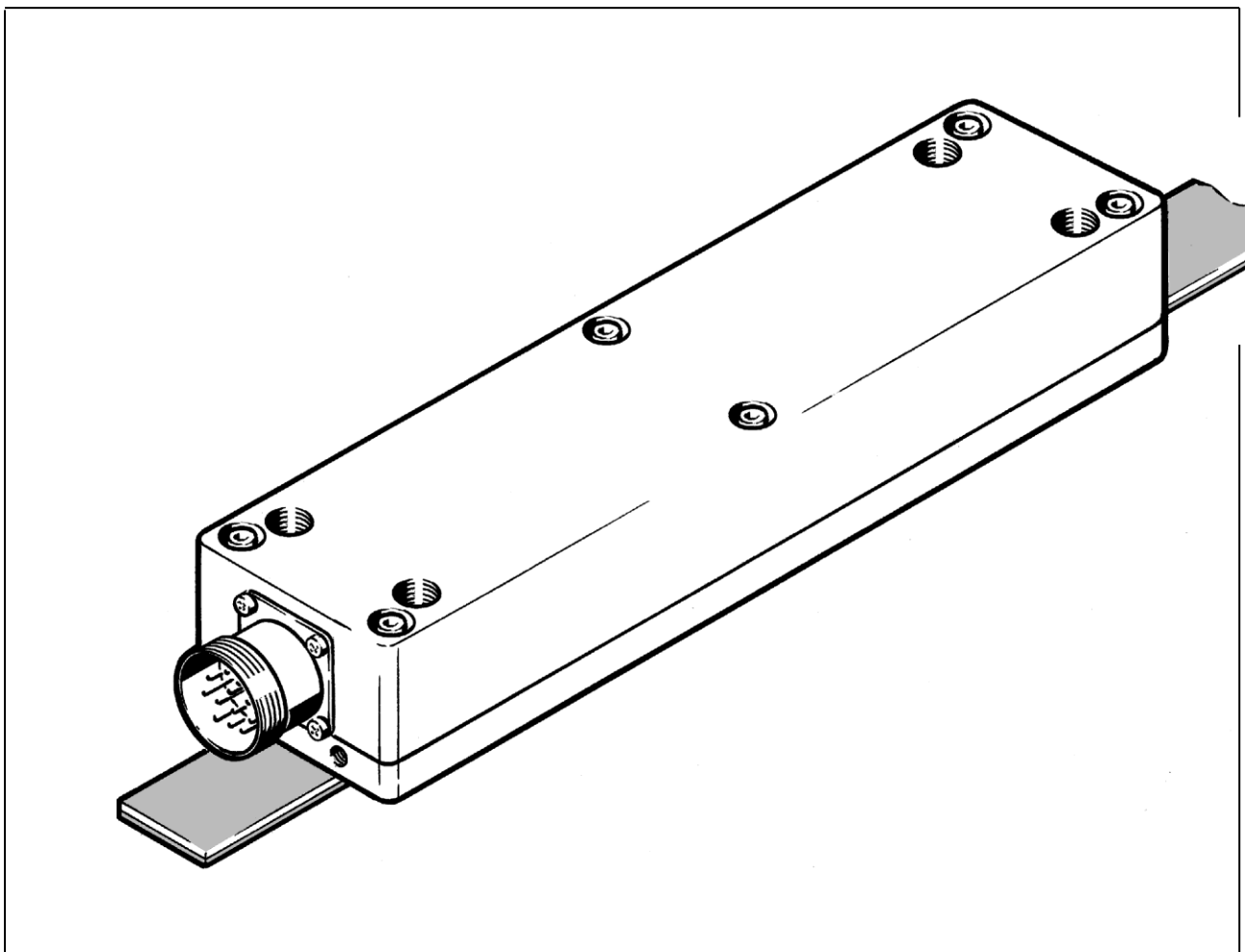


Operating Instructions

LinCoder[®] L 230

Contactless, absolute length measuring system





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The right is reserved to change designs and devices.

Documentation overview

The overall documentation on the **LinCoder® System** comprises the following:


- **Product information**
- **Operating instructions***

* this is the present documentation.

To request these documents, please apply to SICK AG

The address and the telephone/fax number will be found on the inside front cover of these operating instructions.

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1 Foreword

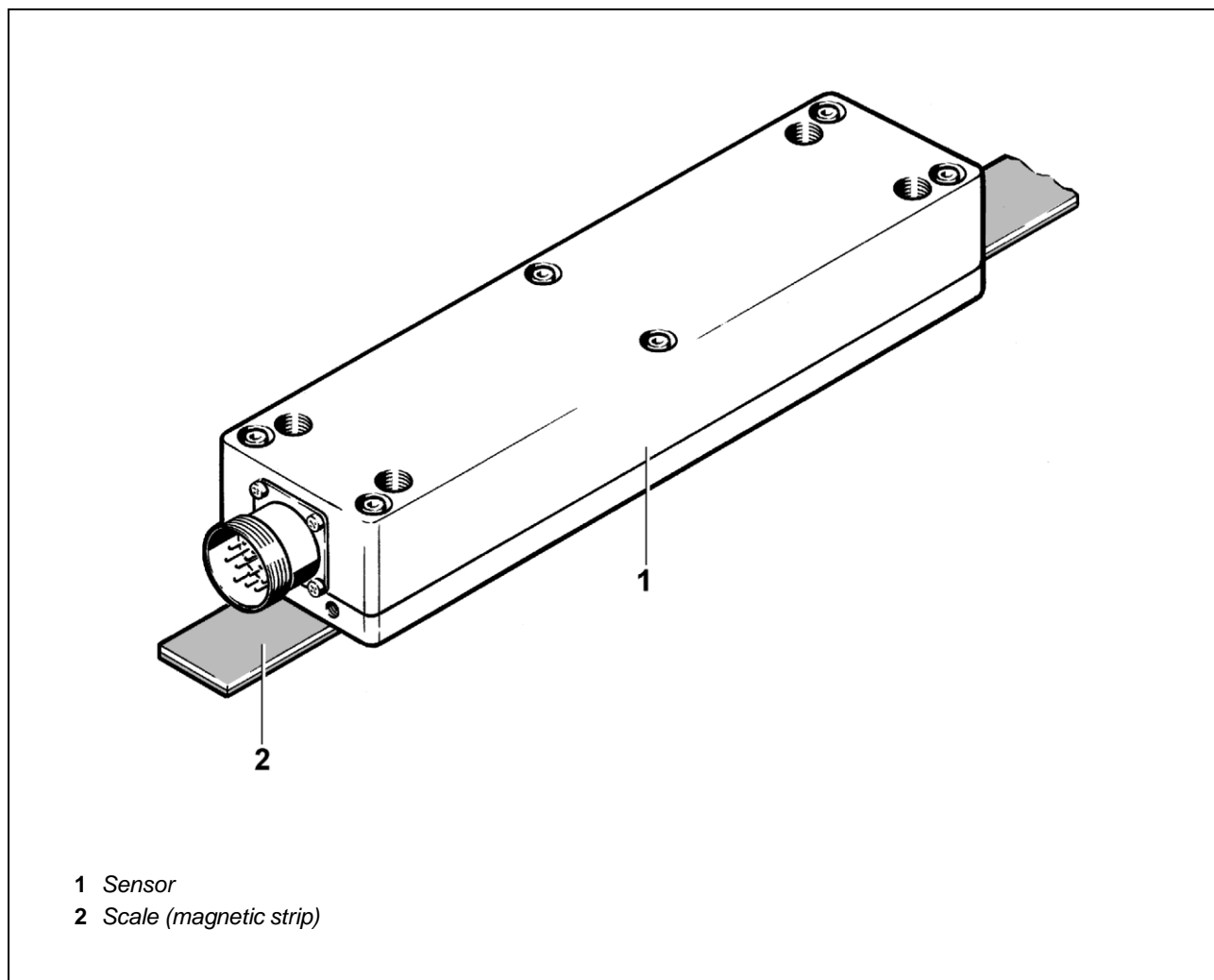


Fig. 1-1 LinCoder® length measuring system

Dear Customer,
Dear Engineer,

You are about to mount a SICK LinCoder® System.

These operating instructions are intended to give you the knowledge which is necessary for you to be able to carry out the mounting rapidly and correctly.



Please read these instructions through carefully and pay particular attention to the advice and warning notes!

The **LinCoder® System** from SICK is a contactless, absolute length measuring system.

The measuring system is suitable for length measurement up to maximum of 40 metres, both indoors and outdoors under normal ambient condition.

The measuring system comprises at least two parts:

- the scale
- the sensor

Scale

The scale – referred to below as the magnetic strip – comprises a magnetized plastic strip which, at the factory, is laminated to a (ferromagnetic) steel strip.

The plastic strip contains the absolute length information magnetized on in the form of a 12-bit code.

Sensor

The sensor substantially comprises a rectangular aluminium housing with a flanged plug or PG outlet.

In the application, the sensor is guided over the magnetic strip.

The sensor registers the information magnetized onto the magnetic strip and from this determines a defined absolute length value.

The absolute position data are transmitted from and by the sensor to a control system or to a host computer.

If you have any questions in relation to the **LinCoder® System**, we shall be pleased to answer them.

The telephone number will be found on the inside front cover of these operating instructions.

SICK AG

2 General Advice

2.1 Validity

These operating instructions apply to the **LinCoder® L 230** contactless, absolute length measuring system.

The configuration of the length measuring system is specific to a customer, that is to say the system is composed of a sensor and a magnetic strip which depends on the measured length.

2.2 Proper use

The **LinCoder® L 230** length measuring system may be used only for the purpose corresponding to its design – **the determination of length or distance information**.

Any further use or use going beyond this counts as improper and may lead to personal injury or damage to property.

2.3 Symbols and their meaning



Text which is identified with this symbol contains very important advice, also including advice **for averting health risks**.

Observe these texts without fail.



Text which is identified with this symbol contains very important advice, also including advice for **preventing damage to property**.

Observe these texts without fail.



This symbol indicates text which contains comments/advice or tips.

- This bullet identifies the descriptions of actions which you should carry out.

3 Safety advice



3.1 Personal protection

The **LinCoder® System** operates exclusively with safe low voltages and, because of its low inherent weight, represents a virtually negligible potential hazard. Nevertheless, the measuring system may pose a threat in conjunction with further devices, machines or plant.

Therefore, please observe the following advice:

- **Switch off all the devices/machines/plant affected by mounting or repair.**
If appropriate, isolate the devices/machines/plant from the mains.
- **Depressurize pneumatic/hydraulic devices/machines/plant before mounting or repair.**
- **If necessary, set up warning signs in order to prevent the inadvertent starting up of the devices/machines/plant.**
- **Do not under any circumstances start up the length measuring system**
 - with faulty safety equipment and/or
 - with damaged components/modules (for example damaged plug connectors).

In these cases, isolate the system from the mains.

- **Ensure that, during the defect or the repair, the system cannot inadvertently be connected to the mains. If necessary, set up warning signs.**
- **After completing the repair work, carry out a test run of the system and check the correct functioning of the safety equipment.**
- **Observe the relevant professional safety and accident prevention regulations when carrying out the mounting/repair work.**
- **Prevent hands or fingers being able to get between sensor and magnetic strip, if necessary by means of covers or the like.**
- **Check the correct function of the safety equipment (for example the emergency off push buttons) of the higher-order devices/machines/plant at regular intervals.**



3.2 Device safety

The **LinCoder® System** is a quality product produced in accordance with the recognized industrial regulations and meets the quality requirements of ISO 9001.

The system left the manufacturing plant in perfect condition with regard to safety.

In order to maintain this condition, as installer you must carry out your task **in accordance with the descriptions in these instructions, technically correctly and with the greatest possible precision.**

In addition, we assume that you have sound knowledge in mechanical, precision engineering and electrical engineering.

- **Use the length measuring system only for the purpose corresponding to its design.**
- **Switch off the devices/machines/plant affected by mounting.
If appropriate, isolate the devices/machines/plant from the mains.**
- **Depressurize pneumatic/hydraulic devices/machines/plant before mounting.**
- **If necessary, set up warning signs, in order to prevent inadvertent starting up of the devices/machines/plant.**
- **Take care, for example in the case of long mounting lengths, that no parts of the plant penetrate into the mounting area.**
- **Lay the data cable from the sensor to the controller in such a way that it**
 - **does not remain hanging during operation when moving over the measurement length;**
 - **is not crushed, kinked or otherwise damaged;**
 - **does not run directly beside power lines or through relatively strong alternating electromagnetic fields.**
- **In the case of electrical welding work which is carried out in the immediate vicinity of the LinCoder® System, switch off its supply voltage, in order to rule out damage to the measuring system from high induced currents.**
- **Never open the housing of the sensor.
Opening the sensor impairs the functional reliability and leads to the cancellation of the guarantee or guarantee claims.**
- **Use only undamaged/fault-free tools and components for the mounting work.**
- **Do not start up the LinCoder® System if any parts are damaged.**
- **Following the mounting of the measuring system, and before releasing the devices/machines/plant affected by it to the production process, carry out a test run.**
- **Avoid intense external magnetic fields acting on and ferromagnetic foreign bodies (for example iron filings) being deposited on the magnetic strip.**

4 Testing the system components

4.1 Goods inward inspection

- Check
 - directly after delivery, the parts of the measuring system for any **transport damage** and deficiencies.
 - with reference to the accompanying **delivery note**, the number of parts and that all the small parts are present.
- Do not leave any parts in the packaging.

4.2 Scope of supply

- Sensor
- Magnetic strip (sold by the metre)
- Operating instructions for **LinCoder® L 230**



Accessories: see Chapter **12.2 Accessories**

4.3 Complaints

Claims for compensation which relate to transport damage can only be considered valid if the delivery company is notified without delay.

- For returns (because of transport damage/repairs), prepare a damage report immediately and send the parts back to the manufacturing plant, if possible in the original packaging.
- Attach the following information to the return:
 - Name and address of the recipient
 - Reference/Order/Part number
 - Description of the defect

4.4 Guarantee

For the **LinCoder® L 230** length measuring system, we give a guarantee period in accordance with the sales contract.

The general guarantee conditions of **SICK AG** apply.

5 System description

5.1 Construction of the system components

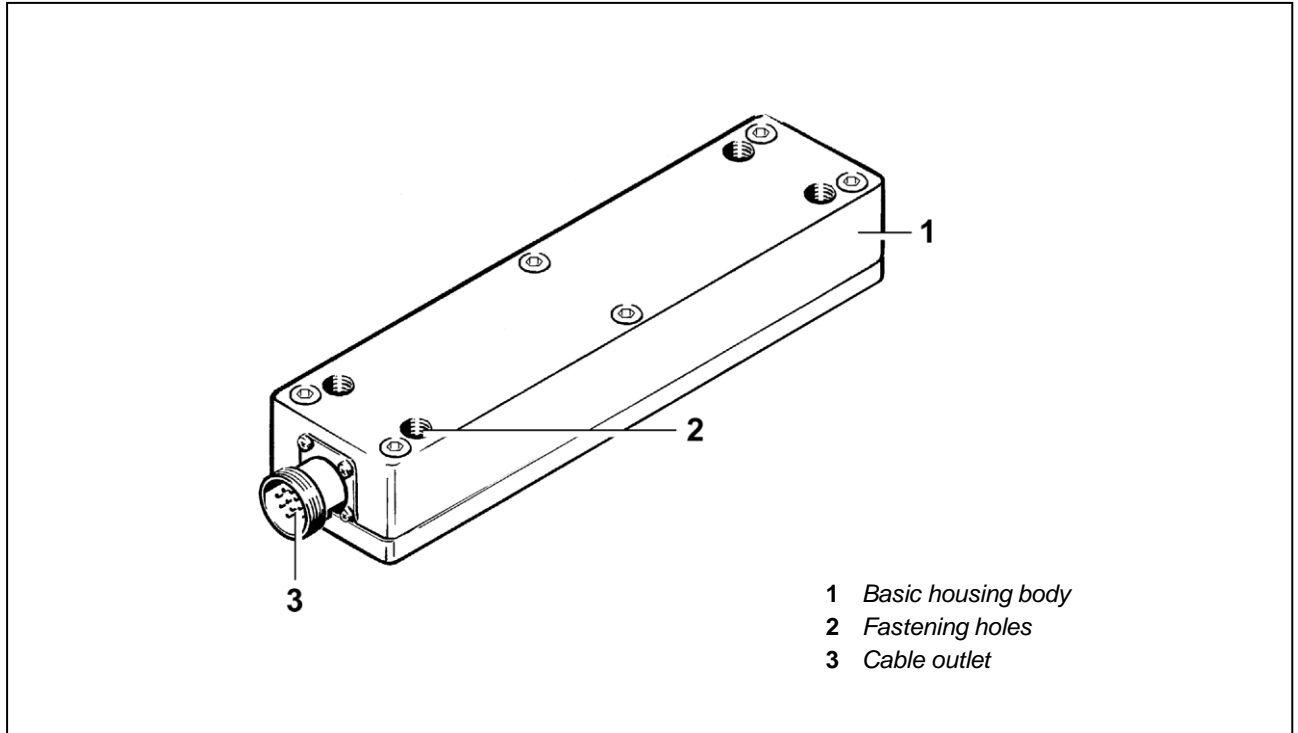


Fig. 5-1 Scanning unit (sensor)

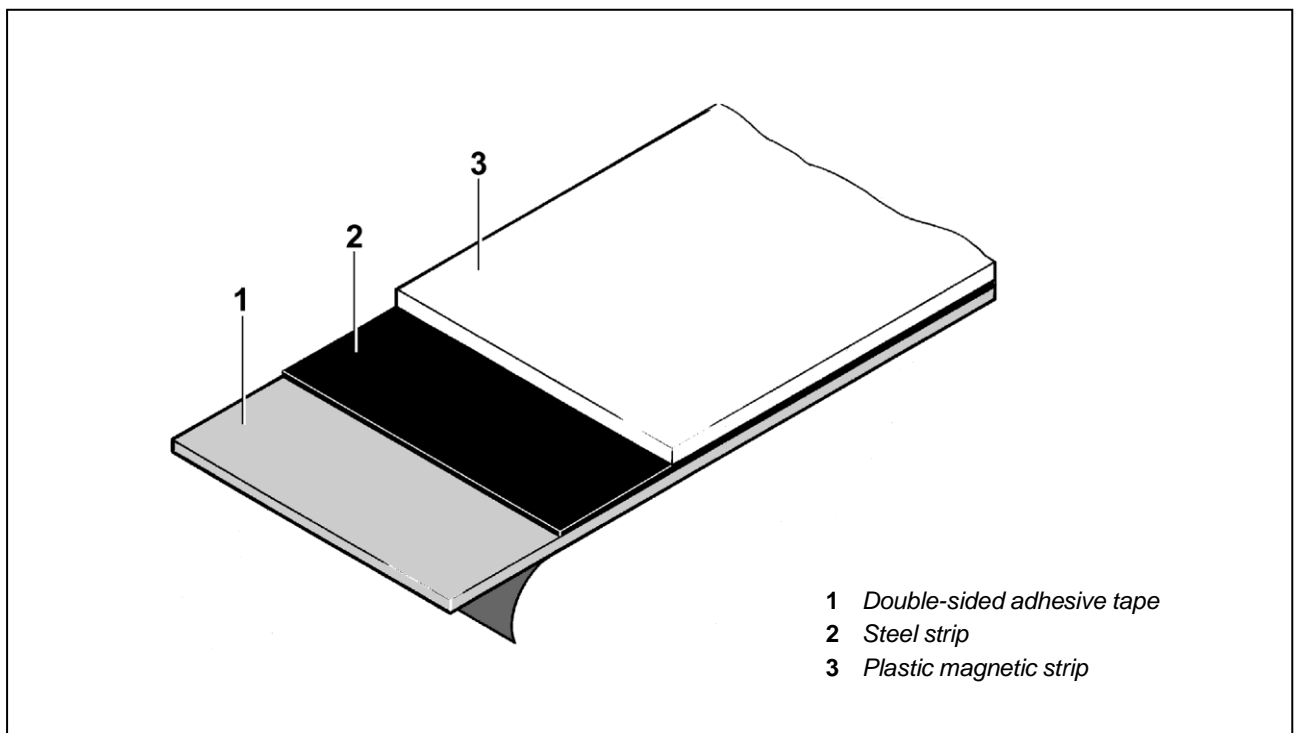


Fig. 5-2 Construction of the plastic magnetic strip (scale)

5.2 Functional principle

The **LinCoder® L 230** length measuring system comprises a magnetic strip and a sensor. The magnetic strip represents the scale for a distance of up to 40 metres.

The absolute information is magnetized onto the strip in a sequential 12-bit code. In order to achieve as high a resolution and accuracy as possible, a so-called incremental track is also magnetized onto the magnetic strip, that is to say north and south poles are always present alternately.

The magnetic strip is laminated by the manufacturer onto a ferromagnetic strip (steel strip) which, firstly, serves as a magnetic return path and, secondly, serves as a dimensionally stable mounting aid. The magnetic strip can therefore be bonded directly onto a ferromagnetic carrier without any restriction, without there being any influence on the magnetization. Depending on the composition of the carrier material (for the magnetic strip) at the customer, the magnetic strip is supplied with an appropriate double-sided adhesive tape, which is already bonded to one side of the steel strip by the manufacturer.

A contactless magnetic sensor with integrated evaluation electronics and corresponding interface is led over the measurement path, and its position is output with a resolution of 1 µm/10 µm/156.25 µm.

The sensor outputs its information to the control system either via an SSI interface (synchronous serial interface) or via a HIPERFACE® interface (high performance interface).

6 Ambient conditions

The **LinCoder® System** has been conceived for normal operating conditions. Therefore, some restrictions have to be observed for its mounting and subsequent operation.

- Take care that
 - the measuring system is mounted in accordance with the operating instructions listed below.
 - during operation, no foreign bodies – in particular ferromagnetic bodies – can be deposited on the magnetic strip.
 - the measurement system is not exposed to severe temperature **fluctuations**.
 - the coefficient of thermal expansion of the carrier material (device/machine/plant) agrees approximately with that of the stainless steel strip of the magnetic strip.
 - no external magnetic fields of more than 64 mT (640 Oe; 52 kA/m) act on the measuring system.
 - the measuring system or individual parts of the system are employed in accordance with the characteristic values specified in the technical data.

Non-compliance with the operating instructions, or use outside the specified characteristic values, can have a negative influence on the accuracy of the system.

The use of the measuring system under the influence of radioactive radiation may take place only after discussions with the manufacturer.

7 Operating instructions

Because of the many possible areas of use and mounting arrangements of the **LinCoder® System**, we can give only general advice.

As a specialist, you can yourself solve specific tasks or applications on site, or in specific cases after consultation with the manufacturer.



- **Before mounting, it is absolutely necessary to take note of the safety advice and warning notes under**

3 Safety advice

- Comply exactly with the predefined installation dimensions.
- In order to mount the sensor, use only **screws, nuts, washers and spring rings made of non-ferrous material** (non-magnetic materials).



- **Never open the sensor.**
Opening the sensor impairs the functional reliability and leads to cancellation of the guarantee and guarantee claims.

7.1 Mounting options

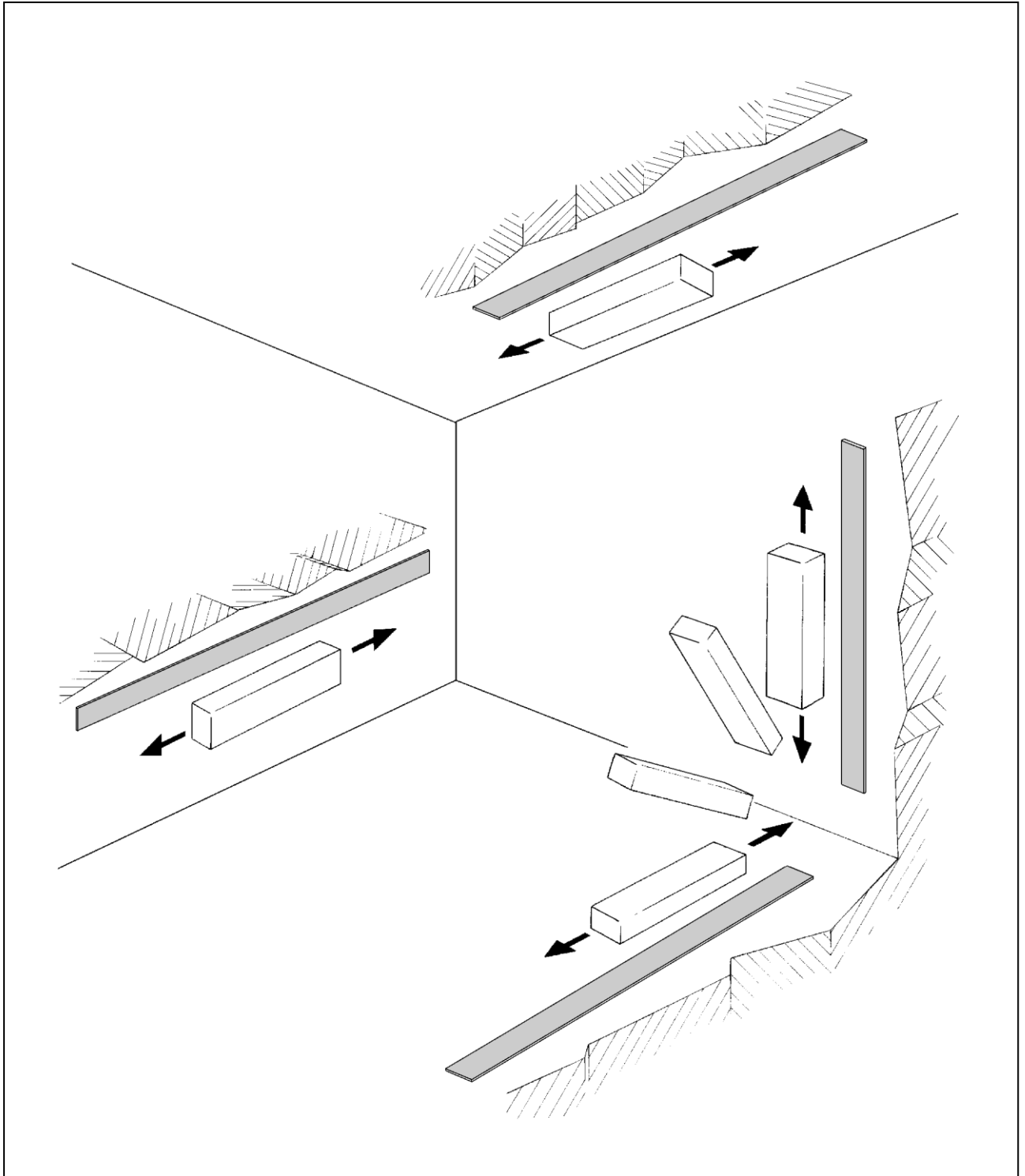


Fig. 7-1 Mounting options

The **LinCoder® System** can be mounted and operated in all three axes.

7.2 Mounting arrangement

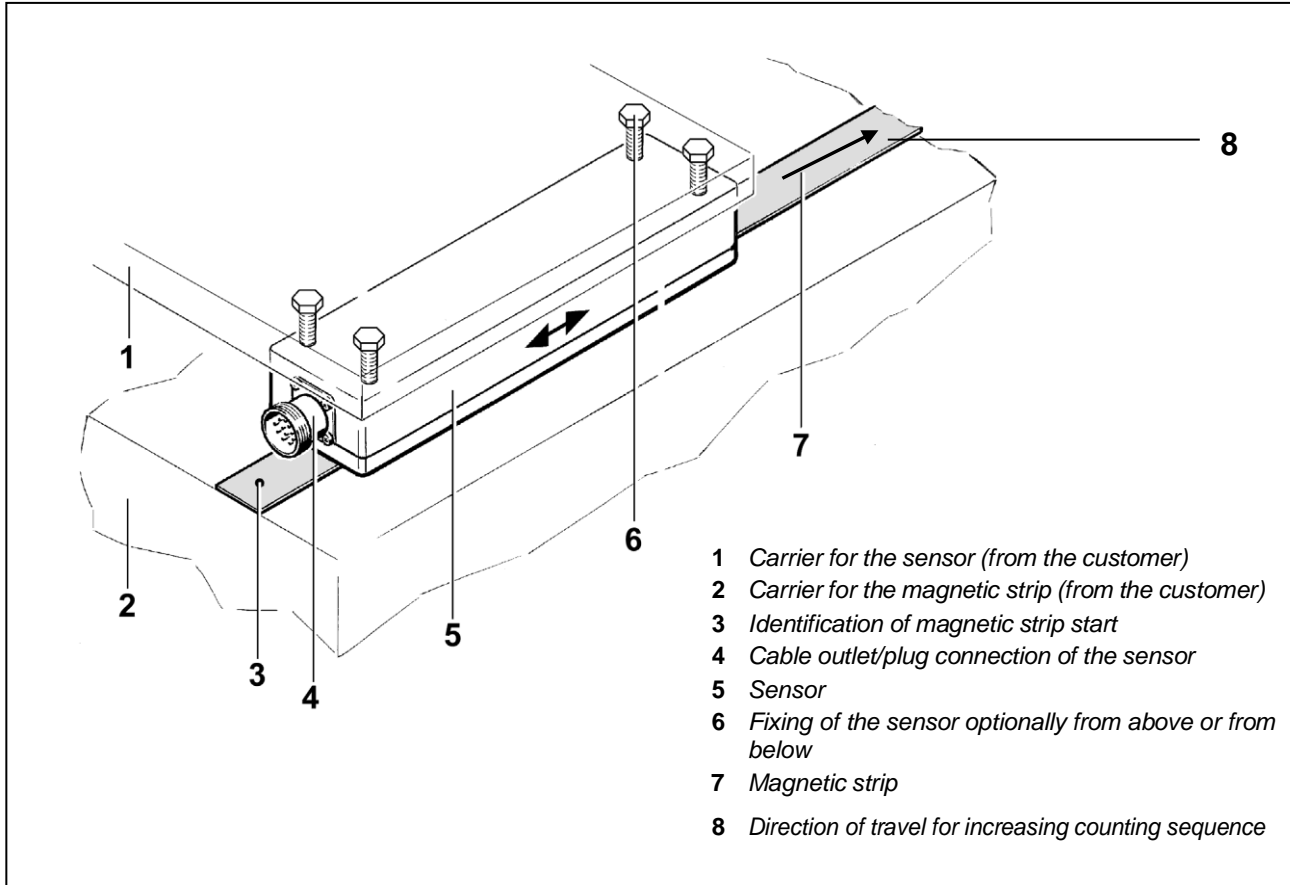


Fig. 7-2 Mounting arrangement for sensor and magnetic strip

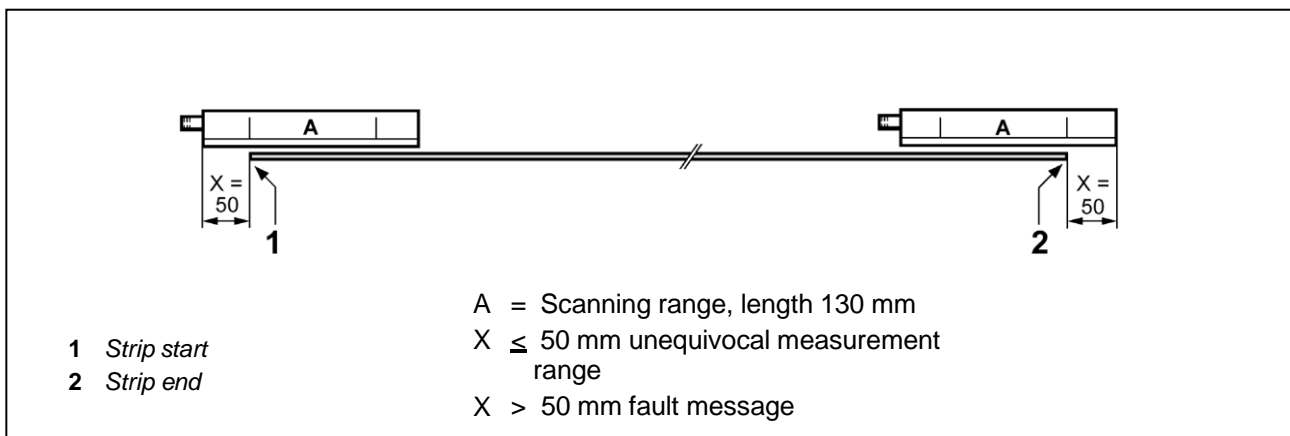


Fig. 7-3 Distances covered



The mounting arrangement must ensure that the sensor can overtravel the start and finish of the magnetic tape by at least 50 mm; this enables the complete measurement length of the tape to be registered. The start of the tape is marked by a coloured dot. The arrow indicates the direction of travel which results in an increasing code sequence. Due to the way the system operates, the magnetic tape is always 130 mm longer than the measurement length required.

7.3 Mounting tolerances

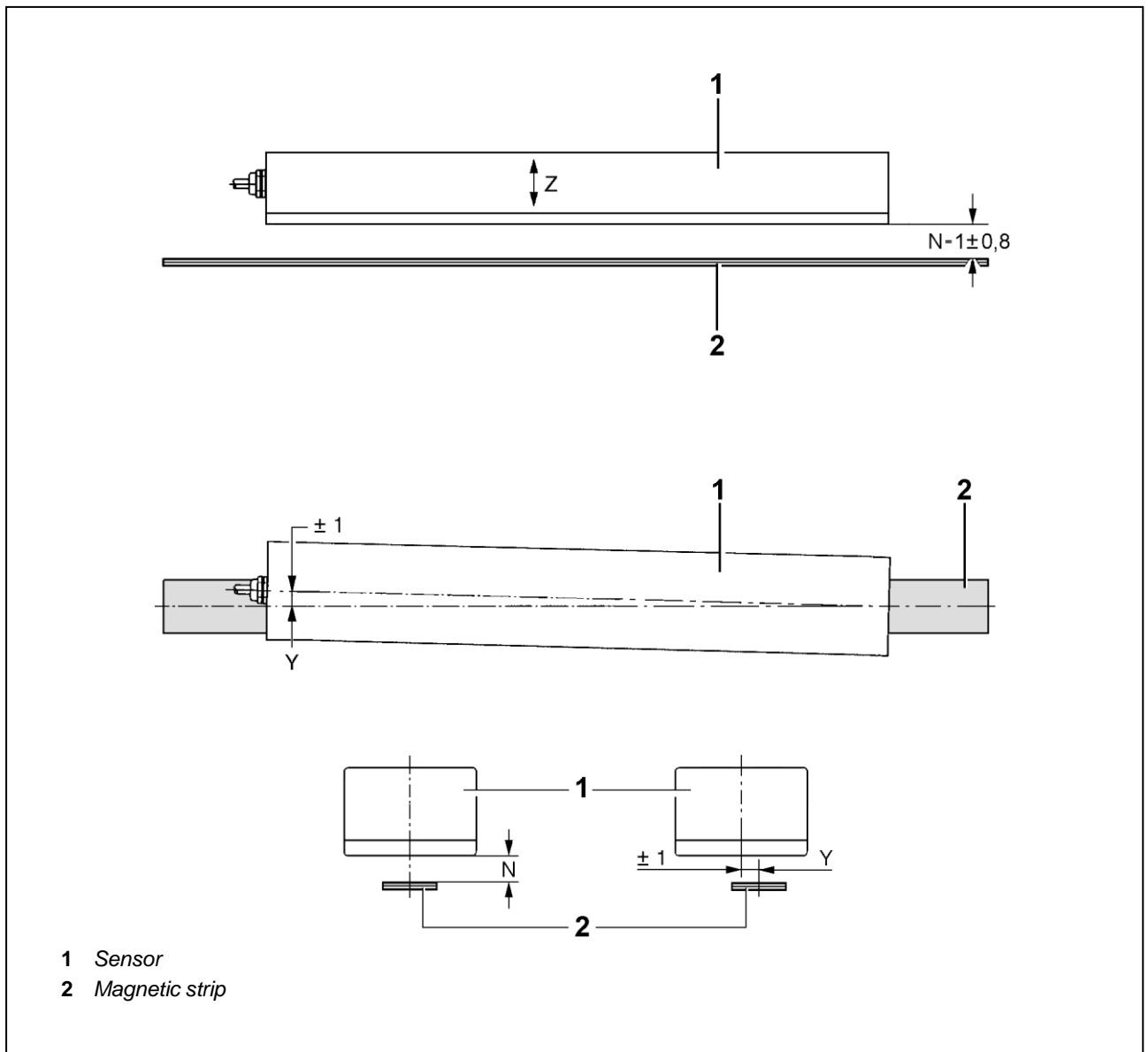


Fig. 7-4 Mounting tolerances

The operational reliability and accuracy of the measuring system assumes (amongst other things) compliance with the mounting tolerances.

Fig. 7-4 shows that the sensor is to be mounted at a distance of 1 mm parallel to the magnetic strip (nominal distance). From this, a deviation of at most ± 0.8 mm in the Z direction (distance between sensor and magnetic strip: 0.2 mm to 1.8 mm*) is permitted.

The lateral deviation of the sensors from the centre line of the magnetic strip (Y direction) must be at most ± 1 mm over the entire measurement length.

* between 1.8 mm and 3.5 mm, jumps in the position are undefined, at > 3.5 mm a fault message is output.

8 Mounting/Disassembly/Expansion



In the following description, we assume that you have read through the preceding chapter carefully and that, during the mounting/disassembly work, you will observe the safety advice and the warning notes.



- Note that the following descriptions are only general examples, since we do not know the actual mounting situation on site.
- Please adapt the examples to your mounting situation.
- Before carrying out the mounting, take note of the dimensions and sizes under

12 Technical data.

8.1 Mounting the sensor

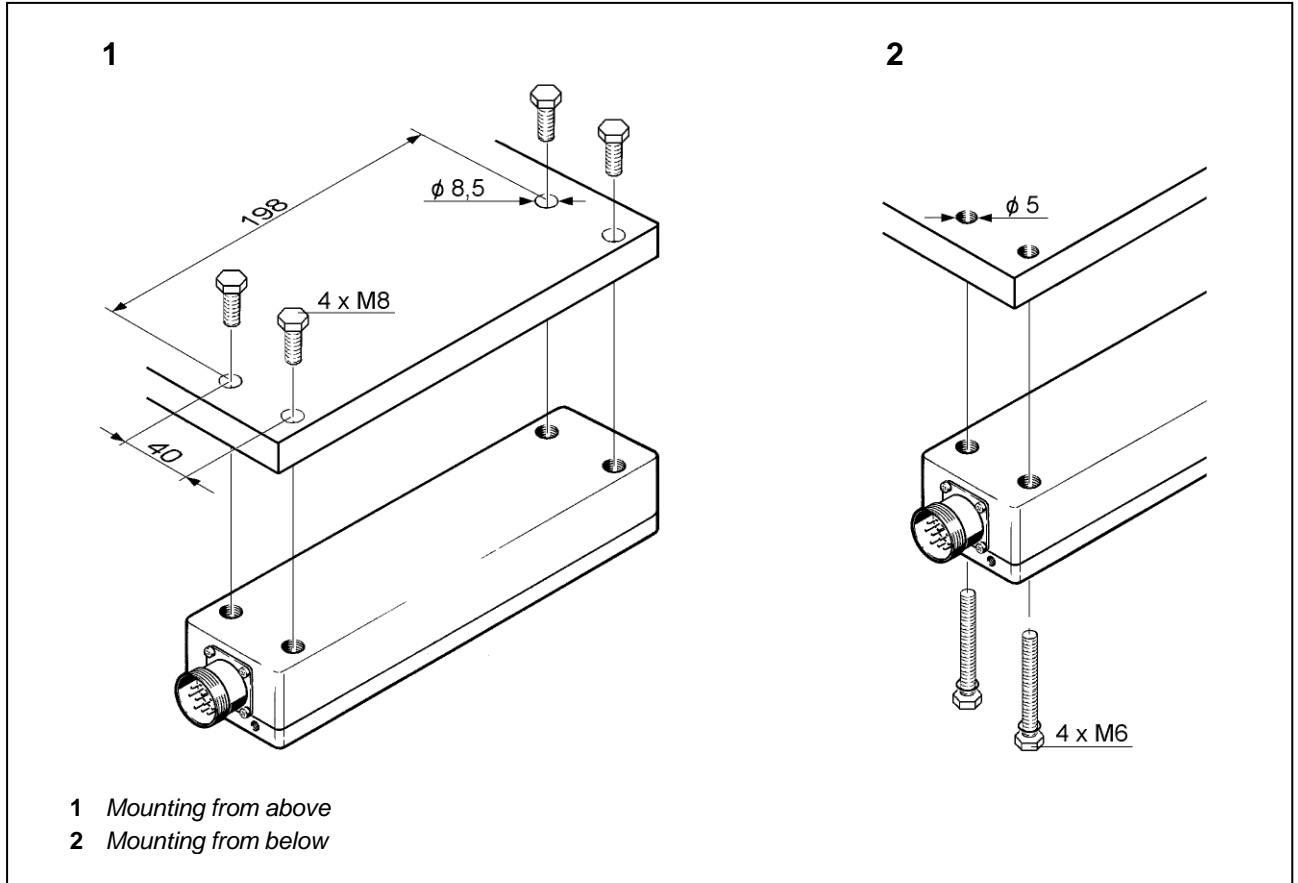


Fig. 8-1 Mounting options for the sensor

The sensor is to be mounted on that part of the device/machines/plant whose travel represents the future measurement path.

Mounting can be carried out either from above, using four M8 screws, from below, using four M8 screws (and nuts from above) or from below using four M6 screws.

- Taking into account the conditions and the dimensions specified in Fig. 8-1, either drill four clearance holes (diameter 8.5 mm) or four tapping holes (diameter 5 mm) into the sensor mounting plate.
- If necessary, cut four M6 threads into the sensor mounting plate.
- Position the sensor in such a way that the plug or cable outlet points in the direction of the start of the measurement path, i.e. opposite direction to the direction the arrow is pointing on the magnet strip.

Mounting/Disassembly/Expansion

- Push the non-ferrous screws from the figure appropriately through the holes and tighten them loosely.
- If necessary, shift the sensor until its longitudinal axis runs parallel to the reference edge of the part of the device/machine/plant.
- Fix the sensor by tightening the fixing screws.
- If necessary, mount dust-clearing brushes on the front and rear of the sensor.
- If appropriate, connect the cable to the sensor and lay it as far as the control system.
- Lay the cable such that it is not rubbed, crushed or sheared off.
- When laying the cable, maintain a bending radius of greater than 80 mm.

This concludes the mounting of the sensor.



8.2 Mounting the magnetic strip

We assume the surface(s), onto which the magnetic tape is glued, to be stable, even, dry, free from dust, oil, oxides, release agents and other contamination. Cleaning agents such as isopropanol/water (50/50), heptane, ethanol, acetone and MEK may be used to remove contamination. The cleaning agent must be chosen such that the substance used does not attack the surface to be glued and does not leave any residues; basically, it depends on the materials to be cleaned. When cleaning metal surfaces with acetone, the metal surface may cool down during the evaporation phase, and condensate may form. If so, wait until the surface has dried again.

In order to fix the magnetic strip, we recommended, if not already supplied, the use of the double-sided adhesive tape type 3M4611F (from Scotch). This adhesive tape is particularly suitable for bases made of steel, galvanized steel, aluminium and plastic. In order to check the adhesive strength with other bases in advance, we will gladly provide a sample on request.

- Make the sensor travel over the measurement path and, by means of a plumb line or a square, transfer the centre line of the sensor to the base. Identify this point by means of a scribe, lead pencil or the like.
- Connect the individual points by means of a rule, chalk line or with the aid of a laser beam to form a continuous line. This line corresponds to the centre line of the measurement path.
- If necessary, draw a second line at a distance of 12.5 mm from the centre line.
- If appropriate, stick a double-sided adhesive tape over the complete magnetic strip length, flat on the underside of the magnetic strip.
- Lay the magnetic strip centrally on the centre line over its complete length. The point-like marking on the magnetic strip must point in the direction of the start of the measurement path.
- Fix the magnetic strip provisionally (for example with weights, non-ferrous screw clamps) at a number of points.
- Lift the magnetic strip upwards a little at the start of the measurement path and, in the starting area, remove the protective film from the double-sided adhesive tape.
- Stick the starting area of the magnetic strip exactly onto the centre line.
- Stick the rest of the magnetic strip onto the base, by removing the fixing piece by piece and pulling out the protective film sideways.

This concludes the mounting of the **LinCoder® System**.

8.3 Disassembly of the LinCoder® System



- **Before you begin disassembling the LinCoder® System,**
 - switch off all the devices/machines/plant affected by the disassembly.
 - if appropriate, isolate the devices/machines/plant from the mains.
 - Depressurize pneumatic/hydraulic devices/machines/plant.
- **If necessary, set up warning signs in order to prevent the inadvertent starting up of the devices/machines/plant.**
- Disassemble
 - the cable from the sensor to the control system,
 - the sensor,
 - the magnetic strip.
- Treat the parts carefully, collect all the parts together – including the screws, nuts and so on, and keep them for possible subsequent use.
- **Inform the user of the device or the machine/plant that the measuring system has been disassembled.**

8.4 Expansion

Expanding an existing measurement system is possible only by removing the old and mounting a new, longer magnetic strip, because of the system used. In this case, please take note of the descriptions in these operating instructions.

9 Commissioning/test run

Following the mounting/expansion/repair, the device or the machine/plant should be subjected to a test run before it is released for the production process.

- Remove all tools, aids or the like from the active area of the measuring system.
- Check whether all parts of the measurement system are correctly and firmly installed.
- Switch on all parts of the device/machine/ plant which have a functional relationship with the measuring system.



- **If appropriate, activate the necessary safety equipment (for example shut-off systems, warning lamps or the like).**
- Start up the device, the machine/plant, and check whether the sensor can move correctly over the measurement path.
- Check whether the control system is receiving the data from the sensor and whether the part of the device/machine/plant to which the sensor is fitted is reacting to the control signals.



- **Check the functioning of any emergency off buttons or other safety equipment which may be present.**
- Only release systems for the production process which function without error.

10 Faults/Repairs

Like any technical system, the **LinCoder® System** can also fail as a result of faults or exhibit malfunctions. The causes are often of a trivial nature and easy to rectify.

Before you make contact with us, we request that the first measure you take is to look for the cause of the fault yourself.

In the following list, we have compiled the most frequent fault causes for you.

In the event of a system fault, please read through the listed causes carefully and check whether one of these applies.

Should this list not help you further, please telephone us. The telephone number will be found on the front inside cover of these operating instructions.

10.1 Fault causes

- Plant or parts of the plant not switched on
- Cable not plugged in (correctly)
- Cable defective
- Plugs/sockets defective
- Centre mounted incorrectly (cable/plug outlet does not point to the start of the measurement path, i.e. see direction of the arrow on the magnet strip)
- Positional tolerances not observed (Sensor mounted too high or too far removed from the centre line of the measurement path)
- There is ferromagnetic material on or in the vicinity of the magnetic strip
- The magnetic strip has been mounted the wrong way round (marking not pointing to the start of the measurement path)
- Information on the magnetic strip has been changed or erased by the action of external magnetic fields
- Power supply to the sensor not serviceable, or it is too weak
- Interfaces of control system and sensor not compatible

Once you have defined the cause of the fault unequivocally, please rectify it if it lies within your capabilities.

10.2 Repairs



The repair work on the **LinCoder® System** is restricted, as far as you are concerned, to the activities which you have also carried out during the mounting.



- Before carrying out repairs, it is absolutely necessary to take note of:

**3 Safety Advice,
7 Mounting Advice and
8 Mounting/Disassembly/Expansion**

- **Before carrying out the repairs, switch off all the parts of the device/machine/plant that are affected.**
- Under no circumstances open the parts of the measuring system. Damaged parts such as sensor or magnetic strip must be replaced.

In this regard, see:

12.1 LinCoder® ordering key.

- Use only original SICK spare parts as replacement parts.
- Following repair work, carry out a test run of the measuring system.

In this regard, see:

9 Commissioning/Test run.

11 Maintenance/Cleaning



- **Before carrying out maintenance/cleaning work, switch off all the parts of the device/machine/plant that are affected.**

11.1 Maintenance

The **LinCoder® System** is a contactless measuring system and contains no moving parts. Therefore it is basically maintenance-free.

Under rough operating conditions – above all outdoors – corrosion or material fatigue phenomena (adhesive tape) may be produced by ambient influences.

Before this wear causes faults, the influences should be prevented by suitable measures.

- Therefore, from time to time check the parts of the measuring system for damage.
- Replace damaged parts only by original SICK spare parts.
- **Under no circumstances open the parts of the measuring system.**

11.2 Cleaning



- **Do not use any scouring or corrosive cleaning agents.**
- **Prevent liquids or moisture penetrating into the sensor.**
- **Under no circumstances open parts of the measuring system.**

12 Technical data

12.1 Accessories

Connection Systems

Programming Tool for individual parametrizing of
HIPERFACE Encoders

12.2 General data

	Values	Units
Measurement length	Max. 40	m
Magnetic strip length	Measurement length + 130 ¹⁾	mm
Reproducibility	± 10	µm
Measurement accuracy	typ. ± 0.3 mm/m at 20 °C	
Max. speed of travel	6	m/s
Temperature expansion coefficient $T_{k_{\text{steel strip}}}$	16	µm / °C / m
Position and mounting tolerances	see page 13: 7.3 Mounting tolerances	
Dimensions	see page 26 12.3 Dimensional drawing	
Material	sensor part magnetic strip steel strip	AlMgSiPbF28 Tromaflex 928 Nr. 1.4435
Working temperature range SSI	0 ... + 70	°C
Working temperature range HIPERFACE	0 ... + 60	°C
Storage temperature range	- 40 ... + 100	°C
Fixing the magnetic tape with adhesive tape (unprocessed)	10 months min. from date code (yyww), at around 20°C and 50% humidity	
Protection class	IP 65	

¹⁾ Technically necessary constant



	Values	Units
Position resolution	0 to 8.35 m ²	1 μm
	0 to 40 m	10 μm
Position repetition time	750	μs
Initialisation time	3500	ms
Supply voltage	10 ... 32	V
Max. power consumption	4.8	W

²⁾ longer measurement lengths on request

HIPERFACE®

	Values	Units
Periodic length	5 ± 3%	mm
Position resolution (Periodic length /32=5mm/32)	156.25	μm
Initialisation time	2500	ms
Supply voltage	7...12	V
Max. operating current, no load	4.3	W
Interface signals: <i>Process data channel</i> SIN, COS REFSIN/REFCOS Non-linearity within one sine/cosine cycle, differential non-linearity <i>Parameter channel</i>	0.9...1.1 2.2...2.8 ± 50 to EIA 485	V _{pp} V μm



External magnetic fields

External magnetic fields should not exceed 64 mT (640 Oe; 52kA/m) on the surface of the gauge, since this can damage the coding on the gauge. Magnetic fields > 1 mT at the measuring system affect the measurement accuracy.



Initial commissioning

The measurement path can start at any position between 0 m and 40 m. Therefore it will be helpful, prior to initial commissioning, to align the electrical zero point to your intended mechanical position. When operating with the SSI interface, this can be performed via the SET input, for HIPERFACE variants, this can be programmed via software.

12.3 Dimensional drawing

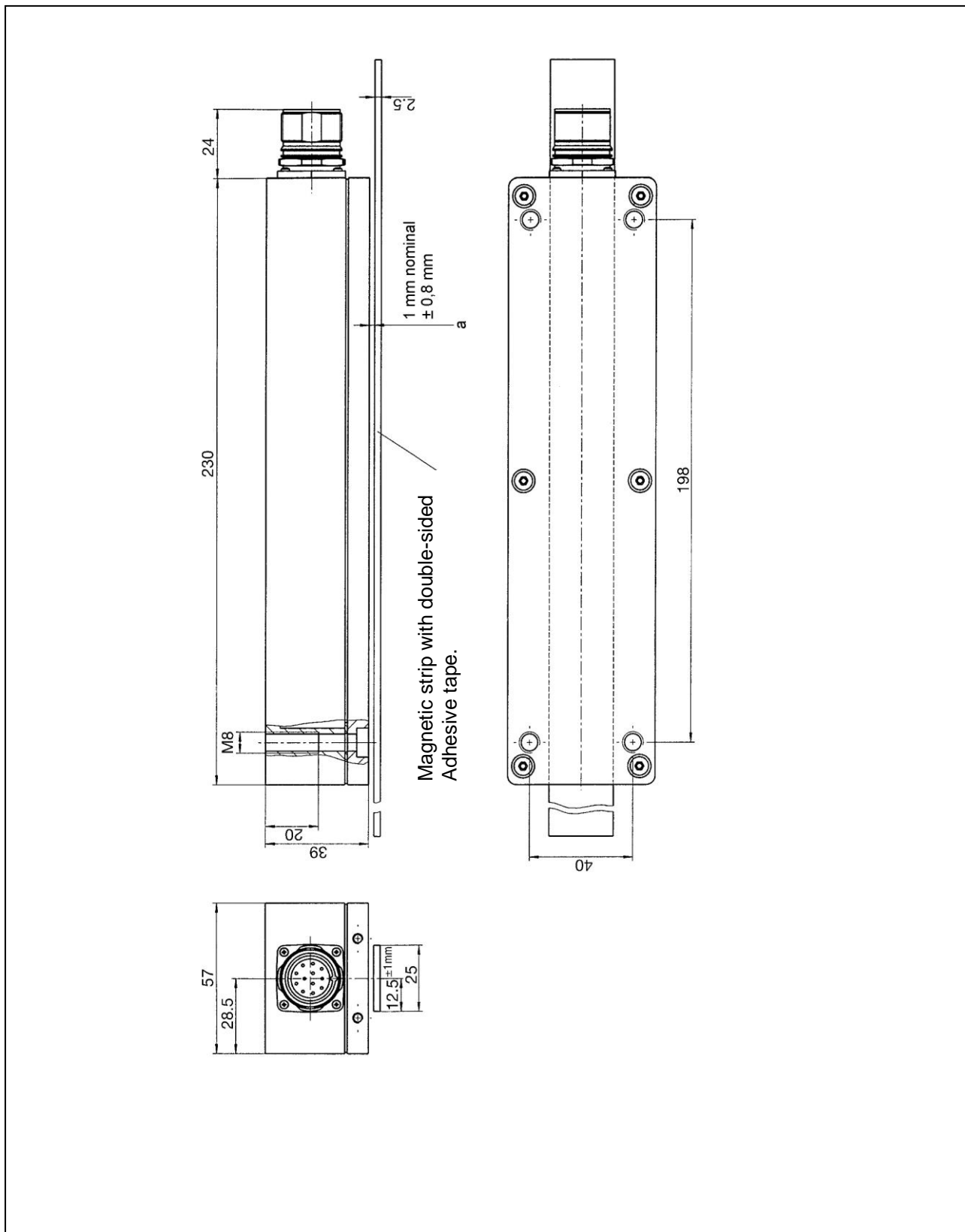


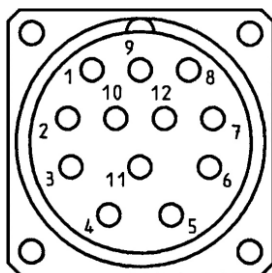
Fig. 12-1 LinCoder® L 230 dimensions

12.4 Connection details for HIPERFACE® and **SSI** interfaces

12-pole round connection for SSI	Cable	For serial interface SSI	12-pole round connector for HIPERFACE®	Cable	For HIPERFACE® interface
PIN	Colour	Signal	PIN	Colour	Signal
1	Blue	GND	1	Black	REFCOS
2	White	Data (+)	2	Grey	RS 485 (+)
3	Yellow	Clock (+)	3	–	N. C.
4	Grey	RS 485 (+)	4	–	N. C.
5	Green	RS 485 (-)	5	White	SIN
6	–	N. C.	6	Brown	REFSIN
7	–	N. C.	7	Green	RS 485 (-)
8	Red	US (+)	8	Pink	COS
9	Orange	Set *	9	–	N. C. Screen
10	Brown	Data (-)	10	Blue	GND
11	Purple	Clock (-)	11	–	N. C.
12	Black	V/R **	12	Red	US

* This input is used for electronic adjustment. By means of a high signal (Us) > 20 ms on this terminal, the LinCoder position is set to 0.

** This output programmes the counting direction of the LinCoder. If not connected, this input is “high”. If the LinCoder is moved from the start to the end of the magnetic strip, it counts upwards. If the LinCoder is to count upwards from the end to the start of the magnetic strip, this terminal must be connected permanently to “low” GND.



View on the plug side at the LinCoder

N.C.: = no connection

Screening via housing plug



Please observe the connection details of the measuring system without fail.

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