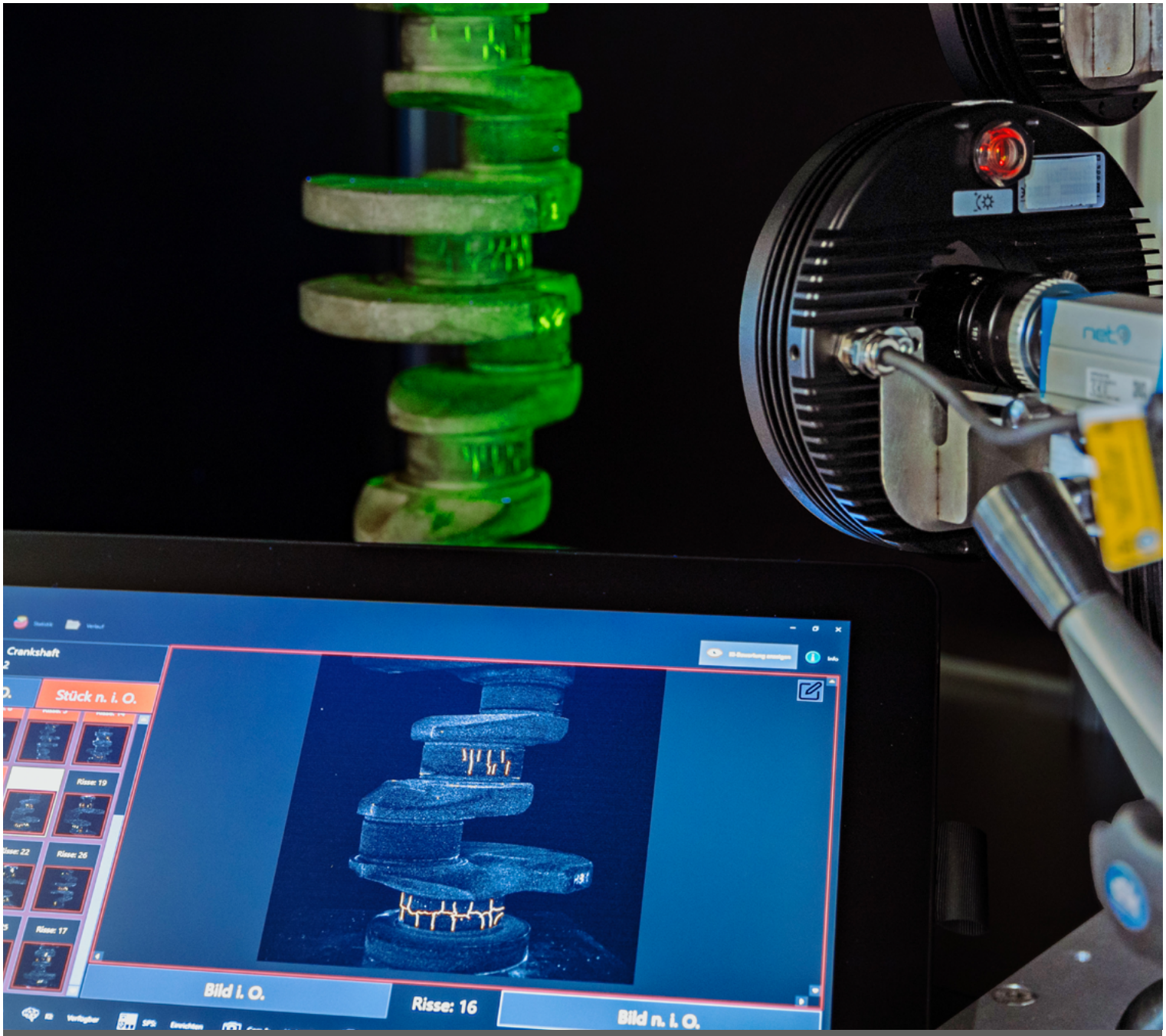


CRACKVIEW AI

Automated AI-based Detection of MT Indications

KARL DEUTSCH

CRACKVIEW AI
Automated AI-based Detection of MT Indications

CRACKVIEW AI enables automated detection of MT indications with the help of artificial intelligence

The CRACKVIEW AI system digitises magnetic particle testing. The surfaces of the test parts prepared with magnetic particle are photographed using industrial cameras. The images of the surfaces are then analysed by a neural network (artificial intelligence / AI) trained by KARL DEUTSCH. It carries out a semantic segmentation of the images and determines the shape, position and number of possible crack indications with the associated crack probability. Thus, the components can be sorted to OK / NOT OK without a human inspector having to view them. The system significantly reduces inspection costs and delivers consistent inspection quality 24/7, all year round. In addition, the individual test results of the components can be documented, archived and traced for the first time.

CRACKVIEW AI all-in-one solution

The CRACKVIEW AI test station is designed as a compact complete system for viewing. It can be used directly on the customer‘s premises during production. This allows customers to experience the system‘s capabilities for themselves. The image data required for training the neural network can be generated before the entire system is finalised.

CRACKVIEW AI test station with a test part on a rotary plate

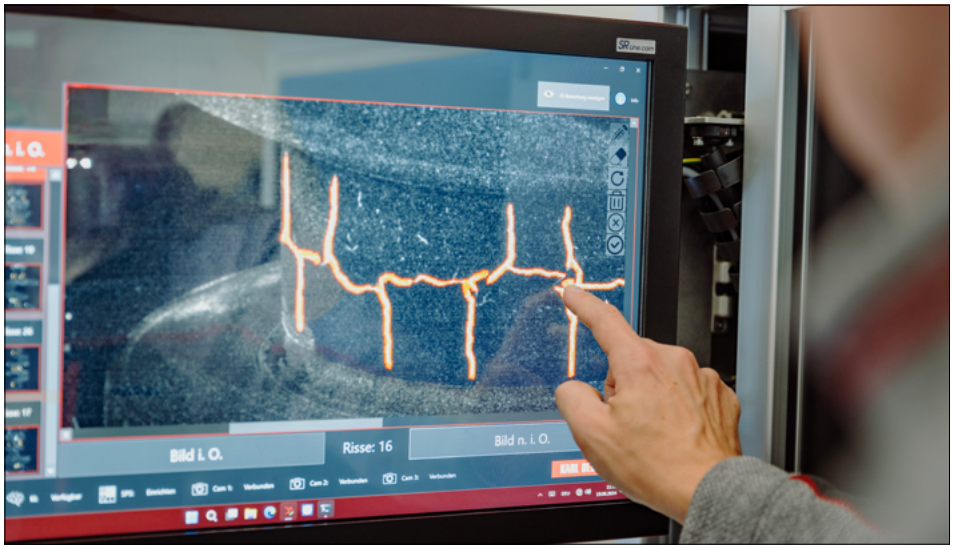
CRACKVIEW AI test station

- CRACKVIEW AI software
- High-performance industrial PC with NVIDIA GPU
- Flexible multi-camera setup with UV-illumination complying with ISO 3059
- Motorised rotary plate with component fixture
- Automated image acquisition by PLC control

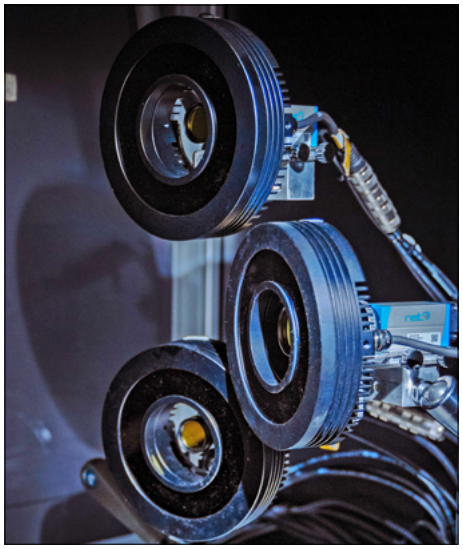
CRACKVIEW AI user interface

CRACKVIEW AI software

- Core of the CRACKVIEW AI system
- Interface between neural network, PLC and cameras
- Neural network for semantic segmentation
- 3 modes: Adjustment / Manual / Automatic
- Database for order/part-related test results
- Inspection statistics



Manual annotation of the training data


UV lamps with a camera system

Training of a neural network (AI) for crack detection

The neural network of an AI (artificial intelligence) emulates the way the human brain works and must be trained in the same way as the human brain. In the case of crack detection, this is done using images with crack indications. The images must be prepared for training by an annotation process. This means, that by manually tracing the crack contours, a pixel-precise mask is created for each image describing the shape and position of the crack.

During the training process, the neural network learns to recognise crack indications using the images and masks. The more cracks are presented to the network, the more reliable the subsequent crack detection will be. This usually requires several thousand images, however not all of which have to show a specific customer component. The CRACKVIEW AI software contains the necessary tools to annotate the image data directly during the inspection or afterwards.

CRACKVIEW AI implementation process

PHASE 0

In its Applications Laboratory, KARL DEUTSCH conducts an extensive feasibility study using typical customer components that show the entire range of relevant crack patterns.
The aim is to ensure early on that the AI-supported testing system CRACKVIEW AI can deliver the required quality standards consistently and reliably.

PHASE 1

From the start of the project, KARL DEUTSCH records additional high-resolution image data of the customer‘s components. Ideally, the customer provides as many cracked parts with representative crack indications as possible.
This data is the basis for the initial component-specific neural network of CRACKVIEW AI. The model is then trained thoroughly and prepared for initial commissioning.

PHASE 2

After commissioning, CRACKVIEW AI runs in parallel with an experienced tester. Each automatic evaluation is then compared to the human decision. Discrepancies as well as all components with crack indications are systematically tracked and used to make purposeful improvements to the model.
This “human-in-the-loop” approach helps to iteratively optimise the network until the desired performance level is met.

PHASE 3

After achieving the desired accuracy, CRACKVIEW AI takes over the decision making of the evaluation completely. The operators simply monitor the system parameters and conduct random sampling inspections.
As part of a maintenance contract, KARL DEUTSCH conducts regular system checks and – if necessary – further training cycles. CRACKVIEW AI is thus ensured to provide a consistently high level of evaulation quality over the long term and may be adapted to new component versions anytime.

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Hardware buttons for manual component evaluation

SIMATIC HMI touchscreen for controlling of the detection process

Complete system solution from KARL DEUTSCH

When introducing AI-based, automated crack detection, the inspection process must be considered as a whole. Image analysis by the neural network is only the last step. It is essential that the parts are prepared in accordance with ISO 9934-1 using inspection media optimised for camera viewing and that the parts are conveyed to the viewing station without any loss of crack display quality. KARL DEUTSCH is the ideal partner for a complete solution. We have more than 75 years of experience in the design and construction of inspection systems and also develop and produce in-house our own inspection media for magnetic particle inspection. The experts in our application laboratory will be happy to assist you with any questions you may have about automated, AI-based detection of MT indications.

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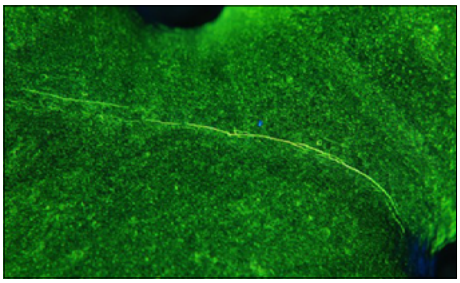
Example of a conventional DEUTROMAT magnetic particle inspection system with viewing booth



Indication of finest cracks with FLUXA testing agents

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