Monorails

REALIZING SYSTEM SYNERGIES

KNORR-BREMSE
As cities all over the world continue to grow, expanding their public transport systems is becoming an increasing challenge. Even well-established urban networks can struggle to keep up with the pace of growth. In Asian metropolises in particular – but also in South America and the Middle East – planners are increasingly turning to monorail systems. Their tight curve radii and the flexibility offered by building them on stilts mean they can be installed relatively easily, even in densely populated areas. With decades of experience in the field, Knorr-Bremse is a leading supplier of monorail subsystems – and offers all the required support from a single source.

IFElThe 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.

MERAkOur 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 – lifelong 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.
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

HYDRAULICS | HYDRAULIC UNIT HGES
- Best power density due to optimized design for brushless DC application
- Combination of various additional functions possible (security brake, auxiliary release circuit)
- Customized interfaces
- Ideal for stopping/holding brakes and brakes with wheel slide protection
- Smallest measurement: 148 mm height

BRAKE CONTROL | DISTRIBUTED BRAKE CONTROL EP2002
Growing passenger numbers on monorail 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.

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.

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.
**RAIL VEHICLE SYSTEMS**

**MONORAILS**

**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 rail operational conditions
- Low compressor noise level
- Low vibration

**AIR DRYER**
- Dual chamber regeneration dryer
- Disposable cartridges
- Integrated pre-filtration

**HGE/HGK**
- Lightweight
- Very compact – maximum height 100 mm
- Several types for various installations available
- 3-phase AC drive and DC drive available
- Option for security brake functionality available

**EP2002® CUBE**
- Distributed control
- Compact design

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

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

**BRAKE CALIPER SN7**
- Light, compact design
- Even brake pad wear
- Approx. 20 million used worldwide
- Ability to sensor brake pad wear
- Economical in service

**SPLINED DISC**
- SD7 modular design
- Reduced thermal stress cracking
- Robust design protected against external shock and vibration

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

**HYDRAULIC BRAKE CALIPER**
- Ideally suited for confined installation space
- Low maintenance required
- Available as a spring actuated brake or active brake

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**BRAKE SYSTEMS**

**PRODUCT RANGE**

**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:
  - Driver advisory system (iCOM Assist)
  - Energy metering (iCOM Meter)
  - Energy management (iCOM Energy Saver)
  - Service tool (iCOM Service)

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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

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

<table>
<thead>
<tr>
<th>E4 DOOR DRIVE</th>
<th>RLS DOOR DRIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WITHIN THE DOOR PORTAL, DOUBLE-LEAF</td>
<td>OUTSIDE THE DOOR PORTAL, SINGLE- AND DOUBLE-LEAF</td>
</tr>
<tr>
<td>Active floor-level locking device fitted in the installation space of a rotary column</td>
<td>Linear and encapsulated guiding system for swiveling and sliding</td>
</tr>
<tr>
<td>Increased safety thanks to four over-dead-center locks</td>
<td>Suitable for frequent opening and closing cycles</td>
</tr>
<tr>
<td>Maintenance-free door drive</td>
<td>Decades of field experience ensure high reliability</td>
</tr>
<tr>
<td>Adjustment-free design</td>
<td>Lubrication-free spindle drive</td>
</tr>
<tr>
<td>Rugged guiding system</td>
<td>Modular design</td>
</tr>
</tbody>
</table>

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
- Amenity-free 5-point guiding system
- Tolerant to torsion 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. 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 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, Merak HVAC systems are in operation in all parts of the world – with local teams ensuring seamless service, every day.

PRODUCT RANGE

ROOF-MOUNTED HVAC UNIT
- Designed for elevated monorail platforms
- Lightweight, molded fiberglass design for seamless integration with vehicle profile
- Redundant systems and emergency ventilation
- Efficient, low-capacity unit ideal for smaller passenger vehicles

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 to respond intelligently to the other systems’ current operating status. For example the HVAC unit can immediately shut down if a fire alarm is triggered, instead of continuing to blow air into the vehicle.
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 MBV 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 on 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.
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

**LTHS320HF MOTOR PROTECTION CONTACTOR**
- Three-phase contactor, with voltage rating up to 2 kV
- Intended to separate permanent magnet motors from inverters during short circuits
- Capability of interrupting currents at high frequency, up to 300 Hz
- Compact design and high breaking capacity

**PRODUCT RANGE**

**LINE CONTACTORS**
- Compact design for easy installation within traction converters
- Widest range on the market, consisting of standard units and customized versions
- Availability of energy-saving devices on the control coil

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

**BRAKING RESISTOR**
- Installation on board the train or within the ground-based power supply switchgear
- Naturally or fan-cooled
- Custom-designed resistance value and cooling pattern
- Custom-designed interfaces

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

**SYSTEMS SOLUTIONS – BENEFITS FOR THE CUSTOMER**

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POWER ELECTRICS

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

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.

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.