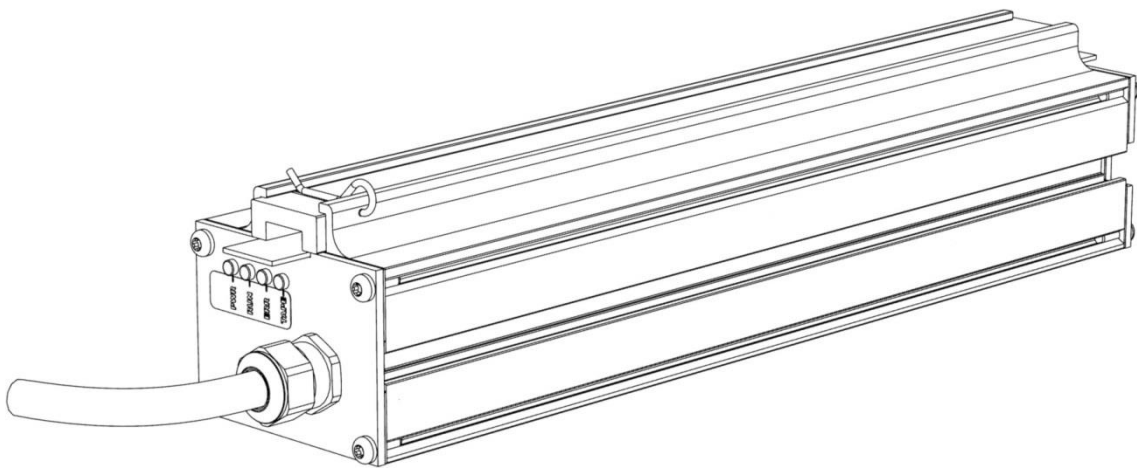**ELGO**
ELECTRONIC

Operating Manual
SERIE *LIMAX02*

Magnetic Absolute Shaft Information System for Elevators

- Robust measuring principle for usage in rough environments
- Insensitive against dirt, smoke and humidity
- Simple and flexible installation
- High accuracy and reproducibility
- Absolute position measurement with a length up to 260 m
- Resolution up to 1 mm, higher resolution on request
- Absolute position is always directly available

  no referencing even after long power failure

- Compatible with many established controls with absolute encoder interface
- Available interfaces:
  SSI, CAN, CANopen (DS406, DS417), RS422, RS232, PROFIBUS

1 Contents

2   General, Safety, Transport and Storage

2.1   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.

2.2   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.

2.3   Statement of Warranties

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

2.4   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.

2.5   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.

2.5.1   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.

2.5.2   Conventional Use

The ELGO-device is only conceived for the conventional use described in this manual.
The LIMAX02 - ELGO- 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.

2.5.3   Safety Instructions for Transport, Unpacking and Loading

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

2.5.4   Handling of Packaging Material

Notes for proper disposal: ☞ 2.4

2.5.5   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.

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

2.5.6   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 (☞ 4) needs to be observed
▪ Relative humidity (☞ 4) must not be exceeded
▪ Inspect packages regularly if stored for an extensive period of time (>3 months)

3 Product Features

LIMAX02 is an absolute measuring shaft information system that is used for positioning of elevator cars. It consists of only two components: sensor and magnetic band.

A big advantage of the system is the simple and flexible installation. The assembly of the system components is very simple and can be performed by specialists in less than an hour. The system can be placed anywhere in the shaft, depending of the space conditions. With the small space requirement, LIMAX02 is perfect for retrofitting and modernization.

LIMAX02 detects the absolute car position up to a hoisting height of 260 meters and is designed for speeds of up to 10 m/s. In the standard configuration LIMAX02 evaluates the position with a resolution of 1 mm. Resolutions up to 0.0625 mm are possible.

LIMAX02 is equipped with various interfaces and thus can be directly connected to the most established elevator controls.

The features at a glance:
- Robust measuring principle for usage in rough environments
- Simple and flexible installation
- High accuracy and reproducibility
- No slip
- Absolute position is always directly available - no referencing even after long power outages

3.1 Functional principle

The concept is simple: A sensor mounted on the elevator car detects the current absolute car position using Hall sensors, which read the magnetic tape mounted in the shaft without any contact. Through this method, the car´s position can be determined at any time with high accuracy. The guide is only used to keep the tape within a defined distance from the sensor.

Due to its robustness, the magnetic tape technology is ideal for use in elevator systems - dust, dirt, and even dense black smoke won't affect measurement quality. The system even withstands humidity and high temperatures without any problems - making LIMAX02 ideally suited for firefighters´ elevators. And that with a long maintenance-free service life.

4 Technical Data

4.1 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.

4.2 Dimensions Sensor Standard
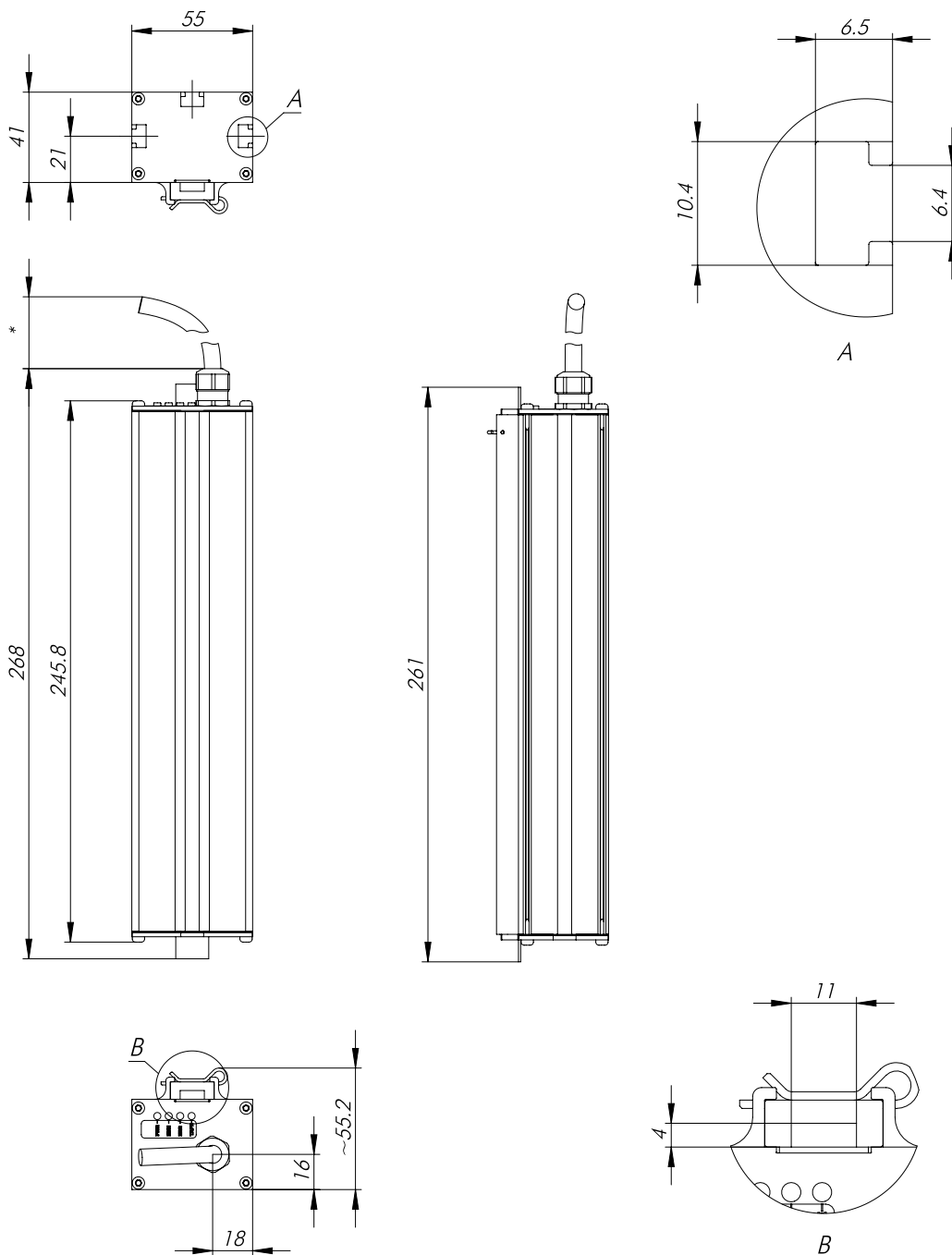
Figure 1: Dimensions Sensor Standard

4.3   Dimensions Sensor Option unguided
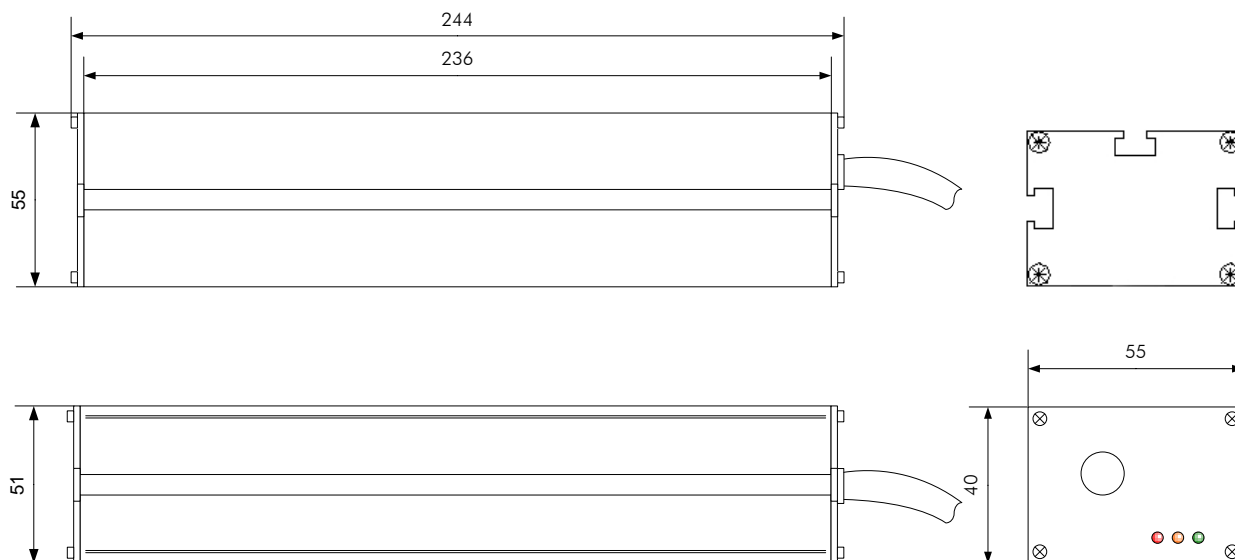
Figure 2: Dimensions Sensor Option unguided

4.4   Dimensions Sensor Option PNO
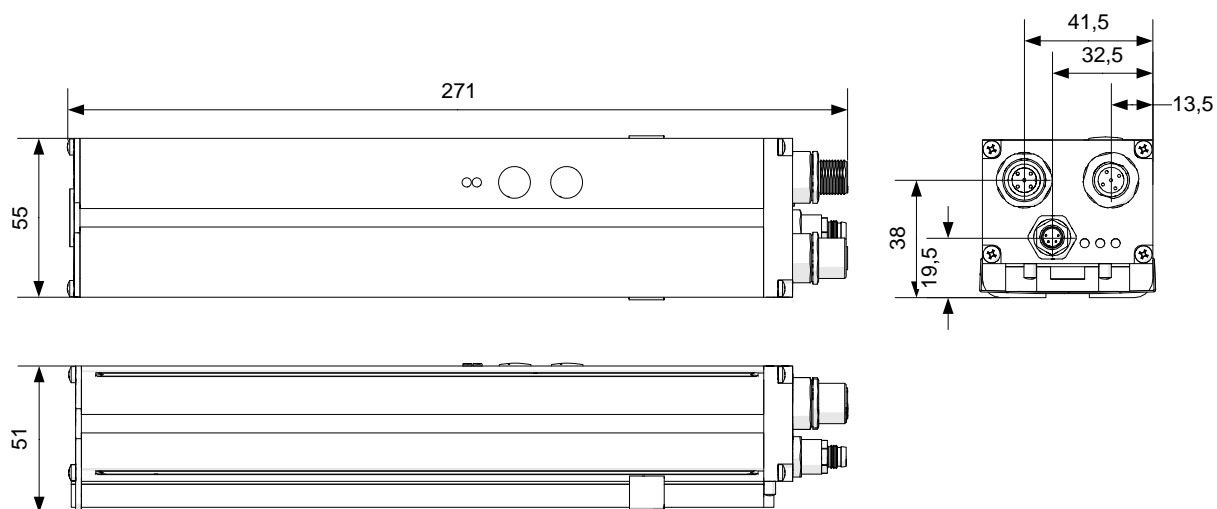
Figure 3: Dimensions Sensor Option PNO

4.5 Dimensions Magnetic Tape
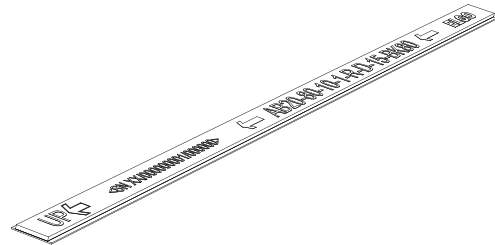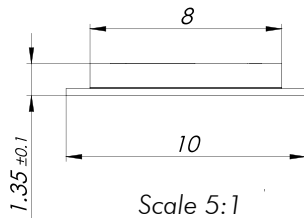
Figure 4: Dimensions Magnetic Tape

4.6 Technical Data Sensor

LIMAX02 (Standard version)

Mechanical Data

Measuring principle	absolute
Repeat accuracy	+/- 1 Increment
System accuracy in μm at 20°C	+/- (1000 + 50 x L[m]) L = measuring length in meter
Distance from sensor to magnetic tape	4 mm
Basic pole pitch	8 mm
Sensor housing material	aluminium
Sensor housing dimensions	L x W x H = 246 x 55 x 55 mm
Necessary type	AB20-80-10-1-R-D-15-BK80
Maximum measuring length	260 m
Connection	Open cable ends (more options ☞ 8)
Sensor cable	3 m standard cable length (other on request)
Weight	approx. 460 g without cable (cable approx. 60 g/m)

Electrical Data

Supply voltage	10 … 30 VDC
Residual ripple	10 … 30 VDC < 10%
Power input	max. 200 mA
Interfaces	SSI, CAN, CANopen (DS406, DS417), RS422, RS232, RS485, PROFIBUS
Resolution	According to the Type Designation (☞ 8)
Speed	max. 10 m/s (higher speeds on request)

Conditions

Storage temperature	-20 … +85° C
Operation temperature	-10 … +70° C (-25 … +85° C on request)
Humidity	max. 95 %, not condensing
Protection class	IP50

4.7 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

TEMPLATE Magnetic Tape AB20-80-10-1-R-D-15-BK80
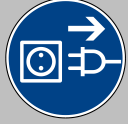
Coding	absolute, single track system
Pole pitch	8 mm
Operation temperature installed	-20 … +65° C (-20 … +80° C when using without adhesive tape, options „B" or „D")
Storage temperature uninstalled	Short-term: -10 … +60° C Medium-term: 0 … +40° C Long-term: +18° C (-20 … +80° C when using without adhesive tape, options „B" or „D")
Gluing temperature:	+18 … +30° C
Relative humidity	max. 95 %, non-condensing
Accurateness 20°C in μm	+/- (1000 + 50 x L[m]) (L = measuring length in meters)
Material carrier tape	Precision strip 1.4310 / X10CrNi 18-8 (EN 10088-3)
Double-faced adhesive tape	3M-9088 (observe instructions), others on request

Dimensions	➔ without adhesive tape:
	   10 mm (+/- 0.1) x 1,35 mm (+/- 0.11)
	➔ with adhesive tape (excl. carrier):
	   10 mm (+/- 0.1) x 1,56 mm (+/- 0.13)
	➔ with adhesive tape (incl. carrier):
	   10 mm (+/- 0.1) x 1,63 mm (+/- 0.14)

Length expansion coefficient	$\alpha \approx 16 \times 10^{-6}$ 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 lengths	up to 260 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

5   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.

Der Betreiber ist dazu verpflichtet, geeignete sicherheitsrelevante Maßnahmen zu ergreifen und durchzuführen.

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.

5.1   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.

5.2 Description installation of the Sensor

5.2.1 Installation Principe
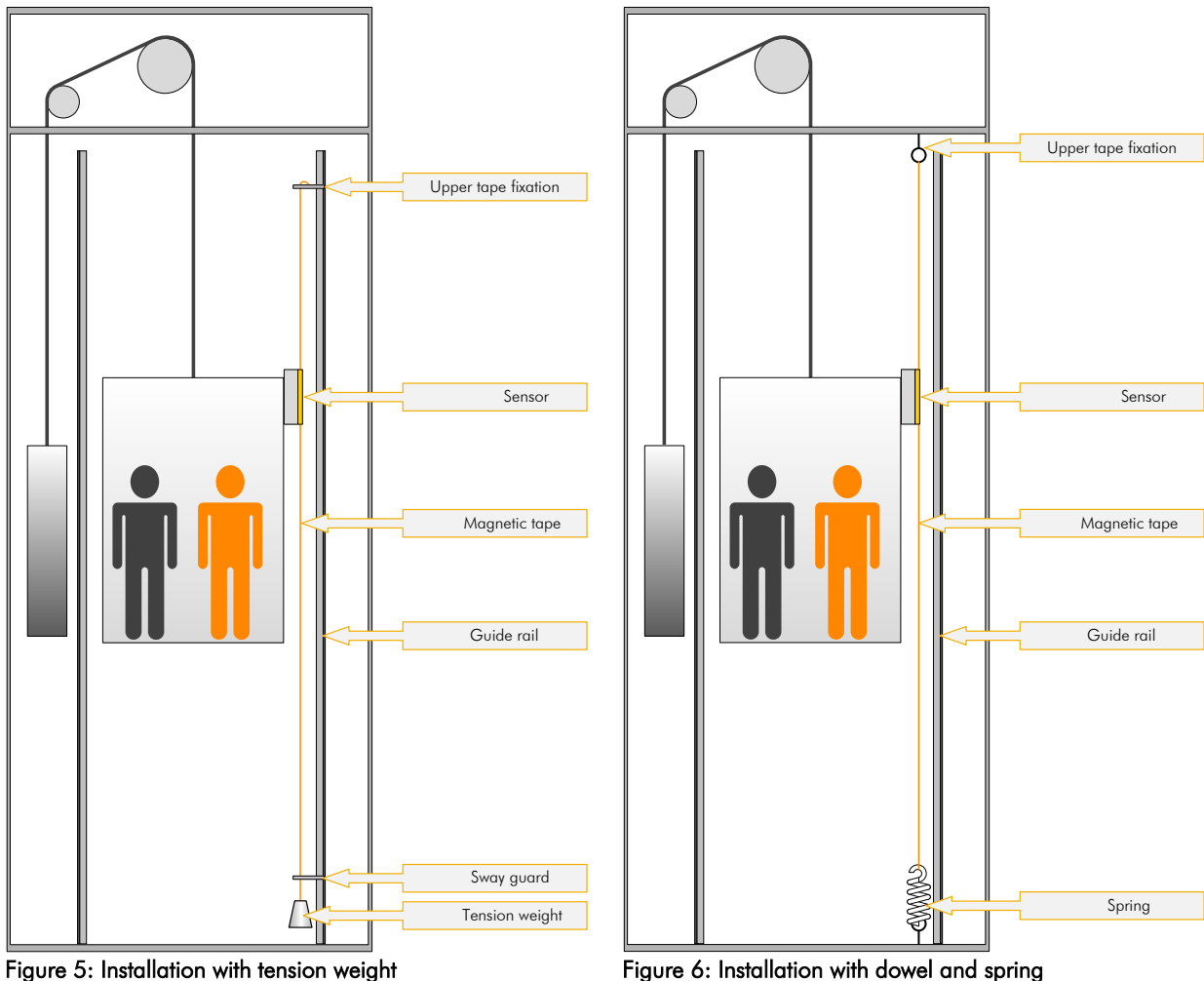
Figure 5: Installation with tension weight   Figure 6: Installation with dowel and spring

LIMAX02 can be installed at any position in the shaft, depending on spatial conditions and layout of the particular elevator installation.

The magnetic tape is installed freely suspended in the shaft. It can be fixed with the RMS mounting kit (available as option) on the guide rail. Alternatively fixation in the shaft head is either on beams or directly bolted into the ceiling. The necessary tension in the tape is provided by a tension weight of about 5 kg. A sway guard at the bottom will keep the tape from swaying in an uncontrolled position. Alternatively the magnetic tape can be tensioned by a spring.

The sensor head can be mounted onto the cabin or cabin frame, depending on the spatial conditions of the elevator.

5.2.2   Installation of the Sensor

The sensor is fixated on the cabin or on the car frame. The mounting position is basically determined by the condition.

The integrated mounting notches on the housing of the sensor head allow for a very simple and self-explanatory installation from three sides. You can either use M6 hexagon head screws (DIN 933) or M6 square nuts (DIN 562), to mount the system at the desired position.
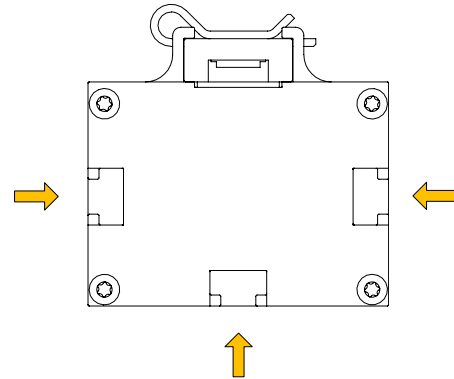
Figure 7: Mounting grooves on the sensor

	NOTE
	During installation of the magnetic tape in the sensor, pay attention to the marks on the magnetic tape and on the sensor head.
	Wrong orientation of tape vs. Sensor head will yield incorrect position readings! The arrows printed on the magnetic tape and sensor head point in positive counting direction (in the direction of the shaft head)!

5.3   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.

5.3.1   General Information

The technology has proven to be highly robust. LIMAX02 will work under the most adverse environmental conditions. Extreme temperatures, high moisture and excessive soiling will not alter the information coded onto the tape nor will these conditions affect reading precision of the sensor. Even weak magnetic fields such as they are generated by door magnets can be tolerated.

If some basic rules and guidelines are followed LIMAX02 systems require a minimum amount of installation and maintenance effort while offering maximum lifetime.

One important issue to consider is the protection of the magnet tape against mechanical wear. The LIMAX02 tape consists of two components:

- The magnetic tape which actually carries the position information
- A protective steel tape which gives the mechanical properties

5.3.2 Installation Concept

5.3.2.1 Basic Principle for the Mounting

> **NOTE!**
> The magnetic tape itself is not designed to withstand excessive mechanical wear. It is therefore important to ensure that the system is installed such that the mechanical contact between tape and sensor head is mainly between the steel tape and the polymer sensor guide. These two materials have been specifically paired for this application.

Avoiding contact between the magnetic side and the sensor could be achieved with a perfectly perpendicular installation of the band. Yet, in reality this is not practicable. It is therefore preferable to install the tape with a horizontal offset from the sensor. During operation this method will result in a forced contact between the steel side of the band and the polymer guide of the sensor which guarantees an optimal operation of the system.

Tape touches the guide with the magnetized side

Tape touches the guide with the steel side

Wrong
Constant contact between magnetized side and sensor housing lead to abrasion

Tolerable
Vertical alignment minimal contact between band and sensor

Recommended
Enforced contact between steel band and polymer housing
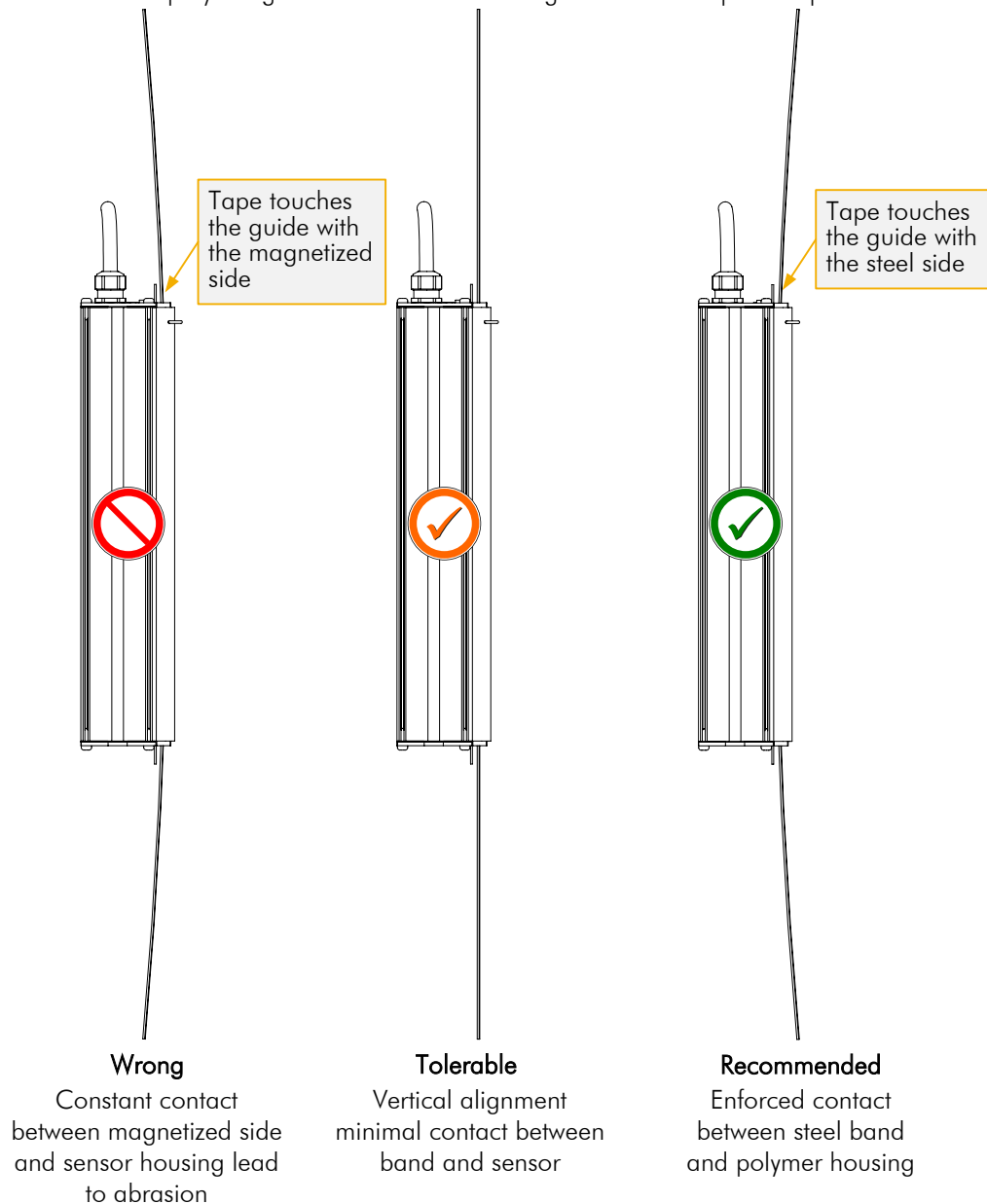
Figure 8: Assessment of the pretention of the magnetic tape

5.3.3   Installation Procedure

1.   Attach the top end of the tape in the shaft head. Ideally use an ELGO Mounting Kit. Check for correct orientation of the tape. The arrows on the magnetic side must point in upward direction.

Shaft head ◄━━━   Shaft pit ━━━►

UP⇐   <SN XX/000000001/000000>   ⇐ AB20-80-10-1-R-D-15-BK80 ⇐   ELGO

Figure 9: Correct orientation of the magnetic tape

2.   The magnetic side of the tape must face the sensor body. In most situations this means that the steel side points to the shaft wall.

3.   Drive down the shaft with inspection speed and unroll the tape. The ELGO tape packaging system has been specifically designed for this purpose. The tape can be unwound directly from the box without opening.

4.   Attach the tension weight (about 7.5 kg) at the bottom end of the tape in the shaft. Secure the tape with a sway guard. Pay attention to a proper vertical mounting of the tape.
     If you use dowels to fix the tape in the shaft, tighten the spring such, that the according tractions results to minimum 7.5 kg. When using the ELGO Mounting Kit RMS/RMS90 this is equivalent to a spring elongation of about 90 mm.
     Note that slightly higher tensile forces are never a problem, but avoid under-tensioning. In higher buildings it may even be preferable to slightly increase the tension in order to prevent flapping of the tape during operation. However, if correctly installed tensile forces of more than 10 kg should never be necessary.

5.   Drive the car to the middle of the shaft.

6.   Attach the sensor to the car. The side with the cable outlet and the LED's must face upward.

7.   Adjust the sensor using the tape as a reference. First, align sensor and magnet band on their centerline.

Magnetic Tape

Sensor

Mounting Angle

15 min.

Car
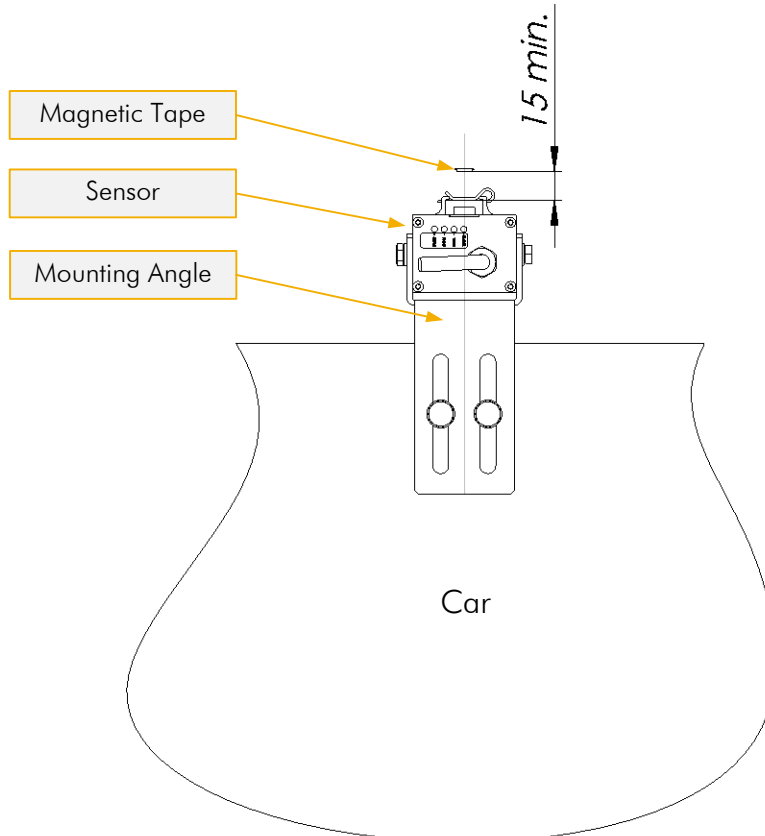
Figure 10: Distance and orientation of the magnetic tape in relation to the sensor

8. Adjust now the distance between sensor and tape. Up to a travel height of 50 m we recommend an offset of at least 15 mm. This will ensure steady contact between steel side of the band and the polymer guide of the sensor. This level can be increased later, if it turns out that the band still rubbing with the magnetic side on the sensor.
    In higher installations this distance may be increased by the initial assembly up to 5 cm.

    Pay attention to a perpendicular alignment of the sensor. Misalignment will lead to increased wear.

9. Pass the tape through the sensor. Loosen the splint-pin and release the polymer guide. Insert the tape and re-attach the guide with the tape in its position.

10. Pay attention that the pad does not slip after removal of the polymer guide from the aluminum guide out and drops down in the shaft.

11. Check for proper alignment of band vs. sensor. Any angular offset should be corrected.
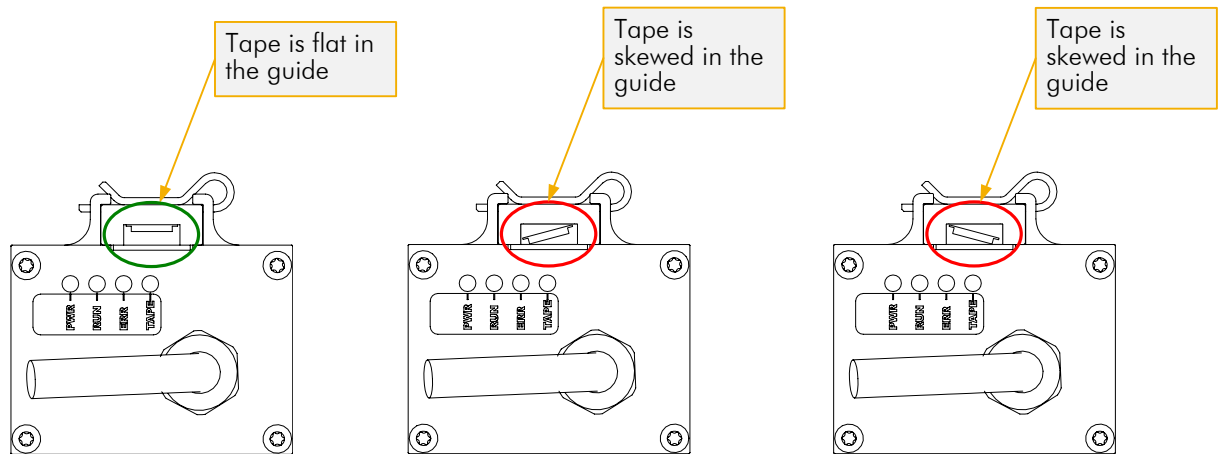
Figure 11: Assessment of the guiding rail of the tape in the sensor - twisted magnetic tape
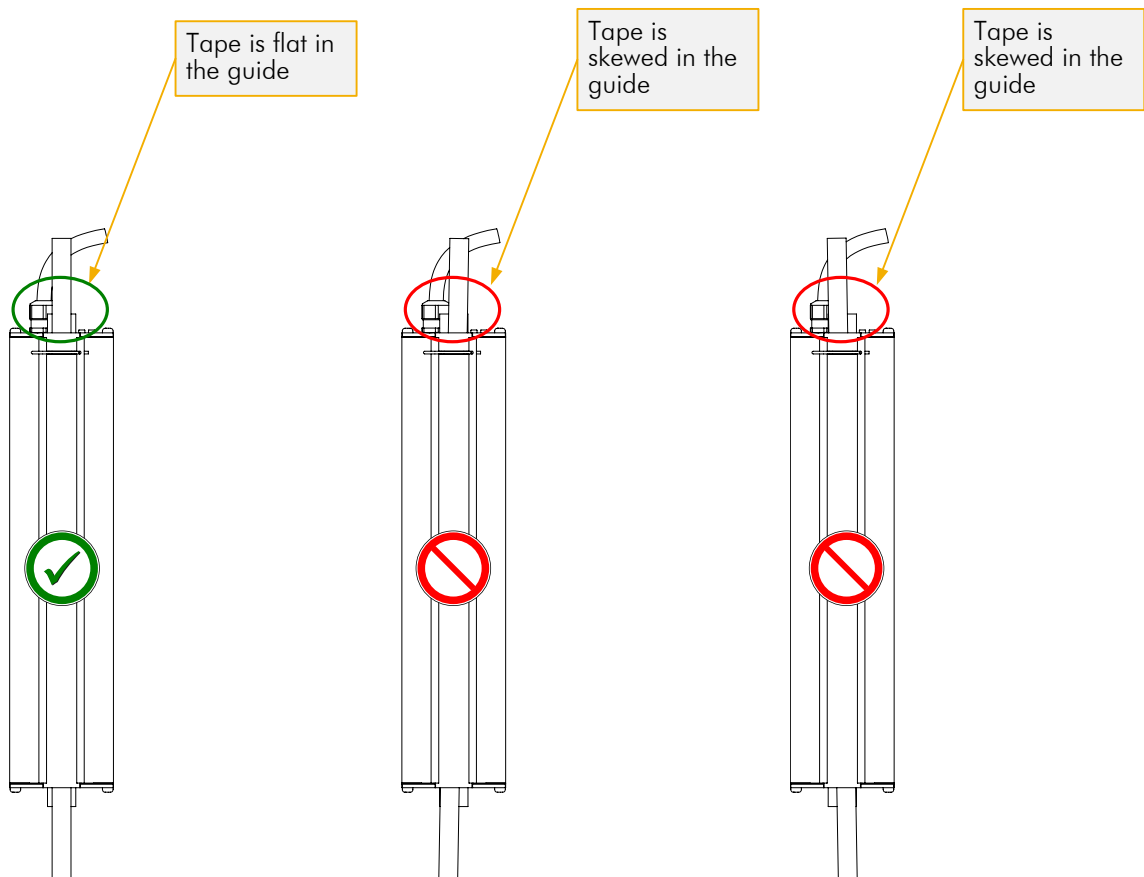
Figure 12: Assessment of the guiding rail of the tape in the sensor - skewed mounting of the magnetic tape

12.   IMPORTANT: Installation check!

Values for tape tension and offset between tape and sensor are guidelines based on experience. But in any case, a proper check after installation is mandatory. **It must absolutely be avoided that the magnetic side constantly grinds on the sensor body during operation.** Run an inspection trip along the complete shaft. Observe the system and pay attention to the respective positions of band and sensor. You have achieved an optimal installation if the steel side of the tape is constantly pressed slightly against the polymer guide of the sensor. At some points in the shaft also double-check on the bottom side of the sensor. If the sensor is tilted it may look good on top but the tape can still grind along the bottom edge of the sensor.

Recommended   Falsche vertikale
                     Ausrichtung
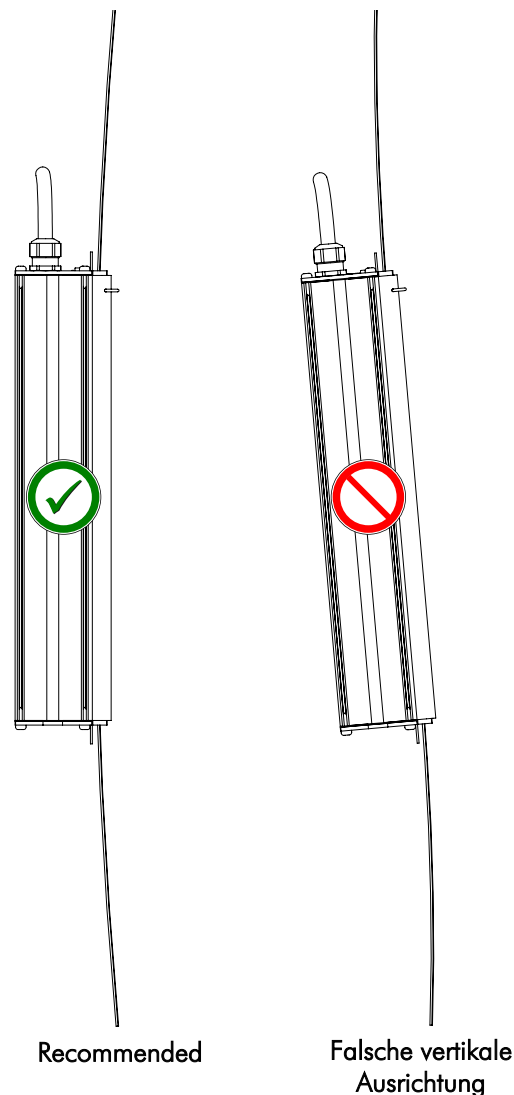
Figure 13: Assessment of the vertical alignment of the sensor

13.   If the installation check reveals that the tape slides on magnetic side, start to increase the offset between sensor and tape. Values of up to 5 cm are acceptable. If this measure does not solve the problem it is very likely that the tape is not plumb in the shaft. This is easy to check for, provided your elevator control allows for inspection trips without the absolute position signal: Just take the tape out of the sensor and run an inspection trip along the shaft. Observe the distance between sensor and tape along the travel. Misalignments will become obvious.
Also ensure that the tension on the tape is sufficient. A loosely tensioned tape will hinder proper guiding.

14.   After completion of the installation clean the tape. Beginning at the top of the shaft drive down the complete travel distance pulling the magnet tape through a dry cloth.
Be specifically alert if steel construction work is taking place in the shaft. Steel particles released by grinding, welding, or such work will adhere to the magnetic tape. Clean this debris off instantly.
Repeat the cleaning process before putting the elevator into service after complete installation.

6 Connections and Interfaces

6.1 LED's (Operating status and notices)

The LED's located on the front serve for monitoring of operating conditions.

With startup it has to be ensured that the yellow LED illuminates as this monitors the internal supply voltage.
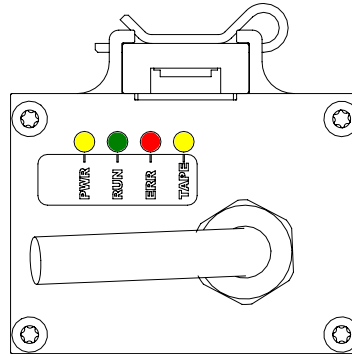
Figure 14: LED signals on the upper side of the sensor

- **PWR YELLOW** → Supply voltage
  ON   =   Supply voltage OK
  OFF   =   Supply voltage not provided

- **RUN GREEN**
  for CANopen device: RUN-LED according to DR 303-3
  other device: Interface state, flashes during active communication

- **ERR RED**
  for CANopen device: ERR-LED according to DR303-3
  other device: Error message
  ON   =   State error, system not operational
  OFF   =   State OK, system ready for operation

- **TAPE YELLOW** → Indicator for magnet tape
  ON   =   Magnet tape missing
  OFF   =   Magnet tape available

6.2 CAN Interface

6.2.1 CAN Standard

Table 1: Configuration of CAN Standard

CAN Standard	
Bitrate	250 kbit/s
Resolution	1.0 mm
Identifier	184 (hex)
First 4 Bytes	Position in mm
Next 2 Bytes	Speed in mm/s

MSB xxh	MSB xxh	LSB xxh	LSB xxh	MSB yyh	LSB yyh

ABS-Position   Speed
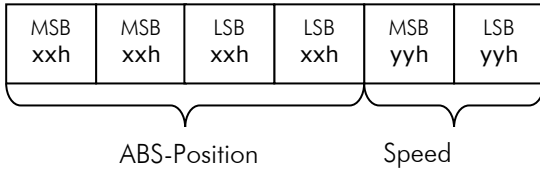
Figure 15: Protocol CAN Standard

6.2.2 CANopen DS 406 and DS417

For LIMAX02 the CANopen Interfaces DS406 (Encoderprofile) und DS417 (Liftprofile) are available. These interfaces are configured by default as follows:

Table 2: Configuration of CANopen DS406

CANopen DS406	
Bit rate	250 kbit/s
Identifier	184 (hex)
Eventtimer	10 ms
Producer Heartbeat	500 ms
Resolution	1.0 mm
First 4 Bytes	Position in mm
Next 2 Bytes	Speed in mm/s

MSB xxh	MSB xxh	LSB xxh	LSB xxh	MSB yyh	LSB yyh

ABS-Position   Speed
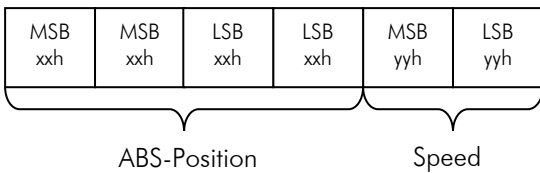
Figure 16: Protocol DS406

Table 3: Configuration of CANopen DS417

CANopen DS417	
Bit rate	250 kbit/s
Identifier	18 C (hex) [Node ID 0x04]
Eventtimer	0 (switched off)
Producer Heartbeat	500 ms
Resolution	0.5 mm

MSB xxh	MSB xxh	LSB xxh	LSB xxh

ABS-Position
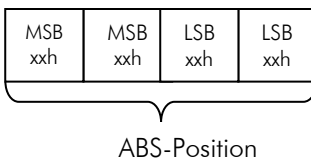
Figure 17: Protocol DS417

6.2.3 Pin Assignment CAN

Table 4: Pin Assignment CAN

9-pin D-SUB connector		Open cable exit	
PIN-No.	Function	Color	Function
Pin 6	0 V / GND	White	0 V / GND
Pin 9	+ 24 VDC	Brown	+ 24 VDC
Pin 2	CAN L	Green	CAN L
Pin 7	CAN H	Yellow	CAN H
Pin 3	CAN GND	Blue	CAN GND
Housing*	PE	Shield*	PE

*) please connect shield only at control unit side!

6.2.4 Command Descriptions

6.2.4.1 Initial Operation

After starting the CANopen device is in the Pre-operational Mode (☞ 6.2.6.2) and therefore doesn't send any position data. In order to achieve this, the device needs to be set into Operational Mode (☞ 6.2.6.1) and if necessary the sending cycle of the position data has to be adjusted (☞ 6.2.4.4).

6.2.4.2 Normal Mode

Note!
The commands which are described in section 6.2.4.2 Normal Mode are only processed by the CANopen device in the Operational and Pre-Operational mode.

6.2.4.3 Setting the Heartbeat Cycle Duration

A CANopen device sends the heartbeat cyclically. This message communicates the current Operating Mode to the other bus sharing units.

1. Change into the Operational or Pre-operational Mode, if necessary
2. The following illustration shows the CAN-message, which should be transmitted to the CANopen device and the following answer.

Master CANopen device

Set Heartbeat cycle time

ID:	XXX			DLC:	8		
2B	17	10	00	YY	ZZ	00	00

XXX = 600h + node-ID
Example: 604h for the device node-ID 4

YY = LSB of cycle time in milliseconds
ZZ = MSB of cycle time in milliseconds
Example: for a cycle time of 500ms (1F4h) is
        YY = F4h and ZZ = 01h

Acknowledgment of the CANopen device

ID:	XXX			DLC:	8		
60	17	10	00	00	00	00	00

XXX = 580h + node-ID
Example: 584h for the device node-ID 4

Figure 18: Setting the Heartbeat Cycle Duration

3. If the setting should be maintained in the case of a power failure, the changes have to be saved, as described in section (☞ 6.2.5).

6.2.4.4 Setting the Sending Cycle for the Position Data

The position data are sent cyclically by the device, therefore the device has to be in the Operational Mode (☞ 6.2.6.1).
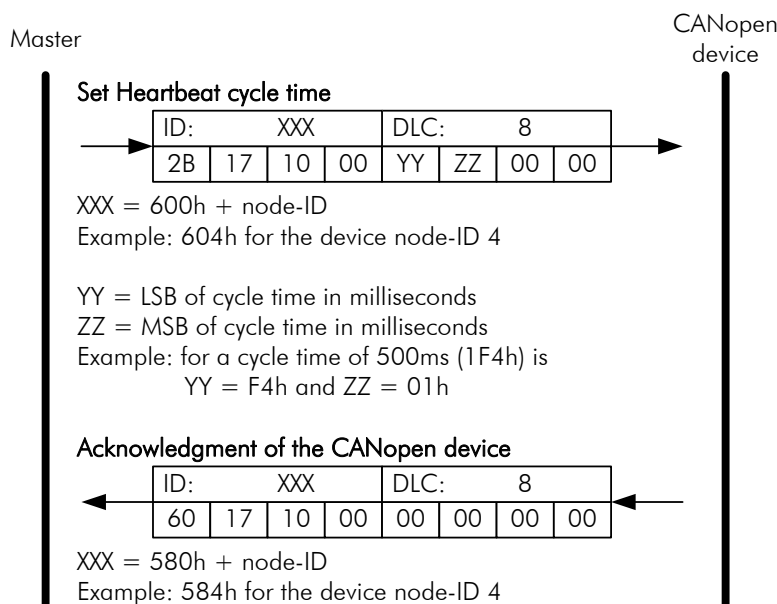The settings of the cycle duration takes place in the device profile DS406 in the object 1800h, Sub-index 5 and for devices with DS417 profile in object 1906h, Sub-index 5.

1. Change into the Operational or Pre-operational Mode, if necessary.
2. The following figure shows the CAN-message, which should be transmitted to the CANopen device and the following answer.

Master CANopen device

Set cycle time for position data

ID:		XXX		DLC:		8	
2B	UU	VV	05	YY	ZZ	00	00

XXX = 600h + node-ID
Example.: 604h for the device with node-ID 4

UU = 00h (DS406), 06h(DS417)
VV = 18h (DS406), 19h(DS417)
YY = LSB of cycle time in milliseconds
ZZ = MSB of cycle time in milliseconds
Example: for a cycle time of 10ms (Ah) is
      YY = 0Ah and ZZ = 00h

Acknowledgment of the CANopen device

ID:		XXX		DLC:		8	
60	UU	VV	05	00	00	00	00

XXX = 580h + node-ID
Example: 584h for the device node-ID 4

Figure 19: Setting the Sending Cycle for the position data

3. If the settings should be maintained in case of a power failure, the changes have to be saved, as described in section (☞ 6.2.5).

6.2.5 Saving the Parameters

In the normal case the settings are lost at power failure. In order to avoid this, they need to be saved according to the following procedure.

1. Change into the Operational or Pre-operational Mode, if necessary.
2. The following figure shows the CAN-message, which should be transmitted to the CANopen device and the following answer:
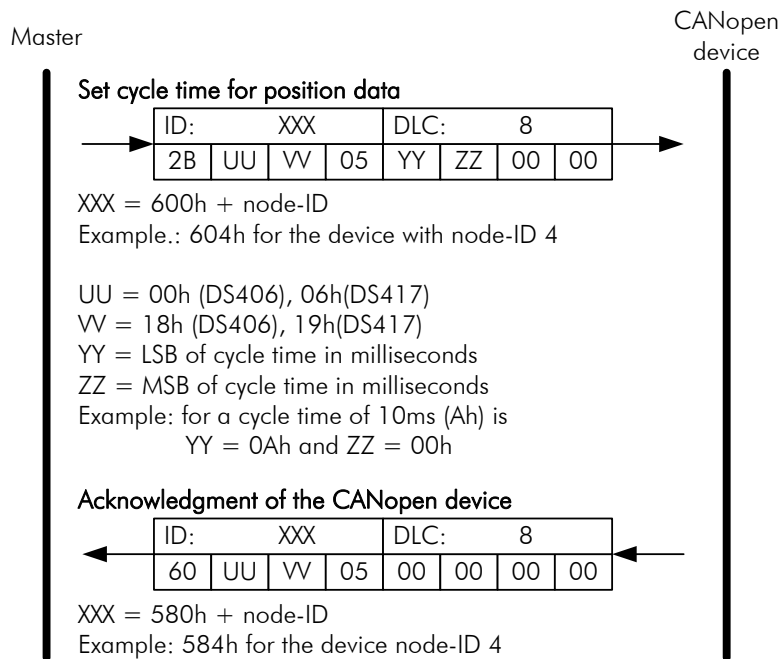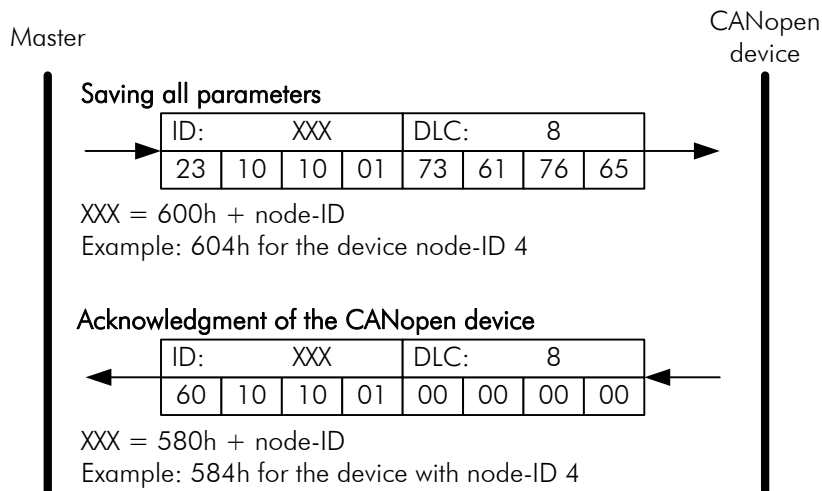
Master

CANopen device

Saving all parameters

ID:			XXX	DLC:			8
23	10	10	01	73	61	76	65

XXX = 600h + node-ID
Example: 604h for the device node-ID 4

Acknowledgment of the CANopen device

ID:			XXX	DLC:			8
60	10	10	01	00	00	00	00

XXX = 580h + node-ID
Example: 584h for the device with node-ID 4

Figure 20: Saving the parameters

6.2.6 Changing the Operating Modes

6.2.6.1 Changing the device into the Operational Mode

In the Operational Mode the communication of the device is fully functional.

The following CAN-message causes the change of all CANopen participants into the Operational Mode.

Master

CANopen device

Changing all participants into the Operational Mode

ID:		000	DLC:		2		
01	00						
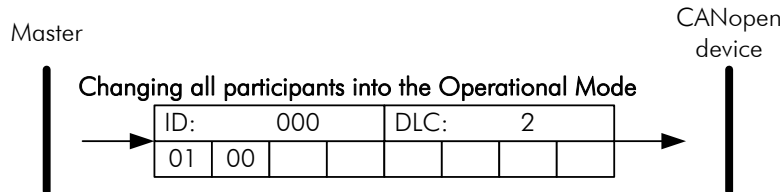
Figure 21: Changing the device into the Operational Mode

6.2.6.2 Changing the device into the Pre-operational Mode

In the Pre-operational Mode the communicating settings of the device are adjusted.

The following CAN-message causes the change of all CANopen participants into the Pre-Operational mode.

Master

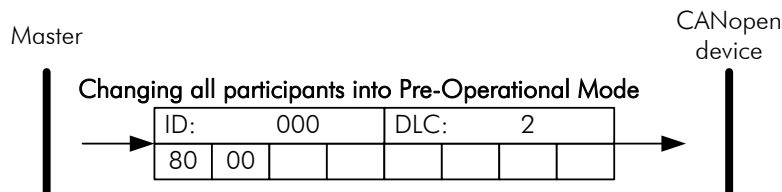CANopen device

Changing all participants into Pre-Operational Mode

ID:		000	DLC:		2		
80	00						

Figure 22: Changing the device into the Pre-operational Mode

6.2.6.3 Changing the device into the Stopped Mode

Bus sharing units in the Stopped Mode are passive participants. In this mode all the communication is turned off, except the monitoring activity (e.g. heartbeat).

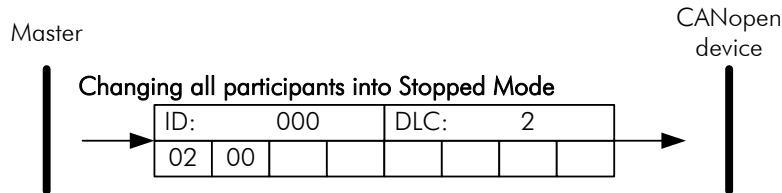The following CAN-message causes the change of all CANopen participants into the Stopped Mode:

Master — CANopen device

Changing all participants into Stopped Mode

ID:		000	DLC:			2	
02	00						

Figure 23: Changing the device into the Stopped Mode

6.2.7 LSS Configuration

Basic settings like node-ID and baud rate have to be adjusted with the Layer Setting Services (LSS).

6.2.7.1 Changing into the LSS Configuration Mode

In order to be able to change the Parameter (node-ID, bit rate), the device has to be changed into the LSS Configuration Mode.

ATTENTION!
With the following command all the bus sharing units which are in the Stopped Mode are changed into the LSS Configuration Mode. Use this command, if only one device is connected to the bus, because other devices could be affected in their function.

The following CAN-message causes the change into the LSS Configuration Mode.

Master — CANopen device

Changing all participants into LSS Configuration Mode

ID:		7E5	DLC:			8	
04	01	00	00	00	00	00	00
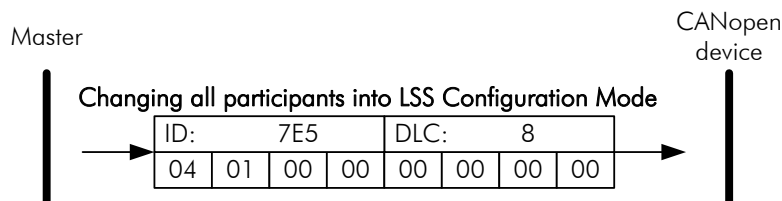
Figure 24: Changing into the LSS Configuration

6.2.7.2 Saving the Parameters in the LSS Mode

In order not to lose the changes in case of a power failure, they have to be saved in the non-volatile memory of the CANopen device.

The following figure shows the necessary message for this procedure.

Master — CANopen device

Saving the parameters

ID:		7E5	DLC:			8	
17	00	00	00	00	00	00	00

ID:		7E4	DLC:			8	
17	00	00	00	00	00	00	00

Figure 25: Saving the parameters in the LSS Mode

> **ATTENTION!**
> During the saving procedure the device is not accessible over a period of a few milliseconds.

6.2.8 Setting the Baud Rate

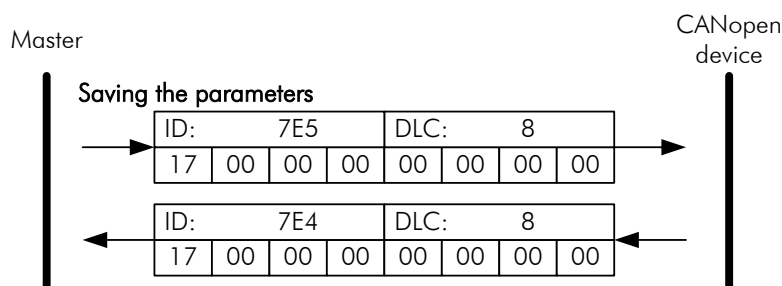1. Change the device into the Stopped mode (☞ 6.2.6.3)
2. Change the device into the LSS Configuration Mode (☞ 6.2.7.1)
3. Change baud rate according to the following command:

Figure 26: Setting the baud rate

4. Save parameter as described in section (☞ 6.2.7.2).
5. Turn the device off and restart it again.

6.2.9 Setting the node-ID

1. Change the device into the Stopped Mode (☞ 6.2.6.3)
2. Change the device into the LSS Configuration Mode (☞ 6.2.7.1)
3. Change node-ID with the following message:
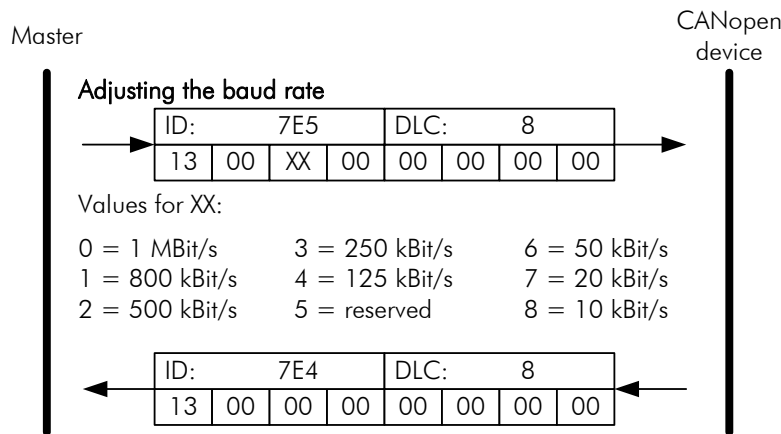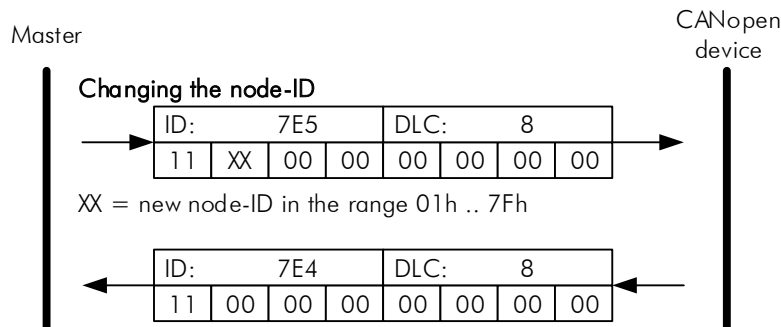

Figure 27: Setting the node-ID

4. Save parameter as described in section (☞ 6.2.7.2).
5. Turn the device off and restart it again.

6.3 SSI Interface

6.3.1 Function Principle

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 the evaluation). Some encoders contain a Power Failure Bit (PFB). **Attention: With the LIMAX02 the PFB is always "LOW"!**

6.3.2 Data Protocol
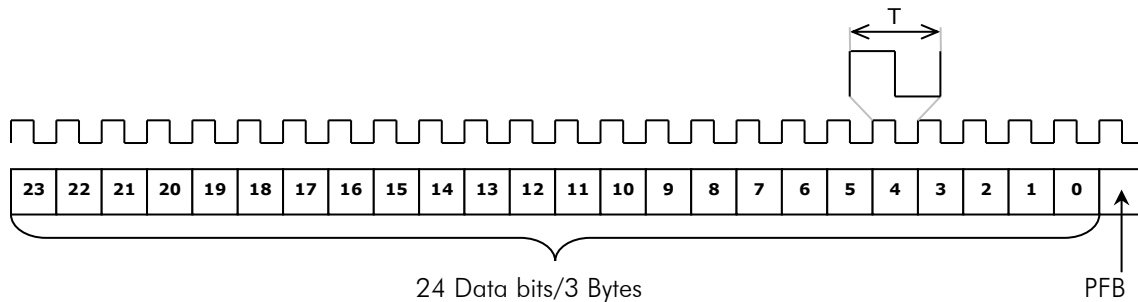
PFB = Power Failure Bit
T = length of clock signal
Tm = monostable multivibrator time > 10µs

Figure 28: Data Protocol SSI Interface

6.3.3 Pin Assignment

Table 5: Pin Assignment SSI open cabel ends

Open cable ends	
Color	Function
White	0 V / GND
Brown	+ 24 VDC
Pink	Data -
Grey	Data +
Yellow	CLK -
Green	CLK +
Shield	PE

Table 6: Pin Assignment SSI Interface

9-pin. D-SUB Connector	NEWLIFT FST1 (D9M0)	NEWLIFT FST2 (D9M1)
Pin	Function	Function
1	DATA +	0V / GND
2	CLK -	CLK +
3	-	N.C.
4	24 VDC	DATA +
5	0V / GND	0V / GND
6	DATA -	+ 24 VDC
7	CLK +	CLK -
8	-	DATA -
Housing	PE	N.C.

6.4   RS232 / RS422 / RS485*

*) Attention: RS485 only unidirectional

If the measuring system is equipped with an RS232, RS485 or an addressable RS422 interface (Option A22; ☞ 6.5), the data communication has the following format:

19200 baud (other baud rates on request)
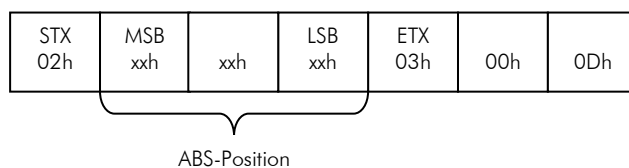1 Start bit
8 data bits
1 stop bit
no parity

6.4.1   Data Protocol

The measured absolute position will be represented in the three ABS-position data bytes.

Version 2321 / 4221 / 4851

STX 02h	MSB xxh	xxh	LSB xxh	MSB yyh	LSB yyh	ETX 03h	00h	0Dh

ABS-Position   Speed

STX 02h	MSB xxh	xxh	LSB xxh	ETX 03h	00h	0Dh

ABS-Position
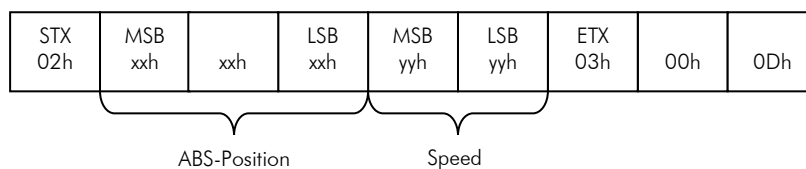
STX = starts a message
ETX = ends a message

Figure 29: Data Protocol Version 2321 / 4221 / 4851

6.5   RS422 (Version 1.4) addressable (Option A22)

6.5.1   Pin Assignment

Table 7: Pin Assignment of the addressable RS422 interface

Open cable ends (Standard)			
Color	RS232	RS422	RS485
White	0 V / GND	0 V / GND	0 V / GND
Brown	+ 24 VDC	+ 24 VDC	+ 24 VDC
Pink	TX	TX -	TX -
Grey	RX	TX +	TX +
Yellow	-	RX -	
Green	-	RX +	
Shield	PE ⏚	PE ⏚	PE ⏚

6.5.2   Command Descriptions

Important:
Before you send a new message to the LIMAX02 wait for the answer first. After allocating a new address the LIMAX02 answers in max. 0.5 seconds. In other cases it even in a few milliseconds. After this time it is not expected to get an answer (transmission error).

6.5.2.1   Principle Format of Message

To LIMAX02

STX 02h	Byte 1	Byte 2	Byte check	ETX 03h

answer

STX 02h	Byte 1	Byte 2	Byte 3	Byte 4

STX   = starts a message
ETX   = ends a message
Check Byte = contains the arithmetic checksum of STX, byte 1 and byte 2.
The meaning of bytes 1 to 4 can be found in the following chapters.

6.5.2.2   Position request of LIMAX02 with the address "i"

To LIMAX02

STX 02h	04h	i	Byte check	ETX 03h

answer

STX 02h	MSB xxh	xxh	LSB xxh	Adr. i

ABS-Position

04h = characterises the message as position request
i   = address of the LIMAX02 (0Bh – 7Fh) to request
Bit 0 has the value $10\mu m$, position values are always smaller than FFFF00h

6.5.2.3   A LIMAX02 address request

Attach in each case only one LIMAX02 e.g. over a RS422/RS232 converter to the serial interface (COM-port) of a PC.

To LIMAX02

STX 02h	05h	05h	Byte check	ETX 03h

answer

STX 02h	FFh	FFh	i xxh	ETX 03h

05h = characterizes a message as address request
i   = LIMAX02 address
FFh FFh does not occur immediately after STX with position inquires as answer!
In this case (0Bh <= i <= 7Fh) this is the answer of the address request.

6.5.2.4   Allocation of an LIMAX02 address

Attach in each case only one LIMAX02 e.g. over a RS422/RS232 converter to the serial interface (COM-port) of a PC.

To LIMAX02

STX 02h	06h	i	Byte check	ETX 03h

answer

STX 02h	FFh	FFh	i + 80h	ETX 03h

06h = characterizes a message as address allocation
i = the new LIMAX02 address. Important: At the answer you get the new address + 80h.

The addresses 80 h – FFh as well as 00 h – 0 Ah are FORBUDDEN. If you try to assign an address smaller than eight, LIMAX02 gives you a "negative answer" and keeps its former address.

6.5.2.5 Error Messages

If one of the described operations failed for some reason LIMAX02 gives an error message with a respective error-code.

Answer from LIMAX02

STX 02h	FFh	FFh	ERR xxh	ETX 03h

ERR   = Error-Code (04h – 0Ah) error – codes are listed at the next page.

Table 8: Error-codes of an addressable LIMAX02

| Code	Meaning
04h	Wrong sequence of bytes sent to LIMAX02, for example if 4. Byte after STX is no ETX or the Byte after STX is not 0x04, 0x05 or 0x06.
05h	Receiving Error / Interface Error (for example if a message with a wrong baud rate was sent etc.)
06h	Invalid LIMAX02 address: appears after trying to assign an address smaller 0Bh or bigger 7Fh to LIMAX02.
07h	LIMAX02 has lost its address: internal check of X redundantly stored address of LIMAX02 has failed. This message is sent at power up immediately if an error in reading EEPROM is detected or if the internal address error cannot be fixed.
08h	Internal EEPROM storage error.
09h	Error in transmission of position (no tape, tape damaged or distance between tape and sensor head too big).
0Ah	Check-Sum-Error: Check-sum of a message sent to LIMAX02 is wrong.

6.5.2.6 Connection to a RS422 Master
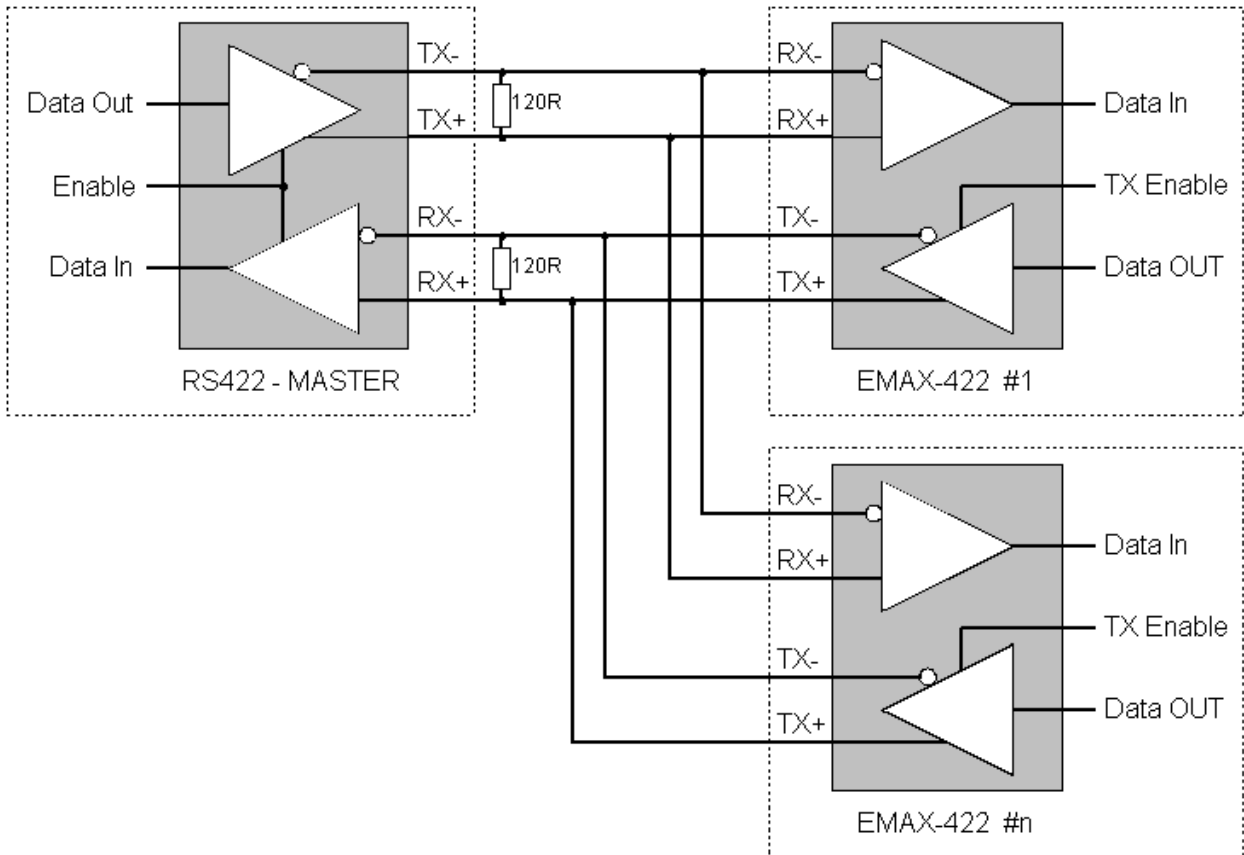
Figure 30: Connection to a RS422 Master

6.6 Option Unguided

LIMAX02 "*unguided*" is an absolute measuring system, which is used for positioning in the most diverse areas horizontally and vertically. It consists of only two components: magnetic tape and the sensor.

Figure 31: LIMAX02 Option unguided

6.7   Option PROFIBUS Interface

6.7.1   LED's (Operation Status and Messages)

The LED's located on the top side, a green LED (Bus Run) and a red LED (Bus Fail), serve for monitoring of operating status. For setting the address are two rotary coding switches located on the top next to the LED's

- **BUS RUN GREEN**
ON	= Ready
OFF	= Supply voltage not provided
Flashes cyclic	= Slave has no cyclic data exchange with PROFIBUS-DP-MASTER
Flashes irregular	= start: Missing or faulty configuration
	Runtime: Host watchdog- time error

- **BUS FAIL RED**
ON	= unrecoverable Converter – Fault
OFF	= no error / bus in cycle
Flashing	= Converter not addressed by the master

6.7.2   Adjustment

6.7.2.1   Address Adjustment

The address adjustment is carried out with the coding switches on top of the housing. The higher decade with the coding switch MSD and the low decade with the coding switch LSD.
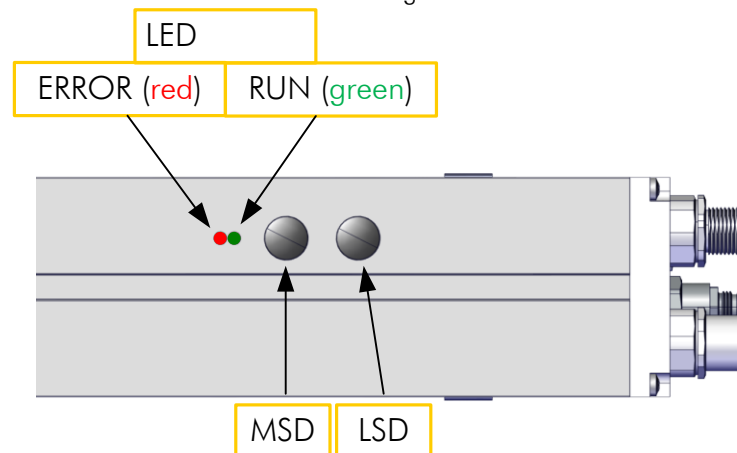

Figure 32: Address Adjustment and LED Signaling

6.7.2.2   Parameter Adjustment

The following parameters can be adjusted by GSD File.
(GSD File is on CD-ROM delivered

Table 9: Parameter Adjustment by GSD File

Function	Setting Range	Factory Setting
Monoflop	20 … 255 μs	[200]
Clock quantity SSI	18 … 32	[24]
Scale SSI/x	1 … 255	[1]
Offset	-1073741823 … 1073741824	[0]

6.7.2.3 PROFIBUS Interface

The sensor option profibus is fitted as standard with a profibus interface according to IEC61158 / IEC61784. The following parameters are specified.

Table 10: Parameter PROFIBUS Interface

PROFIBUS Interfac	
Transmission	RS485 two-wire line
Wire lenght	1200 m at 9,6 kBaud 200 m at 1,5 Mbaud 100 m at 12 MBaud
Baud rate	9,6 kBaud to 12 Mbaud (auto detect)
Clock rate max.	250 kHz
Participants	max. 32 per Segment (with repeater until 126 expandable) Mono- and Multi-master systems are possible → In delivery status is participant 05 set

6.7.2.4 Pin Assignment

Table 11: Pin Assignment PROFIBUS IN

Table 12: Pin Assignment PROFIBUS OUT

PROFIBUS IN (Flanged Plug M12)		PROFIBUS OUT (Flanged Socket M12)	
Pin	Function	Pin	Function
1	N.C.	1	N.C.
2	Data A	2	Data A
3	N.C.	3	N.C.
4	Data B	4	Data B
5	Shield	5	Shield

Table 13: Power Supply

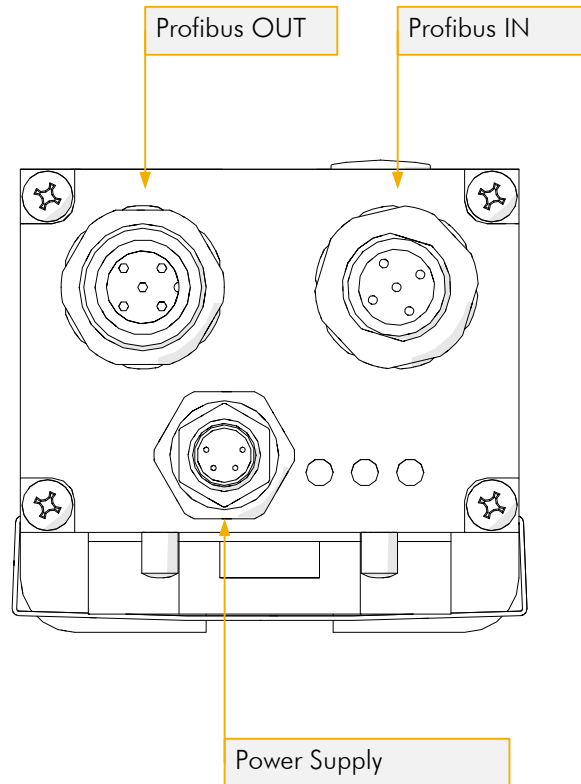| Power supply (Fanged Plug M8)		
Pin	Color	Function
1	Brown	+ 10 to 30 VDC
2	White	N.C.
3	Blue	0 V / GND
4	Black	N.C.

Profibus OUT   Profibus IN

Power Supply

Figure 33: Pin Assignment PROFIBUS

7 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 ☞ 7.1.
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).

7.1   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. <u>Do not</u> connect protective earth and ground
> 5. Connect a mains filter ahead of the external power pack

7.2   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 ☞ 5.

> **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

7.3   Maintenance

The LIMAX02 shaft information system requires little maintenance. On the occasion of regular elevator inspection and maintenance do the following:

- Optical inspection of proper alignment between sensor and band. Worn off material indicates possible alignment flaws. Check for proper guiding of the band along the complete travel distance. Correct if necessary as described in the installation procedure above.

- Optical inspection of the band. Check for abrasions or other mechanical damages. Small mechanical damages (scratches, dents, or even small chips) do not interfere with the measuring performance at all.
  However, a pre-damaged band is more exposed to mechanical stress and is prone to further wear.

- Check for proper tension of the band. If the mounting was via a flute, the tension can decrease over time. Readjust if necessary.

- Inspect the polymer guide for wear. Clean if dust and dirt have accumulated between polymer guide and sensor case. The polymer guide is a wear part. Replace if necessary.

- Clean the band. Use a dry and clean cloth. Begin at the head of the hoistway drive down the complete travel distance pulling the magnet band through a dry cloth.

⚠	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.

7.4   Cleaning

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

8 Type Designation

8.1 Type Designation

| LIMAX2 | - | 00 | - | 030 | - | 1000 | - | CO0T | - | D9M |

Series / Type:
LIMAX2 = LIMAX02 (1-Kanal)

SN-number:
00 = standard version
01 = special version

Signal cable length:
030 = 3,0 m (Standard)
050 = 5,0 m
Other on request

Resolution:
62N5 = 62,5 μm = 0,0625 mm
0125 = 125 μm = 0,125 mm
0250 = 250 μm = 0,25 mm
0500 = 500 μm = 0,50 mm
1000 = 1000 μm = 1,00 mm

Interface:
2320 = RS232 [standard protocol, RS232 / position]
2321 = RS232 [extended protocol RS232 / position & speed]

4220 = RS422 [standard protocol, RS422 / position]
4221 = RS422 [extended protocol RS422 / position & speed]

4850 = RS485 on request

CN0 = CAN   [standard protocol, basic-CAN]
CO0 = CANopen   [Encoder Profil DS406]
CO1 = CANopen   [Elevator Profil DS417]

PNO = Profibus   [according to IEC61158/IEC61784, standard ID 5, other on request]

SSB0 = SSI-Interface   [25-bit binary code / position]
SSG0 = SSI-Interface   [25-bit gray code / Position]

CAUTION:
-> CAN Interface is optional available with galvanic isolation / assembly CAN-load resistor selectable
-> RS232- Interface is never terminated!
-> RS422- & RS485- & SSI- Interface is basically terminated!

CAN Interface	Without galvanic isolation	With galvanic isolation (G)
Terminated 120R (T)	CN0T (Standard)	CN0TG
Not terminated	CN0	CN0G
Terminated 120R (T)	CO0T (Standard)	CO0TG
Not terminated	CO0	CO0G
Terminated 120R (T)	CO1T	CO1TG
Not terminated	CO1 (Standard)	CO1G

SSI Interface		
	Without optocoupler at clock input (terminated 120R)	With optocoupler at clock input (G) (terminated 120R)
	SSB0 (Standard)	SSB0G
	SSG0 (Standard)	SSG0G

Options:
(Multiple choice possible)
U = option unguided
PNO = 1 pc. Flange plug M8, 1 pc. Flange plug M12 und 1 pc. Flange socket M12
D9M = 9-pol. D-Sub-connector   [CAN & CANopen]
D9M1 = 9-pol. D-Sub-connector   [SSI / option NEWLIFT FST2]
D9M3 = 9-pol. D-Sub-connector   [SSI / option LödigeSEW]
D9F0 = 9-pol. D-Sub-socket   [RS232 / to connect to DEE/DTE]
M12M = 5(8)-pol. M12-round plug   [Number of poles or assignment depending on interface]
(open cable end if no option is selected!)

Figure 34: Type designation

8.2 Control specific Sensors

Table 14: Control specific Sensors

Product key	Control type
LIMAX2-00-030-0500-CO1TG-D9M	Böhnke bp306/bp308 (CANopen CiA 417)-terminated
LIMAX2-00-030-0500-CO1G-D9M	Böhnke bp306/bp308 (CANopen CiA 417)- not terminated
LIMAX2-00-030-62N5-SSG0-D9M1	NEWLift FST2
LIMAX2-00-030-1000-SSB0	KW Aufzugstechnik David 606
LIMAX2-00-030-1000-CO0	LIMAX02 with CANopen encoder profile DS406
LIMAX2-05-030-1000-SSB0	Kollmorgen MRL4 / MFE4 (MPK400)
LIMAX2-04-015-1000-CO1-D9M	Sodimas Quickinstall
LIMAX2-52-030-1000-CO0G	Securelift

8.1 Accessories

Table 15: Accessories

Order Designation	Description	Image
AB20-80-10-1-R-D-15-BK80	Magnetic Tape	
Installation kit LIMAX MKF	Mounting set for suspended installation with dowel.	
Installation kit LIMAX MKB	Mounting set for suspended installation with guiding rails and rail holder.	
Installation kit LIMAX RMS	Mounting set for suspended installation with crossbeam for standard layout.	
Installation kit LIMAX RMS 90	Mounting set for suspended installation with crossbeam for "Rucksack" layout.	
Installation kit LIMAX S-RMS	Mounting set for suspended installation with crossbeam and tape detection.	
LIMAX2 MW	Mounting flange for LIMAX02	
CD-ROM with GSD File	Supplied with option profibus	
Connection cable power supply PNO	M8 coupling, 4-pin 5 m length	
PROFIBUS – signal line	M12 connector, 5-pin, b-coded (assembled at one end) 5 m length	
PROFIBUS – signal line	M12 coupling, 5-pin, b-coded (assembled at one end) 5 m length	
PROFIBUS – signal line	M12 plug / socket (assembled at both ends) 5 m length	
PROFIBUS - Terminator	M12 4-pin, b-coded	

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