

Reaching a parking position without encoders or hall sensors

Save space – Increase reliability

The rotor magnetic field angle must be known to control the speed of machining spindles and to move to a specific parking position. Usually hall sensors or encoders are applied, but with the innovative sensorless-technology from Celeroton these additional parts are no-longer required.



*Celeroton motor CM-2-500
with converter CC-75-500*

Celeroton

The Swiss high-tech company Celeroton AG is the leading manufacturer of ultra-high-speed electrical drive systems with speeds up to 1 million rpm. The turbo compressors, converters and permanent magnet motors of Celeroton are designed for the highest energy efficiency and the lowest volume and weight. Application areas of the turbo compressors include air supply systems for fuel cells, air conditioning and heat pumps, respirators and oxygen concentrators. The motors and converters are applied in the medical and dental industry, in spindles for micromachining, and to drive rotating mirrors and prisms in optical systems, lasers and scanners.

The Swiss spindle manufacturer Meyrat SA, headquartered in Biel, is using Celeroton's sensorless technology to move its spindles to a parking position without hall sensors and encoders. In one application, the spindle is used to position the workpiece for a subsequent manufacturing step before accelerating again. Positioning the spindle to a pre-defined park position is also useful for automatically changing the tool. The Celeroton converters are controlled by the SPS of the machine, where the angle of the targeted park position is controlled and can be variably defined by the operator of the machine during operation.

Significantly less connectors and cables

With the sensorless technology the number of cables and connectors can be reduced, which brings significant advantages for compact motors used in spindles for micromachining, the watch industry or medical applications. The mechanical stability and rotor dynamics are also improved and the maximum speed is increased since there is no need for additional angle sensor discs or magnets. This results in a complete system with higher reliability.

From standstill to 1 million rpm

Celeroton offers different control methods for the operation of motors and spindles from standstill to 1 million rpm. For the operation of motors with low speeds or even from standstill, special inductivity-based methods are applied for the sensorless speed control. Position detection, acceleration and control from standstill can be even realised for small saliency (near symmetrical) motors. Optimized methods also exist for the targeted speed and application range of high-speed, up to 1 million rpm, or high torque motors.

To achieve this range of control, several sensorless methods, with different inverter modulation methods, are combined. The realisation effort of the combinations differs and the best combinations are selected for the application.



*Example of a high-performance and air-cooled motor spindle
from the MMO-72 Axial series*

Switching between different methods without any jerking is even possible using the same converter. Auto tuning routines are applied to enable simple commissioning of different motors and applications, and the routines automatically calculate the speed control parameters from the measurements.

Meyrat

Founded in 1947 at Biel-Bienne, a region recognized as the Swiss birthplace of machine-tools, Meyrat SA develops and manufactures standard and custom spindles for small to medium sized machines. Their customers are active in the automotive, aeronautical, dental, electronics, tooling, medical and watchmaking fields and use manufacturing processes such as grinding, turning, lathing, milling, drilling, and cutting.

Asked

Industry always searches for more compact solutions



Even Quirici, Project Manager at Meyrat SA

Why did you decide to omit hall sensors and encoders for the positioning of your spindles and use the technology of Celeroton?

Because of a proposal by one of our customers, who was looking for a low priced solution. The client needed an attractively priced positioning instrument, which should have similar precision as an encoder. Unfortunately, the encoder was too expensive for this application. With the Celeroton solution we have found a very good compromise.

Where do you see the advantages of the chosen approach and what does it bring the customer?

The sensorless positioning solution of Celeroton is very compact. Encoders and hall sensors need additional space in the spindle. Because of the fact that the machines of our customers are getting smaller and smaller, we have continuously less space available. It is our job, to help out our clients in this situation.

An advantage of the sensorless technology is the large speed range from standstill. Where do you see further, interesting application areas for this technology?

We like to work together with the creative team from Celeroton, as they have a high-level of expertise and a lot of knowhow in modern drive concepts. We know and we are convinced that we will always find a good solution for our drive challenges with Celeroton. We will collaborate with Celeroton in future projects where higher power levels are needed.

Infoservice

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