

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

For further processing in the controller, the encoders deliver square-wave signals whose pulses can be counted for exact positioning or speed measurement. Channels A and B pick up phase shifted signals, which are compared with one another to determine the rotation direction. 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.

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 EASY encoder
- Digital MR encoder
- Digital Hall effect encoder
- Digital optical encoder
- Analog DC Tacho
- Analog Resolver

Magnetic principles

On the magnetic Encoder a small multipole permanent magnet sits on the motor shaft. The changes in the magnetic flow are recorded by sensors and supplied to the electronics as processed channel A and B. Magnetic encoders require a minimum of space.

MR encoder

- Sensor with magnetoresistive principle
- High counts per turn possible, thanks to interpolator
- Different number of pulses can be selected
- with/without index
- with/without line driver

MEnc

- Digital Hall sensors
- 2 channels A and B
- No line driver possible
- Low number of pulses

EASY encoder

- Integrated circuit with Hall sensor and interpolator
- Counts per turn programmable from 1 to 1024
- With index channel and RS422 line driver

QUAD encoder

- Digital Hall sensors
- 4 statuses per turn
- Line driver not possible

- 1 End cap
- 2 Electrical connections motor and encoder
- 3 PCB
- 4 MR sensor
- 5 Graduated disk
- 6 Magnetic multi-pole wheel
- 7 Encoder housing
- 8 Solid measure
- 9 Flange
- 10 Sensor with housing
- 11 Encoder fork coupler

Optical principle

In the optical principle of the fork light barrier (example: HEDL, HEDS, SCH16F, 2RMHF, Enc22) an LED sends light through a finely resolved impulse disc, which is mounted on the motor shaft. The receiver (photo transistor) changes light/dark signals into corresponding electrical impulses that are amplified and processed in the electronics.

Characteristics

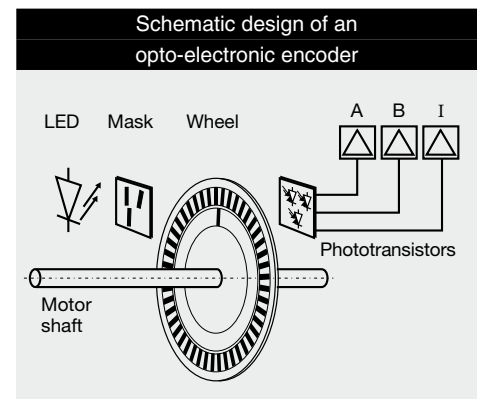
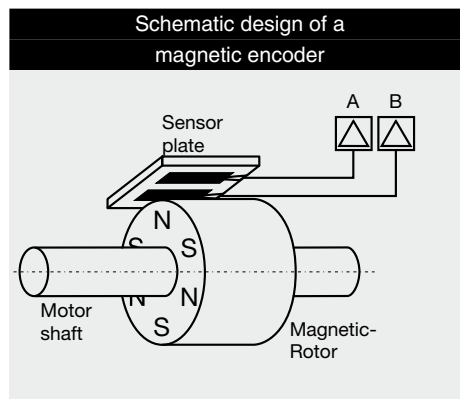
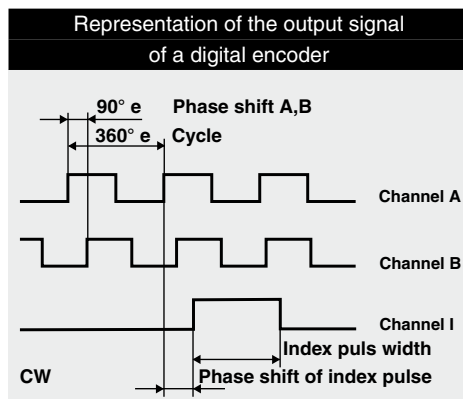
- High number of pulses
- Index channel and line driver possible
- Very high accuracy

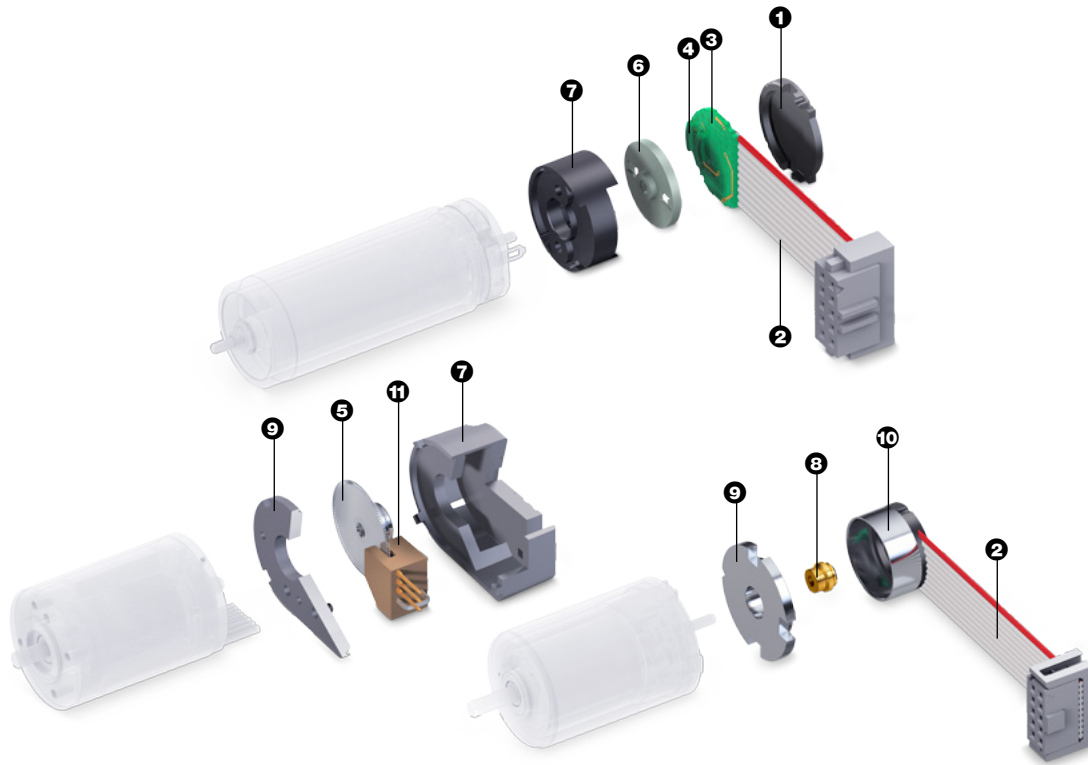
Inductive principle

With inductive MILE encoders, a high-frequency alternating field is transformatively transmitted and thus angle dependant modulated, using a structured copper disk.

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





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 pre-set for encoders with 500 pulses per revolution.
- The input frequency of the controller electronics can limit the maximum possible counts per turn of the encoder.
- 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.

The following applies especially to positioning systems:

- 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.

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

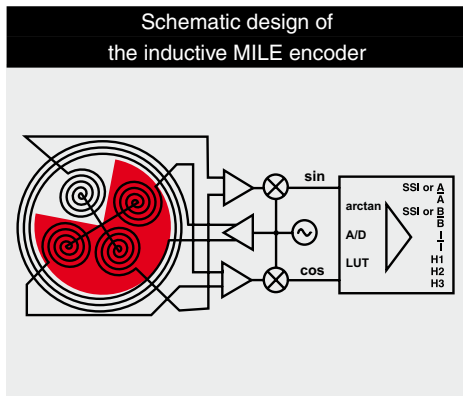
- The output DC voltage is proportional to the speed thanks to the precious metal brushes
- AlNiCo magnet for high signal stability with temperature fluctuations
- No additional tacho bearings or friction
- No couplings, high mechanical resonance frequency

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



Recommendations on encoder selection						
(✓) Conditionally applicable	QUAD	MEnc	MR	EASY	MILE	optical
1 very high speed	✓	✓		✓	✓	
2 very low speed			(✓)	(✓)	✓	✓
3 precise position			(✓)	(✓)	(✓)	✓
4 line driver possible			✓	✓	✓	✓
5 index channel possible			✓	✓	✓	✓
6 compact design	✓	(✓)	✓	✓	✓	
7 dust, dirt, oil	✓	✓	✓	✓	✓	
8 External magnetic fields	(✓)	(✓)		(✓)	✓	✓
9 ionising radiation		✓				