High-Speed Trains

REALIZING SYSTEM SYNERGIES
Today’s high-speed trains travel at speeds that would have been regarded as impossible a few years ago. Operating at up to 350 km/h, they are developing into serious competitors for air travel in many markets. But where such high speeds are involved, there can be no compromises. On the basis of tried-and-tested technologies, Knorr-Bremse develops innovative solutions for the high-speed sector that ensure maximum safety, outstanding reliability and excellent levels of economy. From project planning to assembly and installation – and a broad range of aftermarket services – vehicle builders can receive everything from a single source.
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 windshield 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.

The Perfect Combination of High-Quality Systems and Services

Knorr-Bremse

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.
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

BOGIE EQUIPMENT | ISOBAR600
The ISOBAR600 is the answer to the demands for a modern brake pad. Due to its unique design, it provides outstanding performance for high-energy applications. The perfect combination is to use the ISOBAR600 with the Knorr-Bremse axle-mounted brake disc or the new wheel-mounted brake disc. This offers the opportunity of reducing the overall volume of brake equipment, resulting in savings of weight and energy consumption during the operation of the vehicle. The ISOBAR600 is designed to support aspects of sustainability: Noise emissions are reduced, and the pad is fully recyclable. Reduced wear characteristics allow an extension of exchange intervals, with significant advantages in terms of operating costs.

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 redundant infrastructure and creates additional benefit through new cross-system functions. For example the braking system’s vehicle weight sensors can be used by the HVAC system to adjust output when passenger density drops.
PRODUCTS FOR ALL STANDARDS

Knorr-Bremse is the partner of choice for high-speed 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 and individual operating scenarios. And with a worldwide production and service network that meets even the strictest requirements for local content.

WORLDWIDE COMPETENCE IN HIGH SPEED APPLICATIONS
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

SCREW COMPRESSOR
- Special design to cope with tough rail operational conditions
- Low compressor noise level
- Low vibration

EP COMPACT
- Flexible brake control platform
- Central and distributed control
- Compact design
- Continuous pneumatic load correction
- Full set of auxiliary functions
- CENELEC and TSI compliant

MODULAR BRAKE CONTROL
- Intelligent combination of pneumatic and electronic control
- Intelligent blending and brake management
- Modular and suitable for various customer requirements
- CENELEC and TSI compliant

Screw Compressor
- Special design to cope with tough rail operational conditions
- Low compressor noise level
- Low vibration

WHEEL-MOUNTED BRAKE DISC
- Robust design with high protection against external shock and vibration for long service life
- Different materials for cost-efficient solutions for all kinds of applications available
- Service-proven on high-speed trains with regular service speeds of 350 kph
- Energy-efficient design due to low ventilation losses

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

SANDING SYSTEMS
- Purely pneumatic sand dosing principle, no abrasion
- Separation of sand dosing and sand conveying functions
- Highest accuracy
- Optionally integrated heating and drying functions

WINDSCREEN WIPER AND WASH SYSTEMS
- Pneumatic system with electric control and diagnosis
- Highest system availability through emergency operating unit
- Based on more than 20 years of experience in high-speed/very high-speed train wiper systems
**COMPLETE AIR SUPPLY UNITS**
- Compact, light, highly reliable
- Developed especially for installation beneath the frame
- All components to be maintained can be accessed through a maintenance port

**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

**SYSTEMS FOR BOGIE MONITORING (e.g. COMORAN®)**
- Derailment detection
- Fulfills TSI requirements
- Condition monitoring

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

**ISOBAR600**
- Sinter pad for high-energy applications
- Outstanding performance
- Long disc life due to even temperature distribution on brake disc
- Temperature-resistant with constant friction behavior
- Increased wear volume
- Fully recyclable

**EDDY CURRENT BRAKE**
- Brake force does not depend on friction coefficient
- Constant brake force even for high-speed applications
- Significant wear reduction on brake discs and brake pads

**iCOM**
- iCOM transfers the mobile device philosophy to the railway industry:
  - Condition Based Maintenance (iCOM Monitor)
  - Driver Advisory System (iCOM Assist)
  - Energy Metering (iCOM Meter)
    - One common back office
    - Addition of functions via apps
    - Open system platform and architecture
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 the 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 characterised 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 E3D
The only pressure-sealed entrance system on the market with a door leaf size of more than 1200 mm. The E3D convinces through robust design, which can be combined with wide and heavy door leaves and is pressure-sealed for large entrance widths of up to 1600 mm. The four over dead centre locks guarantee pressure-sealing for pressures of up to 8000 Pa at 1600 mm width, even once they are taken out of service.

ADVANTAGES
- Pressure-sealed for entrance widths up to 1600 mm
- Robust telescopic guiding system
- Four active locks
- Modular construction
- One single motor for door and lock

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 1600 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

SWIVELING 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
- Optional weight detection

ACCESS DEVICES

SLIDING PLUG DOOR
SINGLE-LEAF – OUTSIDE
THE DOOR PORTAL

PRODUCTION RANGE

RAIL VEHICLE SYSTEMS

HIGH-SPEED TRAINS

PRODUCTION RANGE

RAIL VEHICLE SYSTEMS

HIGH-SPEED TRAINS
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.

CUTTING-EDGE TECHNOLOGIES

ROOF-INTEGRATED HVAC SYSTEM
- Roof-integrated HVAC system with integrated pressure-wave protection
- 2 independent units for the saloon area provide full redundancy and even back-up for the cab
- Adjustable load management by optimizing the balance of fresh air based on external conditions, passenger load and CO₂
- Condition Based Maintenance (CBM) Diagnosis System permits easy and cost-optimized maintenance

ROOF-MOUNTED HVAC SYSTEM WITH SAND FILTRATION
- Dual refrigerant circuits for redundancy, capacity control and energy optimization
- Designed for operation in desert conditions at extreme ambient conditions of up to 55 °C
- Adjustable load management by optimizing the balance of fresh air based on external conditions, passenger load and CO₂
- Control panel and controller are installed outside of the HVAC unit for easy access
- Sand filtration system with self-cleaning mechanism specifically designed for desert and dusty environments, responding to the need for cleaner air with optimum maintenance cost
PRODUCT RANGE

ROOF MOUNTED HVAC UNIT

SALOON
- Dual refrigerant circuits for redundancy, capacity control and energy optimization
- Designed for operation at ambient temperatures from -40°C up to +40°C
- Control panel and controller are installed outside of the HVAC unit for easy access
- Integrated fairings for aerodynamics
- Air sterilisation by ultraviolet germicidal irradiation

CABIN
- Split HVAC system with evaporator in ceiling and condenser in the underframe area
- Designed for operation at ambient temperatures from -40°C up to +40°C
- Control panel and controller are installed outside of the HVAC unit for easy access

HVAC UNIT FOR DOUBLE-DECKER HIGH-SPEED TRAINS
- HVAC unit mounted inside the car body
- Dual refrigerant circuits for redundancy, capacity control and energy optimization
- Four different VAC modules guarantee ambient conditions for both passenger levels and the cafeteria car
- The control panel and controller are installed outside of the HVAC unit for easy access
- Energy-efficient system with adjustable condenser airflow
- Eco Mode allows operation in ventilation mode only, when trains are at the depot
- Incorporates pressure-wave protection 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 and operator, as this enables intelligent response to the other systems’ current operating status. For example the HVAC unit can be immediately shut down if a fire alarm is triggered, instead of continuing to blow air into the vehicle.
POWER SUPPLY

As the number of different energy consumers in 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. 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
- Stand-alone battery charger
- Low noise thanks to continuously speed-controlled fan
- Communication with the train via CAN (optional MVB or IP bus)
- Expanded input voltage range
- Lightweight and compact design thanks to medium-frequency electrical isolation
- Easy maintenance due to modular 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.
Brake resistors enable safe, controlled deceleration, preserving friction brakes; contactors switch on and off electric circuits under load; disconnectors change the configuration of the traction circuit adapting it to different catenary voltage levels; energy metering transducers provide reliable data for the energy consumption calculation, for the vehicle logic, drive control and for 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 are, such control components have one thing in common: There can be no compromises in terms of safety. Microelettrica 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

ENERGY METERING SYSTEM
- System compliant with EN50463, for railway interoperability
- Complete energy metering solution, including: AC/DC voltage and current transducer, DHS (data handling system) and DCS (data collection system)
- The voltage and current transducer, for installation on the roof of the train, features a very compact design, integrating all measuring functions in a single device, both for AC and DC systems
- Thanks to an Ethernet-based communication architecture, the different components of the system can be installed in various train locations and interact with other systems

BRAKING RESISTOR WITH FLAT DESIGN AND LOW-NOISE MOTOR FANS
- Roof mounted braking resistor, totally integrated in the roof of the train
- Low height, thanks to the small diameter of the motor fans
- State-of-the art motor fans generate extremely low noise, despite their small size and the very high air pressure

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

**LINE CONTACTORS**
- For AC and DC voltage systems
- Up to 4 kV voltage rating
- 1-, 2-, 3-pole versions
- Different power terminal positions

**DC HIGH-SPEED CIRCUIT BREAKER**
- Up to 4 kV voltage rating
- Thermal current up to 4 kA
- Vertical and horizontal versions
- Enclosures for underframe or on-the-roof installation
- Extremely compact design

**PRE-CHARGING SYSTEM**
- AC/DC pre-charge contactor
- Pre-charge resistor, with customizable resistance level, 1 to 100 ohm
- Up to 4 kV voltage rating

**SYSTEM CHANGE-OVER DISCONNECTOR**
- For multi-voltage platforms
- Bistable, for very low power consumption
- Up to 4 kV voltage rating
- 1 to 4-pole versions, with different power terminal positions

**BRAKING RESISTOR**
- Naturally or ventilator-cooled
- Custom-designed resistance value and cooling pattern
- Custom-designed interfaces

**TRACTION MOTOR BLOWER**
- Centrifugal or centraxial design
- Very high pressure
- Highly customizable
- High resistance to corrosion

**TRACTION CONVERTER COOLING FAN**
- Centrifugal, centraxial or axial design
- Very wide range of fans, with flexible design
- High resistance to corrosion

**ENERGY METERING**
- AC/DC transducer, compliant to EN50463 standard for energy billing
- On-board data transmission system, with Ethernet interfaces
- Software for energy data analysis available
- Suitable for new vehicles, or for overhaul projects
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.
SERVICE

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.