

# GRP System FX

The «all in one»  
railway surveying solution





# Rail traffic without limits

## New challenges for railway construction and operation

**Borders open, centres of economic activity spread, people and goods need to move more frequently, more rapidly. The railway is again becoming the centre of attention as an ideal mass transport system – irreplaceable for passenger and goods traffic. Railway companies, operators, track construction and design companies and especially surveying are in demand for the construction and maintenance of the railway networks.**

### **Railway operation**

#### **Reliable data for successful operation**

Comprehensive infrastructure asset management, reliable quality control in the construction process as well as knowledge of the condition and requirements of the rail network: these are important elements for a reliable and efficient transport infrastructure.

#### **An optimal railway system means:**

- Greater safety
- Less maintenance
- Higher speeds and train frequencies
- Less down times
- More profit

### **Surveying**

#### **Efficient and flexible surveying technology for maximum competitiveness**

It is not only the requirements placed on the infrastructure that are increasing continuously, but also those on surveying. Innovative surveying companies can successfully meet these challenges by using the latest track surveying technology.

#### **Competitive advantages result from:**

- «All in one» technology with comprehensive functionality for maximum cost effectiveness
- Appropriate results «just in time»
- Flexibility in application and use
- Perfect data flow within the overall project
- Quantifiable return of investment

### **Railway construction and maintenance**

#### **Profit potential due to optimal interaction**

The optimal interaction between all parties involved in a project is a key issue on the way to a high quality network. Avoidance of delays as well as higher productivity in track maintenance and construction projects provides a significant potential for cost savings.

#### **Modern surveying solutions can lead projects to financial success by means of:**

- High quality track geometry
- Comprehensive as built survey data
- Maximum efficiency, quality and reliability
- System flexibility
- Qualified documentation



GRP 5000



GRP 3000



GRP 1000



GRP 1000



GRP 3000



GRP 5000



# GRP System FX

## The modular solution for track geometry and infrastructure data

**Modularity is the key to success. The universal track surveying system GRP System FX from Amberg Technologies, with modular system components, can be configured to meet the most stringent and demanding project requirements.**

### GRP System FX

#### The «all in one» railway surveying solution

- Latest technology for automatic comprehensive railway surveys
- Powerful software modules for data evaluation with minimum user intervention
- Adjustable options for display of results
- Modular technology with high return on investment

### GRP 1000

#### The precise and robust track measuring system

- TGS FX track gauging trolley with high precision sensors for measurement of:
  - Gauge
  - Superelevation (Cant)
  - Stationing (Chainage)
- Precise determination of track coordinates with the Leica total station
- Operator interface designed for the slab track construction survey
- Real time display of results and corrective data
- Quality analyses of outer and inner track geometry
- Optional expansion to the GRP 3000 and the GRP 5000 system configuration

### GRP 3000

#### The versatile system for railway surveying

- TGS FX platform combined with the reflectorless measuring Profiler 100 FX for automatic clearance profile surveying of:
  - Infrastructure including tunnels, bridges, etc.
  - Platform edges
  - Signals and power lines
- Real time comparison between as built and theoretical clearance envelopes
- Optional coordinate surveying with the Leica total station
- Point coding of objects
- Configurable data interface
- Optional expansion to the GRP 5000

### GRP 5000

#### The mobile scanner solution for infrastructure analyses

- TGS FX platform combined with the high-performance imaging scanner Profiler 5002 for:
  - Continuous clearance analysis
  - Geometric and visual infrastructure documentation
- Results displayed as
  - Layered clearance maps
  - Greyscale image
  - 2D cross section
  - List of object points
- Combination of the 2D scanning with the results of a 3D track survey (e.g. from the GRP 1000/3000)
- Modular structure for functional expansion to the GRP 1000 or GRP 3000



# GRP 1000

## Precise track geometry data

### Track geometry recording and analysis

The wheel-rail interface requires perfect track geometry for smooth operation. High quality of the track geometry after construction, reconstruction or maintenance work means lower future maintenance costs, higher operational safety and improved economics.

### Survey requirements:

- Precise documentation of track position and geometry
- Detection of deviations from absolute track position
- Identification of deviations from inner track geometry

### GRP 1000 for the surveying of track geometry:

- Precise surveys of absolute track geometry using the Leica TPS total station
- Direct evaluation of actual track to design data
- Checking of inner geometry by determining horizontal and vertical versines with definable chord lengths
- Qualified data reporting with flexible interface

### System benefits:

- Reliable quality control of track construction
- High quality track positioning assures operational safety

### Construction slab track

The new forms of slab track construction offer the railway operator higher speeds, increased ride comfort, less noise, reduced wear and minimum maintenance needs.

### Survey requirements:

- Submillimeter precision
- High efficiency and reliability
- Optimal integration into the construction process
- Easy operation
- Comprehensive reporting system

### GRP 1000 for slab track construction:

- High-precision sensors for superelevation and gauge measurement
- Precise 3D track position with help of Leica TPS total station
- Real time display of corrective values during track laying
- Professional graphic and numeric logging

### System benefits:

- Higher productivity due to flexible survey solutions, fully integrated into the construction process
- Very high track geometry quality due to optimised technology surveying
- Cost effective project management







# GRP 3000

## Track geometry and clearance profile data

### Construction and maintenance ballasted track

The traditional ballast track with its advantages of low cost and mechanised construction requires regular maintenance. The latest track tamping machines provide automated track alignment processes for this purpose.

### Survey requirements:

- Flexible and efficient track as built surveying
- Provision of the corrections to design
- Optimal integration into the construction process
- Qualified documentation

### GRP 1000/3000 for the construction and maintenance of ballast tracks:

- Track geometry surveying with comparison to the design centre line
- Real time corrections for marking directly on the sleepers
- Digital correction data file for track tamping machines
- GRP 3000: Check of critical encroachments direct on site

### System benefits:

- Flexible and optimised maintenance process
- Short notice work preparation
- Continuous data flow from survey to tamping machine
- Confidence in track geometry quality, leading to longer maintenance intervals

### Installations close to the track route – Approval of encroachments

Existing routes can be upgraded with signal and communication systems increasing reliability, comfort and speed. Therefor maximizing existing assets.

### Survey requirements:

- Inventory data as basis for planning
- Quality assurance for installations and clearance
- Documentation, data management and transfer to encroachment registers

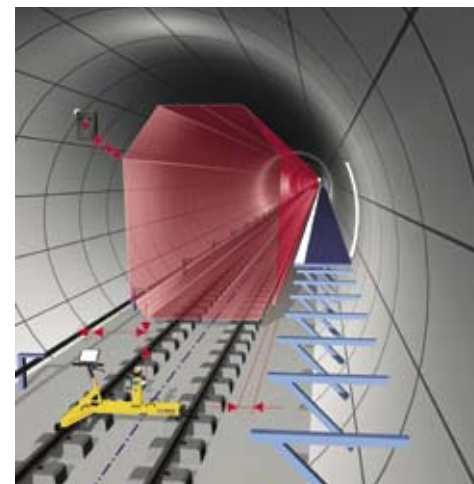
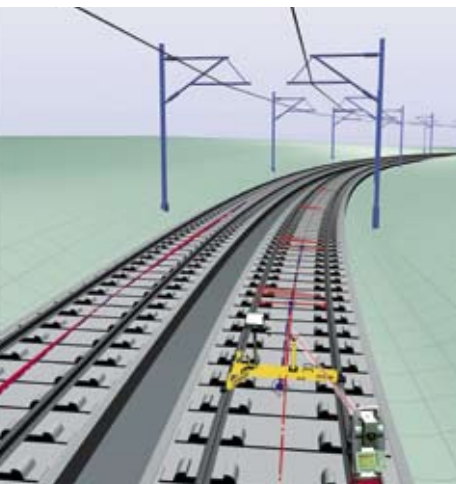
### GRP 3000 for clearance envelope compliance:

- Combination of track gauging trolley and profile measurement unit for inventory documentation and installation planning
- Automated clearance surveying referenced either to the current track (2D) or design centre line (3D)

- Distances to different, user defined clearance envelopes in real time
- Complete documentation and transfer to encroachment registers

### System benefits:

- Cost effective installation due to higher productivity
- Adherence to the clearance envelope
- Highly flexible and mobile systems permit profile checks at short notice





# GRP 3000

## Clearance profile, as built documentation

### Design surveying

Current and complete survey documentation of the inventory prior to the modernisation of a line is a prerequisite for a successful planning process.

#### Survey requirements:

- Complete inventory survey of the section of line to be included in the planning:
  - Civil structures
  - Track bed position
  - Signals and poles
  - Powerline incl. sag
  - Installations

### GRP 3000 for design surveying:

- Unique combination of track gauging trolley and cross section measurement unit for object surveying in the track environment
- Point coding for complete inventory documentation
- Reliable measurement of overhead wire position
- Filter for specific export of as built results for in the planning process

#### System benefits:

- Complete, accurate inventory documentation
- Seamless data flow for rapid planning and project implementation
- Reliable data for the project costing

### Clearance profile surveying

Critical encroachments form a significant hazard potential and can result in restrictions in the operation of a railway. Reliable clearance profile data forms the basis for safe operation, for modernisation projects, the procurement of new rolling stock or the safe transport of out-of-gauge loads.

#### Survey requirements:

- Acquisition, documentation and checking of encroachments in the railway network
- Data management and transfer to an encroachment register

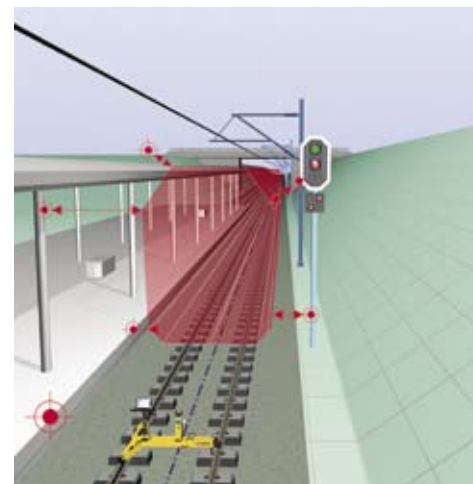
### GRP 3000 for clearance profile surveying:

- Automated clearance surveying relative to the track centre line
- Comparison with user definable clearance envelope in real time

- Complete documentation, check and transfer of the results to the encroachment register
- Practical and easy to use

#### System benefits:

- Complete overview of the nature and scope of encroachments in the railway network
- Reliable basis for decisions on investments in new rolling stocks
- Highly flexible and mobile system permits rapid deployment







# GRP 5000

## High density data, capture and analysis

### Condition assessments Inventory survey

Intensive utilisation, environmental influences and the impact of natural phenomena all take their toll on the railway infrastructure. Comprehensive knowledge of structure conditions is essential for planning and maintenance as well as for safety.

#### Survey requirements:

- Geospatial data complemented by status information forming the basis for good planning and operations

- Optimisation of route design
- Cost effective data capture and analysis with minimum track occupation

### GRP 5000 for condition and inventory surveys:

- Kinematic surveying system with imaging scanner technology
- High point density to sub-centimetre
- Measurement data combine geometric and visual information
- Digital imaging to scale – Basis for (periodic) state assessments

#### System benefits:

- Portable surveying system requires no additional access or supporting infrastructure
- Highly efficient surveying with minimal on-track time
- Uncomplicated operation enables use even during short track access periods
- Results form the base for digital inspection system
- Optimisation of tunnel inspections
- Significant cost savings in maintenance and upgrades

### Complete clearance analysis

Knowledge of clearance profiles is essential for the safe operation of the railway network. Minimum clearance between the train and encroachments must be guaranteed.

#### Survey requirements:

- Complete acquisition of the current geospatial situation
- Assured capture of all tight spots
- Optimal integration into the railway network operation
- Documentation and transfer to the encroachment database

### GRP 5000 for complete clearance analysis:

- Combination of track gauging trolley and high performance scanner
- Kinematic automated clearance survey relative to the current track axis
- Absolute construction data when combined with 3D track surveying

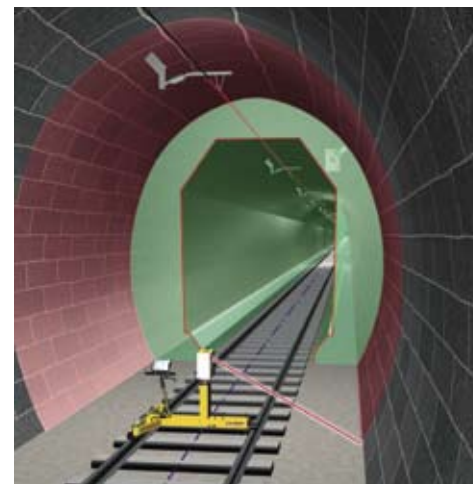
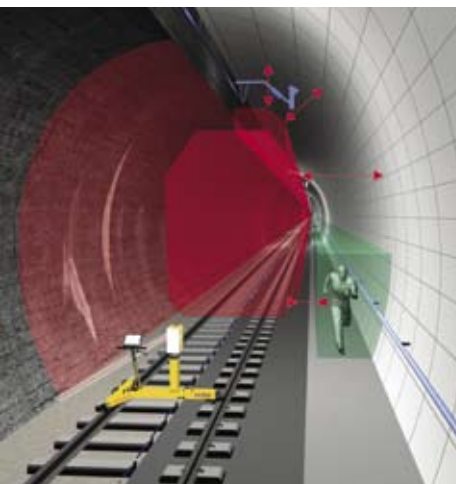
- Results available as

- Clearance maps
- Optional overlay of greyscale image
- 2D cross section
- List of object points

- Practical system design for flexible on site data capture

#### System benefits:

- Comprehensive analysis of all encroachment data for optimum utilisation of available space
- No additional resources or special access required for survey operation
- Highly flexible and mobile system permits rapid deployment



# GRP System FX hardware

## Portable, precise, modular

The platform of the GRP System FX is the TGS FX track gauging trolley. Manufactured to the highest engineering standards, it combines precision sensors with practical design, making the GRP System FX a reliable partner in the challenging railway survey environment.

### GRP 5000

- Amberg Profiler 5002:**
- 100 Hz rotation frequency
  - Up to 20'000 points per rotation
  - Range 1 m to 79 m

- GBC 5000 battery column:**
- Power supply for the scanner system
  - Exchangeable battery module



- Lightweight system:**
- Light, high-precision frame construction
  - System can be easily dismantled for transport
  - Ready to measure in minutes



- Gauge sensor:**
- Accuracy +/- 0.3 mm
  - Measurement range -25 mm to +65 mm in relation to nominal gauge
  - Measurement reference 14 mm under top of rail – other references available on request



- Precision wheels:**
- High specification synthetic (PET) wheels for complete conductless operation (GRP 3000/5000 by default)
  - Stainless steel wheels with isolated core – precise and robust with non-electric contact from left to right rail (GRP 1000 by default)

- Isolated system:**
- Electrically isolated trolley frame

- Odometer:**
- Measurement of relative track stationing
  - Accuracy < 0.5%

- Cant sensor:**
- Measurement of superelevation
  - Accuracy +/- 0.5 mm nominal gauge





## GRP 3000

### Profiler 100 FX:

- Motorised reflectorless laser distance meter
- Servo-motorised fine tuning for precise pointing at the smallest objects
- Range 0.3 m to 30 m
- Range measurement accuracy +/- 1.5 mm

## GRP 1000

### GPC 100 prism column:

- Raised prism position to reduce the influence of refraction

### Variable gauges:

- GRP System FX operation on common gauges between 1000 mm and 1676 mm
- Further gauges on request

erelevation  
m at 1435 mm



## Georeferencing

### Leica GPS:

- For general surveys with lower (GPS) accuracy demands
- GRP System FX is compatible with Leica GPS systems GPS1200 and GPS500
- GPS integration kit including antenna pole, installation and accessoires

### User ergonomics:

- Trolley design for save handling in the field
- Fully adjustable push handle
- Balanced device for safe «one man» operation
- Dead-man's brake to prevent unintentional movement of the trolley

### Trolley adjustment set:

- Adjustment kit for regular trolley accuracy checks
- GRP Fidelity software
- Nominal gauge frame and accessoires

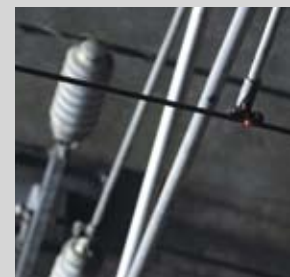
### Quick change adapter:

- Precision adapter plate for quick and accurate configuration change GRP 1000 – GRP 3000 – GRP 5000



### Leica TPS:

- For track surveys with highest precision
- GRP System FX is compatible with Leica total stations TPS1100 / TPS1200 / TPS2000 (ATR required)

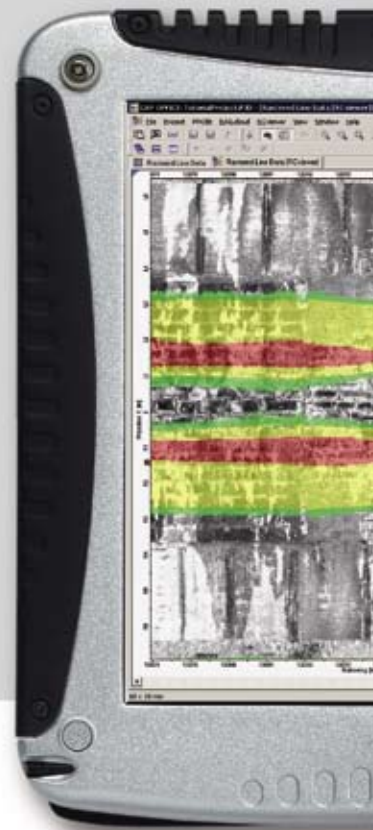


### Visible laser dot (GRP 3000):

- Enables rapid targeting of specific object points
- GRP software supports automatic power line survey

# GRP System FX software

## Simple, practical, modular



### GRP System FX software The railway surveying software

- Intuitive software for efficient measurement, analysis and reporting
- Powerful calculation routines
- Results in real time
- User friendly result display
- Data interfaces to third parties
- Modular structure

#### Clearance surveying

##### GRPwin module «CLEARANCE» Clearance profile surveying

###### The application for:

- 2D clearance profile surveying
- 3D clearance surveying – requires GRPwin module «TRACK»



###### Data management:

- Clearance envelope definition including distance calculation modes
- Reliable management of the clearance profile measurements



###### Measurements:

- Control and management of clearance surveys
- Real time comparison of measurements to the clearance envelope

###### Evaluation:

- Documentation and result plots of the measurements

#### Track geometry surveying

##### GRPwin module «TRACK» Track set out and recording

###### The application for:

- 3D track geometry surveying
- Basis for 3D clearance surveying



###### Data management:

- Route design data (horizontal and vertical alignment, superelevation and stationing reference line)
- Track control points
- Track survey data

###### Measurement:

- Control and management of track surveys



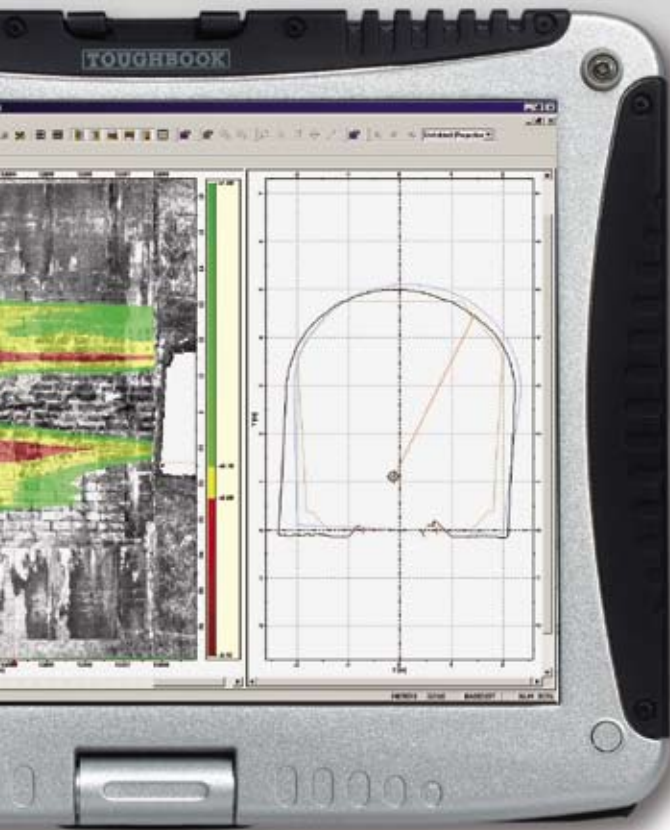
###### Track construction mode:

- Optimised screen layout for track adjustment in real time
- Display of correction values for horizontal and vertical adjustment

###### Evaluation:

- Analysis and documentation of (inner and outer) track geometry





## Comprehensive infrastructure documentation and clearance analysis

### GRP ScanControl

#### Scan data acquisition on the track

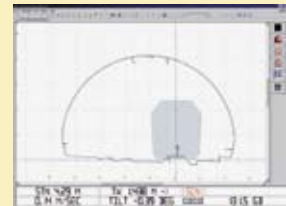
##### The application for:

- Condition surveying of route infrastructure, e.g. tunnels, bridges
- Archiving of current state assessment
- Fully automated clearance control in tunnels and on super structures



##### Measurement:

- Fully automated scanning with user friendly control software
- Direct display of speed, gauge, stationing and superelevation
- Real time display of actual measured profile
- Selection of continuous profile or single cross section measurement



##### Data management:

- Automatic scan and sensor data management

## Automated track maintenance

### GRPwin module «TAMPING»

#### Export to tamping machine

##### The application for:

- Track maintenance with tamping machines – requires GRPwin module «TRACK»



##### Measurement:

- Surveying of the actual track position and geometry

##### Function:

- Automatic calculation of the corrections for the actual track position relative to the design centre line
- Digital correction of data files to track tamping machines



## GRP RailCloud

### Scan data evaluation and reporting

##### The application for:

- Postprocessing of GRP ScanControl data

##### Evaluation:

- Automated evaluation processes for clearance analyse
- User definable clearance envelope
- Standardisation of scan results



##### Result:

- Digital clearance map with user definable colour coding
- 2D profile evaluation using GRP ProFit
- Export interface to CAD
- Individual object report



# GRP System FX

## The «all in one» railway surveying solution

### GRP System FX The modular system solution for railway surveying

- Portable and flexible system configurations
- The high precision track measurement system for track geometry surveys
- Precise profile measurement device for 3D clearance surveys
- High density scanner module for complete kinematic infrastructure analyses
- The perfect partnership with Leica total stations for 3D surveying
- Results in real time
- Available for all gauges between 1000 mm and 1676 mm



**CAUTION**  
LASER RADIATION - DO NOT  
STARE INTO BEAM  
620-690nm/0.95mW max.  
CLASS II LASER PRODUCT

GRP 3000:  
Profiler 100 FX –  
distance meter (RL, standard range):  
Laser class II in acc. FDA 21CFR Ch. §1040  
Laser class 2 in acc. IEC 60825-1 or EN 60825-1

GRP 5000:  
Profiler 5002 / Profiler 5003 scanner:  
Laser class 3R in accordance with EN 60825-1

Amberg Technologies is a leading provider of specialised rail and tunnel measurement systems since more than 25 years. This unique combination of industry knowledge and engineering expertise has produced innovative and flexible systems, based on practical designs and user-friendly software. With worldwide support and service, these solutions have won the trust and respect of both the rail and tunneling industry.

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