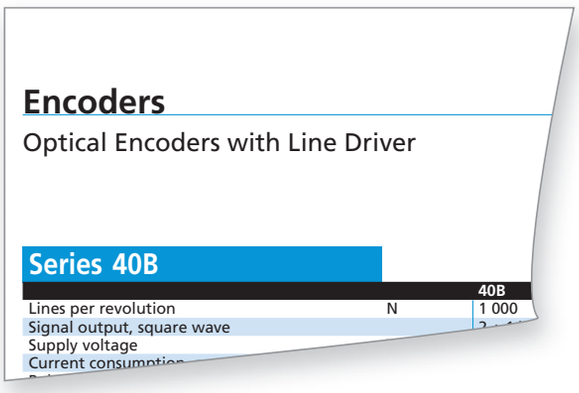
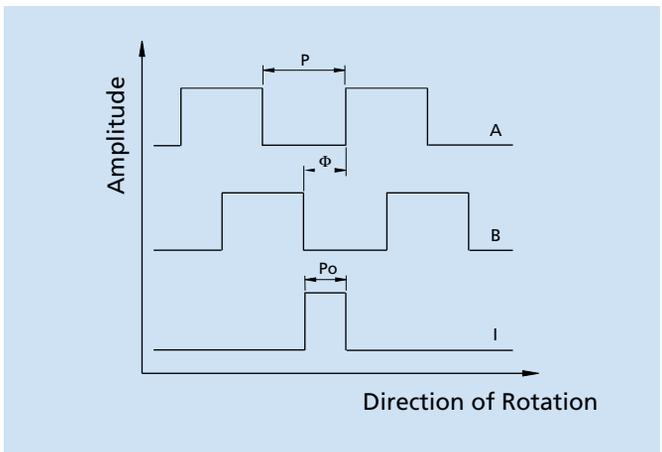


Notes on technical data

Lines per revolution (N)
The number of incremental encoder pulses per revolution per channel.

The output signal is a quadrature signal which means that both the leading and following edge, or flank, can be evaluated. For example, an encoder with two channels and 256 lines per revolution has 1024 edges, or flanks per revolution.

Output signal
The number of output channels. For example, the IE3 encoders offer 2 channels, A and B, plus an 1 additional index channel.



Supply Voltage (U_{DD})
Defines the range of supply voltage necessary for the encoder to function properly.

Current consumption, typical (I_{DD})
Indicates the typical current consumption of the encoder at the given supply voltage.

Output current, max. (I_{OUT})
Indicates the maximum allowable load current at the signal outputs.

Puls width (P)
Width of the output signal in electrical degrees (°e) of the channels A and B. The value corresponds to one full period, or 360°e at channel A or B.

Index pulse width (P_0)
Indicates the width of the index pulse signal in electrical degrees.

Tolerance ΔP_0:

$$P_0 = \left| 90° - \frac{P_0}{P} * 180° \right|$$

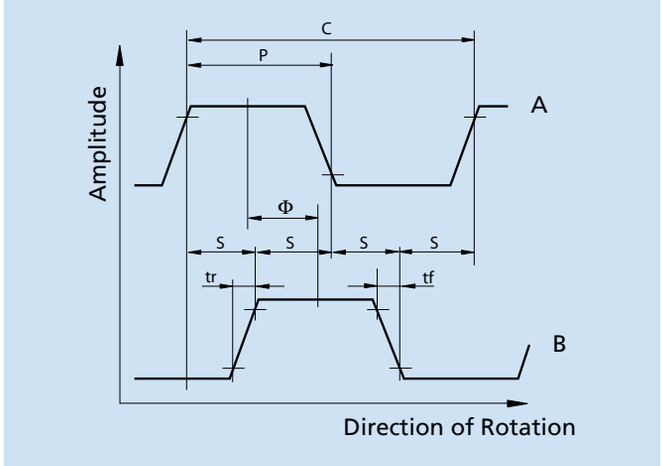
Phase shift, channel A to B (Φ)
The phase shift in electrical degrees between the following edge of output channel A and the leading edge of output channel B.

Phase shift tolerance ($\Delta\Phi$)
Indicates the allowable position error, in electrical degrees, between the following edge of channel A to the leading edge of channel B.

$$\Phi = \left| 90° - \frac{\Phi}{P} * 180° \right|$$

Signal period (C)
The total period, measured in electrical degrees of one pulse on channel A or B.

Typically one period is 360 °e.



Logic state width (S)
The distance measured in electrical degrees (°e) between two neighbouring signal edges, for example the leading edge of signal A to the leading edge of signal B.

Typically this has a value of 90 °e.

Signal rise/fall time, typical (tr/tf)
Corresponds to the slope of the rising and falling signal edges.

Frequency range (f)
Indicates the maximum encoder frequency. The maximum achievable motor speed can be derived using the following formula.

$$n = \frac{60 \cdot f}{N}$$

Inertia of the code disc (J)
Indicates the additional inertial load due on the motor due to the code wheel.

Operating temperature range
Indicates the minimum and maximum allowable temperature range for encoder operation.

Test speed
The speed at which the encoder specifications were measured.

Line Driver
This is an integrated signal amplifier in the encoder that makes it possible to send the encoder signals through much longer connection cables. It is a differential signal with complementary signals to all channels which eliminates sensitivity to ambient electrical noise.

Synchronous serial interface
The synchronous serial interface (SSI) is an interface for absolute encoders with which absolute position information is supplied via serial data transfer. Position value transfer is synchronized with a clock rate defined by a control.

Steps per revolution
Steps per revolution indicates the number of position values per motor revolution.

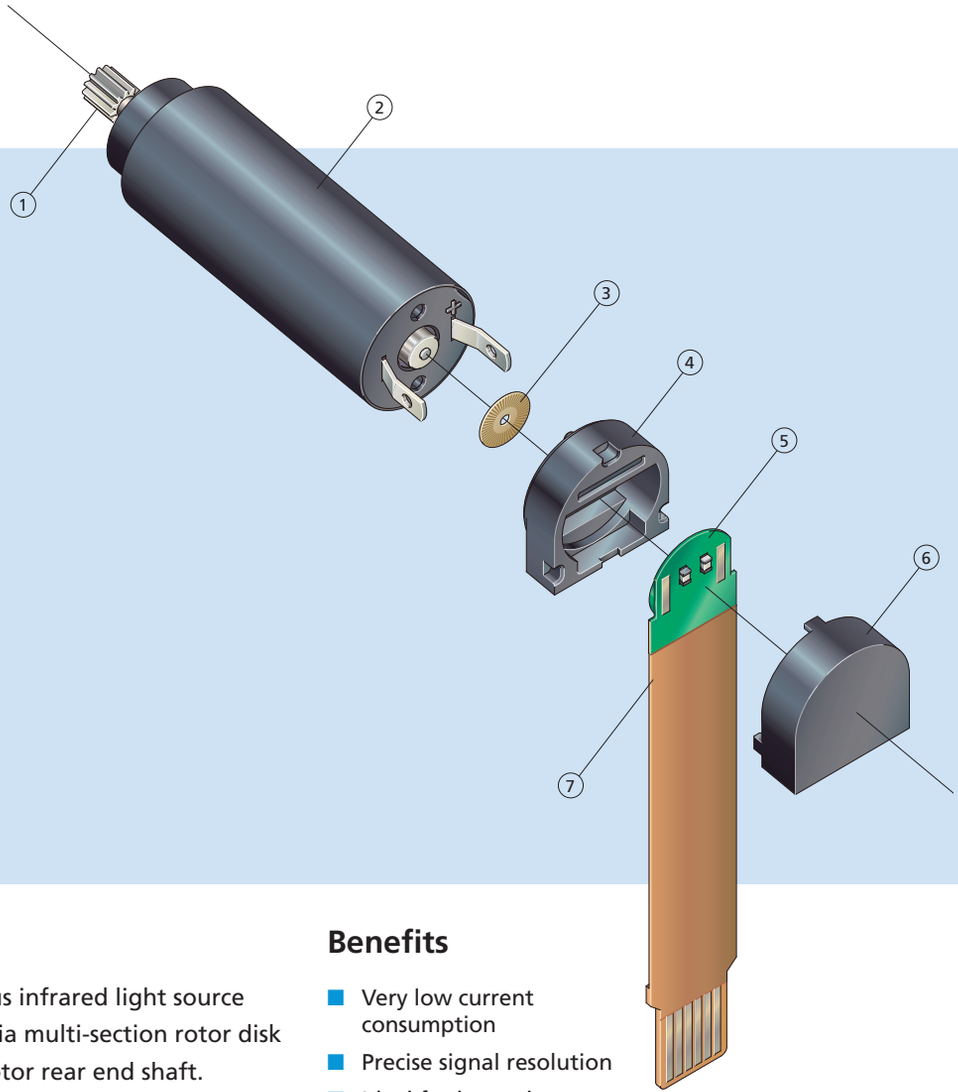
Set-up time after power on
Maximum time to availability of the output signals, as of when supply voltage is applied.

Clock frequency max.
Maximal permissible clock frequency for reading the extended synchronous serial interface.

Timeout
Refers to the time after which communication is terminated by the encoder, when the master is no longer transmitting a clock rate.

Optical Encoders

Technical Information



Optical Encoder

① Output shaft
② Motor
③ Code wheel
④ Adapter flange
⑤ Encoder PCB
⑥ End cap
⑦ Flex cable

Features

Optical encoders use a continuous infrared light source transmitting through a low-inertia multi-section rotor disk which is fitted directly on the motor rear end shaft. The unit thus generates two output signals with a 90° phase shift.

In optoreflective encoders, the light source is sent and reflected back or alternately absorbed to create the necessary phase shifted pulse.

Benefits

- Very low current consumption
- Precise signal resolution
- Ideal for low voltage battery operation
- Insensitive to magnetic interference
- Extremely light and compact

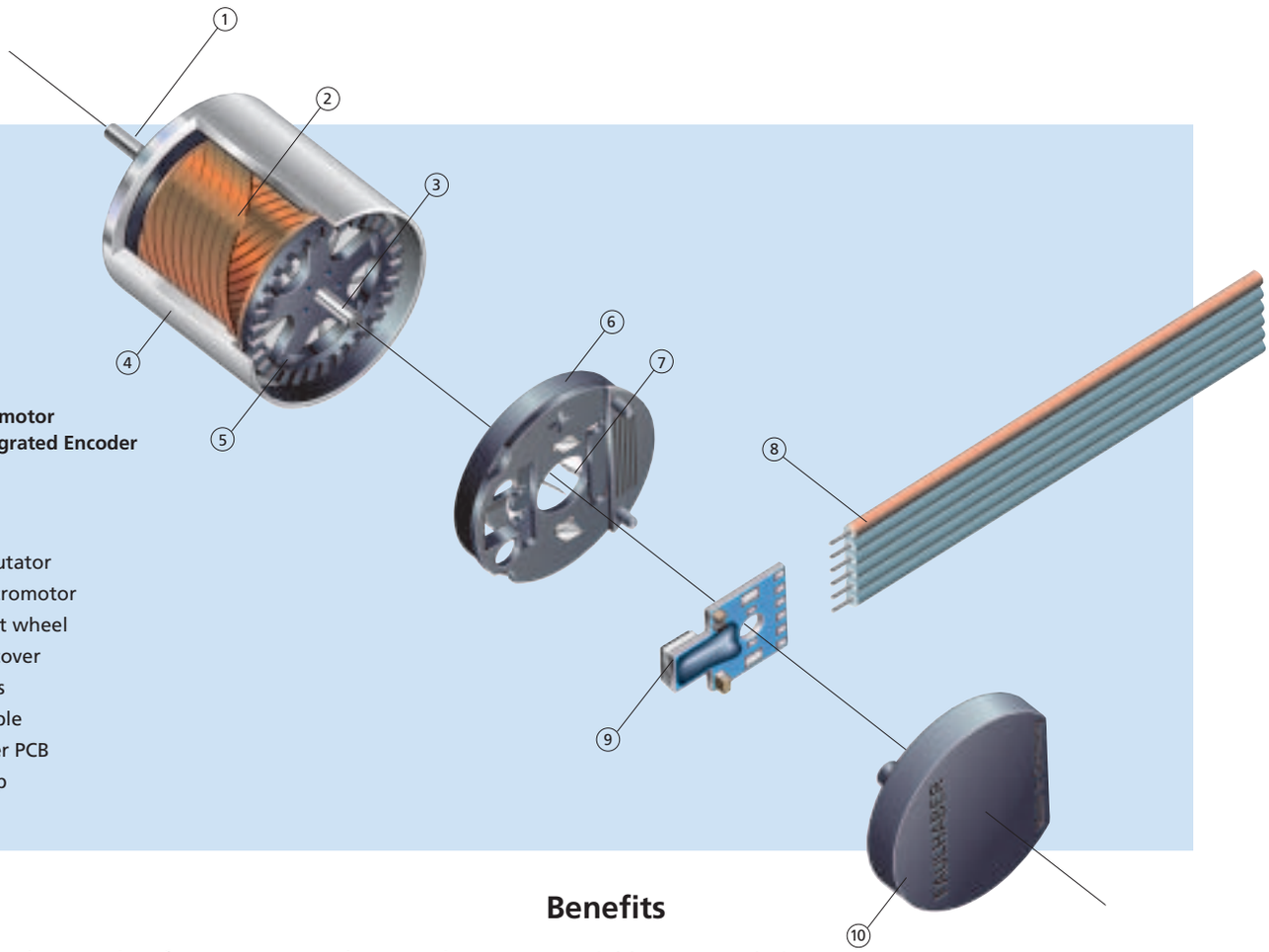
Product Code

PA	Encoder series
2	Number of Channels
50	Resolution

PA2 - 50

Integrated Encoders

Technical Information



DC-Micromotor with integrated Encoder

① Shaft
② Coil
③ Commutator
④ DC-Micromotor
⑤ Magnet wheel
⑥ Brush cover
⑦ Brushes
⑧ Flat cable
⑨ Encoder PCB
⑩ End cap

Features

Series IE2 encoders consist of a rotormounted magnetic toothed ring and a special hybrid circuit.
The magnetic field differences between the tip and base of each tooth are converted into electrical signals by a sensor integrated into the circuit.
This signal is then processed by a proprietary circuit.
The output consists of two 90°-offset square-wave signals with up to 1024 pulses.

The encoder is integrated into the SR-Series motors, increasing its length by a mere 1,4 mm and as built-on option for DC-Micromotors and brushless DC-Servomotors.

Benefits

- Highly compact design
- High resolution up to 4096 steps per revolution (corresponding to an angular resolution of 0,18°)
- No pull-up resistors across outputs because no open-collector outputs
- Symmetrical pulse edges, CMOS- and TTL -compatible
- Low power consumption
- Available in many combinations

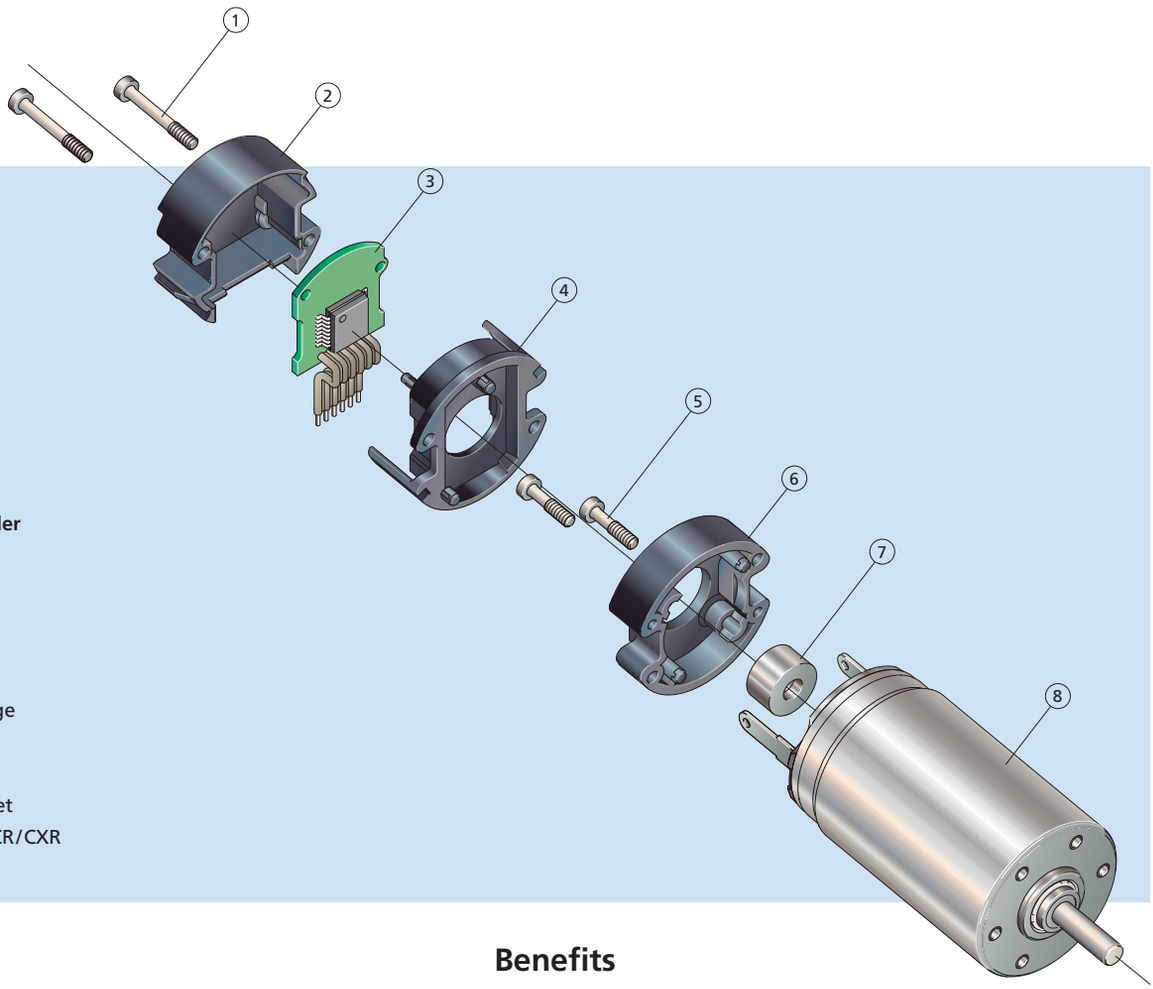
Product Code

IE	Incremental Encoder
2	Number of Channels
1024	Resolution

IE2 – 1024

Magnetic Encoders

Single Chip



Magnetic Encoder
Single Chip

① Screws
② Rear cover
③ Encoder PCB
④ Encoder flange
⑤ Screws
⑥ Motor flange
⑦ Sensor magnet
⑧ Motor Serie CR/CXR

Features

FAULHABER IE3 encoders are designed with a diametrically magnetized code wheel which is pressed onto the motor shaft and provides the axial magnetic field to the encoder electronics. The electronics contain all the necessary functions of an encoder including Hall sensors, interpolation, and driver. The Hall sensors sensed the rotational position of the sensor magnet and the signal is interpolated to provide a high resolution position signal.

The encoder signal is a two channel quadrature output with a 90 °e phase shift between channels.
A third channel provides a single index pulse per revolution. These encoders are available as attachable kits or preassembled to FAULHABER DC-Motors with graphite commutation, or as integrated assemblies for many FAULHABER Brushless DC-Servomotors.

Benefits

- Compact modular system
- A wide range of resolutions are available
- Index channel
- Line Drivers are available
- Standardized encoder outputs
- Ideal for combination with FAULHABER Motion Controllers and Speed Controllers
- Custom modifications including custom resolution, index position and index pulse width are possible

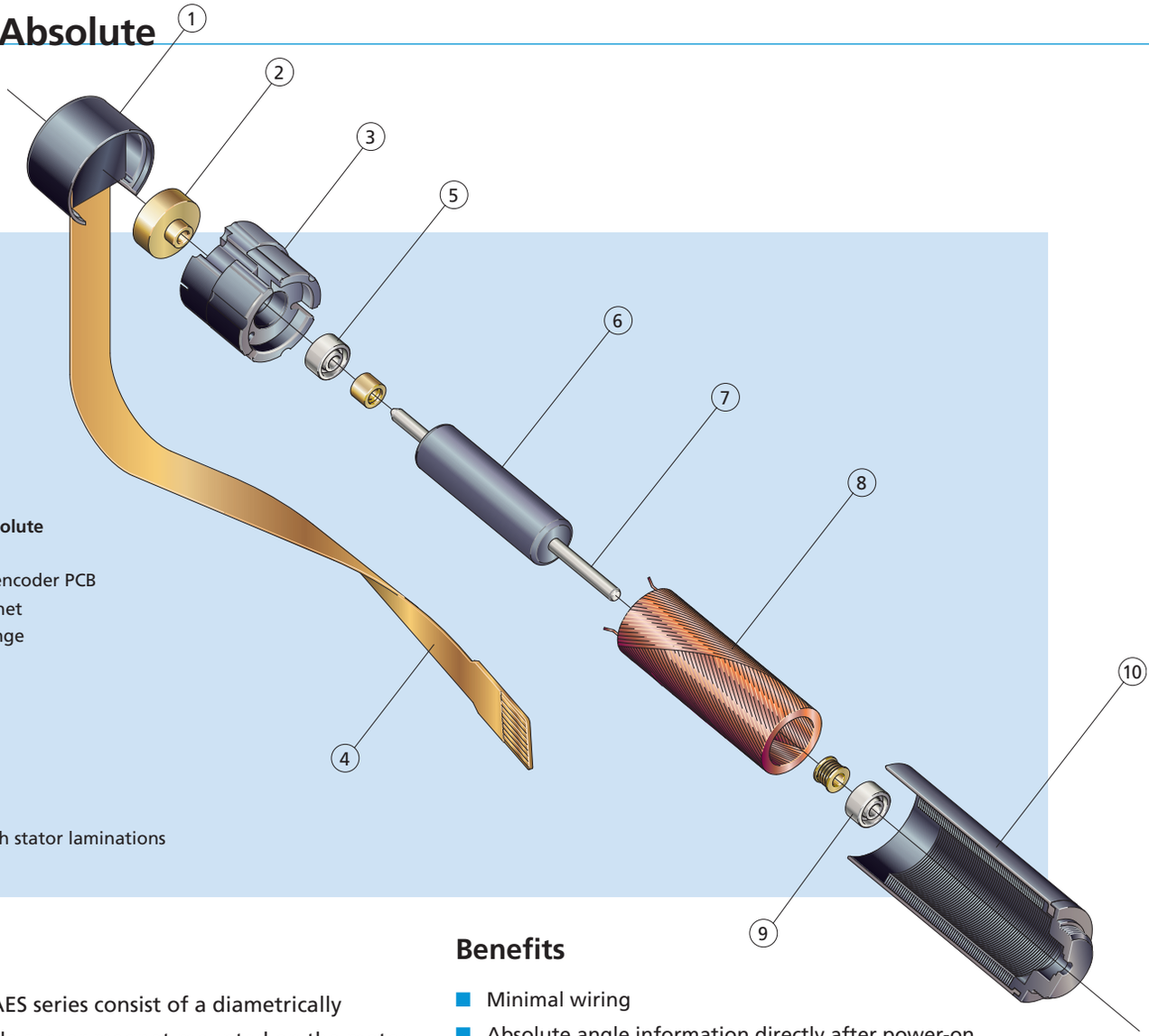
Product Code

IE3 – 1024 L

IE	Incremental Encoder
3	Number of Channels
1024	Resolution
L	with integrated Line Driver

Encoders Absolute

Single Chip



Encoders - Absolute

① Cover with encoder PCB
② Sensor magnet
③ Encoder flange
④ Flex cable
⑤ Ball bearing
⑥ Magnet
⑦ Shaft
⑧ Coil
⑨ Ball bearing
⑩ Housing with stator laminations

Features

Encoders in the AES series consist of a diametrically magnetized 2-pole sensor magnet mounted on the motor shaft. A special single-chip angle sensor for detecting the drive shaft position is positioned in an axial direction in relation to the sensor magnet. The angle sensor contains all the necessary functions such as Hall sensors, interpolator and driver stages. The analog signal of the sensor magnet detected by the Hall sensors is processed, after appropriate amplification, by a special algorithm to produce a high-resolution encoder signal. At the output there is absolute angle information available with a resolution of 4096 steps per revolution. This data can be scanned by an extended serial interface (SSI). The absolute encoder is ideal for commutation, rotational speed control and position control.

Benefits

- Minimal wiring
- Absolute angle information directly after power-on
- No referencing necessary
- Enhanced control characteristics even at low rotational speeds
- Ideal for combination with FAULHABER Motion Controllers and FAULHABER Speed Controllers
- Flexible customization of resolution and direction of rotation is possible

Product Code

AESM	Encoder Series
4096	Steps per revolution

AESM – 4096