

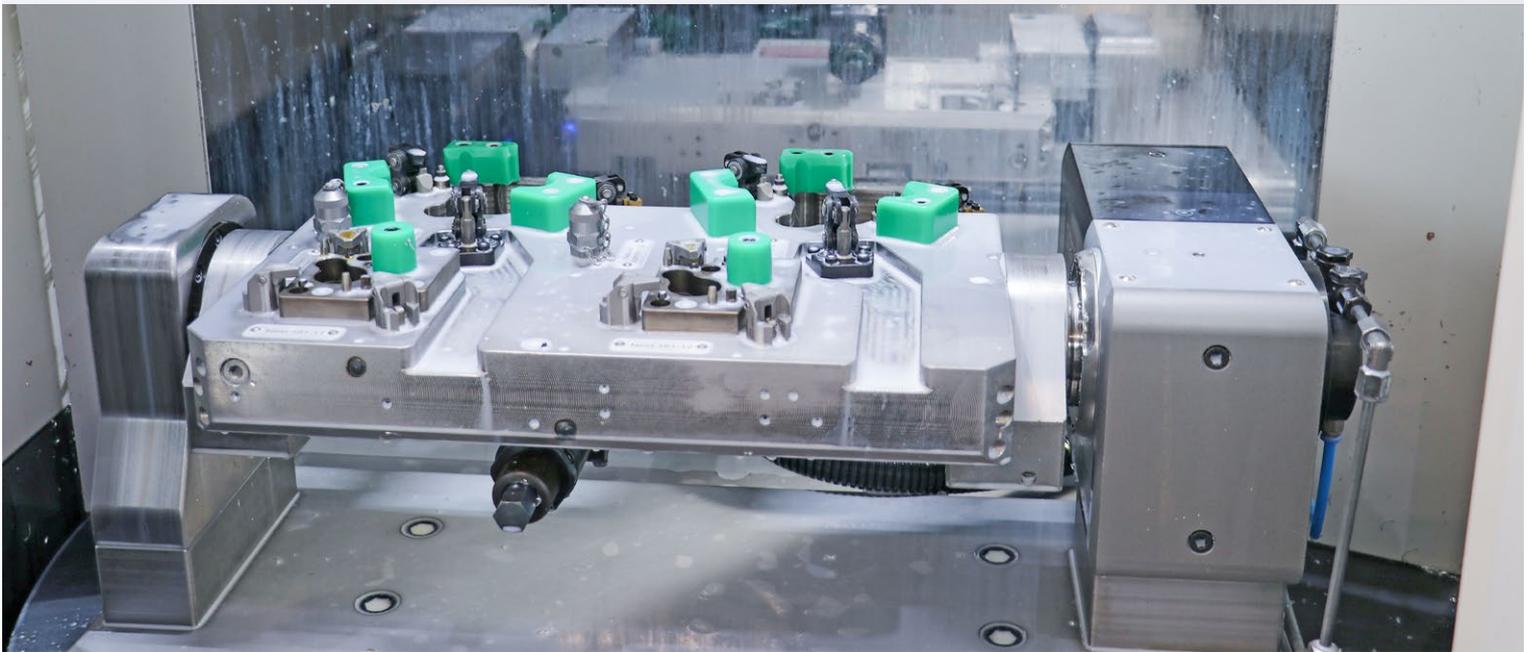
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Swiss Rotary Table Technology

## NEWSLETTER

# Globally competitive

EA-507



### Milling machine with loading table and fourth axis ensures high precision, quality and economy

The machine concept used by a global machining service provider to machine transmission components for e-bikes is particularly economical over the long term. The basis: a three-axis Hyundai WIA i-CUT 400TD. The addition: a CNC rotary table from pL LEHMANN with an custom clamping device.

«As a service provider for any machining tasks, we have to be maximally flexible in order to hold our own against international competitors,» says Felix Mull, Managing Director of Andreas Mull Werkzeugbau und Zerspanungstechnik GmbH, describing the most important challenge for his company. «That is why we have positioned ourselves in such a way that we can take on almost any order, from prototypes to large-scale pro-



EA-507 rotary table from pL LEHMANN. (Image: pL LEHMANN)

duction with unit numbers in the millions. And we always deliver the required quality at the best prices.»

The Mull company in Bockenem, which has its origins in toolmaking and one-off production, has grown steadily. When small batches and medium-sized orders were joined by requests from the automotive industry to machine aluminum and magnesium die castings in large batches, Felix Mull did not hesitate. «We have proven several times in recent years that we can also master such tasks. However, volume production requires different processes, so we formed a separate company for this purpose.» AM CNC-Präzisionstechnik GmbH, with 16 employees, is located in a separate hall on the same company premises as its larger sister Mull Werkzeugbau und Zerspanungstechnik with its approximately 40 employees.

Mull serves customers from a wide range of industries – automotive and aerospace, electromobility, chassis and metrology, and general machinery construction. The core competence is the machining of steel and aluminum materials, magnesium, titanium and plastics. «We also support our customers in development tasks and have experience in fixture construction and automation», adds Felix Mull. At the same time, he points to the qualified workforce and the modern, diverse CNC machinery, which is equipped with 5-axis machining centers, horizontal machines with loading tables and turning centers from a wide range of manufacturers, in many cases automated. This is the basis of his successful business model, says the trained mechanical engineer and master craftsman. «If no suitable machine capacity is available for an interesting order, we invest accordingly for the required products.»



The compact Hyundai WIA i-CUT 400TD drilling-milling center is ideally suited for e-bike transmission and housing parts. The supplementary EA-507 pL rotary table is controlled directly via the CNC as the fourth axis.

## Even the choice of machine determines later success

This is what happened for an order comprising various housing and transmission parts for an e-bike motor. In addition to various 3-axis parts to be machined on one side, the main challenge was an uncoated magnesium component that had to be machined on the front and rear sides – something Felix Mull was keen to do in a single operation.



View of the work area where four components can be finished while the other half of the loading table is used for setup.  
(all images: pL LEHMANN)

The production team thought through various concepts: multi-axis machines, two-spindle machines, single-spindle machines, etc. Being able to perform setup in parallel with machining was a basic requirement, and further automation should be possible in any case. «When we buy machines for a specific job», explains the company boss, «the solution has to be an exact fit in terms of performance, but also in terms of space requirements and energy consumption. In addition, availability is a knockout criterion. We can't wait six months or more for installation.»

The best offer for the production of the housing and gear-box parts was received from ARO-tec in Bielefeld. Sebastian Lebioda, Managing Director, and Oliver Stabenow, Sales Manager, submitted it at EMO 2019: «We were able to offer Mull four Hyundai WIA i-CUT 400TD machines at a very good price and deliver them immediately.» The South Korean company Hyundai WIA has been the market leader for machine tools in its own country since 2000 and, as a relatively small cog, is integrated into a huge group that operates as a global player in a wide variety of industries: as a steel producer, in shipbuilding, heavy machinery and plant engineering, as a logistics company and much more.

### Concentrated power in a small space

The compact Hyundai WIA i-CUT 400TD vertical drilling-milling centers are equipped with a loading table that offers a clamping surface of 650 × 400 mm each. The other machine data (direct-drive spindle with BBT30 interface and a maximum speed of

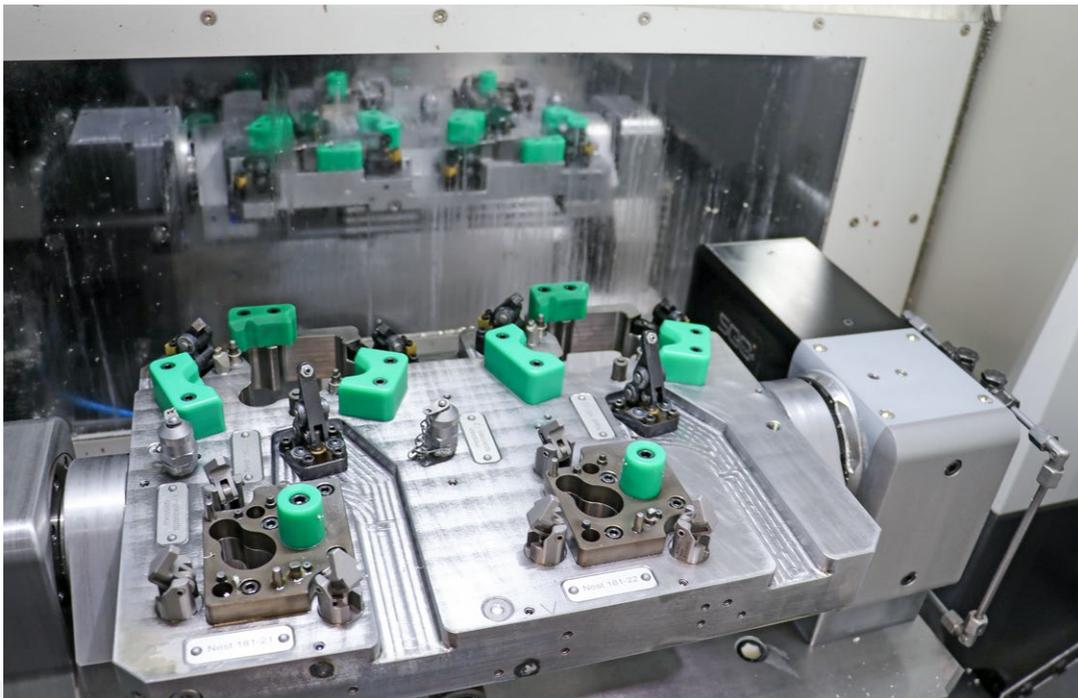
12,000 rpm, chip-to-chip time of 1.72 sec, rapid traverse rates of up to 5 6m/min) also suited the maximum 300 mm die cast parts, according to Felix Mull.

In order to machine the components that needed to be machined on both sides in one operation, he considered adding an additional rotary table solution to one of the four Hyundai WIA i-CUT 400TD machines. At EMO 2019, he had even looked around in this regard and discovered a favorite: the renowned manufacturer pL LEHMANN from the Swiss town of Bärau. «The family-owned company offers compact, powerful equipment at an affordable price», decided Mull. «I received very friendly and competent advice – and was assured that I could get any rotary table within a few days.»

With this information, Mull started talks with the ARO-tec representatives, who were already familiar with pL LEHMANN from previous projects. Sebastian Lebioda explains: «We see ourselves as a solution provider that not only sells Hyundai machines, but also puts together complete packages for production, right through to full automation. We therefore maintain good contacts with the leading suppliers of complementary components.»

### Swiss quality and precision

Further planning took place in a team of three. The rotary table specialist from pL LEHMANN (represented in Germany by pL SOLUTIONS Deutschland – operated by IVO OESTERLE NC-



The pL LEHMANN EA-507 rotary table (on the right in the image) swivels the clamping device developed by Mull with its four nests. Unfortunately, the components may not be shown.

CNC Technik Vertriebs GmbH) suggested the «Light» EA-507 variant, since the load is relatively low, so that the clamping values of 300 Nm are perfectly adequate. The other performance data (speed up to 66.7 rpm, feed torque up to 80 Nm, cycle time for 180° as quick as 0.53 sec.) also convinced Felix Mull.

He agreed and took on another part himself: «In order to be able to arrange the components optimally, we only bought the basic pL table, then designed and built the clamping device and the counter bearing ourselves.» He has high praise for pL LEHMANN: «A great business partner. Because although the company itself has a huge range of complementary components in its program and would be happy to sell them, I was provided with the necessary design data without discussion.»

The clamping yoke designed by Mull can accommodate a total of four components, two of which are machined on one side and two on both sides. Machining of the rear side takes place after a 180-degree rotation of the pL axis via openings milled in the fixture.

## Cooperation among equals

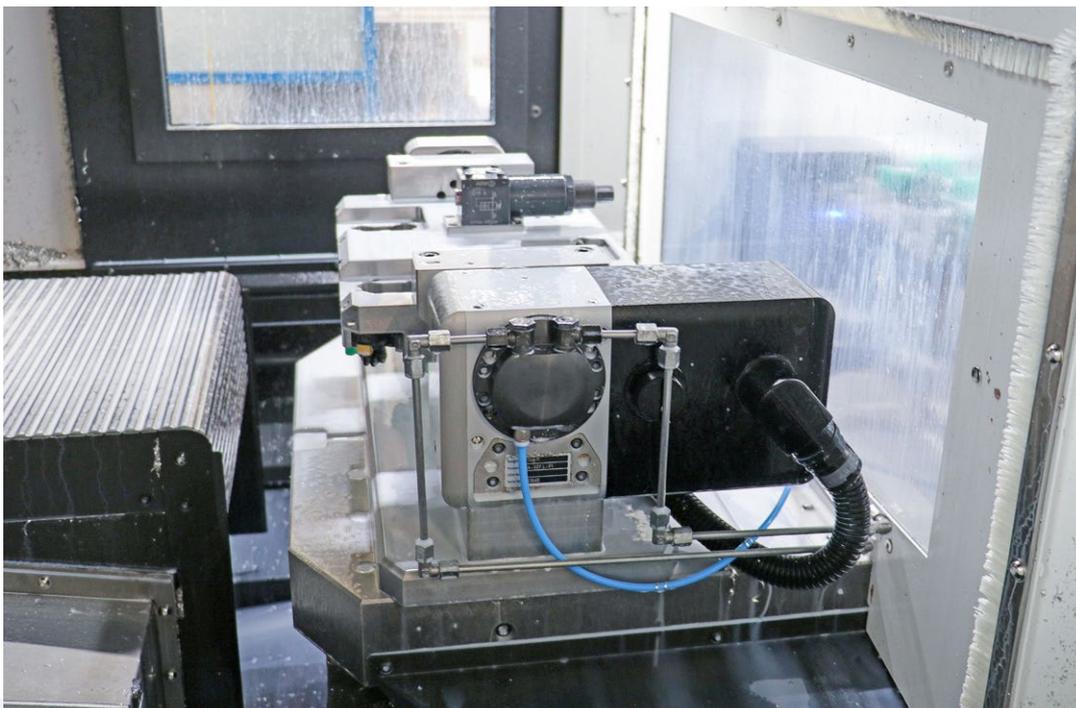
The preparation and commissioning were teamwork at its best. First, ARO-Tec developed a rotary feed-through concept to supply the two work tables and the additional axes on them with data, power and hydraulic lines. Mull's desired air sensor technology for checking the clamping was also taken into account. Felix Mull praises: «ARO-tec has done a very good job here and developed a solution that accommodates the arm-



A rotary union concept was developed to supply the two work tables and the additional axes on them with data, power and hydraulic lines.

thick bundle and guides cables and wires through the table to the required connections. For hydraulic clamping of the components, the lines were also routed through the rotary union of the Lehmann table, which is a super option.»

Control of the rotary table and the safety sensors via the Fanuc CNC still posed a sticking point, because the fourth and fifth axes (one on each of the two worktables) were not initially prepared for the Hyundai WIA i-CUT 400TD. Felix Mull worked closely with its suppliers on this as well. With input from the rotary table manufacturer pL LEHMANN, ARO-tec was able to adapt the PLC on site so that the axis, including the clamping device and sensors, is now fully integrated into the machine control system.



For hydraulic clamping of the components, the lines were routed through the rotary union of the Lehmann table.



Mull invested in a total of four Hyundai WIA i-CUT 400TD drilling-milling centers for the job. One of them is equipped with the EA-507 pL rotary table for demanding machining operations.

## pL rotary table helps save energy

Mull is extremely satisfied with his manufacturing solution: «ARO-tec and pL LEHMANN have proven to be reliable partners with whom we can work as equals. The machine, CNC and rotary table work together perfectly and achieve the precision we need, for example position tolerances of 0.05 mm on average.» The entire system has been running flawlessly for more than a year, the Managing Director adds, and according to his calculations, the expected durability has also been achieved. Space requirements are minimal and power consumption is low, he said. The pL rotary table also plays a large part in this, as it requires significantly less energy than a large, fixed table axis. «Our next step will be automation with an upstream robotic cell,» says Felix Mull, revealing his plans. «Then the manufacturing system will become even more economically attractive.»

## Service from prototype to volume production

Andreas Mull founded his eponymous company in 1987 and initially manufactured one-off parts and prototypes on just one CNC milling machine. Over time, the company grew. Production was expanded to include fixture and tool making and volume production. Today, the group of companies led by the founder's son Felix Mull consists of Andreas Mull Werkzeugbau und Zerspanungstechnik GmbH and AM CNC-Präzisionstechnik GmbH, which exclusively undertakes high-volume projects for the automotive industry. Both companies are certified to the ISO 9001:2015 quality management system.

## CNC rotary tables with Swiss quality

Founded in 1960 strictly as a contract manufacturer, pL LEHMANN has been developing and producing CNC rotary tables for over 40 years. With innovations and Swiss quality, the family-owned company in the Swiss town of Bärau (Emmental) succeeded in opening up new opportunities for its customers and developing lean machining solutions characterized by high productivity through use of additional NC axes. One of the highlights of the company's history is the powerful and flexible Series 500 – developed in 2009 – which is ideal for the most demanding tasks thanks to its modular design. With the backlash-free, preloaded PGD gear unit – developed in 2014 – pL LEHMANN reached another milestone. In 2017, the company introduced, among other things, the new pL iBox generation, making their rotary tables ready for Industry 4.0 and digital production. This was followed in 2019 by introduction of the Series 900 DD (Direct Drive) rotary tables with speeds of up to 5,450 rpm. As an additional new product, the AM-LOCK system, a special zero-point clamping system for 3-D printing, including preprocessing and postprocessing, was presented for the first time in 2019.

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