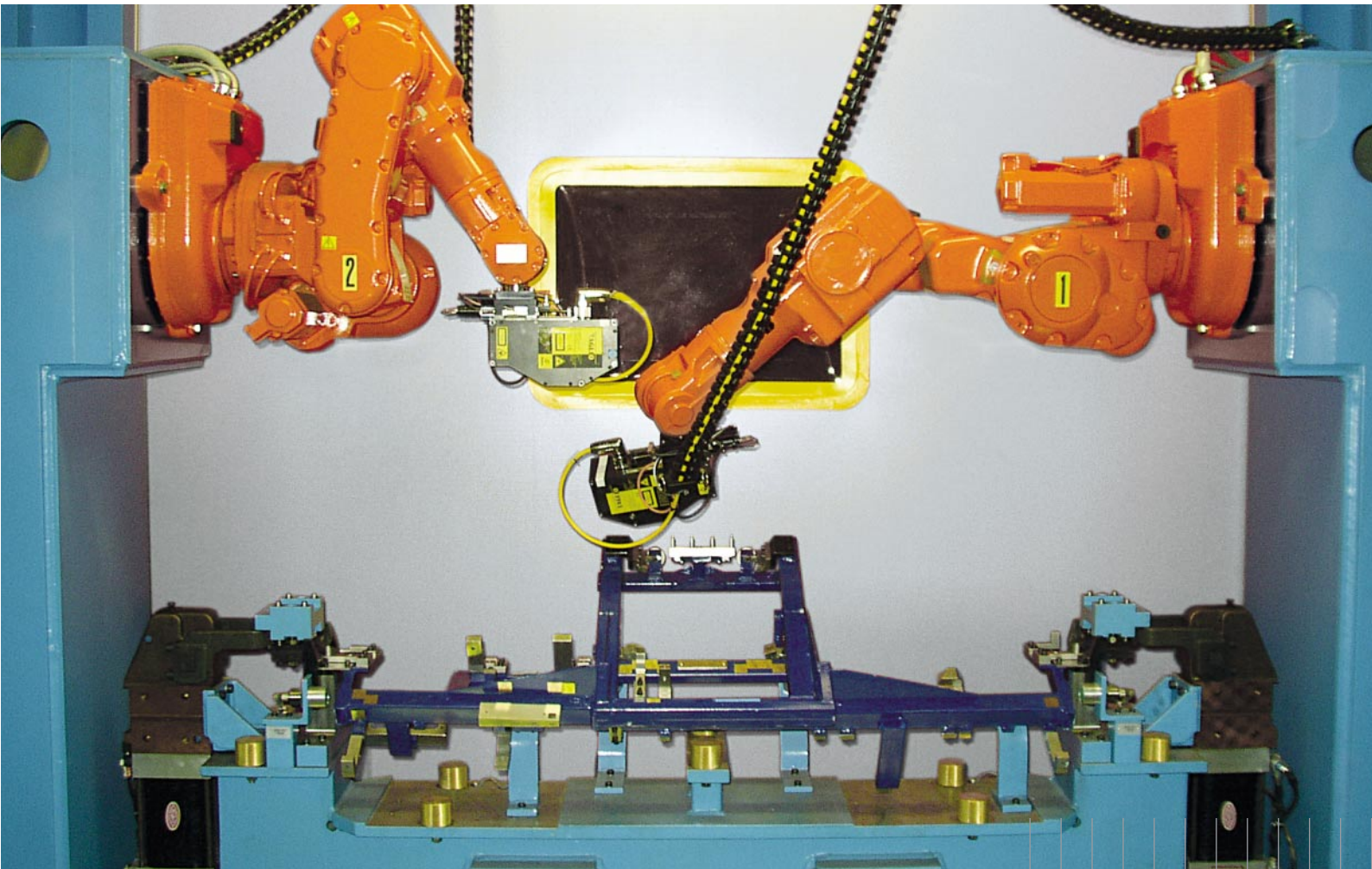


CLM – CLAAS laser measuring machine for welded assemblies

Non contact 3D-geometry inspection in the production cycle



Advantages through modern technology: CLM for assembly measurement

Technical features of the measuring system

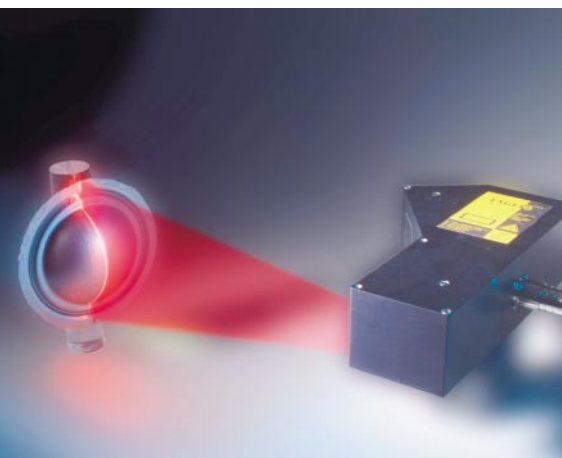
- Modular system concept: Conversion to other components merely by replacing the clamping device, machine bed and robots remain unchanged
- Robots of various manufacturers can be integrated in the systems
- Through the measuring method employed it is possible to compensate the reduced position accuracy of standard industrial robots, allowing absolute measurement
- With 100,000 measurement points per second the measuring method employed by CLAAS allows accurate recording of 3D-geometries

- The measurement equipment capability e.g. according to the Measurement System Analysis Standard (MSA) – even with small tolerances under 1 mm – ensures traceability and comparability with the 3D-coordination measurement technology
- The sensor system of light section sensor with additional axis forms the basis of systematic process optimisation
- Flexibility: Measurement characteristics can generally be changed or supplemented without mechanical and/or control system conversion
- Optimized laser sensors for difficult measurement surfaces, picking up measurement characteristics even under unfavourable angles

- Simple integration in the production process through Profibus interface
- Standardized data filing of the measurement and inspection results in the QS-Stat-Standard
- Print displays of the measured values allow corrective data tracing for upstream manufacturing processes (if applicable, separated for parallel stations)

System accessories

- Reading device for barcode or data matrix can be integrated
- Calibrated adjusting masters for automatic adjustment and monitoring of the measurement systems
- Handling systems (gantry systems, handling robots, etc.)



Laser light section sensor projected on a test sample

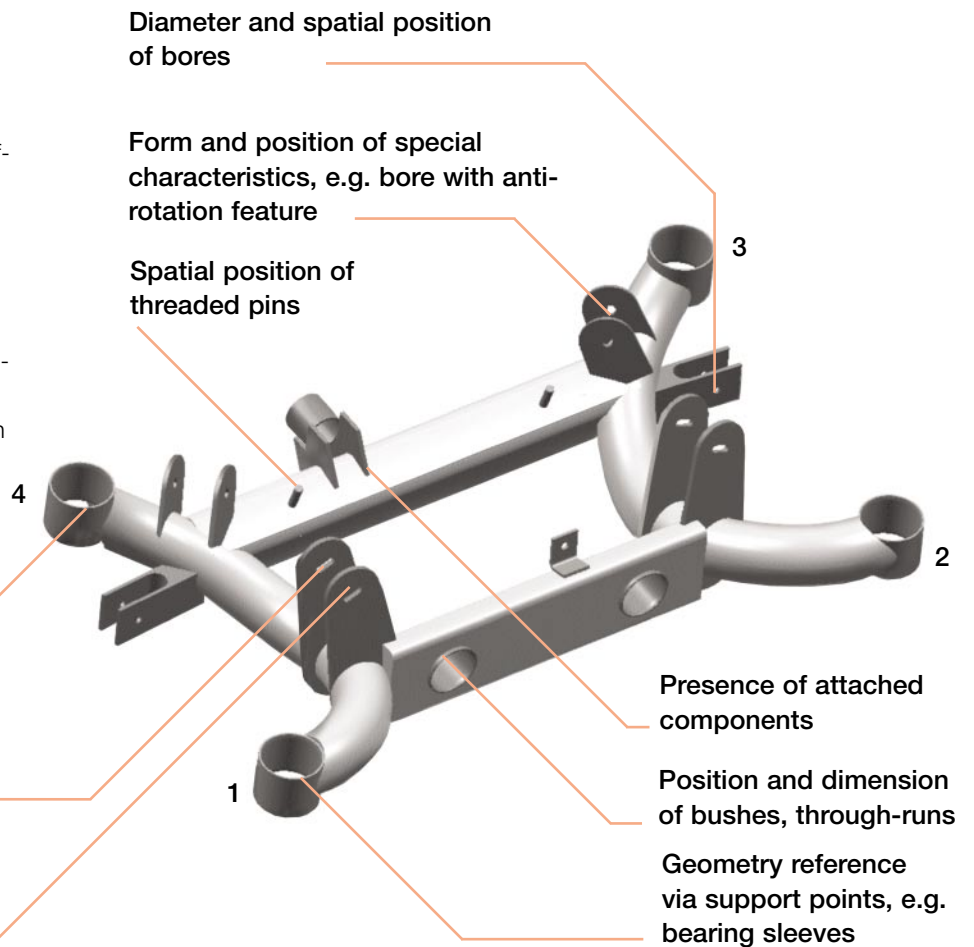
System structure	CLAAS laser measurement
Non contact measurement	++
Low maintenance effort	++
Setting effort for production change	+
Harsh operating conditions	+
High availability	++
Measuring and inspection time	+
Flexibility for new characteristics and changes	++
Measuring accuracy	+(+)

Measurement characteristics, example axle subframe

- Bearing sleeves (position, orientation)
- Bores (position, diameter)
- Form and shape of special characteristics (elongated holes, bores with anti-rotation feature)
- Presence of attached components (Poke-Yoke) (Bores, straps, panels, etc.)
- Groups of characteristics, e.g. flatness of several mounting points

Example: Axle subframe measurement

A typical application for the laser measuring systems of CLAAS Fertigungstechnik are axle subframes. The large number of different measuring characteristics combined with the short cycle times typical for industrial manufacture often prevented complete yet flexible inline measurement of such assemblies in the past. With the systems of CLAAS Fertigungstechnik all relevant quantities are measured in the production cycle. Typical measuring characteristics are shown adjacently.



Automatikbetrieb CLM

Typ: 0 Nr.: 42 Messung: 20.01.04 22:12:45 Fehler: 5

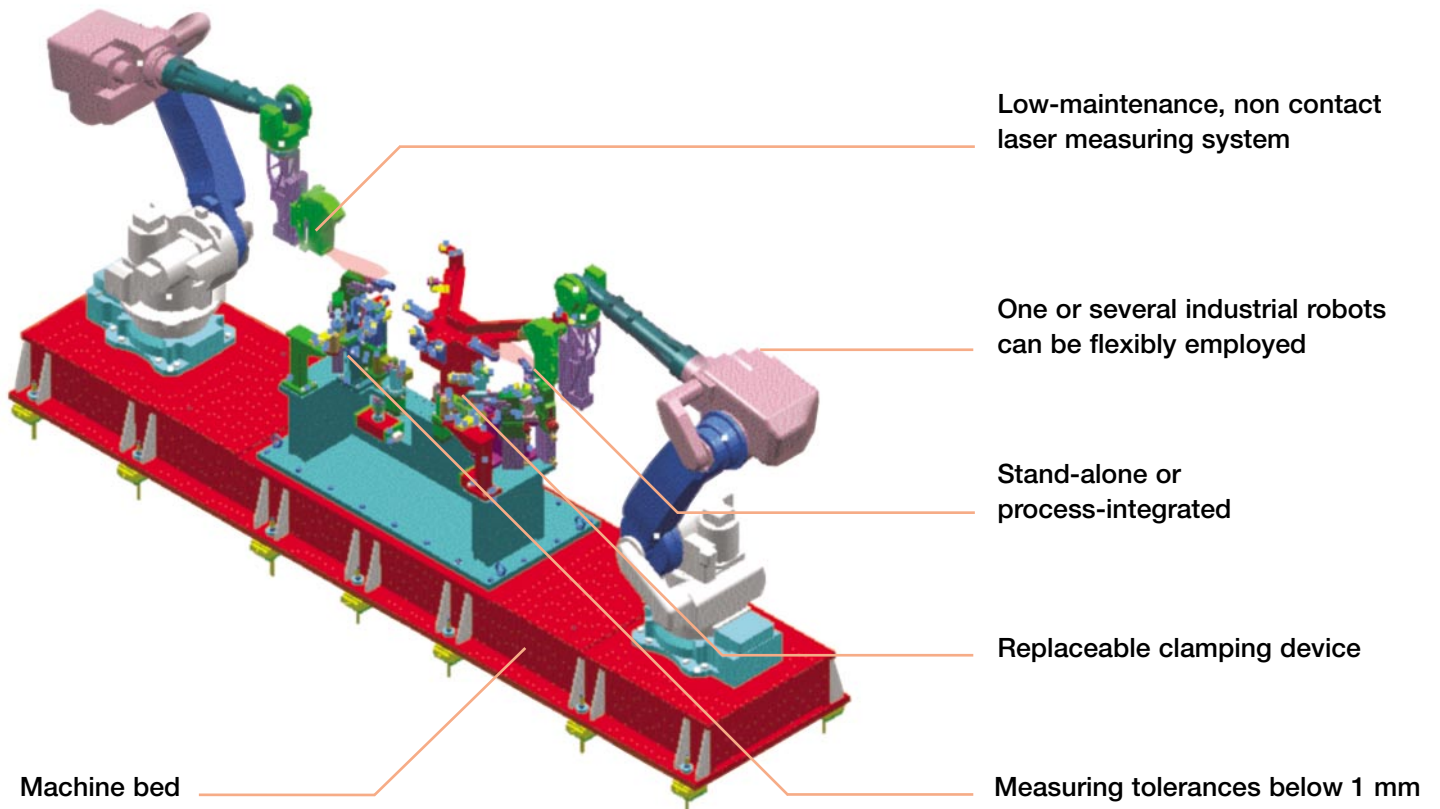
Merkmal	Abw.	Einh.	Merkmal	Abw.	Einh.	Merkmal	Abw.	Einh.
1.2	0.000		13.8 z	-0.124	mm	23.2 z	-0.210	mm
1.3	0.000		13.8 x	-0.189	mm	23.4 x	-0.096	mm
1.4 x	0.025	mm	13.8 y	0.139	mm	23.4 z	-0.189	mm
1.4 z	0.017	mm	13.8 z	-0.189	mm	24.3 x	-0.136	mm
5.2 y	0.238	mm	15.1 x	0.138	mm	24.3 z	-0.084	mm
5.2 z	-0.056	mm	15.1 y	-0.178	mm	24.4 x	-0.102	mm
8.1 x	-0.104	mm	15.1 z	0.138	mm	24.4 z	-0.055	mm
8.1 y	0.107	mm	15.2 x	-0.056	mm	25.1	0.000	
8.1 z	-0.056	mm	15.2 y	-0.055	mm	25.2	0.000	
7.2 y	0.027	mm	15.2 z	-0.236	mm	26.1	0.000	
7.2 z	-0.135	mm	17.1	0.000		27.1	0.000	
8.1 x	-0.081	mm	18.1	0.000		28.1 x	-0.069	mm
8.1 y	-0.073	mm	19.1 x	0.070	mm	28.1 y	0.112	mm
8.1 z	0.004	mm	19.1 y	0.067	mm	28.1 z	-0.002	mm
8.1 x	-0.041	mm	19.1 z	0.029	mm	31.1	0.000	
8.1 y	0.122	mm	20.1 x	-0.064	mm	38.1	0.000	
8.1 z	-0.071	mm	20.1 y	0.061	mm	40.1	0.000	
8.2	-0.207	mm	20.1 z	-0.077	mm	42.1	0.000	
18.1 x	0.135	mm	21.1	0.000		42.2	0.000	
18.1 z	-0.157	mm	21.2	0.000		44.1	-1.000	
18.2	-1.000		21.3 x	0.163	mm	45.1	0.000	
12.1	0.000		21.3 y	-0.091	mm	46.1 y	0.068	mm
13.1	0.000		21.4 x	-0.115	mm	47.1 y	0.028	mm
13.2	0.000		22.1	0.000		48.1	-1.000	
13.3	0.000		22.2	0.000		48.2	-1.000	
13.4	0.000		22.3 x	-0.081	mm	48.3	-0.062	mm
13.5	0.000		22.3 z	-1.038	mm	48.3	0.239	mm
13.6	0.000		22.4 x	-0.091	mm	48.4	0.040	mm
13.8	-0.149	mm	22.4 z	0.095	mm			

Buttons: Bereit, Roboter, Laser, Störung, Drucken, Entladebereit



Measuring and inspection results overview

Trend display allows the timely correction of upstream processes



Technical data

Industrial robot:	as requested by customer
Typical measuring time:	15 measuring positions/minute per robot (approximately 50 measuring characteristics)
Laser sensor system:	
- Basic distance:	272 mm
- Measuring range:	105 x 130 mm
- Travel distance of additional axis:	150 mm
Resolution	
- Lengths/diameters:	1 μ m
- Angles:	0.001°

Achievable measurement precision (1 σ)

Length dimensions:	3 μ m (dependent on characteristic)
Angles:	0.01°

Advanced laser measuring systems for more productivity

As a leading production equipment manufacturer for welding and assembling machinery CLAAS Fertigungstechnik knows the quality requirements of the industry. Requirements such as 100% measurement, rapid cycles and the increased documentation obligation resulted in the CLM CLAAS laser measure: mature laser measuring systems for inline measurement of complete assemblies.

CLM CLAAS laser measure can be integrated in a closed loop concept to monitor trends, recognize deviations and adjust upstream equipment. This allows a systematic reduction of the scrap rate. The fully automatic measurement results in increased production security, opens up a considerable savings potential and in this way allowing rapid amortization.

A CLAAS laser measurement system can be converted to changed or new components without major effort. For the modular system concept requires merely the replac-

ing of the clamping device, the basic system can be reused. High flexibility is also guaranteed with regard to the industrial robots: One or several robots can be integrated in the measuring systems as required, while the type of robot can be chosen specific to the application.

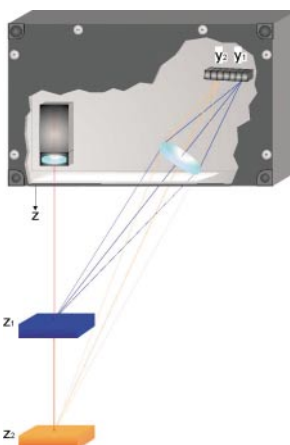
The technology: Optical triangulation

The non contact laser measuring system of CLAAS Fertigungstechnik is based on optical triangulation. The laser light is scattered on the work piece surface and optically detected. In the sensor the detected signal is subsequently converted into the real geometrical distance between sensor and measurement object – depending on measurement task one, two or three dimensional. For top results and optimum sensors for any application, customer requirements are continuously incorporated in the development. These systems are consistently

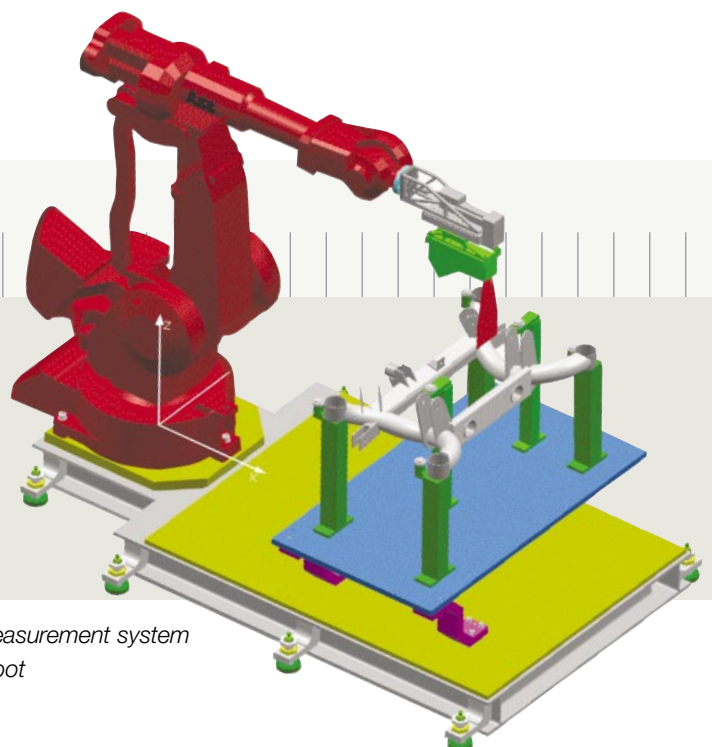
adapted to the market requirements through the experience from a large number of projects in plant manufacture and the innovative power of our employees.

Adaptation and integration

Each machine is adapted to the appropriate task by the specialists of CLAAS Fertigungstechnik. Whether stand-alone or process-integrated: software and hardware are optimized for the respective application and integrated in the concept of the customer. In accordance with the project and service-orientated organization structure of CLAAS Fertigungstechnik the customer has only one dedicated contact person from the design to the integration.



Measuring principle during laser triangulation



Modular laser measurement system with industrial robot

Services around the laser measuring machine

Training

A standardized software surface, with clearly arranged displays, graphic surface configuration and intuitive operator prompting permits simple handling of the measuring machines. Training courses – from instructing the operating personnel to intensive training of the customer's technical personnel – are conducted to suit the customer's needs.

Maintenance and service

Due to the non contact measuring method, CLAAS measuring machines are particularly low in maintenance. Sensors of CLAAS Fertigungstechnik can be replaced within a few minutes. The measuring machines were also developed for optimum maintenance friendliness and through on-line maintenance the specialists are always available when support is required. Due to the corporate structure CLAAS Fertigungstechnik is also able to work out and offer individual service concepts for its customers.

Laser measuring technology – Innovations made by CLAAS

CLAAS is continuously giving new inputs to manufacturing technology. Be it in the cooperation with customers or in the project or development of in-house machines and equipment. It is not only these in-house developments that make CLAAS Fertigungstechnik one of the leading medium-sized tool and production equipment manufacturers in Germany. CLAAS Fertigungstechnik is an enterprise of the CLAAS group of companies which is also a leading manufacturer of agricultural machinery with over

8,000 employees. This background gives CLAAS Fertigungstechnik the perfect support for general contracting responsibility and for large projects of any dimension. The deliberate exchange of know-how between the technology-intensive industries automotive and aerospace is the basis of our multiple corporate synergies. The innovative solutions for quality assurance using non contact laser measurement technology developed from this comprehensive technological know-how and the experience at many levels of automation and production equipment manufacturing.

Trusted cooperation with customers



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