

# Renishaw and RLS help to drive a robot revolution



**Customer:**  
TQ-RoboDrive (Germany)

**Industry:**  
Electronics

**Challenge:**  
TQ-RoboDrive required a custom precision encoder solution to meet the demands of a new class of miniature motors.

**Solution:**  
An absolute rotary magnetic encoder solution designed with a custom miniature ring size.

## Background

A revolution in collaborative robots (cobots) promises to change how assistive care is delivered to the elderly, how people interact with their work environment and even how surgeons perform heart surgery.

RLS d.o.o., a Renishaw associate company, has over many years cultivated a value-added partnership with the German company, TQ-RoboDrive, part of the TQ-Group.

TQ-RoboDrive manufactures a range of frameless hollow shaft stator-rotor kits (ILM series) for cobots, with payloads of up to 20 kg. It also manufactures a range of framed hollow shaft and solid shaft servomotors that combine the powerful motor design of TQ-RoboDrive's frameless servo kits with a space-optimised housing.

RLS supplies TQ-RoboDrive with AksIM™ magnetic absolute off-axis (hollow shaft) encoders, as well as OnAxis™ encoders. In conjunction with Renishaw, it has adapted the AksIM™ encoder to meet the new challenging form factors and performance requirements of TQ-RoboDrive as they work to make advanced cobots a reality.



They were able to design a sensor that fits our ILM25 and ILM38 sizes perfectly, giving us a complete drive solution for both the hollow shaft framed motors and the frameless servo kits. They did a fantastic job.



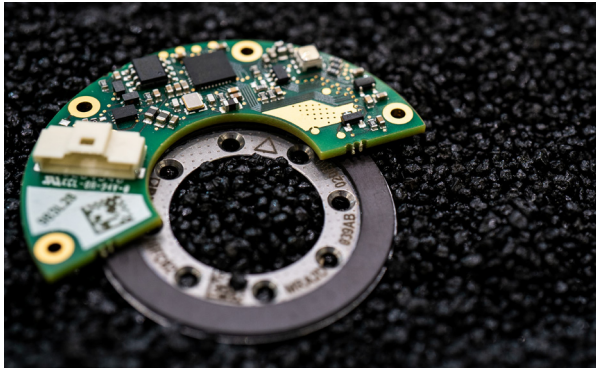
**TQ-RoboDrive (Germany)**

## Challenge

Modern cobot designs tend to be built on a human scale and require compact, lightweight motorised joints with high motor torque densities. When a robot that is already holding a load is then required to lift the load to a higher level, the current drawn by the motor will spike considerably. Such operational tasks can lead to a torque overload condition (over-torque).

Heavy motors (over 500 g) can absorb the excess heat produced during an overload without difficulty, but lighter motors risk burning out. TQ-RoboDrive motors are designed to withstand thirty seconds of 3x rated overload, which is an industry benchmark.

TQ-RoboDrive motors offer high torque at a low weight, which is important for applications with exoskeletons and cobots. This combination of high torque and low weight (high torque density) is what differentiates TQ-RoboDrive motor systems from those of other motor manufacturers.



RLS AksIM™ magnetic absolute Off-axis (hollow shaft) encoder.

For its ultra-low weight frameless motors designed for robotics applications, TQ-RoboDrive sought a precision magnetic encoder solution. This demanded a new miniature absolute encoder that wasn't available on the market.

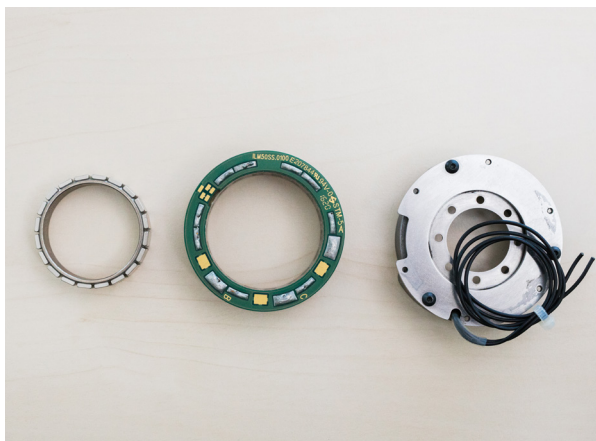
Ulrich Kerber, Head of Industrial Drives at TQ-RoboDrive, explains:

"We were thinking about what might happen in robotics in the near future, and one of our conclusions is that the robots have to become smaller and smaller. We already had the small motor sizes available (ILM25 and ILM38), but the search for the right accessory components, such as encoders, was proving difficult. Having found nothing that suited our needs, we contacted RLS and Renishaw and told them that we needed an encoder with an outer diameter of no more than 28 mm and a remaining hollow shaft of up to 5 mm."

## Solution

TQ-RoboDrive approached RLS and Renishaw to help with finding a solution. RLS already supplies its AksIM encoders to TQ-RoboDrive for other larger diameter motors and offered to design and manufacture a new variant of this encoder with the required ring diameter.

"RLS and Renishaw acknowledged that it would be challenging — but they were also very keen to take up the challenge", recalls Mr Kerber.



From left to right: rotor, stator and safety break of a TQ-RoboDrive frameless ILM servo kit.



TQ-RoboDrive's frameless servo kit solutions on display.

Improvements in existing AksIM technology were implemented to meet the challenging requirements of the electric motor such as extended temperature range, higher immunity against stray magnetic fields and ease of set-up.

TQ-RoboDrive motors consist of several main components: the stator and rotor, a safety brake, and an encoder — all mounted in a compact motor housing. The encoder sits at the rear of the motor and each component has a different diameter. The sequence of assembly is important as there is a stray magnetic field emanating from the safety brake, which requires that the encoder be positioned behind the brake to shield the encoder ring.

"In the end, they were able to design a sensor that fits our ILM 25 and ILM38 sizes perfectly, giving us a complete drive solution for both the hollow shaft framed motors and the frameless servo kits. They did a fantastic job", concludes Mr Kerber.

## Results

The partnership with RLS and Renishaw has allowed TQ-RoboDrive to expand its product offering to include servomotors with the highest torque densities available for the robotics market. Customers benefit from improved communication between TQ-RoboDrive and its suppliers as this results in faster problem resolution, better technical support and better customer service.



Ulrich Kerber highlights the important role played by the RLS AksIM™ magnetic absolute encoder in robot drive applications.



Ulrich Kerber expands on the importance of collaboration and industrial partnerships in robotics:

“The world of collaborative robotics in particular is still relatively small, but it is growing dynamically with every year. Within this community, I see the need for constant dialogue amongst suppliers and customers to ensure that we’re all working to fuel the newest trends and solve the biggest challenges. It is very important to have a reliable encoder partner. The variety on the market is huge and we needed the best technology that would fit into our motors. One of the benefits of a partnership with RLS and Renishaw is that they are key players on the market with products that everybody knows. Trouble shooting is also much easier as TQ-RoboDrive can call on RLS and Renishaw for technical support if needed.”



Cut-away of a TQ-RoboDrive hollow-shaft servomotor with an AksIM™ magnetic absolute encoder.

## About RLS

RLS d.o.o is a Renishaw associate company. It produces a range of robust magnetic rotary and linear motion sensors for applications such as industrial automation, metalworking, textiles, packaging, electronic chip / board production, robotics and more.

For more information about RLS visit [www.rls.si](http://www.rls.si)

These motors also offered excellent speed stability, high dynamic response and good thermal connectivity, and are a pioneering technology ideally suited for use in robotics. Today, TQ-RoboDrive motor solutions are used in demanding applications within the areas of robotics and collaborative robotics, medical technology, aerospace equipment, machine engineering, laser technology and optical equipment.

## About TQ-Group

TQ-Group was founded in 1994 by Detlef Schneider and Rudiger Stahl. TQ, which stands for Technology in Quality, delivers electronic engineering solutions to a variety of industries and can assist companies in every phase of the product lifecycle. TQ-Group is also a production service (E2MS) provider and is a recipient of numerous awards for innovation and design.

TQ-RoboDrive technology has its origins in the Institute for Robotics and Mechatronics at the German Aerospace Center (DLR). DLR researchers developed a new frameless motor technology — a servomotor with outstanding power density and high torque coupled with compact size and lightweight construction.

For more information and to watch the video visit, [www.renishaw.com/robodrive](http://www.renishaw.com/robodrive)

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