Operating Manual
SERIES EMI X23
Magnetic Linear Encoder with 1 μm resolution

- With periodically index pulse or optional reference pulse
- Direct and contactless measurement (allowed distance between sensor and magnetic tape: 0.1 ... 0.8 mm)
- Optional LED distance monitoring available
- Measurement lengths theoretically unlimited
- High standard resolution of 1 μm
- Very robust against dust and dirt
- Speed proportional square wave outputs
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4 General, Safety, Transport and Storage

4.1 Information Operating Manual

This manual contains important information regarding the handling of the device. For your own safety and operational safety, please observe all safety warnings and instructions. Precondition for safe operation is the compliance with the specified safety and handling instructions. Moreover, the existing local accident prevention regulations and the general safety rules at the site of operation have to be observed. Please read the operating manual carefully before starting to work with the device! It is part of the product and should be kept close to the device and accessible for the staff at any time. The illustrations in the manual are for better demonstration of the facts. They are not necessarily to scale and can slightly differ from the actual design.

4.2 Explanation of Symbols

Special notes in this manual are characterized by symbols. The notes are introduced by signal words which express the magnitude of danger. Please follow this advice and act carefully in order to avoid accidents, damage, and injuries.

Warning notes:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🚨</td>
<td>DANGER! This symbol in connection with the signal word “Danger” indicates an immediate danger for the life and health of persons. Failure to heed these instructions can result in serious damage to health and even fatal injury.</td>
</tr>
<tr>
<td>🚨</td>
<td>WARNING! This symbol in connection with the word „Warning“ means a possibly impending danger for the life and health of persons. Failure to heed these instructions can result in serious damage to health and even fatal injury.</td>
</tr>
<tr>
<td>🚨</td>
<td>CAUTION! This symbol in connection with the signal word “Caution” indicates a possibly dangerous situation. Failure to heed these instructions can lead to minor injuries or damage of property.</td>
</tr>
</tbody>
</table>

Special safety instructions:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🚨</td>
<td>DANGER! This symbol in connection with the signal word “Danger” indicates an immediate danger for the life and health of persons due to voltage. Failure to heed these instructions can result in serious damage to health and even fatal injury. The operations may only be carried out by a professional electrician.</td>
</tr>
</tbody>
</table>

Tips and recommendations:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>📚</td>
<td>NOTE! …points out useful tips and recommendations as well as information for an efficient and trouble-free operation.</td>
</tr>
</tbody>
</table>

Reference marks:

- Marks a reference to another chapter of this manual.
- Marks a reference to another chapter of another document.
4.3 Statement of Warranties

The producer guarantees the functional capability of the process engineering and the selected parameters.

4.4 Demounting and Disposal

Unless acceptance and disposal of returned goods are agreed upon, demount the device considering the safety instructions of this manual and dispose it with respect to the environment.

**Before demounting:** Disconnect the power supply and secure against re-start. Then disconnect the supply lines physically and discharge remaining energy. Remove operational supplies and other material.

**Disposal:** Recycle the decomposed elements: Metal components in scrap metal, Electronic components in electronic scrap, Recycle plastic components. Dispose the remaining components according to their material consistence.

**CAUTION!** Wrong disposal causes environmental damages! Electronic scrap, electronic components, lubricants and other auxiliary materials are subject to special refuse and can only be disposed by authorized specialists!

Local authorities and waste management facilities provide information about environmentally sound disposal.

**Safety**

**CAUTION!** Please read the operating manual carefully, before using the device! Observe the installation instructions! Only start up the device if you have understood the operating manual. The operating company is obliged to take appropriate safety measures. The initial operation may only be performed by qualified and trained staff. Selection and installation of the devices as well as their embedding into the controlling system require qualified knowledge of the applicable laws and normative requirements on the part of the machine manufacturer.

4.5 General Causes of Risk

This chapter gives an overview of all important safety aspects to guarantee an optimal protection of employees and a safe and trouble-free operation. Non-observance of the instructions mentioned in this operating manual can result in hazardous situations.

4.6 Personal Protective Equipment

Employees have to wear protective clothing during the installation of the device to minimize danger of health.

**Therefore:** Change into protective clothing before performing the works and wear them throughout the process. Additionally observe the labels regarding protective clothing in the operating area.

**Protective clothing:**

- **PROTECTIVE CLOTHING** … is close-fitting working clothing with light tear strength, tight sleeves and without distant parts. It serves preliminarily for protection against being gripped by flexible machine parts. Do not wear rings, necklaces or other jewellery.

- **PROTECTIVE GLOVES** … for protecting the hands against abrasion, wear and other injury of the skin.

- **PROTECTIVE HELMET** … for protection against injuries of the head.
4.7 Conventional Use

The ELGO-device is only conceived for the conventional use described in this manual. The EMIX23 length measuring system only serves to measure lengths and positions.

**CAUTION!**
Danger through non-conventional use!
Non-intended use and non-observance of this operating manual can lead to dangerous situations. Therefore:
- Only use the device as described
- Strictly follow the instructions of this manual

Avoid in particular:
- Remodeling, refitting or changing of the construction or single components with the intention to alter the functionality or scope of the device.

Claims resulting from damages due to non-conventional use are not possible. Only the operator is liable for damages caused by non-conventional use.

4.8 Safety Instructions for Transport, Unpacking and Loading

**CAUTION!**
Transport the package (box, palette etc.) professionally. Do not throw, hit or fold it.

4.9 Handling of Packaging Material

Notes for proper disposal: 4.4

4.10 Inspection of Transport

Check the delivery immediately after the receipt for completeness and transport damage. In case of externally recognizable transport damages:
- Do not accept the delivery or only accept under reserve.
- Note the extent of damages on the transportation documents or delivery note.
- File complaint immediately.

NOTE!
Claim any damage immediately after recognizing it. The claims for damage must be filed in the lawful reclaim periods.

4.11 Storage

Store the device only under the following conditions:
- Do not store outside
- Keep dry and dust-free
- Do not expose to aggressive media
- Protect from direct sun light
- Avoid mechanical shocks
- The storage temperature (∆6 Technical Data) needs to be observed
- The relative humidity (∆6 Technical Data) must not be exceeded
- Inspect packages regularly if stored for an extensive period of time (>3 months)
5 Product Features

The EMIX23 is an incremental magnetic length measuring system. The sensor technology and translator are placed in the same housing. The magnetic tape is adhered to a flat base with the supplied adhesive tape. The EMIX23 can be installed up to a maximum distance of 0.8 mm.

The measuring system offers decisive advantages:

- Direct and contactless measurement
- Distance range between sensor and tape: 0.1... 0.8 mm
- Status LED for reading distance available (option only for version 5 VDC / 5 V-TTL)
- Theoretically unlimited measurement length
- High standard resolution of 1 µm
- Repeat accuracy:
  - ± 1 increment at resolutions >10 µm
  - ± 2 µm at resolutions ≤ 10 µm
- Very robust against dust and dirt
- Definable reference pulse (option)


5.1 Functional principle

The basis of the magnetic incremental encoder consists of a scanning technology, which scans the north and south poles on the coded magnetic tape and produces a single Sine/Cosine wave for each pole.

The complete sine/cosine signal process is interpolated electronically. Depending on the interpolation refinement, together with the pole distance of the magnetic tape, the resolution of the measuring system is determined. The MB 20-20 magnetic tape has a pole pitch of 2 mm. A special evaluation electronic (translator) processes the sine/cosine wave into square output signals from the signal information of the magnetic tape. These square signals are equivalent to conventional optical rotary- or linear encoder outputs.

![Figure 1: Code of the Magnetic Tape](Image)

5.2 Pulse diagram

![Figure 2: Pulse Diagram](Image)

The channels A and B are phase shifted by 90°.

The index pulse output occurs periodically every 2 mm or optionally as a free definable reference pulse (R / R’).
6 Technical Data

6.1 Identification

The type label serves for the identification of the unit. It is located on the housing of the sensor and gives the exact type designation (=order reference, see type designation) with the corresponding part number. Furthermore, the type label contains a unique, traceable device number. When corresponding with ELGO always indicate this data.

6.2 Dimensions Sensor

Figure 3: Dimensions Sensor

6.3 Dimensions FBK80 and End / Connection Profile AFBK80

Dimensions of the FBK80 (guiding profile for magnetic tape BK80)

Figure 4: Dimensions FBK80
### Technical Data Sensor

#### EMIX23 (standard version)

**Mechanical Data**

- **Measuring principle:** incremental
- **Repeat accuracy:**
  - ± 1 increment at resolutions > 10 µm
  - ± 2 µm at resolutions ≤ 10 µm
- **System accuracy in µm at 20°C:** ± (20 + 20 x L) L = measuring length in meters
- **Allowed distance sensor / tape:** max. 0.8 mm
- **Pole pitch:** 2 mm
- **Sensor housing material:** zinc die cast
- **Sensor housing dimensions:** L x W x H = 30 x 12.5 x 25 mm
- **Required magnetic tape with higher resolutions ≤ 1 µm:**
  - standard: MB20-20-10-1-R-EPS
  - option REF: MB20-20-10-2-R-C-REFXXX-EPS
  - option BK80: MB20-20-10-1-R-D-BK80-EPS
  - option BK80 + REF: MB20-20-10-2-R-D-BK80-REFXXX-EPS
- **Required magnetic tape with coarser resolutions > 1 µm:**
  - standard: MB20-20-10-1-R
  - option REF: MB20-20-10-2-R-C-REFXXX
  - option BK80: MB20-20-10-1-R-D-BK80
  - option BK80 + REF: MB20-20-10-2-R-D-BK80-REFXXX
- **Maximum measuring length:** theoretically unlimited
- **Connection type:** open cable end or with plug connector (option D1, D3)
- **Sensor cable:** 1.5 m standard length, others on request (max. 30 m)
- **Weight:** approx. 40 g without cable (cable approx. 60 g/m)

**Electrical Data**

- **Power supply:** 5 VDC or 10 ... 30 VDC
- **Residual ripple:** 5 V: +/-25 mV; 10-30 V: < 10 %
- **Consumption:** max. 200 mA
- **Output channels:** A, A', B, B', Z, Z' (index pulse) resp. R, R' (reference pulse)
- **Output levels:** 5 V-TTL / 10...30 V-HTL
- **Resolution (at 4-edge triggering):** 0,001 mm
- **Index pulse:** 2 mm periodically or free definable reference pulse (option R)
- **Max. output frequency per channel:** 1 MHz
- **Max. movement speed:** 2 m/s

**Ambient conditions**

- **Storage temperature:** -20 ... +85°C
- **Operation temperature:** -10 ... +70°C (-25 ... +85°C on request)
- **Humidity:** max. 95 %, not condensing
- **Protection class:** IP67
### Technical Data Magnetic Tape

The magnetic tape consists of two components:

- The actual magnetic tape which carries the position information
- A mechanical stainless steel back iron (interference band)

#### Magnetic Tape MB20-20-10-1-R

<table>
<thead>
<tr>
<th>Coding</th>
<th>Absolute, single track system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pole pitch</td>
<td>8 mm</td>
</tr>
<tr>
<td>Operation temperature installed</td>
<td>-20 ... +65° C (-20 ... +80° C usage without adhesive tape, options „B“ or „D“)</td>
</tr>
</tbody>
</table>
| Storage temperature uninstalled | Short-term: -10 ... +60° C  
Medium-term: 0°...+40° C  
Long-term: +18° C  
(-20 ... +80° C usage without adhesive tape, options „B“ or „D“) |
| Gluing temperature | +18 ... +30° C |
| Relative humidity | max. 95 %, non-condensing |
| Accurateness 20°C in mm | ± (0.025 + 0.02 x L)  
L = measuring length in meters |
| Material carrier tape | Precision strip 1.4310 / X10CrNi 18-8 (EN 10088-3) |
| Double-faced adhesive tape | 3M-9088 (observe instructions), others on request |
| Dimensions |  
without adhesive tape:  
10 mm (± 0.1) x 1.35 mm (± 0.11)  
with adhesive tape (excl. carrier):  
10 mm (± 0.1) x 1.56 mm (± 0.13)  
with adhesive tape (incl. carrier):  
10 mm (± 0.1) x 1.63 mm (± 0.14) |
| Length expansion coefficient | α = 16 x 10^{-6} 1/K |
| Thermal length expansion | ΔL[m] = L[m] x α x ΔT[K]  
(L = tape length in meters, ΔT = relative temperature change) |
| Bending radius | min. 150 mm, min. 50 mm in case of usage without adhesive tape (options B and D) |
| Available lengths | up to maximum 32 m |
| Weight magnetic tape | approx. 62 g/m (incl. magnetic tape and cover tape) |
| Tape imprint | ELGO standard, printing color black, digit height >= 5 mm |
| Influence of external magnets | External magnetic fields must not exceed 64 mT (640 Oe; 52 kA/m) on the surface of the magnetic tape, because this could damage or destroy the code on the tape. |
| Protection class | IP65 |
# 7 Installation and First Start-Up

**CAUTION**
Please read the operating manual carefully before using the device! Strictly observe the Installation instructions!
In case of damage caused by failure to observe this operating manual, the warranty expires.

ELGO is not liable for any secondary damage and for damage to persons, property or assets.

The operator is obliged to take appropriate safety measures.

The first start-up may only be performed by staff that has been trained and authorized by the operator.

## 7.1 Operating Area

**WARNING!**
Do not use the device in explosive or corrosive environments!
The device must not be installed close to sources of strong inductive or capacitive interference or strong electrostatic fields!

**CAUTION!**
The electrical connections must be made by suitably qualified personnel in accordance with local regulations.

The device may be designed for switchboard mounting. During work on the switchboard, all components must be de-energized if there is a danger of touching the energized parts!
(protection against contacts)

Wiring works may only be performed in the de-energized state!

Thin cable strands have to be equipped with end sleeves!

Before switching on the device, connections and plug connectors have to be checked!

The device must be mounted in a way that it is protected against harmful environmental influences such as splashing water, solvents, vibration, shock and severe pollution and the operating temperature must not be exceeded.
### 7.2 Installation of the Magnetic Tape

**NOTE: External Magnetic Fields**

The magnetic tape must not be influenced by external magnetic fields!
The magnetic tape must not come into direct contact with other magnetic fields (e.g. permanent magnets, magnetic clamps, electromagnets, magnetic stands)! This may cause irreparable damage, which will compromise the measuring accuracy or even the functioning.

### 7.2.1 The Magnetic Tape MB20-20-10

In the standard case, the magnetic tape is delivered as described. It is installed by gluing it to the respective mounting surface.

**IMPORTANT NOTE:**

EMIX23 with a resolution of \( \leq 1 \mu m \) (e.g. 0.001 mm) require single pole magnetized magnetic tapes with the addition "EPS" (see type designation \( \varnothing 10.2 \)). Otherwise the required accuracy cannot be guaranteed.

For resolutions \( > 1 \mu m \) (e.g. 0.005 mm) the conventional magnetic tape can be used without the addition "EPS".

The magnetic tape consists of 2 pre-assembled components (see Figure 6):

- A magnetized, flexible plastic tape (Pos. 3), which is connected with a magnetically conductive steel tape as inference band (Pos. 4) and is supplied with an adhesive tape (Pos. 5).
- A magnetized permeable cover tape (Pos. 1), which serves for the mechanical protection of the plastic tape (not required for the measurement) and is supplied with an adhesive tape (Pos. 2). The cover tape is not necessary for the measurement.

Therefore a divergent tape structure and scope of delivery is also possible. The cover tape is also available separately.

![Figure 6: Magnetic Tape Structure](image)

Pos. 1: Stainless steel cover tape  
Pos. 2: Double-sided tape  
Pos. 3: Magnetized plastic tape  
Pos. 4: carrier tape stainless steel  
Pos. 5: Double-sided tape  
Pos. 6: Mounting surface, for example machine bed
7.2.2 Magnetic Tape with Option BK80

Top view:

![Magnetic Tape with Option BK80](image)

The cover tape (C) is not included in the delivery of this version.

7.2.3 Handling

In order to avoid tension in the tape, it must not be stretched, compressed or twisted and should be stored with the magnetized plastic tape to the outside. The minimum bending radius is 150 mm.

![Handling](image)

7.2.4 Processing hint for the gluing of magnetic tapes

**Surface-Preparation:** In order to guarantee optimal adhesion, all anti-adhesive contamination (e.g. oil, grease, dust, separating agents) has to be removed using solvents with residue-free evaporation. Suitable agents are ketones or alcohols. Typical solvents for cleaning the surface are a 50/50 isopropyl alcohol/water mixture or heptane. Those agents are offered by Loctite and 3M among others as surface cleaners. When using solvents, always observe the manufacturer instructions! If the surface is copper, brass etc., it should be sealed to avoid oxidation.

**Contact-Pressure:** The strength of the adhesion is directly dependent on the contact the adhesive can form with the surface. Therefore it is important to use as much pressure as possible when gluing the tape, possibly by using aids such as draw rolls. The optimum contact pressure is 4...5 kg/cm²).

**Gluing temperature:** The optimal gluing temperature is between +18°C and 30°C. Avoid colder sticking surfaces than +10°C, because in this case the adhesive becomes too hard and perhaps a sufficient immediate adhesion is hardly to achieve. After proper sticking, the stability of the connection is ensured also when the temperature is below zero. The final tackiness of a sticking is from experience reached after approximately 72 hours (at +21°C). For gluing use only the supplied adhesive tape.
7.2.5 Cutting and Gluing

Before starting the gluing process, both the magnetic and the cover tape have to be cut to the required length.

Length cover tape = measuring length + sensor length + 50mm (end caps)

**NOTE!**
When sticking the magnetic tape pay attention to the markings on the tape and the Sensor. Improper installation does not provide the correct values. Already glued magnetic tape is destroyed after the removal, and cannot be used again. Note also the direction of counting of the measuring system.

Preferably the magnetic tape should be glued close to an edge or into a groove, which should be deep enough to embed the magnetic tape and the cover tape.

**When unprotected, the cover tape may peel off!**
Therefore:
Use tape end caps (⌀ 11) or let the cover tape overlap* the end of the magnetic tape and fix it with a screw.

The tape must be glued smoothly on the surface. The measuring accuracy decreases if the tape is not even!

Before gluing the magnetic tape and the cover tape onto the surface, they should be left lying on the mounting surface for approximately 30 minutes so that the temperature matches. This prevents strain in the tape due to thermal expansion.

**Mounting steps:**
- Thoroughly clean surface (⌀ 7.2.4)
- Let magnetic tape and cover tape adjust their temperature
- Remove protection foil of adhesive tape on magnetic tape
- Glue magnetic tape using great pressure
- Thoroughly clean surface of magnetic tape
- Remove protection foil of adhesive tape on cover tape
- Glue cover tape using great pressure
- Safeguard the ends of the cover tape against peeling off (using end caps see chapter 9.2)
### 7.2.6 Resistance against Chemical Influence

Table 1: Resistance against Chemical Influence

<table>
<thead>
<tr>
<th><strong>Show no or little effect in constant contact after 2-5 years:</strong></th>
<th>formic acid</th>
<th>glycerol 93°C</th>
<th>linseed oil</th>
<th>soy beans oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>cotton seed oil</td>
<td>N-hexane</td>
<td>lactic acid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>formaldehyde 40%</td>
<td>Iso octane</td>
<td>petroleum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Show weak to moderate effects in constant contact after approximately 1 year:</strong></th>
<th>acetone</th>
<th>gasoline</th>
<th>acetic acid 30%</th>
<th>oleic acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetylene</td>
<td>steam</td>
<td>acetic acid, pure acetic acid</td>
<td>sea water</td>
<td></td>
</tr>
<tr>
<td>ammonia</td>
<td>acetic acid 20%</td>
<td>isopropyl ether</td>
<td>stearic acid 70°C, anhydrous</td>
<td></td>
</tr>
<tr>
<td>kerosene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Have strong effects when contacting permanently after 1-5 months:</strong></th>
<th>benzene</th>
<th>nitric acid 70%</th>
<th>turpentine</th>
<th>toluene</th>
</tr>
</thead>
<tbody>
<tr>
<td>lacquer solvent</td>
<td>nitric acid, red, vitriolic</td>
<td>carbon tetrachloride</td>
<td>tetrahydrofuran</td>
<td></td>
</tr>
<tr>
<td>trichloroethylene</td>
<td>nitrobenzene</td>
<td>hydrochloric acid 37%, 93°C</td>
<td>xylene</td>
<td></td>
</tr>
</tbody>
</table>
7.2.7 Magnetic Tape Variants

Standard (1 track)
Magnetic tape: MB20-20-10-1-R

Option REF (reference pulse, 2 tracks)
Magnetic tape: MB20-20-10-2-R-C-REFXXXX

Standard BK80 - 1 track (compatible with guiding profile FBK80)
Magnetic tape: MB20-20-10-1-R-D-BK80

Option BK80 - REF - 2 tracks (compatible with guiding profile FBK80)
Magnetic tape: MB20-20-10-2-R-D-BK80-REFXXXX

Figure 9: Magnetic Tape Variants

Magnetic Tape with guiding profile FBK80

Standard BK80 - 1 track with guiding profile FBK80
Magnetic tape: MB20-20-10-1-R-D-BK80

Option BK80 – REF - 2 tracks with guiding profile FBK80
Magnetic tape: MB20-20-10-2-RD-BK80-REFXXXX

Figure 10: Magnetic Tape Variants with FBK80
7.3 Mounting of the Sensor

When mounting the sensor head, two M3 screws must be used. The specified mounting tolerances must be adhered to.

7.3.1 Mounting Tolerances EMIX23

Table 2: Mounting Tolerances EMIX23

<table>
<thead>
<tr>
<th>Tolerances</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance sensor / tape</td>
<td>max. 0.8 mm</td>
</tr>
<tr>
<td>Pitch</td>
<td>the maximum allowed distance of 0.8 mm may not be exceeded at any position</td>
</tr>
<tr>
<td>Yaw and Roll angle</td>
<td>&lt; ± 0.5°</td>
</tr>
<tr>
<td>Lateral offset</td>
<td>± 2.5 mm (for standard magnetic tape) ± 0.5 mm (for magnetic tape with option REF)</td>
</tr>
</tbody>
</table>

Sensor distance

Pitch

Roll

Lateral offset

Yaw

Figure 11: Sensor Tolerances

*) Related to the system accuracy (see Technical Data) and 10 mm wide tape
7.3.3 Active Sensor Areas

7.3.3.1 Sensor areas for horizontal mounting

![Sensor areas for horizontal mounting](image)

Figure 12: Sensor areas for horizontal mounting

7.3.3.2 Sensor areas for vertical mounting (option L)

![Sensor areas for vertical mounting (option L)](image)

Figure 13: Sensor areas for vertical mounting (Option L)
7.3.4 Mounting Options of the Sensor

Figure 14: Sensor - Mounting Options

7.3.5 Alignment of the Sensor to the Magnetic Tape

7.3.5.1 Alignment without Reference Pulse (standard)

**Standard** without reference pulse
Required single-track magnetic tape: MB20-20-10-1-R

**Top view**

Figure 15: Alignment without Reference Pulse (standard)

7.3.5.2 Alignment with Reference Pulse (Option R)

To ensure that both sensor surfaces (measuring sensor and reference sensor) are positioned correctly above the corresponding magnetic track, make sure that the sensor head is aligned centrically to the magnetic tape center.

When ordering, the reference pulse position is starting from the right side of the magnetic tape. The position of the reference pulse can be determined by using the pole finder card available as an accessory (see Figure 11).

**With reference pulse** (Option R) via separate magnetic tape track
Required dual-track magnetic tape: MB20-20-10-2-R-REF0154 (example)

**Top view**

*) 154 mm (example)

Figure 16: Alignment with Reference Pulse (Option R)

**NOTE:**
Option R (reference pulse) is only available for the horizontal version (see Figure 7.3.3).
7.3.6 Mounting of the Guiding Profile FBK80 and End / Connection Profile AFBK80

Controlled thermal expansion:
The magnetic tape can be fixed left, right or centrally - depending on the terminal expansion.

Expansion (right)  Expansion (both directions)  Expansion (left)

Figure 17: Mounting of FBK80 / AFBK80

7.3.7 Mounting of the FBK80 on beams with different heights

The guide rail is able to compensate unevenness up to max. +/- 0.5mm

Figure 18: FBK80 on beams with different heights

8 LED for Distance Monitoring (Option E)

EMIX23 encoders which are equipped with an LED are able to indicate the correct or incorrect reading distance between sensor and magnetic tape.

- LED lights green → Reading distance is ok
- LED lights red → Reading distance is not ok

NOTE:
This option is (currently) only available for the version with 5 VDC supply / TTL output levels.

More information about the reading distance ≈ 7.3.1
9 Connections

9.1 Pin Assignments

Table 3: Pin assignment with open cable ends

<table>
<thead>
<tr>
<th>Connection type</th>
<th>Color</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open cable ends</td>
<td>white</td>
<td>GND</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td>brown</td>
<td>VCC</td>
<td>10-30 V / 5 VDC</td>
</tr>
<tr>
<td></td>
<td>green</td>
<td>A</td>
<td>Channel A</td>
</tr>
<tr>
<td></td>
<td>yellow</td>
<td>B</td>
<td>Channel B</td>
</tr>
<tr>
<td></td>
<td>black</td>
<td>Z resp. R'</td>
<td>Channel Z / R</td>
</tr>
<tr>
<td></td>
<td>violet</td>
<td>A'</td>
<td>Channel A inverted</td>
</tr>
<tr>
<td></td>
<td>orange</td>
<td>B'</td>
<td>Channel B inverted</td>
</tr>
<tr>
<td></td>
<td>grey</td>
<td>Z' resp. R''</td>
<td>Channel Z / R inverted</td>
</tr>
</tbody>
</table>

Table 4: Pin assignment of option D1 (ELGO standard assignment)

<table>
<thead>
<tr>
<th>Connection type</th>
<th>Drawing</th>
<th>Pin</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 pin D-SUB connector</td>
<td><img src="image" alt="Diagram" /></td>
<td>1</td>
<td>GND</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>VCC</td>
<td>10-30 V / 5 VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>A</td>
<td>Channel A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>B</td>
<td>Channel B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>A'</td>
<td>Channel A inverted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>B'</td>
<td>Channel B inverted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>Z resp. R'</td>
<td>Channel Z / R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>Z' resp. R''</td>
<td>Channel Z / R inverted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen²</td>
<td>PE</td>
<td>Shield / Earth</td>
</tr>
</tbody>
</table>

Table 5: Pin assignment of option D3 (round connector suitable for SKA-1)

<table>
<thead>
<tr>
<th>Connection type</th>
<th>Drawing</th>
<th>Pin</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 pin Round connector</td>
<td><img src="image" alt="Diagram" /></td>
<td>1</td>
<td>GND</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>VCC</td>
<td>10-30 V / 5 VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>A</td>
<td>Channel A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>B</td>
<td>Channel B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Z resp. R'</td>
<td>Channel Z / R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>A'</td>
<td>Channel A inverted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>B'</td>
<td>Channel B inverted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>Z' resp. R''</td>
<td>Channel Z / R inverted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen²</td>
<td>PE</td>
<td>Connected to housing</td>
</tr>
</tbody>
</table>

---

1 With reference pulse versions the index pulse output (Z / Z’) is used as reference pulse output (R / R’).
2 Connect shield only at the machine side!
10 Disturbances, Maintenance, Cleaning

This chapter describes possible causes for disturbances and measures for their removal. In case of increased disturbances, please follow the measures for fault clearance in chapter 9.1.
In case of disturbances that cannot be eliminated by following the advice and the fault clearance measures given here, please contact the manufacturer (see second page).

10.1 Fault Clearance

**CAUTION!**
The device, the connection line and the signal cable must not be installed next to sources of interference that emit strong inductive or capacitive interference or strong electrostatic fields.

External perturbations can be avoided thorough suitable cable routing.

The screen of the signal output cable should only be connected to the following circuit on one side. The screens should not be grounded on both sides. Signal cables always have to be routed separately from the load power line. A safety distance of at least 0,5 m has to be kept from inductive and capacitive sources of interference such as contactors, relays, motors, switching power supplies, clocked controllers etc!

If interferences occur in spite of all the items stated above being observed, please proceed as follows:
1. Installation of RC-circuits via contactor coils of AC-contactors (e.g. 0,1 µF / 100 Ω)
2. Installation of recovery diodes via DC-inductors
3. Installation of RC-circuits via the different motor phases (in the terminal box of the motor)
4. **Do not** connect protective earth and ground
5. Connect a mains filter ahead of the external power pack

10.2 Re-start after Fault Clearance

After the fault clearance:
1. Reset the emergency stop mechanism if necessary
2. Reset the error report at the super-ordinate system if necessary.
3. Ensure that there are no persons in the danger area.
4. Follow the instructions from chapter 7.

**WARNING!**
Danger of injury through non-conventional fault clearance!

Non-conventional fault clearance can lead to severe injuries and damage of property.

Therefore:
- Any work to clear the faults may only be performed by sufficiently qualified staff
- Arrange enough space before starting the works
- Make sure that the mounting area is clean and tidy. Loose components and tools are sources of accidents.

If components need to be replaced:
- Pay attention to a correct installation of the spare parts.
- Reinstall all the fixing elements properly
- Before turning on the device, ensure that all covers and safety equipment is installed correctly and functions properly
## 10.3 Maintenance

The device is maintenance-free.

<table>
<thead>
<tr>
<th>WARNING!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger through non-conventional maintenance!</td>
</tr>
</tbody>
</table>

Non-conventional maintenance can lead to severe injuries and damage of property.

Therefore:

Maintenance works may only be completed by staff that has been authorized and trained by the operator.

## 10.4 Cleaning

<table>
<thead>
<tr>
<th>WARNING!</th>
</tr>
</thead>
<tbody>
<tr>
<td>The device can only be cleaned with a damp cloth, do not use aggressive cleanser!</td>
</tr>
</tbody>
</table>
11 Type Designation

11.1 Type Designation EMIX23

Series/Type: EMIX23 Linear encoder

Version No.: 000 = Standard version

Signal cable length (in m): 01.5 = 1.5 m standard length

Resolution in µm: 0001 = 0.001 mm at 4 edge triggering

Power supply / output levels:
- 00 = 10-30 VDC / 10-30 V- HTL
- 01 = 10-30 VDC / 5 V-TTL
- 11 = 5 VDC / 5 V-TTL

Options:
- D1 = Connection by 9 pin D-SUB, ELGO standard assignment
- D3 = Connection by round connector (compatible with SKA1 signal cable)
- L = Vertical position of the sensor*
- R = With free defineable single reference pulse
- E = LED > green LED = reading distance is ok / red LED = reading distance is not ok.**

* Option L cannot be combined with Option R
** Currently only available with power supply: 5 VDC / output levels: 5 V-TTL

NOTE
When ordering, please use the here described ordering code (Type Designation). Options that are not required are filled in with “-“.

11.1.1 Ordering Examples for EMIX23

EMIX23-000-01.5-0001-00
EMIX23 standard, with 1.5 m signal cable, 0.001 mm resolution, 10 … 30 VDC power supply, output levels HTL, connections via pre-assembled cables (open wires)

EMIX23-000-01.5-0001-00-D1-R-E
EMIX23 standard, with 1.5 m signal cable, 0.001 mm resolution, 10 … 30 VDC power supply, output levels HTL, connections via 9pin. D-SUB, reference pulse and LED for reading distance

EMIX23-000-01.5-0005-11
EMIX23 standard, with 1.5 m signal cable, 0.005 mm resolution, 5 VDC power supply, output levels TTL, connections via pre-assembled cables (open wires)
11.2 Type Designation Magnetic Tape

<table>
<thead>
<tr>
<th>Bezeichnung:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB20 = Incremental magnetic tape</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Basic pole pitch:</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 = 2 mm pole pitch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tape Width in mm:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 = 10 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Tracks:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of tracks</td>
</tr>
<tr>
<td>1 = Single track system</td>
</tr>
<tr>
<td>2 = Dual track system (necessary for reference pulse)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tape Structure:</th>
</tr>
</thead>
<tbody>
<tr>
<td>R = Standard: Magnetic tape on interference band (glued with adhesive tape on the interference band side and glued cover tape (supplied))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Options:</th>
</tr>
</thead>
<tbody>
<tr>
<td>B = Without adhesive tape on the interference band side</td>
</tr>
<tr>
<td>C = Without supplied cover tape</td>
</tr>
<tr>
<td>D = Without adhesive tape and cover tape (B+C)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional Information:</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF 0154 = Reference pulse after 154 mm</td>
</tr>
<tr>
<td>BK80 = 8 mm magnetized plastic tape on a 10 mm carrier tape</td>
</tr>
<tr>
<td>EPS = single pole magnetized (necessary with a resolution of ( \leq 1 \mu m ))</td>
</tr>
</tbody>
</table>

**NOTE**
When ordering, please use the here described ordering code (Type Designation). Options that are not required are filled in with “-“.

11.2.1 Ordering Examples for Magnetic Tape

**MB20-20-10-1-R-EPS (standard)**
Magnetic tape with 2 mm pole pitch, 10 mm wide, single track system, bonded with interference material. With single-pole magnetization (required for high sensor-resolutions from 1 µm on).

**MB20-20-10-1-R (standard)**
Magnetic tape with 2 mm pole pitch, 10 mm wide, single track system, bonded with interference material. Without single-pole magnetization (suitable for sensor-resolutions coarser than 1 µm, e.g. 0.005 mm).

**MB20-20-10-2-R-D-BK80-REF0154**
Magnetic tape with 2 mm pole pitch, 10 mm wide, dual track system, standard: magnetic tape bonded with interference material, without adhesive tape and cover band, 8 mm plastic tape on a 10 mm carrier tape, single reference pulse 154 mm from the right side (cable output right). Without single-pole magnetization (suitable for sensor-resolutions coarser than 1 µm, e.g. 0.005 mm).
### 11.3 Type Designation Guide Profile

**FBK80**

**XXX**

**Series / Type:**
Guide profile (aluminium)

**Length in mm:**
1000 = 1000 mm

Standard length in stock
(FBK80-0997)

![Figure 19: FBK80 Drawing](image)

**NOTES**
To order the guide profile, please use the order code above (type designation).

### 12 Accessories

<table>
<thead>
<tr>
<th>Type designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FW2070</td>
<td>Guide carriage for EMIX23</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>AP-00-XX</td>
<td>Cover profile (length: AP-00-1m = 1.0 m / AP-00-2m = 2.0 m)</td>
</tr>
<tr>
<td>Magnetic tape end cap set (10 mm)</td>
<td>2 end caps (10 mm) and two M3 screws; additional fixation in the radial and linear range and protection of the magnetic tape ends</td>
</tr>
<tr>
<td>FBK80</td>
<td>Guiding profile for magnetic tape BK80</td>
</tr>
<tr>
<td>AFBK80</td>
<td>Connection profile for the connection of FBK80</td>
</tr>
<tr>
<td>POSU</td>
<td>Pole finder card 85 x 55 mm for magnetic tapes</td>
</tr>
</tbody>
</table>