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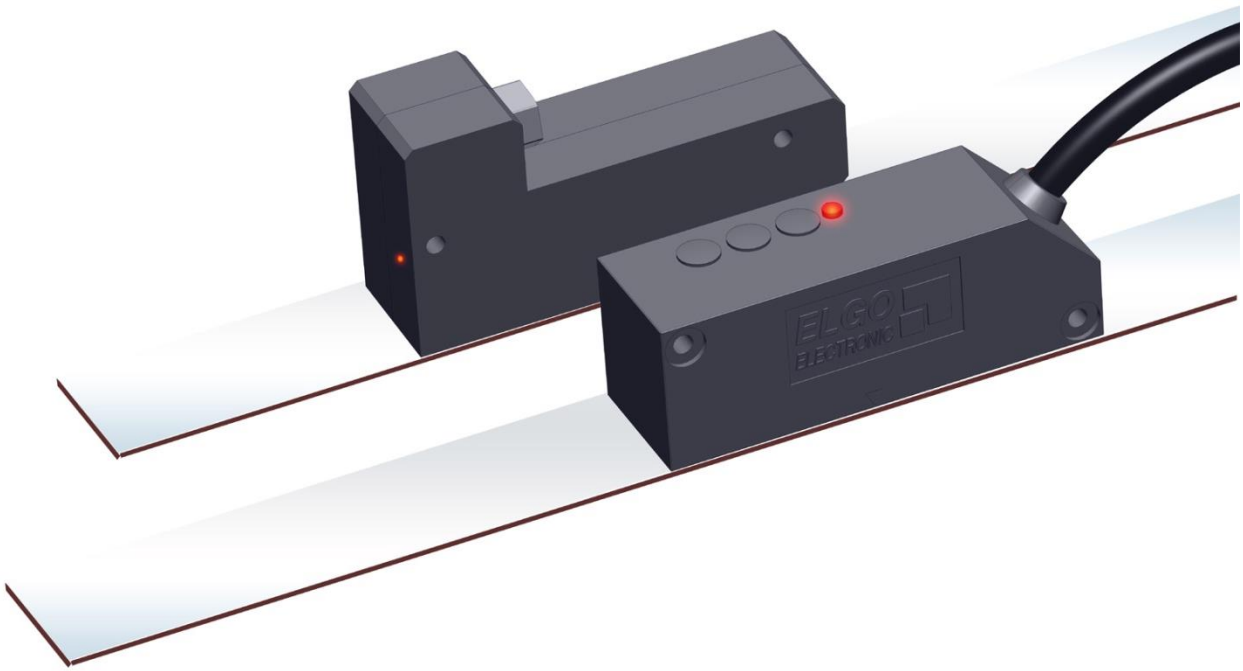
Translation of the original operating manual

ELGO ELECTRONIC

Operating Manual

SERIES *EMAX* / EMAL

Magnetic Absolute Linear Encoder with 10 µm resolution



- Absolute encoder with 10 µm resolution
- No referencing required (changes of position are also recognized in the de-energized state)
- Wear free and contactless measurement
- Measuring length up to 10 m (EMAX) resp. 20 m (EMAL)
- 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

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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 product described in this manual was developed to execute safety-related functions as a part of an entire assembly or machineThe ELGO-device is only conceived for the conventional use described in this manual.
The ELGO EMAX / EMAL linear encoders only serve 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 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 paste 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:

- EMAX up to 10 m
- EMAL up to 20 m

SSI, CAN, RS232, RS422 and IO-Link are available as interfaces for the EMAX / EMAL sensors.
For more information about the interfaces see section ☞ 8.

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

Two different designs are possible as sensor housings:

1. sensor housing with fixed cable outlet (see ☞ 6.2)
2. sensor housing with M9 round connector (see ☞ 6.3)

For versions with fixed cable outlet, a guide carriage and a guide rail are available (see accessories ☞ 12.2).

Overview of features:

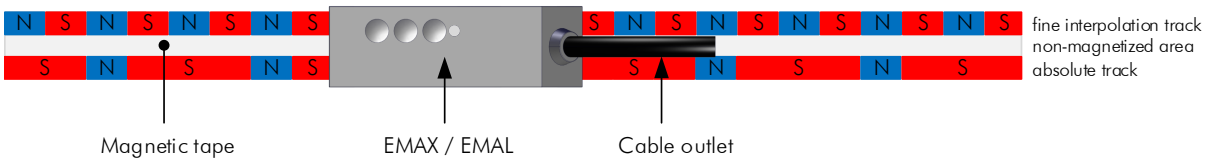
- no referencing required
- direct wear free and contactless measurement
- allowed distance range between sensor and magnetic tape: 0.1 ... 1.5 mm
  → Distance not ok = red LED on
- measuring length up to 10 m (EMAX) resp. 20 m (EMAL)
- high resolution 10 µm
- repeat accuracy +/- 1 increment
- very resistant against dirt

5.1 Functional principle

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

The fine interpolation track encloses alternately north- and south-pole tracks 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.

Sensor with cable outlet:



Sensor with M9 round connector:

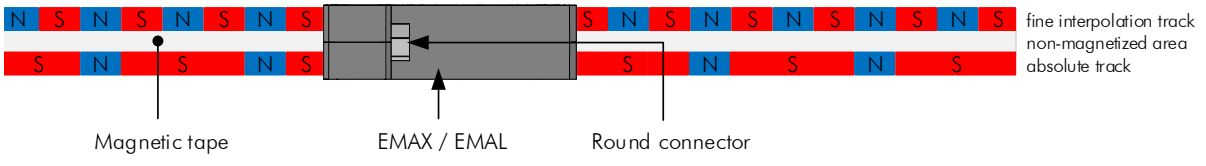


Figure 1: Coding of the magnetic tape

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 Housing with Cable Outlet

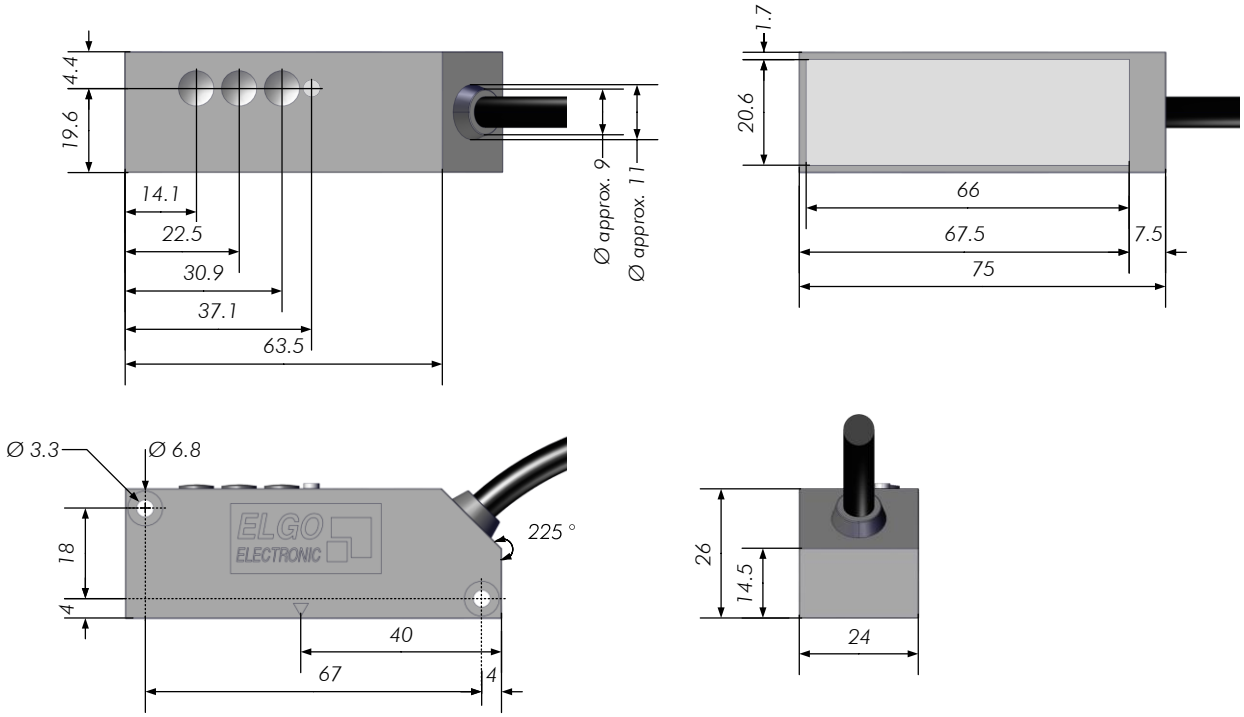


Figure 2: Dimensions of sensor with cable outlet

6.3 Dimensions Sensor Housing with M9 round connector

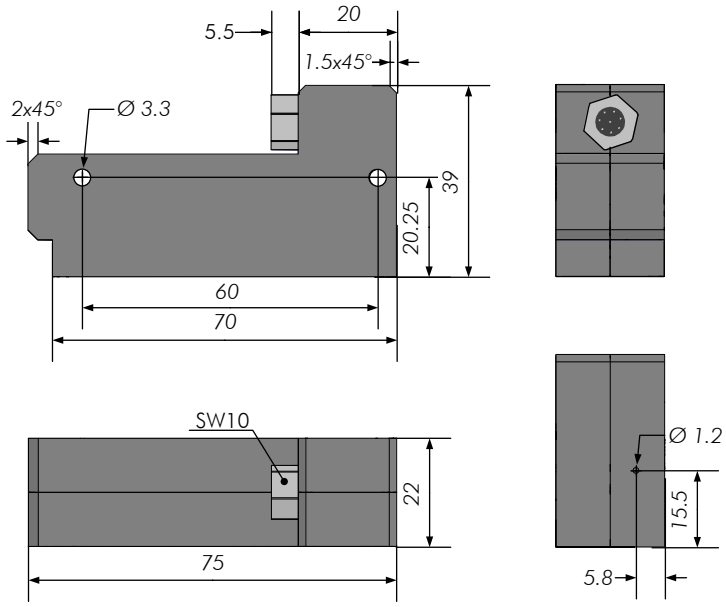
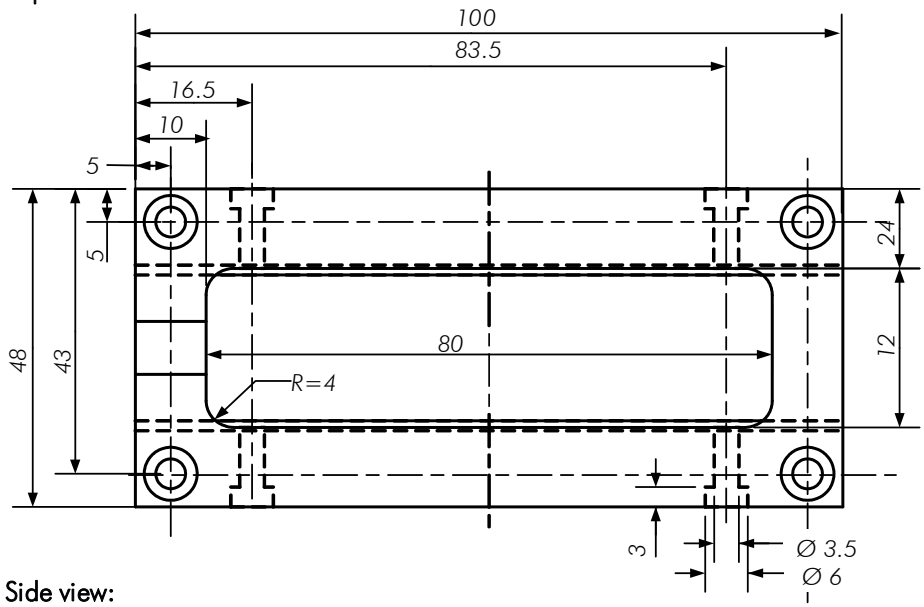


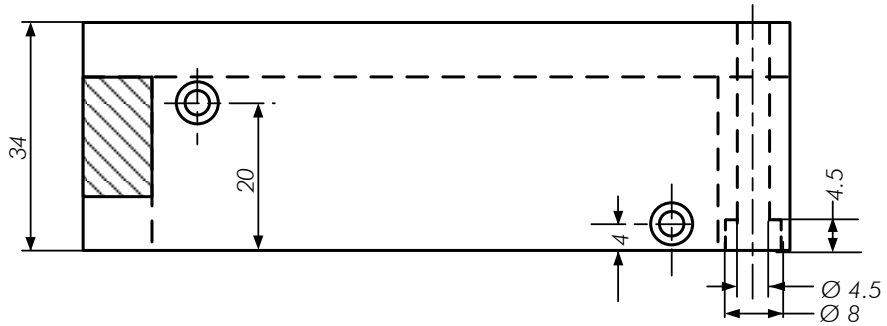
Figure 3: Dimensions of sensor with M9 round connector

6.4 Dimensions Guide Carriage FW2080

Top view:



Side view:



Rear view:

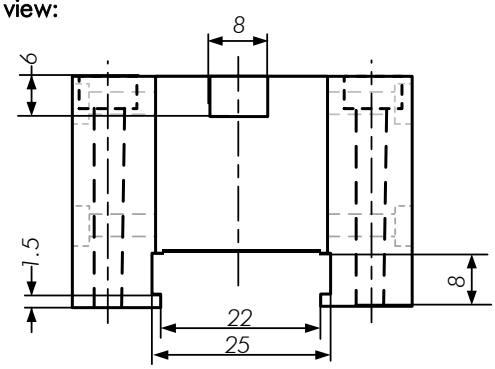


Figure 4: Dimensions of guide carriage FW2080

	REMARK! The accessorial guide carriage FW2080 (☞ 12.2) is only available for the housing version with a fixed cable outlet (☞ 6.2).

6.5 Technical Data Sensor

EMAX / EMAL (standard version)	
Mechanical Data	
Measuring principle	absolute
Measurement	linear
Repeat accuracy	±1 Increment
System accuracy in µm at 20°C (L = measuring length in meters)	±(150 + 20 x L) (standard 010 ☞ 12) ±(50 + 20 x L) (option F10 ☞ 12)
Distance sensor / magnetic tape	max. 1.5 mm (2.0 mm with reduced measuring accuracy)
Basic pole pitch	5 mm
Sensor housing material	with cable outlet: zinc die cast with M9 connector: aluminium
Sensor housing dimensions	a) Version with cable outlet: W x B x H = 75 x 24 x 26 mm, resp. a) with FW2080 (☞ 12.2): W x B x H = 100 x 34 x 48 mm b) Version with M9 connector: W x B x H = 75 x 22 x 39 mm
Required magnetic tape	EMAX: AB20-50-20-R-11 EMAL: AB20-50-20-R-12
Maximum measuring length	EMAX up to 10 m EMAL up to 20 m
Connections	Version with cable outlet: open cable ends (more options ☞ 12) Version with M9 connector: via DKA cable (accessories ☞ 12.2)
Sensor cable	Version with cable outlet: 1.5 m standard length (others upon request) Version with M9 connector: no cable (accessorial part, see ☞ 12.2)
Weight	Sensor approx. 100 g without cable, (cable approx. 60 g/m)
Electrical Data	
Supply voltage	+ 10 … 30 VDC
Residual ripple	10 … 30 V: <10%
Power input	max. 150 mA
Interfaces	SSI, CAN, RS422, RS232 or IO-Link acc. to IEC 61131-9
Resolution	0.01 mm
Speed	max. 4 m/s
Conditions	
Storage temperature	-20 °C … +85 °C
Operation temperature	-10 °C … +70 °C (-25 °C … +85 °C upon request)
Humidity	max. 95 %, not condensing
Protection Class	IP40 (standard) IP65 (option V)

6.6 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 AB20-50-20-2-R-11 and AB20-50-20-2-R-12	
Coding	absolute, dual track system
Pole pitch	5 mm
Operation temperature installed	−20 °C … +65 °C (−20°C … +80°C when using without adhesive tape, options „B“ or „D“)
Storage temperature uninstalled	Short-term: −10°C … +60°C Medium-term: 0°…+40°C Long-term: +18°C (−20°C … +80°C when using without adhesive tape, options „B“ or „D“)
Gluing temperature:	+18°C … +30°C
Relative humidity	max. 95 %, non-condensing
System accuracy in µm at 20°C (L = measuring length in meters)	±(150 + 20 x L) (standard 010 ☞ 12) ±(50 + 20 x L) (option F10 ☞ 12)
Material carrier tape	Precision Strip Steel 1.4310 / X10CrNi 18-8 (EN 10088-3)
Double-faced adhesive tape	3M-9088 (observe instructions), others on request
Dimensions	20 mm (±0.3 mm) x 1.8 mm (±0.1 mm)
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)
Available measuring lengths	EMAX: max. 10 m EMAL: max. 20 m min. 0.2 m
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

7 Installation and First Start-Up

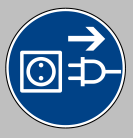
CAUTION
Please read the operating manual carefully before using the device! Strictly observe the Installation instructions! In case of damage caused by failure to observe this operating manual, the warranty expires.

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 Structure of magnetic tape

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 (Figure 5: 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

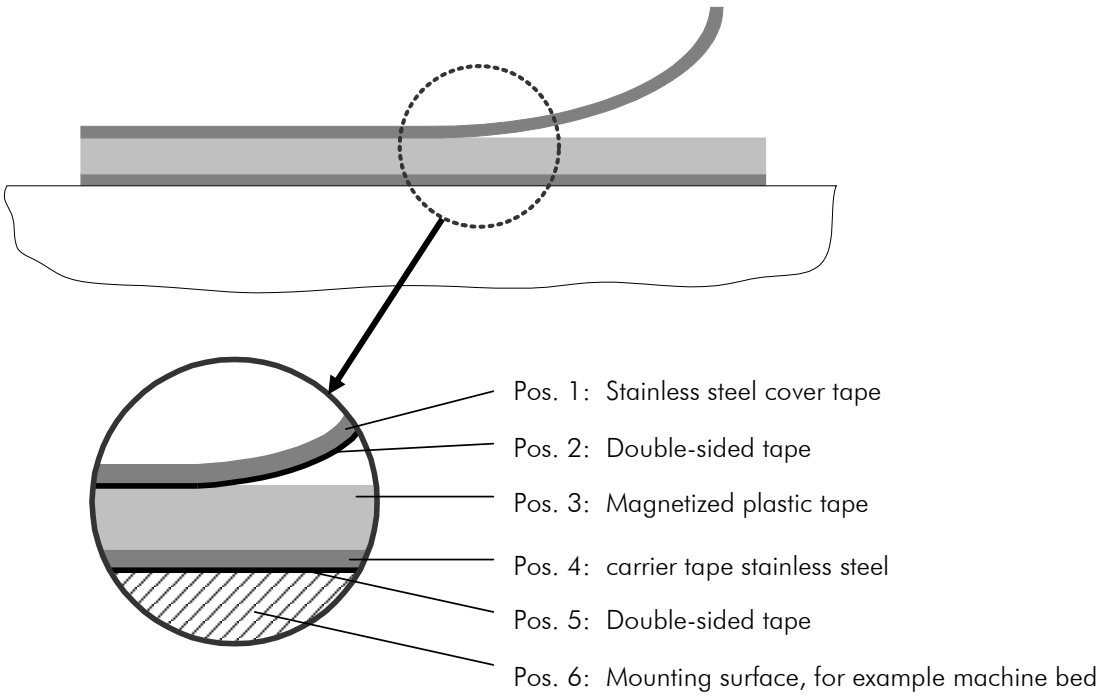


Figure 5: Components of the magnetic tape

7.2.2 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

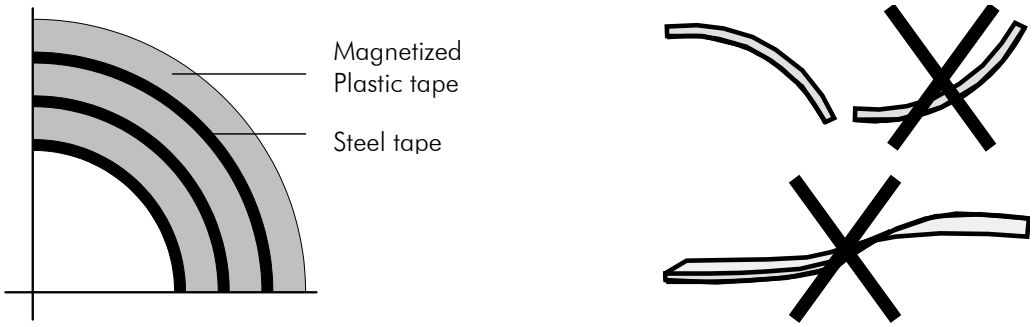


Figure 6: Handling

7.2.3 Processing hint for the gluing of magnetic tapes

Surface-Preparation: In order to guarantee optimal adhesion, all antiadhesive 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 + 21 ° C and 38 ° 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.

7.2.4 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 (see chapter 9.2) 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 (☞7.2.3)
2. Let magnetic tape and cover tape adjust their temperature (acclimatization)
3. Remove protection foil of adhesive tape on magnetic tape
4. Glue the magnetic tape by using great pressure
5. Thoroughly clean the surface of magnetic tape
6. Remove the protection foil of adhesive tape on cover tape
7. Glue the cover tape by using great pressure
8. Safeguard the ends of the cover tape against peeling off (e. g. by using end caps ☞ 12.2)

7.3 Installation of the Sensor

In order to fasten the sensor head, two M3 must be used.

> **NOTE!**
>
> The correct distance sensor / magnetic tape is monitored and displayed by the LED on the top resp. on the front sensor (depends on design). Distance not correct → **LED glow red**
>
> The mounting tolerances given below are valid for both housing types (standard version with fixed cable outlet or sensor housing with round connector).

7.3.1 Mounting Tolerances

Further, the following tolerances must be observed:

Table 1: Mounting tolerances

Tolerances	
Magnetic tape type	AB20-50-20-2-R-11 and AB20-50-20-2-R-12
Ride height (distance to the tape)	0.1 … 1.5 mm
Pitch	The max. Distance 1.5 mm must not be exceeded at any position
Yaw angle	0 ° ±0.5 °
Roll	The max. Distance 1.5 mm must not be exceeded at any position
Lateral offset	±0.5 mm

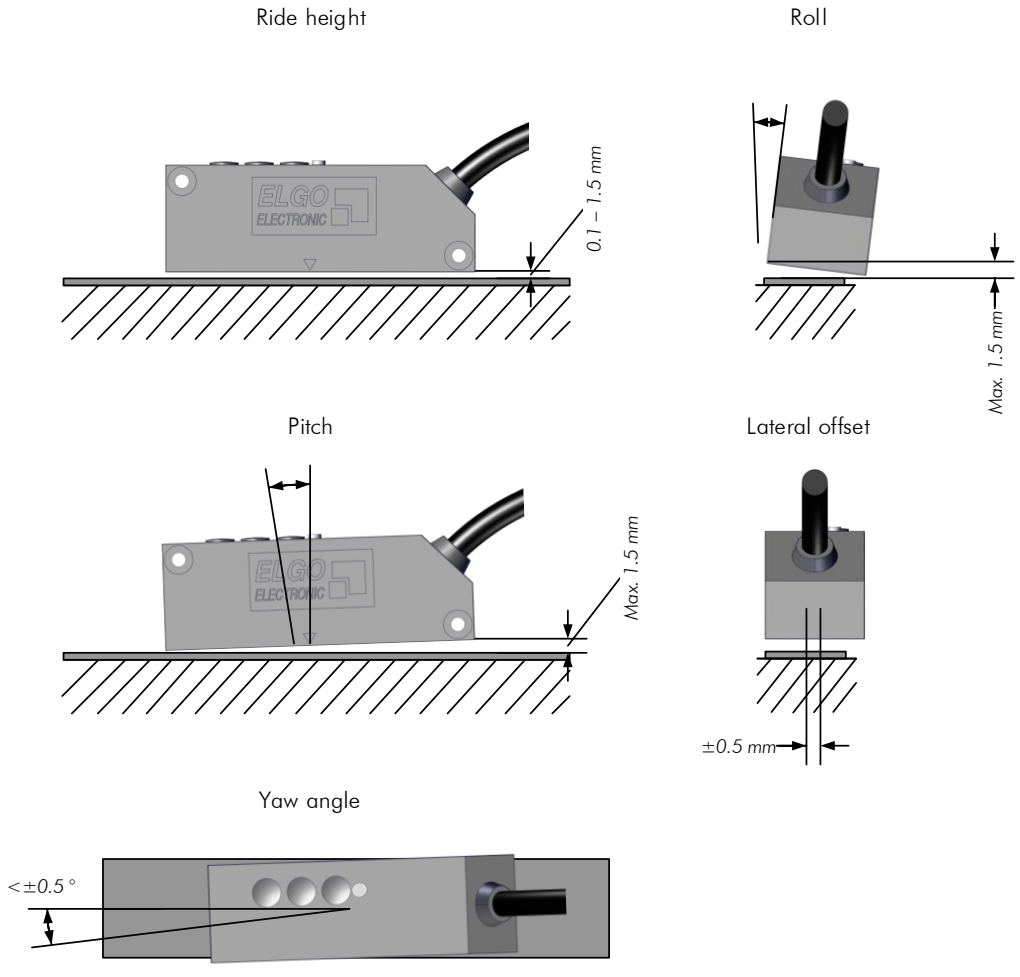


Figure 7: Tolerances

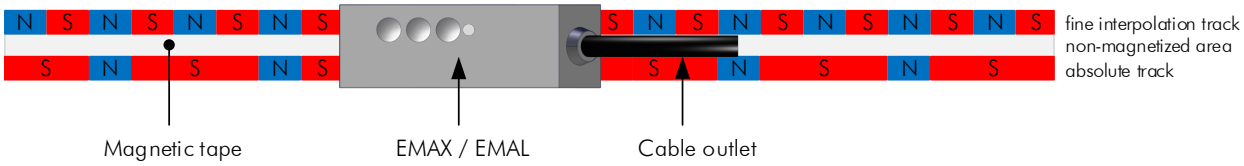
7.3.2 Mounting Direction of EMAX / EMAL Sensor to Magnetic Tape

Since the magnetic tape has two magnetized tracks, the sensor and magnetic tape must always be mounted in the correct direction in order to obtain correct measurement results.

Marking arrows on the tape and sensor clearly indicate the correct mounting direction.

The pole finder foil, which is available as an accessory (☞ 12.2) and is placed on the magnetic tape, can also be used to determine the respective pole pitches. The pole pitches result in the following mounting direction:

Sensor with cable outlet:



Sensor with M9 round connector:

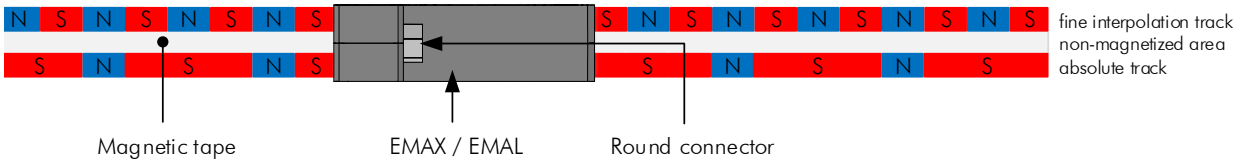


Figure 8: Mounting direction on magnetic tape

- The sensor center must be aligned to the magnetic tape center (±0.5 mm)
- Markers on tape and sensor are additionally indicators for the mounting direction
- When using the accessorial option FS-1000 (☞ 12.2), the mounting direction is marked on the guide rail

7.4 Offset Calibration

After the installation of magnetic tape and measuring system (sensor head), a value is transmit via interface. Since this value does not correspond to the machine zero point, it should be possible to store an offset on the control side.

NOTE!

An offset is necessary in each case of a replacement of the EMAX / EMAL or magnetic tape.

8 Interfaces

The following chapters give detailed information about the available interfaces.

8.1 Interface SSI (option SB0 and SG0)

Principle of the function: If the clock is not interrupted for the time Tm-T/2 (output of further 25 periods), the shift register clocks once again the same data value (error recognition in evaluation). With the SSI interface, transmission frequencies up to max. 250 KHz can be ensured. The SSI interface is generally terminated with an internal terminating resistor.

Some encoders contain a Power Failure Bit (PFB):

With EMAX the PFB is always „low“, unless the maximum allowed distance from sensor to tape is exceeded.

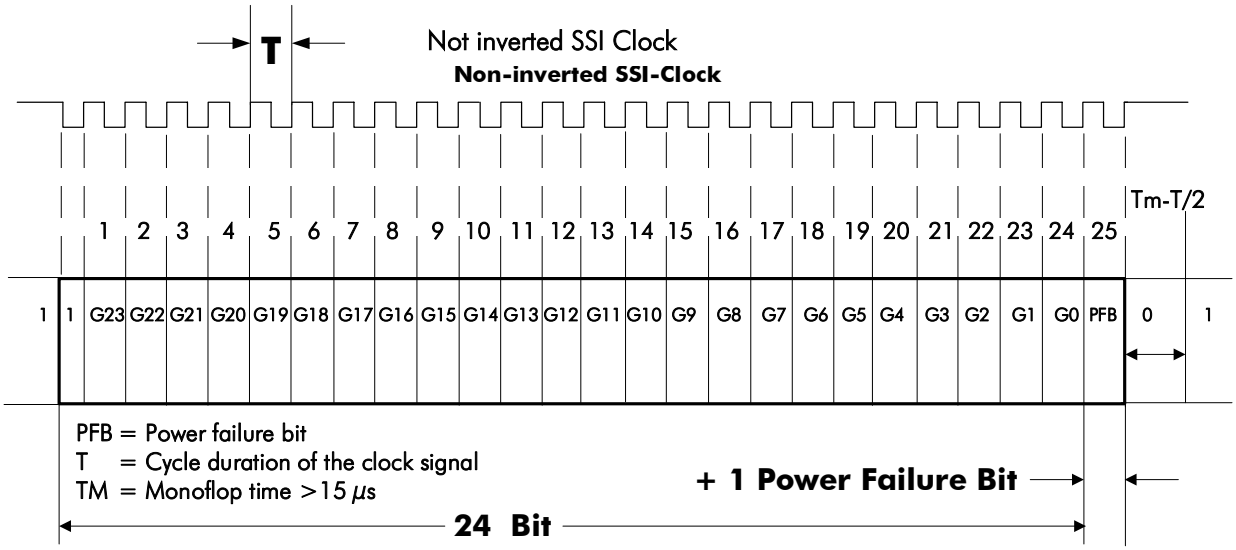


Figure 9: SSI - reading the data

By using the rotary code switch, which is located behind a protection cap (see figure below), the data format of the SSI interface can be set to Gray or binary code.

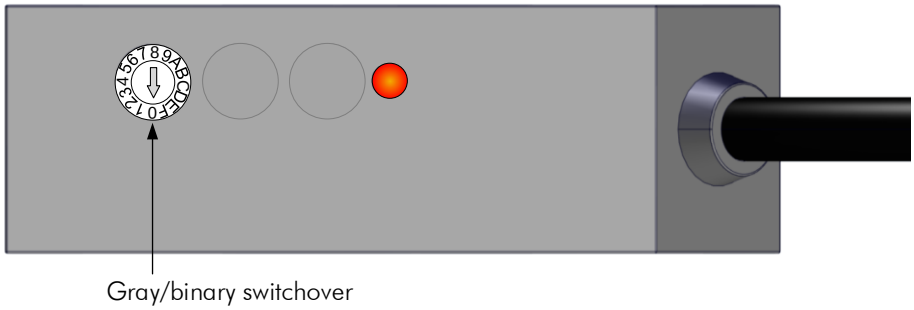
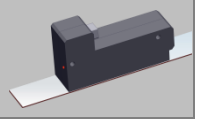


Figure 10: SSI - Gray / binary switchover

Position	Code
1	Binary
0	Gray

REMARK!

No coding switches are accessible on the sensor housing with M9 round connector. Therefore, please specify the desired configuration when ordering!

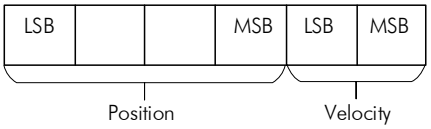


8.2 Interface CANopen (option CA0)

When ordering option "CA0", the encoder is equipped with a CAN interface according to the CANopen standard DS406. To start the communication (start sending) an NMT command must be given first. If the position value is needed to be sent automatically after power on, the special version **11** can be ordered (☞ 12).

The following identifiers are given:

CAN - Identifier
(6 byte telegram)
181 h (16) = Identifier
First 4 bytes = Position (resolution 0.01 mm), bit rate 250 KB/s
Following 2 bytes = velocity in mm/s



All available CAN options and information about the DS406 device profile can be found in the corresponding EDS or XDD file. Download: https://www.elgo.de/fileadmin/user_upload/software/EMAX_DS406.zip

The CAN-Identifier can be adjusted in the range of $181_{(16)}$ to $18F_{(16)}$ by rotary code switches, which are located behind a protection cap on the top of the sensor housing:

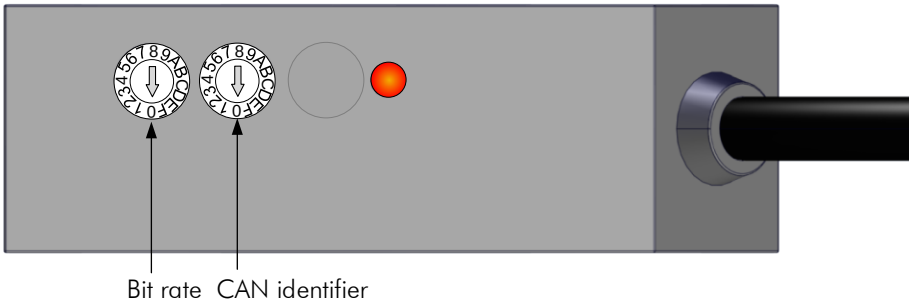


Figure 11: Bit rate and CAN identifier settings

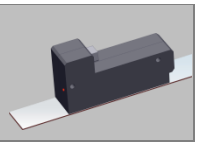
Table 2: Bit rate and CAN-Identifier with option CA0

Position	Bit rate (left)
0	-
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	bit rate from memory
9	1 MBit/s
A	800 kBit/s
B	500 kBit/s
C	250 kBit/s
D	125 kBit/s
E	100 kBit/s
F	50 kBit/s

Position	CAN identifier (right)
0	Identifier from memory
1	181
2	182
3	183
4	184
5	185
6	186
7	187
8	188
9	189
A	18A
B	18B
C	18C
D	18D
E	18E
F	18F

REMARK!

No coding switches are accessible on the sensor housing with M9 round connector. Therefore, please specify the desired configuration when ordering!



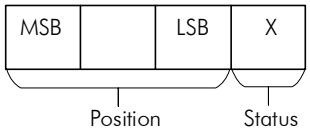
8.3 CAN BASIC ELGO (Option CN0)

Interface / Protocol: When ordering option "CN0", the EMAX / EMAL encoder is equipped with a CAN interface according to the ELGO CAN standard protocol. The following identifiers are given:

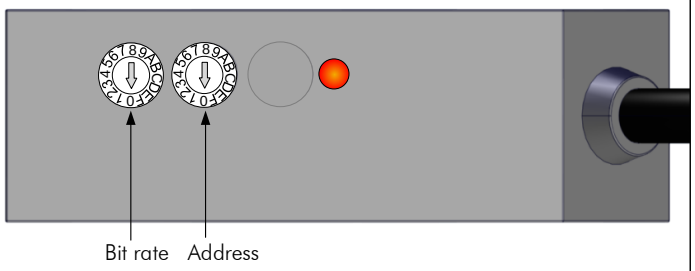
Table 3: Identifier Option CN0

80 (16) + EMAX address	Identifier to request the absolute position
10 (16) + position of rotary code switch	Identifier contains absolute position of the device
(4 byte telegram)	EMAX / EMAL (resolution 0.01 mm)

4 byte acknowledgement telegram:



Status
X = 0 → no errors
X = 1 → magnetic tape error



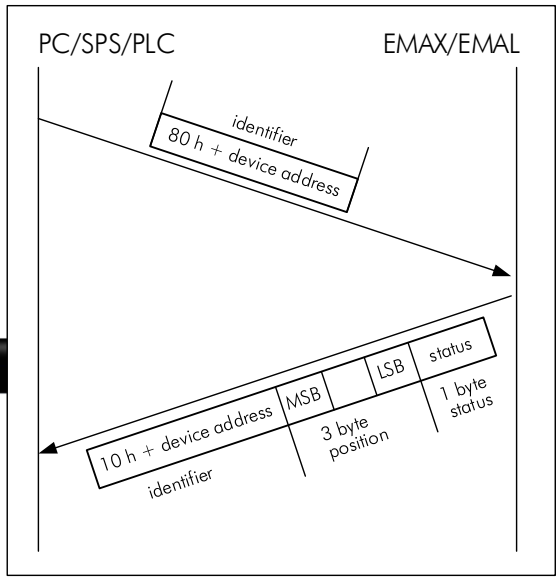


Figure 12: Bit rate / address (option CN0)

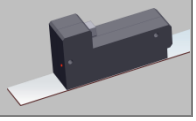
The settings of bit rate and address (range from 0 (16) to F (16)) be done by using the rotary coding switches, which are located behind a protection cap on the top of the sensor housing.

Table 4: Bit rate and address settings (option CN0)

Position	Bit rate (left)	Position	Address (right)
0	1 MBit/s	0	0
1	500 kBit/s	1	1
2	250 kBit/s	2	2
3	125 kBit/s	3	3
4	100 kBit/s	4	4
5	-	5	5
6	-	6	6
7	-	7	7
8	-	8	8
9	-	9	9
A	-	A	A
B	-	B	B
C	-	C	C
D	-	D	D
E	-	E	E
F	-	F	F

REMARK!

No coding switches are accessible on the sensor housing with M9 round connector. Therefore, please specify the desired configuration when ordering!

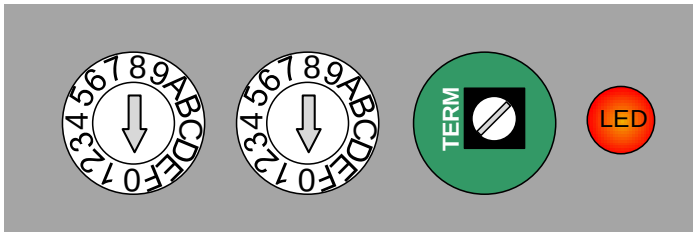


8.4 Termination Resistor

As standard the interfaces CANopen and addressable RS422, is supplied with an internal 120 Ω termination resistor. For sensors with a fixed cable outlet, this can be deactivated via a trimmer located under a protective cap right next to the LED.

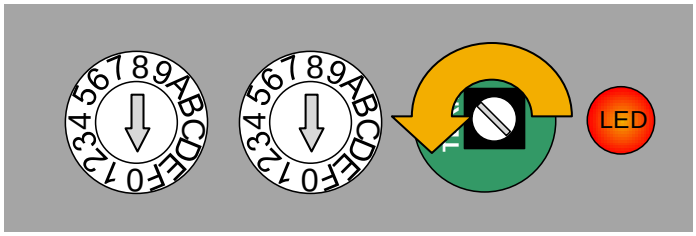
> **PLEASE NOTE:**
> With the sealed option V or sensor housings with round connector, the above-mentioned terminating resistor is not accessible! If no terminating resistor is required for these variants, this can be specified by ordering option A (see ☞ 12 Type Designation).

Termination resistor: ON



By default, the 120 Ω termination impedance is enabled (see "ON" setting in the figure).

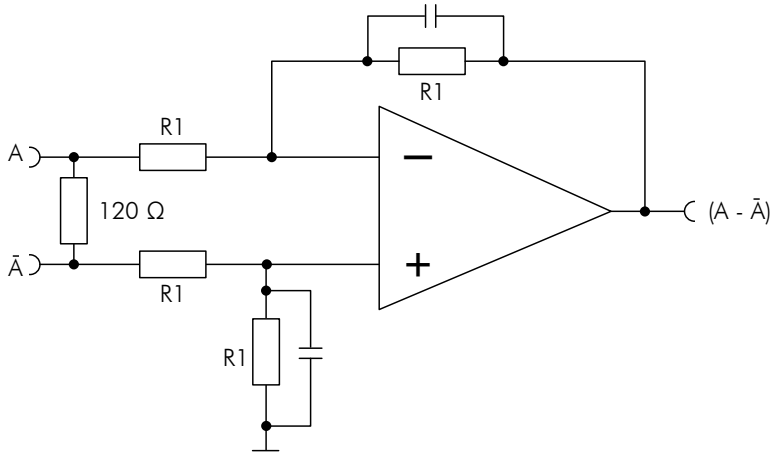
Termination resistor: OFF



In order to deactivate the termination impedance, use a micro screwdriver and turn counter-clockwise up to the stop.

Figure 13: Termination resistor ON / OFF

Example of a follow-up circuit:



8.5 Interface RS422 (Option 420) & RS232 (Option 230)

Depending on the order specification the encoder can be equipped with a RS422 (option "420") or RS232 interface (option "230"). Both versions use the same protocol and differ only in their level height.

The data transmission has the following format:
1 Start Bit / 8 Data Bits / 1 Stop Bit / No Parity

Data protocol:
The actual value is transmitted with 9600 bit/s, 8 data bits, 1 stop bit, without parity bit in the following format:
02h STX
xxh ABS data MSB
xxh ABS data
xxh ABS data LSB
03h ETX
00h
0Dh
The scanned absolute position is shown binary with 0.01 mm resolution in the 3 ABS data bytes.

Standard	9600 bit/s, 8 data bits, 1 stop bit, no parity 7 Bytes, 02 MSB MSB-1 LSB 03 00 0D STX — binary position value — ETX

Other protocols are available on request.

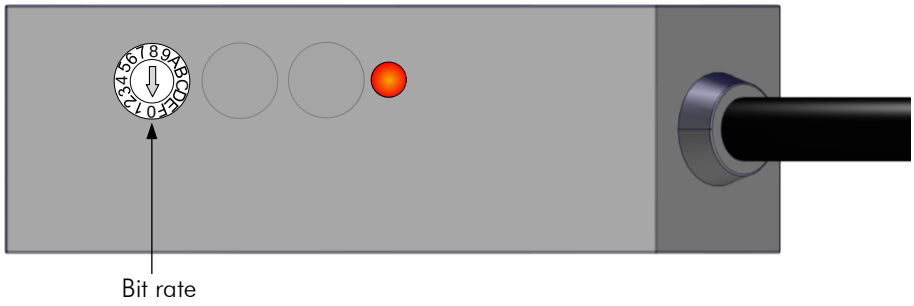
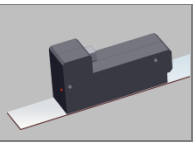


Table 5: Bit rate RS422 (option420) and RS232 (option 230)

Position	Baud rate
8	9600 bit/s
9	600 bit/s
A	1200 bit/s
B	2400 bit/s
C	4800 bit/s
D	19200 bit/s
E	38400 bit/s
F	115200 bit/s

REMARK!
No coding switches are accessible on the sensor housing with M9 round connector. Therefore, please specify the desired configuration when ordering!



RS422: Further an addressable version is available as option "A20" (☞ 8.6).

8.6 RS422 Addressable Version (Option A20)

The device address can be defined by using a rotary code switch that is located behind a protective cap on the top of the sensor housing:

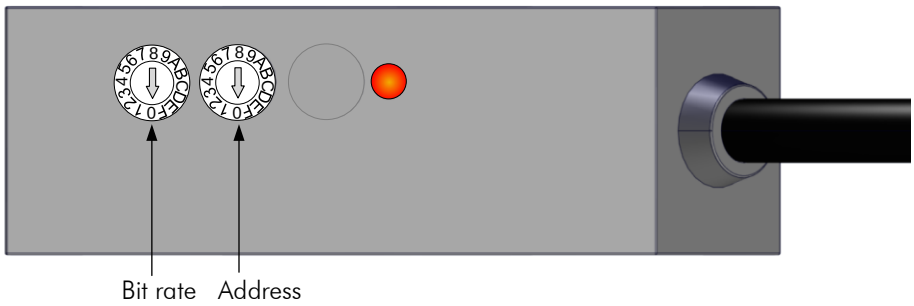


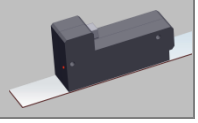
Figure 14: Set options on top of the housing

Table 6: Addressable RS422 Option A20

Position	Bit rate (left)	Position	Address (right)
0	9600 bit/s addressable [adrb]	0	0B
1	600 bit/s [adrb]	1	0C
2	1200 bit/s [adrb]	2	0D
3	2400 bit/s [adrb]	3	0E
4	4800 bit/s [adrb]	4	0F
5	19200 bit/s [adrb]	5	10
6	38400 bit/s [adrb]	6	11
7	115200 bit/s [adrb]	7	12
8	9600 bit/s auto send [asnd]	8	13
9	600 bit/s [asnd]	9	14
A	1200 bit/s [asnd]	A	15
B	2400 bit/s [asnd]	B	16
C	4800 bit/s [asnd]	C	17
D	19200 bit/s [asnd]	D	18
E	38400 bit/s [asnd]	E	19
F	115200 bit/s [asnd]	F	1A

REMARK!

No coding switches are accessible on the sensor housing with M9 round connector. Therefore, please specify the desired configuration when ordering!



Protocol of an addressable EMAX / EMAL:

General format of a message **to** the EMAX or EMAL:				
0x02	Byte1	Byte2	Byte3	0x03
STX			check	ETX

0x02 (STX) starts a message
0x03 (ETX) close the message
Byte3 (check) is the arithmetic sum of 0x02(STX), Byte1 and Byte2.
ETX is not included in the checksum

General format of a message **from** the EMAX or EMAL:				
0x02	Byte1	Byte2	Byte3	Byte4
STX				

Position-request **from** the EMAX or EMAL with address i:				
Message to the EMAX or EMAL				
0x02	0x04	i	check	0x03
STX			check	ETX

0x04 characterizes the message as position-request
i is the address of the requested EMAX / EMAL (i = 0x0b... 0x7f).

Answer of the requested EMAX or EMAL:				
0x02	PosHigh	PosMid	PosLow	EMAX address

The position value consists of 3 byte:
PosLow (bit 0… bit 7), PosMid (bit 8… bit15), PosHigh (bit16...bit23).
Bit 0 has the value10 μm. Position-values are always smaller than 0xffff00.
Please note: The last byte is no ETX, like in all the other messages, but the **EMAX / EMAL** address.

Interrogation of the address of an **EMAX / EMAL**:
Connect always only a single **EMAX / EMAL** to be interrogated via RS422/RS232 converter to COM port of a PC.

Message to the EMAX or EMAL:				
0x02	0x05	0x05	0x0c	0x03
STX	address request		check	ETX

Answer of the EMAX or EMAL:			
0x02	0xff	0xff i	0x03
STX		EMAX address	ETX

Note: The combination 0xff 0xff does not appear in normal mode for position answers of EMAX / EMAL (directly after STX) It is a sign for a special message not a position (in this case with 0x0b <= i <=0x7f it is the answer to the interrogation of the address).

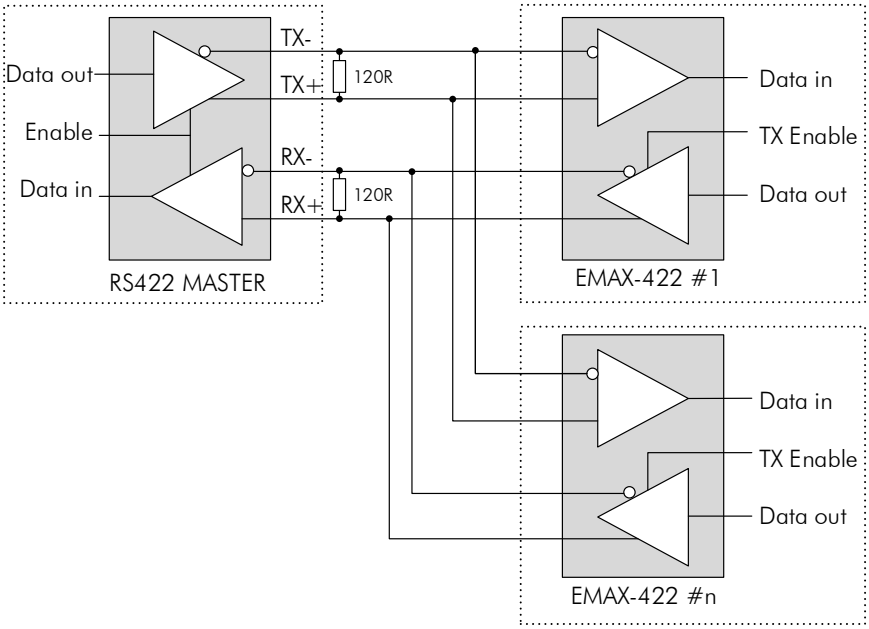
Negative answer: If one of the described operations failed for some reasons, the EMAX / EMAL encoder will give a negative answer with a concerning error code.

EMAX or EMAL answers:				
0x02	0xff	0xff	Err	0x03
STX	0xff	0xff	Error Code	ETX
With Err = 0x04... 0x0a				

Table 7: Error messages of an addressable EMAX / EMAL

Code	Description
0x04	**Wrong succession of bytes** sent to EMAX / EMAL for example if the 4. byte after the STX is no ETX or the byte after STX is not 0x04, 0x05 or 0x06.
0x05	**Receive Error:** Error concerning the interface **(for example if there has been sent a message with a wrong baud rate etc.)**
0x06	Invalid EMAX / EMAL address: appears while trying to assign an address less than 0x0b or greater tha 0x7f.
0x07	Lost EMAX / EMAL Address: The check of the internal, redundant stored address is failed. This messag is issued immediately after the reconnecting the power supply, if an error was found during reading ou the EEPROM's or the problem cannot be resolved by an redundant stored address.
0x08	Internal EEPROM- storage error.
0x09	**Error in calculation of position (No tape, tape damaged or to big distance)**
0x0a	**Check-Sum-Error** - Check-Sum of a message sent to EMAX / EMAL is wrong

8.7 Connection to a RS422 Master



Color	Function
Green	RX+
Violet	RX–
Yellow	TX+
Orange	TX–
Brown	+ 24 VDC
White	0 V / GND

Figure 15: Connection to a RS422 Master

8.8 IO-Link Interface

The IO-Link interface is available in both designs (housing with fixed cable outlet or with round connector).

8.8.1 Connections

- In order to comply with the IO-Link standard, the housing variant with fixed cable outlet is supplied with a 4-pin M12 (male) round connector with the IO-Link standard pin assignment.
  → Pin assignment see ☞ 10.1.5

- For versions with IO-Link and additional incremental output (see ☞ 9) the 4-pin IO-Link standard round connector is no longer sufficient. Here, the sensor cable is supplied with open cable ends as standard. Optionally, the cable can be supplied with a 12-pin M12 (male) round connector
  (see ☞ 12 Type Designation → Connection options → "RCM0").
  → Pin assignment see ☞ 10.1.6

- For the housing version with round connector, an additional DKA cable with the M12 round connector mentioned above and identical pin assignment is available as an accessory (see ☞ 12.2 Accessories). For this version no incremental outputs (see option ☞ 9) are available.
  → Pin assignment see ☞ 10.2.2

8.8.2 Functional Description

The IO-Link interface integrated in the sensor enables continuous communication between the system controller and the field level.

Position information and errors are independently reported to the controller and can be easily viewed. Conversely, format adjustments, for example, can be set up more easily.

8.8.3 Process Data

EMAX-IO cyclically transmits a measurement value via the IO-Link interface.
Properties of the measurement value:

- signed
- is output in µm
- 32 bit format
- index 28 (16)

Byte			
3	2	1	0
Measurement value			

8.8.4 Set Zero

1. Move the EMAX-IO sensor to the desired position.
2. Write E0 (16) on Index 2 / Subindex 0 via system command “Set Zero”.
3. EMAX-IO calculates the offset so that zero is output at the approached position.

8.8.5 Download Data Sheet

The download of the complete data sheet with all relevant data, commands and parameters can be found on:
https://www.elgo.de/fileadmin/user_upload/pdf/flyer/sensors/EMAX-IO-000-TD-E.pdf

9 Optional Incremental Output

Note: This option is only available for EMAX/EMAL sensor designs with fixed cable outlet.

9.1 Incremental A/B Signals (TTL / HTL)

Optionally two 90° phase shifted, rotary pulse encoder compatible square-wave signal outputs with HTL or TTL level (push/pull) are available. Order specifications see 12 „Type Designation“.

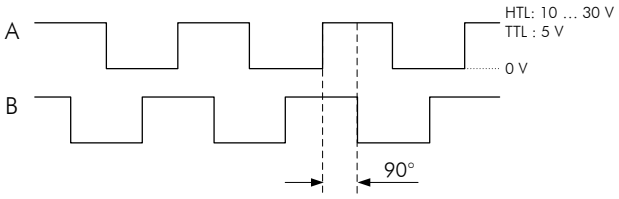


Figure 16: A/B - Inkrementalsignale (TTL / HTL)

9.2 Sine/Cosine Incremental Signals (Option SC50)

Optionally an incremental sine/cosine output with 1 Vpp levels is available (push/pull, short-circuit proof).

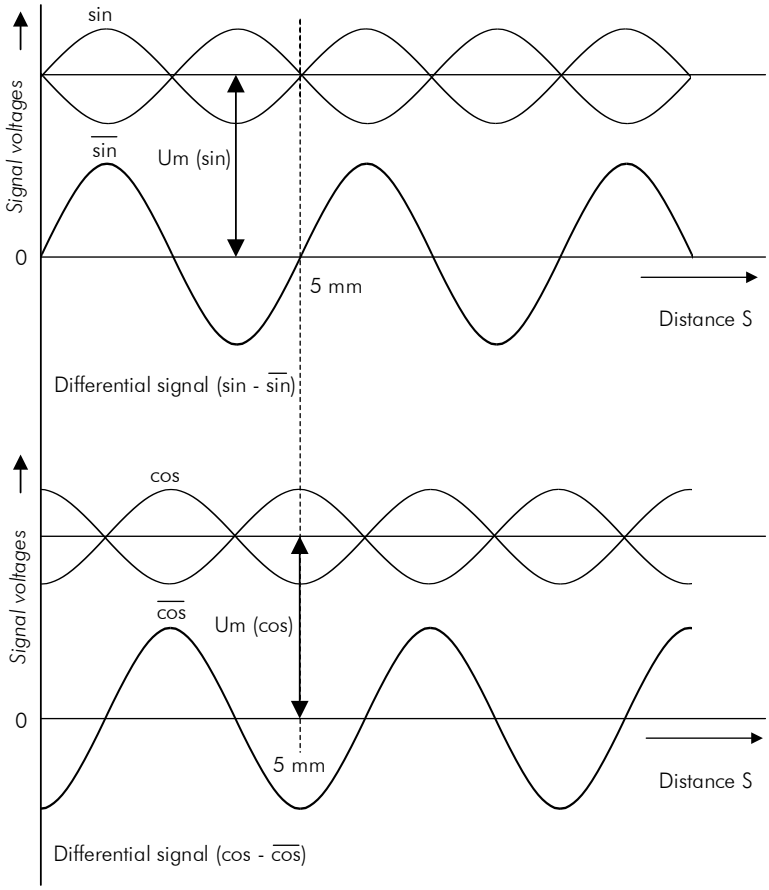


Figure 17: Sine – Cosine Incremental Signals

Table 8: Characteristics values for option SC50

Parameter	Description	min.	typ.	max.	Einheit
Medium voltage	Um (sin) / Um (cos)	2.4	2.5	2.6	V
Amplitude	sin – sin‘ / cos – cos‘	400	500	600	mV
Ratio	(sin – sin‘) / (cos – cos‘)	0.9	1.0	1.1	-
Difference of Phase	φ	85	90 ±10 %	95	° Grad
Distortion factor	K	-	-	3	%

10 Pin Assignment

10.1 Connections of Housing with fixed Cable Outlet

10.1.1 SSI-Interface

Table 9: Connections of SSI interface cable 1

Color	SSI (SG0, SB0)	SSI (SG0, SB0) + Incremental HTL
White	0 V / GND	0 V / GND
Brown	+ 10 … 30 VDC	+ 10 … 30 VDC
Yellow	TX DATA +	TX DATA +
Orange	TX DATA –	TX DATA –
Green	CLK CLOCK +	CLK CLOCK +
Violet	CLK CLOCK –	CLK CLOCK –
Grey	-	HTL A (option)
Black	-	HTL B (option)
Shield	PE* ⏚	PE* ⏚

Table 10: Connections of SSI interface cable 2

Color	SSI (SG0, SB0) + Sine/Cosine SC50	SSI (SG0, SB0) + Incremental TTL
White	0 V / GND	0 V / GND
Brown	+ 10 … 30 VDC	+ 10 … 30 VDC
Grey	TX DATA +	TX DATA +
Pink	TX DATA –	TX DATA –
Yellow	CLK CLOCK +	CLK CLOCK +
Green	CLK CLOCK –	CLK CLOCK –
Blue	1 Vpp SIN + (option)	TTL A (option)
Red	1 Vpp SIN – (option)	TTL A' (option)
Black	1 Vpp COS + (option)	TTL B (option)
Violet	1 Vpp COS – (option)	TTL B' (option)
Shield	PE* ⏚	PE* ⏚

*) Connect shield only at the device!

Table 11: Connections of SSI interface with option M8F0, 8-pin (female) M16 round connector

Pin	Color	Function
1	White	0 V / GND
2	Brown	+ 10 … 30 VDC
3	Orange	DATA –
4	Yellow	DATA +
5	Violet	CLOCK –
6	Green	CLOCK +
7	-	-
8	-	-

Table 12: Connections of SSI interface with option MCM0, 12-pin (male) M16 round connector

Pin	Color	Function
A	White	0 V / GND
B	Brown	+ 10 … 30 VDC
C	Green	CLOCK –
D	Yellow	CLOCK +
E	Grey	DATA +
F	Pink	DATA –
G	Blue	1 Vpp SIN + (option)
H	Red	1 Vpp SIN – (option)
J	Black	1 Vpp COS + (option)
K	Violet	1 Vpp COS – (option)
L	-	-
M	-	-

Table 13: Connections of SSI interface with option D9M0, 9-pin (male) D-SUB connector

Pin	Color	Function
1	White	0 V / GND
2	Brown	+ 10 … 30 VDC
3	-	-
4	-	-
5	Blank	Shield
6	Green	CLOCK +
7	Violet	CLOCK –
8	Yellow	DATA +
9	Orange	DATA –

Table 14: Connections of SSI interface Option M8M0, 8-pin (male) M16 round connector

Pin	Color	Function
1	White	0 V / GND
2	Brown	+ 10 … 30 VDC
3	Orange	DATA –
4	Yellow	DATA +
5	Violet	CLOCK –
6	Green	CLOCK +
7	Grey	HTL A (option)
8	Black	HTL B (option)

10.1.2 CANopen Interface

Table 15: Connections of CANopen interface (open cable ends)

Color	CAN (CA0)	CAN (CA0) + Incremental HTL	CAN (CA0) + Incremental TTL
White	0 V / GND	0 V / GND	0 V / GND
Brown	+ 10…30 VDC	+ 10 … 30 VDC	+ 10 … 30 VDC
Yellow	CAN HIGH	CAN HIGH	CAN HIGH
Orange	CAN LOW	CAN LOW	CAN LOW
Green	-	-	TTL A‘ (option)
Violet	-	-	TTL B‘ (option)
Grey	-	HTL A (option)	TTL A (option)
Black	-	HTL B (option)	TTL B (option)
Shield	PE* ⏚	PE* ⏚	PE* ⏚

*) Connect shield only at the device!

Table 16: Connections of CANopen interface with option D9M, 9-pin (male) D-SUB connector

Pin	Color	Function
1	-	-
2	Orange	CAN LOW
3	-	-
4	-	-
5	-	-
6	White	0 V / GND
7	Violet	CAN HIGH
8	-	-
9	-	-
Housing	Blank	Screen

Table 17: Connections of CANopen interface with option R5M0, 5-pin (male) D-SUB connector

Color	Function	Description
1	CAN_GND / Shield	CAN Ground / CAN Shielding
2	+VCC	10 … 30 VDC
3	0 V / GND	Ground
4	CAN HIGH	positive CAN signal
5	CAN LOW	negated CAN signal
Housing	Shield	Shielding

10.1.3 RS422 Interface

Table 18: Connections of RS422 interface (open cable ends)

Color	Function
White	0 V
Brown	+ 10 … 30 VDC
Yellow	TX (+)
Orange	TX (−)
Violet	RX (−) (only with A20 available)
Green	RX (+) (only with A20 available)
Grey	HTL A (option)
Black	HTL B (option)
Shield	PE* ⏚

*) Connect shield only at the device!

Table 19: Connections of RS422 interface with option D9M0, 9-pin (male) D-SUB connector

Pin	Color	Function
1	White	0 V / GND
2	Brown	+ 10 … 30 VDC
3	-	-
4	-	-
5	Blank	Shield
6	Green	RX (+)
7	Violet	RX (−)
8	Yellow	TX (+)
9	Orange	TX (−)

Table 20: Connection of RS422 interface option D9M5, 9-pin (male) D-SUB connector

Pin	Color	Function
1	White	0 V / GND
2	Brown	+ 10 … 30 VDC
3	Yellow	TX (+)
4	-	-
5	-	-
6	Orange	TX (−)
7	-	-
8	-	-
9	-	-
Housing	Blank	Shield

Table 21: Connections of RS422 interface option M8M0, 8 pin (male) M16 round connector

Pin	Color	Function
1	White	0 V / GND
2	Brown	+ 10 … 30 VDC
3	Orange	TX (−)
4	Yellow	TX (+)
5	Violet	RX (+)
6	Green	RX (−)
7	Grey	HTL A (option)
8	Black	HTL B (option)

10.1.4 RS232 Interface

Table 22: Connections of RS232 interface (open cable ends)

Color	Function
White	0 V / GND
Brown	+ 10 … 30 VDC
Yellow	RX
Orange	TX
Violet	-
Green	-
Grey	HTL A (option)
Black	HTL B (option)
Shield	PE* ⏚

*) Connect shield only at the device!

Table 23: Connections of RS232 interface with option D9M0, 9-pin (male) D-SUB connector

Pin	Color	Function
1	White	0 V / GND
2	Brown	+ 10 … 30 VDC
3	Grey	HTL A (option)
4	Black	HTL B (option)
5	Blank	Shield
6	Yellow	RX
7	-	-
8	Orange	TX
9	-	-

10.1.5 IO-Link Interface

Table 24: Connections - cable outlet with 4-pin. (male) M12 round connector

4-pin M12	IO-Link interface (IOL)
1	+10 … 30 VDC
2	-
3	0 V / GND
4	C / Q

Note: The 4-pin M12 round connector and its assignment comply with the IO-Link standard.

10.1.6 IO-Link Interface with optional Incremental Output

Table 25: Connections - open cable ends (standard)

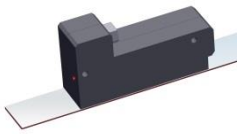
Color	IO-Link interface (IOL) + Incremental HTL	IO-Link interface (IOL) + Incremental TTL	IO-Link interface (IOL) + Sine/Cosine (SC50)
White	0 V / GND	0 V / GND	0 V / GND
Brown	+ 10 … 30 VDC	+ 10 … 30 VDC	+ 10 … 30 VDC
Yellow	-	-	-
Orange	C / Q	C / Q	C / Q
Green	HTL B (option)	TTL B (option)	1 Vpp COS + (option)
Violet	-	TTL B‘ (option)	1 Vpp COS − (option)
Grey	HTL A (option)	TTL A (option)	1 Vpp SIN + (option)
Black	-	TTL A‘ (option)	1 Vpp SIN − (option)
Shield	PE* ⏚	PE* ⏚	PE* ⏚

*) Connect shield only at the device!

Table 26: Connections - 12-pin (male) M12 round connector (RCM0)

12-pin M12	IO-Link interface (IOL) + Incremental HTL	IO-Link interface (IOL) + Incremental TTL	IO-Link interface (IOL) + Sine/Cosine (SC50)
1	0 V / GND	0 V / GND	0 V / GND
2	+ 10 … 30 VDC	+ 10 … 30 VDC	+ 10 … 30 VDC
3	-	-	-
4	C / Q	C / Q	C / Q
5	-	-	-
6	-	-	-
7	HTL B (option)	TTL B (option)	1 Vpp COS + (option)
8	-	TTL B‘ (option)	1 Vpp COS − (option)
9	HTL A (option)	TTL A (option)	1 Vpp SIN + (option)
10		TTL A‘ (option)	1 Vpp SIN − (option)
11	-	-	-
12	-	-	-

10.2 Connections of Housing with M9 Round Connector



REMARK: Additional incremental outputs as well as sine/cosine outputs are not available with the connector housing design (☞ 12).

10.2.1 SSI / CANopen / RS422 / RS232

Table 27: Connections of the 7-pin M9 round connector (male)

Pin	SSI	CANopen	RS422	RS232
1	0 V / GND	0 V / GND	0 V / GND	0 V / GND
2	+10 … 30 VDC	+10 … 30 VDC	+10 … 30 VDC	+10 … 30 VDC
3	DATA (−)	CAN HIGH	TX (−)	RX
4	DATA (+)	CAN LOW	TX (+)	TX
5	CLOCK (−)	-	RX (−)	-
6	CLOCK (+)	-	RX (+)	-
7	-	-	-	-

Table 28: Connections when using the DKA cable with open cable ends

Color	SSI	CANopen	RS422	RS232
White	0 V / GND	0 V / GND	0 V / GND	0 V / GND
Brown	+10 … 30 VDC	+10 … 30 VDC	+10 … 30 VDC	+10 … 30 VDC
Orange	DATA (−)	CAN HIGH	TX (−)	RX
Yellow	DATA (+)	CAN LOW	TX (+)	TX
Violet	CLOCK (−)	-	RX (−)	-
Green	CLOCK (+)	-	RX (+)	-

Order designation of the standard DKA cable: DKA-00-Q7F0-050-XXXX-06-N-N-N (see accessories ☞ 12.2)

10.2.2 IO-Link

Table 29: Connections IO-Link without cable

7-pin M9 Pin	IO-Link
1	0 V / GND
2	+10 … 30 VDC
3	-
4	-
5	C / Q
6	-
7	-

Table 30: Connections IO-Link with DKA cable

4-pin M12 Pin	IO-Link
1	+10 … 30 VDC
2	-
3	0 V / GND
4	C / Q

Order designation of the IO-Link DKA cable: DKA-00-Q7F0-050-R4MA-04-N-N-N (see accessories ☞ 12.2)

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.

11.4 Cleaning

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

12 Type Designation

AAAA	BB	CCC	DDD	EEE	FFFF	G	HHHH	I	J	KKKK

A Series/Type:

EMAX = Measuring length up to 10 m
EMAL = Measuring length up to 20 m (available at extra charge)

B Version:

00 = 00 (standard) 01… 99 (special versions)
11 = EMAX 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 (**Important:** different housing design - see dimensions)
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 - at system accuracy in µm ±(150 + 20 x L)
F10* = 10 µm - at system accuracy in µm ±(50 + 20 x L)
* variant F10 at extra charge

E Interface:

SB0 = SSI interface (25 Bit binary code)
SG0 = SSI interface (25 Bit Gray code)
CA0 = CANopen (DS406)
CN0 = CAN BASIC ELGO
420 = RS422
A20 = addressable RS422
230 = RS232
IOL* = IO-Link acc. to IEC 61131-9

Presetting of the rotary code switch by ELGO is possible on request! **Please note:** For versions with M9 round connector on housing or with sealed option V, the configuration must generally be specified when ordering.

*) The standard IO-Link version generally has a (male) 4-pin M12 round connector with standard IO-Link assignment.

F Bit Rate:

09k6 = 9600 bit/s - standard with RS232 (230) and 422 (420/A20)
19k2 = 19200 bit/s with RS232 or RS422
38k4 = 38400 bit/s with RS232 or RS422
125k = 125000 bit/s with CAN
250k = 250000 bit/s with CAN
500k = 500000 bit/s with CAN
1MHz = 1000000 bit/s with CAN
230k = 230400 bit/s with IO-Link

Additional Options

G Address

0 = device address 0… F (standard setting = 0)

H Connection options*

- - - - = without connector (open cable ends)
D9M = 9-pin (male) D-SUB (only for CAN interfaces available)
D9M0 = 9-pin (male) D-SUB (available for RS232, RS422 and SSI) with ELGO standard pin assignment
D9M5 = 9-pin (male) D-SUB (only for RS422 with Bit rate 09k6) with Option 5 (pin assignment suitable for Z25 indicators)
M8F0 = 8-pin (female) M16 connector with ELGO standard SSI assignment, suitable for ELGO PNO1 (only for SSI)
M8M0 = 8-pin (male) M16 connector (only for RS422 and SSI available)
R5M0 = 5-pin (male) M12 connector with ELGO standard assignment (only for CAN interfaces available)
RCM0 = 12-pin (male) M12 connector (intended for IO-Link interfaces with additional Sin/Cos or A/B signals)
MCM0 = 12-pin (male) M16 connector (intendedfor SSI interfaces with additional Sin/Cos or A/B signals)
MCF0 = 12-pin (female) M16 connector (intended for SSI interfaces with additional Sin/Cos or A/B signals)

*) Connection options apply **only to versions with fixed cable outlet**

I

V = Sealed IP65 construction (Important note: This variant is delivered without rotary code switches. Please specify your configuration when order, since no more settings can be made after sealing.)

J

A = CAN interface resp. addressable RS422 without internal termination resistor

K Incremental output*

H2N5 = Incremental square wave signals HTL with 2.5 µm resolution
H005 = Incremental square wave signals HTL with 5 µm resolution
H010 = Incremental square wave signals HTL with10 µm resolution
H025 = Incremental square wave signals HTL with 25 µm resolution
T2N5 = Incremental square wave signals TTL with 2.5 µm resolution
T005 = Incremental square wave signals TTL with 5 µm resolution
T010 = Incremental square wave signals TTL with10 µm resolution
SC50 = Sine/Cosine signal output 1 Vpp, pole pitch = 5 mm

*) **For technical reasons, this option is not available for versions with connectors on the housing.** The incremental outputs are **only available for versions with fixed cable outlet**.

IO-Link versions with optional incremental output are supplied with open cable ends or optionally with a 12-pin M12 round connector; see connection options "RCM0" (others on request).

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

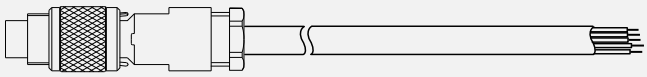
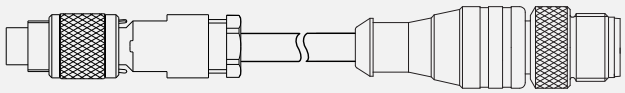
12.1 Example of available Variants

Table 31: Example of available variants

Order description	Description
EMAX00015010SB0----------	EMAX with binary SSI interface, 25 bit and 1.5 m cable
EMAX0001510SB0-----M8F0------	EMAX with binary SSI interface, 25 bit, 1.5 m cable and M16 plug connector (female) for PNO1
EMAX00015010SG0----------T2N5	EMAX with SSI-Gray Interface, 25 Bit, 1.5 m cable, TTL-square-wave signal, 2,5 µm Resolution
EMAL00015010CA0125k0----------	EMAL for measuring lengths up to 20 m, according to ELGO standard, with CANopen interface, 1.5 m cable, 125 kbit/s and device address: 0

12.2 Accessories

Table 32: Accessories

Order Designation	Description
AB20-50-20-2-R-11	Magnetic tape for EMAX
AB20-50-20-2-R-12	Magnetic tape for EMAL
Magnetic tape end cap set (20 mm)	2 end caps (20 mm) and two M3 screws; additional fixation in the radial and linear range and protection of the magnetic tape ends
FS-1000, FS1500 or FS2000	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.
FW2080	Guide carriage for EMAX (only versions with connector housing)
DKA-00-Q7F0-050*-XXXX-06-N-N-N)* 050 = standard length 5 m 020 = 2 m 100 = 10 m (others on request)	Standard signal cable for versions with connector on housing:  (sensor side 7-pin M9) (customer side 6-wire)
DKA-00-Q7F0-050*-R4MA-04-N-N-N)* 050 = standard length 5 m 020 = 2 m 100 = 10 m (others on request)	IO-Link signal cable for versions with connector on housing:  (sensor side 7-pin M9) (customer side 4-pin M12)
PNO1	SSI/ PROFIBUS Converter
POSU	Pole finder card (85 x 55 mm) for magnetic tape codings

Notes:

Notes:

Notes:

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