



# Assembly instructions CNC portal milling machine kit Basic-Line

## Technical specifications

Basic-Line	0605	0607	1005	1007
<b>Travel</b>	X: 635 mm Y: 515 mm Z: 140 mm	X: 635 mm Y: 715 mm Z: 140 mm	X: 1035 mm Y: 515 mm Z: 140 mm	X: 1035 mm Y: 715 mm Z: 140 mm
<b>Clearance under portal</b>	180 mm	180 mm	180 mm	180 mm
<b>Clamping area</b>	X: 840 mm Y: 530 mm	X: 840 mm Y: 730 mm	X: 1240 mm Y: 530 mm	X: 1240 mm Y: 730 mm
<b>Outer dimensions</b>	L: 950 mm B: 790 mm H: 820 mm	L: 950 mm B: 990 mm H: 820 mm	L: 1350 mm B: 790 mm H: 820 mm	L: 1350 mm B: 990 mm H: 820 mm
<b>Ball screw spindles Tolerance class T07</b>	X: 16 x 10 mm Y: 16 x 10 mm Z: 16 x 5 mm	X: 16 x 10 mm Y: 16 x 10 mm Z: 16 x 5 mm	X: 16 x 10 mm Y: 16 x 10 mm Z: 16 x 5 mm	X: 16 x 10 mm Y: 16 x 10 mm Z: 16 x 5 mm
<b>Weight without accessories</b>	approx. 46 kg	approx. 52 kg	approx. 50 kg	approx. 57 kg

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## Machine parameters BASIC LINE

	Machine parameters BASIC LINE			
	<i>Mechanical properties</i>			
TYPE:	BASIC 0605	BASIC 1005	BASIC 0607	BASIC 1007
Travels mm:	X: 635   Y: 515   Z: 140	X: 1035   Y: 515   Z: 140	X: 635   Y: 715   Z: 140	X: 1035   Y: 715   Z: 140
Clamping surface mm:	X: 840   Y: 530	X: 1240   Y: 530	X: 840   Y: 730	X: 1240   Y: 730
Passage under portal:	Z: 180	Z: 180	Z: 180	Z: 180
Installation dimensions:	L: 950   B: 790   H: 820	L: 1350   B: 790   H: 820	L: 950   B: 990   H: 820	L: 1350   B: 990   H: 820
Ball screws:	X: 16 x 10 mm   Y: 16 x 10 mm   Z: 16 x 5 mm   Tolerance class T07   2 % pre-tensioned by special balls, so there is no play			
Repeatability:	approx. +/- 0.02 mm			
Weight w/o accessories:	approx. 46 kg	approx. 52 kg	approx. 50 kg	approx. 57 kg
Linear guides:	Linear guides 20 mm   carriage with medium preload			
Clamping plate:	Optional silkscreen or aluminum T-slot plate			
	<i>Software parameters</i>			
Steps / revolution:	X: 3200   Y: 3200   Z: 3200 *1)			
Steps / mm:	X: 320   Y: 320   Z: 640 *1)			
Max. Feed speed Geschwindigkeit:	X: 150 mm/s or 9 m/min   Y: 150 mm/s or 9 m/min   Z: 83 mm/s or 5 m/min *2)			
Acceleration mm/s <sup>2</sup> :	X: 300   Y: 300   Z: 200 *2)			
Remarks:	*1) with 3200 micro steps of the power amplifier *2) with 48 V supply voltage and high-quality power amplifiers.			

## Introduction

Congratulations on the purchase of our kit for a Basic-Line CNC portal milling machine. We recommend reading through these instructions completely before assembly and then assembling the kit step by step as described.

## Required tools

The following tools and aids must or should be available during assembly:

- Common hand tools, such as Allen keys, screwdrivers, plastic hammers, etc.
- Work surface as flat as possible in the size of the base frame
- Flat or stop angle, at least
- 300 mm long in tolerance class 1 or better
- Dial indicator with stand / holder
- Torque wrench from 6 Nm up to
- at least 25 Nm<sup>1)</sup>

<sup>1)</sup> In order to avoid warping due to screws tightened unevenly, the use of a torque wrench for load-bearing screws M5 to M8 is recommended. By observing the prescribed tightening torque also prevents unwanted loosening during later operation of the machine.

## Optional accessories

The fully assembled machine can be supplemented and adapted to your requirements with optional accessories. In the Sorotec shop you will find:

- Performance Kit <sup>2)</sup>
- Milling spindles
- Electrical installation kit
- Control electronics
- Control software
- T-slot plate
- Vacuum table
- Minimum quantity lubrication



## Caution!

Only carry out the work if you are familiar with the necessary actions and suitable tools are available.

Sorotec GmbH assumes no liability for damage to property or personal injury occurring during assembly or operation of the CNC portal milling machine!

## General information

Please assemble the kit as carefully and precisely as possible - the accuracy of the finished machine does not only depend on the quality of the delivered components, but also to a high degree on the correct assembly and exact alignment. Before assembly, all components must be checked for burrs and reworked if necessary.

<sup>2)</sup> recommended for processing non-ferrous metals

## Infosheet Measure Screws

### Dimensions

Screw sizes are always given in the form of "diameter x length". In the case of metric screws, the diameter is given by an M. Wood, sheet metal or plastic screws are not specially marked in the dimensioning. The unit of measurement mm is usually not specified.

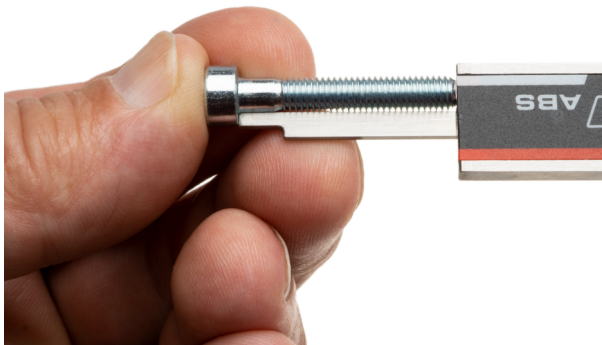
#### Examples:

M4 x 40 - metric screw with M4 thread and 40 mm length

3 x 25 - wood screw 3 mm in diameter and 25 mm in length

### Diameter

Measurements are always made with the vernier caliper and on the outside of the thread. To prevent the cutting edges of the measuring jaws from slipping into the thread grooves, the screw is placed lengthways between the jaws.



### Length

Everything that disappears in the material is part of the length of a screw. This means that measurements are taken - ideally with the depth gauge of the caliper - from the underside of the screw head to the end of the screw. Any parts without a thread are also part of the length.

### Exception countersunk screw

Because the head of the countersunk screw disappears into the material, the head height here is part of the length. So the length is measured over everything. But really: Only with the countersunk screw!



## Scope of delivery


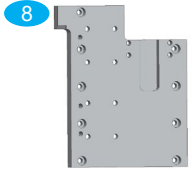

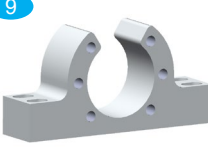
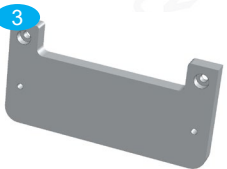
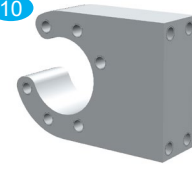

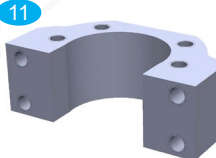

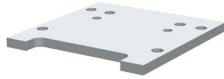



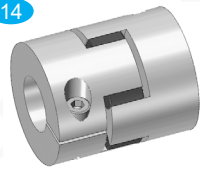


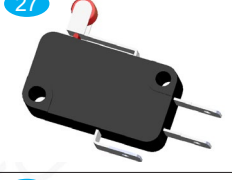
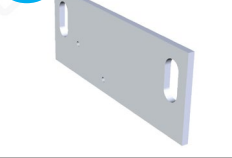
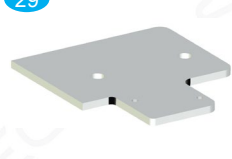

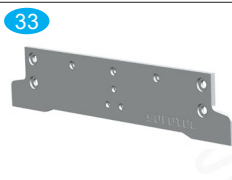
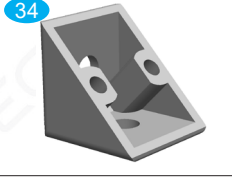

Illustration	Description	Number	Illustration	Description	Number
	End plate Y on the left BL.FT.007.01	1		Base plate Z BL.FT.012.01	1
	End plate Y on the right BL.FT.008.01	1		Flange bracket X BL.FT.018.01	1
	Stop plate Z BL.FT.013.01	1		Flange bracket Y BL.FT.019.01	1
	Drive X: fixed bearing <b>4F</b> CL.ZAN.FL16.H Ball screw <b>4S</b> see page 7 Recirc. ball nut <b>4K</b> readily mounted on ball screw floating bearing <b>4L</b> BL.FT.017.01 and AL.ZAN.LA6000RS	1 1 1 1		Flange bracket Z BL.FT.020.01	1
	Drive Y: fixed bearing <b>5F</b> CL.ZAN.FL16.H Ball screw <b>5S</b> see page 7 Recirc. ball nut <b>5K</b> readily mounted on ball screw floating bearing <b>5L</b> CL.ZAN.LL16.H	1 1 1 1		Flange plate BL.FT.016.01	1
	Drive Z: fixed bearing <b>6F</b> CL.ZAN.FL16.H Ball screw <b>6S</b> ZAN.NTS.KGS1605.0270.M Recirc. ball nut <b>6K</b> readily mounted on ball screw	1 1 1		Device base (self-adhesive) AL.EZB.0109	7
	Stiffeners Z: left <b>7L</b> / right <b>7R</b> BL.FT.022.01	2		Claw clutch MZK.080.100.V25	3
				Carriage ZFW.NTS.HGH20CA	5 (7)
				Linear rail X see page 7	2

Illustration	Description	Number
	Linear rail Y see page 7	2
	Linear rail Z (300 mm lg.) BL.ZFS.HGR20R.0300	1
	Motor flange Z BL.FT.011.01	1
	Plate Z BL.FT.010.01	1
	Portal beam (preassembled) see page 7	1
	Portal beam see page 7	1
	Portal cheek: left  BL.FT.005.01 right  BL.FT.004.01	1 1
	Profile 10 45 x 90 light see page 7	3 (4)
	Profile 10 45 x 90 heavy (819 mm lg.) see page 7	2

Illustration	Description	Number
	Profile 5 20 x 20 BL.PR.0520201N.0372	2
	Reference switch with shim EZB.T1 / AL.IS.001	3
	Switch carrier X CL.FT.013.01	1
	Switch carrier Y BL.FT.021.01	1
	Sled Y BL.FT.009.01	1
	Face plate in the back see page 7	1
	Front plate see page 7	1
	Angle 20 x 20 BL.PR.W.052020 including cover	5
	Angle 40 x 40 AL.PR.WS.084040 including cover	6

# Assembly instructions

## Basic-Line kit



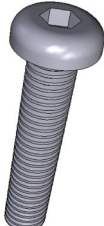

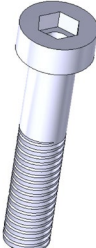

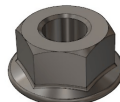


Illustration	Description	Number
	Angle 45 x 45 AL.PR.WS.104545	8 (12)
	Drag chain holder CL.FT.032.01	1
	Tapered grease nipple M6 x 1 ZB.HI.SN008	2
	Grease nipple 90° M6 x 1 ZB.HI.SN003	3
	Cylinder head screw DIN 912 M3 x 20 <b>A1</b> M4 x 16 <b>B1</b> M4 x 20 <b>B2</b> M4 x 25 <b>B3</b> M5 x 12 <b>C1</b> M5 x 14 <b>C2</b> M5 x 16 <b>C3</b> M5 x 18 <b>C4</b> M5 x 20 <b>C5</b> M5 x 22 <b>C6</b> M5 x 25 <b>C7</b> M6 x 14 <b>D1</b> M6 x 35 <b>D2</b> M6 x 50 <b>D3</b>	
	Sliding block 5 M5	
	Hammer nut Slot 8 M5 <b>G1</b> Slot 8 M6 <b>G2</b> Slot 10 M5 <b>H1</b> Slot 10 M6 <b>H2</b> Slot 10 M8 <b>H3</b>	

Illustration	Description	Number
	Hammer screw Slot 10 M8 x 20 <b>J</b> enclosed with angle	
	Flat headed screw ISO 7380 M5 x 8 <b>K1</b> M5 x 20 <b>K2</b> M6 x 16 <b>K3</b> M6 x 25 <b>K4</b> M8 x 16 <b>K5</b> M12 x 30 <b>K6</b>	
	Mounting bracket drag chain CL.PR.BW.604020	1
	Cylinder head screw DIN 6912 M5 x 10 <b>L1</b> M5 x 16 <b>L2</b> M6 x 40 <b>M1</b> M8 x 20 <b>N1</b>	
	Nut DIN 934 M3 <b>O</b> M4 <b>P</b>	
	Flange nut DIN 6923 M8 <b>Q</b> enclosed with angle	
	Washer DIN 125 3,2 <b>U</b> 8,4 <b>X</b>	
	Dowel pin hard DIN 6325 5 x 18 mm <b>Z</b>	

### Order numbers of size-dependent parts

	Bezeichnung	Maschine			
		BL 0605	BL 0607	BL 1005	BL 1007
4S	Ball screw X	ZAN.NTS.KGS1610.0800.M	ZAN.NTS.KGS1610.0800.M	ZAN.NTS.KGS1610.1200.M	ZAN.NTS.KGS1610.1200.M
5S	Ball screw Y	ZAN.NTS.KGS1610.0650.M	ZAN.NTS.KGS1610.0850.M	ZAN.NTS.KGS1610.0650.M	ZAN.NTS.KGS1610.0850.M
16	Linear rail X	BL.ZFS.HGR20R.0817.BL	BL.ZFS.HGR20R.0817.BL	BL.ZFS.HGR20R.1217.BL	BL.ZFS.HGR20R.1217.BL
17	Linear rail Y	BL.ZFS.HGR20R.0622.BL	BL.ZFS.HGR20R.0822.BL	BL.ZFS.HGR20R.0622.BL	BL.ZFS.HGR20R.0822.BL
21	Portal beam	BL.FT.023.01	BL.FT.028.01	BL.FT.023.01	BL.FT.028.01
22	Portal beam	BL.FT.003.01	BL.FT.024.01	BL.FT.003.01	BL.FT.024.01
24	Profile 10 45 x 90 light	BL.PR.104590L.0395	BL.PR.104590L.0595	BL.PR.104590L.0395	BL.PR.104590L.0595
25	Profile 10 45 x 90 heavy	BL.PR.104590S.0819	BL.PR.104590S.0819	BL.PR.104590S.1219	BL.PR.104590S.1219
32	Face plate back	BL.FT.001.01	BL.FT.025.01	BL.FT.001.01	BL.FT.025.01
33	Face plate front	BL.FT.002.01	BL.FT.026.01	BL.FT.002.01	BL.FT.026.01

## Floating bearings are not "loose bearings"

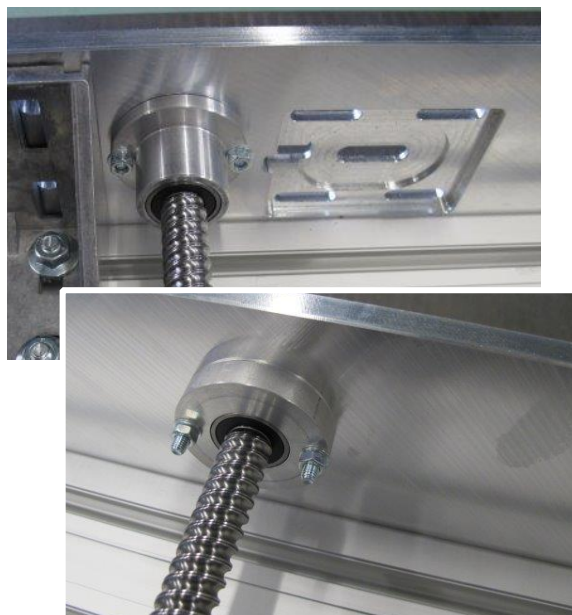
When storing a shaft in a machine, the thermal linear expansion must always be taken into account in the design. In the case of a ball screw made of high-alloy steel, for example, with a length of 0.1 ... 0.2 mm per meter per 10 Kelvin temperature difference, this is quite considerable - the additional tenths have to go somewhere.

If the roller bearings were to be firmly connected at the ends both to the shaft and to the surrounding housing, considerable axial stress would quickly arise as a result of thermal expansion. The bearings would be severely overloaded and would wear out after a short time; Gradually louder, grinding rolling noises are the alarm signal for bearing damage at the end.

### Conflicting requirements

For this reason, the fit between the bearing seat on the shaft and the inner ring of the bearing as well as that between the outer ring and the bore in the housing is very tight on the fixed bearing. Great forces may be required for assembly (plastic hammer, if necessary driving sleeve for the inner ring), the use of heat and/or cold to expand or shrink the components can also be helpful. In any case, use oil!

At the floating bearing, a firm clamping should only guarantee the guidance of the shaft radially (so that it does not "slack around"), but it should be movable in the longitudinal direction to allow thermal expansion without the build-up of tension forces. The mobility can take place either between the shaft and the inner ring of the bearing or between the outer ring and the housing seat. The bearing must not jam in one of the seats. However, the seat must not be too loose either: even before any disruptive radial mobility comes into play, one of the rings could begin to "wander" and gradually wear down the seat on the shaft or in the housing.



*Fixed bearing (above) and floating bearing in a Sorotec Alu-Line*

### Compromise: tight but not clamped

In practice, a workable compromise is usually reached by sliding the floating bearing tightly onto the end of the shaft, but without using much force. How large the force may be is at the discretion of the machine builder. The span of justifiable handling ranges from energetic pressing by hand (but without hammer blows) to pushing it onto the "sucking" seat.

Important to know: Standard parts such as bearings also have tolerances. With the problem discussed here, a few thousandths of a millimeter can make a big difference - one bearing is jammed, the next can be easily pushed on. If possible, trying out several bearings can lead to success. Otherwise it has to be reworked. This is also normal and commonplace in mechanical engineering.

### Regind bearing seat

If necessary, use a piece of abrasive fleece to make the loose bearing seat of the ball screw sufficiently free to move. Alternatively, you can also use very fine-grain sandpaper. Make sure you work evenly all around. Try frequently to slide the bearing onto the oiled seat. If the inner ring is tight without binding, the floating bearing is installed correctly.



#### **Attention!**

If you have to pull of a bearing that accidentally stuck by gripping the outer ring, it is likely badly damaged and should no longer be used.

## Preparatory work

### Preparing angles for surface mounting

When installing an angle **34** or **35** on a component without fastening grooves, the centering tabs on the angle must be removed before installation (see Figure 1). This can be done by breaking off with a screwdriver or filing / sanding.

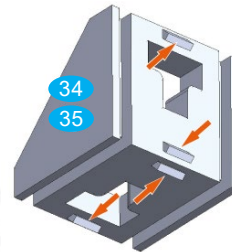


Fig. 1: Centering tabs on mounting bracket

### Pre-assembly of the ball screws, spindle nuts and bearing units



#### Caution!

The pre-assembled recirculating ball nuts must not be turned off the ball screws!

The ball nuts and ball screws are sensitive and must be handled with care!

### Install the grease nipple (all drives):

Equip all ball nuts with 90° angled grease nipples (see picture 2). Do not fully tighten the grease nipples to be able to align them later.

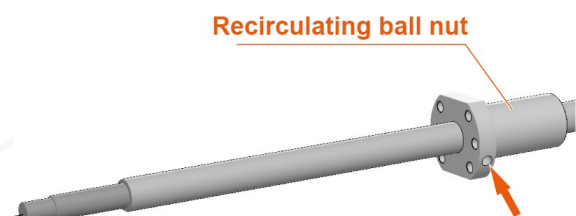


Fig 2: Bore and thread for grease nipples

### Mount the fixed bearings

- Push the first bushing onto the ball screw. Place the fixed bearing unit on the ball screw.
- Push the second bushing onto the ball screw.
- Screw the shaft nut onto the ball screw. Attention: The collar of the shaft nut in the direction of the fixed bearing block.
- To adjust the axial play, tighten the shaft nut until the ball screw can only be turned with difficulty in the fixed bearing unit. Then carefully loosen the shaft nut a little (approx. 5 °) until the ball screw can easily be turned again.
- Screw the stud bolts into the threaded holes in the shaft nut and tighten.
- X drive only: screw the fixed bearing **4F** to the flange plate **12**; Tighten the screws **D2** slightly.
- Align the rear edges of the fixed bearing and flange plate in parallel and tighten the screws.

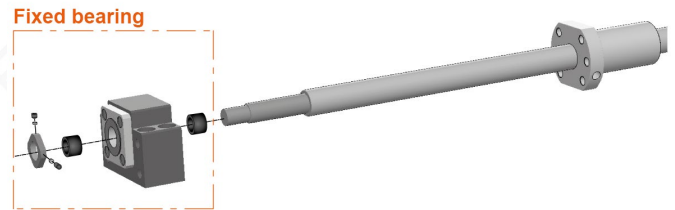


Fig. 3: Mounting fixed bearings

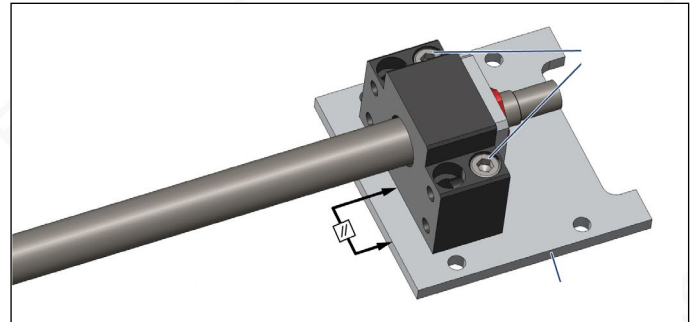


Fig. 4: Fixed bearing on X-drive

### Install floating bearing X drive

- Press the roller bearing into the housing.

**i** **Note:**

*In order not to damage the rolling bearing when installing it in the housing, only push / hit on the bearing outer ring. Use a suitable drive sleeve (tube) and oil the outer bearing ring before assembly!*

- Place the floating bearing on the ball screw.

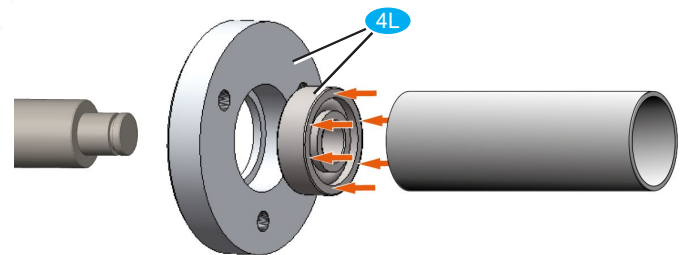


Fig. 5: Rolling bearing assembly with drive sleeve

### Install floating bearing Y drive

- Place the floating bearing unit on the ball screw and attach the circlip to the end of the ball screw.

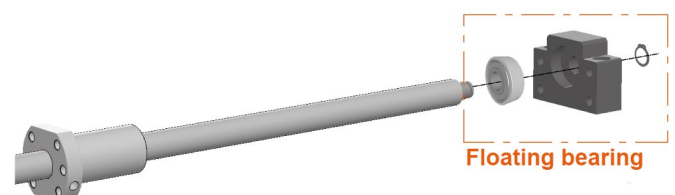


Fig 6: Floating bearing assembly

## Assembly X axis and base frame

**i Note:**

The following illustrations show the Basic-Line 0605 kit. The Basic-Line 1005 is installed analogously.

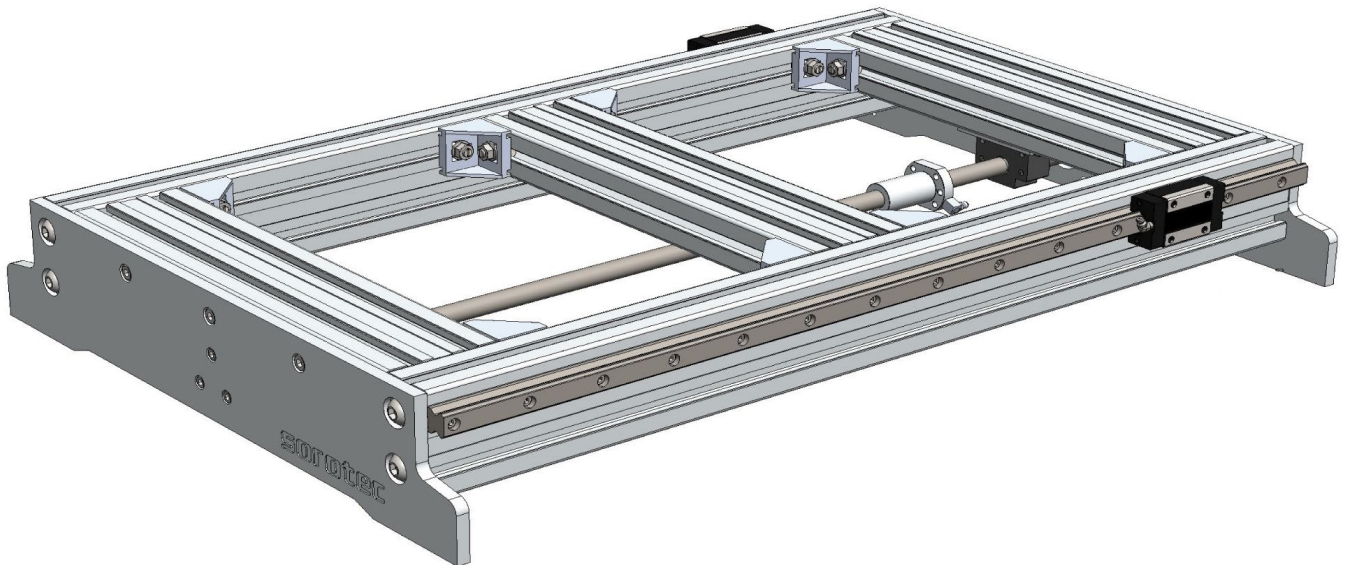


Fig. 7: Completely assembled base frame

- Screw the linear guide **16** to the profile **25**; The lower edge of the linear guide must lie along the milled stop edge of the profile over its entire length (see Figure 8).
- Tighten the screws evenly outwards in the middle. Tightening torque: 6 Nm
- Repeat steps with a second profile and a second linear guide.

**i Note:**

The sealing plugs for the holes in the guide rails prevent the accumulation of dirt and chips, which could otherwise damage the sealing lips of the carriages.

- Insert the sealing plugs into the holes in the guide rails. Make sure they sit flush. Use a piece of flat hard wood, for example, as a support when hammering in the plugs.

**i Note:**

The further assembly of the base frame is carried out lying on its back, as shown in Figure 9.

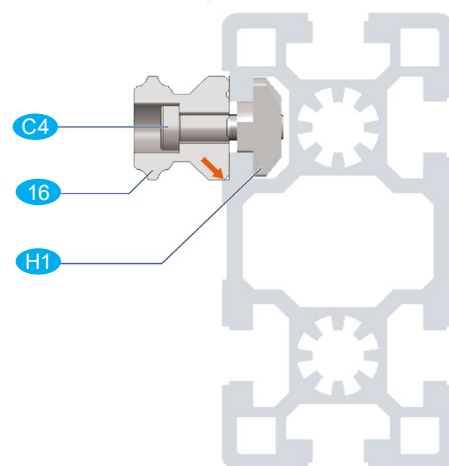


Fig. 8: Linear guides on the stop edge (arrow)



Fig. 9: Base frame in supine position

# Assembly instructions

## Basic-Line kit

The base frame must be mounted in such a way that there is an air gap of approx. 0.5 mm between the end faces of the profiles **24** and the long profile **25** for aligning the base frame (see red arrows in Figure 10). On the opposite side, the end faces of the profiles **24** must be in contact with the long profile **25**. The base frame should be installed as stress-free as possible.

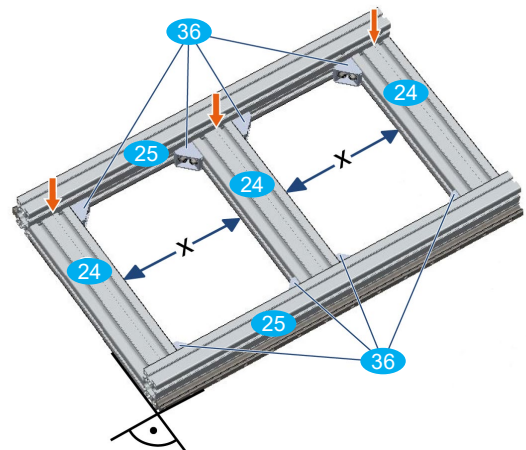


Fig. 10: Assembly of the base frame

- Lay out profiles **24** / **25** as shown on a flat work surface and loosely screw them together with angles **36**. Use the hammer screws **J** and flange nuts **Q** for this.
- Move the inner profile **24** or inner profiles (1005) so that equally long fields (x) are created.
- Tighten the screws one after the other from an outside corner (tightening torque: 25 Nm). Always check the perpendicularity and parallelism of the base frame and correct if necessary.

- Fit three front screws **K5** on the front plate **33** and loosely screw on three hammer nuts **H3** on the inside.
- Position the front plate **33** at the front, threading the hammer nuts into the T-groove of the profile. Tighten the screws slightly to turn the hammer nuts 90° in the T-slot

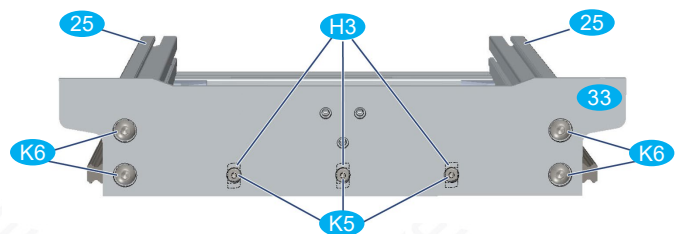


Fig. 11: Mounting end plate on frame profiles

- Screw front end plate **33** with profiles **25**; Tighten screws **K6** slightly.
- Tighten all front panel mounting screws.

- Push one or two carriages **15** on each side onto the linear guides **16**. **Please note:** smoothed, bare surfaces on the long sides of the carriage point down towards the work surface.
- Load the carriage with straight grease nipples **SN** so that they point outwards.

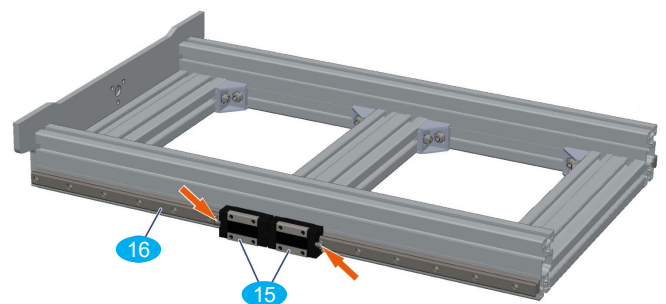


Fig. 12: Lubricating nipples on the carriage point outwards

### **i** Note:

The illustration shows the assembly with the Performance Kit, i.e. with two carriages per side on the guide of the X axis.

- Equip the rear faceplate **32** with three screws **N2** and loosen screw on three hammer nuts **H3** on the inside.
- Position the rear end plate, threading hammer nuts into the T-slot of the profile. Tighten the screws slightly to turn the hammer nuts in the T-slot by 90°.
- Screw the rear face plate to the profiles with flat-head screws **K6**; Tighten screws slightly.
- Tighten all rear face plate mounting screws.

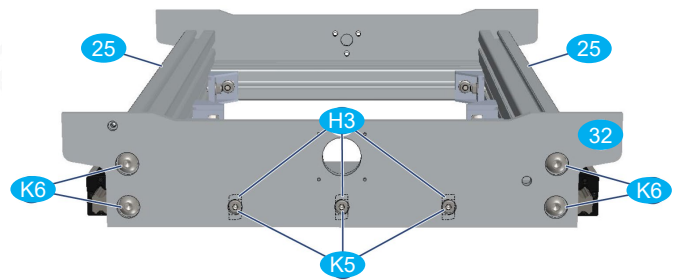


Fig. 13: Assembly of the rear face plate

- Place the pre-assembled X drive **4** in the base frame as shown in Figure 14.
- Screw the floating bearing to the front face plate with socket head screws **D1**; Tighten screws slightly.
- Insert two hammer nuts **H2** in the groove of the profile, turn them 90° and slide them under the mounting holes of the fixed bearing.
- Screw the fixed bearing to the profile using socket head screws **D3**; Tighten screws slightly.
- Insert four hammer nuts **H1** in the grooves of the profile, turn them 90° and slide them under the mounting holes of the flange plate **12**.
- Screw the flange plate to the profile using socket head screws **C3**; Tighten screws slightly.

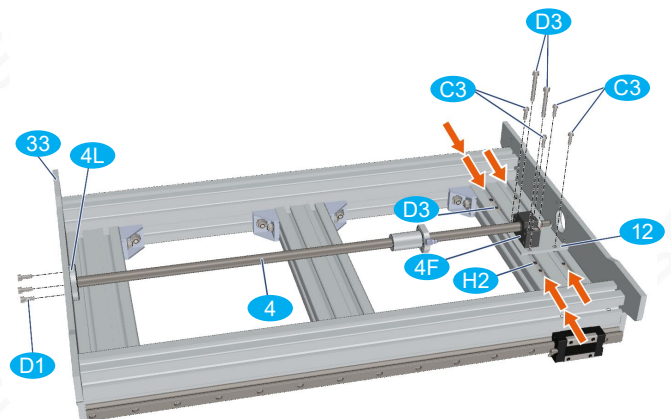


Fig. 14: Assembly of the X drive

**i Note:**

The fastening screws **C3**, **D1** and **D3** of the bearing units **4L** / **4F** are not tightened until aligning.

For the following reference switch assembly, if necessary, observe the additional instructions for assembly „Electrical installation kit“.

- Equip switch carrier X (28) with screws (K5) and washers (X) and loosely screw on two hammer nuts (H3) on the inside.
- Position switch carrier X as shown on the fixed bearing side of the base frame, threading hammer nuts into the T-slot of the profile.
- Tighten the screws, turning the hammer nut through 90° in the T-slot.
- Place the shim between the reference switch and switch carrier X and screw on the reference switch.

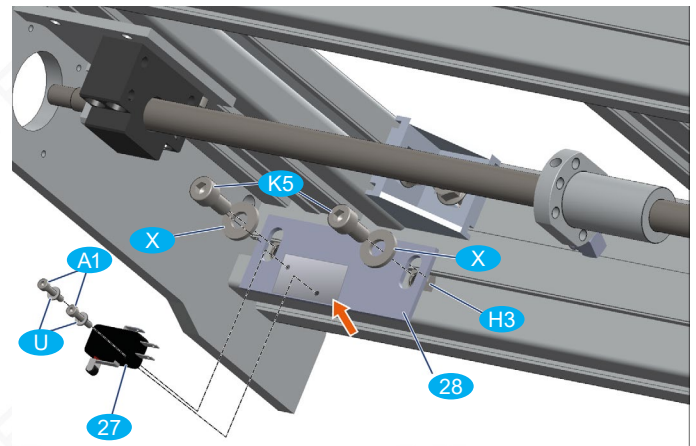


Fig. 15: Assembly of the X reference switch

## Assembly of Y-axis / portal

**Note:**

The following illustration shows the assembly without a performance kit, i.e. with one carriage per side on the X axis.

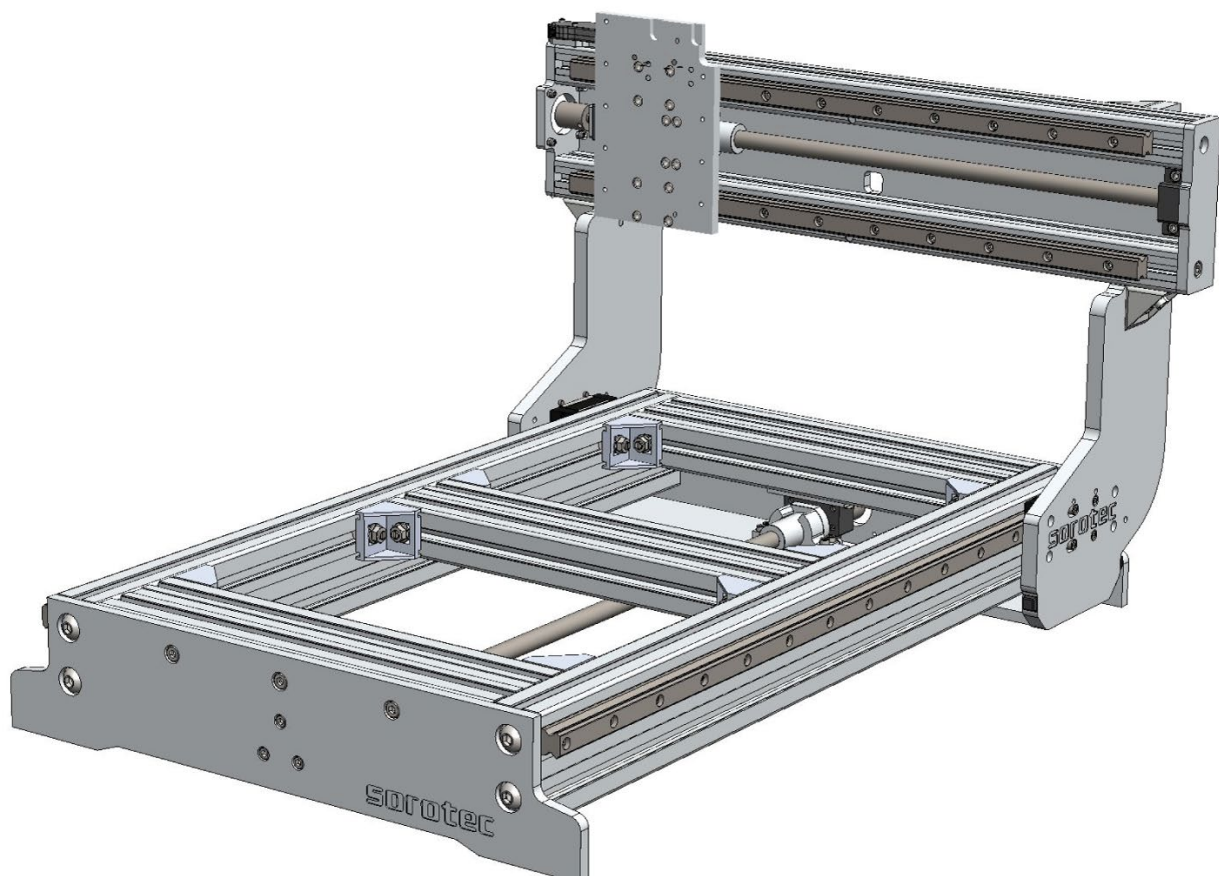


Fig. 16: Fully assembled portal with Y axis

- Drive in dowel pins **Z** into the portal cheeks **23L/23R** until they protrude approximately 3 ... 4 mm on the inside.
- Place the portal cheeks with the cylinder pins on the carriages **15** and screw them in with cylinder screws **Z**. Tightening torque: 6 Nm. Remove pins after assembly.
- Load the linear rails **17** from above with cylinder screws **C4** and screw on the hammer nuts **G1** from below.
- Place the linear rails on the profiles of the portal beam in such a way that the lower edges of the linear guides marked with arrows in Figure 18 (detail) point to the milled stop edges.
- Align the linear rails in the center of the profiles and turn the screws slightly in order to turn the hammer nuts by 90° in the T-slot.
- Screw the linear rails to the profiles; continue to watch the lower edges of the linear guides matching the milled stop edges of the profiles over their entire length. Tightening torque: 6 Nm
- Insert the sealing plugs into the holes in the guide rails. Make sure they sit flush.

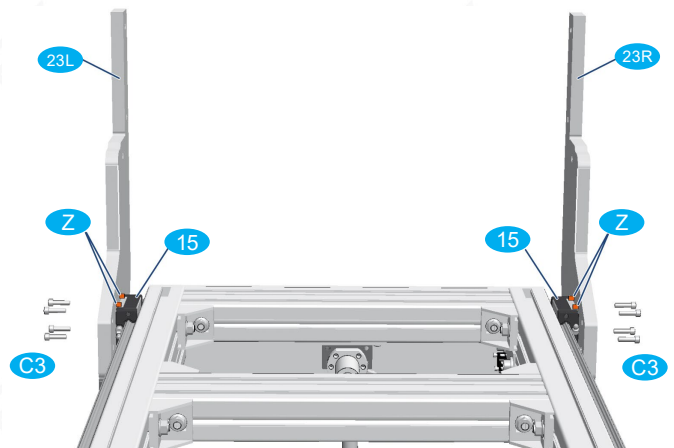


Fig. 17: Assembly of the portal cheeks

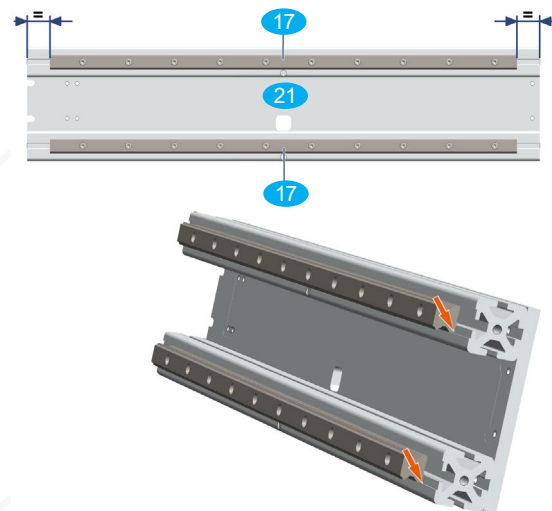


Fig. 18: Assembly of the Y linear guides

- Load four angles **35** with one screw **K4** each and loosely screw on a hammer nut **G2** at the back.
- Insert the hammer nuts through the elongated holes on the back of the gantry beam into the profile and screw the brackets (Fig. 19, magnifying glass above); Tighten the screws slightly so that the angles can just be shifted.
- Screw two angles **35** with flat-head screws **K3** and hammer nuts **G2** to the lower profile of the gantry beam **21** (Fig. 19, magnifying glass below); Tighten the screws slightly so that the angles can just be moved on the profile.
- Place the portal beam on the two portal cheeks as shown and screw all angles to the portal cheeks with flat-head screws **K3** and hammer nuts **G2**; Tighten screws slightly.

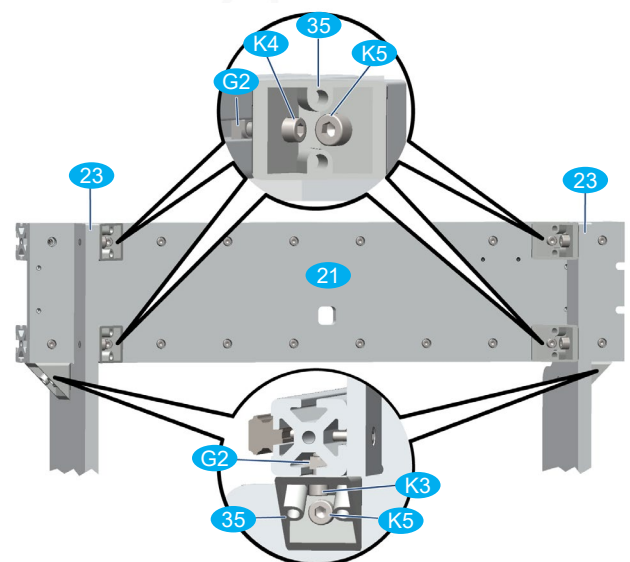


Fig. 19: Connection of portal beams and cheeks

- Insert the portal beam **22** as shown in Figure 20 in the recesses in the portal cheeks and mount with cylinder screws **D1**; Tighten screws slightly
- Degrease the adhesive surfaces and stick a device foot **13** on the portal cheeks at the front and rear.

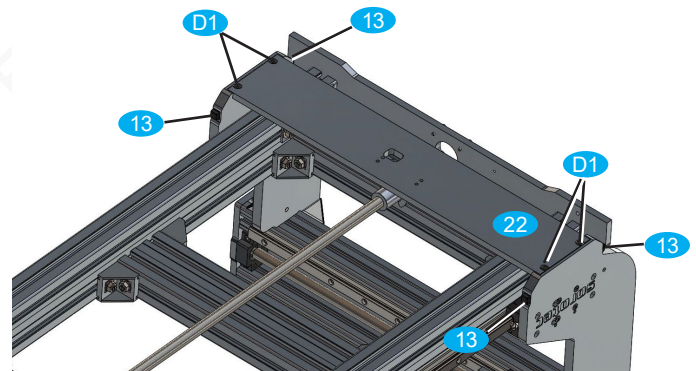


Fig. 20: Installation of girder portal beam

- Before aligning the X axis (Figure 21), check that the following screw connections are not yet tight, but are only slightly tightened:

- D1** Connections portal girder / portal cheeks
- K5** Connections angle / portal cheeks
- K4** Connections angle / portal beam
- K3** Connections angle / profile

- If necessary, loosen screw connections and fasten slightly.

- Move the portal several times from one end of the base frame to the other end, gradually tightening the screws in the following order:

- D1** Connections portal girder / portal cheeks
- K5** Connections angle / portal cheeks
- K4** Connections angle / portal beam
- K3** Connections angle / profile

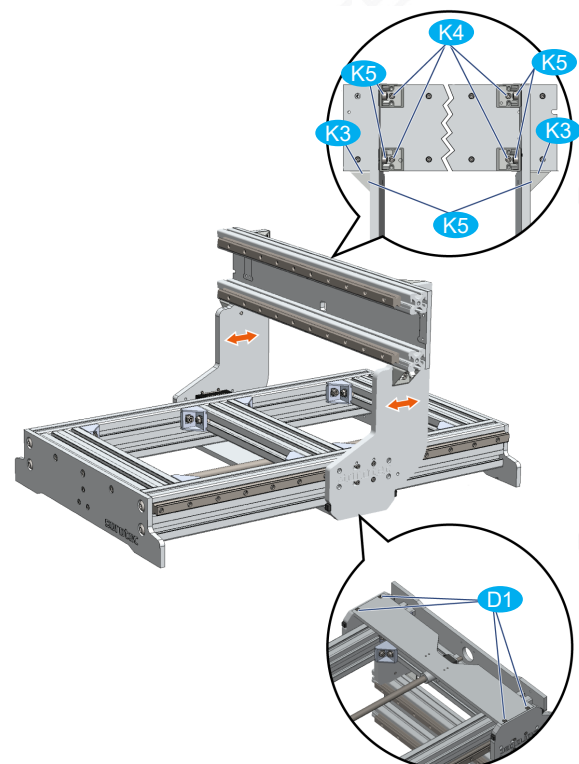


Fig. 21: Align the X axis

To adjust the parallelism of the base frame, some screw connections are loosened on the side with the air gap (see Fig. 10 and Fig. 22) so that the width of the base frame can be shifted slightly.

- Loosen screw connections somewhat.
- Move the portal several times from one end of the base frame to the other end and gradually tighten the loosened screws again.
- Check whether the portal can be easily moved over the entire travel path over the base frame after all screws have been tightened.

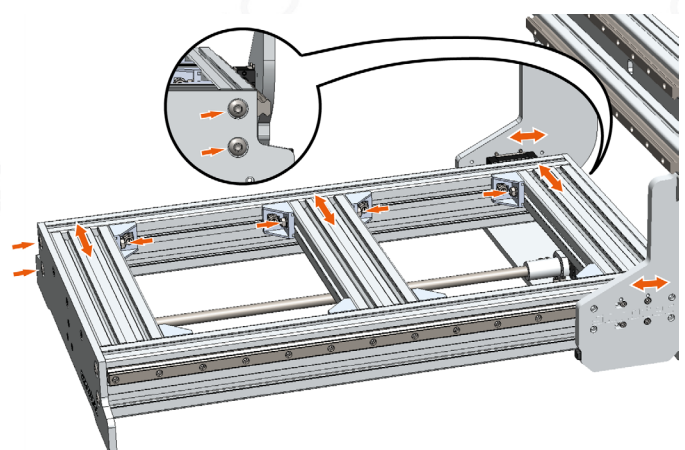


Fig. 22: Setting the parallelism of the basic frame

- Tighten the lubricating nipple of the recirculating ball nut **4K** so that it faces the rear face plate.
- Mount the ball nut on the flange bracket X **9** using socket head screws **C5**; Tighten screws slightly.
- Move the portal until the flange bracket X is above the portal beam.
- Screw flange bracket X to the gantry beam using socket head screws **C7**; Tighten screws slightly.
- Move the portal as far forward as possible by turning the ball screw **4S**.
- Tighten the fixing screws **D2** of the floating bearing. Tightening torque: 10 Nm
- Tighten the fixing screws **C5** of the ball nut on the flange bracket X (see Figure 23). Tightening torque: 6 Nm

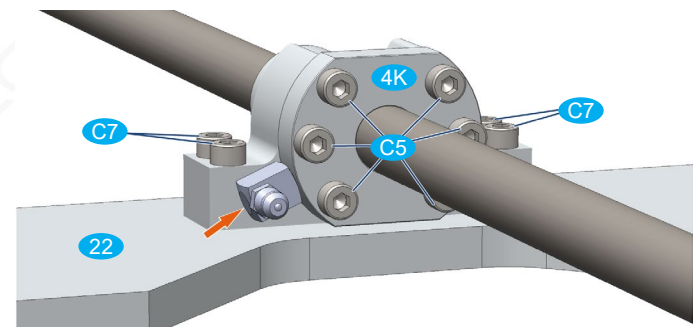


Fig. 23: Mounting flange bracket

- Carefully tighten the fastening screws **C7** of the flange bracket X on the gantry beam (see Fig. 23).
- Move the portal backwards by turning the ball screw so that the fixing screws **4F** of the fixed bearing are just accessible.
- Tighten the fixing screws **D3** of the fixed bearing. Tightening torque: 10 Nm
- Befestigungsschrauben der Flanschplatte 12 festziehen. Schraubenanzugsdrehmoment: 6 Nm Tighten the fastening screws **C3** of the flange plate **C5**. Tightening torque: 6 Nm
- Drive the dowel pins **Z** into the Y slide **31** flush to the back.

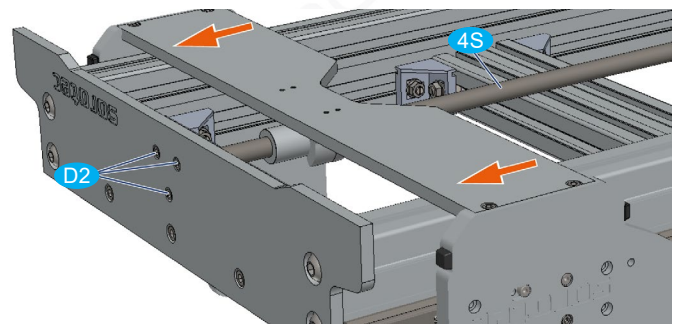


Fig. 24: Tighten floating bearing X-axis

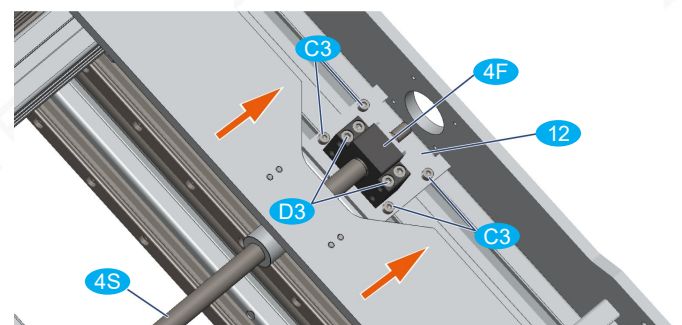


Fig. 25: Festziehen Festlager und Flanschplatte X-Achse

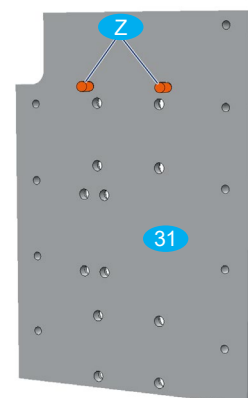


Fig. 26: Dowel pins in sledge

- Push one carriage **15** each onto the linear rails **17**; Please note the following:
  - smoothed, bare surface on the long sides of the carriage point upwards
  - Grease nipples point to the left (see picture 27)
- Place the slide Y **31** with the cylinder pins **Z** on the upper carriage and screw them in with cylinder screws **C1**. Tightening torque: 6 Nm
- Screw carriage Y to the lower carriage; Tighten screws slightly.
- Slide carriage Y back and forth on the linear rails several times as far as possible; gradually tighten the fastening screws of the lower carriage. Tightening torque: 6 Nm

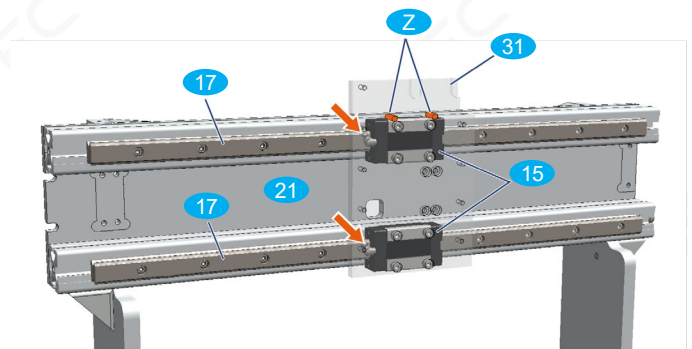


Fig. 27: Location of the grease nipples on the Y carriage

- Guide the pre-assembled Y drive **5** behind the Y carriage as shown in Figure 28. Screw the floating bearing **5L** with 2 and the fixed bearing **5F** with 4 cylinder screws **M1** to the portal beam; Tighten screws slightly.
- Tighten the 90° lubrication nipple on the recirculating ball nut **5K** facing the opening.
- Mount the ball nut on the flange bracket Y **10** using pan head screws **K2**; Tighten screws slightly.
- Slide the slide Y to the screw connection with the flange bracket Y.
- Screw slide Y and flange bracket Y with socket head screws **C1**; Tighten screws slightly
- Move the slide Y to the fixed bearing by turning the ball screw **5S** until the fixing screws of the fixed bearing are just accessible.

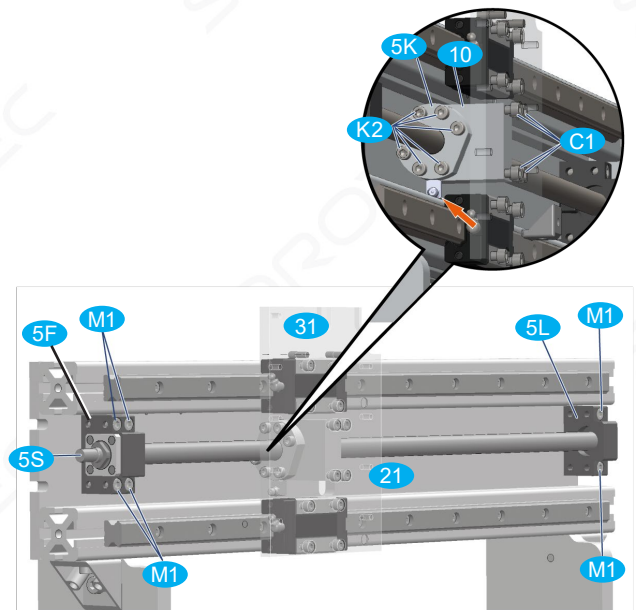


Fig. 28: Assembly of flange bracket and Y-slide

- Tighten the fixing screws of the fixed bearing. Tightening torque: 10 Nm
- Tighten the fixing screws of the ball nut on the flange bracket Y. Tightening torque: 6 Nm
- Carefully tighten the fastening screws of the flange bracket Y.
- Move the slide Y to the floating bearing by turning the ball screw until the fastening screws of the floating bearing are just accessible.
- Tighten the fixing screws of the floating bearing. Tightening torque: 10 Nm
- Degrease the adhesive surfaces on the fixed bearing and floating bearing and stick on the device feet **13**.

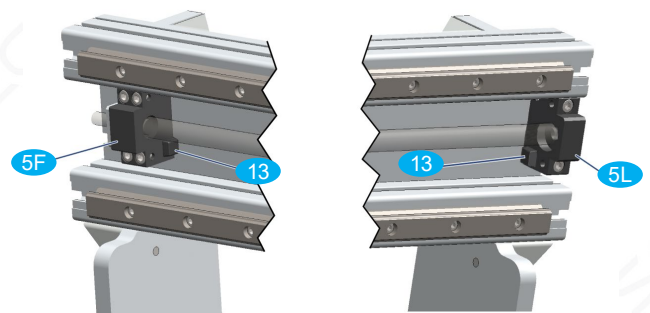


Fig. 29: Stick on the device feet as a buffer

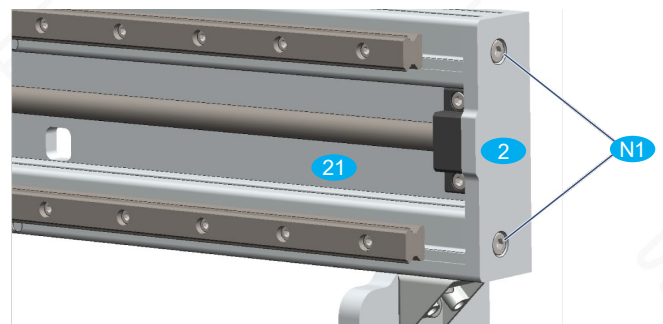


Fig. 30: Assembly of the right end plate

- Screw the right end plate Y **2** to the gantry beam using cylinder screws **N1**.
- Screw the left end plate Y **1** with cylinder screws **N1** on the portal beam.

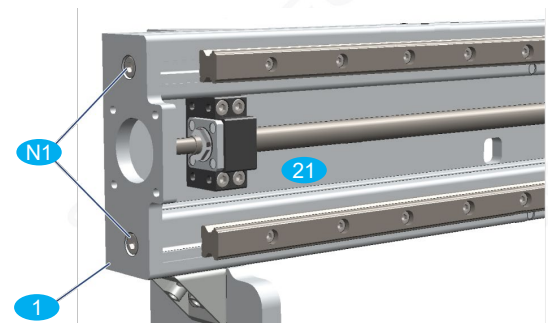


Fig. 31: Assembly of the left end plate

**Note:**

The switch bracket Y **29** is mounted on the outside left on the profile of the portal beam.

When installing the reference switch, observe the additional instructions for the „Electrical installation kit“.

- Equip switch carrier Y **29** with two cylinder head screws **C2** and loosely screw on hammer nuts **G1** at the bottom.
- Position switch carrier Y, threading hammer nuts into the T-slot of the profile. Tighten the screws slightly to turn the hammer nuts in the T-slot by 90°.
- Place the shim between the reference switch **27** and switch carrier Y and screw the reference switch to the switch carrier Y using cylinder head screws **A1** and a washer **U**.

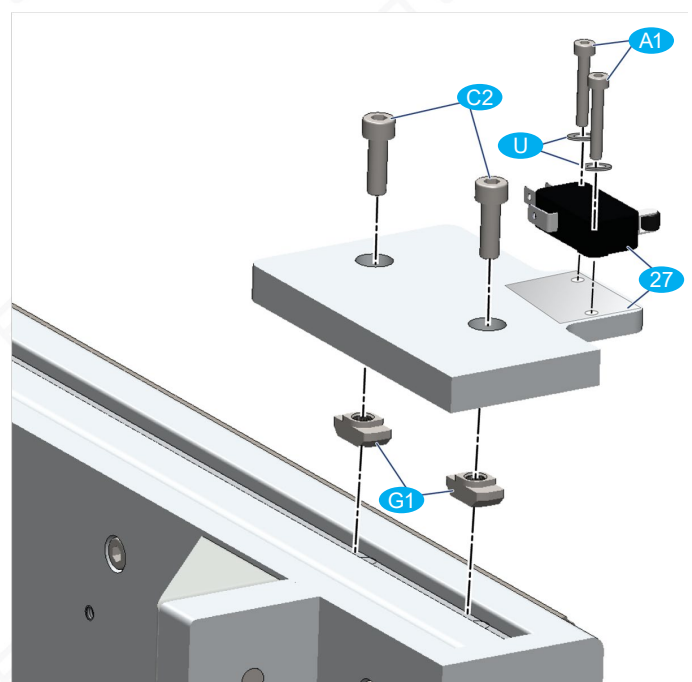


Fig. 32: Installation of Y reference switch

## Assembly Z axis / spindle holder

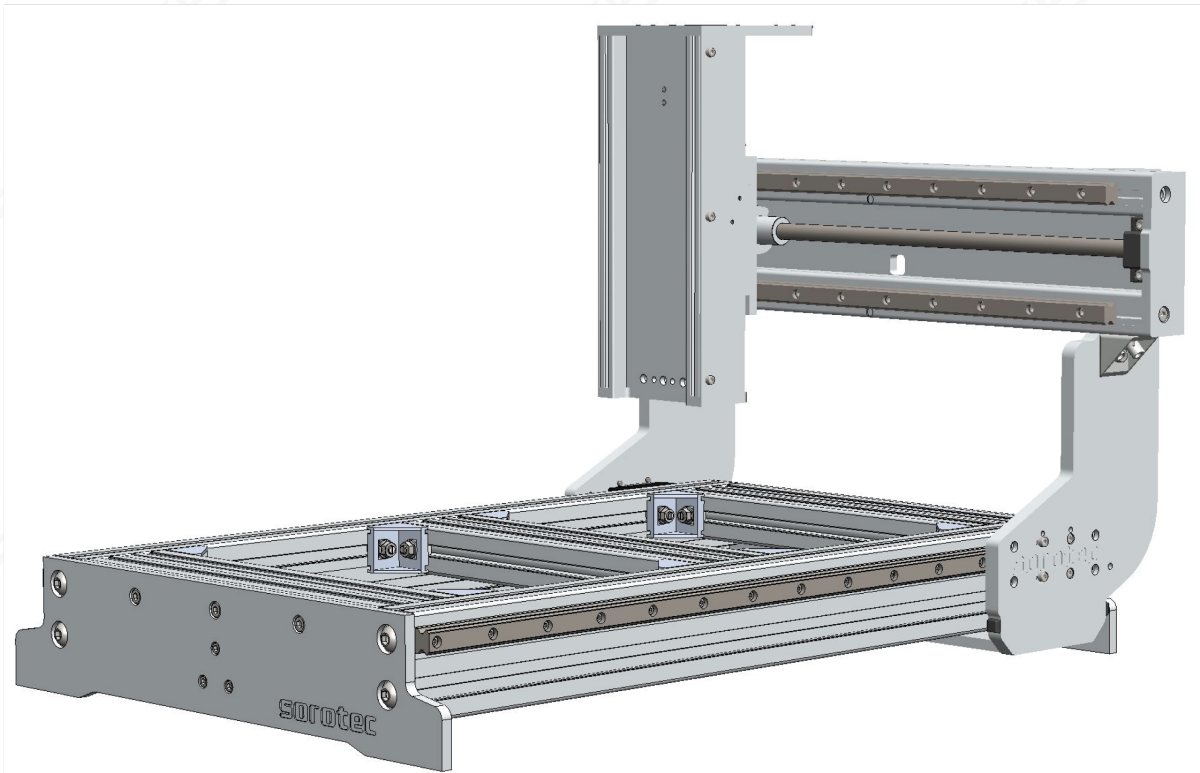


Fig. 33: Basic-Line with mounted Z-axis

**Note:**

The Z-axis is assembled as a single assembly. The complete Z axis is then screwed to the guide plate Y using screws **C3**.

After aligning the Z axis, the side braces Z are finally installed. When equipped with a performance kit, the stronger parts of the kit are used instead of the simple reinforcements.

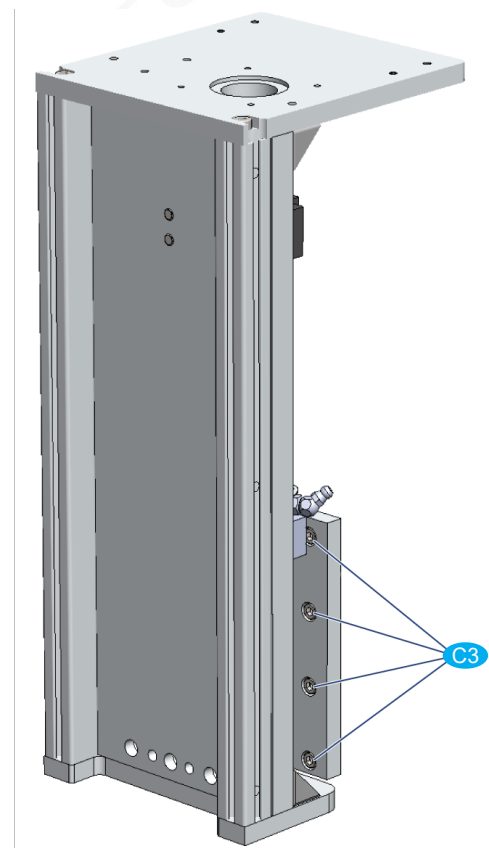


Fig. 34: Screwing the Z-axis onto the guide plate

**i Note:**

The illustration shows the assembly with the Performance Kit, i.e. with two carriages 15 on the Z axis.

### Carriage assembly without Performance kit:

- Drive in dowel pins ZA and ZB flush into base plate Z 8 protruding on the underside.
- Screw the carriage 15A to the base plate Z using socket head screws C1; Please note the following:
  - smoothed, bare surface on the long side of the carriage lies against the dowel pins
  - The grease nipple on the carriage points down and to the right as shown for 15A in Figure 35

Tightening torque: 6 Nm

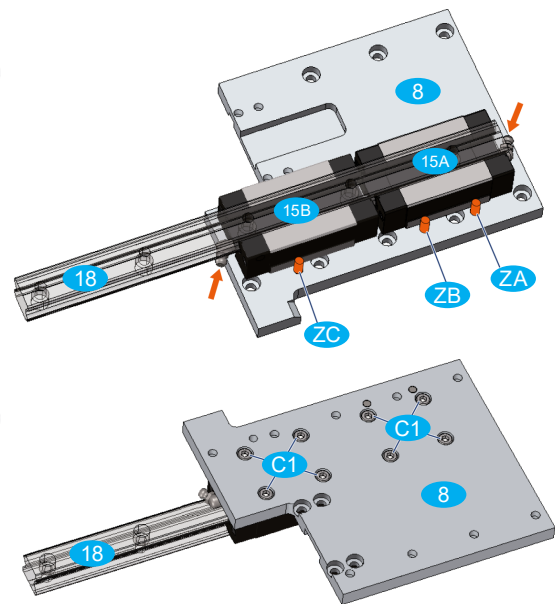


Fig. 35: Assembly of the Z-axis carriage. Red arrows show the location of the grease nipples.

### Carriage assembly with Performance kit:

- Drive in dowel pins ZA and ZB flush into base plate Z 8 protruding on the underside.
- Screw the carriages 15A and 15B to the base plate Z using socket head screws C1; Please note the following:
  - smoothed, bare surface on the long side of the carriage lies against the dowel pins
  - The grease nipple on the carriage 15A points down and to the right as shown in Figure 35
  - Grease nipple on the carriage 15B points up and left
- Push the linear rail Z into the carriage, press the carriage against the dowel pins and tighten the fastening screws C1 of the carriage.

Tightening torque: 6 Nm

### Continued for all kits:

- Align the linear rail Z **18** on the plate Z **20** and screw it in with socket head screws **C5**; the lower edge of the linear rail must lie on the milled stop edge of plate Z over its entire length (red arrows in Fig. 36). Tightening torque: 6 Nm
- Insert the sealing plugs into the holes in the guide rails. Make sure they sit flush.

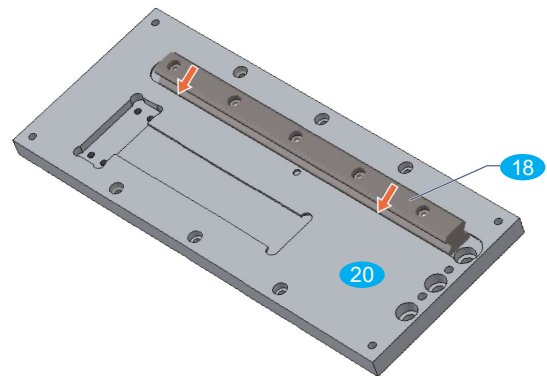


Fig. 36: Assembly of Z-axis linear rail

- Place the pre-assembled drive Z **6** on plate Z **20** as shown in Figure 37; Please note the following:

- Lubricating nipple of the recirculating ball nut **6K** points upwards as shown

- Screw the fixed bearing **6F** to plate Z using four socket head screws **M1**; Tighten screws slightly.

- Push plate Z **20** and base plate Z **8** together as shown.

- Proceed the flange bracket Z **11** into place and screw it to the base plate Z **8** using socket head screws **C2**; Tighten screws slightly.

- Screw the ball nut onto the flange bracket Z **11** using socket head screws **C5**.  
Tightening torque: 6 Nm

- Move the base plate Z to the fixed bearing **6F** as far as possible by turning the ball screw **6S**.

- Carefully tighten the screws **C2** of the flange bracket Z **11**.

- Tighten the screws **M1** of the fixed bearing **6F**  
Tightening torque: 10 Nm

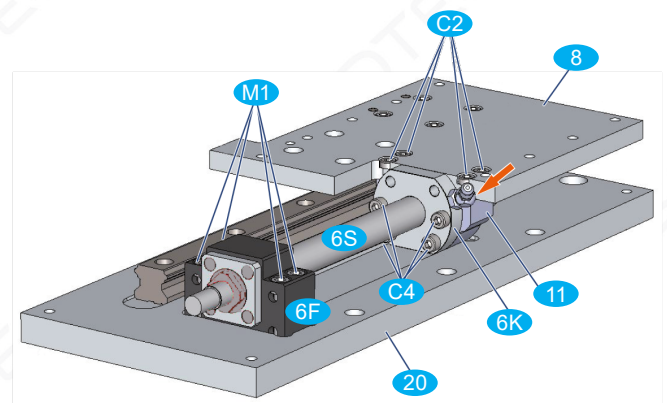


Fig. 37: Installation of drive Z

**Note:**

For reasons of clarity, the components previously mounted on the plate Z 20 are not shown in the figure.

All components shown in the illustration are first loosely screwed together, then aligned with each other and finally tightened the screws!

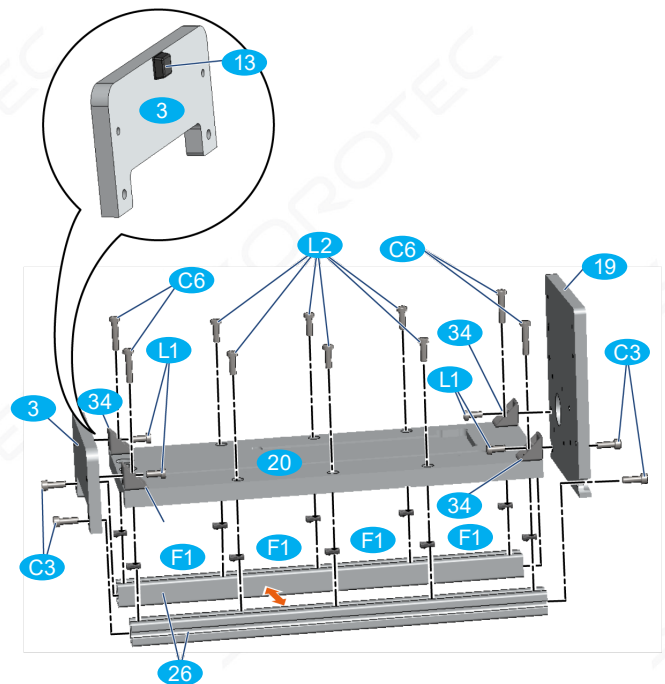


Fig. 38: Assembly of the Z-axis assembly

- Degrease the adhesive surface on the stop plate Z 3 (see magnifying glass in Fig. 38) and stick on the device foot 13 as a stop buffer.
- Place an angle 34 on each corner of plate Z 20.
- Insert the socket head screws C6 from above through the angles 34 and the holes in the plate Z and screw on a sliding block F1 from below.
- Insert the socket head screws L2 through the holes in plate Z and screw on one sliding block F1 each.
- Slide profiles 26 onto the hammer nuts; It should be noted that the closed sides of the profiles face each other on the inside (red double arrow in Figure 38).
- Slightly tighten the screws C6 / L2 so that the profiles can still be moved.
- Mount the stop plate Z 3 and the motor flange Z 19 with cylinder screws C3 on the front of the profiles; Tighten screws slightly.
- Mount the angles 34 to the stop plate Z and the motor flange Z using socket head screws L1. Tighten screws slightly.
- Align profiles flush with the outer edges of plate Z 20 and tighten screws C6 / L2.
- Align stop plate Z and motor flange Z flush and tighten screws L1 / C3.
- Mount the pre-assembled Z-axis on the slide Y using socket head screws C3; Tighten screws slightly.

- To align the Z axis **20**, a dial gauge must be attached to the Z plate and a stop bracket attached to the table. By turning the ball screw of the Z axis, it is moved up and down.
- Align the Z axis so that the dial gauge has no deflection when the Z axis is moved up and down. Tighten the fastening screws in this position.

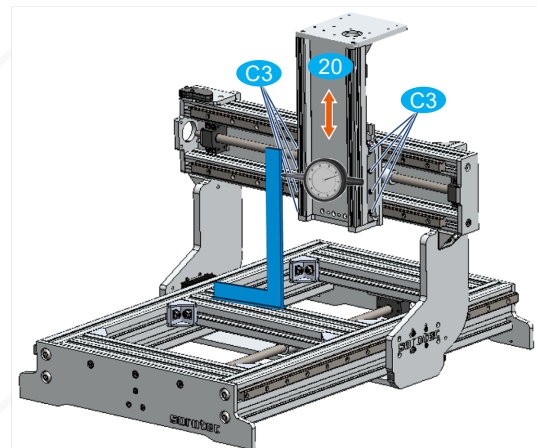


Fig. 39: Aligning the Z axis

**Note:**

When installing the reference switch, observe the additional instructions for the „Electrical installation kit“.

- When using the performance kit, replace the simple bracings **7L** and **7R** with the stronger parts from the kit.
- Place the shim between the reference switch **27** and the left bracing Z **7L** and screw the reference switch to the bracing Z using socket head screws **A1**, washers **U** and nuts **O**.
- Insert pan head screws **K1** from the outside through the holes in the bracing Z **7** and screw on a sliding block **F1** on the inside.
- Push the hammer nuts of the bracings Z into the profiles from above.
- Align bracings Z flush and tighten screws.

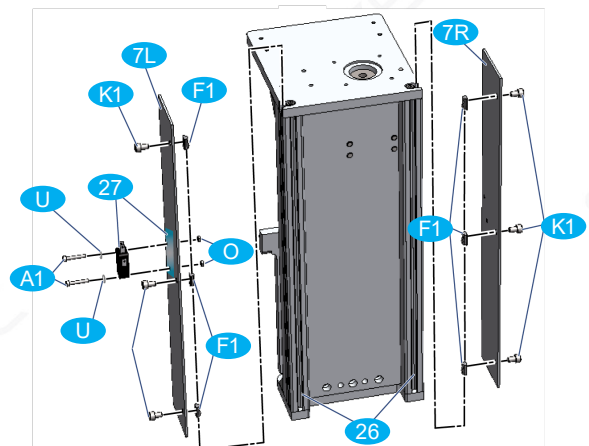


Fig. 40: Installation of stiffeners and Z reference switch

## Assembly of the axis drives

### Note:

The stepper motors shown below are not part of the scope of delivery. They are shown to clarify the structure of the axis drives.

### X axis

- Slide the claw coupling **13** as far as possible onto the shoulder of the ball screw and fix it with the locking screw.
- Insert the stepper motor into the claw coupling and screw it into the rear face plate **32** with socket head screws **B2**.
- Secure the stepper motor with the locking screw of the claw coupling.

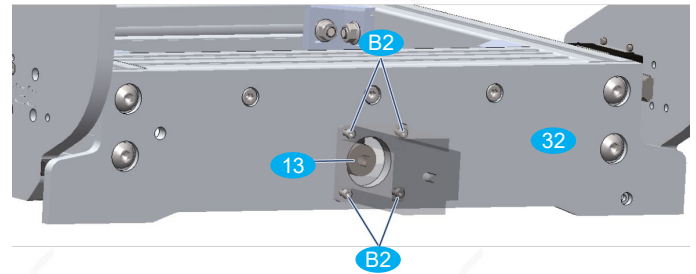


Fig. 41: Assembly of stepper motor X-axis

### Y axis

- Slide the claw coupling **13** as far as possible onto the shoulder of the ball screw and fix it with the locking screw.
- Insert the stepper motor into the claw coupling and screw it to the right end plate Y **1** using socket head screws **B3** and nuts **P**.
- Fix the stepper motor with the claw coupling locking screw.

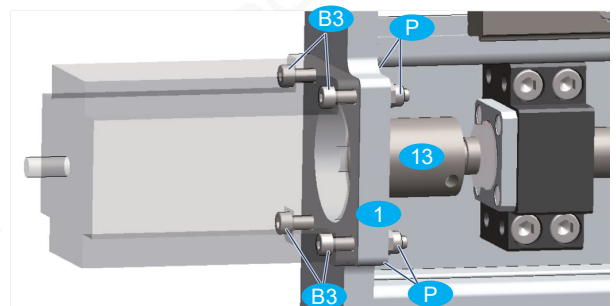


Fig. 42: Assembly of stepper motor Y-axis

### Z axis

- Slide the claw coupling **13** as far as possible onto the shoulder of the ball screw and fix it with the locking screw.
- Insert the stepper motor into the claw coupling and screw it onto the motor flange Z **19** using socket head screws **B1**.
- Fix the stepper motor with the claw coupling locking screw.

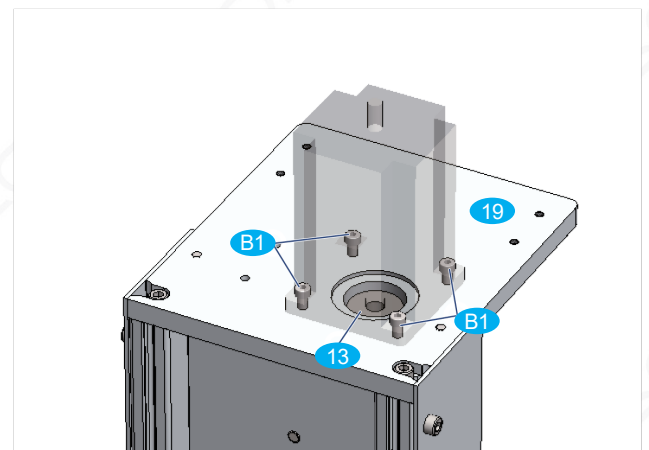


Fig. 43: Assembly of Z-axis stepper motor

### Note:

Claw couplings can make loud noises during operation. In this case, lubricate the plastic buffer with a little Vaseline. Under no circumstances use normal grease or lubricating oil! Ordinary lubricants attack the plastic and can destroy it.

## Maintenance

In normal use, the portal milling machine should be lubricated every six months, but at the latest after twelve months. To do this, proceed as follows:

### All lubrication points

After greasing, remove excess grease with a rag.

**Note:**

As a grease gun, we recommend the „HIWIN grease gun“ set from the Sorotec online shop (item no. SM.00014).

Common multi-purpose grease is sufficient to lubricate the spindle nuts and guide carriages.

### X-axis carriage

- Drive the portal to the front stop of the X axis. The lubrication nipples of the carriages are now easily accessible from the front.
- Lubricate left and right as shown in Figure 44.
- On a machine with a performance kit, repeat the process for the rear carriages from the rear.

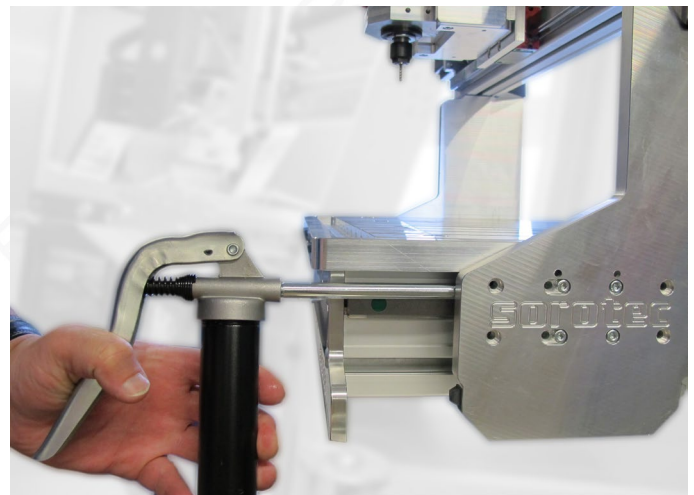


Fig. 44: Lubricating the front carriage X-axis

### Spindle nut X axis

- Apply lubrication as shown in Figure 45.

**Note:**

The lubrication nipple of the X spindle nut can only be reached from below. With a maintenance opening in the machine base, you can simplify the lubrication process.

Otherwise, the portal milling machine must be put to one side or raised at the back to lubricate the X spindle nut.



Fig. 45: Lubricating the X spindle nut with the machine tilted forward

### Y-axis carriage

- Drive the Y axis to the right stop. The grease nipples of the upper and lower carriage are now easily accessible from the left side.
- Lubricate the Y-axis carriage as shown in Figure 46.



Fig. 46: Lubricating Y-axis carriage

### Spindle nut Y axis

- Bring the Y axis in the center position. The lubrication nipple of the Y-spindle nut is now easily accessible through the opening in the middle of the portal beam.
- Lubricate the Y-spindle nut as shown in Figure 47.

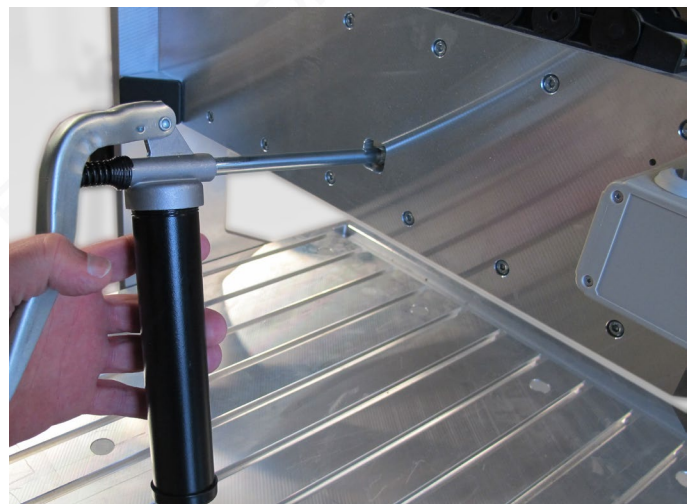


Fig. 47: Lubricating Y-axis spindle nut

### Z-axis carriage

- Drive the Y axis to the right stop.
- Remove the Z-axis left stiffener. It is not necessary to remove the reference switch beforehand. The lubrication nipples of the runner blocks are now easily accessible from the left side.
- Lubricate the lower carriage as shown in Figure 48.
- For machines with a performance kit, repeat the process for the upper carriage.

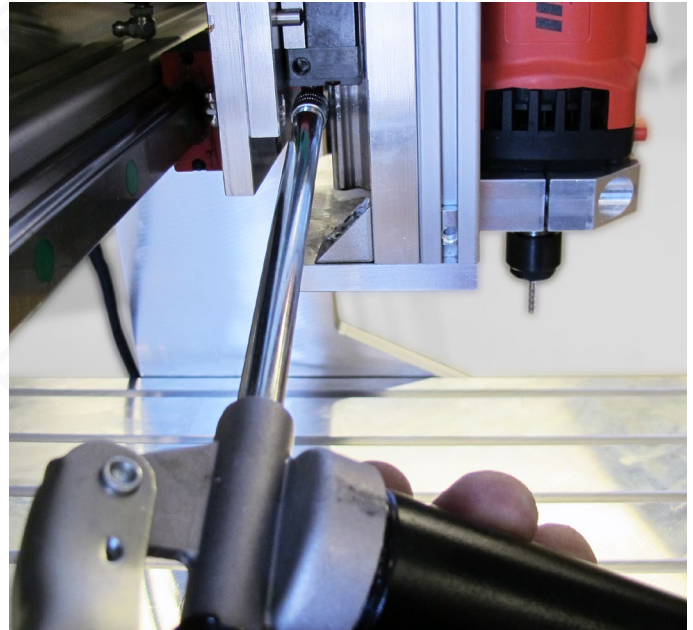


Fig. 48: Lubricating carriage Z-axis

### Spindle nut Z axis

The grease nipple on the spindle nut of the Z axis is easily accessible from behind and above.

- Lubricate the Z-spindle nut as shown in Figure 49.

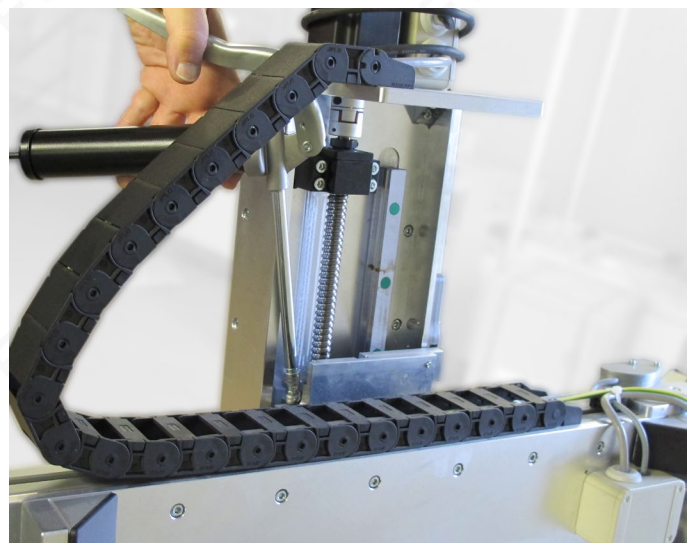


Fig. 49: Lubricating Z-axis spindle nut