EP2002 3.0
Distributed Brake Control

APPLICATIONS
Passenger rail vehicles
EP2002 3.0 is a mechatronic distributed brake control system, delivering individual bogie or axle control in a unique package. Smaller, lighter and easier to install and commission than conventional systems, EP2002 3.0 sets a new standard in advanced brake control for passenger rail vehicles.

Developed from the outstanding successful EP2002 Distributed Brake Control system, in service today on over 35,000 equipped cars around the world, EP2002 3.0 employs advanced but proven mechatronic technology to optimize brake performance across the entire train. EP2002 3.0 is an ‘intelligent’ system which self-compensates, in real time, to address variable operating conditions such as passenger loading, wheel spin and slide and variations in friction brake performance. This latest evolution of Knorr-Bremse advanced Distributed Brake Control has been developed for passenger trains and is fully compatible with Knorr-Bremse Plus modules, providing outstanding choice and flexibility.

**The Benefits of EP2002 3.0 for Train Builders**

- Lower costs thanks to faster installation and commissioning
- Light, compact and requiring a smaller installation envelope
- Fully integrated system which includes optimized wheel slide protection (WSP) with WSPA-3 algorithm
- Electronic or pneumatic load signal
- DHA function in accordance with EN15595 for high-speed trains
- Ability to incorporate I/O extension devices into the system
- Fast response to changes in brake demand
- Input from distributor valve or variable load valve allows provision of backup brake pipe control system
- One common brake control covering all passenger rail vehicle platforms for metro, regional and high speed trains

**The Benefits of EP2002 3.0 for Train Operators**

- Reduced operational costs
- Overhaul periodicity of 10 years as standard, extendable by up to 20% based on operational conditions
- In-service availability is maximized
- Optimized spare parts holding through a standardized approach
- Optimized braking performance
- Deceleration control provides more accurate stopping performance in service and emergency braking
- Optimized wheel slide protection MGS3 minimizes wheel flats and offers outstanding low-adhesion performance
- Specially developed integrated service tool software provides system status information
- Large memory capacity for fault logs for longer periods

**EP2002 3.0 Technical and Quality Features**

- Intelligent per bogie or axle braking delivering optimized braking performance
- Modular unit is configurable to suit most global train management system protocols
- Fully integrated system
- BCP control to an accuracy of ±0.1 bar
- Operational temperatures from -40 °C to +60 °C
- Voltage range of 24 V to 110 V
- Wheel slide protection (WSP) included using advanced MGS3 certified to EN15595 (in accordance with LOC and PKS TSIL, GAVSN 2695 for UK and S2180 for LU)
- Complies with latest EN safety and software standards
- Engineered to TÜV-certified (functional safety) standard
- Manufactured (including facility) to TÜV-certified standard

**Applications for Passenger Trains**

EP2002 3.0 provides outstanding and highly accurate braking performance for passenger trains including metro, regional and commuter and high-speed trains.

This outstanding flexibility is achieved through new, innovative features such as:

- Brake pipe control
- Extending functionality with Knorr-Bremse Plus module’s compatibility, delivering:
  - Sanding
  - Magnetic track brake
  - Parking brake
EP2002 3.0 SMART
The Smart unit contains all of the mechatronics (mechanical and electronic elements) to deliver service brake, emergency brake and wheel slide protection (WSP) control on an individual bogie.

EP2002 3.0 SMART valve now has an extendable option to accommodate additional interfaces to train wires (both Analogue and Digital signal).

EP2002 3.0 GATEWAY
The Gateway unit delivers all the functions of the Smart unit. In addition, it provides both the interface of the EP2002 3.0 system with the Train Management System and the management of the whole train braking operation, including the dynamic brake.


OUTSTANDING CONNECTIVITY
- Supports Level 2 Ethernet protocols
- Supports Level 2 train bus connections
- Integration of new faster multi-core processors to facilitate system monitoring
- Modular approach to software execution with a reduction of application programming
- Modular approach to increasing I/O
- Integrated service tool (IST)

INTEGRATED SERVICE TOOL (IST)
The EP2002 3.0 Integrated Service Tool is an integrated, web based diagnostic software package, which facilitates an ‘inside view’ into how each EP2002 3.0 unit is performing using clear and user-friendly on-screen graphics. It connects to the EP2002 3.0 units via the on-train Ethernet bus allowing a train wide view. The Integrated Service Tool enables maintenance- and diagnostics functions to be carried out easily as well trackside as in the workshop.

- Interface for user connection and authentication
- Read and set system time
- Read and overwrite system signals and system parameters
- Store and record signal values continuously or trigger-based on the EP2002 3.0. IST is used for configuration and data reading interfaces.
- Read out software and hardware identifiers of all devices in the system
- Inspect faults and alarms in the system / Review and export historical change of faults and alarms
- Program and install a user-selected software package
EP2002 3.0 has been developed to cater to the demand for a high-performance distributed brake control system which delivers outstanding performance combined with lower operating costs and is suitable for passenger rail vehicles, in a wide range of operating conditions.

**LOWER INSTALLATION AND OPERATING COSTS**
- Mechanical and electronic elements are combined in a single compact unit
- Lighter and smaller than conventional brake control systems
- Easy and quick to install and commission
- Reduced piping requirements
- Optimized wheel slide protection MGS3 delivers outstanding performance even in extremely low adhesion conditions
- Overhaul period of 10 years as standard, extendable by up to 20% based on operating conditions
- Optimized brake control algorithm delivers fewer valve switching cycles
- Individual units easy and fast to replace at trackside

**CERTIFICATION DURING DEVELOPMENT**
During the creation of EP2002 3.0 the proven attributes of EP2002 and the global experience of its in-service characteristics were taken on-board and engineered into the architecture of the new system. From the earliest days of the development of EP2002 3.0 regular safety audits and reviews were carried out on all hardware and software, the main focus being on detailed safety analysis and extensive reliability testing.

The system was then repeatedly subjected to exhaustive testing including extreme temperature and vibration testing. The result is an extremely robust system which builds on the heritage of the proven EP2002 system.

EP2002 3.0 IMPLEMENTS THE FOLLOWING SAFETY DESIGN PRINCIPLES:
- The network of connected EP2002 3.0 units forms a system which maintains high availability. EP2002 3.0 also delivers inbuilt redundancy and fail-safe operation.
- Independence of software functions between brake management and brake control
- ‘Watchdog’ function for all microprocessors
- Protection against over-voltage and under-voltage
- High levels of integrity for both WSP and emergency brake functions
- Running tests to monitor all safety functions
- Comparison of speed signals between Smart units
- Safety-critical data sent via the CAN bus protected by a safety protocol to EN50159-1
- Uses the very latest multicore microcontrollers; specifically designed for applications critical to train safety.