



ADJUSTMENT TOOL

For NUMERIK JENA incremental encoders with Online Compensation



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1 Features and Applications

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 to optimize the encoder signals regarding to the mechanical mounting conditions (tolerances).

To make signal adjustment as simple and effective as possible, the ADJUSTMENT Tool and the associated EPIFLEX Pro software were developed.

1.1 Functions of the ADJUSTMENT Tool

- Automatic signal adjustment/optimization and programming of the sensor module
- Display of the sinusoidal counting signals with amplitude, offset and phase position
- Enables evaluation of the mechanical mounting conditions
- Display and adjustment of the index signal

1.2 Online Compensation

The sensor modules from NUMERIK JENA are equipped with dynamic offset and amplitude control (online compensation). The amplitude and offset of the analog diode signals are corrected to their nominal values in real time via an internal automatic signal control (gain control). This reduces measuring errors due to contamination of the scale tape as well as from inaccuracies in the guide way. The phase position between the sine and cosine signals and the position of the reference signal are not taken into account by the control.

1.3 Suitable Encoders

The ADJUSTMENT Tool is suitable for the following NUMERIK JENA - products:

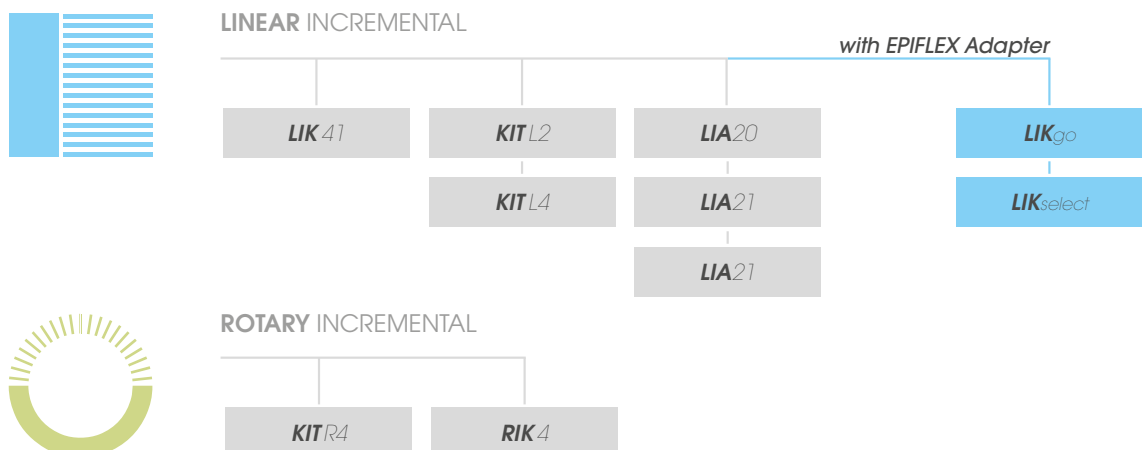


Image 1

2 General Information

2.1 General specifications and notes

- Make sure to familiarize yourself thoroughly with the contents of the user manuals and data sheets before installing and starting up the encoder!
- For additional information, please contact our authorized representatives or NUMERIK JENA GmbH. Corresponding contact data can be found on the website at www.numerikjena.de/en/service/contact-information
- The encoders as well as the accessory are guaranteed to function if the mounting and operating conditions are maintained as stated in the respective user manuals and data sheets.
- NUMERIK JENA GmbH is not liable for damages caused by unauthorized handling of the encoders and the accessory. Any unauthorized handling leads to forfeiture of all warranty claims!
- The stated mounting tolerances must be maintained in order to achieve the accuracies listed in the specifications! If the machine tolerances exceed the tolerances stated in the user manuals or data sheets, malfunctions during operation can occur and lead to measuring errors.
- NUMERIK JENA GmbH does not assume any liability for any damages or operating errors caused by incorrect mounting and/or startup operations.
- Please consider user manuals, data sheets and safety instructions of devices from other manufacturer which will be used in combination with encoders and accessories from NUMERIK JENA to ensure a reliable operation.
- Please pay attention to the safety instructions and warning symbols in the user manuals and data sheets from NUMERIK JENA!



Danger to the device or to 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 comply with the EMC Directive 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 61010^{3rd 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.

The CE declaration of conformity can be requested at the following address:

NUMERIK JENA GmbH

Im Semmicht 4

07751 Jena

Germany

or www.numerikjena.de. Other countries on request.

2.3 Notes on Transport, Storage and Handling

The products of NUMERIK JENA GmbH may only be transported and stored in the original packaging!

2.4 Notes on Operation



Only connect or disconnect plugs when the device is switched off - otherwise there is a risk of damage to internal components.

* 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.



The measuring systems and accessory products from NUMERIK JENA may only be operated with the supply voltage specified in the operating instructions or in the data sheet.

When connecting subsequent electronic units (e.g. control or display), the pin assignment must be observed!

2.5 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.

2.6 Scope of delivery

Depending on the version of the Adjustment-Set used, the scope of delivery includes at least the following components:

- ADJUSTMENT Tool
- Diagnostic cable to connect the measuring system
- USB cable to connect a PC
- USB-D-Sub-adapter cable (15-pin)
- Two exchangeable 8-pin plug connectors
- Carrying case and documentation/installation instructions

The latest version of the data sheet is available in the download section at www.numerikjena.de.

2.7 Nameplate

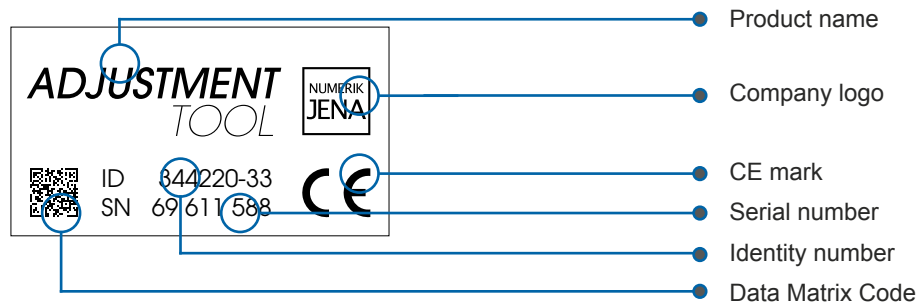


Image 2

3 EPIFLEX Pro Software

The EPIFLEX Pro software was specially developed for the ADJUSTMENT Tool and offers the user various options for setting up the measurement system. The EPIFLEX Pro software enables the display of sensor signals as well as their evaluation.

With the help of the EPIFLEX Pro software, the measuring system can be automatically optimized electronically in respect to the given mounting conditions.

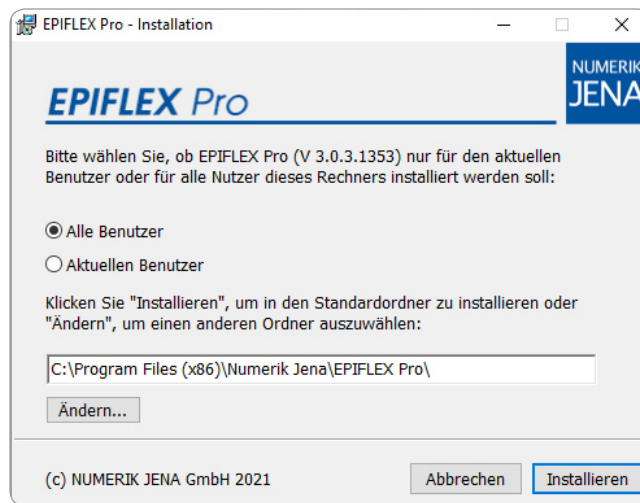


Image 3

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

The software is suitable for the following operating systems: Windows 7 / 8 / 10 (32 or 64 bit).



We perform bug fixes and performance improvements of our EPIFLEX Pro software at regular intervals. We therefore recommend to keep the software always up to date.

3.1 Installation



ATTENTION!

Please install the software first, then connect the ADJUSTMENT Tool to your PC!!

For software updates, please visit our website. In our download area we always provide the latest software version for free download. We usually offer these software packages in a packed ZIP folder. After downloading, unpack this folder on your computer, run the installation file and follow the installation instructions.



Uninstalling a possibly already existing older software version is not necessary!

3.2 Overview & Functionality



Image 4

ADJUSTMENT & EPIFLEX Tool-Set

Display device information	✓	Ident number & serial number of the measuring head
Online compensation	✓	ON/OFF switchable
Relative counting value	✗	
Adjustment of analogue signal	✓	automatic & manual adjustment possible
Adjustment of the reference signal	✓	automatic & manual adjustment possible
Error check	✗	
Save/read	✓	The values of the factory/delivered settings can be saved and files can be loaded.

3.3 Software interface

3.3.1 Software menu

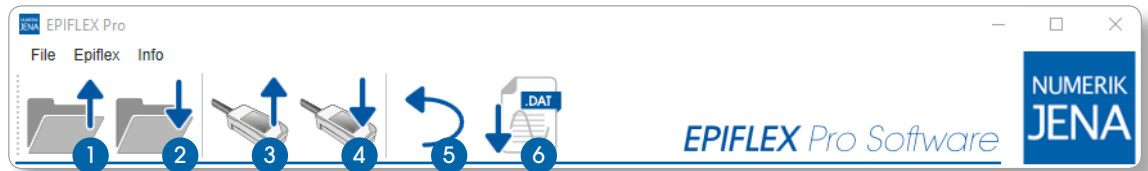


Image 5

- 1 Read from file: Reads the settings from a file with stored setting values (adjustment file) into the volatile internal memory of the measuring head.
- 2 Save to file: Writes the current settings to a file.
- 3 Read from measuring head: fetches the data from the connected sensor module..
- 4 Save to measuring head: saves the current settings permanently in the connected sensor module.
- 5 Undo: reverts all settings from the last time the measuring head was connected/read or saved.
- 6 Saving the raw measurement data to a file for further evaluation (e.g. Excel...).



NOTE:

The following options may be displayed differently for sensors of different product families, depending on the type of integrated sensor amplifier. The EPIFLEX Pro software automatically recognizes which system is connected and provides the corresponding setting options. It is optimized to show the customer only the parameters that are relevant for optimal adjustment.

3.3.2 Signal window with Lissajous figure

The signal window shows the sine and cosine counting signals in the form of a Lissajous figure.

The shape of the signal should ideally be circular. If the circle is oval or its center is not centered on the 0-volt axes, this usually has mechanical causes. These deviations can be corrected with the help of the automatic signal adjustment.

If the Lissajous figure or parts of it lie outside the gray boundary lines, signal adjustment is probably no longer possible. In this case, we recommend checking the mounting tolerances of the measuring head and the measuring scale. Information on the mounting tolerances can be found in the operating instructions of the respective product (see „5.3 Evaluation of the analog signals with the control switched off“ for further advices).



Image 6

- 7 Signal window for counting signals
 - Dark blue circle: current signal as Lissajous figure
 - Light blue area: signal optimum
 - Gray circles: tolerance limits 0.6 V_{pp} respectively 1,2 V_{pp}
- 8 Button for online compensation (ON /OFF)
- 9 Initiates the automatic signal adjustment
- 10 Shows a short description of the relevant area when the mouse pointer hovers over the element
- 11 Displays the sensor number

3.3.3 Index Signal Window

This window displays the sine and cosine count signals and the reference impulse. The reference pulsewidth should correspond approximately to a period duration. The upper intersection of sine and cosine should be centered within the reference impulse. This setting is also made by the automatic adjustment. It is important here that the reference mark is detected on the measuring scale during the adjustment.

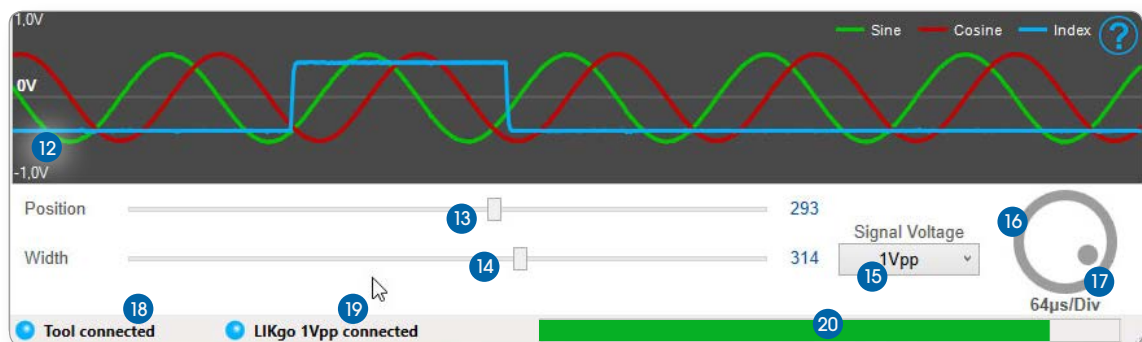


Image 7

- 12 Signal window for the index impulse (Reference Index)
 - Green signal period: Sine signal
 - Red signal period: Cosine signal
 - Blue signal: Index impulse
- 13 Controller for adjustment of the index – Change of position
- 14 Controller for adjustment of the index – Change of width

Only minor corrections due to the mounting should be necessary for (13) and (14).
- 15 Drop-down menu for signal output (interface). When using the interpolation boards from Numerik Jena, nominal signal amplitudes of $3 V_{PP}$ or $1 V_{PP}$ can occur at the adjustment connection. In this case, the measuring range of the Adjustment Tool must be switched to:
 - $1 V_{PP}$ (for sensor modules with and also without integrated signal interpolation)
 - $3 V_{PP}$ (for sensor modules with external interpolation electronics / PCB)
- 16 This control is used to change the capture rate of the Adjustment Tool. This corresponds to the time base setting of an oscilloscope.
- 17 Display for the time-base value
- 18 Status display connection to ADJUSTMENT Tool
- 19 Status display connected system
- 20 Bar display showing the progress of the current operation

3.4 Manual settings

3.4.1 Tab: Adjustment

If online compensation is deactivated, a manual signal adjustment can be done within the „Adjustment“ tab.

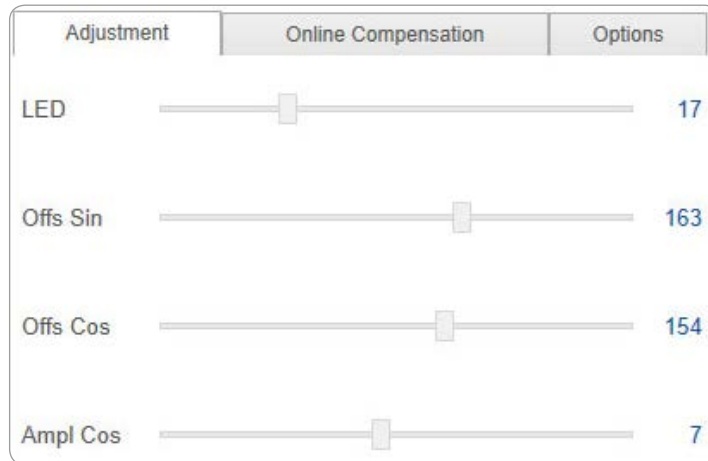


Image 8

The following adjustment parameters can be changed, they have a direct influence on the sine signals (Lissajous figure) :

- Slider to adjust the LED current (influences the amplitudes of sine and cosine)
- Slider to adjust the sine offset (Offs Sin) and cosine offset (Offs Cos)
- Slider for adjusting the cosine amplitude to the sine amplitude (signal amplitude of the sine signal* (Ampl Sin) & signal amplitude of the cosine signal (Ampl Cos))

Depending on the connected measuring system, menu items (tabs) or ranges are either not displayed or displayed in different colors.*



To simplify the adjustment, depending on the connected measuring device, only the relevant settings are displayed.

The slider must be positioned within the green range if the online compensation is intended to be used.

Image 9

* These options may not be supported for sensors with external interpolation electronics or depending on the type of integrated sensor amplifier.

3.4.2 Tab: Online Compensation

In this tab, the default settings (setpoints) of the online compensation can be influenced, but this is not necessary in standard cases. The online compensation must be enabled for this purpose.

The online compensation adjusts the amplitudes of the sine and cosine signals dynamically.

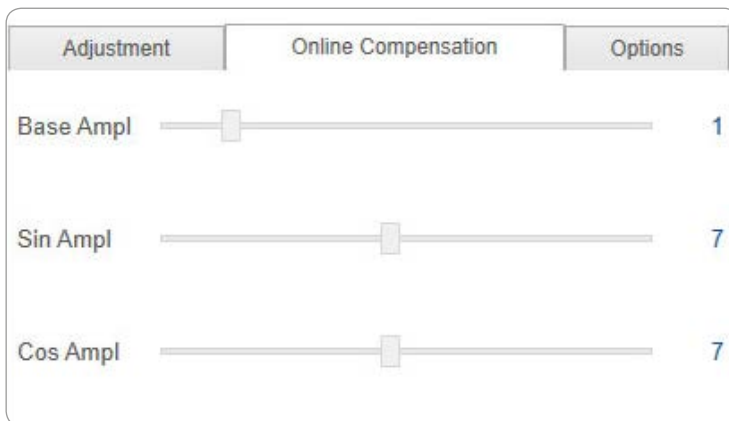


Image 10

* The following options may be displayed differently for sensors of different product families, depending on the type of integrated sensor amplifier. The EPIFLEX Pro software automatically recognizes which system is connected and provides the corresponding setting options. It is optimized to show the customer only the parameters that are relevant for optimal adjustment.

3.4.3 Tab: Options

The Options - Tab allows to activate or deactivate the error or monitoring signal (NAS). Furthermore the interface of the scanning head (1 V_{pp} or RS 422), the speed index of the sensor module and the counting direction can be changed.*

Sensor # 31102017

Adjustment	Options
<input checked="" type="checkbox"/> NAS	
Interface: <input type="radio"/> 1Vpp	<input checked="" type="radio"/> Square Wave
Speed Index	Id 3 (4MHz) ▾
<input type="checkbox"/> Invert Counting Direction	
Ident #:	1244546-01
Serial #:	99775533

Image 11

The interface setting is necessary to display the sine signals when connecting an RS 422 sensor without signal interpolation. When performing the automatic signal adjustment, this presetting is not necessary. It is then set automatically.

For selected measuring systems, it is also possible to adapt the maximum output frequency to the subsequent electronics in the case of the square-wave interface (not supported by all systems).

This tab also shows the ID and serial number of the sensor module. Please have this information ready in case you have any additional questions.

* These options may not be supported for sensors with external interpolation electronics or depending on the type of integrated sensor amplifier.

3.5 Advanced Software Settings

Advanced user settings can be made in the program menu under the menu item File > Settings or by pressing the keys [Ctrl] + [Shift] + [S] simultaneously. The selection calls the following window:

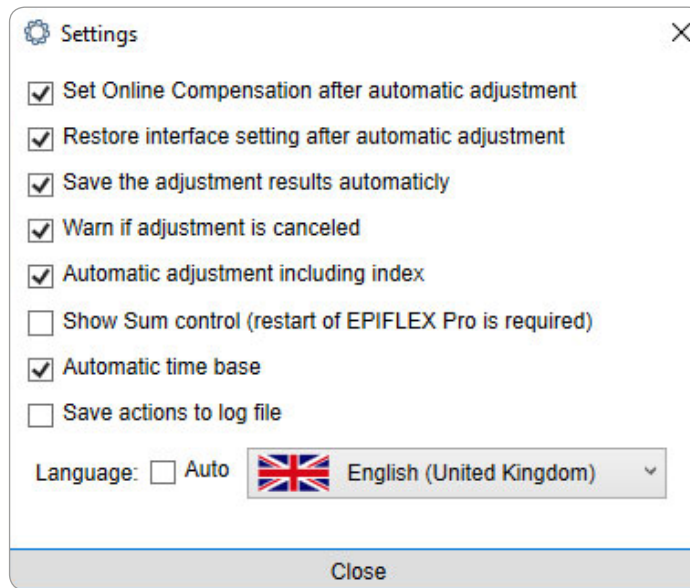


Image 12

The following functions can be activated or deactivated within the settings window:

- Set Online Compensation after automatic adjustment (enabled by default)
The automatic adjustment is generally performed with online compensation deactivated and ends with saving the values in the sensor - with activated online compensation.
- Restore interface setting after automatic adjustment (enabled by default)
Only applies to sensors with digital signal output (activated by default - recommended).
- Warn if adjustment is canceled (enabled by default)
If this option is disabled, adjustment values may not be saved afterwards.
- Automatic signal adjustment with reference (enabled by default)
With this option, the automatic adjustment includes the reference mark in the adjustment. For systems without reference, this option must be deactivated.
- Show Sum control in index signal window (restart of EPIFLEX PRO is required) - Then an additional sum control appears in the signal window for the reference impulse below the controls for position and width. This allows an even deeper adjustment of the reference signal for very special applications (disabled by default - recommended).
- Save activities in LOG file. (disabled by default)
- Language settings, automatic or manual (English/German)

4 Wiring Diagram

4.1 Differentiation based on NUMERIK JENAs product groups

The connection method depends on the product group. A distinction must be made between connection method A and B:

Connection method A:

- for the new LIK product family with LIKgo and LIKselect.

Connection method B:

- for the linear incremental product families, such as the KITL, LIK2x, LIK4, LIA series and products of the rotary incremental portfolio.

4.1.1 Connection method A

To adjust LIKgo or LIKselect measuring systems* (with D-Sub connector), they are connected to the ADJUSTMENT Tool with the EPIFLEX Adapter.

Connect the ADJUSTMENT Tool, the EPIFLEX Adapter and the measuring head to your PC according to the illustration.

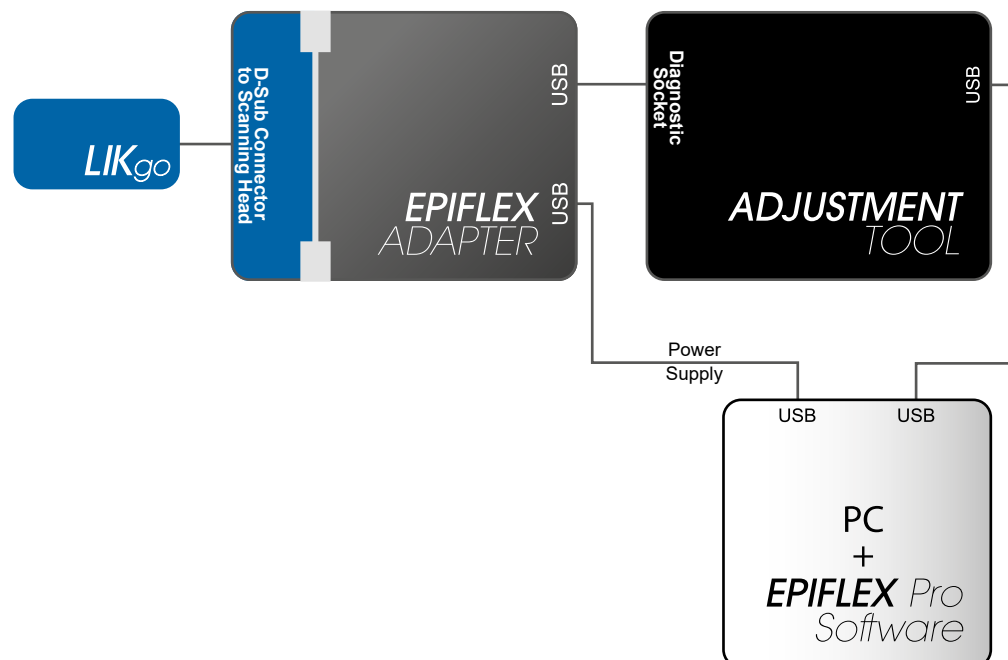


Image 13

Measuring systems of the LIKselect series, which are delivered without D-Sub connectors, require an adapter for adjustment. Ordering information for the adapter set LIKS1 is listed in chapter 9.

* EPIFLEX adapter compatible devices: LIKgo & LIKselect

4.1.2 Connection method B

The measuring systems of the linear incremental product family, such as the KITL, LIK2x, LIK4, LIA series and products of the rotary incremental portfolio from NUMERIK JENA have an 8-pin diagnostic connector. This is used for signal evaluation, enables electronic signal adjustment and is located either in the measuring head or in the D-Sub connector, depending on the type. The relevant information can be taken from the product key on the nameplate.

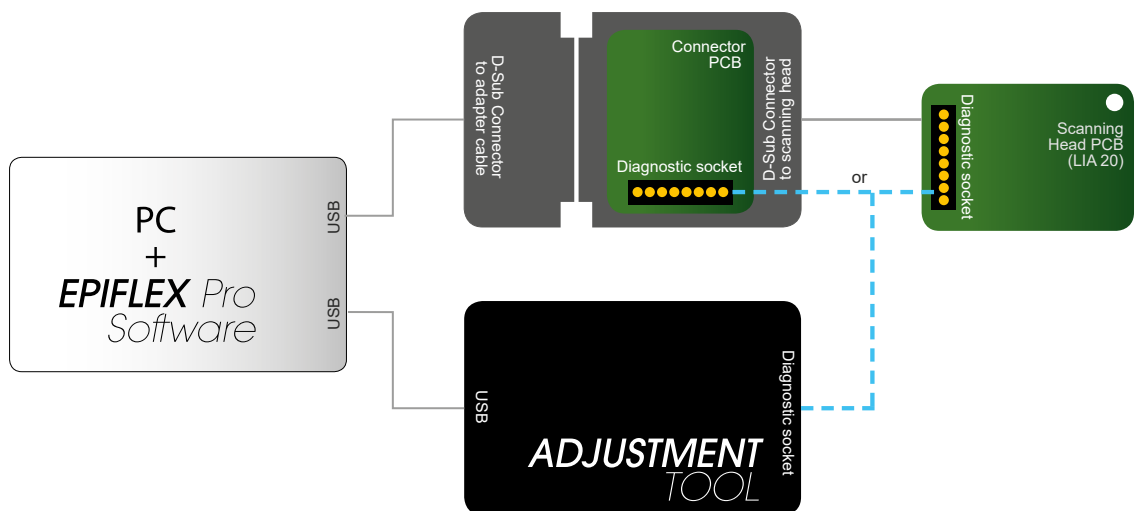


Image 14



ATTENTION!

The power supply must be shut off when connecting or disconnecting the diagnostic connector! Connect the diagnostic connector to the diagnostic socket as shown in the graphics with the connecting variants.

Please pay attention to the white marking on the diagnostic connector!

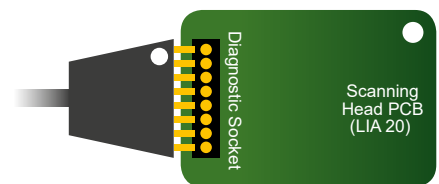
4.2 Connection options of the diagnostic connector

For measuring systems with signal processing inside the connector, the connector must be opened to reach the diagnostic socket. For measuring systems where the signal processing is located in the measuring head, the housing cover of the measuring head must be opened carefully.

4.2.1 With scanning heads PCBs

RS 422

with interpolation



1V_{pp} or RS 422

without interpolation

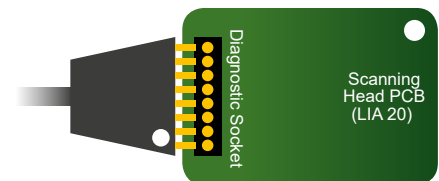


Image 15

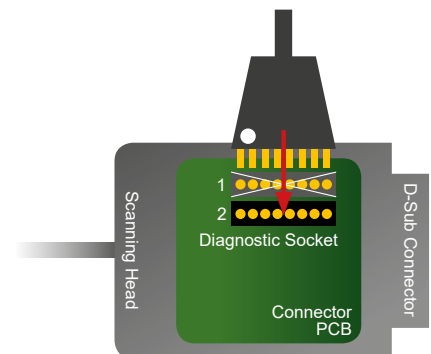
4.2.2 Scanning head with Connector PCB

RS 422

with interpolation



Please use diagnostic socket „2“!



1V_{pp} or RS 422

without interpolation

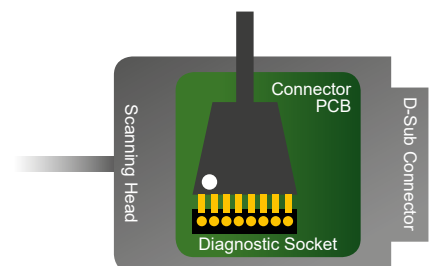


Image 16

4.3 Operating the ADJUSTMENT Tool

During the signal adjustment, please pay attention to:

- Any noise disturbances which are interfering with the measuring system can lead to incorrect signal settings. This will cause non-optimal signal parameters during function.
- **During the signal adjustment the signals of the encoder should not be used to control the drive motor. Unintentional misadjustments could cause wrong signal values in the controller and lead to malfunction of the drive system.**
- The stage should be moved without motorized drive during the signal adjustment. If a motorized drive is necessary, a manual operation has to be used.



ATTENTION!!

Encoder system, stage, ADJUSTMENT TOOL and controller must have the same ground and earth potential. For safety purposes use the included USB-D-SUB-adapter cable during the adjustment to supply the measuring system with power over your PC, not your controller!

If you are not in possession of the USB-D-SUB-adapter cable, you can order it separately from NUMERIK JENA GmbH.

5 Electronic Signal Adjustment

The manual optimization of the signal influencing parameters of a measuring system, can sometimes be somewhat complicated and time-consuming. Therefore, the EPIFLEX Pro software offers an automatic signal adjustment function that optimizes all setting parameters for you easily and quickly.



ATTENTION!

Before you start the electronic adjustment please pay attention to any contamination on the scale. This can affect the adjustment process negatively. Clean the surface of the scale with a soft microfibre cloth and acetone if necessary.



The blue button switches the online compensation (signal control) active or inactive. This function should be deactivated to evaluate the signal quality. This button is used to activate or deactivate the signal control inside the measuring head.



The green button starts the automatic adjustment process. After the start, a status window opens. The online compensation is automatically set to active after the successful adjustment. In general, the signal images should be inspected visually over the travel range of the system even after successful adjustment.

5.1 Procedure automatic adjustment

To start the automatic adjustment please proceed as described in the following:

- 1 Click on the green Start - Button to start the automatic adjustment procedure. Subsequently a status window appears.
- 2 Please follow the instructions displayed in the status window!
- 3 Move the scanning head to the scale back and forth. In doing so it is important to cross a reference mark to ensure that the system can also adjust this parameter correctly. Please traverse the reference mark in both directions at a constant speed (of $v > 1$ mm/s).
- 4 At the bottom of the main window a green progress bar will be displayed. This bar shows the progress of the adjustment. The status window displays the progress of each adjusted parameter.
- 5 If the adjustment is done, please click on the Save - Button. By doing so the new adjusted parameter will be saved to the sensor module. With „Cancel“ the process can be terminated at any time without changing the settings.

If the adjustment fails, it can be executed again with „Repeat“.

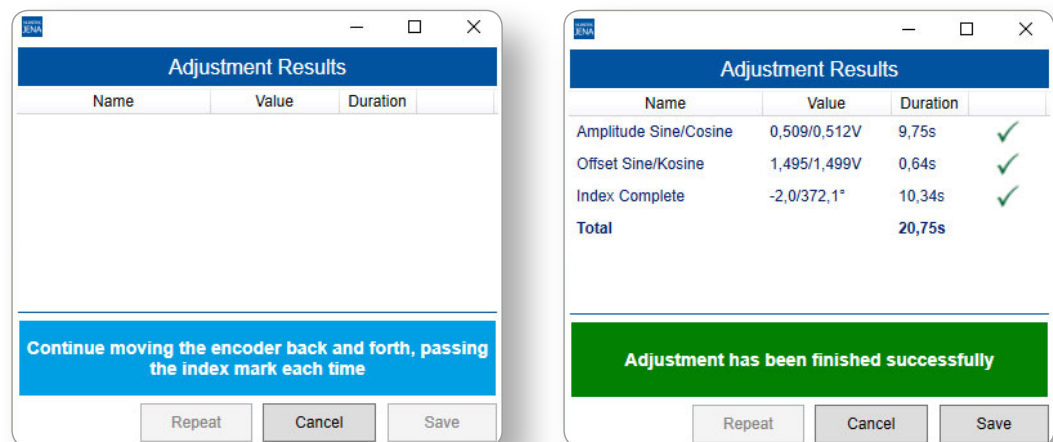


Image 17

5.2 Hints to the Automatic Signal Adjustment

The movement of the measuring system during the automatic signal adjustment should be as steady as possible. In the window for the index impulse 2 to 6 signal periods should be displayed. Otherwise adjust the movement speed or regulate the time base of the software oscilloscope. Furthermore, you should pay attention that you cross the reference mark during the movement.

If you get error messages in the status window after the adjustment it may have several reasons. In this case please start the automatic adjustment procedure again to verify a legitimate failure. Additionally, please pay attention to our mounting instructions in the data sheet of the measuring system. Often, problems occur because of a transgression of the mechanical mounting tolerances.

In chapter 8 we have compiled some potential error causes. If these error causes do not apply to your application, please contact us.

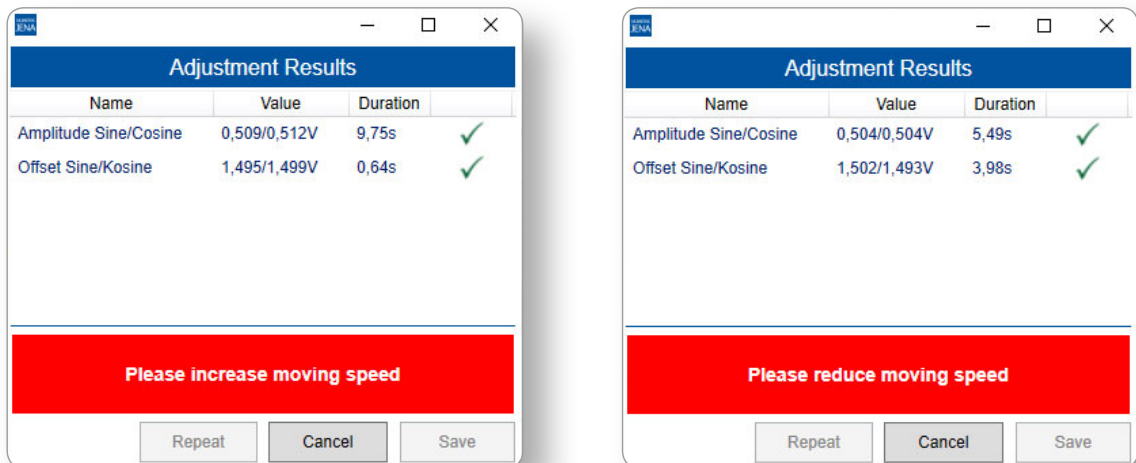


Image 18

If the automatic adjustment procedure is finished successfully, you can use the encoder at full capability. If you change something regarding your mounting conditions afterwards, e.g. disassembling and renewed assembling of the scanning head, it is recommended to do the automatic adjustment again.

5.3 Evaluation of the analog signals with the control switched off

If the specified signal tolerances cannot be achieved with the aid of the electronic adjustment and mechanical fine adjustment, the mechanical mounting of the measuring system must be checked:

- Checking the dimensions and tolerances specified in the mounting drawings.
- Check of the guideway sequence
- Check of the correct mounting position of the scale tape
- Dimensional scale contamination
- Is the protective film still on the scale tape or sensor?

The shape and position of the signals allow conclusions to be drawn about possible mounting errors of the measuring head. Signal deviations and possible causes are given below:

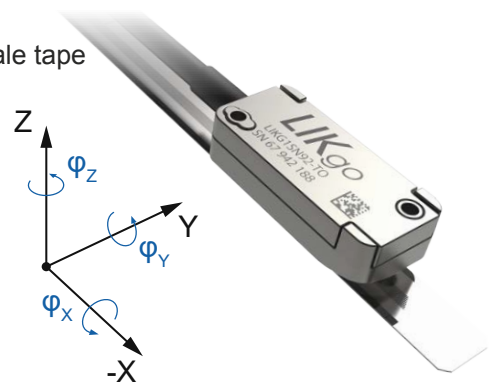
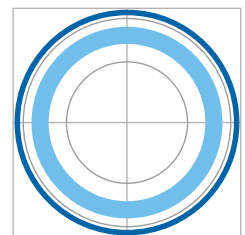
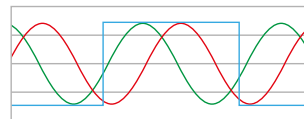


Image 19

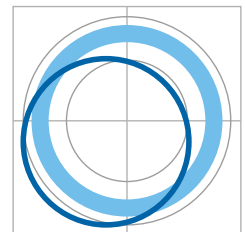
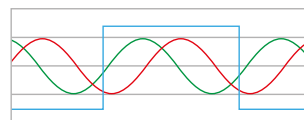
Amplitude error

(results in no interpolation error)
(Cause: ΔZ , φX , φY , φZ)



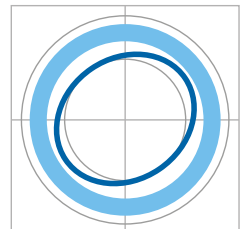
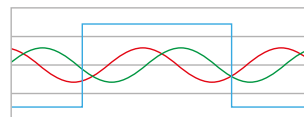
Offset error

(Cause: ΔY , φY)



Phase error

(Cause: φY , φZ)



Symmetry error

($\sin \neq \cos$)

(Cause: ΔZ , φX , φY , φZ)

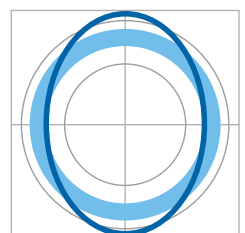
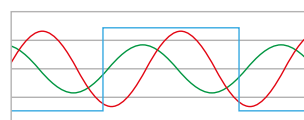


Image 20

6 Interface Settings

The EPIFLEX Pro Software recognizes the output interface of the sensor automatically during startup of the automatic signal adjustment. If the EPIFLEX Pro Software is used to check the sensor signals only, possibly an interface setting must be done (see page 12, image 7).

The following settings are valid:

Signal processing	Interface	Output interface
Scanning head	1 V _{PP}	1 V _{PP}
	1 V _{PP} / 3 V _{PP}	RS 422 with interpolation
	RS 422	RS 422 without interpolation
Connector	1 V _{PP}	1 V _{PP}
	3 V _{PP}	RS 422 with interpolation
	RS 422	RS 422 without interpolation

Chart 2

7 Pin Assignment of the diagnostic connector

Pin	Signal	Description
1	SCL	Serial Clock (white marking on diagnostic connector)
2	SDA	Serial Data
3	RI	Index rough impulse
4	U _m	Middle voltage
5	A+	Sine+
6	B+	Cosine+
7	CS	not used
8	GND	Ground

Chart 3

8 Troubleshooting

We have listed some possible error causes and solutions below. If this is not helpful, please contact one of our authorized representations or NUMERIK JENA GmbH. You will find respective contact data on the NUMERIK JENA website www.numerikjena.de.

Error	Possible cause	Solution
Incorrect sensor values	Sensor data deleted. Everything set to standard values (0 or 255)	Please contact NUMERIK JENA
	Incorrect sensor settings	Load the sensor values again
Amplitude or offset cannot be changed with the controllers	Online compensation is active	Switch off the online compensation
Amplitude or offset are not changed by mechanical adjustment	Online compensation is active	Switch off the online compensation
No reference mark detected	Mounting of the scanning head outside permitted tolerances	Check the mounting conditions
	Position and size of the rough pulse outside permitted tolerances	Set the rough pulse correctly
Double index impulse	Mounting of the scanning head outside permitted tolerances	Check the mounting conditions
	Rough pulse too wide	Set the rough pulse correctly

Chart 4



Image 21

9 Ordering information

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) Exchangeable 8-pin plug connectors Transport case and documentation 	344220-90	
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 Pro Software	Available for free via download on www.numerikjena.de		
Optional Single Components			
EPIFLEX Adapter-Set	To connect the LIKgo & LIKselect measuring head to the ADJUSTMENT Tool. <ul style="list-style-type: none"> EPIFLEX USB-Adapter EPIFLEX Adapter cable Transport case and documentation 	344220-50	
Diagnostic cable	To connect the measuring system to the ADJUSTMENT Tool	589055-01	
USB-D-Sub-adapter cable (15-pin)	To supply the measuring system with voltage via PC	341693-0M	
8-pin plug connector	To connect the diagnostic cable to the diagnostic socket	348958-01	
Adapter-Set LIKS1	To adjust a LIKselect without cable and PCB <ul style="list-style-type: none"> Cable: 1.0 m; $\varnothing=3.7$ mm Cabel outlet: 15-pin D-Sub connector 	analog Output signal: 1 V _{PP}	344220-51
		digital Output signal: TTL/RS-422	344220-51

Chart 5

Required components (not included): PC with OS Windows 7 / 8 / 10 (32 or 64 bit)



SIMPLY PRECISE

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