Regional and Commuter Trains

REALIZING SYSTEM SYNERGIES
They carry commuters into big cities 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.
Regional and Commuter Trains

Mercak
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.

Microeletrica Scientifica
Microeletrica 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 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.

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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.

**BRAKE SYSTEMS**

**AIR SUPPLY | OIL-FREE COMPRESSOR 2.0**
- Environmentally friendly design
- Designed for railroad applications
- Continuously improved product based on long-term worldwide experience
- Less complex system with fewer interfaces than conventional compressor systems
- Robust design for underfloor mounting conditions as well as for standing installation, roof-mounted or interior

**BRAKE CONTROL | WHEEL SLIDE PROTECTION SYSTEM (MGS3)**
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.
- 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

**BOGIE EQUIPMENT | COMPACT BRAKE CALIPER UNIT RZT AND WZT**
- Suspension arrangement with single central pin and no hangers allows maximum lateral movement and tilting of the wheelset without usage constraints
- Simple standard interface to bogie for lighter and less cost-intensive bogie-side mounting brackets and easy mounting of brake caliper units
- Installation space independent of brake force
- Robust design for very harsh environmental conditions (–60 °C)
- RZT and WZT are further developments of the service-proven KB standard products RZS(S) and WZK, with optimized robustness and overhaul period

**CUTTING-EDGE TECHNOLOGIES**
PRODUCTS FOR ALL STANDARDS

Knorr-Bremse is the partner of choice for regional train 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 REGIONAL AND COMMUTER TRAIN 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

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

EP2002®
- Intelligent braking system optimizes brake effort across the whole train
- Per bogie distributed braking
- Smaller, lighter and faster to commission than conventional brake control

WHEEL- AND AXLE-MOUNTED BRAKE DISC
- Standardized interface and mounting on wheel
- Resistant against thermal cracks due to movable friction disc
- Robust design with high safety 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

SANDING SYSTEMS
- Pure pneumatic sand dosing principle, no abrasion
- Separation of sand dosing and sand conveying functions
- Highest accuracy
- Optional integration of heating and drying functions

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

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

INTELLIGENT AIR DRYER
- Compact, light, highly reliable
- Developed especially for installation beneath the frame
- All components to be maintained can be accessed through a maintenance port

BP COMPACT
- High power delivery
- Compact design
- Integrated pre-control and relay graduation
- Isolation function
- Width adaption

MOTION CONTROLLER KIT
- Brake, traction and master controller
- Integrated pre-control and relay graduation
- Isolation function
- Width adaption

TREAD-BRAKE UNIT
- Modular design
- Flexible mounting
- High output forces

MAGNETIC TRACK BRAKE
- Modular standardized solutions
- Robust and proven design
- Pole shoes with increased braking performance available

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

MODULAR MAGNETIC TRACK BRAKE CONTROL SYSTEM
- Reduced life cycle costs
- Monitoring of track brake during testing
- Automatic one-man brake test - no additional personnel required
- Simultaneous checking of all track brakes
- Self-diagnostics enable corrective maintenance
- No wearing parts in brake control system
ENTRANCE SYSTEMS

Increasing passenger volumes and the intensified use of public transport require highly reliable entrance systems. Rolling stock manufacturers, systems suppliers and train operators are facing the technical challenge of meeting the continuously rising requirements for safety, passenger comfort and barrier-free use for persons with reduced mobility. As a leading manufacturer of entrance systems for regional and commuter trains, we offer the whole range of suitable products: from double-leaf sliding plug doors and sliding doors from 1,200 to 2,000 mm entrance width through to single-leaf systems. The offering is complemented by a variety of door leaf types and access devices such as sliding or movable step systems.

CUTTING-EDGE TECHNOLOGIES

ENTRANCE SYSTEM GENERATION 4
The IFE entrance system generation 4 consists of the evolutionary E4 Door Drive Unit, the X4 Sliding Step, newly designed AN/AI Door Leaves with increased noise and heat insulation as well as the new FLEX Door Control Unit. All components of the system were developed and validated with a view to maximum life cycle. An advanced system which sets new standards in ease of installation, service and maintenance.

ADVANTAGES
- 20% less weight through lighter and more compact design and 44% fewer parts
- Active floor-level locking device fitting in the installation space of a rotary column
- Robust and deformation-tolerant linear guiding system with adjustment-free design
- Reliable function thanks to 3-point guiding prevents jamming of the X4 sliding step
- Rugged design, not affected by dirt, corrosion as well as ice and snow
- Reduced heat coefficient of the door leaves by up to 50% and improved noise insulation by a factor of 3 to 4 compared to similar products
- Energy consumption 20% of the FLEX door control unit reduced by 25% and installation height reduced by 20%
- Input voltages of the FLEX DCU may vary between 24 and 110 V DC to reduce the number of different parts

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

E4 DOOR DRIVE
(WITHIN THE DOOR PORTAL)
- Increased safety thanks to four over dead center locks
- Active floor-level locking device fitting in the installation

E3H DOOR DRIVE
(WITHIN THE DOOR PORTAL)
- Door opening widths of up to 1,400 mm are possible
- Strong guiding system
- Pre-adjusted system allows for component changes without any further adjustments
- Lubrication-free spindle drive
- Pressure-tight version also available

S3 DOOR DRIVE
(OUTSIDE THE DOOR PORTAL)
- Robust and dirt-resistant guiding system
- Lubrication-free spindle drive
- Low system weight
- Adjustment-free design
- S3 drive module positioned in portal center → perfect accessibility
- Direct, individual locking of each door leaf, independent of screw drive

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

RLS DOOR DRIVE
(OUTSIDE THE DOOR PORTAL)
- Linear and encapsulated guiding system for swiveling and sliding of both door leaves
- Lubrication-free spindle drive
- Modular design
- Suitable for frequent opening and closing cycles
- Decades of field experience → high reliability

MOVEABLE STEP
- Small installation dimensions
- Simple construction
- Robust design against dirt and corrosion
- Direct link to the door drive

SLIDING PLUG DOOR
SINGLE- AND DOUBLE-LEAF
ENTRANCE DEVICES
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-MOUNTED HVAC SYSTEM FOR SUBURBAN TRAINS
- Dual refrigerant circuits for redundancy, capacity control, and energy optimization
- Two units incorporated into a single frame for reduced weight and interfaces
- Incorporates exhaust air openings so that no exhaust opening on the vehicle is required
- Each condenser fan is equipped with a specially developed noise reduction device in order to ensure quiet operation

ROOF-MOUNTED HVAC PLATFORM FOR DOUBLE-DECKER TRAINS
- Roof-integrated system with 2 independent circuits, specially conceived for double-deckers
- 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 both evaporator and exhaust motors as well as exhaust energy recovery system
PRODUCT RANGE

ROOF-MOUNTED HVAC UNIT FOR DOUBLE DECK WITH HIGH CAPACITY
- Roof-mounted HVAC unit, specially conceived for double deck train
- 4 independent supply air outlets using a duct system located within the unit
- Adjustable load management and energy efficiency by optimizing the balance of fresh air based on external conditions, passenger load and CO₂
- NFF-compliance
- Condition Based Maintenance (CBM) system

COMPACT ROOF-MOUNTED HVAC UNIT
- Dual refrigerant circuits for redundancy, capacity control and energy optimization
- 2 independent supply air outlets and integrated exhaust
- Adjustable load management by optimizing the balance of fresh air based on external conditions, passenger load and CO₂
- Adjustable speed condenser fans to enable high ambient operation along with low noise operation
- Control panel and controller are installed outside of the HVAC unit for easy access

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 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. 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.
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

**IR4000VH HIGH-SPEED CIRCUIT BREAKER**
- Flat mounting position, for installation on the roof or under the frame of a car
- Enclosure for outdoor mounting
- Extremely compact design of the breaker and of the outer enclosure
- High performance / size ratio

**CONVECTION-COOLED BRAKING RESISTOR**
- Braking resistor for installation on the roof or under the frame of a car
- No motor fan required for cooling
- Ideal airflow pattern resulting from extensive testing and a large number of installations

## 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

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

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

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 centrifugal design
- Very high pressure
- Highly customizable
- High resistance to corrosion

TRACTION CONVERTER COOLING FAN
- Centrifugal, centrifugal 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
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.
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.