

Fully automatic inspection of painted parts: A new level of quality assurance

At many car manufacturers and their tier1 suppliers, experienced employees visually inspect painted surfaces for defects using the bare eye. However, visual inspections for quality assurance purposes are very subjective, even after many years of experience and training, and often provide varied results with regard to reproducibility or quantifiability. Inspection quality depends on multiple factors, ranging from the personal viewpoint of quality, through margins of discretion, all the way up to employee performance on the very day. However, overlooked defects cause high additional costs and errors in production processes and thus represent a high cost and risk factor.

Highly efficient and automated inspection solutions for quality assurance can reduce costs and increase the quality of painting processes. A robot-guided inspection system enables the objective and consistent evaluation of the quality of painted surfaces. The robot ensures that the sensor moves precisely over the contours of the surfaces to be inspected. This is an extremely important task and one which the human hand-eye coordination is not able to consistently repeat over long periods with the required precision and reliability.

These intelligent systems for paint inspection are integrated directly in the production line, where they check the surfaces of individual coated parts, all the way up to entire bodies. Automated inspection systems allow to determine and rectify errors in the painting process significantly earlier. Through the precise marking of areas requiring repair, they also provide valuable assistance in manual reworking. Moreover, this exact knowledge of the defect locations enables robots to perform repairs.

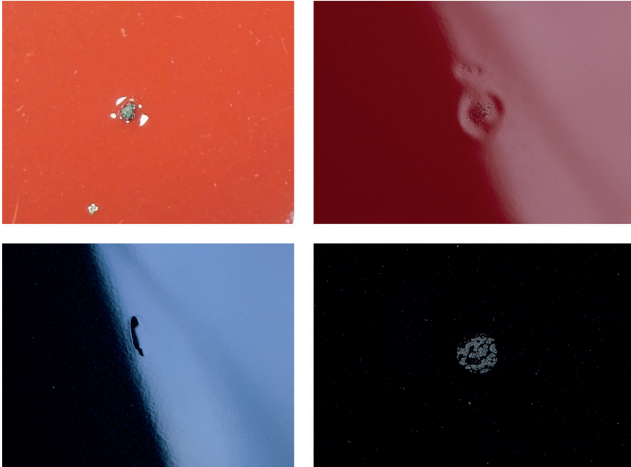
Automated paint repairs combine optical inspection, sanding, and polishing processes, thereby enabling a more efficient process with high savings potential.

Detecting surface defects is a complex technological challenge, particularly when it comes to diverse and intricately shaped components. And the only way to solve this challenge is to employ expertise in surface inspection and robotics. Based on its decades of experience, ISRA VISION, the leading supplier of inspection systems, has enhanced its successful Car Paint Vision (CPV) system, which is used as a standard to inspect entire car bodies. With a new high-end concept for the automated inspection of painted parts, it is now also possible to reliably inspect exterior components for defects, such as front and rear bumpers.

The newly developed and fully automated system with PAINTSCAN Compact sensors uses industrial robots for the inline inspection of painted surfaces, enabling even large parts to be inspected, all while keeping pace with the production output at all times. In the scalable and highly flexible system, between one and four robots are equipped with PAINTSCAN Compact sensors. The system uses a high-performance multi-mode LED line to detect defects measuring ≥ 0.15 mm. Every defect is detected or inspected several times at 200 Hz using oversampling and is then classified in multiple dimensions. The defect detection rate for topographical and non-topographical defects is typically $> 98.5\%$. Data is processed in the process cycle so that defect information is immediately available. Analyses of the collected inspection data enable production processes to be optimized sustainably and continuously.

Reliable quality control for painted individual parts

The cutting-edge multi-mode LED line technology in the PAINTSCAN Compact sensor uses the latest sensor technology and precision optics to enable quality control over large areas as well as highly reliable and precise detection and classification of relevant topographical paint defects, such as inclusions, craters, and scratches.



All relevant defects – such as inclusions, craters, pigment defects, scratches – are reliably detected and classified by the PAINTSCAN Compact sensor.

Precise inspection is also possible for closely stacked parts, including bumpers, cover panels, and spoilers. PAINTSCAN Compact combines the strengths of robotics and surface inspection and is capable of detecting both topographical and non-topographical defects. An optional downstream station automatically marks the detected errors for reworking. The support options for reworking are especially practical; these include automatic spray dot marking by robots and a laser marking interface for reworking.

The new solution for paint inspection combines a powerful classification pipeline, which defines the type and relevance of the detected errors and is used to generate process-relevant quality data during the inspection. For example, craters are differentiated from other types of defects to indicate process problems should the defect always occur at similar locations on the painted part. There is also the option of setting specific tolerances for individual zones (hood, roof, etc.). An example here are defects on primary surfaces that are directly in the customer's line of sight or on secondary surfaces (e.g., roof, frame) with medium to high priority, as well as defects on parts that are usually out of the customer's line of sight.



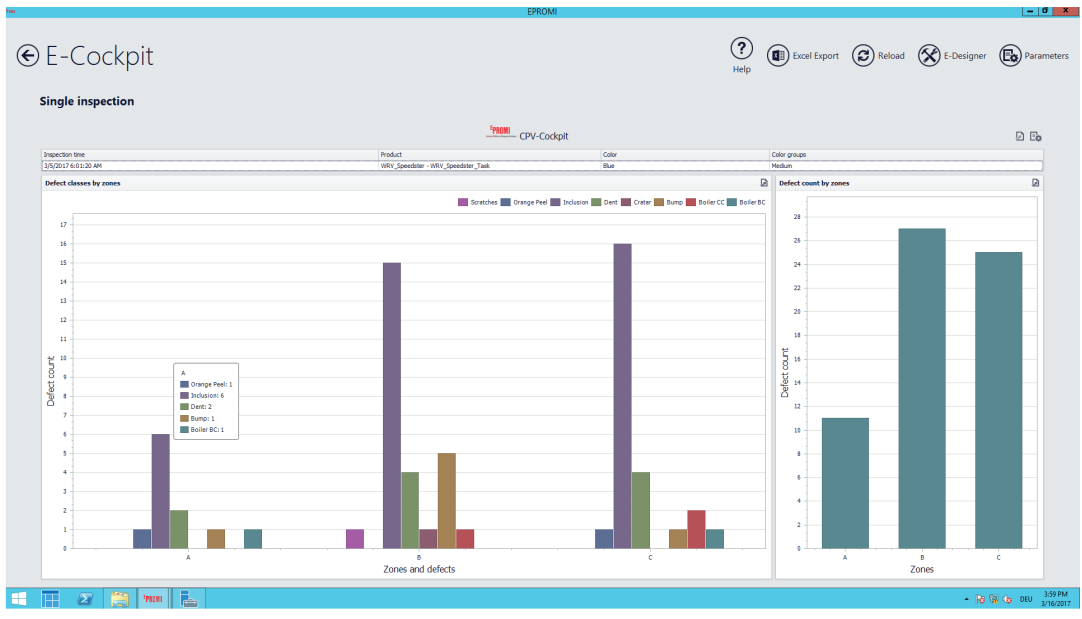
PAINTSCAN Compact sensor

All data derived from the inspection system is recorded in a paint defect database, thereby enabling further improvements to the production process.

Statistical data can be displayed on corresponding dashboards via the customized Enterprise PROduction Management Intelligence solution (EPROMI), while production-specific evaluations are always available in the form of a PDF report.

Improved paint inspection raises quality standards

The automated quality inspection solution for detecting surface defects on painted components guarantees consistently high quality in production with reliable and precisely defined results. PAINTSCAN Compact sensors enable defects in the painting process to be determined significantly earlier and rectified. In doing so, they drastically reduce the need for costly manual reworking to remove the defects while at the same time increasing product quality and ensuring that this remains at a consistent level.



Enterprise PROduction Management Intelligence-solution (EPROMI)

Quick amortization of the automated inspection solution

Quality expectations in the automotive industry – an industry that is under intense cost pressure – from the demanding end customers are constantly growing. Maximum quality at acceptable costs can only be achieved with highly efficient and automated inspection solutions. ISRA's distinctive surface inspection system can be retrofitted at any time. Operators benefit from comprehensive inspection results, which in turn form the basis for systematic improvements to products and production processes.

Rectifying paint surface defects of a finished product after the process is completed requires significant effort.

The high costs for remedying such defects can often have a drastic impact on the economic feasibility of production. Therefore, deploying an automatic surface inspection system to detect defects quickly pays for itself: Scanning for defects instead of searching for them enables economical surface inspection. Plus, defects are detected in line with reproducible specifications. Employees can therefore focus on repairing the defects and eliminating their sources. This saves staff and production costs, increases product quality, reduces the number of complaints, and thus ensures competitiveness.

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