# Digital freight transport on track:

## Monitoring & automation with the digital overall system WaggonTracker

**Unique worldwide:** WaggonTracker is the first and only digital overall system for monitoring and automating freight wagons. The system is a true all-rounder, combining automated processes such as brake testing, weight monitoring, monitoring functions and radio-based in-train communication.

**All-rounder:** The digital wagon backbone manages the integration and connection of all wagon components such as couplings, brakes and trestles / kingpins at safety and non-safety level.

**Condition Based Maintenance:** Due to the extensive monitoring of the goods train, extensive data material is determined. The advantages: Effective maintenance and servicing planning saves costs and valuable time. Increased safety and automated processes shorten turnaround times and increase the efficiency of rail operations.

**Immediate benefit:** The functionalities create immediate advantages, for example through savings in costs, time and resources as well as more safety.


*The most intelligent freight train in Europe was realised for Mercitalia Intermodal. The extensive monitoring functions generate numerous advantages: shorter train preparation, faster delivery times, lower maintenance and repair costs, less wear on certain components, more efficiency and safety.*

## The backbone of smart freight trains: The digital overall system WaggonTracker

- Autonomous and powerful power supply thanks to wheel hub generator
- Scalable for further applications desired by the customer
- DAC-compatible
- Easy installation: The system is easy to integrate, both for new vehicles and for existing vehicles
- Patented technology
- Autonomous information acquisition: All data is reported directly to a web portal via mobile network. This guarantees the highest availability of data anywhere in the world. The data is transmitted via an encrypted, secure connection.
- Always available, robust and maintenance-free: The hub generator provides energy self-sufficiently. The WaggonTracker is very robust and long-lasting. It was designed to sustain hard weather conditions and was tested for temperatures ranging- 40° to + 60° degrees Celsius. The system is nearly maintenance-free. A possible replacement of the rechargeable battery can be done according to the vehicle's service interval.

# A wide range of functionalities

**Train stand still**

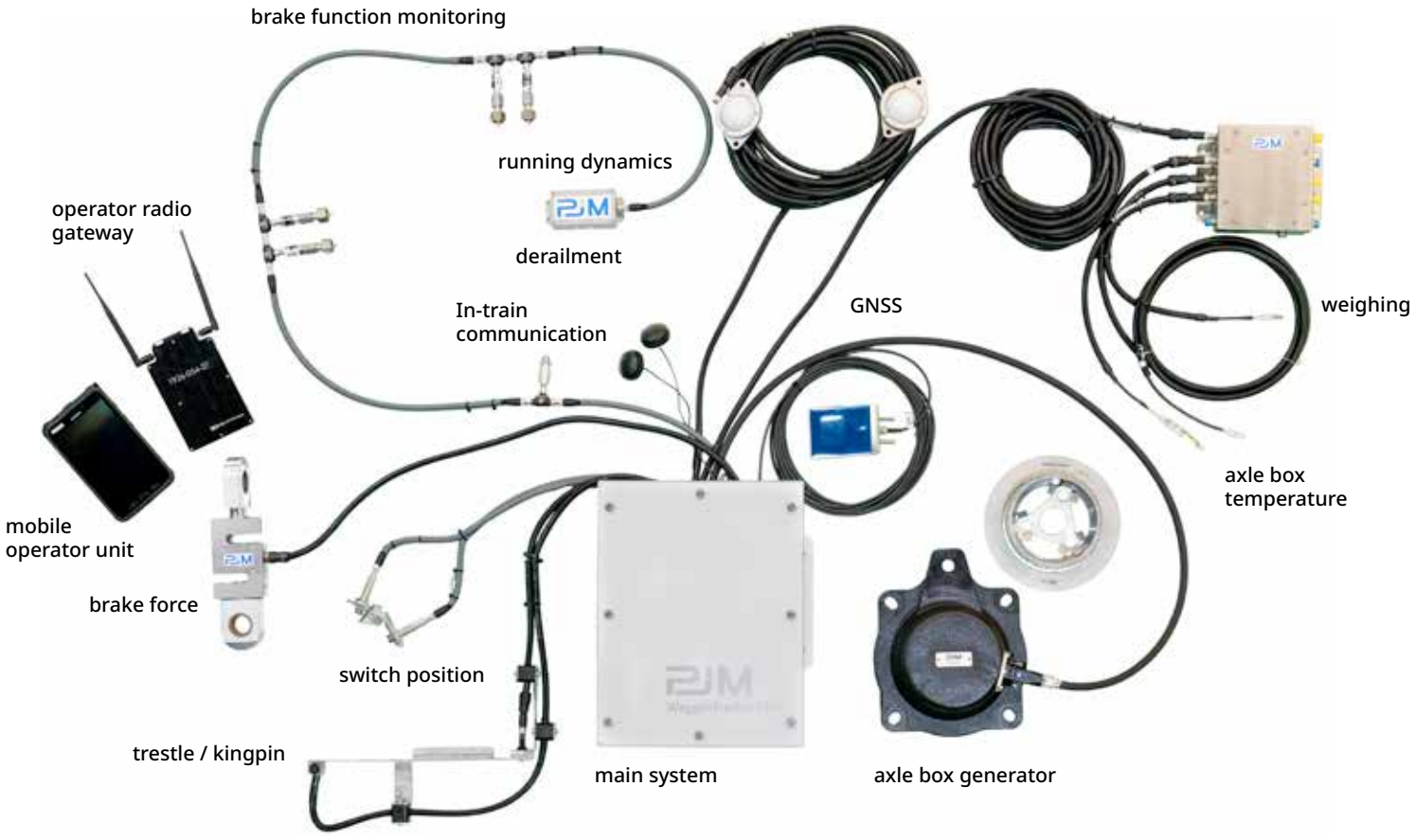
- Automated brake test (operational brake test)
- Partly automated train preparation
- Wagon order
- Load monitoring “optimal load”, asymmetric / overload protection, on-vehicle visualisation
- Impact monitoring (lateral, vertical)
- Free-fall alert (waggon is lifted during loading process)
- Brake system monitoring (correct technical functioning)
- Handbrake status monitoring
- Trestle / king pin status monitoring and notification (intermodal traffic)
- Cargo goods and theft monitoring incl. door alerts

**Train operation**

- Brake system monitoring (correct functioning)
- Brake release check and notification (operational)
- Trestle / king pin status change alert (intermodal traffic)
- Running dynamics (safety, stability)
- IDDS: Derailment analysis
- Flat spot diagnosis
- Axle box temperature monitoring

Upcoming

- Bearing monitoring
- Coupler monitoring
- Automated de-coupling
- Train integrity



## Intelligent freight train: Real-Time monitoring during train operation

- → Brake status of last waggon
- → Derailment diagnosis
- → Hot axle box warning
- → Automatic/remote controlled park brake
- → Automatic/remote controlled de-coupling
- → Diagnosis of faulty braking wagons during operation (adjust pressure)
- → Safety relevant measurement of trestle/hitch
- → Base for future requirements

## Safety relevant development

According to EN 50155, EN 50126, EN 50129, EN 50657, EN 50159, EN 61508, EN 62061, et al.

**Safety relevant system solution**

- → SIL2 sensors in combination with safety electronics for safe and reliable status determination
- → Wireless LoRa in train communication system with safe communication protocol
- → Utilization of existing standard tablets for status visualization

**Homologation and approval by TÜV Süd Rail**

- → WaggonTracker ABT is the first and only approved automated brake test system in Europe

## WaggonTracker MDS – overview (Multi Diagnosis System)

Depending on the waggon, 2-3 sensor are mounted on the waggon frame

**Sensor is the basis for**

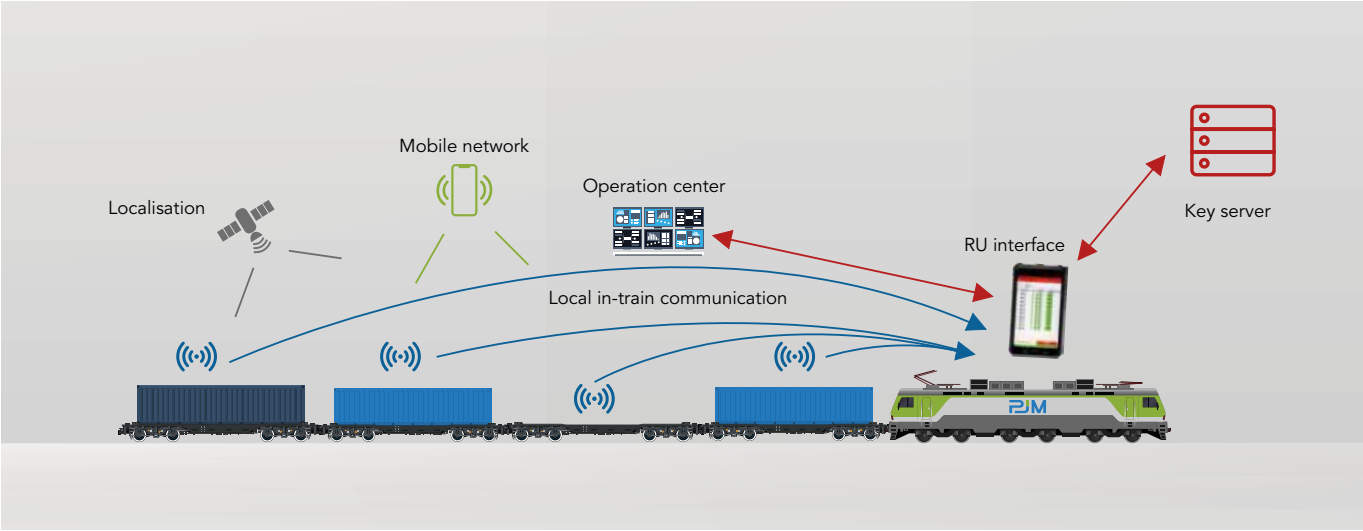
- → Impact monitoring according to EN 12663
- → Vertical impact monitoring
- → Running safety behaviour and stability based on EN 14363
- → Free fall detection during loading/unloading
- → Dynamic derailment detection
- → Flat spot diagnosis (in development)

**WaggonTracker MDS – free fall detection**

- → Detection of derailments during loading/unloading process
- → Calculation of free fall distance
- → Calculation of free fall time
- → Data transmission to the WaggonTracker web portal via mobile network

## In-Train communication

- → In-train long-range wireless system
- → Direct communication
- → Wagon in stand-by
- → Relaying possible
- → Designed for maximum availability
- → Encrypted, secure connection
- → Locally available, inter-operable, fully integrated, open interfaces




*Highest availability and an encrypted, secured connection due to in-train communication.*

# Automated brake test and partly automated train preparation


*For a 500-long freight train, the automated brake check takes less than 5 minutes. The automatic brake test fulfils all safety-relevant regulations in terms of operation and vehicle.*

- → Reliable and safe detection of brake state
- → Increase safety, efficiency, availability
- → Support train preparation
- → G/P switch position
- → Train length
- → Verification of train wagon order

Video:
The automated brake test in operational mode →

# Brake monitoring at stand-still and during operation

Determination of:

- → Brake events (service / full / emergency braking)
- → Correct functioning of the brake system: adequate pressure levels of HL/C/T
- → Fill time: Determination of brake- and release times
- → Realized brake energy: per time unit (thermal stress) as well as in total (wear)
- → Bogie load / vehicle weight (weighing valve pressure)

# Safety relevant trestle and coupler monitoring

- → Automation of operational processes requires safe and reliable status determination
- → Risk assessment determines required safety levels for the system (e.g. SIL2 for sensors, safety electronics, data evaluation and result interpretation)
- → Safe and secure transmission of the wagon status via LoRa communication to the existing operator tablet

### Advantages

- → Providing safety relevant data via in-train communication whenever needed
- → Increase of overall safety and reliability

*On-site visualition in real-time via signal lamps. Automatic load weight monitoring indicates in real time during loading: Overloading, asymmetric loading, wheelset and wheel disc overloading, inadmissable load distribution on the bogie, loading level and loading is ok.*

## Automated Load Monitoring

Video Automated LoadMonitoring

- → Real-time visualization during loading process
- → On-site and in remote via web service
- → Advantages: Prevention of overload, higher efficiency and safety, best possible loading capacity

## Prevention and detection of derailment

### Prevention of derailments

- → Detect incorrect loading
- → Detect vehicle damages & malfunctioning components
- → Ensure maintenance and servicing
- → Detect infrastructure defects and report them (vehicle monitoring and information to infrastructure department)

### Behaviour in the case of derailments

- → Quickest possible detection due to PJM IDDS
- → Real-time alarm to train driver (due to in-train communication) and warning the infrastructure operator (information provided by WaggonTracker web service)

## References

### International customers appreciate the WaggenTracker systems and its wide range of advantages

SBB Cargo | Mercitalia Intermodal | VTG | TRANSWAGGON | Mercer | Lenzing | GATX | Rail Cargo Austria | DB Cargo / MEG

## Awarded Technology

### Awarded WaggonTracker system

RailTech Innovation Award 2022 | Winner Export Award 2022 | Winner Styrian Export Award 2022 | ERCI Innovation Award 2021 (Best SME of 17 European Railway Cluster nations) | German Innovation Award Winner 2020 | Austrian Mobility Award 2020 | Finalist Houska Award 2020 | Fast Forward Award 2019

### PJM at a glance

PJM is an internationally renowned system specialist for rail transport and has successfully implemented projects in 30 countries on 6 continents. As an accredited test centre according to ISO/IEC 17025, PJ Messtechnik GmbH carries out tests for the approval of rail vehicles worldwide. PJ Monitoring GmbH is a technology leader in the automation of rail freight transport with forward-looking comprehensive solutions. PJM was founded in 2006.
60 employees at the Graz site ensure „100 % Made in Austria“: R&D, hardware and software development, production & administration come exclusively from Austria.

Get more on PJM in the video:
https://www.youtube.com/watch?v=mde4KbH93L8

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