

NUMERIK
JENA



 **LIKgo**

Optical Linear Encoder with Online Compensation

English Original Instruction

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The new LIK series stands for user friendliness, versatile deployability, and high quality.

The brand-new, three-field scanning module with integrated scanning-head electronics offers multiple improvements:



Save **MONEY**

Reduced cost of production and lower encoder prices thanks to standardized components



Precise **POSITIONING**

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



Save **TIME**

Fast delivery thanks to in-stock encoder components and improved production

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 short-range 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 **LIKgo** 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 μm 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:

- Reference signal(s) with repeatability accurate to a specific increment, regardless of the direction from which the reference mark(s) is/are traversed
- Compact size and large mounting tolerances
- High resistance to contamination due to 2-field scanning
- Possibility of electronic signal adjustment (signal optimization after mounting)
- Special, easy to mount scale tape (SINGLEFLEX) for a variety of applications and ambient conditions

2. GENERAL INFORMATION

2.1 Specifications and recommendations

- 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!

2.2 Notes on Legal Requirements



- The NUMERIK JENA encoders conform to EC standards and carry the CE mark.
- They are conform to EMC-standards (2014/30/EU)
- NUMERIK JENA encoders fulfill the requirements of the (German) Product Safety Act (ProdSG) from November 8th, 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 610103rd Ed., 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.

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 3rdEd., 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

- 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.



**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 7 „Cleaning“.

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



Image 1

3. SETUP OF THE LINEAR MEASURING SYSTEM LIKgo

The measuring system consists of the following components:

- Measuring head including EPIFLEX sensor module and cable with connector
- Stainless steel or glass measuring standard with incremental track and reference mark

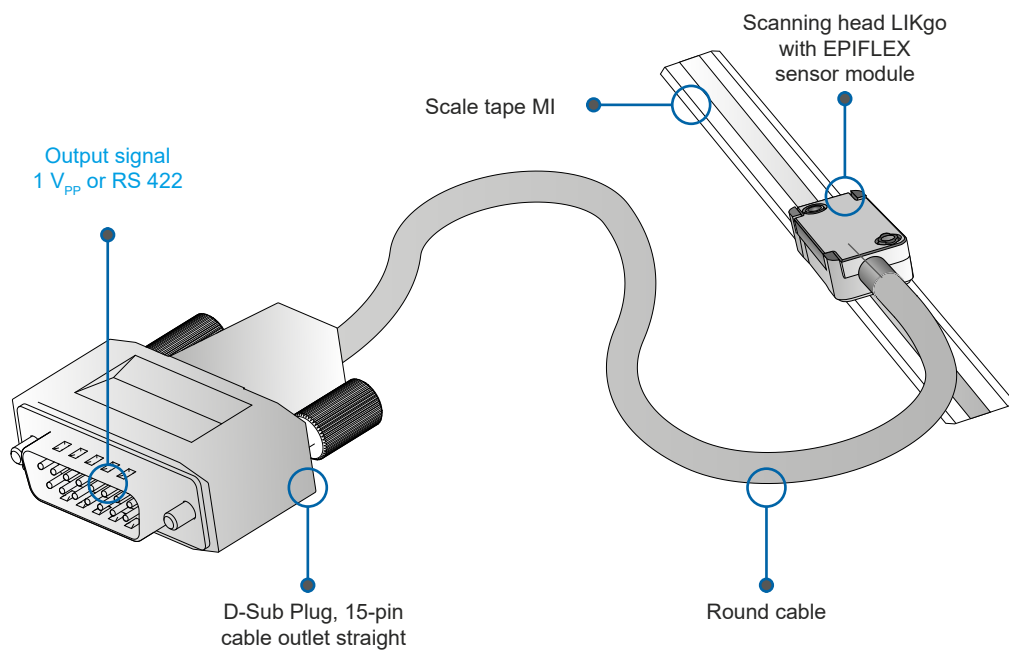


Image 2

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

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 $\pm a$ µm with respect to their mean value.

For measuring length up to 1 m, the tolerance ($\pm a$ µm) 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 mm² 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.

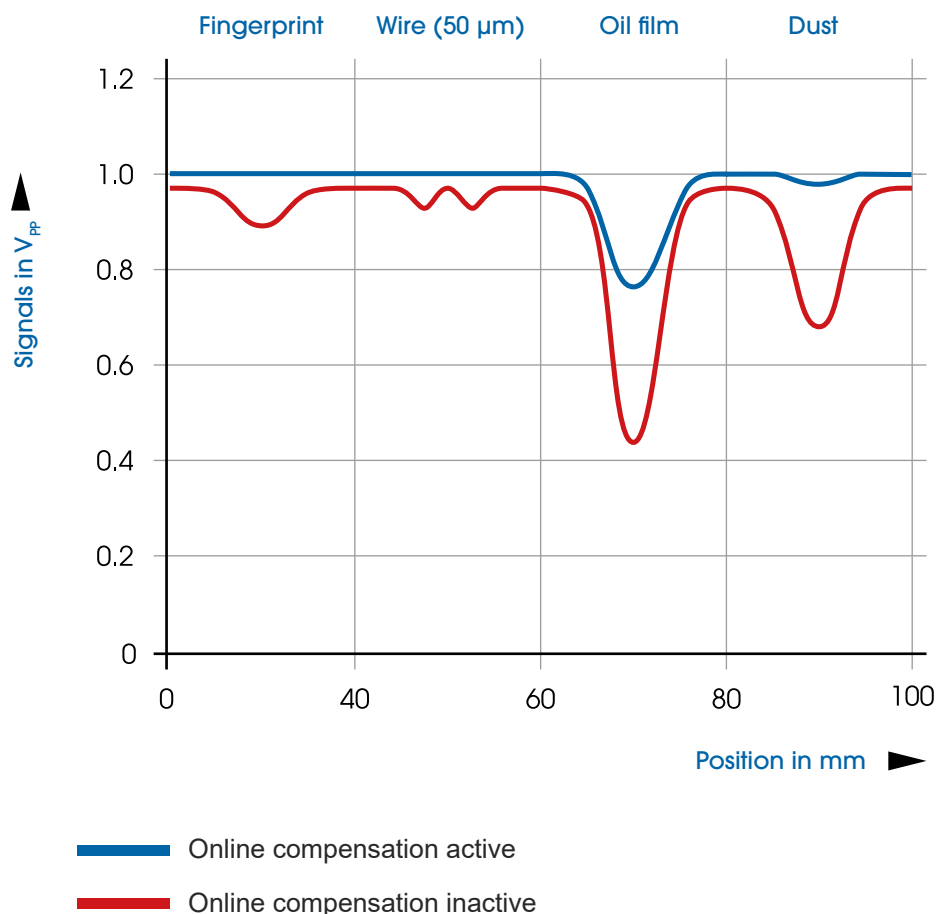


Image 3

4.3 Ambient Conditions

Ambient condition	LIKgo
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 ... 3000 Hz)	≤500 m/s ²
Shock (6 ms)	≤1000 m/s ²
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 table 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.

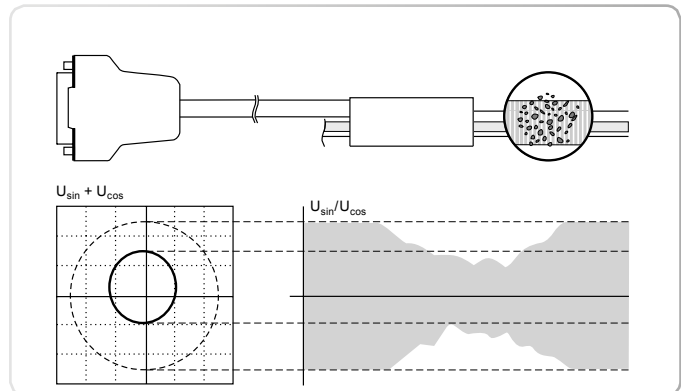


Image 4

Incorrect Mounting

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

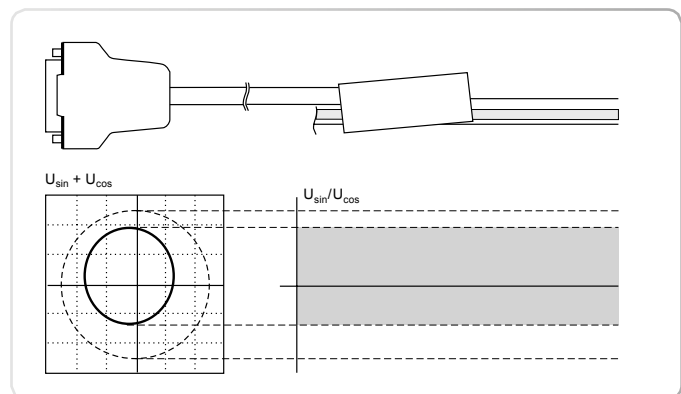


Image 5

Active Online Compensation

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

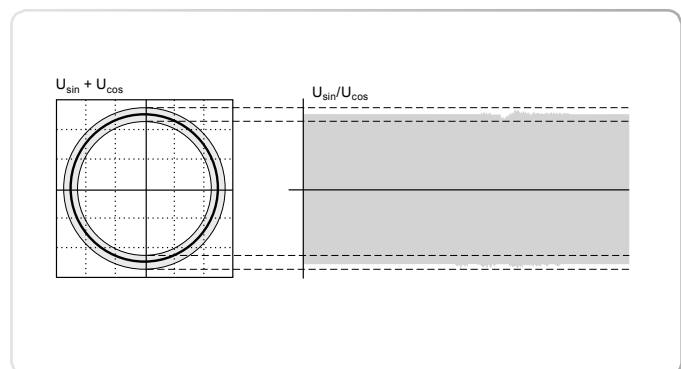


Image 6

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 LIKgo

Parameter	LIKgo
Dimensions of scan head (in mm)	28 x 13 x 7.5
Weight of scan head (w/o cable)	10 g
Traversing speed	
depending on auxiliary electronic unit	see Speed Chart

Chart 3

Permissible Mounting Tolerances

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

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.

5.1.2 SINGLEFLEX Scale Tape

SINGLEFLEX Scale tape MI	
Material	Stainless Steel
Grating period (TP)	20 μm
Reference marks	<ul style="list-style-type: none"> • In the middle of the measuring length (ML) • without • every 50 mm • Others on request
Measuring length (ML)	up to 2 490 mm (others on request)
Linear thermal expansion coefficient	$10.6 \times 10^{-6} \text{ K}^{-1}$ (expansion will be influenced by the mounting surface)
Accuracy classes (a)	<ul style="list-style-type: none"> • $\pm 3 \mu\text{m/m}$ • $\pm 5 \mu\text{m/m}$
Baseline error	$\pm 750 \text{ nm} / 50 \text{ mm}$

Chart 5

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.

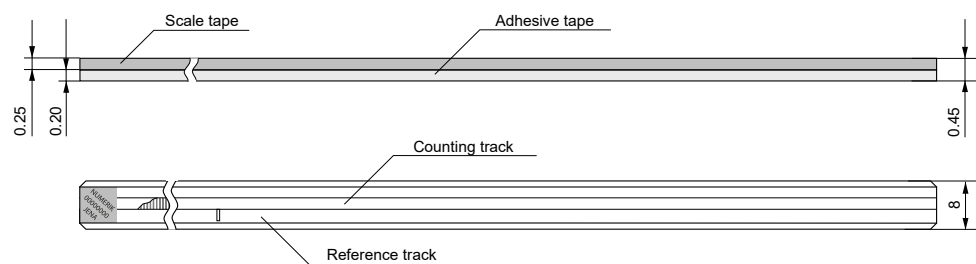
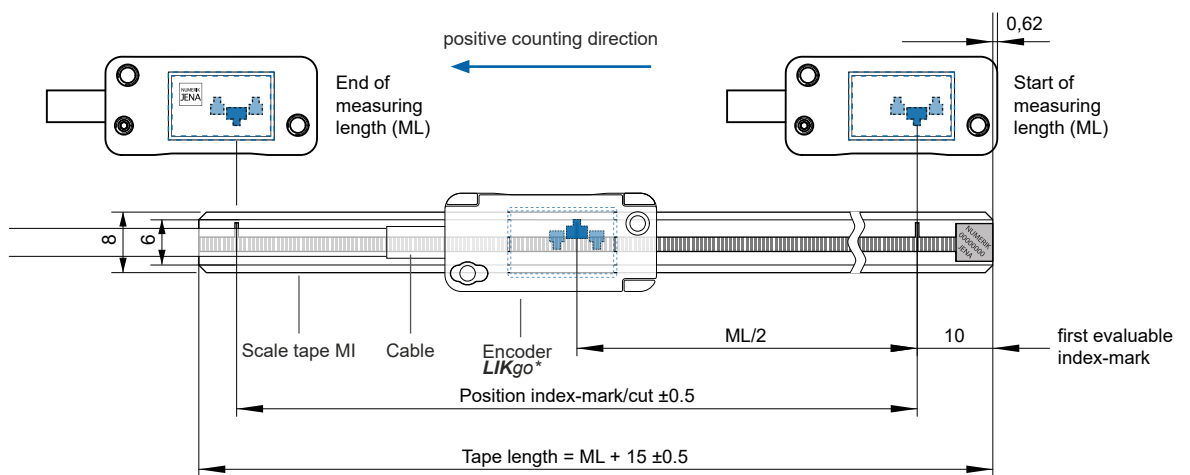


Image 6

Counting Direction

The alignment of the scale tape 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 scale tape.



* View of the sensor from above through the housing

Image 7

5.1.3 Cables

Cable	
Cable diameter	3.7 mm
Permissible bending radius	<ul style="list-style-type: none"> Occasional flexing ~8 mm Constant flexing ~40 mm
From scan head to the D-Sub connector	<ul style="list-style-type: none"> 0.3 m 1.0 m 3.0 m

Chart 6

5.1.3.1 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 ≥ 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 point 4.2 - "Mechanical data")!

5.1.3.2 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	LIKgo	
Scanning frequency	max. 500 kHz	
Supply voltage	5 V \pm 10%	
Output interfaces		
Voltage output		1 V _{PP}
Square wave output		RS 422 with interpolation up to 64-times
Current consumption		
Voltage output		\leq 50 mA*
Square wave output RS 422		\leq 150 mA*
Interpolation error (highest resolution - with the interpolation factor 64)		
typical maximum value	\pm 85 nm	

* with 120 Ω load resistance

Chart 7

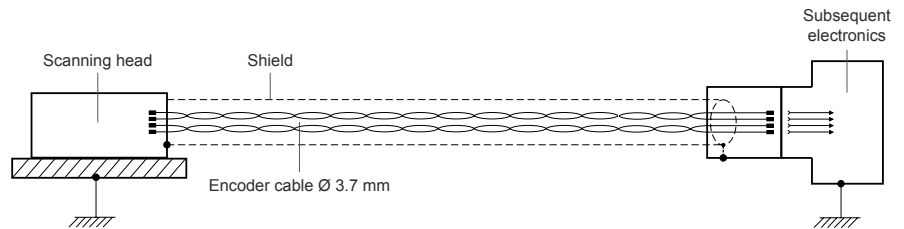
5.2.1 Electromagnetic Compatibility (EMC)

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

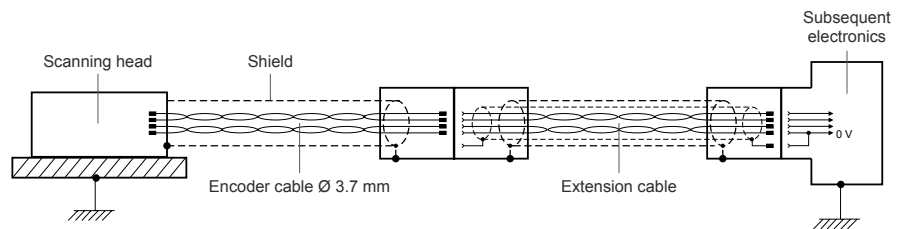
- The encoder must be mounted to a galvanic conductive surface. The mounting surfaces, the threads of the mounting screws and the threads in the machine must be free from electrically non-conductive coatings.
- Maintain the NUMERIK JENA GmbH shielding concept for the measuring system!
- Shielding for 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 \geq 6 mm²) 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 Shielding Concepts

- 1 V_{pp} and RS 422 output



- 1 V_{pp} output



- RS 422 output

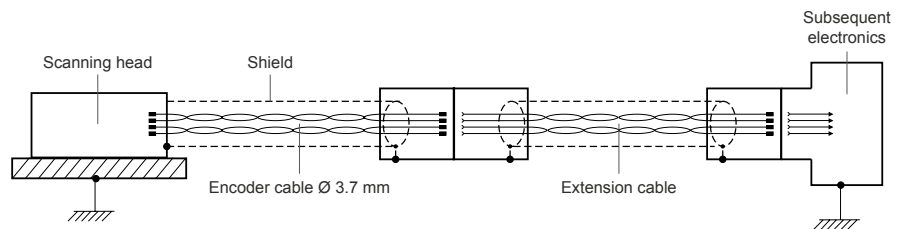


Image 8

5.2.3 Connector

15-pin D-Sub Connector

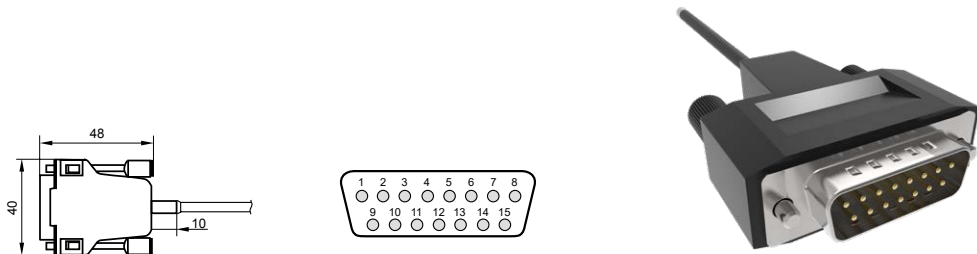


Image 9

PIN Assignment

PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Housing
1 V_{PP}	–	–	–	U ₀₋	U ₂₋	U ₁₋	–	5V	0V	–	–	U ₀₊	U ₂₊	U ₁₊	n.c.	Shield
RS 422	–	–	NAS	Z ₀₋	Z ₂₋	Z ₁₋	–	5V	0V	–	AS	Z ₀₊	Z ₂₊	Z ₁₊	n.c.	Shield

Chart 8

1 V_{PP}

U ₁₊	Counting signal 0° (sin)
U ₁₋	Counting signal 180° (-sin)
U ₂₊	Counting signal 90° (cos)
U ₂₋	Counting signal 270° (-cos)
U ₀₊	Reference signal
U ₀₋	neg. reference signal
0V	Ground (GND)
5V	Operating voltage (U _B)
n.c.	not connected (must not be connected!)
AS	Error signal (monitoring signal)

RS 422

Z ₁₊	Counting signal 0°
Z ₁₋	neg. counting signal 0° (180°)
Z ₂₊	Counting signal 90°
Z ₂₋	neg. counting signal 90° (270°)
Z ₀₊	Reference signal
Z ₀₋	neg. reference signal
NAS	Neg. error signal
NAS high:	Input signal within the tolerance range
NAS low:	Input signal outside the tolerance range (check measuring system!)

5.2.4 Voltage Output 1 V_{PP}

Optimal Connection Circuit

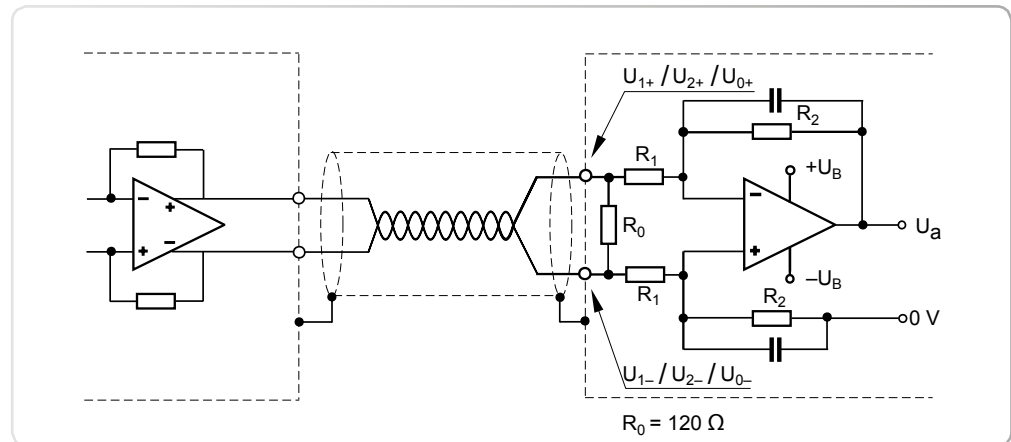


Image 10

Difference signals measured at R₀:

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

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

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

Signal Curve

Encoders with 1 V_{PP}-interface provide voltage signals that can be highly interpolated.

The sinusoidal incremental signals U₁ and U₂ are phase-shifted by 90° elec. and have amplitudes of typically 1 V_{PP}. The illustrated sequence of output signals (with U₂ lagging U₁) applies for the direction of motion shown in the dimension drawing.

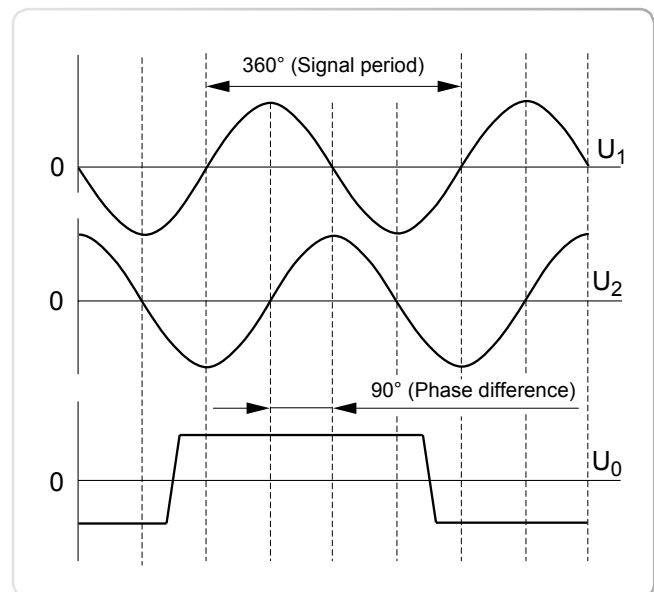


Image 11

The reference mark signal U₀ has an unambiguous assignment to the incremental signals. The output signal might be somewhat lower next to the reference mark.

5.2.5 Square-Wave Output RS 422

Optimal Connection Circuit

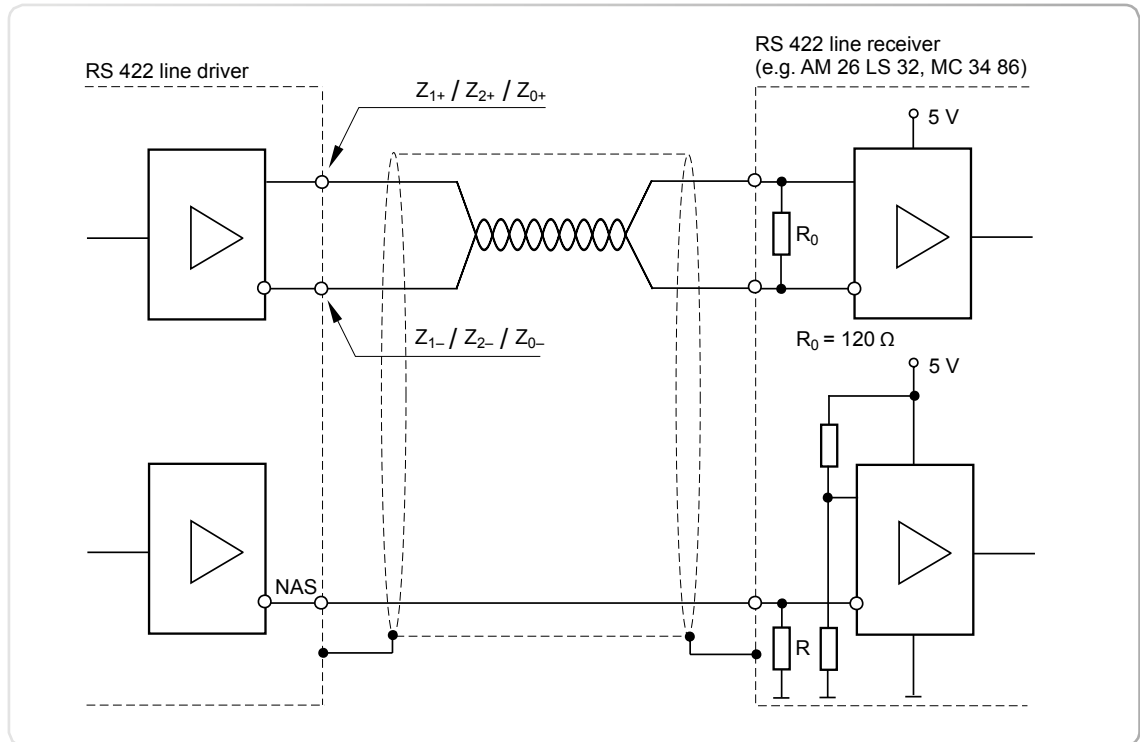
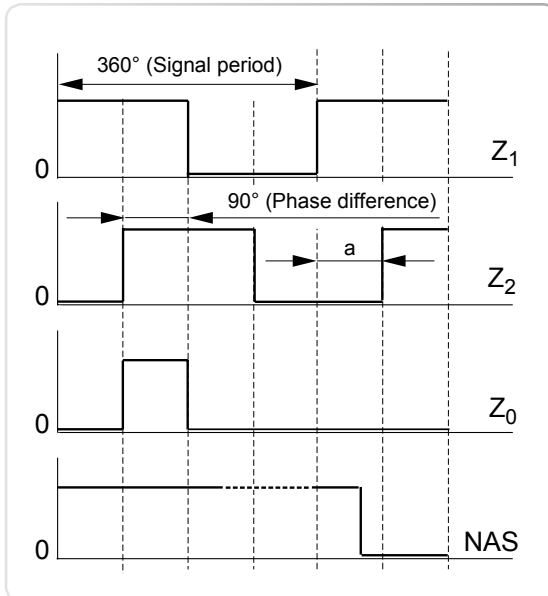


Image 12

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 $R_{0res} \approx 120 \Omega$.

Signal Curve



NAS high:

Encoder functioning properly, input signals within tolerance range

NAS low:

Check the measuring system

α :

Minimum edge separation as a function of the interpolation factor and traversing speed (see also 3.4. or speed chart at 9.2.)

Image 13

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° 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 - LIKGO

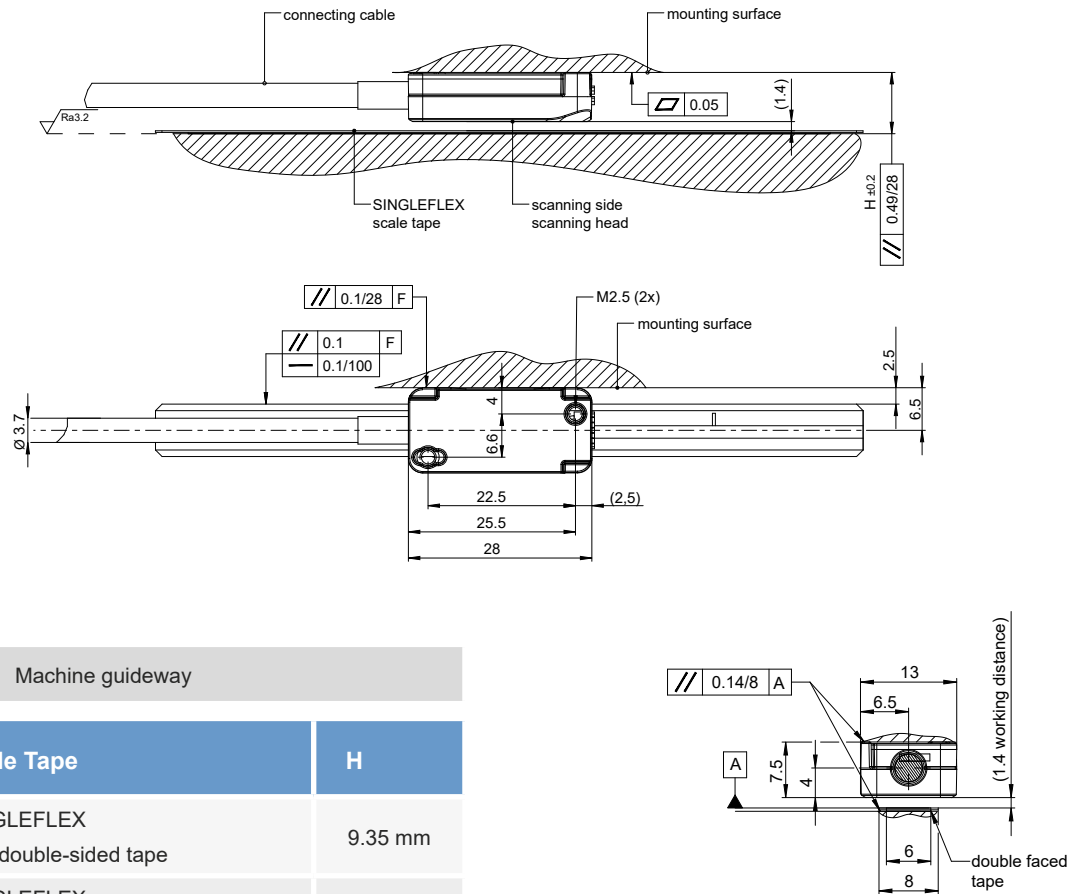


Image 14

7. GENERAL INSTALLATION NOTES

7.1 Delivery Contents

Standard

- **LIKgo** scanning head (according to the ordered specification)
- SINGLEFLEX scale tape (according to the ordered specification)
- Spacing gage for checking the correct working distance when mounting the scanning head (made of plastic; 1.4 mm)
- Information sheet

Optional

- ADJUSTMENT TOOL & EPIFLEX PRO Software
- EPIFLEX Adapter
- NPA - NUMERIK PWT Adapter
- Extension cable



When mounting the encoder head, the screw depth in the encoder head housing must be a minimum of 5.5 mm and a maximum of 7.0 mm. Please note that otherwise the threaded domes of the housing may be damaged.

7.2 Installation Position

- The installation position of the measuring system is arbitrary.
- In order to avoid contamination deposits, a vertical position for the scale tape 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.

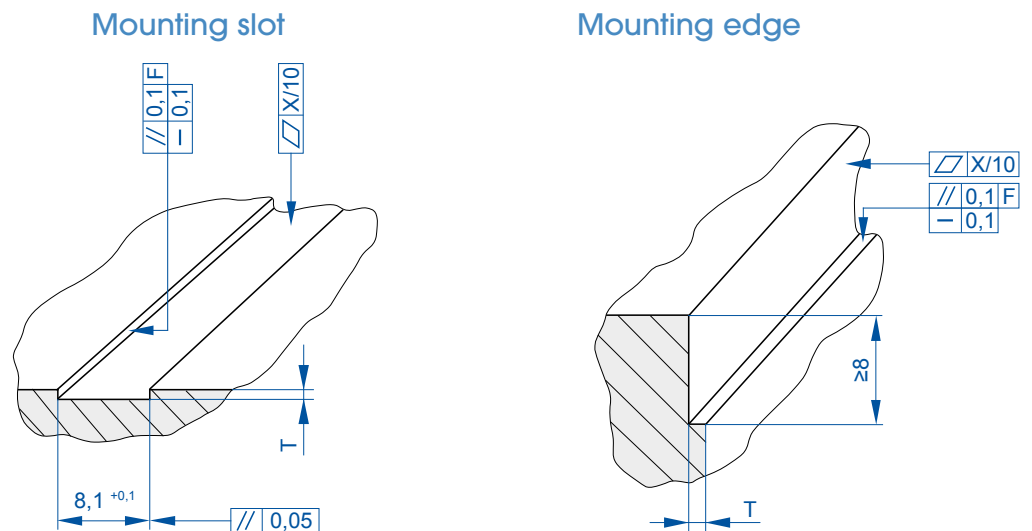
7.3 Mounting Steps

Hereafter the mounting steps for a LIKgo 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!

1 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 (see also image in 4.1.2)



Accuracy class	X
±3 µm/m	0,009
±5 µm/m	0,009

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

Image 15



ATTENTION: Acetone and Alcohol are inflammable liquids!

2 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.
- Alien 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.

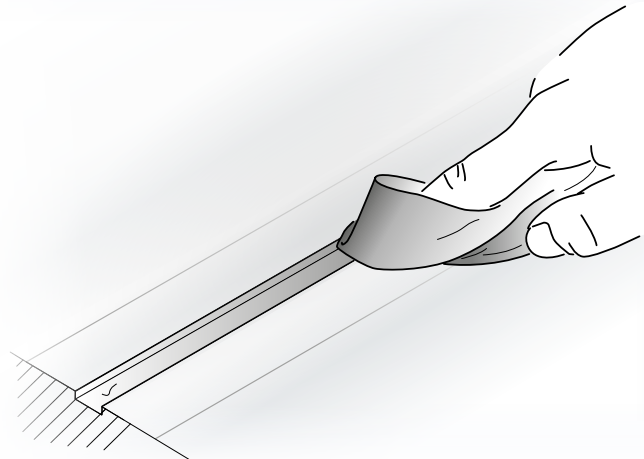


Image 16

3 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!

red protective film
(on the bottom)

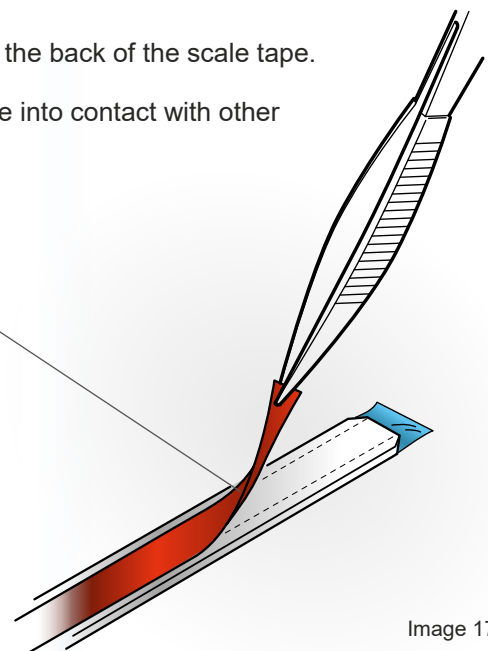


Image 17

4 Step 4

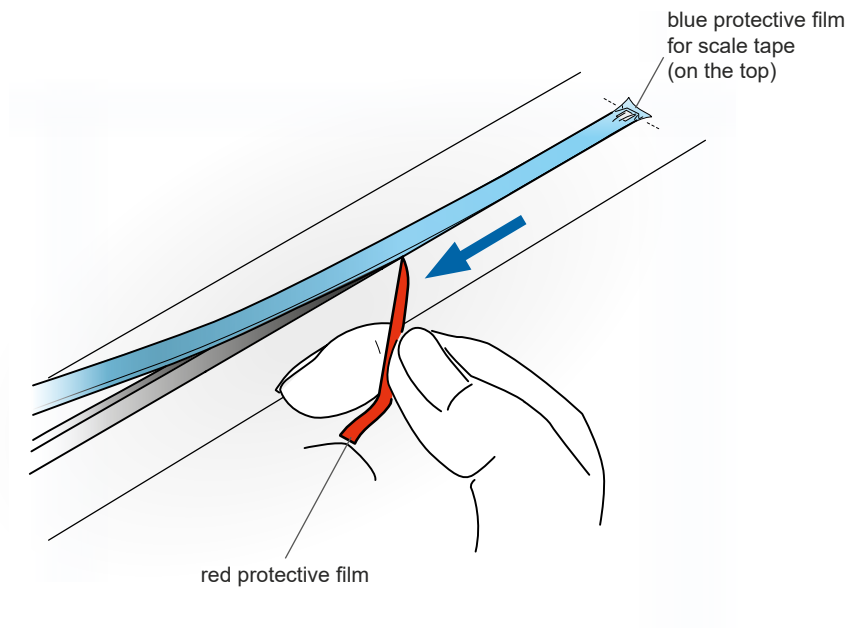


Image 18

- 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).



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

5 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.

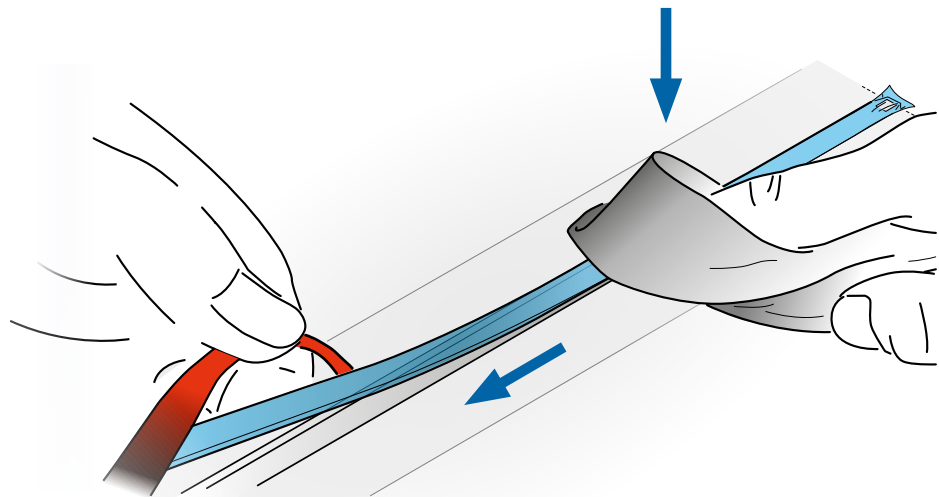


Image 19



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



ATTENTION: Acetone and Alcohol are inflammable liquids!



6 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).

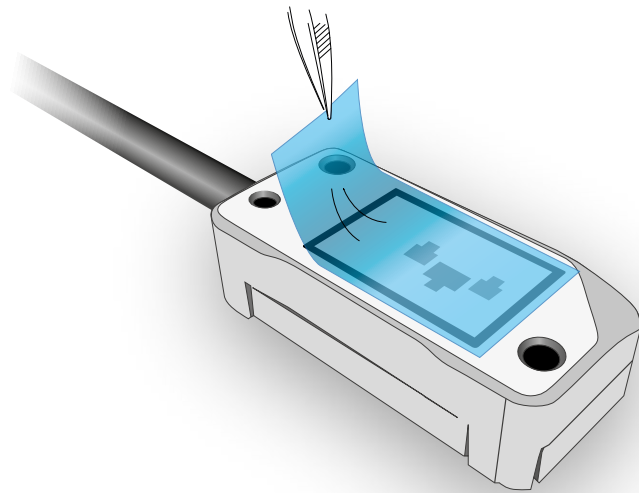


Image 20

7 Step 7

mounting example

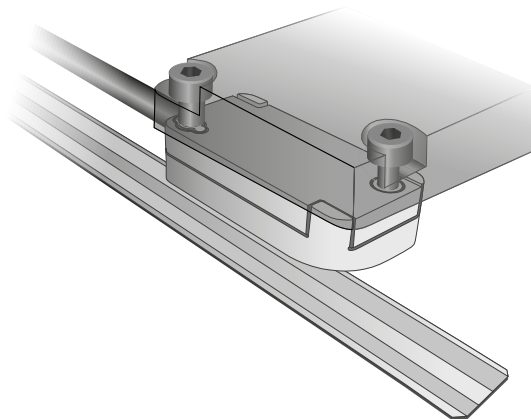


Image 21

- Screw the scanning head onto the prepared mounting surface such that there is still some vertical clearance.



Please pay attention to the specified screw depth. This must be a minimum of 5.5 mm and a maximum of 7.0 mm.

- 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).

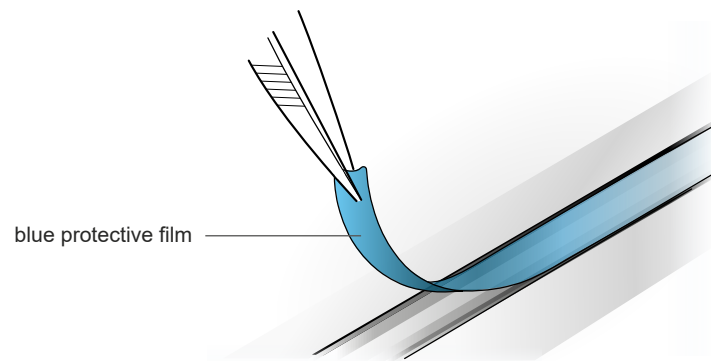


Image 22

8

Step 8

- Ideally, the sensor mounting is constructed by the customer in such 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 to 0.7 Nm).
- To check the parallelism between the housing of the measuring head and the scale tape, you can use the provided 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.
- Slide the spacing gage "1.4" – included in the scope of delivery – 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!

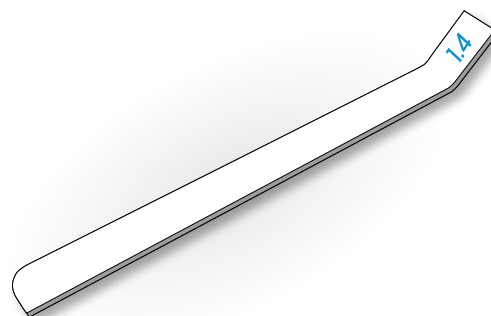


Image 23

9

Step 9

- Position the encoder cable including the 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 the evaluation electronics on and test the functionality.
- If there are errors in the function or during measurement, please read chapter 8 “Troubleshooting” first. If these information are not helpful for your problem, please contact the technical support of NUMERIK JENA or an authorized representation in your country.



ATTENTION: Acetone and Alcohol are inflammable 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 GmbH 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 the new encoder generation to the ADJUSTMENT TOOL. With this adapter, it is no longer necessary to open the encoders housing. It can be connected directly to the 15-pin D-Sub connector of the measuring head.



Image 24

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

- Electronic readjustment of the **LIKgo** without unmounting the encoder.
- Assistance with the installation of the measuring system and its optimization.

8.1.3 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.

8.1.4 Scope of Delivery

Further information about the ADJUSTMENT TOOL and the EPIFLEX PRO software can be found on the NUMERIK JENA website.

8.1.4.2 Scope of Delivery ADJUSTMENT & EPIFLEX TOOL Set

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

8.1.4.2 Scope of Delivery ADJUSTMENT TOOL

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

8.1.4.3 Scope of Delivery EPIFLEX Adapter

- EPIFLEX Adapter
- EPIFLEX cable

8.1.5 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 also allows the user to display the sensor signals and evaluate them without using an oscilloscope or other expensive hardware. Furthermore it is possible to program respectively optimize the encoder to the existing mounting conditions automatically.



Image 25

The EPIFLEX PRO software is available for free via download on the NUMERIK JENA website under www.numerikjena.de.

The EPIFLEX PRO software is suitable for the following operating systems:

- Windows 7 / 8 / 10 (32 or 64 bit)

8.1.6 Wiring diagram ADJUSTMENT & EPIFLEX TOOL-Set

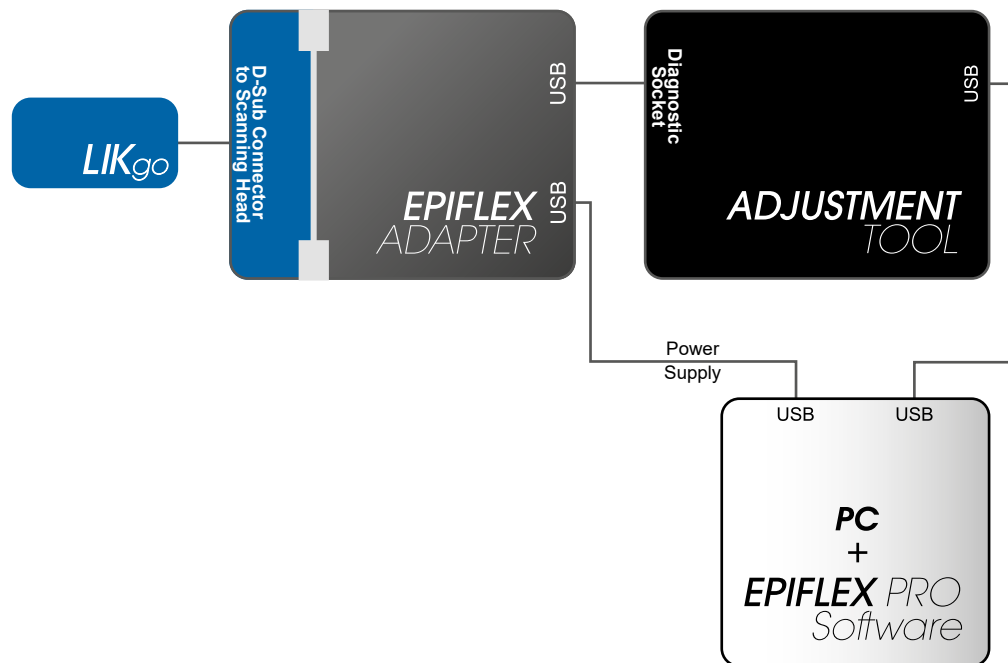


Image 26

8.2 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 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 27

8.2.1 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.

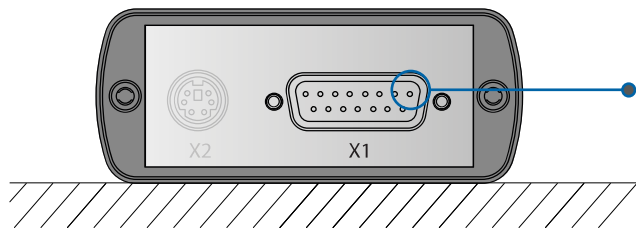


Image 28

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
($< 5 \text{ W} / U_p$)

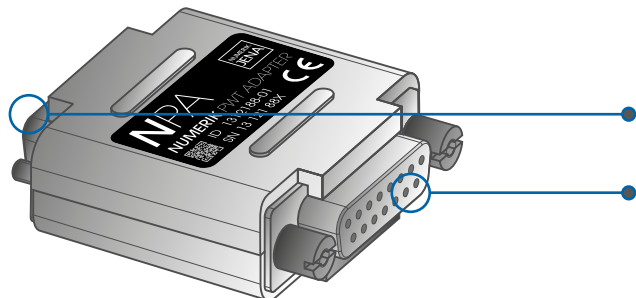


Image 29

X3 – for connection to the PWT 101

X2 – for connection to the NUMERIK JENA measuring device

8.2.2 Wiring diagramm

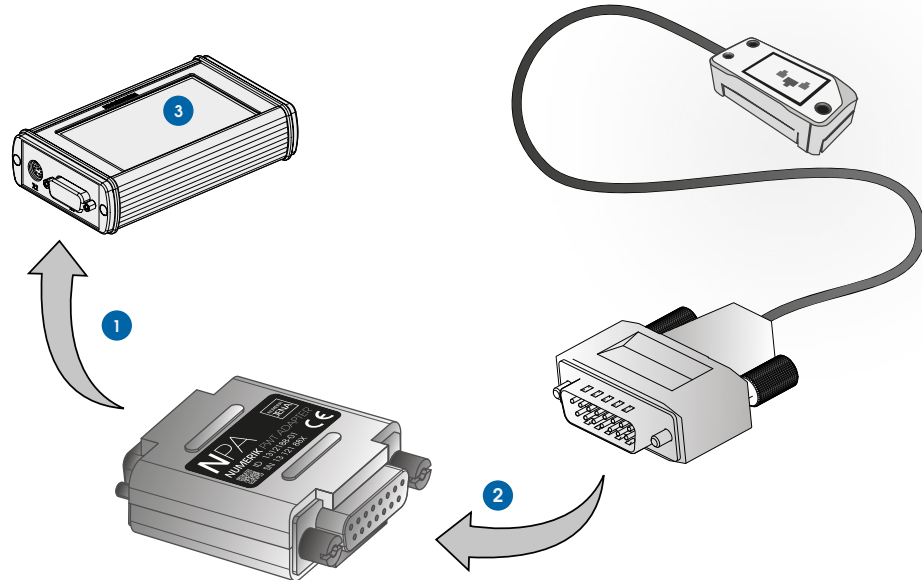


Image 30

8.2.3 Notes on connection

- 1 Step 1:**
The signal adapter must be connected to PWT 101 at input X1.
- 2 Step 2:**
The NUMERIK JENA measuring device must be connected to the signal adapter.
- 3 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.

8.3. 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 9

9. CLEANING

- Depending on the measuring system's mounting attitude and the ambient conditions, it may be necessary to clean the scale tape surface and sensor surface of the scanning head (scanning window for counting and reference track) occasionally.
- 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

The functions of all scanning heads and accuracy of all scale tapes are tested before the encoders are shipped. However, if troubles or problems should occur, please read the following points in the chart and proceed according these information.

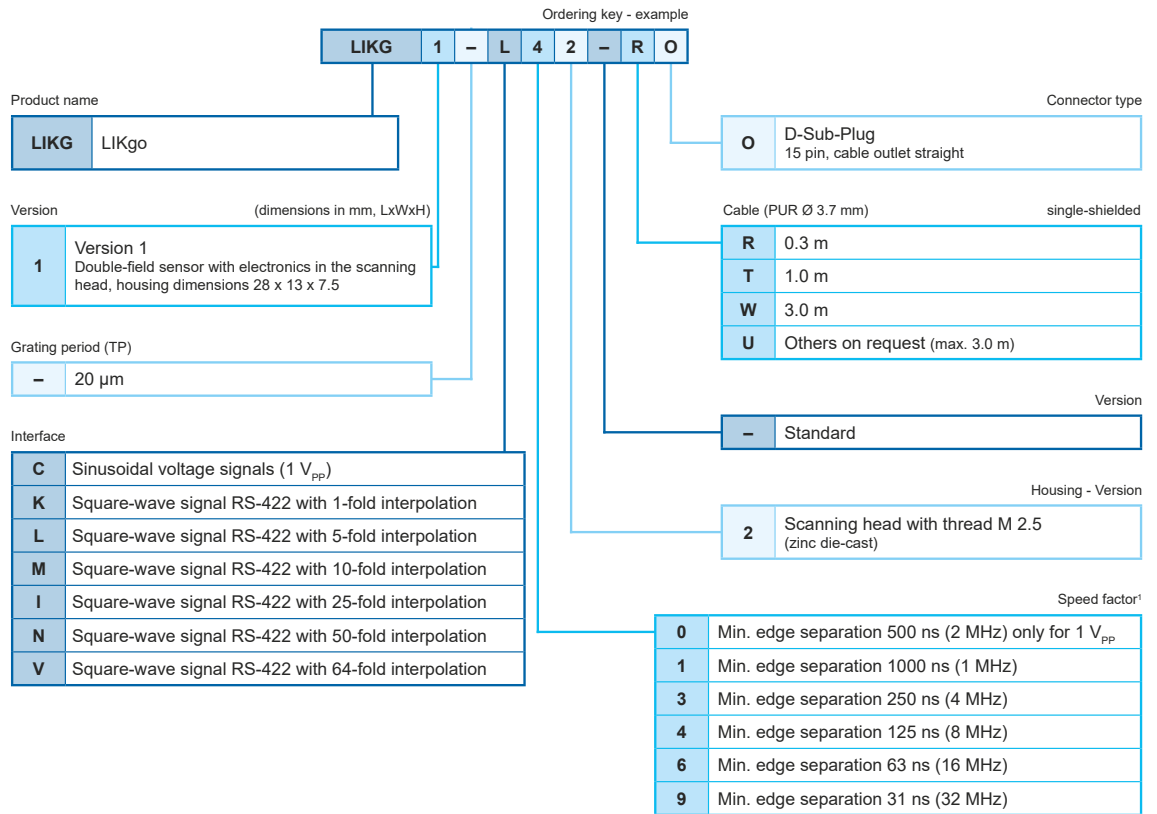
If this is not helpful, please contact the technical support of NUMERIK JENA GmbH or one of our authorized representations. You will find respective contact data on the NUMERIK JENA GmbH website www.numerikjena.de.

Error	Possible causes	Solution
No measuring signal	No power at the scanning head	<ul style="list-style-type: none"> Check the status of the evaluation electronics Check the connection assignment between the encoder and the evaluation electronics
Error message from the evaluation electronics	Following error due to temporary failure of the measuring signal	<ul style="list-style-type: none"> Check the assignment of the scale tape to the scanning head p.r.n. readjust mechanically Readjust electronically with ADJUSTMENT TOOL*
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	Contact the technical support of NUMERIK JENA

* see also chapter 6 - Signal adjustment

11. ORDER INFORMATION

11.1 Scanning head LIKgo



¹ Customer-specific value, depending on the traversing speed and the counting frequency of the evaluation electronics (See speed chart in chapter 11 of the product data sheet).

11.2 Speed Chart for LIKgo 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. Pay attention to your chosen interpolation factor and the targeted traversing speed first. If you have found the respective information, please check if your evaluation electronics is able to achieve the needed counting frequency.

The listed values in the charts 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 _{pp})	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 11

11.3 Scale Tape MI for LIKgo

Ordering key - example

MI	5	1	-	3	0	B	P	00120
----	---	---	---	---	---	---	---	-------

Product name

MI	Measuring standard with asymmetric reference mark suitable for LIKgo & LIKselect
-----------	----------------------------------------------------------------------------------

Material

5	Stainless Steel (SINGLEFLEX)
----------	------------------------------

Design type

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

Version

-	Standard
----------	----------

Accuracy grade

3	±3 µm/m
4	±5 µm/m

Fastening type

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

Position of the reference mark

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

Measuring length (ML)²

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		

Customized measuring length²

Grating period (TP)

P	20 µm
----------	-------

¹ Reference mark for measuring standard with measuring lengths > 1 245 mm available on request.

² Max. ML = 2 490 mm, higher ML on request.

TP – Grating period

ML – Measuring length

GL – Total length

11.4 Order Information for Accessories

To electronically adjust the device, 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"> ADJUSTMENT TOOL EPIFLEX Adapter Diagnostic cable to connect the measuring system USB cable to connect a PC USB - D-SUB - adapter cable (15-pin) EPIFLEX Adapter cable Exchangeable 8-pin plug connectors Transport case and documentation 	344220-90
Optional single components		
ADJUSTMENT TOOL SET	<ul style="list-style-type: none"> ADJUSTMENT TOOL Diagnostic cable to connect the measuring system USB cable to connect a PC USB - D-SUB - adapter cable (15-pin) Exchangeable 8-pin plug connectors Transport case and documentation 	344220-33
EPIFLEX Adapter Set	<p>to connect the scanning head to the ADJUSTMENT TOOL</p> <ul style="list-style-type: none"> EPIFLEX USB-Adapter EPIFLEX Adapter cable Transport case and documentation 	344220-50
NPA - NUMERIK PWT Adapter	<ul style="list-style-type: none"> NPA - NUMERIK PWT Adapter Installation Instructions 	1312188-01
EPIFLEX Pro Software	available for free via download on www.numerikjena.de	
NPA Software Module	The NPA software module is available for free on our website www.numerikjena.de	
PWT 101 Firmware	The latest firmware for the PWT 101 is available for free download on the Heidenhain website at www.heidenhain.de	

Chart 12

Required components (not included):

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

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SIMPLY PRECISE

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