# MiniProf BT)))

DIGITAL PROFILE MEASURING

by
GREENWOOD ENGINEERING A/S
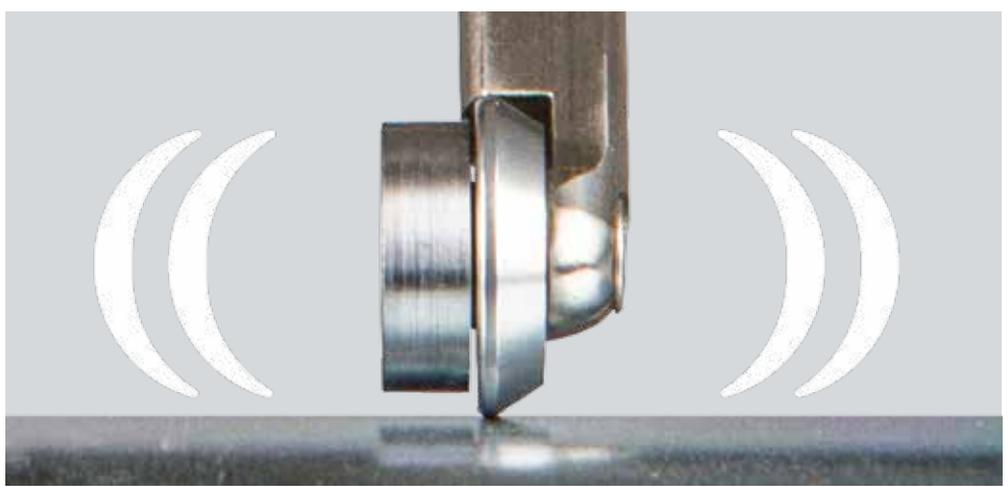
Full contact - Your way to valid and reliable data

Safety

Capacity

Quality

Punctuality

Travelling Comfort

Stay in **full control** of your assets
Choose **full contact** measurements

Frequency

Costs

Area of use

The MiniProf ^{BT} system is an excellent full contact measurement system with Bluetooth connection for fast, reliable and extremely high quality profile measurements. Combined with a user-friendly and flexible software package which can easily be configured from basic use to in-depth post measurement analysis, MiniProf ^{BT} can be used for numerous purposes on all types of wheel, rail and brake profiles. It enables the user to make critical decisions in purchase, maintenance, quality and safety departments etc. and represents a great platform for research and development all over the world.

Product design & development

- Material and life cycle test
- Lubrication/friction effect
- Design of wheel, rail, brake disk, boogie

Research & universities

- WRI studies, verification of research and principles
- Reduce noise and wear-rates to extend asset lifetime
- Improve safety, speed, load and travel comfort

Manufacturing

- Production quality control
- Factory acceptance inspection before shipment
- Verification of production equipment

Safety regulation

- Inspection check if assets are within regulation
- Accident and derailment investigation
- Analysis and documentation of work

Procurement

- On-site field/workshop incoming inspection
- Lifetime/performance monitoring – forecast planning
- Compare quality from different suppliers

MiniProf ^{BT}))

MUCH MORE THAN A MEASUREMENT!

Maintenance

- On-site field/workshop conformity, limit inspection & documentation
- Rail grinding, profile check before/after
- Wheel re-profiling, profile check before/after milling

Quality control

- Verify accuracy of on-site/build-in laser-based gauges
- Verify accuracy of wheel lathes and rail grinding machines
- Verify accuracy of handheld laser-based gauges

Management

- Life cycle wear monitoring
- Trend forecast, planning of on-time maintenance intervals
- Life expectancy / improvements / replacements

Measuring principles

MiniProf [BT] is based on secure full-contact measurements and has a knife-shaped full contact point directly to the surface of a given profile. The magnetic full contact point minimizes influences from oil, lubrication, dirt and other substances on the profile as it "cuts" through the layers. It ensures constant contact to the actual profile during the complete measuring process and minimizes operator influence.

The accuracy of a MiniProf [BT] system is very consistent due to the unique measuring principle with a small magnetic measuring wheel and two rotating optical high resolution encoders which ensure that the measurement is performed perpendicular to the surface of the entire profile.

Due to the unique combination of full contact measurements, consistency and outstanding high-resolution optical encoders, MiniProf [BT] provides the highest accuracy available on the world market today. 20-30.000 collected individual points in one single profile measurement generate outstanding raw material resulting in excellent profile measurements with extremely high accuracies.

Full contact vs. non-contact

A full contact measuring system measures the exact profile. Concerns about dirt, oil and greasy surfaces are minimized thanks to the MiniProf [BT] full contact point which cuts through unwanted layers on the profile.

A non-contact measuring system is not in full contact with the actual profile and therefore provides pictures of a given surface including unremoved dirt, oil etc.

Full contact measuring systems are not influenced by reflecting light on the profile surface or by shiny profile surfaces like a newly turned wheel etc.

Non-contact devices may show inconsistency when used on reflecting surfaces, in bright sunlight, frost, fog and moist climates etc. due to the sensibility of the non-contact data collecting method.

Sand

Dirt

Raindrops

Lubrication

Leaves

Reflecting light

Snow

White frost

Full contact by
MiniProf [BT]

Non contact

Reflective surface

Layers on surface

Actual profile
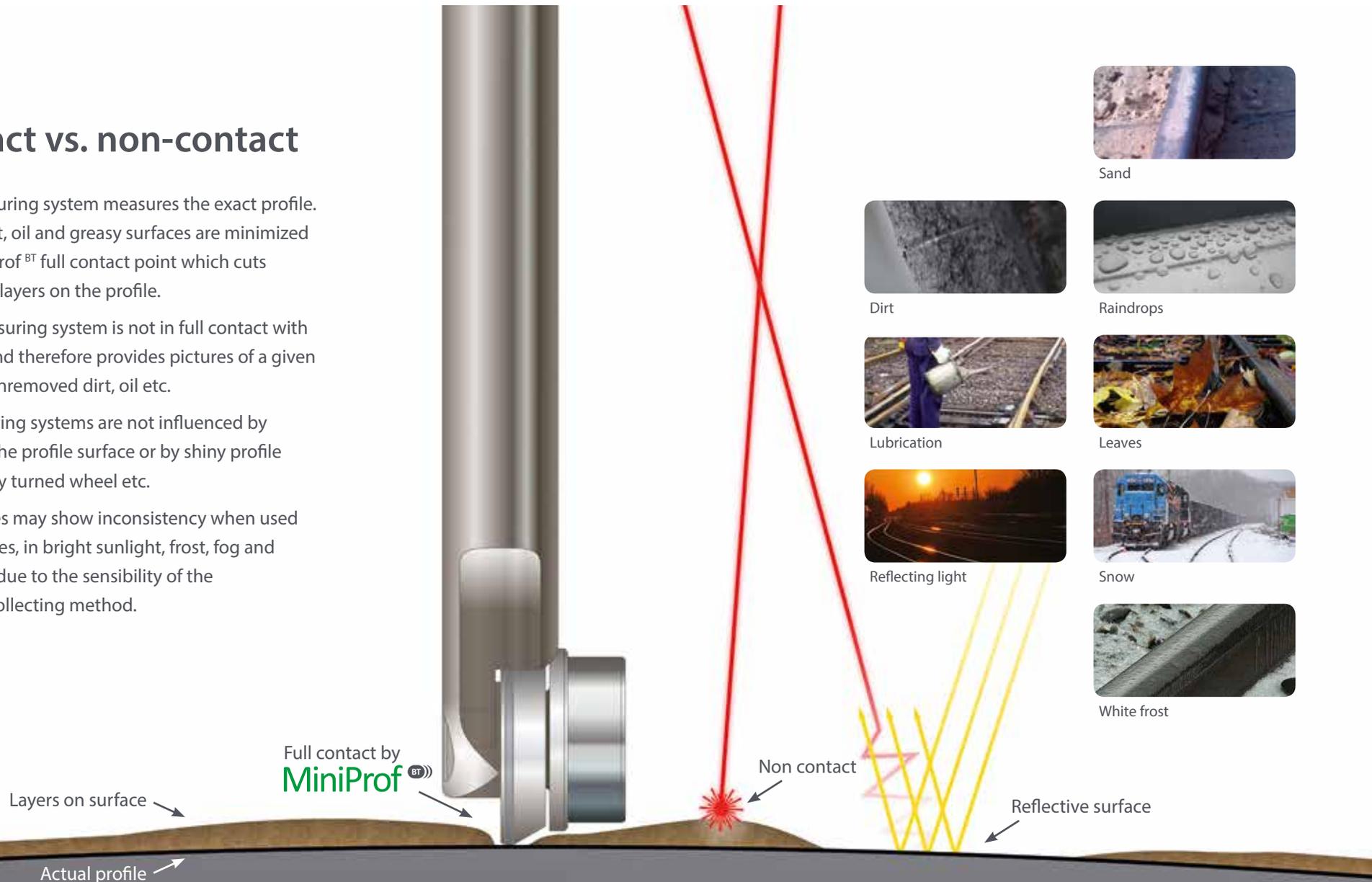
Bluetooth

MiniProf BT has a strong Bluetooth connection with a standard operating range from minimum 5-10 m. The user is able to perform fast and wireless measurements making the measuring process even more flexible and efficient. Option for USB cable connection is included.

Highest accuracy

A MiniProf BT instrument provides the highest accuracy available on the market today. The profile accuracy lies between 9 and 11 µm depending on the MiniProf system configuration.

Lightweight and handheld unit

A MiniProf BT instrument is a compact and wireless handheld unit, which can enter very narrow places. It weighs from only 0,7 kg and is delivered in a ready-to-go transport case for safe storage and transportation.

22
Ti
Titanium
47.867
[Ar]3d²4s²
6.8281

Optical encoders

Profile   Magnetic wheel

Top quality components

MiniProf BT is made of titanium which makes it very temperature and shock resistant and ensures accuracy, stability and a very long lifetime.

Consistent accuracy

The accuracy of a MiniProf BT system is very consistent due to the measuring principle with a small magnetic measuring wheel and two rotating optical high resolution encoders which ensure that the measurement is performed perpendicular to the surface of the entire profile.

Fast and easy to use

The MiniProf BT is a fast and easy to use measuring system which enables the user to carry out a single profile measurement in less than 5 seconds.
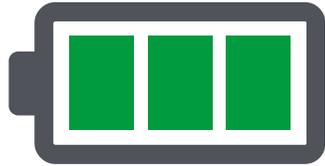
Long battery life

MiniProf ᴮᵀ is the perfect tool for field work. A new fully charged battery contains approximately 1000 Bluetooth measurements or 10 hours of work, which can be even further extended when using the cable connection option.

Easy-to-clean design

The MiniProf ᴮᵀ instrument has an easy-to-clean design, which reduces the accumulation of oil and dirt. The cleaning of the instrument is easily done just by using a mild solvent and a cloth after use of the instrument.

Warranty - 5 years

The MiniProf ᴮᵀ systems are founded on 25 years of solid experience. We are therefore proud and confident to offer up to 5 years warranty on all new MiniProf ᴮᵀ instruments as well as discounted loyalty calibration prices.

Operation temperature

The MiniProf ᴮᵀ instrument can be used for measuring in various types of environments and measures perfectly in temperatures from at least -15°C to +50°C.
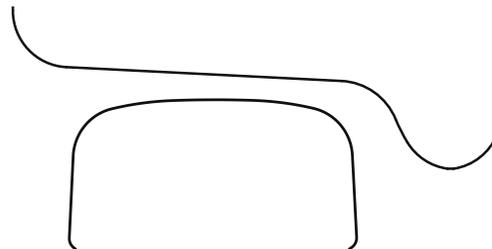
Full digital profile

MiniProf ᴮᵀ uses high resolution optical encoders when measuring a profile. An extreme high amount of data for the total profile is collected and an average of approximately 600 points of the profile is saved digitally for further analysis.

Full software package

MiniProf ᴮᵀ is supplied with the MiniProf Envision software for standard computers and tablets, which allows for data collection and contains powerful modules for advanced data handling, analyzing and reporting. MiniProf ᴮᵀ also includes the MiniProf Criterion app for Android phones which is designed for easy data collection in the field.
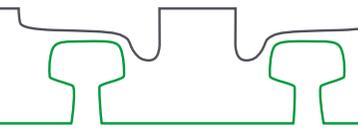
MiniProf ^{BT}
Rail

MiniProf ^{BT} Rail is a high precision, lightweight and portable tool for performing cross-sectional rail profile measurements in order to monitor and analyze the wear of rails. It is equipped with Bluetooth as well as cable connection option and is supplied in few variations for all types of rails, including grooved rails.

- MP-260: Incl. perpendicular device

- MP-261: Incl. gauge determination, grade, super elevation, also suitable for grooved rails

- MP-262: incl. gauge determination, grade, super elevation, perpendicular device

Magnetically attached to the top of the railhead using the opposite rail as reference, the rail profile is measured in less than 5 seconds reducing exposure on the track.

Profile accuracy
Better than: ±11 µm
Repeatability: ±2.5 µm

Measuring speed
Speed: < 5 seconds

Weight
MP-260: 0,8 kg
MP-261: 0,7 kg
MP-262: 1,2 kg
Telescopic rod: 0,6 kg
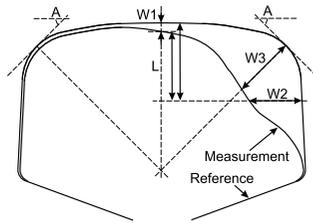
Rail wear calculations

Vertical, horizontal and angled wear is calculated instantly. Numerous additional calculations and alignments for rails are available in the versatile and flexible Envision software package and can easily be added for optimum and customized configuration.

Gauge measuring

MiniProf ^{BT} Rail is equipped with a telescopic rod using the opposite rail as reference. This ensures a correct and stable position and prevents the instrument from tilting. Depending on system configuration, the track gauge is measured simultaneous.
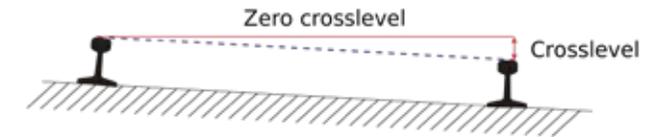
Super-elevation / Grade

Super elevation and grade are measured automatically depending on system configuration. The values are stored with the measurement and can be displayed at any time. The range of the measured inclination is ± 30 deg.

Rail analysis & grinding

The MiniProf Envision software can visualize and calculate residuals and areas automatically and provides a functionality which is often used for rail grinding analysis. Measurements can be compared in multiple ways and easily exported to various formats. MiniProf Envision offers you a powerful rail analysis tool as well as user friendly measuring software.

Perpendicular device

Depending on system configuration, MiniProf ^{BT} Rail is equipped with a small built-in perpendicular device which ensures correct alignment to the rail and prevents faulty diagonal measurements.
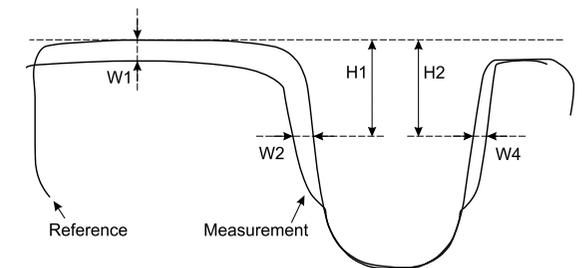
Suitable for grooved rail

MiniProf ^{BT} Rail, type MP-261, can be used on grooved rails. The full contact magnetic measuring wheel ensures that the measurement is taken all the way down to the groove. Based on a reference, both the horizontal wear and the side wear are calculated.
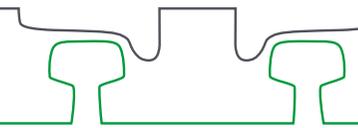
MiniProf BT))
Wheel

MiniProf BT Wheel is a high precision, lightweight and portable tool for performing cross-sectional wheel profile measurements in order to monitor and analyze the wear of wheels. It is equipped with Bluetooth as well as cable connection option and can be used on various types of wheels.

Magnetically attached to the backside of the wheel, the wheel profile is measured in less than 5 seconds. A complete railroad car can be measured in less than 5 minutes.

Various calculations and alignments for wheel are available in the versatile and flexible Envision software package and can easily be added for optimum and customized configuration of the MiniProf BT Wheel system.

Profile accuracy
Better than: ±9 µm
Repeatability: ±2.5 µm

Measuring speed
Speed: < 5 seconds

Weight
Unit: 1,1 kg
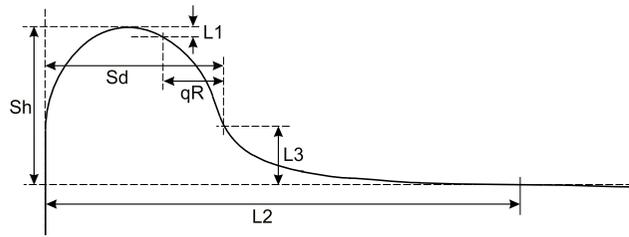
Wheel wear calculations

The Sd, Sh and qR values are calculated instantly and numerous additional calculations and alignments for wheels are available in the versatile and flexible Envision software package.

Wheel analysis

The MiniProf Envision software can visualize and calculate residuals and areas automatically. Measurements can be compared in multiple ways and easily exported to various formats. MiniProf Envision offers you a powerful wheel analysis tool as well as user friendly measuring software.

MiniProf BT))
Lightrail Wheel

MiniProf BT Lightrail Wheel is a small instrument, with an only 100 mm backplate, specially designed for use on tramway vehicles. This small and compact instrument can be mounted where only limited space is available and fits all tram wheels.

Profile accuracy	**Measuring speed**	**Weight**
Better than: ±9 μm	Speed: < 5 seconds	Unit: 0,7 kg
Repeatability: ±2.5 μm		

Reprofiling

The MiniProf BT Wheel system is ideal to use before and after reprofiling of the wheels to determine when to reprofile and how much material to take off during the reprofiling process. This leads to precise reprofiling and improved lifetime of the rolling stock due to the unmatched high accuracy of the MiniProf system.
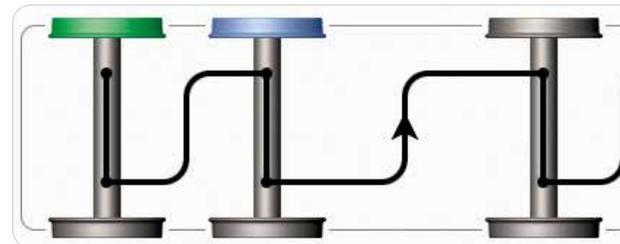
Measuring scheme

When measuring multiple profiles, the MiniProf BT measuring scheme is a very strong tool for clear identification of each profile in advance and for simplifying and reducing the measuring process even further.

MiniProf BT))
Wheel 400

Profile accuracy
Better than: ±9 µm
Repeatability: ±2.5 µm

Measuring speed
Speed: < 5 seconds

Diameter accuracy
800 mm: 30 µm
1000 mm: 50 µm
1200 mm: 80 µm

Weight
Unit: 1,4 kg

MiniProf BT Wheel 400 is equipped with a wide 400 mm backplate instead of the standard 250 mm backplate. The extremely high profile accuracy remains unchanged. Due to the increased width of the backplate, the diameter reading is improved significantly and is three times less sensitive to the state of the wheel and the measuring process.

The calculation of the diameter is based on the versine measuring principle and an assumption of an ideal wheel without local deformations. The state of the wheel, including defects on the top of the flange and incorrect positioning of the instrument, will impact the diameter reading and should be considered carefully as per below illustration.

The versine measuring principle
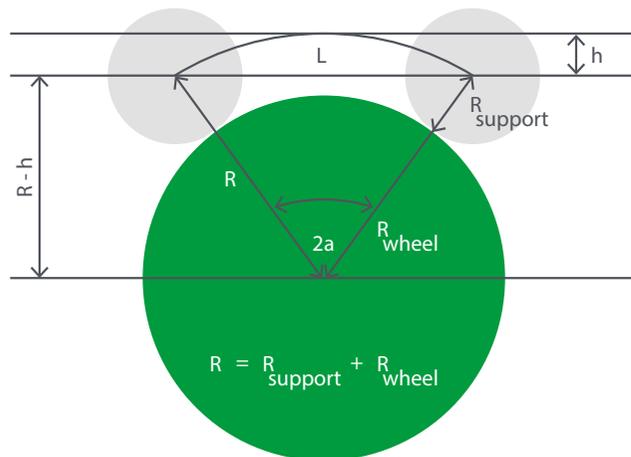
$$R_{wheel} = \frac{(0.5L)^2 + h^2}{2h} - R_{support}$$

Error amplification factor

Forstærkningsfaktor
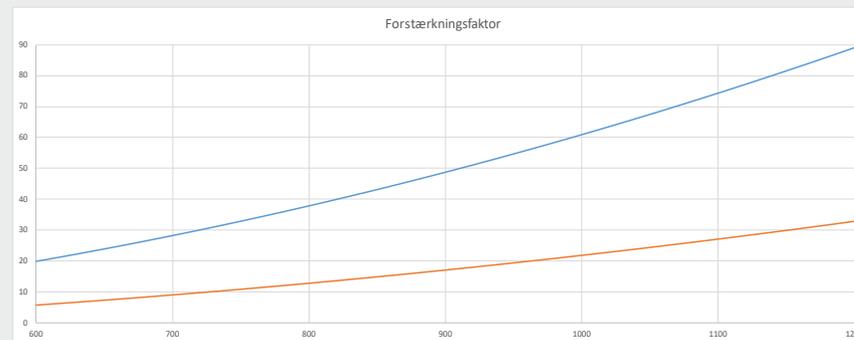
250 mm instrument

400 mm instrument

Wheel diameter (mm)

MiniProf BT)) Brake

MiniProf BT Brake is an excellent tool for measuring the important wear parameters of brake discs and for calculating the brake hollowing and brake thickness.

MiniProf [BT] Brake provides instant calculations of the brake hollowing and brake thickness. The MiniProf Envision software can visualize and calculate residuals and areas automatically. Measurements can be compared in multiple ways and easily exported to various formats. MiniProf Envision offers you a powerful brake analysis tool as well as user friendly measuring software.

Profile accuracy
Better than: ±11 µm
Repeatability: ±2.5 µm

Weight
Wheel mounted: 0,9 kg
Axle mounted: 1,2 kg

Measuring speed
Speed: < 5 seconds

Wheel mounted

The wheel mounted MiniProf [BT] Brake instrument is attached magnetically to the vertical part of the wheel, either on the backside of the flange or on the outer side of the rim. This part of the wheel is used as a reference for the measurement.

Axle mounted

The axle mounted MiniProf [BT] Brake instrument is mounted on the outer diameter of the brake disc and is attached using magnetic rollers. These also align with the wear marker on the disc which act as reference points for the measurement.

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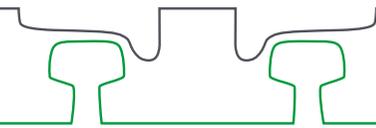
MiniProf BT⟩⟩
TwinHead
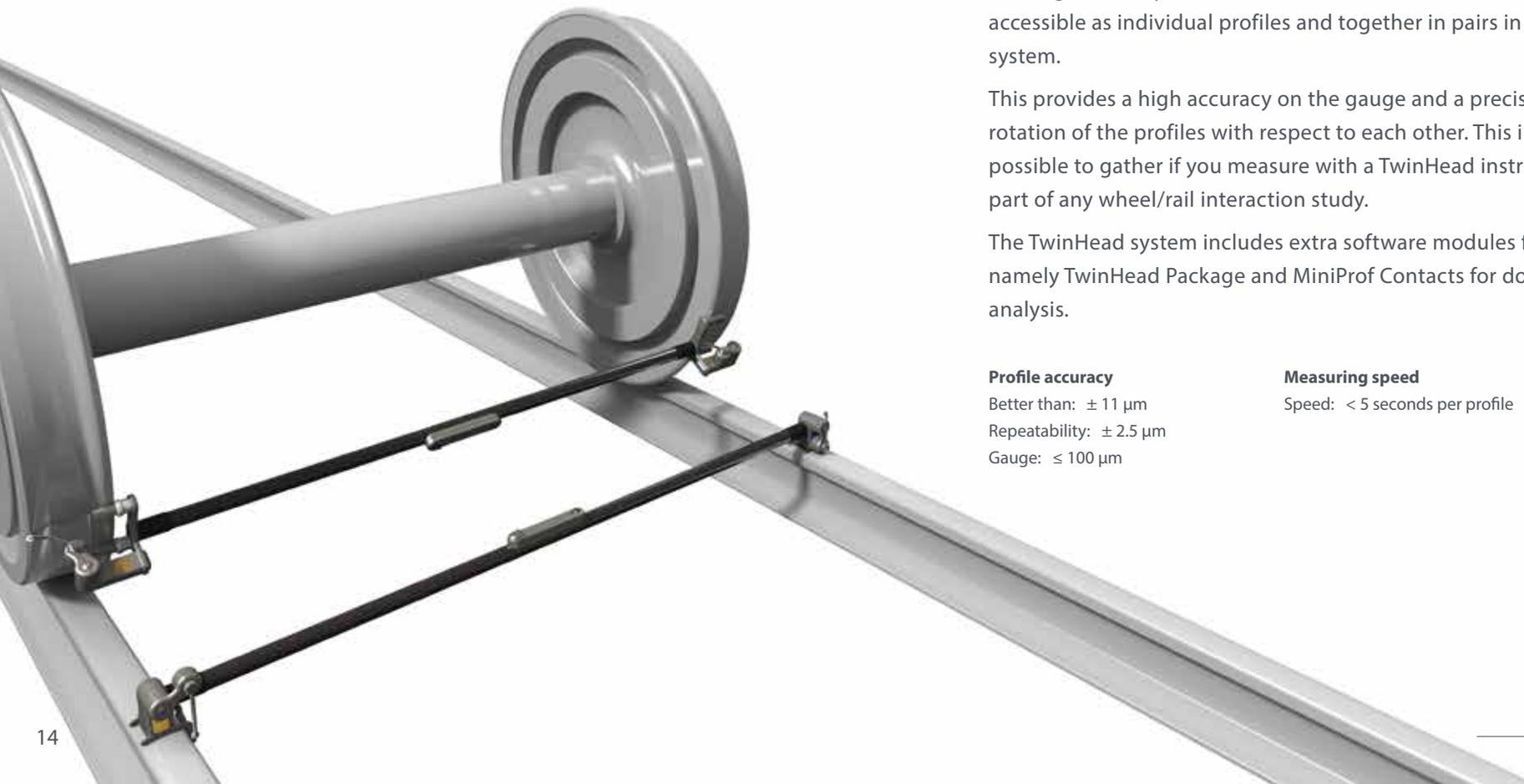
The MiniProf [BT] TwinHead Rail and MiniProf [BT] TwinHead Wheel systems are portable wireless instruments designed to produce fast and exact measurements of track and rolling stock. Opposed to normal single head instruments, the TwinHead measures both left and right profile together, obtaining a highly accurate relationship between the two profiles. This is especially important in analyzing running characteristics for rolling stock using for instance equivalent conicity studies.

The system consists of two measuring heads on a fixed beam. The two profiles are measured consecutively one by one. Each profile measurement will be done as by the single-head system. The measurements are stored on the computer and are accessible as individual profiles and together in pairs in one common coordinate system.

This provides a high accuracy on the gauge and a precise knowledge of any rotation of the profiles with respect to each other. This information is only possible to gather if you measure with a TwinHead instrument and is a crucial part of any wheel/rail interaction study.

The TwinHead system includes extra software modules for MiniProf Envision, namely TwinHead Package and MiniProf Contacts for doing Equivalent Conicity analysis.

Profile accuracy
Better than: ± 11 µm
Repeatability: ± 2.5 µm
Gauge: ≤ 100 µm

Measuring speed
Speed: < 5 seconds per profile

Weight
TwinHead Rail: 1,9 kg
TwinHead Wheel: 2,7 kg
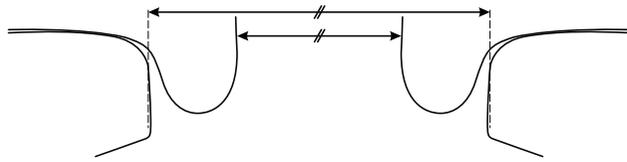
Gauge measurement

The TwinHead systems provides instant results for common gauge values and supports all standard wear calculations for both rails and wheels.
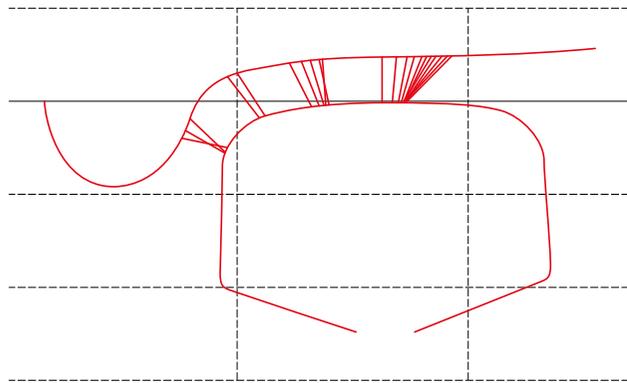
Contact studies

The TwinHead systems are primarily designed for contact studies. This is more than ever a vital area in railways and fully supported through the advanced Contact module available for the MiniProf Envision software.

MiniProf BT))
Switch & Crossings

The MiniProf Switch & Crossings system is a portable wireless instrument designed to measure multiple profiles on switches and crossings. The instrument extends to the opposite rail through a fixed rod, offering stability, gauge and track relative measurements. These give precise information on the physical placement of multiple rails, both useful for maintenance, investigation of problems and for quality control of new installations.

Profile accuracy
Better than: ± 11 µm
Repeatability: ± 2.5 µm
Gauge: ≤ 200 µm

Measuring speed
Speed: < 5 seconds per profile

Horizontal movement
Range: 300 mm
  • 100 mm towards gaugeside
  • 200 mm towards fieldside
Displacement: ≤ 100 µm

Weight
Unit: 5,5 kg
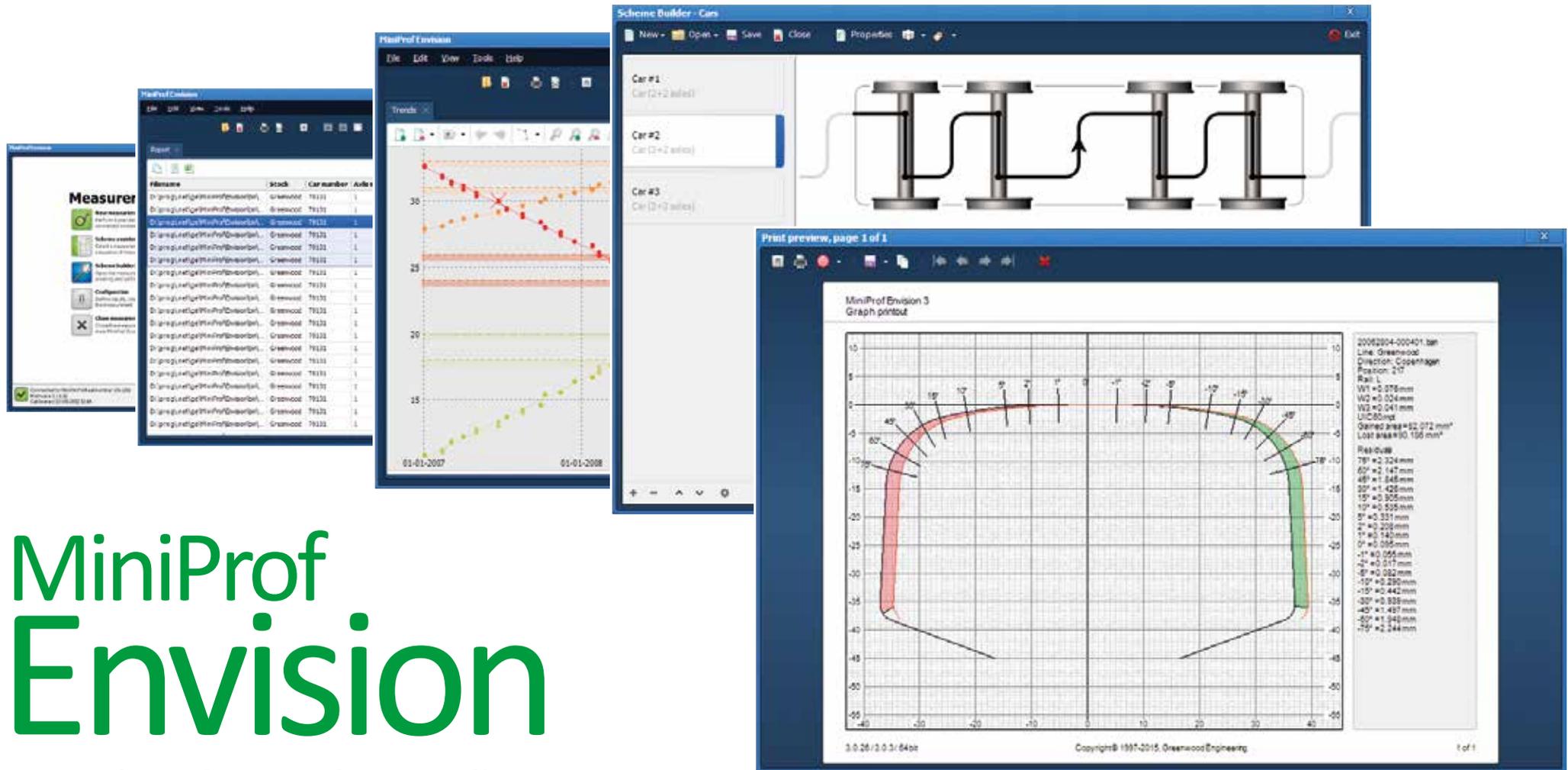
MiniProf
Envision

Complete data analysis toolbox

MiniProf [BT] is supplied with an extensive software package usable for all variations of our MiniProf [BT] instruments. It is highly flexible and customizable to the individual customer requirements and can be used to perform measurements as well as in-depth post measurement analysis. The software package includes measurement schemes, trending and a lot of other analysing possibilities.
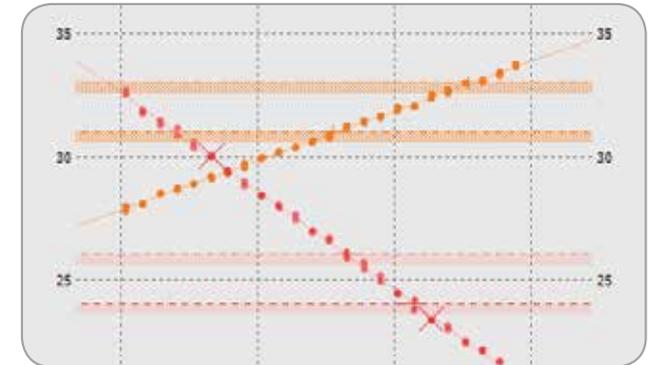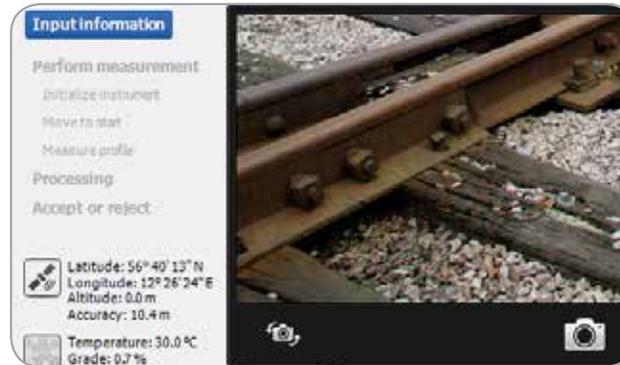
User-friendly design

A MiniProf [BT] system is supplied with modern and user-friendly software package MiniProf Envision. Its smart configuration wizard makes setup process easy and provides a simplified user learning curve.

More than a profile

MiniProf Envision has features such as logging of GPS locations and attachment of photographs to measurements. It can also measure temperature, super-elevation and grade with relevant MiniProf instrument.

Examine trends

You can perform trend analysis on your data which can show alarm and failure warning levels and estimates. These are imperative for safety requirements and decision making for your company.

Measuring scheme

MiniProf Envision features a measuring scheme system to perform large sequences of wheel, rail and brake profiles efficiently. An intelligent scheme wizard, enables the user to make customized scheme solutions.

Presentation and portability

Data and results can be extracted and easily used in third-party applications. Customizable templates allow attention to details when creating reports, which can be saved as PDF, Windows Metafile or printed.

Intelligent cursors

Profile cursor runs smoothly through the data points which allow readings between the points. The advanced functionality also gives instant residuals and area results to the user by highlighting the area between the profiles.
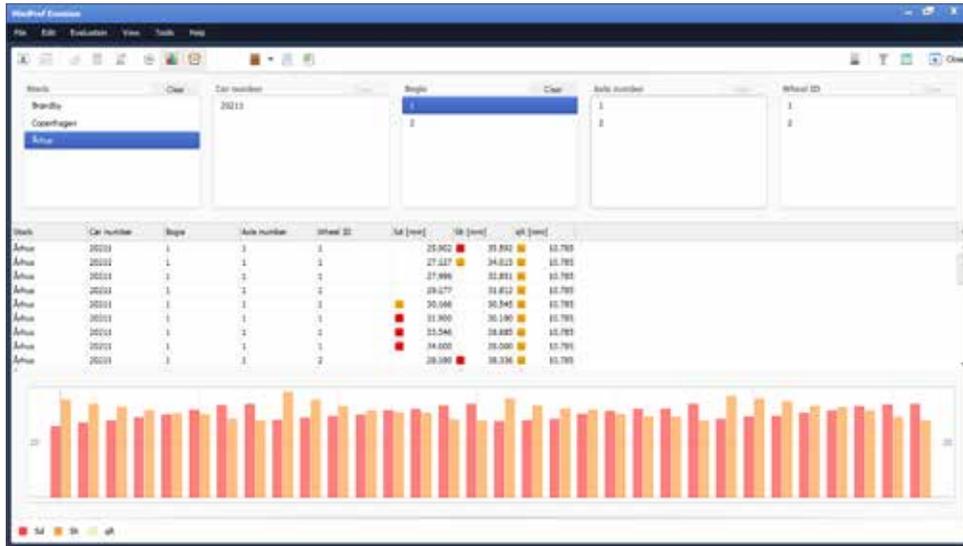
Evaluation Module

The Evaluation module is probably the most powerful tool in the MiniProf Envision software package, as it brings all major functionalities together to transform your data into valuable information.

- Import measurements from all MiniProf instruments
- Backwards compatible with all MiniProf generations
- Filter measurements based on any recorded information
- Overview of wear parameters with live alarm information
- Graphical overview of results to highlight areas of special interest
- Open data to view details on the original profiles and perform trending
- Edit meta data to correct mistakes and unify displayed information
- Recalculate results in case of changes to settings
- Extract data and results for third-party applications
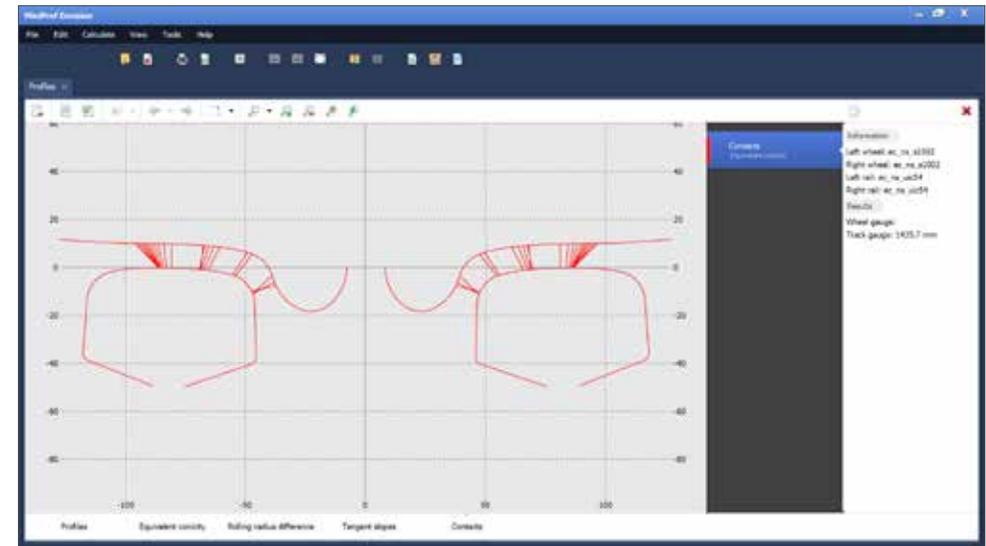
Contacts Module

Wheel/rail interaction is vital for railway safety and comfort. The Contacts module adds functions for calculating equivalent conicity on MiniProf TwinHead measurements.

- Implemented in accordance with international standards
- Shows graphs for equivalent conicity, contacts points, tangent angles and rolling-radius difference.
- Comes with an integrated construct function which allows creation of sophisticated TwinHead reference profiles.
- Includes automated batch processing of TwinHead data sets
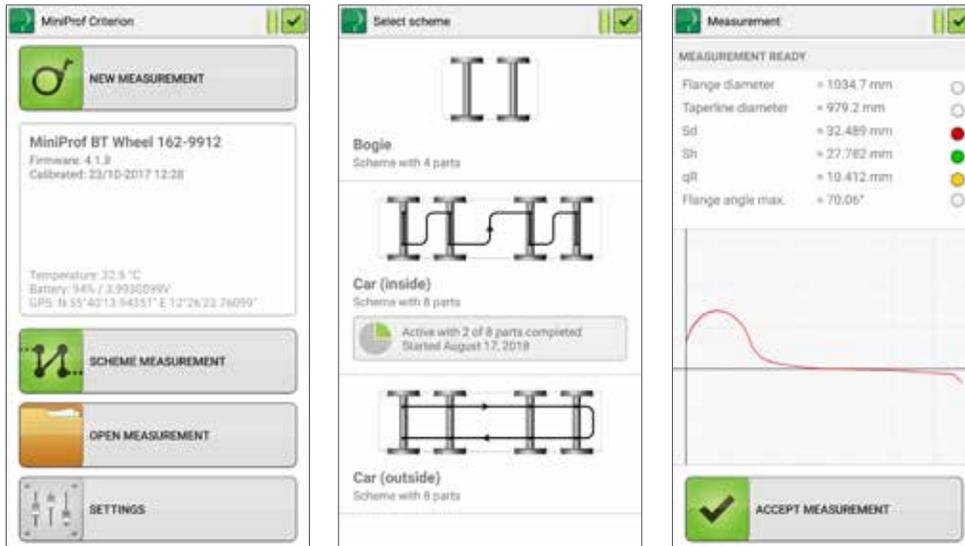
MiniProf Criterion

MiniProf Criterion is an application designed to run on modern Android based phones and similar devices. The software provides easy installation and setup to carry out data collection in the field and workshops.

Highlights of MiniProf Criterion:

- Compatible with various types of mainstream Android phones and similar devices
- Fully compatible with MiniProf BT line of instruments
- Easy data collection
- GPS location recording
- Attach pictures to your measurements
- Integrates directly with MiniProf Envision
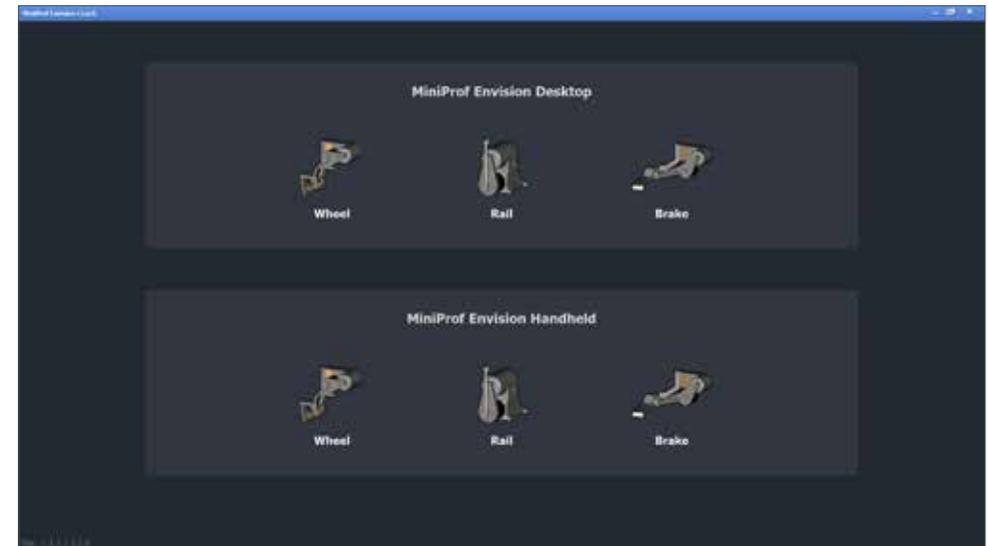
MiniProf Envision Coach

MiniProf Envision Coach is a self-training video tutorial software package supplied with all new MiniProf BT instruments and available for MiniProf Envision users for download on request. The software includes tutorials for:

- Software and license installation
- Instrument setup & measurement configuration
- Measuring with different instruments
- Measuring & functionality on handheld devices
- Analysis functions of the software
- Batch processing and reporting
- Additional modules and tools
- And much more…
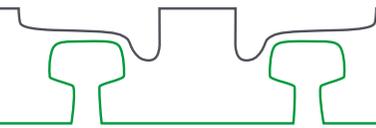
Calculations

Common calculations

Angles

Calculates the tangent angle, measured in degrees, at each point of the selected profile. The angles for a reference profile are calculated and displayed along with the angles of the measured profile if a reference is selected.
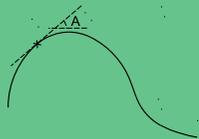
Vertical residuals

Calculates the vertical distance (D) to a measured profile at each point of the eference profile. The calculation assumes that the points in the measured profile can be connected with straight lines.
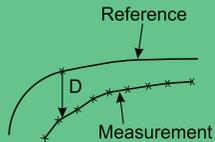
Curvature

Calculates the curvature in every point of a profile by fitting a 2nd degree polynomial to a small part around each point. If a reference profile is available, the curvature will also be calculated for this and the result displayed as a reference for the curvature of the measurement.
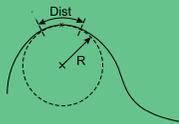
Horizontal residuals

Calculates the horizontal distance (D) to a measured profile at each point of the reference profile. The calculation assumes that the points in the measured profile can be connected with straight lines.
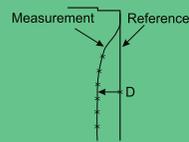
Residuals

Calculates the distance (D) to a measured profile perpendicular to a reference profile at each point of the reference profile. The calculation assumes that the points in the measured profile can be connected with straight lines.
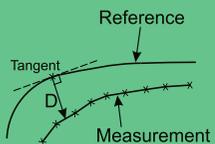
Wheel calculations & alignments

Wheel wear

Calculates the flange thickness (Sd), flange height (Sh) and the flange gradient (qR) for a wheel profile.
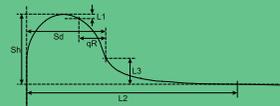
Wheel flange width

Calculates the width of the flange (W) for a wheel profile at a specific distance (L) from the top of the flange.
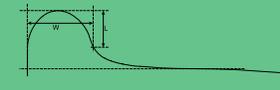
Wheel flange back wear

Calculates the flange back wear (W) for the selected profile.
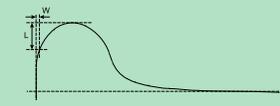
Maximum residuals

Calculates the maximum, minimum and average residual between the reference profile and the measured profile in a given area. This area is defined independently for wheel, rail and brake profiles as illustrated below.
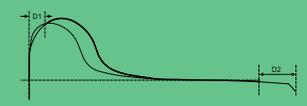
Wheel flange radius

Calculates the radius of the wheel flange (R) for a wheel profile.
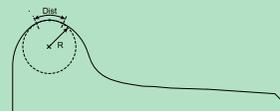
Wheel flange width (Tram)

Calculates the width of the flange (D) for a wheel profile.
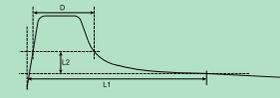
Wheel flange back wear (Tram)

Calculates the flange back wear (D) for the selected profile.
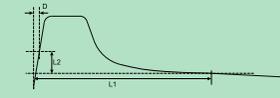
Wheel flange root radius

Calculates the wheel flange root radius (R) at a given point defined from the taperline (L1). The radius is determined from the curvature of a 2nd order polynomial fitted to a specified area (D).

Wheel flange angle maximum

Calculates the maximum flange angle (A) and the position (X) for a wheel profile.
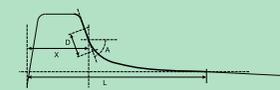
Wheel flange crown thickness

Calculates the thickness of the flange crown (D) for the selected profile.

Wheel flange angle

Calculates the angle of the flange (A) for a wheel profile.
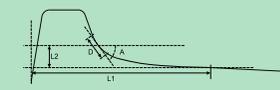
Wheel flange root radius minimum

Calculates the minimum flange root radius (R) and position (X) for the selected profile. The calculation determines the radius using the precalculated curvature values.
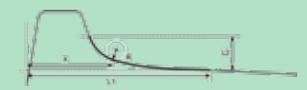
Wheel taperline angle

Calculates the taperline angle (A) using the average for a distance (L2, L3) around the taperline (L1) for a wheel profile.
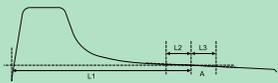
Wheel hollowing

Calculates the maximum wheel hollowing (H) and position (X) for a wheel profile.
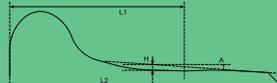
Wheel thread wear maximum

Calculates the maximum thread wear (W) and position (X) between the measurement and the reference in an area set from the flange backside (L1) to the outer thread (L2).
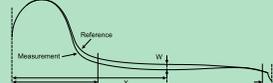
Wheel gauge flange

Calculates a number of wheel dimensions and gauge values given two measured wheel profiles.
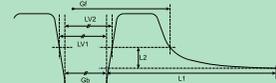
Align wheel on taperline

Aligns a measured wheel profile on a given taperline. This alignment only moves the profile in the vertical direction (dy). No rotation is performed.
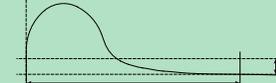
Align wheel on diameter

Aligns a measured wheel profile using the diameter information stored with the profile.
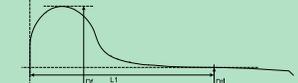
Wheel wear difference

Calculates the difference between the wheel wear on a measured profile and a reference profile.
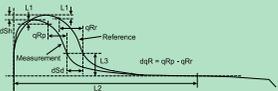
Wheel hollowing maximum

Calculates the highest wheel hollowing (H) and position (X) for the selected profile.
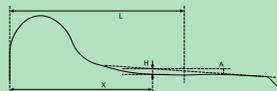
Wheel volume loss

Calculates the volume between the measurement and a reference. This is done using either the measured diameter (if available) or the diameter entered as a parameter for the calculation.
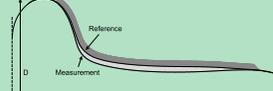
Align wheel

Aligns a measured wheel profile to the reference profile at the top of the flange. This alignment only moves the profile in the vertical direction (dy). No rotation is performed.
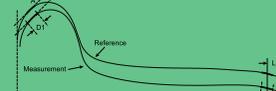
Align wheel on flange back

Aligns a measured wheel profile to the reference profile at the flange back. No rotation is performed.

Align wheel on tyre

Aligns a measured wheel profile using the tyre height information if present.
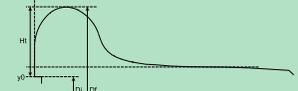
Wheel thread wear

Calculates the thread wear (w) as the distance between the measurement and the reference at a given point (L) defined from the backside of the flange.
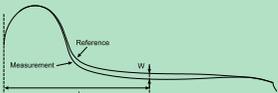
Wheel diameter difference

Calculates the difference between the diameters on wheels in a bogie.
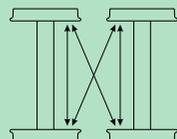
Wheel diameter from tyre

Determines the wheel diameter using the inner diameter and a field containing the tyre height, measured seperately.

Align wheel on flange top

Aligns a measured wheel profile to the reference profile at the top of the flange. This alignment only moves the profile in the vertical direction. No rotation is performed.
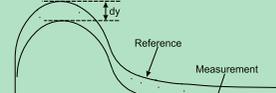
Align wheel on outer thread

Aligns a measured wheel profile to the reference profile on the outer thread. This alignment only moves the profile. No rotation is performed.

CMA: Core, Measurement & Analysis module (included in the standard software)　　Wear pack (to be purchased separately)
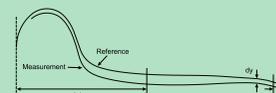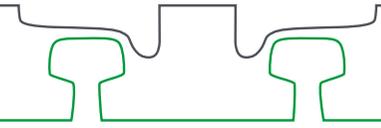
Rail calculations & alignments

Rail wear

This function will calculate the vertical (W1), horizontal (W2) and 45° (W3) wear. The wear is calculated as the difference between a measured profile and a reference profile.
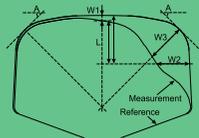
Maximum residuals

Calculates the maximum, minimum and average residual between the reference profile and the measured profile in a given area. This area is defined independently for wheel, rail and brake profiles as illustrated below.
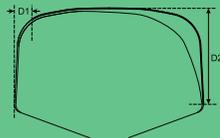
Rail gauge angle maximum

Calculates the maximum gauge angle (A) and position (Y) for the selected profile. The calculation determines the angles either as the tangent angle in each point, as the angle between two points on each side or as the average of the tangent angles in a certain area (D).
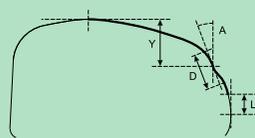
Grooved rail geometry

This function calculates a number of geometrical features for a grooved rail profile: Groove width (W), groove height (H), crown radius (RC) and radiuses for the different parts of the groove (R1, R2, R3 and R4).
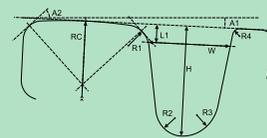
Align rail (CEN)

Aligns a measured rail profile against a reference by moving the measurement so it intersects the reference at the top and in a point on the gauge side. No rotation is performed on the measured profile.
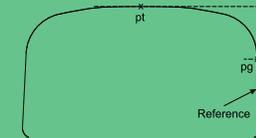
Align rail for grinding (High)

Aligns a measured rail profile against a reference according to the CEN grinding standard for the high rail in curves. No rotation is performed on the measured profile.
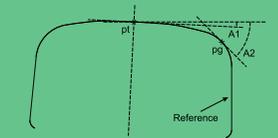
Rail crown radius

The rail crown radius (R) is calculated as the radius of the circle that gives the best fit at the top of the rail head in an area determined by the distance parameter (Dist).
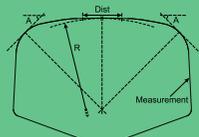
Railhead angle

Calculates the angle of the rail head (A) for the selected profile.
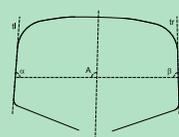
Rail height

Calculates the remaining height of the rail head (H) for the selected profile.
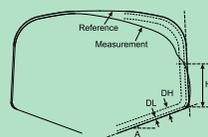
Grooved rail wear

This function will calculate the vertical (W1) and horizontal (W2, W4) wear for a grooved rail. The wear is found as the distance between the measurement and the reference.
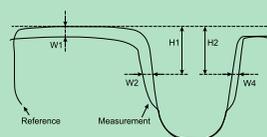
Align rail on wear

Aligns a measured rail profile against a reference by minimizing the wear parameters W1 and W3. No rotation is performed on the measured profile.
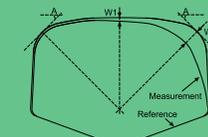
Align rail on top

Aligns a measured rail profile so the profile intersects the horizontal axis at the top point. This alignment only moves the profile in the vertical direction. No rotation is performed.
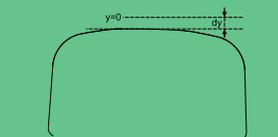
Rail head width

The rail head width (W) is the distance from the field side of the rail head to the gauge side measured at L millimeters from the highest point of the rail profile. Setting the L parameter to 0 makes the calculation return the largest width.
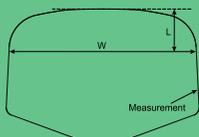
Rail gauge angle

Calculates the gauge angle (A) at a given point defined from the top of the railhead (L). The angle is determined either from the tangent in the point, the angle between two points on each side or as the average of the tangent angels in a certain area (D).
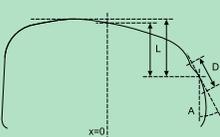
Align rail

Aligns a measured rail profile against a reference by using the field side face and the lower corner. The alignment can optionally use the gauge side face if desired.
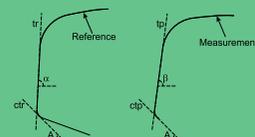
Align rail centered

Aligns a measured rail profile against a reference by using both sides of the profiles and the top point. This alignment is particularly useful for aligning measurements of new rails for quality control.
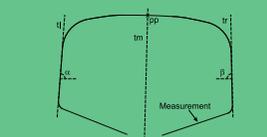
Align rail for grinding (Low)

Aligns a measured rail profile against a reference according to the CEN grinding standard for tangent track and the low rail in curves. No rotation is performed on the measured profile.
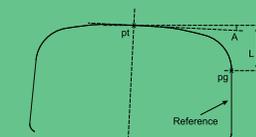
Align grooved rail

Aligns a measured grooved rail profile against a reference using a point on the inner side of the check part and the bottom of the groove.

Brake calculations & alignments

TwinHead calculations & alignments

Align grooved rail (Flat)

Aligns a grooved rail measurement using the bottom parts of the groove, either gauge part or check part.
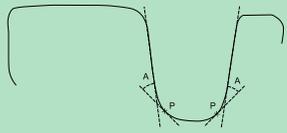
Brake wear

Calculates the brake-disc hollowing (W) and the remaining thickness (T).

Brake volume loss

Calculates the volume between the measurement and a reference. This is done using either the measured diameter (if available) or the diameter entered as a parameter for the calculation.

TwinHead wheel gauge

Calculates the wheel gauge values (Gb, Gtl and Gf) for a set of TwinHead wheel profiles. Gb is the gauge found at the backside of the wheels, Gtl is the gauge found at the taperline on the wheels and Gf is the gauge found on the flange. Default values for the parameters are: L1= 70 mm and L2 = 10 mm.
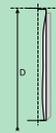
Brake wear (No reference)

Calculates the brake-disc wear (W) and the remaining thickness (T).

Align brake on top edge

Aligns a measured brake profile on the top edge so this edge overlays the horizontal axis.
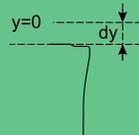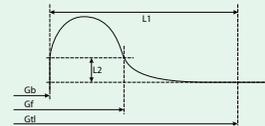
TwinHead wheel gauge (AR)

Calculates the wheel gauge value (AR) for a set of TwinHead wheel profiles. AR is the gauge found at the backside of the wheels at a point relative to the flange top. Default value for the parameter is: L = 32 mm.

Maximum residuals

Calculates the maximum, minimum and average residual between the reference profile and the measured profile in a given area. This area is defined independently for wheel, rail and brake profiles as illustrated below.

Align brake on scale

Aligns a measured brake profile against the reference by stretching the measured profile vertically so the height of the measurement (Hm) matches the height of the reference (Hr).

TwinHead rail gauge

Calculates the gauge between two rail profiles made with a TwinHead rail unit. The two profiles must be linked together for the calculation to succeed. Default value for the parameter is: L = 14.

CMA: Core, Measurement & Analysis module (included in the standard software)   Wear pack (to be purchased separately)   TwinHead pack (included w. TWH instrument)
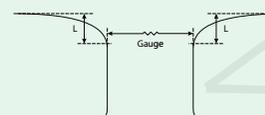
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Vossloh AG
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Wuhan Hanyang Tram
Wuhan Railway Bureau
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Xi'an EMU Depot
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Stahlberg Roensch
Stadtbahn Saar GmbH
Stadtwerke Bonn
SWK Mobil GmbH
Talgo GmbH
TSTG Schienen
TU Berlin
TÜV Süd
VAG
Verkehrsbetriebe Ludwigshafen
Via Essen
Vossloh High Speed Grinding GmbH
Würzburger Straßenbahn
Windhoff Bahn

Greece
STASY S.A.
Urban Rail Transport S.A.

Hong Kong
Jet Leader Cargo Service Ltd.
MTR Corporation

Hungary
Dunakeszi Jármüjavito Kft. (Bombardier HU)
MÁV-Start
Stadler Bussnang

India
Bangalore Metro Rail Corp. Ltd.
Bhilai Steel Plant (BSP)
Delhi Metro Rail Corp. Ltd.
Indian Railways North Central Railway
Indian Railways Northern Railway
Indian Railways South Central Railway
Indian Railways Institute of Civil Engineering
Infiniti Digitech Pvt. Ltd. (IDPL)
RDSO Ministry of Railways

Iran
Iran University of Science and Technology
Farvardin Chemie Co. Ltd.
RAJA railway transport Co.
Tabriz Urban Railway Organization

Ireland
Alstom Ireland Ltd.
Iarnród Éireann
Irish Rail

Israel
Citadis Israel LTD (Alstom Israel)

Italy
AAE
Alstom
Hitachi Rail Italy
ATM Milano
Bombardier Transportation
BTW
CoFren
Commel
Ferrotramviaria Spa
Ferrovie Emilia Romagna
Ferrovie Nord Milano
ITALCERTIFER
GTT Turin
Trenord
Lucchini
Mecno Service
Metro Napoli
Metro Roma
Metrobus Brescia
RFI
SAD Trasporto Locale
Sangritana
Trambus Spa
Trenitalia Spa
Trentino Trasporti

Japan
Akebono Brake Industry
Bureau of Transportation Tokyo Metro
Central Japan Railway Company
Daiichi Kensetsu Industries
East Japan Railway Company
Hankyu Hanshin Railway Technology
Hanshin Electric Railway, Ltd.
Hitachi
Hokkaido Railway Company
Japan Railway Track Technology Consultants Co., Ltd.
JFE Steel
Kawasaki Heavy Industries
Keihan Electric Railway Co. Ltd.
Kobe Electric Railway
Korimoto Ltd.
Kotsu Transport Construction
Kyoto City Transportation Bureau
Kyoto Municipal Transportation Bureau
Kyusyu Railway Company
Mine Seisakusyo
Nabtesco
Nippon Kikai Hosen K.K.
Nippon Speno KK
Nippon Steel Corporation Yawata Works
Nippon Steel & Sumitomo Metal Corporation
NKK Trading
Nagoya Tetsudo
Osaka Metro
Rail Tech
Railway Technical Research Institute
Sagami Railway
Shikoku Railway Company
Sumitomo Metal Industries Ltd.
Technos
Tobu Railway Company
Tokyo Electric Railway
Tokyo Metro
Tokyo Metropolian Government
Toshiba Transport
Totetsu Kogyo
TTL
Ueda Brake Ltd.
West Japan Railway Company
Yamato Trackwork
Yokohama Municipal Transportation Bureau

Malaysia
Peninsular Rail Equipment
Rapid KL
Sistem Transit Aliran Ringan SDN BHD
Star Point

Mauritania
SNIM, Société Nationale Industrielle & Minière

Mexico
Ferromex

Morocco
Alstom

Netherlands
Arriva Nederland
BAM Rail
Connexxion
DEKRA Rail
De Wilde Spoorwegbouw
Eurailscout
GVB Amsterdam
HTM
Movares Nederland BV
Nedtrain Consulting
NS Technisch Onderzoek
RET N.V.
Ricardo Nederland B.V.
Stadler Rail
TU Delft

New Zealand
Kiwi Rail
Vitruvius

Norway
Bane NOR
Bilfinger Industrial Services
Mantena AS
NSB
Sporveien

Peru
GYM Ferrovias
OHD

Poland
PKP Polskie Linie Kolejowe S.A.
SPAW-TOR

Portugal
CP Comboios de Portugal
Metropolitano de Lisboa
REFER

Puerto Rico
ACI Puerto Rico

Qatar
Doha Metro (Qatar Rail)

Romania
AFER-Romanian Railway Authoroty
Alstom Transport S.A.

Russia
Russian Railways

Saudi Arabia
Harmain High Speed Rail
Riyadh Metro
Saudi Railways Company

Serbia
GSP (Public Transport Company Belgrade)

Singapore
SBS Transit
Singapore MRT Ltd

Slovakia
Dopravný Podnik Bratislava, a.s.
Zilina University

South Africa
Bombardier
Cape Metrorail
Gibela Rail
Impala
LRS Lennings Rail Services
Lucchini
Metrorail
OREX
PRASA
Rovos Rail
Spoornet
Surtees Engineering
Transnet

South Korea
Construction Authority
KMI
Korail
Korea High Speed Rail
KRRI
KTX
MLTM
Rotem
Samsung
Seoul Metro

Spain
Adif
Alstom
Arcelormittal
AVE
Bombardier
Btre
CAF
Cetest
E.H.
Eusko Tren
ICER Brakes S.A.
Nertus Mantenimiento Ferroviario
Siemens
Sintersa
Talgo
Talleres de Metro Bilbao
Tecsa Empresa Constructora S.A.
TMB
Universidad Politécnica de Valencia
University of Vasc Country
Visiona Control Industrial
Vossloh

Sweden
Bombardier Transportation Sweden AB
Göteborg Spårväger AB
Infranord AB
LKAB Malmtrafik AB
Luleå University of Technology
Norrköpings kommun
SJ AB
SNC Lavalin
Spark Trade
Stockholms Spårväger AB
SweMaint
Trafikverket
Vossloh Rail Services Scandinavia

Switzerland
Alstom
Basler Verkehrsbetrieve
BLS AG
Bombardier Zürich
East Metals
Furka Oberalp Bahn
Matisa
Matterhorn Gotthard Bahn
Metro Lausanne
Regionalverkehr Mittelland
SBB CFF FFS
Speno International S.A.
Stadler Switzerland
Travys Transports Vallée de Joux
Verkehrsbetriebe Zürich

Taiwan
Groundwood Enterprise Co., Ltd.
Kaohsiung Rapid Transit Corporation (KRTC)
Ming Yu Machinery Co. Ltd.
San Lien Technology Corp.
SGS Taiwan Ltd.
Taiwan Railway Administration
THRSC

Thailand
Siemens

Turkey
Burulas
Istanbul Ulasim A.S.
Rayvag Vagon Sanayi ve Ticaret A.S
TCDD Turkish State Railways

United Arab Emirates
Etihad Rail DB
Serco Dubai Metro

United Kingdom
4-Rail Services
Alstom
Babcock International
Balfour Beatty Rail
Becorit
Bombardier Transportation UK
British Steel
Colas Rail UK
Delta Rail
Docklands Light Railway Ltd.
Direct Rail Services
Eurostar
Eurotunnel (Folkestone)
EWS
Federal Mogul
First Scot Rail
Freightliner Maritime Terminal
Harsco Rail
Heathrow Express
Hitachi Rail Europe Ltd.
Huddersfield University
Knorr-bremse Rail Systems
L.B. Foster
Lucchini Unipart UK Ltd.
Manchester Metropolitan University
MerseyRail
Metropolitan Rail Consultants
Network Rail
Newcastle University
Nottingham Tram
RailMeasurements Ltd.
Schweerbau (UK) Ltd.
Serco Docklands Ltd.
Serco Railtest Ltd.
Siemens
SNC Lavalin
South Eastern Trains Ltd.
South West Railways
SPT Underground Railway
TFL (Transport of London)
TFL LUL (London Underground Ltd.)
TFL Tramlink
West Coast Traincare Company

United States of America
AAR
ABC NACO
American Steel Foundries
Amsted Rail
Amtrak
Anchor Brake
Arcelomittal
ARM
ASF Keystone
Atlantic Streetcar
BART
BC-Rail
Bethlehem Steel Corporation
BNSF
Bombardier Transit Corporation
Booz, Allen & Hamilton Inc.
British Columbia Rapid Capital Metro
City of Charlotte
City of Edmonton
CSX Railroad
Dart
Delta Manufacturing
ENSCO Inc.
Evraz NA
FRA
GE Transportation Systems
General Motors Corp.
GKY Industries
Go Transit
Griffin Wheel Company
Hampton Road Transit
Harsco Rail
Herzog Transit
Houston Metro
L.B. Foster
Long Island Railroad
Loram Maintenance of Way, Inc.
LTK Engineering Services
Luque
Maryland Transit Administration
Massachusetts Bay Commuter Railroad
Massachusetts Bay Transportation Authority
Metro-North Railroad
Miner Enterprises
MTA Baltimore Heavy Rail
MTA Houston
National Castings
National Transportation Safety Board
New Jersey Transit
New York City Transit
Norfolk Southern Corp.
North Shore Mining
NYCTA-MOW
PATH
Penn Machine Company
Port Authority of Allegheny County
Rail Sciences Inc.
Railroad Friction Products Corp. (Wabco)
Resco
Saint Gobain Abrasives
Santa Clara Valley Transportation
Siemens Sacramentos
Siemens Transportation Systems Inc.
Simmons Machine Tools Corp.
Sperry Rail
Standard Car Truck Co.
Steel Dynamics
Strato Inc.
Texas A&M Transport
The Burlington Nothern and Santa Fe Railway
The Modern Continental Construction Co.
TTCI
TTI
TTX
Union Pacific Railroad Company
Utah Transit Authorities
VAE Nortrak North America, Inc.
Valley Transportation Authority
Veolia Transportation
Wabtec
Whitmore
WMATA
Woojin America

Venezuela
Caracas Metro

World of MiniProf

The MiniProf systems are used globally in various combinations by thousands of users, and are distributed and supported locally by a vast agent network covering more than 50 countries. A complete list of MiniProf agents and users can be found on www.greenwood.dk

Greenwood Engineering A/S

Head office - Brøndby, Copenhagen, Denmark

With more than 25 years of international experience, a representative office in China and local agents in more than 50 countries, Greenwood Engineering is the leading manufacturer of highly specialised measuring equipment for monitoring and condition surveys in the global road and railway sector.

The wide product range spreads from the handheld and lightweight MiniProf [BT] units for measuring and analysing the cross sectional profile of train wheels, rails and brakes to the big-size Traffic SpeedDeflectometers (TSD) for network level bearing capacity measurements on roads while driving at normal traffic speed.

Since the establishment of Greenwood Engineering in 1992 by Leif Grønskov, the basic premise for all marketed products has been an uncompromising high technological level, a wish to be at the frontier in the business and to present top of the range solutions operating with the least disturbance to environment and traffic and with the highest safety to the user of the equipment.

With thousands of various measuring systems distributed and used all over the world, Greenwood Engineering has a strong position on the world market! The continuous focus is to maintain close customer relations, to develop products in an on-going process and to keep and always strive towards reaching even higher technological levels.

Head Office

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