REALIZING SYSTEM SYNERGIES
Metros provide the backbone for local public transport systems in cities and major urban conglomerations. Without their ability to transport millions of passengers on a daily basis, traffic gridlock would be virtually inevitable. And as urban centers continue to grow, so too does the need for attractive metro networks. There is increasing demand for lightweight, compact technologies offering enhanced economy, safety and comfort, and Knorr-Bremse sub-systems are global market leaders in this respect. But it is the company’s cross-system approach that offers that crucial extra element of efficiency – enabling manufacturers to deliver their vehicles on time and operators to run them economically throughout their entire operating life.

**THE PERFECT COMBINATION OF HIGH-QUALITY SYSTEMS & SERVICES**

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**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 70 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 650,000 entrance systems delivered in the company’s history IFE continues to shape the industry.

**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 some 100,000 units in successful daily service.

**MICROELETTRICA SCIENTIFICA**
Microelettrica Scientifica, based in Italy, has been developing and producing power switches, transducers, resistors and fans 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 leading supplier of advanced auxiliary power supply solutions, ensuring effective power conversion in all types of rail vehicles. Combining more than 100 years of extensive experience with comprehensive engineering competence, we support customers with tailor-made compact, highly reliable and efficient power supply solutions – life-long services around the globe included.

**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.

**KIEPE ELECTRIC**
Full range of electrical systems, traction/power supply inverters, climatization and cooling systems (motor, battery, traction). Kiepe Electric GmbH is one of the global leaders in electrical systems and traction technology for local public transport vehicles, including LRVs, metro trains and buses. With more than 100 years of experience, the company not only offers pioneering electrical equipment for rail vehicles and buses but also a broad range of related maintenance services. Its comprehensive refurbishment offer for existing vehicles helps many vehicle operators cope with financial pressures.
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
DISTRIBUTED BRAKE CONTROL EP2002
Growing passenger numbers on metro networks call for greater availability of trains and shorter headway – which puts greater demands on brake reaction times and tolerance to failure of the brake system. The intelligent distributed brake control system EP2002, which combines mechatronic and electronic elements in a single, extremely compact system, is the outstanding answer to these challenges. The latest development – EP2002® Cube – allows optimized integration of a wide range of additional functions in a single cube-shaped unit with integrated piping.

BOGIE EQUIPMENT
ALUMINUM DISC
The aluminum brake discs weigh half as much as conventional cast-iron ones, saving over 400 kilograms per individual car. Although the aluminum discs cost more, the investment pays off within a few years. The energy savings due to reduced weight are particularly significant in the case of a metro, which is constantly braking and accelerating. And there is a double benefit, as the discs are mounted directly on the axle and therefore also cost energy through the rotational acceleration required. Cast-aluminum discs also last three times as long as conventional ones and do not heat up as much when the brakes are applied. What’s more, the brake pads also wear more slowly, reducing the environmental impact of the dust generated.

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 information can be used by the HVAC system to adjust output to the number of passengers.

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. It provides innovative, TSI-compliant solutions tailored to local requirements, all current global standards (UIC, AAR, GOST, Chinese Standard, ARA) and individual operating scenarios. And its worldwide production and service network meets even the strictest requirements for local content.
BRAKE SYSTEMS

PRODUCT RANGE

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

SCREW COMPRESSOR
- Special design to cope with tough railway operation conditions
- Low noise level
- Low vibration

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

INTELLIGENT AIR CONTROL COMPLETE AIR SUPPLY UNITS
- Combines perfect air supply and air treatment-related functions
- UAC - intelligent speed control of compressor
- UAC - reduces noise emission and saves energy

EP2002 3.0
- Distributed control
- Compact design
- Advanced functions

EP COMPACT LITE
- Modular and suitable to various customer requirements
- Optional electronics underfloor
- Central control
- Compact design

SYSTEMS FOR BOGIE MONITORING
(e.g. COMORAN®)
- Derailment detection (E-EDT® second generation)
- Detection of unstable running
- Fulfills TSI requirements
- Condition monitoring
- Hot box detection

MOTION CONTROLLER KIT
- Brake, traction and motive power
- Suitable with UIC standard
- Small, flexible installation space
- Robust modular design, proven application

WHEEL- AND AXLE-MOUNTED BRAKE DISCS
- Robust design with high protection against external shock and vibration
- Resistant against thermal cracks due to movable friction disc
- Standardized interface and mounting
- Aluminium friction rings

COMPACT BRAKE CALIPER UNIT
- Optimized design regarding weight, assembly and costs
- Reduced maintenance and long overhaul period
- One interface to bogie
- Highly modular design

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

CLEANING BLOCK UNIT
- Wheel surface conditioning to improve friction
- Flexible mounting in bogie
- Robust and service-proven design

PADS Ppropad
- Large product portfolio covering the specific demands of each application
- Noise-optimized designs to avoid squealing
- Standardized UK designs and 15% increased lifetime KRS designs

BLOCKS PROBLOCK
- Low wear and optimized UIC
- Thermal stability
- Wide range of designs

MAGNETIC TRACK BRAKE
- High braking performance even under poor track conditions
- Additional, independent braking system
- Robust and proven design

INTELLIGENT AIR DRYER
- Compact, lightweight modular design
- Diagnostic with continuous monitoring of air dryer condition
- Optimized closed-loop regeneration minimizes purge air losses
- Low noise emission
SANDING SYSTEMS
- Suitable for manual or automatic sand filling
- Continuous innovation
- Lighter weight and smaller installation space
- Drying, heating and loosening of the grit

WIPER SYSTEMS
- Expertise with all vehicle types
- Extensive investigations and tests to guarantee durable products
- Long-term product support with spare parts delivery of 30 years

DIAGNOSTICS/iCOM
- iCOM transfers the mobile device philosophy to the railway industry
- Condition monitoring (iCOM Monitor)
- Driver advisory system (iCOM Assist)
- Energy metering (iCOM Meter)
- Developer tool (iCOM Developer Studio)
- Energy management (iCOM Energy Saver)
- Service tool (iCOM Service)
ENTRANCE SYSTEMS

41,000,000 safe opening and closing cycles daily with IFE products around the world for LRVs, metros and monorails require highly dependable entrance systems. Matching the steadily increasing requirements regarding safety, passenger comfort and uninterrupted availability for persons with reduced mobility is a technical challenge for rolling stock manufacturers, system suppliers and train operators.

As a leading manufacturer of LRV, metro and monorail entrance systems we offer the full range of suitable products: from sliding plug doors and sliding doors with opening widths between 650 and 2,000 mm and a choice of all glass, aluminum sandwich or stainless steel door leaf options, up to boarding aids such as sliding steps, ramps and gap-bridging devices. 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 renowned 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 entrance systems, including spare parts management.

CUTTING-EDGE TECHNOLOGIES

RLS ENTRANCE SYSTEM
The RLS entrance system is one of the top-selling systems worldwide. It is characterized by reliable operation even under the worst climatic conditions – the system has been successfully implemented in the far north at extreme sub-zero temperatures as well as in desert areas with enormous heat and sand. Thanks to the modular design of the system, we are able to cover the worldwide demand for trams and metros with standardized modules.

The IFE RLS door drive design is straightforward and simple. It needs only one linear guiding system for the swiveling and sliding movements of both door leaves. This drive – which needs no rotary columns – is mainly used for low train speeds and reduced loads but with frequent opening and closing cycles.

ADVANTAGES
- Flexible integration in all types of vehicles with only a small protrusion outside of the portal
- Robust: Durable ball bushing guide allowing for a high number of cycles
- Low maintenance: Use of a lubrication-free spindle drive and encapsulated recirculating ball bushings
- Single-leaf and double-leaf versions
- Straightforward and simple design
- Needs only one linear guiding system for the swiveling and sliding movements of both door leaves.

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, DOUBLE-LEAF
- Actuated floor-level locking device fitting in the installation space of a rotary column
- Increased safety thanks to four over-dead-center locks
- Maintenance-free door drive
- Adjustment-free design
- Rugged guiding system

RLS DOOR DRIVE
OUTSIDE THE DOOR PORTAL, SINGLE AND DOUBLE-LEAF
- Linear and encapsulated guiding system for swiveling and sliding
- Suitable for frequent opening and closing cycles
- Decades of field experience ensure high reliability
- Lubrication-free spindle drive
- Modular design

S3 DOOR DRIVE
OUTSIDE THE DOOR PORTAL, SINGLE- AND DOUBLE-LEAF
- Low system weight
- Adjustment-free design

X4 SLIDING STEP
- Maintenance- and adjustment-free locking module
- Rugged design, not affected by dirt, corrosion or by ice and snow
- Reduced installation height of 50 mm
- Assembly-free 4-point guiding system
- Tolerance to motion of the vehicle

RAMP
- Secure access to the vehicle for wheelchair users, even with high level difference between vehicle and platform
- Delivered as a narrow, pre-mounted cassette
- Requires only minimal installation space at low altitude
- Versions (permissible distance, slope, etc.) can be adapted to the conditions of the customer infrastructure

GAP FILLER
- Reduction of the distance between the vehicle and the platform edge
- Easy access for people with reduced mobility
- Less installation space
- Simple design
- High reliability
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. Knorr-Bremse 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 travelers 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, Knorr-Bremse HVAC systems are in operation in all parts of the world – with local teams ensuring seamless service, every day.

CUTTING-EDGE TECHNOLOGIES

HVAC SYSTEM FOR DESERT APPLICATIONS
- Roof-embedded HVAC system
- Extreme temperature operation (full cooling capacity is maintained at temperatures exceeding 50 °C)
- High-redundancy design - no single point of failure
- Lightweight design
- Suitable for hot and dry climates where climate control is mission-critical

HVAC SYSTEM WITH ALTERNATIVE REFRIGERANTS
- CO₂ (R744) with GWP=1 (global warming potential)
- High energy efficiency thanks to frequency-controlled compressor and new electric expansion valve control
- Heat pump & energy recovery available

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.

PRODUCT RANGE

ROOF-MOUNTED SALOON UNIT
- On-roof mounted HVAC unit
- Special functions include emergency ventilation when power out, automatic shutdown in case of internal car fire and full recirculation airflow in case of external smoke, amongst others
- Dual refrigerant circuits for redundancy, capacity control and energy optimization

ROOF-EMBEDDED SALOON UNIT
- Roof-embedded HVAC unit plus underfloor HR unit with brake energy-to-heat recovery
- Dual refrigerant circuits for redundancy, capacity control and energy optimization
- Quick maintenance access through quarter-turn locks in all covers
- Ideal for applications with low profile tunnels, lightweight requirements and units located in the center of the roof

ROOF-INTEGRATED HVAC SYSTEM
- Compact unit with low height and weight
- Extremely silent unit based on internal silencer
- Variable fresh air and capacity control

CABIN
- Compact unit with low height and weight
- Extremely silent unit based on internal silencer
- Variable fresh air and capacity control

HVAC PLATFORM FOR LOW-PROFILE APPLICATIONS
- Roof-mounted or fully embedded HVAC system
- Catalog of different frame and coil materials
- Wide power range (up to 41 kW) and flexible interfaces
- Ideal for metros with low profile, due to its low height (< 300 mm) and weight
POWER SUPPLY SYSTEMS

With growing comfort and safety requirements in modern rail vehicles, the power demand by various on-board consumers is constantly increasing. The on-board power supply system is thus assuming an increasingly important role. Knorr-Bremse PowerTech stands for more than 100 years of extensive hands-on expertise in power conversion, ensuring effective power supply and efficient energy distribution in all types of rail vehicles.

With our comprehensive engineering competence and a proven track record of more than 30,000 converters in operation worldwide, we supply cutting-edge power converter solutions, distinguished by their compact design as well as high reliability and efficiency. Based on standardized modules, combined with a large range of optional product features, we closely work together with our customers to develop auxiliary power supply and distribution systems, tailored to their specific needs. Added to this, we ensure close proximity to our customers and maximum uptime of our systems through a broad portfolio of custom-fit service solutions and the integration into the global Knorr-Bremse service network.

PRODUCT RANGE

AUXILIARY POWER SUPPLY SYSTEMS
- Wide range of input voltages supporting global requirements
- Scalable architecture for varying power demands
- Optimized efficiency in silicon and silicon carbide
- Supporting all common communication interfaces
- Suitable for all mounting positions
- Parallel switching of AC as well as DC outlets possible

STAND-ALONE BATTERY CHARGERS
- Broad range of input voltages
- Scalable based on modular design
- Efficient and highly reliable
- Supporting RC, CAN, and MVB communication
- Flexible mounting positions incl. 19" enclosure
- Parallel switching of DC outlets possible

INVERTERS FOR VARIABLE VOLTAGE, VARIABLE FREQUENCY LOADS
- Demand-driven power supply for vvvf loads (HVAC, air supply unit)
- Convection-cooled module
- Stand-alone or integrated into load
- Optimized power management on vehicle level
- Full-scope diagnostic functions for improved LCC

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 ELECTRICS

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

LPRC1000 LINE AND PRE-CHARGING CONTACTOR UNIT
- Single unit including a line contactor, a pre-charging contactor and a pre-charging resistor
- Rated voltage: 1500 V DC
- All connections between the contactors and the resistors are implemented
- Easy installation, wiring and maintenance

LTX-HIGH-PERFORMANCE LINE CONTACTOR
- Thermal current up to 1800 A
- Rated voltage up to 4000 V
- Very high breaking capacity in a small space
- Electronic control and power-saving system

SYSTEMS SOLUTIONS – BENEFITS FOR THE CUSTOMER
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PRODUCT RANGE

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

PRE-CHARGING SYSTEM
- Integrated solutions of various contactors and resistors assembled on a common baseplate and wired, for saving time during installation
- Pre-charge resistor, with customizable resistance level, 1 to 100 ohms
- AC/DC pre-charge contactor
- Compact design

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

PERMANENT MAGNET MOTOR PROTECTION CONTACTOR
- 3-phase contactor range for 2000 V, 100 Hz power supply
- High breaking capacity
- Compact design

DC HIGH-SPEED CIRCUIT BREAKER
- Enclosures for underframe or on-the-roof installation
- Up to 2 kV voltage rating
- Thermal current up to 5 kA
- Vertical and horizontal versions
- Very low life-cycle cost

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

TRACTION CONVERTER COOLING FAN
- Centrifugal, centrifugal or axial design
- Very wide range of fans, with flange design
- High resistance to corrosion
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.

The new CPU3xx Smartio® controller family (SIL0/SIL2) has been added to the established Smartio® I/O system.
TRACTION

FULL RANGE OF ELECTRICAL SYSTEMS AND TRACTION TECHNOLOGIES.
Kiepe Electric GmbH is one of the global leaders in electrical systems and traction technology for local public transport vehicles, including LRVs, metro trains and buses. With more than 100 years of experience, the company not only offers pioneering traction technologies for rail vehicles and buses but also a broad range of related maintenance services. Its comprehensive refurbishment offer for existing vehicles helps many vehicle operators cope with financial pressures.

EXTENDED SERVICE LIFE AND MINIMUM MAINTENANCE.
Products from Kiepe Electric are designed to be low-maintenance. Powerful diagnostic tools and a worldwide service network ensure that life-cycle costs are kept to a minimum. This is the result of closely interconnected sub-systems whose data is collected by Kiepe System Diagnostics (KSD) and Kiepe Fleet Management (KFM). These diagnostic and maintenance programs provide operators and service personnel with an overview of the operational and diagnostic data of installed components and reduce downtimes to a minimum.

CUTTING-EDGE TECHNOLOGIES

POWER CONVERTER RANGE UNDERFLOOR TRACTION EQUIPMENT FOR HIGH-FLOOR AND METRO VEHICLES
- Option of axle-selective or bogie-selective traction
- Optional emergency operation using on-board battery
- Ultra-efficient, low-noise cooling through use of variable-speed fan motors
- Rapid, easy maintenance thanks to modular design
- Plug-in electrical connections

PRODUCT RANGE

IGBT DC CHOPPER
Kiepe Electric offers IGBT DC chopper solutions for the modernization of existing DC traction current circuits. Different control versions are possible due to the system's modular construction. Different models can either be integrated into new vehicles or be adapted to existing systems.

THE KIEPE DIRECT PULSE INVERTER (DPU) IN TWO PERFORMANCE CLASSES
This is an indirect converter constructed using IGBT technology for vehicles with three-phase drive supplied by the catenary (DC 600/750 V 250 kVA or 150 kVA). It converts the overhead line's DC voltage into a three-phase AC current system with variable amplitude and frequency in order to supply the three-phase asynchronous traction motor for operation.

TRACTION CONTROL UNITS
The design of the modular control unit is based on a power supply module and a central unit with the option of adding different sub-modules to create the optimum control unit for the task concerned.
- Self-developed, SIL2-certified control hardware, control software (firmware)
- Modular, compact design
- Applicable for 24 V and 110 V
- Rolling stock, bus and refurbishment projects
- Device and systems diagnostics
- Already more than 55,000 modules in operation
- Graphical programming
- SIL & non-SIL functions
- Certified project planning tools
- Automated test systems
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 sub-systems 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:

- **Professional workforce**
- **Worry-free comprehensive service**
- **Increased performance**
- **Just-in-time**
- **Reduced life cycle costs**
- **Improved availability**
- **Reliable service partner**
- **Over the entire life cycle.**

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 on 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 DIGITAL PLATFORM 4.0 – DIGITALIZATION ON BOARD**

Knorr-Bremse provides a digital, innovative platform for the railway industry 4.0. User-friendly applications on a single platform using one on-board computer unit and a back office. This is the flexible expandable Knorr-Bremse solution for the railroad 4.0. 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.

**A reliable service partner – over the entire life cycle.**

**Improving availability**

**Reduced life cycle costs**

**Increased performance**

**Worry-free comprehensive service**

**Professional workforce**

**Over the entire life cycle.**

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