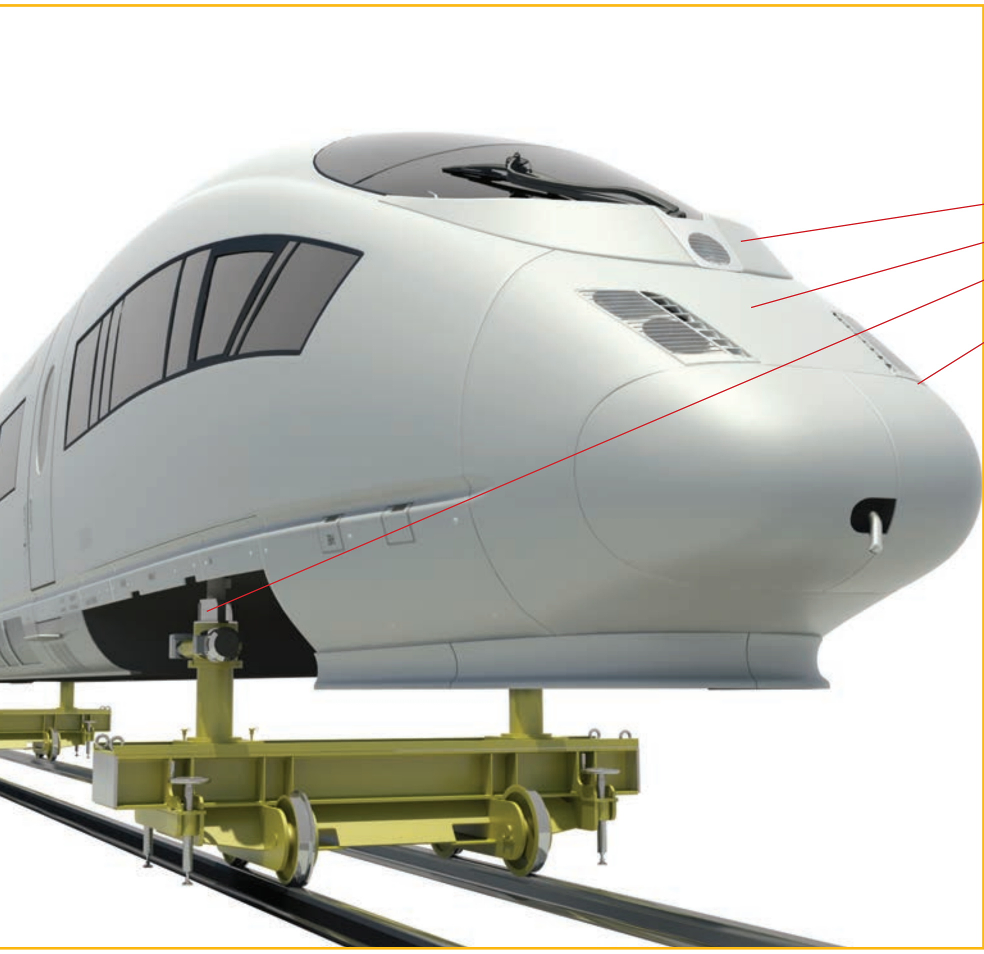
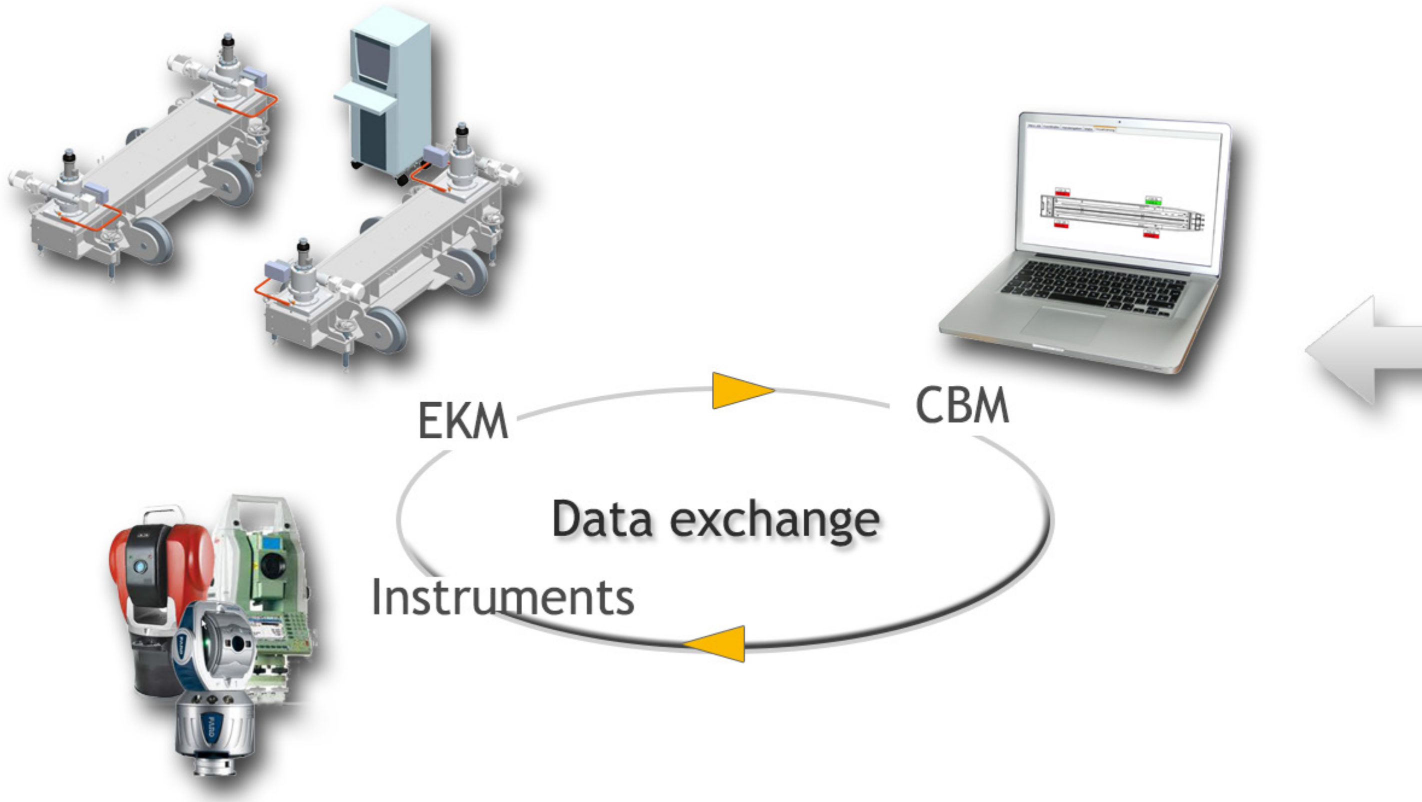
AST Gruppe
Angewandte System Technik

Railway Systems

The system to determine and adjust the rolling stock to torsion free position with integrated geometric measurement





The system to determine and adjust position with integrated

EKM 305 – Systems for the quality assurance of rolling stock, providing the torsion free (tension free) position of rail vehicles, combined with a geometrical measurement solution. A.S.T. provides the highest precision, which is required for manufacturers and during the refurbishment of railway vehicles.

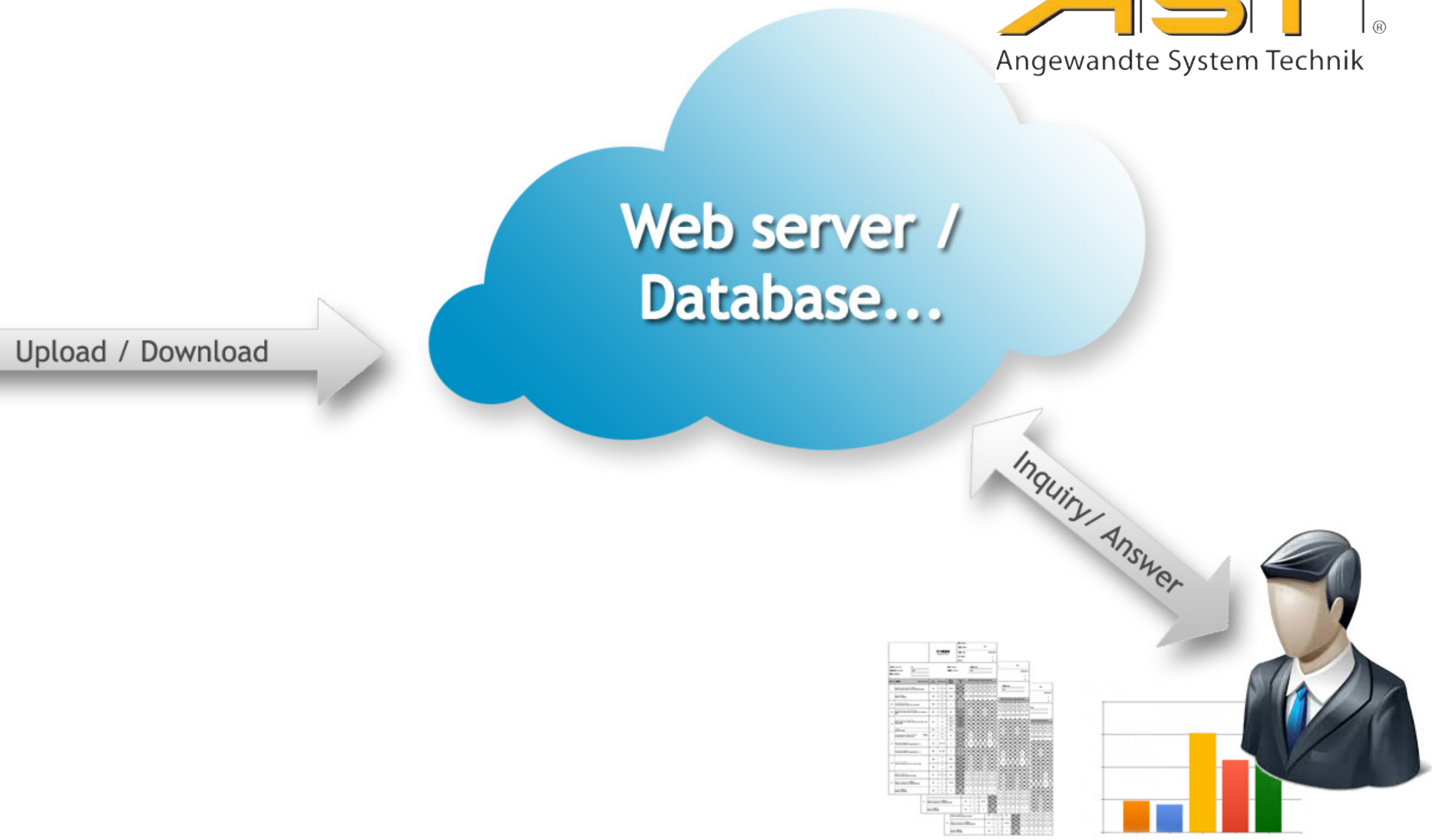
The force and geometrical measurement processes of passenger coach are one of the most important parts of the quality assurance process in rolling stock manufacturing and refurbishment.

Any torsion of the vehicle can cause derailment, particularly for vehicles operating on high speed. For that reason the rolling stock is measured several times during the production process. In most cases the force measurement and the collection of geometrical data is carried out according to German standards DIN 25043.

A.S.T. is an experienced partner for numerous national and international rolling stock manufacturers. Decades of experience in construction, enhancement and improvement of the systems, arises the technology and accumulates the know-how with each individual project. The rolling stock which has been inspected by A.S.T. systems can obtain an increased safety during the operation, improved running properties and reduced costs by reducing the wear and tear of the wheels.

The quality of each product is primarily based on the quality of the production. To ensure the quality, A.S.T. systems can be used during several stages of production to inspect the initial force and geometrical data. A high degree of functional safety, compliance with the construction gauge and safety against derailment will be the benefit. Furthermore these benefits are also applicable during the service and refurbishment of railway vehicles.

There are two types of corner force measurement systems: EKM305-S for the shell production and EKM305-F for the final production. The difference between the types is the mechanical substructure for the precision hoist gear.



the rolling stock to torsion free geometric measurement

Ideally any torsion of the car body should be recognized and adjusted during the shell production. The torsion-free position should be maintained during the extension process and only monitored by measurements. If the torsion-free position is to be adjusted on a finished vehicle, installed masses and their distribution must be taken into account.

The advantages of geometric measurement solution (CBM) are evident in the combination with the whole EKM305 processes both in shell and final productions. The initial reference point of geometric measurement is based on the torsion free position of rolling stock, to confirm and collect the archiving physical recorded measurement data of car body.

EKM305 measures vehicle bodies according to the four points' method on a straightening jig. It records the four points forces and height tolerance, calculates the nominal forces via the position of the vehicle's center of gravity.
As a result of the measurement, the position and thickness of the shims are determined which permanently maintain the vehicle on the torsion free position.
To ensure the EKM 305 systems are consistent in a high measuring accuracy level, A.S.T. also provides the force calibration unit. The systems should be regularly calibrated, remain in an optimum condition.

Also, A.S.T. offers the RAK402 systems which used for confirm each wheel load on the rail track of whole railway vehicle.

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EKM 305-S
The highest standard in shell production

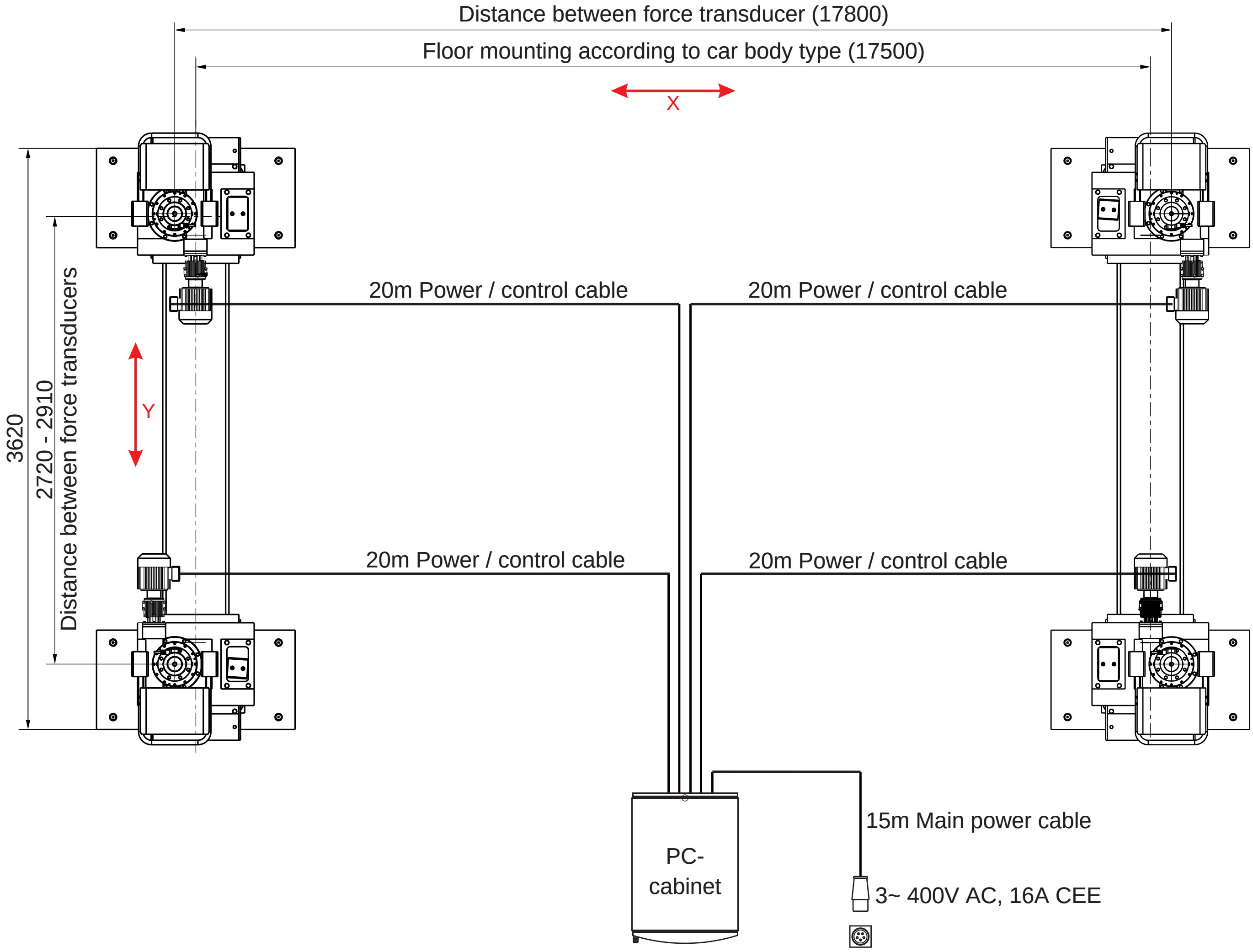
In consideration of the corner force measurement method, the system determinates and adjusts the passenger car bodies to torsion free position and its centre of gravity, according to DIN 25043 standard. Afterwards it starts the geometrical measuring sequence via CBM 305 software by using laser tracker or tachymeter.

The EKM 305-S combines the corner force measurement of passenger car bodies with typical shell production processes such as straightening, welding, rework and mounting. Therefore the EKM 305-S is based on a special measurement and straightening stand. The stationary fixed straightening stand ensures accurate corner force measurement and brings highest robustness for mechanical processing on the car body. The measurement results can be applied immediately in the shell production process.

With the four measuring units (precision lifting gears) the car body is moved into torsion free position as essential initial step for geometrical measurement of the car body.

EKM systems are delivered with the latest version of EKM operating software XKS 305. All relevant data and measurement results are stored in a database, including a viewer for measurement protocols.

System overview



Customer’s dimension is available, based on requirement.

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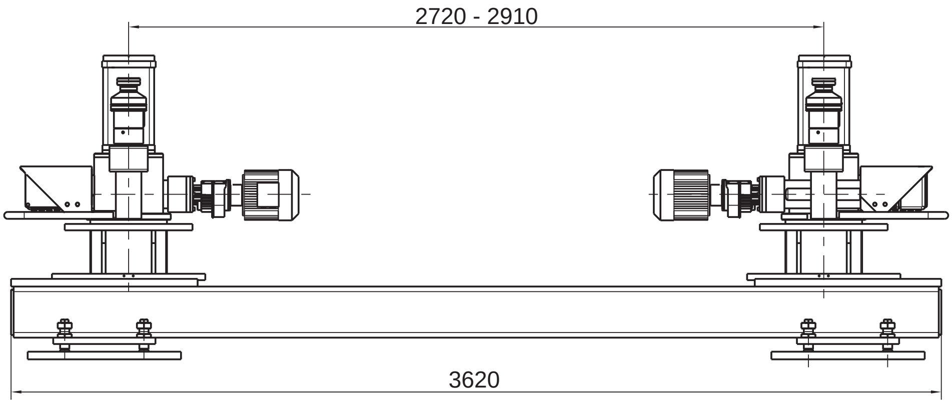
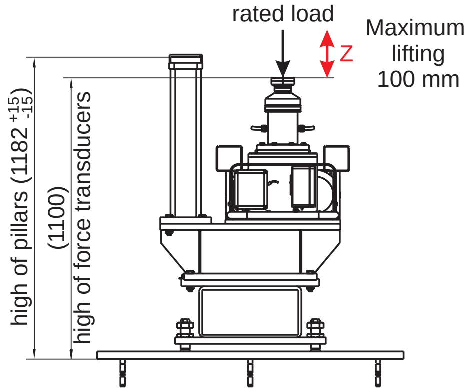
EKM 305-S specification

Supported car bodies		All types of passenger coaches
Max. weight	t	40
Max. width of car body measuring points	mm	up to 2720 - 2910
Adaptation to car body measuring points by various adapters to be fitted onto sensor		
Load measurement		
Sensor rated force (F_{nom})	kN	up to 100
Sensor accuracy	%	0.1
Displacement measurement	mm	0.1
Integrated in precision hoisting gear, accuracy		
Force generation		
By electric gear motor 1.1 kW and precision lifting gear box,		
Fixed speed	mm/s	0,4
Lifting speed during the working process	mm/s	0.04
Max. stroke	mm	100
Measuring and straightening stand (2 in 1 system)		
Total weight with lifting gears	t	2.1
adjustable in y direction for car type adjustment		
adjustable in z direction for initial horizontal levelling		
PC Cabinet		Electrical switching box
Equipment		Industrial 19" PC with TFT monitor and laser printer Various add on cards as interfaces
Protection class of cabinet and cable		IP 54
Weight	kg	240
Power supply		3~400 V AC, 16A CEE
Cables		
Cable from lifting gear to PC-cabinet	m	4 x 20
Power cable	m	1 x 15
Ethernet cable	m	1 x 20
All cables detachable		
Main software functions		Automatically touching of the sensor against the car body Automatically adjustment of the torsion free position - tilting of the car body in torsion free position - hardcopy or export of the measurement report - car body database - user access administration - hardware monitoring
Languages		English, Chinese, German
Operation System, additional software		MS-Windows 7(Multilingual), MS-Office (English) The software completely complies to draft standard DIN 25043:2012 Rail applications – measuring of rail vehicle during production part1 (abstract), part 2 (geometrical) and part 4 (corner forces)

Detail view





EKM 305-F
The highest standard in final assembly

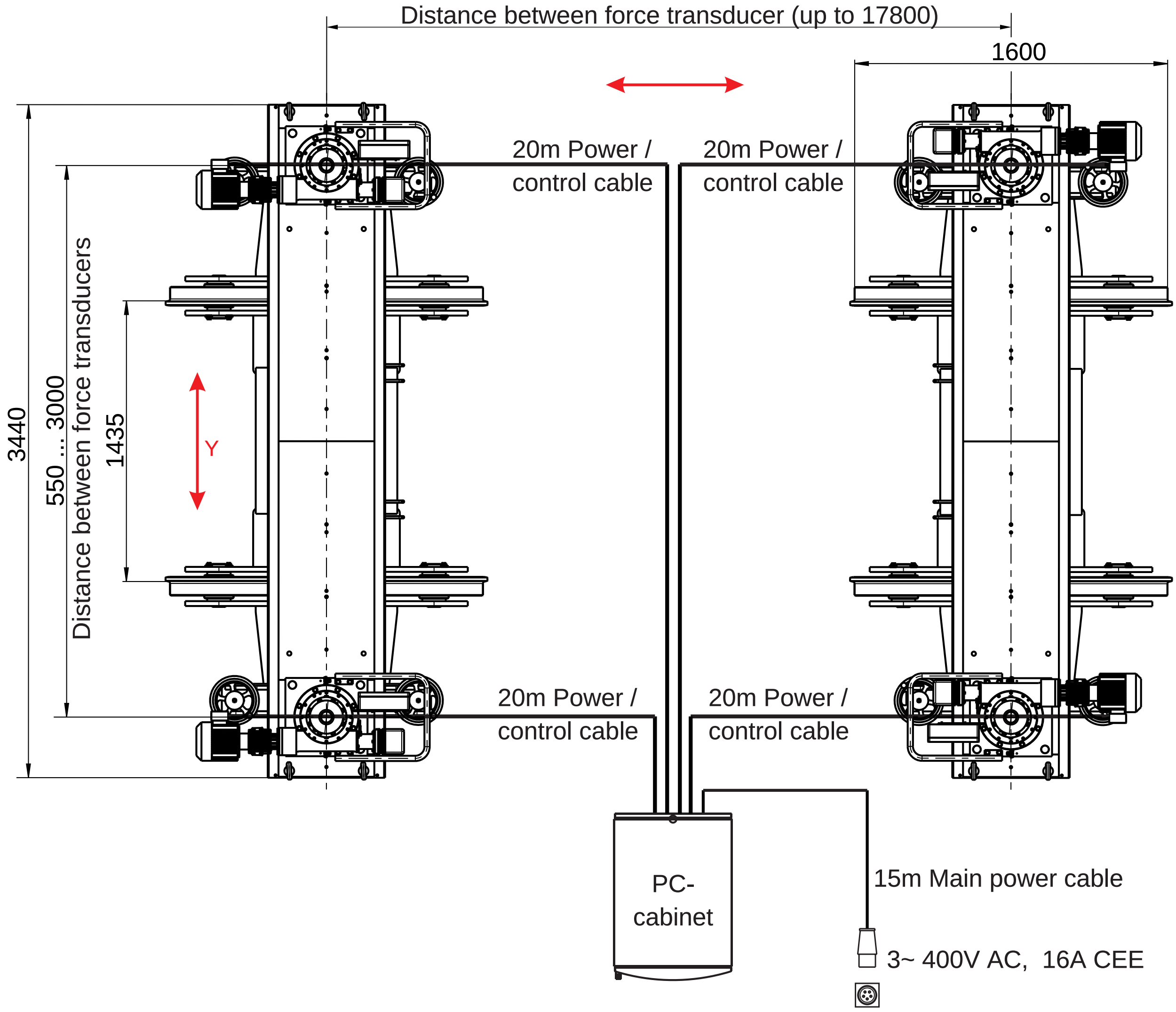
In consideration of the corner force measurement method, the system determinates and adjusts the passenger car bodies to torsion free position and its centre of gravity, according to DIN 25043 standard. Afterwards it starts the geometrical measuring sequence via CBM 305 software by using laser tracker or tachymeter.

The EKM 305-F is the suitable corner force measurement system for final assembly of rail car bodies. Its measurement bogies are designed as perfect compromise between flexibility and robustness. They are easily moveable by hand under the lifted finished car body. The rigid design ensures accurate corner force measurement as well as displacement among each lifted corner of the car body.

Similar to the EMK 305-S the well-proven measuring units (precision lifting gears) are used to move the car body in the torsion free position. The result of the measurement process allows a declaration about the height of necessary bogie shims. The final geometrical measurement can be operated during the car body placed on the EKM 305-F.

EKM systems are delivered with the latest version of EKM operating software XKS 305. All relevant data and measurement results are stored in a database, including a viewer for measurement protocols.

System overview



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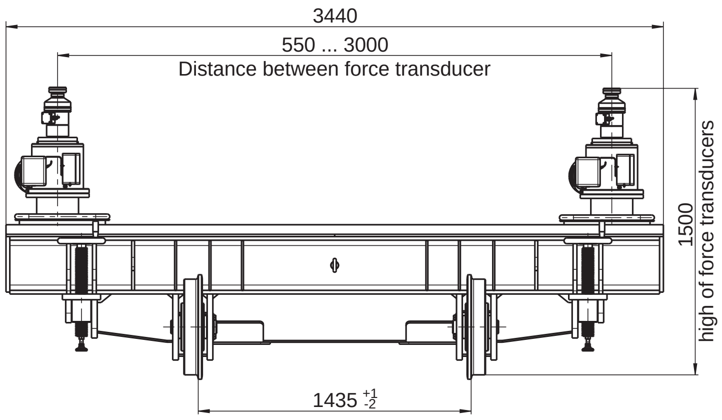
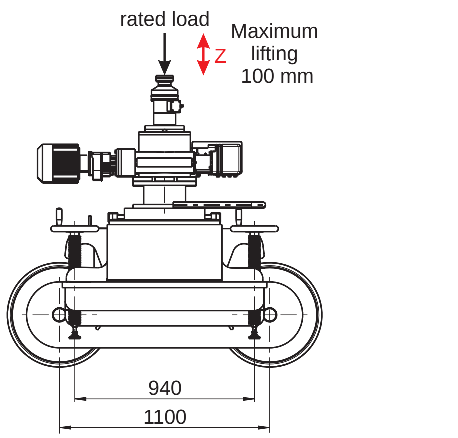
EKM 305-F specification

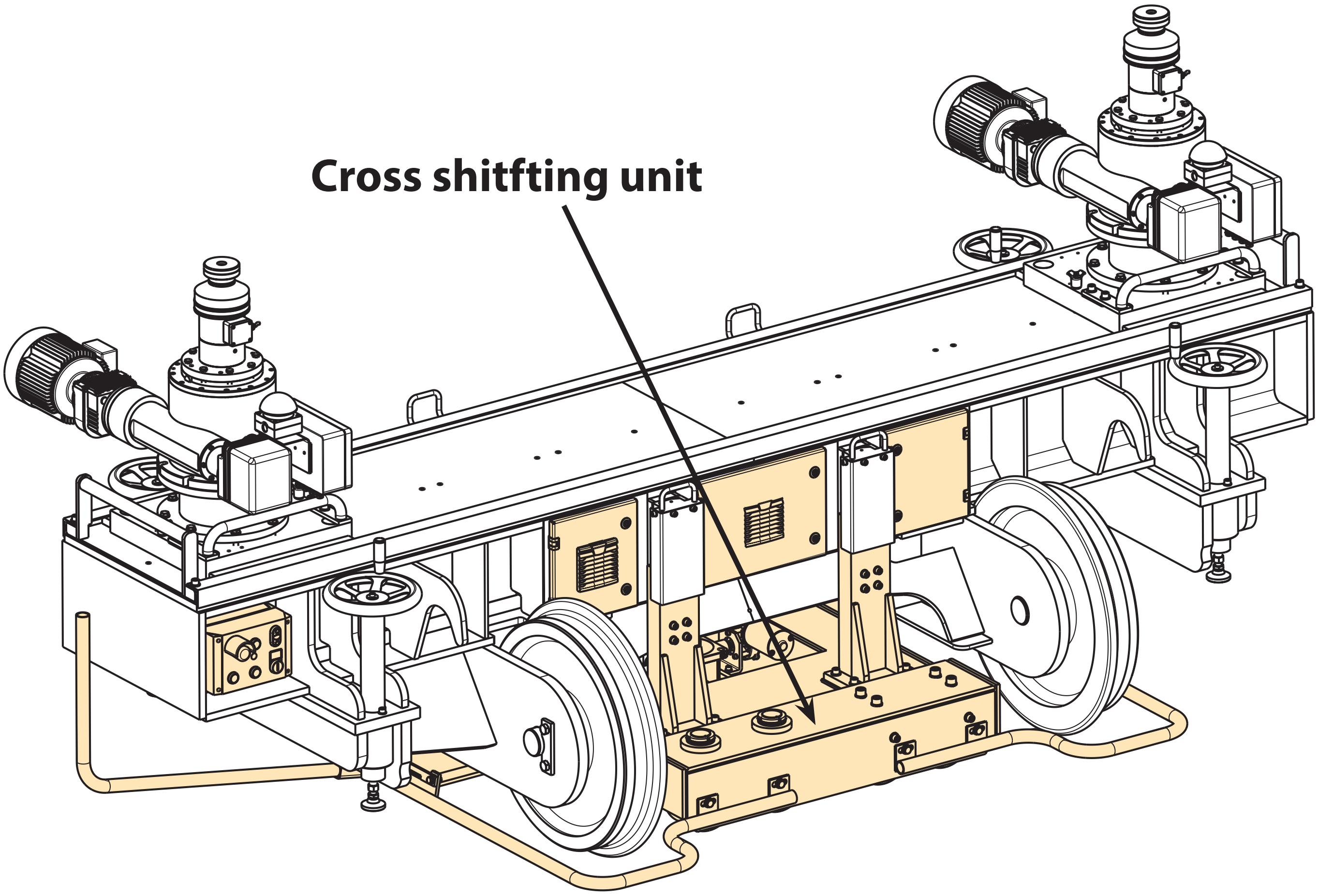
Supported car bodies		All types of passenger coaches
Max. weight	t	60
Max. width of car body measuring points	mm	550 - 3000
Adaptation to car body measuring points by various adapters to be fitted onto sensor		
Load measurement		
Sensor rated force (F_{nom})	kN	up to 200
Sensor accuracy	%	0.1
Displacement measurement	mm	0.1
Integrated in precision hoisting gear, accuracy		
Force generation		
By electric gear motor 1.1 kW and precision lifting gear box,		
Fixed speed	mm/s	0,4
Lifting speed during the working process	mm/s	0.04
Max. stroke	mm	100
Measuring and straightening stand (2 in 1 system)		
Total weight with lifting gears	t	3.7
adjustable in y direction for car type adjustment		
adjustable in z direction for initial horizontal levelling		
PC Cabinet		Electrical switching box
Equipment		Industrial 19” PC with TFT monitor and laser printer Various add on cards as interfaces
Protection class of cabinet and cable		IP 54
Weight	kg	240
Power supply		3~400 V AC, 16A CEE
Cables		
Cable from lifting gear to PC-cabinet	m	4 x 20
Power cable	m	1 x 15
Ethernet cable	m	1 x 20
All cables detachable		
Main software functions		Automatically touching of the sensor against the car body Automatically adjustment of the torsion free position - tilting of the car body in torsion free position - hardcopy or export of the measurement report - car body database - user access administration - hardware monitoring
Languages		English, Chinese, German
Operation System, additional software		MS-Windows 7(Multilingual), MS-Office (English) The software completely complies to draft standard DIN 25043:2012 Rail applications – measuring of rail vehicle during production part1 (abstract), part 2 (geometrical) and part 4 (corner forces)

Detail view





EKM 305-F - Cross shifting unit (option)



Special features
- Easily move the EKM 305-F between the tracks
- Electrically retractable
- Cableless battery operation

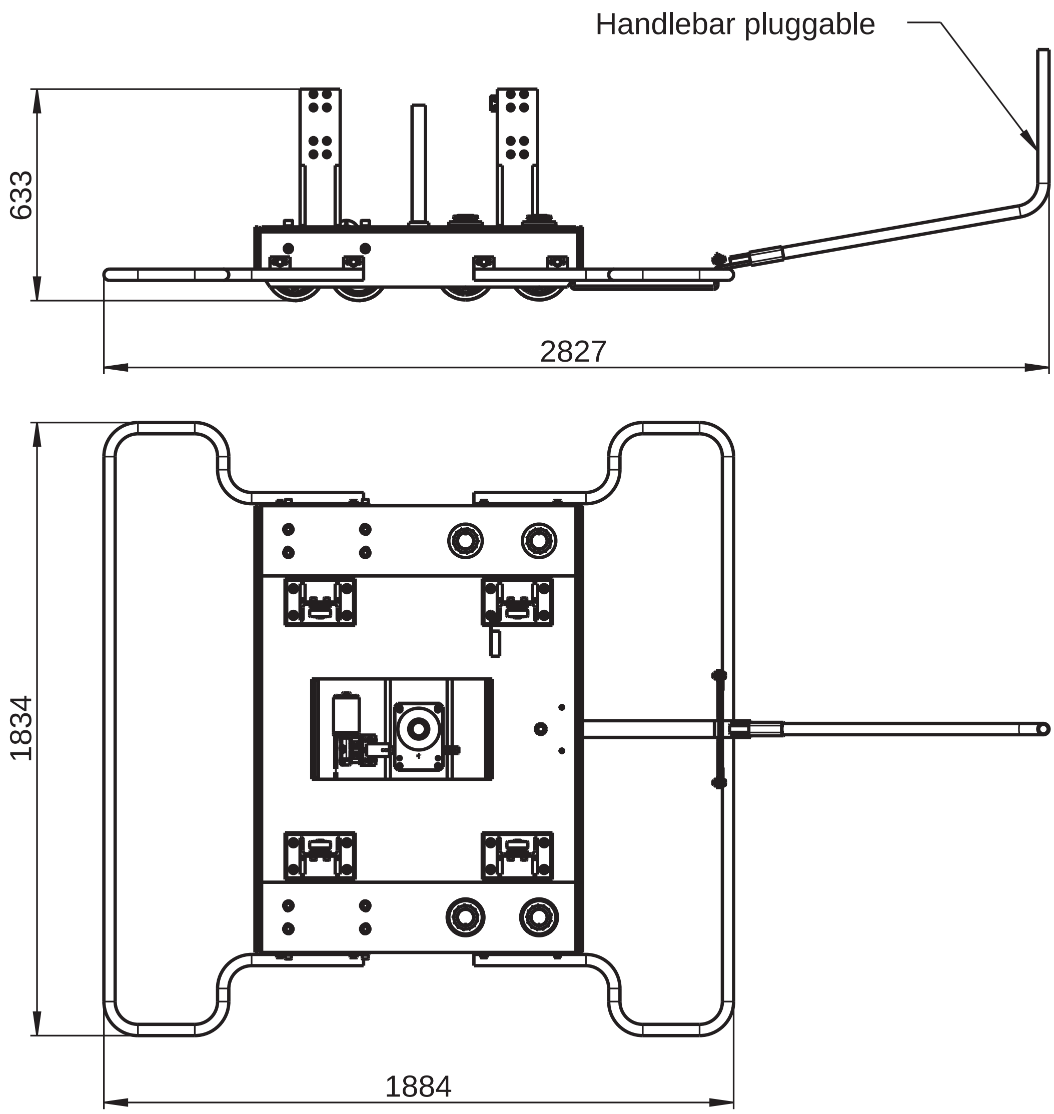
Function:
The cross shifting unit allows one to move the measuring and straightening stand transversely to the direction of movement. By means of an electrically driven motor the cross shifting unit is extended downwards, the measuring and straightening stand is lifted and subsequently can be moved by hand (manually) to another rail. It features an integrated steering device, with which the position of the measuring and straightening stand can be corrected with respect to the rail during the manual process. At least two people are required to move the measuring and straightening stand, due to its weight of approximately 4.2 tons. Additionally, the cross shifting unit is equipped with a battery unit.

Operation:
It is operated via three latching buttons: lowering, lifting and stop.
A key switch is used to protect against unauthorized use.
The power is supplied by a 230 VAC connection cable.

Battery mode:
A switch box with built-in battery for the cross shifting unit is attached to the measuring and straightening stand. The battery will be charged once the switch box is connected to 230V. Line power can also be supplied via a connection cable to a gearbox. In that case the battery is charged during the surveying operation.

Specifications

Motor:	power supply 24VDC
	power consumption 100W
Lifting gear:	traverse path approx. 100mm
	travel time of end-point to end-point approx. 6 minutes
	max. lifting height 50mm
	max. lifting load 5t
Battery:	capacity12Ah
	approx. 5x lifting and lowering cycles
Weight:	475kg



XKS 305

Software for automatic force measurement, torsion free positioning and reporting

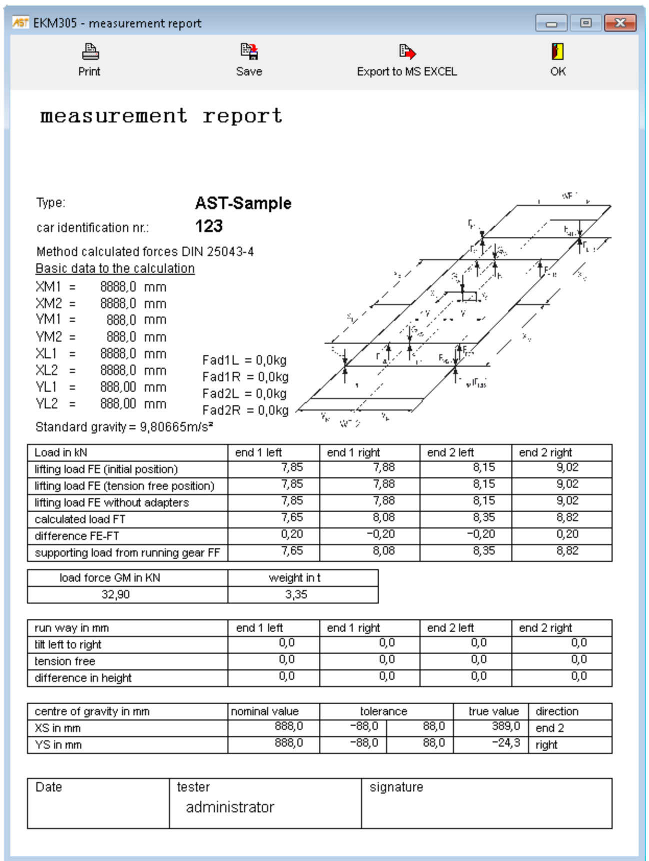
The EKM software XKS 305 is the interface between the corner force measurement system and the operator. The software is installed on an industrial PC terminal and enables the monitoring of all control and measurement functions.

The operator is lead through the structured measurement sequence by the software using clear dialogues:

- touching and lifting the car body
- moving the car body into leveled reference plane (only with EKM305-F)
- measurement of the corner forces
- determination of the center of gravity
- moving the car body in torsion free position
- calculation process and measurement report

The step-by-step procedure minimizes the danger of operating errors and guarantees precise repeatability of the measurements. Certainly all calculations and settings are carried out according to DIN 25043. XKS 305 provides a database for up to 100 different types of car bodies. There all mechanical dimensions which are relevant for the calculation process can be stored for each type of car body.

Additional service functions for maintenance and repair work on the EKM 305 complete the scope of the EKM software. A wireless data interface to A.S.T. CBM 305 software is also provided.



EKM305 - measurement report

Print | Save | Export to MS EXCEL | OK

measurement report

Type: **AST-Sample**

car identification nr.: **123**

Method calculated forces DIN 25043-4

Basic data to the calculation

XM1 = 8888,0 mm
XM2 = 8888,0 mm
YM1 = 888,0 mm
YM2 = 888,0 mm
XL1 = 8888,0 mm
XL2 = 8888,0 mm
YL1 = 888,00 mm
YL2 = 888,00 mm

Fad1L = 0,0kg
Fad1R = 0,0kg
Fad2L = 0,0kg
Fad2R = 0,0kg

Standard gravity = 9,80665m/s²

Load in kN	end 1 left	end 1 right	end 2 left	end 2 right
lifting load FE (initial position)	7,85	7,88	8,15	9,02
lifting load FE (tension free position)	7,85	7,88	8,15	9,02
lifting load FE without adapters	7,85	7,88	8,15	9,02
calculated load FT	7,65	8,08	8,35	8,82
difference FE-FT	0,20	−0,20	−0,20	0,20
supporting load from running gear FF	7,65	8,08	8,35	8,82

load force GM in KN	weight in t
32,90	3,35

run way in mm	end 1 left	end 1 right	end 2 left	end 2 right
tilt left to right	0,0	0,0	0,0	0,0
tension free	0,0	0,0	0,0	0,0
difference in height	0,0	0,0	0,0	0,0

centre of gravity in mm	nominal value	tolerance		true value	direction
XS in mm	888,0	−88,0	88,0	389,0	end 2
YS in mm	888,0	−88,0	88,0	−24,3	right

Date	tester	signature
	administrator	

Customized measurement report

Main screen of the control application software EKM 305

Force Calibration Set

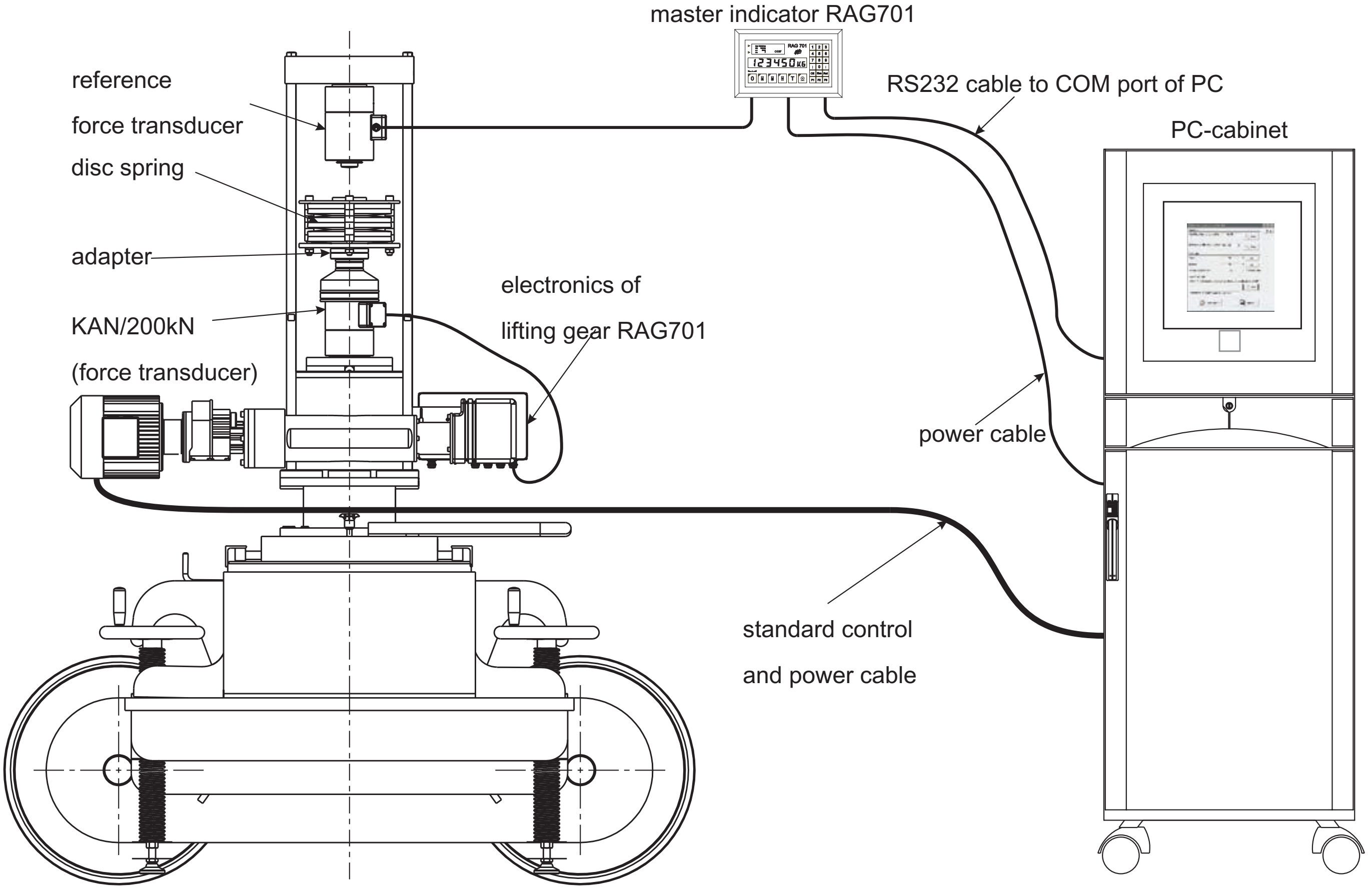
For EKM systems A.S.T. also offers calibration sets for the force transducers. To work in the correct way these should be re-calibrated every year or after impact or after a repairing.

The requirement for a successful recalibration of the force transducer of each lifting gear is a current calibrated reference unit consisting of reference force transducer KAN/200kN (master) connected with an indicator RAG 701.

The force generation is achieved by moving the lifting gear about a short distance in combination with a disk spring. The generated calibration force is applied on both transducers: on the transducer of lifting gear and on the master transducer (reference). If necessary, force values can be adjusted in the electronics of the lifting gear. Calibration values are storable on the PC system.

lifting gear with calibration set

Overview Calibration Set



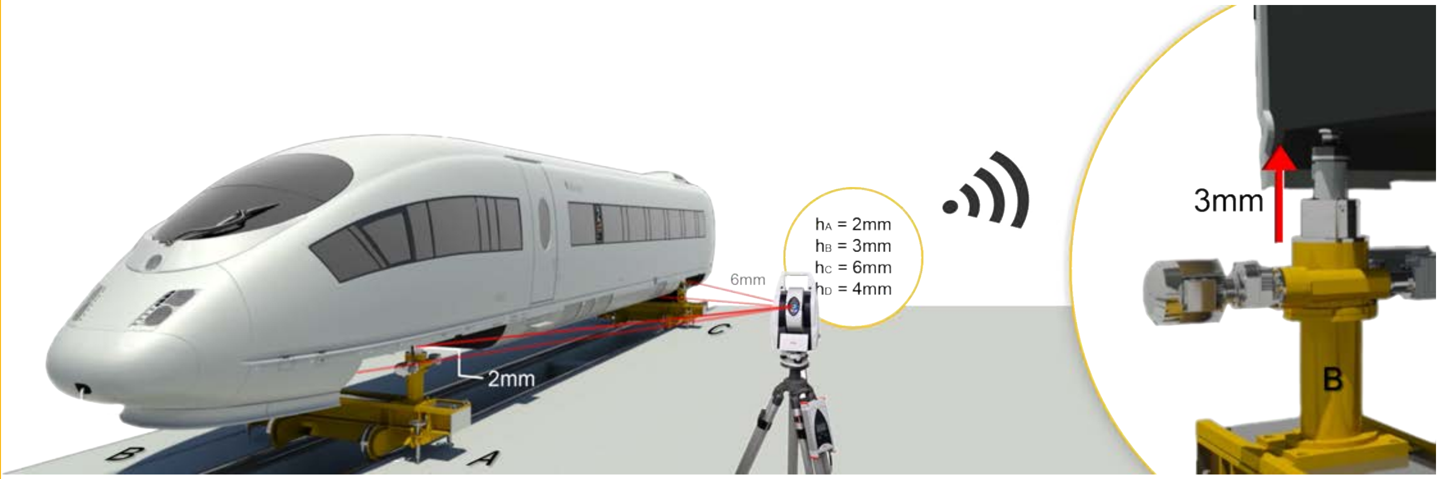


Figure 1. Determination of the differences in height for all lifting points and the automated transfer of the resulting values to the EKM.

CBM 305 - Measurement for Rolling Stock

Abstract

The necessity of measuring rolling stock using modern industrial measuring systems is justified by increasing demands on product quality. Quality control both in production as well as in repair, must be very exact and extremely economical. Irrespective of whether the vehicle measurement is carried out according to DIN 25043, or based on the manufacturer's data, the ride quality, functional safety, derailment safety, or compliance with the vehicle gauge can be proven based on the measurement data. Thus the data serve as proof of suitability for roadworthiness or can be used to adjust the machinery (Reverse Engineering). The measuring software CBM 305 implements these high demands through an integrated solution. With the help of a customizable measuring sequence, customized measuring concepts can be implemented. The software controls the instruments as well as all the required analysis processes after the actual measurement, providing wireless data transmission to our corner force measuring system EKM 305. Data visualization is carried out directly in the application, whereby for instance, data export for creating Excel measurement sheets or databases in in-house networks is possible. Because the software is developed in-house, special solutions for specific needs can be met at any time. An overview of all A.S.T. GmbH systems for production as well as repair can be found in figure 8.

1. Overview

The measuring and analysis software CBM 305 (Car Body Measurement) was developed especially for the quality control of rail-based vehicles. Irrespective of whether the measuring task needs to be carried out during production or repair, CBM 305 has the appropriate solution for each application. The CBM database constitutes the core of the application which contains all data necessary for measurement and can be freely configured by the user. Using a hierarchal design, as many types of rail cars can be configured as needed.

For each type of rail car, a measurement sequence which has been adapted to the measuring location is on file, and with the help of which even untrained personnel can carry out a complete car measurement step by step using visual cues (picture, text). Thanks to a modular design, the software can control almost any modern measurement instrument, by which the stored measurement sequence always remains the same, and only another instrument is used for collecting data. Analysis of the data and creation of the measurement sheets is carried out with the click of a mouse. Additionally, it is possible to export data into other applications or network infrastructures. Nonetheless, the geometric measurement of the rolling stock is not to be seen as an independent process during quality assurance. Rather, measurement usually takes place following the determination of the corner forces by corner force measuring system (EKM). Depending on the intended use (production or repair) we also produce various versions of such measurement systems in our company. This makes it possible to link the EKM and CBM systems.

The advantage of a combination of both applications results from the underlying measurement sequence. After the car body has been placed on the corner force measurement system it must be placed in a level starting position. Frequently a rotating laser was used for this purpose, with which the differences in height on the four lifting points of the EKM were determined. If a total station or laser tracker is used in place of a rotating laser for the measurement, the differences in height can be determined with greater accuracy and also automatically transmitted to the EKM (fig. 1).

The danger of misreading is eliminated. The EKM automatically processes the differences in height. Following the measurement, the torsion-free position can be set and the proper geometry determination begun. In the subsequent measurement sequence, the CBM software is capable of determining the optimum tilting angle of the vehicle using the initial measurements of the sidewalls. This tilting angle can also be transmitted to the EKM and thus physically adjusted.

Vice versa, it is possible to import all force values determined by the corner force measuring system EKM into the CBM database. This way a complete dataset consisting of geometric and force values can be retrieved at all times and can also be jointly reused. A statistics module within the CBM application provides basic analytic options from several measurement series.

2. Measuring Sequence

One of the main criteria during the development of the software lies in the ease of use of the application. The measuring personnel should be able to concentrate on performing the measurement task precisely without thinking about transformation of coordinates, accuracy, or having to choose the proper measurement. CBM software takes care of all these aspects. The entire measuring strategy is on file in the central database, which can be started at the beginning of the measurement using quick selection (fig. 2).

The interface for input data can also be freely configured. After selection of vehicle type and completion of the outline data, the entire measurement configuration is loaded. This includes the entire measurement sequence including the description of each measurement point in text

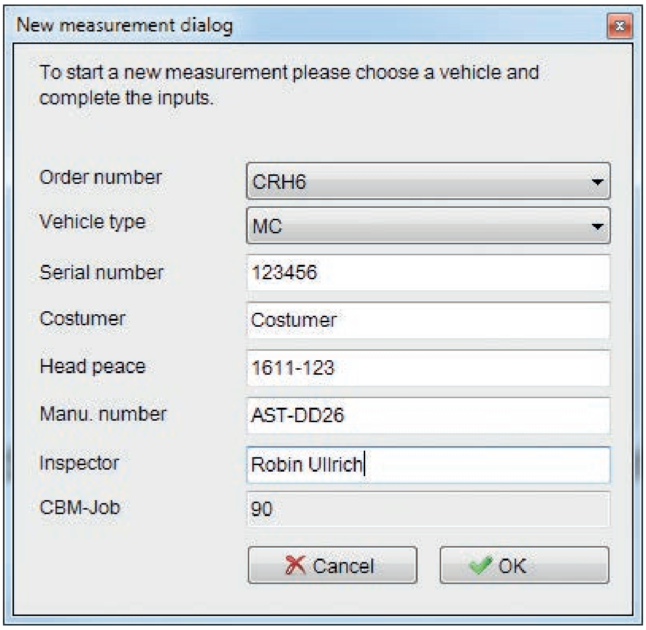


Figure 2. Quick selektion of the measurement configuration. The particular labeling (f.ex.car group, car type) can be defined as needed

and images. Additionally, the adapter to be used for each measurement point is displayed in text and image (fig. 3).

This way each measurement process can be easily visually assessed by the operator. The actual measurement is triggered by mouse click or a remote control, by which one-man operation is possible. If the wrong position is inadvertently measured, the software is capable of localizing the error using a real-time check of the data, indicating this accordingly. This function is helpful, if for example, the sidewall is to be measured at a specific height.

The measurement process is repeated iteratively until the tolerance ranged nominal height is achieved. Only then can the measurement sequence proceed. In general each instrument survey station has its own measurement sequence which is executed tabularly. Even the instrument survey station in relation to the rolling stock is depicted in the measurement sequence. This ensures that all measurement points are visible from the respective instrument survey station. In addition to important information for the measurement personnel, all instrument parameters are automatically set during the measurement. This ranges from connecting the measurement instrument to changing the reflector offset. Thanks to this control

Figure 3. CBM software menu during the measurement. For each measurement task detailed information in text and picture is displayed, which ensures the correctness of the measurement data (left). An indication of each measurement point using the instrument is possible as well (right).

option, and the underlying measurement data in the database, the measurement instrument serves to further ensure the correct measurement point position. This is carried out for the purpose of the automatic measurement signaling. If a new point is to be measured, then the instrument automatically turns to the appropriate position. New instruments can also mark each measurement point with a laser spot (fig. 3).

This way the user has three ways to gain information about the measurement positions: via instruction text, graphic depiction of the measurement point (such as an excerpt from the measurement sheet), and the signaling with the help of the laser. Even if a measurement has to be interrupted, for example to change the battery in the measuring instrument, the measurement sequence can be continued from the last position.
In addition to this highly structured measurement sequence, any number of additional measurement points can of course be incorporated, which are also archived in the database. Identical to each measurement point in the structured measurement sequence, the date, time, reflector and any adapters used, is saved for each point measured. This way the measurement sequence can always be retraced. So that simple check calculations are possible even during the program sequence (for calculating the tilting value of the car body), any Excel template can be opened at any time during the measurement. Measurement data which has already been recorded is automatically imported into the template, and the calculation functions saved in the Excel file are carried out. The resulting file can be archived if needed.

3. Measurement Results

Generally, three dimensional coordinates are recorded during the measurement. After these have been transformed into the car body coordinate system, they are saved in the CBM database. In most cases it is not the coordinate of a measurement point which is important for the evaluation of the measurement results, but rather the dimensions derived from it. The calculation of these dimensions from the measurement points is also part of the measurement configuration which is stored in the database. If the measurement sequence was fully executed, then at the conclusion all di-

Figure 4. Pattern of a measurement sheet. The layout of the sheet is customisable. After all measurements have been taken the measurement sheet is automatically filled. Additional calculations f.ex. of the shims are possible.

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Measuring Record
Measurement according to DIN 25043

Name: Robin Ullrich
Date: 07.07.2015

Car type: Sample Car | Dimension sheet drawing-no.: | Version: 1

Item	Measuring Process	Dimension	Admissible Deviation	Nominal Dimension		Acutal Value	Dimension at the indicated metering points 1	2	3	4	5
3,1	Distance between solebar and car longitudinal centre	y30	0	1500	R		-1,0	2,0	4,0	-5,5	-1,1
			-6		L		0,3	2,4	2,2	1,2	5,5
3,2	Deviation of solebars from straight line (0.4mm/m)	z30	+7.5	0	R				0,2		
			0		L				0,2		
8,1	Half width-sidewall and carbody (Height 336mm from bogie support area)	y32	0	1450	R		3,4	1,0	2,2	2,1	0,9
			-11		L		0,3	0,0	1,9	2,1	3,4
4.1	Distance between bogie interface and reference level	z43	+0.5	0	R						
			-0.5		L						
8,2	Distance between bogie support and car longitudinal centre	y33	+0.5	1455	R			0,2		0,0	
			-0.5		L			0,0		-0,2	
4,1	Transversal parallelism of bogie support surface	z44	0.5/100	0	R			0,2		0,1	
					L			0,1		0,4	
4,1	Longitudinal parallelism of bogie support surface	z45	0.5/100	0	R			0,2		0,2	
					L			0,0		0,1	
3,5	Deviation between the bogie supports on right and left side with respect to the car centre	x32	+2	2950	R			1,0		2,0	
			-2		L			-1,2		1,9	

Car No. | Car body-No. | Date, signature | Stamp mensions are automatically calculated and also archived in the database. Afterwards, the data can be directly viewed in the software, whereby the colored representation provides information at first glance whether the dimensions are within the given tolerances (fig. 5).

In addition to the graphical presentation, all measured values (coordinates, dimensions) are displayed in tables. Also the additional measurements appear and can be processed. With the help of an export function, a company-specific measurement sheet can be created within the software. Often an Excel file is created which contains all metadata and is adapted to the respective company layout (fig. 4). Export into an in-house intranet or webserver is also possible. Special solutions can be integrated at any time.

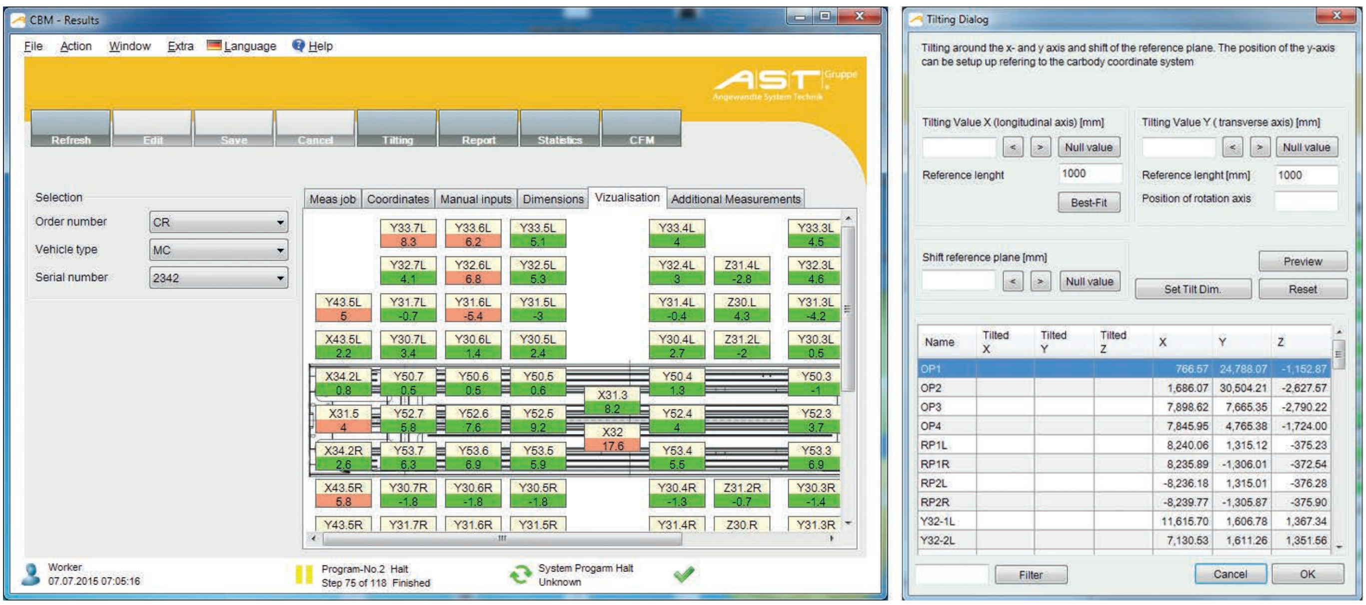
Just as during the actual measurement sequence, the car body can be virtually tilted, which is necessary for checking compliance with the construction gauge. The CBM software provides a separate dialogue which allows for the virtual tilting along the vehicle's longitudinal axis and the vehicle's transverse axis (fig. 5). Additionally, the reference plane can be virtually shifted. After the preview values have been accepted, all measurements are recalculated. If intended in the measurement, the values of the shims can be determined.
The archiving of all measurements in the CBM database allows for easy comparison between different measurements of a particular vehicle body as well as a cross check of multiple vehicle bodies of a series. The statistic module can be used for the comparison of multiple vehicles.

4. Statistics

As has been described in previous sections, all data from all rolling stock which has been measured, is archived in the CBM database. This way access to older measurement results is possible at any time. In order to ensure this functionality, a back-up of the database is carried out every time the program is started. The storage location can be chosen at will and is also possible online. The measurement data or calculated measurements of multiple vehicles can be directly compared
next to each other in a separate program section (fig. 6).

With the help of a quick selection, the measurements of different rolling stock can be compared with each other. The user can select whether data from all rolling stock is displayed or only from particular serial numbers. All measurement results are clearly displayed in a graph as well as in a table. The average and corresponding standard deviation are calculated for the selected measurement and corresponding vehicle selection. This is possible for all calculation results (measurements). the selected measurement and corresponding vehicle selection. This is possible for all calculation results (measurements).shims are possible.

Figure 5. Measurement results (left). Dimensions out of tolerance are displayed red and dimensions within the given tolerances are displayed green. Dialogue for virtually tilting the car (right). If the car was tilted virtually all dimensions are recalculated.



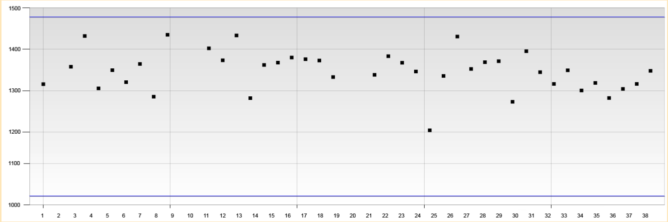


Figure 6. Statistic module of CBM. The graph shows a dimension from different cars.

Figure 4. Pattern of a measurement sheet. The layout of the sheet is customisable. After all measurements have been taken the measurement sheet is automatically filled. Additional calculations f.ex. of the shim are possible.

5. Administration

All program functions described in advance are not to be viewed as rigid program construction. Rather, vehicle-specific program sequences and calculation regulations for various car bodies can be defined in the administration account (fig. 7).

In detail each measurement point and related coordinates and the appropriate adapter can be defined. The adapter in turn, can be firmly defined in the database. That directly affects a change in the adapter offset, e.g. through new calibration, of all respective measurement points and thus the resulting measurement. The coordinates of these measurement points serve as the basis for the calculation of the required dimensions (e.g. measurement sheet). Measurement points and dimensions are added to the database prompted by dialogue.

With the help of various pre-defined calculation functions (e.g. absolute value, distance, perpendicularity) or calculator function, the variables are calculated and added to the visualization (cmp. fig. 6). Even the position of the fields shown can be freely edited using drag & drop. This way the layout of the results output for each car type is possible according to the specific needs.

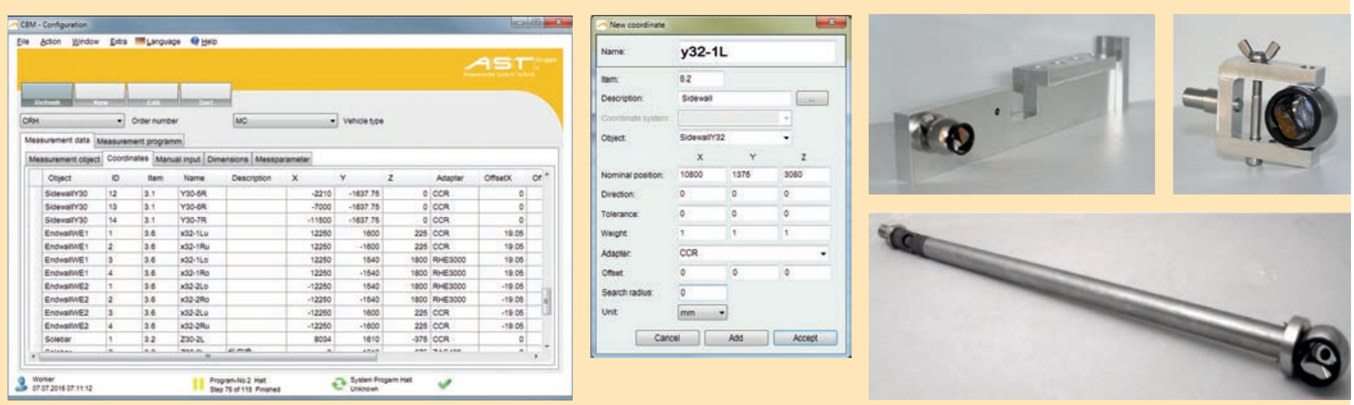
The definition of a measurement sequence follows the same principles. From a selection of pre-defined program steps (e.g. view instructions, start measurement, open Excel document) the functions for instrument control as well as the general program sequence can be selected. This makes it easy to create a complex measuring concept which is tailored to the local conditions, the instrument and output data. Even wildcards, which are designated in CBM as manual inputs, can be created.
Wildcards enable the entry of comments or manually measured dimensions after the measurement sequence, and thus appear in the database and the measurement sheet.

To provide the measured data with special protection, the software features three possible administration levels (administrator, foreman and worker). The administrator has unlimited access to all measurement data and the configuration. The administrator can in turn control the allocating of rights for the foreman and worker. For example, it is possible that the worker can only carry out measurements and view and print results. The foreman could additionally be given the right to edit results, but not to change the measurement sequence. This ensures plant-specific data safety.

6. Service and Accessories

With the purchase of the software, we gladly put together a measurement concept tailored to your

Figure 7. Administration account of CBM (left). Dialogue for measurement point creation (middle). Examples of A.S.T.in-house manufactured and calibrated special adapters (right)

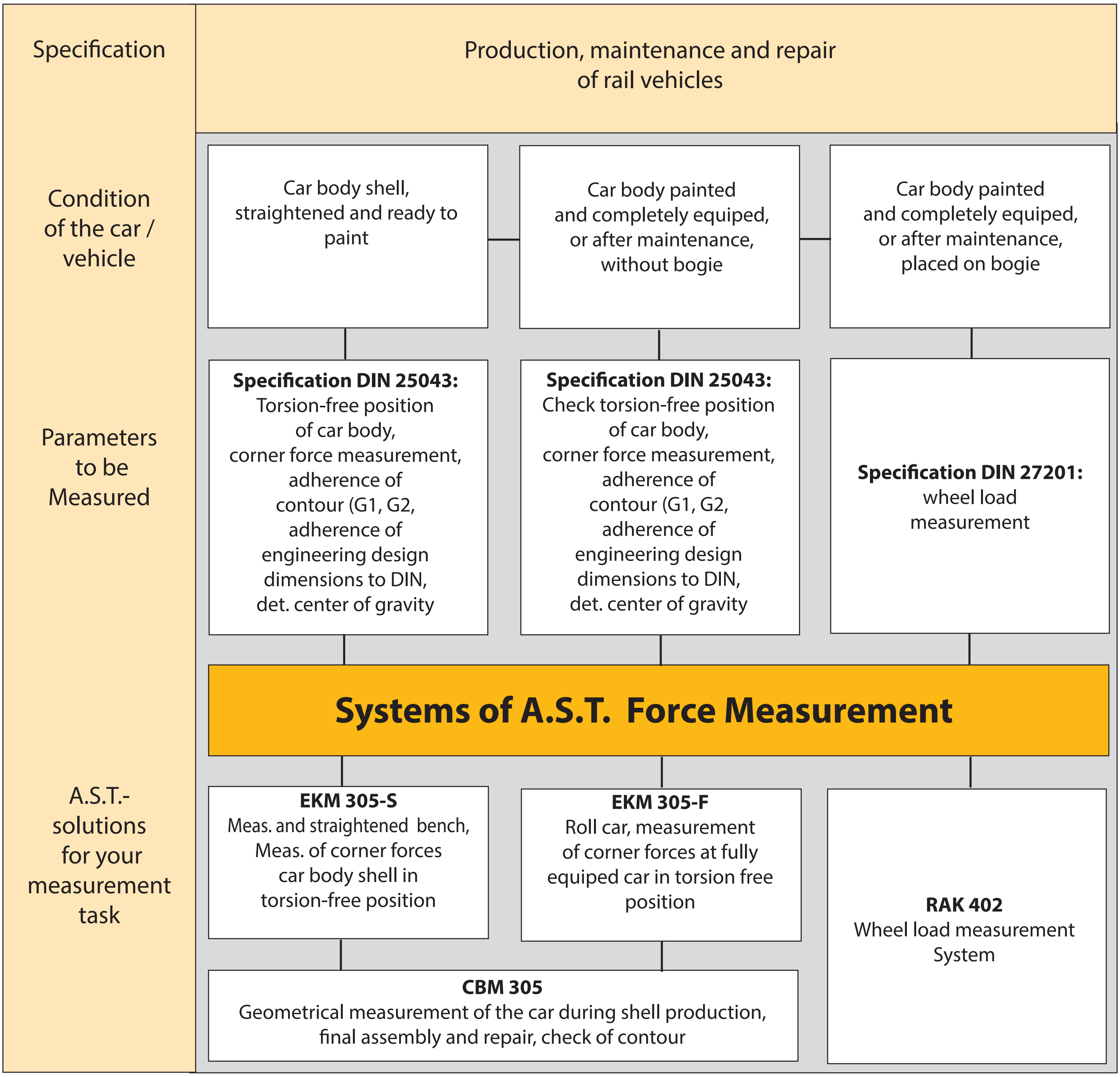


specifications. This includes the development of a suitable measurement sequence and the creation of measurement sheets (e.g. Excel). Of course we take into account existing equipment (measurement instruments, adapters). According to your wishes we incorporate in-house pictures as work instructions or translate the software into the language of your choice. Because this entire configuration can be copied within the software, multiple measurement configurations for various car types can be created quickly. Staff training both as configuration of the measurement sequences and measurement in itself, usually takes place on-site. If additional accessories are necessary, e.g. special adapters, we can manufacture and calibrate these in-house (fig. 7).

In addition to selling software, we also offer our expertise as a service. We measure your rolling stock using our equipment and prepare a measurement protocol according to your requirements.

Contact for Geometrical Measurement :
A.S.T. Angewandte System Technik GmbH
Dipl.-Ing. Robin Ullrich
Phone: +49 (0)351 - 44 55 458
e-mail: robin.ullrich@ast.de

Figure 8. Overview of requirements for production , maintenance and repair



RAK 402

A.S.T. Wheel Load Measuring System for Rail Vehicles

A.S.T. RAK 402 is a highly accurate wheel load measuring system for rail passenger vehicles. It contains 8 weighing modules for measuring 4 axles of rail car as a standard configuration. It also has either single or dual gauges on each weight module, or combines with more weight modules together based on the requirement.

RAK 402 system is designed for easy for installation or adjustment, and is user friendly to operate or calibrate. It complies to the German standard DIN 27201-5: "State of railway vehicles - Basic principles and production technology - Part 5: Checking of wheel forces and vertical wheel set forces of railway vehicles". The weight modules will be installed in concrete pits. Only a fixed installation provides an accuracy and process capability as required in the German standard.

The purpose of using wheel load measurement systems is to prevent derailment of railway vehicle, and to assure to lower wear and tear the static vertical load distribution within the two wheels on an axle, which must be rather even. The wheel load measurement has to be carried out after the following tasks.

- mounting of car body onto bogie during manufacture;
- accidents where a wheel load might be influenced;
- working on the springs of the bogie;
- change out of the wheel set or the bogie

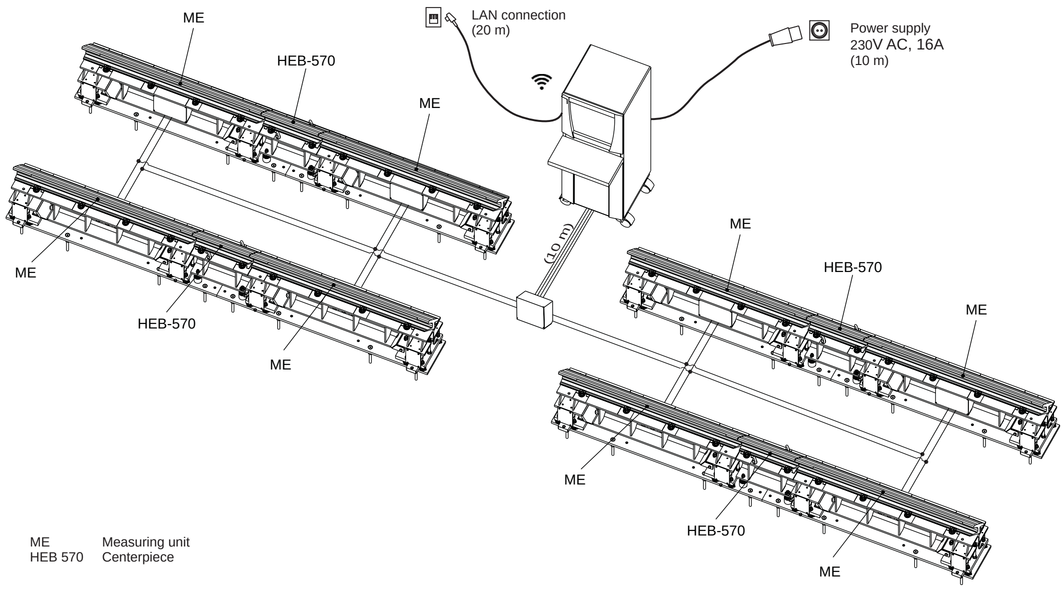
There are many critical measurements of the wheel loads because it is so important for the safety of the railway vehicles

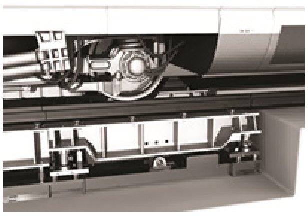
The system is a highly flexible with the identification of the individual wheel or axle loads. By interconnection of a number of required weighing modules, you will get a test profile for all wheel loads of a bogie or vehicle.

The calibrating track includes the RAK 402 features a flatness of better than 1mm. Each of the eight wheels of a passenger car will be positioned onto a weighing module. In total there are 8 weighing modules to cover the variety of length of the vehicles. Weighing modules are rigid enough to cope with moving vehicles to 60 tons with a moving speed up to 5km/h. The calibration is carried out by an accredited body.

The wheel load on each weighing module are recorded and displayed by downstream high-precision amplifier, which are also manufactured by A.S.T. Its task is to supply the load cells with a defined input voltage and digitize the output of the strain gauge measurement bridges. The measured value is communicated to the PC control unit.

System overview





RAK 402 Specifications

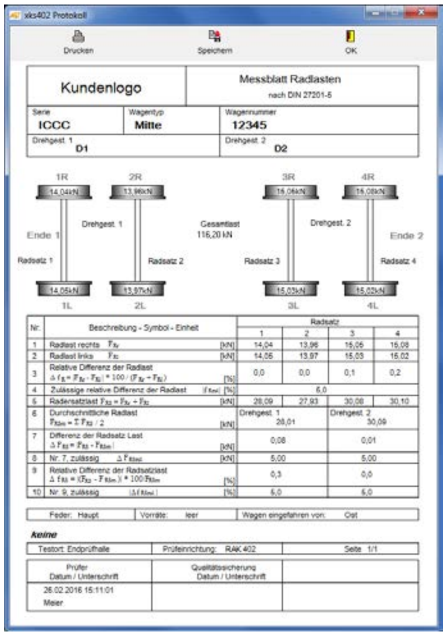
Cars supported		All types of passenger cars
Max. weight	t	60
Rail track		
Track gauges	mm	1435
Distance of axles	mm	2500 (other dimensions are possible on prior consultation)
Rail planarity	mm	max. 1 (adjustable use setting nuts)
RAK-Measuring module		
Rated load per wheel	kN	150
Limit load	kN	225
Accuracy class	%	0,1 / <0,5% reproducible in the same vehicle
Track length	mm	1795
Measuring lengths	mm	1500
Weight	kg	482
Resolution	bit	24
Measuring rate	1/s	400
Max. installation height	mm	500
Height adjustments	mm	ca. +/- 5
Max. installation width	mm	300
Max. riding speed	Km/h	5
PC-Cabinet		
Equipment		19" PC, TFT Monitor and printer
Software		XKS 402, Microsoft Windows; Microsoft Office
Dimensions (hight x wide x depth)	mm	1600 x 600 x 850
Environmental protection		IP 54
Weight	Kg	200
Voltage supply	VAC	230
Power consumption	VA	500

The software main screen displays all important information and can be adapted to customer demands. It meets the requirements of DIN 27201.

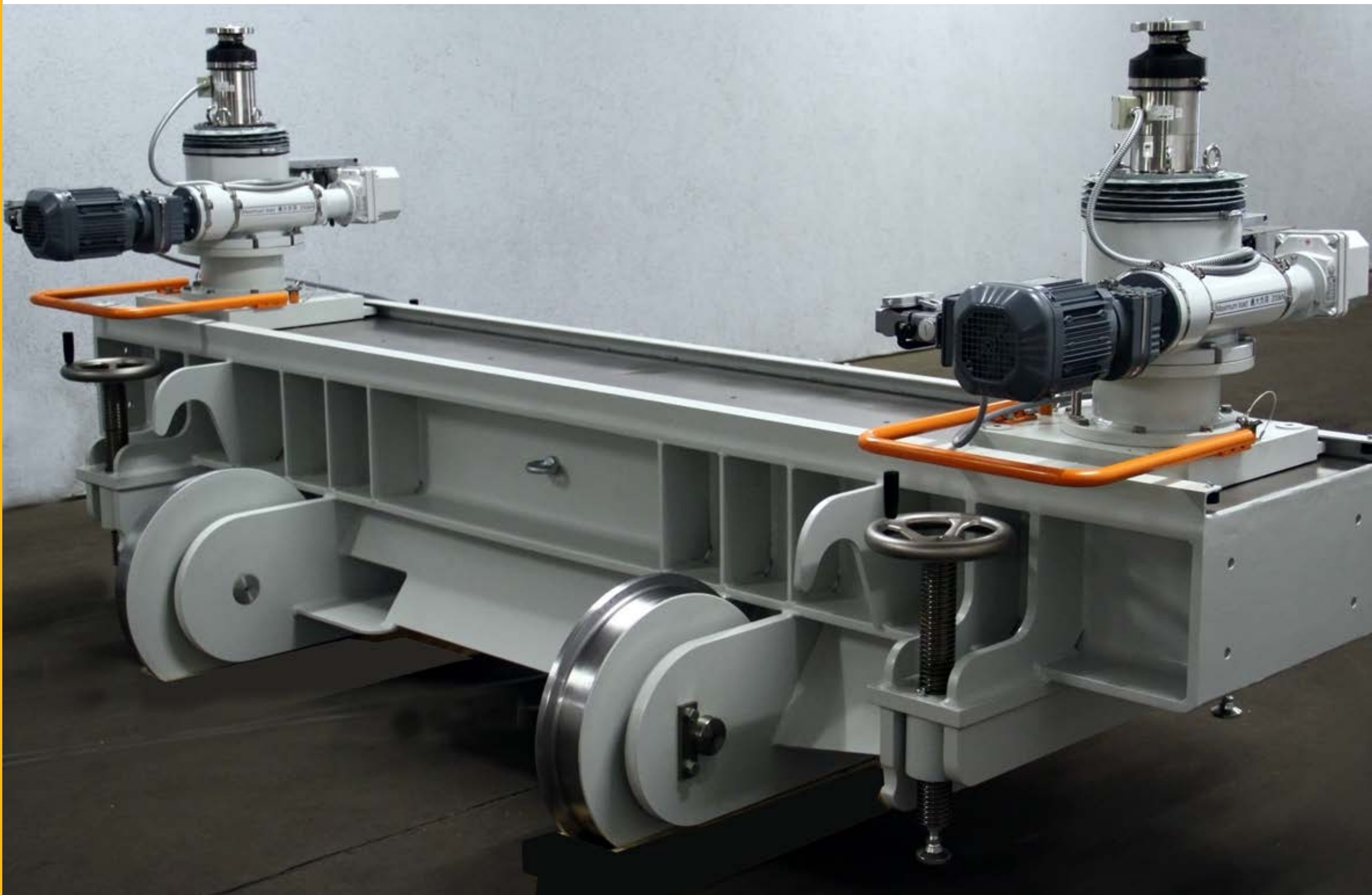
The PC control unit displays the values, calculates and prints out measuring reports. All measurement reports are stored in a database.

Main screen of Software XKS 402 for RAK 402

PC control unit



Customer-specific measurement protocol



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