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Saving costs through complete traceability

Historical technical statements are translated as printed, including the original wording about aperture values and depth of field; this is not an independent validation of the claims. Screenshot labels remain part of the original artwork. Original publisher artwork, logos and advertisements are retained in their original language.

Saving costs through complete traceability

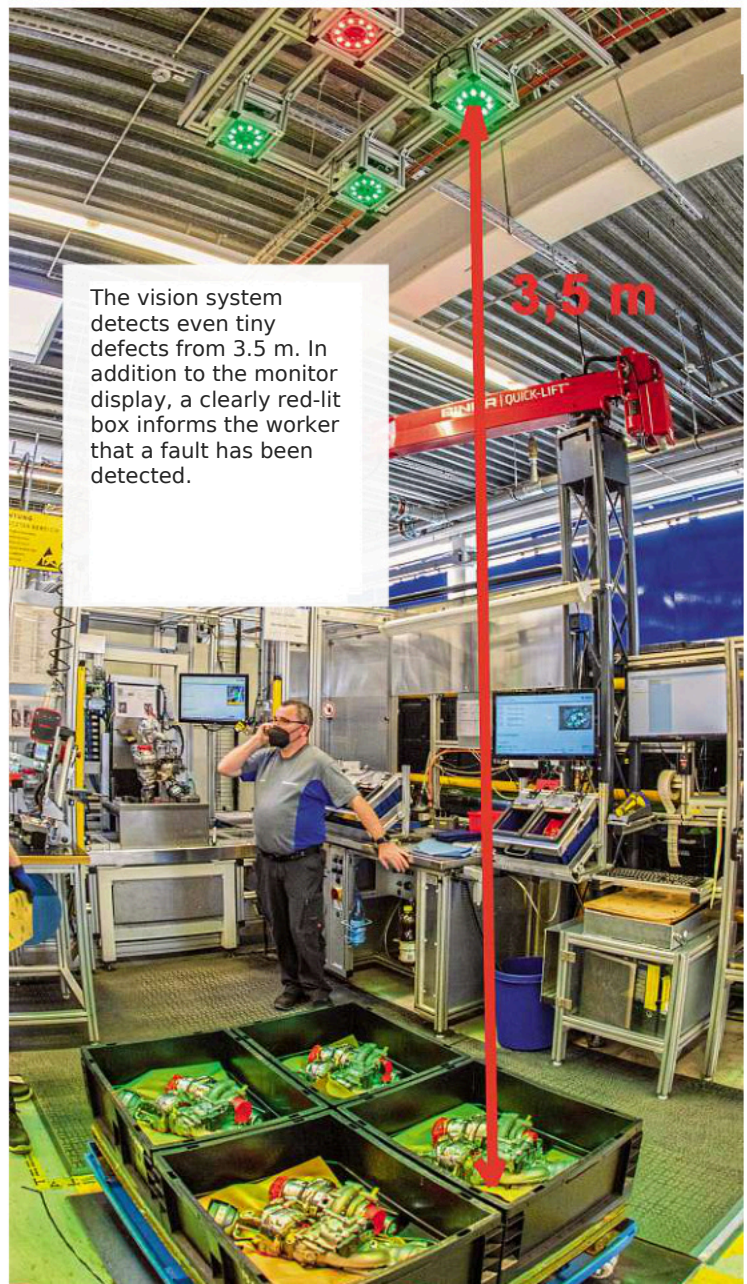
Comprehensive machine vision can inspect and document everything. This enables automotive suppliers to detect defects and refute unjustified complaints. Camera units mounted above the packed turbochargers play an important role.

Kamillo Weiß

High-mix production and assembly need vision systems that enable identification and traceability of every value-adding step through to shipping. To achieve a global audit trail, standardised system structures are required. A platform for global corporate communication at a leading automotive supplier brings advantages in efficiency, operational reliability, economy and sustainability. Controlled and documented by powerful machine vision and 1D/2D code-reading systems, the complete system solution handles numerous challenges. On a high-end industrial-PC-based automation platform, Cretec integrated the powerful HALCON vision software into the customer's TurboPCS system in a joint

At a glance

- Greater flexibility and quality in assembly production at higher cycle rates, through to shipping.
- All applications can be transferred directly to all sites worldwide via the customer's internal servers.



effort.

A strategic step with many advantages

The aim is a decisive improvement in flexibility and quality in assembly production at higher cycle rates, through to shipping. Applications and parameter changes can be checked and modified centrally at any time, independently of current settings. If, for example, an application requires higher quality through a higher-resolution colour camera, the update can be implemented globally very quickly. The automotive supplier can scale this independently, without an integrator.

Result data from the chain of machine-vision stations, with digital continuity across the entire value chain of the complex turbocharger assembly, guarantees 100% traceability. All images and result data are documented and available at any time for further analyses and statistics, including future purposes such as deep learning. Step by step, Cretec supplied vision applications for an entire production line, fully integrated into the customer's TurboPCS system. They meet complex requirements for quality, flexibility and communication in the turbocharger assembly line. Stability at all these assembly stations and throughput were also significantly improved.

The successful experience in operational reliability and economy has led to Cretec solutions being adopted as the standard at 35 sites worldwide at this automotive supplier. All applications can be transferred directly to all locations through the customer's internal servers.

Nothing is impossible

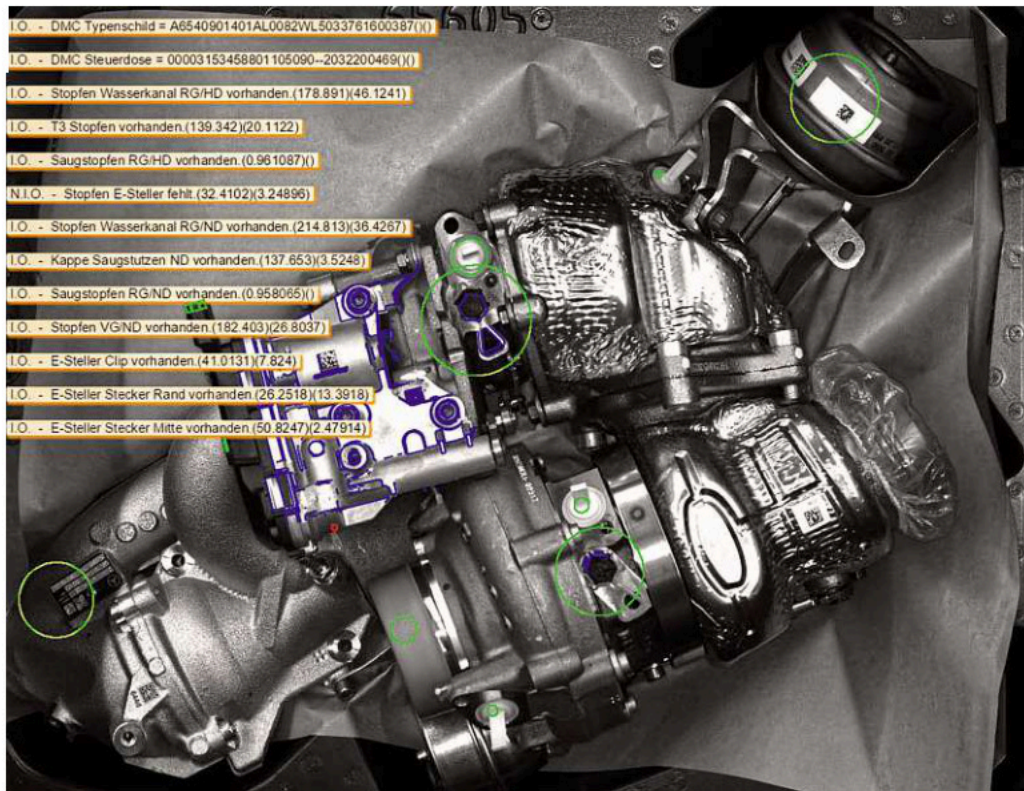


Among twelve features, the details marked with three red circles include a 3 mm plastic web and a 5 mm x 5 mm DataMatrix code on the nameplate, captured from 3.5 m.

In the automotive industry, only the result matters: entirely defect-free goods delivered directly to the customer. Complete turbocharger units are placed in shipping boxes with individually shaped plastic trays and remain protected there until they reach the end customer. Four boxes form one layer, and three layers fit on a pallet. The turbochargers therefore have a height difference of about 1 m between the first and third layers. Handling the assemblies into their trays requires free access to this work area from all sides. Similar situations and

requirements occur in many other logistics automation and handling applications.

The new vision application had to cope automatically with the changing height distance when checking numerous quality features and reading codes and plain text. Technological experience was required to make all the complex requirements work smoothly together. New handling of the finished assemblies was intended to improve the efficiency of automation and traceability. At this production step, plugs could theoretically be missing from the assembly or the connector housing damaged. Absolutely complete data



Up to twelve features are detected from 3.5 m at final inspection in the packaged state. A small missing plug is marked red as a reject. All data and images are documented.

“The vision system also enhances the company’s image.”

and image documentation is therefore required.

Other vision integrators had no usable solution. Cretec delivered an impressive, reliably functioning system for these requirements as early as the feasibility study. The application was extended several times with new features that would have been inconceivable at the start of the project.

The system has been running smoothly since January 2021. According to the user, within only six months it saved several times its investment cost.

At the limits of feasibility

The vision-system solution is outside the handling and crane area, requiring cameras at least 3.5 m above the boxes. The task was again solved using a high-performance industrial PC and complete integration into the customer’s TurboPCS software

environment. Four LED ring-lighting modules with integrated cameras were installed below the factory ceiling, each centrally above one box position.

High-performance LED strobe lighting is controlled directly by the camera, synchronised with image capture. Compared with continuous lighting at larger aperture values and potentially associated image noise, strobe lighting with substantially more light permits smaller aperture values with a considerably greater depth of field. A very short flash duration readily permits LED operation at a nominal current 300% higher, greatly increasing the available illuminance. External interference from ambient light, factory lighting, daylight and reflections can thus be eliminated.

The four cameras, each with a zoom autofocus lens and 20 MP resolution, reliably detect whether a plastic web

only 3 mm thick is intact and complete, even from 3.5 m away. The small DataMatrix code (5 mm × 5 mm) and the nameplate carrying customer data are also read with absolute reliability. This guarantees 100% traceability that can be implemented quickly. In total, twelve features are detected, including whether the plugs are present and correctly positioned.

The vision system can be extended for versatile colour evaluation with minimal configuration work in software and without changing the hardware. With the 20 MP monochrome camera and sequential switching of the red, green and blue channels of the LED strobe lighting, the images can be combined into an RGB colour image without a Bayer filter and with substantially more image information, comparable to a 60 MP colour camera. This reliably detects additional features, such as whether coloured plugs are present. The combined RGB image has the physical resolution of a 60 MP colour camera.

Guaranteed defect-free goods

If a feature of the complete turbocharger in its packed tray is faulty, it is immediately displayed on the monitor with a red circle in the captured image. At the same time, the boxes are brightly illuminated in green or red, controlled directly by the camera. The worker therefore sees a fault indication immediately, without having to look at the monitor, and the cause can be rectified at once. Data and images from every box are stored centrally and are immediately available throughout the company. The automotive supplier can thus guarantee that every turbocharger assembly,



Using a crane, the worker positions the turbochargers in the trays of the four boxes after the final assembly station. Three box layers are stacked on each pallet.

Since commissioning, the system has operated continuously without problems, handling 15 pallets per shift, three shifts per day and seven days per week, including additional shifts.

The important question of the payback period for this quality-assurance inspection station - checking individual assemblies for completeness, absence of defects and correct packaging - produced an impressive result after only a short time. A customer complaint concerning a delivery of 24 supposedly defective assemblies could be rejected because 100% traceability proved that the components were defect-free, with images documenting correct packaging. It is easy to see that this alone quickly amortised the cost of the final-inspection and packaging system. In addition, the automotive supplier's image among its customers is enhanced by the 100% quality of its products.

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accurately packed in its tray, is defect-free when sent to the customer. In the event of a complaint, a six-step plan makes it possible to send the customer all values and

images collected at the respective assembly and quality stations across the production chain within 24 hours.



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