MLD

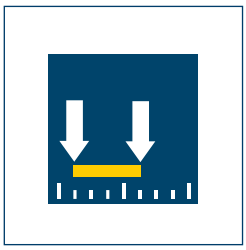
Linear Axes · Direct Drive

Useful stroke
up to 3,800 mm

Driving force
up to 1,500 N

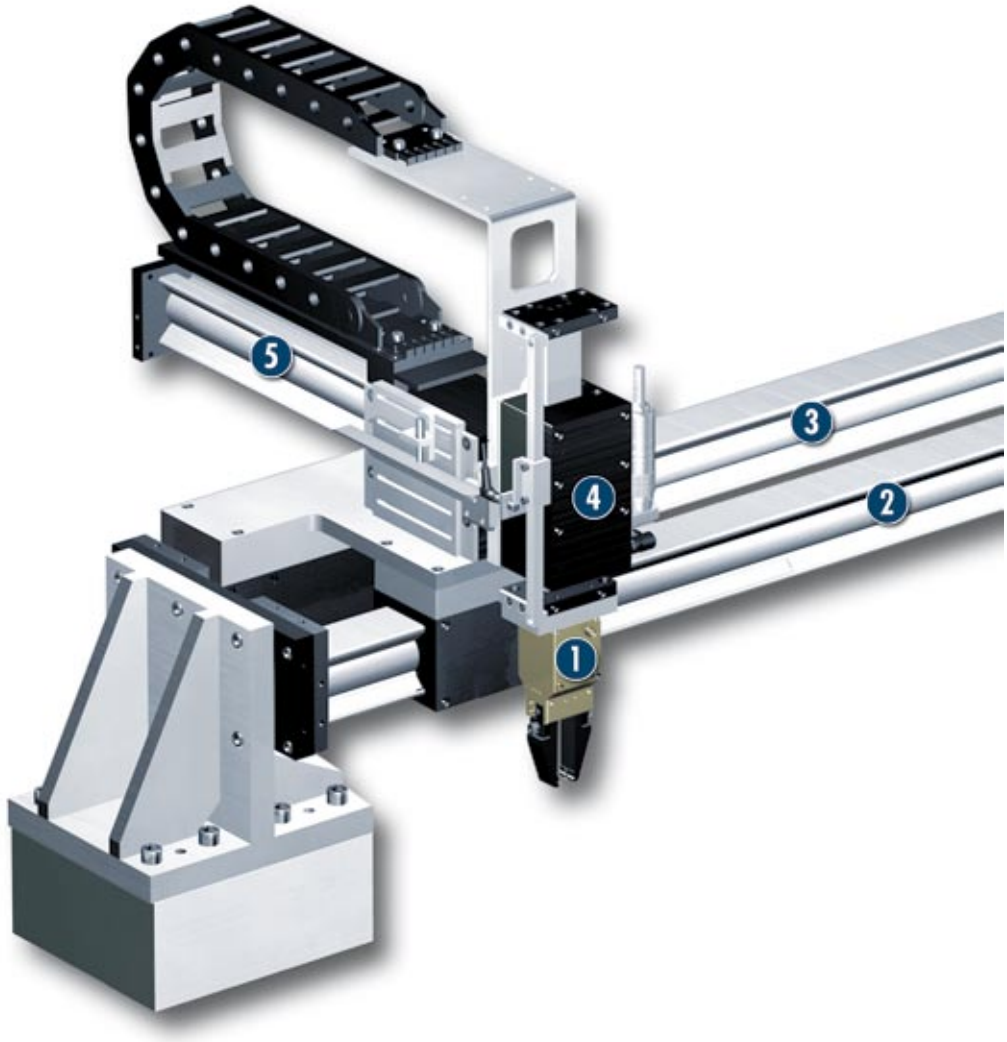
Deflection
0.1 mm .. 1 mm

Moment load
up to 900 Nm



Repeat accuracy
0.01 mm

Application example



Complete electrically powered triple-axis automatic insertion unit for small components

1. MEG 050 EC Servo-electric 2-finger parallel gripper
2. Linear axis with direct drive MLD 100 N / stroke 400
3. Supporting axis
4. Short-stroke axis with direct drive MLD 100 K / stroke 50
5. Linear extension axis with direct drive MLD 100 N / stroke 300

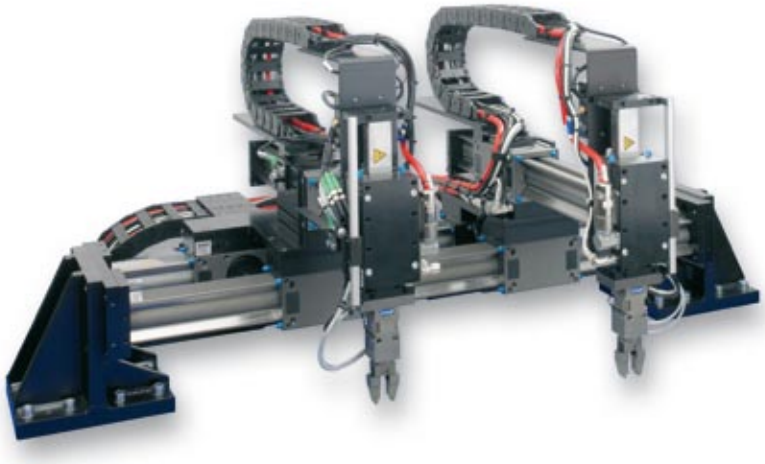
Linear axis with direct drive

and roller guide

Area of application

For highly dynamic applications that also require a high degree of repeat accuracy, e.g.
· Handling and assembly technology
· Measuring and testing technology
· Component marking and identification
· Component assembly and final inspection in microelectronics
· Medical technology

CAUTION:
The linear axes from the MLD series are unsuitable for use in ferro-magnetic environments, particularly in areas directly influenced by ferro-magnetic particles.



Your advantages and benefits

The linear direct drives require no further mechanical elements for force transmission.

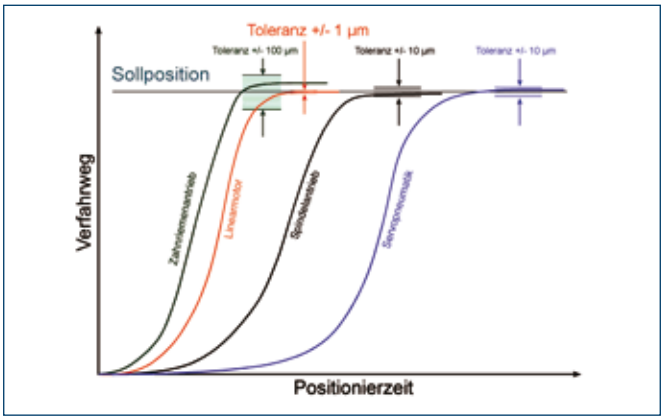
Almost no wearing parts
for long service life and reliability of the system.

No mechanical play between the drive elements
enabling high precision positioning

Low oscillations and high holding force
for the shortest positioning times and stable positioning

Integrated motor and measuring system in the axis
minimize interference contours and spare requirements

Multiple freely programmable slides on one profile guide
allow exceptionally compact and economical drive concepts

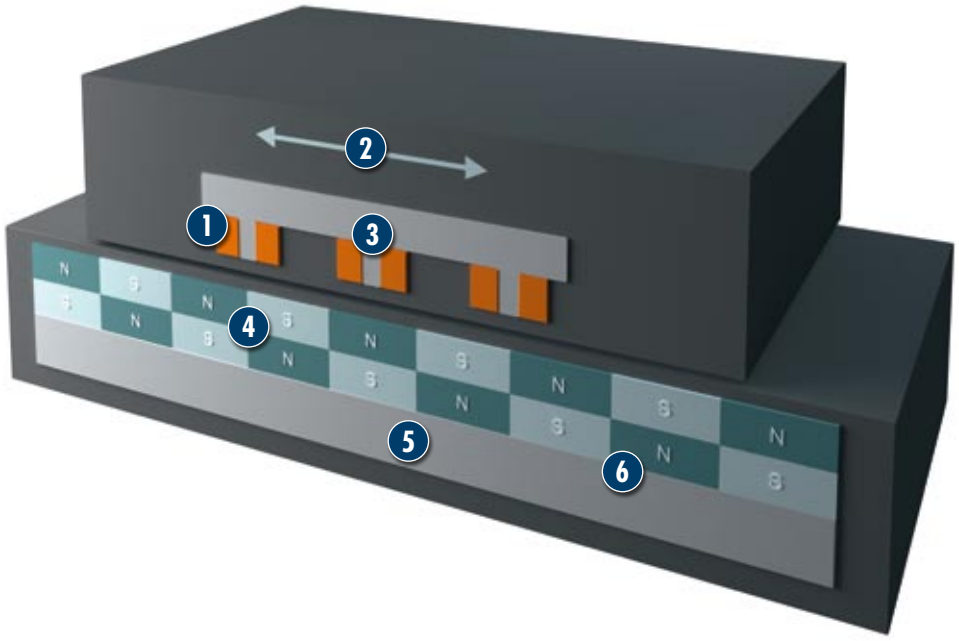


General information about the series

Dynamic and absolutely precise
The MLD axis modules with servo-electric linear direct drive combine positioning accuracy with maximum dynamics and a long lifetime. The axis range represents a sophisticated modular system with a wide range of accessories and allows a variety of axis combinations for different application areas.

For production reasons, the colors may vary from those shown in the catalog.

Functional principle



1 **Copper coil**
2 Directions of movement
3 Primary part
4 Permanent magnets
5 Iron mount
6 **Secondary part**

Description of function

You can manipulate the driving force, acceleration and speed of the slide by regulating the phase and the amplitude of the electrical current applied at the primary part. A direct measuring system, which is integrated in the axis, is used to determine the current position of the drive.

Options and special information

Pneumatic holding brake
for relieving the strain on the drive control

Additional motor slides
for special axis arrangements

Wipers
to protect the guide

Pneumatic weight compensation
to maintain all the benefits of the product even in vertical applications

Accessories

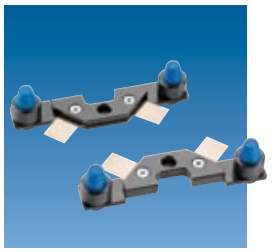
Accessories from SCHUNK – the suitable companion for the best functionality, reliability, and controlled production for all automation components.

Centering sleeves

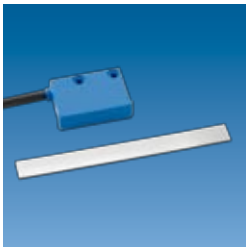
Individual sensor

Mechanical limit switches

Wipers



Stroke measuring system



Shock absorber

Drive controller

Brake, Brake valve

Commissioning software

Interfaces

Parallel interface	Sercos interface
Device Net	CANopen
Profibus	Sercos 3

Cable set

Connection cable for sensor systems

Cable tracks

ⓘ Please see the side views at the end of the respective size for information concerning specific sizes, availability, designation, and ID numbers. More detailed information about our range of accessories can be found on the following introductory pages and in the relevant option code lists.

General information about the series

Safety notes

Caution: magnetic field! This applies especially for persons with implanted medical devices, such as pacemakers, hearing aids, etc.

Ambient conditions

The modules are designed primarily for use in clean ambient conditions. Please note that the lifetime of the modules can be shortened if they are used in harsh ambient conditions and that SCHUNK cannot assume liability in such cases. Please contact us for assistance.

Series overview

Short stroke module
MLD K

Useful load up to 6 kg
Max. speed up to 4 m/s

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Linear axis (flat)
MLD FU

Useful load up to 20 kg
Max. speed 4 m/s

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Gantry axis (self-supporting)
MLD N

Useful load up to 35 kg
Max. speed 4 m/s

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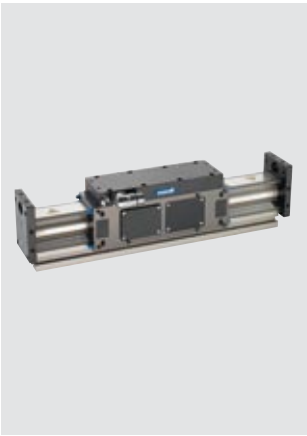

Linear axis (supported)
MLD NU

Useful load up to 35 kg
Max. speed 4 m/s

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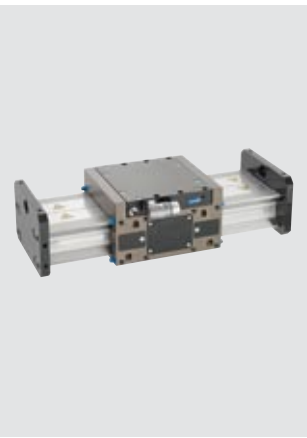

Gantry axis (self-supporting)
MLD M

Useful load up to 40 kg
Max. speed 4 m/s

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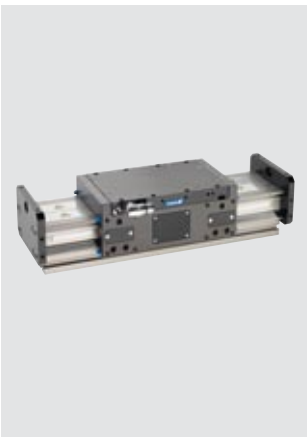

Linear axis (supported)
MLD MU

Useful load up to 40 kg
Max. speed 4 m/s

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Heavy load gantry axis (self-supporting)
MLD T

Useful load up to 50 kg
Max. speed 4 m/s

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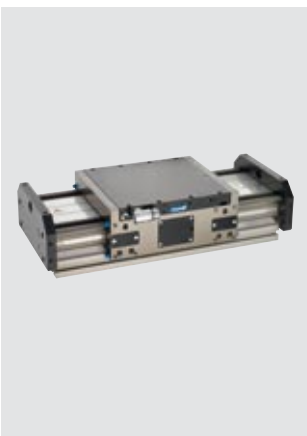

Heavy load linear axis (supported)
MLD TU

Useful load up to 50 kg
Max. speed 4 m/s

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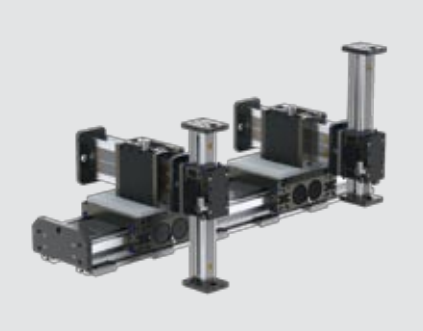
Configuration options

SCHUNK currently offers you numerous different handling systems whose usefulness has been proven in many applications. Please contact us for assistance.

Linear boom
Two-axis module for compact and dynamic motion sequences, e.g. pick & place applications

Surface gantry
The classic for large, three-dimensional working areas

Line gantry
Two-axis system for larger horizontal strokes and short vertical movements



Quadriga
Compact 2x three-axis system with superimposed working areas for high throughput rates

Cross gantry
Three-axis system for use when the available space is limited

Quadrol
Double cross system for use where the available space is limited and there are high throughput rates

X-Y slide
Cross system for use where space is constricted in terms of the height

Special axis configuration to customer requirements
Thanks to the well-thought-out modularity of the individual systems, countless customer-specific solutions are possible

Three-axis boom
Three-axis system for compact three-dimensional working areas

Standard drive system
MLD linear direct axis with Bosch Rexroth INDRADRIVE drive control unit

MLD linear direct axes are available with the innovative Bosch Rexroth IndraDrive drive control units as standard.

Scope of delivery:

We offer complete packages as standard, consisting of

- MLD linear direct axes
- Drive control units
- Commissioning software with parameter sets

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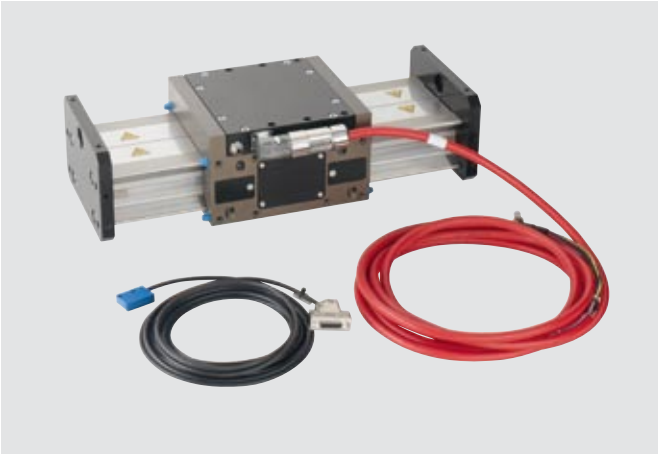


Design:

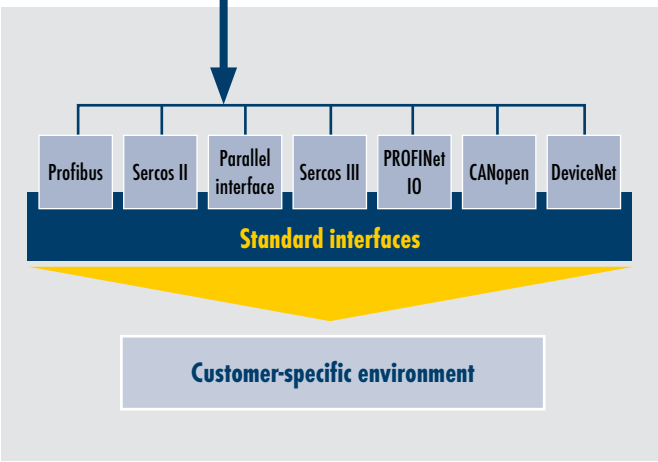
On request, the design of the MLD linear direct axes and drive control units can be optimized by our planners.

Parameter sets

The tested SCHUNK parameter sets provide an easy method of making basic settings.

INDRADRIVE, BASIC and ADVANCED control units

The IndraDrive drive control units can be connected to the customer's machine environment using popular field bus systems or the parallel interface.
All positioning tasks can be performed with a BASIC control unit and the basic firmware package.
The ADVANCED control unit also offers optional integrated safety engineering and greater flexibility in terms of the configuration.

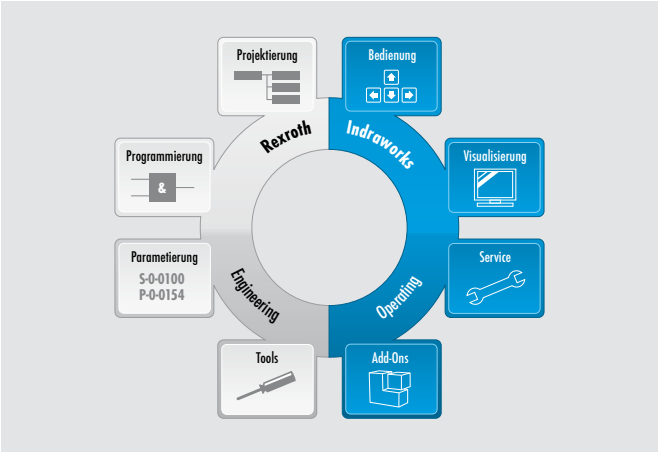


IndraMotion MLD (drive-based motion logic) combines drive functions, motion control and processing logic into a state of the art, open automation platform for modular machine concepts. Programming is possible in all IEC61131-3 languages.

Safety on Board. These days, safety concepts are increasingly being realized easily and economically using IndraDrive drive control units with certified safety engineering. The wide range of integrated safety functions, optionally available under the "Safety on Board" name, provides integrated safety in your application for commissioning, operation and service.

Commissioning software

The IndraWorks engineering tool from Rexroth is an excellent and powerful program for programming, configuration, commissioning and service.



MLD linear direct axis drive system

As an option, the MLD linear direct axes are also available in a version for Siemens SINAMICS S120 converters.
This provides direct access to the world of Siemens SINAMICS.

Scope of delivery:

SCHUNK offers complete packages as standard:
· MLD linear direct axes
· Converters
· Commissioning software with parameter sets

Siemens SINAMICS S120 converter

If MLD linear direct axes are integrated into a machine or device along with Siemens motors, the advantage is that the MLD linear direct axes can also be operated using Siemens SINAMICS converters.

Our planners will work with you to devise the size of the MLD linear direct axes and the converters and will determine the required sensor modules.

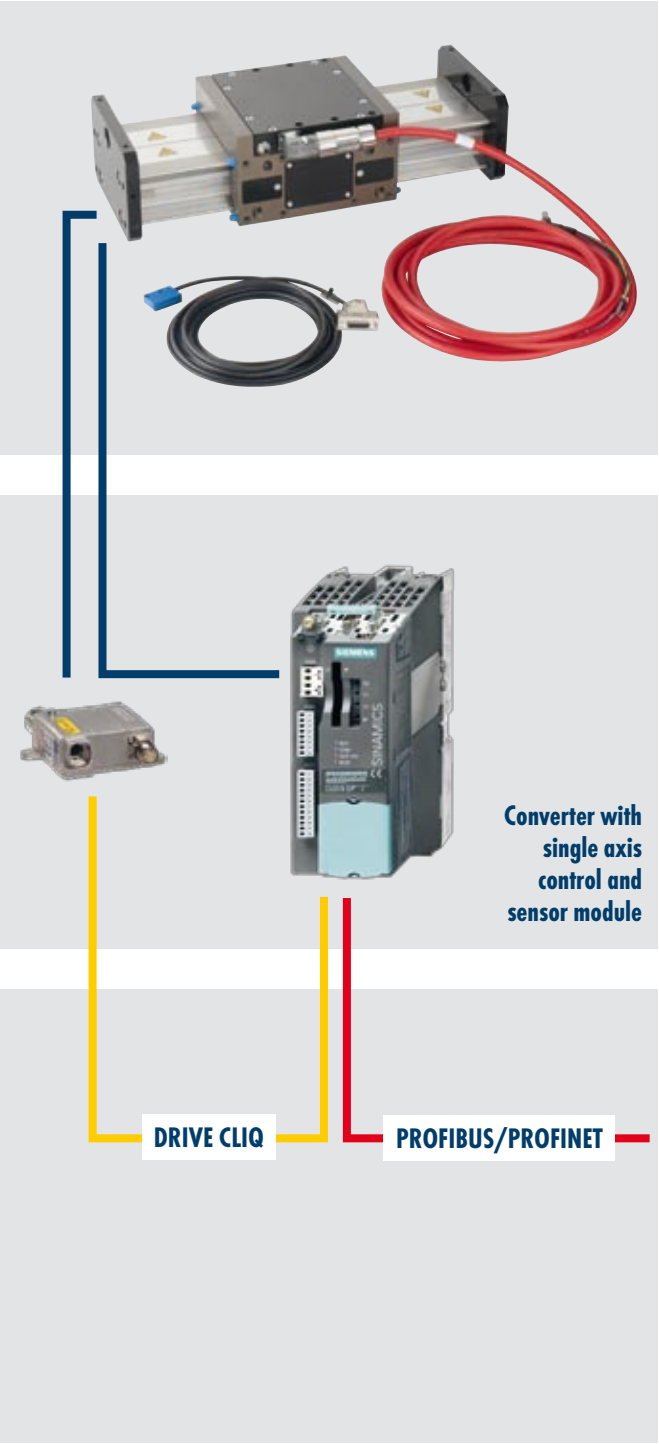
The sensor modules are connected to the Siemens components using DRIVE CLIQ and operated in a similar way to a Siemens motor.

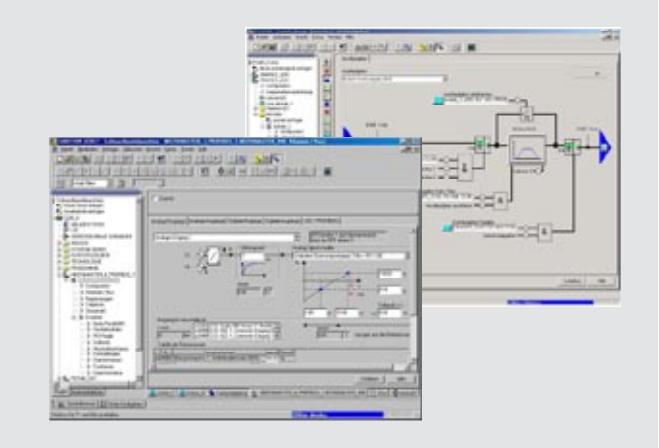
Parameter sets

Special parameter sets have been created for the Siemens SINAMICS converters, which can be used to easily configure the basic settings for axes.

Commissioning software

With STARTER, Siemens provides commissioning software for the SINAMICS converters, enabling the necessary settings to be made very easily.





Direct stroke measuring systems

Definition of resolution

The resolution of a stroke measuring system is the smallest movement of the measuring head relative to the scale that can be distinguished by the electronic processor. It depends on the graduation of the scale, the signal interpolation factor (internal or in the downstream electronics) and the type of evaluation in the meter.

Definition of accuracy

The accuracy of linear stroke measuring systems is specified using accuracy classes. It states the maximum accuracy tolerance, related to any 1m long section of the overall length of the material measure (measuring tape).

LE linear encoder

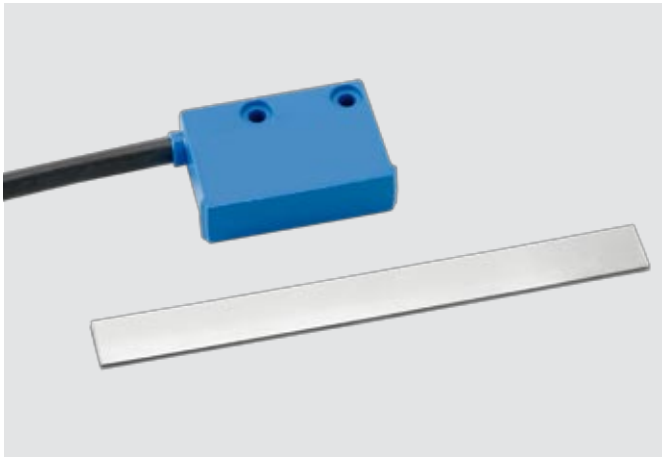
Magnetic incremental stroke measuring system

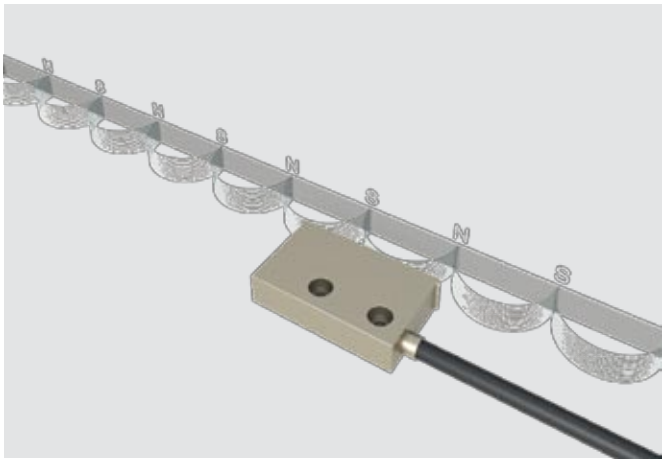
Technical properties

This stroke measuring system works on the principle of zero contact scanning of magnetic fields, and converts measured values into analog signals. It is a magnetically scanning incremental system, which achieves an adjustable resolution of up to 0.2 µm and position variations of max. 10 µm.

The zero contact scanning unit is particularly suitable for precise and highly dynamic applications in linear guide and power train technology. Zero contact and therefore wear free measured value acquisition is a robust and economical alternative to optical systems.

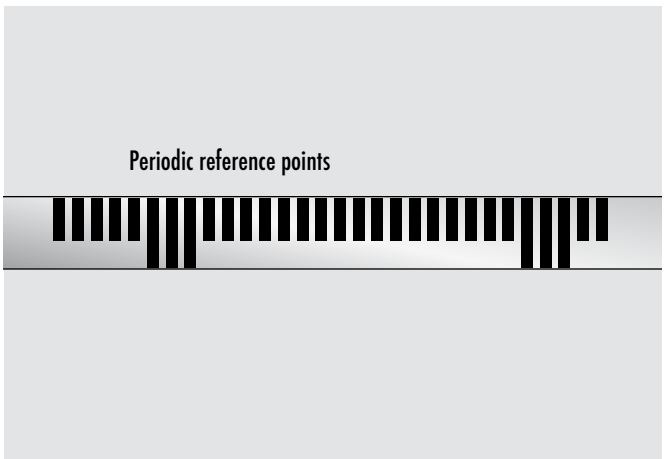
- Easy mounting
- Status LED indicator
- Signal period 1000 µm (analog)
- Scale MB 100
- Reference signal (optional)
- Insensitive to dust, chips, humidity





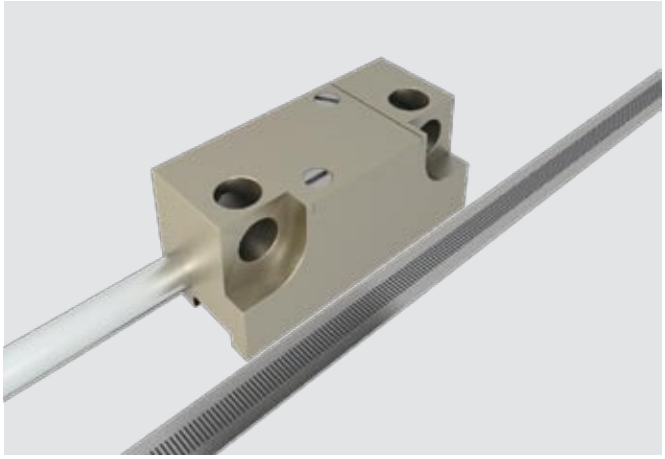
Functional principle

- The measuring tape consists of a magnetizable material.
- Magnets are magnetized at a spacing of 1 mm (period) in a magnetizer.
- The measuring head has 2 Hall-effect sensors, which change their voltage depending on the magnetic field.
- The SIN/COS signals are generated from these voltages as the output signal of the measuring head.
- Periodic or fixed analog reference signal optional



LIA linear measuring system

Optical incremental stroke measuring system



Technical properties

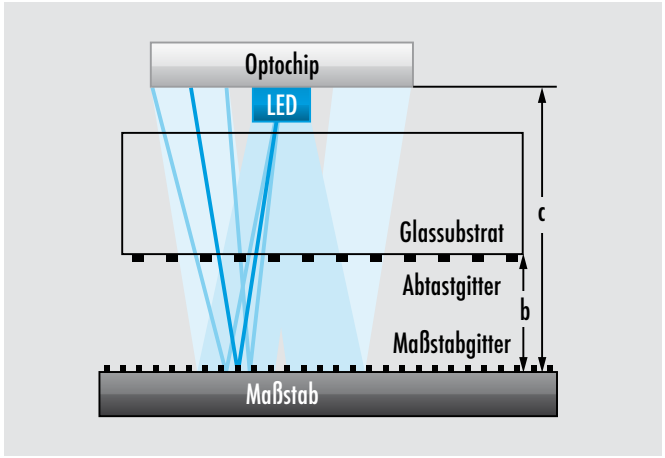
This stroke measuring system works on the principle of optical scanning of the scale by the measuring head. Measured values can be output both as analog signals and as rectangular signals with interpolation. Resolutions of up to 0,05µm and position variations of ± 2 µm can be achieved with no additional electronics.

The scanning unit is used where lengths need to be determined with maximum precision and resolution with no mechanical reaction on the measuring instrument.

- Compact installation dimensions
- Low weight
- High resolution
- Excellent accuracy
- High measuring speeds

Functional principle

of optical scanning for material measure



Functional principle

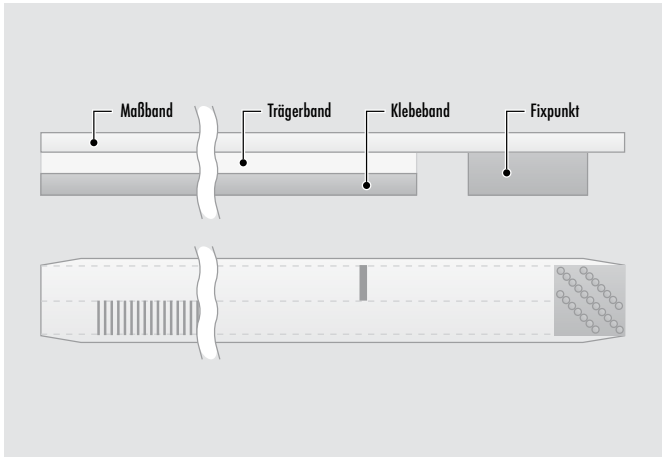
of material measure Mechanical decoupling of measuring tape underlayer and measuring tape results in defined thermal properties.

Ideal for use for

- Supporting materials with thermal expansion properties different than steel
- Measuring lengths of above 100 mm
- Stringent accuracy requirements

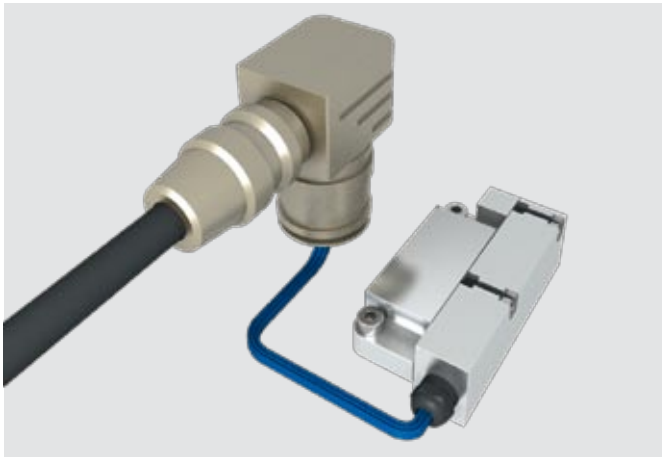
Additional special features:

- Graduation 20 µm
- Choice of measuring tape accuracy classes of ± 1 µm, ± 2 µm, ± 3 µm to ± 5 µm
- Compensation of offset and amplitude fluctuations (insensitive to contamination)
- Detection of end positions
- Various other options



MSA 111 linear measuring system

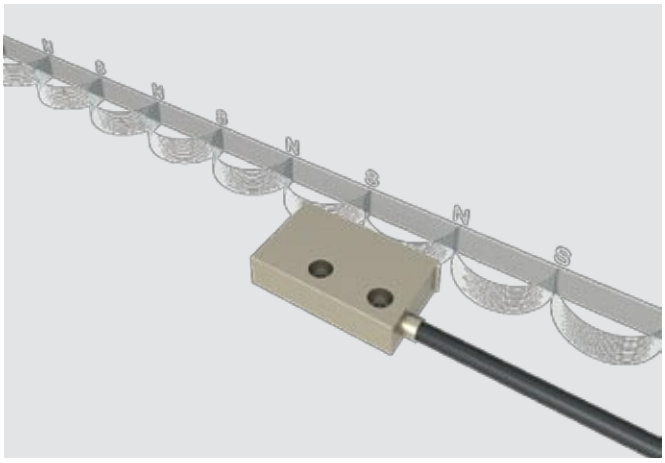
Magnetic absolute stroke measuring system



Technical properties

This stroke measuring system with absolute position detection has the notable property that after a shutdown or any other power failure, a sensor position is immediately detected, even if changed, and this value is used as a direct value for further processing. It also provides all the advantages of a magnetic and zero contact scanning principle that is insensitive to contamination.

- Actual position value is detected
- No reference run required
- No reference run required after power failure
- Increased availability of axes
- External electronic processor necessary

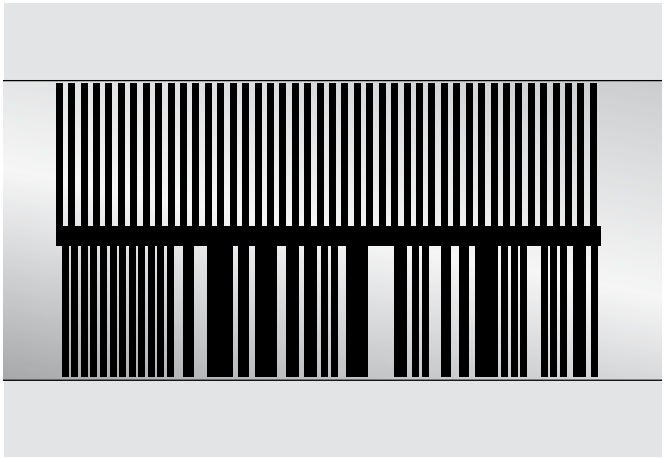


Additional special features:

- Max. resolution 1 µm
- Measuring tape accuracy classes max. 50 µm
- Repeat accuracy max. 5 µm
- Larger installation dimensions in axes
  (check interference contours; contact us for details)
- Electronic processor to be installed in control cabinet
- SSI interface, therefore only available in conjunction with Indradrive Advanced controller

Functional principle

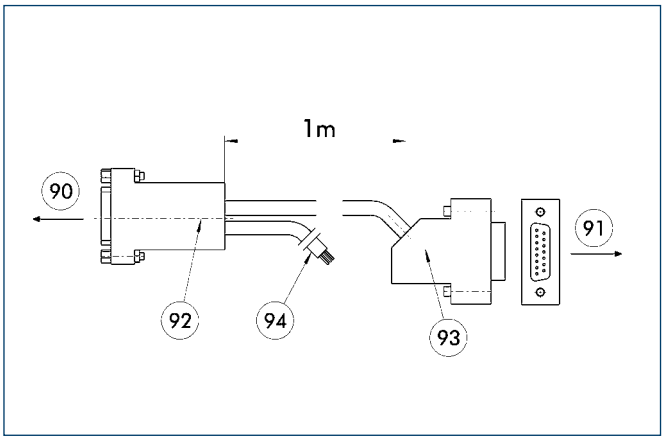
- Scanning of two tracks: one incremental and one absolute track



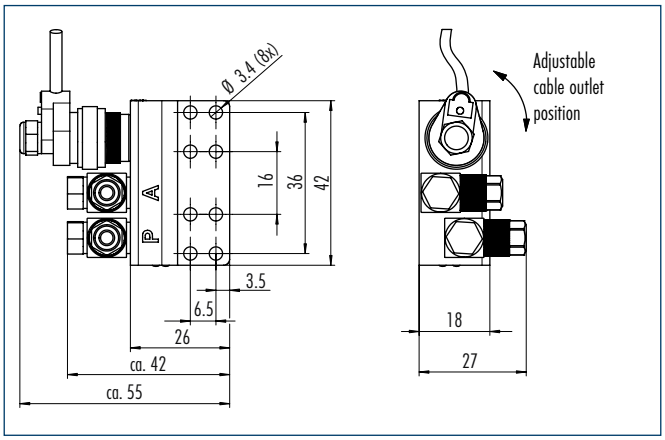
Measuring system selection matrix

	K axis	N axis	M axis	T axis	FU axis
Linear encoder LE 100; graduation 1 mm Reference mark at 20 mm intervals	Yes	Yes	Yes	Yes	Yes
Linear measuring system LIA 22; graduation 20 µm with reference mark and optical switching sensors	MLD 100/200K = Yes MLD 50K = No	Yes	Yes	Yes	No
Linear measuring system MSA 111; graduation 1 mm	Yes	Yes	Yes	Yes	Yes

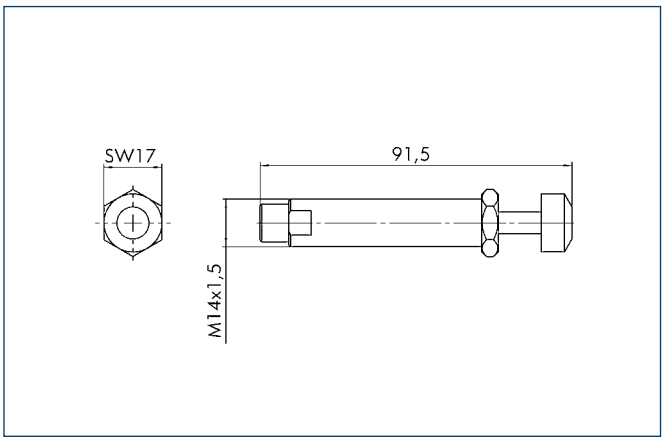
Cable - Optical measuring system



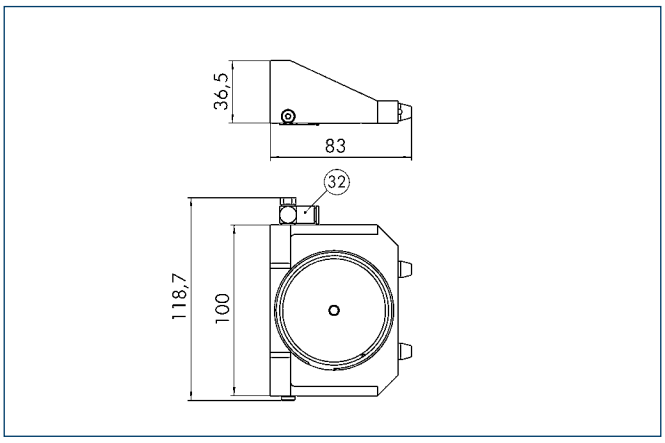
Brake valve



Shock absorber

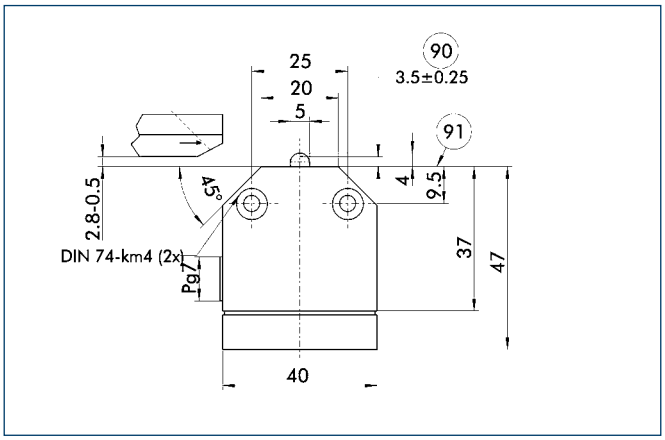


Additional brake (FU)



32 Compressed air connection

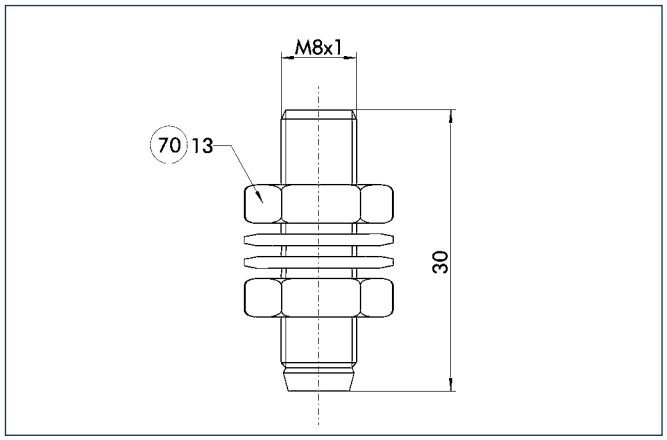
Mechanical limit switches



(90) Switching point
(91) Reference surface

Reproducibility	[mm]	± 0.05
Permissible ambient temperature	[°C]	-5 to +80
Protection class to DIN 40050		IP 67
Bounce time	[ms]	< 2
Insulation to VDE 0110		Group B
Rated voltage AC	[V]	250
Continuous current	[A]	5
Connection type		Screw connection
Contact system		Single pole changeover contact
Switching system		Step system

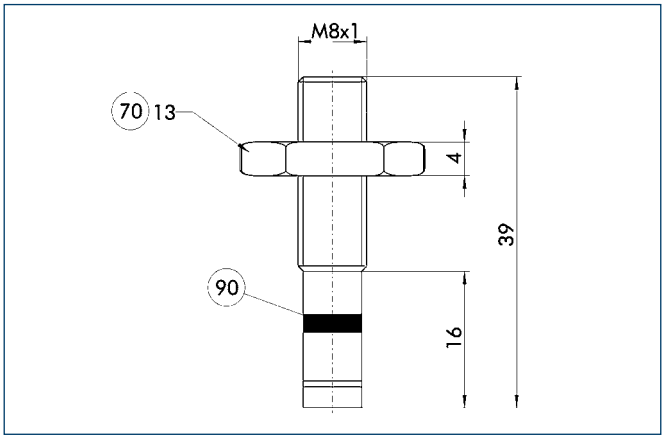
Inductive limit switches



(70) Width across flats

Contact type		PNP opener, 3-wire technology
Repeat accuracy	[mm]	0.1
Permissible ambient temperature	[°C]	-25 to +70
Protection class to IEC 529		IP 65
Switching frequency	[Hz]	1500
Operating voltage DC	[V]	10 to 30
Maximum current on contact	[mA]	200
Nominal switching distance	[mm]	1.5
Installation type		Flush
Display		LED in plug
Connection type		Right-angle plug
Cable length	[m]	5 (others on request)

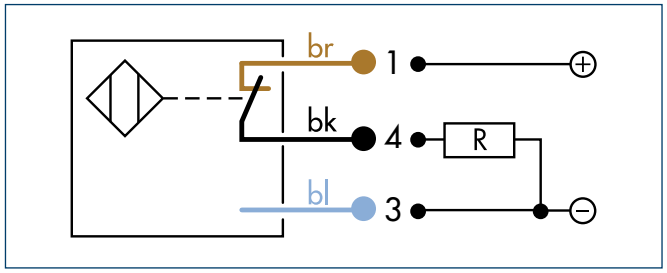
Inductive reference switch



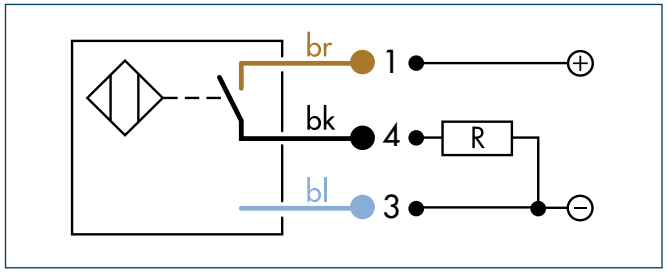
(70) Width across flats

Contact type		PNP closer, 3-wire technology
Repeat accuracy	[mm]	0.1
Permissible ambient temperature	[°C]	-25 to +70
Protection class to DIN 40050		IP 67
Switching frequency	[Hz]	1500
Operating voltage DC	[V]	10 to 30
Maximum current on contact	[mA]	200
Nominal switching distance	[mm]	0.5
Installation type		Flush
Connection type		Right-angle plug
Cable length	[m]	5 (others on request)

Opener circuit diagram



Closer circuit diagram



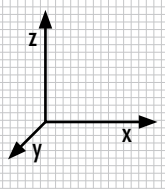
Company		Project	
Contact		Telephone	
ZIP, City		Fax	
Street		E-mail	

1. Task

Please provide an accurate description of the task.

2. Arrangement of application

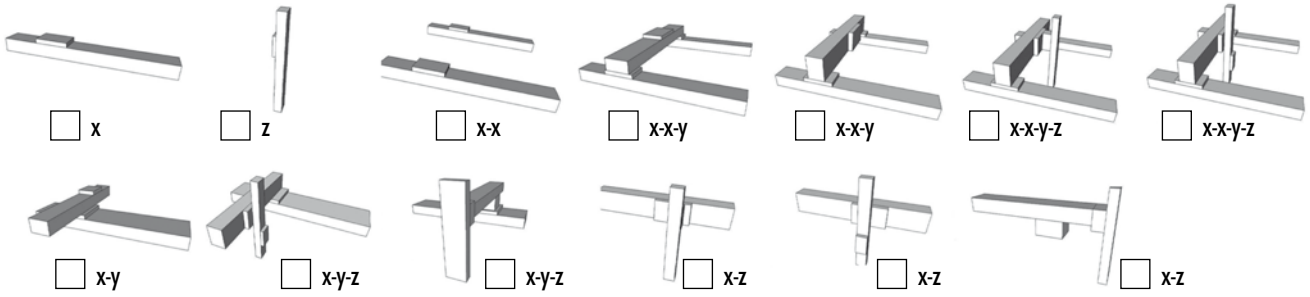
Please provide a sketch of the required process, specifying the dimensions and masses of the individual components.

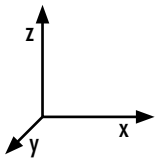
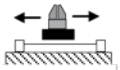


3. Requirement information (please check)

☐ One-off application	☐ Technical improvement
☐ Series, number of units per year:	☐ Cost reduction
☐ New design	☐

4. Axis information - System configuration (please check)



				X-axis horizontal	Y-axis horizontal	Z-axis vertical
	Payload (load)		[kg]			
	Load projection (lever arm) of load at axis fixture	X direction	[mm]	Slide position: Top (1) Side (2) Bottom (3) 		
		Y direction	[mm]			
		Z direction	[mm]			
	Slide position: Enter relevant number (1 - 3)					
Basic information	Attachment type:  Slide moved (standard)  Axis moved (boom)			☐ Standard ☐ Boom	☐ Standard ☐ Boom	☐ Standard ☐ Boom
	Stroke (inc. over stroke)		[mm]			
	...of which useful stroke		[mm]			
Load	Additional force (e.g. process force)		[N]			
	Direction of additional force (axis and direction, e.g. Z+)					
Dynamics	Speed V_{max}		[m/s]			
	a_{max}		[m/s²]			
Emergency stop function				☐ Yes ☐ No		
Operating data	Total cycle time (inc. rest period)		[s]			
	Travel time as proportion of total cycle		[s]			
	Operating hours per year		[hrs] on [days]	hours on days		
Accuracy	Min. repeat accuracy		[mm]			
Environment	Temperature		[°C]			
	Air humidity		[%]			
	Dirt, interference fields, place of use					
Control	Control unit	Bosch Rexroth	Indradrive Basic	☐	☐	☐
			Indradrive Advanced	☐	☐	☐
			Indradrive Cs	☐	☐	☐
		Siemens	Sinamics	☐	☐	☐
		Other: _____				
	Interfaces			☐ Profibus ☐ Sercos III	☐ Profinet ☐ Parallel	☐ Sercos II ☐ _____
	Cable set			☐ 5 m ☐ 10 m ☐ 15 m ☐ 20 m	☐ 5 m ☐ 10 m ☐ 15 m ☐ 20 m	☐ 5 m ☐ 10 m ☐ 15 m ☐ 20 m

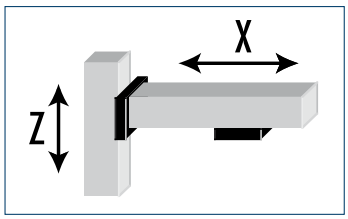
5. MLD axis options

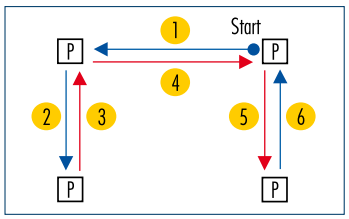
		X-axis horizontal	Y-axis horizontal	Z-axis vertical
MLD type: (N,K,T,M,FU) (please enter if defined)				
Active slides (with linear motor)	Number			
Passive slides (without linear motor)	Number			
Slide center distance for multiple slides	[mm]			
Stroke measuring system	Cable length and stroke measuring system interface based on controller selection			
	Magnetic measuring system (standard)	☐		
	Optical measuring system (maximum resolution)	☐		
	Absolute measuring system	☐		
Inductive reference switches		☐	☐	☐
Limit switches	Inductive limit switches	☐	☐	☐
	Mechanical limit switches	☐	☐	☐
Cable track		☐ Standard ☐ Wide	☐ Standard ☐ Wide	☐ Standard ☐ Wide
Brake		☐	☐	☐
Switching valve for brake		☐	☐	☐
Wipers		☐	☐	☐
Shock absorber		☐	☐	☐
Centering sleeves		☐	☐	☐
Special designs		☐ _____	☐ _____	☐ _____
Documentation	☐ Schunk standard design Language: English / Content: Assembly instructions, drawing(s), bill(s) of materials / Delivery format: PDFs on CD-ROM			
	☐ Special design (additional cost) Definition:			

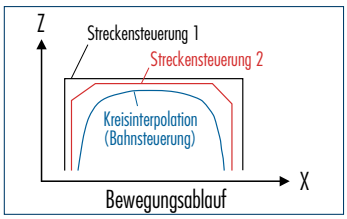
6. Cycle information

To calculate the optimum linear direct drive, it is import to define the future application in as much detail as possible in advance.

Example:
Pick & place application



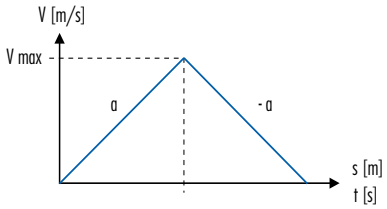




7. Cycle table (each system axis considered individually)

Cycle step	Axis	Travel [mm]	Permissible travel time [s]	Shutdown after positioning [s]	Useful load [kg]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

8. Calculation basis

Definitions						Most extreme movement
Speed	v	[m/s]	Deadweight - slide	m_{dw}	[kg]	
Acceleration	a	[m/s²]	Additional mass - load	m_{add}	[kg]	
Travel	s	[m]	Counter force	F_{cnt}	[N or kgm/s2]	
Time	t	[s]	Theoretical force required	F_{the}	[N or kgm/s2]	
Total mass moved	m_{tot}	[kg]				

9. Formulae

Speed	$V = a \times t = \sqrt{2a \times s}$	Acceleration	$a = 2s / t^2 = V / t$
Travel	$s = a \times t^2 / 2 = v \times t$	Time	$t = V / a = 2s / v$
Mass moved	$m_{tot} = m_{dw} + m_{add}$	Force	$F_{the} = m_{tot} \times a + F_{cnt}$
Motor force	$F = (F_{the}$ + control reserve) x dynamic correction factor x on time factor		