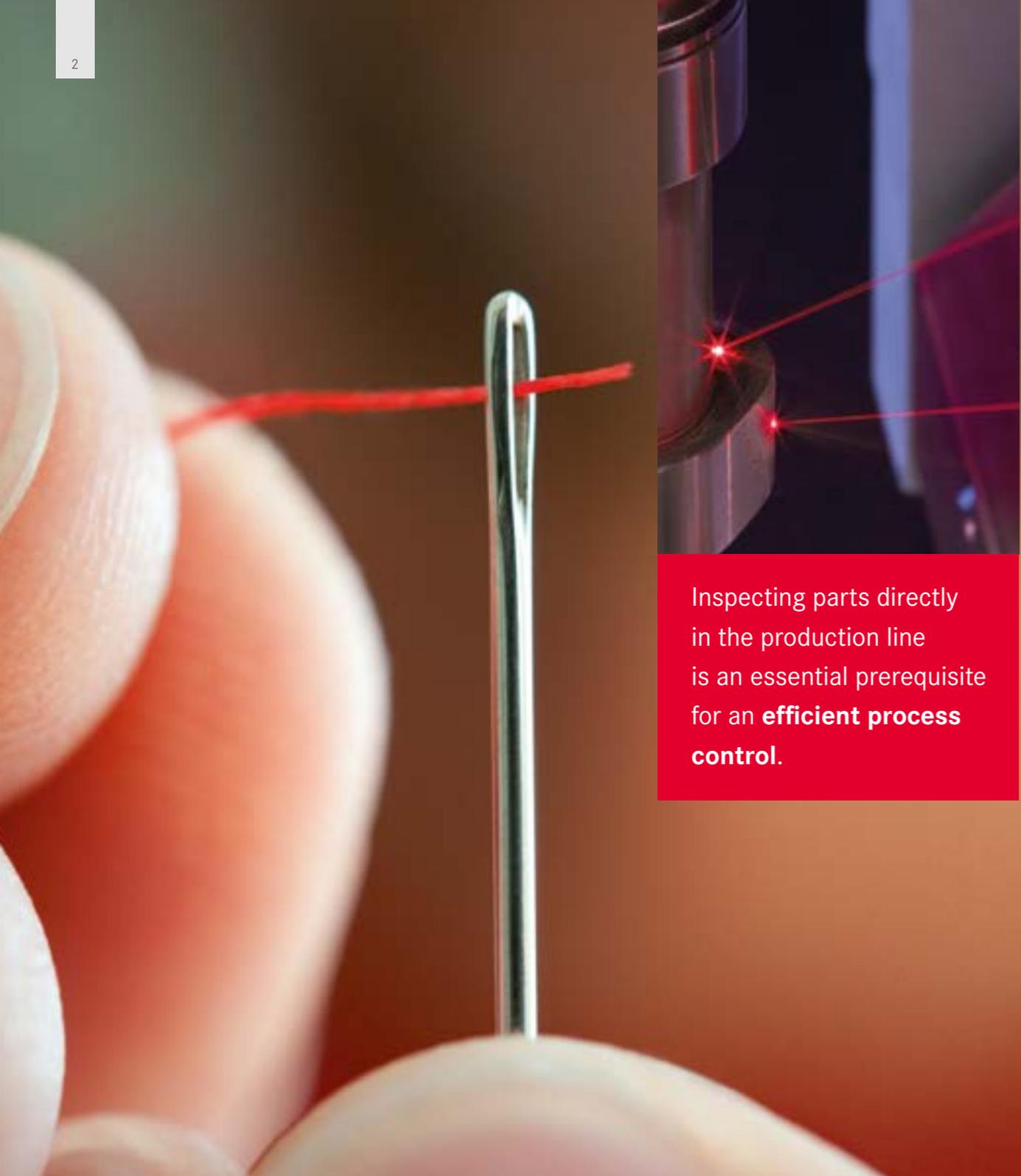


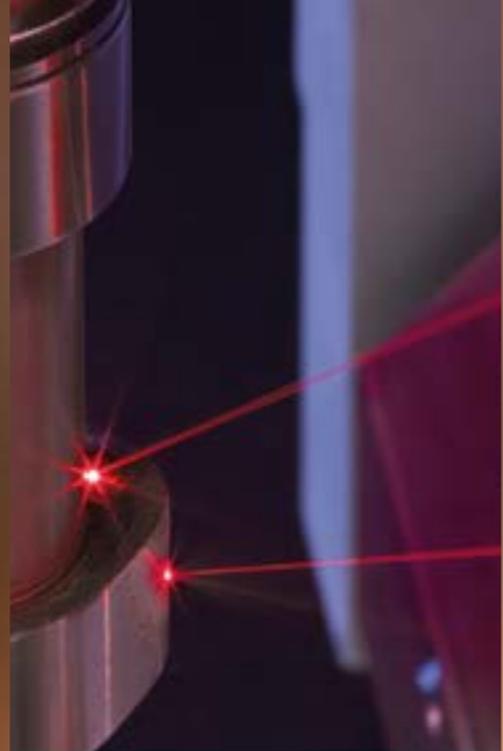


... a passion for precision.





Inspecting parts directly in the production line is an essential prerequisite for an **efficient process control**.



Efficiency

Inline inspection

Due to the progress made so far and the high pace of development, laser measurement already has had a revolutionary effect on the inline inspection of geometrical features. Flatness, straightness, cross section, thickness and width are typical inspection criteria which are being measured optically and therefore without contact within the flow of the production process – **this is the core competence of nokra.**

Our measurement devices inspect within the production cycle time, automatically and without skipping parts. Mixed combinations of different types of parts can be inspected without the need for changeover of the measurement device. The result is objective and traceable inspection data, compiled without the influence of an operator. The automatic feedback of the measurement results to the production process increases **productivity and profitability.**



nokra – an interdisciplinary team of physicists, mechanical engineers, electrical engineers, mathematicians, and computer scientists.



Team

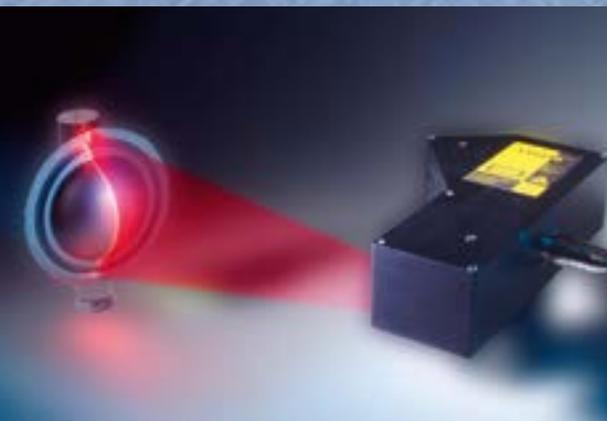
Optical inspection technology and automation

nokra Optische Prüftechnik und Automation GmbH was founded in 1991 as a spin-off from Fraunhofer Institute for Laser Technology (ILT) and Fraunhofer Institute for Production Technology (IPT) in Aachen. As a medium-sized technology company we develop, produce and distribute laser based measurement devices for automatic online inspection of geometric properties of products in the automotive, glass and metal industry. Products to be inspected are vehicle components, e.g. camshafts and crankshafts, axle supports, windscreens, as well as rolled products produced by the steel and aluminum industry.

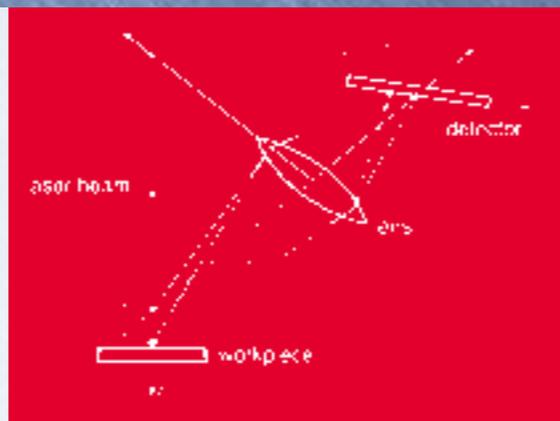
nokra has installed well over 250 inspection systems. Almost 2,500 laser sensors are used in these devices. The group of customers reaches from Germany and Europe to industrial locations in America and Asia. These customers are international automobile manufacturers, plant manufacturers, as well as glass manufacturers and steel and aluminum producers.



nokra's success is based on the know-how and experience of an interdisciplinary team of physicists, mechanical engineers, electrical engineers, mathematicians and computer scientists. Common to all of them is a continuous thirst for knowledge and a passion for technical challenges



The transfer of laser triangulation into new technologies and their application is an important **innovation**.



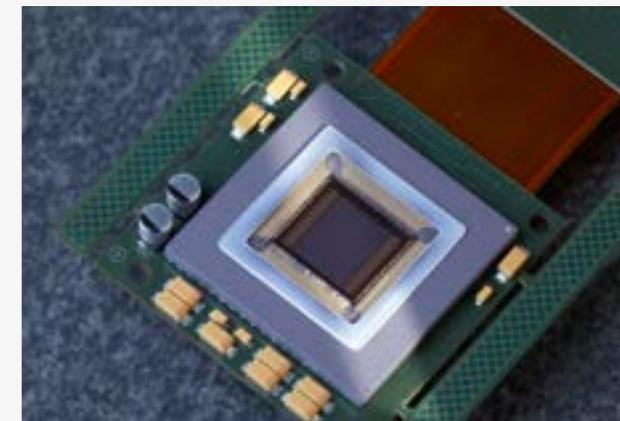
Precision

Triangulation

nokra was one of the first companies in Germany to successfully utilize the method of laser triangulation for inline inspection of geometrical features in an industrial context.

nokra sensors are characterized by a high measurement frequency, an exact synchronization of measurements, and a high adaptability with regard to the light scattering characteristics of the surface to be measured.

Laser triangulation provides contact free measurement of the distance between an object and a reference plane. Similar to a tactile probe, a laser triangulation sensor provides a one dimensional measurement result. The laser beam is directed onto the workpiece. The laser light is scattered at the point of irradiation. An objective, which is located in a defined angle to the direction of the laser beam, projects the spot of light onto a detector. The position of the imaged spot on the detector indicates the distance to the workpiece. By projecting a line instead of a single point of laser light onto the workpiece, the laser triangulation can be extended to provide two dimensional measurements.



At the end of the manufacturing process of a sensor, it is validated with regard to its technical characteristics. For this validation, nokra applies current standards, e.g. DIN 32877. The performance features of all sensors are documented and can easily be checked at any time.

nokra specializes in the measurement of distance, thickness, profile and contour using laser triangulation.

From planning to ...

High requirements

The requirements for our measurement devices are high: we strive to inspect 100% of the manufactured products within the production cycle time, without the need to take the products out of the flow of production. Contact free measurements are performed within a range of centimeters, therefore there is no need for changeover procedures to inspect different part geometries.

The precision of the measurement devices and the verification of traceability of the measurement results to national and international standards is a crucial competitive factor. Because of this, nokra has installed a temperature-controlled measuring laboratory within its production facilities. The highly accurate coordinate measurement equipment which is housed in this laboratory is the link between the laser measurement devices and sensors and the worldwide

established precision standards. But this is not the only difference between us and our competitors. We combine the know-how of all sciences represented in our interdisciplinary team, which is involved in the development process of our measurement devices from planning to implementation. The value added activities of our team are:

- development and manufacturing of the nokra laser sensors
- planning and installation of the electric equipment of the measurement devices
- development of software and algorithms for device control, device operation, analysis of laser measurement data, and visualization and storage of measurement results
- design, assembly, initial operation, and service of all device mechanics



“Our philosophy of continuous improvement forms the basis for high availability and low required maintenance effort of our products.”

– Sebastian Müller, Manager Production nokra –

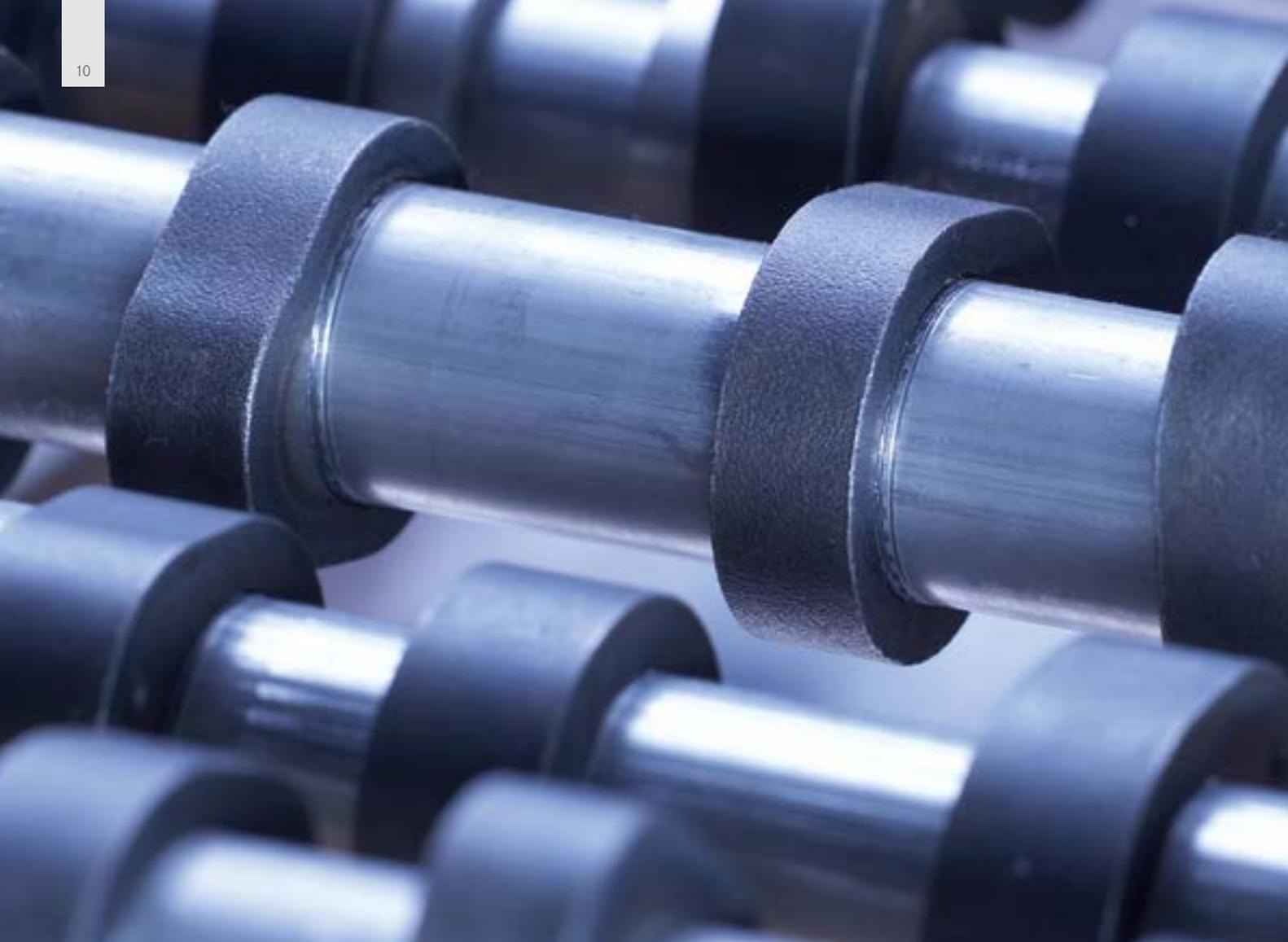
Low maintenance effort – high quality

nokra continuously improves its processes of manufacturing. The core competence is our own development of electronic components, mechanical design and software. This guarantees flexibility and optimized products to the benefit of our customers.

A network of qualified suppliers within the Aachen region is available to us for the manufacturing of mechanical components. Continuity and trust are characteristic for our business relationships. By using high quality components of internationally known suppliers and sound device construction we ensure the acknowledged high quality of our products.

Our quality management system, which is certified according to ISO 9001 since 1995, forms the basis of our development and manufacturing processes. Procedural instructions and operating instructions govern our processes. The effectiveness of our processes is audited in periodic reviews. Corrective action is taken when needed. The latest requirements comply with DIN EN ISO 9001 and OHSAS 18001.

... production



“We provide measuring technology which can inspect **the whole spectrum of shafts** within the production cycle time – without the need for changeover.”

– Günter Lauven, Managing Director nokra –



100% inspection of geometry

Modern energy efficient engines demand weight optimized components. Simultaneously, variety has increased. Camshafts for modern engines are assembled from a number of different unfinished parts, such as tubes, cams, end pieces, and toothed wheels. Some time ago, they were forged or molded as one piece. The assembled camshaft is turned and ground to achieve the final geometry.

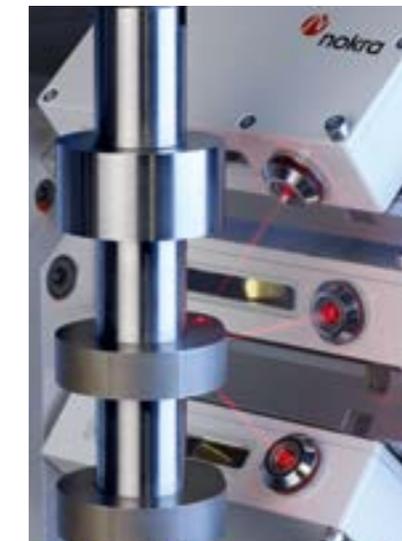
After each production step, a 100% inspection of the geometry is essential. Since an assembly line produces many different types of camshafts in small batch sizes, the inspection system has to be able to check the whole spectrum of parts within the production cycle time and without the need for changeover. nokra's high-performance software enables this flexibility.

In this context, contact free and fast laser measurement technology provides decisive advantages compared to conventional mechanical systems. To measure a camshaft, it is clamped between two cones and rotated. Several laser sensors are positioned on a slide which travels along the length of the shaft while it rotates. These sensors scan the geometric features of the shaft without contact. The measurement device is loaded automatically and unloaded by robots. A solid block of black granite forms the massive machine bed of the measuring device – a distinguishing mark of nokra measurement devices.

nokra geometry inspection of shafts means:

- greatest flexibility through intelligent design and high-performance algorithms
- no changeover for different product types
- integration into serial production
- higher measurement speed
- established at European market leaders

The process is also suitable for crank shafts, gear shafts and other axially symmetrical parts.



Flexibility

“Contact free flatness measurement – an innovative advantage today, the established standard within a few years.”

– Günter Lauven, Managing Director nokra –



Quality



Process control

A typical heavy plate, e.g. for large tubes, pipelines, truck-mounted cranes, ships, or platforms for wind power plants, usually covers several hundred square feet and weighs several tons. The most prevalent reason for complaints is a noncompliance to flatness requirements. By using an automatic contact free flatness measurement device, the flatness of each plate is checked within the production line.

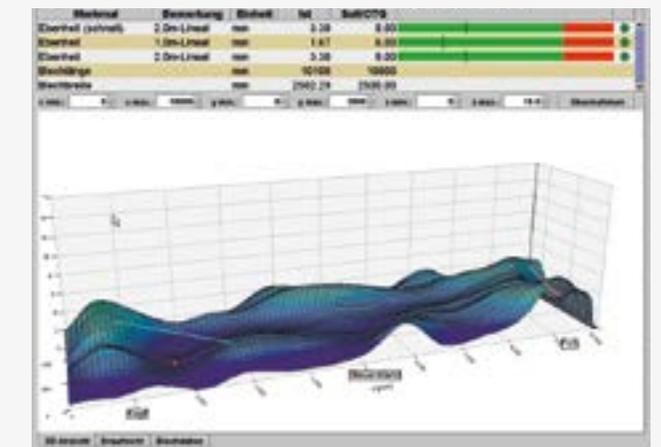
Online feedback in the process

A 3-D-visualization shows the measured flatness of the plate. After the plate has passed the measurement device, the result is immediately displayed at the operator station. Due to the feedback of the measured data into the process control, production faults can be avoided.

nokra's flatness measurement devices are equipped with an automatic adjustment and measurement system analysis feature (measurement system analysis according to DIN EN ISO 9001).

nokra flatness measurement devices provide:

- automatic 100% measurement and complete documentation
- automatic classification of flatness deviations
- optimization of upstream production processes
- measurement of hot and cold plates
- freedom from maintenance efforts
- insensitivity towards external light sources
- flexibility regarding different surface characteristics





“Clever ideas and unconventional solutions are **the key to success** in global competition.”

– Günter Lauven, Managing Director nokra –



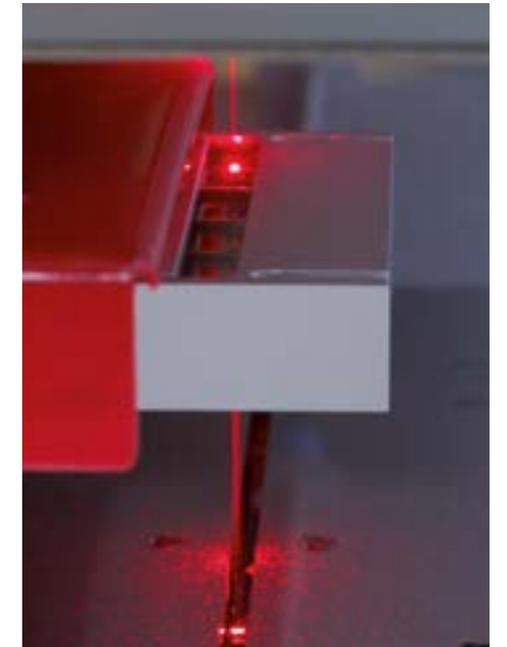
Innovation

Solution-oriented

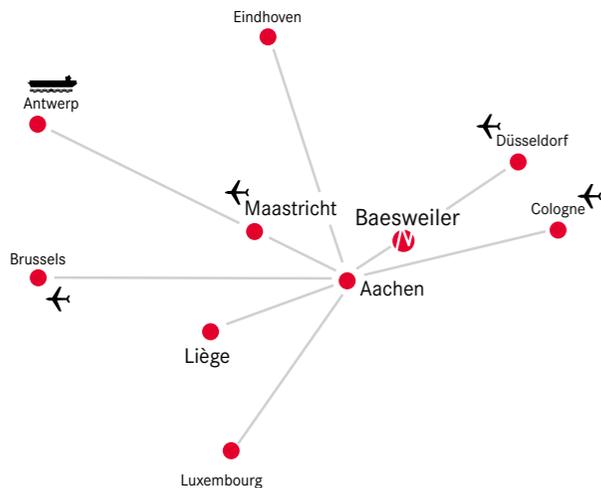
nokra has introduced a number of cutting-edge measurement devices into industrial practice. The current spectrum of measurement devices exceeds the focus points of shaft measurement and flatness measurement. Among others, measurement devices for position and presence of geometric features of welded vehicle parts, e.g. axle supports, have been implemented.

Highly accurate single-track or also multi-track thickness measurements of sheet metal and foam, glass measurement (windshields), and inspection of brake discs are as much part of our portfolio as special equipment, for instance the inspection of railroad tracks or pipeline tubes.

Confront us with demanding challenges. The combination of scientific and technical disciplines among our employees creates a high potential for new ideas and results in innovative and effective solutions.



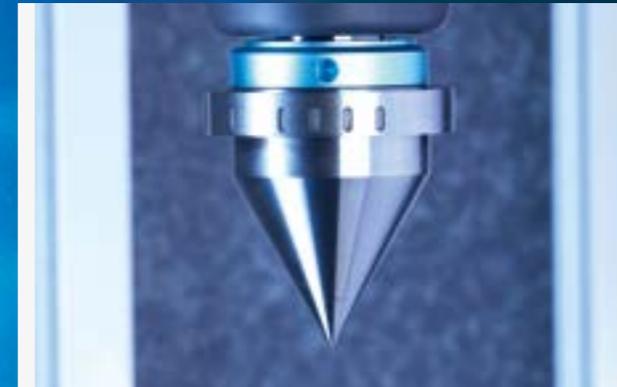
From research ...



Advantage of site

nokra's company headquarters and production facilities are situated at the extremely efficient location of Baesweiler within the economic region of Aachen. The site within the Euregio provides high future potentials as well as a central location within Europe. The important megalopolises Cologne, Düsseldorf, Ruhr district, Eindhoven, and Brussels are close by. Four international airports are conveniently situated within acceptable distance. The proximity of internationally acclaimed technical and scientific research and education institutes (Aachen University of Technology – winner of the excellence initiative of the German federal and state governments, Fraunhofer Institutes, Forschungszentrum Jülich ...) forms the basis for the successful further development of our products. We recruit our highly qualified personnel from these surroundings.

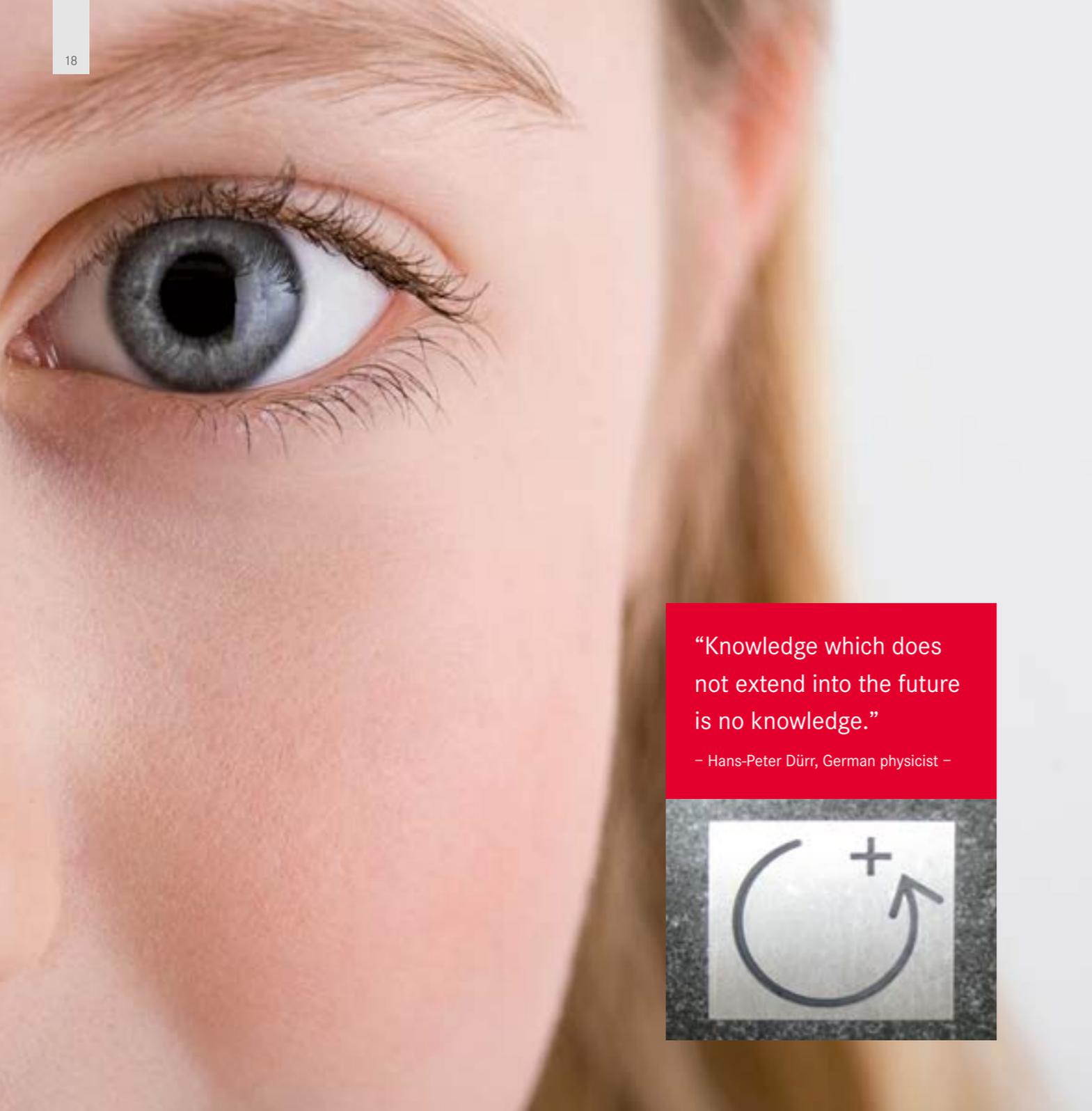
nokra has established itself internationally with locations of our measurement devices in Europe, America and Asia. Initial operation, customer training, and service are carried out by nokra employees worldwide.



“We can establish online connections to all our measurement and testing devices via remote access. **This means that we are always close by when the customer needs us.**”

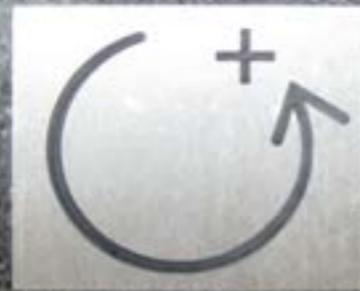
– Norbert Kotthoff, Head of Services nokra –

... to global-player



“Knowledge which does not extend into the future is no knowledge.”

– Hans-Peter Dürr, German physicist –

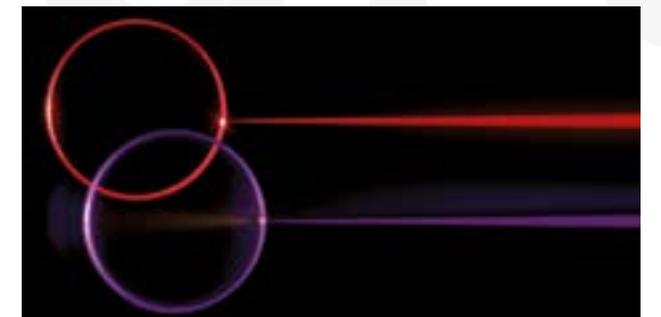


Future

New challenges

nokra's endeavor to provide lasting benefits to its customers by providing first-rate measurement devices extends into the future. Manufacturing processes are going to be improved and made more efficient. nokra is therefore investing in the continuous further development of its technologies and the expansion of capacities. nokra is involved in and committed to research projects and the continuing education of its staff – which is often initiated by the employees themselves. New challenges await us: The precise, non-contact laser thickness measurement systems are soon going to replace the established tactile and radiometric measurement devices. Blue lasers for improved precision of laser sensors, faster and higher resolution detectors for shorter measuring times, more efficient algorithms and evaluation processes for implementing more complex tasks in the product cycle nokra is going to follow new developments closely and use the most efficient achievements to serve its customers and their products.

nokra ... a passion for precision.





nokra

**Optische Prüftechnik
und Automation GmbH**

Max-Planck-Straße 12
52499 Baesweiler · Germany
Phone +49 (0) 2401/60 77-0
Fax +49 (0) 2401/60 77-11
www.nokra.de · info@nokra.de

nokra Inc. (USA)
423 South Eighth Court
Saint Charles, IL 60174
Fax +1 (630) 485-6133
info@nokra.us