

## FMAX SERIES

# Installation manual



## Guided Magnetic Absolute Linear Encoder

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## 1. Introduction

Series FMAX is an absolute magnetic length measuring system and only of use for recordation of lengths. It consists of a guide carriage, where sensor technology and translator are placed, and a guide rail FSMAB. A magnetic tape is installed on the guide rail. The guide carriage is contactless slid over the magnetic tape. For interface a RS422 is available. Further interfaces are in preparation.

The absolute measuring system offers crucial advantages:

- ✘ no reference adjustment necessary
- ✘ direct measurement
- ✘ measuring lengths up to 650 mm
- ✘ high resolution up to 0,01 mm
- ✘ repeating accuracy +/- 0,01 mm
- ✘ protection against dirt and dust
- ✘ easy installation

Typical applications are paper cutting machines, hydraulic presses, wood- and sheet metal processing machines.

## 2. Safety



### **Attention!**

*To ensure a perfect function of the FMAX-System the following installation guidelines must be strictly observed and followed. Otherwise the guarantee expires and ELGO Electric GmbH takes no liability and guarantee for malfunctions or damages caused e.g. by incorrect installed wires or other external sources of error or interference, which are exactly explained below. Please read the instructions carefully before putting the controller into operation..*

*As well ELGO Electric GmbH is not liable for possible machine- and/or personal damages, which could arise through defective material on the measuring system and the following circuit. The machine producer is obliged to take and to carry out appropriate security relevant measures.*

The type label, which can be found on the measuring system is of use for the precise identification of the measuring system. It gives information regarding the precise type designation (see chapter 10. type designation on page 8), delivery date and production number. These details are always necessary, when contacting ELGO Electric GmbH.

### 2.1 Fault clearance

#### Place of Installation

At least 0,5 m away from inductive and capacitive disturbance sources like contactor, relays, motors, switching power supply, clocked controller, etc. In principle lay the FMAX-cable separated from power wires and keep distance to disturbance sources. For installation near other magnets, a minimum distance to the magnetic tape of 100 mm is necessary. If there occurs interferences in spite of applying all above mentioned measures proceed as follows:

1. Add RC elements over contactor reels of AC contactors (for example 0,1  $\mu$ F/100  $\Omega$ ).
2. Add recovery diodes over DC inductances
3. Add RC elements over each engine phase (in connector box of the engine)
4. Install a power filter before the external power supply

### 3. Principal of function

Three sensors are guided over a magnetic tape, recorded with three tracks. The following illustration shows the three magnetic tracks with following north- and south pole magnetization, sensed by magneto-resistive resistor measuring bridges. Between the single magnetic tracks there always is an equal shifting  $\Delta X$ . This is evaluated together with the single signs of the resistive resistor measuring bridges and delivers an absolute value. An unambiguous classification of a absolute position is possible by the combination of the phasing of the three magnetic tracks. The phase position zero repeats every 650 mm for each of the three tracks.

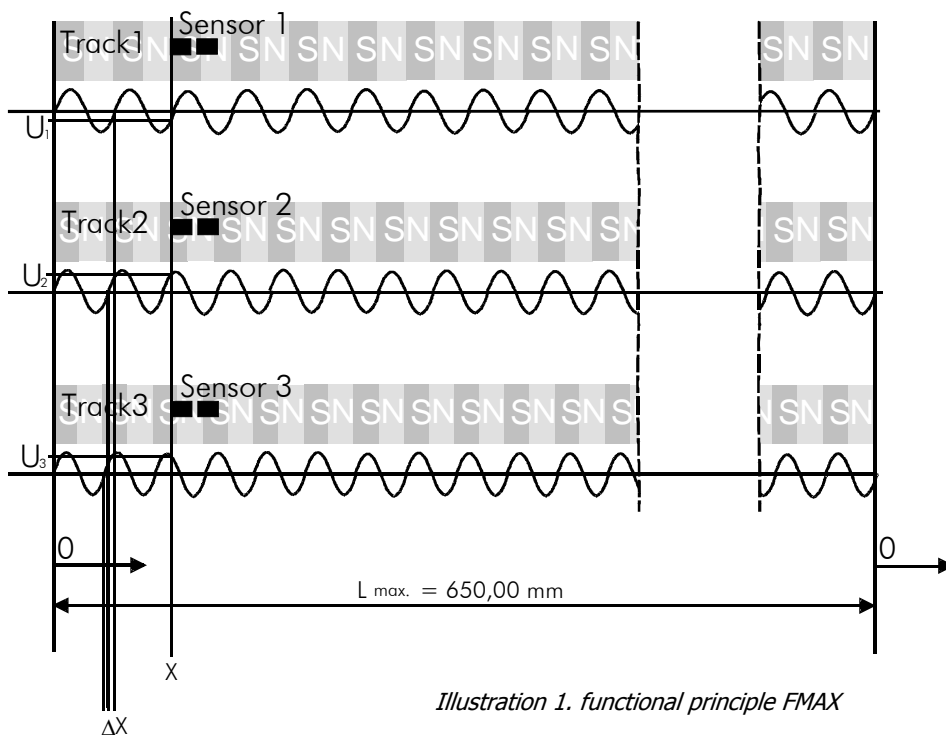


Illustration 1. functional principle FMAX

## 4. Technical specifications

Power supply:	10-30 VDC +/- 10 % ripple < 5%
Consumption:	max. 150 mA
Output level:	5 V TTL at RS422
Repeating accuracy:	+/- 0,01 mm
Resolution:	0,01 mm
Output frequency:	500 Hz (2 msec)
Measuring length:	max. 650 mm
Accuracy of the system (in $\mu\text{m}$ for 20°C):	+/- (40 + 20 x L) (L = Measuring Length in Meters)
Operating temperature:	0 - 50 °C
Store temperature:	0 - 70 °C
Humidity:	non-condensing, 80% max.
Operating height (altitude):	max. 2000 m (sea level)
Protection class:	IP 54 (IP65 when Option V)
Sensor housing / guide carriage:	90 x 48 x 28 mm <sup>3</sup> (L x B x H) Die cast zinc (black)
Wire:	tug chain suitable length 30,0 m max. weight: 58,0 g/m approx. 2 x 0,75 mm <sup>2</sup> , 6 x 0,14 mm <sup>2</sup> radial flexibility 60 mm min. wire exit
Guide rail:	Aluminium Profile
Magnetic tape:	expansion coefficient: $\alpha = 16 \times 10^{-6} \text{ K}^{-1}$ length expansion: $\Delta L = L \times \alpha \times \Delta\theta$

## 5. Dimensions

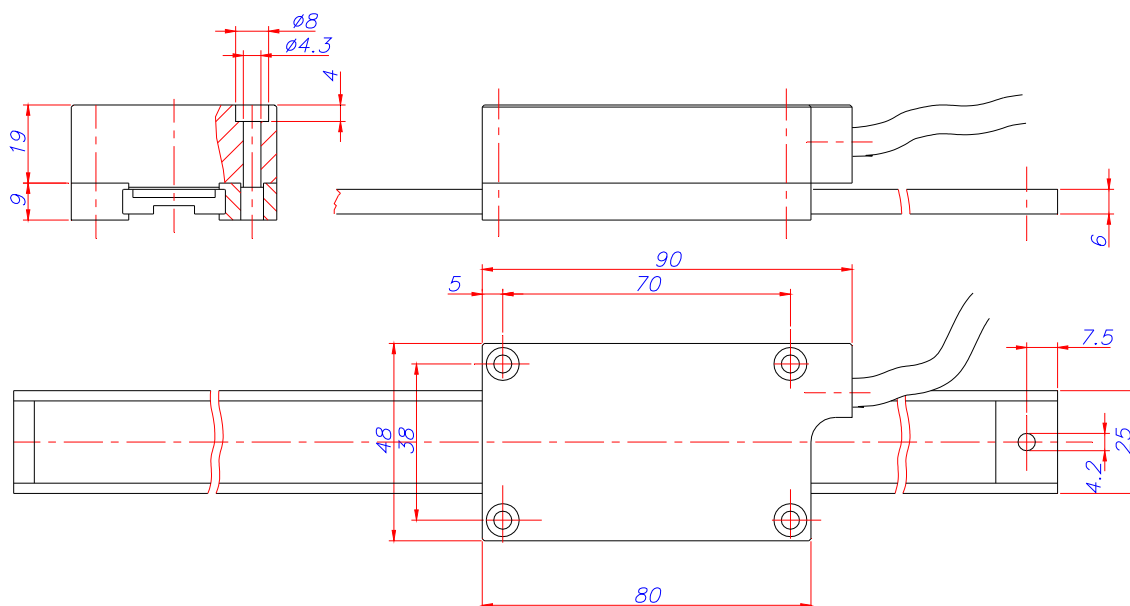


Illustration 1: Dimensions FMAX

## 6. Installation/first start up

### 6.1 Place of Installation

At least 0,5 m away from inductive and capacitive disturbance sources like contactor, relays, motors, switching power supply, clocked controller , etc. In principle lay the FMAX-cable separated from Power wires and keep distance to disturbance sources. For installation near other magnets, a minimum distance to the magnetic tape of 100 mm is necessary.

### 6.2 Installation of the guide carriage

Take four M4-screws to fasten the guide carriage.

### 6.3 Guide rail

The guide rail contains a magnetic tape and a profile rail. Factory made the magnetic tape is stick together with the profile rail.

#### 6.3.1. Installation of the rail

Take four M4-screws to fasten the guide rail. For that, there are drill hole at the ends.

#### Attention:



For installation of guide carriage and guide rail pay attention to the markings on the magnetic tape and on the sensor. A wrong installation will not deliver correct values.

## 7. Terminal assignment

RS232		RS422	
signal cable	function	signal cable	function
white	0 V	white	0 V
brown	+ 24 V	brown	+ 24 V
green	RX	gray	TX -
yellow	TX	pink	TX
		green	RX -
		yellow	RX

## 8. Interface

The measuring system FMAX is provided with an interface in format RS422. The data transfer has the following format:

**9600 Baud**

**1 Start Bit**

**8 Daten Bits**

**1 Stop Bit**

**No Parity**

Data record:

The actual value will be transferred every 2 msec. with following data record:

02h STX  
 xxh ABS-Datas  
 xxh ABS-Datas  
 xxh ABS-Datas  
 xxh ABS-Datas  
 xxh ABS-Datas  
 xxh ABS-Datas  
 03h ETX  
 xxh BCC

The "Block check sum" is an „exclusive OR" of all datas inclusive STX and ETX.  
 All values will be transferred in ADCII-format.

## 8.1 Teaching procedure / Offset

Should the desired display value differ from the factory-made adjusted original offset, a settlement can be carried out by the external counting unit. Alternatively the offset can be changed by the RS-422 interface of the FMAX (see point 8.11 and 8.12).

### 8.11 Teaching procedure:

#### Indication:



On delivery guide carriage and guide rail are numbered and belong together in pairs. A teaching procedure is necessary, if only the guide rail or the guide carriage has to be replaced.

A teaching procedure has to be carried out as follows:

1. Guide carriage and guide rail are installed and the measuring system can stand at any place.
2. Afterwards the following record has to be sent to the measuring system:  
**02h STX**  
**4ch „L“ = teaching procedure is started**  
**03h ETX**  
**4dh „M“ = BCC**
3. The guide carriage has to be moved 30 mm in one direction with a speed of 0,01 m/s max. (10 mm/sec. max.) and following back again.
4. Afterwards the following record has to be sent to the measuring system:  
**02h STX**  
**42h „B“ = teaching procedure is finished**  
**03h ETX**  
**43h „C“ = BCC**

The teaching procedure is completed.

### 8.12 Offset adjustment

After installation and connection of guide carriage and guide rail a value will be transferred over the interface. As this value does not agree with the machine offset, an offset can be deposited usually at the controller side or directly at the measuring system. In order to adjust this offset at the measuring system, the Sensor has to be moved to the machine offset.

Afterwards the following record has to be sent:

**02h STX**  
**4eh „N“ = adjust zero point**  
**03h ETX**  
**4fh „O“ = BCC**

The measuring system is adjusted to offset. All transmitted values are now related from this offset.

#### Attention:



This offset adjustment needs to be carried out at any change of guide carriage or guide rail. In case the counting direction cannot be changed in the controller, the complete slide-system has to be turned over.

## 9. Resistance to chemicals of the magnetic tape

The magnetic tape shows no or only small effects when contacting permanently the following materials after 2 to 5 years: formic acid, glycerol 93°C, linseed oil, soy beans oil, cotton seed oil, N-hexane, lactic acid, formaldehyde 40%, isooctane, petroleum.

Poor to medium effects result when contacting permanently the following materials after approximately 1 year: acetone, gasoline, acetic acid 30%, olein acid, acetylene, steam, acetic acid, pure acetic acid, sea water, ammonia, acetic acid 20%, isopropyl ether, stearic acid 70°C anhydrous, kerosene.

Strong effects result when contacting permanently the following materials after 1 to 5 months: benzene, nitric acid 70%, turpentine, toluene, lacquer solvent, nitric acid red and vitriolic, carbon tetrachloride, trichloroethane, nitrobenzene, hydrochloric acid 37% and 93°C, tetrahydrofuran, xylene.

## 10. Type designation

### Sensor

**FMAX-XXX-XX.X-X-XXX-X**

#### Series/Type

#### Version

000 = Standard

001 = 1. customer specified Version

#### Length of signal wire

03.0 = 3,0 m (Standard)

Lengths of 1,0/3,0/5,0/8,0/10,0 m are available

#### Resolution

2 = 0,01 mm

#### Interface

422 = RS422

232 = RS232

SSI = SSI Interface

#### Options

V = casted Version IP65

### Guide rail with magnetic tape

**FSMAB-000-0650**

#### Type

#### Version

Standard

#### Measuring Length

650 mm = maximum possible measuring length

**Total length = Measuring length + 150 mm**



## 11. Liability exclusion / Guarantee

We have checked the contents of this instruction manual carefully, to the best of our knowledge and belief for conformity with the described hardware and software. Nevertheless errors, mistakes or deviations can not be excluded, therefore we do not guarantee complete conformity. Necessary corrections will be included in the subsequent editions. We appreciate your ideas and improvement suggestions very much. Reprint, duplication and translation, even in extracts, are only allowed with a written authorization by the company ELGO Electric GmbH. We constantly strive for improving our products, therefore we keep all rights reserved for any technical modifications without any notice.

ELGO Electric does not assume any liability for possible errors or mistakes.

The guarantee period is one calendar year from the date of delivery and includes the delivered unit with all components. ELGO Electric GmbH will at its option replace or repair without charge defects at the unit or the included parts, verifiable caused by faulty manufacturing and/or material in spite of proper handling and compliance to the instruction manual.

Damages verifiably not caused by ELGO Electric GmbH and due to improper handling are excluded from any guarantee e.g. by applying faulty voltage, diffusion of liquid into the interior of the engine, using force, scratching the surface, chemical influences etc.!

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