

## INDEX

<b>1</b>	<b>Features and Applications</b>	4
<b>2</b>	<b>General information</b>	6
2.1	General specifications and notes	6
2.2	Notes on Legal Requirements	7
2.3	Notes on Transport, Storage and Handling	7
2.4	Notes on Operation	8
2.5	Notes on Maintenance	8
2.6	Environmental Protection and Disposal	9
2.7	Nameplate	9
<b>3</b>	<b>Setup of the linear LIKselect - measuring system</b>	10
3.1	Setup <b>with</b> connector Printed circuit board (PCB)	10
3.2	Setup <b>without</b> connector PCB	11
<b>4</b>	<b>Technical Properties</b>	12
4.1	Resolution and Accuracy (Definition)	12
4.2	Reliability	13
4.3	Ambient conditions	14
4.4	Attainable traversing speed	14
4.5	Online compensation (Offset and amplitude control)	14
<b>5</b>	<b>Technical Data</b>	16
5.1	Mechanical Data	16
5.1.1	Encoder LIKselect	16
5.1.2	Permissible mounting tolerances	16
5.1.3	Scale tape properties	17
5.1.4	MI SINGLEFLEX scale tape	17
5.1.6	Counting Direction	18
5.1.7	Cables	18
5.2	Electrical Data	20
5.2.1	Electromagnetic Compatibility (EMC)	20
5.2.2	Connection PCB	21
5.2.3	PIN assignments for inputs & outputs (LA1 & X <sub>1</sub> & X <sub>2</sub> & X <sub>3</sub> )	22
5.2.4	PIN assignments for 15-pin D-Sub connector	22
5.2.5	Shielding concept	23
5.2.6	Voltage Output 1 V <sub>pp</sub>	24
5.2.7	Square-Wave Output RS-422	25

<b>6</b>	<b>Mounting Drawing - LIKselect</b>	26
6.1	Scanning head LIKselect	26
6.2	Correlation of measuring head, measuring tape and measuring length	27
6.3	Sensor frame - Examples for LIKselect	28
6.3.1	Frame B	28
6.3.2	Frame C	28
6.3.3	Sensor without frame	29
<b>7</b>	<b>General Installation Notes</b>	30
7.1	Delivery Contents	30
7.2	Installation Position	30
7.3	Mounting Steps	31
<b>8</b>	<b>Signal Adjustment</b>	38
8.1	Signal adjustment with ADJUSTMENT TOOL & EPIFLEX-Adapter	38
8.1.1	Functions of the ADJUSTMENT TOOL	38
8.1.2	Functions of the EPIFLEX Adapter	39
8.2	Dynamic offset and amplitude Control (Online Compensation)	39
8.3	Scope of delivery	39
8.3.1	Scope of delivery ADJUSTMENT & EPIFLEX TOOL Set	39
8.3.2	Scope of delivery ADJUSTMENT TOOL	40
8.3.3	Scope of delivery EPIFLEX Adapter	40
8.3.4	Scope of delivery Adapter-Set LIKS1 analog und digital	40
8.4	EPIFLEX Pro Software	41
8.5	Wiring diagram ADJUSTMENT & EPIFLEX TOOL-Set	42
8.6	Signal adjustment with NPA - NUMERIK PWT Adapter and PWT 101	42
8.6.1	Connection procedure	43
8.6.2	Wiring diagramm	44
8.6.3	Notes on connection	44
8.7	Comparison of the different adjustment variants	45
<b>9</b>	<b>Cleaning</b>	45
<b>10</b>	<b>Troubleshooting</b>	46
<b>11</b>	<b>Order information</b>	47
11.1	Ordering key - Scanning head LIKselect	47
11.2	Speed Chart for LIKselect Series	48
11.3	Ordering key - Scale tape MI for LIKselect	49
11.4	Order Information for Accessories	50

**The new LIK series stands for versatile configuration options, flexible integration, and miniaturization of applications.**

The brand-new scanning module with integrated sensor electronics offers multiple improvements:



Make your **IDEAS** come true

High number of variants due to modular design and individually adaptable components



Save **SPACE**

Considerable space savings for integration thanks to a highly compact and low-profile design



Precise **POSITIONING**

High signal quality and stability thanks to a new sensor design and three separate scanning fields

## 1 Features and Applications

Position encoders in drive systems have to meet high and controversial demands, especially in linear drive systems. The demands opposing each other are high accuracy and resolution on the one hand and low mass, small dimensions and high measuring speed on the other hand.

The graduated scale is definitive for the quality of a linear encoder. Requirements for maximum position deviations of  $\pm 2 \mu\text{m}$  per meter or less are no rarity. The emphasis is mostly on the avoidance of shortrange errors, since long-range errors, mostly linear error components, can often be compensated.

The concentration of multiple axes in motion in very tight spaces, such as in semiconductor-producing machines, requires the miniaturization of the drives, guideways and encoders.

High machining speeds and therefore high accelerations make low masses of the components in motion essential.

The *LIK* series of incremental encoders from NUMERIK JENA are equipped with features which are supposed to fulfill these high requirements in an ideal way.

- Due to an interpolation up to 64-times a resolution down to 78,125 nm is possible without any additional electronics.
- The permissible traversing speed for a sinusoidal signal output amounts to 10 m/s. A square wave signal output with a resolution of 0.1  $\mu\text{m}$  allows a permissible traversing speed of 1.6 m/s.
- The short-range position errors (interpolation errors) were significantly reduced by introducing an electronic compensation of amplitude and offset deviations of the coarse signals. This compensation functions without following error in all velocity ranges.

## Applications:

- Production and inspection machines for the semiconductor industry
- Linear units, drives and coordinate tables
- Measuring machines and measuring microscopes
- Positioning and measuring devices for medical technology
- Precision devices for reprography
- Precision machining
- Robotics

## Additional features:

- Wide range of integration and configuration options through modular system
- Compact size and ultra flat design
- Customizable sensor frames and housings available
- Reference signal(s) with repeatability accurate to a specific increment, regardless of the direction from which the reference mark(s) is/are traversed
- Special, easy to mount scale tape (SINGLEFLEX scale tape) for a variety of applications and ambient conditions
- Possibility of electronic signal adjustment (signal optimization after mounting)

## 2 General information

### 2.1 General specifications and notes

- Make sure to familiarize yourself thoroughly with the contents of these installation instructions before installing and starting up the encoder!
- Please contact the support of NUMERIK JENA GmbH or an authorized representation for further information. Please visit the NUMERIK JENA website to get the contact information.
- NUMERIK JENA GmbH is not liable for damages caused by unauthorized handling of the encoders. Any unauthorized handling leads to forfeiture of all warranty claims.
- The encoders are guaranteed to function if the mounting and operating conditions are maintained as stated in these mounting instructions.
- Make sure to follow the right sequence of the mounting steps during mounting.
- NUMERIK JENA GmbH does not assume any liability for any damages or operating errors caused by incorrect installation or operation.
- The stated tolerances must be maintained in order to achieve the accuracies listed in the specifications!
- If the machine tolerances exceed the tolerances stated in the mounting instructions, errors can occur in both the operation and during measuring. NUMERIK JENA GmbH assumes no liability for this.
- Please refer to the operating manuals and safety instructions included with the devices to ensure the reliable operation of the encoder systems, especially pertaining to: Auxiliary electronic units, Counters, Displays, Controllers, Encoders, Base mechanical devices (machine tools)
- Please pay attention to the safety instructions and warning symbols!



Danger to the device or the function of the device!



Pull the plug!



Highly inflammable!

**The installation of the measuring systems requires good mechanical and electronic knowledge and a precise and safe working practice!  
Assembly should only be carried out by a trained specialist in compliance with the local safety regulations!**

## 2.2 Notes on Legal Requirements



- The NUMERIK JENA encoders conform to EC standards and carry the CE mark.
- NUMERIK JENA encoders fulfill the requirements of the (German) Product Safety Act (ProdSG) from November 8<sup>th</sup>, 2011.
- Connect NUMERIK JENA encoders only to subsequent electronics whose power supply is generated from PELV systems (EN 50178).
- NUMERIK JENA encoders fulfill the requirements of standard IEC 61010-1 only if the power is supplied from a secondary circuit with current limitation as per IEC 61010<sup>3rd Ed.</sup>, Section 9.4 or with power limitation as per IEC 62368-1 2nd Ed., section 6.2.2.5 PS2 or from a Class 2 secondary circuit as specified in UL1310.\*
- This user manual supersedes all previous editions, which thereby become invalid. The basis for ordering from NUMERIK JENA is always the user manual edition valid when the contract is made.
- Standards (ISO, EN, etc.) apply only where explicitly stated in the user manual.

NUMERIK JENA has tested its products to ensure the use of non-hazardous materials in accordance with the European Directives 2011/65/EU (RoHS). For any other needed Manufacturer's Declaration, please contact your sales agency.

### NUMERIK JENA GmbH

Im Semmicht 4

07751 Jena

Germany or [www.numerikjena.de](http://www.numerikjena.de). Other countries on request.

## 2.3 Notes on Transport, Storage and Handling

### Encoder

**Use only the original packaging for transportation!**  
**If possible, use only the original packaging for storage.**



### SINGLEFLEX Scale Tape

- Can be rolled up (minimum bending radius = 140 mm).
- No restrictions regarding to the length.

\* In place of IEC 61010-1 3rd Ed., Section 9.4, the corresponding sections of standards DIN EN 61010-1, EN61010-1, UL 61010-1 and CAN/CSA-C22.2 No. 61010-1 can be applied and in place of IEC 62368-1 2nd Ed., section 6.2.2.5 PS2 the corresponding sections of standards DIN EN62368-1, EN62368-1, UL62368-1, CAN/CSA-C22.2 No. 62368-1 can be applied.

## 2.4 Notes on Operation



**Do not connect or disconnect plugs if the power is on!**



- Only operate the encoder with the supply voltage stated in this product data sheet.
- Comply with applicable PIN assignment if auxiliary electronic units are connected (e.g. controller or display)!
- Integrate exposed encoders in instruments, devices or machines in such a way that they are protected against contamination.
- Protect the scale tape against mechanical damage.
- Protect the scanning head against shock, impact and humidity.

## 2.5 Notes on Maintenance



**When cleaning the encoder, ensure that no solvent flows under the scale tape!**



**When cleaning the components, ensure that the scanning window and scale tape are not scratched by any deposited particles!**



**Please also pay attention to the notes in chapter 11 „Cleaning“.**

- The encoder requires no maintenance whatsoever, but must be cleaned occasionally, depending on the ambient conditions.
- Modifications and repairs of the encoder may only be carried out by NUMERIK JENA GmbH or appropriately authorized persons.
- NUMERIK JENA GmbH is not liable for damages caused by unauthorized handling of the encoder. All warranty claims are forfeited by unauthorized handling.
- Exposed measuring systems are sensitive to contamination, especially the scale surface and the scanning windows for the counting and reference tracks on the scanning head.
- Particularly critical are rough and irregular contamination and deposits (e.g. oil, grease or water).
- The user has to protect the encoder from contamination by way of appropriate design measures.



## 2.6 Environmental Protection and Disposal



Environmental damage due to incorrect disposal of the product, accessories or peripherals!

- Do not dispose in domestic waste.
- Dispose only by authorized collection points. Electrical waste and electronic components are subject to special-waste regulations.
- Observe the applicable country-specific regulations.

More detailed information on legal regulations can be obtained from competent authorities.

## 2.7 Nameplate

The nameplate is located on the outer packaging of the **LIKselect** measuring head. This must be kept in order to be able to identify the device in case of any queries. Alternatively, the serial number can be determined via the EPIFLEX Pro software when using the ADJUSTMENT & EPIFLEX TOOL Set. The Data Matrix Code can also be identified on the sensor surface below the company logo.

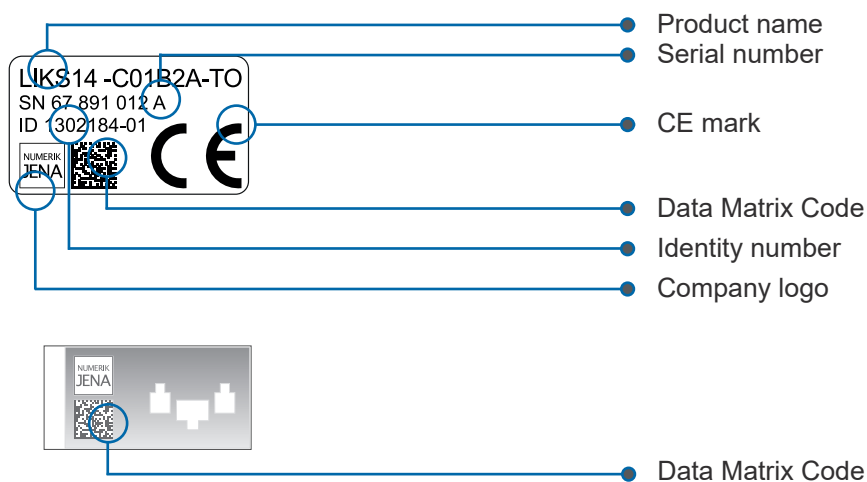


Image 1



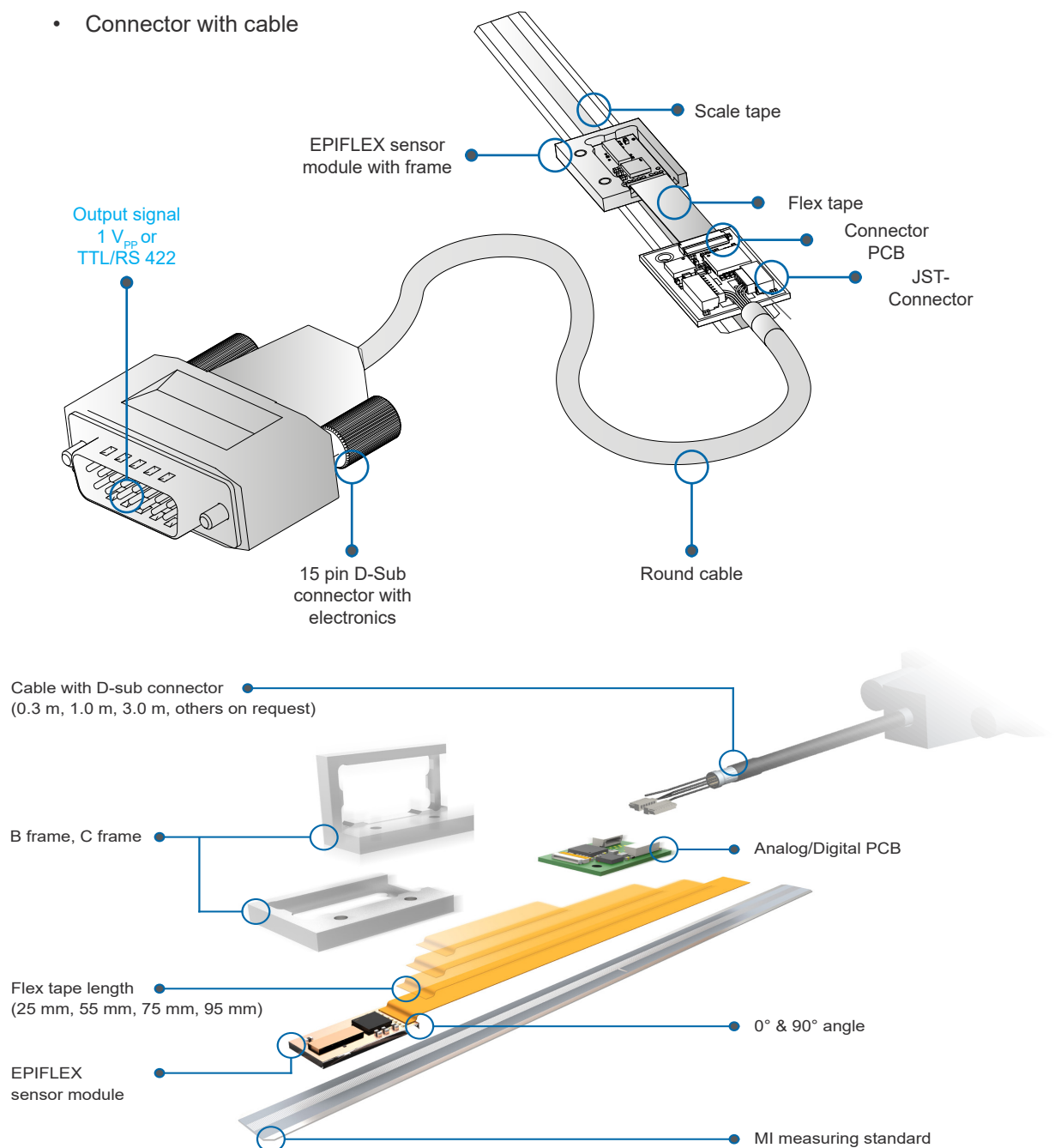
When working with the EPIFLEX Pro software, always ensure that you are using the latest version. This is available for download at [www.numerikjena.de](http://www.numerikjena.de).

## 3 Setup of the linear LIKselect - measuring system

### 3.1 Setup *with connector Printed circuit board (PCB)*

This setup consists of the following components:

- EPIFLEX sensor module
- Measuring standard with graduation and reference mark
- PCB with integrated electronics (1 V<sub>SS</sub> oder TTL/RS 422)
- Connector with cable



## 3.2 Setup *without* connector PCB

This setup consists of the following components:

- EPIFLEX sensor module, mounted in a frame
- Measuring standard with graduation and reference mark

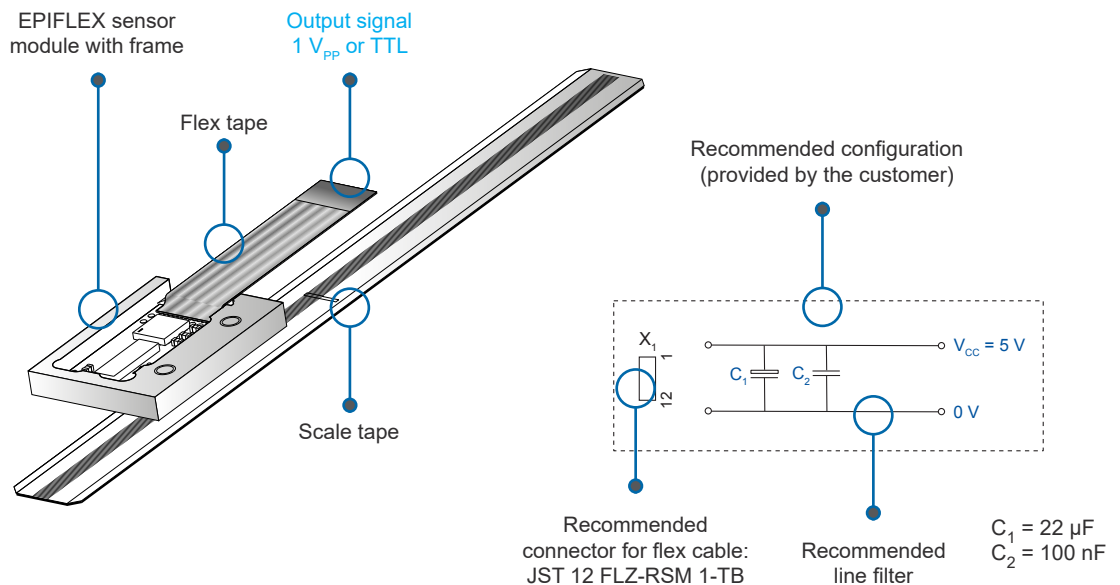


Image 3



For LIKselect product versions without PCB, the adapter set LIKS1 digital/analogue - consisting of PCB, cable and D-Sub connector - can be obtained separately for adjustment. For more information, see chapter 11.5 „Accessories ordering information“.



**Note:**

The contact between the LIKselect and the ADJUSTMENT TOOL is made with the EPIFLEX adapter. For adjustment using the PWT 101 from Heidenhain, the NUMERIK PWT adapter (NPA) and the NPA software module are required.

## 4 Technical Properties

### 4.1 Resolution and Accuracy (Definition)

Basically one has to differentiate 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 chart 1)

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

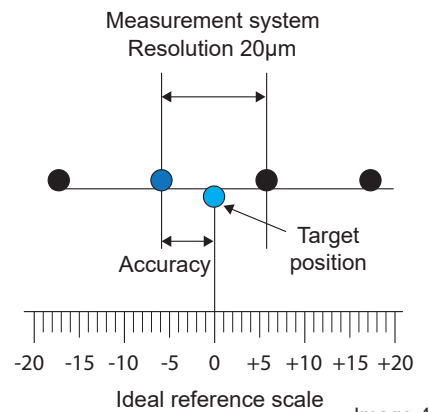


Image 4

Grating period of scale tape	Signal period of sinusoidal signals	Interpolation factor	Signal period after interpolation	Resolution after evaluation in counter
				4-times
20 µm	20 µm	none/1-times	20 µm	5 µm
		5-times	4 µm	1 µm
		10-times	2 µm	0.5 µm
		25-times	0.8 µm	0.2 µm
		50-times	0.4 µm	0.1 µm
		64-times	312.5 nm	78.125 nm

Chart 1

#### 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.

## 4.2 Reliability

With its compact dimensions, the exposed linear encoder from NUMERIK JENA is equipped with two scanning fields. The scanning signals are generated by two large 1.1 mm<sup>2</sup> sensor fields.

Local contamination on the measuring element such as dust, fingerprints or particles have only a minor effect on the signal amplitude, as the ASIC SV4 installed in the measuring head monitors the signals and eliminates any deviations in the amplitude.

If the signal amplitude decreases due to the presence of contamination on the measuring scale, the sensor amplifier readjusts by increasing the signal amplification. The output signals do not change in offset and phase position. The result is a constant signal shape.

This measuring system is especially suitable for applications that require high reliability.

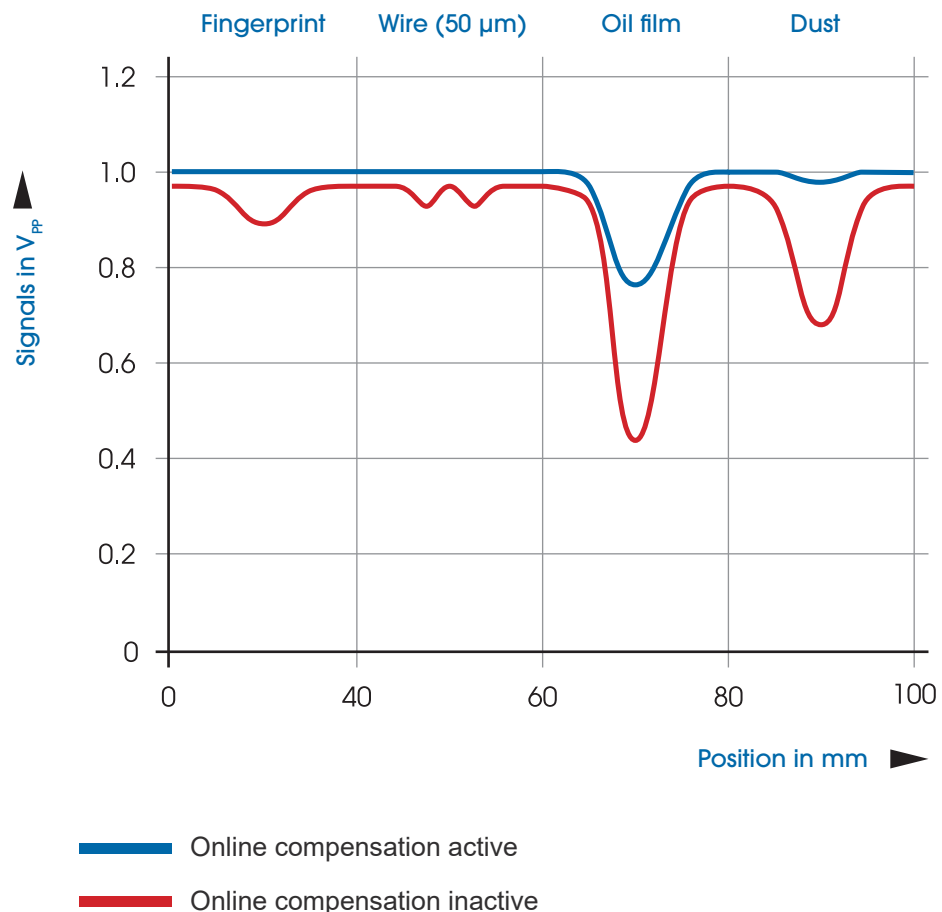


Image 5

## 4.3 Ambient conditions

Ambient condition	LIKselect
Operating temperature range	0°C to +55°C (+32°F to +131°F)
Storage temperature range	-20°C to +70°C (-4°F to +158°F)
Vibration (50 Hz ... 2500 Hz)	≤200 m/s <sup>2</sup>
Shock (11 ms)	≤400 m/s <sup>2</sup>
Humidity (40°C / 104°F)	93% relative humidity (no condensation forming)

Chart 2

## 4.4 Attainable traversing speed

The maximum attainable traversing speed of the encoder is determined by the maximum output frequency of the interpolator and/or the maximum counting frequency of the operator's evaluation electronics.

In order to avoid counting errors, the interpolator's output frequency is matched to the counting frequency of the operator's evaluation electronics. This adaptation is possible in discrete frequency steps. For the selection of the appropriate interpolation factor or speed factor, see the chart in chapter 11.

## 4.5 Online compensation (Offset and amplitude control)

Contamination and mounting errors lead to interferences in the optical scanning of the scale by the scanning head and so to periodic deformations of the sinusoidal counting track signals, which are exemplified as

- Offset deviations
- Amplitude deviations
- Amplitude differences between the sine and cosine channels

and lead to interpolation errors.

## Contaminated scale tape

Scanning head signal with contaminated scale tape before activation of the online compensation.

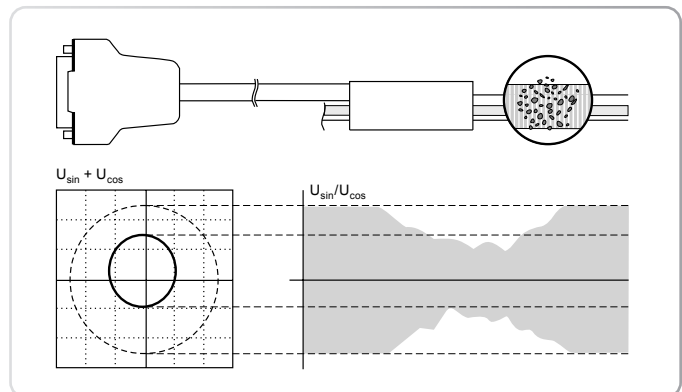


Image 6

## Incorrect mounting

Scanning head signal with faulty mounting before activation of the online compensation.

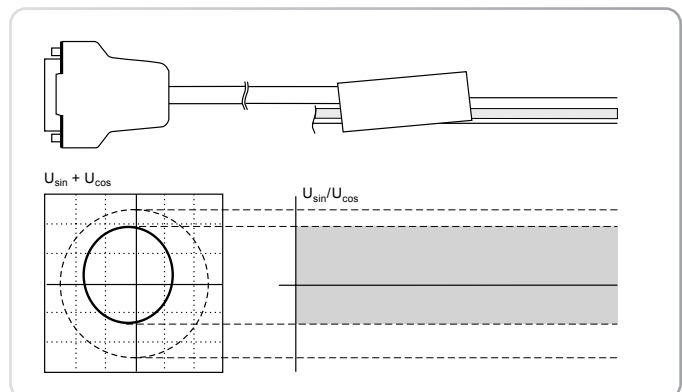


Image 7

## Active online compensation

Scanning head signal with contaminated scale tape and/or faulty mounting after activation of the online compensation.

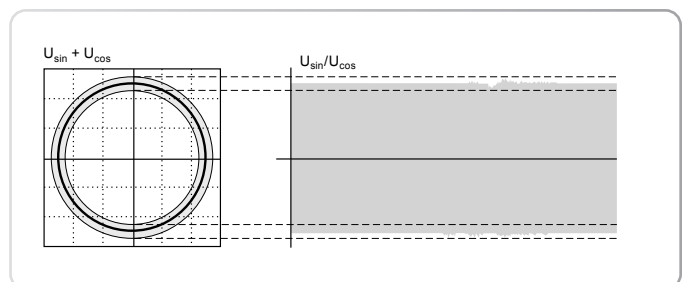


Image 8

The offset and amplitude control automatically corrects the signals generated by the measuring module within the sensor for the entire speed range without following error over the entire velocity range. This improves the accuracy as well as the reliability and the functional reserves.

## 5 Technical Data

### 5.1 Mechanical Data

#### 5.1.1 Encoder LIKselect

Parameter	LIKselect	
Dimensions of scan head (in mm; WxHxD)	A (without frame)	8 x 16 x 2,2
	Frame B	13 x 20,5 x 8,2
	Frame C	15 x 20,5 x 2,5
Weight of scan head (w/o flex cable/cable/connector)	Without frame	1 g (only sensor)
	Frame B	2 g
	Frame C	2 g
Frame - Material	Aluminum (with surface coating SurTec 650)	
<b>Traversing speed</b>		
depending on auxiliary electronic unit	see Speed Chart	

Chart 3

#### 5.1.2 Permissible mounting tolerances

Mounting tolerances/coordinates for LIKselect scanning heads	
<b>Working distance</b> (air gap between sensor and scale)	
1.4 mm	
<b>Mounting tolerances / Position deviations*</b>	
$\Delta Z = \pm 0.2 \text{ mm}$	
$\Delta Y = \pm 0.4 \text{ mm}$	
$\varphi Z = \pm 0.2^\circ (\pm 12')$	
$\varphi Y = \pm 1.0^\circ (\pm 60')$	
$\varphi X = \pm 1.0^\circ (\pm 60')$	

Chart 4

\* These cumulative tolerances include mounting tolerances and guideway errors during operation. The mounting tolerances are only valid for one degree of freedom at a time.



## 5.1.3 Scale tape properties

Scale tape MI	SINGLEFLEX
Grating period (TP)	20 µm
Material	Stainless steel
Reference marks	<ul style="list-style-type: none"> <li>• In the middle of the measuring length (ML)</li> <li>• Without reference mark</li> <li>• In 50 mm intervals beginning at midpoint of ML</li> <li>• Customer specific reference mark</li> </ul>
Measuring length (ML)	Up to 2490 mm with centered reference mark  (other versions/lengths on request)
Linear thermal expansion coefficient $\alpha$ (expansion will be influenced by the mounting surface)	$10,5 \times 10^{-6} \text{ K}^{-1}$
Accuracy grade* (referred to 20°C)	<ul style="list-style-type: none"> <li>• <math>\pm 3 \text{ µm/m}</math></li> <li>• <math>\pm 5 \text{ µm/m}</math></li> </ul>
Baseline error	$\pm 750 \text{ nm} / 50 \text{ mm}$

\* (ML < 1 m related to measuring length; otherwise related to 1 m)

Chart 5

## 5.1.4 MI SINGLEFLEX scale tape

The SINGLEFLEX scale tape consists of a single steel tape with an applied incremental track and one reference mark (more reference marks are possible within the scope of a special design). The scale tape is equipped with a double-sided adhesive tape and can be mounted easily on the machine element.

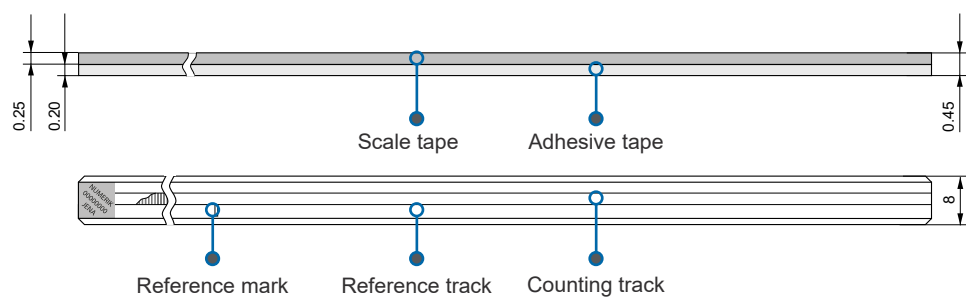


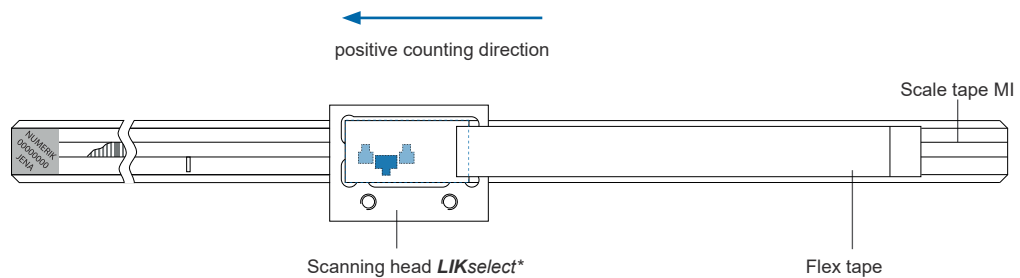
Image 9

## 5.1.6 Counting Direction

The alignment of the measuring standard depends on the mounting position of the scanning head. Ensure that the scanning head's scanning fields for the counter and reference tracks are over the corresponding tracks on the measuring standard.

\* View of the sensor from above through the housing

Image 11



## 5.1.7 Cables

Cable	
Cable diameter	3.7 mm
Permissible bending radius (for stainless steel)	<ul style="list-style-type: none"> <li>Occasional flexing ~8 mm</li> <li>Constant flexing ~40 mm</li> </ul>
From scan head to the D-Sub connector	<ul style="list-style-type: none"> <li>0.30 m</li> <li>1.00 m</li> <li>3.00 m</li> <li>maximum total length: 3,00 m</li> </ul>

Chart 6





### 5.1.7.1 Scanning Head Cable (Connection cable from scanning head to D-Sub connector)

- Please mount the scanning head preferably on the rigid part and the scale tape on the mobile part of the machine. If this is not possible, provide a strain relief for the cable near the scanning head.
- The encoder cables and connecting cables must be laid away from sources of interference (e.g. mains cables, fuses, motors, magnetic valves or power supplies). Normally a distance of  $\geq 100$  mm will be sufficient.
- Install the cable in a way that it cannot be damaged by the moving carriage. Please pay attention to the permissible bending radius (see also 5.1.4 - "Mechanical data")!

## 5.1.7.2 Extension Cable (Connection Cable from D-Sub Connector to Controller)

- Use preferably original extension cables made by NUMERIK JENA. This guarantees an optimum compatibility with the encoders and ensures a maximum protection against electromagnetic interferences.
- Please consult the technical support of NUMERIK JENA before using selfmanufactured extension cables.
- Do not install any other signal lines in the encoder cable!

## 5.2 Electrical Data

Parameter		LIKselect
Scanning frequency		max. 500 kHz
Supply voltage		5 V ± 10%
Output interfaces		
Voltage output		1 V <sub>PP</sub>
Square wave output		RS-422 with interpolation up to 64-times (Version with PCB)
		TTL with interpolation up to 64-times (Version without PCB)
Current consumption		
Voltage output		≤ 50 mA*
Square wave output TTL/RS 422		≤ 150 mA*
Interpolation error (highest resolution - with the interpolation factor 64)		
typical maximum value		±85 nm

\* with 120 Ω load resistance

Chart 7

### 5.2.1 Electromagnetic Compatibility (EMC)

Please observe the following to ensure maximum protection against electrical and magnetic fields:

- The encoder must be mounted to a galvanic conductive surface. The mounting surfaces, the threads of the mounting screws and the threads in the machine must be free from electrically non-conductive coatings.
- Maintain the NUMERIK JENA GmbH shielding concept for the measuring system!
- Shielding for encoders without connectors:
  - When connected directly with the evaluation electronics, ensure that the external shield of the cable is well grounded
  - If cable connectors (e.g. terminal strips, etc.) are used, connect the external shields of the cables with each other and with the shielding of the cable connector
- When using additional electronics, connect the housing electrically conducting to ensure good galvanic conductivity. For insulated installation the housing should be connected at the shortest distance by an additional potential equalization line (Cu line with cross section ≥6 mm<sup>2</sup>) with the machine's protective ground.
- Please contact the NUMERIK JENA support or that of the appropriate manufacturer if you experience any problems when working with specific display or control units.

## 5.2.2 Connection PCB

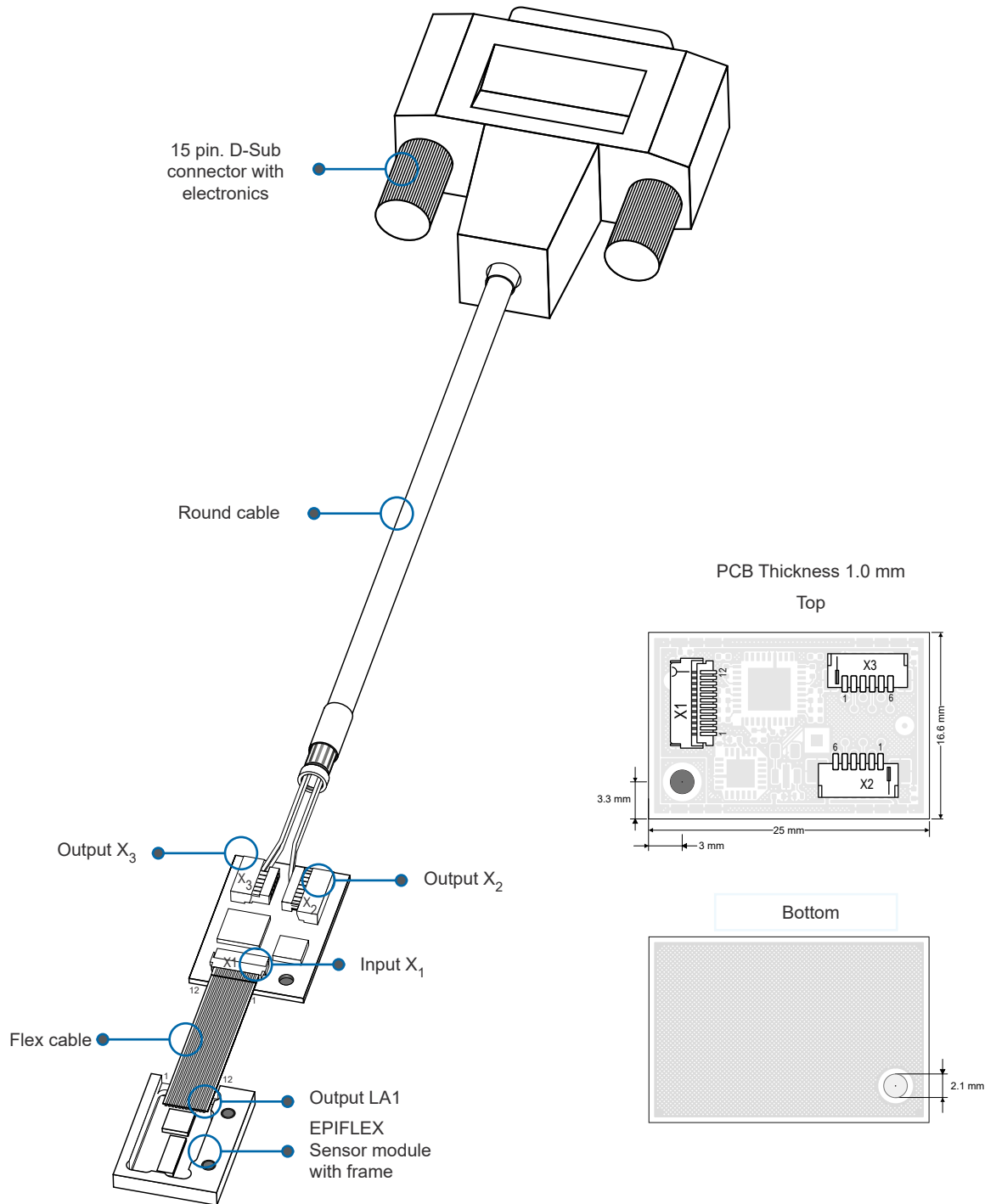


Image 12

X<sub>1</sub>: 12-pins  
 X<sub>2</sub>: 6-pins  
 X<sub>3</sub>: 6-pins

## 5.2.3 PIN assignments for inputs & outputs (LA1 & X<sub>1</sub> & X<sub>2</sub> & X<sub>3</sub>)

Pin	LA1	X1	X2	X3
1	SCL	+5 V	U <sub>2-</sub> / Z <sub>2-</sub>	GND
2	SDA	U <sub>2+</sub> / Z <sub>2+</sub>	U <sub>2+</sub> / Z <sub>2+</sub>	n.c.
3	GND	U <sub>2-</sub> / Z <sub>2-</sub>	n.c.	SDA
4	n.c.	U <sub>0-</sub> / Z <sub>0-</sub>	U <sub>1-</sub> / Z <sub>1-</sub>	SCL
5	U <sub>1-</sub> / Z <sub>1-</sub>	U <sub>0+</sub> / Z <sub>0+</sub>	U <sub>1+</sub> / Z <sub>1+</sub>	U <sub>0-</sub> / Z <sub>0-</sub>
6	U <sub>1+</sub> / Z <sub>1+</sub>	NAS	+5V	U <sub>0+</sub> / Z <sub>0+</sub>
7	NAS	U <sub>1+</sub> / Z <sub>1+</sub>	-	-
8	U <sub>0+</sub> / Z <sub>0+</sub>	U <sub>1-</sub> / Z <sub>1-</sub>	-	-
9	U <sub>0-</sub> / Z <sub>0-</sub>	n.c.	-	-
10	U <sub>2-</sub> / Z <sub>2-</sub>	GND	-	-
11	U <sub>2+</sub> / Z <sub>2+</sub>	SDA	-	-
12	+5 V	SCL	-	-

### 1 V<sub>PP</sub>

- U<sub>1+</sub> Counting signal 0° (sin)
- U<sub>1-</sub> Counting signal 180° (-sin)
- U<sub>2+</sub> Counting signal 90° (cos)
- U<sub>2-</sub> Counting signal 270° (-cos)
- U<sub>0+</sub> Reference signal
- U<sub>0-</sub> neg. reference signal

### RS 422/TTL

- Z<sub>1+</sub> Counting signal 0°
- Z<sub>1-</sub> neg. counting signal 0° (180°)
- Z<sub>2+</sub> Counting signal 90°
- Z<sub>2-</sub> neg. counting signal 90° (270°)
- Z<sub>0+</sub> Reference signal
- Z<sub>0-</sub> Neg. reference signal

Chart 8

- |      |  |           |  |
|------|--|-----------|--|
| SCL  | Programming wire clock                 | AS        | Error signal (monitoring signal)                                   |
| SDA  | Programming wire data                  | NAS       | Neg. error signal  |
| 0 V  | Ground (GND)                           | NAS high: | Input signal within the tolerance range                            |
| 5 V  | Operating voltage (U <sub>B</sub> )    | NAS low:  | Input signal outside the tolerance range (check measuring system!) |
| n.c. | not connected (must not be connected!) |           |  |

## 5.2.4 PIN assignments for 15-pin D-Sub connector

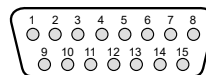
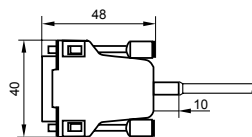


Image 13

PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Housing
1 V <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>	Inner shield	Outer-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>	Inner shield	Outer shield
Cable Ø 3.7 mm	-	-	VT	PK	RD	BN	-	BU	WH	-	YE	GY	BK	GN	WHGN	-

\* available only in combination with the PCB

Chart 9

## 5.2.5 Shielding concept

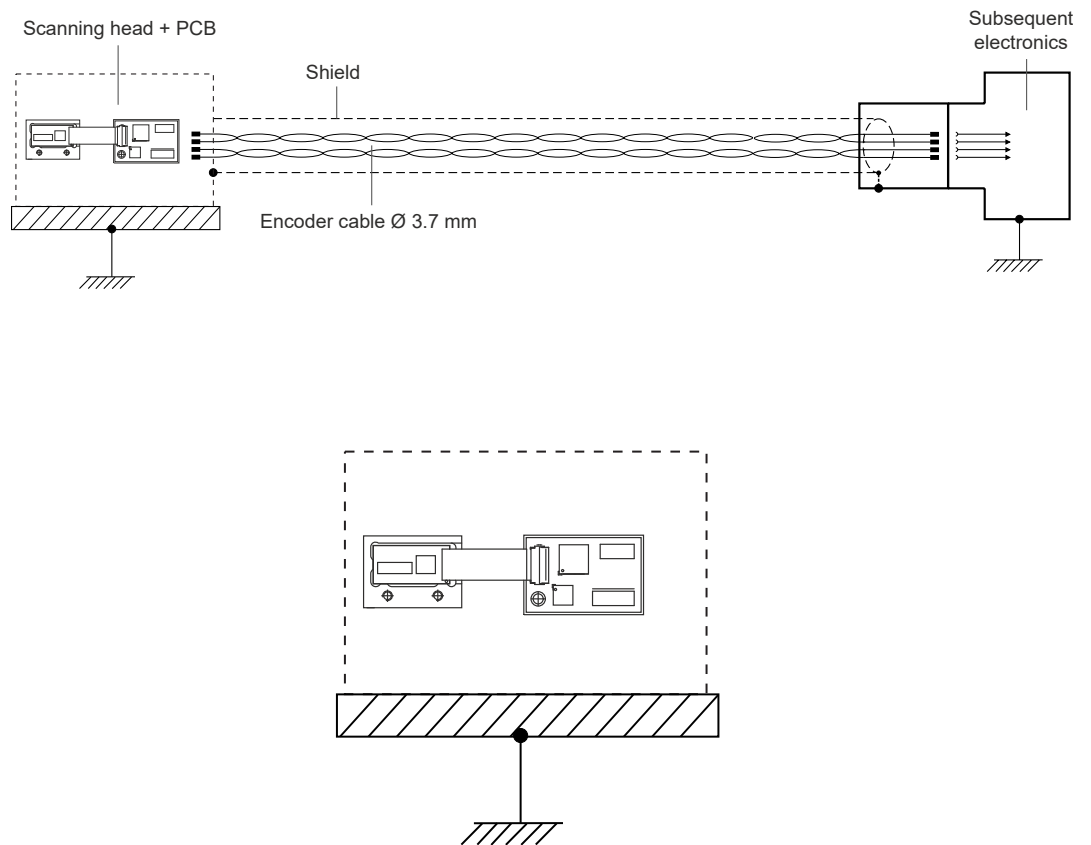


Image 14



### **ATTENTION!**

**The shielding of the measuring head and PCB must be realised by the user in an EMC-compatible design!**

## 5.2.6 Voltage Output 1 V<sub>PP</sub>

### Optimal Connection Circuit

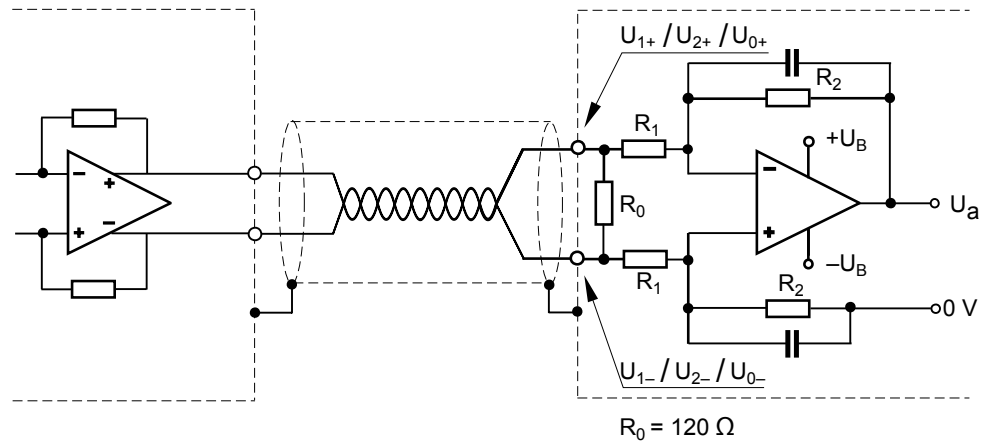


Image 15

Difference signals measured at  $R_0$ :

$$U_1 = U_{1+} - U_{1-} = 0.6 \dots 1.2 V_{PP} \quad (\text{Rated voltage: } 1 V_{PP})$$

$$U_2 = U_{2+} - U_{2-} = 0.6 \dots 1.2 V_{PP} \quad (\text{Rated voltage: } 1 V_{PP})$$

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

### Signal Curve

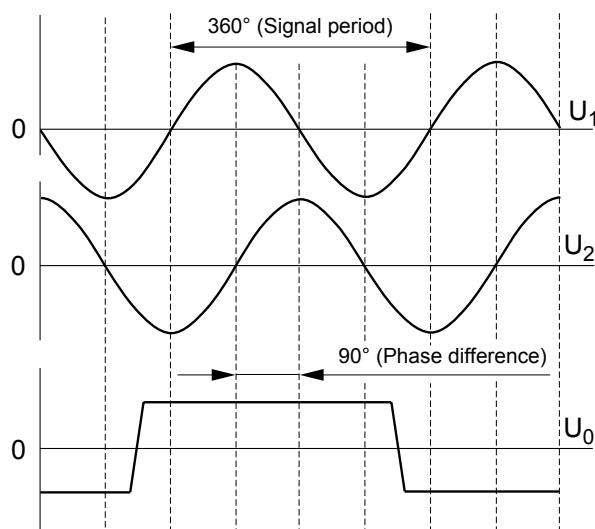


Image 16

Encoders with 1 V<sub>PP</sub>-interface provide voltage signals that can be highly interpolated.

The sinusoidal incremental signals  $U_1$  and  $U_2$  are phase-shifted by 90° elec. and have amplitudes of typically 1 V<sub>PP</sub>. The illustrated sequence of output signals (with  $U_2$  lagging  $U_1$ ) applies for the direction of motion shown in the dimension drawing.

The reference mark signal  $U_0$  has an unambiguous assignment to the incremental signals. The output signal might be somewhat lower next to the reference mark.



## 5.2.7 Square-Wave Output RS-422

### Optimal Connection Circuit

In order to avoid electromagnetic interference, the cable adaptation with a terminal resistor of  $R_0 = 120 \Omega$  is necessary.

When connecting more than one parallel signal input to an encoder output signal (e.g. linear motors with parallel connection to position controller, speed controller or acceleration controller) ensure that the resulting terminal resistance of these inputs is  $R_{0res} \approx 120 \Omega$ .

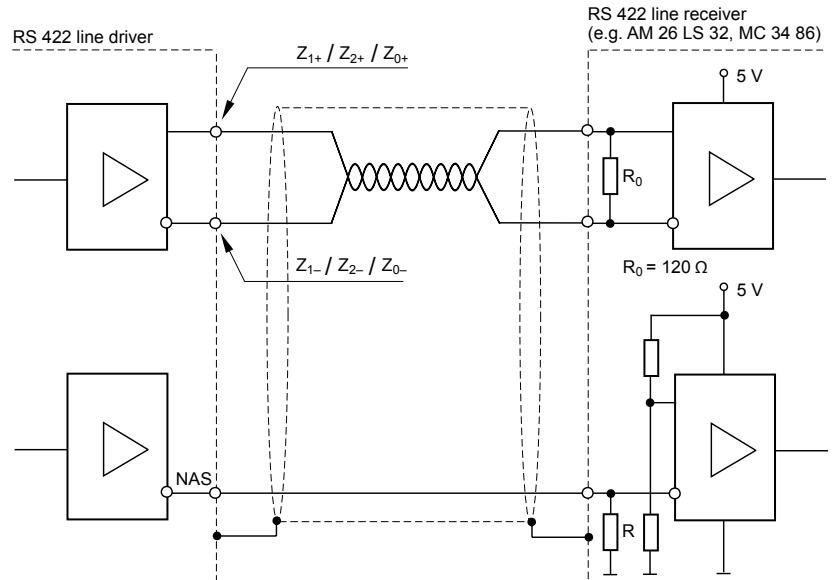


Image 17

### Signal Curve

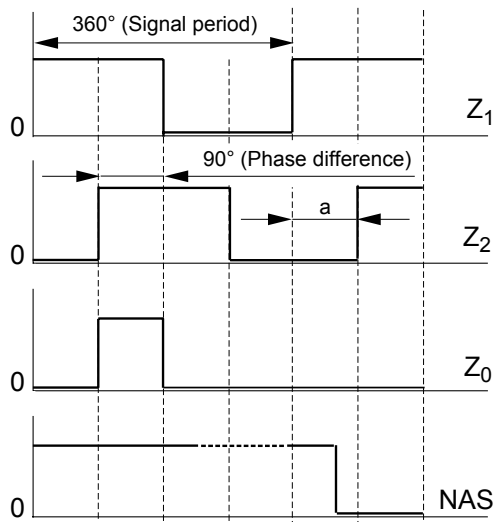


Image 18

#### NAS high:

Encoder functioning properly, input signals within tolerance range

#### NAS low:

Check the measuring system

#### $\alpha$ :

Minimum edge separation as a function of the interpolation factor and traversing speed (see also 4.4. or speed chart at 11.3.)

Encoders with TTL interface incorporate electronics that digitize sinusoidal scanning signals with or without interpolation. The incremental signals are transmitted as the square-wave pulse trains  $Z_1$  and  $Z_2$ , phase-shifted by  $90^\circ$  elec. The reference mark signal consists of one or more reference pulses  $Z_0$ , which are gated with the incremental signals.

In addition, the integrated electronics produce their inverted signals  $Z_{1-}$ ,  $Z_{2-}$  and  $Z_{0-}$  for noise-proof transmission. The illustrated sequence of output signals (with  $Z_2$  lagging  $Z_1$ ) applies to the direction of motion shown in the dimension drawing.

## 6 Mounting Drawing - *LIKselect*

### 6.1 Scanning head *LIKselect*

#### Drawing without sensor frame with measuring standard

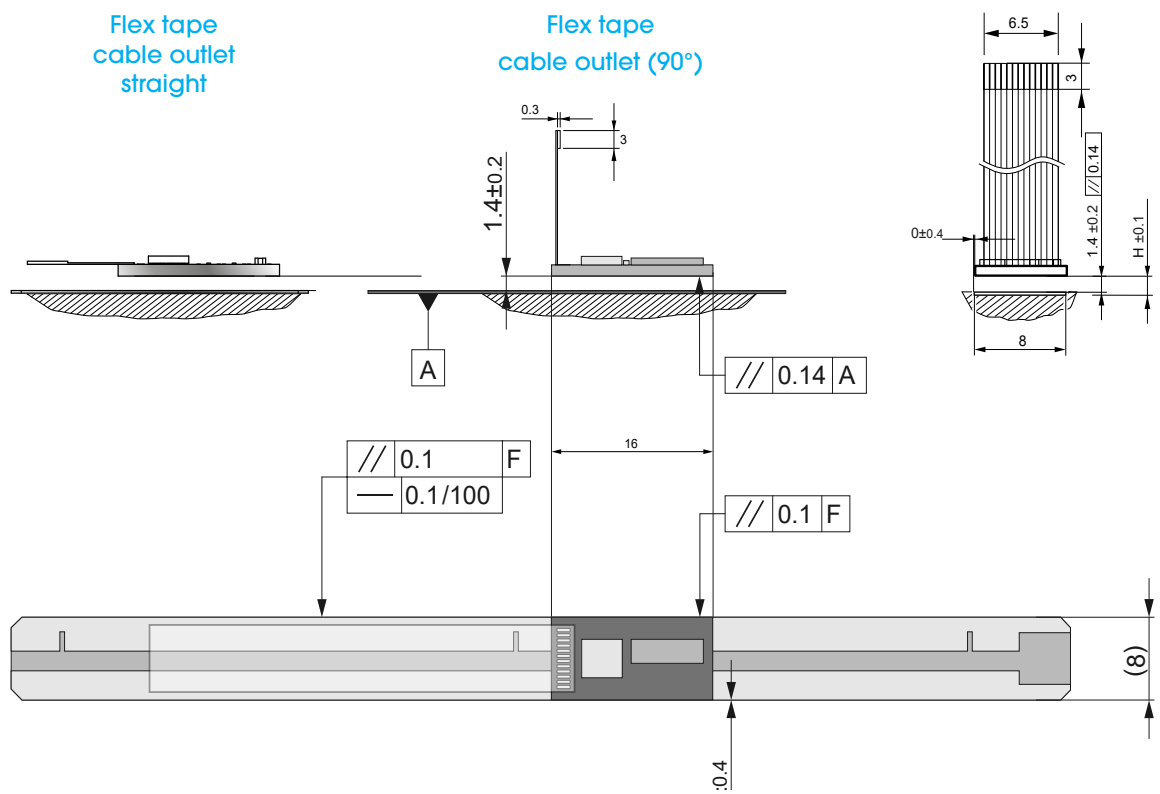


Image 19

Measuring standard	H ± 0,1
SINGLEFLEX	0.25 mm
SINGLEFLEX with fastening tape	0.45 mm

F	Machine guideway
H	Distance of the sensor surface to the mounting surface

Chart 10

## 6.2 Correlation of measuring head, measuring tape and measuring length

### Measuring standard MI with nameplate

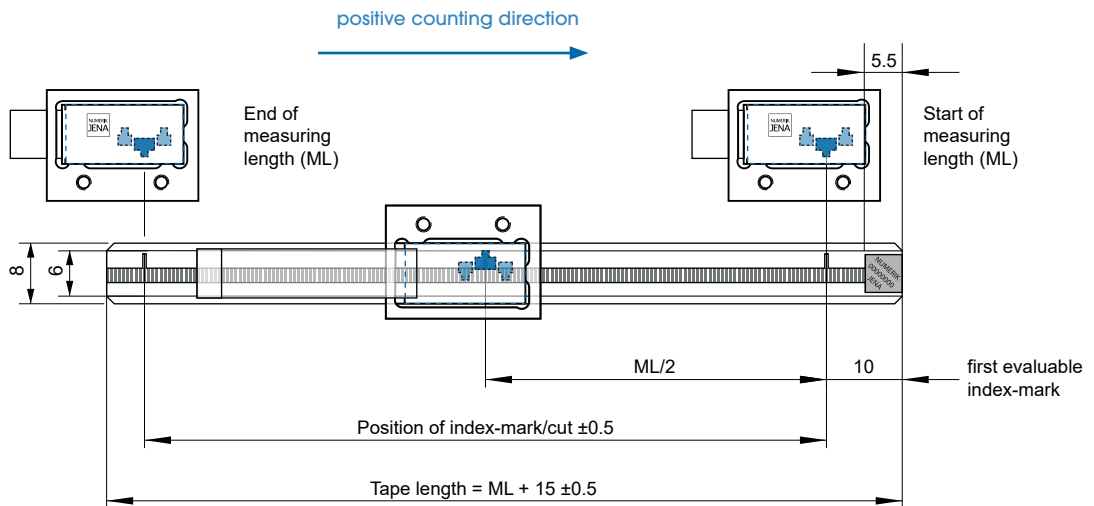


Image 20

### Measuring standard MI without nameplate

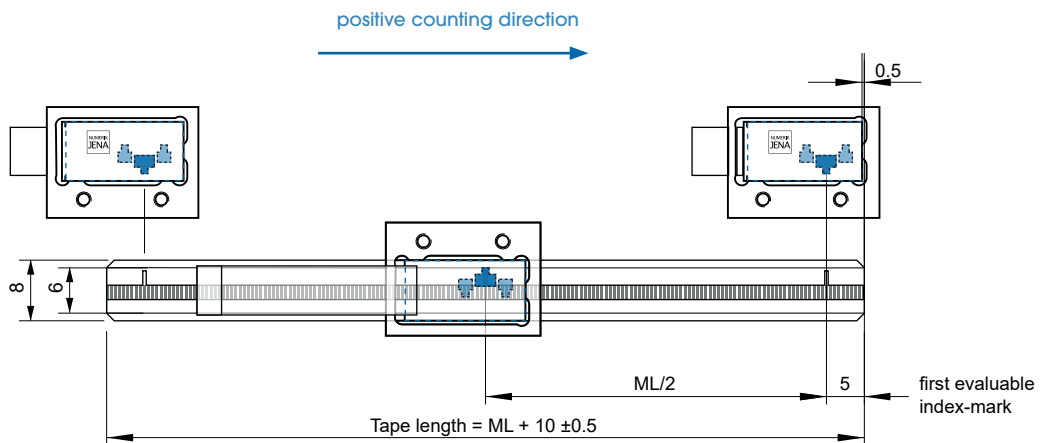


Image 21



CAD files are available for download on our website.

## 6.3 Sensor frame - Examples for LIKselect

### 6.3.1 Frame B

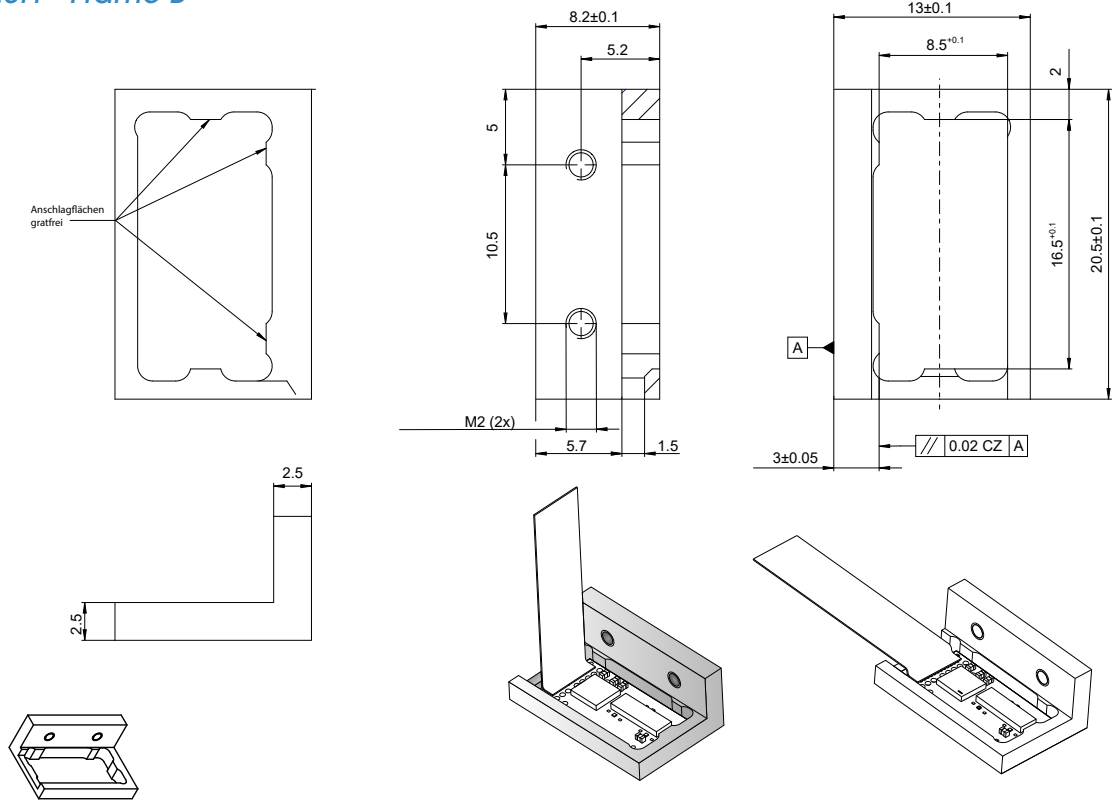


Image 22

### 6.3.2 Frame C

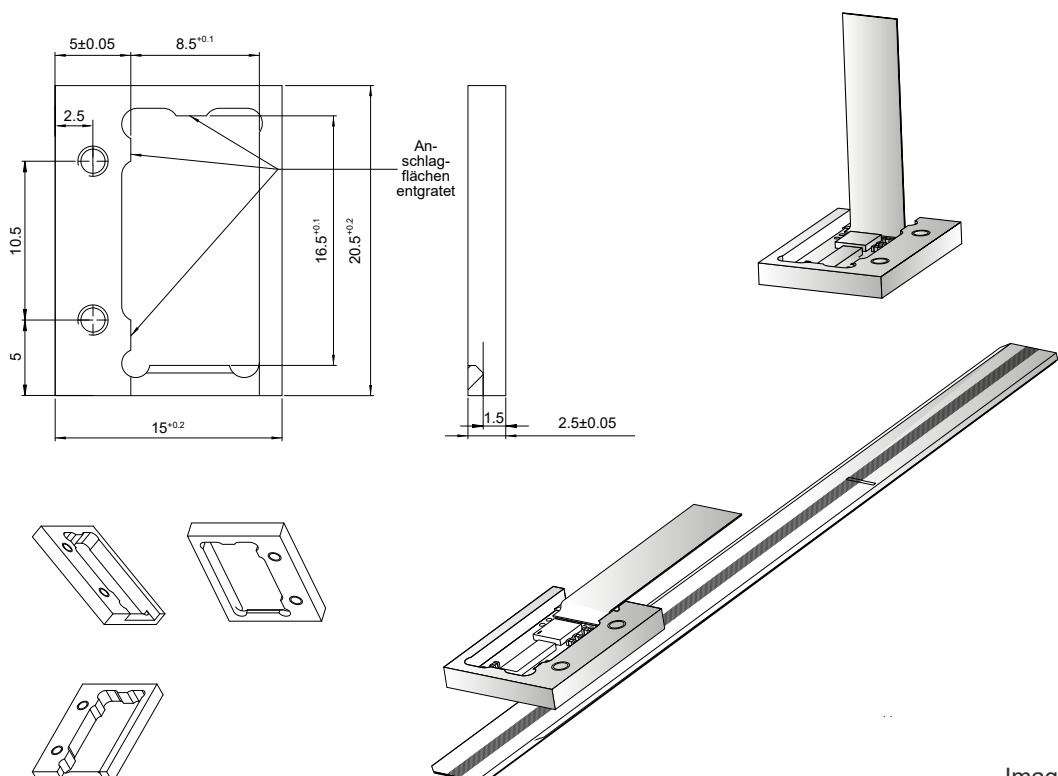
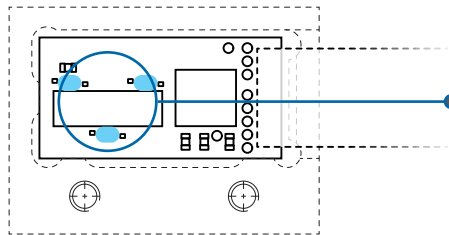


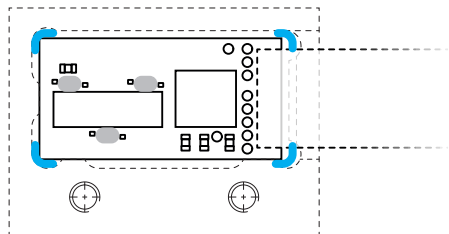
Image 23

## 6.3.3 Sensor without frame

For measuring systems supplied without a frame, the customer must attach the measuring system to the frame.

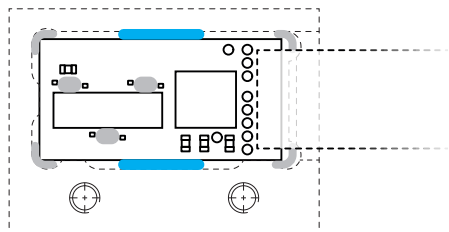


This pressure-, shock- and contact-sensitive area must not be selected for alignment or fixing of the sensor module during the installation process. Mechanical stress can lead to the destruction of the sensor.



### Step 1:

Secure the aligned sensor in the frame. To do this, apply some spots of adhesive to the centre of the fix point. If the corners of the sensor are fixed in the frame with a glue dot, please check the exact alignment and planarity.



### Step 2:

The adhesive can be applied all around, but at least 5 mm long adhesive beads should be applied to the long sides of the sensor. To ensure that the high-precision measuring system works properly, no adhesive residue should remain on the sensor surface.

Image 24



**Note the usage requirements of the manufacturer!**



#### Recommended adhesives:

Cyanoacrylate-based adhesives such as LOCTITE 480 or LOCTITE 401, as well as 2-component epoxy adhesives such as DELO AD 840.



**Note: Improper use or excessive mechanical stress can lead to component failure or even damage to the sensor.**

## 7 General Installation Notes

### 7.1 Delivery Contents

#### Standard

- **LIKselect** scanning head (according to the ordered specification)
- Measuring standard (according to the ordered specification)
- Information sheet

#### Optional

- ADJUSTMENT TOOL & EPIFLEX Pro Software
- EPIFLEX Adapter
- NPA - NUMERIK PWT Adapter and NJ-PWT-software module
- Extension cable
- Adapter-Set LIKS1 Analog/Digital
- Spacing gage for checking the correct working distance when mounting the scanning head (made of plastic; 1.4 mm)



**Note:**  
**Improper use or excessive mechanical stress may cause component failure!**

### 7.2 Installation Position

- The installation position of the measuring system is arbitrary.
- In order to avoid contamination deposits, a vertical position for the measuring standard is recommended.
- The operator of the measuring system is responsible for appropriate design measures to protect the encoders from contamination.
- The counting direction of the encoders is positive (increasing measuring values) in any case if the scanning head opposite the scale tape moves in the direction of the cable outlet.
- In any installation position the scale tape surface and scanning window of the scanning head should be easily accessible for cleaning. Prevent contamination and foreign elements from having an influence on the operation!
- Use preferably slots or edges as an installation orientation for straight mounting of the scale tape, particularly very long ones.

## 7.3 Mounting Steps



Hereafter the mounting steps for a LIKselect measuring system from NUMERIK JENA will be described.



Please read the notes mentioned to the particular mounting steps thorough and follow the indicated sequence of mounting steps exactly!

### Step 1

- Preferably the tape should be mounted in a slot or along an edge.
- Please mark the future location of the scale tape before starting with the mounting.
- The alignment of the scale tape depends on the installation position of the scan head.
- Ensure that the scanning head's scanning fields for the counter and reference tracks are over the corresponding tracks on the scale tape.

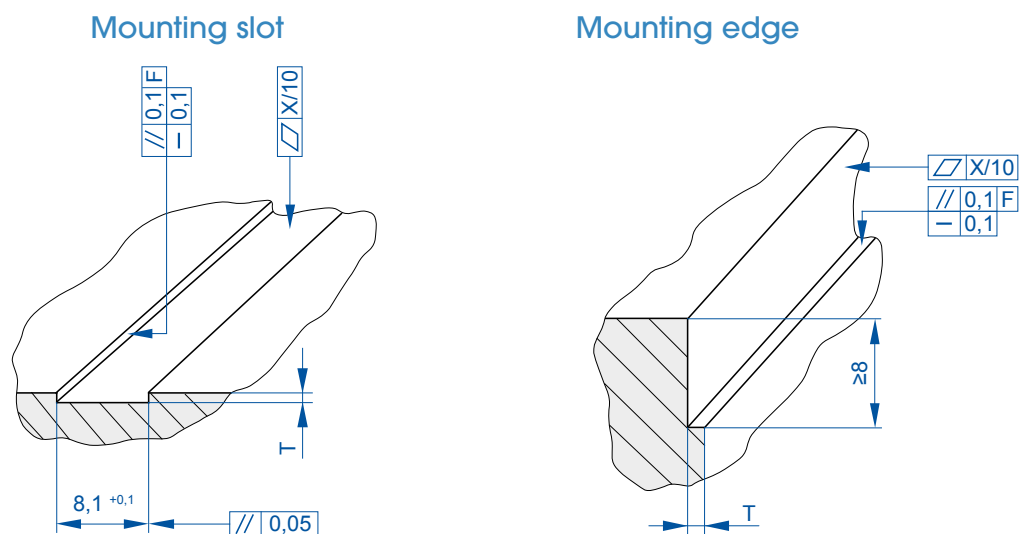


Image 25

Accuracy grade	X
$\pm 3 \mu\text{m/m}$	0,009
$\pm 5 \mu\text{m/m}$	0,009

Scale tape	T
SINGLEFLEX	$0,5_{-0,1}$
F	Machine guideway

Chart 11



**ATTENTION: Acetone and Alcohol are inflammable liquids!**

## Step 2

- Use a solvent to clean the adhesion surface of the machine (e.g. Acetone or Alcohol).
- Make sure that no contaminations remain on the machine's adhesion surface.
- Dirt or other elements between the machine and scale tape cause local differences in the spacing between the scale tape and the scanning head. This may diminish the encoder's functionality and/or result in measuring errors.
- The scale tape can be mounted in a slot already on the machine or along an edge already on the machine.
- Place the edge of the scale tape exactly on the marking for the beginning of the scale tape.
- Run the scale tape exactly along the slot or edge when applying it.

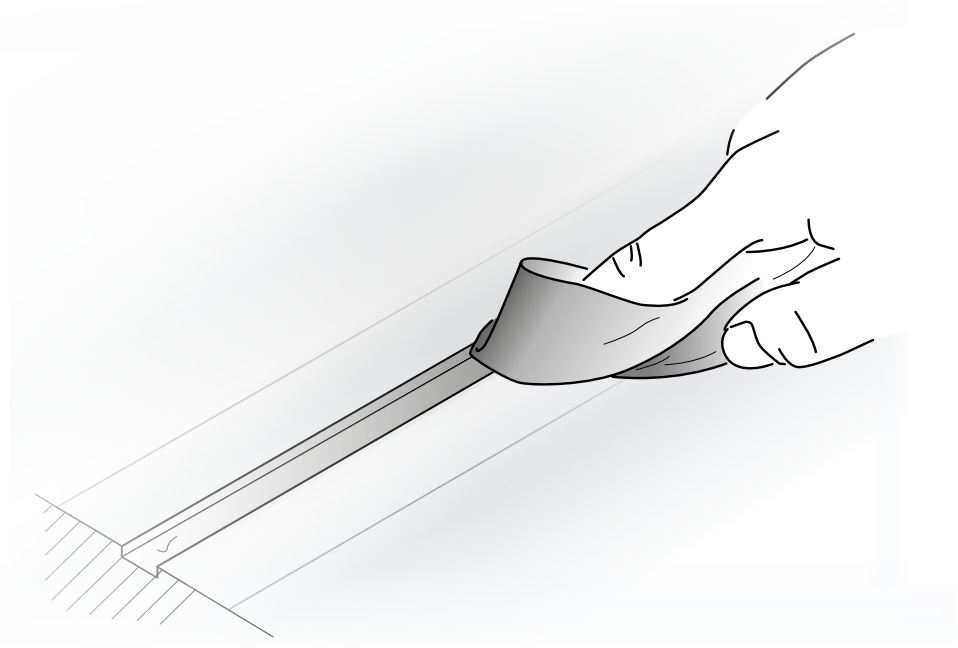


Image 26

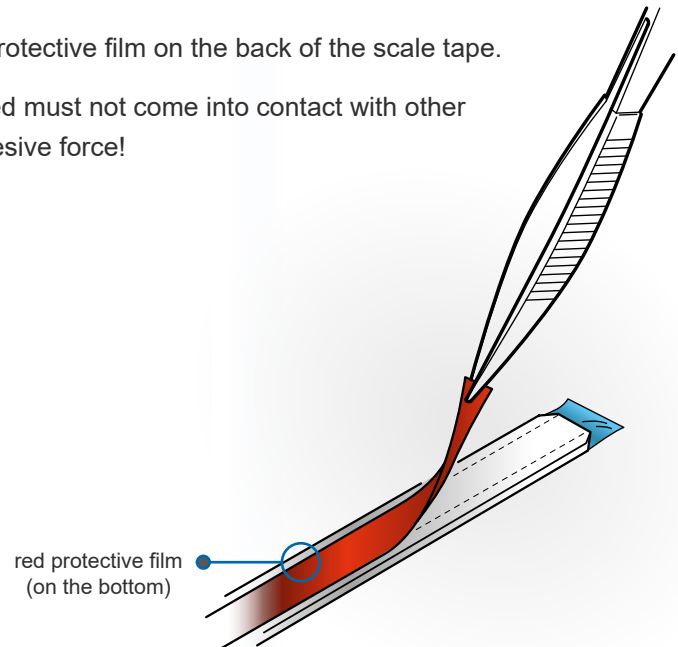


**ATTENTION: Acetone and Alcohol are inflammable liquids!**



## Step 3

- Peel off ca. 70 mm of the red protective film on the back of the scale tape.
- The adhesive tape now exposed must not come into contact with other materials due to its strong adhesive force!



## Step 4

Image 27

- Remove the red protective film from the slot or edge.
- Place the end of the SINGLEFLEX scale tape from which the protective film has been removed against the front end stop (slot) or lateral stop (edge).

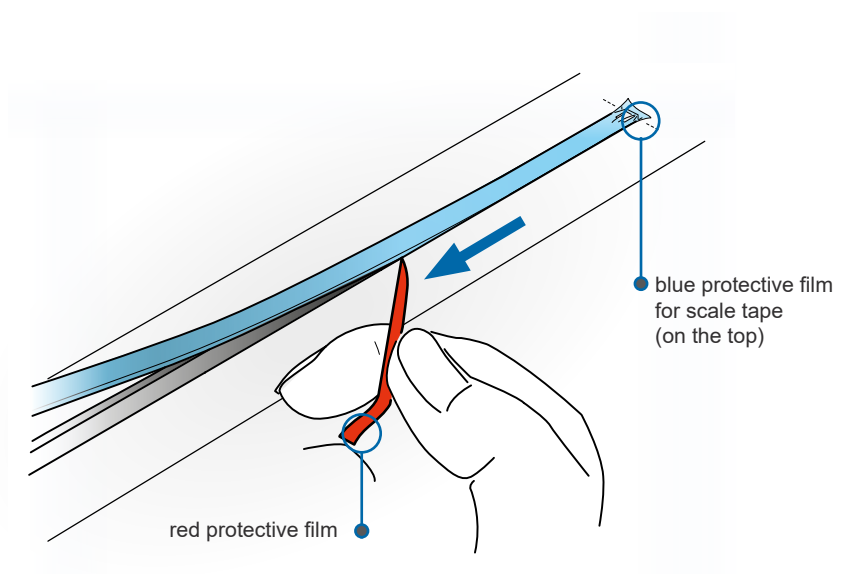


Image 28



**Do not remove the blue transparent protective film from the scale tape yet!**

## Step 5

- Do not remove the blue transparent protective film from the scale tape yet!
- Press the scale tape with your forefinger and by the help of a soft, lint-free rag against the carrier over the entire length. Pull off the red protective film to the side.
- The pressure point should always be ca. 30 mm to 50 mm behind the point where the adhesive tape and the red protective film are being separated.

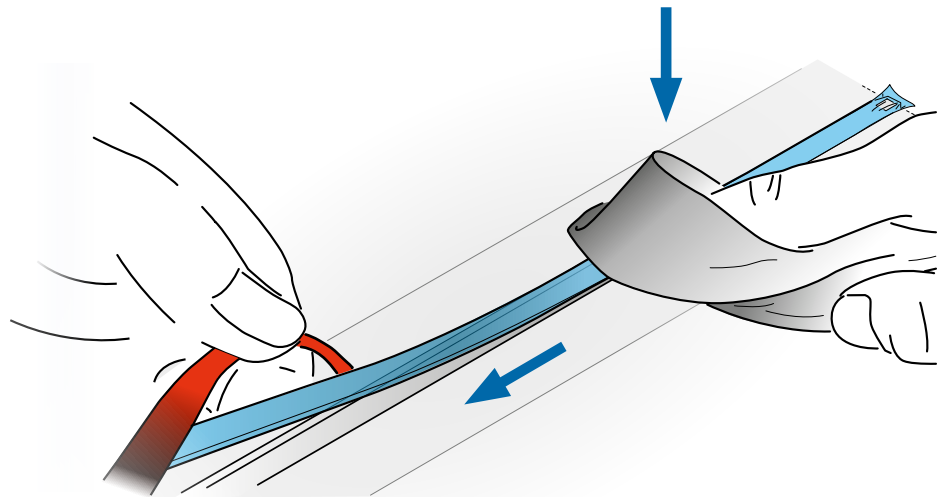


Image 29



Only apply pressure to the scale tape from above and avoid lateral forces!



**ATTENTION: Acetone and Alcohol are inflammable liquids!**



## Step 6

- Clean the mounting surfaces of the scanning head and the machine element.
- Remove the protective film from the scanning head.
- Clean the sensor surface of the scanning head with a soft and lint-free rag. Use a solvent if necessary (e.g. Acetone or Alcohol)

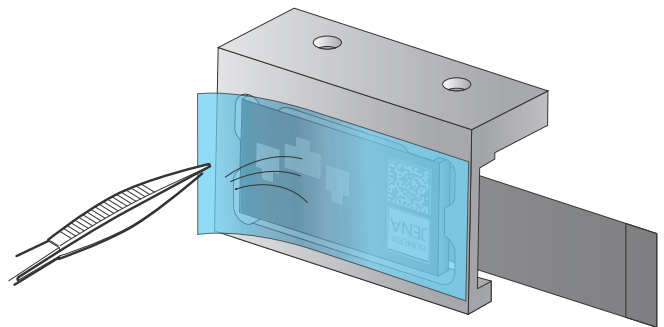


Image 30

## Step 7

- Screw the scanning head onto the prepared mounting surface such that there is still some vertical clearance.
- Remove the blue transparent protective film from the graduation of the scale tape.
- Clean the scale tape surface (graduation) of the scanning head with a soft and lint-free rag. Use a solvent if necessary (e.g. Acetone or Alcohol).

## Mounting example

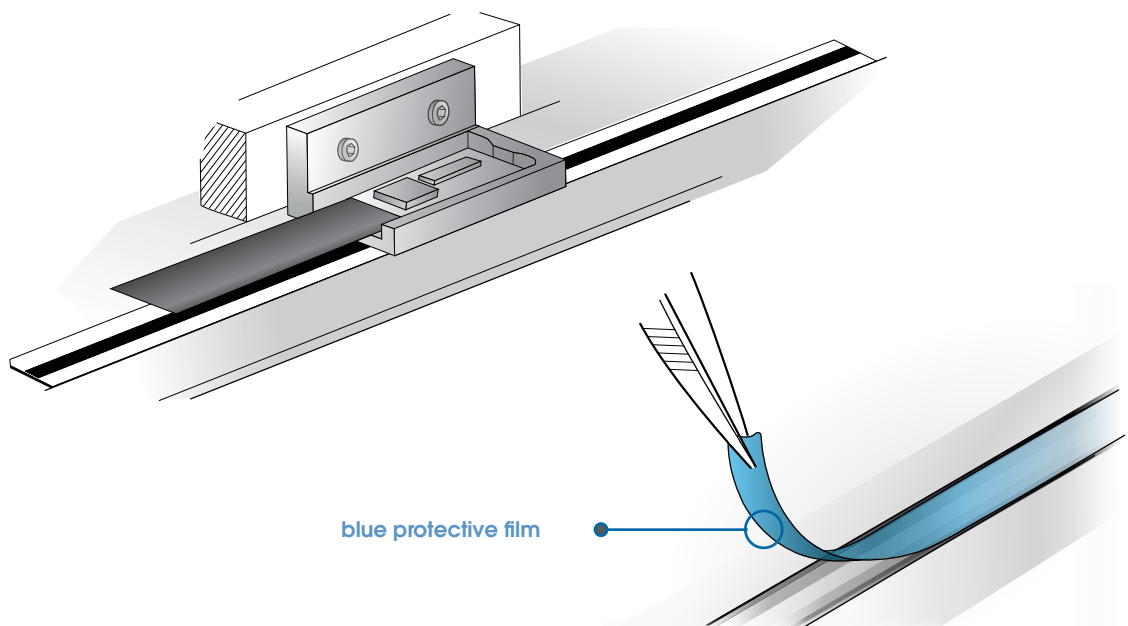


Image 31

## Step 8

- Ideally, the sensor mounting is constructed by the customer in a way that the mounting height of the sensor can be adjusted.
- Place the measuring head on the mounting device and tighten both fastening screws alternately lightly and evenly (tightening torque = 0.5 Nm).
- To check the parallelism between the housing of the measuring head and the scale tape, you can use the spacing gage "1.4". This serves only as a guideline for an approximate check of the mounting, since the ideal working distance of 1.4 mm refers to the distance between the sensor glass and the measuring standard.
- If available – slide the spacing gage "1.4" lengthwise between the scale tape surface and the scanning head and check for even play.
- Please take care not to scratch the measuring system when removing the spacing gage. If it is difficult to remove or jammed, loosen the scanning head and repeat the installation procedure. Otherwise the surface of the sensor module can be damaged!

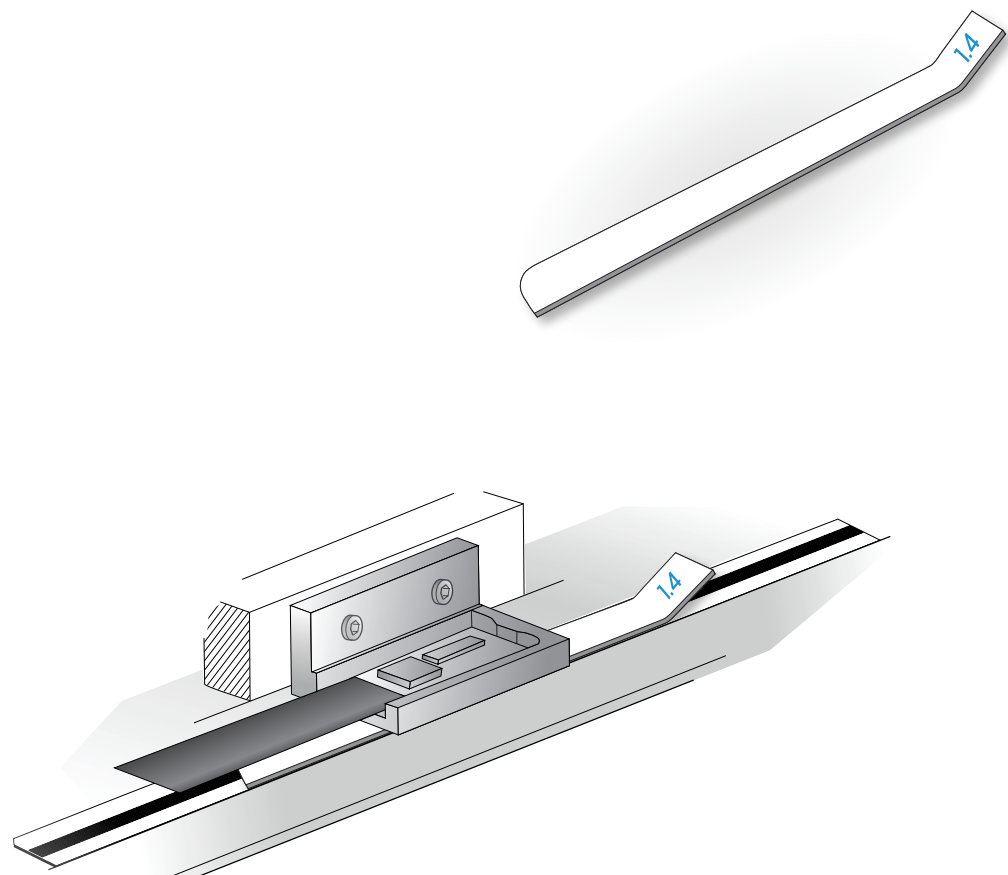


Image 32

## Step 9

- Mount the PCB (tightening torque = 0.1 Nm) and provide strain relief near the scanning head.
- Connect the encoder cable to the evaluation electronics and pay attention to the pin assignment. The evaluation electronics must be switched off!
- After connecting the encoder cable, switch on the evaluation electronics and perform a function test.
- If there are errors in the function or during measurement, please read chapter 10 “Troubleshooting” first. If the given information is not helpful for your problem, please contact NUMERIK JENA or the authorised representation responsible for your country.



**ATTENTION: Acetone and alcohol are flammable liquids!**

## 8 Signal Adjustment

Before delivery the encoders from NUMERIK JENA will be tested and electronically adjusted under ideal mounting conditions. Furthermore, the sensor modules offer the possibility of an electronic signal adjustment after the mounting into the application. This allows the user optimize the encoder signals regarding to the mechanical mounting conditions (tolerances).

### 8.1 Signal adjustment with ADJUSTMENT TOOL & EPIFLEX-Adapter

The ADJUSTMENT TOOL for incremental measuring systems was developed by NUMERIK JENA to make the signal adjustment as simple and effective as possible. This accessory allows the connection of the measuring systems to a PC via USB interface.

With the corresponding EPIFLEX Pro software and the EPIFLEX Adapter, the measuring systems can be optimized and programmed. It enables the connection of a device of the new LIK product family to the ADJUSTMENT TOOL. It can be connected directly to the 15-pin D-Sub connector of the measuring head.



Image 34



Image 35

#### 8.1.1 Functions of the ADJUSTMENT TOOL

- Representation of the sinusoidal counting signals with amplitude, offset and phase position
- Representation of the position and width of the index signal
- Evaluation of the mechanical mounting conditions
- Automatic signal adjustment and programming of the sensor module
- Electronic readjustment of the amplitude and offset of the sensor signals
- Adjustment of the position and width of the index signal

## 8.1.2 Functions of the EPIFLEX Adapter

- Visualisation of the signals
- Electronic readjustment of the **LIKselect**.
- Assistance with the installation of the measuring system and its optimization.



**For measuring system versions without D-Sub connector, the LIKS1 adjustment set analoge/digital is used. Further information can be found in chapter 11 “Ordering information accessories”.**

## 8.2 Dynamic offset and amplitude Control (Online Compensation)

The encoders of NUMERIK JENA are equipped with a dynamic amplitude and offset control (online compensation). The analog diode signals will be corrected to their nominal values in real time. This reduces measuring errors caused by contamination as well as from inaccuracies. The phase position between the sine and cosine signals and the position of the index signal are not influenced by the online compensation.

With help of the EPIFLEX Pro software the preadjusted nominal values of the online compensation can be influenced.

## 8.3 Scope of delivery

Further information about the ADJUSTMENT TOOL and the EPIFLEX Pro software can be found on the NUMERIK JENA website. (See also image 38 for setup)

### 8.3.1 Scope of delivery ADJUSTMENT & EPIFLEX TOOL Set

- ADJUSTMENT TOOL
- EPIFLEX Adapter
- EPIFLEX adapter cable
- Diagnostic cable to connect the measuring system
- USB cable to connect to a PC
- USB-D-SUB-adapter cable (15-pin)
- Exchangeable 8-pin plug connectors (necessary for the adjustment of previous products of NUMERIK JENA)

### 8.3.2 Scope of delivery ADJUSTMENT TOOL

- ADJUSTMENT TOOL
- Diagnostic cable to connect the measuring system
- USB cable to connect to a PC
- USB-D-SUB-adapter cable (15-pin)
- Exchangeable 8-pin plug connectors

### 8.3.3 Scope of delivery EPIFLEX Adapter

- EPIFLEX Adapter
- EPIFLEX adapter cable

### 8.3.4 Scope of delivery Adapter-Set LIKS1 analog und digital

- Cable incl. circuit board for adjusting the LIKselect products without cable and/or circuit board
- can be used for measuring systems with analogue or digital output signals, depending on the version.

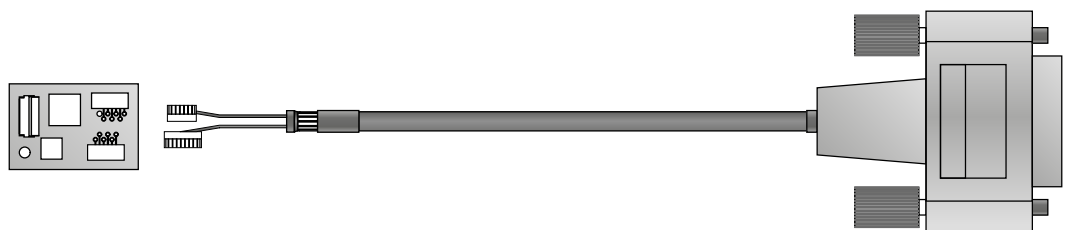


Image 36



For ordering information on accessories, see chapter 11.



## 8.4 EPIFLEX Pro Software

The EPIFLEX Pro software was especially designed for the ADJUSTMENT TOOL. It offers the user versatile possibilities to bring the encoder into service. It allows the user to display the sensor signals and evaluate them. Furthermore it is possible to program respectively optimize the encoder to the existing mounting conditions automatically.

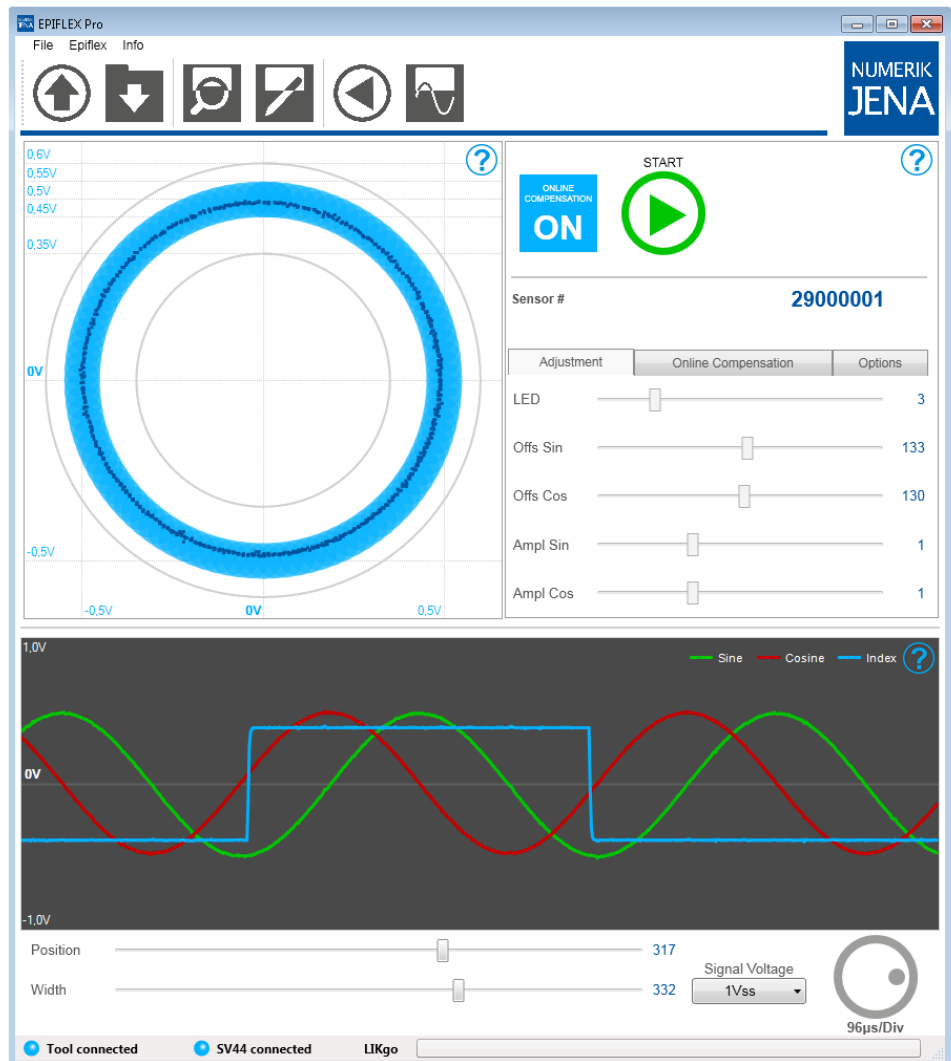


Image 37

The EPIFLEX Pro software is available for free via download on the NUMERIK JENA website under [www.numerikjena.de](http://www.numerikjena.de). It is suitable for the following operating systems: Windows 7 / 8 / 10 (32 or 64 bit)



**As part of the continuous development and improvement of our products, we update our software at regular intervals. The updates include performance improvements as well as bug fixes. In order to ensure a trouble-free operation, we recommend to always use the latest software version.**

## 8.5 Wiring diagram ADJUSTMENT & EPIFLEX TOOL-Set

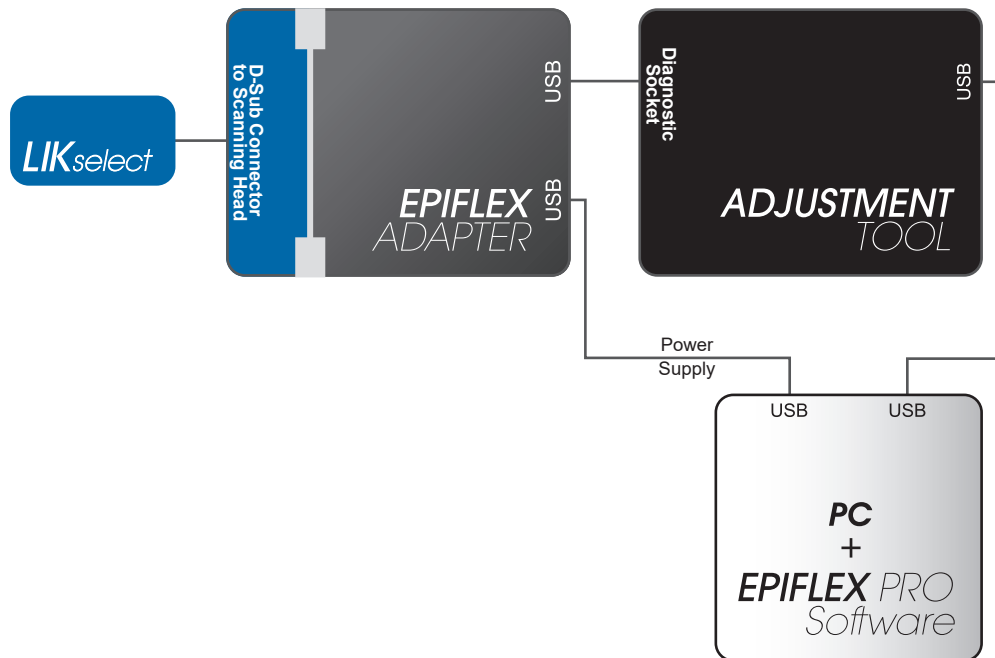


Image 36

## 8.6 Signal adjustment with NPA - NUMERIK PWT Adapter and PWT 101

The NPA – Numerik PWT Adapter – is an accessory item to connect linear incremental measuring systems of the new product generation of NUMERIK JENA to the PWT101, a test device from Dr. JOHANNES HEIDENHAIN GmbH for function control and adjustment of measuring devices. For measuring instruments with pin assignment according to NUMERIK JENA standard (see 4.2.3) the assignment adapter NPA must be used.

In combination with the free-of-charge NJ-PWT-Software module of NUMERIK JENA, the adapter enables the functional range of the PWT 101 to be used in conjunction with the LIKgo and LIKselect.



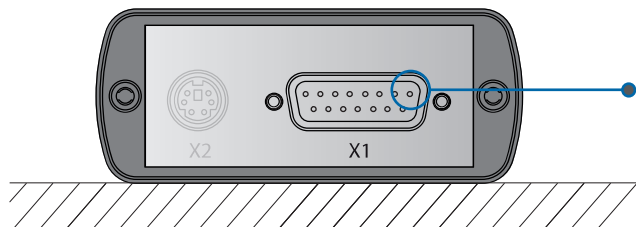
Image 37

## 8.6.1 Connection procedure

Encoders with a 15-pin Sub-D interface are connected to output X3 of the NPA to encoder input X1 on the right side of the device.



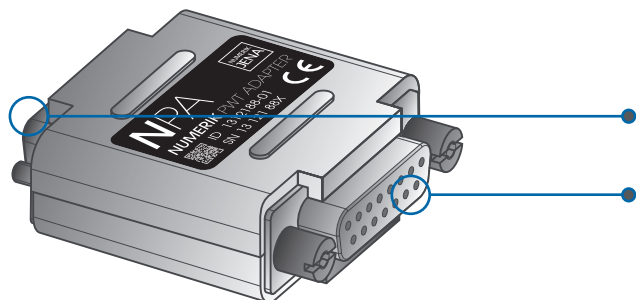
**You may only connect a measuring device to the measuring device input X1. It is not allowed to connect a measuring device to both measuring device inputs at the same time.**



X1 – 15-pin Sub-D socket for measuring instruments on the right side of the device (to connect the NPA - NUMERIK PWT Adapter)

current limitation: 750 mA @ 5 V  
( $< 5 \text{ W} / U_p$ )

Image 38



X3 – for connection to the PWT 101

X2 – for connection to the NUMERIK JENA measuring device

Image 39

## 8.6.2 Wiring diagramm

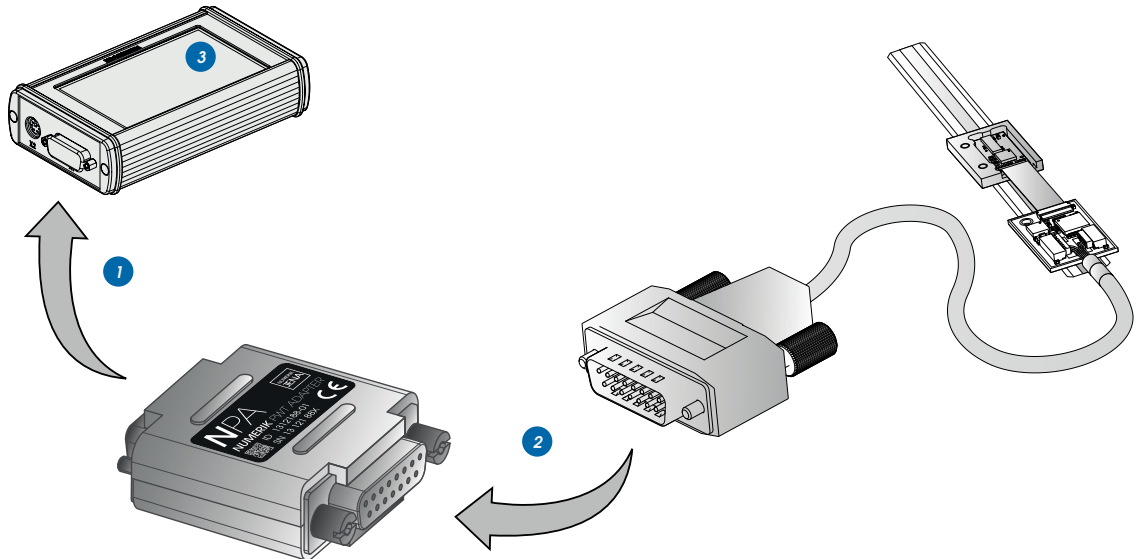


Image 40

## 8.6.3 Notes on connection

### Step 1:

The signal adapter must be connected to PWT 101 at input X1.

### Step 2:

The NUMERIK JENA measuring device must be connected to the signal adapter.

### Step 3:

Then you can start via „Automatic diagnosis“ or „Manual diagnosis“ in the main menu..

Note:

- Make sure to follow the right sequence of the mounting steps during mounting.
- Do not overtighten screws
- Do not exert mechanical stress on the plug connections



**Note: Incorrect power supply range and incorrect wiring / pin assignment can cause damage to the device and the measuring instrument.**

**Pay attention to the power supply range of the connected encoder!!**

**Connect or disconnect the adapter between measuring device and device only when the device is disconnected from the power supply.**

## 8.7 Comparison of the different adjustment variants

	Adjustment & Epiflex Tool Set	PWT 101 + NPA
Info	344220-33 together with 344220-70 OR 344220-90	PWT 101 + NPA
Show device Info	Yes (IdentNr&SN)	Yes (IdentNr&SN)
Online compensation	ON/OFF switchable	ON/OFF switchable
Relative counter value	No	Yes
Adjustment of incremental signal	Yes (automatic/ manual)	No
Adjustment of Reference signal	Yes (automatic/ manual)	Yes (only automatic)
Error check	No	Yes
Save/read function	Yes	No (just rewrite save only for RI adjustment)

Chart 12

## 9 Cleaning

- Depending on the installation position and the ambient conditions, occasional cleaning of the scale surface and the sensor surface of the measuring head (scanning window for counting and reference track) may be necessary.
- When cleaning the components, ensure that the scanning window and scale tape are not scratched by any deposited particles!
- Dirt should be removed using a soft brush or oil-free compressed air.
- Use cotton balls or a soft and lint-free rag for cleaning. Use a solvent if necessary (e.g. Acetone or Alcohol).
- Avoid to contact the solvent and the adhesive tape! This could start to dissolve the adhesive and reducing the adhesive force. Furthermore the scale tape can be detached totally.
- Ensure that no solvent seeps under the scale tape! This could adversely affect the adhesive layer between the scale tape and carrier tape, thereby loosening the scale tape.



**ATTENTION: Acetone and Alcohol are inflammable liquids!**

## 10 Troubleshooting

Before delivery, all NUMERIK JENA measuring systems are checked for function and accuracy. Should you nevertheless experience malfunctions or problems, please go through all the points in the following table and check whether one of the indications solves your problem.

If this is not the case, please contact the technical support of NUMERIK JENA GmbH or authorised representatives. You will find the relevant contact details on the NUMERIK JENA website at [www.numerikjena.de](http://www.numerikjena.de).

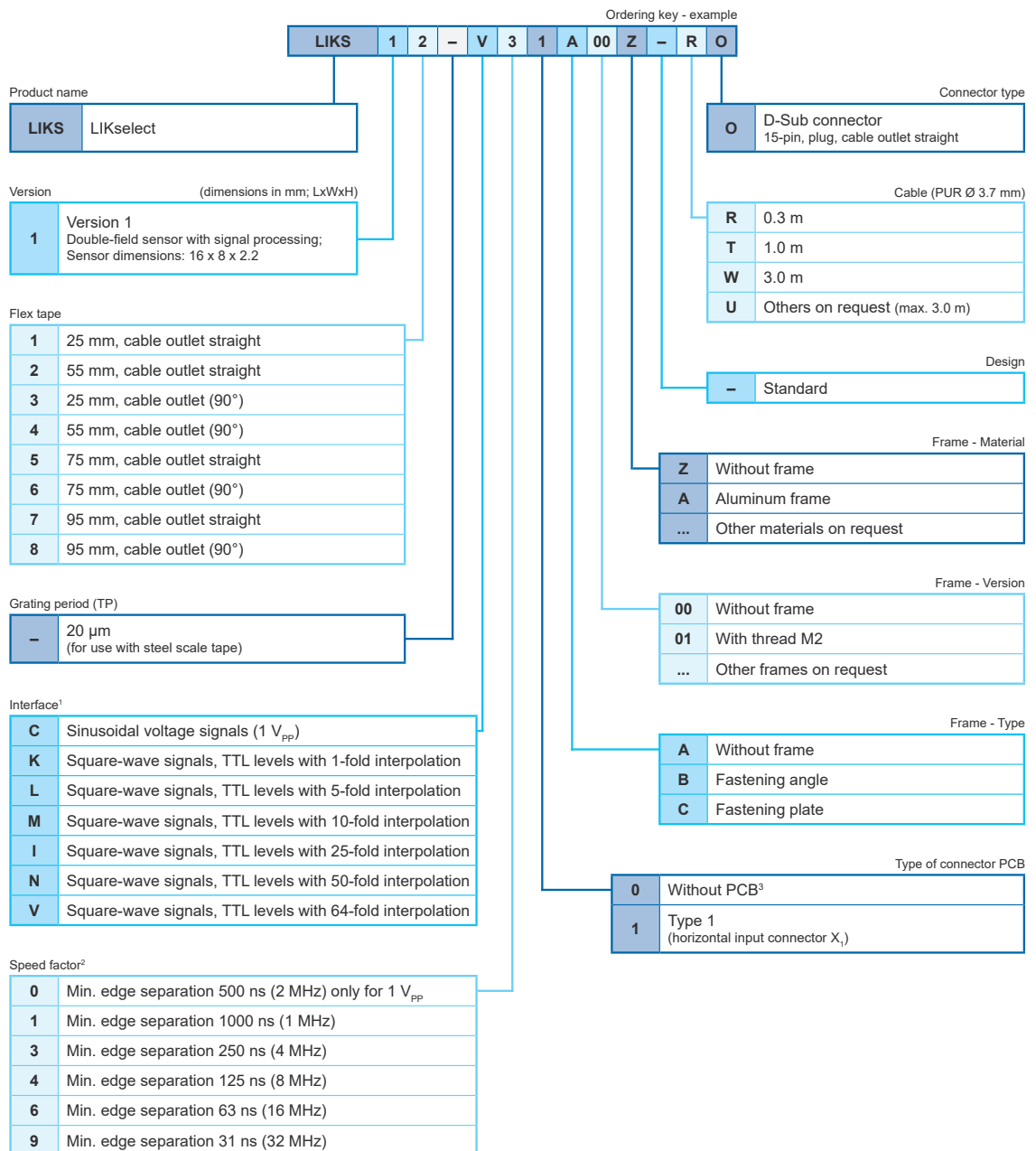
Error	Possible causes	Solution
No measuring signal	No power at the scanning head	<ul style="list-style-type: none"> <li>Check the status of the evaluation electronics</li> <li>Check the connection assignment between the encoder and the evaluation electronics</li> </ul>
Error message from the evaluation electronics	Following error due to temporary failure of the measuring signal	<ul style="list-style-type: none"> <li>Check the assignment of the scale tape to the scanning head</li> <li>p.r.n. readjust mechanically</li> <li>Readjust electronically with ADJUSTMENT TOOL*</li> </ul>
Rough, loud motor running (for linear motors)	Irregular edge separations of the counting signals due to interpolation errors	
Counting error (compared to a standard)	Mounting error	
No reference signal	Mounting error (results in faulty gating of the reference signal and counting signal)	
Reference mark can only be detected from one direction		
Reference mark appears twice		
Not all reference marks are detected		
Failure signal reports (for RS 422)	Mounting error (results in level of the analog signal from the sensor being too low)	Clean the scale tape
	Contamination on the scale tape (results in level of the analog signal from the sensor being too low)	
	Encoder function operating error	

\* see also chapter 8 "Signal adjustment"

Chart 13

## 11 Order information

### 11.1 Ordering key - Scanning head LIKselect



<sup>1</sup> In combination with the PCB (which provides an integrated driver) RS-422 signals (X<sub>2</sub>/X<sub>3</sub>) are available.

<sup>2</sup> Customer-specific value; which identifies the required counting frequency of the evaluation electronics (minimum edge separation) and the permissible traversing speed – see speed chart in the product data sheet (chapter 11.2).

<sup>3</sup> For measuring systems without PCB, the Adapter Set LIKS1 Analog/Digital is required for signal adjustment. (Accessory – for ordering information see chapter 11.5.)



**The variations of products presented correspond to our standards - if your required specifications are not listed - please contact us!**

## 11.2 Speed Chart for LIKselect Series

The maximum attainable traversing speed of the encoder is determined by the maximum output frequency of the interpolator and/or the minimum counting frequency of the operator's evaluation electronics (e.g. controller or display).

Please take the suitable values for your application from the following chart and select it in the ordering key.

First select the interpolation factor you have chosen and the traversing speed you are aiming for. Once you have found the corresponding specifications, please check whether your evaluation electronics guarantee the correspondingly necessary counting frequency.

The listed values in the chart refer to a grating period (TP) of 20 µm.

Speed factor		0	1	3	4	6	9
Interface	Interpolation factor	Max. traversing speed [m/s]					
C	without interpolation (1 V <sub>pp</sub> )	10	–				
K	Interpolation factor 1	–	0,83	1,66	1,66	3,3	6,6
L	Interpolation factor 5		0,66	1,66	1,66	3,3	6,6
M	Interpolation factor 10		0,33	1,33	1,66	3,3	6,6
I	Interpolation factor 25		0,13	0,53	1,06	1,66	3,3
N	Interpolation factor 50		0,07	0,27	0,53	1,06	1,66
V	Interpolation factor 64		0,05	0,21	0,41	0,83	1,66
Min. edge separation [ns]		500	1000	250	125	63	31
Min. counting frequency of the evaluation electronics without 4-edge evaluation [MHz]		2	1	4	8	16	32
Speed factor		0	1	3	4	6	9

Chart 14



## 11.3 Ordering key - Scale tape MI for LIKselect

Ordering key - example

MI	5	1	-	3	0	B	P	00120
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**Product name**

<b>MI</b>	Measuring standard with asymmetric reference mark suitable for LIKgo & LIKselect
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**Material**

<b>5</b>	Stainless Steel (SINGLEFLEX)
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**Design type**

<b>1</b>	SINGLEFLEX, standard (ML + 15 mm)
<b>5</b>	SINGLEFLEX, min. total length (ML + 10 mm), without name plate

**Version**

<b>-</b>	Standard
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**Accuracy grade**

<b>3</b>	±3 µm/m
<b>4</b>	±5 µm/m

**Fastening type**

<b>0</b>	With adhesive tape (double-sided, 0.2 mm material thickness)
<b>3</b>	Without adhesive tape

**Position of the reference mark**

<b>B</b>	In the middle of the ML
<b>E</b>	Customer-specific reference mark up to ML < 1 245 mm
<b>N</b>	In 50 mm intervals beginning at midpoint of ML
<b>O</b>	Without reference mark up to ML < 1 245 mm

**Measuring length (ML)**

Standard measuring lengths			
00070	70 mm	01020	1 020 mm
00120	120 mm	01120	1 120 mm
00170	170 mm	01220	1 220 mm
00220	220 mm	01320	1 320 mm
00270	270 mm	01420	1 420 mm
00320	320 mm	01520	1 520 mm
00370	370 mm	01620	1 620 mm
00420	420 mm	01720	1 720 mm
00470	470 mm	01820	1 820 mm
00520	520 mm	01920	1 920 mm
00570	570 mm	02020	2 020 mm
00620	620 mm	02120	2 120 mm
00670	670 mm	02220	2 220 mm
00720	720 mm	02320	2 320 mm
00770	770 mm	02420	2 420 mm
00820	820 mm	02490	2 490 mm
00920	920 mm		

**Customer-specific measuring length**

<b>P</b>	20 µm
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**Grating period (TP)**



The variations of products presented correspond to our standards - if your required specifications are not listed - please contact us!

## 11.4 Order Information for Accessories

To electronically adjust the *LIKselect*, the ADJUSTMENT TOOL and the EPIFLEX-Adapter are needed.

Name	Scope of delivery / Description	Order-no.
ADJUSTMENT & EPIFLEX Tool-SET	<ul style="list-style-type: none"> <li>ADJUSTMENT TOOL</li> <li>EPIFLEX Adapter</li> <li>Diagnostic cable to connect the measuring system</li> <li>USB cable to connect a PC</li> <li>USB - D-SUB - adapter cable (15-pin)</li> <li>EPIFLEX Adapter cable</li> <li>Exchangeable 8-pin plug connectors</li> <li>Transport case and documentation</li> </ul>	344220-90
<b>Optional single components</b>		
ADJUSTMENT TOOL SET	<ul style="list-style-type: none"> <li>ADJUSTMENT TOOL</li> <li>Diagnostic cable to connect the measuring system</li> <li>USB cable to connect a PC</li> <li>USB - D-SUB - adapter cable (15-pin)</li> <li>Exchangeable 8-pin plug connectors</li> <li>Transport case and documentation</li> </ul>	344220-33
EPIFLEX Adapter Set	to connect the scanning head to the ADJUSTMENT TOOL <ul style="list-style-type: none"> <li>EPIFLEX USB-Adapter</li> <li>EPIFLEX Adapter cable</li> <li>Transport case and documentation</li> </ul>	344220-50
NPA - NUMERIK PWT Adapter	<ul style="list-style-type: none"> <li>NPA - NUMERIK PWT Adapter</li> <li>Installation instructions</li> </ul>	1312188-01
EPIFLEX Pro Software	available free of charge via download on <a href="http://www.numerikjena.de">www.numerikjena.de</a>	
NPA Software Module	The NPA software module is available free of charge on our website <a href="http://www.numerikjena.de">www.numerikjena.de</a>	
PWT 101 Firmware	The latest firmware for the PWT 101 is available for free download on the Heidenhain website at <a href="http://www.heidenhain.de">www.heidenhain.de</a>	

Chart 15

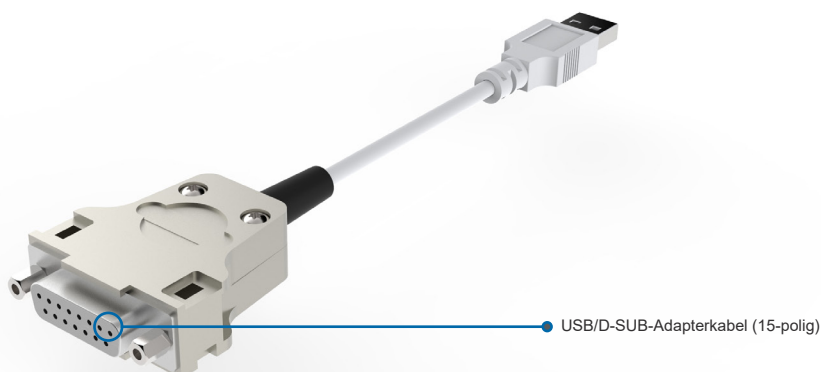


Image 41

**Required components (not included):**

PC with OS Windows 7 / 8 / 10 (32 or 64 bit)

