

When and why using an encoder

Introduction

The strength of a stepper motor is that it does not need any electronics to control the position of the rotor. As one step is realized each time, it is enough to count the number of steps that are achieved during one second to know the exact position of the rotor.

However, some questions remain:

- Does the motor actually achieve the right amount of steps?
- What happen if it loses steps?
- What if one wants a feedback for security reasons?

To answer them, the right solution is often to use an encoder in order to check the position of the rotor. Therefore, the idea of this application note is to present the different encoders compatible with stepper motors and explain their characteristics.

FAULHABER encoders

Today, only the AM0820, AM1020, AM1524, AM2224, AM3248, DM40100 and DM52100 have the possibility to be assembled with an encoder. Please find below the different encoders possibilities:

Table 1 : Encoders suitable with stepper motors.

Motor	Encoder	Lines per revolution	Type
AM0820	IEP3-4096	1 to 10.000	Magnetic
AM1020	IEP3-4096	1 to 10.000	Magnetic
AM1524	IEP3-4096	1 to 10.000	Magnetic
AM2224	PE22-120	120	Optical
AM3248	IE3-1024	1 to 1.024	Magnetic
DM40100	IE3-1024	1 to 1.024	Magnetic
DM52100	IE3-1024	1 to 1.024	Magnetic

All those encoders can provide information about the velocity, position and direction of the rotor motion.

Ordering code

When ordering a motor with an encoder, one must pay attention that the encoder is compatible with the motor and then choose the right execution of the motor. Example:

AM10202R009040 C042E IEP3-2048

AM10202R0090	Standard motor
40	Motor shaft execution, must suit to encoder
C042E	Motor cable is mandatory for combinations with IEP3 or IE3 encoders
IEP3-2048	Standard encoder with chosen resolution

AM32482R070010 C042A IE3-512

AM32482R0700	Standard motor
10	Motor shaft execution, must suit to encoder
C042A	Motor cable is mandatory for combinations with IEP3 or IE3 encoders
IE3-512	Standard encoder with chosen resolution

The motor execution is important since a longer shaft at the rear of the motor is mandatory to assemble the encoder.

How to choose an encoder?

There are some questions that you may ask yourself before choosing the proper encoder. Those are summarized below.

Optical or magnetic?

FAULHABER proposes either magnetic or optical encoders. Most encoders in the portfolio fitted for stepper motors are magnetic encoders. For further information on the difference between optical and magnetic encoders please check our technical information on encoders that can be found on the download section of each encoder product on our website.

Why using an encoder in combination with stepper motors?

An encoder has basically 3 functions:

1. Verify that a stepper motor is not losing steps and control its position
2. Act as a commutation system in order to use the stepper motor as a brushless motor
3. Achieve a precise positioning (less than a step resolution)

Depending on which function your encoder was selected for, the resolution will not be the same. For function 1 and 2, having 10 or 12 lines per revolution for a stepper motor with respectively 20 or 24 steps per revolution is enough. For function 3, the more lines per revolution you can use, the more accurate your positioning control will be.

Absolute or incremental encoder?

FAUHLABER only proposes incremental encoders in the standard combination with stepper motors since the position of the stepper motor can be known by counting the steps (increments) realized by the rotor.

All encoder solutions can be found on our website www.faulhaber.com, including absolute encoder solutions.

Custom encoders

In many cases, the encoder is only useful to control that the motor is rotating and is not losing steps. The cheapest solution is then to build its own encoder. This is possible by fixing a magnet at the rear shaft of the motor and sensing the rotation with a Hall sensor (custom magnetic encoder). Another cheap and simple solution is to fix a plastic component at the rear of the motor and optically detect the rotation (custom optical encoder).

An example of such custom made optical encoder is presented in Figure 1.

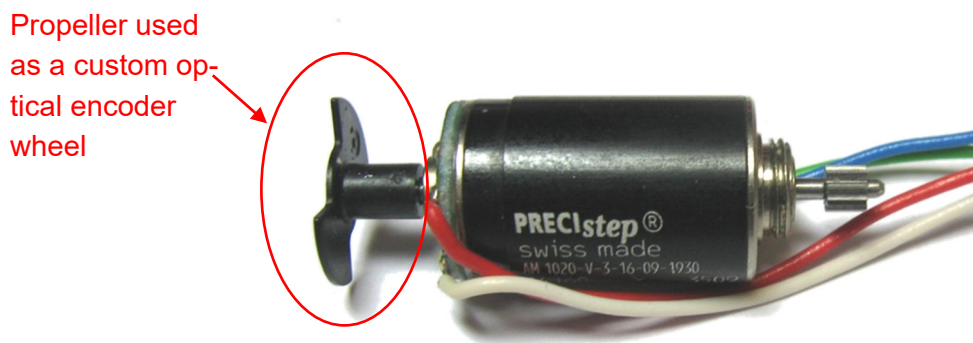


Figure 1 : Motor with a plastic propeller on the rear shaft for a custom optical encoder solution.

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