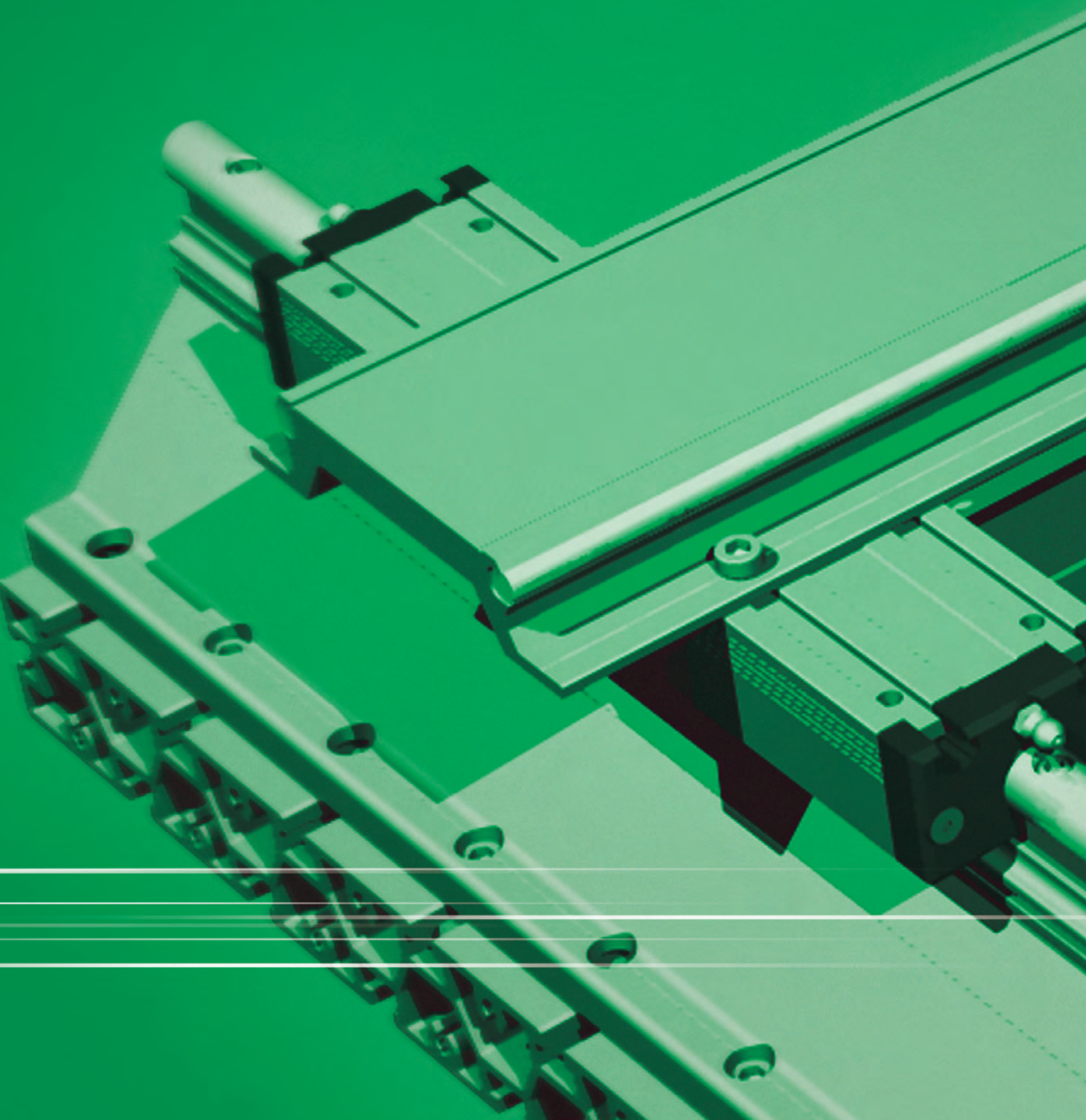


# mechan



# mechanics



## MECHANICS

Aluminium profiles .....2-2

Linear guides .....2-18

Drive elements.....2-44

Linear units .....2-52

Rotational units.....2-94

## Aluminium profiles

## Overview

## PP profiles Panel profiles

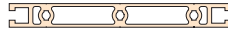
2-4



PP 50



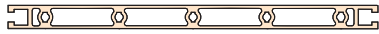
PP 100



PP 150



PP 200



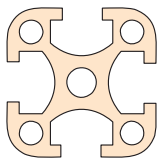
PP 250



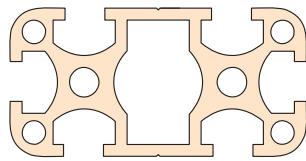
PP 50L

## PU profiles Universal profiles

2-5



PU 25



PU 50

## PT profiles T-slot plates

2-6



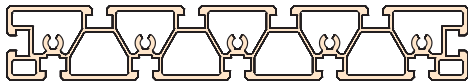
PT 25



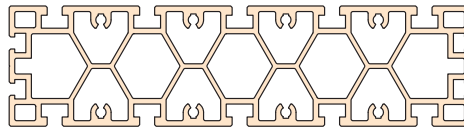
PT 50

## RE profiles Right angle profiles

2-8



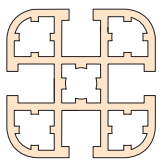
RE 40



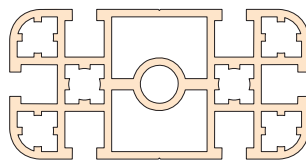
RE 65

## PL profiles Light frame profiles

2-10



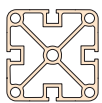
PL 40



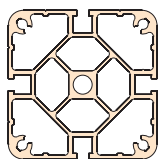
PL 80

## PS profiles Stand profiles

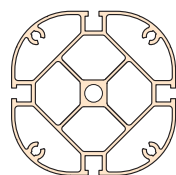
2-11



PS 50



PS 80



PS 100

# Aluminium profiles

## Overview

■ AT	Workbenches	2-13
■	Accessories	2-14
■	Profile connections	2-16
■	Profile snaplock connections	2-17



## Panel profiles



## PP profiles

### Features

- For fast and easy erection of frames, benches and racks
- Aluminium, naturally anodised
- Produced to DIN EN 12020-2
- Easy, very strong under load
- **Top edge particularly suitable as a load-bearing cladding, also takes very high loads**
- The drilled holes and PS profile socket head screws of our profile linkages offer extremely rigid connections, resistant to tension, distortion and bending.
- Profile cutting to order
- Extensive range of accessories (see page 2-14)

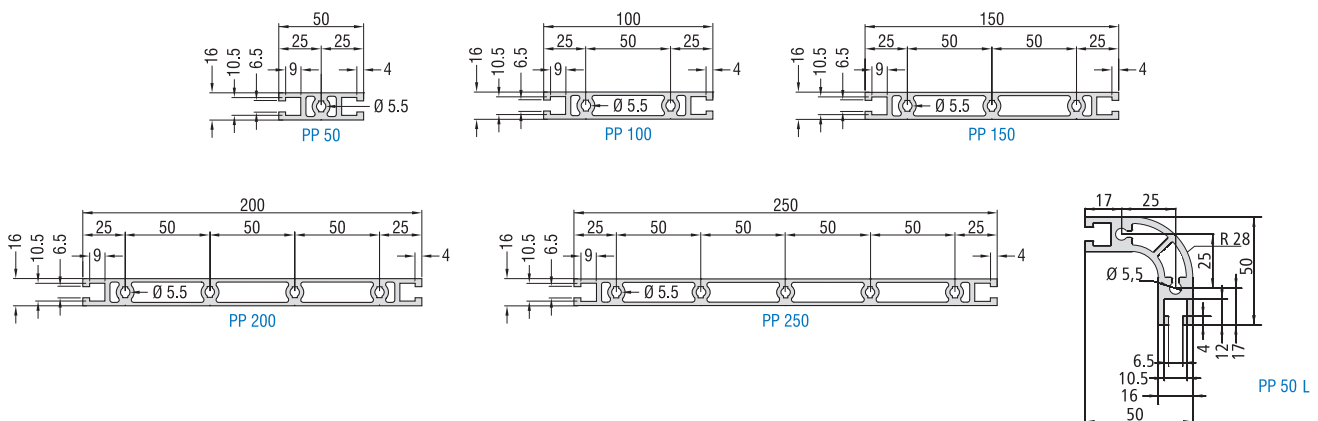
### Technical specification

	PP 50 L	PP 50	PP 100	PP 150	PP 200	PP 250
Dimensions (W × H)	50 x 50 mm	50 x 16 mm	100 x 16 mm	150 x 16 mm	200 x 16 mm	250 x 16 mm
Length	up to 3 metres (special lengths upon request)					
Weight	approx. 1.7 kg/m	approx. 1.1 kg/m	approx. 1.9 kg/m	approx. 2.6 kg/m	approx. 3.4 kg/m	approx. 4.1 kg/m
	2 cavity inserts Ø 5.5 mm für M6 screw	1 cavity insert Ø 5.5 mm für M6 screw	2 cavity inserts Ø 5.5 mm für M6 screw in 50 mm raster	3 cavity inserts Ø 5.5 mm für M6 screw in 50 mm raster	4 cavity inserts Ø 5.5 mm für M6 screw in 50 mm raster	5 cavity inserts Ø 5.5 mm für M6 screw in 50 mm raster
Moment of inertia $I_x$	13.25 cm <sup>4</sup>	8.13 cm <sup>4</sup>	67.27 cm <sup>4</sup>	213.92 cm <sup>4</sup>	482.77 cm <sup>4</sup>	908.52 cm <sup>4</sup>
Moment of inertia $I_y$	13.25 cm <sup>4</sup>	1.37 cm <sup>4</sup>	2.46 cm <sup>4</sup>	3.55 cm <sup>4</sup>	4.64 cm <sup>4</sup>	5.74 cm <sup>4</sup>
Moment of resistance $W_x$	4.39 cm <sup>3</sup>	3.25 cm <sup>3</sup>	13.45 cm <sup>3</sup>	28.52 cm <sup>3</sup>	48.27 cm <sup>3</sup>	72.68 cm <sup>3</sup>
Moment of resistance $W_y$	4.39 cm <sup>3</sup>	1.71 cm <sup>3</sup>	3.08 cm <sup>3</sup>	4.44 cm <sup>3</sup>	5.80 cm <sup>3</sup>	7.17 cm <sup>3</sup>

### Ordering data

Part no. for L=1000 mm	201 045 1000	201 040 1000	201 041 1000	201 042 1000	201 043 1000	201 009 1000
Part no. for L=3000 mm	201 045 3000	201 040 3000	201 041 3000	201 042 3000	201 043 3000	201 009 3000

### Dimensioned drawings



# Universal profiles

## PU 25/PU 50



### Features

- For the fast and simple erection of frames, benches and racks
- Aluminium, naturally anodised
- Produced in accordance with DIN EN 12020-2
- Light, compact & stable
- For universal use
- Suitable for very high loads
- The clamping elements and drilled holes of our clamped linkages produce very rigid connections, resistant to tension, distortion and inter-profile bending.
- Profile cutting to order
- Extensive range of accessories (see page 2-14)

Option: - powder coatings  
in anthracite and light grey

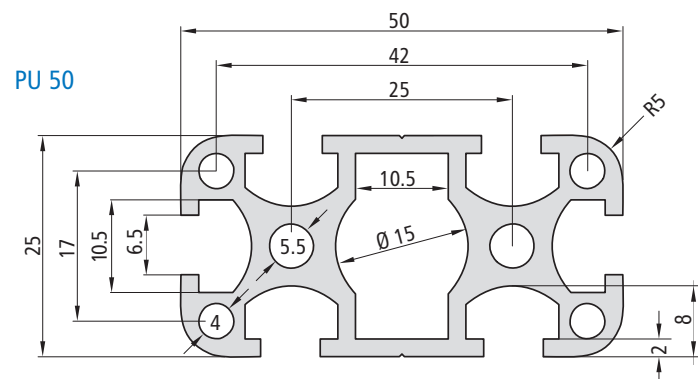
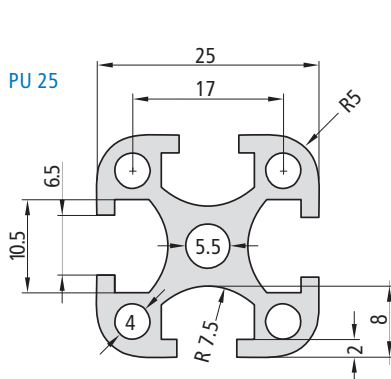
### Technical specification

	PU 25	PU 50
Dimensions (W × H)	25 x 25 mm	50 x 25 mm
Length	up to 3 metres (special lengths upon request)	
Weight	approx. 0.7 kg/m	approx. 1.3 kg/m
	4 T-key inserts for M6 sliding nuts Cavity insert, Ø 5.5 mm for M6	4 T-key inserts for M6 sliding nuts 2 cavity inserts, Ø 5.5 mm for M6
Moment of inertia $I_x$	1.43 cm <sup>4</sup>	10.99 cm <sup>4</sup>
Moment of inertia $I_y$	1.43 cm <sup>4</sup>	2.81 cm <sup>4</sup>
Moment of resistance $W_x$	1.14 cm <sup>3</sup>	4.40 cm <sup>3</sup>
Moment of resistance $W_y$	1.14 cm <sup>3</sup>	2.25 cm <sup>3</sup>

### Ordering data

Profile description	Part no.: L=1000 mm Part no.: L=3000 mm
PU 25 W 25 x H 25 mm	200 001 1000 200 001 3000
PU 50 W 50 x H 25 mm	200 002 1000 200 002 3000

### Dimensioned drawings



# T-slot plates

# PT 25



## Features

- Universal precision, clamping and machining surface
- Aluminium, naturally anodised
- Produced in accordance with DIN EN 12020-2
- Milled flat on both sides
- For use with any machine
- Thick walled, distortion-free and extremely form-retaining
- Profile cutting to order
- Extensive range of accessories (see page 2-14)
- Option:
  - Drainage channel for small quantities of liquid

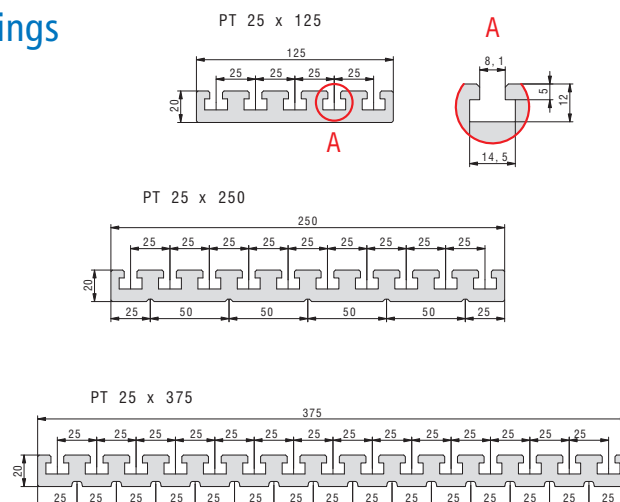
## Technical specification

	PT 25		
	125 x 20 mm	250 x 20 mm	375 x 20 mm
Dimensions (W × H)	125 x 20 mm	250 x 20 mm	375 x 20 mm
Length	up to 3 metres (special lengths upon request)		
Weight	appr. 4.8 kg/m	appr. 9.6 kg/m	appr. 13.7 kg/m
T-slots	one-sided in 25 mm raster		
Moment of inertia $I_x$	243.36 cm <sup>4</sup>	1848.57 cm <sup>4</sup>	5996.01 cm <sup>4</sup>
Moment of inertia $I_y$	6.46 cm <sup>4</sup>	12.77 cm <sup>4</sup>	17.90 cm <sup>4</sup>
Moment of resistance $W_x$	38.94 cm <sup>3</sup>	147.88 cm <sup>3</sup>	319.79 cm <sup>3</sup>
Moment of resistance $W_y$	6.46 cm <sup>3</sup>	12.77 cm <sup>3</sup>	17.90 cm <sup>3</sup>

## Ordering data

L [mm]	PT 25	PT 25	PT 25
	W 125 x H 20 mm	W 250 x H 20 mm	W 375 x H 20 mm
	Part no.	Part no.	Part no.
400	201 014 0400	201 018 0400	201 020 0400
500	201 014 0500	201 018 0500	201 020 0500
600	201 014 0600	201 018 0600	201 020 0600
700	201 014 0700	201 018 0700	201 020 0700
800	201 014 0800	201 018 0800	201 020 0800
900	201 014 0900	201 018 0900	201 020 0900
1000	201 014 1000	201 018 1000	201 020 1000
1100	201 014 1100	201 018 1100	201 020 1100
1200	201 014 1200	201 018 1200	201 020 1200
1300	201 014 1300	201 018 1300	201 020 1300
1400	201 014 1400	201 018 1400	201 020 1400
1500	201 014 1500	201 018 1500	201 020 1500
1800	201 014 1800	201 018 1800	201 020 1800
2000	201 014 2000	201 018 2000	201 020 2000
2500	201 014 2500	201 018 2500	201 020 2500
3000	201 014 3000	201 018 3000	201 020 3000

## Dimensioned drawings



T-nuts - see accessories for aluminium profiles

# T-slot plates

# PT 50



## Features

- Universal precision, clamping and machining surface
- Aluminium, naturally anodised
- Produced in accordance with DIN EN 12020-2
- Milled flat on both sides
- For use with any machine
- Thick walled, distortion-free and extremely form-retaining
- Profile cutting upon request
- Extensive range of accessories (see page 2-14)

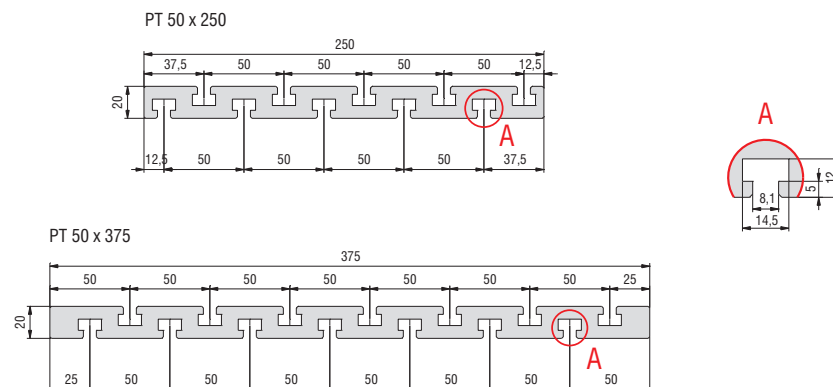
## Technical specification

	PT 50	
	250 x 20 mm	375 x 20 mm
Dimensions (W × H)	250 x 20 mm	375 x 20 mm
Length	up to 3 metres (special lengths upon request)	
Weight	approx. 10.0 kg/m	approx. 14.8 kg/m
T-slots	both-sided in 50 mm raster	
Moment of inertia $I_x$	2062.99 cm <sup>4</sup>	6745.96 cm <sup>4</sup>
Moment of inertia $I_y$	13.85 cm <sup>4</sup>	20.63 cm <sup>4</sup>
Moment of resistance $W_x$	165.04 cm <sup>3</sup>	359.78 cm <sup>3</sup>
Moment of resistance $W_y$	13.85 cm <sup>3</sup>	20.63 cm <sup>3</sup>

## Ordering data

L [mm]	PT 50	PT 50
	W 250 x H 20 mm	W 375 x H 20 mm
	Part no.	Part no.
400	201 016 0400	201 019 0400
500	201 016 0500	201 019 0500
600	201 016 0600	201 019 0600
700	201 016 0700	201 019 0700
800	201 016 0800	201 019 0800
900	201 016 0900	201 019 0900
1000	201 016 1000	201 019 1000
1100	201 016 1100	201 019 1100
1200	201 016 1200	201 019 1200
1300	201 016 1300	201 019 1300
1400	201 016 1400	201 019 1400
1500	201 016 1500	201 019 1500
1800	201 016 1800	201 019 1800
2000	201 016 2000	201 019 2000
2500	201 016 2500	201 019 2500
3000	201 016 3000	201 019 3000

## Dimensioned drawings



T-nuts - see accessories for aluminium profiles



# Rectangular profiles

## RE 40



### Features

- Universal precision, clamping and machining surface
- As a stabiliser for machine and subframe constructions
- Aluminium, naturally anodised
- Produced in accordance with DIN EN 12020-2
- Light & very stable
- Numerous applications with the accessories are possible
- Profile cutting upon request
- Extensive range of accessories (see page 2-14)

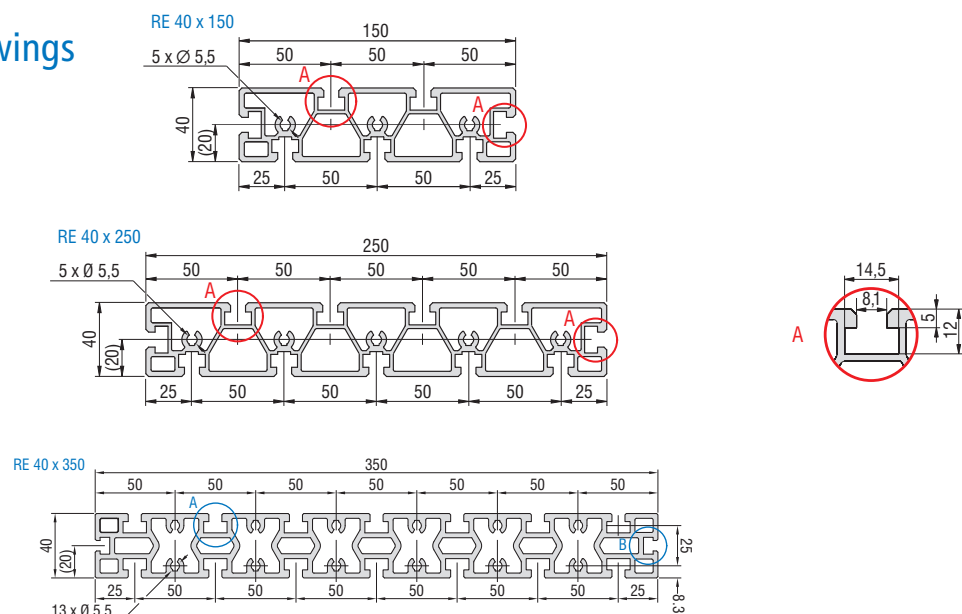
### Technical specification

	RE 40		
Dimensions (W × H)	150 x 40 mm	250 x 40 mm	350 x 40 mm
Length	up to 3 metres (special lengths upon request)		
Weight	approx. 4.8 kg/m	approx. 7.6 kg/m	approx. 13.380 g/m
	various cavities and T-key inserts for sliding nuts or M6 tapped strips for frontal inserts for M6 screws		
Moment of inertia $I_x$	393.7 cm <sup>4</sup>	1654.53 cm <sup>4</sup>	5,626.00 cm <sup>4</sup>
Moment of inertia $I_y$	33.42 cm <sup>4</sup>	54.18 cm <sup>4</sup>	97.45 cm <sup>4</sup>
Moment of resistance $W_x$	52.49 cm <sup>3</sup>	131.64 cm <sup>3</sup>	321.48 cm <sup>3</sup>
Moment of resistance $W_y$	16.71 cm <sup>3</sup>	27.09 cm <sup>3</sup>	48.5 cm <sup>3</sup>

### Ordering data

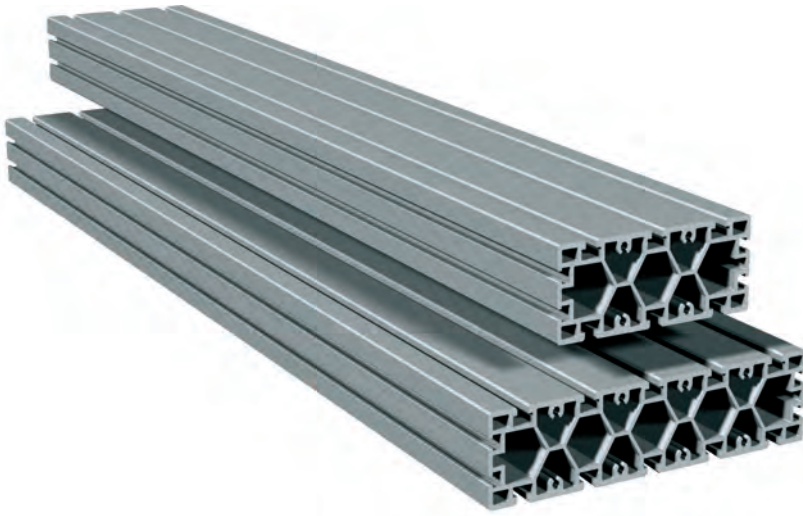
Profile description	Part no.: L = 1000 mm Part no.: L = 3000 mm
RE 40 W 150 x H 40 mm	201 035 1000 201 035 3000
RE 40 W 250 x H 40 mm	201 030 1000 201 030 9000
RE 40 W 350 x H 40 mm	201 031 1000 201 031 3000

### Dimensioned drawings



# Rectangular profiles

## RE 65



### Features

- Universal precision, clamping and machining surface
- As a stabiliser for machine and subframe constructions
- Aluminium, naturally anodised
- Produced in accordance with DIN EN 12020-2
- Light & very stable
- Milled flat on both sides
- Numerous applications with the accessories are possible
- Profile cutting upon request
- Extensive range of accessories (see page 2-14)

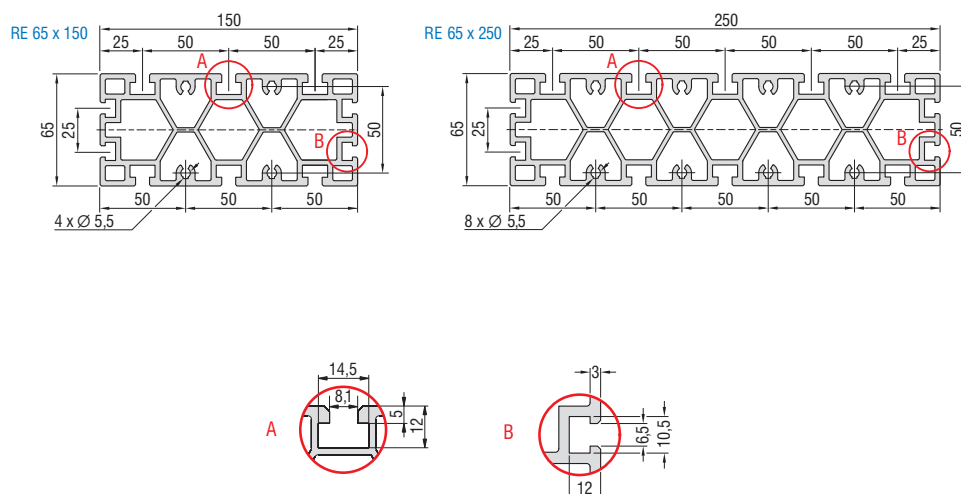
### Technical specification

	RE 65	
Dimensions (W × H)	150 x 65 mm	250 x 65 mm
Length	up to 3 metres (special lengths to order)	
Weight	approx. 7.7 kg/m	approx. 12.4 kg/m
	various cavities and T-key inserts for sliding nuts or M6 tapped strips for frontal inserts for M6 screws	
Moment of inertia $I_x$	633.47 cm <sup>4</sup>	2,658.48 cm <sup>4</sup>
Moment of inertia $I_y$	148.87 cm <sup>4</sup>	243.85 cm <sup>4</sup>
Moment of resistance $W_x$	84.46 cm <sup>3</sup>	212.68 cm <sup>3</sup>
Moment of resistance $W_y$	45.83 cm <sup>3</sup>	75.03 cm <sup>3</sup>

### Ordering data

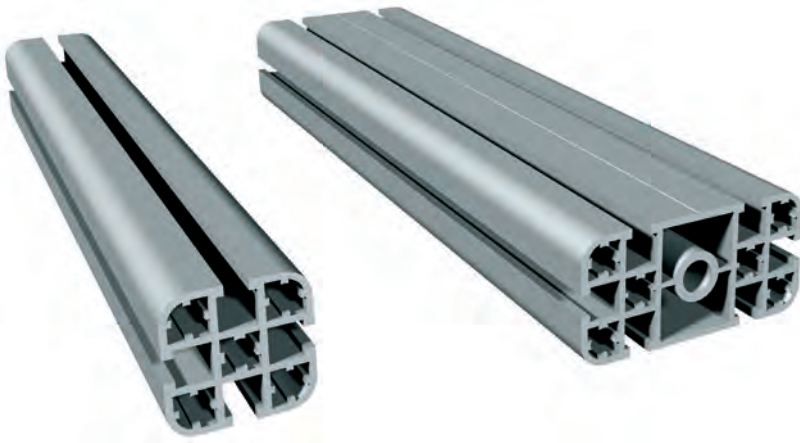
Profile description	Part no.: L=1000 mm Part no.: L=3000 mm
RE 65 W 150 x H 65 mm	201 034 1000 201 034 3000
RE 65 W 250 x H 65 mm	201 032 1000 201 032 3000

### Dimensioned drawings



# Light frame profiles

## PL 40/PL 80



### Features

- For the fast and simple erection of frames, benches and racks
- Aluminium, naturally anodised
- Produced in accordance with DIN EN 12020-2
- Light, compact & stable
- Suitable for very high loads
- The clamping elements and drilled holes of our clamped linkages produce very rigid connections, resistant to tension, distortion and bending between the profiles.
- Profile cutting upon request
- Extensive range of accessories (see page 2-14)

Option: - powder coatings  
in anthracite and light grey

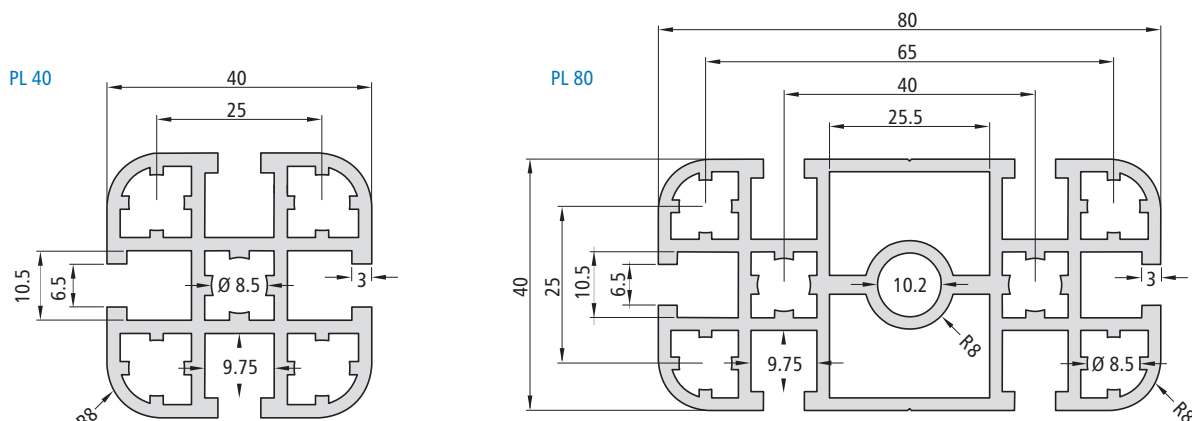
### Technical specification

	PL 40	PL 80
Dimensions (W × H)	40 x 40 mm	80 x 40 mm
Length	up to 3 metres (special lengths to order)	
Weight	approx. 1.5 kg/m	approx. 2.9 kg/m
	4 T-key inserts for M6 sliding nuts 5 cavity inserts, Ø 8.5 mm for M10	6 T-key inserts for M6 sliding nuts 6 cavity inserts, Ø 8.5 mm for M10 Cavity insert, Ø 10.2 mm for M12
Moment of inertia $I_x$	8.38 cm <sup>4</sup>	64.40 cm <sup>4</sup>
Moment of inertia $I_y$	8.38 cm <sup>4</sup>	16.36 cm <sup>4</sup>
Moment of resistance $W_x$	4.19 cm <sup>3</sup>	16.10 cm <sup>3</sup>
Moment of resistance $W_y$	4.19 cm <sup>3</sup>	8.18 cm <sup>3</sup>

### Ordering data

Profile description	Part no.: L=1000 mm Part no.: L=3000 mm
<b>PL 40</b> W 40 x H 40 mm	200 008 1000 200 008 3000
<b>PL 80</b> W 80 x H 40 mm	200 009 1000 200 009 3000

### Dimensioned drawings



# Stand profiles

## PS 50/PS 80



### Features

- For the fast and simple erection of frames, benches and racks
- Aluminium, naturally anodised
- Produced in accordance with DIN EN 12020-2
- Light, compact & stable
- Suitable for high loads
- Our clamped linkages produce very rigid connections, resistant to tension, distortion and bending, between profiles
- Profile cutting upon request
- Extensive range of accessories (see page 2-14)

Option: - powder coatings  
in anthracite and light grey

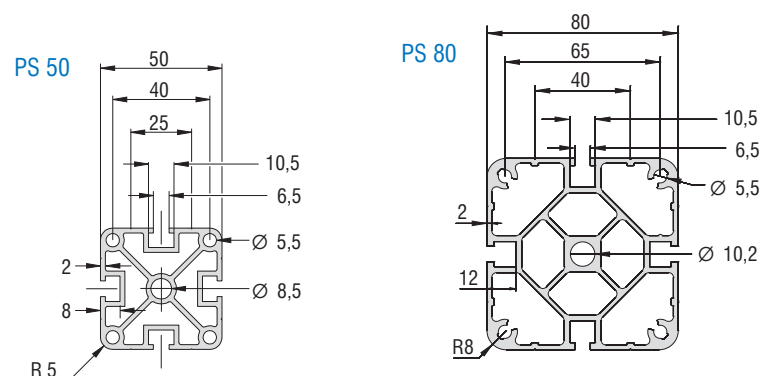
### Technical specification

	PS 50	PS 80
Dimensions (W × H)	50 x 50 mm	80 x 80 mm
Length	up to 3 metres (special lengths upon request)	
Weight	approx. 2.3 kg/m	approx. 4.5 kg/m
	4 T-key inserts for M6 sliding nuts 4 cavity inserts, Ø 5.5 mm for M6 Cavity insert, Ø 8.5 mm for M10	4 T-key inserts for M6 sliding nuts 4 cavity inserts, Ø 5.5 mm for M6 Cavity insert, Ø 10.2 mm for M12
Moment of inertia $I_x$	22.06 cm <sup>4</sup>	111.8 cm <sup>4</sup>
Moment of inertia $I_y$	22.06 cm <sup>4</sup>	111.8 cm <sup>4</sup>
Moment of resistance $W_x$	8.82 cm <sup>3</sup>	27.95 cm <sup>3</sup>
Moment of resistance $W_y$	8.82 cm <sup>3</sup>	27.95 cm <sup>3</sup>

### Ordering data

Profile description	Part no.: L=1000 mm Part no.: L=3000 mm
<b>PS 50</b> W 50 x H 50 mm	200 003 1000 200 003 3000
<b>PS 80</b> W 80 x H 80 mm	200 014 1000 200 014 3000

### Dimensioned drawings





# Stand profiles

## PS100



### Features

- For fast and easy erection of frames, benches and racks
- Aluminium, naturally anodised
- Produced in accordance with DIN EN 12020-2
- Light, compact & stable
- Suitable for high loads
- Our clamped linkages produce very rigid connections, resistant to tension, distortion and bending, between profiles
- Profile cutting upon request
- Extensive range of accessories (see page 2-14)

Option: - powder coatings  
in anthracite and light grey

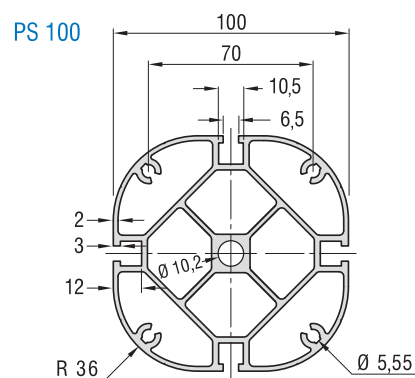
### Technical specification

	PS 100
Dimensions (W × H)	100 x 100 mm
Length	up to 3 metres (special lengths to order)
Weight	approx. 5.1 kg/m
	4 T-key inserts for M6 sliding nuts 4 cavity inserts, Ø 5.55 mm for M6 Cavity insert, Ø 10.2 mm for M12
Moment of inertia $I_x$	163.00 cm <sup>4</sup>
Moment of inertia $I_y$	163.00 cm <sup>4</sup>
Moment of resistance $W_x$	32.60 cm <sup>3</sup>
Moment of resistance $W_y$	32.60 cm <sup>3</sup>

### Ordering data

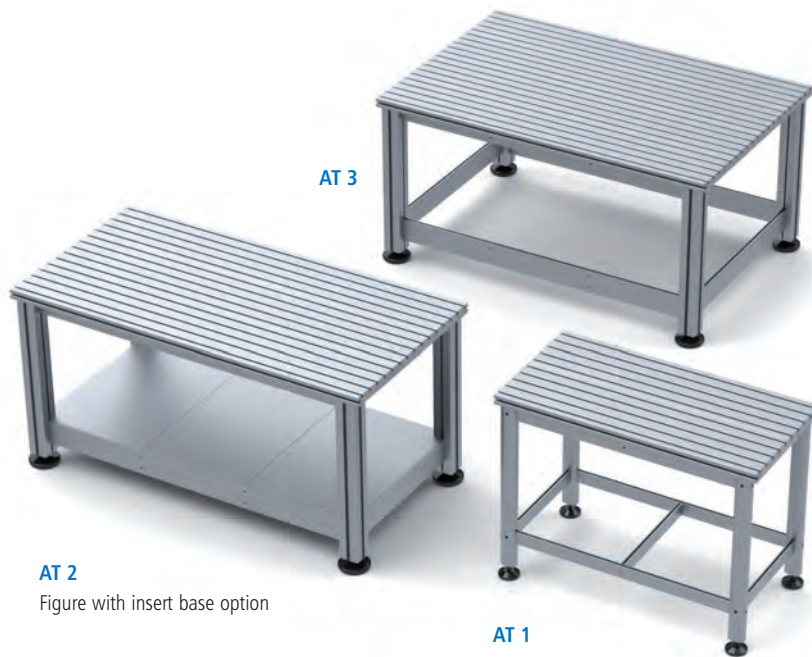
Profile description	Part no.: L=1000 mm Part no.: L=3000 mm
PS 100 W 100 x H 100 mm	200 015 1000 200 015 3000

### Dimensioned drawings



# Workbenches

## AT



### Features

Workbenches AT for clamping devices, clamping means, for measurement, checking, testing, etc.

- Sub-frame from aluminium profiles PS series with braces made from aluminium panel profiles PP series
- Aluminium bench plate RE series of rectangular profiles 40 × 250 mm with T-slots

### Options

- Length up to 2 m
- Various accessories

### Accessories

Insert base for AT 1  
Part no.: **248551 0010**

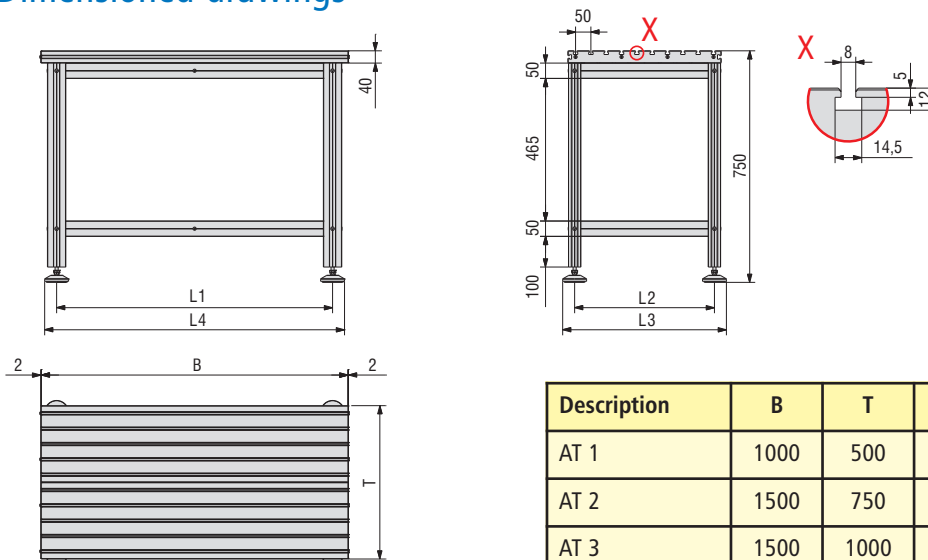
Insert base for AT 2  
Part no.: **248551 0012**

Insert base for AT 3  
Part no.: **248551 0013**

## Ordering data

Part no.	Description	Load: Surface load	Weight	suitable for
248 550 0010	AT 1, W 1000 x D 500 x H 750 mm	200 kg	approx. 30 kg	
248 550 0012	AT 2, W 1500 x D 750 x H 750 mm	400 kg	approx. 60 kg	ICP 3020
248 550 0013	AT 3, W 1500 x D 1000 x H 750 mm	400 kg	approx. 75 kg	ICP/ICV 4030

## Dimensioned drawings



Description	B	T	L 1	L 2	L 3	L 4
AT 1	1000	500	900	456	536	980
AT 2	1500	750	1380	660	780	1500
AT 3	1500	1000	1380	910	1030	1500

# Accessories

## Tapped rails



### M6 tapped rail

- 13 x 6 mm
- Galvanised
- M6 Ra 50 mm
- VE 3 units at 1 m
- For PT/RE 40, 65

Part no.: 209010

### M6 tapped rail

- 10 x 4 mm
- Galvanised
- M6 Ra 50 mm
- VE 3 units at 1 m
- For all except PT/RE 40, 65/SP

Part no.: 209011

## Sliding nuts



### M6 sliding nut (Figure 1)

- L25 x W10 x H3.5
- Galvanised
- VE 100 units
- All except PT/RE 40, 65

Part no.: 209001 0005

### M6 sliding nut (Figure 2)

- L 25 x W 13 x H 5
- Galvanised
- VE 50 units
- For PT/RE 40, 65

Part no.: 209004 0001

### 2 x M6 sliding nuts (Figure 2)

- L45 x W10 x H3.5
- Galvanised
- VE 50 units
- For all except PT/RE 40, 65

Part no.: 209002 0004

### 2 x M6 sliding nuts (Figure 2)

- L 45 x W 13 x H 6
- Galvanised
- 2xM6 Ra 25mm
- VE 25 units
- For PT/RE 40, 65

Part no.: 209005 0001

### M5 sliding nut

- L25 x W10 x H3.5
- Galvanised
- VE 20 units
- For all except PT/RE 40, 65

Part no.: 209006 0001

### Angle sliding nut

- 2 x M6 (Figure 3)
- Galvanised
- VE 25 units
- For all except PT/RE 40, 65

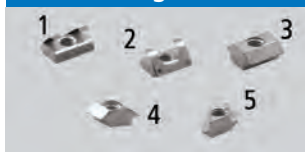
Part no.: 209021 0003

### Special angle sliding nut

- 3 x M6 (Figure 4)
- Galvanised
- VE 25 units
- For all except PT/RE 40, 65

Part no.: 209022 0003

## Sliding nuts



### M5/M6 sliding nuts

- Galvanised
- VE 20 units
- for PT25, PT 50, PS 200, RE 40 and RE 65 (securing only possible at the top) with spring

Part no.: 209005 0002 (M5/Figure 1)

Part no.: 209005 0003 (M6/Figure 2) with large chamfer

Part no.: 209005 0004 (M6/Figure 3) in rhombus shape

Part no.: 209005 0005 (M5/Figure 4)

Part no.: 209005 0006 (M6/Figure 5)

## Tension rods



### Tension rods SE

- With M6 setting screw
- VE 2 units
- For RE/PT

Part no.: 290051

## Clamping devices



### Hand lever clamping device SH 1

- for RE/PT

Part no.: 290001

### Hand lever clamping device SH 2

- For RE/PT

Part no.: 290002

## Stop rails



### Stop rail (galvanised)

- W 20 x H 10 • Ra 50
- VE 2 units + fixing material

L 125 mm

Part no.: 290021 0125

L 175 mm

Part no.: 290021 0175

L 225 mm

Part no.: 290021 0225

## T-keys



### M6 T-keyways

- DIN 508
- Hardened
- VE 20 units
- For PT/RE 40, 65

Part no.: 209119 0003

## Edging strip



### Black edging strip 1-part

- For plate thicknesses 3 - 4 mm
- VE 10 m

Part no.: 209202 0002 (PU profiles)

Part no.: 209202 0001

(PP-/RE- and PS profiles)

## PP 50 cross-braces



### PP 50 cross-braces

- L 490 mm
- Mitred
- M6 drillings
- for all except PT/RE 40, 65

Part no.: 209300 0000

## Hinge strip



### Plastic hinge strip

- L 65 x W 40
- VE 10 units + fixing
- Ra 43 x 20 mm
- For PL

Part no.: 209050 0012

### Aluminium hinge strip

- L 40 x W 40 mm
- VE 10 units + fixing
- Ra 25 x 25 mm
- For all except PT/RE 40, 65

Part no.: 209050 0011

# Accessories

## Profile connection cubes



### Profile connection cubes black

- VE 10 units + fixing material
- For PU 25

2 x Part no.: **209104 0002**

Part no.: Part no.: **209103 0002**



### Profile connection cubes, black

- VE 10 units + fixing material
- For PU 25

Part no.: Part no.: **209106 0002**

Part no.: Part no.: **209107 0002**



### Profile connection cubes black

- VE 10 units + fixing material
- For PU 25

Four-fold Part no.: **209108 0002**

Five-fold Part no.: **209109 0002**

## T-slot cover



### T-slot cover

- VE 30 m
- (turquoise = similar to RAL 5018)
- For all except PT/RE 40, 65

black Part no.: **209201 0004**

turquoise Part no.: **209201 0003**

light grey Part no.: **209201 0007**

## Profile covers



### Profile covers, black

- PU 25 - 25 units
- Part no.: **209105 0003**

- PU 50 - 25 units
- Part no.: **209126 0003**

- PL 40 - 20 units
- Part no.: **209127 0003**

- PL 80 - 20 units
- Part no.: **209128 0003**

- PS 50 - 25 units
- Part no.: **209129 0003**

- PS 80 - 20 units
- Part no.: **209130 0003**

- PS 140 - 10 units
- Part no.: **209130 1001**

## Aluminium corner connector



### Aluminium corner connector

- L 25 × W 25 × H 15 mm
- VE 10 units + fixing material
- For PL, PS, PU, PP

natural  
Part no.: **209114 0101**

black  
Part no.: **209114 0111**

- L 40 × W 40 × H 22 mm
- VE 10 units + fixing material
- For PP/PL/PS/PU

natural  
Part no.: **209115 0101**

black  
Part no.: **209115 0111**

- L 50 × W 50 × H 15
- VE 10 units + fixing material
- For RE/PU/PS

natural  
Part no.: **209116 0101**

black  
Part no.: **209116 0111**

- L 80 × W 80 × H 22
- VE 10 units + fixing material
- For PP/PL/PS/PU

natural  
Part no.: **209117 0101**

black  
Part no.: **209117 0111**

## Plastic equipment bases



### Plastic equipment bases with rubber plate

- VE 4 units + setting screws
- Black

For PL 40/PS 50

- Ø 60
- M10 × 50 setting screws
- Part no.: **209032 0003**

for PL 80 / PS 80

- Ø 80
- M12 × 50 setting screws
- Part no.: **209034 0001**

for PL 80 / PS 80

- Ø 120
- Setting screws M12 × 50
- Black
- Part no.: **209033 0003**

## Guide rollers



### Rubber-tired guide rollers Ø 75 (M10)

- VE 4 units
- 2 with and 2 without locking device
- for PL 40/PS 50

Part no.: **209043 0011**

## Aluminium equipment bases



### Aluminium equipment bases with rubber plate

for PU 50

- VE 4 units, with setting screws  
and reducing bushings
- Ø 50
- M6 × 30 setting screws
- Natural
- Part no.: **209030 0000**

for PS 100/140

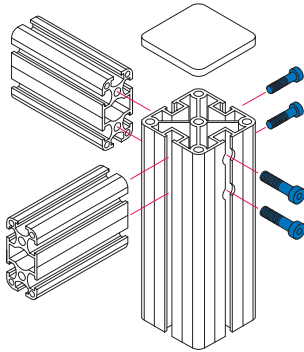
- Ø 170
- M16 × 100 setting screws
- Black
- Part no.: **209035 0001**



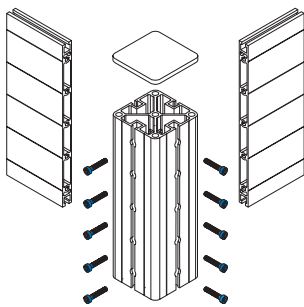
# Profile connections

Examples:

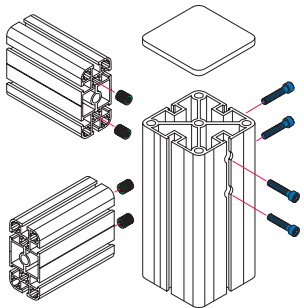
## PS 50 with PU 50



## PS 50 with PP 250



## PS 80 with PL 80



### Allen screws

Allen screws  
M6 × 25 mm

- VE 10 units  
Part no.: **209147 0009**
- VE 50 units  
Part no.: **209147 0010**

Allen screws  
M6 x 50 mm

- VE 10 units  
Part no.: **209147 0003**
- VE 50 units  
Part no.: **209147 0004**

Allen key  
SW 5

- DIN 911
- VE 1 unit  
Part no.: **931152**

### Tapped bushings

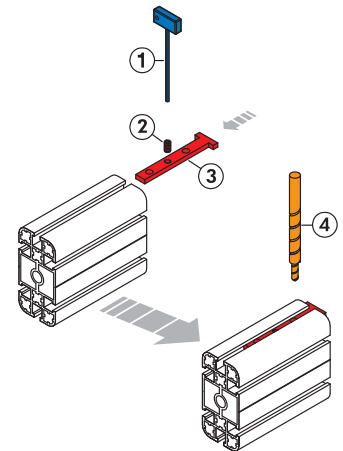
Tapped bushings  
M9/M6

- VE 10 units  
Part no.: **209147 0001**
- VE 50 units  
Part no.: **209147 0002**

Tapped bushings  
M10/M6

- VE 10 units  
Part no.: **209147 0124**
- VE 50 units  
Part no.: **209147 0125**

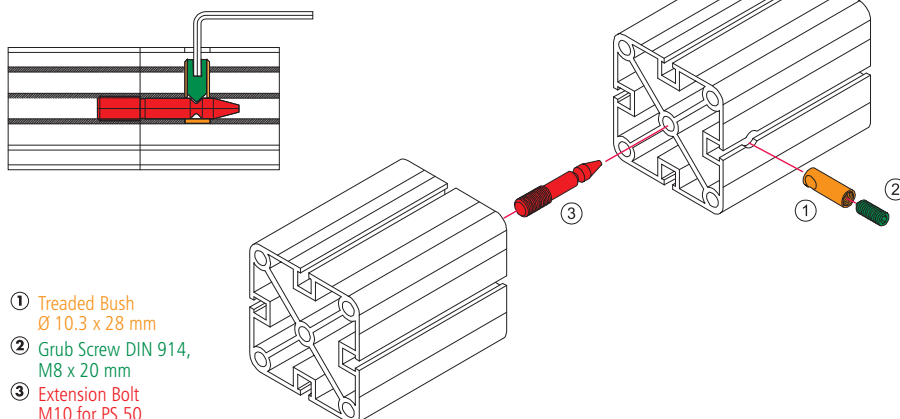
### Example PL 80



- ① Hexagon-Socket Screwdriver
- ② Grub Screw
- ③ Drilling Template
- ④ Twist Drill  
Ø 6 mm / Ø 10.4 mm

Example:

## Profile snaplock extension for PS 50



- ① Treaded Bush  
Ø 10.3 x 28 mm
- ② Grub Screw DIN 914,  
M8 x 20 mm
- ③ Extension Bolt  
M10 for PS 50

### for PS 50/PL 40 (M10)

- Locking bush, tapped pin, extension bolts  
Part no.: **209147 0120**
- 50 sets  
Part no.: **209147 0121**

### for PS 80/PL 80 (M12)

- Locking bush, tapped pin, extension bolts  
• 10 sets  
Part no.: **209147 0122**
- 50 sets  
Part no.: **209147 0123**

### matching drill pattern 2

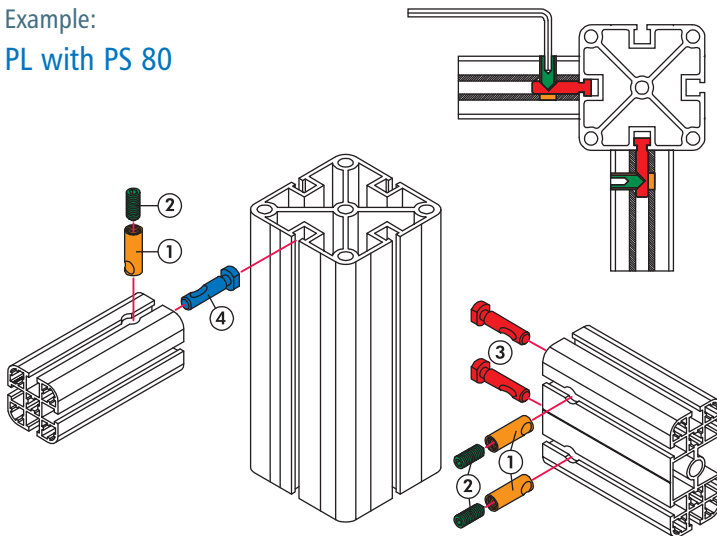
Part no.: **290015 0002**

### Stepped drill

- Ø 6/Ø 10.4 mm  
Part no.: **400090**

# Profile snaplock connections

Example:  
PL with PS 80



- ① Treaded Bush  $\varnothing$  10.3 x 28 mm
- ② Grub Screw DIN 914, M6 x 20 mm
- ③ Connection Bolt 0° for PL 40 and PL 80
- ④ Connection Bolt 90° for PL 40 and PL 80

## Snaplock connection

for PL

- Locking bush, tapped pin and bolts 0°
- 10 sets:  
Part no.: **209147 0102**
- 50 sets:  
Part no.: **209147 0103**

for PL

- Locking bush, tapped pin and bolts 90°
- 10 sets:  
Part no.: **209147 0112**
- 50 sets:  
Part no.: **209147 0113**

for PP/PU

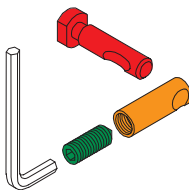
- Locking bush, tapped pin and bolts 0°
- 10 sets:  
Part no.: **209147 0100**
- 50 sets:  
Part no.: **209147 0101**

for PP/PU

- Locking bush, tapped pin and bolts 90°
- 10 sets:  
Part no.: **209147 0110**
- 50 sets:  
Part no.: **209147 0111**

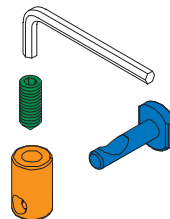
## Snaplock connection 0 degrees

e.g. for  
PL / PS 80

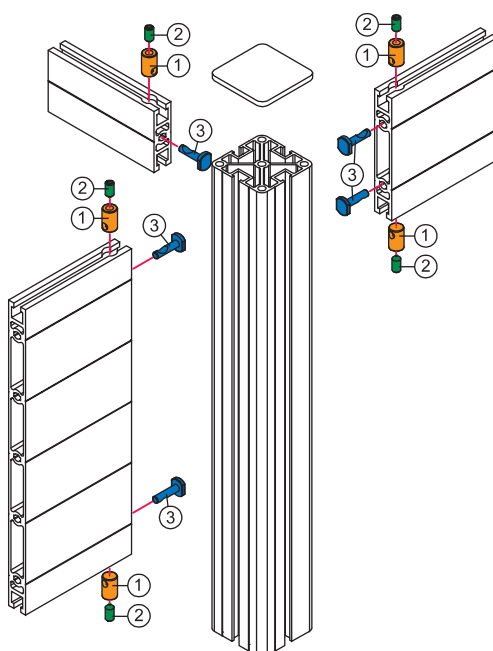


## Snaplock connection 90 degrees

e.g. for  
PP / PU / PS



Example:  
PP with PS 50



- ① Treaded Bush  $\varnothing$  10.3 x 16,5 mm
- ② Grub Screw DIN 914, M6 x 12 mm
- ③ Connection Bolt 90°

## Stepped drill

- $\varnothing$  6 mm/ $\varnothing$  10.4 mm
- Part no.: **400090**

## matching drill pattern 2








Part no.: **290015 0002**

## Allen key SW 3

- DIN 911
- Part no.: **931150**

# Linear guides

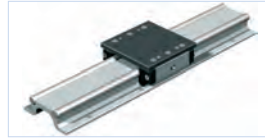
# Overview

<p>Slides functional overview General notes</p>		<p>2-20</p>
<p>LFS-8-1 Linear guide rails LFS-8-2</p>		<p>2-22 with LW 6 trolley with WS1 aluminium slide</p>
<p>LFS-8-3 Linear guide rails</p>		<p>2-24 with LW 7 trolley with WS3 aluminium slide</p>
<p>LFS-8-4 Linear guide rails</p>		<p>2-26 with LW 7 trolley with WS3 aluminium slide</p>
<p>LFS-12-1 Linear guide rails</p>		<p>2-28 with LW 3 trolley with WS4 aluminium slide with LS1 steel slides</p>
<p>LFS-12-11 Linear guide rails</p>		<p>2-30 with LW 5 trolley with WS6 aluminium slide</p>
<p>LFS-12-2 Linear guide rails</p>		<p>2-32 with LW 3 trolley with WS4 aluminium slide</p>

# Linear guides

# Overview

## LFS-12-3 Linear guide rails



with LW 2 trolley  
with LW 8 trolley  
with WS7 aluminium slide

2-34

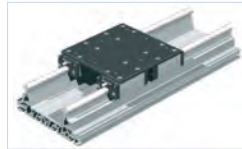
## LFS-12-10 Linear guide rails



with LW 4 trolley  
with WS8 aluminium slide  
with dual track set 1 + 2

2-36

## LFS-16-120 Linear guide rail



with 2 or 4 IWS 1 aluminium slide  
with 2 or 4 ILS 1 steel slides

2-38

## Accessories

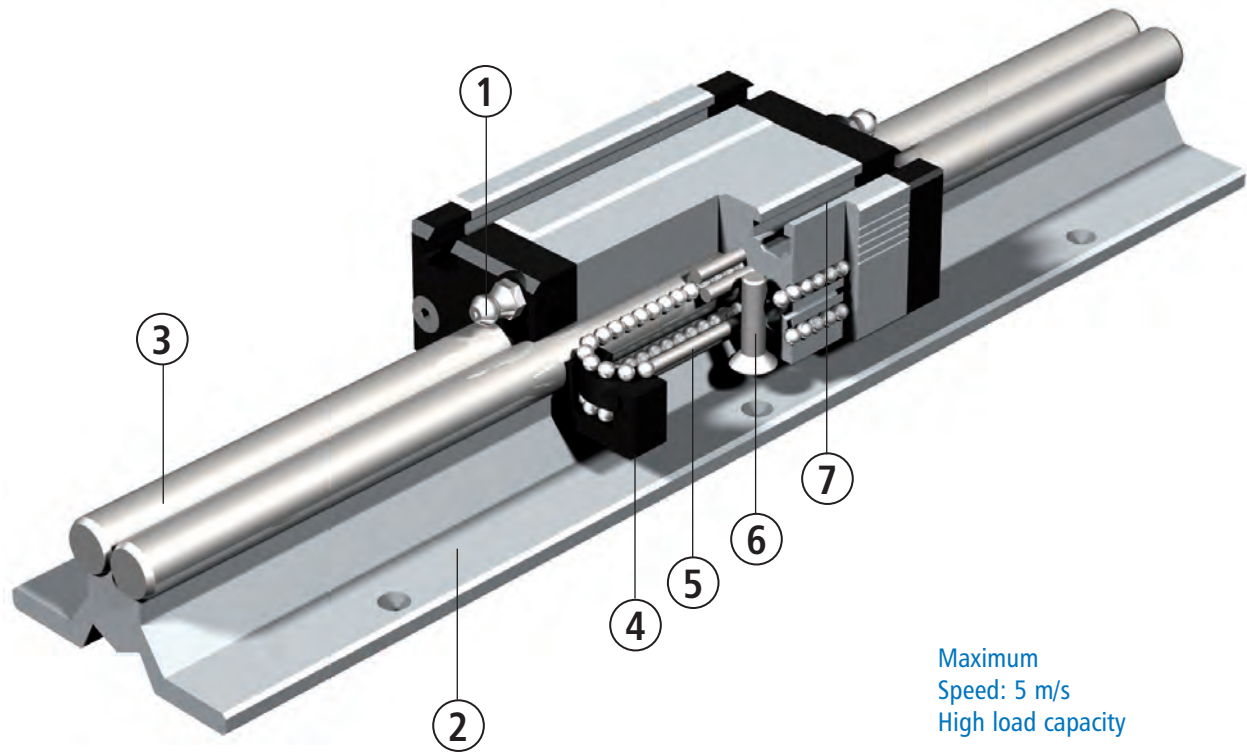
2-40

## Operating loads calculation

2-41



# Linear guide slide function



Maximum  
Speed: 5 m/s  
High load capacity

## Aluminium shaft slides

The patented shaft slides are perfectly suited for assembling of complex multiple axis systems for handling and machining.

The wide range of models covers a multitude of applications.

All models can be produced to order with various profile lengths (70, 100, 150 and 200 mm).

1. Lubrication options to both sides for the recirculating balls.
2. The basic supports for all linear guides are extruded aluminium profiles compliant with DIN EN 12020-2, which are provided with T-slot inserts for fastening in the body of the profile or with drilled hole fixing points.
3. Precision steel shafts with a hardness of  $60 \pm 2$  HRC are used as guide rails. All LFS-8 versions are optionally available with stainless steel shafts.
4. The recirculating ball steering systems are glass fibre reinforced.
5. There are patented recirculating balls in the linear slide. Ball bearings run in each case between two ground steel pins and the guidance shaft.
6. The slide is adjusted with self-locking setting screws. This is how the rows of balls and shafts or pins are used with each other and thus pre-stressed. The slide are preset in the factory to the correct stress. All shaft slides are optionally available in a stainless version.
7. To secure transport loads, slot plates, etc., the shaft slide are provided with T-slot inserts or fixing borings.

# General notes

## Load capacity and working life

### Installation site

In principal, the installation site for linear guides can be chosen anywhere. You merely have to consider whether all the forces and moments arising are below the maximum values for the relevant axes.

### Temperatures

All linear guides are designed for continuous operation at ambient temperatures of up to 60 °C. In short-term operation, maximum temperatures of 80 °C are permissible.

Linear guides are unsuitable for temperatures below freezing.

### Straightness/Warping

The aluminium profiles used are extruded profiles, which exhibit divergences regarding straightness and may be warped, owing to the manufacturing process.

The tolerance of this deviation is set out in DIN EN 12020-2.

In the worst case, the linear guide deviations equal these limits, but typically they are lower.

In order to achieve the desired guidance accuracy, the guide must be aligned using shims or clamped to a bearing service machined to the corresponding accuracy. This achieves tolerances of at least 0.1 mm/1000 mm.

### Principles

#### Load capacity and working life

The dimensioning of a linear guide is based on the load capacity of the individual elements. The load capacity is described by:

- the dynamic load factor C
- the static load factor C0
- the static torques MOX, MOY and MOZ

The basis of the dynamic load factors according to DIN is a nominal working life of 100,000 m displacement path. Far East suppliers often quote load factors for a nominal working life of 50,000 m displacement path; this produces load factor figures which are approximately 20% higher than those according to DIN.

#### Dynamic load capacity

The fatigue characteristics of the material determine the dynamic load capacity. The working life - the fatigue period - also depends on:

- the stress on the linear guide
- the speed at which the linear guide moves
- the statistical randomness of the first damage occurring

### Useful life

Useful life means the working life actually achieved by a linear guide. The useful life may differ from the computed working life.

The following can lead to premature failure through wear or fatigue:

- Misalignments between guide rails or guidance elements
- Contamination of the guide rails
- Insufficient lubrication
- Oscillating motion with very small lifts (formation of grooves)
- Vibrations at rest (formation of grooves)

Owing to the multiplicity of installation and operating relationships, it is impossible to determine the useful life of a linear guide exactly in advance. The safest way to make an accurate estimate of the useful life is, as before, a comparison with similar installations.

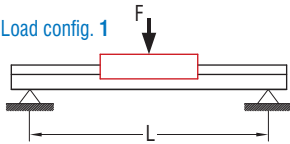


# Linear guide rails

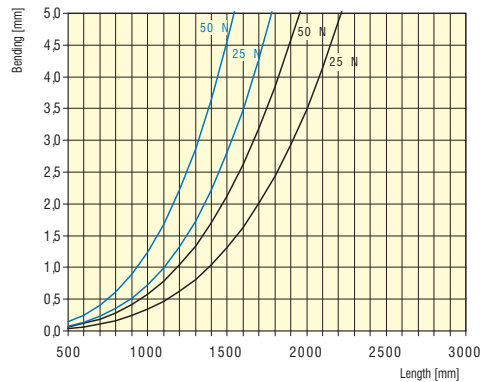
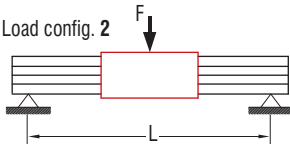
## LFS-8-1 LFS-8-2

### Bending

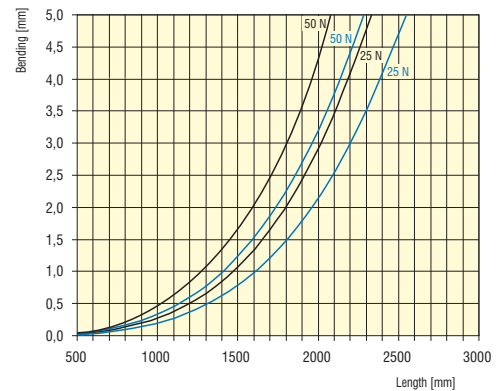
■ Load config. 1



■ Load config. 2



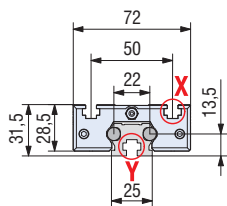
LFS-8-1



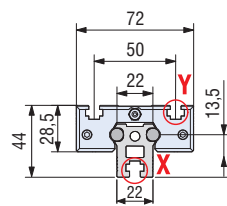
LFS-8-2

### Dimensioned drawings

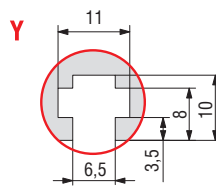
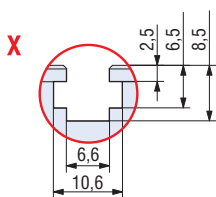
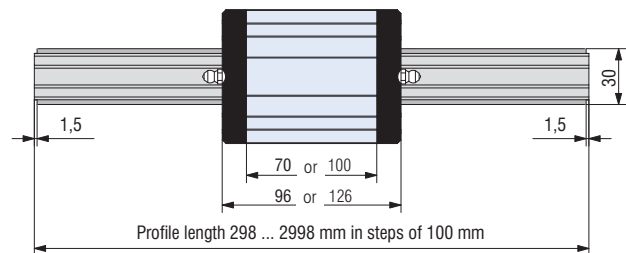
LFS-8-1 or LFS-8-2 with aluminium slide WS 1/70 or WS 1



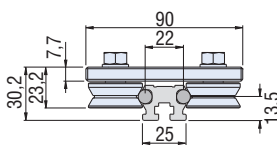
LFS-8-1



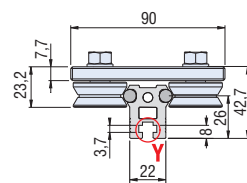
LFS-8-2



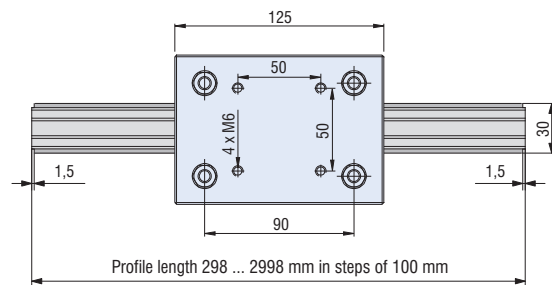
LFS-8-1 or LFS-8-2 with trolley LW 6



LFS-8-1

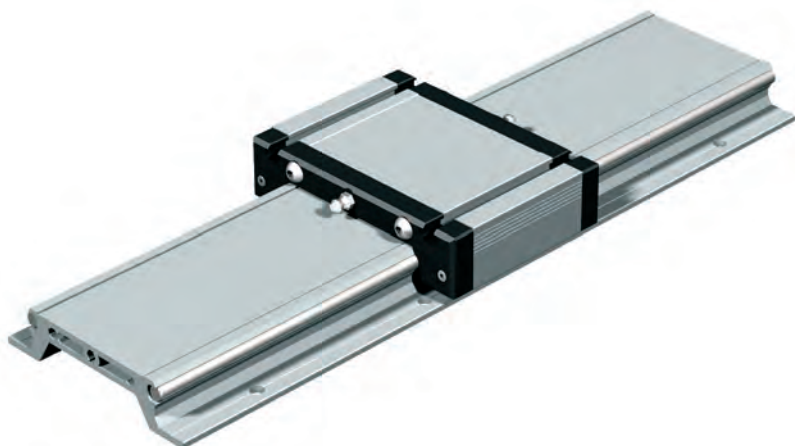


LFS-8-2



# Linear guide rails

# LFS-8-3



## Features

- W 115 x H 25.5 mm
- 2 precision steel shafts Ø 8
- Particularly resistant to twisting
- Aluminium shaft housing profile, naturally anodised
- Fixing from above through M6 drillings in the raster 100 mm
- Conditionally self-supporting
- Special lengths to order
- Weight: approx. 3.2 kg/m
- Option: stainless steel version

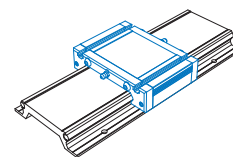
## Ordering key

### 235 00X XXXX

Standard = 4      Length in mm (in 100 mm raster)  
 Stainless = 5      e.g. 0029 = Length 296  
                               0299 = Length 2996

Length overall L -1 mm

Profile up to 6000 mm available without impact connection, steel shafts divided.



## Aluminium slide

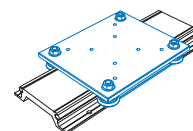
- With recirculating ball guide
- Clamping surface plane milled
- M6 T-key inserts
- Central lubrication option
- Adjustable for no play
- Option: stainless steel version

L 96 x W 130 x H 32 mm (WS 3/70)  
 (weight: approx. 0.5 kg)

Part no.: **223103 0070**  
 Stainless steel: **223103 1070**

L 176 x W 130 x H 32 mm (WS 3)  
 (weight: approx. 0.9 kg)

Part no.: **223103**  
 Stainless steel: **223103 1000**



## Trolley LW 7

- L 175 x W 150 x H 7.5 mm
- ground steel plate
- 4 rollers Ø 31, sealed for life
- adjustable for no play
- weight: approx. 2 kg

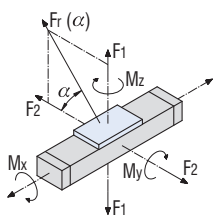
Part no.: **223012**

## Load data

Shaft slide WS 3/70	
C <sub>0</sub>	3141 N
C	1879 N
F <sub>1</sub> static	2682 N
F <sub>1</sub> dynamic	1604 N
F <sub>2</sub> static	3141 N
F <sub>2</sub> dynamic	1879 N
M <sub>x</sub> static	115.7 Nm
M <sub>y</sub> static	105.3 Nm
M <sub>z</sub> static	123.3 Nm
M <sub>x</sub> dynamic	69.2 Nm
M <sub>y</sub> dynamic	62.9 Nm
M <sub>z</sub> dynamic	73.7 Nm

Shaft slide WS 3	
C <sub>0</sub>	6945 N
C	3190 N
F <sub>1</sub> static	5931 N
F <sub>1</sub> dynamic	2724 N
F <sub>2</sub> static	6945 N
F <sub>2</sub> dynamic	3190 N
M <sub>x</sub> static	255.9 Nm
M <sub>y</sub> static	232.8 Nm
M <sub>z</sub> static	272.5 Nm
M <sub>x</sub> dynamic	117.5 Nm
M <sub>y</sub> dynamic	106.9 Nm
M <sub>z</sub> dynamic	125.1 Nm

Trolley LW 7	
C <sub>0</sub>	2160 N
C	4000 N
F <sub>1</sub> static	4320 N
F <sub>1</sub> dynamic	3792 N
F <sub>2</sub> static	2160 N
F <sub>2</sub> dynamic	4000 N
M <sub>x</sub> static	246.8 Nm
M <sub>y</sub> static	302.4 Nm
M <sub>z</sub> static	151.2 Nm
M <sub>x</sub> dynamic	216.7 Nm
M <sub>y</sub> dynamic	265.4 Nm
M <sub>z</sub> dynamic	280 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$

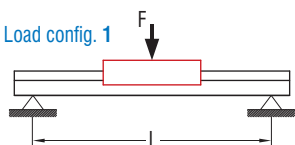


# Linear guide rails

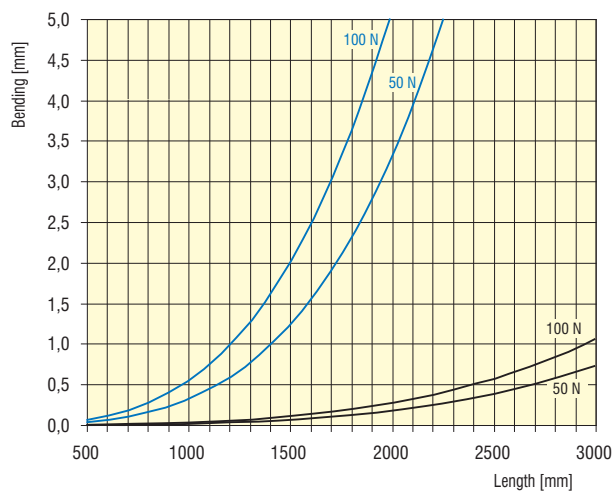
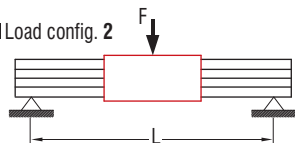
## LFS-8-3

### Bending

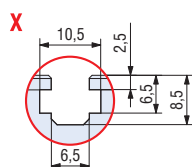
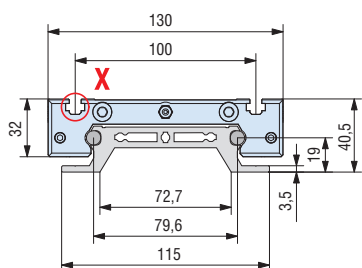
■ Load config. 1



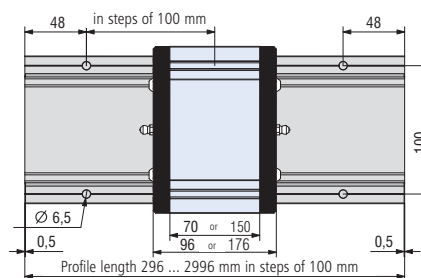
■ Load config. 2



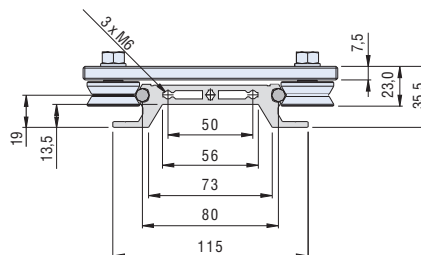
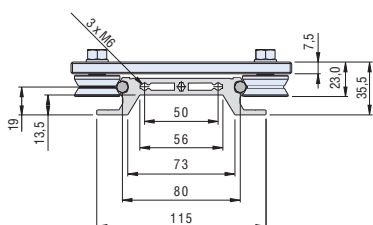
### Dimensioned drawings



LFS-8-3 with aluminium slide WS 3/70 or WS 3



LFS-8-3 with trolley LW7



# Linear guide rails

# LFS-8-4

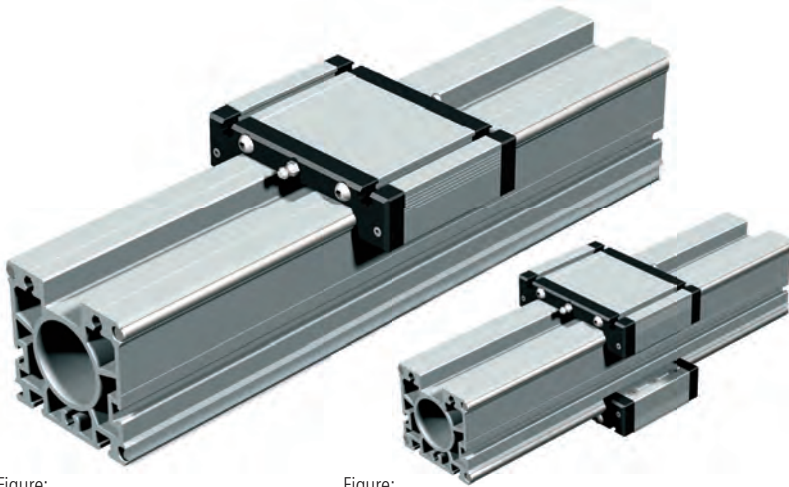


Figure: LFS-8-4 with 2 steel shafts and an aluminium slot

Figure: LFS-8-4 with 4 steel shafts and two aluminium slide (optional)

## Features

- W 80 x H 80 mm
- 4 precision steel shafts Ø 8
- anti-twist
- aluminium shaft housing profiles, naturally anodised
- fixing from below with M6 tapped rails in the T-slot inserts or in the head side through M8 drillings
- side T-key inserts for limit switch securing
- conditionally self-supporting
- special lengths to order
- weight: approx. 7.2 kg/m
- options: stainless steel version with 2 steel shafts 2 slide or trolley

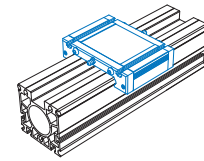
## Ordering key

### 235 00X XXXX

Standard = 6      Length in mm (in 100 mm raster)  
 Stainless = 7      e.g. 0029 = Length 298  
                          0299 = Length 2998

Steel shaft length: total length L - 3 mm

Profile up to 6000 mm available without impact connection, steel shafts divided.



## Aluminium slide

- Clamping surface plane milled
- M6 T-slot inserts
- Central lubrication option
- Adjustable for no play
- Option: stainless steel version

L 96 x W 130 x H 32 mm (WS 3/70)  
 (weight: approx. 0.5 kg)

Part no.: **223103 0070**  
 Stainless steel: **223103 1070**

L 176 x W 130 x H 32 mm (WS 3)  
 (weight: approx. 0.9 kg)

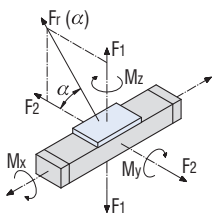
Part no.: **223103**  
 Stainless steel: **223103 1000**

## Load data

Shaft slide WS 3/70	
C <sub>0</sub>	3141 N
C	1879 N
F <sub>1</sub> static	2682 N
F <sub>1</sub> dynamic	1604 N
F <sub>2</sub> static	3141 N
F <sub>2</sub> dynamic	1879 N
M <sub>x</sub> static	115.7 Nm
M <sub>y</sub> static	105.3 Nm
M <sub>z</sub> static	123.3 Nm
M <sub>x</sub> dynamic	69.2 Nm
M <sub>y</sub> dynamic	62.9 Nm
M <sub>z</sub> dynamic	73.7 Nm

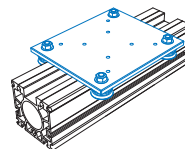
Shaft slide WS 3	
C <sub>0</sub>	6945 N
C	3190 N
F <sub>1</sub> static	5931 N
F <sub>1</sub> dynamic	2724 N
F <sub>2</sub> static	6945 N
F <sub>2</sub> dynamic	3190 N
M <sub>x</sub> static	255.9 Nm
M <sub>y</sub> static	232.8 Nm
M <sub>z</sub> static	272.5 Nm
M <sub>x</sub> dynamic	117.5 Nm
M <sub>y</sub> dynamic	106.9 Nm
M <sub>z</sub> dynamic	125.1 Nm

Trolley LW 7	
C <sub>0</sub>	2160 N
C	4000 N
F <sub>1</sub> static	4320 N
F <sub>1</sub> dynamic	3792 N
F <sub>2</sub> static	2160 N
F <sub>2</sub> dynamic	4000 N
M <sub>x</sub> static	246.8 Nm
M <sub>y</sub> static	302.4 Nm
M <sub>z</sub> static	151.2 Nm
M <sub>x</sub> dynamic	216.7 Nm
M <sub>y</sub> dynamic	265.4 Nm
M <sub>z</sub> dynamic	280 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$



## Trolley LW 7

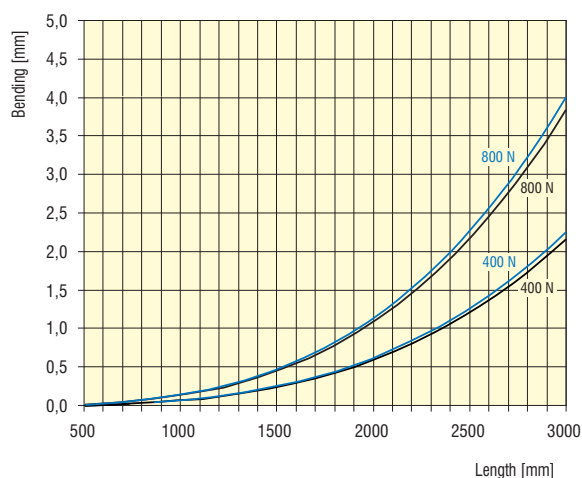
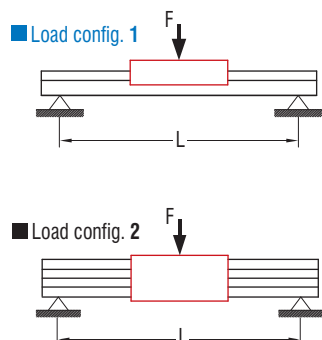
- L 175 x W 150 x H 7.5 mm
- ground steel plate
- 4 rollers Ø 31, sealed for life
- adjustable for no play
- weight: approx. 2 kg

Part no.: **223012**

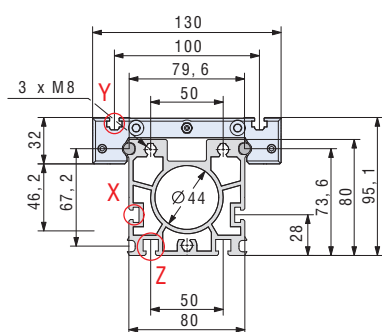
# Linear guide rails

## LFS-8-4

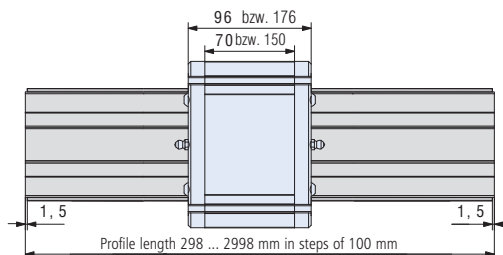
### Bending



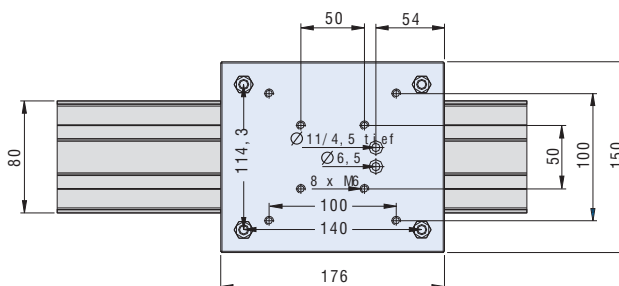
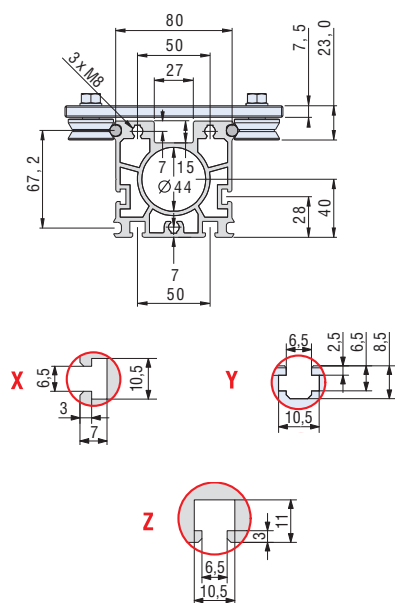
### Dimensioned drawings



LFS-8-3 with aluminium slide WS 3/70 or WS 3



LFS-8-4 with trolley LW 7



# Linear guide rails

# LFS-12-1

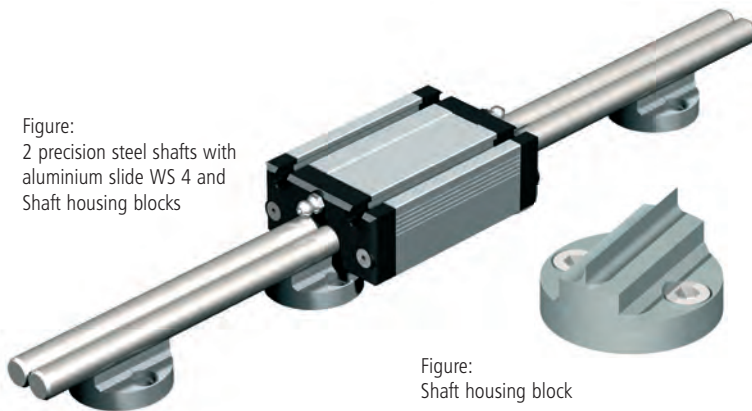


Figure:  
2 precision steel shafts with  
aluminium slide WS 4 and  
Shaft housing blocks

Figure:  
Shaft housing block

## Features

- W 40 x H 27 mm
- 2 precision steel shafts Ø 12
- anti-twist
- aluminium shaft housing blocks
- securing from above or below with M6 drillings in the housing blocks
- guide any length up to 3m
- special lengths to order
- weight: approx. 1.9 kg/m

## Ordering key

**227 312 XXXX**

Length in mm (in 100 mm raster)

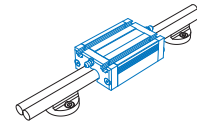
e.g. **0298** = Length 298

**2998** = Length 2998

Special lengths to order

### N.B.!

The part no. refers to one steel shaft only !



### Aluminium slide

- clamping surface plane milled
- weight: approx. 0.3 kg
- option: stainless steel version

L 94 x W 62 x H 31.5 mm (WS 4/70)

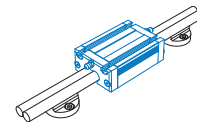
Part no.: **223104 0070**

Stainless steel: **223104 1070**

L 124 x W 62 x H 31.5 mm (WS 4)

Part no.: **223104**

Stainless steel: **223104 1000**

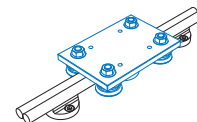


### Steel slide LS 1

L 91 x W 60 x H 32 mm

- clamping surface ground
- weight: approx. 0.8 kg

Part no.: **223006**



### Trolley LW 3

L 125 x W 85 x H 7.7 mm

- ground steel plate
- weight: approx. 0.9 kg

Part no.: **223008**

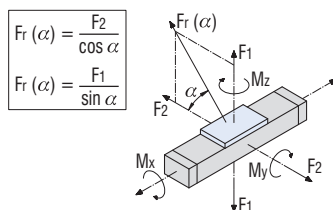
### Shaft housing blocks

- Ø 40 mm, hole spacing 28 mm
- cast zinc, VE 10 units

Part no.: **221501**

## Load data

Shaft slide WS 4/70		Shaft slide WS 4		Steel slide LS 1		Trolley LW 8	
C <sub>0</sub>	3003 N	C <sub>0</sub>	4868 N	C <sub>0</sub>	3508 N	C <sub>0</sub>	2160 N
C	1873 N	C	2426 N	C	2105 N	C	4000 N
F <sub>1</sub> static	2821 N	F <sub>1</sub> static	4157 N	F <sub>1</sub> static	3549 N	F <sub>1</sub> static	4320 N
F <sub>1</sub> dynamic	1599 N	F <sub>1</sub> dynamic	2071 N	F <sub>1</sub> dynamic	2130 N	F <sub>1</sub> dynamic	3846 N
F <sub>2</sub> static	3303 N	F <sub>2</sub> static	4868 N	F <sub>2</sub> static	3508 N	F <sub>2</sub> static	2160 N
F <sub>2</sub> dynamic	1873 N	F <sub>2</sub> dynamic	2426 N	F <sub>2</sub> dynamic	2105 N	F <sub>2</sub> dynamic	4000 N
M <sub>x</sub> static	29.8 Nm	M <sub>x</sub> static	43.9 Nm	M <sub>x</sub> static	36.2 Nm	M <sub>x</sub> static	109.5 Nm
M <sub>y</sub> static	105.3 Nm	M <sub>y</sub> static	155.2 Nm	M <sub>y</sub> static	129.0 Nm	M <sub>y</sub> static	194.4 Nm
M <sub>z</sub> static	123.3 Nm	M <sub>z</sub> static	181.7 Nm	M <sub>z</sub> static	127.5 Nm	M <sub>z</sub> static	97.2 Nm
M <sub>x</sub> dynamic	16.8 Nm	M <sub>x</sub> dynamic	21.8 Nm	M <sub>x</sub> dynamic	21.7 Nm	M <sub>x</sub> dynamic	97.4 Nm
M <sub>y</sub> dynamic	59.7 Nm	M <sub>y</sub> dynamic	77.3 Nm	M <sub>y</sub> dynamic	77.4 Nm	M <sub>y</sub> dynamic	173.0 Nm
M <sub>z</sub> dynamic	69.9 Nm	M <sub>z</sub> dynamic	90.5 Nm	M <sub>z</sub> dynamic	76.5 Nm	M <sub>z</sub> dynamic	180.0 Nm

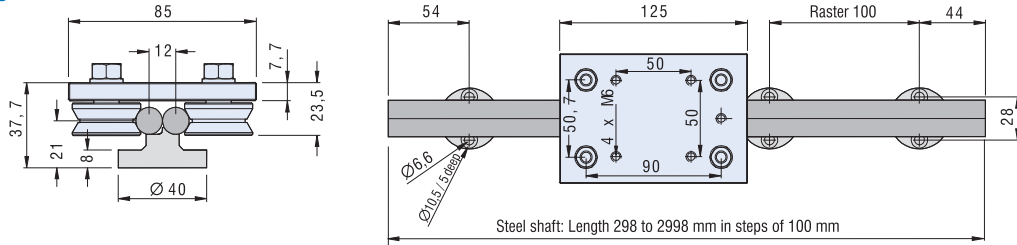


# Linear guide rails

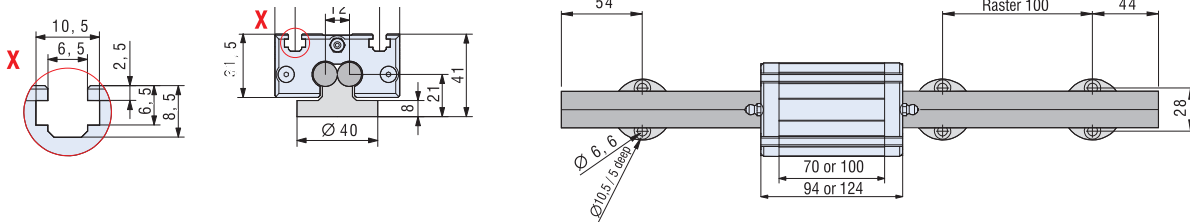
# LFS-12-1

## Dimensioned drawings

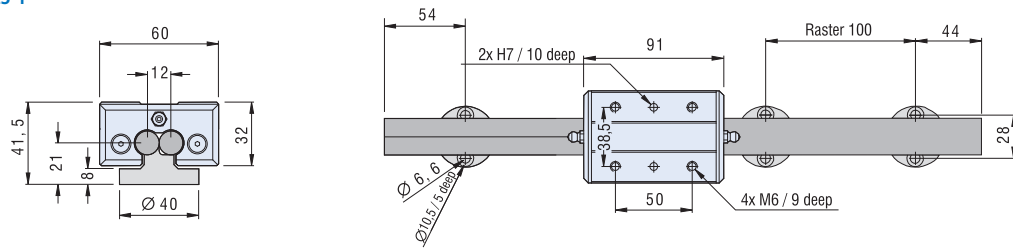
LFS-12-1 with trolley LW 3



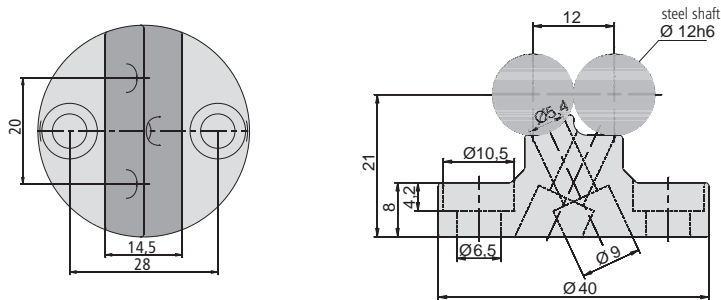
LFS-12-1 with Shaft slide WS 4/70 or WS 4



LFS-12-1 with steel slide LS 1



Shaft housing block





# Linear guide rail

# LFS-12-11



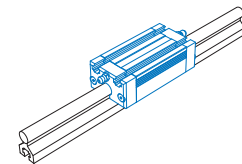
## Features

- W 20 x H 31 mm
- Precision steel shaft Ø 12
- Aluminium shaft housing profile, naturally anodised
- Securing from below with M6 tapped rail in T-slot insert on flat surface
- Special lengths available on request
- Weight: approx. 1.3 kg/m

## Ordering key

**220 002 XXXX**

Length in mm  
 e.g. **0298** = Length 298  
**0998** = Length 998  
 Profile length = Length overall L -2 mm



## Aluminium slides

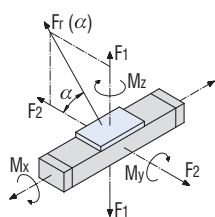
- With recirculating ball guide
- M6 T-slot inserts
- Central lubrication system option
- Adjustable for no play
- Option: stainless steel version

## Load data

Shaft slides WS 6/70	
C <sub>0</sub>	3303 N
C	1873 N
F <sub>1</sub> static	2821 N
F <sub>1</sub> dynamic	1599 N
F <sub>2</sub> static	3303 N
F <sub>2</sub> dynamic	1873 N
M <sub>x</sub> static	-
M <sub>y</sub> static	105.3 Nm
M <sub>z</sub> static	123.3 Nm
M <sub>x</sub> dynamic	-
M <sub>y</sub> dynamic	59.7 Nm
M <sub>z</sub> dynamic	69.9 Nm

Shaft slides WS 6	
C <sub>0</sub>	4868 N
C	2426 N
F <sub>1</sub> static	4157 N
F <sub>1</sub> dynamic	2071 N
F <sub>2</sub> static	4868 N
F <sub>2</sub> dynamic	2426 N
M <sub>x</sub> static	-
M <sub>y</sub> static	155.2 Nm
M <sub>z</sub> static	181.7 Nm
M <sub>x</sub> dynamic	-
M <sub>y</sub> dynamic	77.3 Nm
M <sub>z</sub> dynamic	90.5 Nm

Trolley LW 5	
C <sub>0</sub>	2160 N
C	4000 N
F <sub>1</sub> static	4320 N
F <sub>1</sub> dynamic	3846 N
F <sub>2</sub> static	2160 N
F <sub>2</sub> dynamic	4000 N
M <sub>x</sub> static	-
M <sub>y</sub> static	162.0 Nm
M <sub>z</sub> static	81.0 Nm
M <sub>x</sub> dynamic	-
M <sub>y</sub> dynamic	144.2 Nm
M <sub>z</sub> dynamic	150.0 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

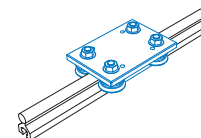
$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$

L 96 x W 50 x H 31.5 mm (WS 6/70)  
 (weight: approx. 0.3 kg)

Part no.: **223106 0070**  
 Stainless steel: **223106 1070**

L 126 x W 50 x H 31,5 mm (WS 6)  
 (weight: approx. 0.5 kg)

Part no.: **223106**  
 Stainless steel: **223106 1000**



## Trolley LW 5

- L 110 x W 75 x H 7.7 mm
- Ground steel plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: 0.81 kg

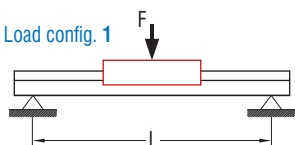
Part no.: **223010**

# Linear guide rail

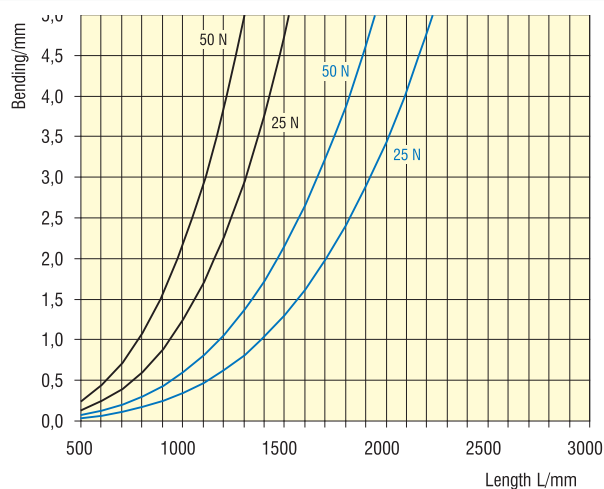
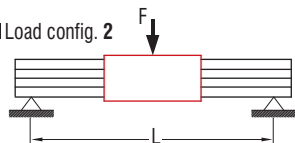
# LFS-12-11

## Bending

■ Load config. 1

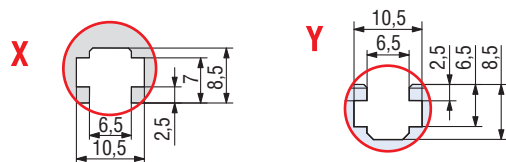
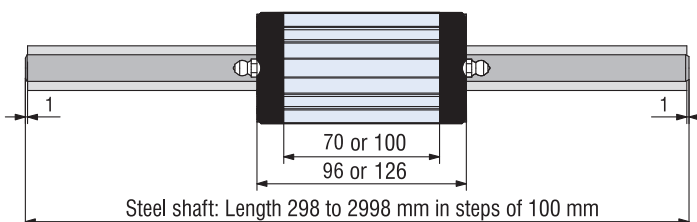
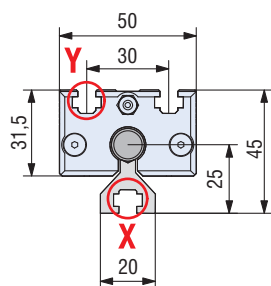


■ Load config. 2

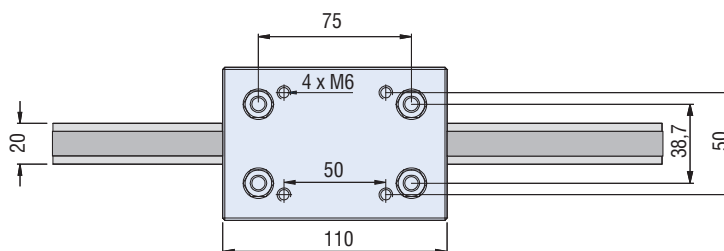
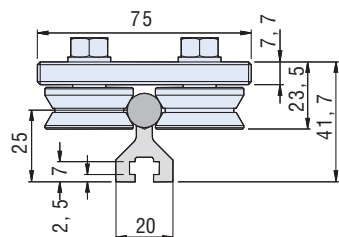


## Dimensioned drawings

LFS-12-11 with aluminium slides WS 6/70 or WS 6



LFS-12-11 with trolley LW5



# Linear guide rail

## LFS-12-2



### Features

- W 62 x H 31 mm
- 2 precision steel shafts Ø 12
- Anti-twist lock
- Aluminium shaft housing profile, naturally anodised
- High parallelism through patented shaft housing outline
- High guidance accuracy
- Securing from above or below using drilled holes Ø 6.5 in 100 mm raster on flat surface
- Lengths in 100 mm raster
- Max. length up to 2998 mm
- Special lengths to order
- Weight: approx. 3.3 kg/m

### Ordering key

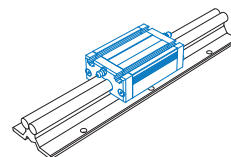
**235 200 XXXX**

Length in mm

e.g. **0298** = Length 298

**0998** = Length 998

Profile length = Length overall L - 2 mm



### Aluminium slides

- With recirculating ball guide
- Clamping surface plane milled
- Option: stainless steel version

L 94 x W 62 x H 31.5 mm (WS 4/70)

(weight: approx. 0.33 kg)

Part no.: **223104 0070**

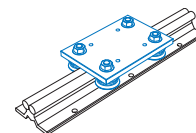
Stainless steel: **223104 1070**

L 124 x W 62 x H 31.5 mm (WS 4)

(weight: approx. 0.46 kg)

Part no.: **223104**

Stainless steel: **223104 1000**



### Trolley LW 3

- L 125 x W 85 x H 7.7 mm
- Ground steel plate
- Weight: 0.93 kg

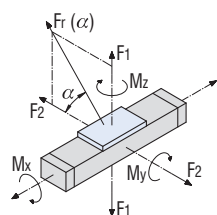
Part no.: **223008**

### Load data

Shaft slides WS 4/70	
C <sub>0</sub>	3003 N
C	1873 N
F <sub>1</sub> static	2821 N
F <sub>1</sub> dynamic	1599 N
F <sub>2</sub> static	3303 N
F <sub>2</sub> dynamic	1873 N
M <sub>x</sub> static	29.8 Nm
M <sub>y</sub> static	105.3 Nm
M <sub>z</sub> static	123.3 Nm
M <sub>x</sub> dynamic	16.8 Nm
M <sub>y</sub> dynamic	59.7 Nm
M <sub>z</sub> dynamic	69.9 Nm

Shaft slides WS 4	
C <sub>0</sub>	4868 N
C	2426 N
F <sub>1</sub> static	4157 N
F <sub>1</sub> dynamic	2071 N
F <sub>2</sub> static	4868 N
F <sub>2</sub> dynamic	2426 N
M <sub>x</sub> static	43.9 Nm
M <sub>y</sub> static	155.2 Nm
M <sub>z</sub> static	181.7 Nm
M <sub>x</sub> dynamic	21.8 Nm
M <sub>y</sub> dynamic	77.3 Nm
M <sub>z</sub> dynamic	90.5 Nm

Trolley LW 3	
C <sub>0</sub>	2160 N
C	4000 N
F <sub>1</sub> static	4320 N
F <sub>1</sub> dynamic	3846 N
F <sub>2</sub> static	2160 N
F <sub>2</sub> dynamic	4000 N
M <sub>x</sub> static	109.5 Nm
M <sub>y</sub> static	194.4 Nm
M <sub>z</sub> static	97.2 Nm
M <sub>x</sub> dynamic	97.4 Nm
M <sub>y</sub> dynamic	173.0 Nm
M <sub>z</sub> dynamic	180.0 Nm



$$F_r(\alpha) = \frac{F_2}{\cos \alpha}$$

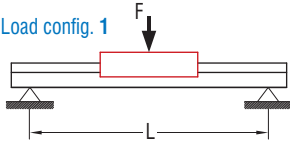
$$F_r(\alpha) = \frac{F_1}{\sin \alpha}$$

# Linear guide rail

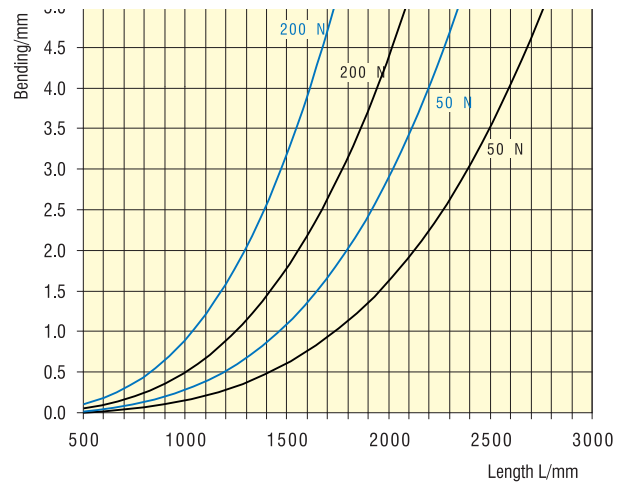
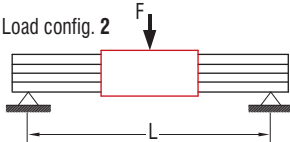
# LFS-12-2

## Bending

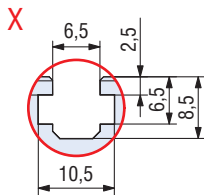
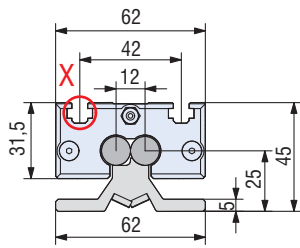
■ Load config. 1



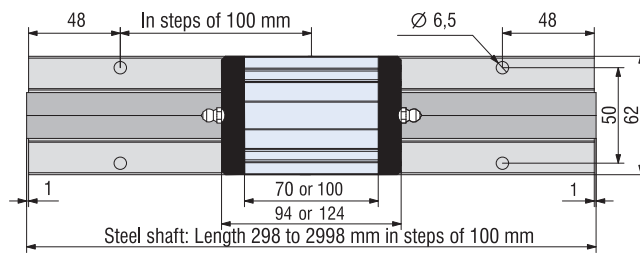
■ Load config. 2



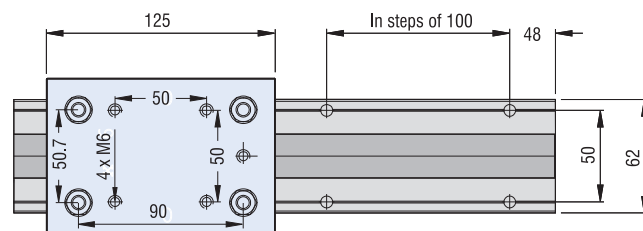
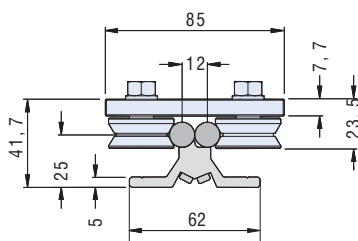
## Dimensioned drawings



LFS-12-2 with aluminium slides WS 4/70 or WS 4

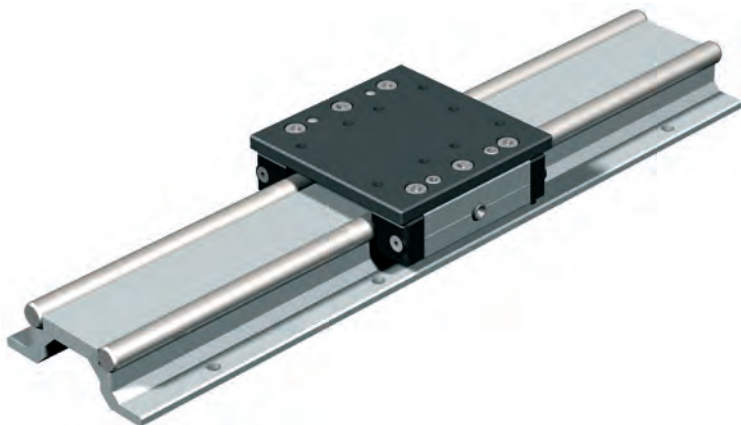


LFS-12-2 with trolley LW3



# Linear guide rail

# LFS-12-3



## Features

- W 90 x H 31 mm
- 2 precision steel shafts Ø 12
- Anti-twist
- Aluminium shaft housing profile, naturally anodised
- increased shaft spacing allows higher torques to be absorbed
- Securing from above or below with M6 drillings in 100 mm raster
- Any guide length
- Weight: approx. 3.9 kg/m

## Ordering key

**235 300 XXXX**

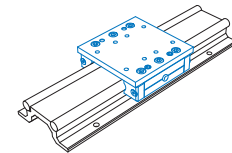
Length in mm (in 100 mm raster)

e.g. **0029** = Length 298

**0299** = Length 2998

Profile length = Length overall L - 2 mm

Special lengths over 3000 mm with rod linkage to order.



## Slides

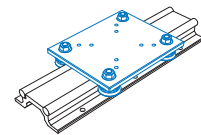
- Ground steel plate
- Central lubrication system option
- Adjustable for no play

L 100 x W 100 x H 32 mm (WS 7/70)  
(weight: approx. 0.8 kg)

Part no.: **223107 0070**

L 200 x W 100 x H 32 mm (WS 7)  
(weight: approx. 1.7 kg)

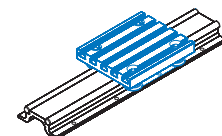
Part no.: **223107**



## Trolley LW 8

- L 150 x W 125 x H 7.5 mm
- Ground steel plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: 1.51 kg

Part no.: **223013**



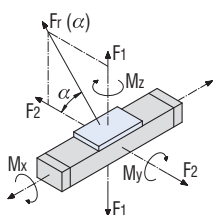
## Trolley LW 2

- L 150 x W 125 x H 34.5 mm
- Aluminium T-slot plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: 0.97 kg

Part no.: **223005**

## Load data

Shaft slides WS 7/70		Shaft slides WS 7		Trolley LW 2		Trolley LW 8	
C <sub>0</sub>	3303 N	C <sub>0</sub>	7303 N	C <sub>0</sub>	3114 N	C <sub>0</sub>	2160 N
C	1873 N	C	3179 N	C	1846 N	C	4000 N
F <sub>1</sub> static	2821 N	F <sub>1</sub> static	6237 N	F <sub>1</sub> static	2659 N	F <sub>1</sub> static	4320 N
F <sub>1</sub> dynamic	1599 N	F <sub>1</sub> dynamic	2715 N	F <sub>1</sub> dynamic	1576 N	F <sub>1</sub> dynamic	3846 N
F <sub>2</sub> static	3303 N	F <sub>2</sub> static	7303 N	F <sub>2</sub> static	3114 N	F <sub>2</sub> static	2160 N
F <sub>2</sub> dynamic	1873 N	F <sub>2</sub> dynamic	3179 N	F <sub>2</sub> dynamic	1846 N	F <sub>2</sub> dynamic	4000 N
M <sub>x</sub> static	82.0 Nm	M <sub>x</sub> static	181.2 Nm	M <sub>x</sub> static	216.0 Nm	M <sub>x</sub> static	189.2 Nm
M <sub>y</sub> static	105.3 Nm	M <sub>y</sub> static	232.8 Nm	M <sub>y</sub> static	100.5 Nm	M <sub>y</sub> static	248.4 Nm
M <sub>z</sub> static	123.3 Nm	M <sub>z</sub> static	272.5 Nm	M <sub>z</sub> static	108.0 Nm	M <sub>z</sub> static	124.2 Nm
M <sub>x</sub> dynamic	46.4 Nm	M <sub>x</sub> dynamic	78.8 Nm	M <sub>x</sub> dynamic	168.4 Nm	M <sub>x</sub> dynamic	168.4 Nm
M <sub>y</sub> dynamic	59.7 Nm	M <sub>y</sub> dynamic	101.3 Nm	M <sub>y</sub> dynamic	192.3 Nm	M <sub>y</sub> dynamic	221.1 Nm
M <sub>z</sub> dynamic	69.9 Nm	M <sub>z</sub> dynamic	118.6 Nm	M <sub>z</sub> dynamic	200.0 Nm	M <sub>z</sub> dynamic	230.0 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

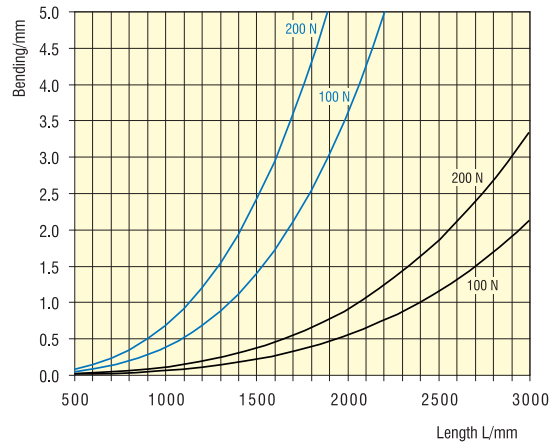
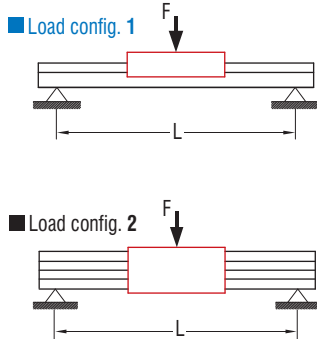
$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$



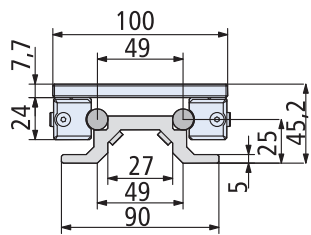
# Linear guide rail

# LFS-12-3

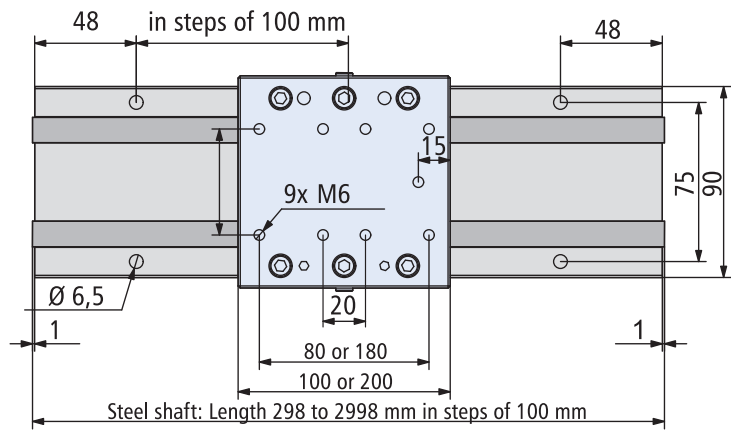
## Bending



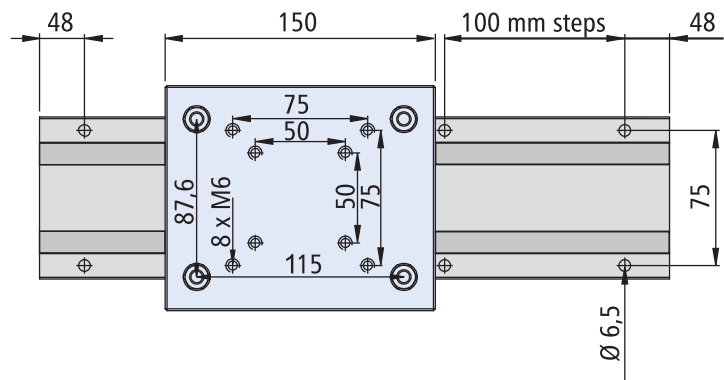
## Dimensioned drawings



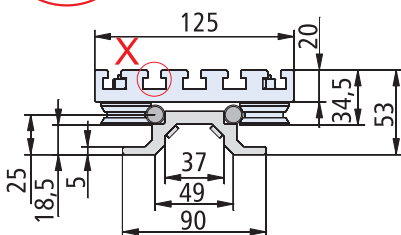
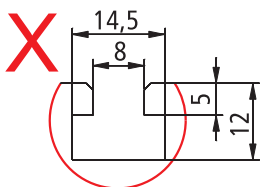
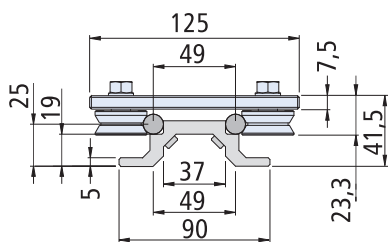
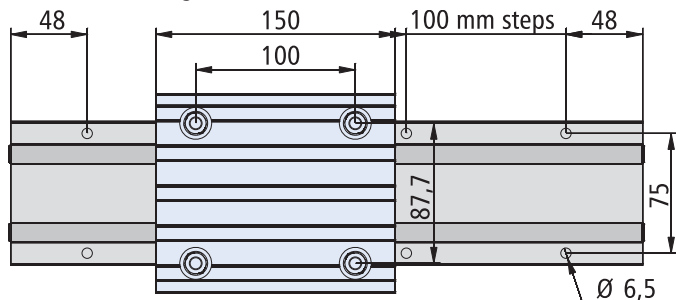
LFS-12-3 with aluminium slides WS 7



LFS-12-3 with Carriage LW 8

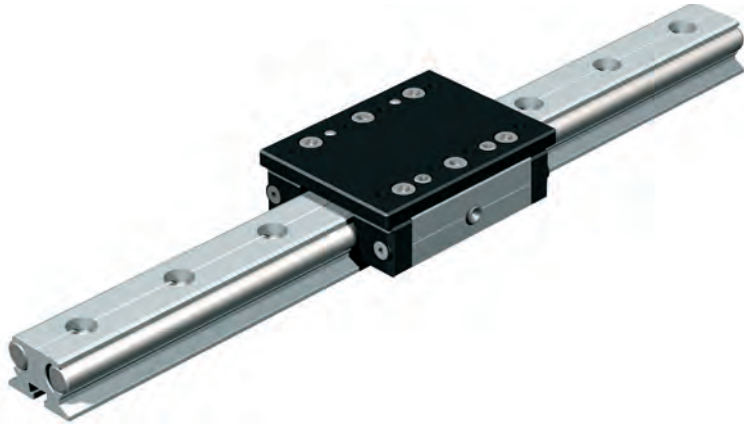


LFS-12-3 with Carriage LW 2



# Linear guide rail

# LFS-12-10



## Features

- W 36 x H 24.5 mm
- 2 precision steel shafts Ø 12
- Anti-twist
- Aluminium shaft housing profile, naturally anodised
- Fixing from below with M6 tapped rail in T-slot insert and from above M6 drillings in the Raster 50 mm
- Conditionally self-supporting
- Special lengths to order
- Weight: approx. 2.9 kg/m

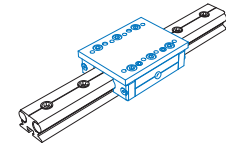
## Ordering key

**220 001 XXXX**

Length in mm (in 100 mm raster)  
e.g. **0300** = Length 296  
**3000** = Length 2996

Profile length = Length overall L - 1 mm

Special lengths over 3000 mm with rod linkage to order.

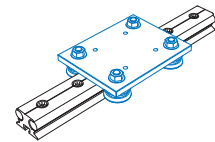


## Slides

- Ground steel plate
- Lubrication system option
- Adjustable for no play

L 100 x W 75 x H 31.5 mm (WS 8/70)  
(weight: approx. 0.7 kg)  
Part no.: **223108 0070**

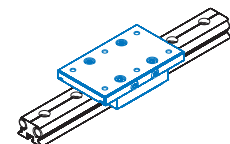
L 150 x W 75 x H 31.5 mm (WS 8)  
(weight: approx. 1,0 kg)  
Part no.: **223108**



## Trolley LW 4

- L 125 x W 97 x H 7.7 mm
- Ground steel plate
- 4 rollers Ø 31, sealed for life
- Adjustable for no play
- Weight: 1.02 kg

Part no.: **223009**



For steel shafts Ø 12 mm

## Dual track set 1

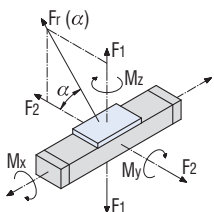
- L75 x W75 x H30.2 mm
  - With 2 SMALL linear ball bearings
- Part no.: **223001**

## Dual track set 2

- L125 x W75 x H30.2 mm
  - With 2 LARGE linear ball bearings
- Part no.: **223002**

## Load data

Slides WS 8/70		Slides WS 8		Trolley LW 4				Dual track set 1		Dual track set 2	
C <sub>0</sub>	3303 N	C <sub>0</sub>	4868 N	C <sub>0</sub>	2160 N	C <sub>0</sub>	645 N	C <sub>0</sub>	1905 N	C <sub>0</sub>	1905 N
C	1873 N	C	2426 N	C	4000 N	C	600 N	C	1125 N	C	1125 N
F <sub>1</sub> static	2821 N	F <sub>1</sub> static	4157 N	F <sub>1</sub> static	4320 N	F <sub>1</sub> static	652 N	F <sub>1</sub> static	1927 N	F <sub>1</sub> static	1927 N
F <sub>1</sub> dynamic	1599 N	F <sub>1</sub> dynamic	2071 N	F <sub>1</sub> dynamic	3846 N	F <sub>1</sub> dynamic	607 N	F <sub>1</sub> dynamic	1138 N	F <sub>1</sub> dynamic	1138 N
F <sub>2</sub> static	3303 N	F <sub>2</sub> static	4868 N	F <sub>2</sub> static	2160 N	F <sub>2</sub> static	645 N	F <sub>2</sub> static	1905 N	F <sub>2</sub> static	1905 N
F <sub>2</sub> dynamic	1873 N	F <sub>2</sub> dynamic	2426 N	F <sub>2</sub> dynamic	4000 N	F <sub>2</sub> dynamic	600 N	F <sub>2</sub> dynamic	1125 N	F <sub>2</sub> dynamic	1125 N
M <sub>x</sub> static	46.7 Nm	M <sub>x</sub> static	68.8 Nm	M <sub>x</sub> static	135.4 Nm	M <sub>x</sub> static	16.0 Nm	M <sub>x</sub> static	46.0 Nm	M <sub>x</sub> static	46.0 Nm
M <sub>y</sub> static	105.3 Nm	M <sub>y</sub> static	155.2 Nm	M <sub>y</sub> static	194.4 Nm	M <sub>y</sub> static	13.0 Nm	M <sub>y</sub> static	119 Nm	M <sub>y</sub> static	119 Nm
M <sub>z</sub> static	123.3 Nm	M <sub>z</sub> static	181.7 Nm	M <sub>z</sub> static	97.2 Nm	M <sub>z</sub> static	13.0 Nm	M <sub>z</sub> static	118 Nm	M <sub>z</sub> static	118 Nm
M <sub>x</sub> dynamic	26.4 Nm	M <sub>x</sub> dynamic	34.2 Nm	M <sub>x</sub> dynamic	120.5 Nm	M <sub>x</sub> dynamic	15.0 Nm	M <sub>x</sub> dynamic	27.0 Nm	M <sub>x</sub> dynamic	27.0 Nm
M <sub>y</sub> dynamic	59.7 Nm	M <sub>y</sub> dynamic	77.3 Nm	M <sub>y</sub> dynamic	173.0 Nm	M <sub>y</sub> dynamic	12.0 Nm	M <sub>y</sub> dynamic	71.0 Nm	M <sub>y</sub> dynamic	71.0 Nm
M <sub>z</sub> dynamic	69.9 Nm	M <sub>z</sub> dynamic	90.5 Nm	M <sub>z</sub> dynamic	180.0 Nm	M <sub>z</sub> dynamic	12.0 Nm	M <sub>z</sub> dynamic	70.0 Nm	M <sub>z</sub> dynamic	70.0 Nm



$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

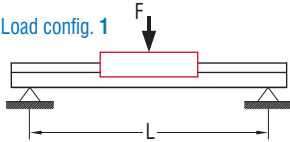
$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$

# Linear guide rail

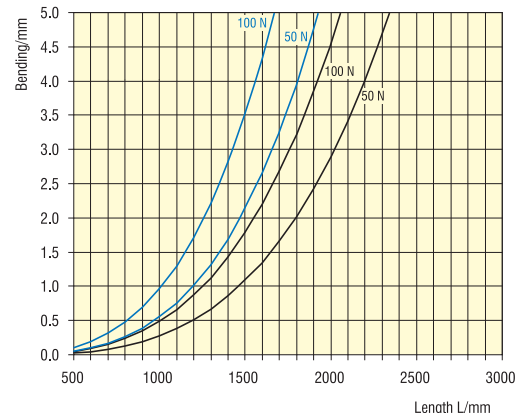
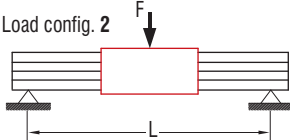
# LFS-12-10

## Bending

■ Load config. 1

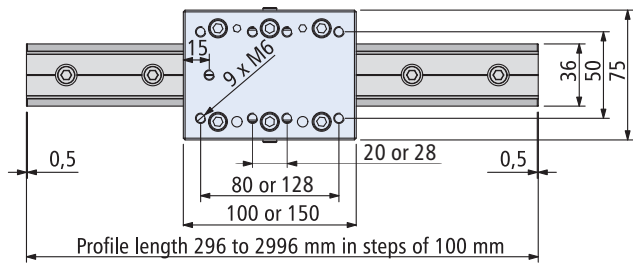
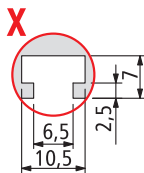
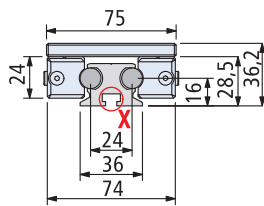


■ Load config. 2

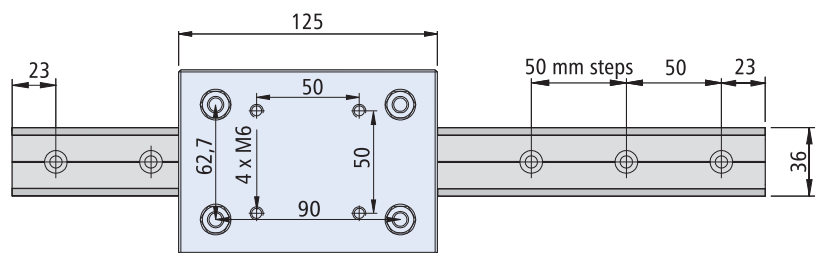
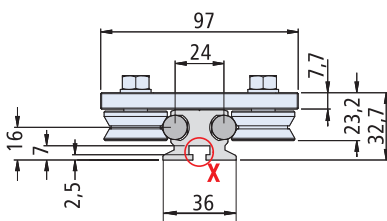


## Dimensioned drawings

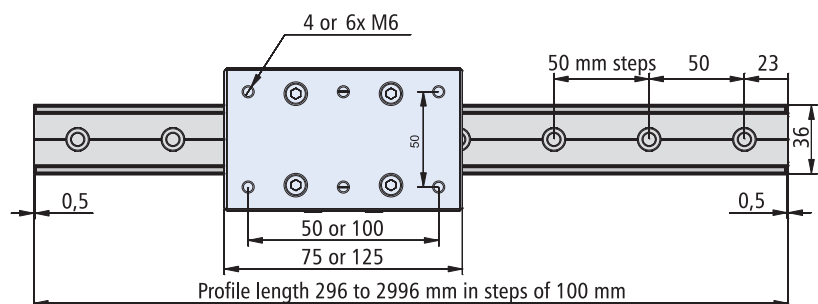
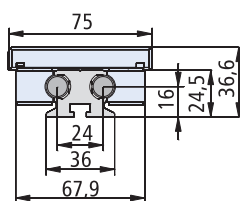
LFS-12-10 with slides WS 8



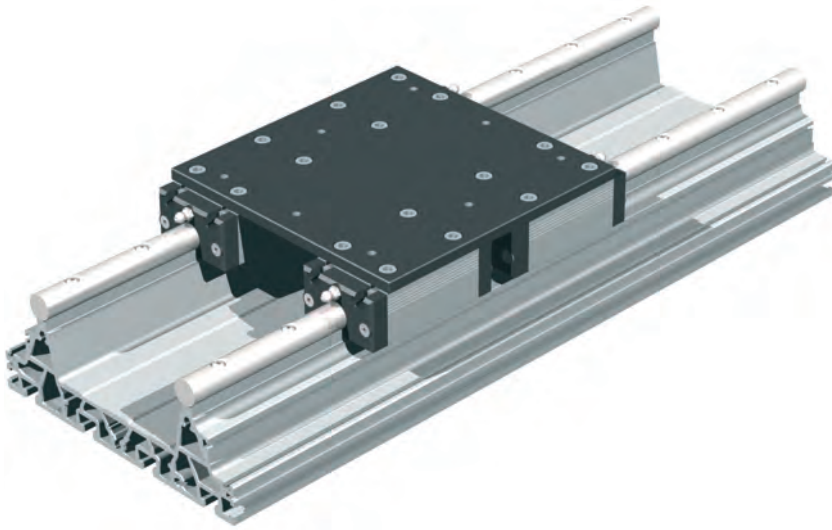
LFS-12-10 with trolley LW 4



LFS-12-10 with dual track set



# Linear guide rail LFS-16-120



## Features

- W 190 x H 61 mm
- 2 precision steel shafts Ø 16
- Anti-twist
- Aluminium shaft housing profile naturally anodised
- Securing from below with M6 tapped rail in T-slot profile
- Conditionally self-supporting
- Any guide length
- Weight: 10.2 kg/m

## Ordering key

**220 008 XXXX**

Length in mm (in 100 mm raster)

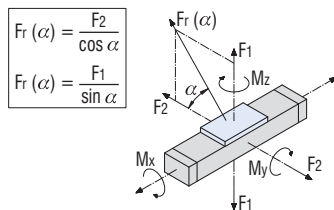
e.g. **0029** = Length 298

**0299** = Length 2998

Profile length = Length overall L - 2 mm

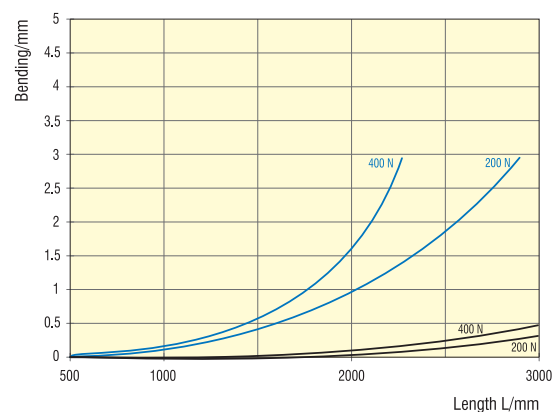
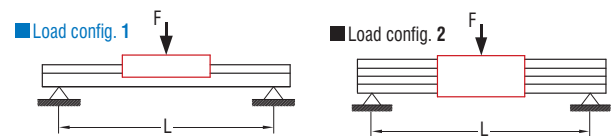
Special lengths available on request!

## Load data



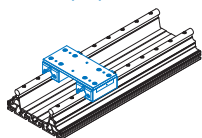
Einheit mit 2x IWS 1		Einheit mit 2x ILS 1		Einheit mit 4x IWS 1		Einheit mit 4x ILS 1	
$C_0$	4929 N	$C_0$	7598 N	$C_0$	6572 N	$C_0$	10130 N
C	2660 N	C	4857 N	C	3546 N	C	6476 N
$F_1$ stat.	4209 N	$F_1$ stat.	6488 N	$F_1$ stat.	5612 N	$F_1$ stat.	8650 N
$F_1$ dyn.	2271 N	$F_1$ dyn.	4148 N	$F_1$ dyn.	3028 N	$F_1$ dyn.	5530 N
$F_2$ stat.	4929 N	$F_2$ stat.	7598 N	$F_2$ stat.	6572 N	$F_2$ stat.	10130 N
$F_2$ dyn.	2660 N	$F_2$ dyn.	4857 N	$F_2$ dyn.	3546 N	$F_2$ dyn.	6476 N
$M_x$ stat.	253 Nm	$M_x$ stat.	389 Nm	$M_x$ stat.	337 Nm	$M_x$ stat.	519 Nm
$M_x$ dyn.	147 Nm	$M_x$ dyn.	195 Nm	$M_x$ dyn.	309 Nm	$M_x$ dyn.	476 Nm
$M_y$ stat.	173 Nm	$M_y$ stat.	228 Nm	$M_y$ stat.	361 Nm	$M_y$ stat.	557 Nm
$M_y$ dyn.	136 Nm	$M_y$ dyn.	249 Nm	$M_y$ dyn.	182 Nm	$M_y$ dyn.	332 Nm
$M_z$ stat.	79 Nm	$M_z$ stat.	124 Nm	$M_z$ stat.	167 Nm	$M_z$ stat.	304 Nm
$M_z$ dyn.	93 Nm	$M_z$ dyn.	146 Nm	$M_z$ dyn.	195 Nm	$M_z$ dyn.	356 Nm

## Bending



# Linear guide rail LFS-16-120

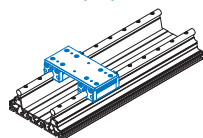
**Slide unit with 2 × steel slides ILS 1 (kit)**



- L 84 x W 178 x H 8 mm
- Ground steel plate
- 2 x ILS 1, central lubrication option
- Adjustable for no play
- Total weight: 2.30 kg

Part no.: **223240 0009**

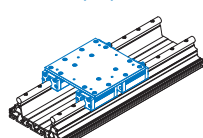
**Slide unit with 2 × aluminium slides IWS 1 (kit)**



- L 84 x W 178 x H 8 mm
- Ground steel plate
- 2 × IWS 1, central lubrication option
- Adjustable for no play
- Total weight: 1.50 kg

Part no.: **223240 0007**

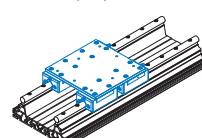
**Slide unit with 4 × aluminium slides IWS 1 (kit)**



- L 180 x W 178 x H 8 mm
- Ground steel plate
- 4 x IWS 1, central lubrication option
- Adjustable for no play

Part no.: **223240 0008**

**Slide unit with 4 × steel slides ILS 1 (kit)**

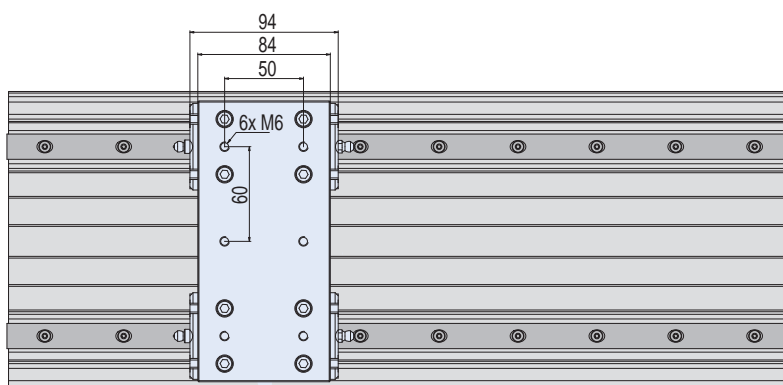
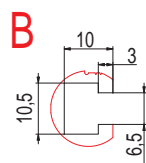
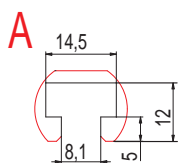
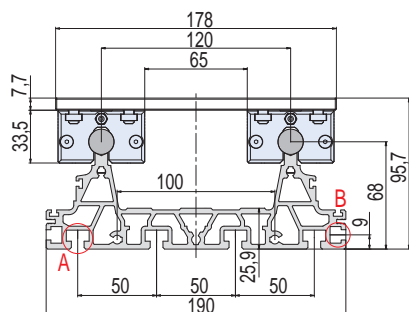


- L 180 x W 178 x H 8 mm
- ground steel plate
- 4 x ILS 1, central lubrication option
- Adjustable for no play

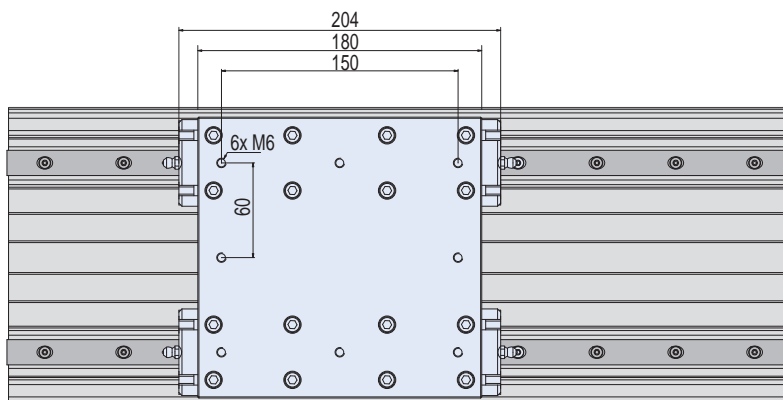
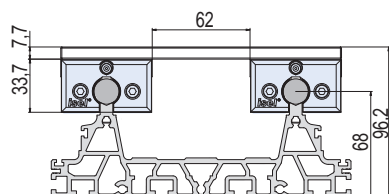
Part no.: **223240 0010**

## Dimensioned drawings

Aluminium slides IWS 1



Steel slides ILS 1





# Accessories

## Tapped rail



### M6 tapped rail

- 10 x 4 mm
- Galvanised
- M6 Ra 50 mm
- VE 3 units at 1 m

Part no.: **209 011**

## Sliding nuts



### M6 sliding nut (Figure 1)

- L 25 x W 10 x H 3.5 mm
- Galvanised
- VE 100 unit
- All except PT/RE 40, 65

Part no.: **209 001 0005**

### 2 x M6 sliding nuts (Figure 2)

- L 45 x W 10 x H 3.5
- Galvanised
- VE 50 unit
- For all except PT/RE 40, 65

Part no.: **209 002 0004**

### 2 x M6 sliding nuts (Figure 2)

- L 45 x W 13 x H 6 mm
- Galvanised
- 2 x M6 Ra 25 mm
- VE 25 unit
- For PT/RE 40, 65

Part no.: **209 005 0001**

### Angle sliding nut

#### 2 x M6 (Figure 3)

- Galvanised
- VE 25 units
- For all except PT/RE 40, 65

Part no.: **209 021 0003**

### Special angle sliding nut

#### 3 x M6 (Figure 4)

- Galvanised, VE 25 unit
- For all except PT/RE 40, 65

Part no.: **209 022 0003**

## Sliding nuts



### M5 sliding nuts

- Galvanised • VE 20 unit
  - For all except PT25, PT 50, PS 200, RE 40 and RE 65
- (Securing only possible from above)

### with spring

Part no.: **209005 0002**

(M5/Figure 1)

Part no.: **209005 0003**

(M6/Figure 2)

### with large chamfer

Part no.: **209005 0004**

(M6/Figure 3)

### in rhombus shape

Part no.: **209005 0005**

(M5/Figure 4)

Part no.: **209005 0006**

(M6/Figure 5)

## Linear ball bearing



For steel shafts  $\varnothing$  12 mm

### Linear ball bearing large

- L80 x W20 x H19 mm, VE 2 units

Part no.: **222 002 0001**

### Linear ball bearing medium

- L60 x W20.5 x H17.8 mm, VE2 units

Part no.: **222 000**

### Linear ball bearing small

- L40 x W20 x H19 mm, VE 2 units

Part no.: **222 001**

## Grease/grease gun

### Grease

Part no.: **299 032 0002**

### Impact press for grease and oil

Part no.: **299 032 0003**

## Guide shafts



### Guide shaft SF 12/SF 16

- Precision steel shafts
- $\varnothing$  12 or 16 mm, length 3 m
- Hardened and ground
- With M5 blind hole tapping (SF12) or M6 (SF16) in 100 mm raster or with drilled holes for M4 (SF 12) or M5 (SF 16) in 100 mm raster

Part no.: **220019 0299**

(SF12, 3m, with blind holes for M5)

Part no.: **220020 0299**

(SF12, 3m, with stepped holes for M4)

Part no.: **220023 0299**

(SF16, 3m, with stepped holes for M5)

Part no.: **220024 0299**

(SF16, 3m, with blind holes for M6)

## Rollers



### Roller $\varnothing$ 20 mm for SF 12

- With M4 tapped drilling
- VE 2 units

Part no.: **222 010**

## Rollers



### Roller $\varnothing$ 21 mm

- Concentric
- VE 2 units

Part no.: **222 003**

- Eccentric
- VE 2 units

Part no.: **222 004**

### Roller $\varnothing$ 31 mm

- Concentric
- VE 2 units

Part no.: **222 006**

- Eccentric
- VE 2 units

Part no.: **222 007**

# Operating loads calculation

## Effective loading calculation

Various factors affect the calculation of the loading of isel guides. This includes the position of the C of G of the load, tensile and compressive forces, torques, load and acceleration forces.

For a linear bench on 4 bearings, the bearing forces are calculated according to the force application point for various load directions.

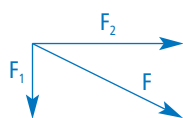
The dimension LL/2 is used as the dimension L (see dimensioned drawings for the relevant guides).

The calculation can also be applied to a slide configuration with 2 slides.

The load factor in this case is C0/2.

## Combined load

If the load alignment of an element does not coincide with one of the main load directions, then the equivalent load is calculated:



$$P = |F_1| + |F_2|$$

If a force F and a torque M load an element simultaneously, then the dynamically equivalent load is:

$$P = |F| + |M| \cdot \frac{C_0}{M_{0(XYZ)}}$$

- P [N] dynamically equivalent load
- F [N] opposing force  $= \sqrt{F_1^2 + F_2^2}$
- F1 [N] vertical component see sketch (4)
- F2 [N] horizontal component see sketch (4)
- C0 [N] static load factor
- M [Nm] opposing torque
- M0(XYZ) [Nm] static torque in the direction of the opposing torque

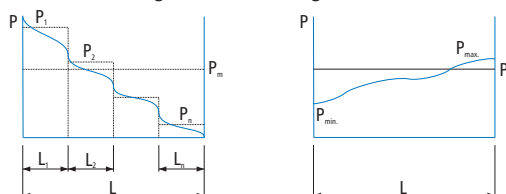
According to DIN, the dynamically equivalent load should not exceed the value  $P = 0.5 \cdot C$ .

## Equivalent load calculation

Operating conditions

Equivalent load

A incremental change B uniform change



$$P = \sqrt[3]{\frac{1}{L} \cdot (P_1^3 \cdot L_1 + P_2^3 \cdot L_2 + P_3^3 \cdot L_3 + \dots + P_n^3 \cdot L_n)}$$

$$P = \frac{1}{3} \cdot (P_{\min} + 2 \cdot P_{\max})$$

- P dynamically equivalent load [N]
- P<sub>1...n</sub> Individual load [N]
- L Total travel [m]
- L<sub>1...n</sub> Individual travel [m]
- P<sub>min</sub> smallest load [N]
- P<sub>max</sub> largest load [N]

## Static safety

Operating conditions	S <sub>0</sub>
Normal motion	1.0 - 3.0
High speed	2.0 - 4.0
With impacts and vibration	3.0 - 5.0

$$S_0 = \frac{C_0}{P_0} = \frac{M_0}{M}$$

- S<sub>0</sub> static load safety
- C<sub>0</sub> static load factor [N]
- P<sub>0</sub> statically equivalent bearing loading [N]
- M<sub>0</sub> static loading torque [Nm]
- M equivalent static torque [Nm]

## Nominal working life

The nominal working life is achieved or exceeded by 90% of an adequately large quantity of identical bearings, before the first signs of material fatigue become apparent.

$$L = \left(\frac{C}{P}\right)^3$$

$$L_h = \frac{833}{H \cdot n_{osz}} \cdot \left(\frac{C}{P}\right)^3$$

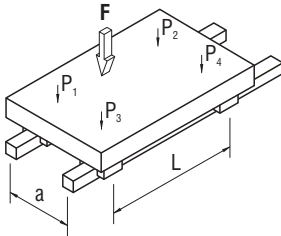
$$L_h = \frac{1666}{V} \cdot \left(\frac{C}{P}\right)^3$$

- L [m] nominal working life in units of 100,000 m
- L<sub>h</sub> [h] nominal working life in hours run
- C [N] dynamic load factor
- P [N] dynamically equivalent load
- H [m] single stroke of the oscillating motion
- n<sub>osz</sub> [min] Number of double strokes per minute
- v [m/min] average speed of movement

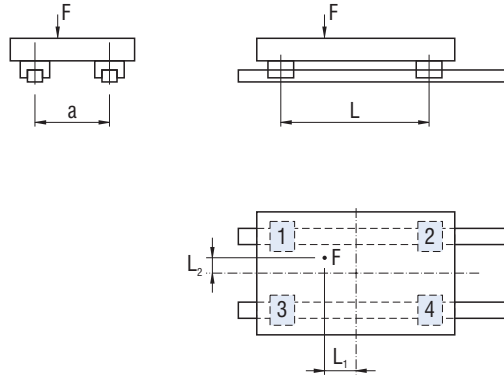
# Operating loads calculation

## Load vertical on the bench surface

Loading



Dimensioned figure



Load on a trolley

$$P_1 = \frac{F}{4} + \frac{F \cdot L_1}{2L} + \frac{F \cdot L_2}{2a}$$

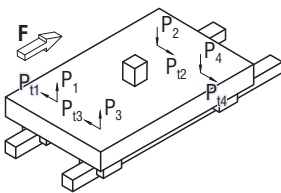
$$P_2 = \frac{F}{4} - \frac{F \cdot L_1}{2L} + \frac{F \cdot L_2}{2a}$$

$$P_3 = \frac{F}{4} + \frac{F \cdot L_1}{2L} - \frac{F \cdot L_2}{2a}$$

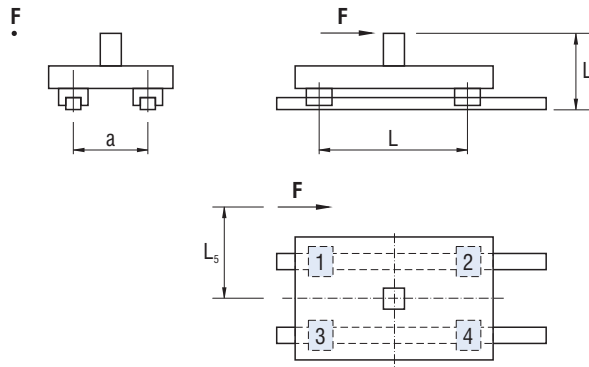
$$P_4 = \frac{F}{4} - \frac{F \cdot L_1}{2L} - \frac{F \cdot L_2}{2a}$$

## Load in direction of motion

Loading



Dimensioned figure



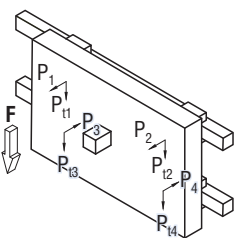
Load on a trolley

$$P_1 \dots P_4 = \frac{F \cdot L_6}{2L}$$

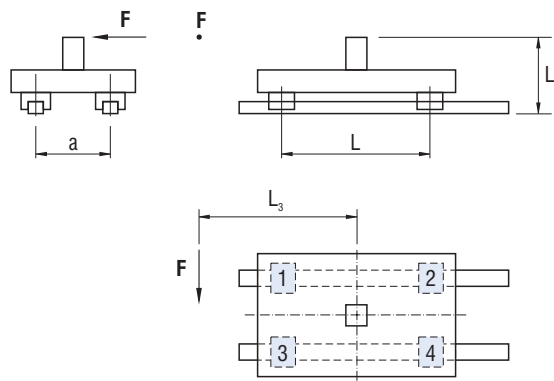
$$P_{11} \dots P_{14} = \frac{F \cdot L_5}{2L}$$

## Load at right angles to the direction of motion

Loading



Dimensioned figure



Load on a trolley

$$P_1 \dots P_4 = \frac{F \cdot L_4}{2a}$$

$$P_{11} = P_{13} = \frac{F}{4} + \frac{F \cdot L_3}{2L}$$

$$P_{12} = P_{14} = \frac{F}{4} - \frac{F \cdot L_3}{2L}$$

Space for your notes

# Drive elements

# Overview

Functional overview	2-45
Ball screw spindle Ø 16	2-46
Ball screw spindle Ø 25	2-46
Ball screw nut 2	2-47
Ball screw nut 3	2-47
Clamping blocks for nut version 3	2-48
Flange bearing for spindle Ø 16	2-49
Flange bearing for spindle Ø 25	2-49
Bearing supports	2-50

Ball screw nuts supplied by isel Germany are high-quality, precise and wear-free (hardened and ground). Combined with ball screw spindles, ball screw nuts ensure that rotary motion is converted into linear motion at extremely low values of friction.

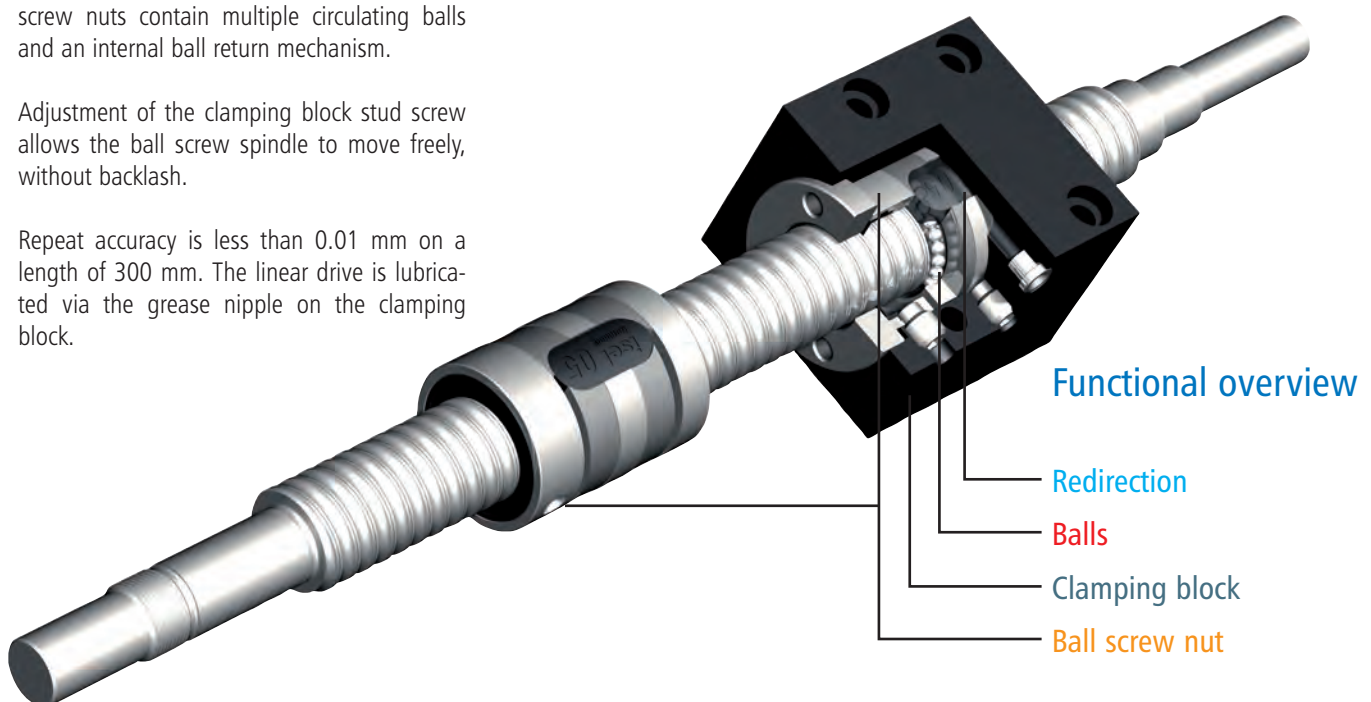
The ball screw nut is positioned and held in the clamping block using a stud screw. The ball screw nuts contain multiple circulating balls and an internal ball return mechanism.

Adjustment of the clamping block stud screw allows the ball screw spindle to move freely, without backlash.

Repeat accuracy is less than 0.01 mm on a length of 300 mm. The linear drive is lubricated via the grease nipple on the clamping block.

Ball screw spindles are roll manufactured using modern machines prior to hardening and polishing.

Our linear drives are technically advanced and have proven themselves over a period of more than 20 years of practical application.

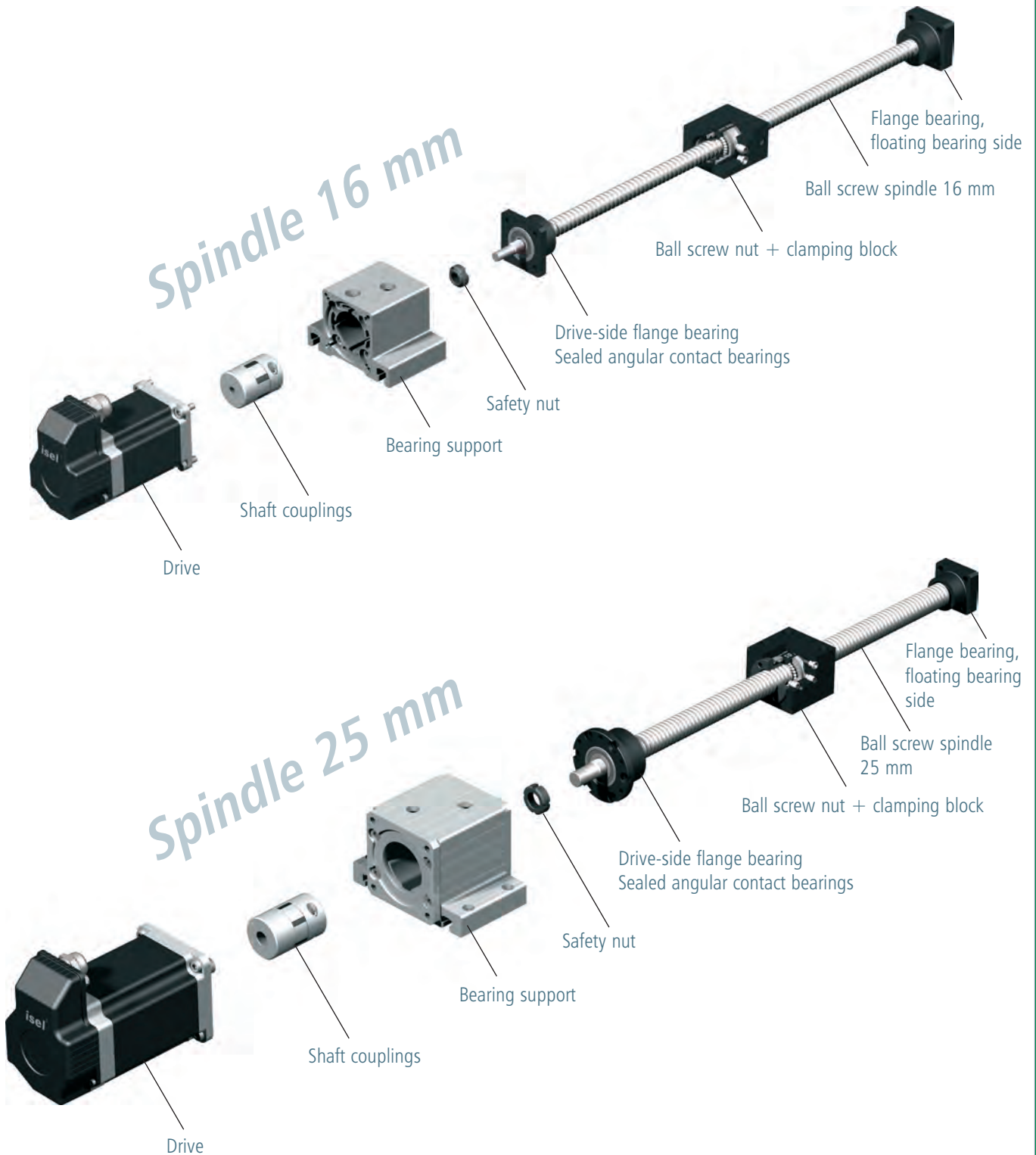


# Drive elements

# Overview

## Linear drive

The most common variable when using linear drives is whether the spindles are driven directly or via toothed-belt.





# Recirculating ball spindles

## Ø 16, 25 mm

### Ø 16 features

- Ø 16 mm, rolled, hardened and polished
- Material CF 53, inductively hardened (HRC 60 ± 2); (for detailed information see DIN 17212)
- Spindle pitches: 2.5 / 4 / 5 / 10 and 20 mm
- Lengths up to max. 3052 mm available
- End machining to isel standard or according to customer specification (see "Available lengths")
- Produced to DIN 69051, Part 3, Tolerance class 7

### Options

- End machining according to customer specification
- Available in other lengths

### Available lengths

Without end machining  
in 100 mm raster

- 352 to 3052 mm

Two-sided end machining  
in 100 mm raster

- 368 mm to 3068 mm
- Special length to dimensioned drawing:  
211 13X XXXX

Special length to  
Drawing: 211 13X 0998

### Ordering key

**211 13X XXXX**

#### Spindle pitch

- 2** = 2.5 mm
- 3** = 4 mm
- 4** = 5 mm
- 5** = 10 mm
- 6** = 20 mm

#### End machining

- 0** = not machined
- 5** = both-sided machining suitable for all feeds (aluminium profile length 78 mm)

#### Lengths

- e.g. **045** = 452 mm
- 086** = 868 mm
- 305** = 3052 mm (rounded to the final digit)

See "Available lengths" for permissible combinations.

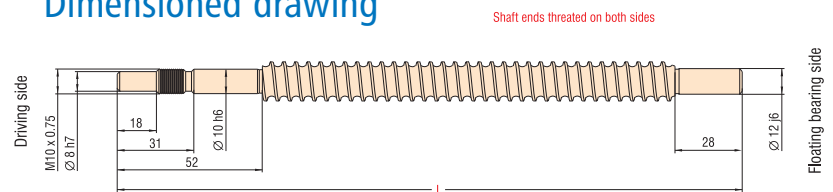
### Ordering data

#### Slotted nut

- Self-locking
- M 10 × 0.75 mm

Part no.: **890257 0011**

### Dimensioned drawing



### Ø 25 features

- Ø 25 mm, hardened and polished
- Material CF 53, inductively hardened (HRC 60 ± 2); (for detailed information see DIN 17212)
- Spindle pitches: 5/10 and 20 mm
- Lengths up to max. 3000 mm available
- End machining to isel standard or according to customer specification (see "Available lengths")
- Produced in accordance with DIN 69051, Part 3, Tolerance class 7

### Option

- End machining to order

### Available lengths

Without end machining  
in 100 mm raster

- 500 to 3000 mm

Special length in accordance  
with drawing: 211 14X 0999

Two-sided end machining  
in 100 mm raster

- 295 to 2995 mm
- Special length in accordance  
with drawing: 21114X XXXX

### Ordering key

**211 14X XXXX**

#### Spindle pitch

- 4** = 5 mm
- 5** = 10 mm
- 6** = 20 mm

#### End machining

- 0** = not machined
- 2** = both sides

#### Lengths

- e.g. **050** = 500 mm
- 100** = 1000 mm
- 289** = 2895 mm (rounded to the last digit)

See "Available lengths" for permissible combinations.

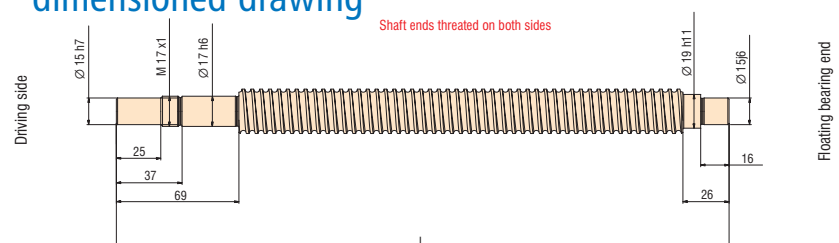
### Ordering data

#### Slotted nut

- Self-locking
- M 17 × 1.0 mm

Part no.: **890259 0011**

### dimensioned drawing



# Ball nuts

## Version 2—Ø16



### Features

- Material 16MnCr5 or 20MnCr5, pressed, hardened, polished
- Versions for recirculating ball spindle Ø16 mm
- Nut pitches: 2.5 / 4 / 5 / 10 mm
- Balls are rerouted internally
- As block housing with base fixing
- Regreasing through grease nipples 90°, 0°

### Load factors

Pitch	Nominal Ø	dynamic load factor	static load factor
2.5 mm	16 mm	3500 N	5500 N
4.0 mm	16 mm	4600 N	7200 N
5.0 mm	16 mm	4600 N	7200 N
10.0 mm	16 mm	4200 N	6500 N

### Ordering data

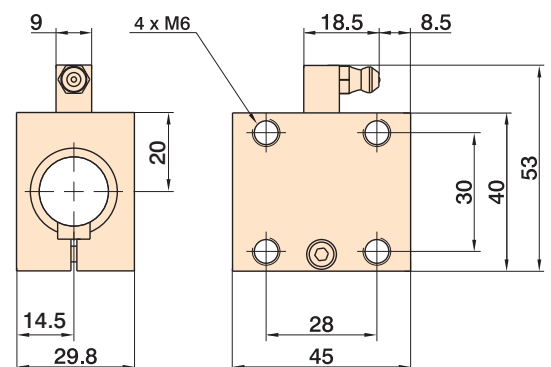
only for spindles Ø16

Pitch	Part no.
2.5 mm	213 003 1003
4.0 mm	213 003 1004
5.0 mm	213 003 1005
10.0 mm	213 003 1010

with matching:  
dirt scraper

• VE 2 unit Part no.: 213500 0001

### Dimensioned drawings



## Version 3—Ø16 Ø25



### Features

- Material 16MnCr5, ground
- Versions for recirculating ball spindles Ø16 and Ø25 mm
- Nut pitches: 2.5 / 4 / 5 / 10 mm 20 mm (Ø 16 mm), 5/10 and 20 mm (Ø25 mm)
- Balls are rerouted internally
- The version with nut pitch 20 mm is supplied with scrapers

### Load factors

Pitch (mm)	Nominal Ø (mm)	Dyn. load factor (N)	Static load factor (N)
2.5	16	3500	5500
4.0	16	4600	7200
5.0	16	4600	7200
10.0	16	4200	6500

5.0	25	5100	12600
10.0	25	5100	12600
20	25	3570	8800

### Ordering data

only for spindles Ø25

Pitch	Part no.
5.0 mm	213 700 0005
10.0 mm	213 700 0010
20.0 mm	213 700 0020

with matching:

dirt scraper

• VE 2 unit  
Part no.: 213700 9000

only for spindles Ø16

Pitch	Part no.
2.5 mm	213 503
4.0 mm	213 514
5.0 mm	213 505
10.0 mm	213 510
20.0 mm	213 520

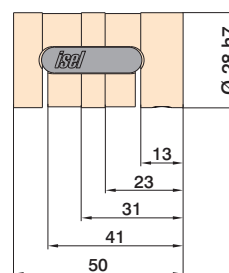
with matching:

dirt scraper

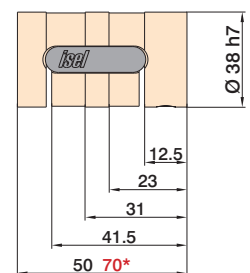
• VE 2 unit  
Part no.: 213500 0001

### Dimensioned drawings

for spindle Ø 16



for spindle Ø 25

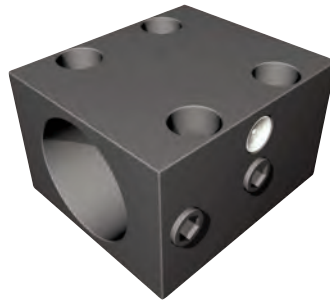


\*) At pitch = 20

# Clamping blocks for nut version 3



Flange securing



Base securing

## Features

- Material steel, gunmetal finish
- Versions for recirculating ball spindles  $\varnothing 25$  and  $\varnothing 16$  mm
- Nut pitches  
5/10 and 20 mm ( $\varnothing 25$  mm)  
2.5/4/5/10 and 20 mm ( $\varnothing 16$  mm)
- Recirculating ball nuts are adjustable for no-play
- Clamping blocks for base and flange securing

## Ordering data

Clamping block 2  $\varnothing 16$   
Flange securing

Pitch	Part no.
all	213 501

Clamping block 1  $\varnothing 16$   
Base securing

Pitch	Part no.
all	213 500

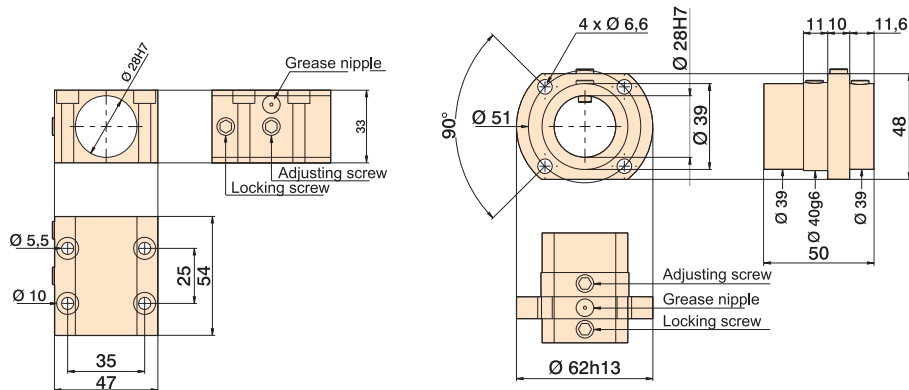
Clamping block 2  $\varnothing 25$   
Flange securing

Pitch	Part no.
5 / 10	213 700 9003
20	213 700 9004

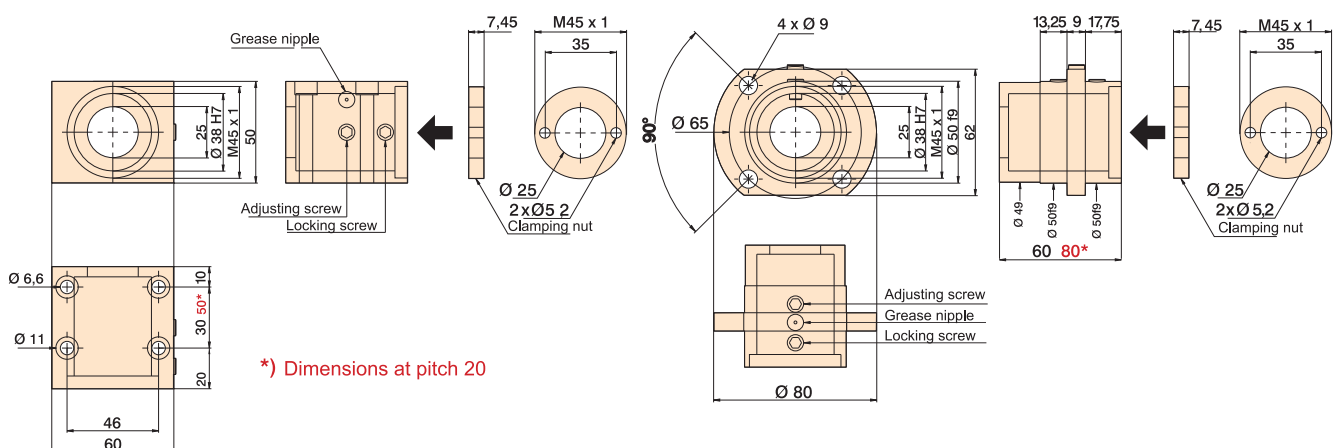
Clamping block 1  $\varnothing 25$   
Base securing

Pitch	Part no.
5 / 10	213 700 9001
20	213 700 9002

## Dimensioned drawings - spindle clamping blocks $\varnothing 16$

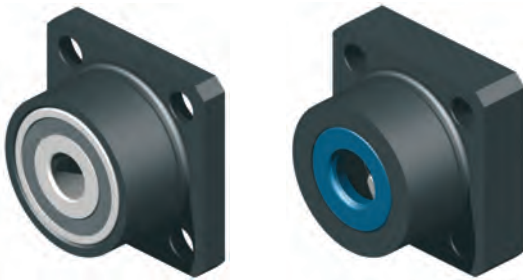


## Dimensioned drawings - spindle clamping blocks $\varnothing 25$



# Flange bearing

## for spindle $\varnothing$ 16 mm



Flange bearing  
drive side

Flange bearing  
floating bearing side

## Ordering data

Flange bearing, drive side

Part no.: **216 504 0001**

Flange bearing, floating bearing side

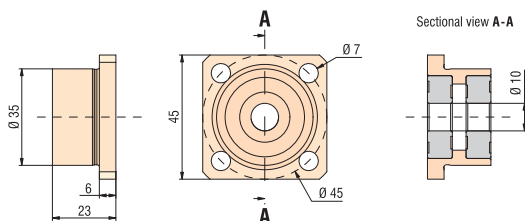
Part no.: **216 504 0002**

## Features

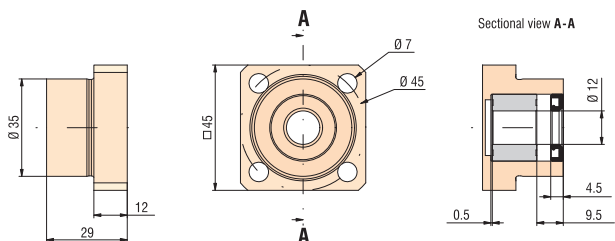
- Bearing, spindle drive side (fixed bearing side) and the spindle floating bearing side
- Flange bearing, drive side: bushing with two pressed angular contact ball bearings in an O-configuration
- Flange bearing, floating bearing side (counter-bearing): bushing with pressed needle bearing

## Dimensioned drawings

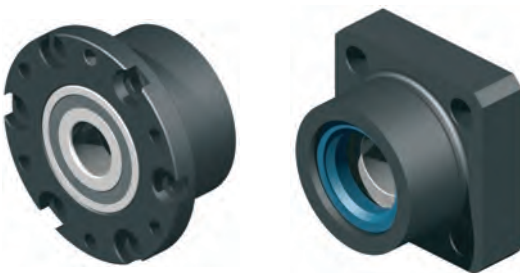
Flange bearing  
drive side



Flange bearing  
floating bearing side



## for spindle $\varnothing$ 25 mm



Flange bearing  
drive side

Flange bearing  
floating bearing side

## Ordering data

Flange bearing, drive side

Part no.: **216 504 0006**

Flange bearing, floating bearing side

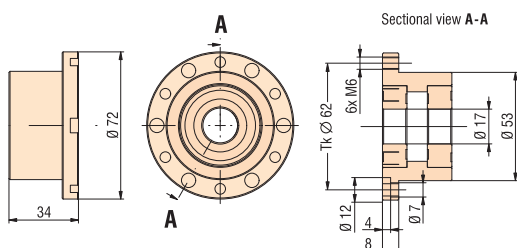
Part no.: **216 504 0005**

## Features

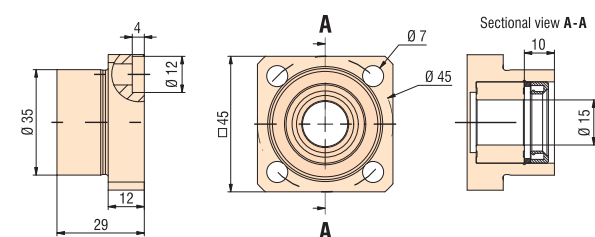
- Bearing, spindle drive side (fixed bearing side) and the spindle floating bearing side
- Flange bearing, drive side: bushing with two pressed angular contact ball bearings in an O-configuration
- Flange bearing, floating bearing side (counter-bearing): bushing with pressed needle bearing

## Dimensioned drawings

Flange bearing  
drive side



Flange bearing  
floating bearing side



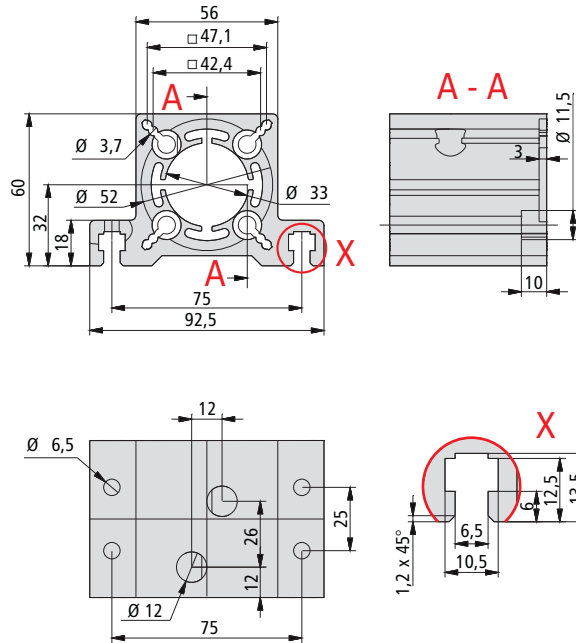
# Bearing supports

## Bearing support 1

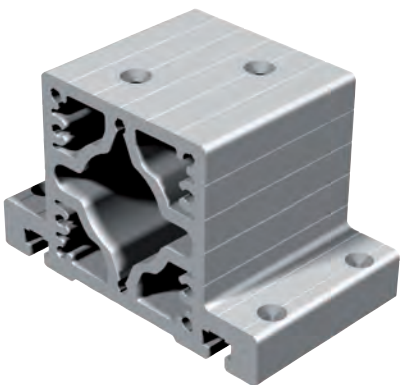


- Aluminium profile compliant with DIN EN 12020-2
- As a parallel connection between the flange bearing and motor flange
- Flat milled securing surfaces
- Version for recirculating ball spindle  $\varnothing 16$  mm
- Universal securing options

Part no.: **216504 0007**

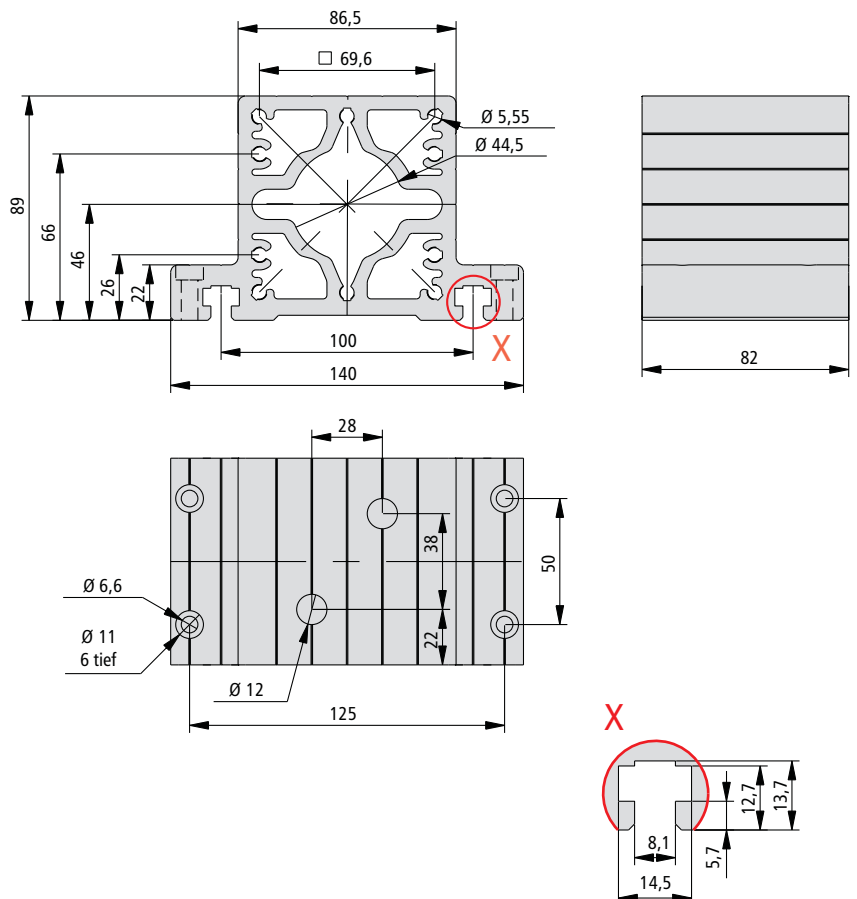


## Bearing support 2



- Aluminium profile compliant with DIN EN 12020-2
- As a parallel connection between the flange bearing and motor flange
- Version for recirculating ball spindle  $\varnothing 25$  mm
- Universal securing options

Part no.: **216504 0008**

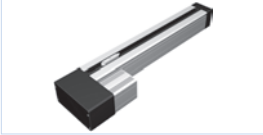





Space for your notes






# Linear units

## Overview

LES functional overview		2-54
LES 4 with spindle drive		2-56
LES 6 with spindle drive		2-58
LES 5 with spindle drive		2-60
Calculations		2-62
Combination examples		2-64
Motor modules		2-66
Clutch housing		2-68
Motor leads		2-70
Installation kit <small>with angular transmission</small>		2-72
Slots/crossbench plates		2-74
T-slot plates		2-77
Angle brackets		2-79
Accessories		2-81
iLD 50-6 with linear motor		2-82

# Linear units

# Overview

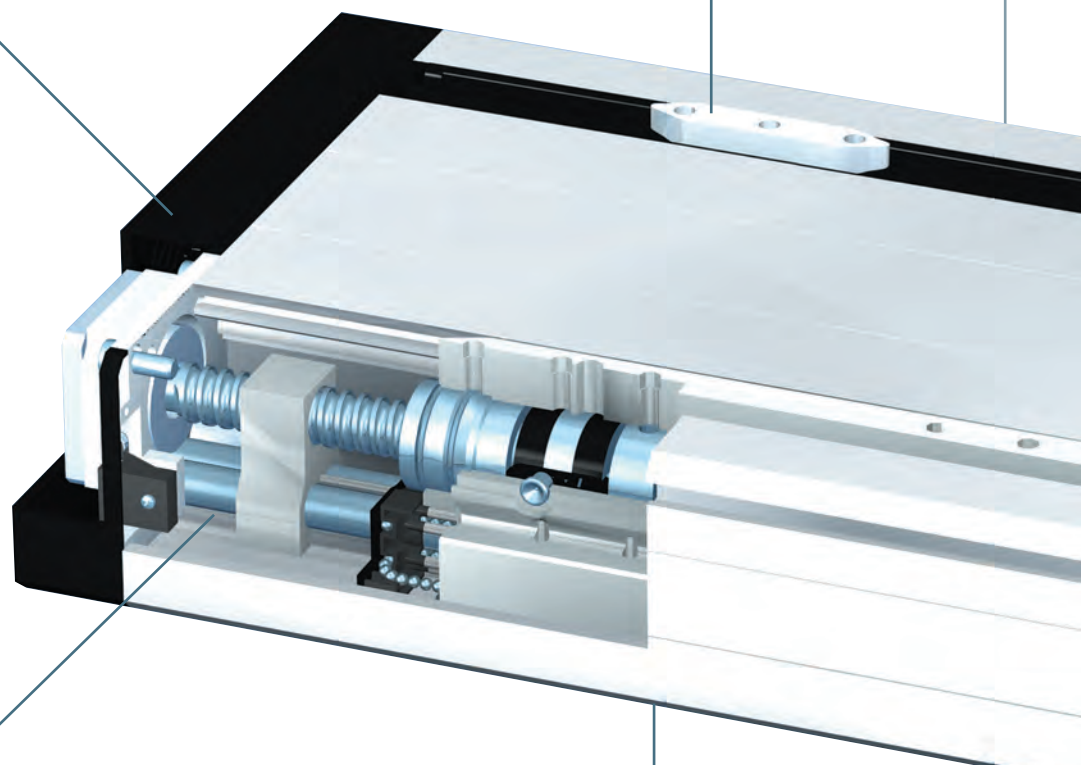
LEZ functional overview		2-84
LEZ 1 with toothed belt drive		2-86
LEZ 2 with toothed belt drive		2-88
LEZ 3 with toothed belt drive		2-90
Accessories		2-92
Examples in use		2-93

# Functional overview

at example LES 5

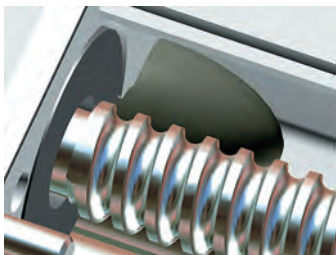
Plastic cap  
electromagnetically shielded

Clamping surface  
milled flat

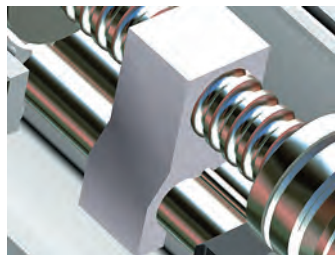


Shaft housing outline  
precision milled

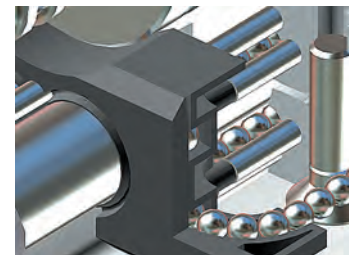
Profile underside  
milled flat



- End position buffering both sides with soft PVC parabolic springs
- Counter-bearing with 2 needle sleeves



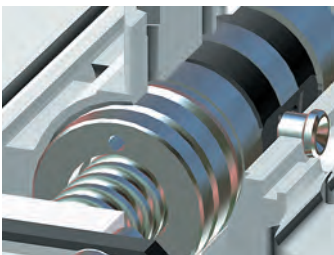
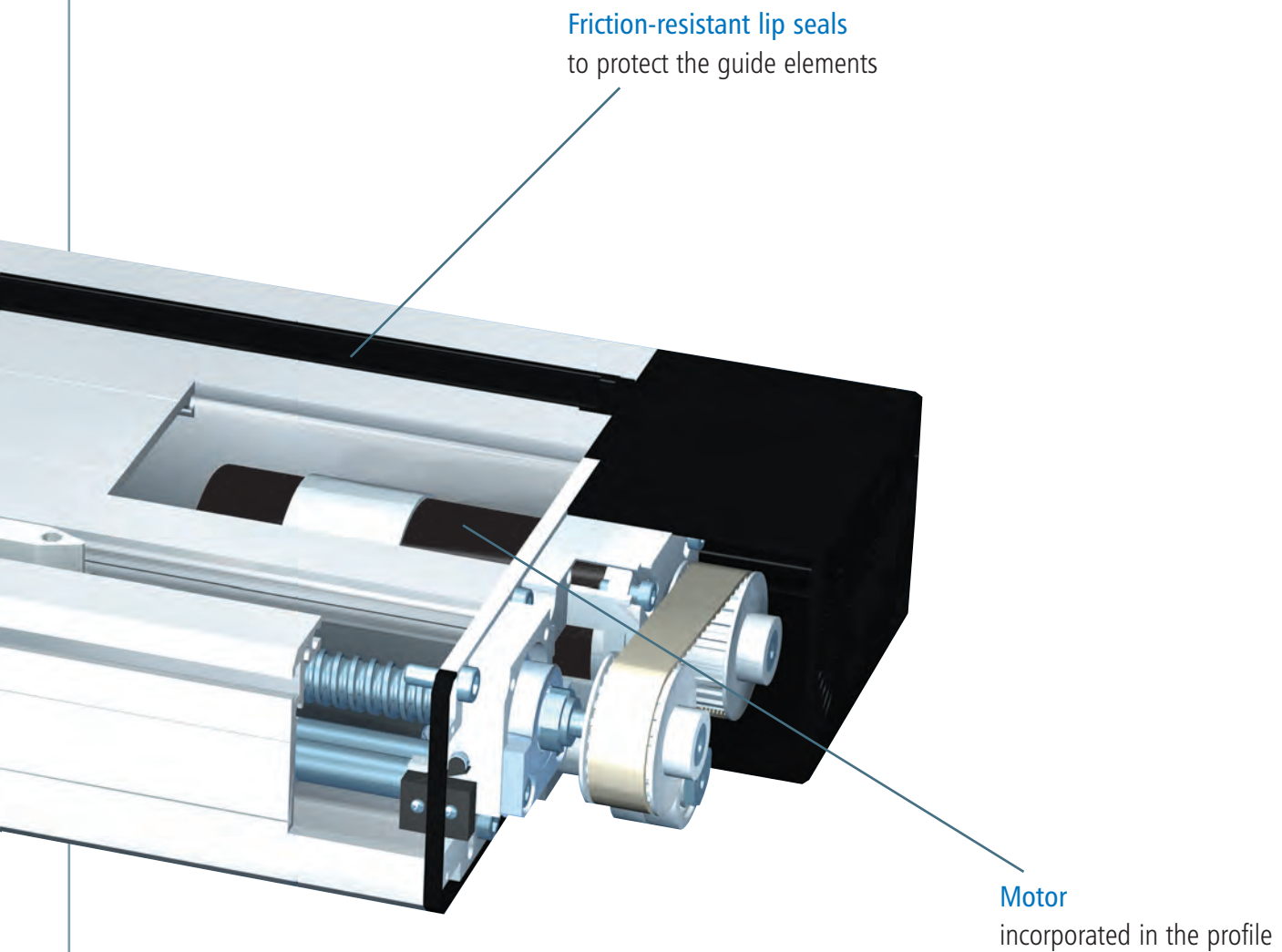
- Spindle support from a profile length of 1500 mm without limiting the process range



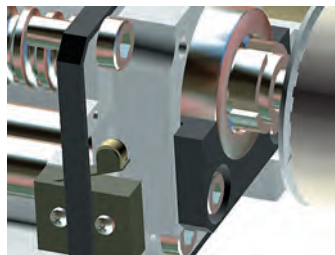
- Recirculating ball in patented aluminium linear slides
- Glass fibre reinforced loop components with scrapers

# Functional overview

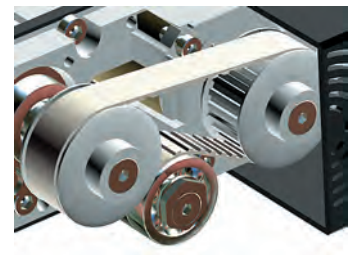
at example LES 5



- Preset play-free recirculating ball nut with scrapers
- Central lubrication system for recirculating ball nut and circulations



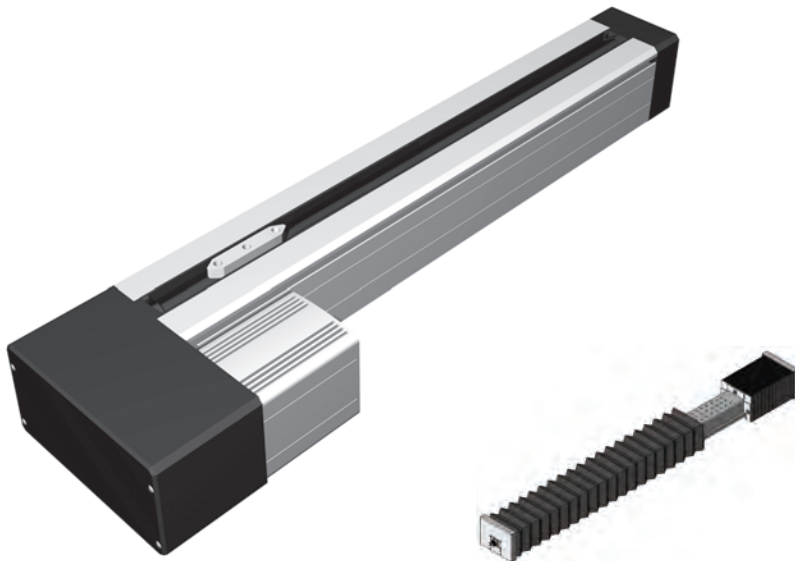
- Integrated overrun limit switch
- Spindle bearing with angular contact bearings
- Axially free from play by means of self-locking special nuts



- Belt return and connecting electronics covered completely by protective cap

# Linear units with spindle drive

## LES 4



LES 4 with side-mounted belt drive module

LES 4 - bellows gaiter option

### Features

- Aluminium shaft housing profile W75 × H75 mm, naturally anodised
- Clamping area and profile underside milled flat
- with 2 precision steel shafts Ø 12 h6, material Cf53, Hardness 60 ± 2 HRC
- Aluminium shaft slides WS 5/70, 2 x WS 5/70 (70 mm long), adjustable for no play, central lubrication system
- Recirculating ball drive 2.5/4/5/10 and 20 mm pitches
- Profile sealing with friction-resistant lip seals
- Cast aluminium end plates
- With 2 limit or reference switches, Repeat accuracy ± 0.02 mm
- Sealed angular contact bearings in drive - steel flange

### Ordering key

2 3 4 X X X 0 X X X

**Drive**

- 0 = Preparation Direct drive modules
- 1 = Preparation Belt drive module

**Shaft slides**

- 0 = 1 Shaft slides 70 mm
- 2 = 2 Shaft slides 70 mm

**Profile length (L1)**

- e.g. 029 = 290 mm (min.)
- 299 = 2990 mm (max.)

(rounded to the last digit)

Standard profile lengths available in 100 mm raster

**Recirculating ball drive**

- 0 = without
- 1 = Pitch 2.5 mm
- 2 = Pitch 4.0 mm
- 3 = Pitch 5.0 mm
- 4 = Pitch 10 mm
- 5 = Pitch 20 mm

**Options:**

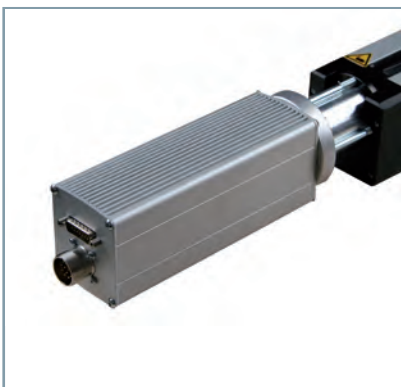
- Black powder-coated aluminium profile
- Electromagnetic brakes in the motor module or in drive spindle extension
- Steel slide LS2 (Part no. 223007)
- External limit switch attachment set (see accessories)

**Available on request:**

- Length measuring system
- Bellows gaiter cover
- Assembly left of the motor module

### Drive modules

see pages 2-66 et seq. of the catalogue



### Technical specification

#### Aluminium profile

Aluminium profile LES 4	
Moment of inertia I <sub>x</sub>	107.711 cm <sup>4</sup>
Moment of inertia I <sub>y</sub>	125.843 cm <sup>4</sup>
*Centre of gravity <small>see dimensioned drawing</small>	33.23 mm
Cross-sectional area	18.81 cm <sup>2</sup>
Material	AlMgSi0, 5F22
Anodising	E6/EV1
Weight with steel shafts	6.2 kg/m
Weight with steel shafts and spindles	7.6 kg/m

### No load running torques

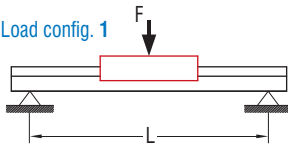
No load torques (Ncm)					
Speed (rpm)	Spindle pitch				
	2.5	4	5	10	20
500	15	15	16	17	18
1500	19	19	19	20	21
3000	23	24	24	25	26

# Linear units with spindle drive

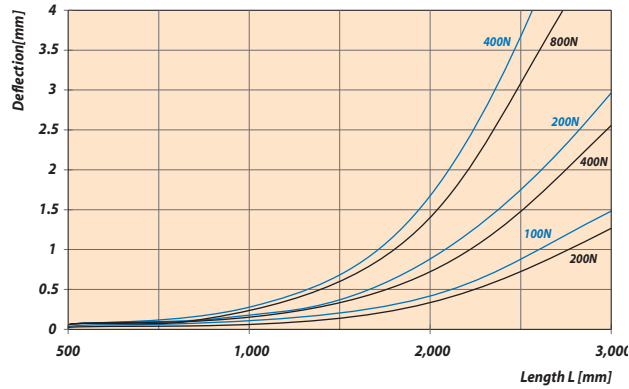
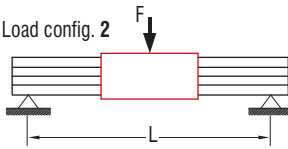
## LES 4

### Bending

■ Load config. 1



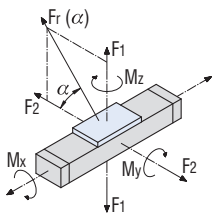
■ Load config. 2



### Load factors

$$F_r(\alpha) = \frac{F_2}{\cos \alpha}$$

$$F_r(\alpha) = \frac{F_1}{\sin \alpha}$$



LES 4 with one WS 5/70	
$C_0$	2576.65 N
C	1461.14 N
$F_1$ stat.	2200.67 N
$F_1$ dyn.	1247.93 N
$F_2$ stat.	2576.65 N
$F_2$ dyn.	1461.14 N
$M_x$ stat.	36.45 Nm
$M_y$ stat.	82.16 Nm
$M_z$ stat.	96.20 Nm
$M_x$ dyn.	20.67 Nm
$M_y$ dyn.	46.59 Nm
$M_z$ dyn.	54.55 Nm

LES 4 with two WS 5/70	
$C_0$	4,954.5 N
C	2,809.5 N
$F_1$ stat.	4,231.5 N
$F_1$ dyn.	2,398.5 N
$F_2$ stat.	4,954.5 N
$F_2$ dyn.	2,809.5 N
$M_x$ stat.	44.7 Nm
$M_y$ stat.	126.945 Nm
$M_z$ stat.	148.635 Nm
$M_x$ dyn.	25.2 Nm
$M_y$ dyn.	71.955 Nm
$M_z$ dyn.	84.285 Nm

### permissible spindle speeds

LES 4 / 5 / 6	Spindle pitch p [mm]	max. permissible feed speed v permissible [mm/s]				
		2.5	4	5	10	20
Profile length L [mm]	max. permissible spindle speed n [rpm]					
490	4000	167	267	333	667	1333
990	3000	125	200	250	500	1000
1390	1500	63	100	125	250	500
1490 *	3000	125	200	250	500	1000
1990 *	1650	69	110	138	275	550
2490 *	1050	44	70	88	175	350
2990 *	750	31	50	63	125	250

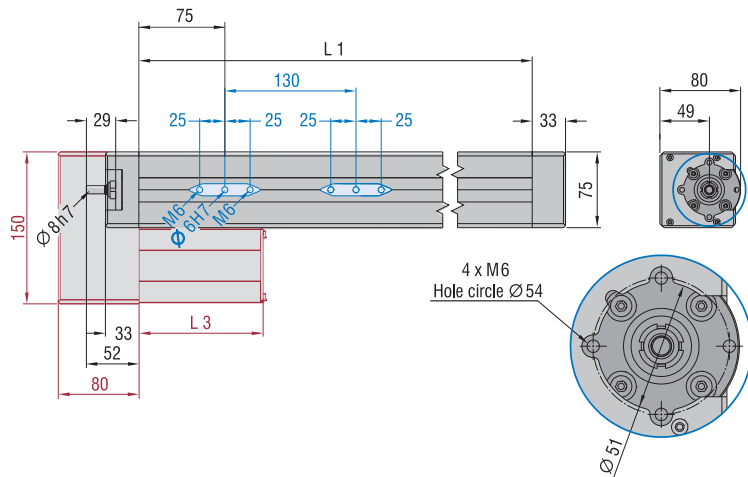
\* with spindle support

### dimensioned drawing

process travel

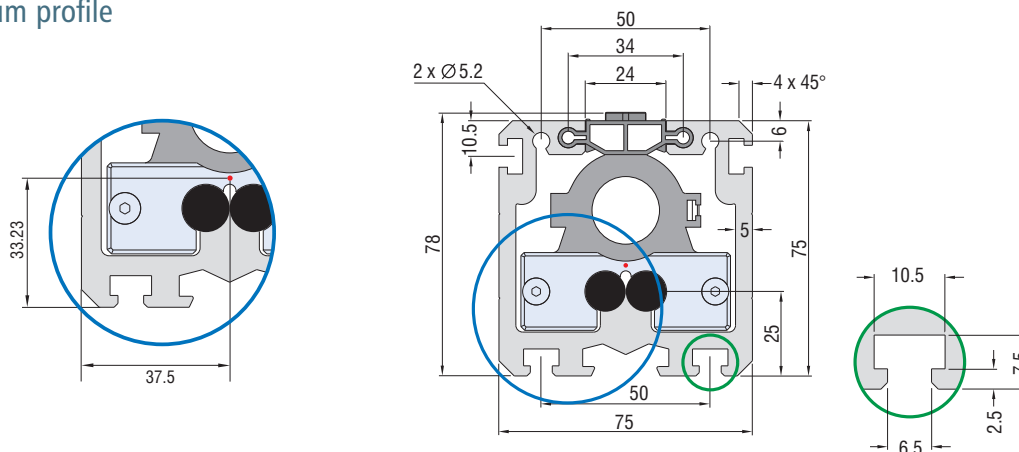
at 1 × WS 5/70 = L1 -150 mm  
at 2 × WS 5/70 = L1 -280 mm

external limit switches see pages 2-83



### dimensioned drawing

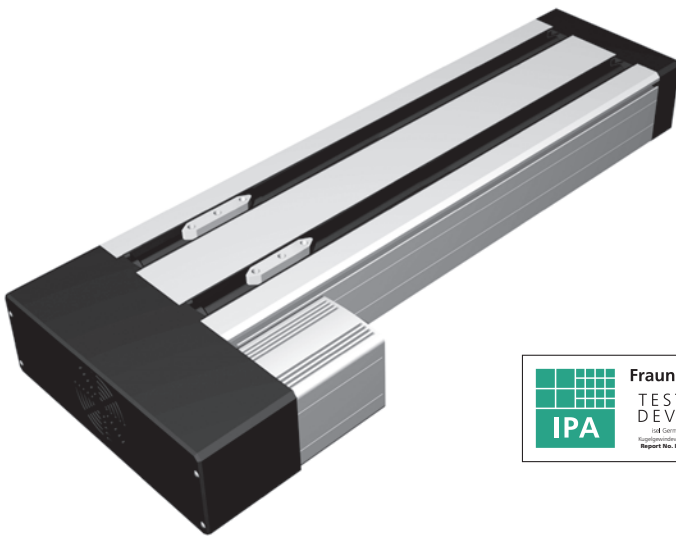
Aluminium profile





# Linear units with spindle drive

# LES 6



LES 6 with side belt drive module

## Features

- Aluminium shaft housing profile W150 × H75 mm, naturally anodised
- Clamping area and profile underside milled flat
- With 4 precision steel shafts Ø 12 h6, material Cf53, Hardness 60 ± 2 HRC
- Aluminium shaft slides WS 5/70, 2 x WS 5/70 (70 mm long), adjustable for no play, central lubrication system
- Recirculating ball drive 2.5/4/5/10 and 20 mm pitches
- Profile sealing with friction-resistant lip seals
- Cast aluminium end plates
- With 2 limit or reference switches, Repeat accuracy ± 0.02 mm
- Sealed angular contact bearings in drive - steel flange

## Ordering key

2 3 4 XXX 0 XXX

### Drive

- 6 = Preparation Direct drive modules
- 7 = Preparation Belt drive module

### Shaft slides

- 0 = 2 Shaft slides 70 mm
- 2 = 4 Shaft slides 70 mm

### Profile length (L1)

- e.g. 029 = 290 mm (min.)
- 299 = 2990 mm (max.)

(rounded to the last digit)

Standard profile lengths available in 100 mm raster

### Recirculating ball drive

- 0 = without
- 1 = Pitch 2.5 mm
- 2 = Pitch 4.0 mm
- 3 = Pitch 5.0 mm
- 4 = Pitch 10 mm
- 5 = Pitch 20 mm

### Options:

- Black powder-coated aluminium profile
- Electromagnetic brake
- Steel slides LS2 (Part no. 223007)
- Limit switch attachment kit (see accessories)

### To order:

- Length measuring system
- Bellows gaiter cover
- Assembly left of the motor module

## Drive modules

see pages 2-68 et seq. of the catalogue



## Technical specification

### Aluminium profile

Aluminium profile LES 6	
Moment of inertia $I_x$	707.100 cm <sup>4</sup>
Moment of inertia $I_y$	212.200 cm <sup>4</sup>
*Centre of gravity <small>see dimensioned drawing</small>	32.78 mm
Cross-sectional area	30.07 cm <sup>2</sup>
Material	AlMgSi0, 5F22
Anodising	E6/EV1
Weight with steel shafts	11.4 kg/m
Weight with steel shafts and spindles	12.8 kg/m

## No load running torques

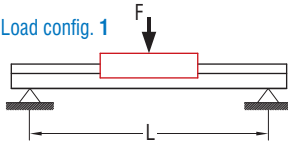
No load torques (Ncm)					
Speed (rpm)	Spindle pitch				
	2.5	4	5	10	20
500	17	17	18	20	21
1500	20	20	22	24	25
3000	24	25	26	29	30

# Linear units with spindle drive

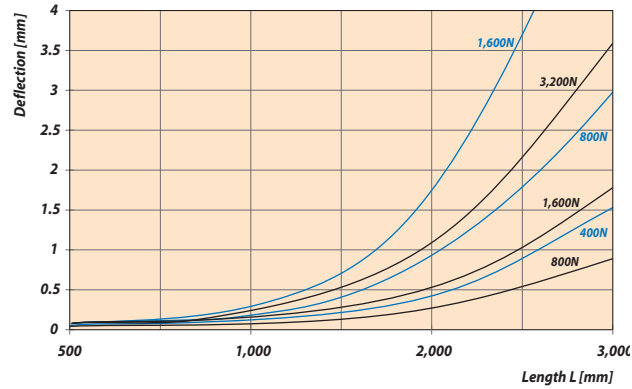
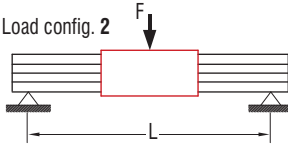
## LES 6

### Bending

Load config. 1



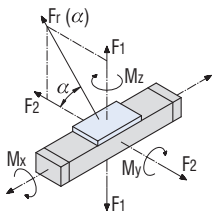
Load config. 2



### Load factors

$$Fr(\alpha) = \frac{F_2}{\cos \alpha}$$

$$Fr(\alpha) = \frac{F_1}{\sin \alpha}$$



LES 6 with two WS 5/70	
C <sub>0</sub>	5153.30 N
C	2319.41 N
F <sub>1 stat.</sub>	4401.33 N
F <sub>1 dyn.</sub>	1980.96 N
F <sub>2 stat.</sub>	5153.30 N
F <sub>2 dyn.</sub>	2319.14 N
M <sub>x stat.</sub>	211.54 Nm
M <sub>y stat.</sub>	164.31 Nm
M <sub>z stat.</sub>	192.39 Nm
M <sub>x dyn.</sub>	95.21 Nm
M <sub>y dyn.</sub>	73.95 Nm
M <sub>z dyn.</sub>	86.59 Nm

LES 6 with four WS 5/70	
C <sub>0</sub>	6,606 N
C	3,746 N
F <sub>1 stat.</sub>	5,642 N
F <sub>1 dyn.</sub>	3,198 N
F <sub>2 stat.</sub>	6,606 N
F <sub>2 dyn.</sub>	3,746 N
M <sub>x stat.</sub>	211.575 Nm
M <sub>y stat.</sub>	366.73 Nm
M <sub>z stat.</sub>	429.39 Nm
M <sub>x dyn.</sub>	119.925 Nm
M <sub>y dyn.</sub>	207.87 Nm
M <sub>z dyn.</sub>	243.49 Nm

### permissible spindle speeds

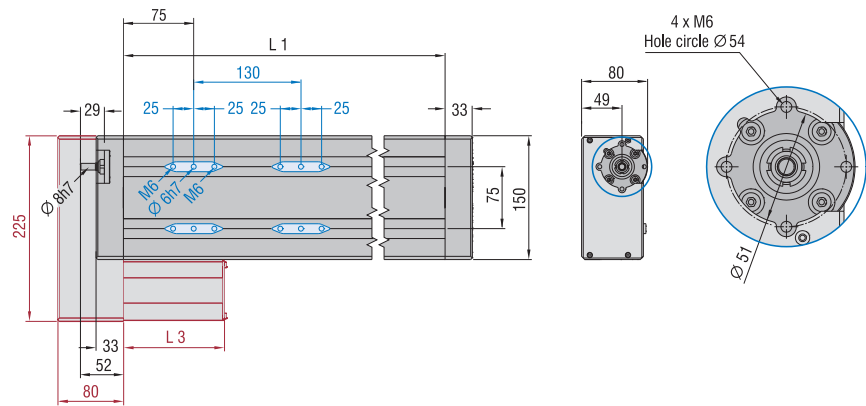
LES 4 / 5 / 6	Spindle pitch [mm]	max. permissible feed speed v permissible [mm/s]				
		2.5	4	5	10	20
490	4000	167	267	333	667	1333
990	3000	125	200	250	500	1000
1390	1500	63	100	125	250	500
1490 *	3000	125	200	250	500	1000
1990 *	1650	69	110	138	275	550
2490 *	1050	44	70	88	175	350
2990 *	750	31	50	63	125	250

\* with spindle support

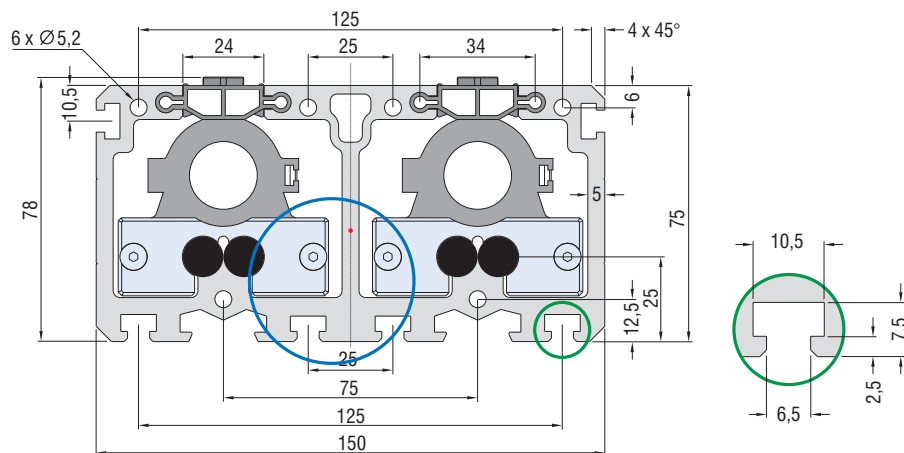
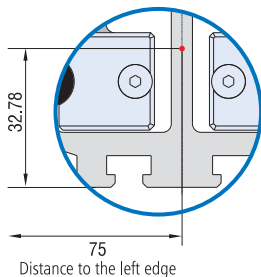
### dimensioned drawing

process travel  
 at 2xWS 5/70 = L1 -150 mm  
 at 4xWS 5/70 = L1 -280 mm

external limit switches see page 2-83



### dimensioned drawing Aluminium profile



# Linear units with spindle drive

# LES 5



LES 5 with integrated belt drive module

## Features

- Aluminium shaft housing profile W225 × H75 mm, naturally anodised
- Clamping area and profile underside milled flat
- With 4 precision steel shafts Ø 12 h6, material Cf53, Hardness 60 ± 2 HRC
- Aluminium shaft slides WS 5/70, 2 x WS 5/70 (70 mm long), adjustable for no play, central lubrication system
- Recirculating ball drive 2.5/4/5/10 and 20 mm pitches
- Profile sealing with friction-resistant lip seals
- Cast aluminium end plates
- With 2 limit or reference switches, Repeat accuracy ± 0.02 mm
- Sealed angular contact bearings in drive - steel flange

## Ordering key

2 3 4 X X X 0 X X X

### Drive

- 3 = Preparation Direct drive modules
- 4 = Preparation Belt drive module

### Shaft slides

- 0 = 2 Shaft slides 70 mm
- 2 = 4 Shaft slides 70 mm

### Profile length (L1)

- e.g. 029 = 290 mm (min.)
- 299 = 2990 mm (max.)

(rounded to the last digit)

Standard profile lengths available in 100 mm raster

### Recirculating ball drive

- 0 = without
- 1 = Pitch 2.5 mm
- 2 = Pitch 4.0 mm
- 3 = Pitch 5.0 mm
- 4 = Pitch 10 mm
- 5 = Pitch 20 mm

### Options:

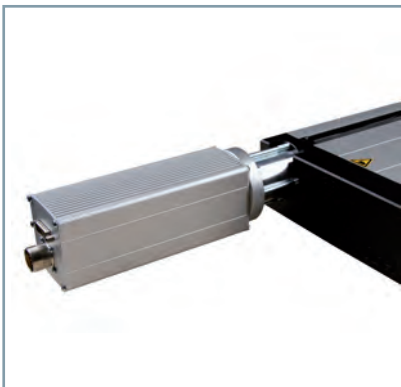
- Black powder-coated aluminium profile
- Electromagnetic brake
- Steel slides LS2 (Part no. 223007)
- Limit switch attachment kit (see accessories)

### Available on request:

- Length measuring system
- Bellows gaiter cover

## Drive modules

see pages 2-66 et seq. of the catalogue



## Technical specification

### Aluminium profile

Aluminium profile LES 5	
Moment of inertia I <sub>x</sub>	2,361.654 cm <sup>4</sup>
Moment of inertia I <sub>y</sub>	298.925 cm <sup>4</sup>
*Centre of gravity <small>see dimensioned drawing</small>	33.39 mm
Cross-sectional area	42.49 cm <sup>2</sup>
Material	AlMgSi0, 5F22
Anodising	E6/EV1
Weight with steel shafts	13.8 kg/m
Weight with steel shafts and spindles	15.2 kg/m

## No load running torques

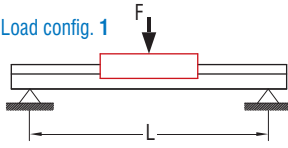
No load torques (Ncm)					
Speed (rpm)	Spindle pitch				
	2.5	4	5	10	20
500	15	15	16	17	18
1500	19	19	19	20	21
3000	23	24	24	25	26

# Linear units with spindle drive

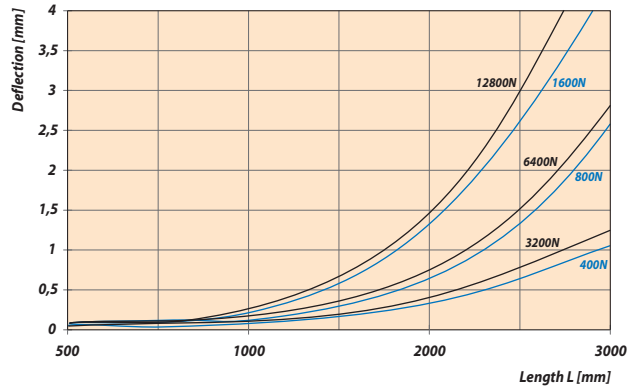
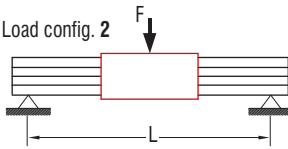
## LES 5

### Bending

Load config. 1



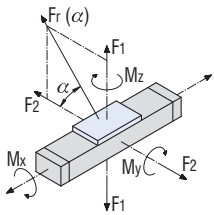
Load config. 2



### Load factors

$$F_r(\alpha) = \frac{F_2}{\cos \alpha}$$

$$F_r(\alpha) = \frac{F_1}{\sin \alpha}$$



LES 5 with two WS 5/70		LES 5 with four WS 5/70	
$C_0$	5153.30 N	$C_0$	6,606 N
C	2319.41 N	C	3,746 N
$F_1$ stat.	4401.33 N	$F_1$ stat.	5,642 N
$F_1$ dyn.	1980.96 N	$F_1$ dyn.	3,198 N
$F_2$ stat.	5153.30 N	$F_2$ stat.	6,606 N
$F_2$ dyn.	2319.14 N	$F_2$ dyn.	3,746 N
$M_x$ stat.	376.59 Nm	$M_x$ stat.	423.15 Nm
$M_y$ stat.	164.31 Nm	$M_y$ stat.	366.73 Nm
$M_z$ stat.	192.39 Nm	$M_z$ stat.	429.39 Nm
$M_x$ dyn.	169.49 Nm	$M_x$ dyn.	239.85 Nm
$M_y$ dyn.	73.95 Nm	$M_y$ dyn.	207.87 Nm
$M_z$ dyn.	86.59 Nm	$M_z$ dyn.	243.49 Nm

### Permissible spindle speeds

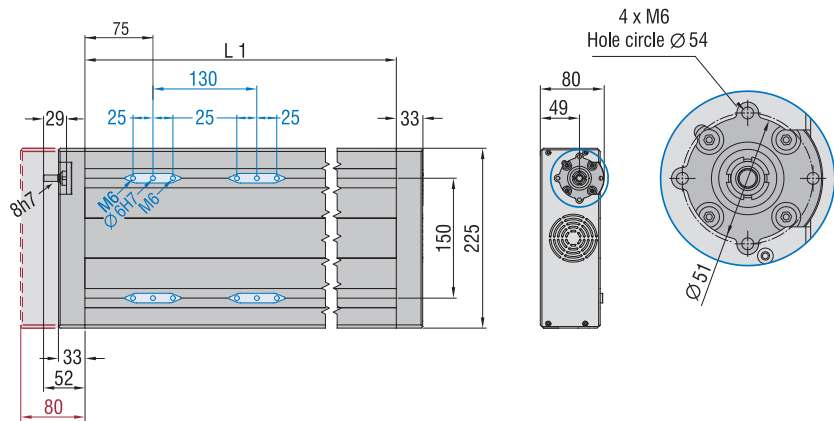
LES 4 / 5 / 6	Spindle pitch p [mm]	max. permissible spindle speed n [rpm]					max. permissible feed speed v permissible [mm/s]				
		2.5	4	5	10	20	167	267	333	667	1333
490	4000	167	267	333	667	1333					
990	3000	125	200	250	500	1000					
1390	1500	63	100	125	250	500					
1490 *	3000	125	200	250	500	500					
1990 *	1650	69	110	138	275	550					
2490 *	1050	44	70	88	175	350					
2990 *	750	31	50	63	125	250					

\* with spindle support

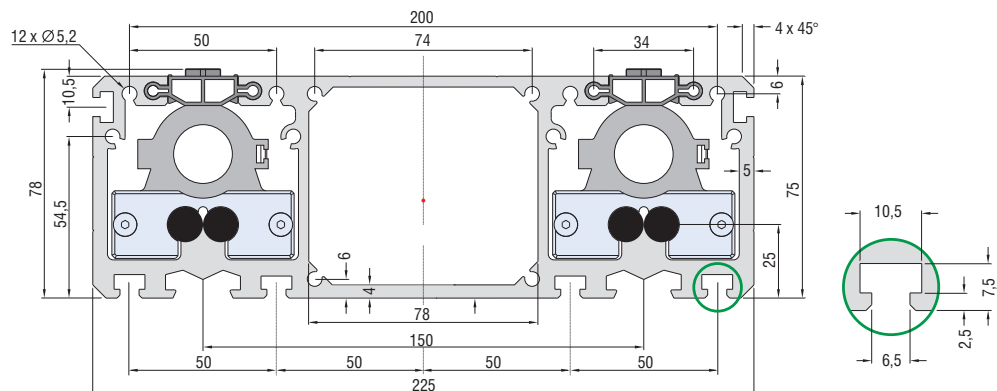
### Dimensioned drawing

Process travel  
at 2xWS 5/70 = L1 -150 mm  
at 4xWS 5/70 = L1 -280 mm

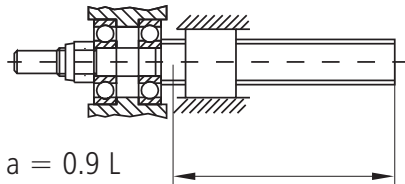
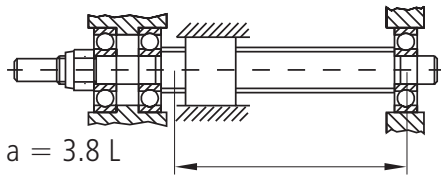
external limit switches see pages 2-81



### Dimensioned drawing Aluminium profile



# Theoretically critical speed



## Definitions

$n_{\text{perm.}}$ [min <sup>-1</sup> ]	maximum permissible speed
$a$	Installation coefficient
$d_2$ [mm]	Spindle core diameter
$L$ [mm]	Spindle length between the spindle bearings and spindle ends

## Calculations

### Critical speed

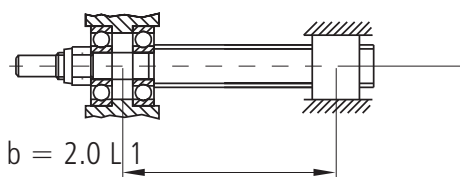
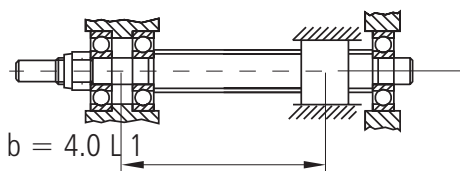
In most applications, you need to check tapped spindles at their critical speed.

The critical speed is that speed which causes resonance oscillations of this spindle.

This critical speed depends on the core diameter, the free load-bearing length and on the way the tapped spindle is constructed.

Given a general safety factor of 0.8, the maximum permissible speed can be calculated as follows:

$$n_{\text{perm}} = 392 \cdot \frac{a \cdot d_2}{L^2} 10^5$$



## Definitions

$F_{\text{perm}}$ [N]	permissible compressive loading
$d_2$ [mm]	Spindle core diameter
$L_1$ [mm]	free buckling length, i.e. the maximum distance between the central bearing and the centre of the tapped nut
$b$	Installation coefficient

### Buckling load

The recirculating ball spindle should as far as possible be subjected only to tensile stress. If it is subjected to compressive loads, then the spindle may buckle.

With a safety factor of 3.0 against buckling, the result is

$$F_{\text{zul}} = \frac{34\,000 \cdot b \cdot d_2^4}{L_1^2}$$

# Drive dimensioning

## Calculations

### Drive torque calculation

The required drive torque is made up of

- Load torque  $M_{load}$
- Acceleration torques  $M_{trans}$  and  $M_{rot}$
- No load torque  $M_{no\ load}$

$$M_A = M_{load} + M_{trans} + M_{rot} + M_{no\ load}$$

### Load torque

$$M_{last} = \frac{F_X \cdot p}{2 \cdot \pi \cdot 1000}$$

with feed force  $F_X = m \cdot g \cdot \mu$

### Translational Acceleration torque

$$M_{trans} = \frac{F_a \cdot p}{2 \cdot \pi \cdot 1000}$$

with feed force  $F_a = m \cdot a$

If used vertically, the mass acceleration  $a$  must be added to the acceleration due to gravity  $g$  ( $9.81\ m/s^2$ ).

### Rotational acceleration torque

$$M_{rot} = \frac{J_{sp} \cdot L \cdot n_{max} \cdot a \cdot 2 \cdot \pi}{V_{max} \cdot 60 \cdot 1000}$$

### Drive power

$$P = \frac{M_A \cdot n_{max}}{9550}$$

### Definitions

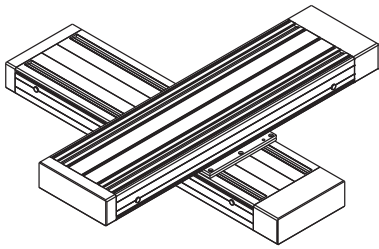
$M_A$	[Nm]	required drive torque
$M_{leer}$	[Nm]	Torque, resulting from the various loads
$M_{leer}$	[Nm]	No load torque
$M_{rot}$	[Nm]	Rotational acceleration torque
$M_{trans}$	[Nm]	translational acceleration torque
$F_X$	[N]	Feed force
$g$	[m/s <sup>2</sup> ]	Acceleration due to gravity
$v_{max}$	[m/s]	maximum process speed
$m$	[kg]	The weight to be conveyed
$a$	[m/s <sup>2</sup> ]	Acceleration
$p$	[mm]	Spindle pitch
$P$	[kW]	Power
$L$	[mm]	Length
$n_{max}$	[rpm]	maximum speed
$\mu$		coefficient of friction
$J_{sp}$	[kgm <sup>2</sup> /m]	Inertial torque of inertia of the spindle per meter
$F_a$	[N]	Accelerating force

### Mechanical specification

Linear unit	LES 4	LES 5	LES 6
Aluminium profile WxH (mm)	75 x 75	225 x 75	150 x 75
Guide weight (kg/m)	6.2	13.8	11.4
Moment of inertia $I_x$ (cm <sup>4</sup> )	126	299	212
Moment of inertia $I_y$ (cm <sup>4</sup> )	107	2362	707
Weight with spindle (kg/m)	7.6	15.2	12.8
Guide slides	1x WS 5-70 2x WS 5-70	2x WS 5-70 4x WS 5-70	
Slide weight (kg)	0.34 / 0.68	0.68 / 1.36	
Spindle pitch (mm)	2.5 / 4 / 5 / 10 / 20		
Max. permissible feed force (N)	2626 / 3450 / 3450 / 3150 / 1425		
Repeat accuracy (mm)	± 0.02		
Process path (mm)	L 1 - 150 / L 1 - 280		
Noise level (dBA)	< 85		
Storage temperature range (°C)	0 – 40		
Operating temperature range (°C)	0 – 60 (80)		
Relative air humidity (%)	< 90		

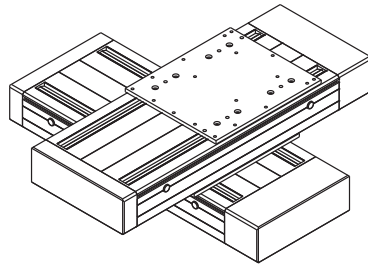


# Combination examples



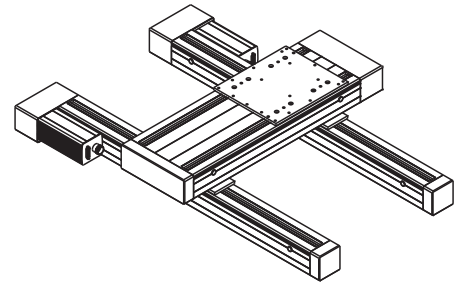
## Crossbench

2 × LES 5  
PS 4 with VP 2  
Slide on slide assembly



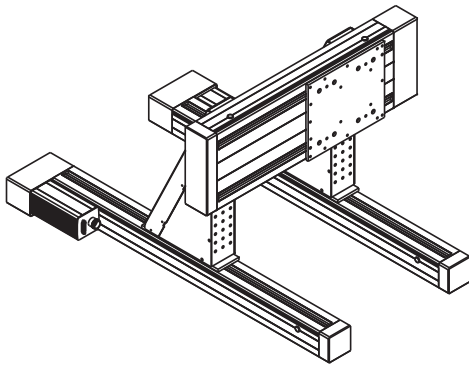
## Crossbench

2 × LES 5  
VP 2 with PS 4



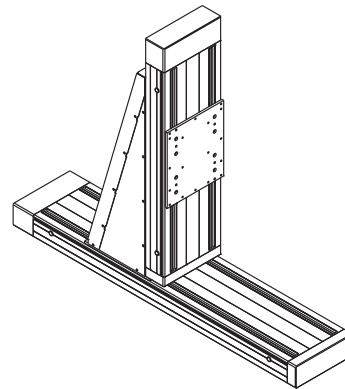
## 2-axis H-design

2 x LES 4, LES 5, 2 x PS 6, PS 4,  
gantry mode



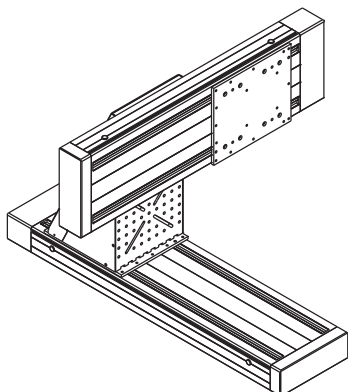
## 2-axis flatbed configuration

2 x LES 4, LES 5, 2 X PS 2  
2 x WV 2, PS 4, gantry mode



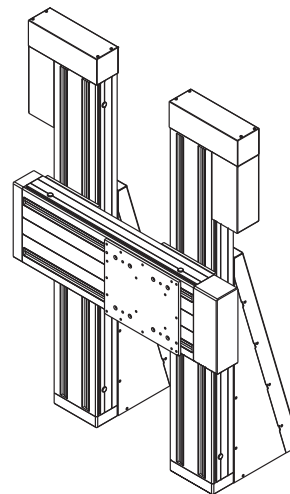
## 2-axis lifting configuration

2 × LES 5, 2 × PS 4  
WV 6



## 2-axis boom configuration

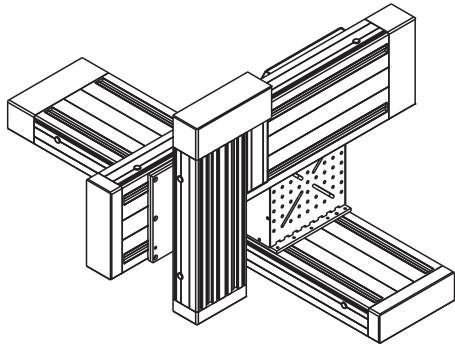
2 × LES 5  
2 × PS 4  
WV 3



## 2-axis H-design

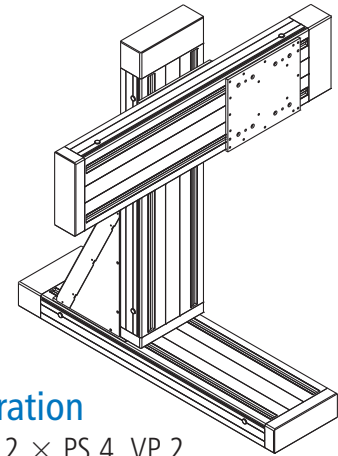
LES 5, 2 x LES 6, 2 x WV 7,  
2 x PS 12, PS 4, gantry mode

# Combination examples



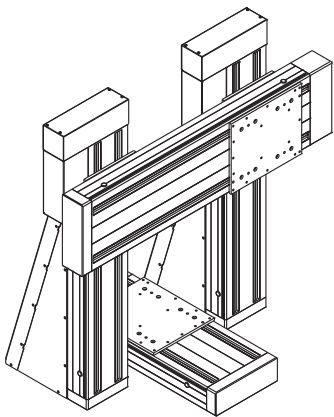
## 3 axis boom configuration

2 × LES 5, LES 6, WV 3, 2 × PS 4, PS 7



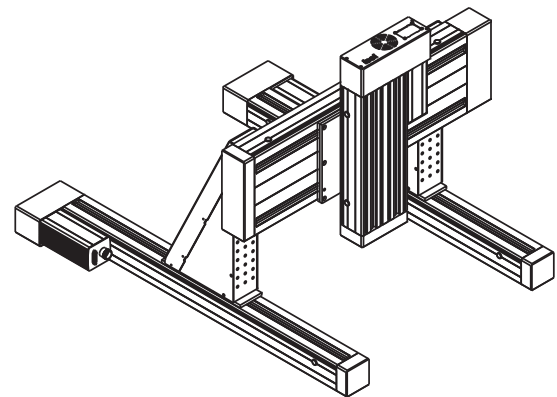
## 3-axis raised boom configuration

3 × LES 5, WV 3, 2 × PS 4, VP 2



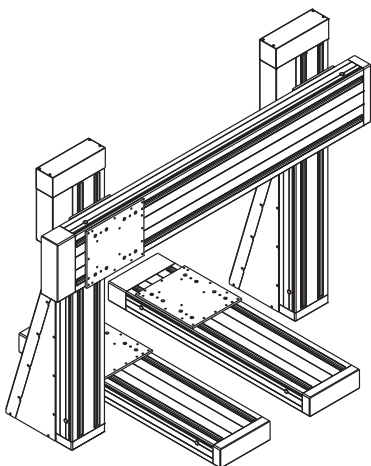
## 3-axis portal configuration

2 × LES 5, 2 × LES 6, 2 × WV 7,  
2 × PS 4, PS 12, gantry mode



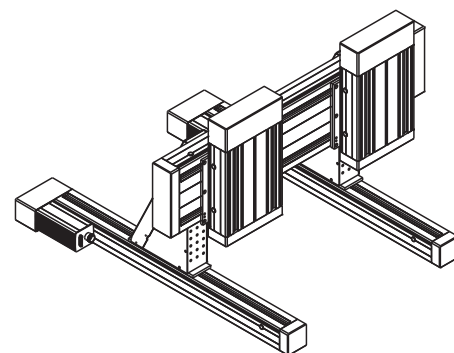
## 3-axis flatbed configuration

2 × LES 4, LES 5, LES 6, 2 × PS 2, 2 × WV 2,  
PS 4, PS 7, gantry mode



## 4-axis portal configuration

3 × LES 5, 2 × LES 6, 2 × WV 7,  
3 × PS 4, 2 × PS 12



## 5-axis flatbed configuration

2 × LES 5 (Z-axis), LES 5 (2 spindle drives)  
2 × LES 4, 2 × PS 2, 2 × WV 2,  
2 × PS 4 with VP 2

# Motor modules

## Ordering overview

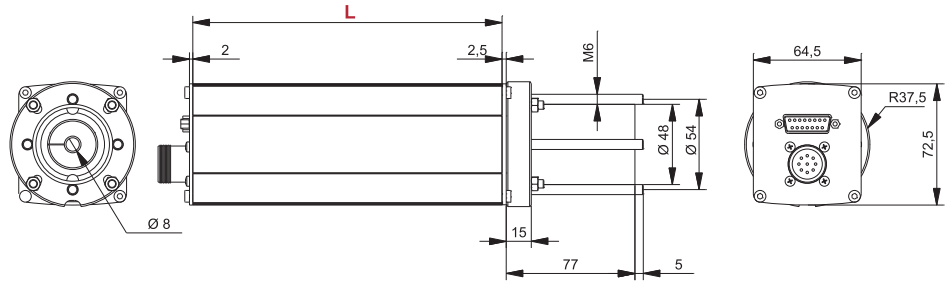
LES 4/5/6 direct drives	Circular plug	Circular plug with brake	Single axis controller	Multiple axis controller
DC servomotor DC 100	396112 0060	-	MC 1-10	iCU-DC / iPU-DC
Stepper motor MS 200 HT - 2	396058 0060	396058 0260	IT 116 Flash	iMC-P / iMC-S8
EC servomotor EC 60S	396415 0060	396415 0260	MC 1-20	iCU-EC / iPU-EC
EC servomotor EC 60L 48V	396423 0060	-	MC 1-20	iCU-EC / iPU-EC
EC servomotor EC 60L 310V	396423 0070	396423 0270	MC 1-40	iCU-EC / iPU-EC
EC servomotor EC 86L	396466 0070	-	MC 1-40	Switching cabinet
EC servomotor EC 86S	396444 0070	-	MC 1-40	Switching cabinet
Stepper motor MS 300 HT - 2	396082 0060	396082 0260	iMC-S8	iMC-S8
Stepper motor MS 600 HT	396085 0060	-	iMC-S8	iMC-S8
Stepper motor MS 900 HT	396088 0060	-	iMC-S8	iMC-S8
LES 5 integrated	Circular plug	Circular plug with brake	Single axis controller	Multiple axis controller
Stepper motor MS 200 HT - 2	396058 1060	396058 1260	IT 116 Flash	iMC-P / iMC-S8
DC servomotor DC 100	396112 1060	-	MC 1-10	iCU-DC / iPU-DC
EC servomotor EC 60S	396415 1060	396415 1260	MC 1-20	iCU-EC / iPU-EC
EC servomotor EC 60L 48V	396423 1060	-	MC 1-20	iCU-EC / iPU-EC
EC servomotor EC 60L 310V	396423 1070	396423 1270	MC 1-40	Switching cabinet
LES 4/LES 6 side mounting	Circular plug	Circular plug with brake	Single axis controller	Multiple axis controller
Stepper motor MS 200 HT - 2	396058 2060	396058 2260	IT 116 Flash	iMC-P
DC servomotor DC 100	396112 2060	-	MC 1-10	iCU-DC
EC servomotor EC 60S	396415 2060	396415 2260	MC 1-20	iCU-EC
EC servomotor EC 60L 48V	396423 2060	-	MC 1-20	iCU-EC
EC servomotor EC 60L 310V	396423 2070	396423 2270	MC 1-40	iCU-EC

# Motor modules

## dimensioned drawing

### Motor module 1

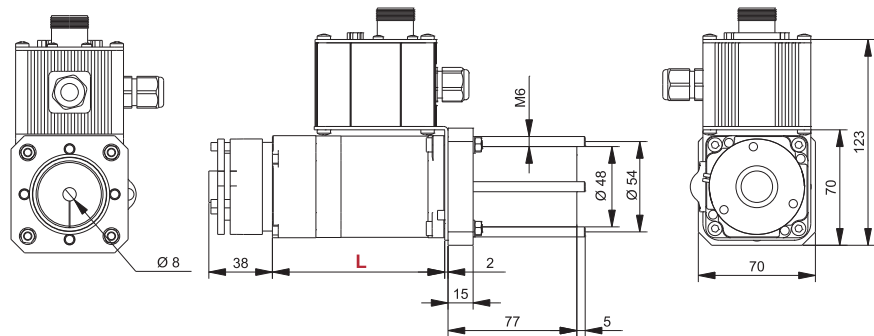
Part no.	Motor module	Length L
396112 0060	DC 100	185 mm
396058 0360	MS 200 HT-2 with brake	165 mm
396058 0060	MS 200 HT-2 without brake	105 mm



## dimensioned drawing

### EC 60

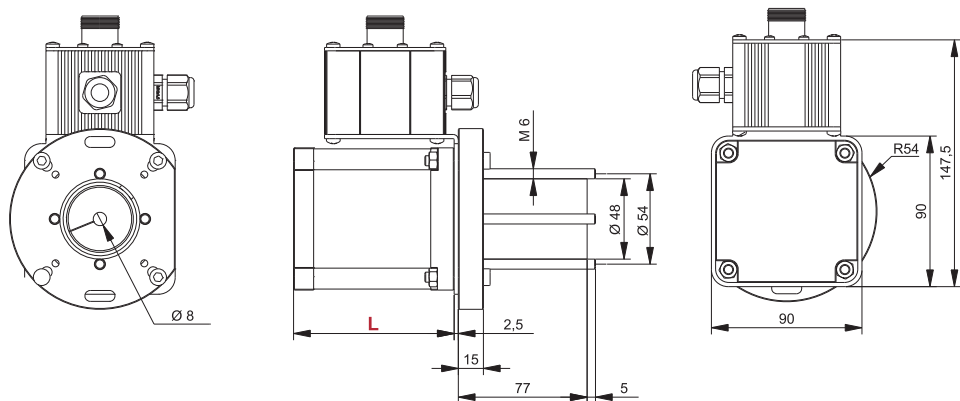
Part no.	Motor module	Length L
396415 0260	EC 60S with brake	99 mm
396415 0060	EC 60S without brake	99 mm
396423 0060	EC 60L 48V	120 mm
396423 0070	EC 60L 310V	120 mm



## dimensioned drawing

### Motor module 2

Part no.	Motor module	Length L
396466 0070	EC 86L	151 mm
396444 0070	EC 86S	126 mm
396085 0060	MS 600HT	96 mm
396088 0060	MS 900 HT	126 mm



# Clutch housing

## Drive element accessories

### Connection options

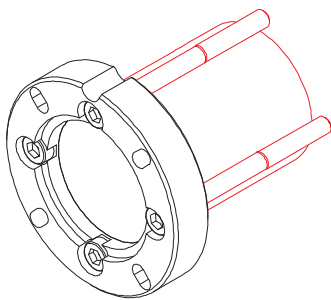
Direct drive preparation

Connecting options <i>Direct drive</i>	LES 4	LES 6	LES 5	Angular gear fixing 0°	Angular gear fixing 90°
MS 200 HT-2 DC 100 EC 60	Connection via coupling casing 1 <i>short sleeve</i> with adequate shaft coupling			Coupling casing 1 <i>long sleeve</i>	
MS 600 HT MS 900 HT EC 86	Connection via coupling casing 2 <i>short sleeve</i> with adequate shaft coupling			Coupling casing 2 <i>long sleeve</i>	
Angular gear fixing 0°	split coupling casing <i>short sleeve</i> with adequate shaft coupling			Connection via transmission shaft set	
Angular gear fixing 90°	split coupling casing <i>short sleeve</i> with adequate shaft coupling				

### Ordering overview

Clutch housing

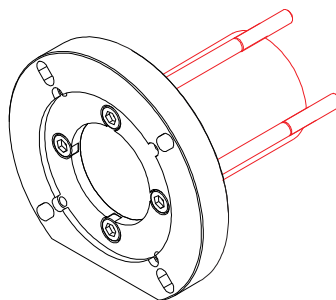
Clutch housing 1



short sleeve  
Part no.: 218 100 0001

long sleeve  
Part no.: 218 100 0002

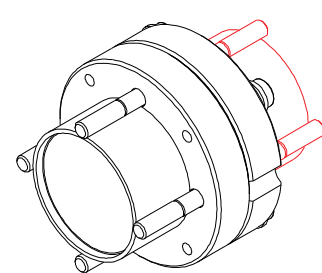
Clutch housing 2



short sleeve  
Part no.: 218 100 1001

long sleeve  
Part no.: 218 100 1002

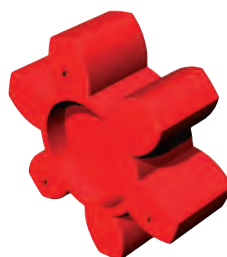
Split clutch housing



short sleeve  
Part no.: 218 100 2001

long sleeve  
Part no.: 218 100 2002

### Clutches



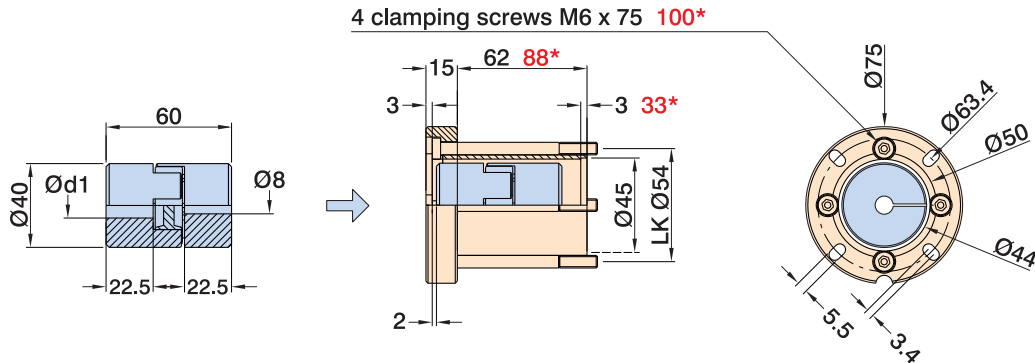
coupling	Item no.:	d <sub>1</sub>	d <sub>2</sub>
20/30	218 001 5060	5,0	6,0
	218 001 9999	from 4 to 7 mm	
30/40	218 002 6380	6,35	8,0
	218 002 8080	8,0	8,0
	218 002 9999	from 6 to 13 mm	
40/60	218 003 9580	9,52	8,0
	218 003 9999	from 8 to 18 mm	

# Clutch housing

## Drive element accessories

### dimensioned drawing

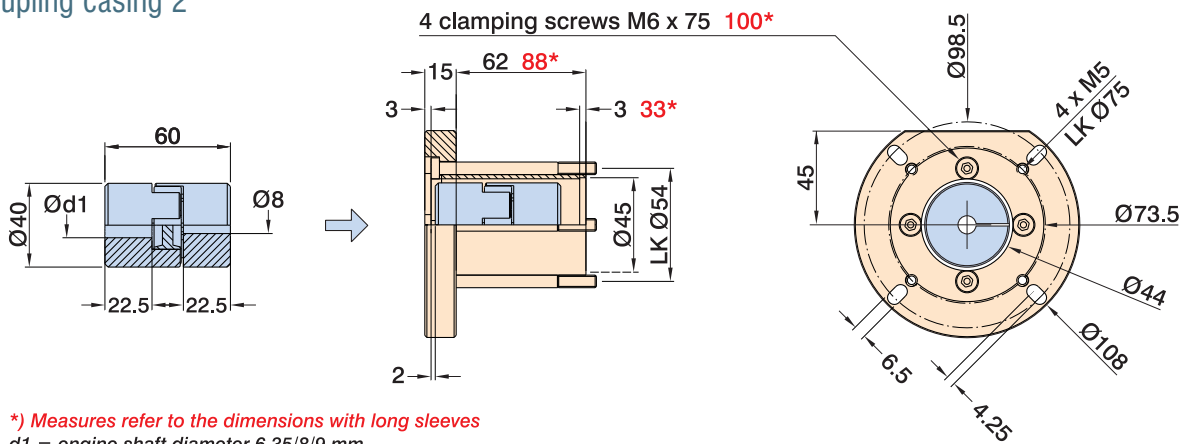
#### Coupling casing 1



*\*) Measures refer to the dimensions with long sleeves*  
 d1 = engine shaft diameter 6.35/8/9 mm  
 Suitable shaft coupling WK 40/60 on page 2-68 (not included in scope of delivery)

### dimensioned drawing

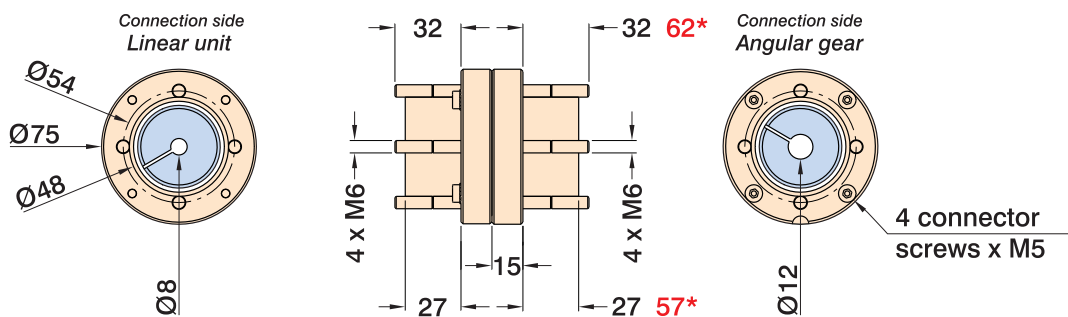
#### Coupling casing 2



*\*) Measures refer to the dimensions with long sleeves*  
 d1 = engine shaft diameter 6.35/8/9 mm  
 Suitable shaft coupling WK 40/60 on page 2-68 (not included in scope of delivery)

### dimensioned drawing

#### Split coupling casing



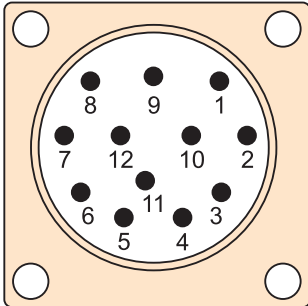
*\*) Measures refer to the dimensions with long sleeves*  
 Suitable shaft coupling WK 40/60 on page 2-68 (not included in scope of delivery)



# Motor pin assignments

## Pin assignment for stepper motors

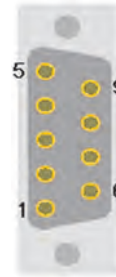
### Motor connection



View of pin insert at the insertion side

M23 12-pin Pin	
1	Motor phase 1A
2	Motor phase 1B
3	Motor phase 2A
4	Motor phase 2B
5	+24V switch
6	+24V brake
7	GND switch
8	GND brake
9	Limit switch 1
10	Limit switch 2
11	---
12	---
Housing - cable shield	

### Motor connection

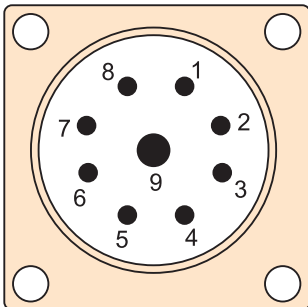


View of pin insert on the socket side

Sub-D 9-pin Pin	
1	Motor phase 1A
2	Motor phase 1B
3	Motor phase 2A
4	Motor phase 2B
5	+24V switch
6	+24V brake
7	Limit switch 2
8	GND brake
9	Limit switch 1
Housing - cable shield	

## Pin assignment for DC servo motors with brushes (BDC)

### Motor connection

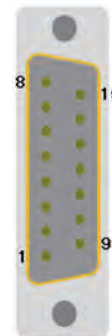


View of pin insert on the socket side

M23 9-pol. (8+1) pin	
1	Motor phase 1 (V+)
2	Motor phase 1 (V-)
3	Motor phase 1 (V+)*
4	Motor phase 1 (V-)*
5	+24V brake
6	GND brake
7	---
8	---
9	Earthing lead
Housing - cable shield	

\* Part motor phase connection also by means of 2 wires.

### Encoder connection

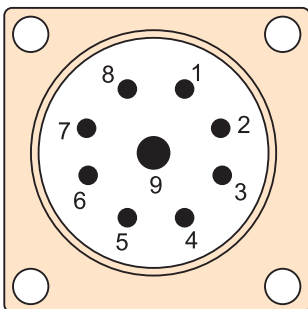


View of pin insert on the socket side

Sub-D 15-pin Pin	
1	---
2	+5V encoder
3	Encoder track/Z
4	Encoder track/B
5	Encoder track/A
6	+24V switch
7	Limit switch 1
8	GND switch
9	---
10	GND encoder
11	Encoder track Z
12	Encoder track B
13	Encoder track A
14	Reference switch
15	Limit switch 2
Housing - cable shield	

## Pin assignment for brushless EC servo motors (BLDC) 48V

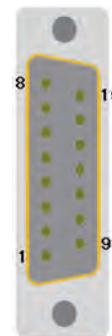
### Motor connection



View of pin insert on the socket side

M23 9-pol. (8+1) pin	
1	Motor phase U
2	Motor phase V
3	Motor phase W
4	---
5	+24V brake
6	GND brake
7	---
8	---
9	Earthing lead
Housing - cable shield	

### Encoder connection



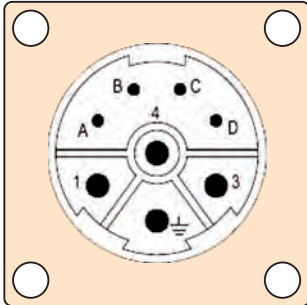
View of pin insert on the socket side

Sub-D 15-pin Pin	
1	Hall signal A
2	+5V encoder/Hall
3	Encoder track/Z
4	Encoder track/B
5	Encoder track/A
6	+24V switch
7	Limit switch 1
8	GND switch
9	Hall signal B
10	GND encoder
11	Encoder track Z
12	Encoder track B
13	Encoder track A
14	Hall signal C
15	Limit switch 2
Housing - cable shield	

# Motor leads

## Pin assignment for brushless EC servomotors (BLDC) 310V

### Motor connection



View of pin insert at the insertion side

M23 9-pol. (4+3+1) pin	
1	Motor phase U
PE	Earthing lead
3	Motor phase W
4	Motor phase V
A	+24V brake
B	GND brake
C	Temp +
D	Temp -
Housing - cable shield	

### Encoder connection



View of pin insert at the insertion side

Sub-D 15-pin Pin	
1	Hall signal A
2	+5V encoder/Hall
3	Encoder track/Z
4	Encoder track/B
5	Encoder track/A
6	+24V switch
7	Limit switch 2
8	GND switch
9	Hall signal B
10	GND encoder
11	Encoder track Z
12	Encoder track B
13	Encoder track A
14	Hall signal C
15	Limit switch 2
Housing - cable shield	

## Overview of motor leads for stepper, DC servo and EC motors\*

Part number	Description
392750 0500	5-metre stepper motor lead M23 12-pin plug - socket 1:1
392755 0500	5-metre stepper motor lead D-sub 9-pin plug - M23 12-pin socket
392781 0500	5-metre stepper motor lead D-sub 9-pin plug - socket 1:1
392759 0500	5-metre DC/EC servo motor lead M23 9-pin (8 + PE) plug - socket 1:1
392760 0500	5-metre DC/EC servo motor lead M23 9-pin (8+PE) socket - wire end ferrules
392740 0500	5-metre encoder lead D-sub 15-pin plug - socket 1:1
392325 0500	5-metre encoder lead M23 17-pin socket - D-sub 15-pin plug
392305 0500	3-metre EC/AC servo motor lead M23 310V (4+3+PE) socket - wire end ferrules
392307 0500	5-metre EC servo motor lead M23 (4+3+PE) plug - socket 1:1

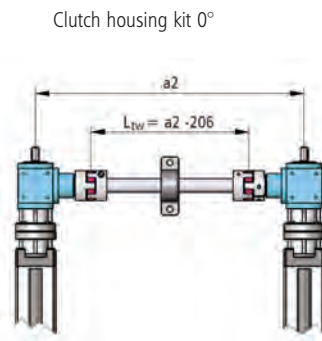
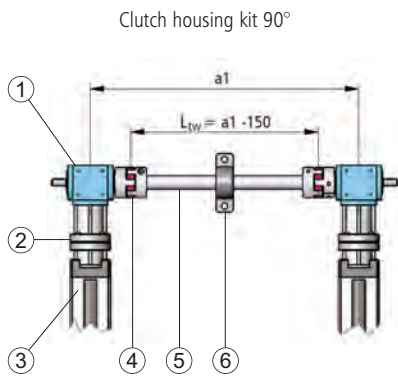
All listed motor and encoder leads are fit for use with tow chains.

\* Different lengths available on request!

# Installation kit with angular transmission

# Drive element accessories

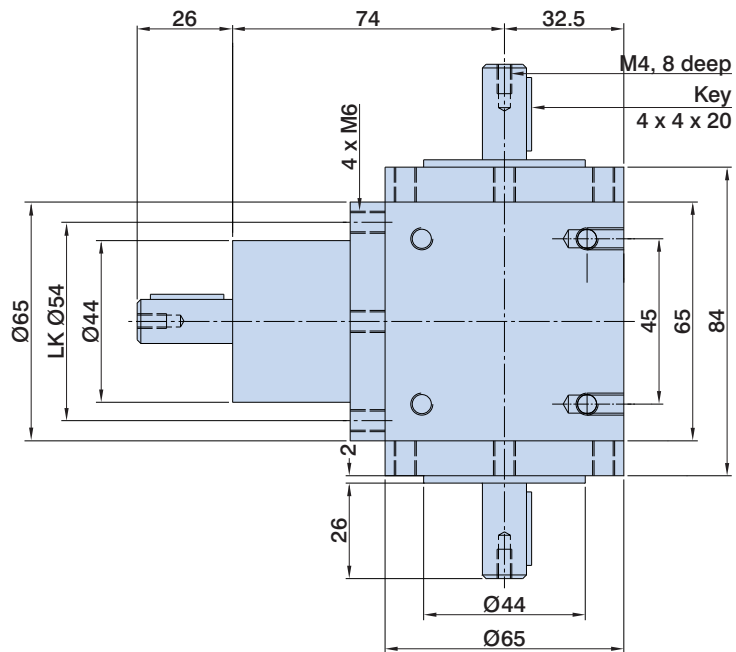
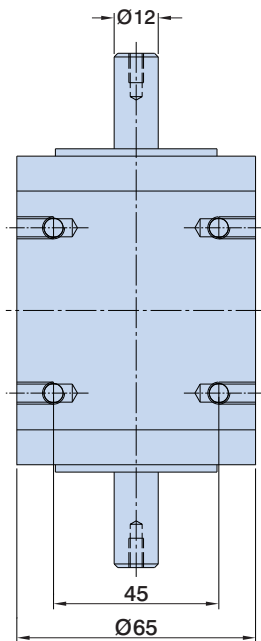
## Installation alternatives



- ① Angular gear
- ② Split coupling casing with shaft coupling WK 40/60
- ③ LES 4, LES 6 or LES 5 (preparation for direct drive)
- ④ Coupling for transmission shaft Ø 25
- ⑤ Transmission shaft Ø 25
- ⑥ Pedestal bearing - recommendable from : transmission shaft length of 1,500 mm up

## dimensioned drawing

### Angular transmission



## Ordering overview

### Installation kit with angular transmission

for H-design on LES 4/LES 6/LES 5,  
0° mounting  
Scope of delivery: 2 x ①, 2 x ②, 2 x ④  
Part no.: **216150 0001**

for H-design on LES 4/LES 6/LES 5,  
90° mounting  
Scope of delivery: 2 x ①, 2 x ②, 2 x ④  
Part no.: **216150 0002**

### Transmission shaft

Hollow shaft Ø 25 mm × 4 mm, blank  
1000 mm  
Part no.: **219001 0125**

Hollow shaft Ø 25 mm × 4 mm, blank  
2000 mm  
Part no.: **219001 0225**

### Coupling/stationary bearing

Coupling for transmission shaft  
12 to 25 mm adaptor, VE 2 units  
Part no.: **218050 0002**

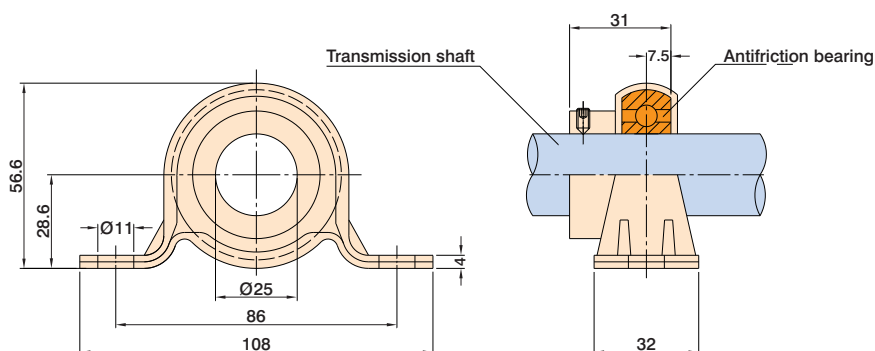
Stationary bearing for transmission shaft  
VE 1 unit  
Part no.: **896202 5562**

For matching direct drive modules LES 4/5/6 see table on page 2-66

# Installation kit with angular transmission

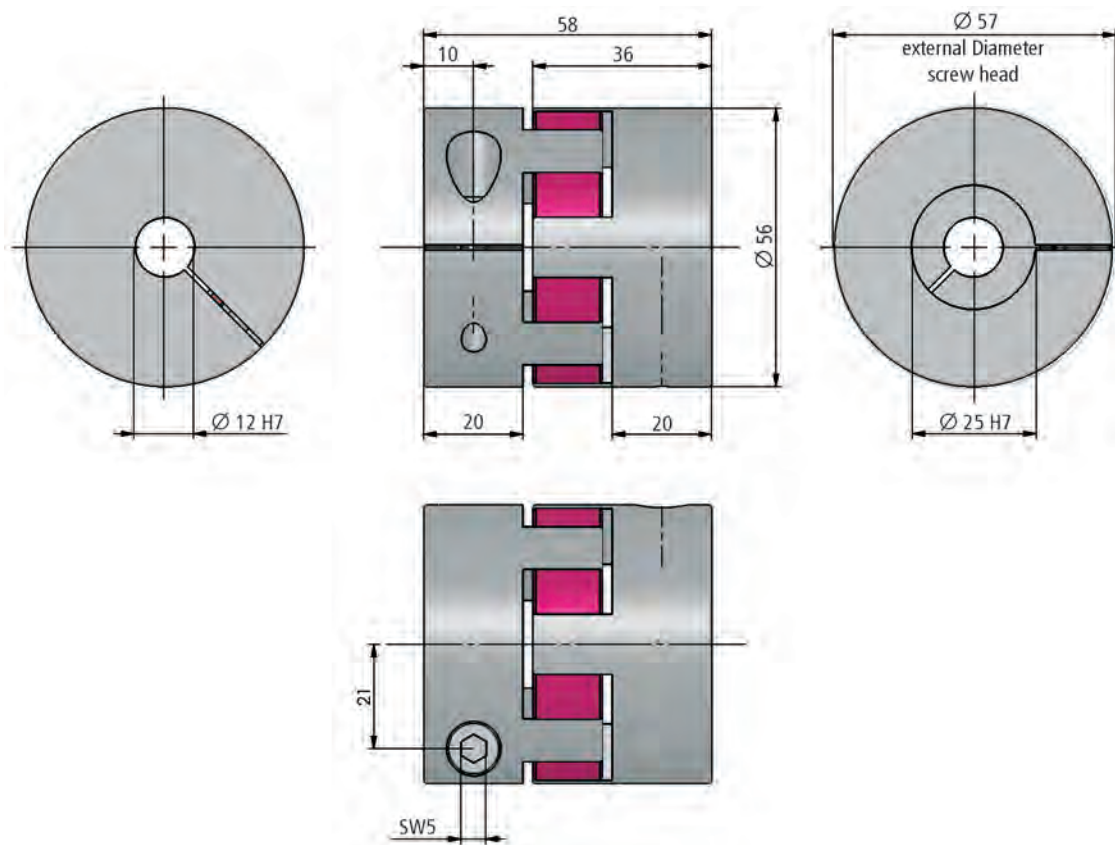
# Drive element accessories

## Dimensioned drawing and technical specification



Pedestal bearing- to avoid vibrations/to support the transmission shaft (recommendeable from a transmission shaft length of 1,500 mm up)	
Transmissible torque	18 Nm
Weight of coupling	0.3 kg
Weight of shaft	0.540 kg/m
Moment of inertia of both couplings	$2.68 \cdot 10^{-4} \text{ kgm}^2$
Moment of inertia of shaft	$8.171 \cdot 10^{-6} \text{ kgm}^2/100 \text{ mm}$

## Dimensioned drawing - coupling



Part no. **218050 0002**

# Slide/crossbench plates

# Connectors

## Hole diagram, slide plate PS 1

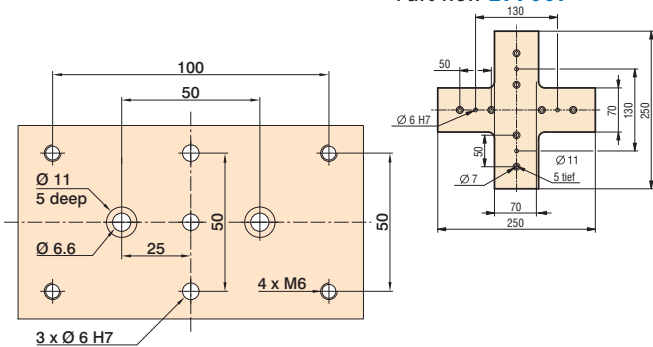
L 125 x W 70 x H 7.7 mm

Mounting on:  
LES 4 with 1 x WS 5/70

Part no.: **277001**

Connecting cross  
2 x LES 4

Part no.: **277007**



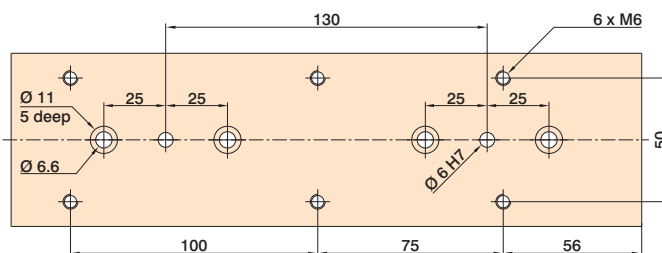
## Hole diagram, slide plate PS 2

L 255 x W 70 x H 7.7 mm

Mounting on:  
LES 4 with 2 x WS 5/70

Fixing option for:  
Angle bracket WV 2 / WV 5

Part no.: **277002**

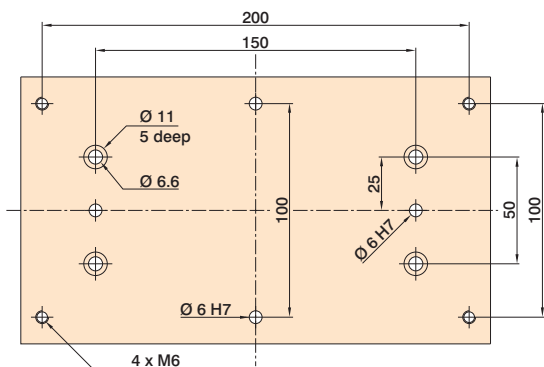


## Hole diagram, slide plate PS 3

L 220 x W 125 x H 7.5 mm

Mounting on:  
LES 5 with 2 x WS 5/70

Part no.: **277003**



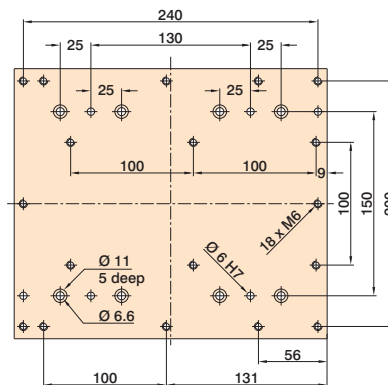
## Hole diagram, slide plate PS 4

L 225 x W 220 x H 7.5 mm

Mounting on: LES 5 with 4 x WS 5/70

Mounting on crossbench: LES 5 with LES 5 (in conjunction with VP 2) Fixing option for: Angle bracket WV 3 / WV 6

Part no.: **277004**



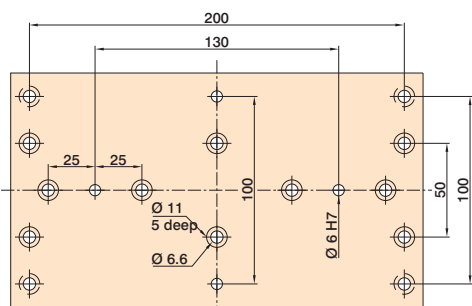
## Hole diagram, slide plate PS 6

L 220 x W 125 x H 7.5 mm

Mounting on: LES 4 with 2 x WS 5/70

Mounting on crossbench: LES 4 with LES 5 (in conjunction with PS 3). Fixing option for: LES 4/LES 5

Part no.: **277011**



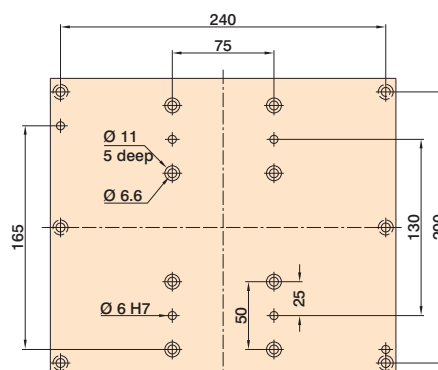
## Hole diagram, slide plate PS 7

L 255 x W 220 x H 7.5 mm

Mounting on: LES 6 with 4 x WS 5/70

Mounting on crossbench: LES 6 with LES 5 (in conjunction with PS 4)

Part no.: **277016**



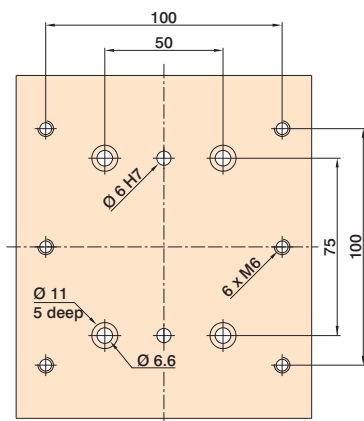
## Slide/crossbench plates

## Connectors

## Hole diagram, slide plate PS 8

L 125 × W 145 × H 7.7 mm

Mounting on:

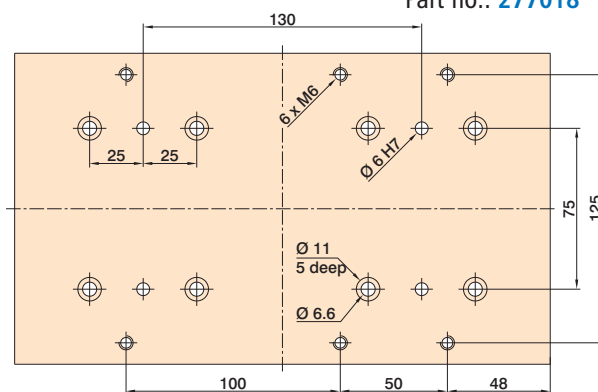
LES 6 with 2 × WS 5/70 **Part no.: 277017**

## Hole diagram, slide plate PS 9

L 250 × W 145 × H 7.5 mm

Mounting on: LES 6 with 4 × WS 5/70

Fixing option for: Angle bracket WV 7

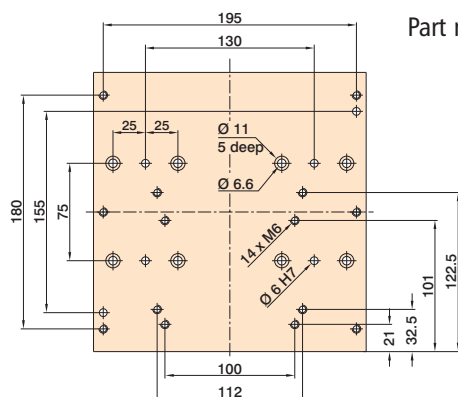
**Part no.: 277018**

## Hole diagram, slide plate PS 10

L 210 × W 215 × H 7.5 mm

Mounting on: LES 6 with 4 × WS 5/70

Mounting on crossbench: LES 6 with LES 6 (in conjunction with PS 11)

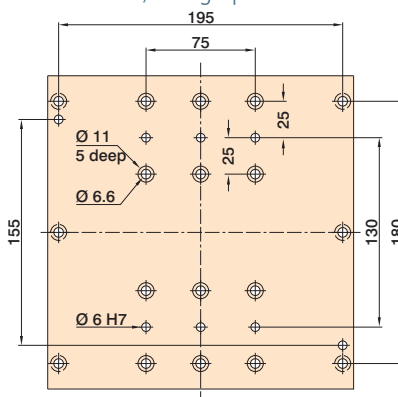
**Part no.: 277019**

## Hole diagram, slide plate PS 11

L 210 × W 215 × H 7.5 mm

Mounting on: LES 6 with 4 × WS 5/70

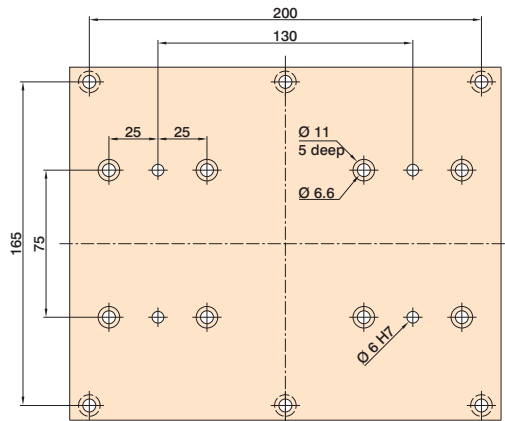
Mounting on crossbench: LES6 with LES4 (in conjunction with PS10) Fixing option for: LES 6

**Part no.: 277020**

## Hole diagram, slide plate PS 12

L 220 × W 180 × H 7.5 mm

Mounting on: LES 6 with 4 × WS 5/70

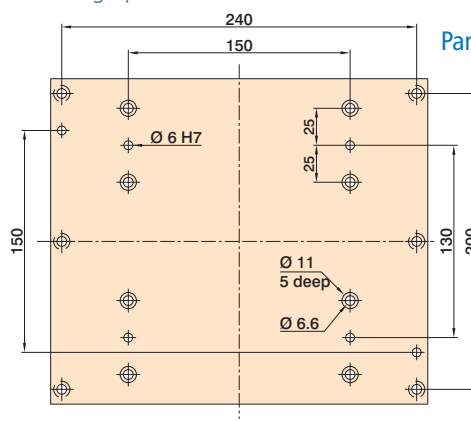
Fixing option for: LES 5 **Part no.: 277021**

## Hole diagram, connection plate VP 2

L 255 × W 220 × H 7.5 mm

Mounting on: LES 5 with 4 × WS 5/70

Fixing option for: LES 5

**Part no.: 277006**

# Slide/crossbench plates

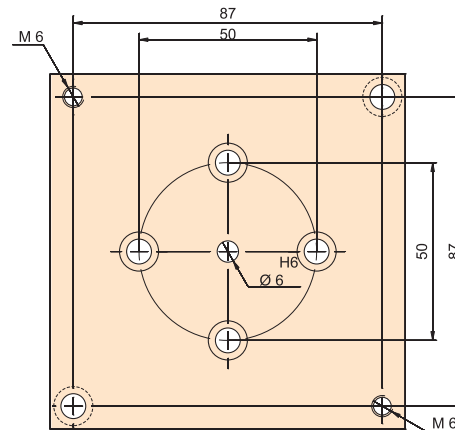
## Connectors

### Hole diagram, slide plate set for crossbench LES 4

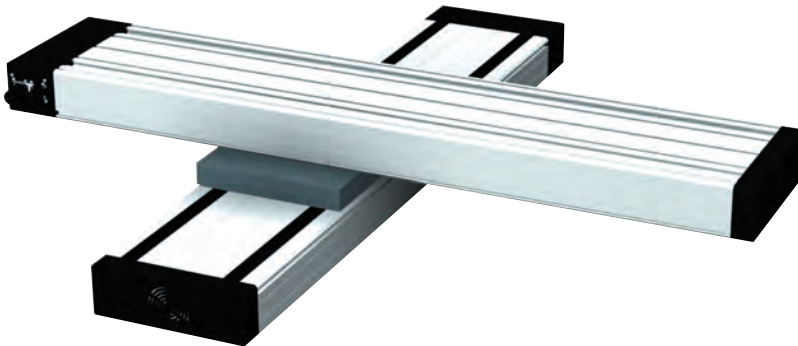
L 100 x W 100 x H 8 mm

Mounting on: LES 4  
Fixing option for: LES 4

Part no.: **277008**



### Crossbench connection plates 1



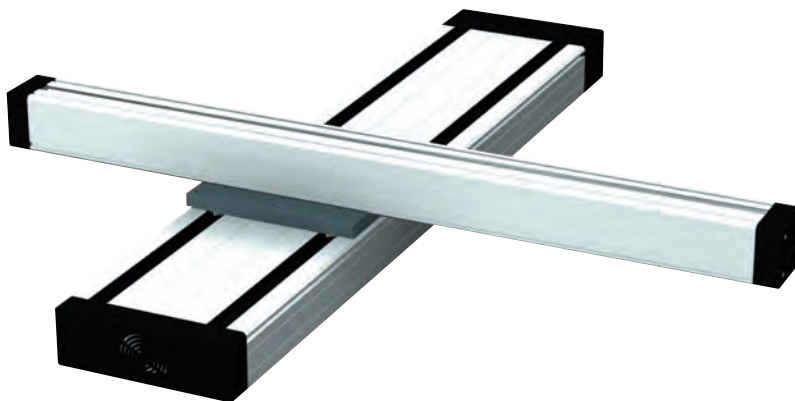
### Crossbench connection plates 1

2 × L 255 × W 220 × H 8 mm

one set from PS 4 and VP 2,  
for right-angled connection  
two linear guides LES 5

Part no.: **277010**

### Crossbench connection plates 2



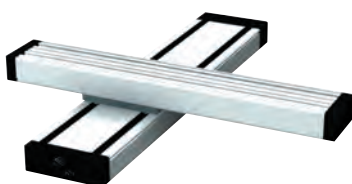
### Crossbench connection plates 2

2 x L 220 x W 125 x H 8 mm

one set from PS 3 and PS 6,  
for right-angled connection  
one linear guide LES 5 with one  
linear guide LES 4

Part no.: **277012**

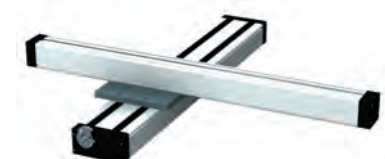
### Additional combination examples



Crossbench LES 5 and LES 6  
PS 4 and PS 7



Crossbench 2 × LES 6  
PS 10 and PS 11



Crossbench LES 4 and LES 6  
PS 11 and PS 10



# T-slot slide plates

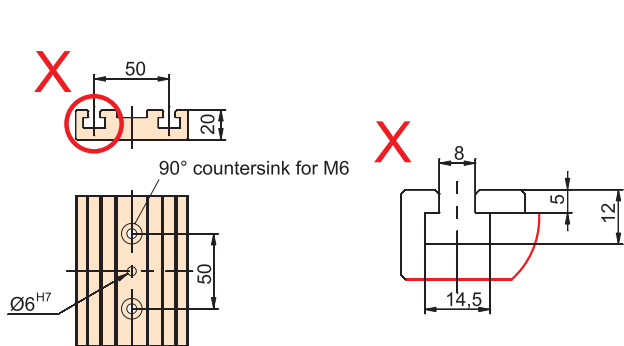
# Connectors

## Hole pattern T-slot plate PT 25 × 250 for LES 4

L 100 x W 75 x H 20 mm

Mounting on: LES 4 with 1 x WS 5/70

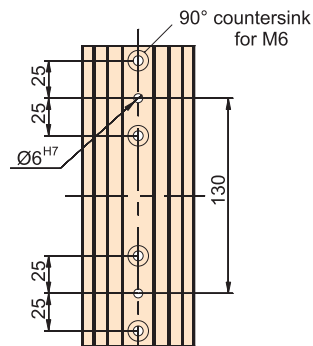
Part no.: **277030 0001**



L 200 x W 75 x H 20 mm

Mounting on: LES 4 with 2 x WS 5/70

Part no.: **277030 0002**

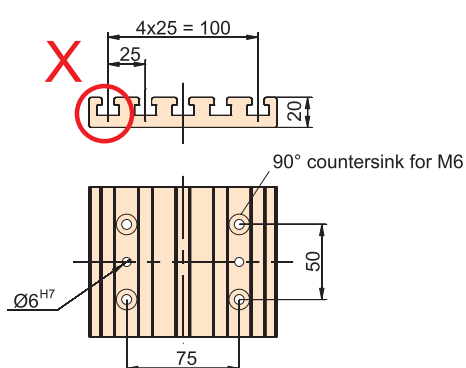


## Hole pattern T-slot plate PT 25 × 250 for LES 6

L 100 x W 125 x H 20 mm

Mounting on: LES 6 with 2 x WS 5/70

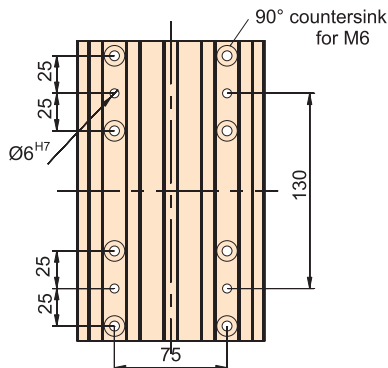
Part no.: **277030 0003**



L 200 x W 125 x H 20 mm

Mounting on: LES 6 with 4 x WS 5/70

Part no.: **277030 0004**

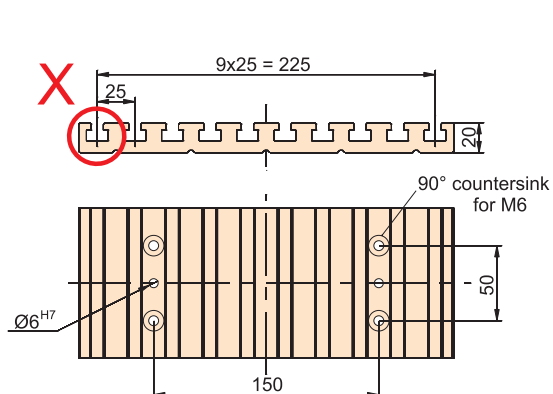


## Hole pattern T-slot plate PT 25 × 250 for LES 5

L 100 x W 250 x H 20 mm

Mounting on: LES 5 with 2 x WS 5/70

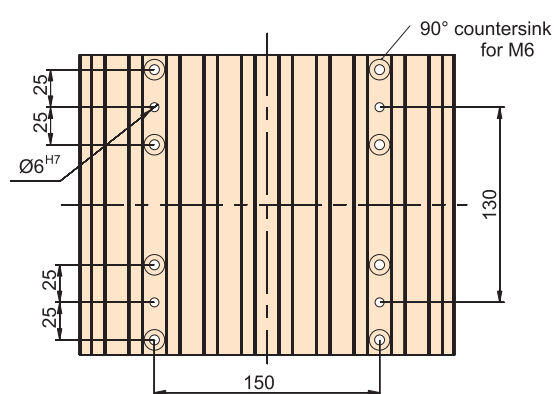
Part no.: **277030 0005**



L 200 x W 250 x H 20 mm

Mounting on: LES 5 with 4 x WS 5/70

Part no.: **277030 0006**

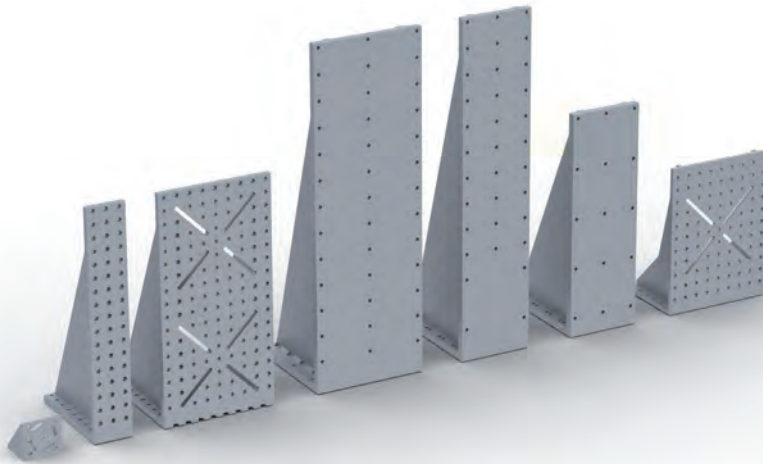


# Angle brackets

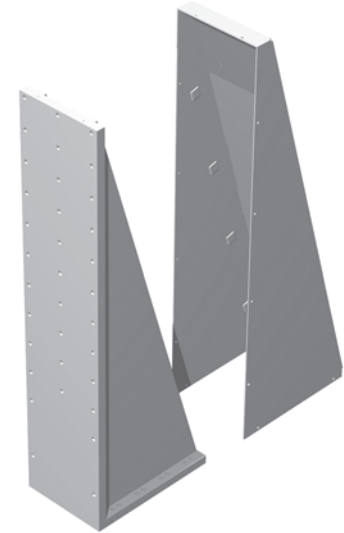
# Connectors

## Angle bracket with clamping surfaces milled flat

## matching cover plates



WV 1 WV 2 WV 3 WV 6 WV 7 WV 8 WV 19



### Angle bracket WV 1

- blank
- Aluminium casting (0.2 kg)
- L71 × W75 × H71

Part no.: **209110 0010**

### Angle bracket WV 2

- blank
- Aluminium casting (2.6 kg)
- L221 × W75 × H446

Part no.: **209110 0022**

### Angle bracket WV 3

- blank
- Aluminium casting (5.8 kg)
- L221 × W221 × H446

Part no.: **209110 0032**

### Angle bracket WV 6

- blank
- Aluminium, welded (13.3 kg)
- L220 × W220 × H670

Part no.: **209110 0060**

### Angle bracket WV 7

- blank
- Aluminium, welded (10.8 kg)
- L220 × W145 × H670

Part no.: **209110 0070**

### Angle bracket WV 8

- blank
- Aluminium, welded (7.4 kg)
- L222 × W145 × H446

Part no.: **209110 0080**

### Angle bracket WV 19

- blank
- Aluminium, welded (2.5 kg)
- L150 × W221 × H300

Part no.: **209110 0190**

### Cover plate for WV 2

- Naturally anodised
- Aluminium sheet, weight 0.8 kg

Part no.: **209110 0021**

### Cover plate for WV 3

- Naturally anodised
- Aluminium sheet, weight 1.15 kg

Part no.: **209110 0031**

### Cover plate for WV 6

- Naturally anodised
- Aluminium sheet, weight 1.8 kg

Part no.: **209110 0061**

### Cover plate for WV 7

- Naturally anodised
- Aluminium sheet, weight 1.5 kg

Part no.: **209110 0071**

### Cover plate for WV 8

- Naturally anodised
- Aluminium sheet, weight 1 kg

Part no.: **209110 0081**

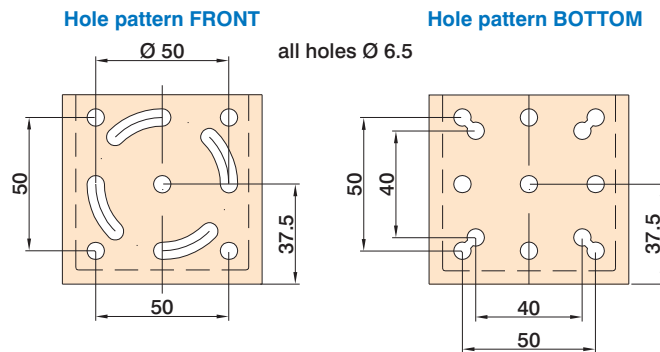
# Angle bracket

## Connectors

### Hole diagram

Angle bracket WV 1

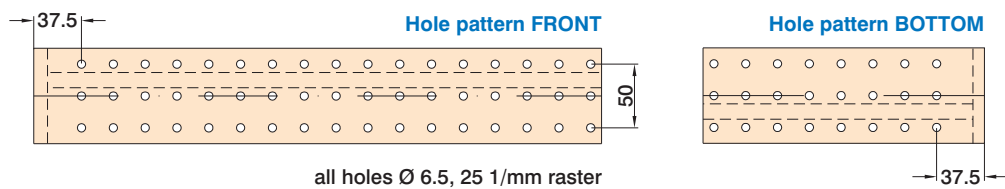
L 71 x W 75 x H 71 mm



### Hole diagram

Angle bracket WV 2

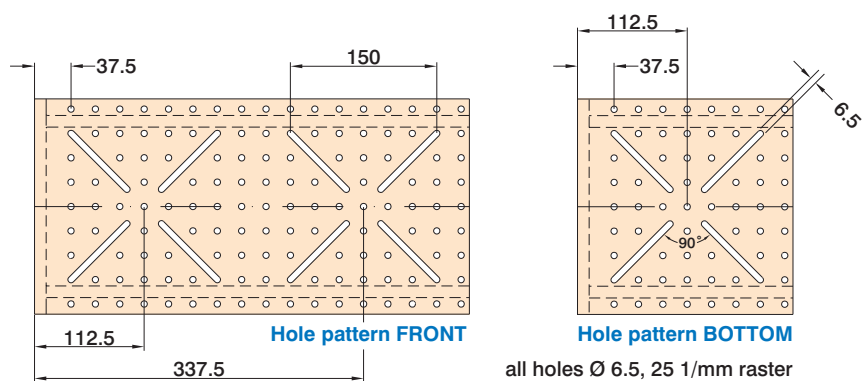
L 221 x W 75 x H 446 mm



### Hole diagram

Angle bracket WV 3

L 221 x W 221 x H 446 mm



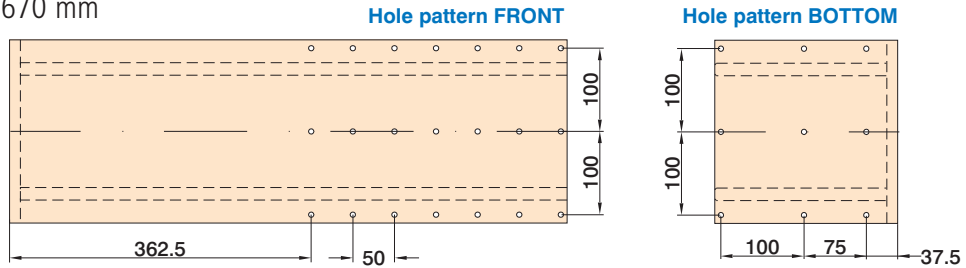
# Angle brackets

# Connectors

## Hole diagram

Angle bracket WV 6

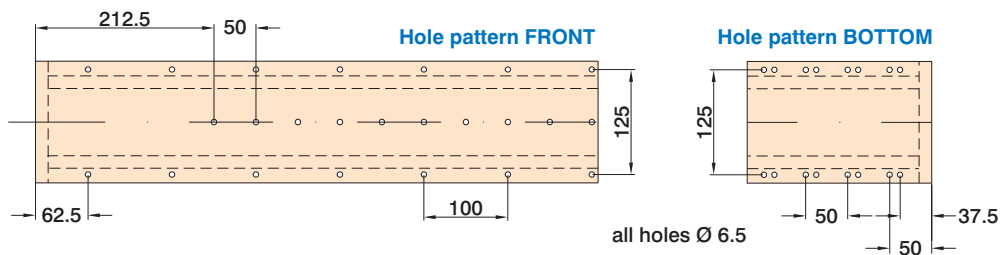
L 220 x W 220 x H 670 mm



## Hole diagram

Angle bracket WV 7

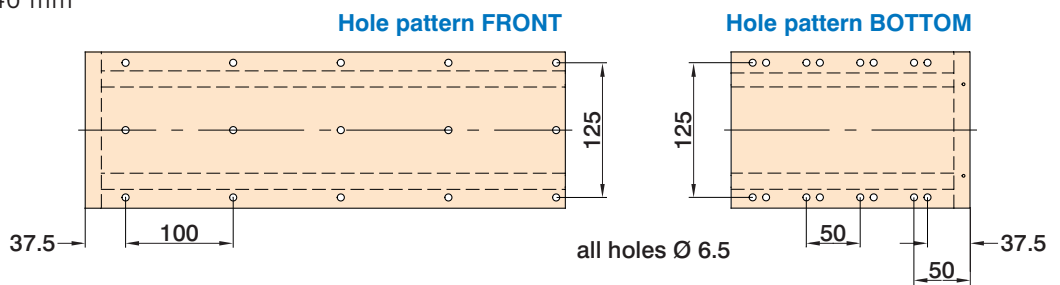
L 220 x W 145 x H 670 mm



## Hole diagram

Angle bracket WV 8

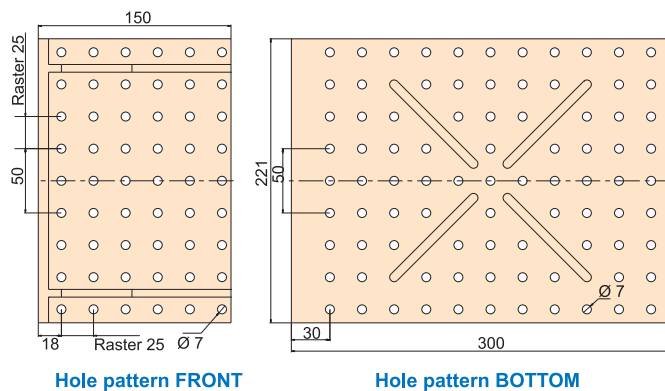
L 222 x W 145 x H 446 mm



## Hole diagram

Angle bracket WV 19

L 150 x W 221 x H 300 mm

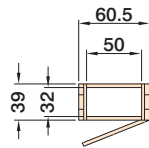


# Accessories

## Energy guidance chain

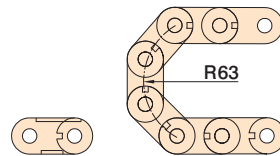


Dimensioned drawing  
Energy guidance chain



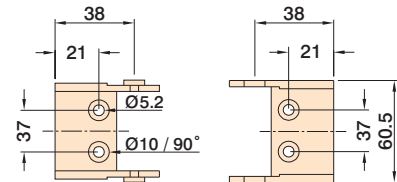
### Energy guide chain 3

- VE 1 unit at 1 m
- Part no.: **219204 1000**

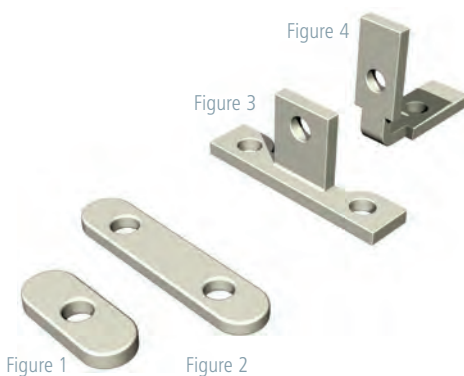


### Connectors for energy chain 3

- with strain relief
- VE 1 kit
- Part no.: **219205 0002**



## Tapped strips/sliding nuts



### Tapped strips

- M6** (no figure)
- Galvanised
  - Ra 50 mm
  - 3 x VE 1 m piece
  - Part no.: **209011**

### Sliding nut

- 2 × M6** (Figure 2)
- Galvanised
  - VE 50 pieces
  - Part no.: **209002 0004**

### Special angle sliding nut

- 3 x M6** (Figure 3)
- Galvanised
  - VE 25 pieces
  - Part no.: **209022 0003**

### Sliding nut

- M6** (Figure 1)
- Galvanised
  - VE 100 pieces
  - Part no.: **209001 0005**

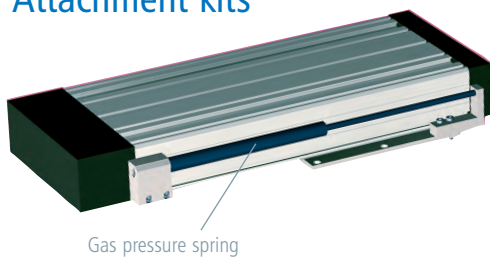
### Angle sliding nut

- 2 × M6** (Figure 4)
- Galvanised
  - VE 25 pieces
  - Part no.: **209021 0003**

### Sliding nut

- M5** (no figure)
- Galvanised
  - VE 20 pieces
  - Part no.: **209006 0001**

## Attachment kits

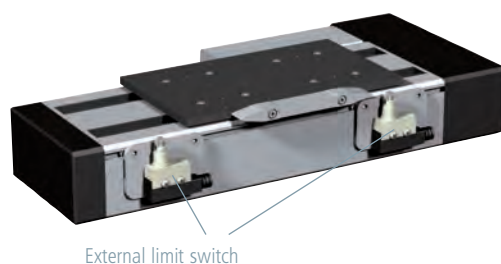


### Gas strut attachment kit

- Hub 220 mm
- Nominal length 490 mm
- Part no.: **216450 0001**

### Gas strut attachment kit

- Stroke 300 mm
- Nominal length 690 mm
- Part no.: **216451 0001**



### Limit switch attachment kit for LES 4

- for external limit switches
- Process path reduction by approx. 40 mm
- Part no.: **216460 0001**

### Limit switch attachment kit LES 6

- for external limit switches
- Process path reduction by approx. 40 mm
- Part no.: **216460 0003**

### Limit switch attachment kit LES 5

- for external limit switches
- Process path reduction by approx. 40 mm
- Part no.: **216460 0002**

### Mounting set for sealing air

- for LES4 - LES6
- Part no.: **216460 0006**

# Linear unit

## with linear motor

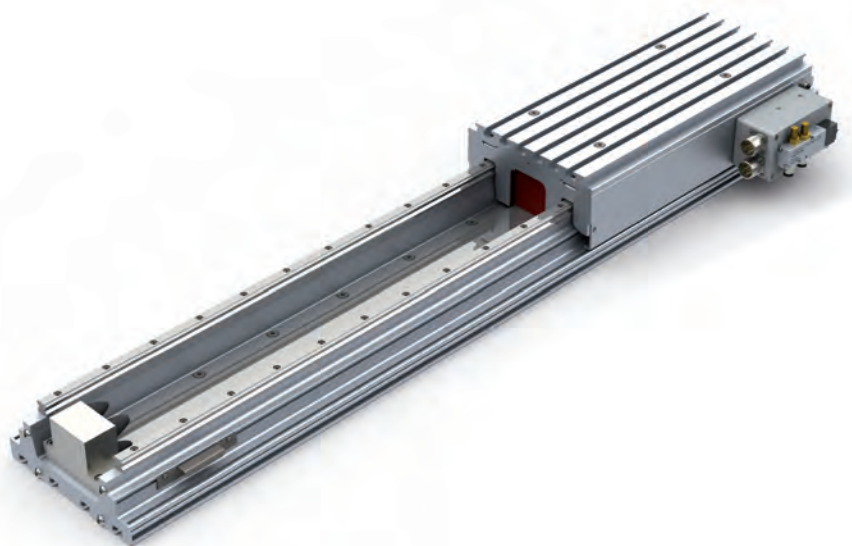
## iLD 50-6

### Features

- Robust design in industrial quality
- Pinpoint positioning accuracy
- Wear-free design with no mechanical connecting links
- high dynamic acceleration up to 30 m/s<sup>2</sup>
- Multi-motor operation with multiple, separately moveable slides
- Extendable to 15 m travel

### Options:

- Complete linear unit (see Order Information Table)
- Energy guide chain + guide plate to required length
- Brake MBPS1512ES1
- Motor cable, lengths 3, 5, 10 m
- Encoder cable, lengths 3, 5, 10 m, Linear motor to Metronix output stage
- Control package Metronix ARS 2310 (3-phase, 6 kVA, incl. configuration software)
- Control package Metronix ARS 2105 (1-phase, 2 kVA, incl. configuration software)
- Package B&R ACOPOS 1045 (3-phase, 2 kVA)
- Package B&R ACOPOS 1090 (3-phase, 4kVA)
- Package B&R ACOPOS 1180 (3-phase, 6 kVA)
- Switching unit Metronix output stage
- Drive controller ISEL iMD 40
- CAN CPC 12 positioning module
- Cable set iLD 50-6 for ISEL iMD 40



### General

Linear units with linear motors are advantageous in precisely those areas where linear units with typical spindle drives are limited - they achieve high values of acceleration, offer pinpoint positioning and operate practically wear-free due to the absence of mechanical linkages.

Linear motors are increasingly used in linear technology machine tool applications, positioning systems and handling systems. Linear units with profile guides are particularly suitable for use in both machine tools and positioning systems.

isel iLD series linear units are constructed from rigid aluminium profiles. Guides consist of proven guide rails and recirculating ball shaft slots. A magnetic length-measuring system is also included. In this regard, isel linear motor units have the advantage of greater acceleration and higher traverse velocity. Iron-core linear motors can produce very high forces. An integrated brake is offered as an option, to allow the iLD to also be used in the vertical mode. The "made by isel" concept stands for optimum price/performance-ratio. This in turn means very short amortisation periods for customers.

### Ordering data

Part number	L	L1
237110 0069	691	181
237110 0089	892	382
237110 0109	1094	584
237110 0129	1296	786
237110 0149	1497	987
237110 0169	1699	1189
237110 0190	1900	1390
237110 0210	2102	1592
237110 0230	2304	1794
237110 0250	2505	1995
237110 0270	2707	2197
237110 0290	2908	2398
237110 0311	3110	2600
237110 0331	3312	2802
237110 0351	3513	3003

# Linear unit

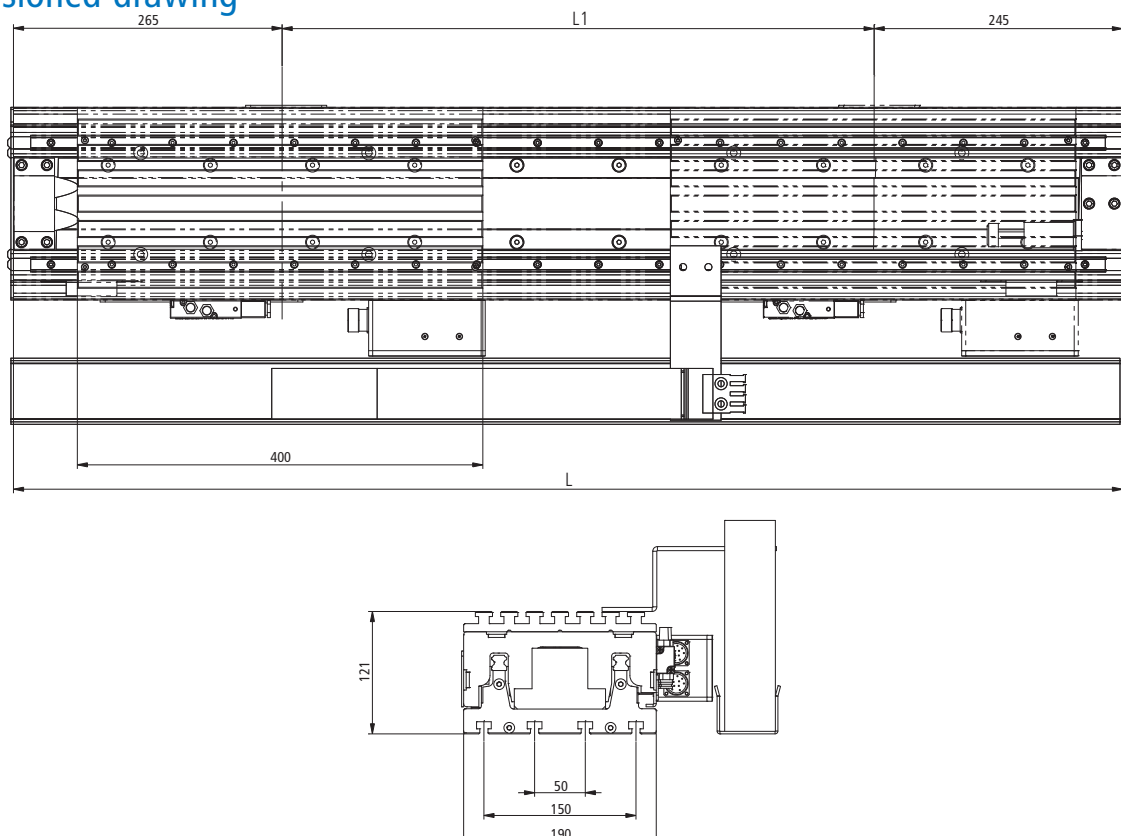
with linear motor

## iLD 50-6

### Technical specification

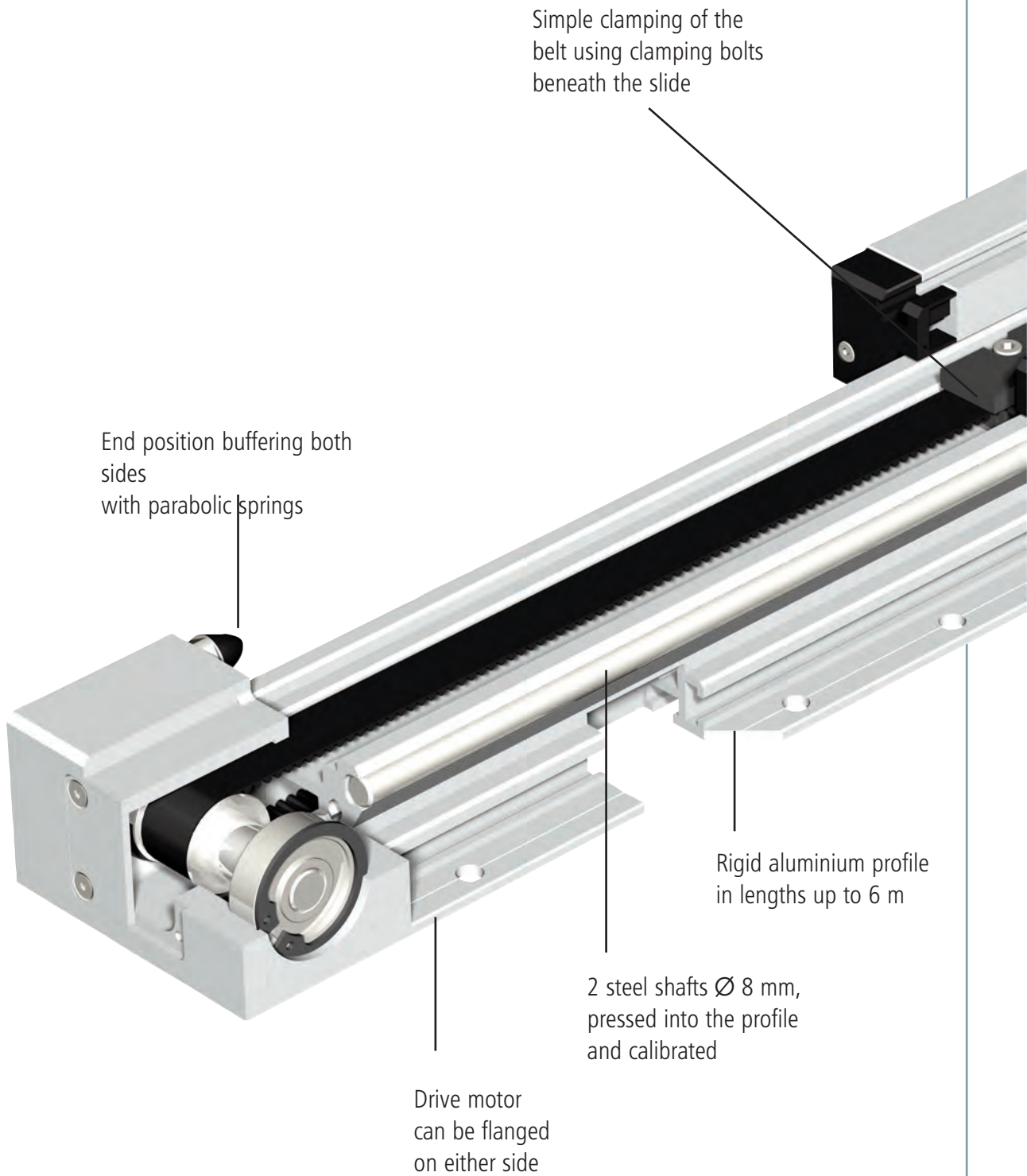
General	
Areas of application	Positioning axes for the semiconductor industry and for general industrial applications, CNC machine axis
Processing speed (m/s)	to 4.5
Acceleration (m/s)	to 30
Repeatability (mm)	< 0.01
Process path (mm)	181 to 3003, optionally extendible to 15000
Drive electronics	Servo amplifier, communication via CAN bus or analogue input (+/- 10 V)
Maintenance	Maintenance-free, rapid component replacement (MTTR approx. 2 hours)
Mechanics	
Profile	Bend-proof hollow chamber profile (isel ILF 6), straightness of 0.1 mm per 1 m length, Bending max. 0.2 mm per 1 m length under 50 kg load, max. load 100 kg
Guides	Profile rail guide Series 15 to DIN EN 120/20
Mechanical brake (optional)	Profile guide brake, pneumatically operated, Braking power Z-axis < 0.1 mm stationary, 50 mm at full speed
Stop position damping	Adjustable or parabolic spring for opposite side + pneumatic spring respectively
Installation options	X-axis, X,Y-axis, Z-axis
Maximum adjustment force	285 N
Electronics	
Limit position switch	inductive with adjustable limit position, circular plug connection (8x8x40)
Magnetic strip	isel MS 50
Linear motor	isel LS 50, iron core linear motor with magnetic rails, with or without audio signal, nominal current 6 A, peak current 15 A, max. feed force 600 N
Length measuring system	isel IMS, incremental measuring system
Motor / encoder connection	Protection type IP 67, M23 connecting socket for motor and encoder cable
Energy chain	Optional
Supported interfaces	Standard RS422 A <sub>1</sub> /A <sub>2</sub> , B <sub>1</sub> /B <sub>2</sub> optional z <sub>1</sub> /z <sub>2</sub> , Option SIN/COS 1V <sub>ss</sub> +20%, -40%, Z and /Z Right-sign

### Dimensioned drawing



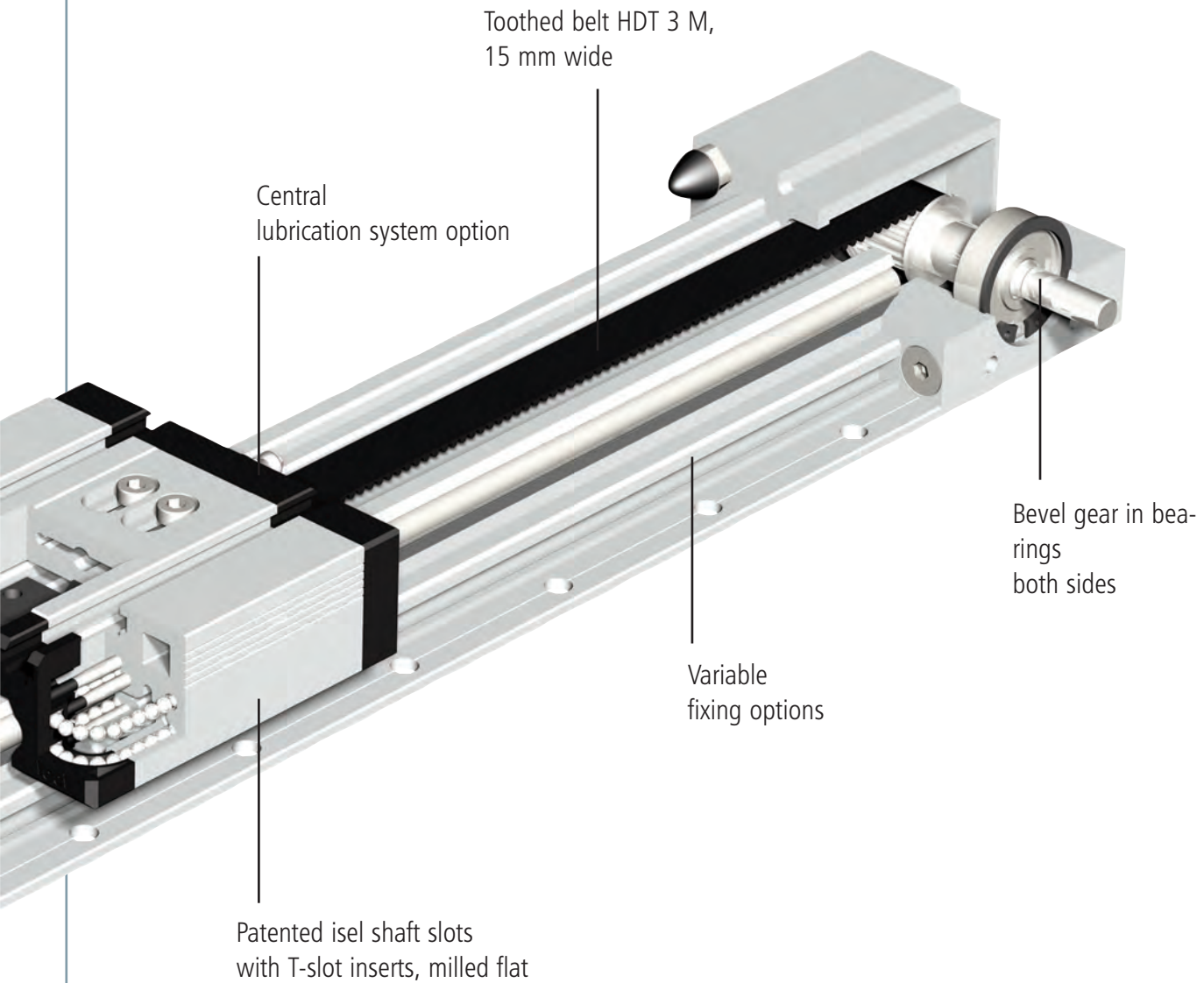


# Functional overview Linear unit with toothed belt drive



# Functional overview

## Linear unit with toothed belt drive



# Linear units with toothed belt drive

## LEZ 1

Guides  
and shaft slides  
also available stainless.



with shaft slide



with trolley

### Features

- Aluminium profile, miniature linear guide LFS-8-2
- No-play feed with toothed belt drive
  - toothed belt with 3 mm interval, width 9 mm
- Feed per turn: 60 mm
- Repeatability less than or equal to  $\pm 0.2$  mm
- Max. feed. 1.5 m/s

Accessories can be found on pages 2-94.

#### Options:

- Special 100 mm raster lengths to order, max. 6000 mm
- Securing with integrated M6 tapped rail, raster 50 mm

### Ordering key

232 005 XXXX

#### Drives/Slides

##### Trolley

- 8 = without motor, with shaft slide
- 9 = without motor, with trolley

#### Profile lengths LFS-8-2 (mm)

- 298, 398, 498, 598, 675, 698, 798, 998, 1498, 1798, 1998, 2498, 2998  
 (e. g. 398 mm = 040  
 675 mm = 068)  
 Option: up to 6000 mm

### Technical specification

Belt type.....HTD 3M, width 9 mm  
 Slide weight.....0.430 kg  
 Weight without drive module.....1000 mm = 3 kg  
 specific weight of the toothed belt.....0.0225 kg/m  
 Trolley weight.....1.03 kg  
 specific guide weight.....0.200 kg/100 mm  
 Effective  $\varnothing$  of the synchronous disks.....19.10 mm  
 Moment of inertia of the synchronous discs..... $5.585 \times 10^{-7}$  kgm<sup>2</sup>  
 Feed per turn.....60 mm

Drive module with stepper motor MS-045 HT

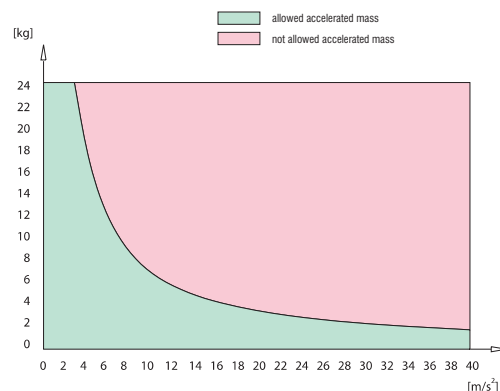


Drive module with stepper motor MS-135 HT



### Load diagram

Permitted accelerated weights relative to the belt strength.\*



\* with vertical construction, the acceleration due to gravity ( $g = 9.81$  m/s<sup>2</sup>) must be taken into account

Bending data is on page 2-23.

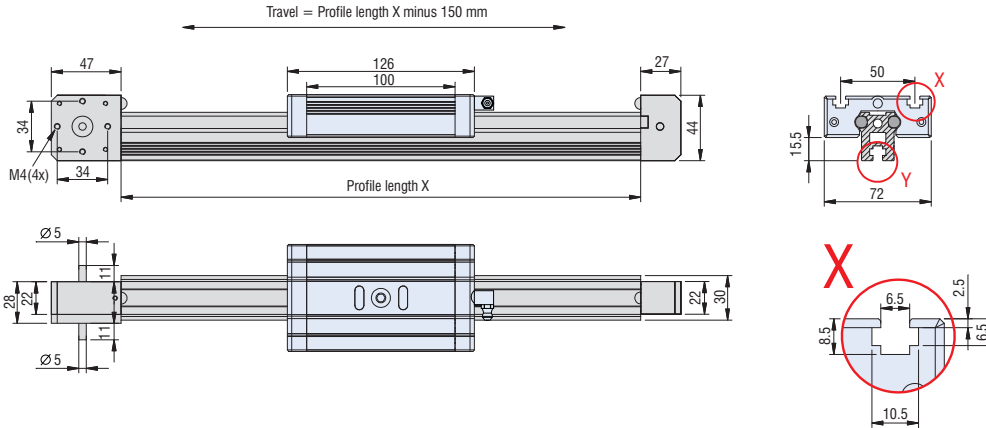
# Linear units

with toothed belt drive

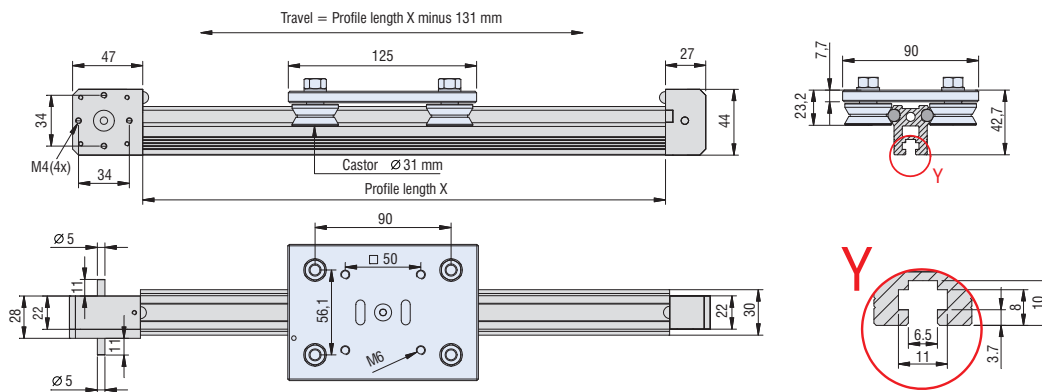
## LEZ 1

### Dimensioned drawings

without motor, with shaft slides



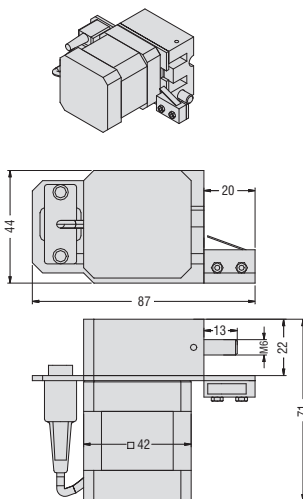
without motor, with trolley



### Motor modules (Motor pin assignments are on Page 2-70.)

Drive module with stepper motor  
MS-045 HT (direct drive)  
Feed: 60 mm / turn

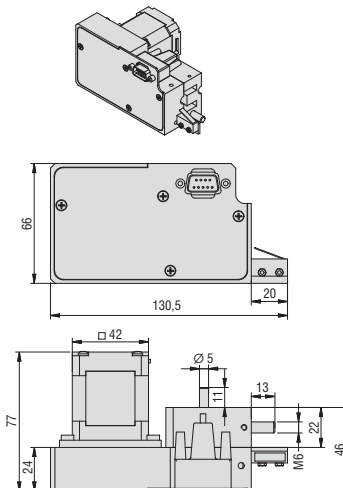
Part no.: **396048 3015**



Total length with motor module: profile length + 94 mm

Drive module with stepper motor  
MS-045 HT (reduction 2:1)  
Feed: 30 mm / turn

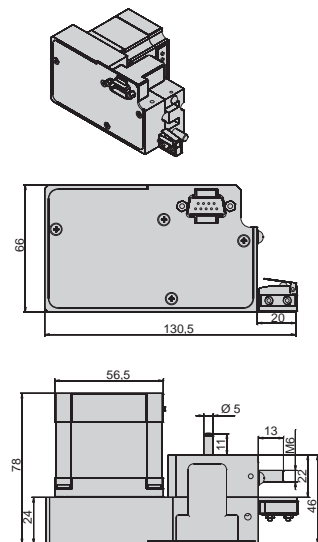
Part no.: **396049 3015**



Total length with motor module: profile length + 138 mm

Drive module with stepper motor  
MS-135 HT (reduction 2:1)  
Feed: 30 mm / turn

Part no.: **396056 3015**



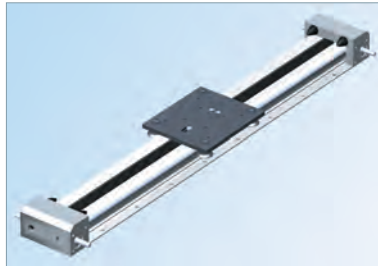
# Linear units with toothed belt drive

## LEZ 2

Guides  
and shaft slides  
also available in a stain-  
less version



with shaft slide



with trolley

### Features

- Aluminium profile with miniature linear guide LFS-8-5
- No-play feed with toothed belt drive - toothed belt with 5 mm interval, width 25 mm
- Max. feed. 5 m/s
- Shaft slides WS 3, L 176 × W 130 mm
- Feed per turn: 70 mm
- Repeat accuracy less than or equal to ± 0.2 mm
- available in lengths up to 6,000 mm

Accessories can be found on pages 2-92

### Options:

- Special 100 mm raster lengths available to order, max. 6000 mm
- Also as direct drive with
  - stepper motor
  - Servomotor
- Overrun limit switch with lead (only integrated in conjunction with drive module)

### Ordering key

232 002 XXXX

Profile lengths (mm)

696, 996, 1496, 1996,  
2496, 2996

(e. g. 696 mm = 070  
1496 mm = 150)

Option: up to 6000 mm

### Drives/Slides, Trolley

8 = without motor, with shaft slides

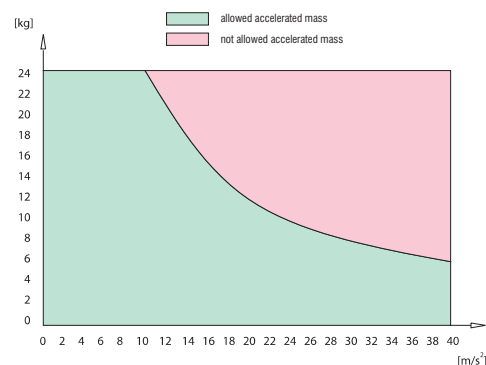
9 = without motor, with trolley

### Technical specification

Belt type.....	HTD 5M, width 25 mm
Slide weight.....	0,940 kg
Weight without drive module.....	1000 mm ≅ 7.9 kg
specific weight of the toothed belt.....	0.09 kg/m
Roller carriage weight.....	2.03 kg
specific guide weight.....	0.472 kg/100 mm
Effective diameter of the synchronous disks.....	∅ 22.28 mm
Moment of inertia of the synchronous disks.....	5.58·10 <sup>-6</sup> kgm <sup>2</sup>
Feed per turn.....	70 mm

### Load diagram

Permitted accelerated weights relative to the belt strength.\*

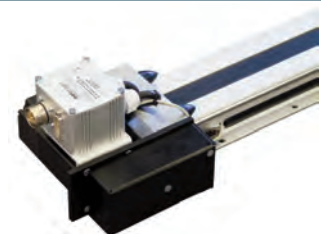


\* with vertical construction, the acceleration due to gravity (g = 9.81 m/s<sup>2</sup>) must be taken into account

### Linear guide rail LFS-8-5

Moment of inertia I <sub>x</sub> .....	137,48 cm <sup>4</sup>
Moment of inertia I <sub>y</sub> .....	27,98 cm <sup>4</sup>
Resistance torque W <sub>x</sub> .....	23,91 cm <sup>3</sup>
Resistance torque W <sub>y</sub> .....	13,09 cm <sup>3</sup>

Drive module  
with servo motor  
EC 60 L

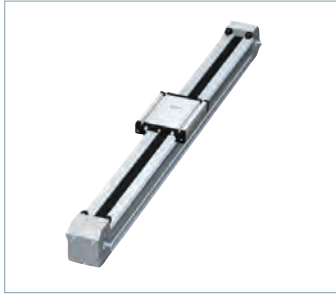




# Linear units with toothed belt drive

## LEZ 3

Guides  
and shaft slides  
also available stainless.



with shaft slide



with trolley

### Features

- Aluminium profile, miniature linear guide LFS-8-4
- No-play feed with toothed belt drive, toothed belt with 5 mm interval, width 25 mm
- Max. feed. 5 m/s
- Shaft slides WS3, L176 × W130 mm
- Feed per turn: 70 mm or 150 mm
- Repeat accuracy less than or equal to ± 0.2 mm
- Limit or reference switch accuracy < 0.1 mm
- Available in lengths up to 6,000 mm
- Motor modules can be flange-mounted on left or right side

Accessories can be found on page 2-92.

### Options:

- Special 100 mm raster lengths available to order, max. 6000 mm

### Ordering key

23200X XXXX

#### Profile lengths (mm)

698, 998, 1498, 1998, 2498, 2998

(e. g. 698 mm = 070  
1498 mm = 150)

#### Feed

6 = 150 mm / turn

7 = 70 mm / turn

#### Slides, trolley

0 = with shaft slides

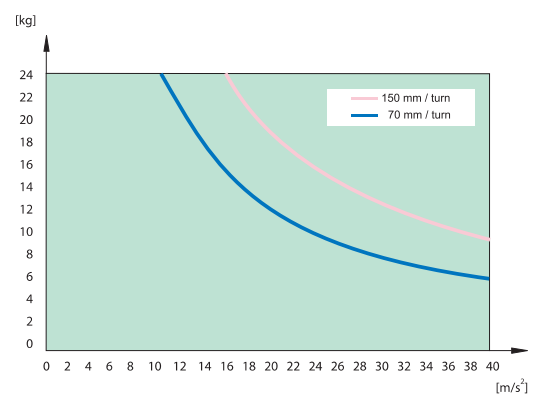
1 = with trolley

### Technical specification

Belt type.....	HTD 5M, width 25 mm
Slide weight.....	0.940 kg
Weight without drive module.....	1000 mm $\hat{=}$ 10.5 kg
specific weight of the toothed belt.....	0.09 kg/m
Roller carriage weight.....	2.03 kg
specific guide weight.....	0.648 kg/100 mm
Feed per turn.....	70 mm or 150 mm
Effective diameter of the synchronous disks	
Feed 70 mm/turn.....	22.28 mm
Feed 150 mm/turn.....	47.75 mm
Moment of inertia of the synchronous disks	
Feed 70 mm/turn.....	5.58E-6 kgm <sup>2</sup>
Feed 150 mm/turn.....	1,796.10 <sup>-4</sup> kgm <sup>2</sup>

### Load diagram

Permitted accelerated weights relative to the belt strength.\*



\* with vertical construction, the acceleration due to gravity (g=9.81 m/s<sup>2</sup>) must be considered

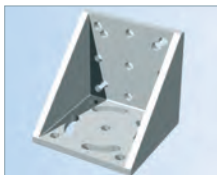
Bending data can be found on page 2-27.





# Accessories

## LEZ 1



Angle bracket

- for LEZ 1

Part no.: **209110 0010**



20/30 coupling

- for LEZ 1
- 1 VE = 1 coupling

Part no.: **218001 5081**

### Shaft slides 1/70

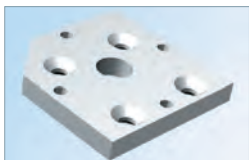
- L 96 x W 72 x H 28.5mm
- Clamping surface plane milled, T-slide thread M6
- Central greasing option, adjustable for no-play
- Weight: 0.35 kg
- Option: stainless steel version

Part no.: 223 100 0070  
stainless steel: **223 101 0070**

### Transmission shaft

Length 1 m  
Part no.: **227008 1000**

## LEZ 2



Motor fixing plate

- for LEZ 2
- incl. fixing material
- for direct drive see page C78 et seq.

Part no.: **232199 0004**



Coupling for Transmission shaft

- for LEZ 2
- 1 VE = 2 unit couplings

Part no.: **218050 0002**

### Transmission shaft $\varnothing$ 25 mm

Length 1 m  
Part no.: **219001 0125**

Length 2 m  
Part no.: **219001 0225**

### Stationary bearing for transmission shaft

VE 1 unit  
Part no.: **896202 5562**

## LEZ 3



Coupling for transmission shaft

- for LEZ 3
- 1 VE = 2 unit couplings

Part no.: **218050 0002**

### Transmission shaft $\varnothing$ 25 mm

Length 1 m  
Part no.: **219001 0125**

Length 2 m  
Part no.: **219001 0225**

### Stationary bearing for transmission shaft

VE 1 unit  
Part no.: **896202 5562**

## LEZ 9



30/40 coupling

- for LEZ 9
- 1 VE = 1 coupling

Part no.: **218002 8081**

### Shaft slides WS 11/70

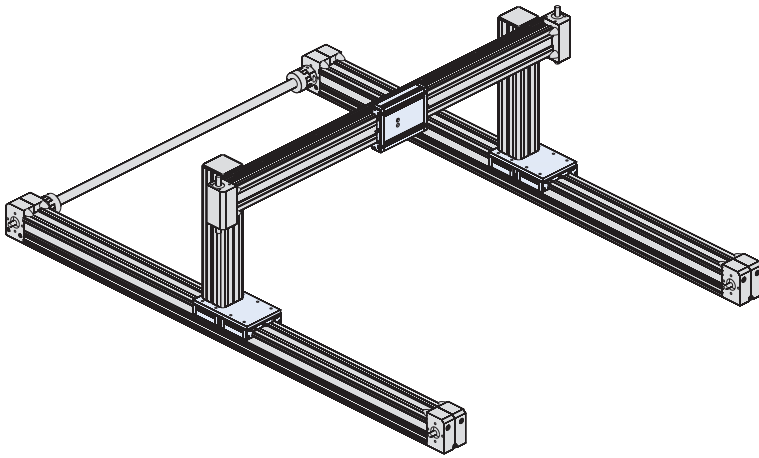
- L 96 x W 96 x H 32 mm
- Clamping surface plane milled, T-slide thread M6
- Central greasing option, adjustable for zero play
- Weight: 0.4 kg
- Option: stainless steel version

Part no.: **223111 0070**  
Stainless steel: **223111 1070**

### Transmission shaft

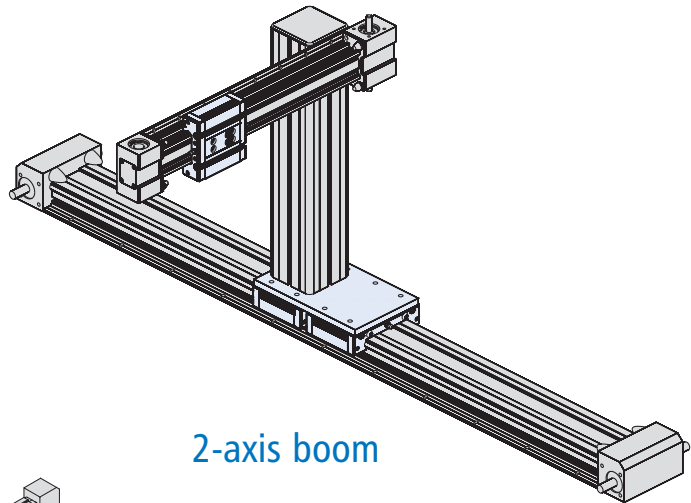
Length 1 m  
Part no.: **227008 1000**

## Examples in use



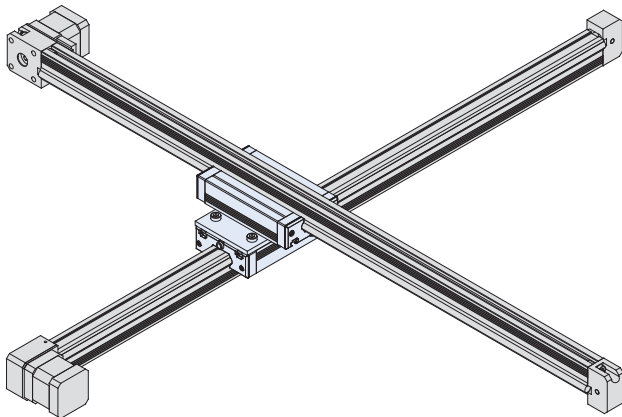
### 2-axis H-design

- 2 x LEZ 3
- 1 x LEZ 2
- Transmission shaft



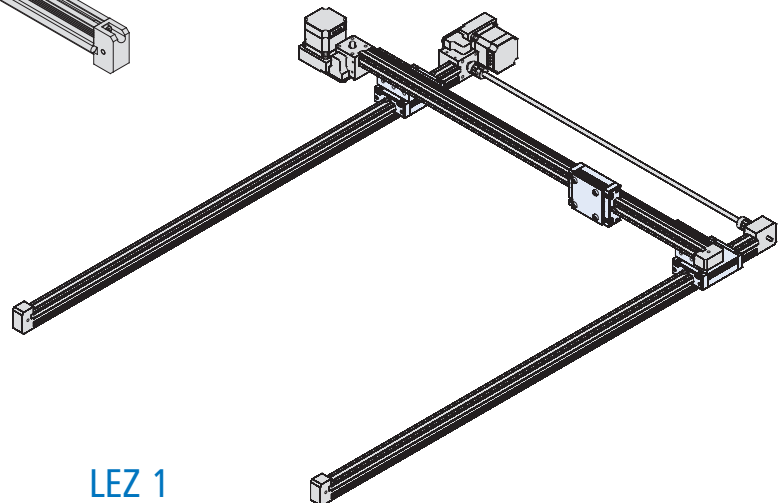
### 2-axis boom

- 1 x LEZ 2
- 1 x LEZ 9 (discontinued)



### Crossbench LEZ 1

- 2 x LEZ 1



### LEZ 1

- 2-axis flatbed configuration

# Rotational units

# Overview

**RDH-M** Indexing table / Rotary unit

2-96



**RDH-S** Indexing table / Rotary unit

2-98



**RDH-XS** Indexing table / Rotary unit

2-100



**DSH-S** Rotary tilting unit

2-102







**RF 1** Indexing table

2-104



# Rotational units

# Overview

MD 1	Miniature rotary unit		2-106
ZD 30	Rotary unit		2-108
ZR 20	Indexing table		2-109
ZDS 2030			2-110
Pin assignments			2-112
Transported loads Machining forces Feed			2-113

CAD data on our website [www.isel-germany.de](http://www.isel-germany.de)

## Indexing table / Rotary unit

## RDH-M



RDH-M as Indexing table  
(solid shaft design)

RDH-M as Rotary unit  
(hollow shaft design)



## Features

- With precision transmission
  - High load capacity, rigid drive bearing
  - Absence of play and high torsional rigidity
- Reduction 1:51 or 1:101
- Stepper or servomotor
- Protection class IP 65
- Stainless design
- Transfer accuracy < 1 minute of arc
- Repeatability <  $\pm 6$  seconds of arc
- Available in solid or hollow shaft design
- No maintenance

For pin assignment see page 2-112  
For transport loads see page 2-113

## Ordering key

2 6 6 2 X X 0 X 0 0

## Flanged shaft

- 0 = solid shaft
- 1 = hollow shaft

## Transmission reduction

- 0 = 101
- 1 = 51

## Motors

- 0 = Stepper motor MS 200 HAT with encoder (400 imp., 3-channel, RS422)
- 3 = brushless EC servomotor EC 60S
- 4 = brushed DC servomotor DC 100
- 5 = Stepper motor without encoder

## Accessories



## Chuck assembly

3-jaw chuck  $\varnothing$  125  
Part no.: **269063 2125**  
\* including flange



## Aluminium T-slot plate

$\varnothing$  240 mm/PT 25  
Part no.: **269050 0240**  
 $\varnothing$  365 mm/PT 25  
Part no.: **269050 0365**



## Tailstock unit RE M

Part no.: **269100 2100**  
(1000 mm)  
Part no.: **269100 2150**  
(1500 mm)  
Part no.: **269100 2200**  
(2000 mm)

# Indexing table / Rotary unit

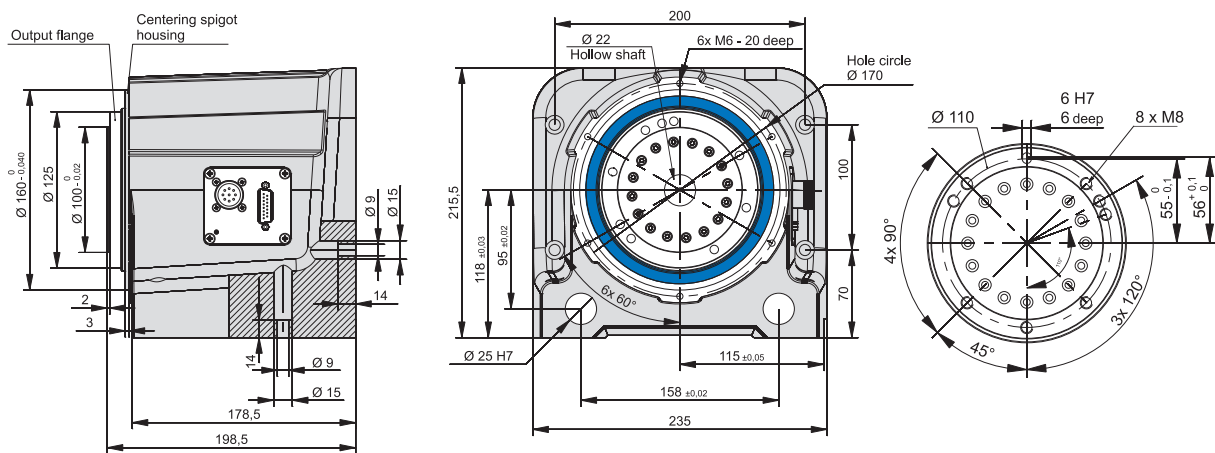
# RDH-M

## Technical specification

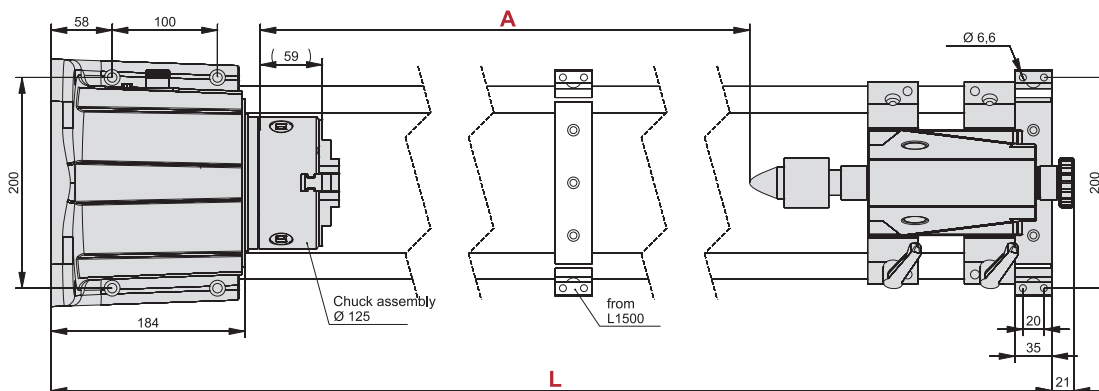
	stepper motor MS 200 HT *		EC servomotor EC 60S (brushless)		DC servo motor DC 100 (brushed)	
Reduction ratio	1:51	1:101	1:51	1:101	1:51	1:101
Nominal output speed [1/min]	4	2	22	11	22	11
Max. output speed [1/min]	at 1500 Hz (225 1/min)		at 1100 1/min			
	24	12	59	30	59	30
Nominal torque [Nm]	at 8000 Hz		--			
	24	46	9	17	7	14
Max. torque (short term) [Nm]	at 1500 Hz		--			
	--	--	42	80	39	73
Rated holding torque (static load) [Nm]	55	108	26	51	15	30
Max. transmission load [Nm]	98	157	98	157	98	157
Dynamic load factor C [N]	Limit for repeatable peak torque					
Static load factor C <sub>0</sub> [N]	21800					
Weight [kg]	35800					
	13.7					

\* Values for half-step operation

## Dimensioned drawings



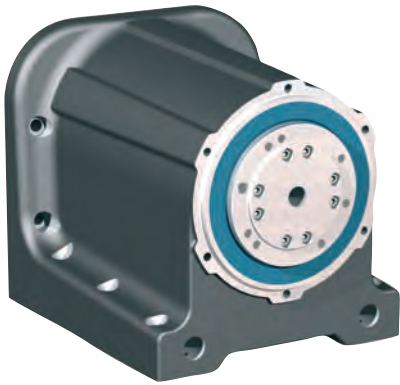
Versions	Part no.	L	A
Tailstock unit RE-M 1000 mm	269100 2100	1110	624.5
Tailstock unit RE-M 1500 mm	269100 2150	1610	1124.5
Tailstock unit RE-M 2000 mm	269100 2200	2110	1624.5





## Indexing table / Rotary unit

## RDH-S



RDH-S as Indexing table  
(solid shaft design)

RDH-S as Rotary unit  
(hollow shaft design)



## Features

- With precision transmission
  - High load capacity, rigid drive bearing
  - Absence of play and high torsional rigidity
- Reduction 1:51 or 1:101
- Stepper or servomotor
- Protection class IP 65
- Stainless design
- Transfer accuracy < 1.5 minute of arc
- Repeatability <  $\pm 6$  seconds of arc
- Available in solid or hollow shaft design
- No maintenance

For pin assignment see page 2-112

For transport loads, see page 2-113

## Ordering key

2 6 6 1 X X 0 X 0 0

## Flanged shaft

- 0 = solid shaft
- 1 = hollow shaft

## Transmission reduction

- 0 = 101
- 1 = 51

## Motors

- 0 = Stepper motor MS 045 HT with encoder (400 imp., 3-channel, RS422)
- 2 = brushless DC servomotor RE 40
- 3 = brushless EC servomotor EC 42
- 5 = Stepper motor without encoder

## Accessories



## Chuck assembly

3-jaw chuck  $\varnothing$  65

Part no.: **269060 3065\***

3-jaw chuck  $\varnothing$  80

Part no.: **269063 2080\***

3-jaw chuck  $\varnothing$  100

Part no.: **269063 2100\***

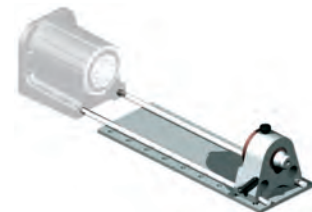
\* including flange



## Circular plate

$\varnothing$  150

Part no.: **269 050 0150**



## Tailstock unit RE S

for RDH-S

Part no.: **269100 1020** (200 mm)

Part no.: **269100 1030** (300 mm)

Part no.: **269100 1040** (400 mm)

Part no.: **269100 1050** (500 mm)

## Indexing table / Rotary unit

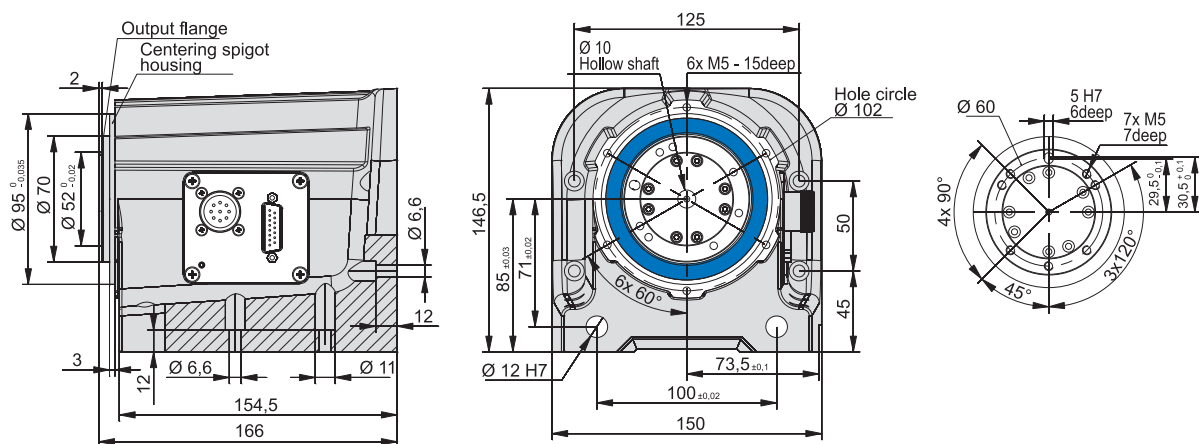
## RDH-S

## Technical specification

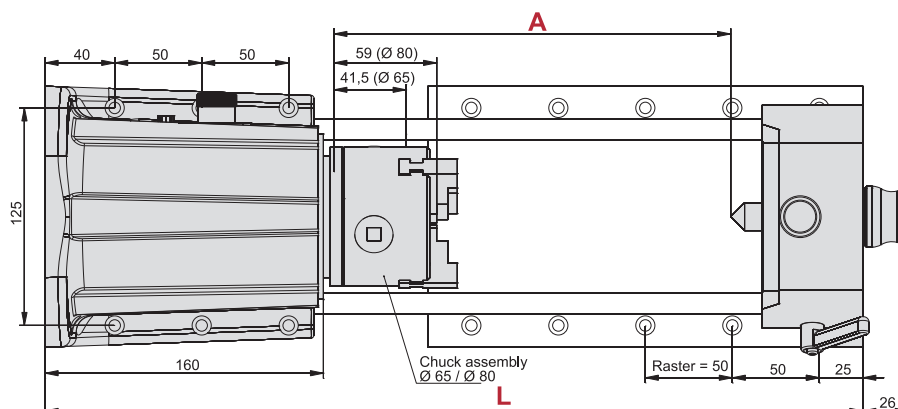
	stepper motor MS 045 HT *		EC servomotor EC 42 (brushless)		DC servo motor RE 40 (with brushes)	
Reduction ratio	1:51	1:101	1:51	1:101	1:51	1:101
Nominal output speed [1/min]	4	2	22	11	22	11
	at 1500 Hz (225 1/min)		at 1100 1/min		at 1100 1/min	
Max. output speed [1/min]	24	12	59	30	69	35
	at 8000 Hz		--		--	
Nominal torque [Nm]	7	11	4.8	9.2	4.6	9
	at 1500 Hz		--		--	
Max. torque (short term) [Nm]	--	--	7	11	7	11
Rated holding torque (static load) [Nm]	7	11	7	11	7	11
Max. transmission load [Nm]	18	28	18	28	18	28
	Limit for repeatable peak torque					
Dynamic load factor C [N]	5800					
Static load factor C <sub>0</sub> [N]	8600					
Weight [kg]	4.6					

\* Values for half-step operation

## Dimensioned drawings



Versions	Part no.	L	A
Tailstock unit RE-S 200 mm	269100 1020	370	128
Tailstock unit RE-S 300 mm	269100 1030	470	228
Tailstock unit RE-S 400 mm	269100 1040	570	328
Tailstock unit RE-S 500 mm	269100 1050	670	428



# Indexing table/Rotary unit

## RDH-XS



RDH-XS as Rotary unit



RDH-XS as Indexing table

### Features

- With precision transmission
  - High load capacity, rigid drive bearing
  - Absence of play and high torsional rigidity
- Reduction 1:50 or 1:100
- Stepper or servomotor
- Protection class IP 65
- Stainless design
- Transfer accuracy < 2 minutes of arc
- Repeatability <  $\pm 1$  minute of arc
- No maintenance

For pin assignment see page 2-112  
For transport loads, see page 2-113

### Ordering key

2 6 6 0 0 X 0 X 0 0

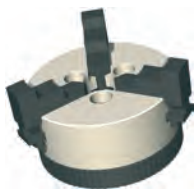
#### Transmission reduction

- 0 = 100
- 1 = 50

#### Motors

- 0 = Stepper motor MS 045 HT with encoder (400 imp., 3-channel, RS422)
- 2 = brushed DC servomotor RE 40
- 3 = brushless EC servomotor EC 42
- 5 = Stepper motor without encoder

### Accessories



#### Chuck assembly

3-jaw chuck  $\varnothing$  65

Part no.: **269060 4065\***

\* including flange



#### Tailstock unit RE XS

for RDH-XS

Part no.: **269100 0020** (200 mm)

Part no.: **269100 0030** (300 mm)

Part no.: **269100 0040** (400 mm)

Part no.: **269100 0050** (500 mm)

# Indexing table/Rotary unit

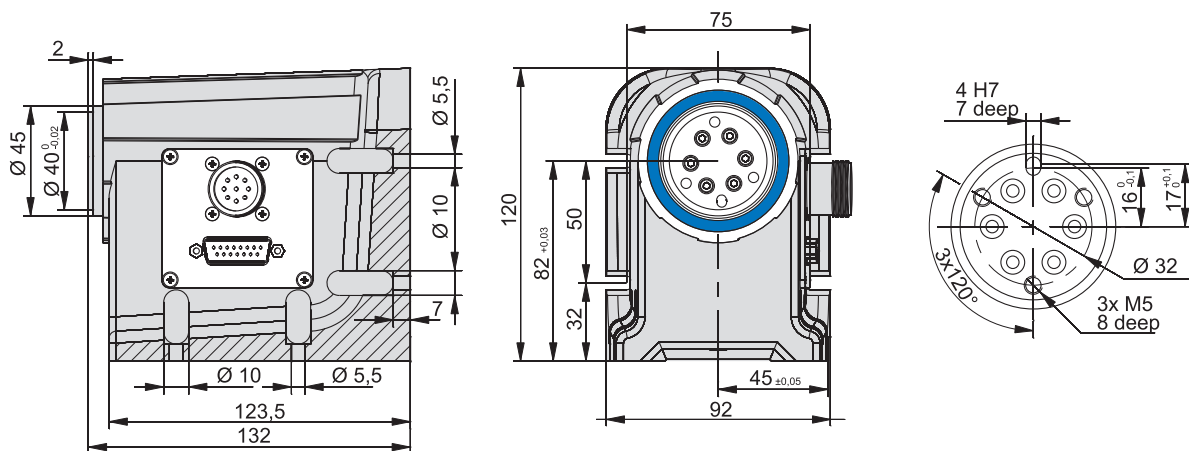
# RDH-XS

## Technical specification

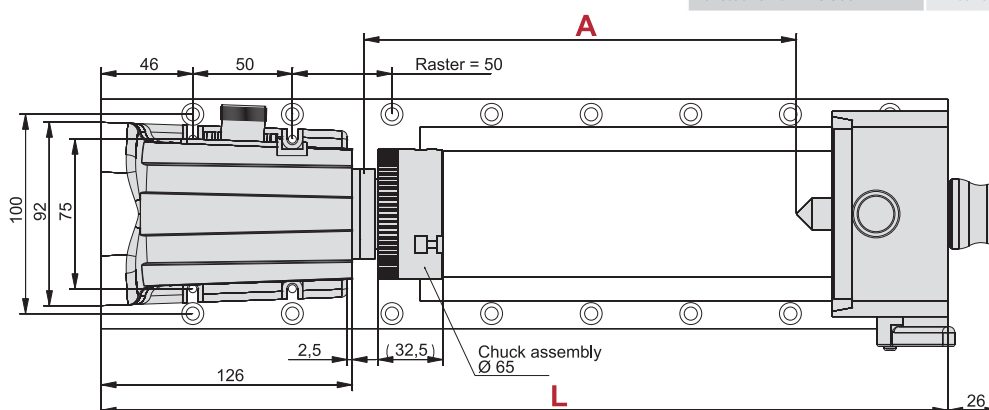
	stepper motor MS 045 HT *		EC servomotor EC 42		DC servo motor RE 40	
Reduction ratio	1:50	1:100	1:50	1:100	1:50	1:100
Nominal output speed [1/min]	5	2	22	11	22	11
	at 1500 Hz (225 1/min)		at 1100 1/min		at 1100 1/min	
Max. output speed [1/min]	24	12	59	30	70	35
	at 8000 Hz (1200 rpm)		--			
Nominal torque [Nm]	5	7	5	7	5	7
	at 1500 Hz (225 1/min)		--			
Max. torque (short term) [Nm]	--	--	5	7	5	7
Rated holding torque (static load) [Nm]	5	7	5	7	5	7
Max. transmission load [Nm]	9	14	9	14	9	14
	Limit for repeatable peak torque					
Dynamic load factor C [N]	392					
Static load factor C <sub>0</sub> [N]	392					
Weight [kg]	2.3					

\* Values for half-step operation

## Dimensioned drawings



Versions	Part no.	L	A
Tailstock unit RE-XS 200 mm	269100 0020	325	117
Tailstock unit RE-XS 300 mmm	269100 0030	425	217
Tailstock unit RE-XS 400 mmm	269100 0040	525	317
Tailstock unit RE-XS 500 mmm	269100 0050	625	417



# Rotary tilting unit

## DSH-S



### Features

- With precision transmission
  - High load capacity, rigid drive bearing
  - Absence of play and high torsional rigidity
- With rotary unit RDH-S
- Reduction 1:51 or 1:101
- Stepper or servomotor
- Protection class IP 65
- Stainless design
- Transfer accuracy <math>< 1.5</math> minute of arc
- Repeatability <math>< \pm 6</math> seconds of arc
- No maintenance
- Swivel range continuously variable

For pin assignment see page 2-112

For transport loads, see page 2-113

### Ordering key

2 6 5 4 1 X X 0 0 0

#### Motors

- 0 = Stepper motor MS 045 HT with encoder (400 imp., 3-channel, RS422)
- 2 = brushed DC servomotor RE 40
- 3 = brushless EC servomotor EC 42
- 5 = Stepper motor without encoder

#### Transmission reduction

- 0 = 1 : 101
- 1 = 1 : 51

### Accessories



#### Chuck assembly

3-jaw chuck  $\varnothing$  65

Part no.: **269060 3065\***

3-jaw chuck  $\varnothing$  80

Part no.: **269063 2080\***

3-jaw chuck  $\varnothing$  100

Part no.: **269063 2100\***

\* incl. Flange



#### Circular plate

$\varnothing$  150

Part no.: **269 050 0150**

# Rotary tilting unit

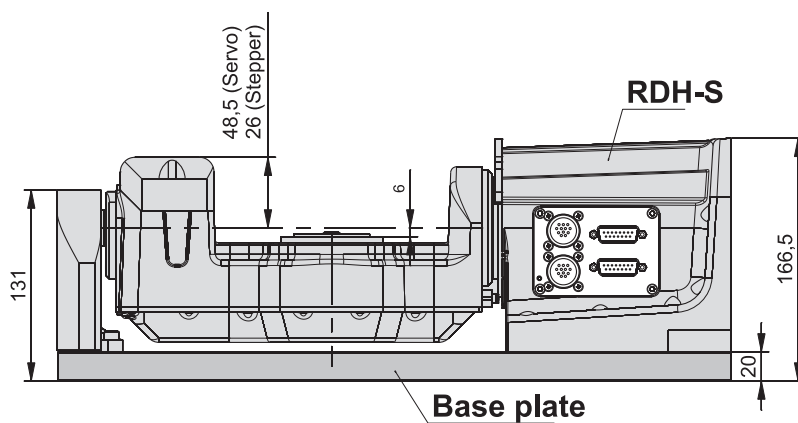
# DSH-S

## Technical specification

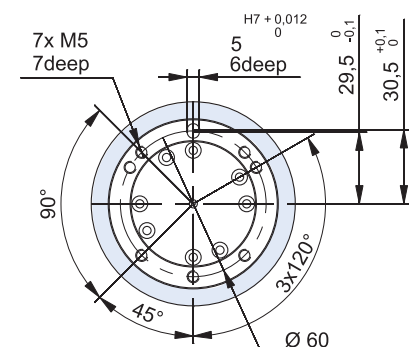
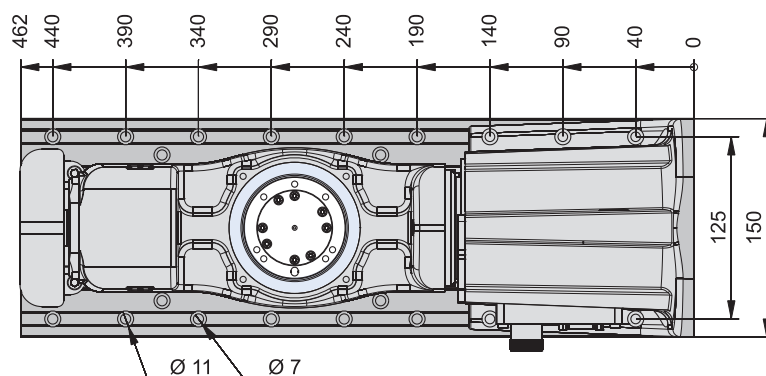
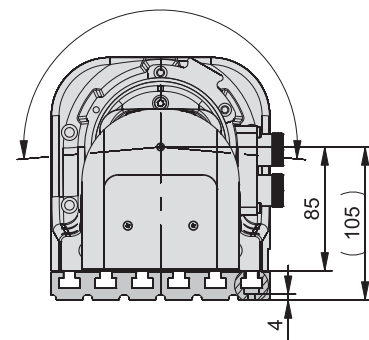
	stepper motor MS 045 HT *		EC servomotor EC 42		DC servo motor RE 40	
	1:51	1:101	1:51	1:101	1:51	1:101
Reduction ratio	1:51	1:101	1:51	1:101	1:51	1:101
Nominal output speed [1/min]	4	2	22	11	22	11
	at 1500 Hz (225 1/min)		at 1100 1/min		at 1100 1/min	
Max. output speed [1/min]	24	12	59	30	69	35
	at 8000 Hz		--			
Nominal torque [Nm]	7	11	4.8	9.2	4.6	9
	at 1500 Hz		--			
Max. torque (short term) [Nm]	--	--	7	11	7	11
Rated holding torque (static load) [Nm]	7	11	7	11	7	11
Max. transmission load [Nm]	18	28	18	28	18	28
	Limit for repeatable peak torque					
Dynamic load factor C [N]	5800					
Static load factor C <sub>0</sub> [N]	8600					
Weight [kg]	12 kg					

\* Values for half-step operation

## Dimensioned drawings

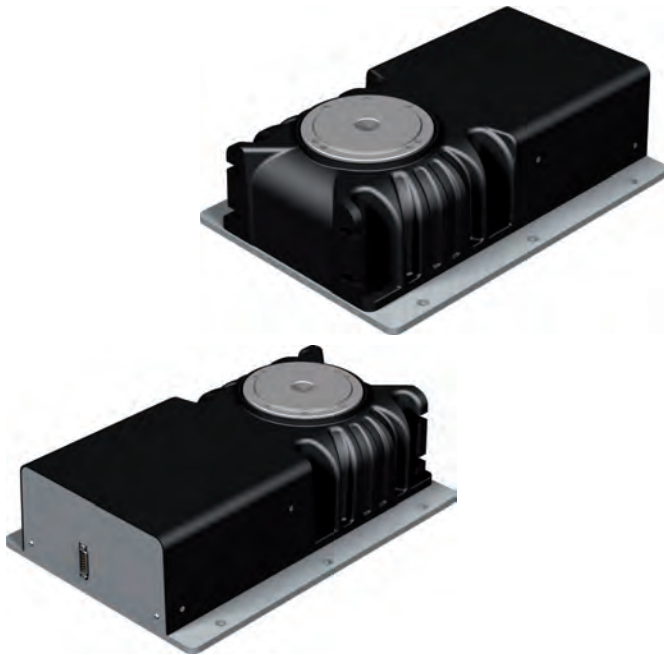


Swivel range  
190° / max. 230°



# Indexing table

## RF 1



### Features

- Low play toothed belt drive with stepper or DC servo motor
- Reduction 1: 24 (standard)
- Weight: 14.6 kg

For pin assignment see page 2-112  
For transport loads, see page 2-113

### Options:

- Reduction installation set  
1 : 52 or 1 : 100
- Electromagnetic brake [60 Nm]
- Step motor drive with encoder
- CNC controller

### Ordering key

2 6 0 2 4 X X X 0 0

#### Motores

- 1 = Stepper motor MS 200 HT without encoder
- 4 = brushed DC servomotor DC 100
- 5 = brushless EC servomotor EC 60S

#### Brake

- 0 = without brake
- 1 = magnetic brake

#### Plug

- 1 = servomotor: M23 + SubD15
- 2 = Stepper motor: SubD9

### Accessories



#### Installation set

for reduction 1:52

Part no.: **269077 0001**

for reduction 1:100

Part no.: **269077 0002**



#### Aluminium T-slot plate

Ø 240 mm / PT 25

Part no.: **269050 0240**

Ø 365 mm / PT 25

Part no.: **269050 0365**



#### Chuck assembly

3-jaw chuck Ø 125

Part no.: **269063 2125**



# Indexing table

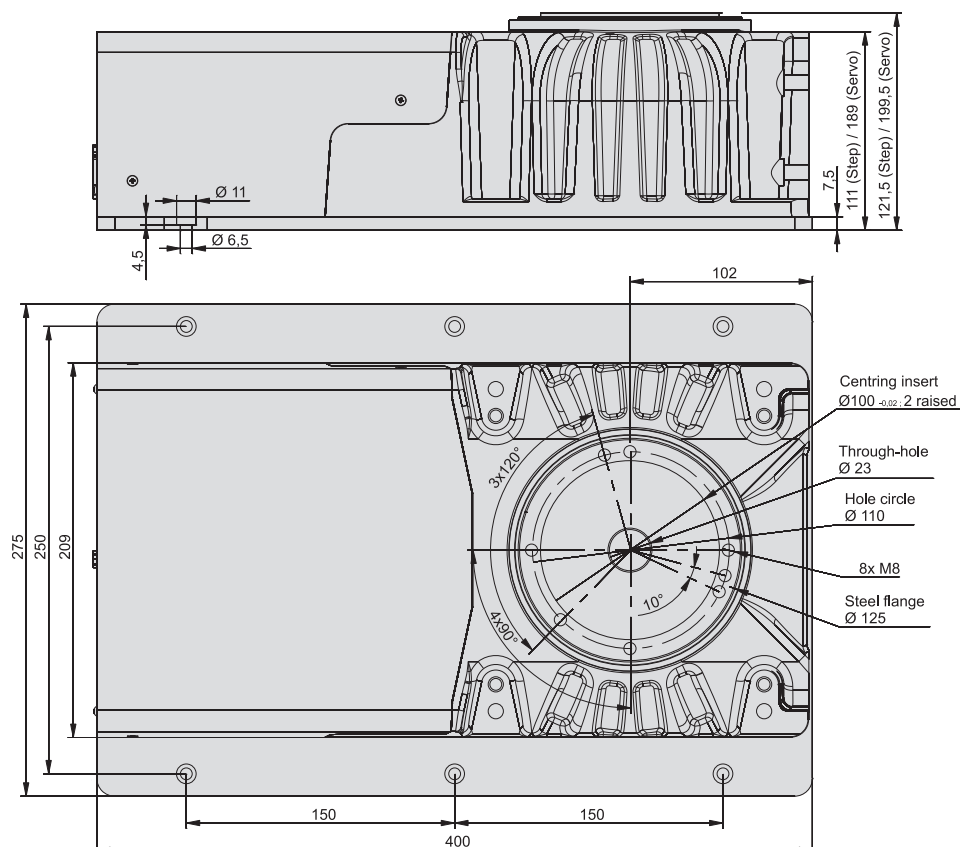
# RF 1

## Technical specification

	stepper motor MS 200 HT *			Servomotor DC 100/EC 60S		
Reduction ratio	1:24	1:52	1:100	1:24	1:52	1:100
Output speed [1/min]	0 - 50	0 - 23	0 - 12	0 - 125	0 - 58	0 - 30
Operating torque (0 - 500 Hz) [Nm]	20	42	75	--		
Operating torque (500 - 1000 Hz) [Nm]	18	38	75	--		
Rated torque [Nm]	--			41070	13 / 22	25 / 42
Rated holding torque (static load) [Nm]	37	75	75	41102	16 / 26	30 / 50
Angle accuracy [°]	0.16					
Weight [kg]	14.6					

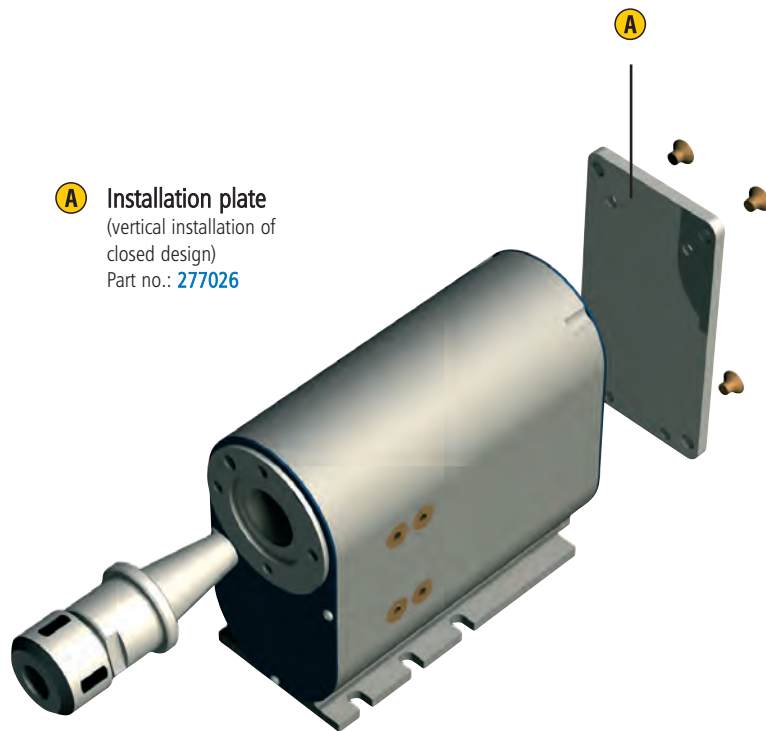
\* Values for half-step operation

## Dimensioned drawings



# Mini rotary unit

## MD 1



**A** Installation plate  
(vertical installation of  
closed design)  
Part no.: **277026**

### Features

- Low play toothed belt drive with stepper or DC servo motor
- Reduction 1 : 20
- Shaft  $\varnothing 9$  mm with boring
- Housing flange with inner cone SK 20
- Weight:  
depending on design, from 1.35 kg

For pin assignment see page 2-112  
For transport loads, see page 2-113

#### Options:

- Additional installation plate  
(vertical installation possible)
- CNC controller

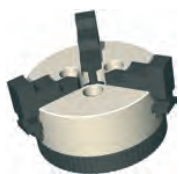
### Ordering key

**261010 0X10**

#### Motors

- 0** = MS 045 HT stepper motor
- 2** = DC servomotor RE 40, with brushes
- 3** = brushless EC servomotor EC 42

### Accessories



**Chuck assembly**  
3-jaw chuck  $\varnothing 65$   
Part no.: **269060 2065\***

\* incl. Flange



**Collet holder**  
Collet holder SK 20  
for tools  $\varnothing 3 - 13$  mm, with  
installation ring  
Part no.: **239172 0020**

Collets are on page 5-32.

# Mini rotary unit

# MD 1

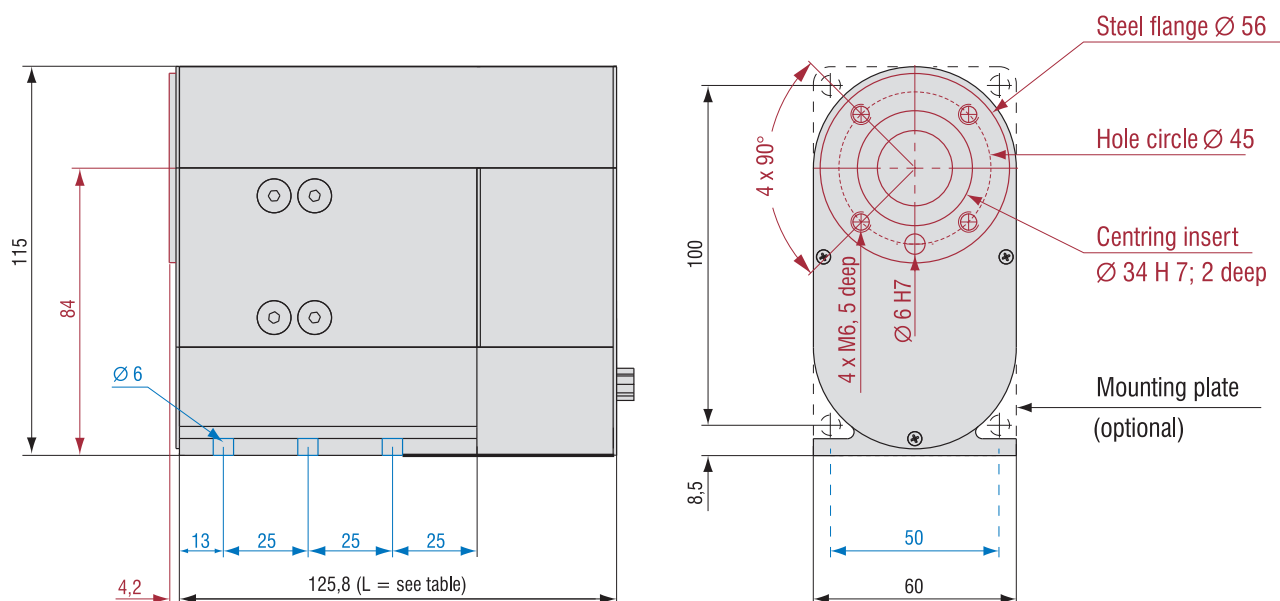
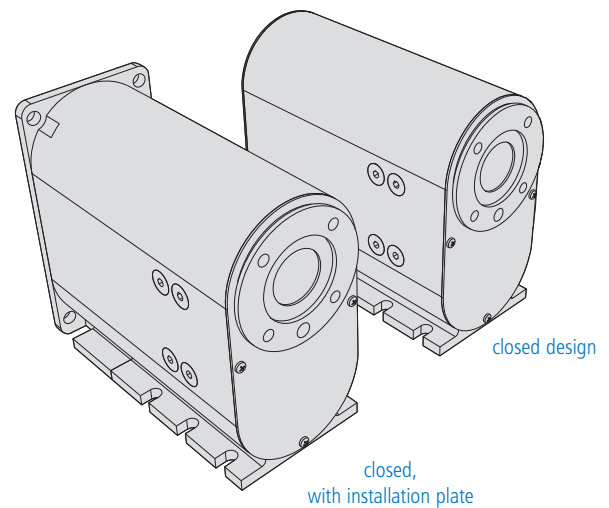
## Technical specification

	MS 045 HT stepper motor *	DC servomotor RE 40	EC servomotor EC 42
Reduction ratio	1:20	1:20	1:20
Output speed [1/min]	0 - 60	0 - 175	0 - 150
Operating torque (0 - 1600 Hz) [Nm]	8	--	--
Rated torque [Nm]	--	3	3.2
Rated holding torque (static load) [Nm]	14	3.9	4
Min. step (positional accuracy) [arcmin]	3.5	2	2
Gewicht [kg]		1.35	

\* Values for half-step operation

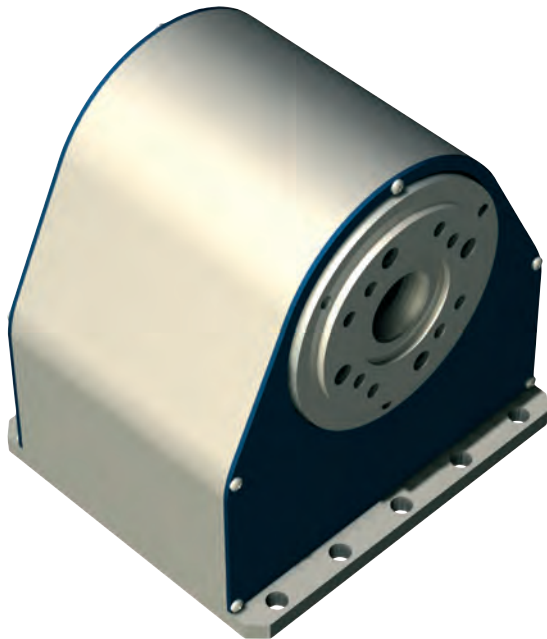
## Dimensioned drawings

	Length L per step	Length L for DC servo
closed design	129 mm	180 mm
closed with installation plate	133 mm	184 mm



# Rotary unit

## ZD 30



### Features

- Low play toothed belt drive with Stepper motor
- Reduction 1 : 30
- Shaft with  $\varnothing$  15 mm boring
- Housing flange with inner cone SK 20
- Weight: 2,9 kg

For pin assignment see page 2-112  
For transport loads, see page 2-113

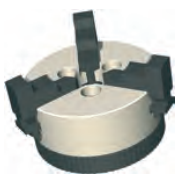
### Options:

- CNC controller via Sub D

### Ordering data

ZD 30 rotary unit  
Part no.: **261100 0000**

### Accessories



**Chuck assembly**  
3-jaw chuck  $\varnothing$  65  
Part no.: **269060 2065\***



**Chuck assembly**  
3-jaw chuck  $\varnothing$  80  
Part no.: **269063 3080\***



**Collet holder**  
Clamping ring housing SK 20  
for tools  $\varnothing$  3 - 13 mm, with  
installation ring  
Part no.: **239172 0020**

Clamping rings are on  
page 5-32.



**Tailstock unit RE-ZD30**  
200 mm Part no.: **269 100 1060** L 331  
300 mm Part no.: **269 100 1070** L 431  
400 mm Part no.: **269 100 1080** L 531  
500 mm Part no.: **269 100 1090** L 631

\* including flange

# Rotary unit

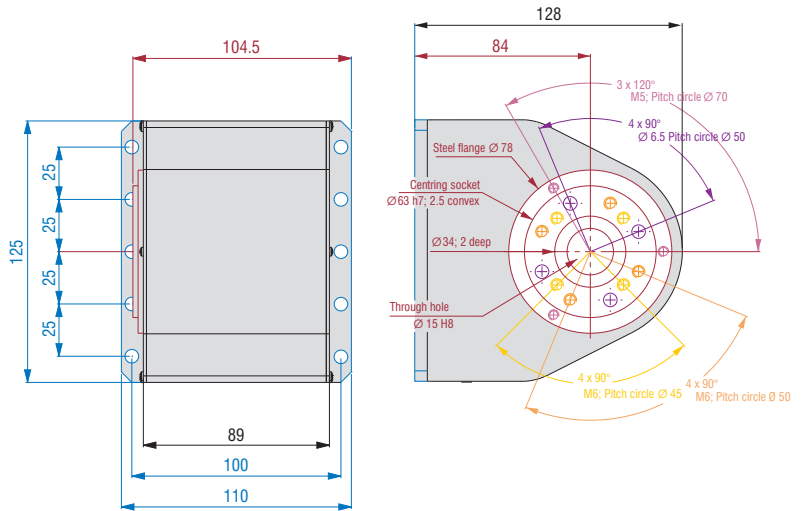
# ZD 30

## Technical specification

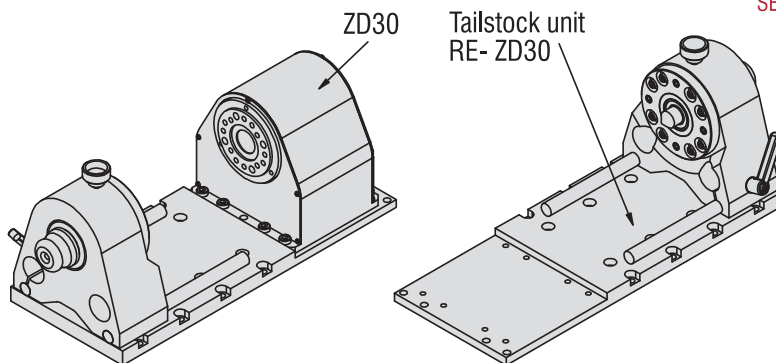
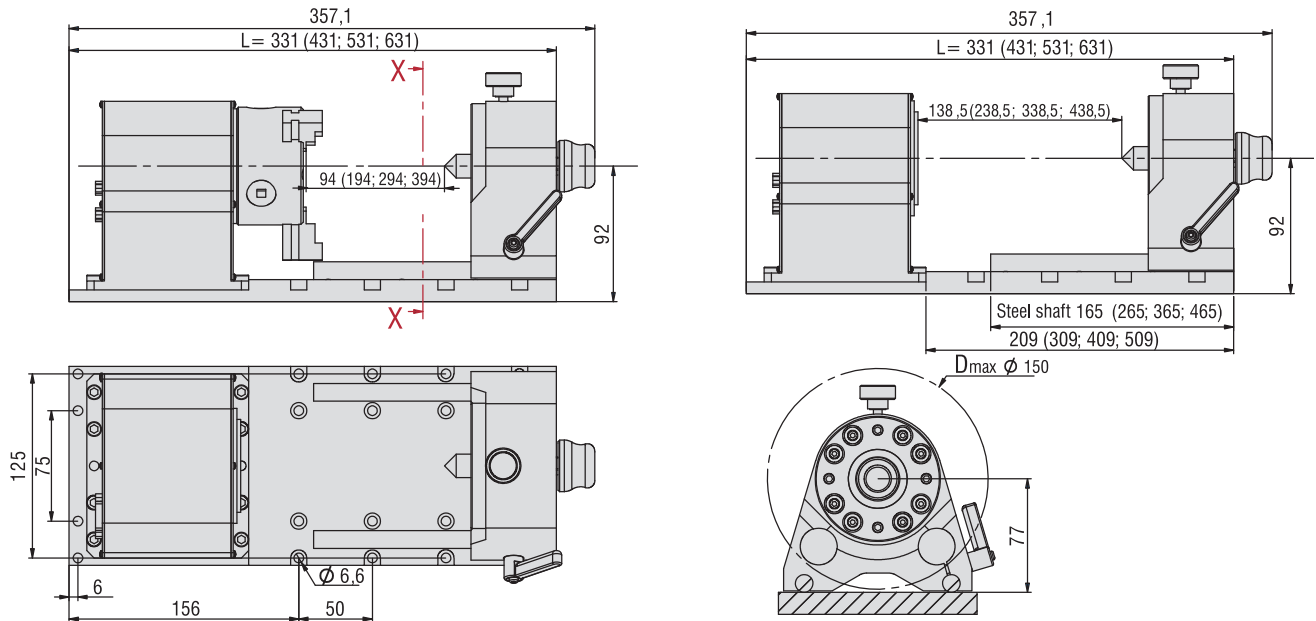
		stepper motor MS 045 HT *
Reduction ratio		0.0625
Output speed	[1/min]	0 - 40
Operating torque (0 - 1600 Hz)	[Nm]	12
Rated holding torque (static load)	[Nm]	20
Min. step (positional accuracy)	[arcmin]	2.5
Weight	[kg]	2.9

\* Values for half-step operation

## Dimensioned drawings

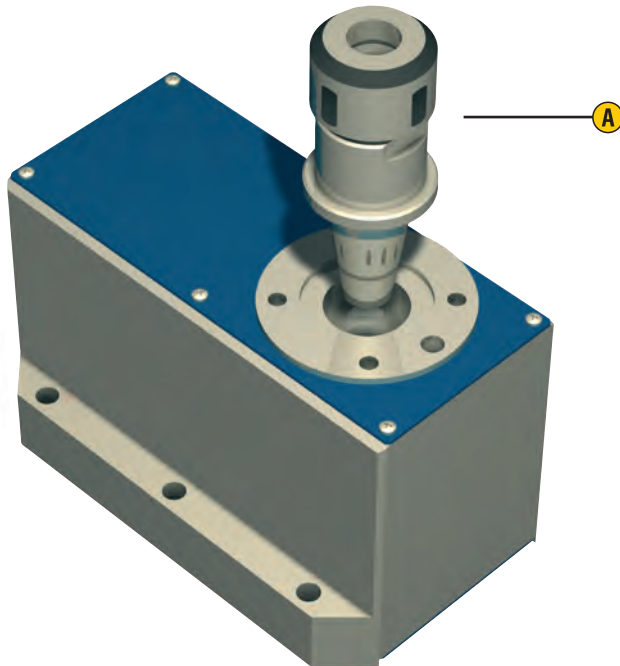


## Tailstock unit RE-ZD30



## Indexing table

## ZR 20



## Features

- Low play toothed belt drive with stepper motor
- Reduction 1 : 20
- Shaft with  $\varnothing$  15 mm boring
- Housing flange with inner cone SK 20•  
Weight: 2,1 kg

For pin assignment see page 2-112  
For transport loads, see page 2-113

## Options:

- CNC controller via Sub D

- Ⓐ Collet holder SK 20  
(Accessories)

## Ordering data

ZR 20 Indexing table  
Part no.: **260300 0000**

## Technical specification

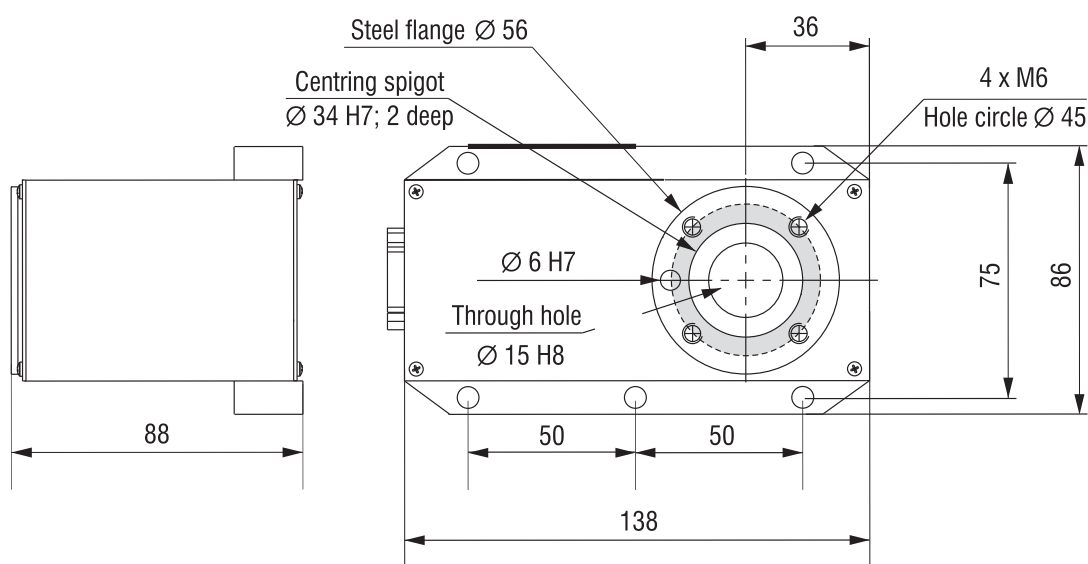
		stepper motor MS 045 HT *
Reduction ratio		1:20
Abtriebsdrehzahl	[1/min]	0 - 60
Operating torque (0 - 1600 Hz)	[Nm]	8
Rated holding torque (static load)	[Nm]	14
Min. step (positional accuracy)	[arcmin]	3.5
Weight	[kg]	2.1

\* Values for half-step operation

## Accessories

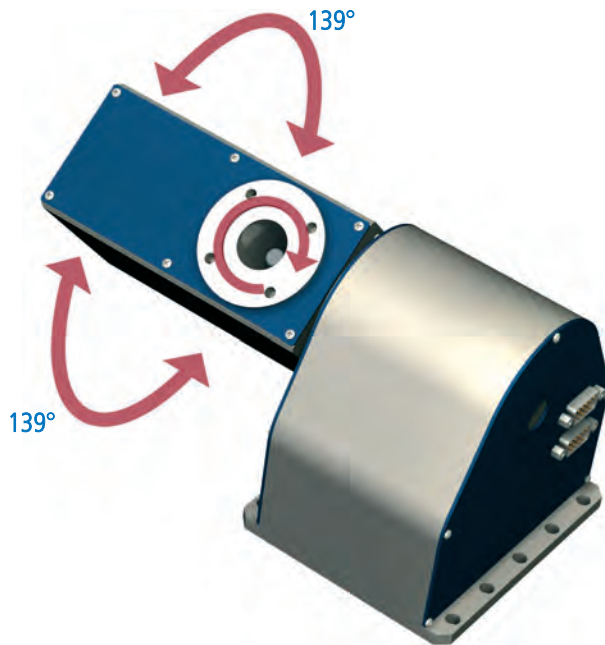
see rotary tilting unit ZDS 2030

## dimensioned drawing



# Rotary tilting unit

# ZDS 2030



## General

The **rotary tilting unit ZDS 2030** can be used as a 4th/5th axis in CNC machines for fine workshops or in the handling area.

It is a combination of ZD 30 and the modified version of ZR 20.

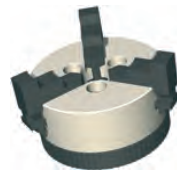
ZDS 2030 enables 5-side machining or free-form surface machining on a conventional 3-axis system of easily machinable materials (e.g. plastic).

The tilting angle is  $139^\circ$  in both directions.

## Ordering data

Rotary tilting unit ZDS 2030  
Part no.: **265000 0000**

## Accessories



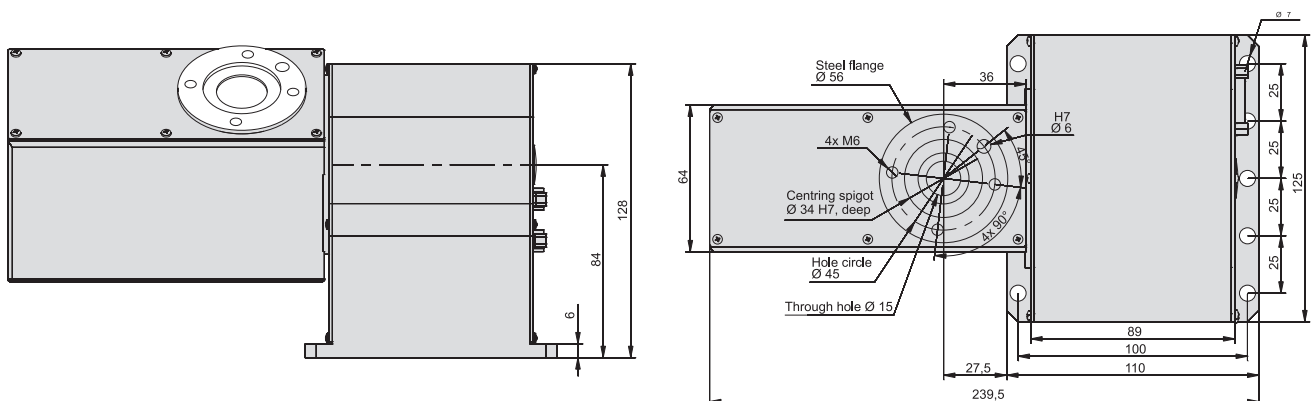
**Chuck assembly**  
3-jaw chuck  $\varnothing 65$   
Part no.: **269060 2065\***

\* including flange



**Clamping ring housing**  
SK 20 clamping ring housing for tools  $\varnothing 3 - 13$  mm, with installation ring  
Part no.: **239172 0020**  
Clamping rings are on page 5-32.

## dimensioned drawing



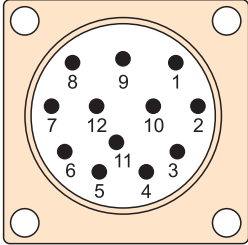


# Motor pin assignments

## Pin assignment for 12-pin stepper motors

(for RDH, DSH-S)

### Motor connection



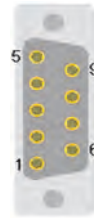
Plug side view of pin insert

M23 12-pin Pin	
1	Motor phase 1A
2	Motor phase 1B
3	Motor phase 2A
4	Motor phase 2B
5	+24V switch
6	+24V brake
7	GND switch
8	GND brake
9	Limit switch 1
10	Limit switch 2
11	---
12	---
Housing - cable shield	

## Pin assignment for 9-pin stepper motors

(for RF1, iZD 54, MD 1, ZD 30, ZR 20, ZDS 2030)

### Motor connection



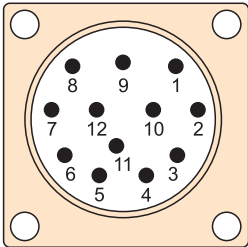
Plug side view of pin insert

Sub-D 9-pin Pin	
1	Motor phase 1A
2	Motor phase 1B
3	Motor phase 2A
4	Motor phase 2B
5	+24V switch
6	+24V brake
7	Limit switch 2
8	GND brake
9	Limit switch 1
Housing - cable shield	

## Pin assignment for stepper motors with encoder

(for RDH)

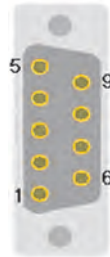
### Motor connection



Plug side view of pin insert

M23 12-pin Pin	
1	Motor phase 1A
2	Motor phase 1B
3	Motor phase 2A
4	Motor phase 2B
5	+24V switch
6	+24V brake
7	GND switch
8	GND brake
9	Limit switch 1
10	Limit switch 2
11	---
12	---
Housing - cable shield	

### Encoder connection

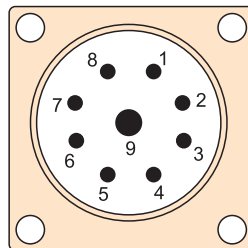


Plug side view of pin insert

Sub-D 9-pin Pin	
1	+5V encoder
2	Encoder track A
3	Encoder track B
4	Encoder track Z
5	---
6	GND encoder
7	Encoder track/A
8	Encoder track/B
9	Encoder track/Z
Housing - cable shield	

## Pin assignment for DC servo motors with brushes (BDC)

### Motor connection

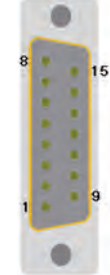


Plug side view of pin insert

M23 9-pol. (8+1) pin	
1	Motor phase 1 (V+)
2	Motor phase 1 (V-)
3	Motor phase 1 (V+)*
4	Motor phase 1 (V-)*
5	+24V brake
6	GND brake
7	---
8	---
9	Earthing lead
Housing - cable shield	

\* Part motor phase connection over 2 wires.

### Encoder connection

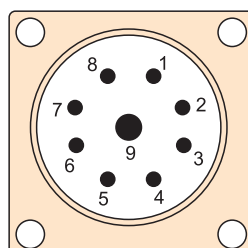


Plug side view of pin insert

Sub-D 15-pin Pin	
1	---
2	+5V encoder
3	Encoder track/Z
4	Encoder track/B
5	Encoder track/A
6	+24V switch
7	Limit switch 1
8	GND switch
9	---
10	GND encoder
11	Encoder track Z
12	Encoder track B
13	Encoder track A
14	Reference switch
15	Limit switch 2
Housing - cable shield	

## Pin assignment for brushless EC servomotors (BLDC) 48V

### Motor connection



Plug side view of pin insert

M23 9-pol. (8+1) pin	
1	Motor phase U
2	Motor phase V
3	Motor phase W
4	---
5	+24V brake
6	GND brake
7	---
8	---
9	Earthing lead
Housing - cable shield	

### Encoder connection

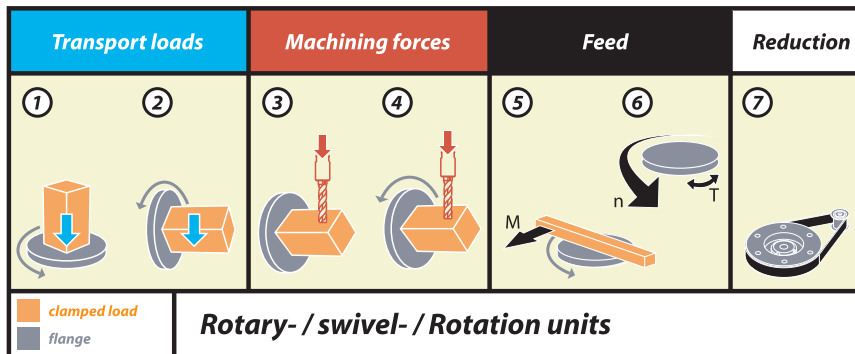


Plug side view of pin insert

Sub-D 15-pin Pin	
1	Hall signal A
2	+5V encoder/Hall
3	Encoder track/Z
4	Encoder track/B
5	Encoder track/A
6	+24V switch
7	Limit switch 1
8	GND switch
9	Hall signal B
10	GND encoder
11	Encoder track Z
12	Encoder track B
13	Encoder track A
14	Hall signal C
15	Limit switch 2
Housing - cable shield	

Turn/tilt/rotation units:

# Transport loads, machining forces, feed



Rotary or tilting units	1*	2*	3	4	5	6	7
RDH-M (step)	100 kg	45 kg	55 Nm	24 Nm	24 Nm	4 rpm	1:51
RDH-M (step)	160 kg	70 kg	108 Nm	45 Nm	45 Nm	2 rpm	1:101
RDH-M (EC-servo, brushless)	110 kg	50 kg	26 Nm	9 Nm	9 Nm	22 rpm	1:51
RDH-M (EC-servo, brushless)	180 kg	80 kg	51 Nm	17 Nm	17 Nm	11 rpm	1:101
RDH-S (step)	30 kg	15 kg	7 Nm	7 Nm	7 Nm	4 rpm	1:51
RDH-S (step)	48 kg	24 kg	11 Nm	11 Nm	11 Nm	2 rpm	1:101
RDH-S (EC-servo, brushless)	30 kg	15 kg	7 Nm	4.6 Nm	4.6 Nm	22 rpm	1:51
RDH-S (EC-servo, brushless)	48 kg	24 kg	11 Nm	4.6 Nm	9.2 Nm	11 rpm	1:101
RDH-S (DC-servo)	25 kg	13 kg	7 Nm	4.6 Nm	4.6 Nm	22 rpm	1:51
RDH-S (DC-servo)	40 kg	20 kg	11 Nm	8.7 Nm	8.7 Nm	11 rpm	1:101
RDH-XS (step)	30 kg	10 kg	5 Nm	5 Nm	5 Nm	24 rpm	1:50
RDH-XS (step)	30 kg	10 kg	7 Nm	7 Nm	7 Nm	12 rpm	1:100
RDH-XS (EC-servo, brushless)	30 kg	10 kg	5 Nm	5 Nm	5 Nm	59 rpm	1:50
RDH-XS (EC-servo, brushless)	30 kg	10 kg	7 Nm	7 Nm	7 Nm	30 rpm	1:100
RDH-XS (DC-servo)	30 kg	10 kg	5 Nm	5 Nm	5 Nm	70 rpm	1:50
RDH-XS (DC-servo)	30 kg	10 kg	7 Nm	7 Nm	7 Nm	35 rpm	1:100
RF 1 (step)	60 kg	30 kg	37 Nm	17.5 Nm	17.5 Nm	50 rpm	1:24
RF 1 (step)	100 kg	50 kg	75 Nm	38 Nm	38 Nm	23 rpm	1:52
RF 1 (step)	150 kg	75 kg	75 Nm	75 Nm	75 Nm	12 rpm	1:100
RF 1 (DC servo/EC servo)	70 kg	35 kg	7 / 12 Nm	6 / 10 Nm	6 / 10 Nm	125 rpm	1:24
RF 1 (DC servo/EC servo)	110 kg	55 kg	16 / 26 Nm	13 / 22 Nm	13 / 22 Nm	58 rpm	1:52
RF 1 (DC servo/EC servo)	160 kg	80 kg	30 / 50 Nm	25 / 42 Nm	25 / 42 Nm	30 rpm	1:100
MD 1 (step)	5 kg	2.5 kg	14 Nm	8 Nm	8 Nm	60 rpm	1:20
MD 1 (DC servo)	6 kg	3 kg	3.9 Nm	3 Nm	3 Nm	175 rpm	1:20
MD 1 (EC servo, brushless)	6 kg	3 kg	4 Nm	3.2 Nm	3.2 Nm	150 rpm	1:20
ZR 20 (step)	10 kg	5 kg	14 Nm	8 Nm	8 Nm	60 rpm	1:20
ZD 30 (step)	14 kg	8 kg	20 Nm	12 Nm	12 Nm	40 rpm	1:30

\*) Guideline values will vary according to application !!