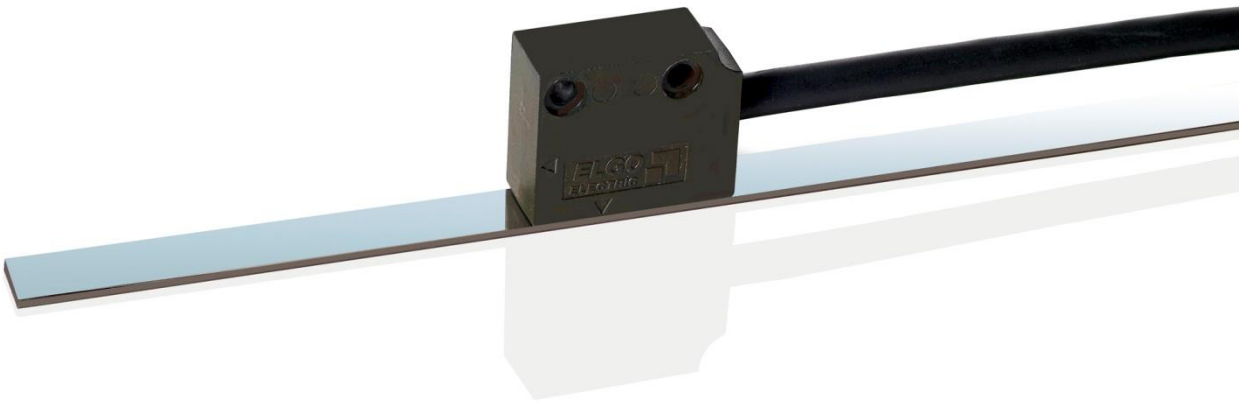
799000609 / Rev. 7 / 2017-05-12
Translation of the original operating manual

ELGO ELECTRONIC

Operating Manual

SERIE *LMIX22*

Magnetic incremental Length Measuring System with selectable resolution



- With periodic index pulse or optional reference pulse
- Distance between sensor / magnetic tape of up to 2.0 mm
- Differential HTL or TTL Line Driver outputs
- Various resolution at 4 edge triggering available (specified by order)
- Repeat accuracy ± 1 increment
- Small sensor with integrated evaluation electronic (translator)
- Speed proportional output of the square wave signals

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Document- No. 799000609

Document- Name LMIX22-000-MA-E_12-19

Document- Revision Rev. 8

Issue Date 2019-03-18

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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:

	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.
	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.
	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.

Special safety instructions:

	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.

Tips and recommendations:

	NOTE! …points out useful tips and recommendations as well as information for an efficient and trouble-free operation.

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 measure. 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 ELGO LMIX22 length measuring system only serves to measure lengths.

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:

- Remodelling, 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
- Storage temperature (☞6) needs to be observed
- Relative humidity (☞6) must not be exceeded
- Inspect packages regularly if stored for an extensive period of time (>3 months)

5 Product Features

The length measuring system LMIX22 bases on the proven LMIX encoder system. The system extends the existing LMIX product series and offers two considerable advantages:

- The resolution can be freely selected (☞ 0)
- The sensor is also available with a unique reference pulse (☞ 5.1 resp. ☞ 5.2)

Overview of features:

- Distance between sensor / magnetic tape up to 2.0 mm
- Differential HTL or TTL Line Driver Outputs
- Various resolution with 4 edge triggering available (order designation)
- Repeat accuracy +/- 1 increment
- Small sensor with integrated evaluation electronic (translator)
- Speed proportional output of square-wave signals
- Periodic index pulse every 5 millimeters (standard version) or optional reference pulse output (versions 007 and 027) available

Despite the small dimensions the evaluation electronic (translator) is integrated in the sensor head. Optionally, a vertically mountable LMIX22 variant is available. This must be specified as option "L" with the order (☞ 12.1).

Please note the following when ordering option "L":
The position of the internal sensor board is displaced by 90°. So a horizontal mounting, respectively sensing is no longer possible!

Further information about the mounting positions:

- Standard: horizontal installation (☞ 7.3.2.1)
- Option L: vertical installation (☞ 7.3.2.2)

5.1 Version LMIX22-007

Instead of a periodical index pulse (channels Z / Z'), a single reference pulse (channels R / R') occurs at the position where the magnet angle MW-007 (accessorial part ☞ 12.5) is installed. For more information refer to sections ☞ 7.4 and ☞ 8.2.

5.2 Version LMIX22-027

Instead of a periodical index pulse (channels Z / Z'), a single reference pulse (channels R / R') occurs at a desired position of the magnetic tape (☞ 8.3). In this case, a dual track magnetic tape (type MB20-50-10-2) must be used. The desired reference pulse position can be ordered by using the type designation of the magnetic tape (☞ 12.3). See also example ☞ 8.3.

5.3 Functional Principle

The basis of the magnetic incremental encoders 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 refinement of the interpolation, together with the pole distance of the magnetic tape, the resolution of the measuring system is determined.

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.

The translator circuit of the LMIX22 measuring system is already integrated in the sensor head.

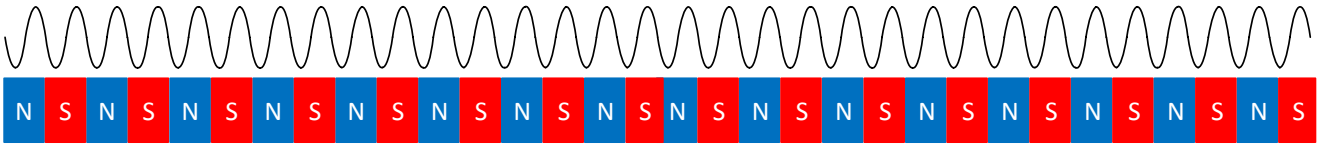
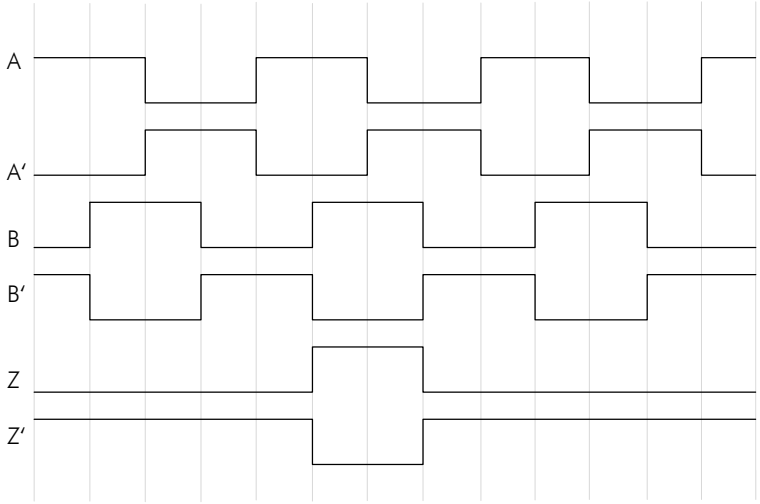


Figure 1: Magnetic Tape

5.4 Pulse Diagram



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

The index pulse output occurs periodically every 5 mm or optionally as a free definable reference pulse (R / R').

Figure 2: Pulse diagram

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

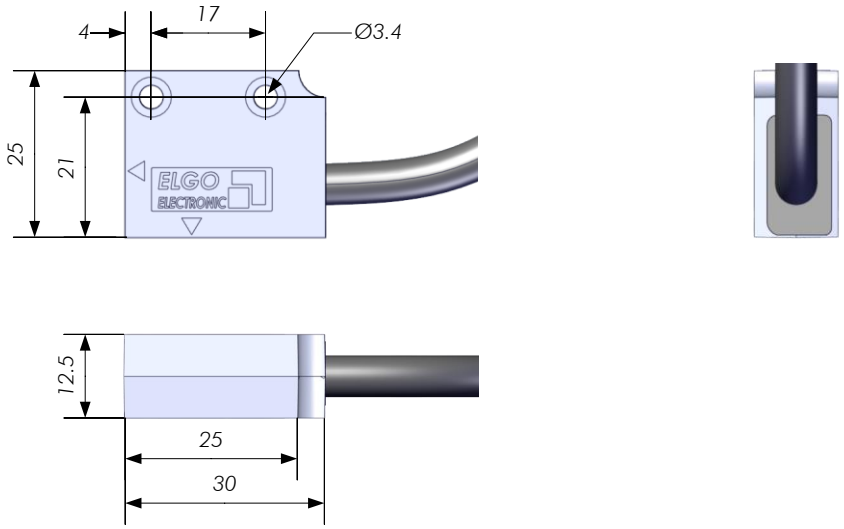


Figure 3: Dimensions LMIX22 sensor

6.3 Dimensions of Guiding Profile and End / Connection Profile

Dimensions of FBK80 (guiding profile for magnetic tape BK80)

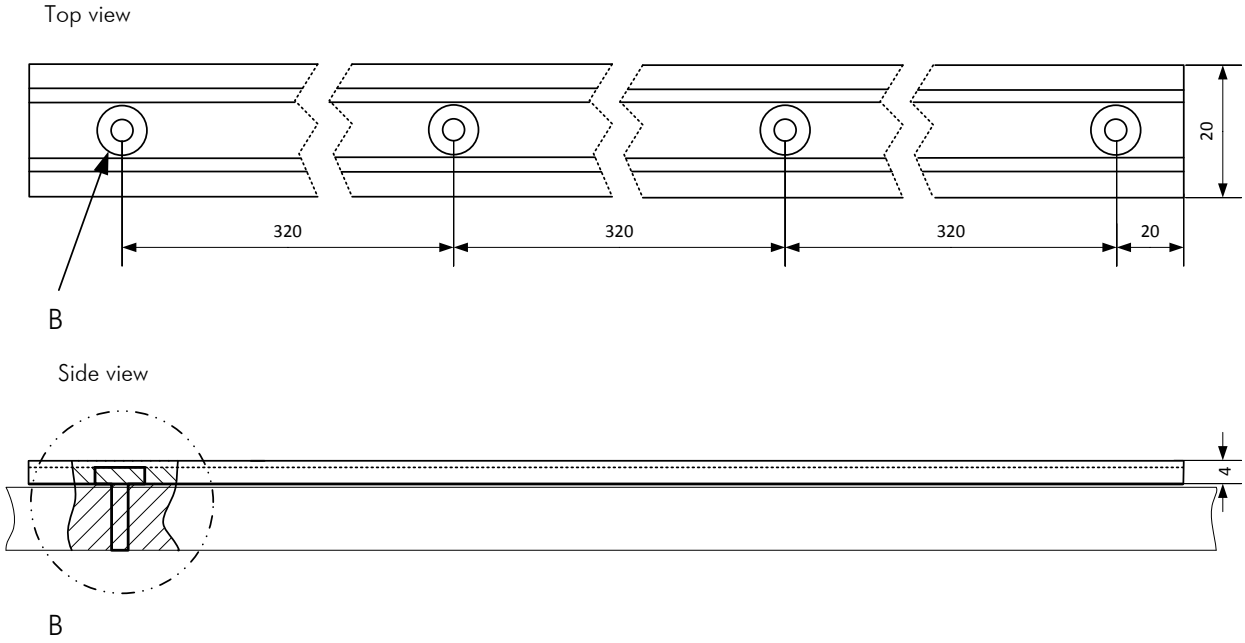


Figure 4: Dimensions FBK80

Dimensions of the End / Connection Profile AFBK80

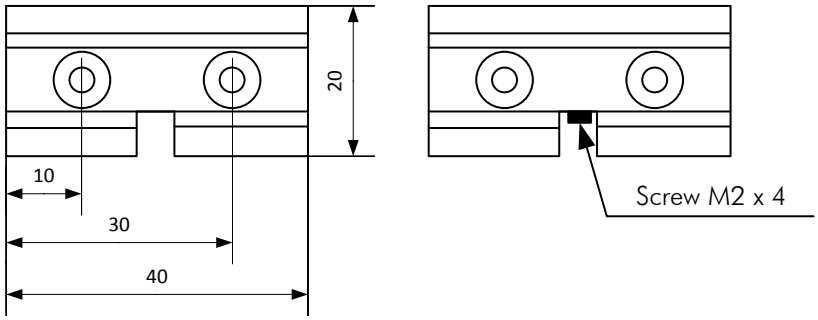


Figure 5: Dimensions AFBK 80

6.4 Technical Data Sensor

LMIX22 (Standard version)	
Mechanical Data	
Measuring principle	Incremental
Repeat accuracy	+/- 1 Increment
Signal output	Speed proportional
System accuracy in µm at 20°C	+/- (25 µm + 20 µm x L) L = measuring length in meters
Distance from sensor to magnetic tape	max. 2.0 mm
Sensor housing material	Zinc die-cast
Sensor housing dimensions	L x W x H = 30 x 12.5 x 25 mm
Required magnetic type	MB20-50-10-1-R (standard and version 007) MB20-50-10-2-R (version 027)
Maximum cable length	5 VDC / TTL = 10 m 10 … 30 VDC / HTL = 30 m 10 … 30 VDC / TTL = 50 m
Bending radius of sensor cable	min. 60 mm
Connection	Open cable ends (optionally with plug connector ☞ 12.1)
Sensor cable	1.5 m standard cable length (other on request)
Weight	ca. 35 g without cable; cable approx. 60 g/m
Electrical Data	
Power supply voltage	5 VDC or 10… 30 VDC
Residual ripple	10 … 30 VDC: <10 %
Power input	5 VDC: max. 200 mA 10 ... 30 VDC: max. 150 mA
Resolution	Selectable, see type designation ☞ 12.2
Speed	max. 4 m/s (at 10 µm resolution)
Output level	TTL Line Driver or HTL
Output channels	A, A‘,B, B‘ and Z, Z‘ (standard) resp. R, R‘ (versions 007 and 027)
Max. output frequency per channel at 10µm resolution	TTL: 100 KHz at 4 m/s HTL: 100 KHz at 4 m/s with an optimal evaluation
Output current per channel	20 mA
Index pulse (standard version)	Periodically output of channels Z and Z‘ every 5 mm
Reference pulse (versions 007, 027)	Output of reference pulse R and R‘ at magnetic angle position (version 007) or by a second magnetic tape track (version 027)
Ambient Conditions	
Storage temperature	-25 … +85° C
Operation temperature	-10 … +70° C (standard) -40 … +85° C (option T, see ☞ 9 and ☞ 12.1)
Humidity	max. 95 %, non-condensing
Protection class	IP67 (standard)

6.5 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

Magnetic Tape MB20-50-10-1-R resp. MB20-50-10-2-R	
Coding of MB20-50-10-1-R	Incremental, single track system (1 x fine interpolation)
Coding of MB20-50-10-2-R	Incremental, dual track system (1 x fine interpolation, 1 x reference pulse*)
*) The position of the reference pulse is determined by order key REF XXXX, see type designation ☞ 12.3	
Pole pitch	5 mm
Operation temperature installed	-20 °C … +65 °C (-40 °C … +80 °C with option "T", see ☞ 9)
Storage temperature uninstalled	Short-term: -10°C … +60°C Medium-term: 0°…+40°C Long-term: +18°C (-40 °C … +80 °C with option "T", see ☞ 9)
Gluing temperature:	+18°C … +30°C
Relative humidity	max. 95 %, non-condensing
Accurateness 20°C in µm	+/- (25 µm + 20 µm 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	10 mm (± 0.2 mm) x 1.8 mm (± 0.1 mm) incl. cover band (option R)
Length expansion coefficient	$\alpha \approx 16 \times 10^{-6}$ 1/K
Thermal length expansion	$\Delta L[m] = L[m] \times \alpha[1/K] \times \Delta\vartheta[K]$ (L = tape length in meters, $\Delta\vartheta$ = relative temperature change)
Bending radius	min. 60 mm
Available lengths	32 m (up to 70m on request)
Weight magnetic tape	ca. 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 as this could damage or destroy the code on the tape.
Protection class	IP65

6.6 Sensor position (active sensor area)

The following figures show the active sensor area (red hatched) for the horizontal and vertical sensor installation. Please read the mounting instructions ☞ 7.3.1.

6.6.1 Sensor position with horizontal installation (standard version)

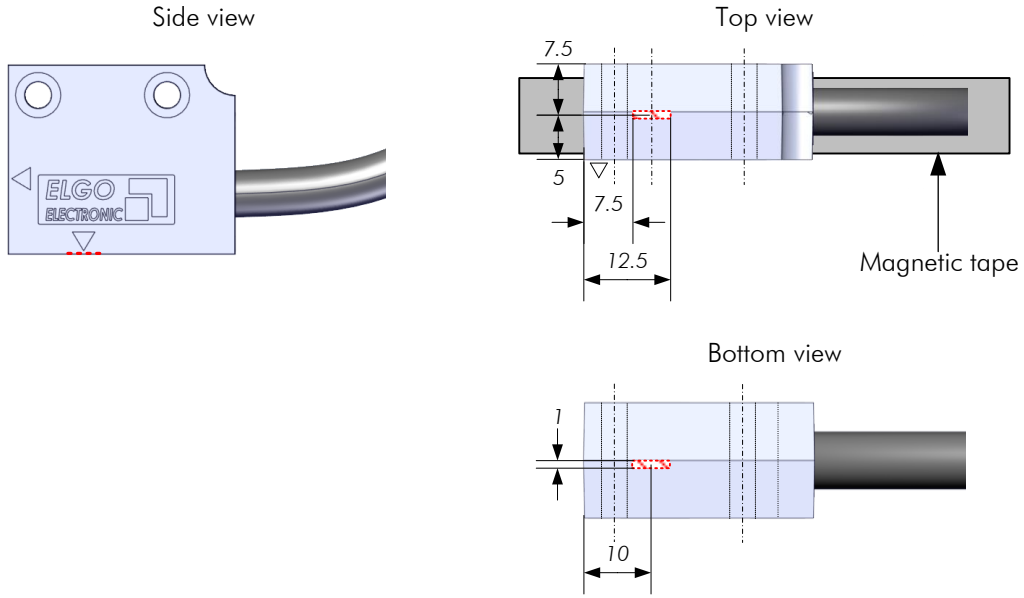


Figure 6: Sensor position with horizontal installation

Installation hints (standard) ☞ 7.3.2.1

6.6.2 Sensor position with vertical installation (option L)

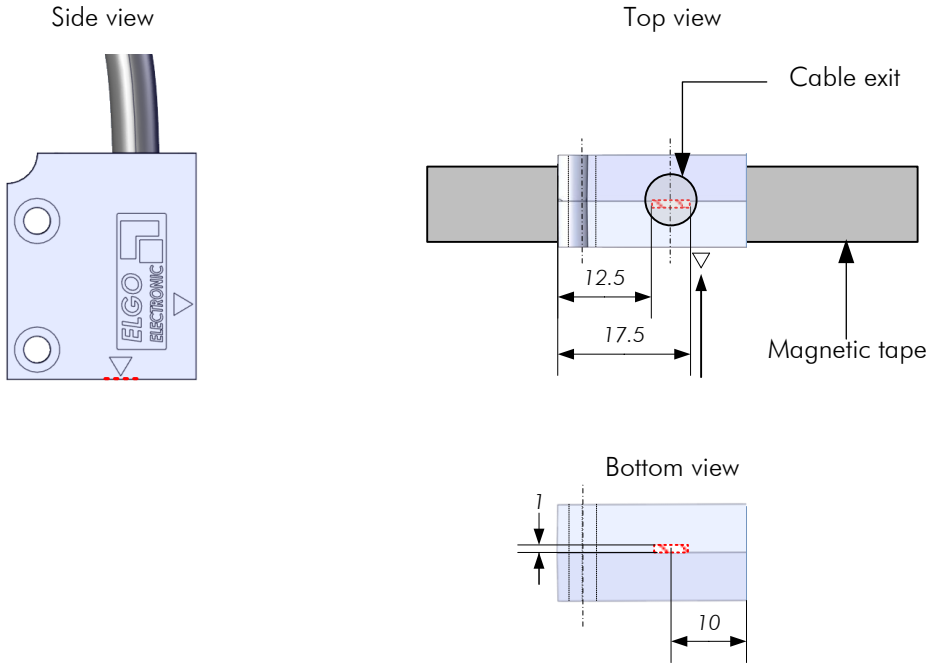


Figure 7: Sensor position with vertical installation

Installation hints (option L) ☞ 7.3.2.2

7 Installation and First Start-Up

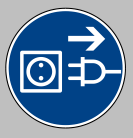
CAUTION
Please read the operating manual carefully before using the device! Strictly observe the Installation instructions!
In case of damage caused by failure to observe this operating manual, the warranty expires.

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 Description installation / Mounting 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 MB20-50-10-1(2)-R

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

The magnetic tape consists of 2 pre-assembled components (Figure8: Components of the magnetic tape):

- 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).

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

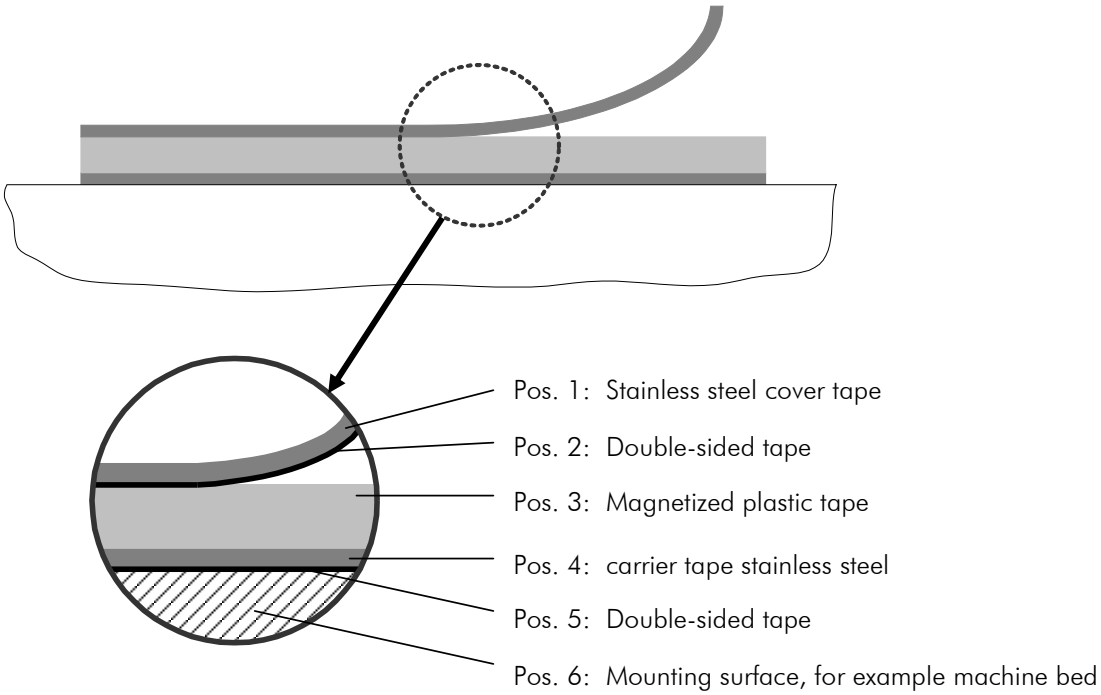


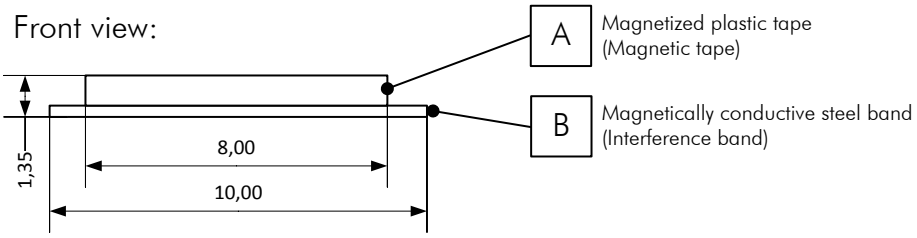
Figure8: Components of the magnetic tape

7.2.2 Magnetic Tape MB20-20-10-1(2)-R-D-BK80

Top view:

<SN XX/000000001/00000 MB20-20-10-1(2)-R-D-BK80 ELGO

Front view:



Scale 5:1

Figure 9: Magnetic Tape MB20-20-10-1(2)-R-D-BK80

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.
It should be stored with the magnetized plastic tape to the outside, the minimum bending radius must be noted here.

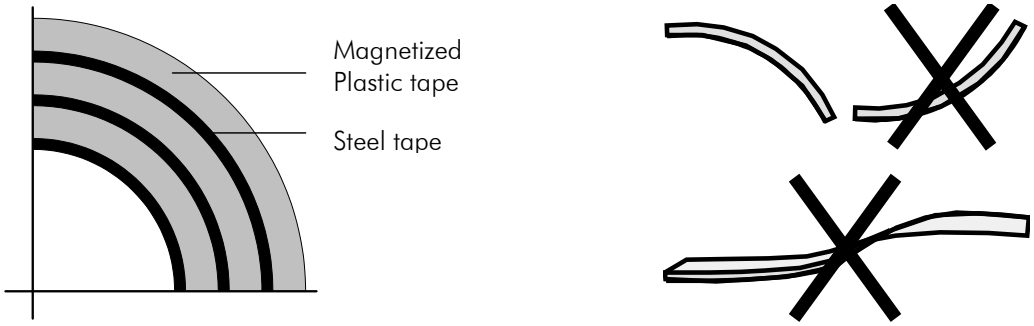


Figure10: Handling

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/cm^2).

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. A 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 (☞ 12.5) 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 ca. 30 minutes so that the temperature matches. This prevents strain in the tape due to thermal expansion.

Mounting steps:

1. Thoroughly clean surface (☞ 7.2.4)
2. Let magnetic tape and cover tape adjust their temperature
3. Remove protection foil of adhesive tape on magnetic tape
4. Glue magnetic tape using great pressure
5. Thoroughly clean surface of magnetic tape
6. Remove protection foil of adhesive tape on cover tape
7. Glue cover tape using great pressure
8. Safeguard the ends of the cover tape against peeling off (using end caps see chapter ☞ 12.5)

7.2.1 Resistance against Chemical Influence

Table 1: Chemical Influences

Show no or little effect in constant contact after 2-5 years:			
formic acid	glycerol 93°C	linseed oil	soy beans oil
cotton seed oil	N-hexane	lactic acid	
formaldehyde 40%	Iso octane	petroleum	
Show weak to moderate effects in constant contact after approximately 1 year:			
acetone	gasoline	acetic acid 30%	oleic acid
acetylene	steam	acetic acid, pure acetic acid	sea water
ammonia	acetic acid 20%	isopropyl ether	stearic acid 70°C, anhydrous
kerosene			
Have strong effects when contacting permanently after 1-5 months:			
benzene	nitric acid 70%	turpentine	toluene
lacquer solvent	nitric acid, red, vitriolic	carbon tetrachloride	tetrahydrofuran
trichloroethylene	nitrobenzene	hydrochloric acid 37%, 93°C	xylene

7.2.2 Magnetic tape variants

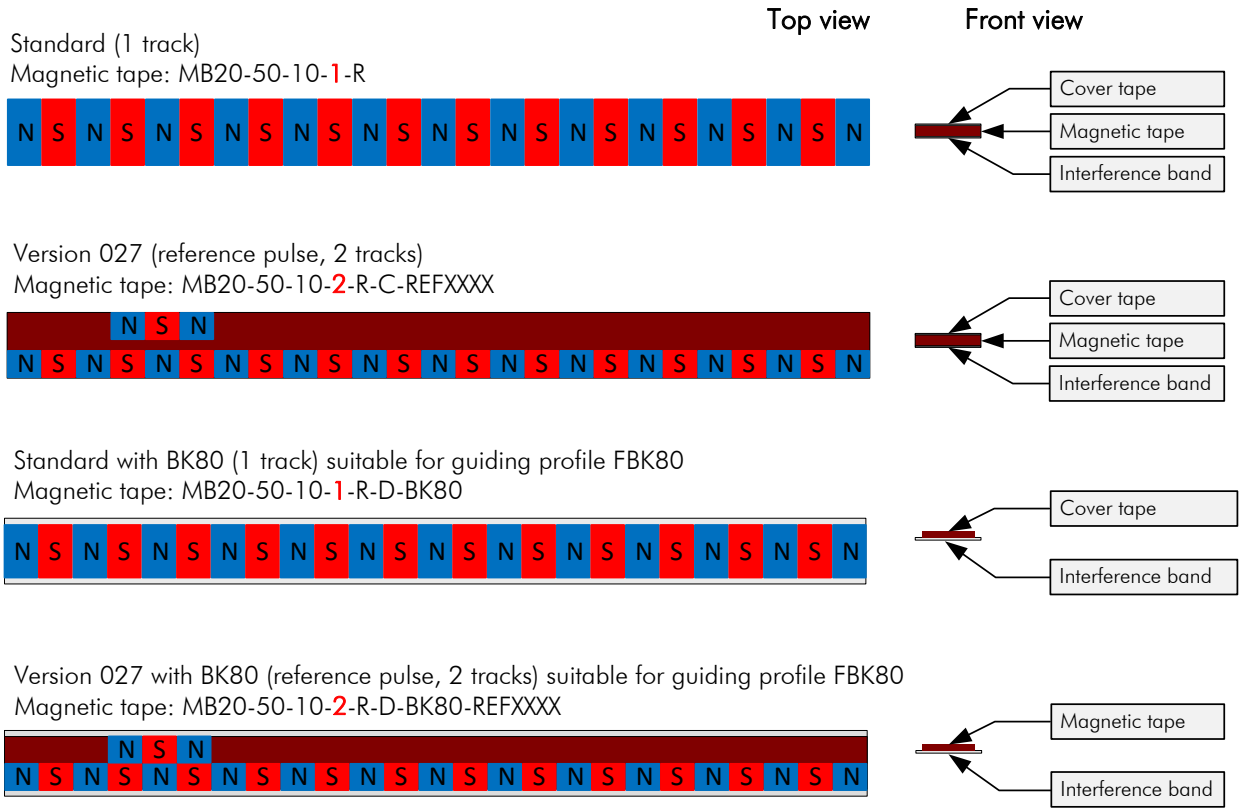


Figure 11: Magnetic tape variants

Magnetic tape with guiding profile FBK80

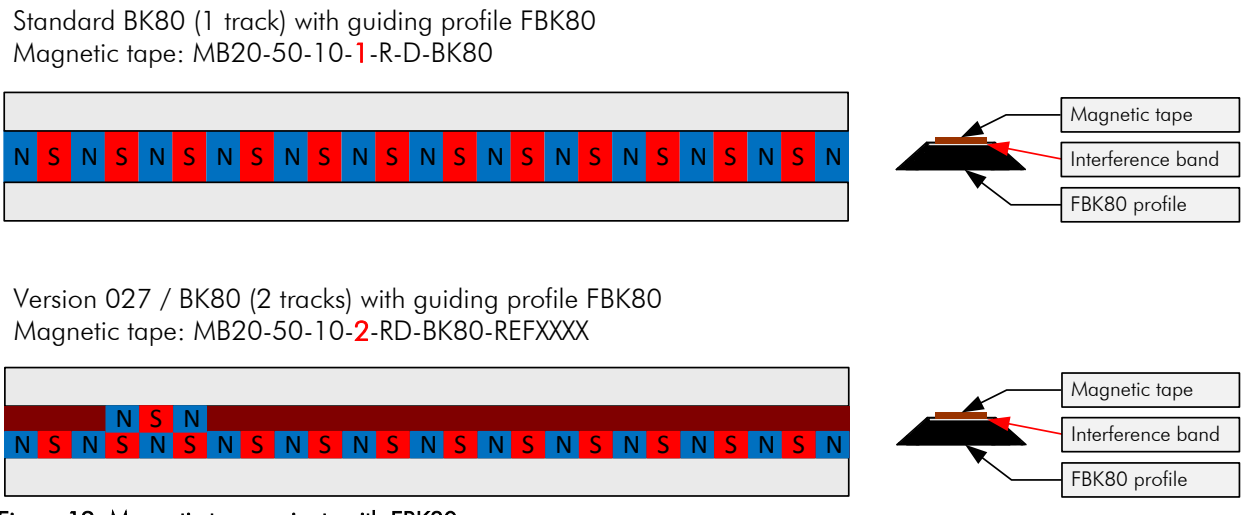


Figure 12: Magnetic tape variants with FBK80

7.3 Installation of the Sensor

7.3.1 Mounting options of the Sensor

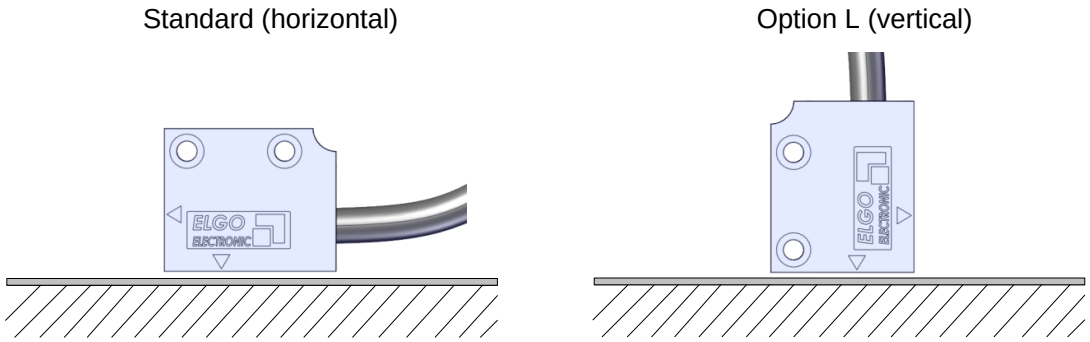


Figure 13: Sensor - mounting options

7.3.2 Installation with Magnetic Tape MB20-50-10-1(2)-R

The sensor is not centric positioned in the sensor housing (☞ 6.6.1,☞ 6.6.2). Therefore it should be ensured that the active (red hatched) sensor area sensor and not the sensor housing is centred on the magnetic tape (☞ 7.3.2.1, ☞ 7.3.2.2). Please observe also the permitted mounting distance of max. 2.0 mm.

7.3.2.1 Installation of standard version

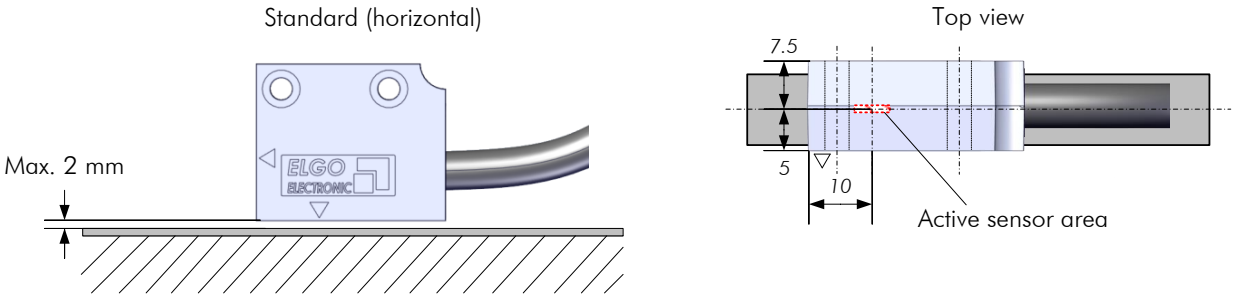


Figure 14: Installation of horizontal standard version

7.3.2.2 Installation of vertical version (Option L)

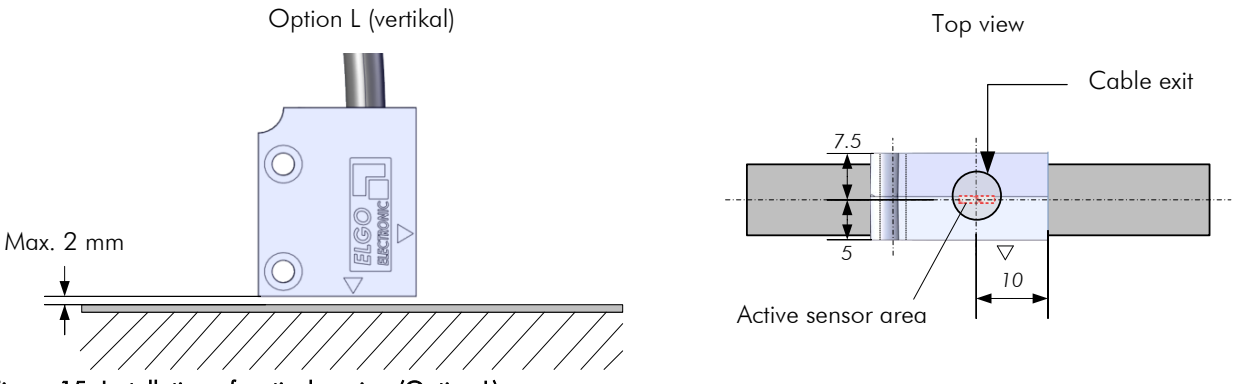


Figure 15: Installation of vertical version (Option L)

7.3.3 Mounting Tolerances

Fasten the sensor head by using two M3 screws. Please note: The tolerances given in the table and in the drawings (below) must be observed. Outside these areas the function of the system is not guaranteed!

Table 2: Tolerances

Tolerances	
Magnetic tape type	MB20-50-10-1-R resp. MB20-50-10-2-R
Ride height	max. 2.0 mm
Pitch	The max. allowed distance of 2 mm must not be exceeded at any position
Roll	The max. allowed distance of 2 mm must not be exceeded at any position
Yaw angle	<+/- 1.5 °
Lateral offset with standard magnetic tape Lateral offset with option REF (magnetic tape)	± 2.5 mm ± 0.5 mm

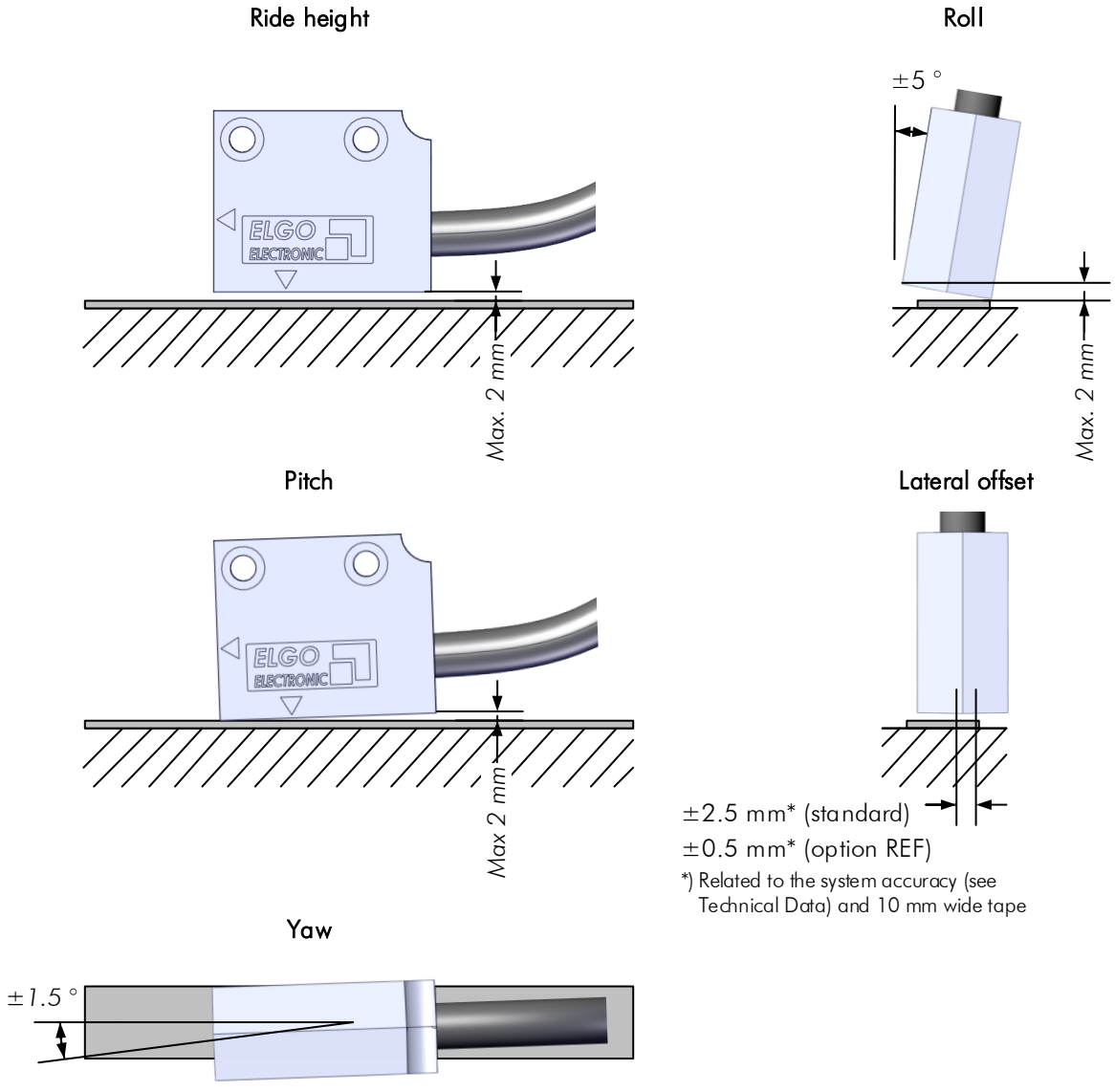


Figure 16: Tolerances

7.4 Installation of the Magnetic Angle MW-007 for Version LMIX22-007

The magnetic angle must be centred to an arbitrary pole change. In order to determine a pole change, the magnetic tape poles can be made visible by using the provided pole search film "POSU" (accessory ☞ 12.3).

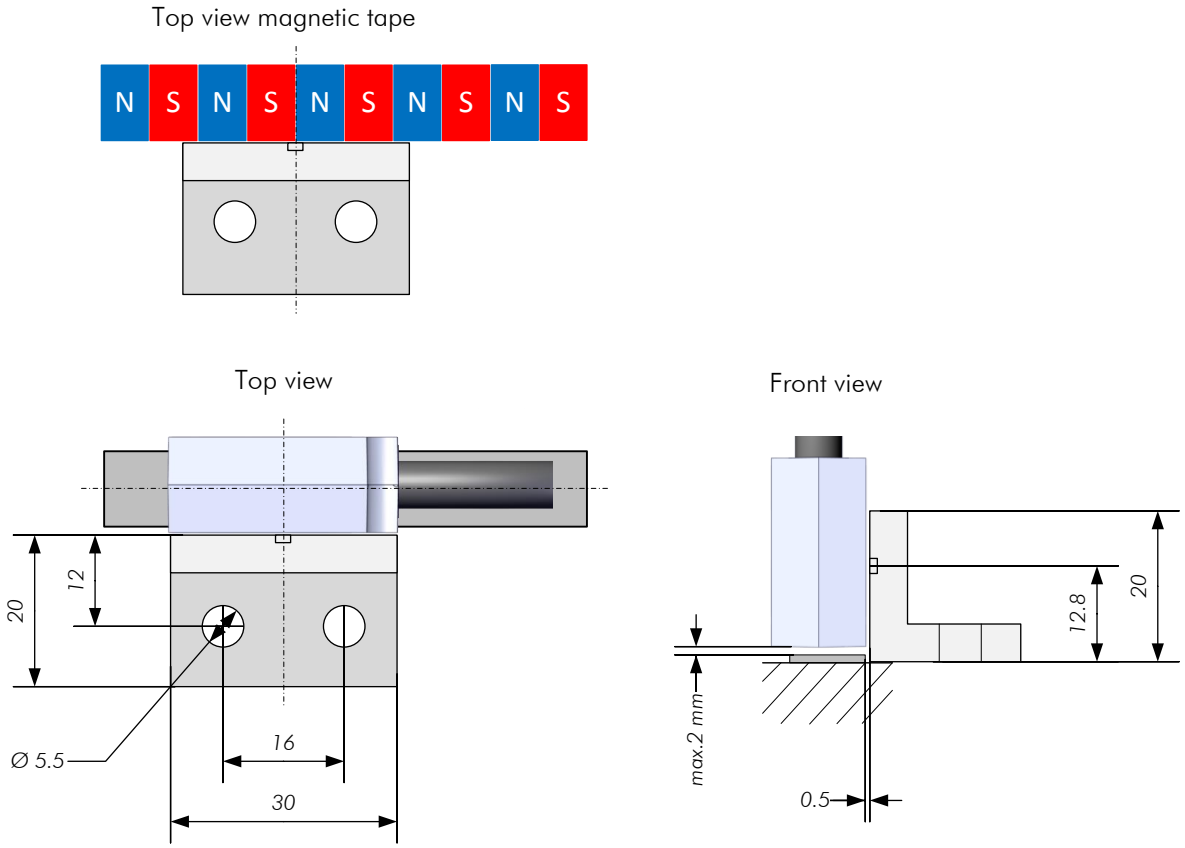


Figure 17: Installation of magnetic angle MW-007 for special version LMIX22-007

7.5 Offset

After the installation of the magnetic tape and the measuring system (sensor head), a value is transmit by the interface. Because this value does not conform to the machine zero point, an offset should to be deposited at the controller side.

NOTE!
An offset is necessary in each case of a replacement of the encoder (sensor head) or magnetic tape.

7.6 Activation of the Device

The device starts automatically after operation voltage application.

8 Overview: Versions with and without Reference Pulse

The following drawings will show the different version types viewed from above.

8.1 Version 000 (standard)

Standard, without reference pulse (single track tape)
Magnetic tape: MB20-50-10-1-R

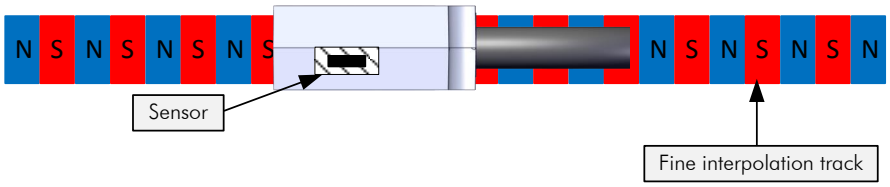


Figure 18: Overview (standard version)

8.2 Version 007

Reference pulse from magnetic angle (single track tape)
Magnetic tape: MB20-50-10-1-R

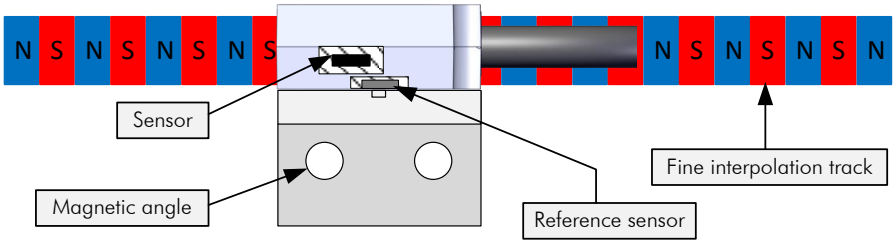


Figure 19: Overview (version 007)

8.3 Version 027

Reference pulse from magnetic tape (dual track tape required)
Magnetic tape: MB20-50-10-2-R-REF0154 (example position)

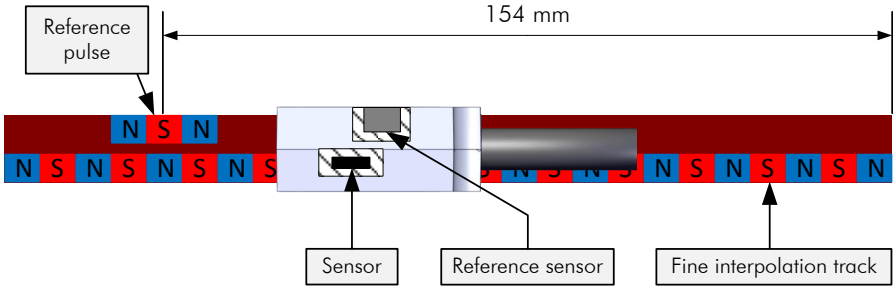


Figure 20: Overview (version 027)

NOTE!

- The position of the reference pulse (starting from the right side of the magnetic tape) can be defined in the. See type designation ☞ 12.3 .
- A printed mark on the magnetic tape indicates on which side the fine interpolation track and the reference pulse are located.
- The poles and tracks can also be made visible by the accessory POSU (☞ 12.5).

9 Extended temperature range (option T)

When ordering option T (☞ 12.1) the LMIX22 sensor is supplied with an extended temperature range which is particularly suitable for use in rough environmental conditions (e.g. outdoor solar systems). The extended temperature range with option T is -40 … + 80° C (instead of +10 … +70 °C with standard versions).

In the case of the extended version, it must be noted that the magnetic tape is subject to certain restrictions at these temperatures:

- At these temperatures, the adhesive tape cannot be used for fixing the magnetic tape, but only as a mounting aid. With extremely high temperatures, the adhesive can soften or become brittle at extremely low temperatures. Thus extremely temperatures will have a negative effect on the adhesion.
- The measuring length with option T is limited to maximum 1000 mm.

9.1 Magnetic tape fixation with option T

Due to the above-mentioned restrictions, the magnetic tape must be mechanically fixed in a different manner in addition to the adhesive tape (depending on the application and space, for example by clamping the two ends, fixing with cable ties or the like).

	NOTE! Due to the hardened steel bands, any mounting holes at the beginning and end of the magnetic tape cannot be drilled, but must be punched.

9.2 Prefabricated magnetic tape for option T

In the case of larger numbers, the magnetic tape can be prefabricated on request by ELGO. For this purpose, a mounting hole with a diameter of 5 mm is punched at the beginning and at the end of the magnetic tape. The total length of the magnetic tape must be extended accordingly (see box below).

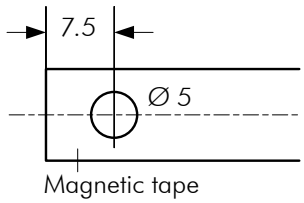


Figure 21: Magnetic tape with punched holes

	NOTE! Total length of the magnetic tape = measuring length + 30 mm

10 Connections

The LMIX22 standard measuring system is delivered with open cable ends. The versions with plug connection are options that need to be specified in the order (☞ 12.1).

Table 3: Pin assignment with open cable ends

Connection type	Colour	Function	Description
Open cable ends	White	GND	0 V
	Brown	VCC	10-30 VDC / 5 VDC
	Green	A	Channel A
	Yellow	B	Channel B
	Black	Z resp. R[1]	Channel Z / R
	Violet	A‘	Channel A inverted
	Orange	B‘	Channel B inverted
	Grey	Z‘ resp. R‘ [1]	Channel Z / R inverted
	Screen[2]	PE	Shield / Earth

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

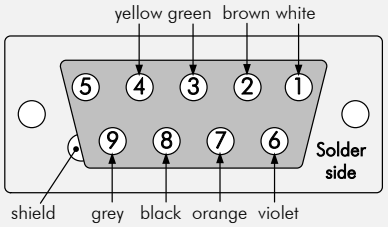
Connection type	Drawing	Pin	Function	Description
9 pin (male) D-SUB		1	GND	0 V
		2	VCC	10-30 VDC / 5 VDC
		3	A	Channel A
		4	B	Channel B
		6	A‘	Channel A inverted
		7	B‘	Channel B inverted
		8	Z resp. R [1]	Channel Z / R
		9	Z‘ resp. R‘[1]	Channel Z / R inverted
		Screen[2]	PE	Connected to housing

Table 5: Pin assignment with option D2 (18.50)

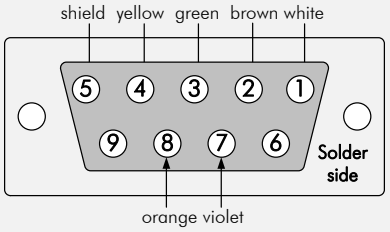
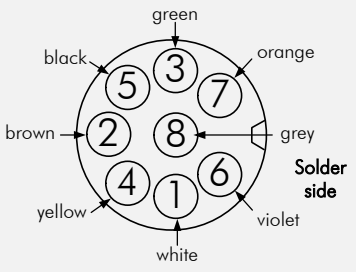
Connection type	Drawing	Pin	Function	Description
9 pin (male) D-SUB **Remark:** There is no index or reference pulse available		1	GND	0 V
		2	VCC	10-30 VDC / 5 VDC
		3	A	Channel A
		4	B	Channel B
		5[2]	PE	Shield / Earth
		7	A‘	Channel A inverted
		8	B‘	Channel B inverted

Table 6: Pin assignment with option D3 (round connector suitable for SKA-1 resp. MIX)

Connection type	Drawing	Pin	Function	Description
8 pin round connector		1	GND	0 V
		2	VCC	10-30 VDC / 5 VDC
		3	A	Channel A
		4	B	Channel B
		5	Z resp. R[1]	Channel Z / R
		6	A‘	Channel A inverted
		7	B‘	Channel B inverted
		8	Z‘ resp. R ‘[1]	Channel Z / R inverted
		Screen[2]	PE	Connected to housing

[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!

11 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 11.1.
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).

11.1 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

11.2 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

11.3 Maintenance

The device is maintenance-free.

WARNING!
Danger through non-conventional maintenance!

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.

11.4 Cleaning

WARNING!
The device can only be cleaned with a damp cloth, do not use aggressive cleanser!

12 Type Designation

12.1 Type Designation Sensor

LMIX22 - AAA - BB.B - CCCC - DD - EEE

Serie/Type:
LMIX22 Linear Encoder

Version- No.:
000 = Standard
007 = Reference pulse on magnetic angle
027 = Reference pulse on magnetic tape track

Signal cable length:
01.5 = 1.5 m (Standard length)

Resolution in µm:
Indicate key values, see table „LMIX22 Resolutions“

Power Supply:
00 = 10-30 VDC / 10-30 HTL
01 = 10-30 VDC / 5V TTL line driver
11 = 5 VDC / 5V TTL line driver

Options:
(Multiple nominations possible)
D1 = 9 pin D-SUB connector (standard pin assignment)
D2 = 9 pin D-SUB connector (18-50 compatible pin assignment)
D3 = 8 pin round connector (MIX compatible pin assignment)
L = Vertical mounting position
T = Extended temperature range (-40 … +85° C)

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

12.2 LMIX22 Resolutions

Table 7: LMIX22 Resolutions

Interpolation rate	Resolution in µm at 4 edge triggering	Type designation code
2000	2.5	2N50
1600	3.125	3N12
1000	5	0005
500	10	0010
250	20	0020
200	25	0025
125	40	0040
100	50	0050
50	100	0100
40	125	0125
25	200	0200
16	312.5	0312
8	625	0625

12.3 Type Designation Magnetic Tape

MB20 - 50 - BB - C - D - E - FFFFFFF

Designation:
MB20 = Incremental magnetic tape

Basic pole pitch:
Basic pole pitch with a resolution of 100 µm:
50 = 5 mm pole pitch (e. g. LMIX22)

Tape width:
Tape width in mm:
10= 10 mm

Number of tracks:
Number of tracks
1 = Single track system
2 = Dual track system (necessary for reference pulse)

Band structure:
R = Standard: Magnetic tape on interference band
(glued with adhesive tape on the interference band side
and glued cover tape (supplied)

Options:
B = Without adhesive tape on the interference band side
C = Without supplied cover tape
D = Without adhesive tape and cover tape (B+C)

Additional information:
REF 0154 = Reference pulse after 154 mm (example)
BK80 = 8 mm magnetized plastic tape on a 10 mm carrier tape

12.4 Type Designation Guide Profile FBK80

FBK80 - XXXX

Series / Type:
Guide profile (aluminium)

Length in mm:
1000 = 1000 mm

Standard length in stock
(FBK80-0997)

12.5 Accessories

Table 8: Accessories

Order Designation	Description	Article No.
MB20-50-10-1-R	Single track magnetic tape for LMIX22-000 and LMIX22-007	
MB20-50-10-2-R	Dual track magnetic tape for LMIX22-027 (with reference pulse track)	
MW-007	1 magnetic angle with reference pulse for special version LMIX22-007	733282100
End cap 10 mm	1 end cap (10 mm) for magnetic tape	731031000
End cap set 10 mm	2 end caps (10 mm) and two M3 screws, additional fixation in the radial and linear area as well as a protection of the magnetic tape	731031002
AP1.0	Aluminum profile	
FW2070	Guide carriage for LMIX22	
FS2050-000-XXXX	Guide rail for LMIX22 (incl. magnetic tape)	
FS-1000	Guide rail without magnetic tape	
FBK80	Guide rail for magnetic tape BK80	
AFBK80	Connection profile for the connection of FBK80	
POSU	Pole finder card 85 x 55 mm	

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Notes:

Notes:

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