered in the company’s history IFE continues to shape the industry.
BRAKE SYSTEMS

More than 110 years of experience have made Knorr-Bremse the world’s leading manufacturer of rail vehicle braking systems. The company’s skills are evident not just in the individual components it manufactures but also in their perfect interaction – the key to a braking system that meets the highest standards of functionality, reliability and safety. Building on both proven and innovative technologies, Knorr-Bremse works closely with customers to develop project-specific solutions from a single source with a carefully designed combination of electronic, pneumatic, mechanical and hydraulic components. A single, direct interface ensures cost-effective and resource-efficient integration into the overall vehicle system.

CUTTING-EDGE TECHNOLOGIES

BRAKE CONTROL / WHEEL SLIDE PROTECTION SYSTEM
Wheel slide protection systems provide shorter stopping distances even in extreme weather conditions and enable dramatic reduction of maintenance costs by avoiding wheel flats. Decades of experience and ongoing technical improvement enable Knorr-Bremse to offer state-of-the-art wheel slide protection. The full system comprises sensors, valves and an electronic control.

ADDITIONAL FEATURES: HIGH-PERFORMANCE MGS3
- Multi-mode switchover WSP control between low and extremely low adhesion for shorter stopping distances
- Higher pneumatic performance for shorter ventilation times
- eNozzle functionality: electronic adaption to different brake cylinder volumes for less commissioning effort
- Improved system control and diagnostics by pressure sensor integration

Multi-mode switchover during operation

MGS3: Multi-mode switchover WSP control for different track conditions
PRODUCTS FOR ALL STANDARDS
Knorr-Bremse is the partner of choice for passenger railroad car applications – with systems based on more than 110 years of development, production and practical field experience. With innovative, TSI-compliant solutions tailored to local requirements, all current global standards (UIC, AAR, GOST, Chinese Standard, ARA) and individual operating scenarios. And with a worldwide production and service network that meets even the strictest requirements for local content.

WORLDWIDE COMPETENCE IN PASSENGER COACH APPLICATIONS

SYSTEMS SOLUTIONS – BENEFITS FOR THE CUSTOMER
The more closely braking systems are networked with other rail vehicle sub-systems, the greater the benefit for the operator, as this reduces overall complexity by avoiding redundant infrastructure. For example the braking system’s vehicle weight sensors can be used by the HVAC system to adjust output when passenger density drops.
BRAKE SYSTEMS
PRODUCT RANGE

OIL-FREE COMPRESSOR 2.0
- No oil exchange, no disposal of used oil, no contaminated condensate to collect
- Specially optimized design to minimize noise and vibrations
- Cold starts without preheating, down to -50 °C

INTELLIGENT AIR DRYER
- Compact, lightweight modular design
- Diagnosis with continuous monitoring of air dryer condition
- Optimized closed-loop regeneration minimizes purge air losses
- Low noise emission

BRAKE PANEL
- Intelligent combination of pneumatic and electronic control
- Tailored to various customer requirements
- Optimized packaging, clear interface

MOTION CONTROLLER KIT
- Brake, traction and master controller
- Compatible with UIC standard
- Small, flexible installation space
- Robust modular design, proven application

WHEEL- AND AXLE-MOUNTED BRAKE DISC
- Standardized interface and fixation on wheel
- Resistant against thermal cracks due to movable friction disc
- Robust design with high protection against external shock and vibration

COMPACT BRAKE CALIPER
- Only one interface to bogie
- Highly modular design
- Optimized design regarding weight, assembly and costs
- Reduced maintenance

iCOM MONITOR
Monitors and analyzes the vehicle system and provides prognosis of services requirements.
- Online monitoring of vehicle and component status
- Preventive maintenance to increase vehicle availability and optimizing maintenance and utilization costs

AUXILIARIES

BOGIE EQUIPMENT

AIR SUPPLY

BRAKE CONTROL

KNORR-BREMSE
WINDSCREEN WIPER AND WASH SYSTEMS
- Maximum lifetime of the electric driving units
- Optimized availability via optional emergency unit
- Maximum flexibility of functionalities (e.g., middle parking position)

SANDING
- Modular design delivers a wide range of systems
- Optimal performance with low weight and installation space
- Low life-cycle costs

PASSENGER ALARM AND PASSENGER EMERGENCY OVERRIDE SYSTEM
- Compatible with UIC standards UIC 541-5 and UIC 541-6
- Complete set of components available

MODULAR MAGNETIC TRACK BRAKE CONTROL
- Permanent detection of cable break
- Monitoring of the differential and minimum current
- Various options for installation

FRICTION MATERIAL
- Organic brake pads up to 200 km/h
- Compatible with UIC standard
- Robust design, proven application

MAGNETIC TRACK BRAKE
- Modular standard solutions
- Robust and proven design
- Wear-optimized pole shoes available
ENTRANCE SYSTEMS

Increasing requirements in meeting train schedules and higher comfort expectations of passengers are some of the new challenges the manufacturers of entrance systems are faced with. Notwithstanding this, safety, reliability and availability of entrance systems remain the key priorities. At the same time improvements for ease of use by persons with reduced mobility are requested.

As global leader in entrance systems for passenger coaches and for pressure-sealed entrance systems for high-speed trains, we cover the complete range of market requirements with our sliding plug doors E3 and DET from 600 to 1600 mm entrance width. The offering is complemented by a variety of door leaf types and access devices such as sliding or movable step systems. Further development is not only driven by technical and functional excellence but also by long-term economic considerations. Our products are characterized by a particularly low-maintenance and easy-to-install design featuring the lowest life cycle costs.

IFE is globally known as a reliable partner for the supply of entrance systems. The range of offered services, however, goes far beyond this area and furthermore includes installation, commissioning as well as maintenance over the whole product life of our door systems, including spare parts management.

CUTTING-EDGE TECHNOLOGIES

ENTRANCE SYSTEM E3H-RIC
The E3H-RIC convinces with its rugged design, which enables it to be combined even with wide and heavy door leaves. Its ability to be installed within the door frame opening and its compact dimensions allow for its use in all types of vehicles and available spaces. There is a purely mechanical activation of the optional folding step.

ADVANTAGES
- Entrance widths up to 1600 mm
- Robust telescopic guiding system
- Lubrication-free spindle drive
- One single motor for door, step and lock
- Easy to install

SYSTEMS SOLUTIONS – BENEFITS FOR THE CUSTOMER
The more closely entrance systems are networked with other rail vehicle sub-systems, the greater the benefit for the vehicle builder, as a well-designed solution can enable data from adjoining systems to be used. For example sub-systems can 'share' information on the train’s speed to ensure that the doors only open once the train has come to a complete standstill in a station.
PRODUCT RANGE

DET-H DOOR DRIVE (HYBRID SYSTEM):
- ELECTRIC DRIVE, PNEUMATIC LOCKING DEVICE
  - Dirt-resistant guiding system
  - Lubrication-free spindle drive
  - Highest safety level
  - Top-selling pressure-sealed door system worldwide
  - In operation up to 380 km/h

DET-E DOOR DRIVE (ALL-ELECTRIC SYSTEM):
- ELECTRIC DRIVE AND LOCKING SYSTEM
  - Dirt-resistant guiding system
  - Lubrication-free spindle drive
  - Increased level of reliability compared to a hybrid system
  - Highest safety level
  - Highest degree of versatility of pressure-sealed door systems worldwide

E3H-RIC DOOR DRIVE
- Entrance widths up to 1400 mm
- Robust telescopic guiding system
- Lubrication-free spindle drive
- One single motor for door, step and lock
- Easy to install

E3D DOOR DRIVE
- Entrance widths up to 1600 mm
- Robust telescopic guiding system
- Four active locks
- Modular construction
- One single motor for door and lock

X4 SLIDING STEP
- Reduced installation height of 50 mm
- Jamming-free 3-point guiding system
- Tolerant to torsion of the vehicle
- Maintenance- and adjustment-free locking module
- Rugged design, not affected by dirt, corrosion or by ice and snow

FOLDING STEP
- Low installation measures
- Easy construction
- Robust against dirt and corrosion
- Direct connection to the door drive

SWIVELLING STEP
- Extends to a fixed distance due to its kinematics
- Various kinematic solutions can be adapted to the specific needs of a project
- Proven for decades
HVAC SYSTEMS

HEATING, VENTILATION AND AIR-CONDITIONING

Passengers expect the rail sector to steadily improve levels of comfort. Noise and vibration are increasingly regarded as sources of irritation, and a properly air-conditioned interior is taken for granted. Merak HVAC systems ensure the right level of comfort for all passengers, whether they are commuters on urban metro trains operating in tropical conditions, or long-distance travellers in the arctic winter. Project-specific application of service-proven technologies means that systems can be flexibly configured for all rail vehicle types and operating environments, and always deliver the right performance with low weight, noise, and energy consumption. Available as roof-mounted, floor-level, or under-floor units, for driver’s cabs or passenger cars, for newly-built vehicles or modernizations, Merak HVAC systems are in operation in all parts of the world – with local teams ensuring seamless service, every day.

PRODUCT RANGE

VERTICALLY INSTALLED HVAC UNIT
- Stainless steel frame
- Capable of operating at extreme ambient temperatures of -40° / + 40°
- Adjustable load management by optimizing the balance of fresh air based on external conditions, passenger load and CO₂
- Compliant with GOST requirements
- Air sterilisation by ultraviolet germicidal irradiation

ROOF-MOUNTED HVAC UNIT
- Stainless steel frame
- Designed for performance in high ambient temperatures of up to 45 °C
- Compact fresh air intake design to avoid water entering
- Redundant electrical control system
- Fault visualization management in display unit

UNDER-FRAME MOUNTED HVAC UNIT
- Stainless steel frame
- Designed according to BS6853
- Adjustable load management by optimizing the balance of fresh air based on external conditions, passenger load and CO₂
- Specific design following GRM 2100 structural shock FEM calculation
- Air distribution and comfort design & CFD at coach level

ROOF-MOUNTED HVAC UNIT FOR DOUBLE DECK TRAINS
- Roof-integrated system with 2 independent circuits
- 3 independent supply air outlets and integrated exhaust
- Adaptable cross-section according to requested gauge, high-voltage/low-voltage heating, available for high-speed operation
- Adjustable load management by optimizing the balance of fresh air based on external conditions, passenger load and CO₂
- Excellent energy efficiency with stepless adjustable airflow for evaporator and exhaust motors as well as exhaust energy recovery system
SYSTEMS SOLUTIONS – BENEFITS FOR THE CUSTOMER
The more closely an HVAC system is networked with other rail vehicle sub-systems, the greater the benefit for the vehicle builder, as this enables it to respond intelligently to the other systems’ current operating status. For example the HVAC unit can be immediately shut down if a fire sprinkler is triggered, instead of continuing to blow air into the interior of the train.
POWER SUPPLY

As the number of different energy consumers on rail vehicles increases in line with growing comfort and safety expectations, the power supply system is assuming an increasingly central role. The PowerTech brand brings together Knorr-Bremse’s full range of expertise in power converters and electrical equipment for rail vehicles, power generation and storage, engine and transmission test benches and research applications. From tailor-made control and regulation solutions to real and simulated test runs, we cover today’s professional energy conversion requirements for all performance categories and train types – including a service network on every continent.

PRODUCT RANGE

BATTERY CHARGER
- Battery protection by special charging characteristic and temperature compensation
- Compact and rugged design, IP65 degree of protection
- High efficiency rate up to 92%
- Temperature range –25 °C to +45 °C
- 19” enclosure, free positioning in car possible
- Advanced technology, service-proven in many projects all over the world
- Lightweight and compact design

HVAC INVERTER
- Inverter for HVAC compressor supply
- Compact design
- Optimized mechanical concept
- Cooled by natural convection
- VVVF operation for motor management

SYSTEMS SOLUTIONS – BENEFITS FOR THE CUSTOMER

The more closely power supply systems are networked with other rail vehicle sub-systems, the greater the benefit for the vehicle operator. For example a smart air supply unit could adjust compressor performance when the train enters a station, thereby reducing noise emissions.
POWER SUPPLY

Resistors enable safe, controlled braking to take place, contactors connect and disconnect circuits under load, and disconnectors change the configuration of the traction circuit when the catenary voltage changes. High-voltage metering transducers provide reliable data for the vehicle logic, drive control and many other measuring devices. Systems like these are often invisible to the outside world but are essential for the proper functioning of a modern vehicle. And however diverse their tasks, such control components have one thing in common: There can be no compromises in terms of safety. Microeletrica Scientifica’s cutting-edge solutions have met this requirement for more than 50 years, and today the company is a global market leader in electrical and electromechanical control components for rail applications.

CUTTING-EDGE TECHNOLOGIES

LTSS CONTACTOR FOR CONTROL OF HEATING RESISTORS

- Solid-state contactor
- Maintenance-free
- Virtually infinite life endurance, even in demanding application with high switching frequency
- Compact design

SYSTEMS SOLUTIONS – BENEFITS FOR THE CUSTOMER

The more closely power supply systems are networked with other rail vehicle sub-systems, the greater the benefit for the vehicle operator. For example a smart air supply unit could adjust compressor performance when the train enters a station, thereby reducing noise emissions.
PRODUCT RANGE

BATTERY SWITCH
- 2 poles
- 2 stable positions, for saving energy when closed
- Suitable for low voltages, but high currents
- Compact design

HEATING CONTACTORS
- Up to 4 kV voltage rating
- Conceived for high switching frequency

AUXILIARY-CONVERTER LINE AND PRE-CHARGING CONTACTOR
- For AC and DC voltage systems
- Up to 4 kV voltage rating
- Available in 1-, 2-, 3-pole versions
- Standardized base design, with possibility of high customization levels
CONNECTED SYSTEMS

Modern rail vehicles are highly complex systems incorporating braking, door and HVAC systems as well as traction, lighting and power supply components. They also carry a wide range of display units for vehicle diagnostics, passenger information and safety alerts. The train control management system (TCMS) links all these functions into a single, intelligent system that offers maximum precision, safety and reliability. This is where Selectron Systems AG comes in – the market leader in rail vehicle control technology and automation. Selectron's comprehensive product portfolio includes freely programmable control units, central and distributed remote I/O systems and train setup components. At the heart of the systems is an EN 50155-compliant family of control systems.

SYSTEMS SOLUTIONS – BENEFITS FOR THE CUSTOMER

The more closely a rail vehicle’s sub-systems are networked with each other, the greater the benefit for the vehicle builder and operator. For example cross-system diagnostics can make individual service tools superfluous. Cutting-edge control technology from Selectron Systems AG provides the perfect basis for this.
CUTTING-EDGE TECHNOLOGIES

SMARTIO
The smart remote I/O system ("Smartio") simplifies the complexity of the wiring in the body of the vehicle, in the cabinet, and in the driver's desk allowing a lean design, savings on installation and service time, and is extremely space-saving and easy to install. It can be flexibly expanded for all applications and is, therefore, a "just enough" solution.

PRODUCT RANGE

ROUTER/SWITCH
The new switches and routers provide flexible network architectures and meet the new TCN standard IEC 61375. Configuration of individual devices within the network is carried out across the trains from one data access point. Application development, commissioning, and service are simplified.

MAS 835
The MAS 83x family of controllers has been generically designed and can be used, for example, as a safe vehicle control unit or as a safe monitoring unit. The processing unit has high performance, is flexibly expandable, and easy to program. Variations from SIL0 up to SIL2 are available. The generic certificate for safe applications simplifies vehicle registration.

HMI
The HMI portfolio includes display sizes from 8.4" up to 12.1". The units are available as both SIL0 and SIL2 versions. The high processing power allows, among other things, multichannel video streaming over Ethernet; the display is particularly bright. The simple and intuitive graphical programming interface reduces development and commissioning times.
A reliable service partner – over the entire life cycle. All train operators are unique – and their servicing requirements for braking and on-board systems are also highly specific. But they have one thing in common: They depend on their vehicles remaining operational at all times and in all places. The mission of our RailServices brand is to ensure that this happens – for all Knorr-Bremse subsystems and over the vehicle’s entire life cycle.

The extended RailServices portfolio includes comprehensive service and support for all our products and systems, including vehicle maintenance.

- Worldwide Service Center close to the customer
- Highest quality of maintenance via standardized production system
- RailServices standards for services and maintenance for on-train and off-train operations
- Field service and training
- Innovative component upgrades and systems modernization for existing fleets
- Service life extended and its life-cycle costs reduced
- Maintenance of rail vehicles ranging from commissioning to overhaul as well as light maintenance and repair campaigns.
- Original quality parts over the entire life cycle
- Parts management
- Supply chain premium services
- iCOM serving as a platform for applications that require a connection to the wayside to enable digital solutions
- Upgrade of trains with Knorr-Bremse components from the one source
Products and services creating genuine added value in line with ongoing changes in the rail sector – RailServices is further developing its range of services.

**Service Centers – always close to the customer**
Excellent service calls for rapid reaction times. With 30 service centers in all continents, our RailServices specialists are close at hand when local customers need them. The first European Rail Services sites already fulfill the requirements of European Regulation (EU) no. 445/2011 for freight wagons.

**Modernization – customer-specific solutions breathe new life into existing vehicles**
RailServices provides innovative component upgrades and systems modernization for existing fleets. We offer attractive system solutions worldwide for rail vehicles of all ages. Modernization is delivered by RailServices specialists with expertise and above all, passion. It is our ongoing commitment to your operational needs and to continued product innovation that makes modernization projects a realistic and affordable option for our customers.

**iCOM – digitalization on board**
iCOM ushers in a new era in vehicle servicing. This retrofittable system extends rail vehicle diagnostics to cover not just specific systems but whole vehicles. By introducing tablets, smartphones and apps to the railroad sector, it offers unique access to data on the condition of the entire vehicle fleet. Sophisticated measurement and analysis processes combine with automatic diagnostics to enable iCOM to predict maintenance requirements in advance – allowing operators to take measures pro-actively. This powerful and flexible system already supports additional applications such as driver advisory systems and energy metering as well as third-party products due to the open architecture.