

HIGH IMPACT CUSTOMIZED SOLUTIONS

Interconnected engineering service increases productivity and creates tangible added value



The linear axis can be positioned exactly using an AKD & AKM one-cable package (incl. control unit).

MEquadrat AG is a start-up that has been providing highly specialized solutions for four years as a mechatronics service provider, particularly in the laboratory and medical areas. Interdisciplinary thinking plays a fundamental role in this company's product development activities. Original ideas related to implementation, efficient development and customized support also characterize the collaboration they had with drive specialist Kollmorgen on their new production module for the medical sector. Kollmorgens backlash-free direct drive solution allows exact synchronicity and concentricity with maximum precision up to 2 μm , and is more cost-effective.

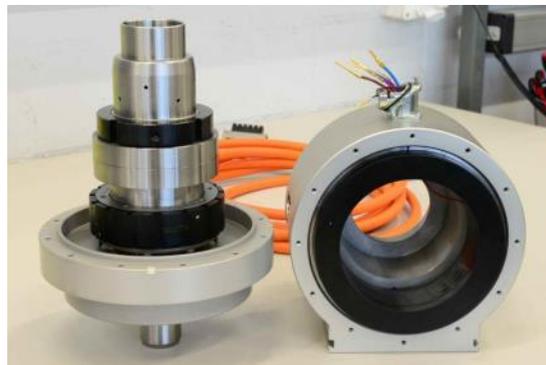
One of the founding concepts of the service company MEquadrat AG, situated in the municipality of Root in Lucerne, is networked thinking and the creation of new machines and systems that meet its customers' needs through consistency in the software used, the sophisticated mechanical and electronic components, and the associated increase in the degree of automation. One thing is clear for Stefan Nyffenegger, a member of the executive management team at MEquadrat AG: "The interlock between the mechanics, electronics, and software is the key to innovative products and higher productivity. We also break new ground with our unconven-

tional approach, as can be seen with the current project for a machine module that is designed for processing thin-walled material in the medical sector”.

A difficult objective: Precise clamping despite high levels of rotation

The two-sided and torsion-free clamping of highly sensitive glass and aluminum tubes is a particular challenge for the production module developed and constructed in Root. The product diameter ranges from between around one millimeter to 20 mm, with very thin wall thicknesses of around one-tenth of a millimeter. Cutting and joining processes are carried out on the sensitive hollow rod material. The high speed for the material clamped on both sides in the process requires absolute precision in terms of the synchronicity.

Developing the overall module in such a compact manner in accordance with the customer's strict specifications required a highly meticulous and extremely precise drive system for the spindles in the workpiece feeder mechanism and for the relevant process steps with the clamped product. Stefan Nyffenegger highlights: “With the KBM kit motor solution from Kollmorgen we have found the perfect solution for our needs, as the product can be guided through the drive in a fluid process thanks to the large hollow shaft.”



Detailed view of Kollmorgens KBM Kit Motor. The delicate product can be guided through the drive in a fluid process as a result of the large hollow shaft. Absolute precise synchronization up to 2 μm is central to this.

Collaboration on an equal footing for unconventional solutions

The engineers at MEquadrat already had the idea of selecting a direct drive as they were designing the drive system. Their intention was to use an existing modular design in order to meet the precision requirements and to guarantee implementation on a time and cost-efficient basis.

But it became apparent that a rotor and a stator with the full functionality of a servo drive should be used as a result of the compact packing density and complexity of this assembly. In the end, the company decided the best solution was from Kollmorgen. The experts at the drive manufacturer were ready for any special requests. Decisions at the implementation stage for this project were made very quickly, as the experts from both companies collaborated with each other on an equal footing. The synchronicity however remained a problem. But a few ideas were developed for this and the product selection was narrowed down during some initial telephone discussions. The Key Account Manager at Kollmorgen, Martin Zimmermann, and his colleagues provided their full support: “When MEquadrat only requested the rotor and the stator for the feeder unit in this project, we knew that a mechatronics engineer would need to focus on the motor in greater detail. You have to have confidence when trying new things like in this project, which requires mutual and absolute trust”.



Stefan Nyffenegger and Martin Zimmermann in front of the machine module.

Nyffenegger emphasizes: *“With the KBM kit motor solution from Kollmorgen we have found the perfect solution for us, and the overall drive concept really was customized to our needs.”*

Zimmermann: *“The team from MEquadrat knew exactly what they wanted. We were able to make concrete proposals based on their input in order to get there. This allowed us to develop the best solution together.”*

Aside from the time pressure and the extreme requirements related to precision in the functional specifications, there was another additional crucial challenge related to the medical technology: “The drive solution must be free from abrasion and lubricant, and we weren’t able to carry out any experiments at the implementation and commissioning stages for the mechanics and software”, says Nyffenegger. All of the components provided in this machine module therefore had to be tested and shown to be absolutely reliable.

The interaction of the direct drive with [AKD Drives](#) and the controllers from National Instruments (NI) enables extremely precise positioning. The cycle times in the current regulator are around 670 ns, and are just 62.5 µs in the speed regulator. Nyffenegger stresses: “This allows us to achieve optimum synchronicity in line with these high dynamic requirements. As such this drive combination represents the optimum price-performance ratio.”

Precise positioning with plug-and-play solutions

The crucial thing here that the two synchronized axes achieve extremely precise concentricity of 2 µm. Nyffenegger adds: “We’re talking about accuracy ranges that are otherwise only seen in spindle axes in large production plants.” The high speed was another of the major challenges in this project. There are systems on the market that “can indeed clamp sensitive products such as these at the required level of accuracy, but they often lose their clamping force from 500 rotations per minute. I haven’t seen any comparable product on the market that maintains its full clamping force at 3000 rpm!” highlights Nyffenegger.

The “AKM” drive with single-cable solution and SFD feedback were selected for the linear axis in the machine design. The components now just needed to be put together and everything fitted perfectly.

The resolver method as a single-cable solution is one of the drive expert’s specialties aimed at making optimum use of the robustness of the resolver. Nyffenegger stresses: “The wiring required in the AKM motor is al-

so minimal here as a result. Highly compact cable carriers can also be used which really are sensational for tight spaces.”



The linear axis can be positioned exactly using an AKD & AKM one-cable package (incl. control unit). The KBM Kit motor which is responsible for synchronization of the tubes fed through sits on top of this.



The direct drive permits extremely precise positioning. The cycle time for the current regulator is 670 ns, while for the speed regulator it is 62.5 μ s.

Summary: Achieving the objective using collaboration based on trust

The AKD one-cable package (controller & servo motor) is used for the components in the linear drive for the feeder mechanism. The major benefit with this is that the system comes from one source. Nyffenegger emphasizes: “This way I don’t need to worry about any screw fittings or pins that do not fit. We just had to plug it in and get started, which also made the implementation time very short.” Integration of the precise drive technology in the precise mechanics was therefore the central element in the very close and focused collaboration for this project. Keeping an eye on the costs – despite the required level of speed accuracy, the bearing and form tolerances for the mechanics and the fact that everything fits right from the word go, required a lot of mutual trust for both sides. Martin Zimmermann adds: “Our specific part in the project related in particular to our comprehensive recommendation as to how the customer can achieve its objective in an optimized and most cost-effective manner.”

One thing is clear for Stefan Nyffenegger: “We were also able to discuss ideas directly with the Kollmorgen product developers, and put forward our requests related to the shaft and hub connections. Sitting down at a table and discussing in order to find solutions, or discussing the design details on the phone, provided us with the assurance that everything would work correctly with the drive, and that we would be able to get things right the first time on this project.” The design phase alone for the machine took just three months, which is extremely efficient. “The Kollmorgen part such as the installation of the axes and connection of the motor with full configuration and testing was completed within two days. This drive concept which was really customized to our needs worked out brilliantly for us. It fulfilled its objective, worked straight away, and met all of the requirements that we set ourselves for our customer.”



The AKD servo amplifiers are fast, flexible, are suitable for a wide range of functions with Ethernet-based communication, and can therefore be integrated quickly and easily into any application.

Benefits of Use:

- *High flexibility of the coordinated components*
- *Integrated hollow shaft for special application predestines integration of a clamping system which maintains its clamping force even at 3000 rpm*
- *Direct drive without any play or redundant mechanical parts allows exact synchronization and concentricity with the utmost precision up to 2 μm and is thereby hard-wearing*
- *EtherCAT on board for simple implementation and integration (hardware and software) – also in LabVIEW*
- *Excellent, comprehensive support from Kollmorgen from design through execution to commissioning*
- *Easy conversion to different diameters*
- *High process stability when increasing the degree of automation, achieving higher productivity*

Products used: The following Kollmorgen motors (with a 1-cable system) and drives are used in the project:

AKM standard synchronous servo motors with permanent magnets. The powerful synchronous servo motors from the AKM series, which includes more than 500,000 standard models, are available in different fastening, connection, speed, and feedback versions and with lots of additional options.

KBM frameless kit motors (modified by the customer in order to fit into the module). KBM frameless kit motors for rotary direct drive applications. The wide selection of frameless fit motors in the KBM series is the latest direct drive technology. They meet all of the requirements from machine constructors in terms of flexibility, power density, dynamics, lifespan, and simple installation.

AKD & AKM one-cable package for easy integration. AKD servo controllers and AKM servo motors can be used in any application and are particularly cost-efficient one-cable solutions. The AKD servo amplifiers are fast, flexible, are suitable for a wide range of functions with Ethernet-based communication, and can therefore be integrated quickly and easily into any application. AKD enables plug-and-play commissioning and interfaces with all parts of the machine without barriers.

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About Kollmorgen

Kollmorgen is a leading supplier of integrated automation and driver systems, as well as related components, aimed at machine manufacturers all over the world. With over 70 years of experience in Motion Control Design and application, as well as its extensive knowledge in the areas of production standards and bespoke solutions, Kollmorgen provides prominent solutions in terms of performance, quality, reliability and ease of use. As a result, our clients gain indisputable leverage in the market. www.kollmorgen.com/uk - think@kollmorgen.com