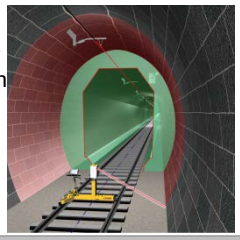
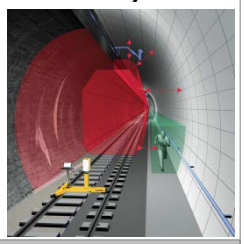
AMBERG TECHNOLOGIES

GRP 5000

System specification and typical accuracies for system application

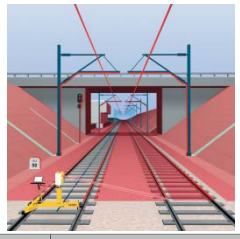
	Clearance gauging (2D relative)	**Structure gauging (3D absolute)**
	Clearance analysis of selected vehicle envelope and adjacent structures in 2D relative mode. 	3D survey of potential encroachments for clearance analysis and variant studies during re-alignment and design process. 
Requirements		
Data resolution	1 x 1 cm	1 x 1 cm
Accuracy	Profile: ±10 mm Stationing: Unambiguous station assignment ±1m	Profile: ±10 mm Stationing: ±5 cm
System operation		
GRP System	GRP 5000	GRP 5000
Measuring mode	Kinematic, 2D	Kinematic, 3D
Geo-referencing (positioning)	Stationing (datum) plates	TPS: Leica Viva TS15 A / GPS: Leica Viva GNSS [2]
Resolution of profile (pts/profile)	10'160 10'160 5'080	10'160 10'160 5'080
Scan head rotation (rot./sec.)	50 Hz 100 Hz 200 Hz [1]	50 Hz 100 Hz 200 Hz [1]
GRP measuring speed	1.8 km/h 3.6 km/h >3.6 km/h	1.8 km/h 3.6 km/h >3.6 km/h
Application accuracy		
Application accuracy represents the quality of the resulting object coordinate, which can be achieved by means of recommended system configuration, appropriate geodetic survey methods and under consideration of typical project conditions. According to system utilisation different components form the overall accuracy:		
1. Track position 1.1 Raw coordinate (Prism / antenna)	not applicable	TPS ±5 mm GPS ±40 mm
Note: This component of coordinate determination is based on geodetic measurements which are independent from Amberg Rail. The resulting accuracy is influenced by e. g. quality of fixed point network, accuracy of positioning sensor (TPS, GPS), survey method (e. g. layout of measurement, distances, measuring process), atmospheric conditions, measuring speed, et al. Accuracies as indicated are based on geodetic measurements under good measuring conditions. Lower accuracies will effect directly quality of resulting profile coordinates according to the rules of error propagation.		
1.2 Track geometry parameter - Cross level - Gauge	±1 mm ±0.3 mm	±1 mm ±1 mm ±0.3 mm ±0.3 mm
1.3 Stationing Synchronisation of raw coordinate + GRP measurements (Stationing accuracy)	±20 mm	±30 mm
Accuracy of (1.1 – 1.3) resulting track coordinate (Error propagation acc. to Gauss)	not applicable	TPS ±31 mm GPS ±51 mm Approximation: Lateral error ±5 mm ±40 mm Longitudinal error ±30 mm ±50 mm Major axis of error ellipses in direction of measurement.
2. Profile survey - Up to 7 m distance relative to track axis	±5 mm	±5 mm
Resulting Application Accuracy (Error propagation following Gauss)	**2D Profile Coordinate** Relative to track axis **±5 mm** (1 σ) ±15 mm (3 σ) Stationing accuracy **±2 cm** (1 σ) ±6 cm (3 σ)	**3D Profile Coordinate** [3] **TPS** [4] **GPS** **±31 mm** **±52 mm** (1 σ) ±93 mm ±155 mm (3 σ)

[1] Maximal frequency depends on scanner model. Supported models: Amberg Profiler 5033 / 6012.
[2] Various models supported. Please contact our distribution partner or Amberg Technologies AG.
[3] Accuracy relative to track axis - as 2D application.
[4] Main error component in direction of track stationing.

Legend:
1 σ ≙ 68 % of measured values
3 σ ≙ 99 % of measured values

GRP 5000

System specification and typical accuracies for system application

	3D Point Cloud Mapping Topographic 3D track corridor survey for planning, design and infrastructure asset management works. 		**High-Density Image Data** Detailed image data of adjacent railway infrastructure for inspection and life-cycle management.
Requirements			
Data resolution	HiRes 10 x 10 mm	LowRes 20 x 20 mm	HiDensity 5 x 5 mm
Accuracy	Object coordinate: ±20 mm	Object coordinate: ±50 mm	Add-on: Profile: ±10 mm Adequate scale of image for measurement of length and area of faults of structure <5 % deviation
System operation			
GRP System	GRP 1000 (Track) GRP 5000 (Profile)	GRP 5000 (Track + Profile)	GRP 5000
Measuring mode	Track: 3D Stop+Go, 5 m interval Profile: 2D kinematic	Track+Profile: 3D kinematic	2D kinematic
Geo-referencing (positioning)	Track: TPS Leica TS15 A [2)] Profile: Stationing plates	TPS: Leica TS15 A [2)] GPS: Leica Viva GNSS [2)]	Stationing (datum) plates
Resolution of profile (pts/profile)	10'160 / 5'080 / 5'080	10'160 / 5'080	10'160
Scan head rotation (rot./sec.) [1)]	50 Hz / 100 Hz / 200 Hz	100 Hz / 200 Hz	100 Hz
GRP measuring speed	GRP 1000/5000: 1.8 km/h	> 3.6 km/h	1.8 km/h
Application accuracy based on positioning with total station TPS			
Application accuracy represents the quality of the resulting object coordinate, which can be achieved by means of recommended system configuration, appropriate geodetic survey methods and under consideration of typical project conditions. According to system utilisation different components form the overall accuracy:			
1. Track position 1.1 Raw coordinate (Prism / antenna)	±2 mm	±5 mm	Not applicable
Note: This component of coordinate determination is based on geodetic measurements which are independent from Amberg Rail. The resulting accuracy is influenced by e. g. quality of fixed point network, accuracy of total-station (TPS), survey method (e. g. layout of measurement, distances, measuring process), atmospheric conditions, measuring speed, at al.. Accuracies as indicated are based on geodetic measurements by total-station (TPS) under good measuring conditions. Lower accuracies will effect directly quality of resulting profile coordinates according to the rules of error propagation.			
1.2 Track geometry parameter - Cross level - Gauge	 ±0.5 mm ±0.3 mm	 ±1 mm ±0.3 mm	 ±1 mm ±0.3 mm
1.3 Stationing Synchronisation of raw coordinate + GRP measurements (Stationing accuracy)	±20 mm	±30 mm	±15 mm
Accuracy of (1.1 – 1.3) resulting track coordinate (Error propagation acc. to Gauss)	±20 mm	±30 mm as application "Structure gauging 3D"	Not applicable
2. Profile survey - Object distance up to 7 m - Object distance up to 20 m relative to track axis	 ±5 mm ±15 mm	 ±5 mm ±15 mm	 ±5 mm
Resulting accuracy based on positioning with total-station (TPS) (Error propagation following Gauss)	**3D Object Coordinate** [3) 4)] dist. <7 m **±21 mm** (1 σ) <20 m **±25 mm** dist. <7 m ±63 mm (3 σ) <20 m ±75 mm	**3D Object Coordinate** [3) 4)] dist. <7 m **±31 mm** (1 σ) <20 m **±33 mm** dist. <7 m ±93 mm (3 σ) <20 m ±99 mm	**Scale of Image** (Stationing accuracy) **±1.5 cm** (1 σ) ±4.5 cm (3 σ) **Profile Derolement** Accuracy to size depending on chosen projection profile: <5 % possible

Note: Achievable accuracy is depending on actual project conditions and may vary.
All listed parameter are based on experiences of numerous system application at various application.
Unless otherwise stated accuracies are given at one sigma (1 σ).

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