ARGOS® – a high accurate wayside train monitoring system
Hottinger Baldwin Messtechnik - the Global Market Leader

- 60 years experience
- 1,700 employees
- 6 engineering sites
- 26 sales locations
- Represented in over 50 countries by 33 independent distributors
- 140 developers
- Over 4,000 products

HBM Engineering Sites
- Marlboro, MA
- Detroit, MI
- Urbana, IL

HBM Sales & Service
- Darmstadt, Germany
- Sheffield, UK

HBM Representatives
- Suzhou, PRC

measure and predict with confidence
Competence from Physical Measurement to Virtual Testing

Projects
- Sensors

Services
- DAQ Hardware
- DAQ Software

Calibration
- Analysis & Data Processing

Simulation and Prediction

measure and predict with confidence
Typical HBM railway applications

railway applications

- Vehicle (MDA)
- Infrastructure measurement
- Test bench

- Vehicle certification
- Mobile
- Stationary

- Argos® System
- Asset health monitoring (especially bridges)
- R&D infrastructure components (e.g. switches)

measure and predict with confidence
1998: initial research started and driven by OBB

2006: out of the box modular standardised solution
Reasons for “wayside anti-derailment devices”

**SAFETY:**
Prevent accident

- Hot Box detection
- Bearing and Break
- Derailment detection
- Arglos® Level 1
- Fire detection
- Train gauge Monitoring
- Over loading,
Unbalanced load,
Instability
Argos® Level 2 & 3

Sensors are connected with the signaling system: Alarms stop the train!
Reasons for wayside train monitoring systems

**Economical**

Enhancement of vehicle durability

Cost optimization and infrastructure protection

Permanent, centralized rolling stock monitoring and technical traffic check prevention
• Quasi-stationary vertical forces and loads (Q)
• Dynamic vertical forces and loads
• (derived quantities like axle side to side difference etc.)
• Quasi-stationary lateral forces and loads (Y)
• Dynamic lateral forces and loads
• Quasi-stationary longitudinal force (T)
• Wheel out-of-roundness

= all rail-wheel force parameters
The Argos® approach

• Sensors integrated in the infrastructure
• Mounting on all track types possible
• No influence on the track maintenance
• Measurements on regular track speed (typical 20 up to 300 km/h)
• Best possible accuracy (better 1,5% on track speed)
• Near real-time measurement results (typical less than 5s)
• No vehicle type limits
• No sensors on the vehicle are necessary (but possible e.g. RFID-Tags)
The Argos® approach

Level 1 – Derailment detection

Level 2 – straight line train control

Level 3 – train control and derailment safety

after derailment risk and cost reduction

Prevention
Cost reduction
Features Level 1

1. Simple principle, well developed technology
2. For all types of concrete, wooden sleepers
3. Easy mounting
4. All rail mounting elements are free visible
5. All derailment situations to be detected
6. No influence on track maintenance
Detection of risk factors caused by:

- Wheel load (force) variations
- Wheel defects

Sensors taking over responsibility
Argos® Level 2 - Examples
Argos® Installation with machine support
Argos® Quasi-stationary vehicle over loadings

Vehicle mass [t]

Axle load [t]

Number of axle

One bar = one vehicle

One bar = one axle

Average axle load >26 [t] (>15% overload)

In Europe: 22.5t max. allowed axle load
What accuracy do we need?

Example old Bridge in Austria: Max allowed axle load is 25t (strict limit)

Allowed axle load on the track 22.5t

Measured with +/- 10% accuracy class
Vehicles with 22.75t axle load have to stopped
This is not practicable

Measured with +/- 1.5% accuracy class
Vehicles with 24.62t axle load have to be stopped
This is practicable!
Wheel defects
Argos® Modul „wheel shape irregularities“ measurement principle

special engineered accelerometers

EP 1883 565: The signals are derived from the measuring elements, which displace the rails in the vertical direction and, then an information array is formed in the evaluation device from the signals, which corresponds at least to the periphery of the wheel. The periodic signal of the shapes of the wheel is evaluated with the aid of a Fourier development

http://tiny.cc/889qz
Argos® Dynamic wheel Q-force

Measured dynamic wheel force over 400KN (allowed 200KN)
Argos® Measurement of wheel defects

Out of roundness

wheel circumference

Out of roundness

wheel circumference
Example development of wheel defects

amplitude (out-of roundness)
wheel defects Bogie 1

amplitude (out-of roundness)
wheel defects Bogie 2
- Continuous vertical Q forces in curves
- Continuous lateral Y forces in curves
- Accuracy better 2.5% (Q/Y)
- Radius between 190m and 500m (installation on all track types possible, measuring length 12 meters)
Argos® Level 3a – Results

Achslasten (Q-Kräfte)  
Y-Kräfte  
Y/Q

![Graphs showing Achslasten, Y-Kräfte, and Y/Q](image-url)
Argos® Level 3b – Instability and Noise

\[ \tan(\gamma) = 0.4 \text{ mean value} \]

Length = min 25 m

- **Secondary zone (y)**
- **Core zone (y,q)**
- **Secondary zone (y)**

Direction of traffic

Microfon and ground vibration measurement

Measure and predict with confidence
Argos® Level 3b – results hunting

stable / instable 2-axle vehicle

stochastic

resonance

Source: FFG-Bericht/BAMM
Argos® Automatic data handling

Permanent TCP/IP connection
Data transfer via FTP
Data interfaces like xml, etc.

Limit exceeding reports, red-reports, Alarms

Signaling System

Result Handling:
User system: through web application
Expert system: through special applications (ARGOS-Client, ARGOS-Statistic), or data interfaces like xml, etc.
Argos® 10 systems installed in Austria

Austrian railway network

Level 3a Blisadona

Level 2 Wels

2x Level 2 Enns

Level 2 Melk

Level 3b und 1 Deutsch-Wagram

Weiche Dürnkrut

Level 2 und 1 Himberg

Level 3a Semmering

Level 3a Velden

Level 3a Melk
Reduce stopping times in border stations
e.g.: Korridor X line railways partnership

„We connect nations by establishing an cross-border infrastructure for freight and passenger traffic which is in line with market requirements and budget-conscious.”

Argos® gives objective measuring results about
- running safety
- weights and overloads
- wheel defects

No further inspections of these properties at the border stations are necessary.
Why use wayside train monitoring systems?

Quickly and objectively know how about vehicles and tracks interaction reduce undesirable interaction situations

Enhanced Safety & Better Protection

and:

Correctly maintained and loaded vehicles reduce wear and Life cycle cost

Decreasing costs
Costs and efficiency

• To reduce maintenance costs = Seamless infrastructure integration is necessary

Example 10.000km line (mixed strait line + curves):
Invest to install 40 Argos Systems ca. 20 Mio€

Costs saving (study Ernst Basler & Partner):
2-3 Mio€/year reduced maintenance costs
500 K€/year reduced costs after derailments
2-3 Mio€/year more income for correct freight pricing
Thanks

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