



Precision measuring systems for the determination of rail and wheel roughness

# Roughness measuring systems m|rail trolley m|rail m|wheel

# High-precision measuring systems for rough operating conditions

**More passenger comfort and less rolling noise in rail traffic: the precise measurement of rail and wheel roughness makes it possible.**

The rolling noise of rail vehicles depends on the roughness of rails and wheels. Therefore, concerning the acoustics of rail vehicles, detailed knowledge about the unevenness of the running surface is crucial.

In particular, for acoustic acceptance tests of moving trains the different test sections have to be comparable. Accurate knowledge of the rail roughness is therefore fundamental. The measurement of rail and wheel roughness poses high precision demands on the measuring system as unevenness in the dimension of a micrometer or even less has to be reliably determined.

Müller-BBM Rail Technologies is one of the internationally leading providers of solutions concerning the measurement of acoustic rail and wheel roughness. This is what m|rail trolley, m|rail, and m|wheel stand for: a series of robust and user-friendly high-precision measuring devices which are particularly suitable for outdoor use. The calibration of these measuring systems is metrologically traceable. The system's software is always adjusted to the current standards.

## Typical applications are

- Qualification of track sections for acoustic acceptance tests (according to the standards EN 15610, EN ISO 3095, TSI NOI CR/HS)
- Estimation/simulation of rolling noise for the development of rail vehicles
- Monitoring of the track quality in the railroad network
- Evaluation of rail grinding (according to EN 13231-3 as well as acoustic rail grinding)
- Determination of defects which are relevant with regard to acoustics and vibrations, e.g. wheel polygons, wheel flats, rail grooves and corrugations



# m|rail trolley

m|rail trolley is a high-precision measuring system to continuously record the rail roughness. The measuring system can be operated by one person and is simply pushed along the track. In this way, even long tracks can be measured without any problem and acoustically suitable test sections can be quickly identified. Another application is the mapping of the acoustic quality of a railroad network.



# m|rail

m|rail is the reference for measuring rail roughness at individual sections. It can be quickly and easily transported between the test sections and can be removed from the rail area any time simply by lifting it. By means of a line laser, the position of the track is visualized. The roughness signal is shown on a monitor in real time during the measurements, and immediately afterwards the determined roughness spectrum can be compared with the limit curves of the decisive standards.



## Advantages

- Real-time display of the measuring signal on a Tablet PC
- Measurement of all common grooved rails and vignole rails
- Simple and quick measurement and evaluation according to EN 15610, EN ISO 3095 and EN 13231-3
- Low weight
- Power supply via USB port
- Calibration according to ISO/IEC 17025
- Two devices combinable
- GPS localization optionally available

## Technical data

- Measuring sensor resolution: 0.1  $\mu\text{m}$ , mechanical displacement sensor
- Scanning in longitudinal direction: 1 mm
- Measuring velocity: max. 0.5 m/s
- Measurement trace adjustment: continuous (manually)
- Third-octave wavelength range: 3.15 mm to 315 mm
- Dimensions (LxWxH): 1255 mm x 210 mm x 210 mm
- Length of the sliding surface: 1245 mm
- Weight: 16 kg, with transport bag: 21 kg
- Operating temperature range: -10 °C to 40 °C

## Advantages

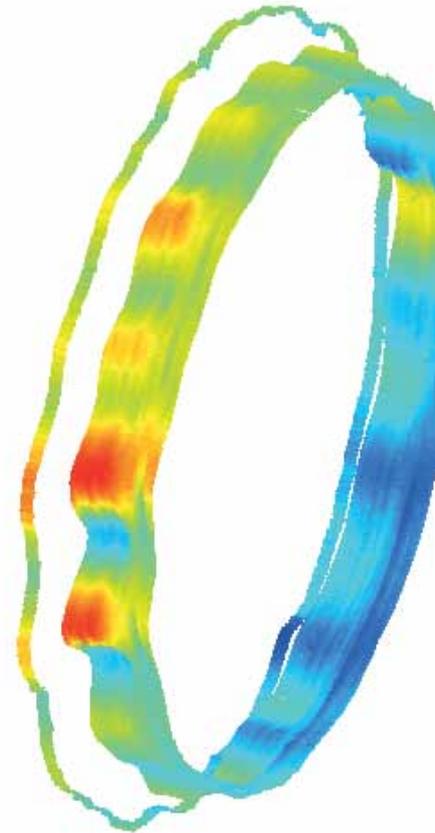
- High security without any cables
- Measurements in the dark are possible with LED technology
- Control via Tablet PC with wireless connection
- Real-time display of the measuring signal
- Quick and easy measurement and evaluation according to EN 15610, EN ISO 3095 and EN 13231-3
- All common rail types can be measured
- Calibration according to ISO/IEC 17025

## Technical data

- Measuring length: 1200 mm
- Measuring sensor resolution: 0.1  $\mu\text{m}$ , mechanical displacement sensor
- Scanning in longitudinal direction: 0.5 mm
- Measuring velocity: 0.1 m/s
- Measurement trace adjustment: 0.5 mm
- Third-octave wavelength range: 1.6 mm to 315 mm
- Power supply: lithium ion rechargeable battery
- Dimensions (LxWxH): 1600 mm x 290 mm x 350 mm
- Weight: 43 kg
- Operating temperature range: -10 °C to 40 °C

# m|wheel

m|wheel is a compact, robust and user-friendly device for precise measurements of rail vehicle wheels. It can be used to record the acoustically relevant roughness for the investigation of rolling noise as well as the polygonization (out-of-roundness) and the exact wheel diameter to examine the wear behaviour. Further fields of application are the determination of wheel flats and other wheel defects, the recording of input data for acoustic simulations as well as research work.



## Advantages

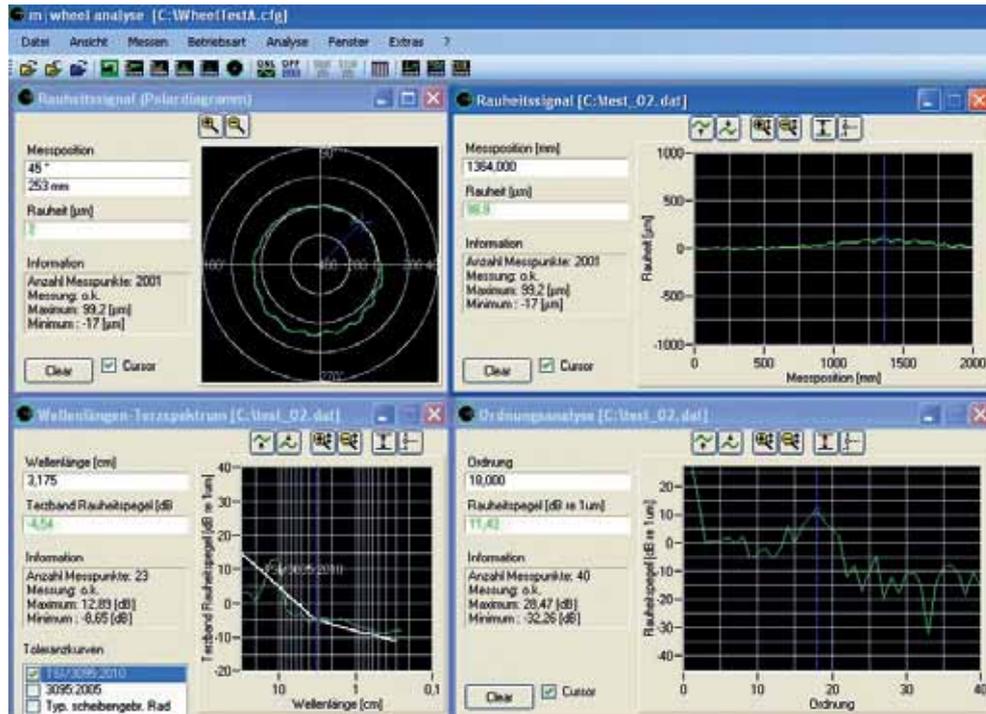
- Robust construction and easy to operate for the use in rail vehicle workshops
- Quick and easy fixation on the rail by means of an adjustable magnetic base
- Real-time display of the measuring signal on a Tablet PC
- Automatic start and stop with magnetic sensor
- Measurement and evaluation based on EN 15610
- Power supply via USB port, no battery required

## Technical data

- Measuring sensor resolution: 0.1  $\mu\text{m}$ , mechanical displacement sensor
- Scanning in running direction of the wheel: 1 mm (determination of the diameter with an accuracy of  $\pm 0.15$  mm, better accuracy is optionally available)
- Measuring velocity: max. 0.5 m/s
- Measurement trace adjustment: continuous (manually)
- Third-octave wavelength range: 3.15 mm to wheel circumference
- Dimensions (LxWxH): 250 mm x 130 mm x 175 mm
- Weight without transport case: 4.5 kg
- Operating temperature range: -10  $^{\circ}\text{C}$  to 40  $^{\circ}\text{C}$

# Software m|rail trolley analyse, m|rail analyse and m|wheel analyse

The scope of supply of m|rail trolley, m|rail and m|wheel also includes the measuring and analysis software exactly adapted to the respective task. This way, the devices can be conveniently controlled and the measured data can be easily evaluated.



## The software functions at a glance

- Data recording and display in real time
- Data processing according to EN 15610
- Calculation, averaging and standardized representation of roughness third-octave spectra
- Direct comparison with the limit curves of the relevant standards
- Export and import of measuring data and spectra in ASCII format

## Additional device-specific functions

### m|rail trolley analyse

- Display of longitudinal velocities during the measurements
- Calculation of narrowband spectra
- Calculation of the roughness single-value indicator  $L_{\lambda CA}$

### m|wheel analyse

- Presentation of the measuring data in the form of polar diagrams
- Output of the exact wheel diameter and out-of-roundness
- Calculation of order spectra and narrow-band spectra
- Calculation of the roughness single-value indicator  $L_{\lambda CA}$

Müller-BBM Rail Technologies GmbH is a subsidiary of Müller-BBM Holding AG, with headquarters in Planegg near Munich, Germany.

Müller-BBM Rail Technologies is a spin-off of Müller-BBM consultancy, which is one of the world's leading engineering firms in all fields of acoustics.

Müller-BBM Rail Technologies develops and distributes measurement and monitoring systems for rail vehicles and track systems. These systems have been developed based on the knowhow coming from our decade-long measurement activities in all fields of railway acoustics.

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