DATA SHEET

Wabtec CORPORATION

THE WABTEC FLEXX FAMILY

METROFLEXX & REGIOFLEXX

Advanced Integrated brake control

Brake control for single & double pipe systems for mass transit & mainline trains

THE CONCEPT

- Replacing pneumatic components where possible with software modules with same safety level (up to SIL4)
- Redesign remaining pneumatic components using new material to improve reliability, performance & service life
- Develop a new generation of algorithms to improve component performance & service life

THE RESULT

- An integrated brake control, a 10 kg LRU
- Train interfaces via traditional wires or network
- Guaranteed high GEBR thanks to native control per axle. A single failure cannot affect more than 50% of local emergency brake effort.
- Extended MTBO (10 years mass transit, 15 years mainline applications)
- Safety targets certified by TÜV SÜD
- TSI/EN compliance certified by DB Systemtechnik (Regioflexx / mainline)
- Metroflexx & Regioflexx: More than 85% carry over

METROFLEXX & REGIOFLEXX

METROFLEXX

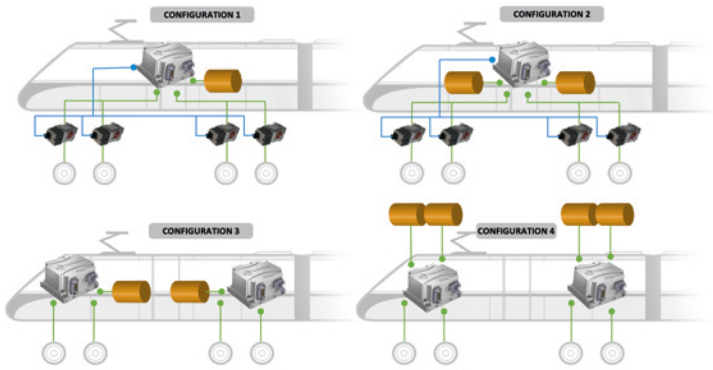
- Single pipe brake system
- Service brake (SIL2), remote release per channel
- Emergency brake
- 4 configurations available to reach efficiently GEBR targets (EB per axle, per bogie or per car)
- Wheel slide protection with DM-Adaptive WSP & DM-SmartSanding avail
- Deceleration compensation (SIL2)
- Low integration cost with dual homing (minimal cabling)
- Advanced diagnostic functions (incl. CBM)
- Fast & stable overtime response time
- 10 years (mass transit operation), or 15 years (mainline operation) MTBO
- Safety targets certifed by TÜV SÜD
- Compliant to cybersecurity standards

REGIOFLEXX

- Same as Metroflex, with...
- Double pipe brake system, regional, commuters & VHST
- One unit per bogie, optionally one unit per car*
- DM-Control+ (Deceleration compensation SIL4)
- Wheel rotation monitoring, EN15595 DNRA
- Dynamic WSP monitoring
- High integrity brake: Electro-dynamic brake can be safety used in emergency brake
- UIC 540 / EN15355 compliant distributor emulation
- High integrity (SIL4) speed & deceleration
- External distributor input (for towing with no battery)
- EN/TSI compliance certified by DB Systemtechnik

** with external dump valve control board for Regioflexx*

CONFIGURATIONS



- **Configuration 1:** Emergency brake per car, service brake per bogie*
- **Configuration 2:** Emergency brake per bogie, service brake per bogie*
- **Configuration 3:** Emergency brake per bogie, service brake per axle
- **Configuration 4:** Emergency brake per axle, service brake per axle
- **In all configurations** WSP is per axle

** with external dump valve control board for Regioflexx*

CUSTOMER BENEFITS TRAIN OPERATOR & MAINTAINER

- **Native control per axle**, for best safe deceleration
- **Train availability**: Thanks to remote isolation per channel, a single failure affecting SB cannot immobilize the train unduly. In the event of a forced isolation, emergency brake remains available, no GEBR impact.
- **Best Guaranteed Emergency Brake Rate**: A single failure cannot impact more than 50% of the local emergency brake effort.
- **SIL4 holding brake**, to guarantee safe stopping in station.
- **Predictable braking distance**: DistanceMaster embedded guarantees up to -50% braking distance extension in case of low adhesion vs traditional WSP.
- **Light weight**: At 10 kg each, it can be replaced in less than 20 minutes by a single operator, reducing downtime.
- **Extended MTBO** thanks to pressure control algorithms, leads to -45% on TCO vs traditional brake control equipment.
- **One part # per fleet**: A SIL4 optical reader recognizes train position, locally required braking performance is set automatically, for easy asset & spares management.
- Simple design enables train maintainer to perform maintenance in house.
- **CBM ready**: Also provides remaining time prior to overhaul and request for inspection based on performance drift detection. Latent failures are detected before impacting train operation.
- **DistanceMaster** embedded drastically improves very low adhesion conditions, with up to -80% wheel flats.

CUSTOMER BENEFITS CAR BUILDERS

- **Simplified interfaces**: One single box instead of separate elements.
- **Simplified piping**: LRU concept, pneumatic components replaced by software emulations.
- **Optimized system**: Regioflexx SIL4 architecture enables the safe use of ED brake in emergency without exporting safety constraints to other train systems. This leads to weight & cost reduction.
- **Wiring simplification**: can be wired either the traditional way or through dual ethernet (Dual homing). Up to 300 m wire saving per car.
- **Light weight**: 10 kg per unit, up to 60 kg per bogie saving vs traditional EMU brake system.
- **Versatile**: multiple brake control configuations upon GEBR needs. Regioflexx natively features all requirements for VHST applications. One product for all platforms.
- **Commissioning time**: DM-Adaptive WSP embedded does not need setting, save up to 2 weeks commissioning in new trains.

CONTACT

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WABTECCORP.COM

DATA SHEET

Wabtec CORPORATION

METROFLEXX

Brake control system for mass transit

The most advanced, lightest weight, fastest response time, integrated brake control.

Metroflexx is designed to provide service brake, emergency brake, wheel slide protection and train communication.

Metroflexx offers a very fast response time, the lightest weight available on the market, an extended up to 10/12-years MTBO, high scalability and a very flexible and simple TCMS connection.

KEY CUSTOMER BENEFITS

Highly scalable architecture
to fit with you Guaranteed EmergencyBrake Rate (GEBR) needs

Smart pressure management
for up to 10/12-years MTBO

Extended communication capability
for low integration cost

Very fast response time
for low dwell time & line efficiency

High pressure accuracy
for accurate braking distance

Very low weight
for energy efficiency

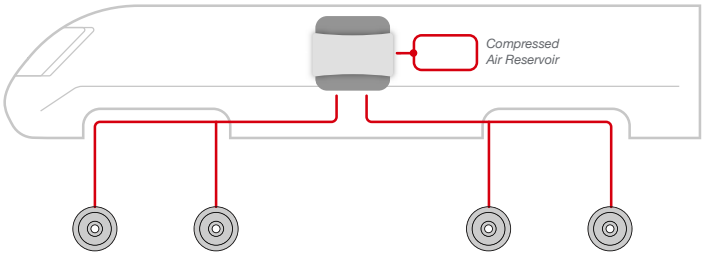
Real time data collection, embedded event recorder and CBM ready
for low operation cost

Safety certified
by TÜV SÜD to reduce project risks and ease execution

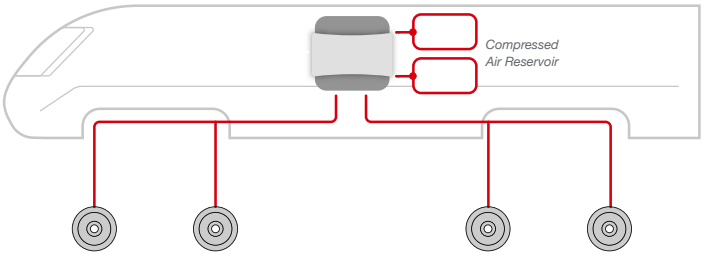
Compliant
to cybersecurity standards

PRODUCT SPECIFICATIONS

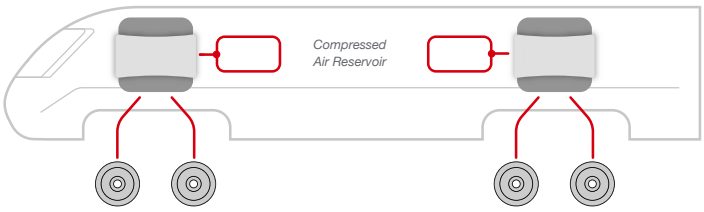
Configuration 1



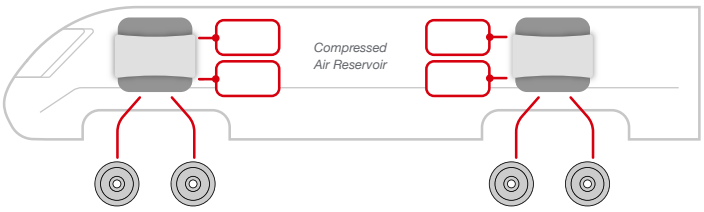
Configuration 2



Configuration 3



Configuration 4



- **Configuration 1:** Emergency brake per car, service brake per bogie
- **Configuration 2**: Emergency brake per bogie, service brake per bogie
- **Configuration 3:** Emergency brake per bogie, service brake per axle
- **Configuration 4:** Emergency brake per axle, service brake per axle
- **In all configurations** WSP is per axle

PRODUCT SPECIFICATIONS

Dimensions	**270x315 H192, without mating connectors**
Weight	**Less than 10 Kg with additive manufacturing**
Main technical features	• Air supply up to 10 bar; • 24V to 110Vdc , 60W power consumption • -40 to +55°C [-40 to +131°F] operating temperature • Can, Ethernet, MVB and Echelon networks are available • Up to 2 pneumatic channels spare input available • Service brake and remote release per axle • Emergency Brake SIL4 at train level; service brake SIL2 at bogie level; WSP implemented SIL2 at bogie level • Electronic pressure switch available SIL2 at bogie level • Park Lock ready system SIL2 at bogie level • Long life of components, up 10/12 years to overhaul • Low weight components and simple concept design • High flow brake valve with large flow exhaust section suitable to perform WSP function and a fast pneumatic reaction • Unique architecture: a single failure cannot affect more than 50% of the emergency brake effort per unit

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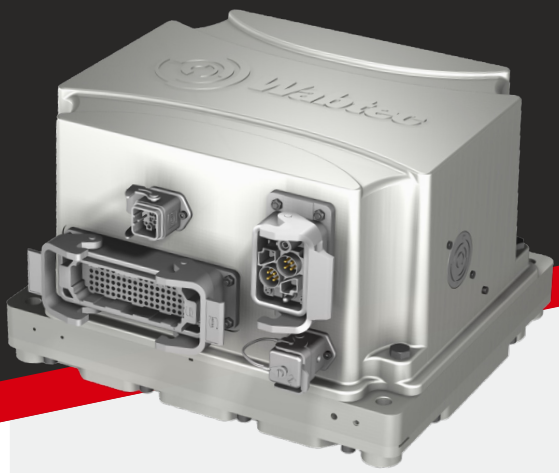
REGIOFLEXX

Advanced integrated brake control for TSI main lines

Performance, scalability and ease of maintenance: the best integrated brake control system for main line trains on the market



Regioflexx features an integrated brake control with service and emergency braking, our latest suit of adhesion management solutions DistanceMaster™, communication with the train network for brake blending, and diagnostics. Developed for regional, high speed and very high-speed trains (EN16185; EN15734; LOC&PASS TSI), the system is also compliant with most national standards. Sharing the same pneumatic platform as Metroflexx, our integrated brake control for Mass.

Regioflexx is our second SIL4 development, providing the full set of braking functions required for regional and high-speed trains. It features two independent input load signals (pneumatic and electric); two independent weighed service and emergency brake channels; and SIL4 protected wheel slide protection independent per channel. This unique and patented architecture allows multiple brake control configurations within a single product. Regioflexx is natively capable to be fully Train Control Network driven: Dual Ethernet + safety loop is all you need.

KEY CUSTOMER BENEFITS

Safety guaranteed
Compliance assessment with TSI from DB Systemtechnik and Safety assessment of compliance with CENELEC safety standards from TÜV SÜD.

Top performance
Fast response time, high output accuracy, and adaptive WSP for guaranteed shortest braking distance and reduced maintenance costs.

Reduced initial costs
One system for all market segments and brake control architectures with a simple network connection. Pneumatic heavy/costly components have been replaced by SIL+ electronic HW and software.

Lowest total cost of ownership
A simple design, smart pressure management, and extended MTBO (15 years). Plus, an embedded CBM provides fault reports, time to overhaul, and inspection flags.

Best train availability
One single failure doesn't prevent train to operate. One single part number for the fleet. Replacement on train in less than 20 min, no special tools required.

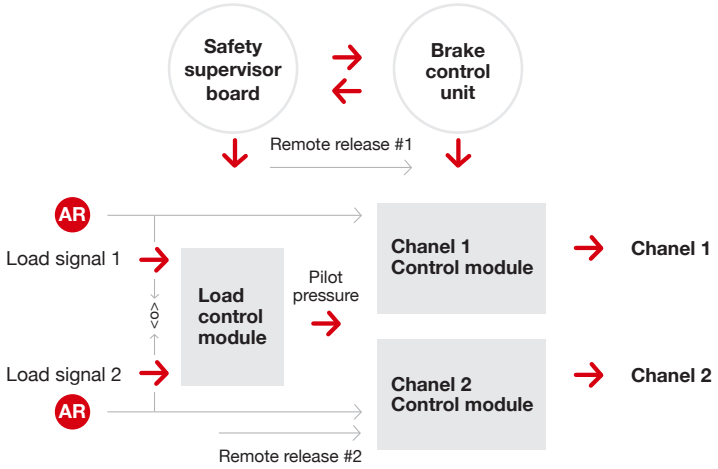
No special tools required
ATO-ready, high-SIL software can be upgraded over the system's lifetime to benefit from the latest innovations and updates.

Light weight
At 10 kg per unit, this is the lightest system on the market.

PRODUCT SPECIFICATIONS

Dimensions	270 x 315 x 192 mm, without mating connectors
Weight	10 kg with additive manufacturing

REGIOFLEXX DIAGRAM



MAIN TECHNICAL FEATURES

Air supply up to 10 bar (145psi)

24 to 110Vdc; power consumption < 60W

-40 to +60°C (-40 to + 140°F) operating temperature

Ethernet, CAN & MVB networks available

Service brake, emergency brake and remote release per axle

Advanced and patented remote release	A single failure on service brake cannot prevent train from continuing service The worst single failure affecting emergency brake cannot impact more than 50% of the emergency brake effort per unit

Emergency brake SIL4 at train level; Service brake SIL2 at bogie level

DistanceMaster™ reduces braking distance elongation up to 50% vs traditional WSP in standard* degraded adhesion (*standard adhesion conditions are defined according to EN 15595 and UIC 541-05).

A Safety Supervisor board performs all brake pipe monitoring and emergency brakes according to EN 16 185 and EN 15 734, and also monitors lower SIL functions, at SIL 4 level. The Safety Supervisor board performs the following functions	Distributor emulation Average load valve emulation Multi-stage valve emulation Safe holding brake Vehicle deceleration compensation Reference speed calculation, available for other safety functions Adaptive WSP monitoring (watchdog performed by dedicated unit) WSP Safety Timer compliant with EN 15595 Smart Safety Timer Wheel Rotation Monitoring (WRM, also known as DNRA) Position recognition (a unique part # for the entire fleet)

Pneumatic input available for rescue mode without energy (dead train)

Park lock ready

Smart safety timer allows optional time adjustment (SIL4)

Patented architecture allows multiple brake control configuration, all supported by parametric SW programming for reduced project-specific costs

Embedded CBM algorithm, providing fault report, time to overhaul and inspection flags

15 years MTBO upon service, very low maintenance cost thanks to smart valves management and very simple design

Regioflexx can safely (SIL4) monitor ED brake contribution. Therefore ED brake can be used in emergency, enabling to reduce friction brake installed in the train without compromising safety

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DISTANCEMASTER™

Advanced solutions for wheel rail adhesion enhancement

THE MOST PERFORMANT ADHESION MANAGEMENT SOLUTION AVAILABLE ON THE MARKET

A new generation WSP algorithm for higher safety, enhanced network capacity & resilience, reduced maintenance cost

Wabtec adaptive wheel slide protection features a new generation of algorithm capable of dynamic self tuning upon actual adhesion conditions, eliminating the need for setting, and reducing dramatically the braking distance elongation in degraded adhesion conditions.

DM-Control + is a deceleration compensation algorithm to optimize the use of available adhesion along the train.

It enables even shorter braking distance and better management of degraded modes (bogie isolated, slope).

Wabtec DistanceMaster™ is our answer to the Shift2Rail PINTA & PIVOT programs aiming to improve the wheel / rail adhesion, which is seen as a major limitation to the performance of railway transportation system

KEY CUSTOMER BENEFITS

Improved safety
34% (A-WSP only) to 50% (A-WSP + DM-Control +) braking distance improvement in standard degraded adhesion conditions

Improved rail transportation efficiency
Operators using variable length blocks (CBTC for metro; ETCS level 3 for main line) can benefit higher train flow thanks to guaranteed emergency braking distance

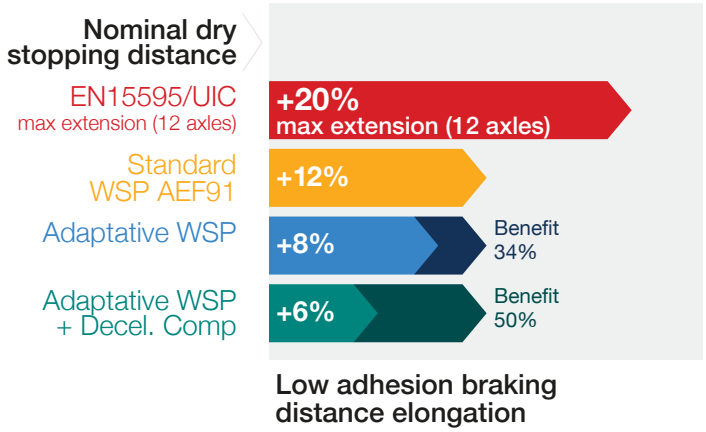
Improved rail transportation resilience to adverse conditions
Many operators are experiencing degraded operation in Autumn & winter. A-WSP is significantly improving resilience to extreme conditions in all seasons

Reduced maintenance cost
Fixed setting of actual WSP system forces to compromises. A-WSP tests shows up to 50% reduction of wheel flats

No setting cost
The Adaptive WSP doesn't require adjustment / setting campaign

Reduced air consumption

DM ADAPTIVE-WSP + DECELERATION COMPENSATION PERFORMANCE



PRODUCT SPECIFICATIONS

DM Adaptive wheel slide protection

A new generation of algorithm based on dynamic self-tuning upon actual conditions	A-WSP doesn't require initial setting, the algorithm will reach optimal braking distance from first brake application 34% performance improvement vs standard UIC approved WSP

DM-Control + brake compensation

A brake control feature to better use available adhesion along the train	Redistribution of the braking effort to reach the target deceleration, especially in case of low adhesion or of one brake equipment unavailable Local comparison of deceleration requested and deceleration achieved, therefore each BCU can increase braking effort up to the adhesion limit. The function is managed locally, no need for communication between BCUs When activated, the function is fully configurable (max adhesion solicited, max BC pressure) Brake compensation can be used in emergency brake (safety is guaranteed by the SIL4 weighted brake with Metroflexx & Regioflexx)

Adaptive wheel slide protection DM-Control + can offer up to 50% braking performance improvement vs standard UIC approved WSP system

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