

Inspect-360° HR Dimensional accuracy and texture testing in free fall

Inspect-360° HR can be used for various component types without setup process or component-specific handling. The system's 16 cameras detect dimensional accuracy and texture defects from a size of 30 µm in free fall.

Optical inline quality control of small parts

Today, formed, stamped or injection-molded parts often have to be produced with tolerances of a few 100ths of a millimeter and without surface defects. Manufacturers face the challenge of documenting the quality of each individual part. The variety of small parts, which are usually processed in bulk, makes automated inspection with a single system virtually impossible. Inspect-360° HR from Fraunhofer IPM inspects small parts in free fall and thus enables automated inspection for a wide range of component variants.

Automated inspection without additional handling

For quality control of small parts, random inspections are often state of the art. Component-specific automatic inspection machines inspect all parts quickly and accurately, but require complex component handling and cannot be used for other types of parts. Inspect-360° HR enables a largely type-independent inspection of such small parts without additional handling.

The parts to be inspected are transported individually into a hollow sphere via a conveyor belt. There, they are inspected simultaneously from all directions in free fall with the aid of 16 cameras. In the process, they are diffusely illuminated and appear free of shadows and reflections even if the surface is bare or coated with oil. The parts pass through the measuring volume every second in any orientation – no specific handling is necessary. Objects up to 60 mm in diameter can be inspected in the system.

Using real-time image processing, the 2D images acquired from different perspectives are mapped to the known CAD model and evaluated. For each 2D image, the deviation of the external contour to the CAD model of the respective view is calculated. Thus, dimensional accuracy errors can be detected immediately.

The component's surface texture is analyzed by means of Albased anomaly detection. The training of the neural network is based on good parts only, which eliminates the need for a time-consuming search for defect parts prior to training the network. Deviations such as scratches, stains or cracks are quickly and efficiently revealed by Inspect-360° HR as defects. The evaluation is performed within a few seconds, so that defective parts can immediately be sorted out. The recurrence of defects points to flaws in the process and allows for rapid intervention and adjustment.



Inspect-360° HR quantifies dimensional accuracy errors as deviations in the outer contour from the CAD model to within a few hundredths of a millimeter.



An AI detects texture anomalies such as this impact point. The color shows the deviation from the norm.

High resolution despite free fall

To inspect small parts up to 30 mm in diameter with a tolerance of a few 1/100 mm in free fall, an almost microscopic optical resolution of 15 µm is required. For this reason, the inspection sphere of the Inspect-360° HR has particularly small dimensions; this keeps the component's fall speed, and thus the influence of motion blur, low. With Inspect-360° HR, the drop distance to the point of image acquisition is just 25 cm. To reduce the drop distance, the photoelectric sensor that triggers the cameras is placed in the center of the inspection sphere. The cameras are arranged in such a way that the light barrier itself does not appear in the image. The image taken at fall speed is "frozen" by means of a light flash of a few microseconds emitted by 48 high power LEDs. To keep the component within the depth of focus, a centering flap is mounted directly at the inlet above the inspection sphere.

Micrometer precision in the production line

Inspect-360° HR is suitable for inspecting formed small parts such as plugs, screws and bolts as well as injection-molded

Typical system properties

Size of object	min. 5 × 5 × 5 mm³ max. 60 × 60 × 60 mm³
Detectable dimensional accuracy deviation / defect size	min. 30 μm
Cycle time	1 Hz
System dimensions	1.2 x 0.8 x 0.8 m ³ (H/W/D)
Number of cameras / inspection perspectives	16
Lighting	monochromatic, diffuse

plastic parts. Dimensional and texture defects as small as approximately 30 μm are detectable. A single system can be used to inspect different parts without having to adapt the hardware. Small parts can be inspected inline every second, allowing direct intervention or feedback into the process.

Inspect-360° HR can also be used to monitor and significantly shorten the setup and warm-up phase of a process. This can increase production efficiency and reduce scrap.

Our offer: test measurements

Fraunhofer IPM performs test measurements on sample components for industrial customers. This is how you can find out how well Inspect-360° HR performs at inspecting your specific component. Please, feel free to contact us.

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