

**LIK 21, 22, 23**

**Exposed Linear Encoders**  
compact model range

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Instruction for Installation

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## 1 Notes on safety

### 1.1 General information

Make sure to familiarize yourself thoroughly with the contents of these installation instruction before installing and starting up the measuring system. On request, our service department or authorized dealers will provide you with supplementary information.

Please refer to the relevant operating instructions for the functions of the measuring system in conjunction with auxiliary electronic units, counters, displays and controls, and the fundamental mechanical instruments such as processing machines, measuring instruments, etc.



**Caution!**

**Observe notes and warnings in text!**

### 1.2 Directives on instrument safety and electromagnetic compatibility (EMC)

The measuring system conforms to relevant regulations for technical equipment (Legislation on Product Safety), revision 1992.10.23 and the appropriate rules for the prevention of accidents.

The manufacturer is responsible for the compliance of the overall system including the basic mechanical unit, the measuring system and the additional electric units, with directives of the Legislation on Product Safety.

The same applies to the EMC regulations.

The measuring system meets the safety requirements for electrical measuring systems, control devices, control apparatus and laboratory IEC 1010-1. Proof of the electromagnetic compatibility EMC for industrial regions was provided by the type tests according to

EN 50081-1 Noise emission

IEC 801-2 Immunity against electrostatic discharges; Air discharge 8 kV, contact discharge 4 kV

IEC 801-4 Immunity against rapid transients; evaluation criterion B

Use the instrument only as intended by the manufacturer in order to maintain this status and adhere to the notes and warnings given in these installation instructions.

The measuring system conforms to EU standards and bears the CE label.

### 1.3 Transport, storage, unpacking

The measuring system may only be transported in its original packing.

The same is recommended for storage. This applies in particular for the DOUBLEFLEX scale tapes.

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The measuring system may only be transported in its original packing.

The same is recommended for storage. This applies in particular for the DOUBLEFLEX scale tapes.

Always use the original packing to transport the DOUBLEFLEX scale tape:  
 Lengths up to 3 m – laid out straight;  
 Lengths exceeding 3 m – laid out in an "eight"-shape

**! Caution!**

**Never store, transport or handle the DOUBLEFLEX scale tape while rolled up.**

SINGLEFLEX scale tapes may be rolled up with a minimum curvature radius of 140 mm. No restrictions apply to the length.

**Handling of DOUBLEFLEX scale tape:**

The great metrological benefits of the DOUBLEFLEX tape are a result of an adhesive layer between the scale tape and the carrier tape.

To make sure that this layer is not impaired, observe the following:

- Only remove the DOUBLEFLEX tape from its packing at the site of installation and immediately prior to installation
- Do not separate the scale tape from the carrier tape
- Also make sure that the scale and the carrier tape are not inadvertently separated, particularly at the ends

- Handle the DOUBLEFLEX tape in such a way that the bending does not exceed 100 mm and the unsupported length between two supporting points does not exceed 800 mm. Tapes with a length up to 1200 mm must be supported about 300 mm from each end, longer ones at several points
- Avoid cross- and lengthwise displacement between the scale tape and the carrier tape

**! Caution!**

**In case of transverse shifting (for example caused by transportation) of the carrier tape to the grating tape a correction is possible (only) by a lateral force.**

**Before assembly the carrier and grating tape have to flush together over the whole length. On the other hand there is a danger of lifting the grating tape from the carrier tape during the mounting into the mounting groove.**

**If, due to poor handling, the ends of scale tape separate from the carrier tape the complete DOUBLEFLEX tape is to send back to the producer for restoration the adhesive layer.**

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#### 1.4 Notes on use

- Comply with applicable pin assignment if auxiliary electronic units are connected (counter, displays, controls)
- Use the measuring system only with the supply voltage described in the installation instructions
- **Disconnect voltage supply before connecting or disconnecting plugs!**
- Integrate the measuring system in instruments, machines or devices in such a way that it is protected against contamination
- Protect the scale tape against mechanical damage
- Protect the scanning head, which contains electronics units, against shock, impact and humidity

#### 1.5 Notes on maintenance

Modifications and repairs of this measuring system may only be carried out by the manufacturer or appropriately authorized persons. The manufacturer is not liable for damages caused by unauthorized handling of the measuring system. All warranty claims are forfeited by unauthorized handling.

#### Measuring system

The measuring system requires no maintenance whatsoever.

Exposed measuring systems are sensitive to contamination and must therefore be protected against dirt by way of suitable construction by the user.

The graduation of scale tape (tape surface) and the side of scanning head (scanning window) facing the scale tape are in special need of protection. They are particularly sensitive to rough and irregular contamination and deposits (e.g. oil, grease, water).

Depending on the position in which the system has been installed and the ambient condition, it may be necessary to clean the tape surface or scanning window from time to time.

If the monitoring signal output by the scanning head is used, a cleaning request is displayed without the functions of the measuring system being impaired.

**When cleaning the components, make sure that the sensor and the scale tape are not scratched by any deposited particles!**

Dirt should be removed using a soft brush or oil-free compressed air. For subsequent cleaning, cotton wool or a soft cloth are ideal, for tenacious stains acetone or methylated spirit.

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Caution!

Acetone and methylated spirit are inflammable.

#### **DOUBLEFLEX sale tape:**

- When cleaning the DOUBLEFLEX scale tape, make sure to always wipe it lengthwise. If the tape is wiped crosswise, the scale tape may be displaced with respect to the carrier tape, resulting in impaired measuring functions.
- No cleaning solvent must flow under the scale tape, as this might affect the adhesive layer between the scale and the carrier tapes, resulting in the scale lifting off.
- If the adhesive tape comes into contact with solvent, the adhesive agent may start to dissolve, reducing the adhesive power.

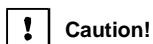
## **2 Delivery specification**

### **Standard version**

- Scanning head LIK according to ordering specification (see chapter *Ordering key*)
- DOUBLEFLEX scale tape according to ordering specification or
- SINGLEFLEX scale tape according to ordering specification
- Spacing gage for installing the scanning head (Plastic; marking "0.6")
- Installation instructions

### **Optional**

- Extension cable



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### **Optional**

- Extension cable

## 3 Installation

### 3.1 Installation conditions

#### Installation position

The measuring system can be installed in any position. However, to eliminate the possibility of heavy contamination it should be installed so that the graduation of the scale tape is in a vertical position.

Adopt suitable measures to

- prevent dirt and particles settling on the measuring system during use;
- install the measuring system so that the graduated surface and the scanning window of the scanning head are easily accessible for cleaning.

#### Preparation of surfaces for scale tape installation

- Use solvent (e.g. acetone, methylated spirits) to clean the adhesion surface of the machine.



**Make sure that no foreign matter are left on the adhesion surface.**

**When applying the scale tape, make sure that no foreign matter can get between the scale tape and the base surface.**

**Foreign matter between the tape and the base (machine components) cause local differences in the spacing between the scale and the scanning head and may thus result in deficiencies of the measuring system and/ or in measuring errors.**

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**Counting direction**

The counting direction of the system is positive (increasing measuring values), if the scanning head opposite the scale tape moves in the direction of the cable outlet.

**Cable**

- Mount the scanning head on the rigid, the scale tape on the mobile part of the machine, if possible; otherwise, provide a strain relief near the scanning head
- The cables of the measuring system and the connecting cable must be laid away from interference sources (mains cables, fuses, motors, magnetic valves, power supplies); normally, a distance of 100 mm will be sufficient
- When installing the measuring system in the machine, lay the cable so that it cannot be damaged by the moving carriage.
- Make sure the cables permissible bending radius (r) as a function of their outside diameter (d = 3.7 mm) is not exceeded;

Rigid configuration:	$r \geq 8 \text{ mm}$
Occasional flexing:	$r \geq 34 \text{ mm}$
Constant flexing :	$r \geq 40 \text{ mm}$

**Extension cable**

Use of original cable is recommended for optimum adaption to the encoder and a maximum resistance against electromagnetic interference.

Please consult the encoder manufacturer before using a self-made cable.

It is to avoid absolutely to use the encoder cable for transmission other signals (non-encoder signals) .

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### Electromagnetic compatibility (EMC) and concept of shielding

Observe the following to ensure maximum protection against electrical and magnetic interference:

- Mount the measuring system to ensure good galvanic conductivity (seating surface paint-free, conductive threads of mounting screws and threads in the machine component)
- Measuring systems without cable connectors:
  - For direkt connection to the evaluation electronic units mount external shield of the cable to ensure good galvanic conductivity with the earth potential
  - For using cable connections (e.g. terminal strips) connect both external cable shieldings and connect to the shielding of cable connections
  - Use shielded connectors.

For cable connectors, designed by the manufacturer, the concept of shielding is met.

- For using additional electronic unit connect the housing to ensure good galvanic conductivity; or for insulated installation connect the housing at the shortest distance by an additional potential equalization line with the machine's protective earth (Cu line with cross section  $\geq 6 \text{ mm}^2$ )

Please contact our service department or that of the appropriate manufacturer if you experience any problems when working with specific display or control units.

The measuring system conforms to the EN 50081-1 and EN 50082-2, regulation provided it is mounted and operated in accordance with these directives and the conditions given in these instruction.  
(see also chapter 1: *Notes on safety*)

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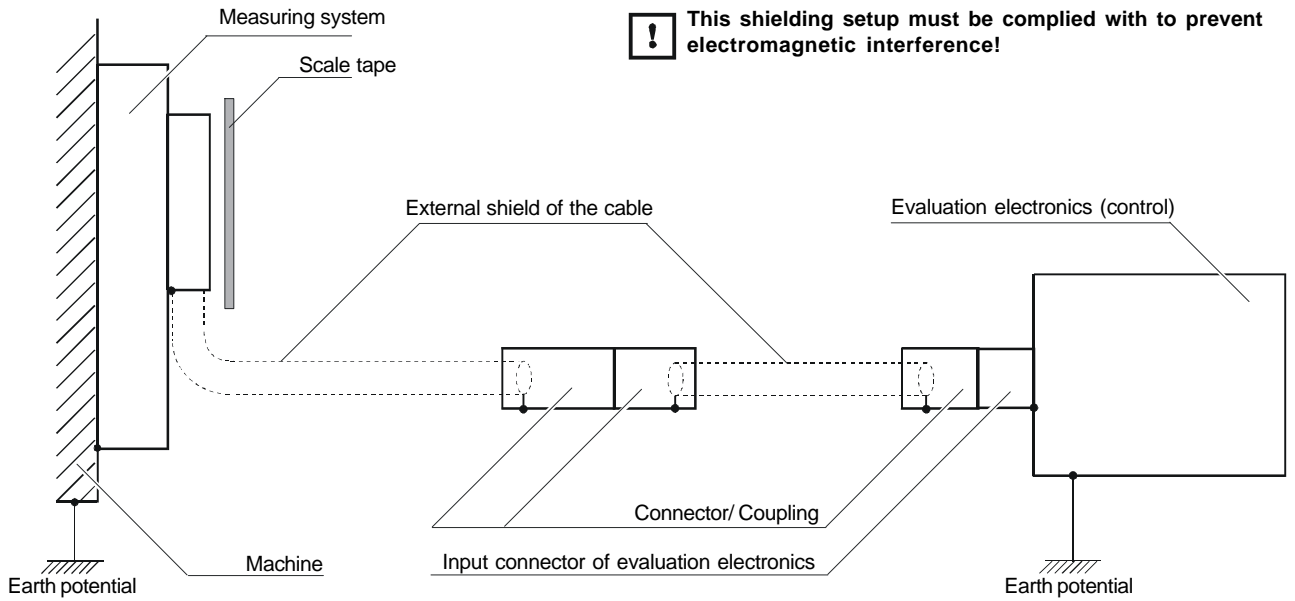


Fig.1: Concept of shielding

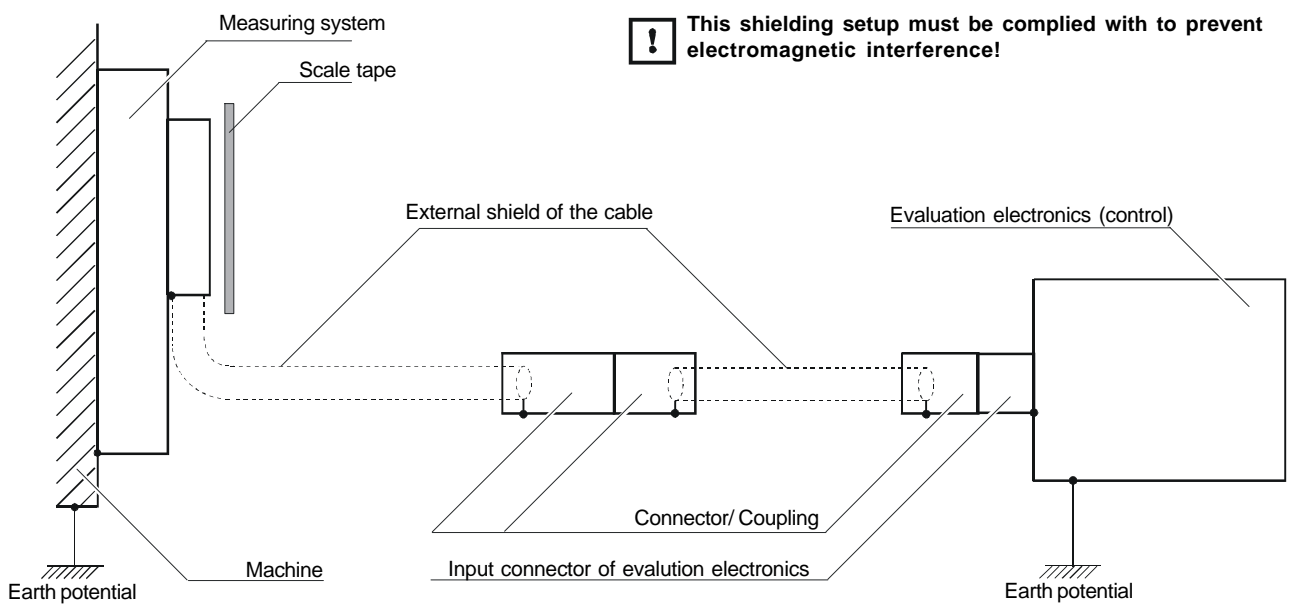
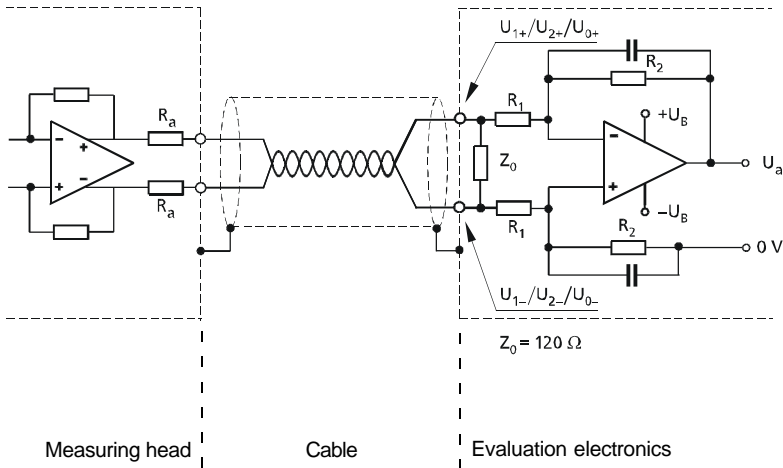


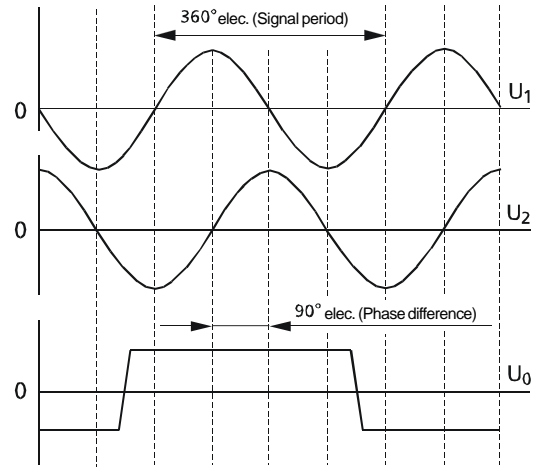
Fig.1: Concept of shielding

Recommended connection circuits

 1 V<sub>pp</sub>



Signal curve



Difference signals measured on  $Z_0$ :

$$U_1 = U_{1+} - U_{1-} = 0.6 \dots 1.2 \text{ V}_{pp} \quad (\text{rated voltage : } 1 \text{ V}_{pp})$$

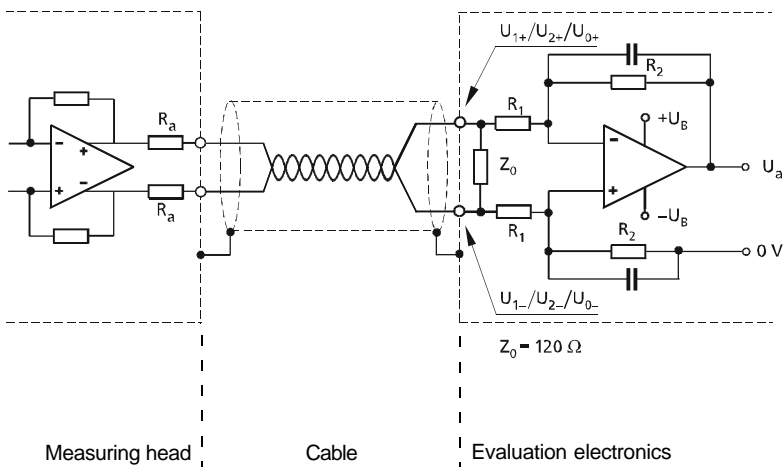
$$U_2 = U_{2+} - U_{2-} = 0.6 \dots 1.2 \text{ V}_{pp} \quad (\text{rated voltage: } 1 \text{ V}_{pp})$$

$$U_0 = U_{0+} - U_{0-} = 0.5 \dots 1.2 \text{ V} \quad (\text{rated voltage: } 0.8 \text{ V})$$

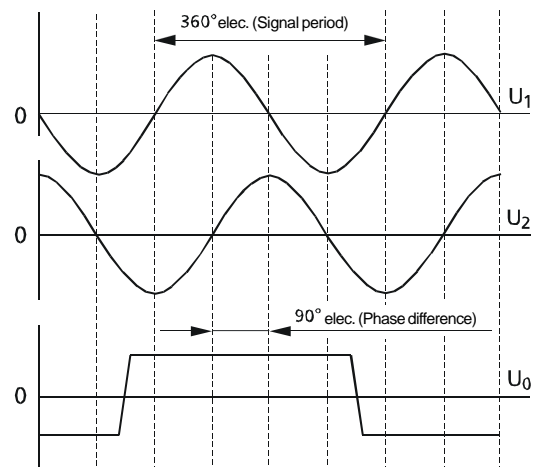
Fig. 2: Voltage output

Recommended connection circuits

 1 V<sub>pp</sub>



Signal curve



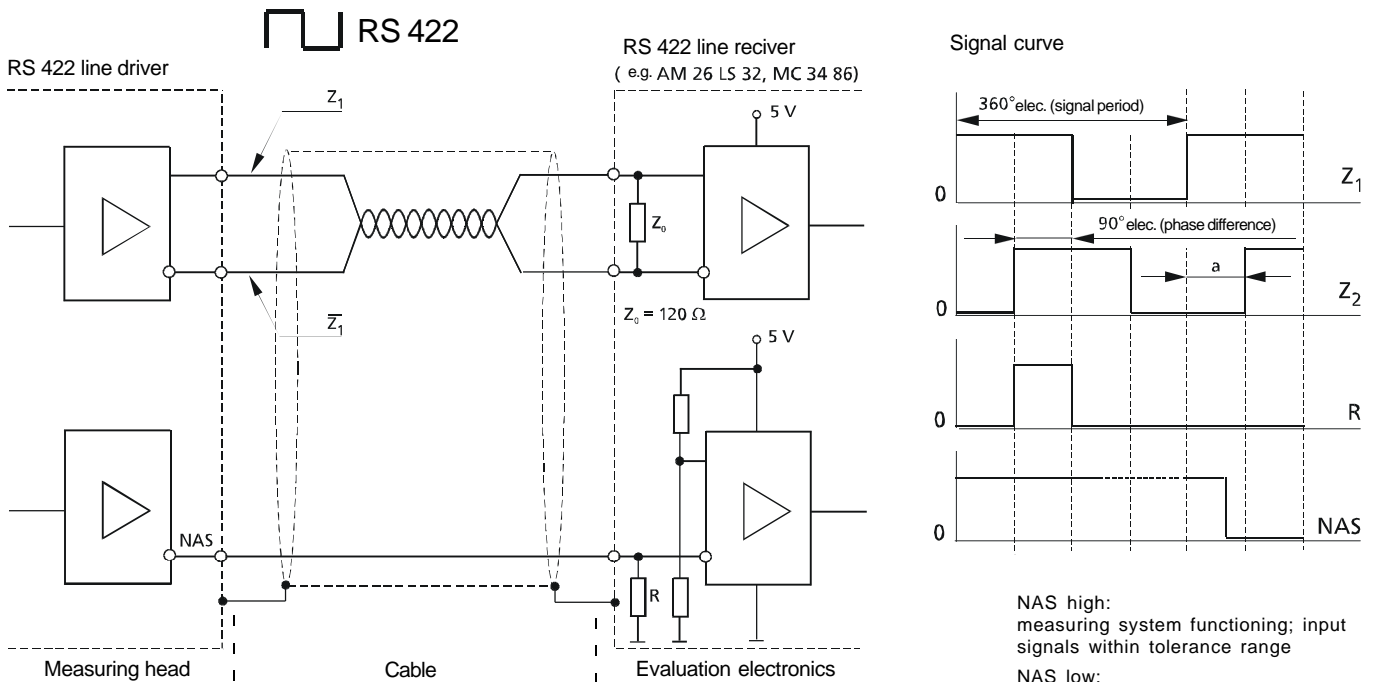
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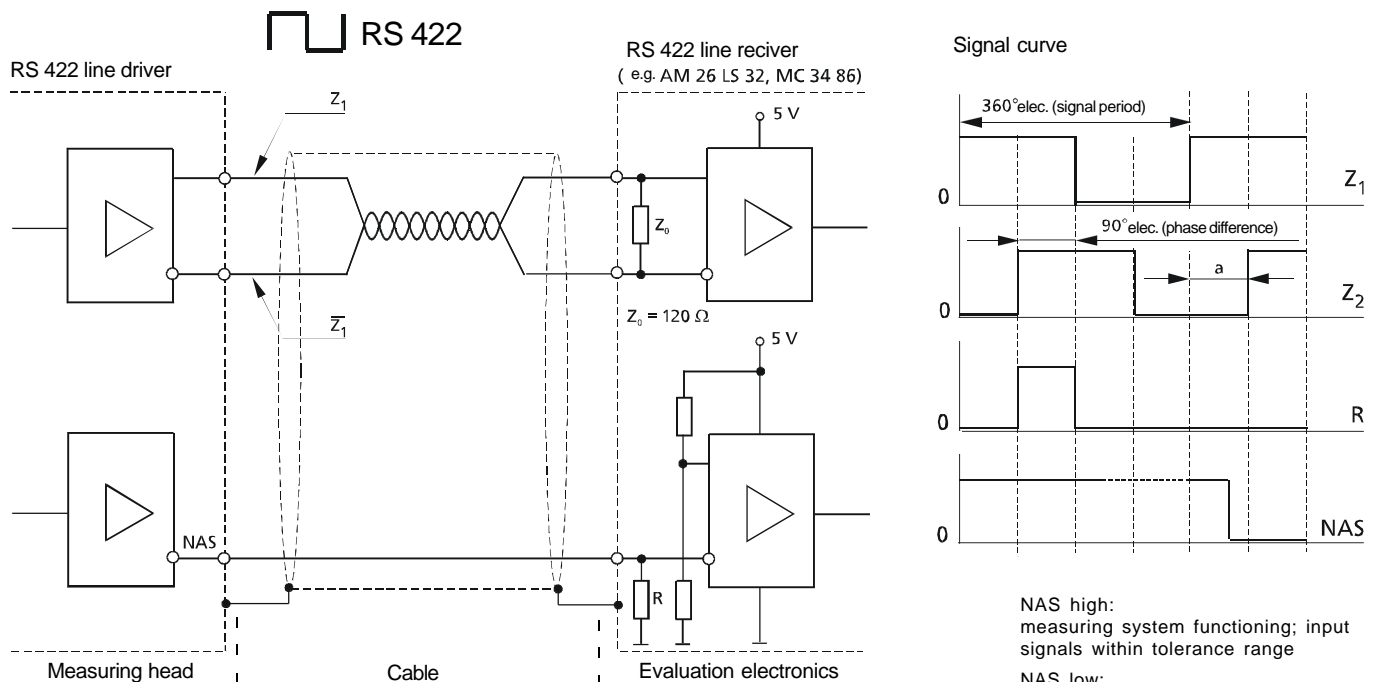
Fig. 2: Voltage output



For avoiding electromagnetic interference the cable adaption with a terminate resistor of  $Z_0 = 120 \Omega$  is necessary. In case of connection of more than one parallel signal input to the encoder output (for example linear motors with parallel connection to position controller, speed controller, acceleration controller) ensure that the resulting terminating resistor of  $Z_{0res} \approx 120 \Omega$ .

NAS high:  
measuring system functioning; input signals within tolerance range  
NAS low:  
measuring system in disorder  
a:  
minimum edge distance as a function of interpolation factor and travel speed

Fig. 3: Square wave output RS 422

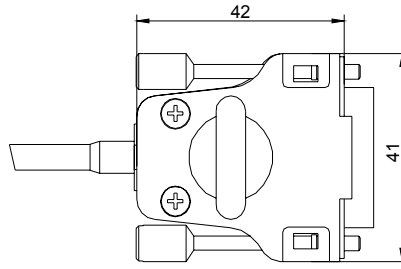



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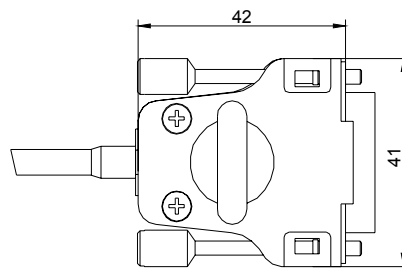
Fig 4: 15pin D Sub connector (male) for 1V<sub>pp</sub> - and square wave (RS 422) interface



Pin (male)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Housing
1V <sub>PP</sub> 	-	-	-	U <sub>0-</sub>	U <sub>2-</sub>	U <sub>1-</sub>	-	5V	0V	-	-	U <sub>0+</sub>	U <sub>2+</sub>	U <sub>1+</sub>	-	Shield
RS 422 	-	-	NAS	Z <sub>0-</sub>	Z <sub>2-</sub>	Z <sub>1-</sub>	-	5V	0V	-	AS	Z <sub>0+</sub>	Z <sub>2+</sub>	Z <sub>1+</sub>	-	Shield
Colour	-	-	vt	pk	rd	bn	-	bu	wh	-	-	gy	bk	gn	-	

AS: monitoring signal  
 NAS: negated monitoring signal

Fig 4: 15pin D Sub connector (male) for 1V<sub>pp</sub> - or square wave (RS 422) interface



Pin (male)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Housing
1V <sub>PP</sub> 	-	-	-	U <sub>0-</sub>	U <sub>2-</sub>	U <sub>1-</sub>	-	5V	0V	-	-	U <sub>0+</sub>	U <sub>2+</sub>	U <sub>1+</sub>	-	Shield
RS 422 	-	-	NAS	Z <sub>0-</sub>	Z <sub>2-</sub>	Z <sub>1-</sub>	-	5V	0V	-	AS	Z <sub>0+</sub>	Z <sub>2+</sub>	Z <sub>1+</sub>	-	Shield
Colour	-	-	vt	pk	rd	bn	-	bu	wh	-	-	gy	bk	gn	-	

AS: monitoring signal  
 NAS: negated monitoring signal

3.2 Installation of scale tape

3.2.1 Requirements

Preferably, the tape should be mounted in a groove or along an edge.

Groove or edges serve as an installation orientation for straight mounting of tapes, particularly very long ones.

For the DOUBLEFLEX scale tape, they also serve as stop to prevent any displacement between scale tape and carrier tape.

Groove or edges are not necessary for measuring lengths up to max. 10 cm. Therefore a suitable rigid stop at the side or end must be used (for DOUBLEFLEX scale tapes preferably at the bonding pad), e.g. a stop measure or stop rail.

The stop must implement the position and tolerance of the stop edge as specified in Fig.6.

**! Caution!**

The stop must not move during installation.

Grooves, stops or guide tapes are required for DOUBLEFLEX tapes which are longer than 300 mm .

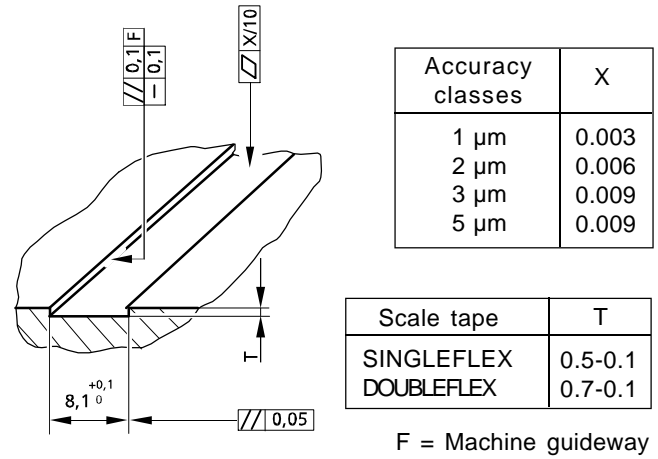


Fig. 5: Mounting groove

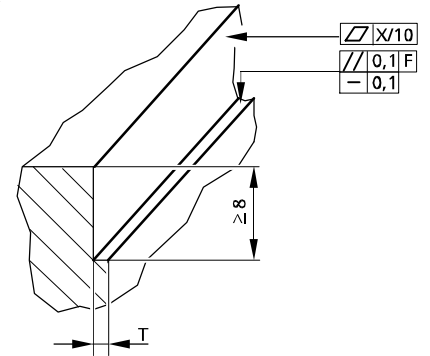


Fig.6: Mounting edge

3.2 Installation of scale tape

3.2.1 Requirements

Preferably, the tape should be mounted in a groove or along an edge.

Groove or edges serve as an installation orientation for straight mounting of tapes, particularly very long ones.

For the DOUBLEFLEX scale tape, they also serve as stop to prevent any displacement between scale tape and carrier tape.

Groove or edges are not necessary for measuring lengths up to max. 10 cm. Therefore a suitable rigid stop at the side or end must be used (for DOUBLEFLEX scale tapes preferably at the bonding pad), e.g. a stop measure or stop rail.

The stop must implement the position and tolerance of the stop edge as specified in Fig.6.

**! Caution!**

The stop must not move during installation.

Grooves, stops or guide tapes are required for DOUBLEFLEX tapes which are longer than 300mm .

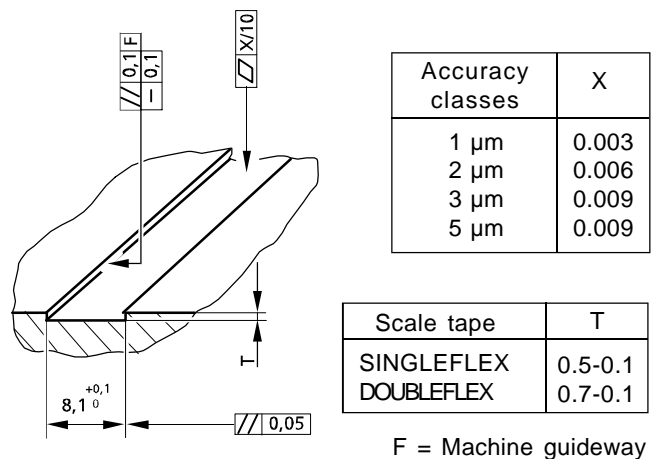


Fig. 5: Mounting groove

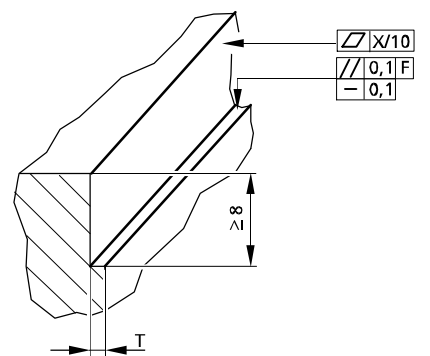


Fig.6: Mounting edge

### 3.2.2 Installation of DOUBLEFLEX scale tape (tapes are per MV 50... ordering key)

**!** Caution!

Before assembly the carrier and grating tape have to flush together over the whole length. On the other hand there is danger of lifting the grating tape from the carrier tape during the mounting into the mounting groove.

Correction (only) by a lateral force!

#### Procedure

- Use a scribing pin, for example, to mark the center of the reference point on the adhesion surface of the machine (6.3 mm from the end and 4 mm from the side of the DOUBLEFLEX scale tape)
- Apply one drop of adhesive (epoxy resin or Loctite 480J) on the marked spot.

**!** Caution!

- Loctite 480 J is a quick-action adhesive on a cyanacrylic base. It sets when exposed to air.
- It has a potlife of 2 minutes.
- Loctite 480 J sticks together skin and eye lids within seconds.
- Keep Loctite 480 J out of the reach of children.

- Do not inhale the adhesive fumes and use it in well ventilated rooms only.
- Make sure to avoid skin and eye contact.
- If your skin has stuck together, soak it in warm soapy water and then use a blunt object to carefully peel it apart.
- If any adhesive gets into your eye, rinse thoroughly with water and consult an ophthalmologist.
- Use water to set spilled adhesive.
- Store in a cool place at 5°C.
- Peel of approx. 70 mm of the red protective film on the back of the carrier tape.

**!** Caution!

The adhesive tape now exposed must not be brought into contact with other materials due to its strong adhesive force.

### 3.2.2 Installation of DOUBLEFLEX scale tape (tapes are per MV 50... ordering key)

**!** Caution!

Before assembly the carrier and grating tape have to flush together over the whole length. On the other hand there is danger of lifting the grating tape from the carrier tape during the mounting into the mounting groove.

Correction (only) by a lateral force!

#### Procedure

- Use a scribing pin, for example, to mark the center of the reference point on the adhesion surface of the machine (6.3 mm from the end and 4 mm from the side of the DOUBLEFLEX scale tape)
- Apply one drop of adhesive (epoxy resin or Loctite 480J) on the marked spot.

**!** Caution!

- Loctite 480 J is a quick-action adhesive on a cyanacrylic base. It sets when exposed to air.
- It has a potlife of 2 minutes.
- Loctite 480 J sticks together skin and eye lids within seconds.
- Keep Loctite 480 J out of the reach of children.

- Do not inhale the adhesive fumes and use it in well ventilated rooms only.
- Make sure to avoid skin and eye contact.
- If your skin has stuck together, soak it in warm soapy water and then use a blunt object to carefully peel it apart.
- If any adhesive gets into your eye, rinse thoroughly with water and consult an ophthalmologist.
- Use water to set spilled adhesive.
- Store in a cool place at 5°C.
- Peel of approx. 70 mm of the red protective film on the back of the carrier tape.

**!** Caution!

The adhesive tape now exposed must not be brought into contact with other materials due to its strong adhesive force.



- Fold out the protective film toward the stop-free side beside the DOUBLEFLEX tape or the groove; apply a drop of Loctite 480J and dip the reference point into this drop within circa 2 minutes (= potlife of adhesive)
- Place the ponding pad in the adhesive drop, at the same time sicking down the first circa 50 mm of the DOUBLEFLEX scale tape.



**Caution!**

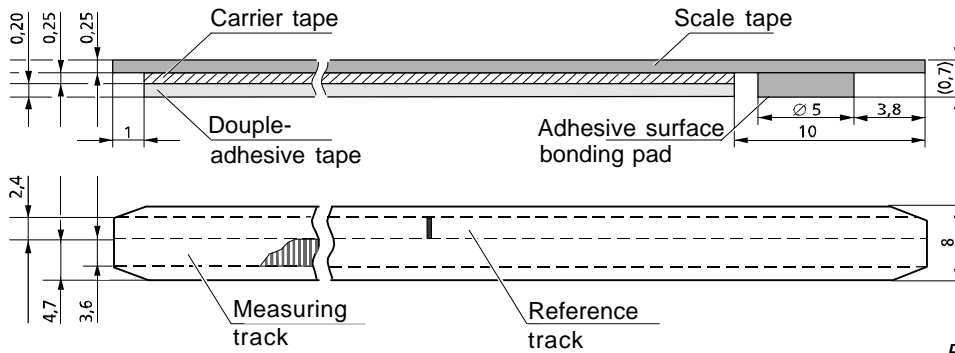
In the adhesive area (exposed adhesive tape) the DOUBLEFELEX scale tape must be positioned against the stop on the machine component or in the groove.

- Carefully pull out the protective film sideways and press the scale tape against the adhesive surface of the machine component from the reference point in the direction of the tape end (using your thumb or a rounded object).  
The pressure point should lie approx. 30 mm to 50 mm behind the line separating the adhesive tape and the protective film.



**Caution!**

Make sure that the full length of DOUBLEFLEX scale tape is lodged securely against the stop mechanism.



For measuring lengths exceeding 300 mm , a groove, stop edge or guide tape is required!

Fig 7: DOUBLEFLEX scale tape

- Fold out the protective film toward the stop-free side beside the DOUBLEFLEX tape or the groove; apply a drop of Loctite 480J and dip the reference point into this drop within circa 2 minutes (= potlife of adhesive)
- Place the ponding pad in the adhesive drop, at the same time sicking down the first circa 50 mm of the DOUBLEFLEX scale tape.



**Caution!**

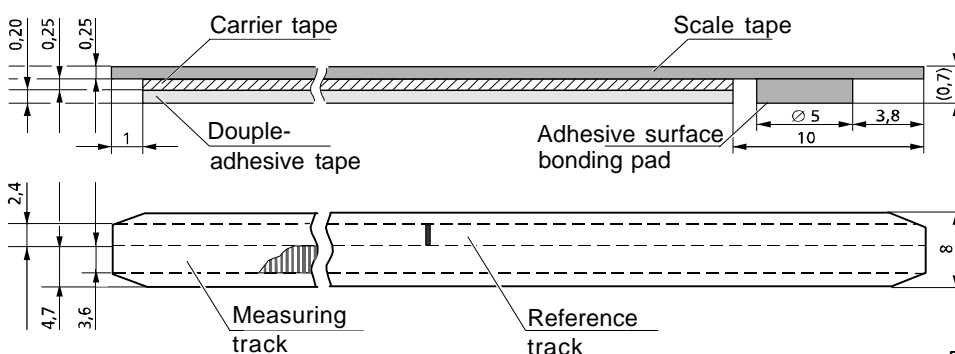
In the adhesive area (exposed adhesive tape) the DOUBLEFELEX scale tape must be positioned against the stop on the machine component or in the groove.

- Carefully pull out the protective film sideways and press the scale tape against the adhesive surface of the machine component from the reference point in the direction of the tape end (using your thumb or a rounded object).  
The pressure point should lie approx. 30 mm to 50 mm behind the line separating the adhesive tape and the protective film.



**Caution!**

Make sure that the full length of DOUBLEFLEX scale tape is lodged securely against the stop mechanism.



For measuring lengths exceeding 300 mm , a groove, stop edge or guide tape is required!

Fig 7: DOUBLEFLEX scale tape

**3.2.3 Installation of SINGLEFLEX scale tape (tapes are per MV 51... ordering key)**

**Procedure**

- Peel off about 70 mm of the red protective film on the back of the carrier tape.

**!** **Caution!**

The adhesive tape now exposed must not be brought into contact with other materials due to its strong adhesive force.

- Fold out the protective film toward the stop-free side beside the SINGLEFLEX scale tape or the groove.

- Place the scale tape with the end from which the protective film has been removed against the end and the side stop mechanism.

- Carefully pull the protective film sideways and press the scale tape against the adhesive surface of the machine component (using your thumb or a rounded object). The pressure point should lie approx. 30 to 50 mm behind the line separating the adhesive tape and the protective film.

**!** **Caution!**

Make sure that the full length of the SINGLEFLEX scale tape is lodged securely against the stop mechanism.

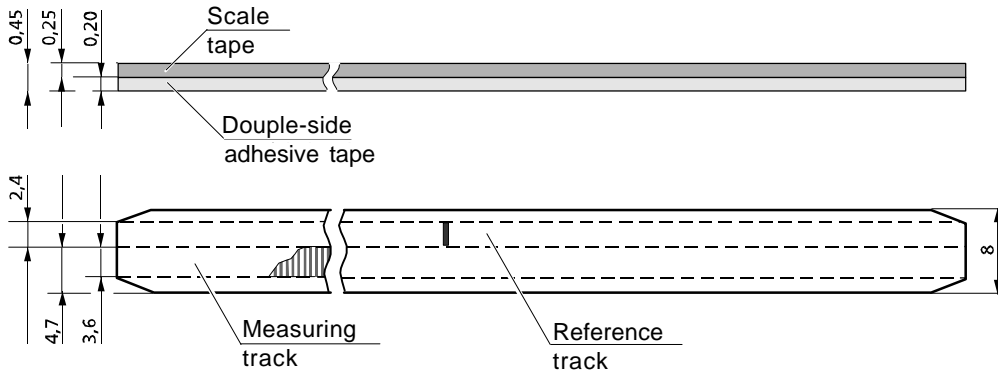


Fig. 8: SINGLEFLEX scale tape

**3.2.3 Installation of SINGLEFLEX scale tape (tapes are per MV 51... ordering key)**

**Procedure**

- Peel off about 70 mm of the red protective film on the back of the carrier tape.

**!** **Caution!**

The adhesive tape now exposed must not be brought into contact with other materials due to its strong adhesive force.

- Fold out the protective film toward the stop-free side beside the SINGLEFLEX scale tape or the groove.

- Place the scale tape with the end from which the protective film has been removed against the end and the side stop mechanism.

- Carefully pull the protective film sideways and press the scale tape against the adhesive surface of the machine component (using your thumb or a rounded object). The pressure point should lie approx. 30 to 50 mm behind the line separating the adhesive tape and the protective film.

**!** **Caution!**

Make sure that the full length of the SINGLEFLEX scale tape is lodged securely against the stop mechanism.

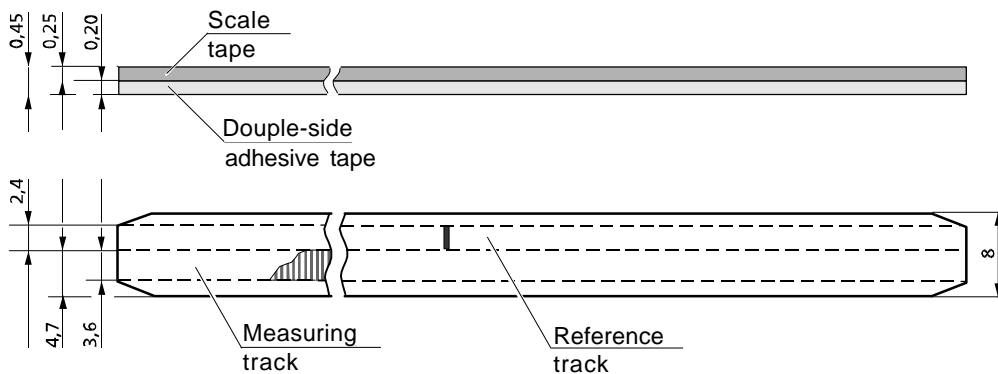


Fig. 8: SINGLEFLEX scale tape

### 3.4 Installation of scanning head

#### Requirements

- The mounting surface must be prepared according to the installation drawing.
- Please observe the installation conditions (see chapter 3.1 *Installation conditions*).

#### Preparation

- Remove the protective foil from the graduated surface of the scale tape.
- Remove the protective foil from the sensor.
- Carefully clean the sensor surface of the scanning head with a lint-free cloth, using a solvent (acetone, methylated spirits) if necessary (see chapter 1.5 *Notes on maintenance*).
- Clean the mounting surface of the scanning head and the machine component.

#### Procedure

- Screw the scanning head on the prepared mounting surface so that it can still be shifted.
- Slide the spacing gage in linear direction between the scale tape surface and the scanning head.

- Slide the scanning head against the spacing gage and tighten the two mounting screws evenly and lightly. It must be possible to still shift the spacer foil.
- Tighten the two mounting screws in turn while checking whether the spacing gage can still be shifted.
- Remove the spacing gage.
- If the removal of spacing gage presents any problems, unscrew the scanning head and repeat the installation starting with step 3 of "Preparation".
- Lay the scanning head cable including the strain relief near the scanning head.
- Carefully clean the scale tape surface (graduation) with a lint-free cloth, using a solvent (acetone, methylated spirit) if necessary (see chapter 1.5 *Notes on maintenance*).
- Connect the measuring system cables with the subsequent electronics, taking into account the connector assignment.



#### Caution!

**The subsequent electronics must not be ON, as this may lead to functional interference or breakdowns. It would then be necessary to recalibrate the measuring system.**

- Switch on the evaluation electronics and perform a function check.

### 3.4 Installation of scanning head

#### Requirements

- The mounting surface must be prepared according to the installation drawing.
- Please observe the installation conditions (see chapter 3.1 *Installation conditions*).

#### Preparation

- Remove the protective foil from the graduated surface of the scale tape.
- Remove the protective foil from the sensor.
- Carefully clean the sensor surface of the scanning head with a lint-free cloth, using a solvent (acetone, methylated spirits) if necessary (see chapter 1.5 *Notes on maintenance*).
- Clean the mounting surface of the scanning head and the machine component.

#### Procedure

- Screw the scanning head on the prepared mounting surface so that it can still be shifted.
- Slide the spacing gage in linear direction between the scale tape surface and the scanning head.

- Slide the scanning head against the spacing gage and tighten the two mounting screws evenly and lightly. It must be possible to still shift the spacer foil.
- Tighten the two mounting screws in turn while checking whether the spacing gage can still be shifted.
- Remove the spacing gage.
- If the removal of spacing gage presents any problems, unscrew the scanning head and repeat the installation starting with step 3 of "Preparation".
- Lay the scanning head cable including the strain relief near the scanning head.
- Carefully clean the scale tape surface (graduation) with a lint-free cloth, using a solvent (acetone, methylated spirit) if necessary (see chapter 1.5 *Notes on maintenance*).
- Connect the measuring system cables with the subsequent electronics, taking into account the connector assignment.



#### Caution!

**The subsequent electronics must not be ON, as this may lead to functional interference or breakdowns. It would then be necessary to recalibrate the measuring system.**

- Switch on the evaluation electronics and perform a function check.

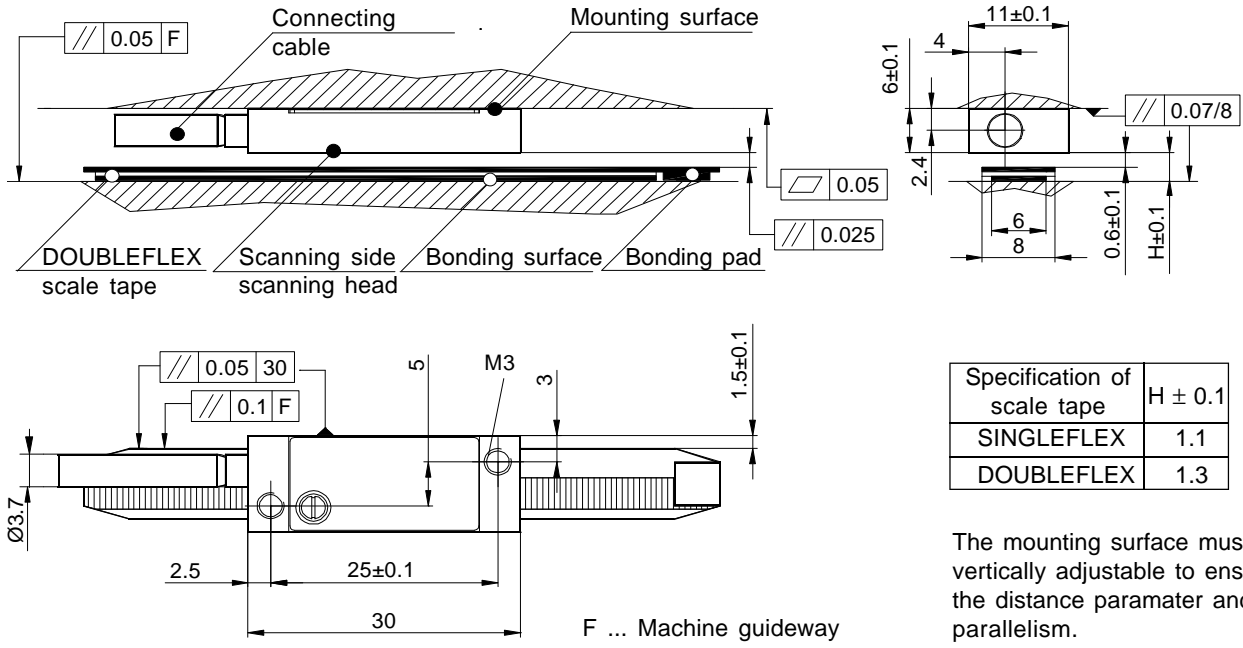


Fig. 9: Installation conditions and dimensions of LIK 21

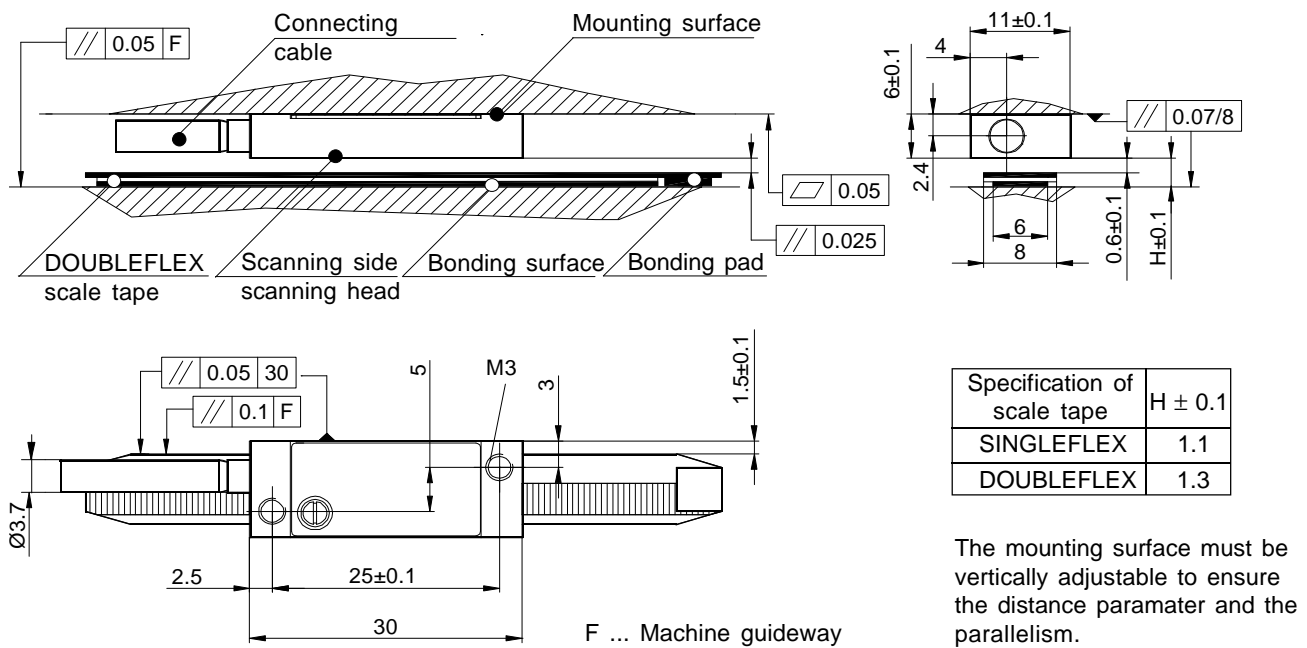


Fig. 9: Installation conditions and dimensions of LIK 21

Fig. 10: Allocation of scanning head, scale tape and measuring length for LIK 21

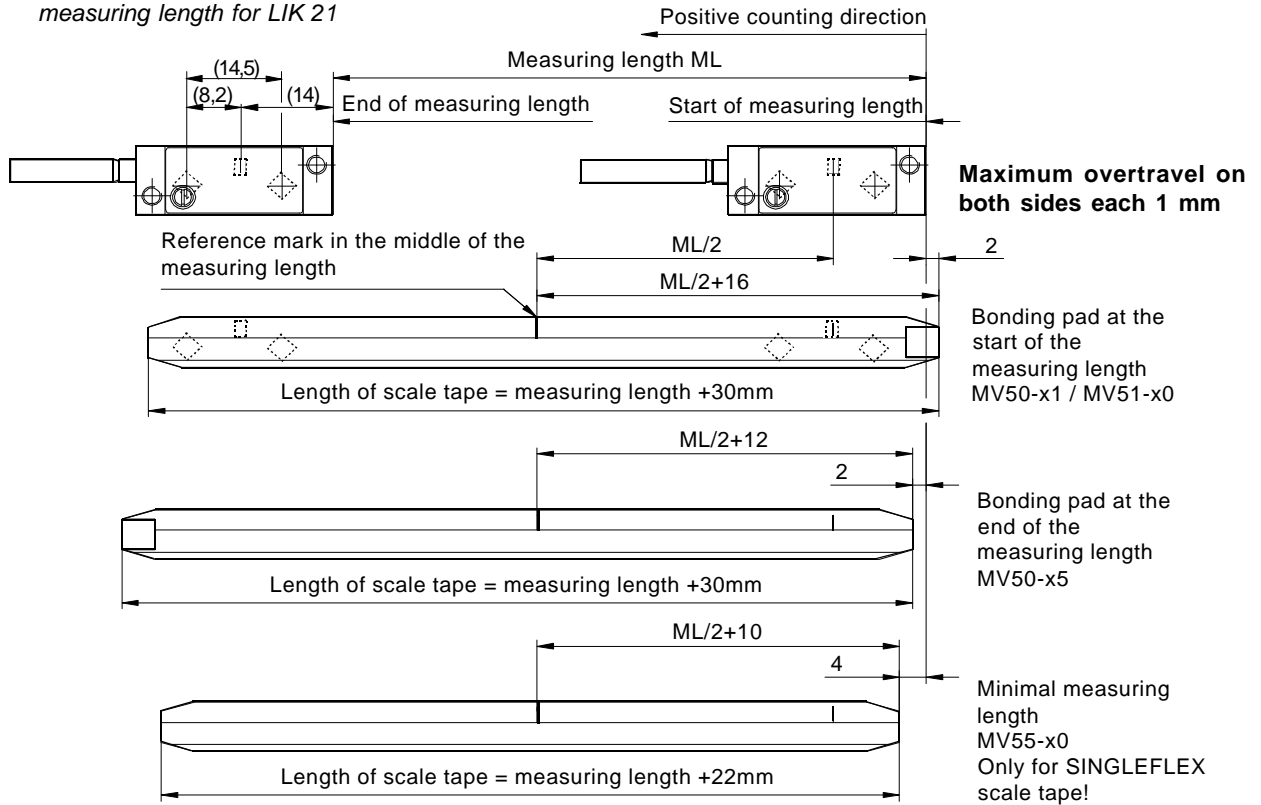
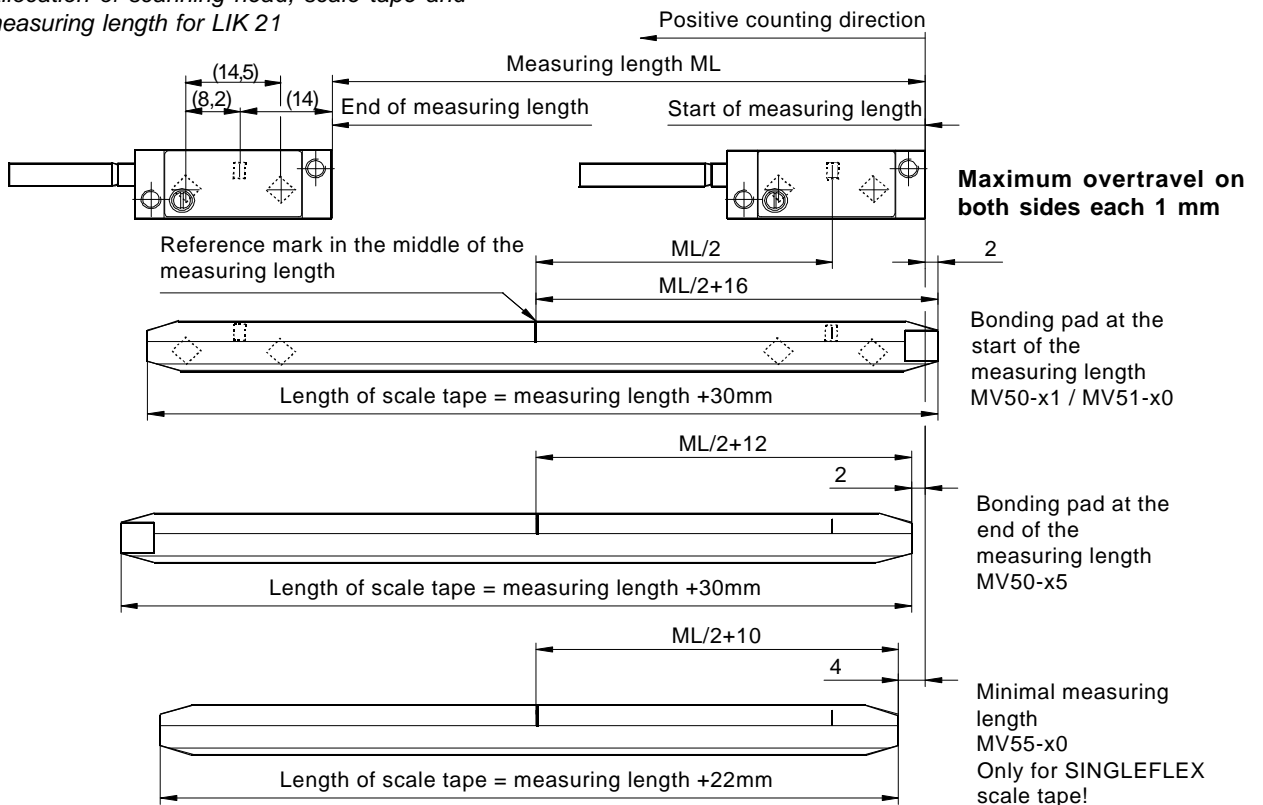


Fig. 10: Allocation of scanning head, scale tape and measuring length for LIK 21



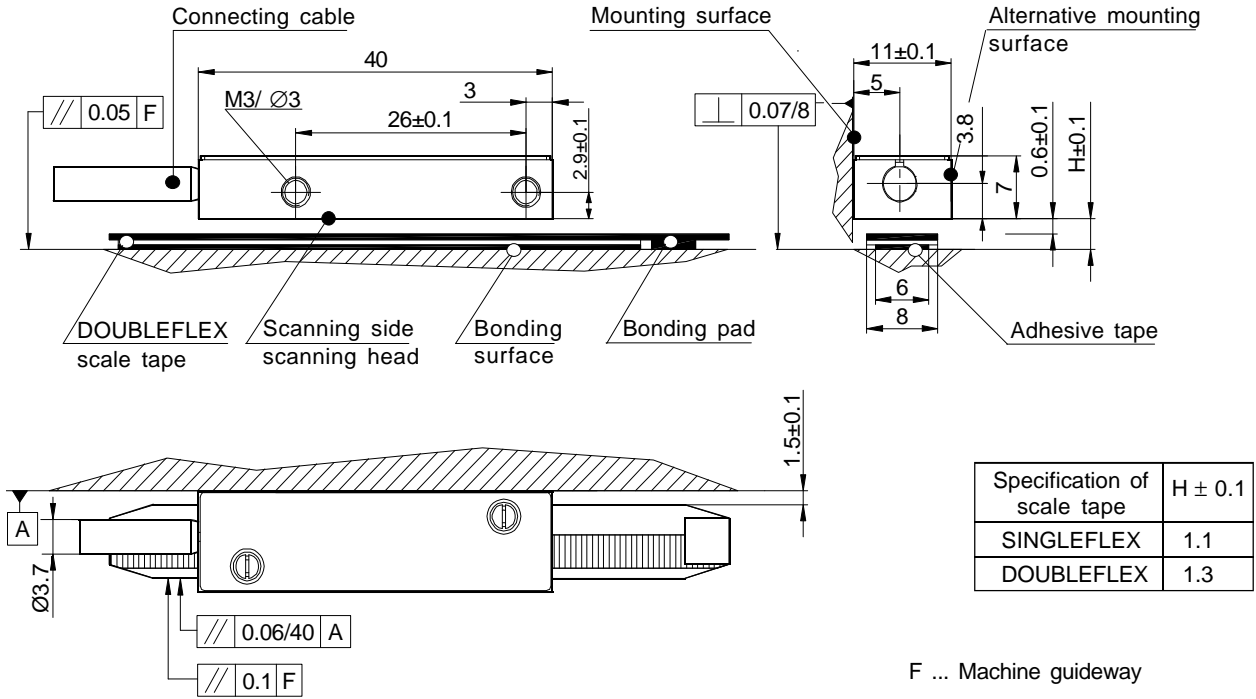


Fig. 11: Installation conditions and dimensions of LIK 22

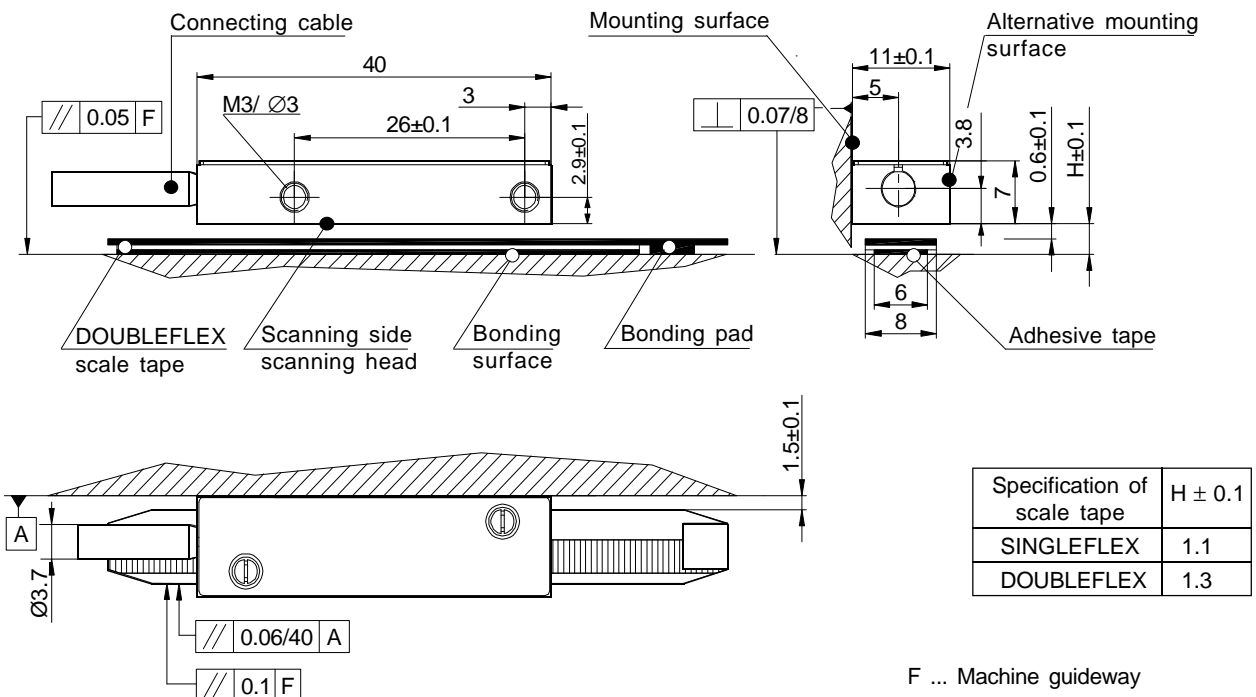


Fig. 11: Installation conditions and dimensions of LIK 22

Fig. 12: Allocation of scanning head, scale tape and measuring length for LIK 22

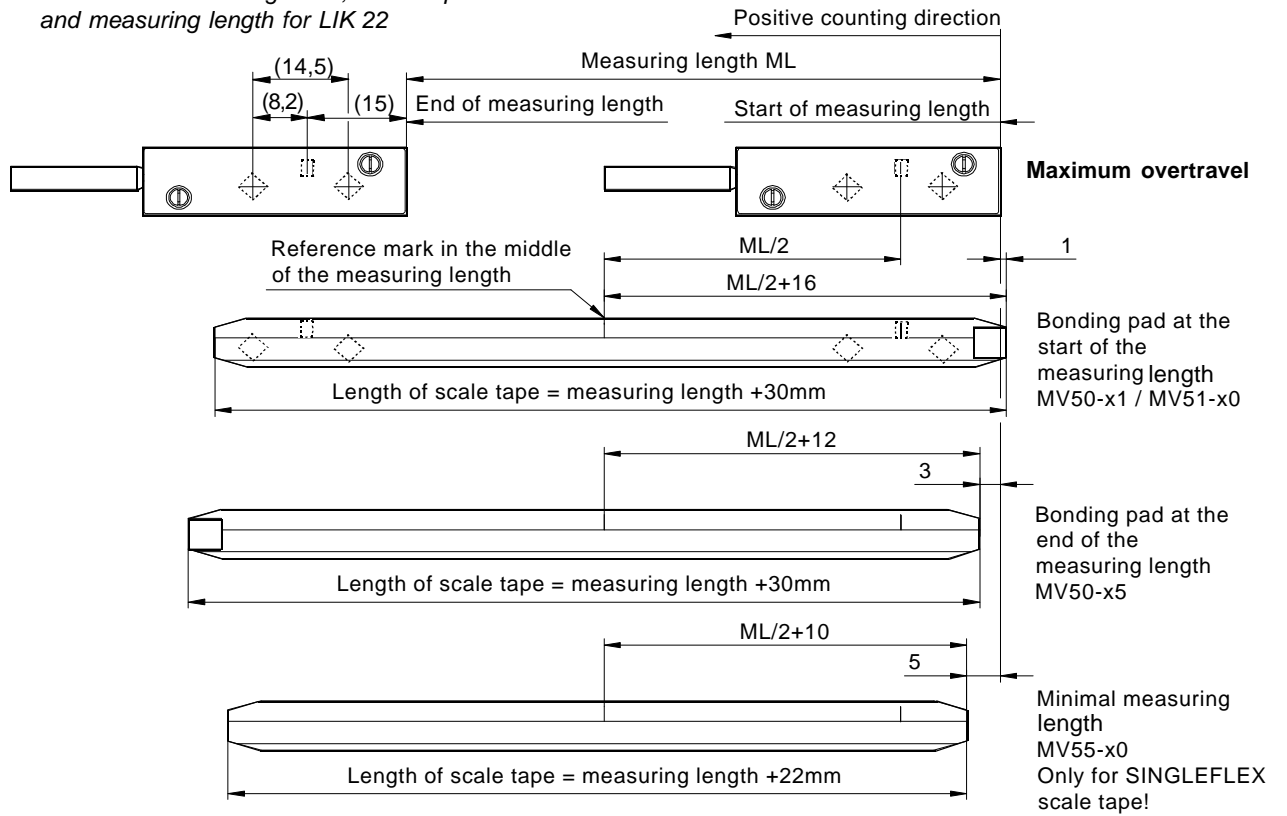
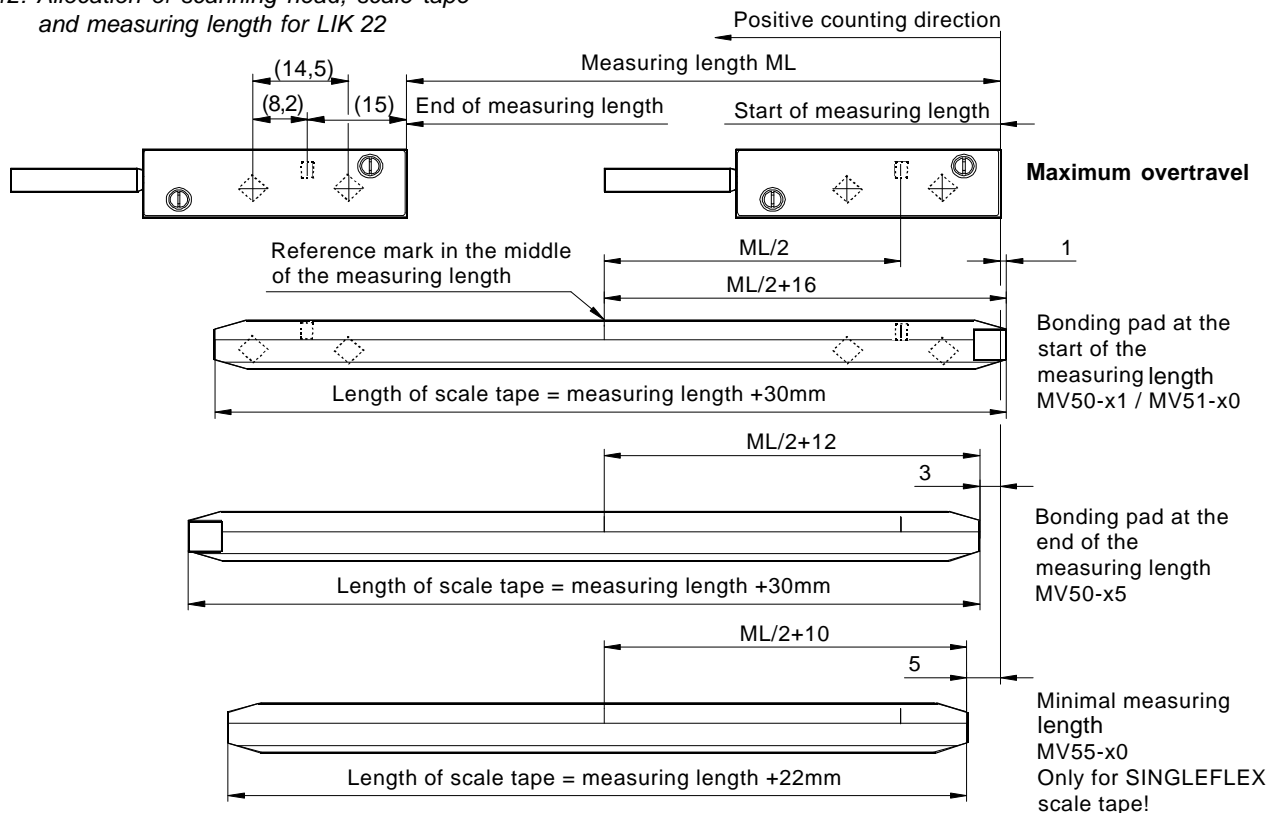


Fig. 12: Allocation of scanning head, scale tape and measuring length for LIK 22



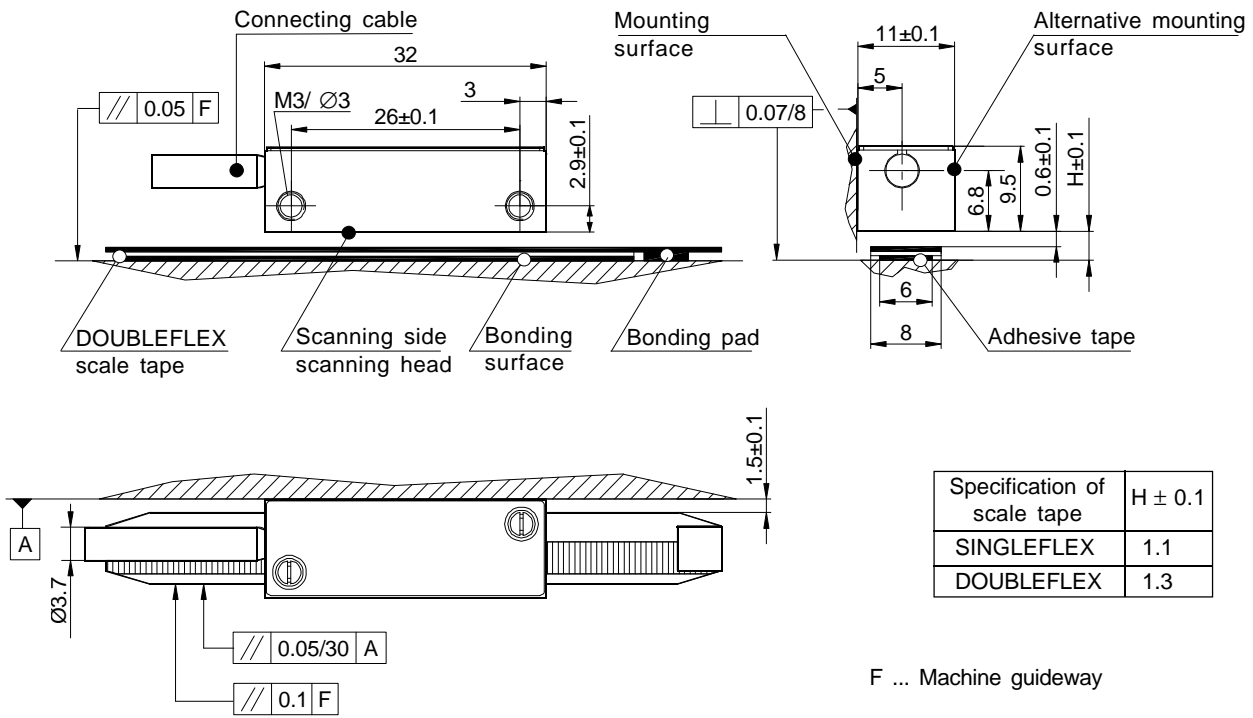


Fig.13: Installation conditions and dimensions of LIK 23

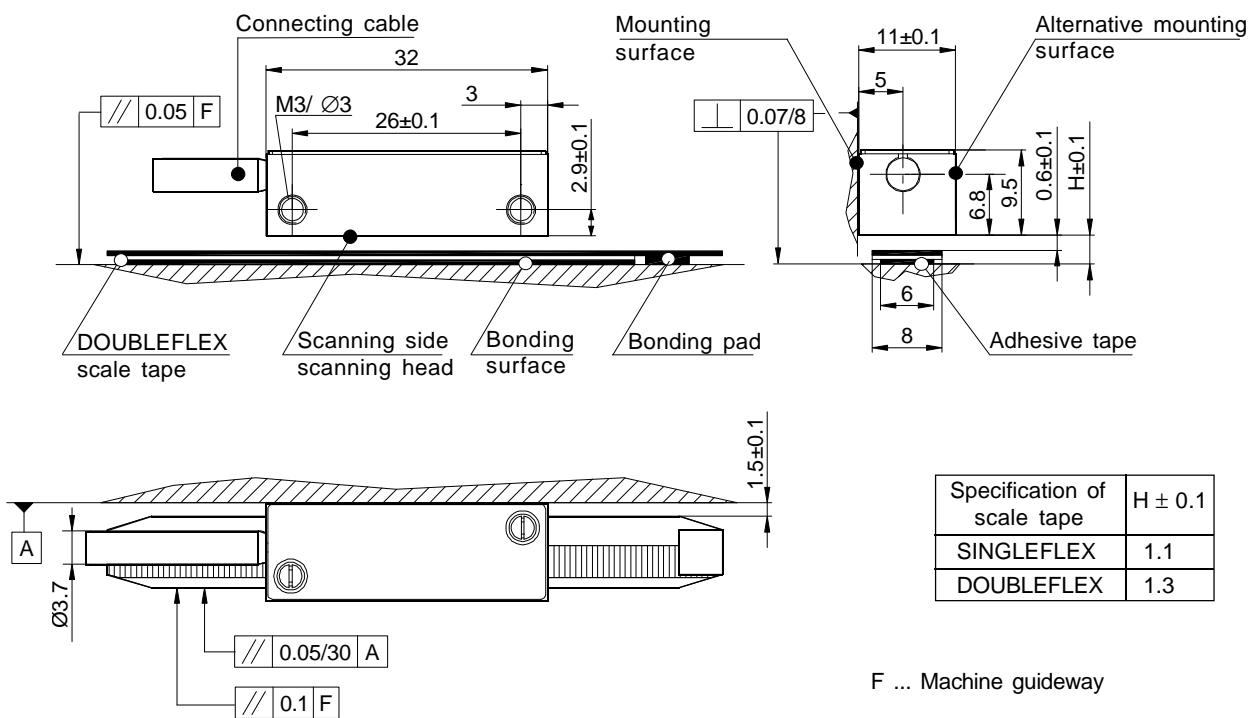


Fig.13: Installation conditions and dimensions of LIK 23



Fig.14: Allocation of scanning head, scale tape and measuring length for LIK 23

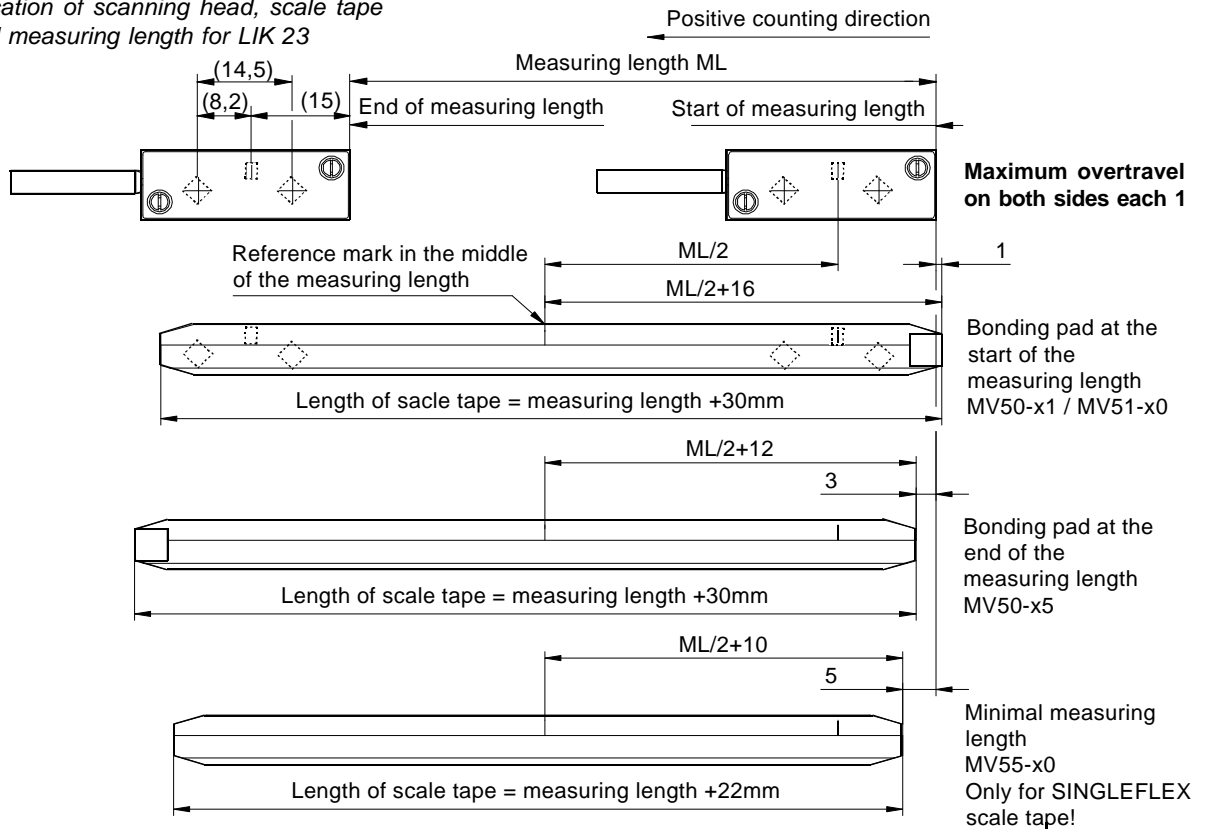
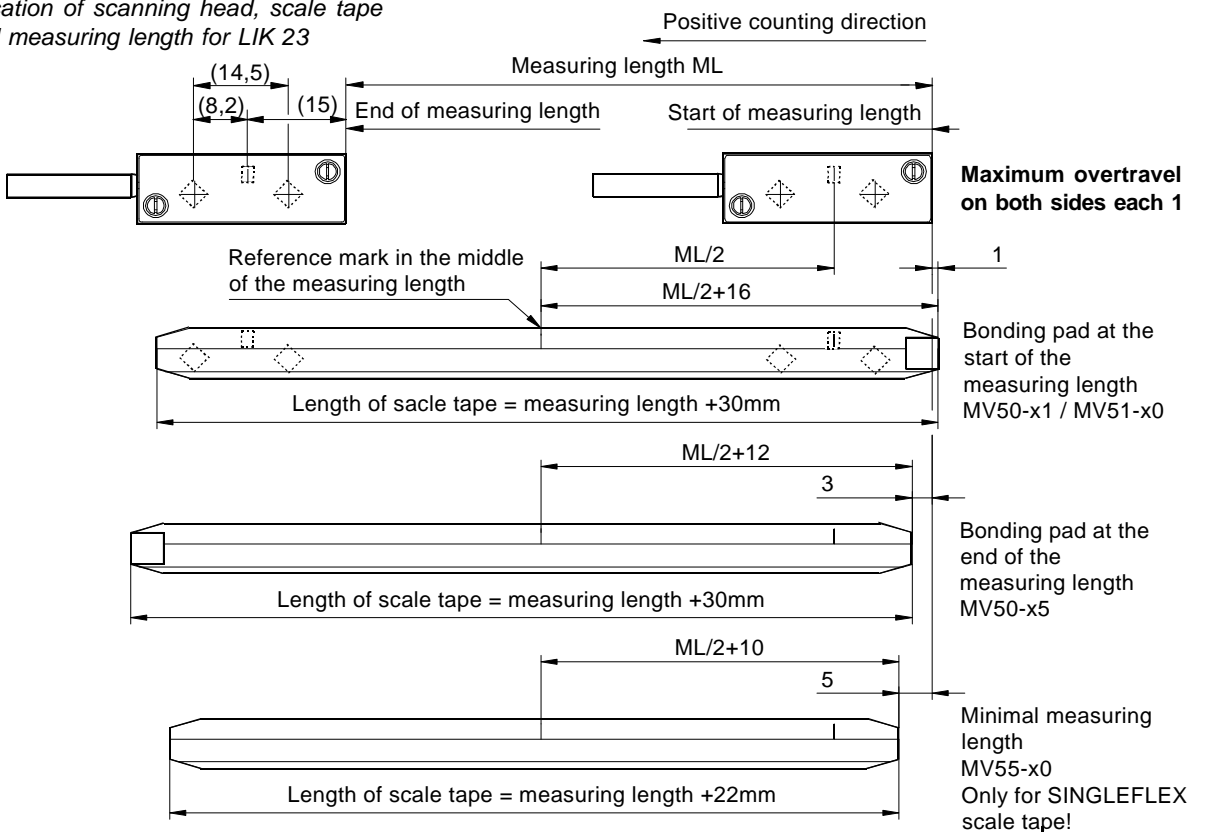


Fig.14: Allocation of scanning head, scale tape and measuring length for LIK 23



## 4 Technical specification

### Resolution and accuracy (definition)

Difference must always be made between the resolution and the accuracy of a measuring system. The two parameters are not directly interdependent and may differ from each other.

### Resolution

The resolution of linear system describes the least possible displacement of scanning head against the scale which can still be discerned by the evaluation electronics (display, control).

It depends on (see table 1)

- the graduation period of the scale
- the signal interpolation factor (internally or in auxiliary electronic unit)
- the evaluation mode in the counter

### Accuracy

The accuracy of linear measuring systems is specified in accuracy classes.

The extreme error values for any max. one-meter section of the measured length lie within the specified accuracy class of  $\pm a \mu\text{m}$  with respect to their mean value.

For measuring length up to 1 m, the tolerance ( $\pm a \mu\text{m}$ ) refers to the actual measuring lengths.

The accuracy applies to a reference temperature of 20°C.

With exposed linear measuring systems, the definition of the accuracy class applies only to the scale. This is called scale accuracy.

Table 1

Graduation period of scale	Signal period of sinus signals	Interpolation factor	Signal period after interpolation	Resolution after evaluation in counter		
				1 x	2 x	4 x
20 $\mu\text{m}$	20 $\mu\text{m}$	none	20 $\mu\text{m}$	20 $\mu\text{m}$	10 $\mu\text{m}$	5 $\mu\text{m}$
		5x	4 $\mu\text{m}$	(4 $\mu\text{m}$ )	2 $\mu\text{m}$	1 $\mu\text{m}$
		10x	2 $\mu\text{m}$	2 $\mu\text{m}$	1 $\mu\text{m}$	0,5 $\mu\text{m}$
		25x	0.8 $\mu\text{m}$	(0.8 $\mu\text{m}$ )	(0.4 $\mu\text{m}$ )	0,2 $\mu\text{m}$
		50x	0.4 $\mu\text{m}$	(0.4 $\mu\text{m}$ )	0.2 $\mu\text{m}$	0,1 $\mu\text{m}$
		100x	0.2 $\mu\text{m}$	0.2 $\mu\text{m}$	0.1 $\mu\text{m}$	0,05 $\mu\text{m}$

## 4 Technical specification

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Difference must always be made between the resolution and the accuracy of a measuring system. The two parameters are not directly interdependent and may differ from each other.

### Resolution

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It depends on (see table 1)

- the graduation period of the scale
- the signal interpolation factor (internally or in auxiliary electronic unit)
- the evaluation mode in the counter

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Table 1

Graduation period of scale	Signal period of sinus signals	Interpolation factor	Signal period after interpolation	Resolution after evaluation in counter		
				1 x	2 x	4 x
20 $\mu\text{m}$	20 $\mu\text{m}$	none	20 $\mu\text{m}$	20 $\mu\text{m}$	10 $\mu\text{m}$	5 $\mu\text{m}$
		5x	4 $\mu\text{m}$	(4 $\mu\text{m}$ )	2 $\mu\text{m}$	1 $\mu\text{m}$
		10x	2 $\mu\text{m}$	2 $\mu\text{m}$	1 $\mu\text{m}$	0,5 $\mu\text{m}$
		25x	0.8 $\mu\text{m}$	(0.8 $\mu\text{m}$ )	(0.4 $\mu\text{m}$ )	0,2 $\mu\text{m}$
		50x	0.4 $\mu\text{m}$	(0.4 $\mu\text{m}$ )	0.2 $\mu\text{m}$	0,1 $\mu\text{m}$
		100x	0.2 $\mu\text{m}$	0.2 $\mu\text{m}$	0.1 $\mu\text{m}$	0,05 $\mu\text{m}$

		LIK 21	LIK 22	LIK 23
<b>Mechanical data</b>	<b>Scanning head dimensions [mm]</b>	30 x 11 x 6	40 x 11 x 7	32 x 11 x 9.5
	<b>Weight of scanning head (without cable)</b>	3.2 g	5.5 g	5.0 g
	<b>Recommended resolution</b>	0.05 µm; 0.1 µm; 0.2 µm; 0.5 µm; 1.0 µm; 5.0 µm		
	<b>Travel speed</b>			
	- <i>maximal</i>	600 m/min resp. 10 m/s		
	- <i>depending on evaluation electronics</i>	see table 2 (page 28)		
	<b>Measuring length</b>	up to 30 m		
	<b>Scale tape</b>			
	- <i>Material</i>	steel		
	- <i>Grating period (GP)</i>	20 µm standard		
	- <i>Reference marks</i>	<ul style="list-style-type: none"> <li>- periodically every 50 mm</li> <li>- distance coded at 1000 x GP</li> <li>- at the center of the measuring length</li> <li>- others on request</li> </ul>		
	<b>Linear expansion coefficient</b>			
	- <i>DOUBLEFLEX- scale tape</i>	10.5 x 10 <sup>-6</sup> deg <sup>-1</sup>		
	- <i>SINGELFLEX- scale tape</i>	depends on material of the mounting surface		
	<b>Accuracy classes</b>			
- <i>DOUBLEFLEX- scale tape</i>	±1 µm; ±2 µm; ±3 µm; ±5 µm			
- <i>SINGELFLEX- scale tape</i>	±5 µm; other on request			

		LIK 21	LIK 22	LIK 23
<b>Mechanical data</b>	<b>Scanning head dimensions [mm]</b>	30 x 11 x 6	40 x 11 x 7	32 x 11 x 9.5
	<b>Weight of scanning head (without cable)</b>	3.2 g	5.5 g	5.0 g
	<b>Recommended resolution</b>	0.05 µm; 0.1 µm; 0.2 µm; 0.5 µm; 1.0 µm; 5.0 µm		
	<b>Travel speed</b>			
	- <i>maximal</i>	600 m/min resp. 10 m/s		
	- <i>depending on evaluation electronics</i>	see table 2 (page 28)		
	<b>Measuring length</b>	up to 30 m		
	<b>Scale tape</b>			
	- <i>Material</i>	steel		
	- <i>Grating period (GP)</i>	20 µm standard		
	- <i>Reference marks</i>	<ul style="list-style-type: none"> <li>- periodically every 50 mm</li> <li>- distance coded at 1000 x GP</li> <li>- at the center of the measuring length</li> <li>- others on request</li> </ul>		
	<b>Linear expansion coefficient</b>			
	- <i>DOUBLEFLEX- scale tape</i>	10.5 x 10 <sup>-6</sup> deg <sup>-1</sup>		
	- <i>SINGELFLEX- scale tape</i>	depends on material of the mounting surface		
	<b>Accuracy classes</b>			
- <i>DOUBLEFLEX- scale tape</i>	±1 µm; ±2 µm; ±3 µm; ±5 µm			
- <i>SINGELFLEX- scale tape</i>	±5 µm; other on request			

Table 2: Maximal travel speed depending on auxiliary electronic units

Interpolation	none	5x		10x		25x		50x		100x	
Resolution [ $\mu\text{m}$ ]	5	1		0.5		0.2		0.1		0.05	
Min. clock frequency [MHz] (of counter)	2	4	24	4	24	4	24	4	24	4	24
Min. edge separation [ $\mu\text{s}$ ]	0.5	0.25	0.042	0.25	0.042	0.25	0.042	0.25	0.042	0.25	0.042
Max. travel speed [m/min]	600	160	600	80	480	32	192	16	96	8	48

Table 2: Maximal travel speed depending on auxiliary electronic units

Interpolation	none	5x		10x		25x		50x		100x	
Resolution [ $\mu\text{m}$ ]	5	1		0.5		0.2		0.1		0.05	
Min. clock frequency [MHz] (of counter)	2	4	24	4	24	4	24	4	24	4	24
Min. edge separation [ $\mu\text{s}$ ]	0.5	0.25	0.042	0.25	0.042	0.25	0.042	0.25	0.042	0.25	0.042
Max. travel speed [m/min]	600	160	600	80	480	32	192	16	96	8	48

		LIK 21	LIK 22	LIK 23
<b>Electrical data</b>	<b>Scanning frequency</b>	max. 500 kHz		
	<b>Output interfaces and connectors</b>			
	<i>voltage output</i>	1V <sub>pp</sub> / 15 pin D Sub connector		
	<i>square wave output (RS 422)</i>	RS 422 interpolation up to 100x/ 15pin D Sub connector		
	<b>Supply voltage</b>	5V DC ±10%		
	<b>Power consumption</b>			
	<i>voltage output</i>	80 mA <sup>(1)</sup> ; 100mA <sup>(2)</sup>		
	<i>square wave output</i>	200 mA <sup>(1)</sup> ; 220 mA <sup>(2)</sup>		
		<sup>(1)</sup> ...without installation-LED; <sup>(2)</sup> ...with installation-LED		
	<b>Cable lengths</b>			
	<i>cable permanently connected to the scanning head</i>	up to 3 m (standard lengths: 0.3 m; 0.5 m; 1.0 m; 1.5 m; 2 m; 3 m)		
	<i>permissible total cable length</i>	max. 100 m for 1V <sub>pp</sub> and RS 422 output		
<b>permissible bending radius of cable</b>	8 mm for rigid configuration 40 mm for constant flexing			
<b>Ambient conditions</b>	<b>Operating temperature range</b>	0°C ... 55°C		
	<b>Storage temperature range</b>	-20°C ... +70°C		
	<b>Vibration (50Hz ... 2000Hz)</b>	≤ 200ms <sup>-2</sup>		
	<b>Shock (11ms)</b>	≤ 400ms <sup>-2</sup>		

		LIK 21	LIK 22	LIK 23
<b>Electrical data</b>	<b>Scanning frequency</b>	max. 500 kHz		
	<b>Output interfaces and connectors</b>			
	<i>voltage output</i>	1V <sub>pp</sub> / 15 pin D Sub connector		
	<i>square wave output (RS 422)</i>	RS 422 with interpolation up to 100x/ 15pin D Sub connector		
	<b>Supply voltage</b>	5V DC ±10%		
	<b>Power consumption</b>			
	<i>voltage output</i>	80 mA <sup>(1)</sup> ; 100mA <sup>(2)</sup>		
	<i>square wave output</i>	200 mA <sup>(1)</sup> ; 220 mA <sup>(2)</sup>		
		<sup>(1)</sup> ...without installation-LED; <sup>(2)</sup> ...with installation-LED		
	<b>Cable lengths</b>			
	<i>cable permanently connected to the scanning head</i>	up to 3 m (standard lengths: 0.3 m; 0.5 m; 1.0 m ; 1.5; m; 2 m; 3 m)		
	<i>permissible total cable length</i>	max. 100 m for 1V <sub>pp</sub> and RS 422 output		
<b>permissible bending radius of cable</b>	8 mm for rigid configuration 40 mm for constant flexing			
<b>Ambient conditions</b>	<b>Operating temperature range</b>	0°C ... 55°C		
	<b>Storage temperature range</b>	- 20°C ... + 70°C		
	<b>Vibration (50Hz ... 2000Hz)</b>	≤ 200ms <sup>-2</sup>		
	<b>Shock (11ms)</b>	≤ 400ms <sup>-2</sup>		

**Scale tape** Designation example

**MV 5 0 - 1 1 B P 00770**

Material

5	steel tape/ double array sensor
---	---------------------------------

Design type

0	DOUBLEFLEX, standard <sup>3</sup>
1	SINGLEFLEX, standard
5	minimal measuring length with reference mark <sup>1,4</sup>

Accuracy class

1	± 1 µm
2	± 2 µm
3	± 3 µm
4	± 5 µm

Position of bonding pad

0	none <sup>1</sup>
1	at the start of measuring length <sup>2</sup>
3	without adhesive tape
5**	at the end of measuring length <sup>2</sup>

measuring length (ML) [mm]

Grating period (GP)

P	20 µm
---	-------

Position of reference mark (RM)

O	none
B	RM in the center of the measuring length
F	RM distance coded at 1000 * GP <sup>5</sup>
N	RM at 50 mm spacings, starting at the center of measuring length
E**	customized version <sup>6</sup>

- 1) ... only for SINGLEFLEX scale tape
- 2) ... only for DOUBLEFLEX scale tape
- 3) ... minimal measuring length of DOUBLEFLEX scale tape= 100 mm  
maximal measuring length of DOUBLEFLEX scale tape= 7300 mm
- 4) ... measuring length + 22 mm
- 5) ... maximal measuring length= 8000m
- 6) ... specified in XXX mm from start of measuring length
- \*\* ) ... no standard, supplied with surcharge

**Scale tape** Designation example

**MV 5 0 - 1 1 B P 00770**

Material

5	steel tape/ double array sensor
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Design type

0	DOUBLEFLEX, standard <sup>3</sup>
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- \*\* ) ... no standard, supplied with surcharge

Designation example

**LIK 2 1 - L 4 1 - T Z**

**Scanning head**

Sensor

2	Two field sensor
---	------------------

Dimension (mm)

1	30 - 11 - 6
2	40 - 11 - 7
3	32 - 11 - 9.5

Grating period

P	20 µm
---	-------

Output signals

C	sinusoidal signal 1 V <sub>pp</sub>
L	square wave signal RS 422 with 5x interpolator
M	square wave signal RS 422 with 10x interpolator
I	square wave signal RS 422 with 25x interpolator
N	square wave signal RS 422 with 50x interpolator
P	square wave signal RS 422 with 100x interpolator

Connectors on cable

Z	15pin D Sub; electronic in the connector
---	--

Cable fixed to the scanning head (Æ= 3.7mm)

R	0.3 m
S	0.5 m
T	1 m
P	1.5 m
V	2 m
W	3 m
U <sup>1</sup>	other length on request

Version

-	standard
3 <sup>1</sup>	unmagnetic scanning head
K	installation- LED in the connector
N	nonmagnetic scanning head; installation- LED in the connector

Installation conditions

2	thread M3 in the scanning head
1 <sup>2</sup>	bore Ø 3 in the scanning head

frequency/ edge separation

X	distinguishing mark for clock frequency of counter on request (only valid for versions with interpolation)
---	--

1... supplied with surcharge  
2... only for LIK 22 and LIK 23

Designation example

**LIK 2 1 - L 4 1 - T Z**

**Scanning head**

Sensor

2	Two field sensor
---	------------------

Dimension (mm)

1	30 - 11 - 6
2	40 - 11 - 7
3	32 - 11 - 9.5

Grating period

P	20 µm
---	-------

Output signals

C	sinusoidal signal 1 V <sub>pp</sub>
L	square wave signal RS 422 with 5x interpolator
M	square wave signal RS 422 with 10x interpolator
I	square wave signal RS 422 with 25x interpolator
N	square wave signal RS 422 with 50x interpolator
P	square wave signal RS 422 with 100x interpolator

Connectors on cable

Z	15pin D Sub; electronic in the connector
---	--

Cable fixed to the scanning head (Æ= 3.7mm)

R	0.3 m
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T	1 m
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frequency/ edge separation

X	distinguishing mark for clock frequency of counter on request (only valid for versions with interpolation)
---	--

1... supplied with surcharge  
2... only for LIK 22 and LIK 23



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**LIK-A-e-03/03**

Subject to change without notice 03/03



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