



HEIDENHAIN

Inductive rotary encoders for efficient robot production

Benefits for lead time, quality and process stability

WHITEPAPER

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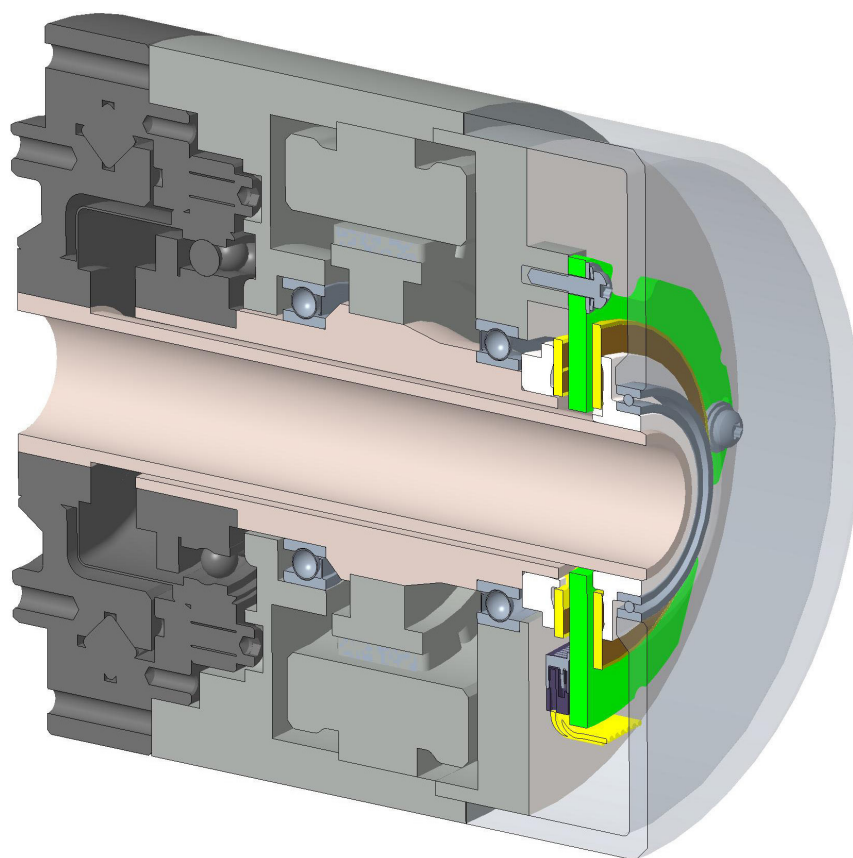
Introduction

A major challenge in robot design is ensuring high positioning accuracy at the Tool Center Point. Without it, welds and assembly screws miss their mark. The critical component for achieving high repeatable accuracy is the rotary encoder. Rotary encoders provide motor feedback and measure axis position and speed for precise motion control.

When selecting a rotary encoder, designers must also consider its effect on the robot assembly process. Because an estimated 70 percent of production costs are due to design decisions, production considerations play a key role. Inductive dual encoders from HEIDENHAIN give designers a unique, high-quality solution for this key component that also benefits robot production. Read on to discover how the numerous benefits of inductive rotary encoders from HEIDENHAIN can reduce cost and effort.

Inductive rotary encoders

Inductive rotary encoders from HEIDENHAIN combine two hollow-shaft encoders that measure motor speed and the rotational motion of the output axis (and thus of the robotic joint). They are made up of two rotors and one scanning unit positioned between them. The rotor for speed measurement is connected to the hollow shaft of the motor, while the rotor for position measurement is attached to the output axis.



Why designers value inductive dual encoders

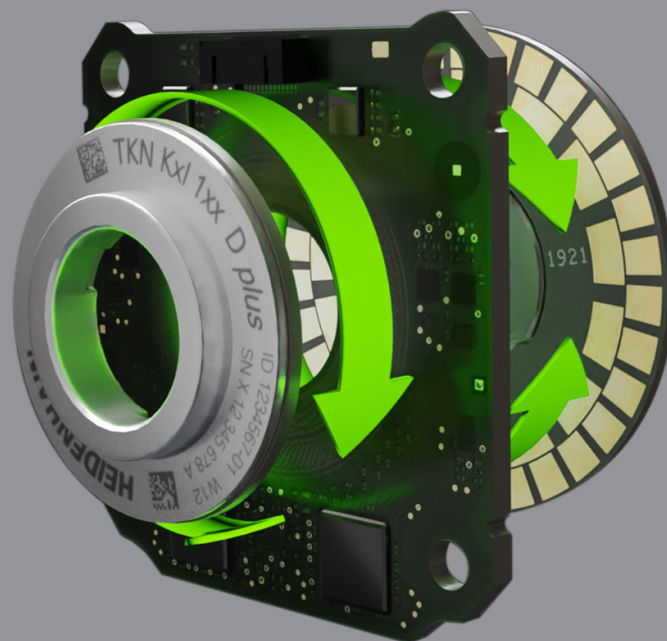
To achieve high positioning accuracy, robot designers must handle a variety of factors, including zero-position error, reversal error of the gearbox, material elasticities, temperature effects, aging, and harsh operating environments.

With inductive dual encoders, designers rely on a component that measures the angular position of the joint directly at its axis. As a result, mechanical inaccuracy in the robotic joint no longer plays a role.

As complete components, these encoders make it easy to document functional safety for safety-related applications, a particularly important benefit for collaborative robots (cobots). The manufacturer can then guarantee the required certification for his component.

The state-of-the-art inductive dual encoders from HEIDENHAIN deliver extensive status data through their digital interface, enabling the implementation of detailed condition monitoring required for predictive maintenance as part of Industry 4.0.

The inductive dual encoders from HEIDENHAIN feature a small footprint thanks to their compact, sandwich-style design. Their low mass improves the dynamic performance of the robot, thereby shortening its cycle time.



How inductive rotary encoders benefit robot production

Inductive dual encoders from HEIDENHAIN bring numerous benefits to robot production.

Shorter lead times

The inductive dual encoders require only three parts: two rotors positioned on either side of a PCB that is rigidly connected to the stator. Each side of the PCB contains a scanning unit for one of the rotors.

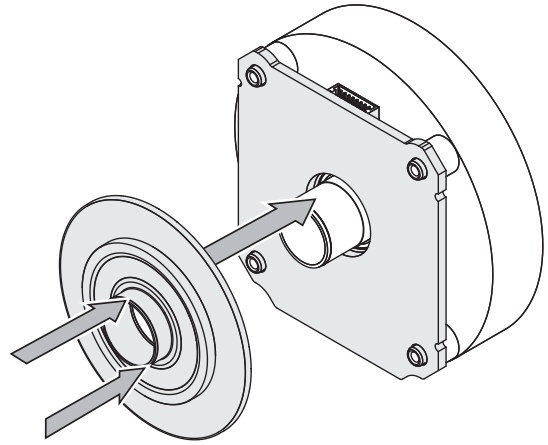
Since a separate bearing for individual rotary encoders is generally not needed, the work of mounting a rolling bearing is eliminated. In most cases, only three components need to be installed.

The electronics for both rotary encoders are located on the PCB, which requires only one connector. This eliminates the need for attaching a second cable during encoder assembly, thus further shortening the lead time.

Automatable assembly steps

Press-fitting is a readily automatable assembly method easily controlled by force displacement monitoring. Press-fitting the two rotors onto their hollow shafts is therefore more efficient than the screw-fastening or clamping-screw methods.

The included mounting instructions specify the permissible force range at the rotor's final position.

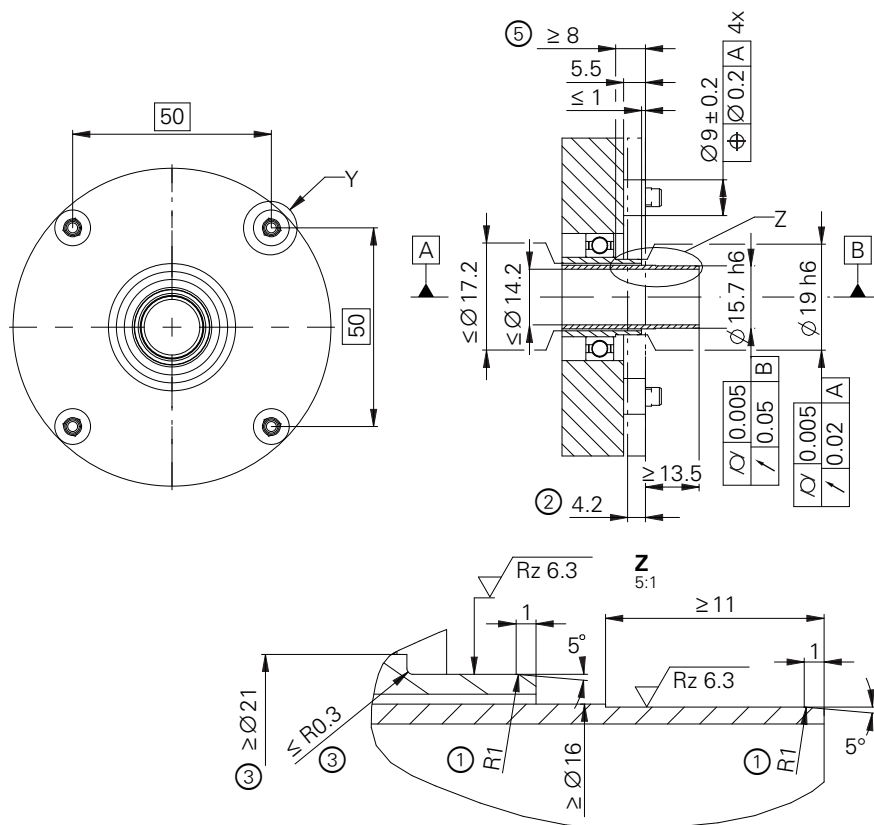


Easier manual assembly

The remaining manual steps are simplified by the fact that the rotors require no specific orientation on the shafts. In addition, the encoder's components have no prescribed pairing. Parts can therefore be provided to the assembly line without any special orientation. The connection between the rotor and shaft is designed to ensure mechanical fault exclusion, allowing the assembler to simply pick up and install the part. Manual assembly work is thereby easier and less prone to error.

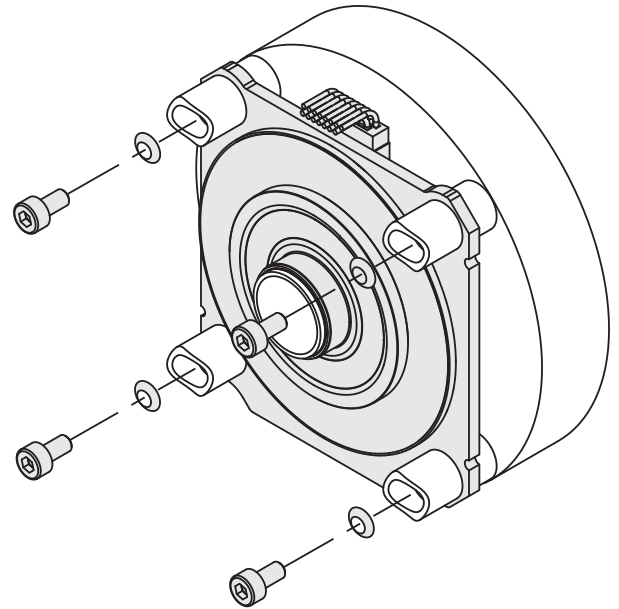
Faster production setup

THEIDENHAIN gives production engineers a variety of aids for determining the most efficient use of production equipment. Detailed mounting instructions help them quickly decide which machines to deploy on the production line. Technical drawings describe the components in detail, and the installation sequence, screw torques, pressing force, and other factors are explained. HEIDENHAIN is also available to answer any questions.possible design iterations and offers little room for experimentation.



Electronic ID labels

Absolute rotary encoders from HEIDENHAIN feature an electronic ID label accessible through the EnDat interface. It delivers data about the encoder's resolution, ID number, serial number, and more. Additional production data can also be stored in a rewritable, non-volatile memory area, including operating parameters, test results for fault-proof mounting, robot serial numbers, and the date of production.



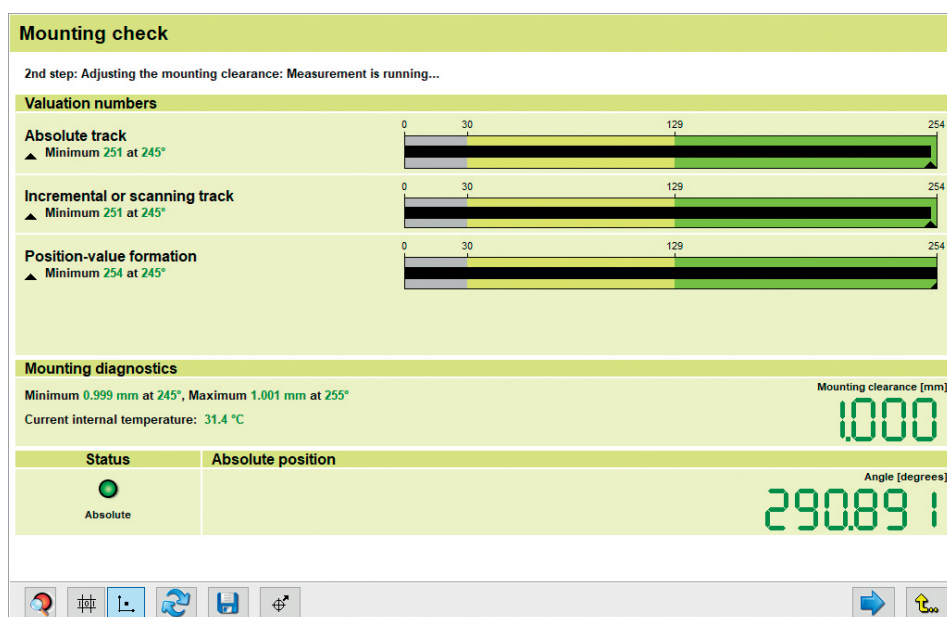
Fast testing for quality assurance and process stability

Rotary encoders from HEIDENHAIN enable electronic mounting diagnostics. This functionality immediately identifies whether the system has been correctly installed and works properly. When mounting diagnostics are used for inductive dual encoders, the interface indicates whether the components have been mounted such that the gaps between elements are within the permissible tolerances. HEIDENHAIN provides its own Adjusting and Testing Software (ATS) for this inspection.

The resulting values can then be incorporated into digital mounting and quality documentation, providing detailed information about every robot. Malfunction and maintenance statistics, for example, can be analyzed in relation to mounting data in order to identify potential improvements to the manufacturing process.

Inductive rotary encoders with circumferential scanning are inherently tolerant toward eccentricity. The encoder's own electronics can also compensate for mounting inaccuracy between the rotors and the scanning unit, thus reducing rework and scrap. The informative and fast mounting diagnostics thereby ensure the quality of the final product and enhance process stability.

In addition, inductive rotary encoders from HEIDENHAIN do not require a calibration run, making them immediately operable after assembly for mount-and-play functionality.



Conclusion

Rotary encoders are essential components in robotics, deciding over precision and safety. Inductive dual encoders from HEIDENHAIN provide an elegant solution to design challenges. They also simplify robot production steps, shorten lead times, and enhance process stability.

HEIDENHAIN encoders help robot manufacturers develop advanced products. Supplier reliability and customer support are important to us. Our products and services are valued by customers around the world.

Please contact us! We look forward to addressing your technical challenges.



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