State-of-the-Art Wheel Detection and Axle Counting Systems

Gerhard Grundnig
1. Innovative Wheel Detection and Axle Counting Systems
2. Company overview
3. Case Studies | References
4. Conclusion
Wheel Detection

Field of applications

- axle counting systems
- level crossings
- switching tasks
- measuring systems
- diameter & speed measurement
- customer-specific applications

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Axle Counting Systems

Axle counting system ACS2000 (relay interface) for

- Main lines
- Metro / trams
- Regional lines
- Industrial lines
Axle Counting Systems

Axle counting system FAdC (serial interface) for

- Main lines
- Metro / trams
- Regional lines
- Industrial lines

Data transmission via Ethernet interface

fail-safe customized protocol
Axle Counting Systems

• Permanent innovation leads to different axle counting systems
  – ACS2000: fail-safe relay interface
  – FAdC: fail-safe serial interface
    (or fail safe relay interface as an option)
  – FAdCi: fail-safe serial interface

• Every axle counting platform consists of variable components
• Based on proven FWD systems (Frauscher Wheel Detection)
• Safe determination of clear/occupied (track vacancy)
• Exhaustive diagnostic information
Axle Counting Systems

- Easy replacement of existing track circuit
- Reliable counting of axles and fail-safe generation of Clear/Occupied message
- Customized reset-function
- Simple integration into any type of interlocking system
- Serial interface affords compact interlocking systems with customer-specific and economic track vacancy detection (FAdC)
- Modular and scalable design
- Additional functionalities configurable (e.g. counting head control, driving direction, etc.)
- Central and distributed architecture
## Axle Counting vs. Track Circuits

<table>
<thead>
<tr>
<th>Track Circuit</th>
<th>Axle Counting Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track superstructure requirements</td>
<td>Electrically insulating</td>
</tr>
<tr>
<td>Measures with reference to track return current</td>
<td>Special measures required (meshing)</td>
</tr>
<tr>
<td>Sensitivity to external influences (e.g. over voltages, track currents, etc.)</td>
<td>High</td>
</tr>
<tr>
<td>Sensitivity to climatic influences (e.g. heat, cold, dirt, etc.)</td>
<td>High, particularly with reference to ballast resistance (leaves, wetness, etc.)</td>
</tr>
<tr>
<td>Section length</td>
<td>Less than 2000 m</td>
</tr>
<tr>
<td>Recognition of rail breaks</td>
<td>Possible under certain circumstances</td>
</tr>
<tr>
<td>Reset</td>
<td>Not required</td>
</tr>
<tr>
<td>Functional scope</td>
<td>Track vacancy detection</td>
</tr>
</tbody>
</table>
## Axle Counting vs. Track Circuits

<table>
<thead>
<tr>
<th>Monitoring of complex point structures, etc.</th>
<th>Track Circuit</th>
<th>Axle Counting Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be carried out under certain circumstances</td>
<td>Can be carried out without restriction</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Can be modified</th>
<th>Track Circuit</th>
<th>Axle Counting Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only with great outlay (superstructure adaptations; rail joints)</td>
<td>Simple (by mounting wheel sensor using rail claw)</td>
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</table>

<table>
<thead>
<tr>
<th>Installation</th>
<th>Track Circuit</th>
<th>Axle Counting Technology</th>
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</thead>
<tbody>
<tr>
<td>Installation of rail joints Drilling of connection cable</td>
<td>Rapid assembly through the use of rail claws</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Availability</th>
<th>Track Circuit</th>
<th>Axle Counting Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF – Gsk high NF – Gs average</td>
<td>Very high</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Required travel cycles</th>
<th>Track Circuit</th>
<th>Axle Counting Technology</th>
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<tbody>
<tr>
<td>24 hours</td>
<td>Up to 2 years</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Maintenance outlay</th>
<th>Track Circuit</th>
<th>Axle Counting Technology</th>
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<tbody>
<tr>
<td>High</td>
<td>Low</td>
<td></td>
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</tbody>
</table>

<table>
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<tr>
<th>Installation costs</th>
<th>Track Circuit</th>
<th>Axle Counting Technology</th>
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</thead>
<tbody>
<tr>
<td>High</td>
<td>Low</td>
<td></td>
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<table>
<thead>
<tr>
<th>Investment costs (components)</th>
<th>Track Circuit</th>
<th>Axle Counting Technology</th>
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<tr>
<td>Comparable</td>
<td>Comparable</td>
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Highest Safety – Maximum Reliability

- Fail safe and reliable operation even under extreme conditions
  - temperatures
  - huge vibrations
  - electromagnetic interferences
  - floodings

- 3 wheel sensor families for different applications

- No electronic components near the track (track side connection box)
Easy and Fast Setup with Rail Claws

- No drilling of rail
- Flexible positioning
- Easy and quick mounting or dismounting
- Proven and efficient solution for every possible requirement
Reduced Maintenance Costs

Diagnostic system FDS allowing

- Preventive maintenance
- Fast and efficient fault clearance
- Reduction of maintenance work
- Remote access
- Statistic evaluation (quantity of axles, train, reset operations…)

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Services for Minimum LCC

- **Consulting for correct system architecture**
  Support in concept phase in case of system structure, technologies and functions choice

- **Operator can handle all Frauscher products**
  Standard and individual adapted training session on-site or at the facilities of Frauscher

- **Effective and smooth project management**
  Support during installation & commissioning periods on-site, via phone / email

- **Short down times and high availability**
  Quick response times in finding of error causes and repairing of faulty components
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Product Portfolio

WHEEL DETECTION

AXLE COUNTING SYSTEMS

DIAGNOSTICS

MEASURING SYSTEMS

SPECIAL SENSORS

SERVICES
Mission of Frauscher

Being the most reliable and cost effective supplier with outstanding products and services for wheel detection and axle counting systems.
Independent Technology Leader

- Founded by Josef Frauscher in 1987
- Frauscher Sensor Technology, Austria
  100% focus on development, manufacture and supply of wheel detection and axle counting systems
- More than 100 employees
- Foundation parent group guarantees long term stability
- Subsidiaries for Sales and Services
  - UK
  - Poland
  - China (Beijing)
  - local agents
- Independent supplier
Company Structure

• Foundation: guarantees long term stability
• Holding: managing of company shares, IPR’s, real estate, capital and company ownership
• Frauscher Sensortechnik GmbH: development, manufacture and supply of inductive sensor technology and rail safety components
• Frauscher Polska, UK, Asia: sales and service subsidiaries
• Frauscher Energietechnik GmbH: Development Stirling engine
• Flight Charter: charter company for business flights / airplanes
Business Philosophy

• Proven safety and reliability is applied at minimum life cycle costs
• Signalling supplier can offer the best and innovative solutions to their customers
• Operator can handle our products by themselves
• Independent supplier
• Dedicated service and local support to the market
Financial Performance

- Organic growth by ownership capital only
- EBIT of company has been continuously positive for 20 years
- Profit has been growing continuously
- Cash flow is positive in all years
Inhouse Production

- Frauscher is the leading producer of inductive sensor technology for the railway industry worldwide
- 100% ownership of all IPR; leading to full control of all development and critical manufacturing processes
- High tech manufacturing facilities capable of producing more than 15,000 sensors per year
Inhouse Development

- Permanent innovations and numerous patents
- Analyzing customer needs (trials, measuring tools, test equipment)
- Development according to CENELEC standards complying with SIL 4 requirements
- Independent „product safety“ division
- R&D expenses 15% turnover
Agenda

1. Innovative Wheel Detection and Axle Counting Systems
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Segments

MAIN LINE
REGIONAL LINE
INDUSTRIAL LINE
METRO | TRAM
LEVEL CROSSING
OTHER APPLICATIONS
## Customers (excerpt)

<table>
<thead>
<tr>
<th>System Integrators / Signalling System supplier</th>
<th>Signalling Companies</th>
<th>Railway operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Alstom</td>
<td>• Atkins Rail</td>
<td>• Austrian Federal Railways (OeBB)</td>
</tr>
<tr>
<td>• Ansaldo</td>
<td>• AZD Praha</td>
<td>• Beijing Metro</td>
</tr>
<tr>
<td>• Bombardier</td>
<td>• Balfour Beatty Rail Signal</td>
<td>• German Railway (DB)</td>
</tr>
<tr>
<td>• CRSC</td>
<td>• BBR</td>
<td>• MTR Hong Kong</td>
</tr>
<tr>
<td>• Invensys rail</td>
<td>• Kombud</td>
<td>• Network Rail</td>
</tr>
<tr>
<td>• Siemens</td>
<td>• SST Signal und Systemtechnik</td>
<td>• SRT Thailand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Vietnam Railways</td>
</tr>
</tbody>
</table>

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Frauscher Worldwide

- **32,000** wheel sensors and **21,000** axle counter systems in operation in Railways
- **3,300** wheel sensors and **2,200** axle counter systems in operation in Light rail / Metro
- **3,200** wheel sensors and **3,100** axle counter systems in operation in Industrial Railways
- **30,000** wheel detection points in operation in position detection, switching and level crossings

Frauscher products can be found on all continents and in more than **50 countries** of the world.
Frauscher Worldwide
Country: Turkey  
Operator: BursaRay  
Partner: BBR  
Date: February until October 2010

Volume:
- 100 counting heads
- 50 counting sections

Frauscher components:
- Wheel sensor RSR180
- Evaluation board IMC
- Axle counting system ACS2000

Features:
- Rapid transit
- Integration in existing systems
- Extension already scheduled
- Trial installation at the beginning
<table>
<thead>
<tr>
<th>Country</th>
<th>UK</th>
</tr>
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<tbody>
<tr>
<td>Operator</td>
<td>London Underground</td>
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<tr>
<td>Partner</td>
<td>Invensys</td>
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<tr>
<td>Date</td>
<td>December 2008</td>
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</tbody>
</table>

Volume
- 100 counting heads

Frauscher components
- Wheel sensor RSR123
- Evaluation board EIB-R

Features / Challenges
- 90 seconds head way
- Check rail
- Quick installation during short line shut down
- 750 V DC
# Hamburger Hochbahn City Ost

<table>
<thead>
<tr>
<th>Country</th>
<th>Germany</th>
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</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Hamburger Hochbahn</td>
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<tr>
<td>Partner</td>
<td>Siemens</td>
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<tr>
<td>Date</td>
<td>December 2007</td>
</tr>
</tbody>
</table>

**Volume**
- 190 counting heads
- 188 evaluation boards

**Frauscher components**
- Wheel sensor RSR180
- Evaluation board IMC

**Features / Challenges**
- High density of different signalling equipment in the track
- High EMI
- 750 V DC
Beijing Subway

Country  China  
Operator  Beijing MTR  
Partner  CRSC/CASCO  
Date  2010  

Frauscher components
- Wheel sensor RSR180
- Evaluation board IMC
- Axle counting system ACS2000

Volume
- 287 counting heads
- 237 counting sections

Features / Challenges
- Axle counting system used to back up track circuits
- 750 V DC
- Three rail system
# Hanoi – Vinh Phase II

<table>
<thead>
<tr>
<th><strong>Country</strong></th>
<th>Vietnam</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operator</strong></td>
<td>Vietnam Railways</td>
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<tr>
<td><strong>Partner</strong></td>
<td>Alstom</td>
</tr>
<tr>
<td><strong>Date</strong></td>
<td>2010</td>
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</tbody>
</table>

**Frauscher components**
- Wheel sensor RSR180
- Evaluation board IMC
- Axle counting system ACS2000

**Volume**
- 534 counting heads
- 432 counting sections

**Features / Challenges**
- Heavy rail
- Non electrified line
- Narrow gauge
# Blue Scope Steel

**Country**  Australia  
**Operator**  BlueScope  
**Steel**  
**Partner**  Selectrix  
**Date**  January 2008

### Frauscher components
- Wheel sensor RSR180
- Evaluation board AMC
- Axle counting system ACS2000

### Volume
- 50 counting heads
- 10 counting sections

### Features / Challenges
- Rough environmental conditions
- Floodings
- Heavy haul train (steel plant)
Kuala Lumpur

Country  Malaysia
Operator  ERL Kuala Lumpur
Partner  Siemens
Date  January 2001

Volume
• 326 counting heads
• 200 counting sections

Frauscher components
• Wheel sensor RSR180
• Evaluation board ASB
• Axle counting system AZF

Features / Challenges
• Tropical thunder storms
• 25 kV AC
State Railway of Thailand

<table>
<thead>
<tr>
<th>Country</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>SRT</td>
</tr>
<tr>
<td>Partner</td>
<td>Siem Huad</td>
</tr>
<tr>
<td>Date</td>
<td>January 2005</td>
</tr>
</tbody>
</table>

Frauscher components
- Wheel sensor RSR180
- Evaluation board AMC
- Axle counting system ACS2000

Volume
- 320 counting heads
- 80 counting sections

Features / Challenges
- Non electrified line
- Remote level crossing system
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Frauscher – The Best Solution

- Technology leader for wheel detection and axle counting system
- Highest safety and maximum reliability
- Easy and fast setup
- Low maintenance
- Customized solutions
- Global experience – successful operation of Frauscher products in more than 50 countries
- Independent component supplier
Frauscher Contacts

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