

# ABIS II

SURFACE INSPECTION



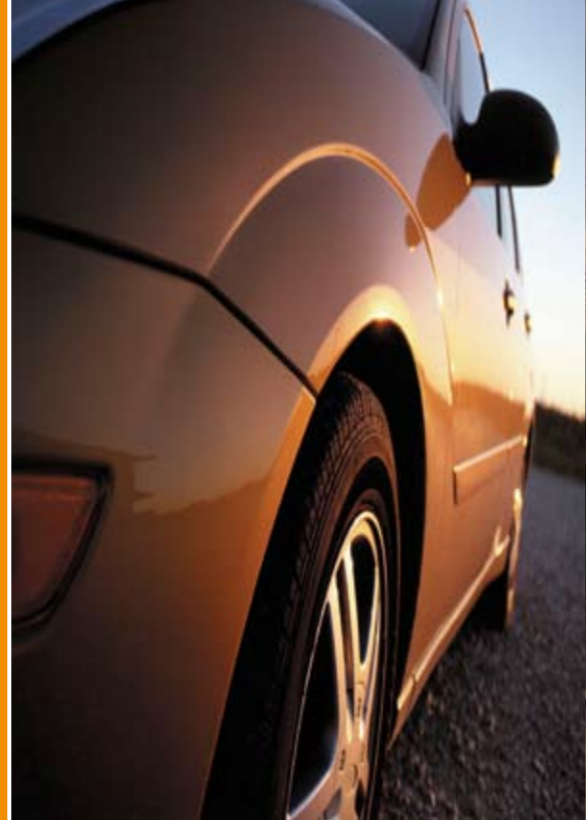
steinbichler

# ABIS II: OPTICAL SURFACE INSPECTION

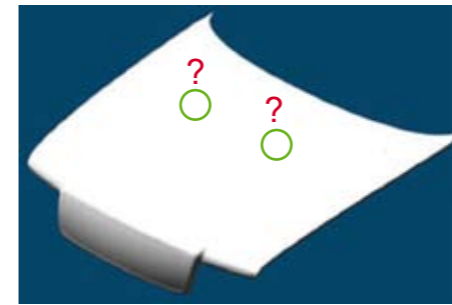
The surface quality of a product - particularly in the automotive industry - constitutes an important criterion for the customer and is generally seen in close relation to the quality of the overall vehicle.

Even inevitable disturbances at the early production stages prior to applying the paint work (e.g. in the press shop or body shop) may cause defects such as dents, bumps, sink marks, etc. which might not be visible to the eye while the vehicle is still unpainted. On a glossy paint surface, however, even the slightest irregularities are clear to see with incident light from the proper angle, and constitute a reduction in quality. Particularly the intense competition among manufacturers demands an increase in the surface quality in conjunction with continuously decreasing production costs. The target freedom from defects is time-consuming and labor-intensive to achieve for automobile manufacturers. It is not 100 % possible through conventional means so that defects that have gone unnoticed during the production process generate very high rework costs.

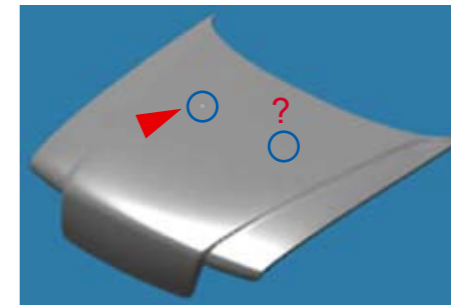
Now, the early and complete detection of surface defects with the effective ABIS II high-precision surface inspection system opens up new perspectives in quality assurance.



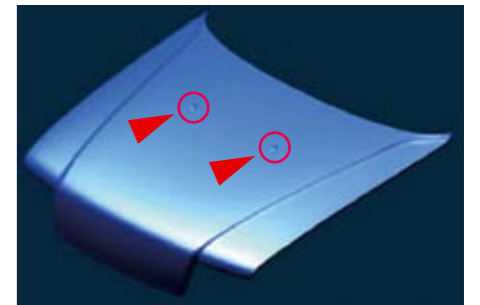
## DEFECT RECOGNITION DURING PRODUCTION PROCESS



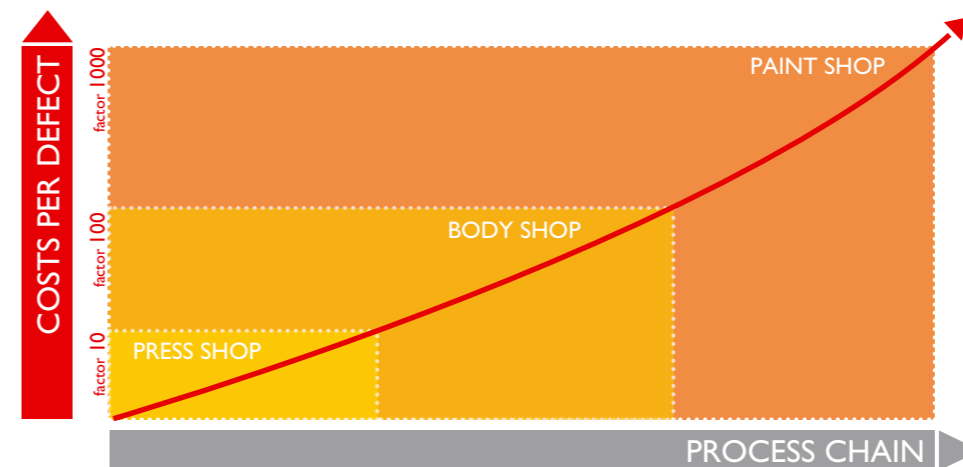
Many relevant surface defects on sheet-metal parts or bodies-in-white are not visible to the human eye.



Depending on individual type, characteristics, and illumination conditions, some quality-relevant defects can be detected after e-coating.



After application of the top coat, previously unrecognized surface defects become clearly visible and require time-consuming corrections.



SIGNIFICANT INCREASE OF COSTS FOR LATE CORRECTION OF SURFACE DEFECTS



## ABIS II: DETECTION OF ALL RELEVANT DEFECT TYPES

The majority of defects that can occur during the production process are “invisible” at the early stages of manufacture. These minute surface defects become visually perceptible later on, however, when subsequent work steps such as paint work have been completed. At that point in time, they can only be remedied using expensive corrective measures.

To achieve a high surface quality under the aspect of cost optimization, a wide range of defect types needs to be detected. The reliable and early detection combined with an objective evaluation and classification of defects, such as dents, bumps, sink marks, waviness, constrictions, cracks, etc., is necessary since the costs of removing these defects increase drastically with the progress of work within the production cycle (press shop, body shop, paint shop, final assembly). Consequently, particularly the rework of defects that have been propagated throughout the production process constitutes a substantial factor with regard to manpower and time. It thus has a considerable influence on the economic efficiency of the manufacturing process.

ABIS II – an optical sensor system that is available in different versions and system concepts – allows the fast, reliable and ultra-accurate detection of not only 3D defects on the inspected part (e.g. dents, bumps, sink marks, waviness, constrictions or cracks), but also of contrast-sensitive defects (e.g. scratches, adhesive residues, dust and dirt) using the new contrast sensor upgrade.

Time-consuming and thus expensive rework in subsequent process steps, e.g. at the finish belt, can be efficiently reduced.

### 3D DEFECTS:

BUMPS

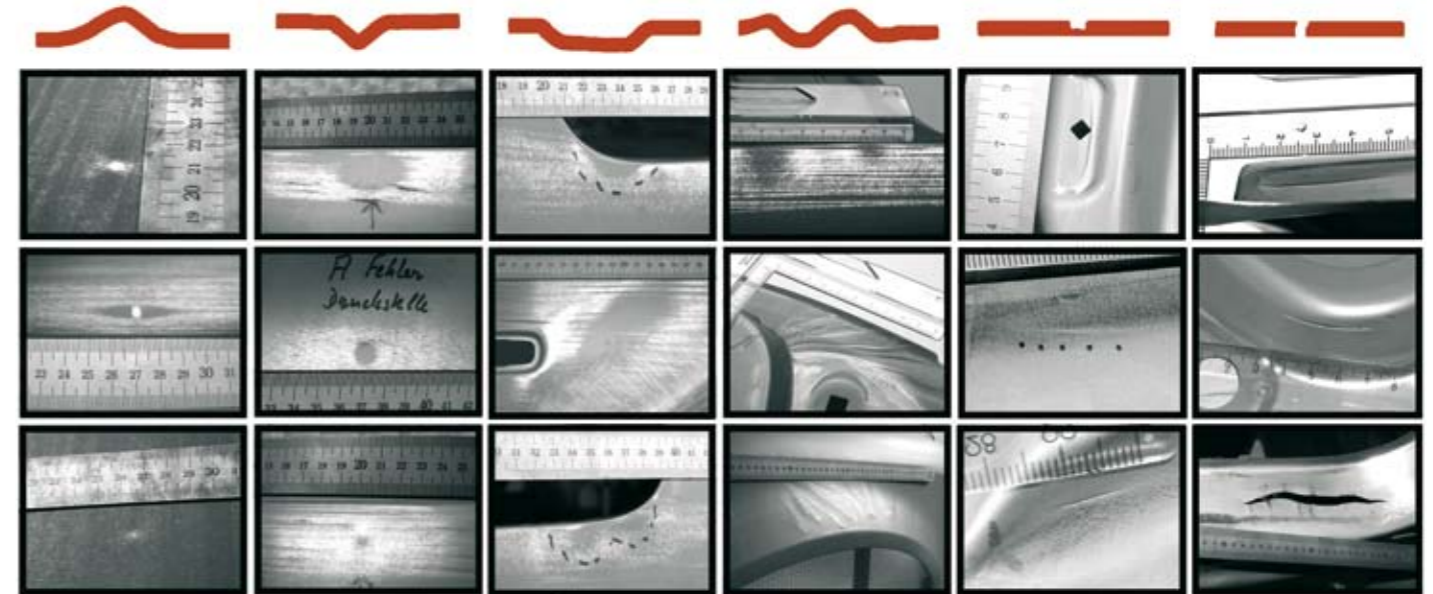
DENTS

SINK MARKS

WAVINESS

CONSTRICTIONS

CRACKS



### EXAMPLES FOR CONTRAST-SENSITIVE DEFECTS:

ADHESIVE RESIDUES

SCRATCHES

DIRT



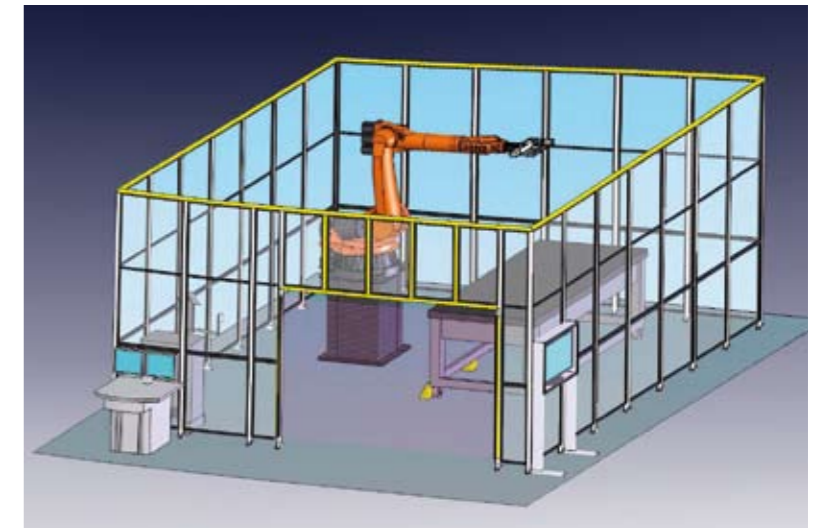
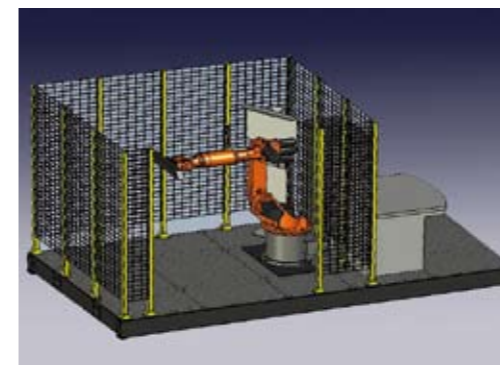
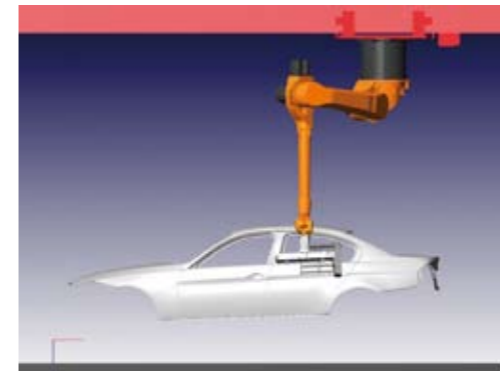
## ABIS II: SYSTEM CONCEPTS



ABIS II is a flexible system concept that comes in three different versions. Users can thus choose the sensor system that best meets their application requirements.

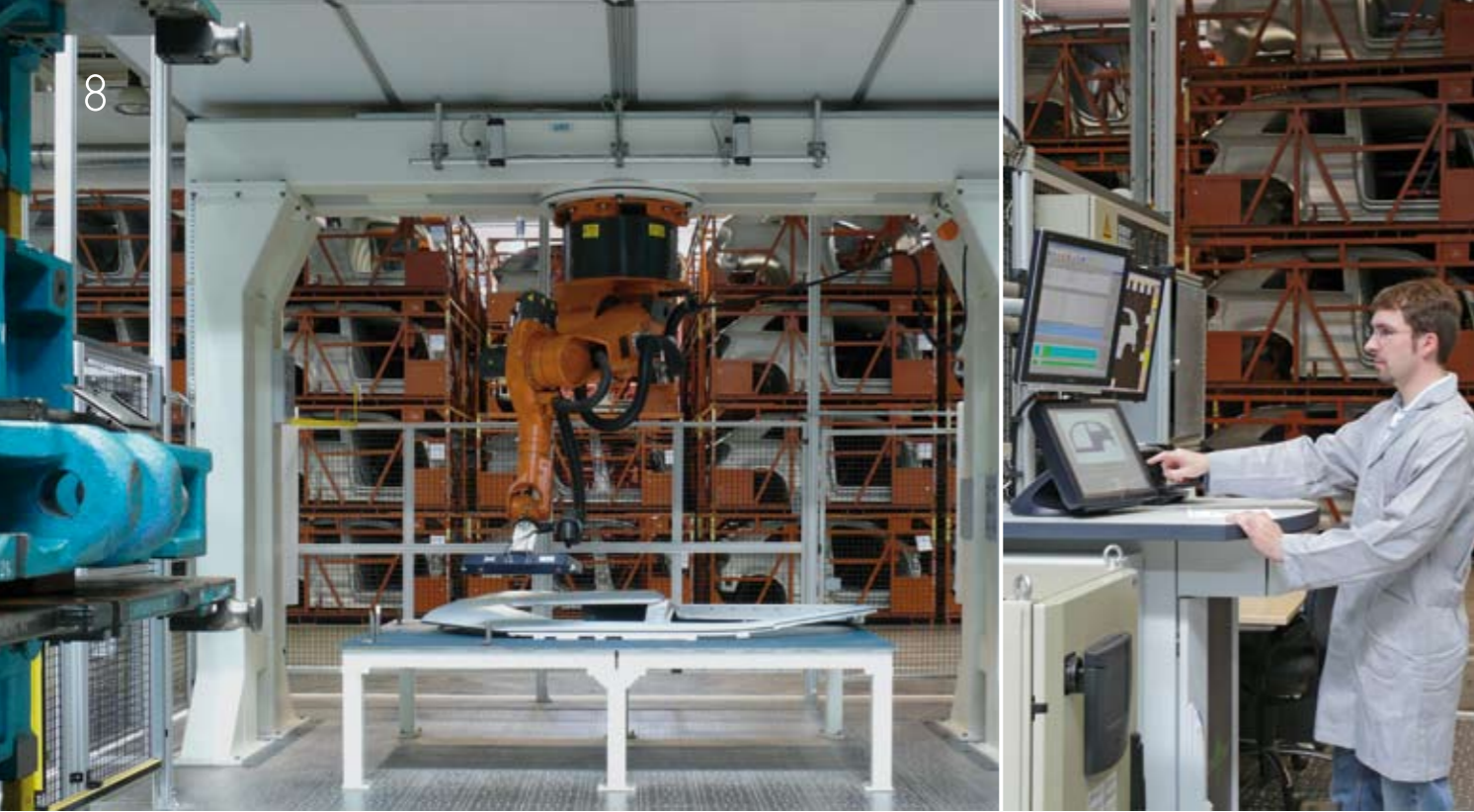
ABIS II Offline allows data acquisition and evaluation at an automatic test stand and is excellently suited for accompanying production monitoring. Fault catalogs and classification criteria that have been compiled during the planning stage can be extended and modified. The ABIS II Offline cell can be configured for both mobile use and stationary installation at a fixed position in the press shop. The mobile Offline version features one or more portable platforms, on which the system components are mounted.

With ABIS II Inline, a fully automatic inspection and assessment can be performed by direct integration of the system concept into the manufacturing environment of the body shop or press shop. According to the customer's specifications, the ABIS II Inline system can be configured for either 100% inspection of all parts or for the inspection of certain object areas and defined zones on the test part. The achieved complete or partial inspection of bodysells and sheet metal parts sets highest standards in quality assurance and auditing.



Before an ABIS II surface inspection system is installed, a virtual system concept is always created first. Simulation programs help to select the specific robot and its position with reference to the part under test. This ensures that the sensor will be able to reach all the positions required for inspection.

How many sensors and data analyzers the final system concept provides depends on the part size(s) (from small bodysell parts to the complete car body / body-in-white) and on the specified maximum inspection time per part (cycle time). The security concept and the construction of the system are designed and implemented in accordance with user guidelines. Customers can choose to do this themselves or order a complete, end-to-end surface inspection solution.



## ABIS II: REFERENCE SYSTEMS

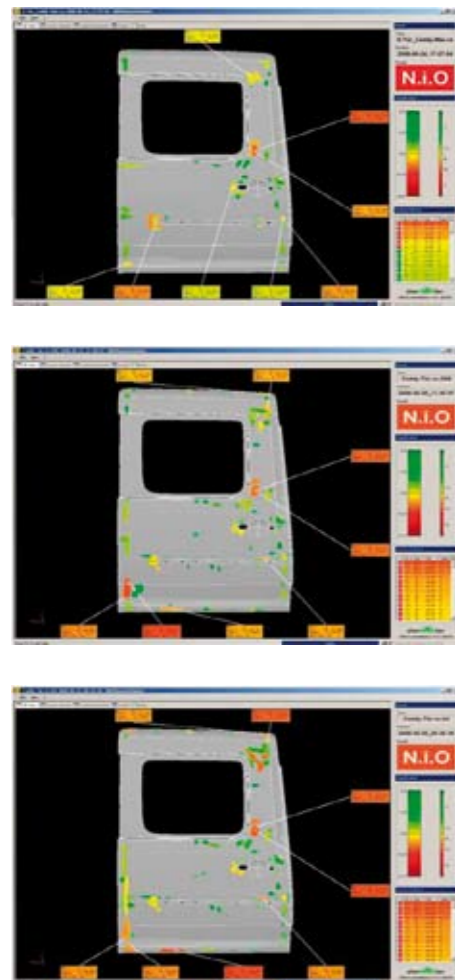
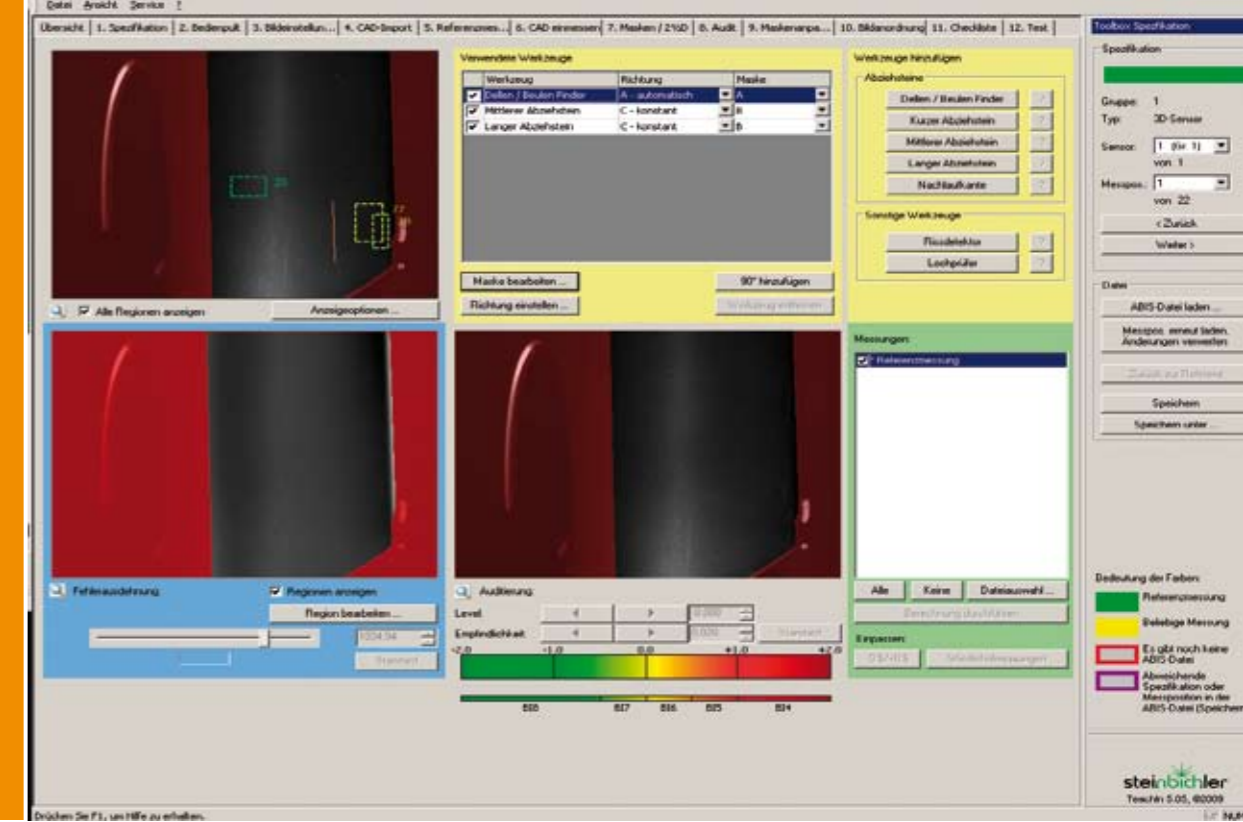
Numerous renowned automakers have implemented the ABIS II surface inspection system with great success in a wide variety of custom concepts tailored to their press shop environments. The ABIS II offline system is ideal not only for ongoing auditing at regular intervals during the manufacture of a press lot, but also for checking the surface quality of the first sheet metal parts after a tool change.



Machine operators can very quickly obtain an objective evaluation of the surface quality of a pressing. An automated central audit station with appropriate conveyor belts is provided for efficiently inspecting large quantities of bodyshell parts.



# EVALUATION AND VISUALIZATION SOFTWARE



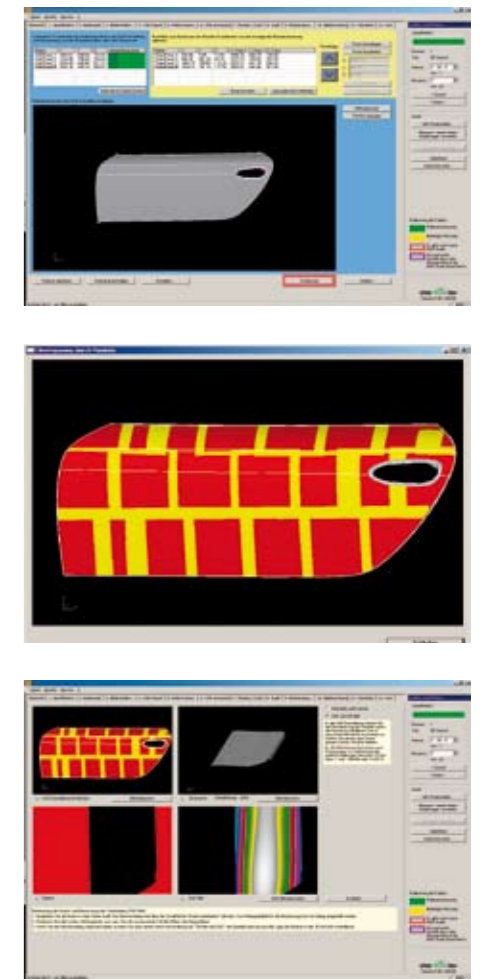
Single Part  
Assembly  
Cathodic Dip Painting

PROCESS CHAIN

Many users in the automotive industry rely on an integrated surface quality analysis across the entire process chain. After each of the process steps Single Part, Assembly and Cathodic Dip Painting, the individual parts are examined again by same inspection application to identify any surface defects that might affect the top coat quality. The development of a defect is documented after each process step. Practical experience in production shows that the relevance of a surface defect can increase or decrease after a process step. Based on a process-wide quality analysis, the required rework is done precisely at the required location on the part and at the required process steps. This increases the efficiency in the finishing area and results in a significant cost saving.

Besides the development of a surface defect across the process chain, the time-related changes within a production period also give users important information on the quality changes. For example, when the audit value deteriorates, corrective action (e.g. regarding press parameters or tool surfaces) can be taken at an early stage before producing parts with defects that will later require rework. Statistics programs provide distribution charts that show the user which component positions and which steps of the production process offer a potential for cost-saving optimization.

ABIS II offers the highest standards in terms of suitability for industrial applications as well as expandability, defect detection and easy use. To inspect a part, all the user has to do is select the part on the touch screen and start the test sequence. Thanks to ABIS II's high-speed inspection and evaluation capacity, a report of the inspection result will be available in minimum time. With an offline system, for example, the user will receive a complete test report, including auditing, in less than 40 seconds after starting the inspection of the sliding door shown in the picture on the left. The entire offline system can be operated simply by selecting the relevant part inspection processes on the touch screen. When programming additional test sequences for new parts, the user is systematically supported by the easy-to-use ABIS-TeachIn software. After defining the individual inspection positions on the part, the user assigns the required quality level to each object area. The latest version of the TeachIn software features a virtual toolbox for auditing. The toolbox comprises whetstones in different sizes that can be used according to the dimensions of the individual surface defect. Short whetstones in the TeachIn software allow inspecting critical positions on parts (e.g. door handle recesses, tight concave surface contours), which cannot be accessed using real whetstones. Additional functions for detecting skid and impact lines, cracks and holes are also easy to activate. The classification criteria and threshold values for a subsequent automatic evaluation of the defects are always based on the customer's specifications. In addition, the system applies the customer's internal audit note standards and defect names. The specified threshold values can be flexibly adapted to the relevant production stage at any time (floating audit).



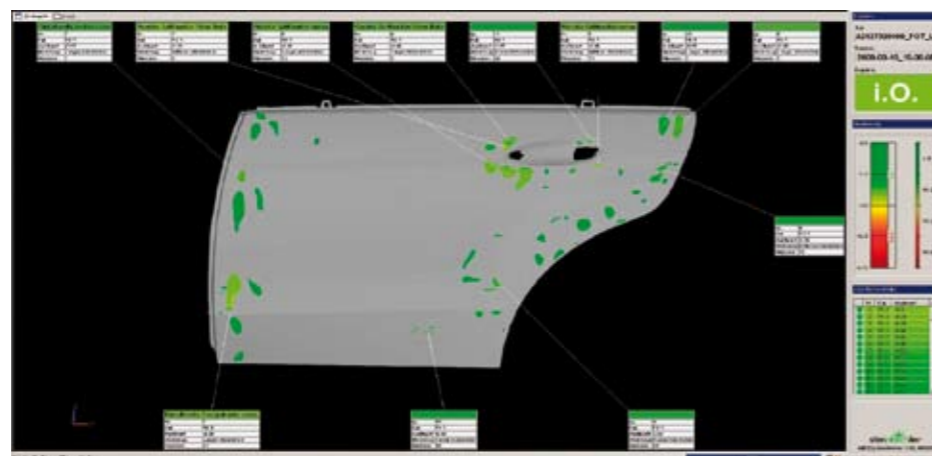
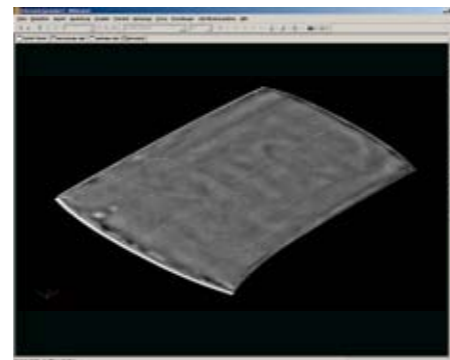


## EVALUATION AND VISUALIZATION SOFTWARE

ABIS II sets standards in optical surface inspection. Independently of offline or inline operation, the inspection system can identify all relevant types of defect - in both the 3D image and the contrast image. Dents, bumps, sink marks, pits, waviness, constrictions, cracks, scratches, dust and dirt, etc. are quickly and reliably detected and analyzed at a high resolution.

If required, the inspection report can include the associated quality image of a surface, showing the part as if a virtual whetstone had been used.

The ABIS II software enables users to enter individual defect characteristics and severity levels based on the auditor's experiences. This allows including the experience of the quality assurance staff directly into the system's classification and tolerance criteria, which in turn can be customized to the individual state of production.



## FUNCTION OVERVIEW ABIS II SOFTWARE COMPONENTS

### ABIS-SystemProcessManager

- Start and administration of all single processes
- Automatic control and display of system diagnosis messages

### ABIS-SystemProgressInfo

- Automatic display of processing progress of a measurement, divided into measurement positions and processes

### ABIS-SystemOfflineUI

- Selection and start of measurements
- Touchscreen functionality
- Configuration of menu buttons and letterings via ABIS-TeachIn
- Easy communication with robot control via I/O interface

### ABIS-AcquisitionSensor

- Automatic image acquisition
- Possible simulation of a series of measurements

### ABIS-AcquisitionPreprocessing

- Automatic correction function for the compensation of minimum measurement position deviations
- Automatic preprocessing of images for defect analysis

### ABIS-Analysis

- Automatic detection and analysis of defect regions
- Possible consideration of different areas of relevance and quality standards

### ABIS-SystemDefectManager

- Automatic registration of classification data acquired with ABIS-Analysis into a central database

### ABIS-SystemMarker

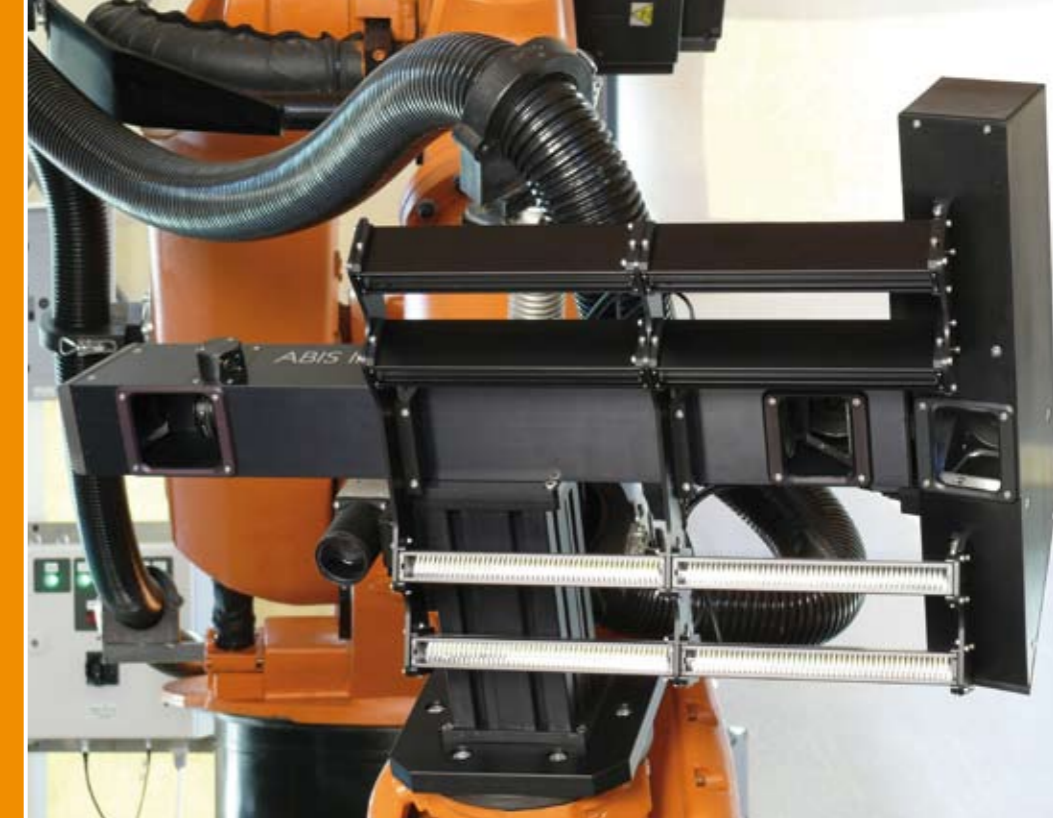
- Automatic display of defects acquired with ABIS-Analysis in a CAD display of the test part - I.O. / N.I.O. display
- Individual configuration possibilities for defect display
- Subsequent loading and display of classification data from a database
- Print functions

### ABIS-TeachIn

- Comfortable setup and teaching of components/test parts
- Clear and methodic processing of the single teaching steps
- Selection of various defect algorithms
- Selection of different virtual whetstones
- Individual classification of all detected features/characteristics
- Configuration and modification of all acquired measurement data



## CONTRAST SENSOR



## ABIS II: SENSOR SYSTEMS

### ABIS II SENSOR

### ABIS II CONTRAST SENSOR

Dimensions (mm <sup>3</sup> )	670 x 80 x 100	755 x 160 x 460 incl. ABIS II sensor
Weight (kg)	4.7	14.8 incl. ABIS II sensor
Image Acquisition Time	0.1 msec	0.1 msec
Robot Capability	yes	yes
Field of View	220 x 300 mm <sup>2</sup>	220 x 300 mm <sup>2</sup>
Data Interface	CamLink	CamLink
Resolution CCD Camera (Pixel)	1200 x 1600	1200 x 1600
3D Defect Size Resolution (Depth)	10 µm (min.) surface dependant	-
Lateral Defect Resolution	1.5 mm surface dependant	10 µm
Stand-Off Distance	432 mm +/- 20 mm	432 mm +/- 20 mm
Light Source	Xenon flash lamp	LED
Lifetime of Light Source	min. 10 <sup>6</sup> flashes at 1 Hz repetition frequency	unlimited



The addition of the new ABIS II contrast sensor system allows quickly and easily extending the range of detectable defects to include surface characteristics that are not visible in the 3D image. With the contrast sensor system, bar-shaped LED lines and the camera are customized for the field of view and the measurement distance of the ABIS II sensor. The images are captured almost simultaneously by the ABIS II sensor and the contrast sensor system (time difference 0.1 msec), so that the overall inspection time for component testing is not prolonged when using the contrast sensor system.

To ensure exact positioning of the part under test, an optional laser beamer can indicate the part's contour on the measuring table of an ABIS II Offline system (see bottom picture on page 14). The position of the part on the table can be determined using an optical position recognition system. This data is then used to correct the robot path during the test procedure. The camera of the position recognition system can be installed either above the measuring table or directly to the robot.

The robust, industrial strength design of the sensors ensures a reliable, high-speed measurement data acquisition in press shop and body shop environments. The ABIS II sensors are not affected by high acceleration loads, vibration, hall lighting, fluctuating temperatures, etc., which they are exposed to on site every day.

Steinbichler Optotechnik GmbH • Georg-Wiesböck-Ring 12 • 83115 Neubeuern - Germany  
fon: +49-8035-8704-0 • fax: +49-8035-1010 • sales@steinbichler.de • www.steinbichler.de



steinbichler