

Blum-Novotest equips toolcraft with measuring systems

Amazing robot machining with measuring probes from BLUM

Measurement of polishing tools in robot cells

Industrial robots are versatile, however considerable experience is necessary in order to use them properly. toolcraft in Georgensgmünd develops and builds robot cells for a great variety of applications, from polishing to milling. Always on duty: measuring systems from Blum-Novotest for exact tool and work piece measurement with a robot arm.

In 1989, Bernd Krebs started his own company with nothing but a milling machine in a garage in Schwabach. He called it toolcraft and, with his new company, he quickly gained a reputation as an innovator and a reliable business partner in the area of contract manufacturing. There has always been an emphasis on innovation at toolcraft. In 2009, along with the new metal laser melting area came additive manufacturing, followed by the robotics area in 2015. In this area, toolcraft produces universally applicable robotics solutions – from hardware to software.

Today, toolcraft employs nearly 400 employees, 300 of which are in Georgensgmünd. The company plant includes approximately 60 five-axis machining centres, ten laser melting facilities and a whole series of robotic cells which manufacture and process parts in the automotive, medical technology, aerospace, semiconductor and motor sport areas for customers. Moreover, Bernd Krebs was early in recognising the potential of CAM software, which makes the offline programming of CNC machines possible, and he founded the company unicom in 1992. unicom still distributes the CAM software today.

The history of the robotics department at toolcraft starts with a customer from the automotive branch. A complex system was implemented for Audi which created a strong increase in demand, leading, in the end, to the foundation of the department. "We have a lot of personal experience with robots in addition to extensive know-how about the software side of things thanks to unicom," highlights department head Thomas Wieland. "We combine these aspects in order to develop customised solutions for the complex tasks of our customers."



A good example of these requirements is a production system which consists of five five-axis grinding machines and five robot cells. These are used to grind and polish all-ceramic backlit gear indicator clasps which can be found on the gear selection lever in the new luxury class BMWs. The components create a number of challenges during the process: For example, the flat clasp, which is curved in all directions, is hard to span and the ceramic is difficult to polish. Additionally, the illuminated areas are created by injecting light-coloured plastic into recesses in the black ceramic. During the polishing phase, the softer plastic cannot be washed out or too deeply worn down.

In toolcraft's cells, high-precision robot arms from Stäubli work together with a specially developed felt tool on a high-speed spindle. The clasps – of which there are eight varieties – are always spanned in pairs in a specially fitted vacuum with zero-point mounting and are processed one after the other. Because the felt gets worn out quickly despite the polishing paste sprayed before every use, and because it also sometimes separates from the support disc, toolcraft uses the Z-Nano tool setting probe from Blum-Novotest in the robot cells in order to check the thickness of the felt before each polishing – and thereby also the condition of the tool's surface. Once the felt has reached a certain wear limit, the robot takes a new felt from a depot.

The tolerances to be complied with are extremely narrow and fall within five-hundredths of a millimetre on the free-form surface. For this reason, the Z-Nano probe is also used in the grinding machines doing the grinding work beforehand in order to precisely measure the grinding pencils. "It was important for us to be able to do the grinding and polishing work without manual intervention – and we were able to achieve that," explains Thomas Wieland. "All of the machines – every five grinding machines and polishing robots – can be operated by one individual. This would not be possible without the tool setting probes from BLUM."

In the course of a current project, a block of extremely abrasive material is milled inside a giant machining cell which uses a robot arm. The material is so aggressive that the tracks and spindle bearings of a traditional machining centre would be destroyed within half a year. The advantage of robot arms is that, instead of linear axes, they have swivel joints which are easier to seal. Furthermore, the arm is wrapped in a protective cover and the arm's housing has been impinged with a slight overpressure in order to keep the abrasive dust from reaching the



interior of the robot arm. Over the course of the machining, the block's weight is reduced from 1,300 kg to just over 200 kg.

At the same time, the utmost precision is required during the machining. In order to check the more than 60 different tools which are used throughout the machining, a LC50-DIGILOG laser measuring system from BLUM has been installed in one corner of the working area. Before a change in tools takes place, the system is used to check for tool breakage and, at critical points of the machining, it is used to precisely measure a tool's individual cuts. "In order to be able to work precisely using a robot arm, I need exact information about the position of the tool and its length. The Blum laser was able to reliably provide this," explains Thomas Wieland. "We use the new LC50-DIGILOG laser measuring system. This system is perfectly suited for the harsh environment as it closes the laser optics openings during the machining so that no dust can get inside." The air purge system of the LC50-DIGILOG, which keeps the laser's view channels free from dust during measuring, creates an 'explosion effect' when the aperture is opened, blowing the aperture opening free with a sudden burst. In this way, reliable measurements can be secured even in very dirty environments.

Another challenge is that the block of material needs to be removed from the robot cell between two processing steps and then re-spanned. In order to continue work, the work piece must be re-calibrated. To do this, the robot cell uses the modular touch probe TC63-10, which is attached to the tip of the robot like a tool and transfers its data to the machine via BRC radio technology.

"The TR63 is perfectly suited for our requirements. It is lean and can be flexibly adjusted for different measurement tasks," reports Thomas Wieland. "The pulling and pressing measurements are also important in order to quickly and reliably collect all of the relevant measurements of a work piece. The time required for the measurement itself is not important because this processing technique could not be put to use at all without first calibrating the work piece in the cell." However, this does not mean that it takes a long time. In Georgensgmünd, we start measuring the measuring points using the TC63-10 on the robot arm at 10 metres per minute in order to then complete the actual measuring at a somewhat slower speed.



toolcraft has not yet been able to gather much experience with the service from BLUM as it has not yet been necessary other than for the initial operation implementation. The touch probes and laser measuring systems have been working completely reliably and inconspicuously for many years. "This deserves high praise when you consider that almost all of our 60 five-axis machining centres have been fitted with a BLUM laser measuring system and each new processing centre receives a probe. And let's not forget the tool setting probes in the grinding and polishing machines," Thomas Wieland reflects positively. "toolcraft has an excellent reputation with customers and this is based on our innovation and quality standards. The BLUM measuring systems are a big part of this because they are flexible while also reliable and exact in their work – just like us."

Contact details Blum-Novotest GmbH:

Tel: 0751/6008-0
Fax: 0751/6008-156
E-Mail: marketing@blum-novotest.com
Internet: www.blum-novotest.com

Box 1: Z-Nano

With the Z-Nano tool setting probe, BLUM has created a robust yet reliable and precise measuring device. The measuring surface, which is put into operation during measurements, is equipped with a ball-bearing-mounted linear guidance. This provides for precise operation without transverse forces affecting the tool, while remaining wear-free and stable in the long run. Equally wear-free is the optical signal generation with a miniature light barrier which allows for high measurement speeds and accuracy. Depending on the model, the Z-Nano transfers the data via cable, infrared signals or radio signals, the latter two of which allow it to be flexibly positioned and started up.

Box 2: TC63-10

The switch signal in the TC63-10 touch probe is generated visually, making it wear-free and providing many years of consistent measurement accuracy. Another advantage of the TC63-10 is its modularity, meaning it can be ordered with various probe tips and extensions. In its robot



cells, toolcraft uses a probe tip with two ruby balls, of which one is placed at the front end of the tip and the other a bit behind the tip on a side extension. Together with the highly precise, 72-toothed shark360 measuring mechanism, the arrangement of the measurement balls allows for, among other things, pulling and pressing measurements which are useful for ridges and grooves. In addition, the touch probe can be extended with carbon-fibre connectors, so that the measurement points in inaccessible areas of the work piece, indentations and holes can be reached.

Image material



Gear selector lever with ceramic clasp





Ceramic clasp before and after polishing



Image 1: Five Staubli robots polish ceramic clasps for gearshift levers. Precision machining is guaranteed through tool length measurement with the BLUM Z-Nano tool setting probe.

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Image 2: The felt tool wears quickly and the Z-Nano tool setting probe therefore measures the current tool length prior to each polishing cycle.



Image 3: Department Manager Thomas Wieland and BLUM sales representative Stephan Otto have been working closely together for many years to solve complex machining tasks with metrology.

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Image 4: Milling precision with the robot arm depends decisively on regular tool measurements using the BLUM laser measuring system.



Image 5: The new laser measuring system LC50-DIGILOG from BLUM is optimally suited for harsh, dusty environments.

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Image 6: Automated measurement in the robot cell - only in this way is it possible to ensure unmanned quality around the clock in the original setup.

