ASIS
Automation Systems & Intelligent Solutions

SURFACE-DETECT

THE AUTOMATIC MEASUREMENT OF COLOUR TONE, STRUCTURE AND LAYER THICKNESS

CONNECTING TECHNOLOGY AND PEOPLE

INTRODUCTION

With the ongoing shortage of skilled workers, the level of automation is steadily increasing. This trend offers many advantages for companies: robots can take on a variety of tasks, relieve personnel, and contribute to increased productivity and quality. By utilizing robots, companies can also free up their own staff to be deployed in other areas or to save costs.

In this context, it is important to carefully consider the advantages and disadvantages of using industrial robots and make an informed decision about whether automation makes sense for the company. We support you with our years of expertise in robotics, providing solutions that are specifically tailored to each task without unnecessary complexity.

ASIS

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STANDARDIZED PLANTS THAT ARE NOT STANDARD.

ASIS solves challenging tasks in automated plant engineering worldwide. The result for their customers are perfect coatings with the highest economic efficiency.

The claim „Connecting Technology and People“ stands for perfect cooperation between man and machine and for sustainable value created in harmony with economy and ecology. The company differentiates itself from its market competitors through its high level of expertise in control technology and the use of digital intelligence.

ASIS IN NUMBERS

- Founded: 01.05.1998
- CEO: Hans-Jürgen Multhammer
- Quality assurance: ISO 9001
- Environmental management: ISO 14001
- Information security: TISAX
- Export countries: > 30 worldwide

The wide range of competences includes turnkey plants in the field of coating, application technology, quality control, surface treatment, electron treatment, process automation technology and digital simulation.

The internationally positioned systems supplier exports from four locations in Germany and a subsidiary near Shanghai to over 30 countries worldwide.

TISAX® RESULT AVAILABLE

Quality/Environmental Management ISO 9001 ISO 14001 DEKRA certified

WHY ASIS?

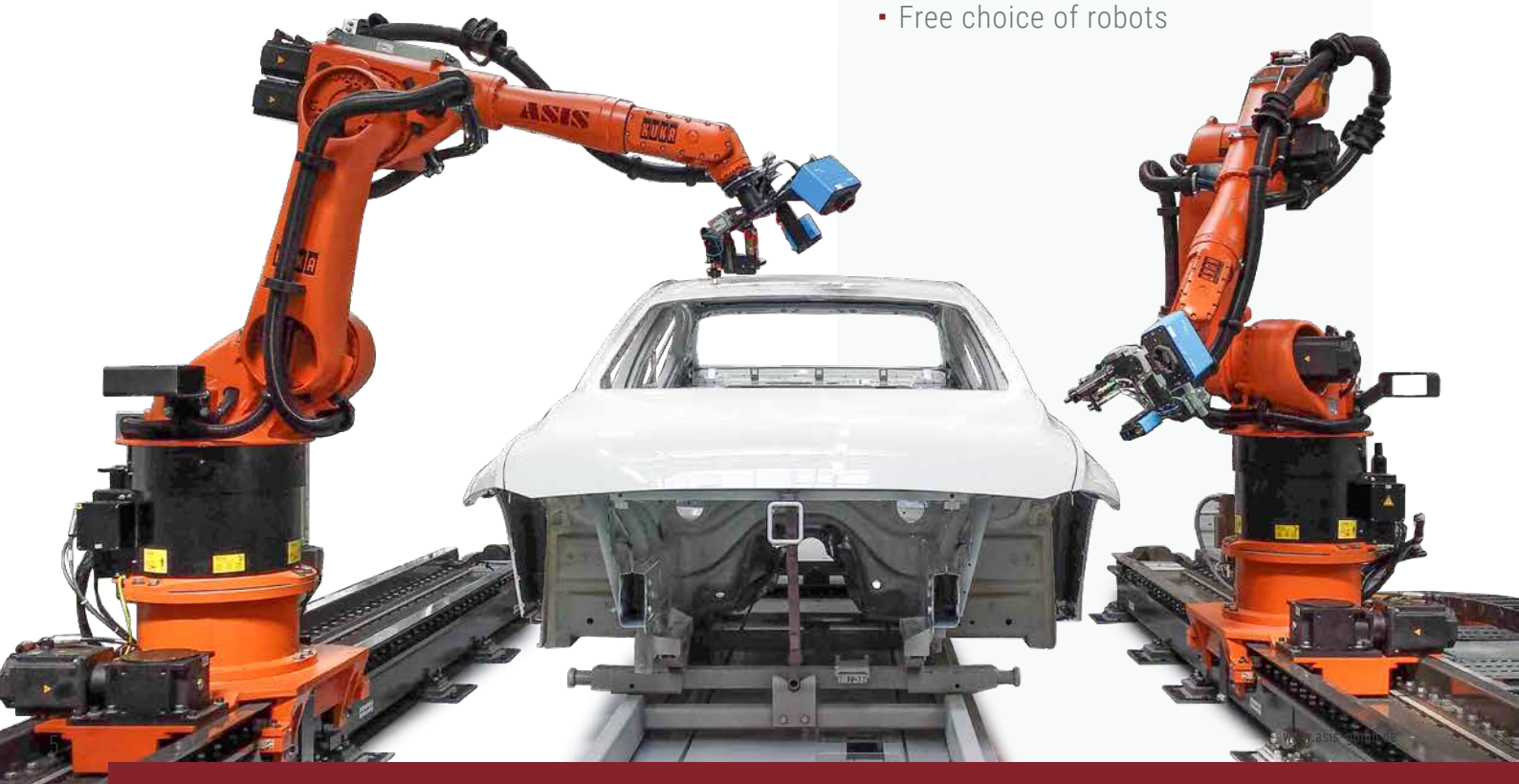
Automatic measurement cells represent a core competence of ASIS. This equipment type has been an integral part of our company history. Over 20 years ago, we initiated our first project as a general contractor, installing the first measurement cell for a German OEM. At that time, only one pilot cell had been built. We accepted the challenge. It was the beginning of an incredible success story.

We currently have the most systems of this type installed worldwide.

ASIS customers benefit not only from this unique wealth of experience but also from our independent expertise. We are neither a manufacturer of robots or measuring devices and can act completely freely. Our clients are free to choose their preferred robot manufacturer or, if they prefer, we can suggest a complete system solution.

UNIQUE CHARACTERISTICS

- Global market leader in automated End-of-Line colour measurement for vehicles
- Extensive wealth of experience
- Manufacturer-independent expertise
- Free choice of robots



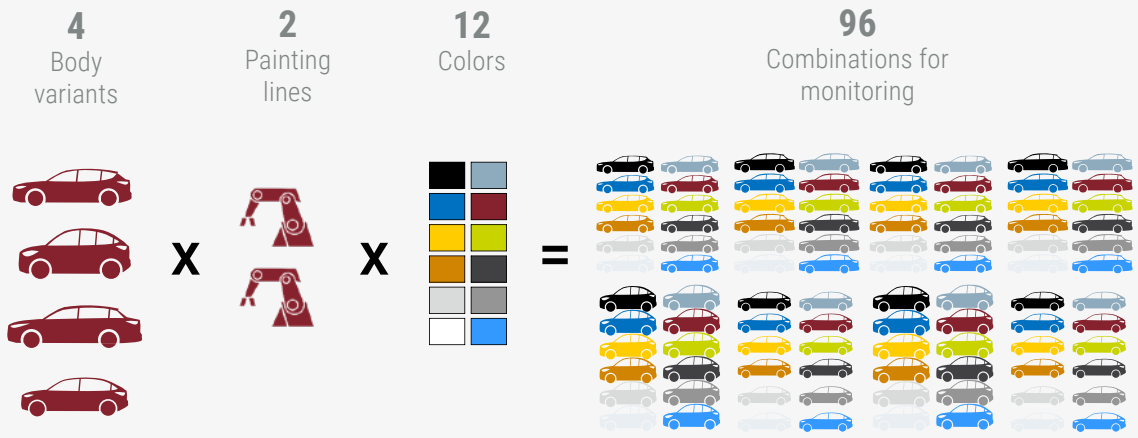
3.

AUTOMATED OR MANUAL MANUAL MEASUREMENT?

REPEATABILITY AND CONSISTENCY OF THE MEASUREMENT POINTS

A key advantage of automated color measurement over manual measurement is the high repeatability and consistency of the measurement points. Automated systems are able to measure exactly the same points on a component, making the measurement results reliable and reproducible. This minimizes deviations that can occur due to slight variations in the positioning of the measuring devices, ensuring consistently high quality.

CALCULATION EXAMPLE COLOR COMBINATIONS



TIME AND COST EFFICIENCY

Automated color measurement systems offer significant time savings compared to manual methods. Manual measurements are time-consuming and require frequent interruptions to the production process. In contrast, automated systems work continuously and efficiently, which shortens throughput times and increases productivity. The rapid recording and evaluation of color data enables an immediate response to deviations, which improves production quality.

IMPROVED
DATA COLLECTION AND ANALYSIS

Another advantage of automated color measurement is improved data acquisition and analysis. The data collected is fed directly into quality improvement systems such as the ASIS Coating Quality Analyzer. These systems enable detailed analysis and monitoring of production quality in real time. By automatically recording and storing the measurement data, trends and patterns can be identified at an early stage and appropriate measures can be taken.

MANUAL
MEASUREMENT
12 DAYS

With the manual measurement
of 8 units per day, it will take 12 days
to test 4 body variants,
2 painting lines and 12 colors

AUTOMATIC
MEASUREMENT
MULTIPLE SHIFTS

The automated sampling
of 4 body variants,
2 paint lines and 12 colors can be
be carried out in several shifts

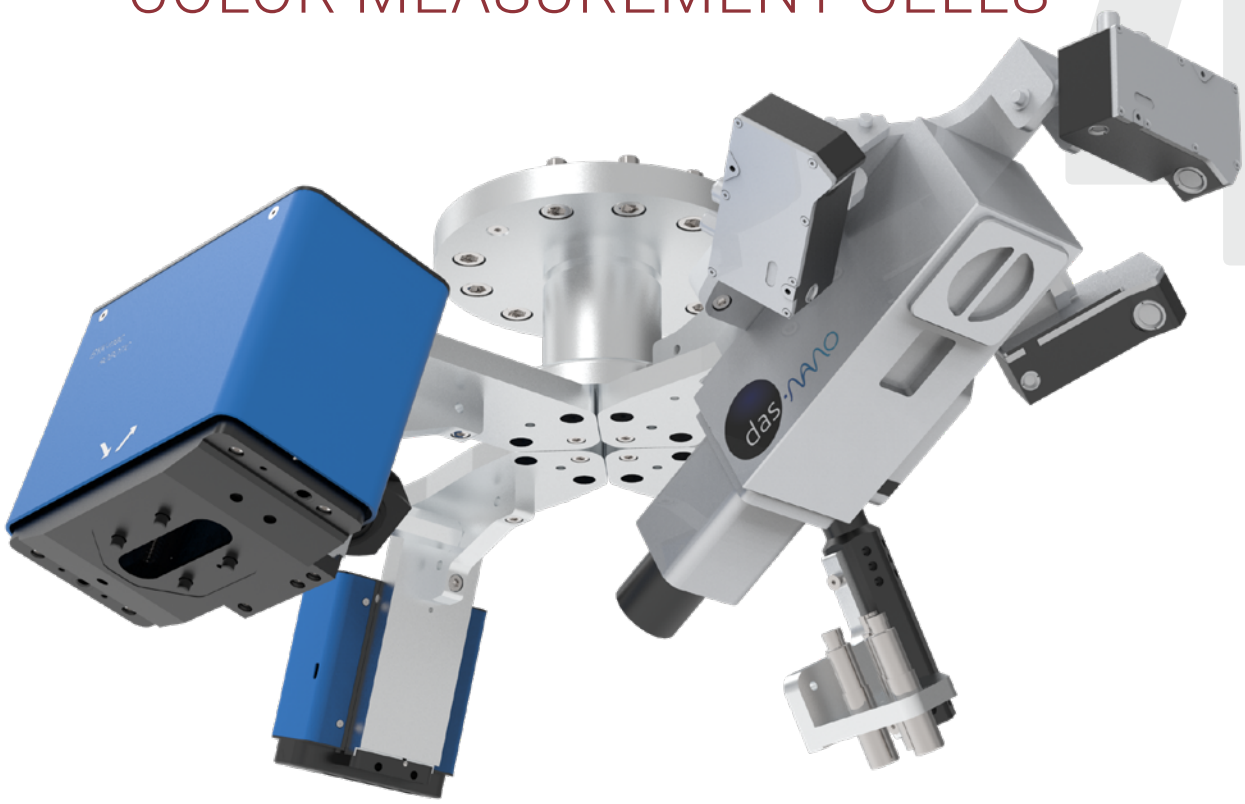
COMPETITIVE ADVANTAGE AND CUSTOMER SATISFACTION

The implementation of automated color measurement systems provides companies with a clear competitive advantage. The high precision, efficiency and improved data analysis lead to consistently high product quality, which increases customer satisfaction and loyalty. The ability to verifiably prove the quality of products means that complaints can be handled better and the market position is strengthened.

SCALABILITY

Automated measurement systems can be easily scaled to meet the demands of growing production capacities. While manual measurement processes are often limited by the availability and capabilities of human labor, automated systems can be expanded by adding more robotic cells.

END-OF-LINE COLOR MEASUREMENT CELLS



APPLICATION AND BENEFITS

End-of-line color measurement cells offer advantages both in automotive series production and at suppliers. Precise colour measurements are particularly important in the car manufacturers' plants where car bodies are produced and painted, as add-on parts are delivered and assembled by the supplier already painted. The interfaces to the car body have a large surface area and the smallest color differences would be easy to detect. The Surface-Detect system eliminates inaccuracies and the high labor costs of manual measurements while delivering highly precise data. This ensures a high-quality and uniform appearance of the vehicle and improves process reliability when working with suppliers.

Similar quality assurance systems are also used in the suppliers' production facilities where plastic parts are painted. With automated color measurement, suppliers can detect deviations early and take targeted actions—whether in process engineering or with the suppliers of the paint materials. This technology also enables a measurable quality check at goods issue, which simplifies the assessment of complaints claims. An additional advantage is the continuous monitoring and assurance of product quality, which strengthens customer confidence and secures competitive advantages in the long term.

TECHNICAL SETUP OF THE CELL

The system is designed as an offline system in which the painted bodies or add-on parts are removed from the production line and measured “offline” in the new cell. This has the major advantage that all necessary points can be measured without affecting the normal cycle time. After the measurement has been completed, the object to be measured can be returned to the line. Optionally, measurements with fewer measurement points can also be carried out online. The 6-axis industrial robots are usually mounted on a 7th axis (rail) and perform the measurement on the stationary workpiece. ASIS customers are free to choose the robot manufacturer (Fanuc, Kuka, ABB, etc.) or can align with the robot brand predominantly used in their plant. The optimal type is determined by ASIS through a reachability study performed digitally. The cell also contains a calibration table. To ensure a consistent reference and precise measurements, the tools calibrate themselves daily on the table. The frequency of this process can be set via the HMI (Human-Machine Interface)

TECHNICAL SETUP OF THE SENSOR HEAD

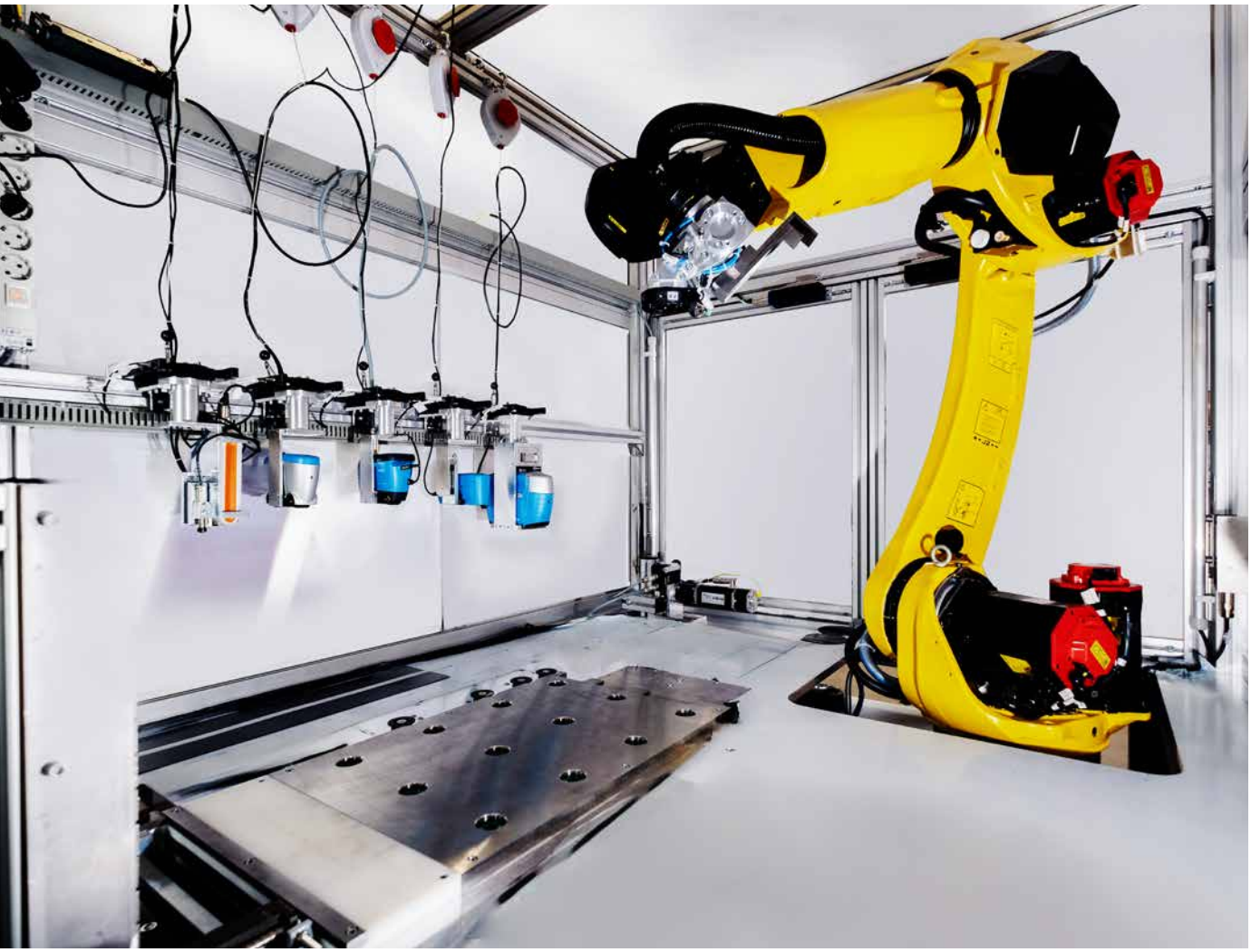
The EOAT robots are equipped with a triple sensor head. It is fitted with three measuring devices, one for measuring colour tone, one for measuring structure and one for measuring coating thickness. Depending on the application and data requirements, the number of measurement tools can vary. This combination typically covers all the necessary parameters. The measurement tools are designed for automated use on an industrial robot and provide comparable results to manual measurement variants.

VIDEO ON YOUTUBE
Watch the system in action
https://www.youtube.com/watch?v=qXalrRqgjPo

MEASUREMENT TABLES FOR THE LAB

APPLICATION AND BENEFITS

ASIS measuring tables are used by automotive OEMs and paint manufacturers for basecoat approval. They generate important relevant measured values for the assessment of paint properties. Currently, the coating thickness, color, structure and cloudiness are measured. The measuring table can be used to assess colored and glossy surfaces such as paint or film. Particularly in the field of painting, the interaction between paint and processing is measurable. The testing method is based on the experience that, depending on the painting process, paint properties such as layer thickness, color, texture, or cloudiness



can be influenced, or that predefined paint properties can affect the application processes. The ASIS measuring table operates completely independently and delivers detailed results with many measuring points. With an impressive repeat accuracy of 0.01 mm, all results can be accurately tracked. We always use the latest technology and offer long-term support. The use of the robot makes the system extremely flexible. Customers are also ideally equipped for future requirements.

TECHNICAL SETUP OF THE MEASURING TABLE

The robot has several measurement tools available and automatically measures the necessary parameters. The reference plates are automatically fed from a magazine and fixed in place with negative pressure during the measurement. The magazine can hold up to 25 samples. Measurements can be fully automated or performed manually. A barcode label assigns the corresponding measurement program. The robot retrieves the appropriate measuring devices and measures the sample autonomously. The end product is

a detailed evaluation of the coating material's properties. The integrated calibration system checks the measuring devices daily using standards. Additionally, the system is very compact.

TECHNICAL SETUP OF THE SENSOR SYSTEM

The special feature of the measuring table is the automated use of handheld measuring devices. This offers the advantage of a very compact size, and furthermore, handheld devices are significantly more cost-effective than the specialized versions used for industrial robots. The devices are automatically picked up and released via a change adapter on the robot. The measurement covers the coating properties of color tone, texture, thickness, and cloudiness.

VIDEO ON YOUTUBE
Watch the system in action
https://www.youtube.com/watch?v=ZuQ7Sj6Mlh8

COLOR TONE MEASUREMENT DEVICES

6.

ADVANTAGES

- Excellent correlation to BYK-mac i and BYK-mac i COLOR
- Excellent device compatibility enables the use of digital standards within the supply chain
- Communication software, installation kit and smart-chart software included

TECHNICAL SPECIFICATIONS

- Dimensions: 21 x 12.5 x 17.5 cm
- Weight: 3.5 kg
- Measurement range: 400 - 700 nm, 10 nm resolution
- Color geometry: 45°
- Illumination angles: -15°, 15°, 25°, 45°, 75°, 110°

BYK-MAC I ROBOTIC

The BYK-mac i Robotic is a multi-angle spectrophotometer designed for metallic and effect surfaces, specifically developed for online operation on an industrial robot and already in use. In addition to multi-angle color measurement, it can also measure effect coatings such as flakes.

An integrated positioning system enables the independent determination of the relative position of the sensor head to the paint surface. By calculating spatial correction data, the system guides the 6-axis articulated arm robot into the correct measurement position.

Color measurement is performed simultaneously at up to six angles (-15°, 15°, 25°, 45°, 75°, 110°). The measurement method is compatible with established laboratory procedures in the automotive industry. Very good correlation with the portable BYK-mac handheld color measurement devices is ensured.

The system works fully automatically, is independent of color tone and position for measurements on stationary objects.

It is designed for use in a dust-free environment within standard working spaces and ambient temperatures of 10°C – 40°C.

SURFACE STRUCTURE MEASUREMENT DEVICES

BYK WAVESCAN ROBOTIC

The wave-scan ROBOTIC, mounted on a robotic arm, enables fully automated measurement of surface quality. The precise robotic system always captures the same test areas, which increases the reproducibility of measurements while maximizing the number of body parts and components tested. A stable process leads to stable quality – the wave-scan ROBOTIC provides comprehensive, objective, and reliable data, making it ideal for statistical process control.

The appearance data obtained correlates excellently with the wave-scan DOI, the established standard in the automotive industry. Additionally, the device offers a detailed structure spectrum that provides in-depth information about surface quality. With this data, the causes of quality changes can be precisely identified and and analyzed, which enables systematic optimization.

In addition to orange peel and DOI, user-specific scales are available to meet individual requirements.

The wave-scan ROBOTIC is mounted on a robotic arm, allowing the automatic measurement of surface quality. The measurement is non-contact.

ADVANTAGES

- Excellent correlation to wave-scan DOI, the appearance standard in the automotive industry
- The structure spectrum provides detailed information about the surface quality
- In addition to Orange Peel and DOI, user-specific scales are available

TECHNICAL SPECIFICATIONS

- Dimensions: 11.2 x 6 x 13.1 cm
- Weight: 0.55 kg
- Scan length: 5 / 10 / 20 cm
- Resolution:
  375 measurement points/cm

COATING THICKNESS MEASUREMENT DEVICES

THE-NANO IRYS (TERAHERTZ)

© das-Nano

Irys is an innovative measurement system that uses terahertz technology to measure coating thicknesses non-contact and non-destructively. It is versatile and can be applied across various industries, such as automotive, marine, aerospace, and in the processing of plastics and composite materials. The system is known for its high precision, with an accuracy of about 1 µm at a minimum coating thickness of 5 µm.

The measurement is automated and can capture up to 7 layers without manual intervention. Irys is applicable to various substrates, including metals, plastics, and composites, and is suitable for both flat and curved surfaces. The system works reliably around the clock without the need for regular stops to recalibrate, thanks to an automatic calibration system for new colours.

With a sampling range of approximately 4 mm per point, Irys provides a flexible and efficient solution for coating thickness measurement in demanding industrial applications. The system is IP54-rated, making it suitable for harsh environments.

ADVANTAGES

- Suitable for dry, wet, and cured coatings, non-contact
- No need for system stoppages for recalibration.
- Automatic calibration system for new colors.

TECHNICAL SPECIFICATIONS

- Sensor head: 38 x 32 x 90 cm | Weight: 5 kg
- Station: 61 x 58.1 x 33.2 cm | Weight: 46 kg
- Up to 7 layers with a minimum coating thickness of 5 µm each
- Sampling range: approx. 4 mm
- Accuracy: ~ 1 µm
- Distance between sensor and station: up to 20 m, with upgrade up to 30 m

HELMUT FISCHER TERASCOPE (TERAHERTZ)

The Terascope from Helmut Fischer is an automated measurement system that uses terahertz waves to non-contact and non-destructively measure the coating thickness of organic and dielectric single and multi-layer coatings, as well as material properties. With a bandwidth of up to 6 THz and a sampling rate of 1.6 kHz, the system offers high measurement accuracy and repeatability, even in harsh environments.

The compact sensor head can analyze up to seven layers in a single measurement cycle and is optimized for 24/7 operation. Clean-Trace technology ensures clear measurement results, while the integrated 3D scanner reliably detects complex surfaces. The Tera Suite software simplifies integration into existing process control systems and ensures efficient data processing.

ADVANTAGES

- Suitable for dry, wet, and cured coatings, non-contact
- Up to 6 THz bandwidth and 1.6 kHz sampling rate
- Highly precise positioning on round and complex geometries via 3D scanner (optional)

TECHNICAL SPECIFICATIONS

- Sensor head: approx. 30 x 20 x 20 cm | Weight: 6 kg
- Station: approx. 60 x 40 x 30 cm | Weight: 25 kg
- Up to 7 layers with a minimum coating thickness of 10 µm
- Sampling range: approx. 1 mm
- Accuracy: < 1 µm

JSR ROBOTIC PELT (ULTRASOUND)

The measuring system works on the basis of the transit time measurement of ultrasound in in the various coating media.

With the measuring device it is possible to to determine up to 5 individual coating thicknesses. The system works non-destructively and on different substrates.

After the rough positioning of the sensor by the robot, deionized water is sprayed onto the area to be measured. The water serves as a contact medium and is blown off with compressed air after the measurement.

ADVANTAGES

- Suitable for dry, hardened paints, touches surface with deionized water
- Integrated distance sensor for determination of the distance and optional alignment of the measuring points.

TECHNICAL SPECIFICATIONS

- Sensor head: 1.6 kg
- Minimum layer thicknesses: Primer 10 µm, Basecoat 10 µm, Clearcoat 25 µm
- Up to 5 layers
- Accuracy: 1.3 µm
- Sample area: 11 mm
- Distance between sensor and station: up to 33 m

HELMUT FISCHER FISCHERSCOPE MMS AUTOMATION (MAGNETIC INDUCTIVE)

The Fischerscope MMS Automation from Helmut Fischer is a multifunctional measuring device to which various probes can be connected. For coating thickness determination, we use it with the FGAB1.3 measurement probe. The sensor is balanced with a spring and is specifically designed for magnetic-inductive measurement technology. Additionally, we can integrate an automatic interface that allows the measurement data to be transferred directly to the PC. This enables the measured values to be easily imported into the BYK SmartChart software.

ADVANTAGES

- Suitable for dry, hardened paints, touches surface
- Modular system with different probes
- Up to the same 4 probes in one application

TECHNICAL SPECIFICATIONS

- Measuring range: typically 10 µm to 2000 µm
- Measurement accuracy: typically 7% relative to the color
- Total coating thickness measurement
- Sampling range: > 10 mm
- Distance between sensor and station: up to 30 m

ADVANTAGES

- Suitable for dry, wet, and cured coatings, non-contact
- Insensitive to distance, angle, environmental influences, substrate thickness, surface roughness, and curvature.
- Safety: eye-safe, no radioactive isotopes, no X-rays.

TECHNICAL SPECIFICATIONS

- Accuracy: 0.5 µm
- Sensor head: approx. 33 x 17 x 10 cm | Weight: 3.5 kg
- Sub-micron accuracy: < ± 200 nm
- Real-time measurement: < 0.5 s
- Coating thickness range: 1 - 3000 µm (depending on the application)
- Stable measurement: < ± 5 cm
- Insensitive to movement and vibration

AIM COAT PRO (PHOTOTHERMAL)

The photothermal coating thickness measurement enables non-contact determination of the thickness of coatings on various substrates through the photothermal effect. In this process, light is absorbed by the coating and converted into heat, which generates a measurable temperature change on the surface. This method is suitable for a wide range of material combinations and works non-destructively.

The measurement principle utilizes the diffusion of heat through the coating to the substrate, as described by the heat conduction equation. The modulated light excitation generates thermal waves that are reflected and transmitted at material interfaces, similar to electromagnetic waves. These interference effects cause a phase shift, from which the coating thickness is determined.

By calibrating with reference samples, measurement accuracy can be improved. The method is flexible and can be adapted to different material requirements by adjusting the light wavelength.

CoatPro allows non-contact measurement of the coating thickness of primers and paints on plastics. The measurement can be performed directly on the wet layer immediately after the coating process. This means that coating thickness values are available during the process, which helps avoid scrap and allows for immediate optimization of coating thickness. Additionally, you receive continuous documentation of your product.

PROCESS TIMES

COLOR TONE MEASUREMENT

COLOR TONE | STRUCTURE | LAYER THICKNESS

BYK-mac-i robotic	Process time
Ultrasonic measurement & correction	4,5 s
Rotation of the tool to the measurement position	8,9 s
Position correction on the part per cycle	2,0 s
Measurement BYK-mac-i robotic, incl. effects	8,8 s
Total time	**26 s**

STRUCTURE MEASUREMENT

COLOR TONE | **STRUCTURE** | LAYER THICKNESS

BYK WaveScan robotic	Process time
2 x Ultrasonic measurement & correction	9,8 s
Rotation of the tool to the measurement position	0,5 s
Measurement BYK WaveScan robotic	3,5 s
Total time	**14 s**

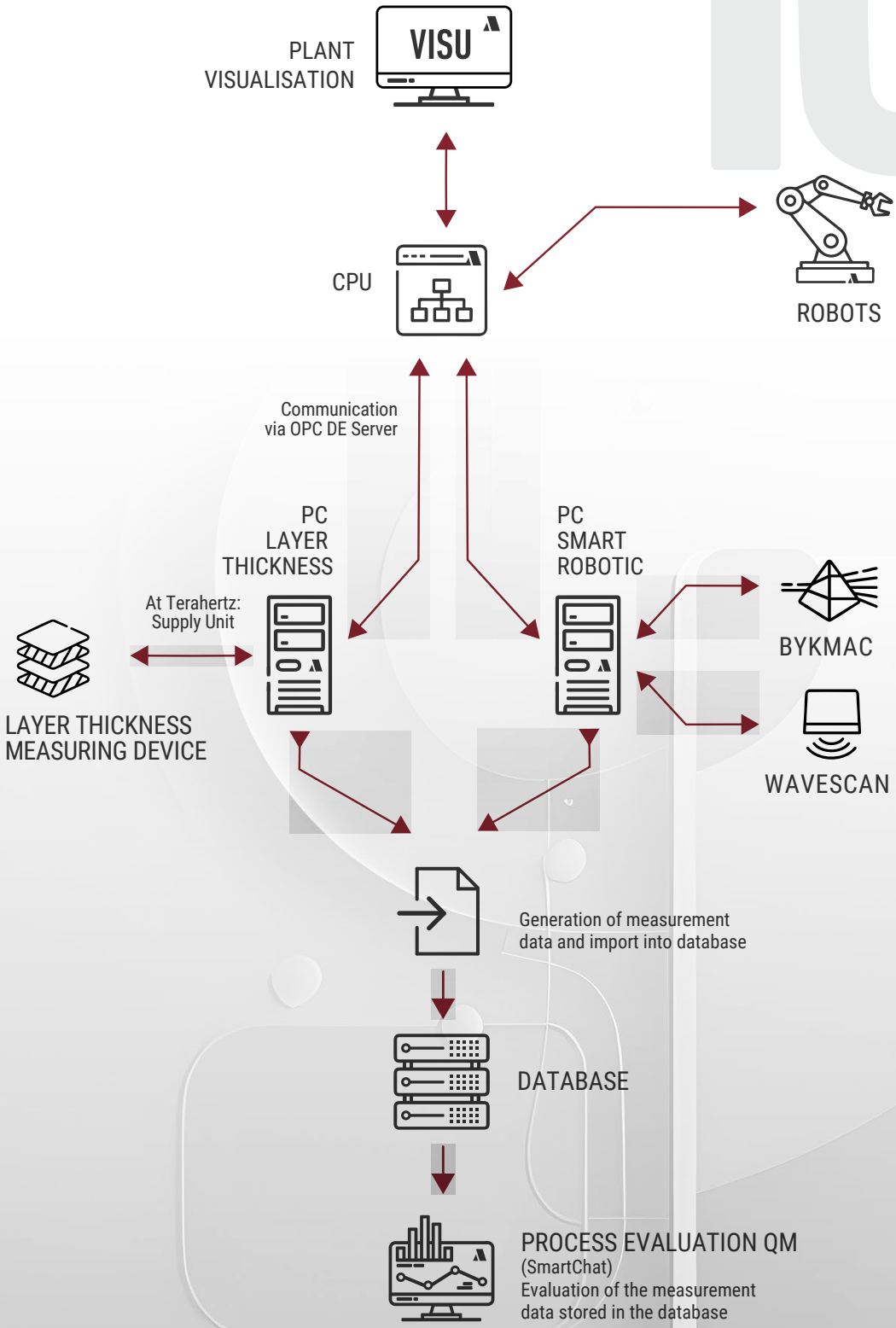
LAYER THICKNESS MEASUREMENT

COLOR TONE | STRUCTURE | **LAYER THICKNESS**

	Process time
Positioning	4,5 s
Rotation of the tool to the measurement position	0,5 s

	das-Nano Irys (terahertz)	**Helmut Fischer Terascope** (terahertz)	**JSR Robotic PELT** (magnetic inductive))
Measurement	1 s	1 s	6 s
Total time	**6 s**	**6 s**	**11 s**

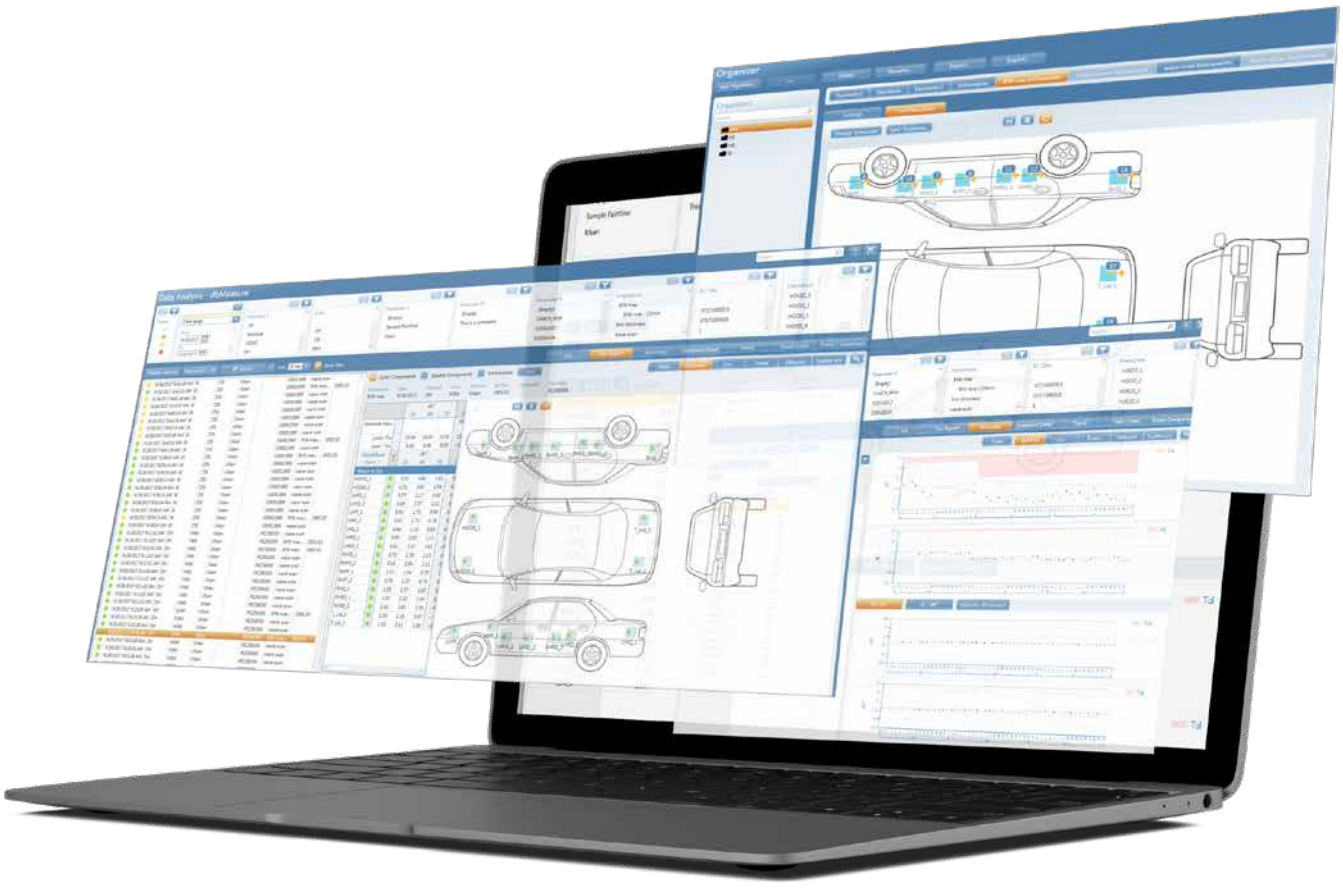
DATA COMMUNICATION



DATA EVALUATION – SMART CHART

All BYK devices are connected to the system control via the BYK Smart Robotic software. The required component data is transferred from the cell controller via an integrated OPC interface and linked to the measurement data of the individual measuring points in a display data set. Control commands for positioning and operating messages are also forwarded to the cell controller.

The BYK Smart Robotic software runs as stand-alone software on the Smart Robotic PC. The XML text format standard is used as the output format for the measurement data. A separate file is created for each body (component) and saved on the Smart Robotic PC.



ASIS

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REFERENCE PROJECT

TASK DEFINITION

An OEM with a production facility in the Czech Republic was planning to integrate an of an automatic measuring system for painted car bodies in its existing factory. The aim was to ensure and optimize the quality of the coating by precisely measuring the color tones, surface structure and coating thickness. Various technologies such as the BYKmac-I for color measurement, the WaveScan for structure analysis and a measuring tool from Fischer to determine the dry film thickness. The system can be operated offline to enable a detailed inspection of the car bodies outside the regular production line.

IMPLEMENTATION

The project involved setting up a new robot cell in which two robots were installed, each on an 8-meter-long seventh axis. Both robots were equipped with the BYKmac-I, the WaveScan and the Fischer measuring tool. This configuration enables a comprehensive inspection of all relevant points of the car body without affecting the production cycle time. The integration of BYK Smart Chart software enabled efficient evaluation of the measurement data, while the system was designed so that two-colour paint finishes could also be checked by separate robot programs. The system installation also included control and safety technology, on-site installation, programming and commissioning of the system.

The system was pre-assembled for smooth commissioning at the headquarters in Landshut for smooth commissioning.

BENEFIT

With the implementation of the new measuring system, the OEM was able to significantly increase in painting quality and process stability. The ability to check all critical measuring points offline enabled a more detailed analysis without interrupting the production flow. The automated measurement processes provided reliable and reproducible data that could be used to continuously improve the painting processes. Additionally, the flexibility of the system to precisely check different vehicle types and color combinations offered added value. Overall, the new system led to a significant increase in production quality and efficiency, which has a positive effect on customer satisfaction and the the OEM‘s long-term competitiveness.

ASIS

SUMMARY

Automated color measurement is clearly superior to manual measurement and cannot be implemented in industrial series production from a practical point of view.

Automated handling with industrial robots offers enormous flexibility, both in the measurement of color charts on the measuring table and in the measuring cells for the OEM and TIER sector.

Various measuring systems with different technologies are available and can be excellently automated. They offer an excellent correlation between the measurement results and the manual devices.

As a provider of turnkey systems, ASIS offers independent advice on advice on measuring methods and robot brands and takes care of integration and integration through to commissioning.

CONTACT

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