EMAX/EMAL
Magnetic Absolute Linear Encoder with 10 µm resolution

- Absolute encoder with 10 µm resolution
- Direct and contact free measurement
- Measuring length up to 10 m (EMAX) / 20 m (EMAL)
- No referencing required (changes of position are also recognized in the de-energized state)
- Too large distances between sensor and magnetic tape are automatically detected and signalized by an LED
- Sensor with fixed cable outlet or optionally with M9 round connector on sensor housing
- Additional incremental or sine-cosine signals for dynamic movement control available
- Available interfaces: SSI, CANopen, RS422, RS232
  New: IO-Link acc. to IEC 61131-9
General

The series EMAX / EMAL is an absolute length measuring system. Sensor and translator and interpolation unit are together in the same compact housing. The magnetic tape of series EMAB is pasted up to a plain area. The EMAX / EMAL encoders can be mounted with a maximum distance of 1.5 mm to the magnetic tape. With a reduced measuring accuracy the sensor distance can be up to 2.0 mm.

The only difference between EMAX and EMAL is the maximum measuring length:
- up to 10 m with version EMAX
- up to 20 m with version EMAL

Product Features
- Absolute Measurement (No referencing required (changes of the position are also recognized in the de-energized state)
- Resolution 0.01 mm
- Contactless measuring principle
- Two designs: Housing with cable outlet or round connector
- Measuring length: EMAX max. 10 m / EMAL max. 20 m
- Automatic distance monitoring: LED glows red if the distance between sensor and magnetic tape is too large
- Additional incremental square wave or 1 Vpp sine-cosine signals for dynamic movement control available (only for housing design with fixed cable outlet available)

Available Interfaces

Different interfaces are available for EMAX and EMAL e.g. RS232, RS422, addressable RS422, SSI, CANopen (according to DS406) or a CAN interface with the ELGO CAN standard protocol. In addition, EMAX / EMAL is also available with an IO-Link interface according to the IEC 61131-9 standard.

Applications

Typical applications are handling systems, conveyor and storage technology, hydraulic presses, stamping machines, casting machines, linear slides, linear drives and pick and place systems.

Versions with IO interface are also predestined for integration into modern industry 4.0 concepts.

Guide Carriage and Rails

The guide carriage type FW2080 is available for the design with fixed cable outlet. In combination with the EMAX / EMAL sensor and the ELGO guide rails FS1000, FS1500 or FS2000, it forms a completely guided linear measuring unit. For details see "Accessories" on the last page.

Functional Principle

A Hall sensor and a magneto-resistive impedance measuring bridge are guided over a two-track magnetic tape with a fine-interpolation track and an absolute track. Together with the sensor line the absolute track provides an absolute value and the fine-interpolation track provides together with the interpolation electronic the measuring systems high resolution.

The fine interpolation track encloses alternately north and south pole traces with a distance of 5 mm, these are scanned with resistance bridges and provide a resolution of 0.01 mm. The absolute value provides the sensor line with 16 single Hall sensors; these sensors are scanning the code sections of the north and south poles. The absolute value on the magnetic tape recurs every 10 m with an EMAX resp. every 20 m with an EMAL system.
**Technical Data**

**EMAX (Standard version)**

<table>
<thead>
<tr>
<th>Mechanical Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring principle</td>
<td>absolute</td>
</tr>
<tr>
<td>Repeat accuracy</td>
<td>± 1 increment</td>
</tr>
<tr>
<td>System accuracy in μm at 20° C</td>
<td>Standard: 010: ±(150 + 20 x L)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Distance from sensor to the magnetic tape</td>
<td>max. 1.5 mm (2.0 mm at reduced measuring accuracy)</td>
</tr>
<tr>
<td>Basic pole pitch</td>
<td>5 mm</td>
</tr>
<tr>
<td>Sensor housing material</td>
<td>with cable outlet = zinc die cast, with round connector = aluminum</td>
</tr>
<tr>
<td>Sensor housing dimensions</td>
<td>with cable outlet = 75 x 24 x 26 mm, with round connector = 75 x 22 x 39 mm</td>
</tr>
<tr>
<td>Required magnetic tape</td>
<td>EMAX: AB20-50-20-R-11</td>
</tr>
<tr>
<td>Measuring length</td>
<td>EMAX: max. 10 m</td>
</tr>
<tr>
<td>Connection</td>
<td>version with cable outlet: open cable ends (connectors optionally), version with round connector: via DKA cable (accessorial part)</td>
</tr>
<tr>
<td>Sensor cable</td>
<td>1.5 m standard cable length (others on request)</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 100 g, cable approx. 60 g/m</td>
</tr>
</tbody>
</table>

**Electrical Data**

| Supply voltage                   | + 10 ... 30 VDC |
| Residual ripple                  | 10 ... 30 V: <10 % |
| Power input                      | max. 150 mA |
| Interfaces                       | SSI, CANopen ([DS406], RS422, RS232 or IO-Link according to IEC 61131-9) |
| Resolution                       | 0.01 mm |
| Speed                            | max. 4 m/s |

**Environment Conditions**

| Storage temperature              | -20 ... +85° C |
| Operation temperature            | -10 ... +70° C (+20 ... +85° C on request) |
| Humidity                         | max. 95 %, not condensing |
| Protection Class                 |          |

**Type Designation**

Please use the following code to order:

```
AAAA BB CCC DDD EEE FFF G HHHH I J KKKK
```

**A Series / Type**
- EMAX = Measuring length up to 10 m
- EMAL = Measuring length up to 20 m (at extra charge)

**B Version**
- 00 = 00 (standard) / 01 ... 99 (special versions)
- 11 = EMAX / EMAL sends automatically without NMT command and has 4 bytes position output without velocity output

**C Sensor housing / Connections:**
- 000 = no cable, sensor housing with M9 round connector (DKA cable available, see accessories)
- 015 = sensor housing with fixed cable outlet (1.5 m standard cable length, other lengths on request available)

**D Resolution in μm**
- 010 = 10 μm - for system accuracy in μm ±(150 + 20 x L)
- F10* = 10 μm - for system accuracy in μm ±(50 + 20 x L)
  * Variant F10 at extra charge

**E Interface**
- SBO = SSI interface (25 bit binary)
- SG0 = SSI interface (25 bit Gray)
- CA0 = CANopen ([DS406], RS422, RS232 or IO-Link according to IEC 61131-9)
- CN0 = CAN BASIC ELGO
- 420 = RS422
- A20 = RS422 addressable
- 230 = RS232
- IOL = IO-Link according to IEC 61131-9

**F Bit rate**
- 096k = 9600 bit/s - standard bit rate for RS232 and RS422
- 192k = 19200 bit/s for RS232 or RS422
- 384k = 38400 bit/s for RS232 or RS422
- 125k = 125000 bit/s for CAN
- 250k = 250000 bit/s for CAN
- 500k = 500000 bit/s for CAN
- 1MHz = 1000000 bit/s for CAN
- 230k = 230400 bit/s for IO-Link (factory setting)

**Additional options**
- Address = Device address 0...F (standard setting = 0)

**H Connection Options** (only for versions with fixed cable outlet)
- D9M = 9-pin (male) D-SUB (only for CAN interfaces)
- D9MO = 9-pin (male) D-SUB, ELGO standard pin assignment (only for RS232, RS422 and SSI interfaces)
- D9M5 = 9-pin (male) D-SUB (only for RS422 with Bit Rate 096k) with option 5 (pin assignment suitable for Z25 indicators)
- M8F0 = 8-pin (female) M16 connector with ELGO standard SSI pin assignment (suitable for ELGO PN01)
- M8MO = 8-pin (male) M16 connector (only for RS422 and SSI)
- RSMO = 5-pin (male) M12 connector, ELGO pin assignment (CAN)
- RCMO = 12-pin M12 connector (only IO-LINK + Sin/Cos or A/B)
- MCMO = 12-pin (male) M16 connector (only SSI + Sin/Cos or A/B)
- MCFO = 12-pin (female) M16 connector (only SSI + Sin/Cos or A/B)

**I V**
- V = Sealed IP65 version (without rotary code switches - please specify the desired configuration when ordering)

**J A**
- A = without termination resistor

**K Additional Incremental Signals** (only versions with fixed cable outlet)
- H2N5 = HTL square wave signals with 2.5 μm resolution
- H005 = HTL square wave signals with 5 μm resolution
- H010 = HTL square wave signals with 10 μm resolution
- H025 = HTL square wave signals with 25 μm resolution
- T2N5 = TTL square wave signals with 2.5 μm resolution
- T005 = TTL square wave signals with 5 μm resolution
- T010 = TTL square wave signals with 10 μm resolution
- T025 = TTL square wave signals with 25 μm resolution
- SC50 = 1 Vpp Sine-Cosine signals with 5 mm pole pitch
**Sensor Housing Dimensions**

**Version with cable outlet**

![Diagram of Sensor Housing Dimensions](image)

**Version with round connector**

![Diagram of Sensor Housing Dimensions](image)

**Accessories**

<table>
<thead>
<tr>
<th>Order Designation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AB20-50-20-2-R-11</td>
<td>Absolute coded magnetic tape for EMAX</td>
</tr>
<tr>
<td>AB20-50-20-2-R-12</td>
<td>Absolute coded magnetic tape for EMAL</td>
</tr>
<tr>
<td>End cap set (20 mm)</td>
<td>2 end caps (20 mm) and two M3 screws; additional fixation in the radial and linear range and protection of the magnetic tape ends</td>
</tr>
<tr>
<td>FS1000, FS1500 or FS2000</td>
<td>Guide rail for magnetic tape (length 1.0, 1.5 or max. 2.0 m). For larger distances several guide rails can be rowed together.</td>
</tr>
<tr>
<td>FW2080</td>
<td>Guide carriage for EMAX / EMAL (only versions with connector housing) L x W x H = 100 x 48 x 34 mm</td>
</tr>
<tr>
<td>DKA-00-Q7F0-050*-XXXX-06-N-N-N</td>
<td>Standard signal cable for versions with connector on housing: (sensor side 7-pin M9) (customer side 6-wire)</td>
</tr>
<tr>
<td>DKA-00-Q7F0-050*-R4MA-04-N-N-N</td>
<td>IO-Link signal cable for versions with connector on housing. (sensor side 7-pin M9) (customer side 4-pin. M12)</td>
</tr>
<tr>
<td>POSU</td>
<td>Pole finder card 85 x 55 mm</td>
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