

maxon sensor

Technology – short and to the point

Sensors

maxon offers a series of sensors. Their characteristics are:

Digital incremental encoder

- Relative position signal suitable for positioning tasks
- Rotation direction recognition
- Speed information from number of pulses per time unit
- Standard solution for many applications

DC tachometer

- Analog speed signal
- Rotation direction recognition
- Not suitable for positioning tasks

Resolver

- Analog rotor position signal
- Analog speed signal
- Extensive evaluation electronics required in the control system
- For special solutions in conjunction with sinusoidal commutation in EC motors

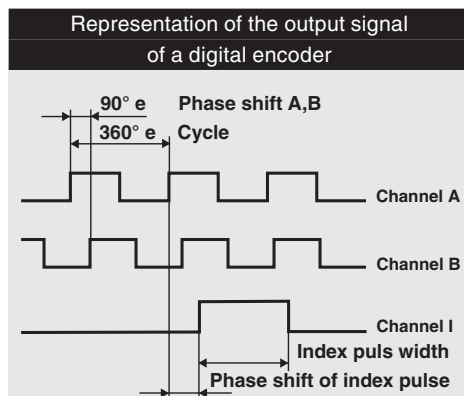
Digital Incremental Encoder

Encoder signals

The encoders provide a simple square signal for further processing in the control system. Its impulses can be counted for exact positioning or determining speed. Channels A and B pick up phase shifted signals, which are compared with one another to determine the rotation direction.

A “home” pulse (index channel I) can be used as a reference point for precise determination of rotation angle.

The line driver produces complementary signals \bar{A} , \bar{B} , \bar{I} which help to eliminate interference on long signal lines. In addition, this electronic driver installed in the encoder improves signal quality by steeper signal edges.



Program

- Digital MILE encoder
- Digital MR encoder
- Digital Hall effect encoder
- Digital optical encoder
- DC Tacho
- Resolver

Magneto-resistant (MR) principle

In an MR-encoder, the multipole magnetic disc mounted on the motor shaft produces a sinusoidal voltage in the MR sensor. The typical encoder signals are created by interpolation and electronic signal refinement.

Characteristics

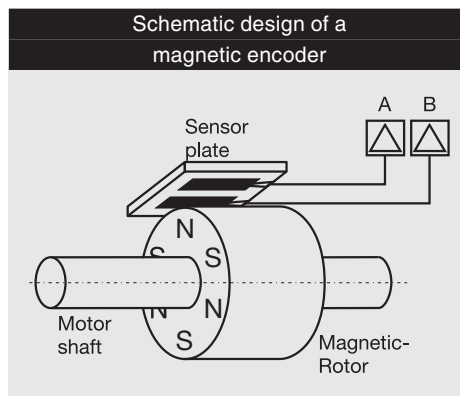
- Needs very little space
- No protruding parts
- High number of pulses by interpolation
- Different number of pulses can be selected
- Index channel possible
- Line driver possible

Magnetic principle with Hall sensors

On the magnetic MEnc-Encoder a small multipole permanent magnet sits on the motor shaft. The changes in magnetic flux are read by Hall sensors and fed into the electronics as channel A and B.

Characteristics

- Small design
- 2 channels A and B
- No line driver possible
- Low number of pulses



- 1 End cap
- 2 Electrical connections motor and encoder
- 3 Print
- 4 MR sensor
- 5 ASIC
- 6 Magnetic multi-pole wheel
- 7 Encoder housing
- 8 Motor connections
- 9 Motor
- 10 Solid measure
- 11 Carrier of solid measure

Optical principle

The opto-electronic principle (example: HEDL HEDS, Enc22) sends an LED light through a finely screened code wheel that is rigidly mounted onto the motor shaft. The receiver (photo transistor) changes light/dark signals into corresponding electrical impulses that are amplified and processed in the electronics.

Characteristics

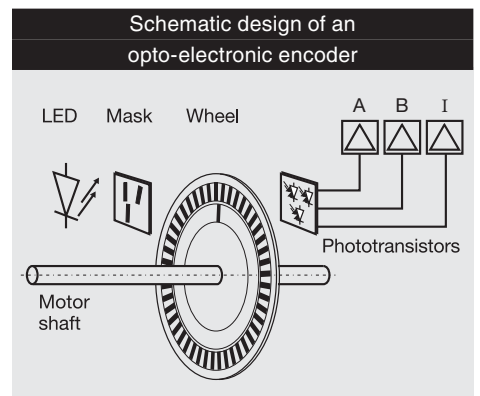
- Needs large space with protruding part
- High number of pulses
- Index channel possible
- Line driver possible
- High accuracy

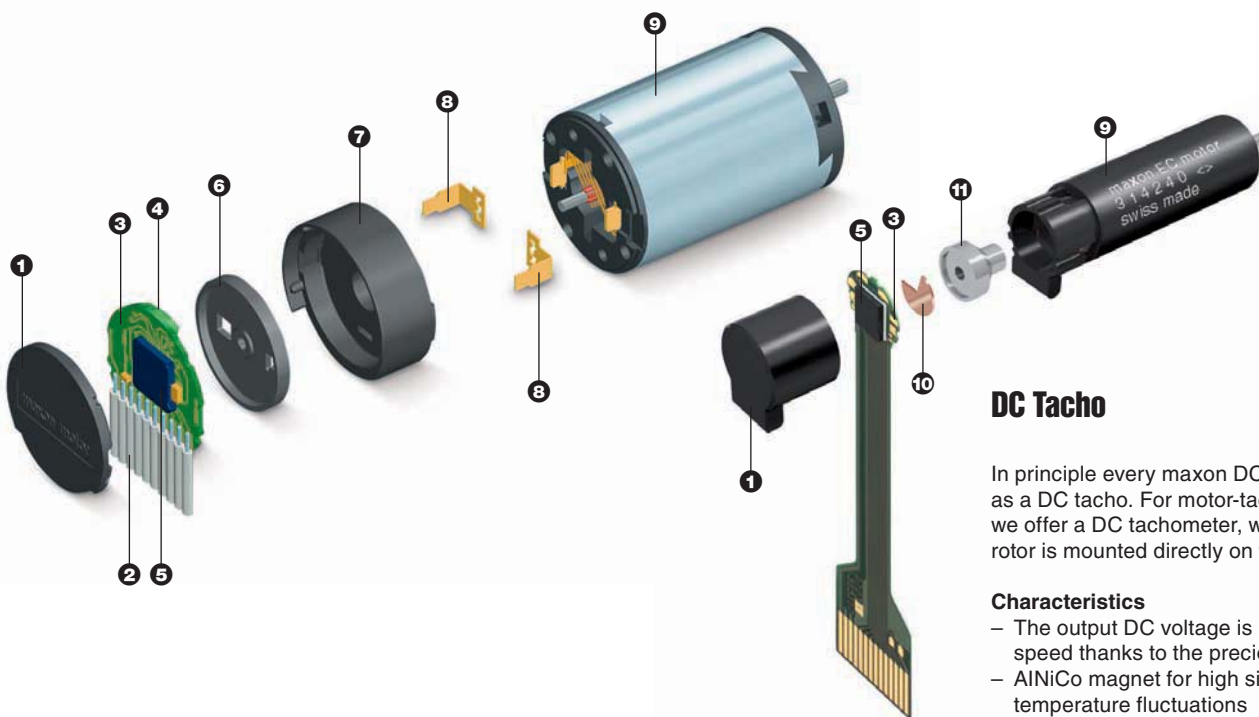
Inductive eddy current principle

In the inductive MILE encoder, a high-frequency magnetic field is brought onto a structured copper disc and the angle-dependent field displacement measured.

Characteristics

- Very robust against magnetic and electrical fields as well as contamination
- Very high speeds possible
- High precision. Interpolation errors are largely compensated for by a look-up table
- Index channel and line driver available
- Absolute interface (SSI) on request





DC Tacho

In principle every maxon DC motor can be used as a DC tacho. For motor-tacho combinations, we offer a DC tachometer, whereby the tacho rotor is mounted directly on the motor shaft.

Characteristics

- The output DC voltage is proportional to the speed thanks to the precious metal brushes.
- AlNiCo magnet for high signal stability with temperature fluctuations
- No additional tacho bearings or friction
- No couplings, high mechanical resonance frequency

Resolver

The resolver is mounted on the motor's through shaft and adjusted according to the magnetic field of the motor rotor. The resolver has a rotating primary coil (rotor) and two secondary coils (stator) offset by 90°. An alternating current connected to the primary coil is transferred to the two secondary coils. The amplitudes of the secondary voltages are $\sin \varphi$ and $\cos \varphi$, where φ is the rotation angle.

Characteristics

- Robust, for industrial use
- Long service life
- No mechanical wear
- Output signal can be transmitted over long distances without problems
- No sensitive electronics
- Special signal evaluation required
- Only one sensor for position and speed information
- EC motors with resolver are supplied without Hall sensors

Tips on encoder selection

Principal features of the maxon incremental encoder are:

- The number of pulses per revolution (increments)
- The accuracy
- Use of an index channel
- The use of a line driver
- The maximum supported speed
- The suitability for special ambient conditions (dust, oil, magnetic fields, ionizing radiation)

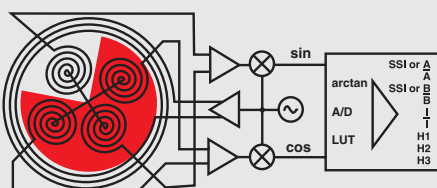
Encoders and maxon controllers

- As a standard the maxon controllers are preset for encoders with 500 pulses per revolution.
- The higher the number of pulses and the higher the accuracy the better a smooth, jerk-free operation can be achieved even at low speeds.
- maxon controllers can be set for low or high speed operation and for encoders with a low or high number of pulses.
- Control electronics can restrict an encoder's maximum possible number of pulses.

The following applies especially to positioning systems:

- All maxon positioning systems evaluate the rising and falling signal edges. With regard to encoder number of pulses, this results in a four times higher positioning precision. This is what is referred to as quadcounts.
- The higher the number of pulses, the more precise the position that can be reached. At 500 pulses (2000 quadcounts) an angle resolution of 0.18° is achieved, which is usually much better than the precision of the mechanical drive components (e.g. due to gear play or elasticity of drive belts).
- Only encoders with an integrated line driver (RS422) should be used in positioning controls. This prevents electromagnetic interference signals from causing signal loss and accumulated positioning errors.
- Positioning applications often require the index channel of the encoder for precise reference point detection.

Schematic design of the inductive MILE encoder



Recommendations for using the maxon encoder

	MR	MEnc	optical	MILE
line driver possible	✓		✓	✓
index channel possible	✓		✓	✓
precise position			✓	✓
very low speed			✓	
very high speed	(✓)	✓		✓
dust, dirt, oil	✓	✓		✓
ionising radiation		✓*		

*on request

Schematic design of a resolver

