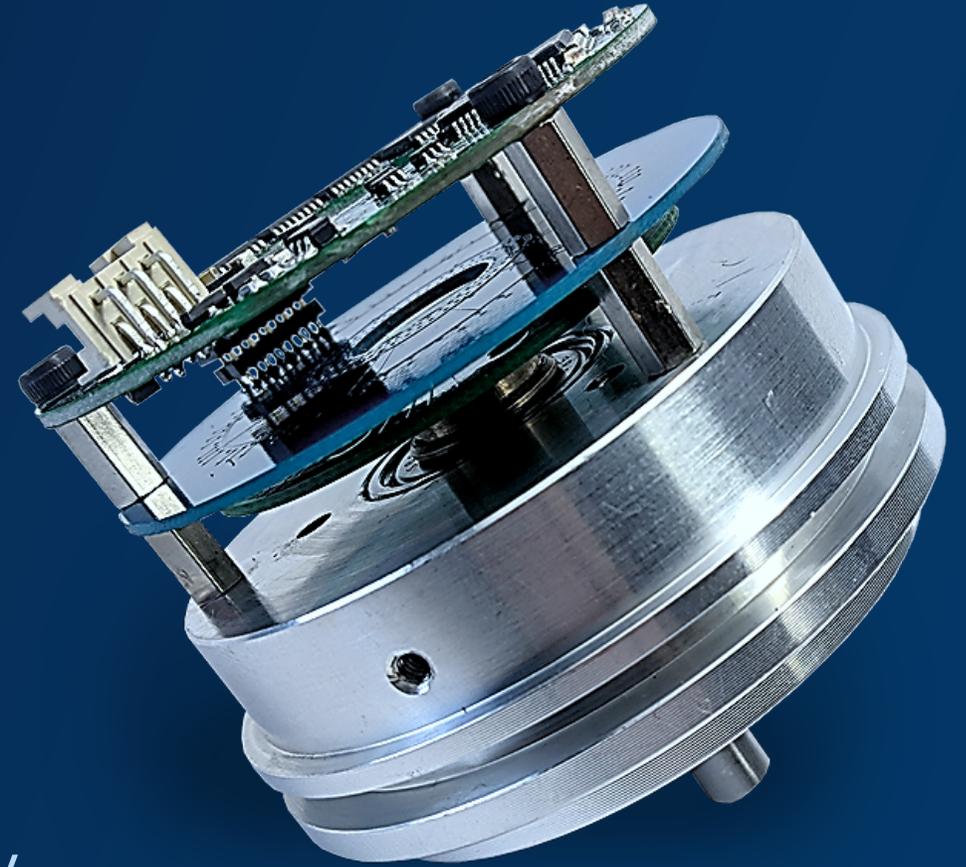


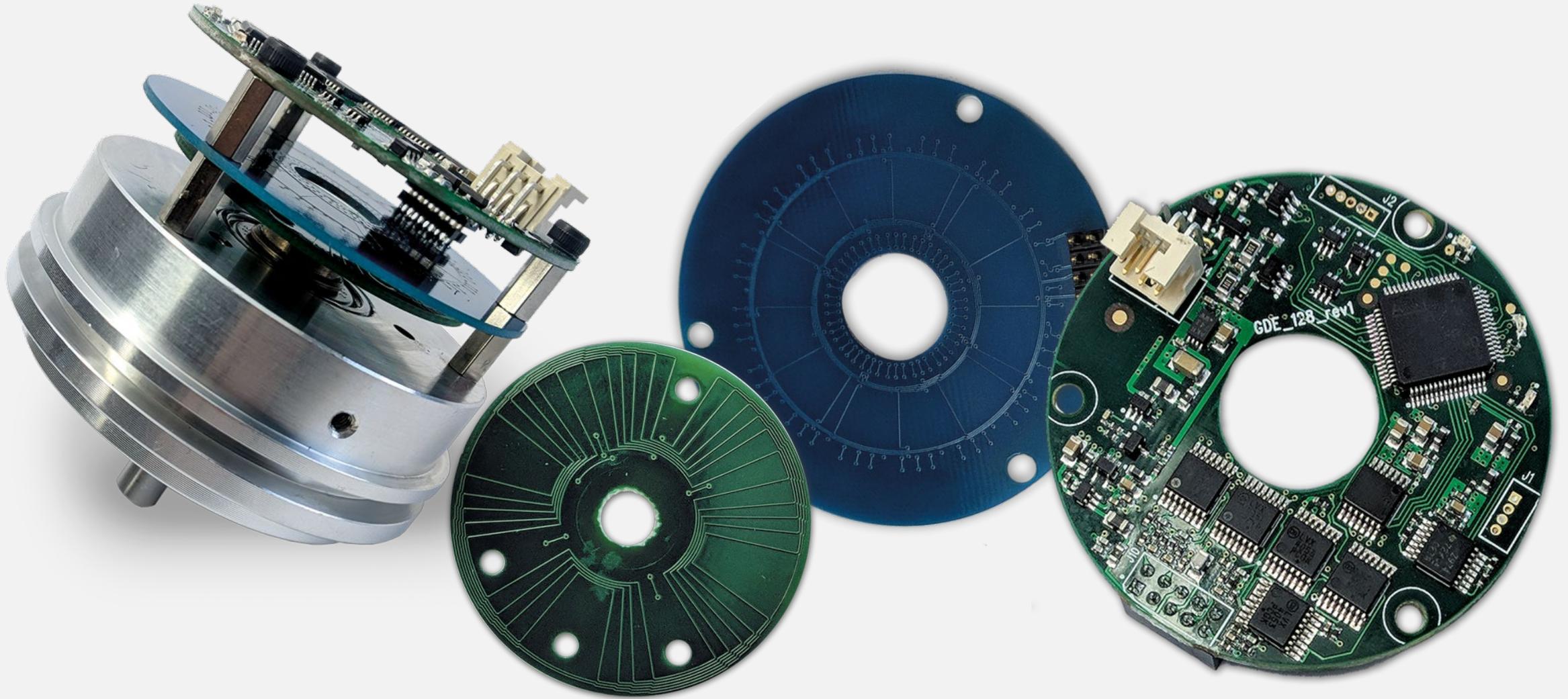


High Precision. Easy Installation. Fast Update Rate.

Precise 2D resolvers built with PCB technology

Dr. Victor Zhitomirsky





Developers of mechatronic systems are aware that their products' quality depends mainly on the quality of the encoders integrated into rotating joints.

High-precision encoders integrated with bearings can be bulky. Instead of buying such encoders, most industrial manufacturers use kit encoders that are assembled on-site by their own technicians.

It is difficult and exhausting to align the targets with the shaft center to several microns of precision to achieve highly accurate angular control. However, this is the only way to reduce the significant sinusoidal angular error, which is proportional to the remaining eccentricity.

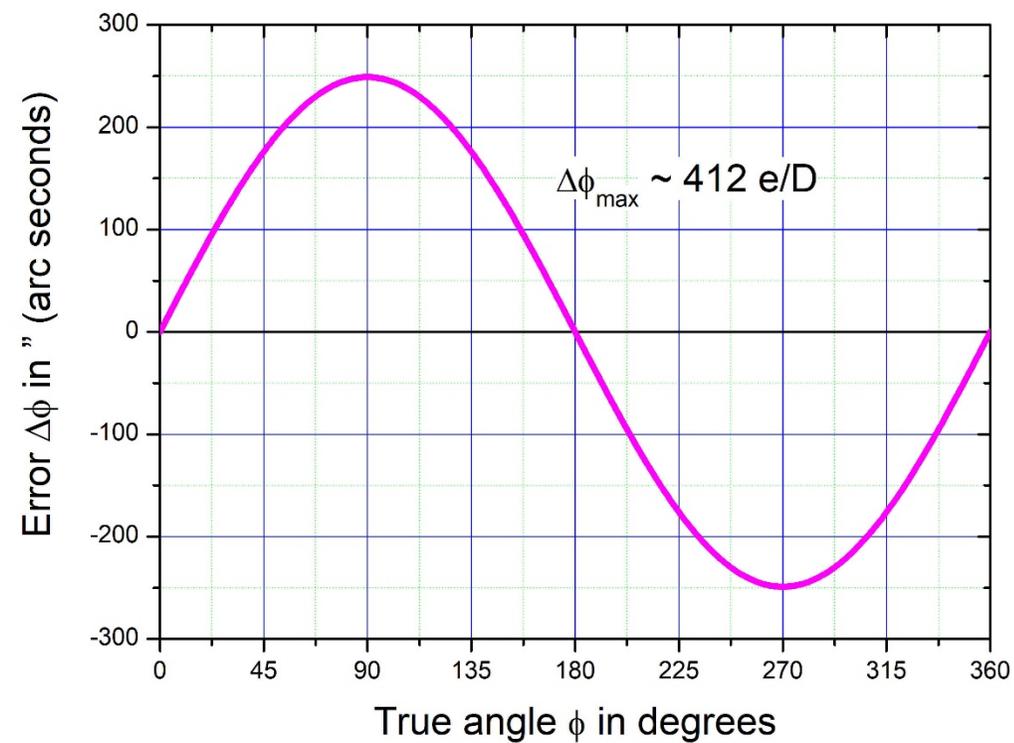
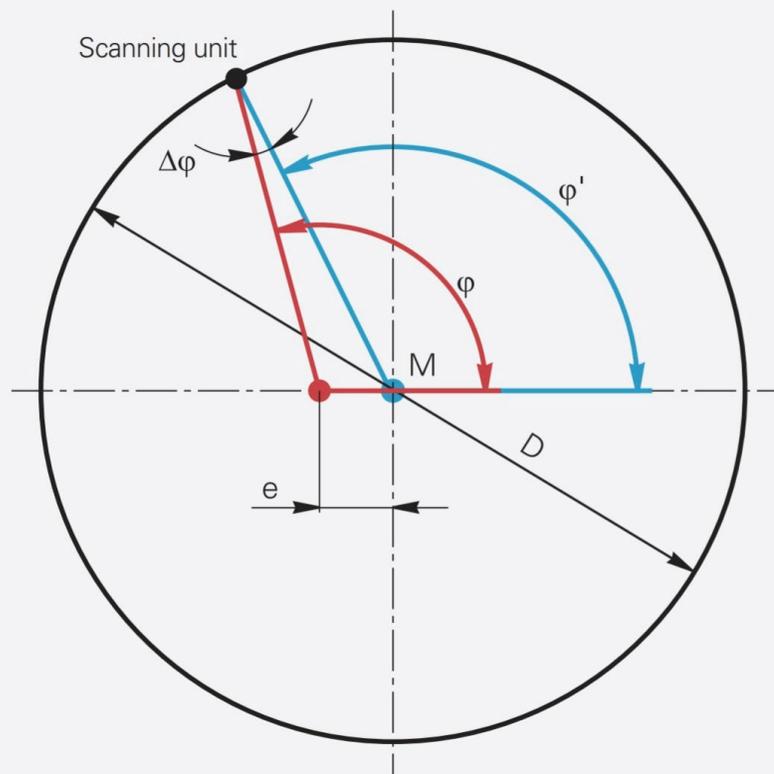
Compared to conventional encoders, inductive technology reduces alignment requirements by more than a hundred times. Consequently, the use of our encoders greatly simplifies the installation of sensors in mechatronic systems and helps achieve much higher accuracy.

Technical Specification

| | | |
|------------------------------------|---|--|
| Resolution | 16-bit to 20-bit | depends on the sensor's diameter |
| Accuracy | 14-bit to 17-bit | greater value for larger diameters |
| Internal update rate | 50kHz, 64kHz, 125kHz | continuous output cyclic scanning up to 40kHz |
| Maximum rotation speed | 24,000 rpm | it's not even a limit |
| Temperature range | -40 to +90°C | works up to 125°C, but special PCB materials must be used at high temperatures |
| Robustness | Can tolerate dust, water, oil, magnetic field | performance can be affected by metal filings |
| Support for different sizes | NEMA 17 to Ø190 mm | Ø 52 mm is an ideal size; up to Ø 600 mm maximum |
| Easy installation | ordinary skills | axial misalignments up to 150 µm airgap of 1.5mm ±0.5mm |

Rotary applications using optical sensors

In actual mechatronic systems, the rotor is used with deep groove ball bearings that have a standard radial clearance of $15\ \mu\text{m}$ even for small diameter bearings.



Rotary applications using inductive sensors

Inductive rotary encoders measure signals along the entire circular path and thus offer a symmetry that optical encoders lack

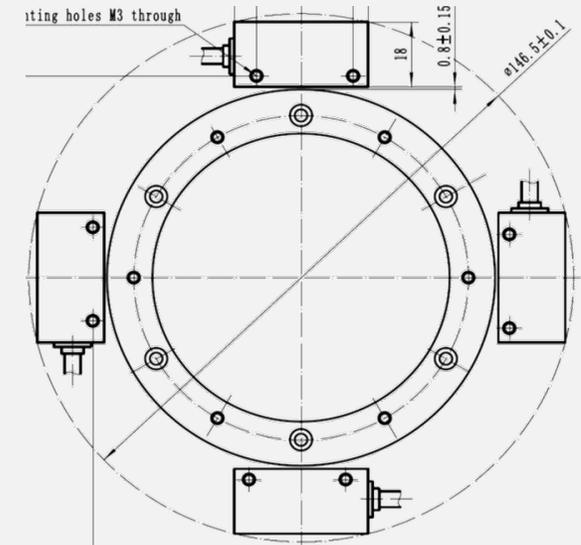
The optical sensor:

A target misalignment of 15 μm can cause an error of up to 250". It is possible to compensate for this error by using multiple distributed sensors and combining their readings.

The inductive sensor:

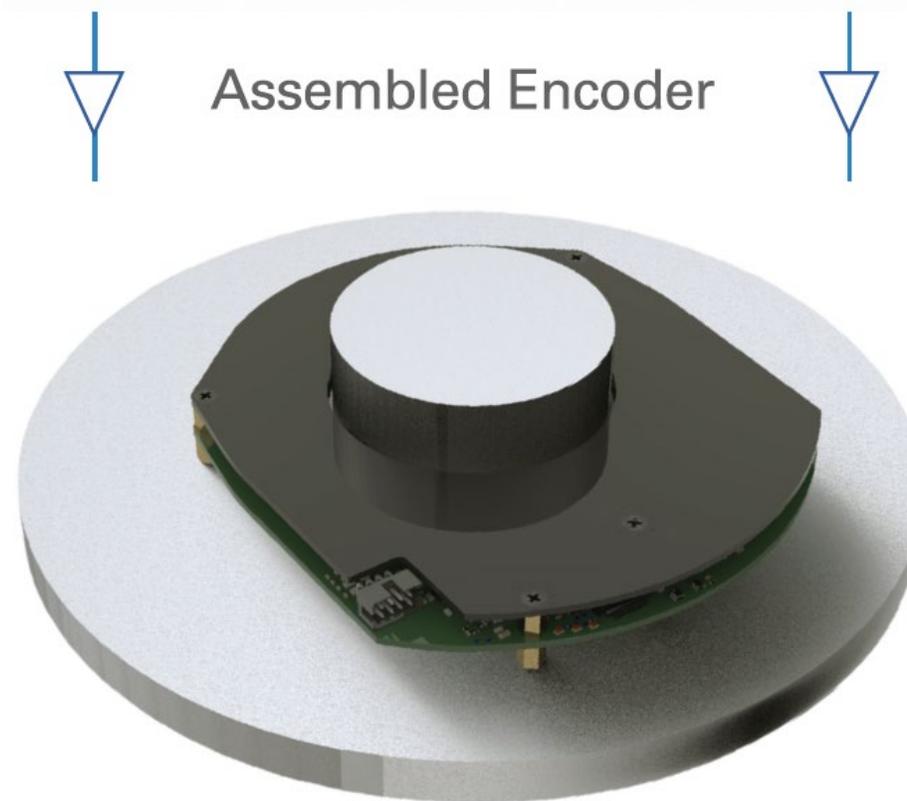
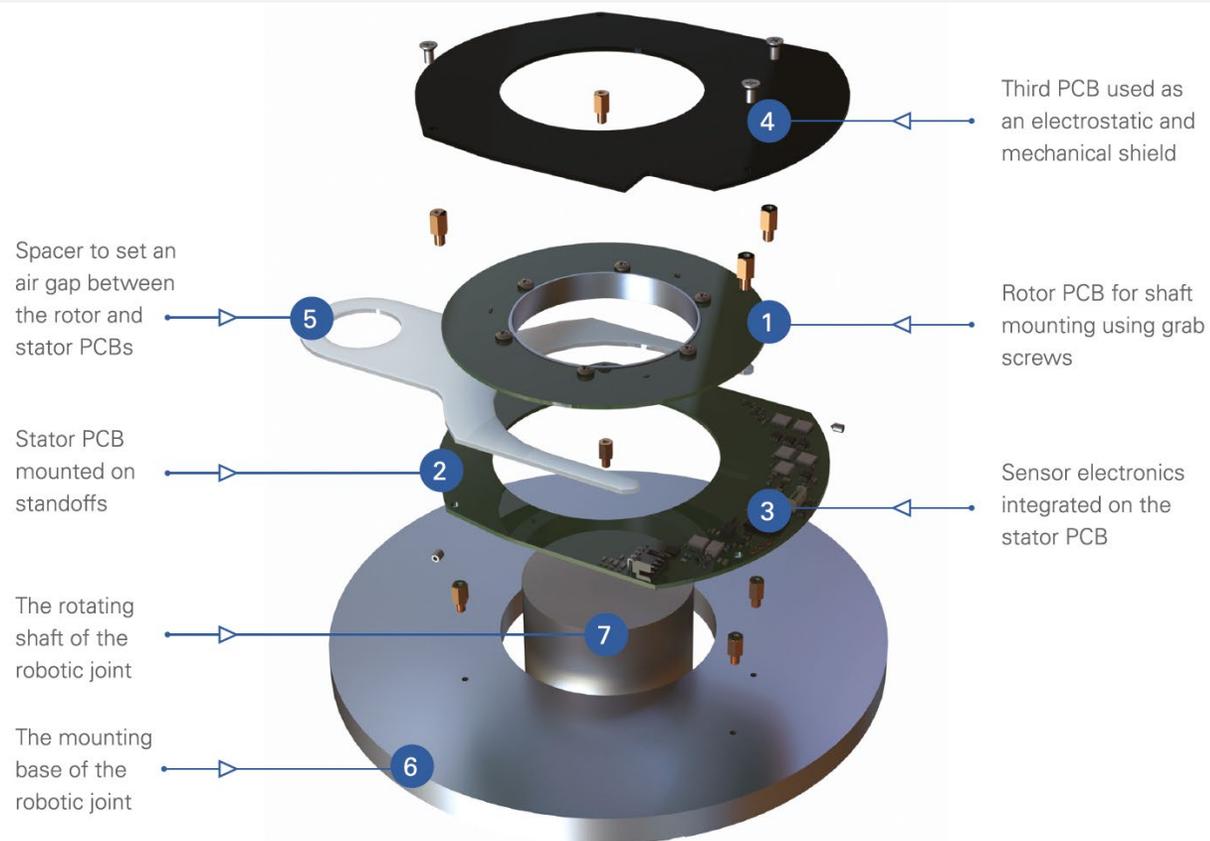
The rotational symmetry of the multi-period sin/cos channel system makes it immune to misalignment up to 150 μm , keeping the system's overall accuracy at 20" ($\pm 0.005^\circ$).

Better rejection of alignment errors than the distributed optical sensor method shown above.



Possible form-factors

Kit encoders can be installed by ordinary technicians; assembly does not require tight mechanical tolerances; accuracy is guaranteed right out of the box.



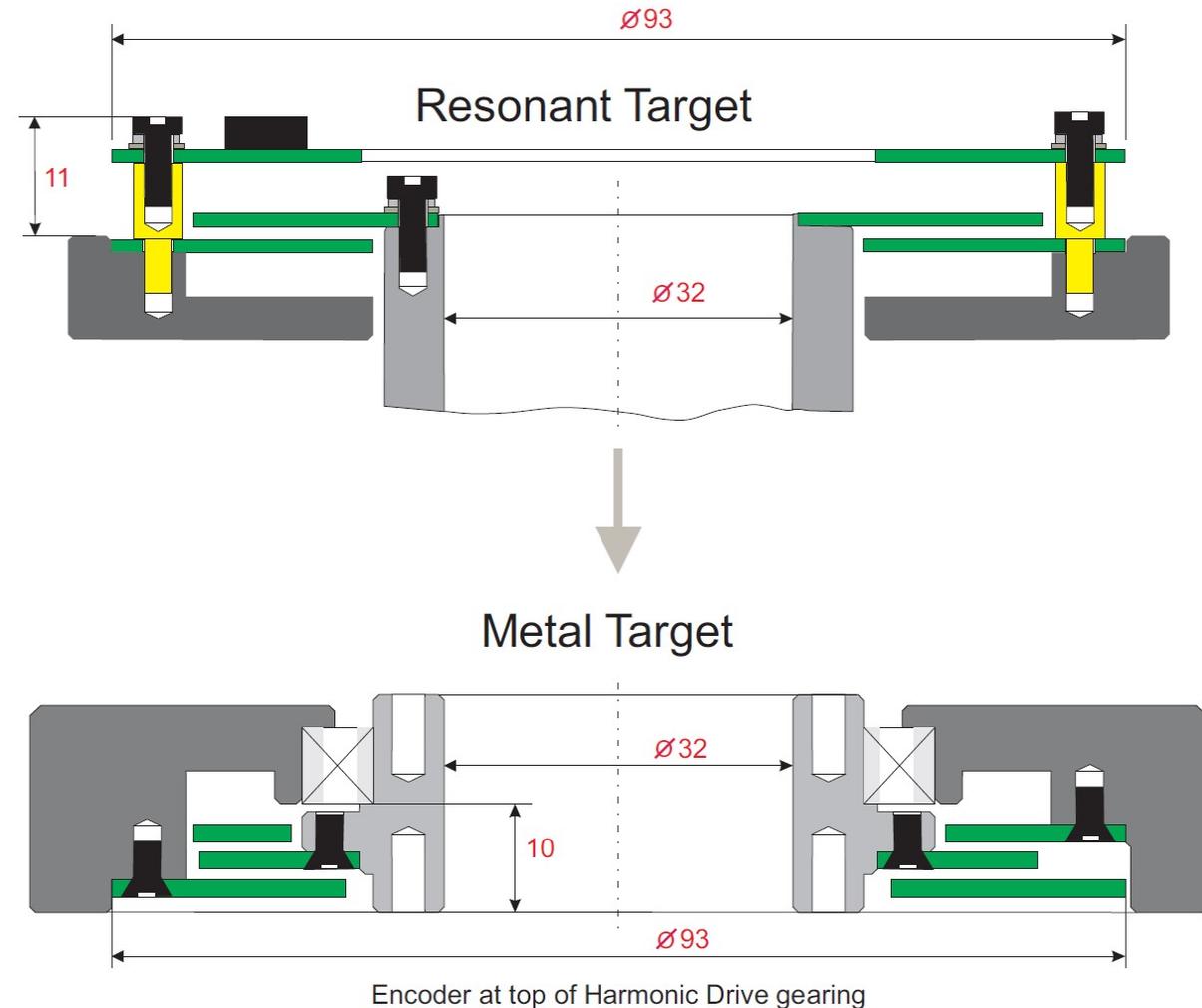
Kit encoders: 19-bit resolution, 16-bit accuracy

When it comes to installing encoders in mechatronic systems, kit encoders are the most economical and compact choice.

Kit encoders can be used immediately after installation. Any combination of electronics, sensor and target can be tested in production before final assembly.

Electronics and sensors have built-in redundant channels. When basic redundancy checks are successful, the green LED lights up.

A more compact design can be achieved with metal target technology. The resonance target provides higher accuracy and resolution.

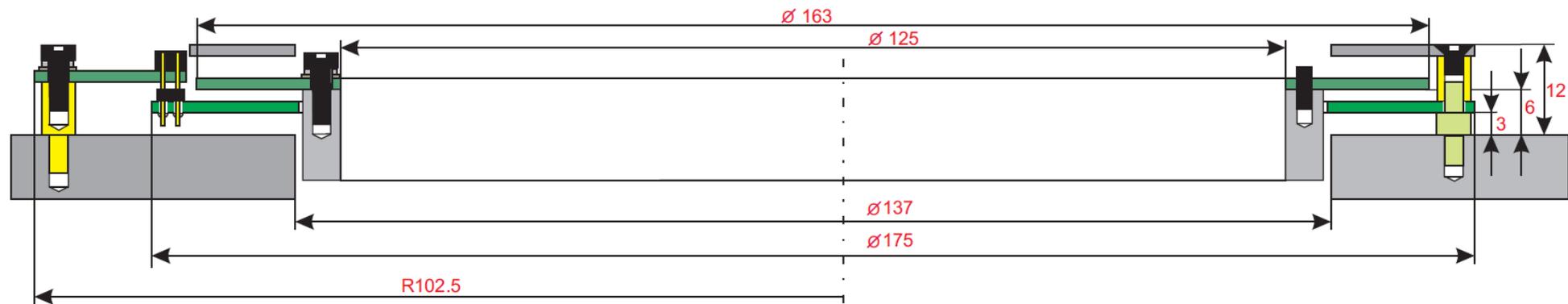


Kit encoders: 20-bit resolution, 17-bit accuracy

As a result of the increased number of fine scale periods in the receive channels, larger diameter sensors can achieve 20-bit resolution (1.24") and 17-bit accuracy (10").

An electronics board is attached to the side of the sensor using a bottom entry connector. Electronics is arranged in an arc section with an approximate length of 120mm (65 degrees). Such an arc section has an outer diameter of 205mm and an inner diameter of 165mm.

The top plate over the rotating target acts as a mechanical and electrical shield.



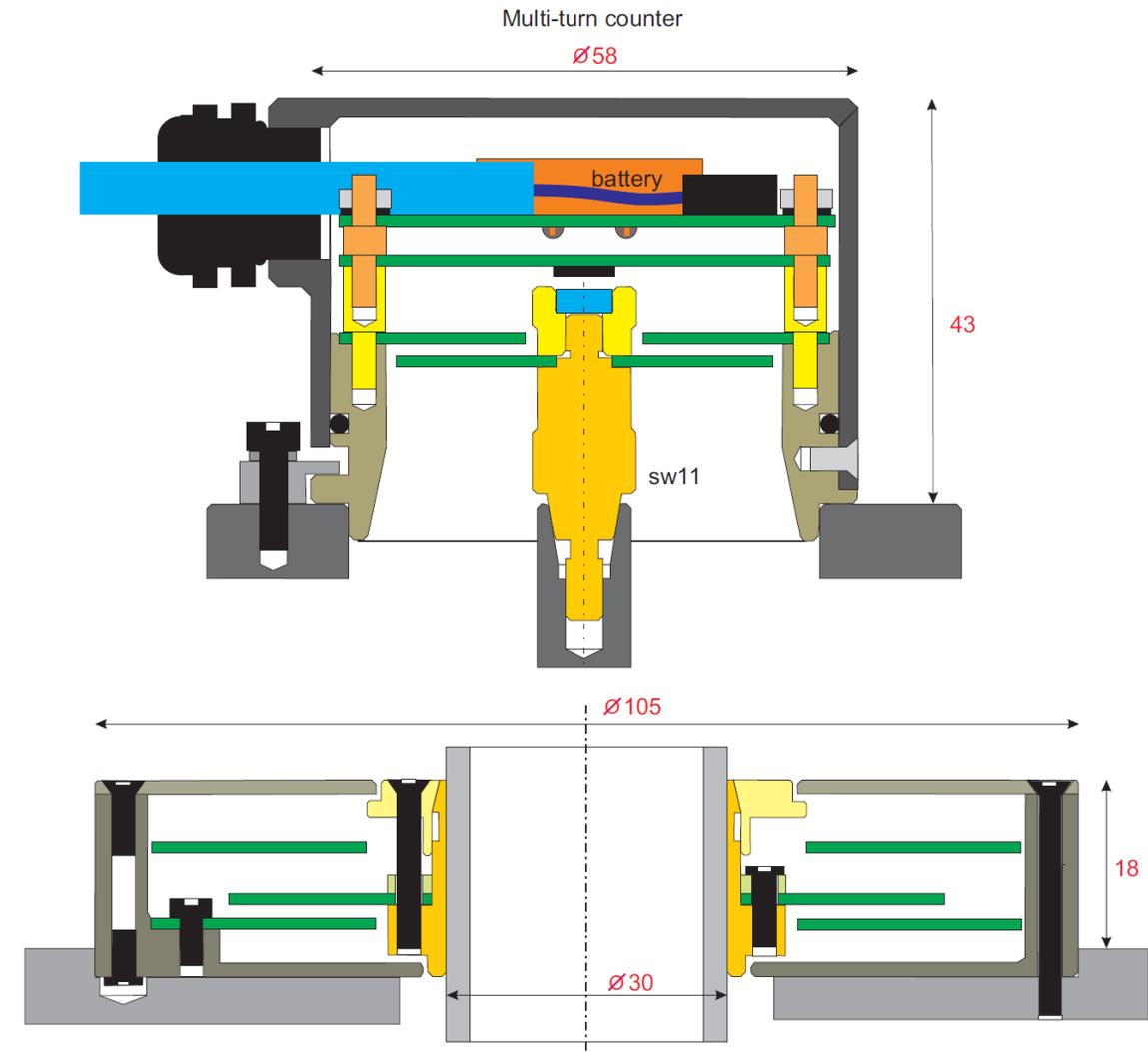
Bearingless encoders

The bearingless encoder is the preferred option for simplified installation. The raw signals and other debugging information were fully investigated after the encoders were assembled in production.

Although bearingless encoders can operate at 24,000 rpm, they are best suited for high-precision applications and provide uncompromised accuracy immediately upon power-up.

Through-hole encoder provides 19-bit resolution (2.5") and 16-bit accuracy (20").

A 58-mm end-of-shaft encoder provides 18-bit resolution (5") and 15-bit accuracy (40").



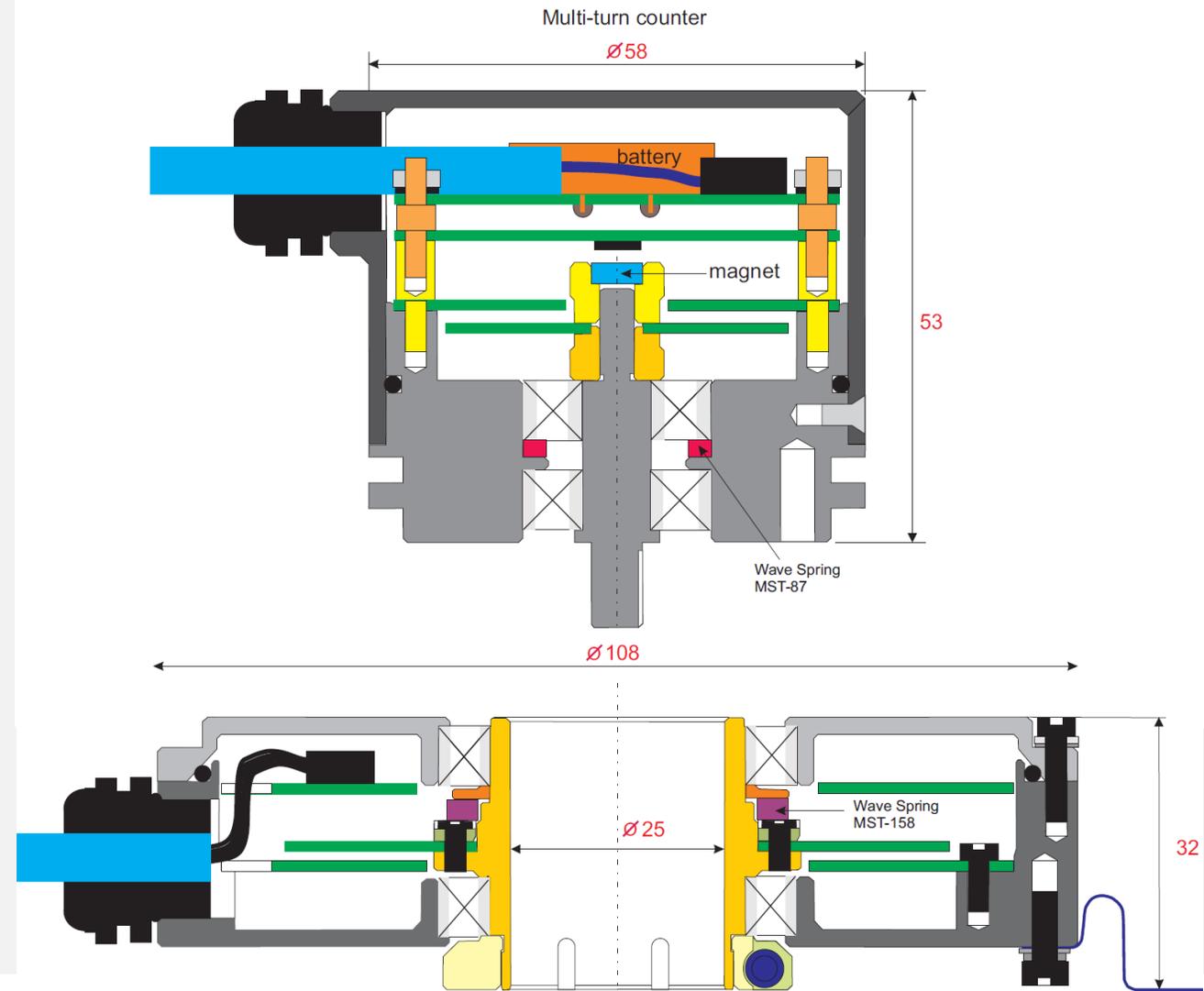
Traditional form factors: 18-bit resolution for 58 mm, 19-bit for the 108 mm encoders

Ruggedized industrial encoders with bearings packaged in a complete unit can be used for demanding applications.

The encoders are sealed to IP65 and can be used in a wide range of industrial test benches.

The rubber seals in the bearings are the only thing that limits the rotational speed. It is possible to install metal shielded bearings on request for supporting faster rotation speed.

Due to the absence of vibrations associated with eccentricity of the shaft coupling, bearingless encoders offers more precise measurements.



Our technology guarantees 16 bit accuracy out of the box

Best rotary sensors in the market are created via the fusion of experience, IP, and know-how developed in the Cambridge technology consultancy cluster

Our sensors provide unique capability to delivery high accuracy of 16-bit (20”) out of the box despite significantly relaxed mounting tolerances:

- radial misalignment up to 150 μm is allowed
- airgap variation of ± 0.5 mm is accepted

Our IP is specifically developed to provide self-calibration of the sensing receive channels without reducing the dynamic speed of the final answer.

The self-calibration algorithm with 1 kHz update rate **does not require rotation of the target. This is a specific feature of inductive resonant target sensors with their almost “ideal” sensing channels.**

We offer service for developing application specific sensor form-factors

How about a more compact design?

Cambridge-based companies have perfected resonant target technology; others use metal target technology, which is better suited to space-constrained applications

Metal target technology is usually considered only for motor encoders because it requires rotor movement for self-calibration. We had developed a self-calibration solution that allows metal target encoders to be used after reduction gearboxes, even in applications without much angular movement at this point.

With IPS2200 ASIC we can build more compact sensors that can be easily redesigned for specific applications. The update rate can be increased to 125 kHz with a group delay of 20 μ s.

Our metal target sensors can use 1.5 mm \pm 0.5 mm for the air gap. The overall height of the sensors can be reduced to 7 mm, and a target can be placed closer to the metal flanges.

Cambridge Encoders provides subcontracted services to OEM customers to develop application-specific motor encoders. Customers receive the microcontroller object code to manufacture their sensors without our further involvement.

Contact Us

Cambridge Encoders - based in Cambridge, UK - was founded to unlock the untapped multi-million dollar business potential in developing highly accurate, cutting-edge high update rate, yet easy-to-install industrial sensors.

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