



# Assembly instructions CNC portal milling machine kit Compact-Line

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## Machine Parameters COMPACT-LINE

### Mechanical Properties

TYPE:	COMPACT 0403	COMPACT 0404	COMPACT 0405	COMPACT 0604	COMPACT 0605	COMPACT 0804	COMPACT 0805	COMPACT 1005	COMPACT 1007
Travel mm:	X: 420   Y: 310 Z: 140	X: 420   Y: 410 Z: 140	X: 420   Y: 510 Z: 140	X: 620   Y: 410 Z: 140	X: 620   Y: 510 Z: 140	X: 820   Y: 410 Z: 140	X: 820   Y: 510 Z: 140	X: 1020   Y: 510 Z: 140	X: 1020   Y: 710 Z: 140
Clamping area mm:	X: 650   Y: 306	X: 650   Y: 406	X: 650   Y: 506	X: 850   Y: 406	X: 850   Y: 506	X: 1050   Y: 406	X: 1050   Y: 506	X: 1250   Y: 506	X: 1250   Y: 706
Outer dimensions:	L: 720   B: 510 H: 750	L: 720   B: 610 H: 750	L: 720   B: 710 H: 750	L: 920   B: 610 H: 750	L: 920   B: 710 H: 750	L: 1120   B: 610 H: 750	L: 1120   B: 710 H: 750	L: 1320   B: 710 H: 750	L: 1320   B: 910 H: 750
Clearance under portal:	Z: 170								
Ball screw spindles:	X: 16 x 10 mm   Y: 16 x 10 mm   Z: 16 x 5 mm   Tolerance class T07   HIWIN   2% preloaded by special balling, therefore free of play								
Repeatability:	approx. +/- 0.02 mm								
Weight w/o accessories:	approx. 48 kg	approx. 55 kg	approx. 62 kg	approx. 67 kg	approx. 76 kg	approx. 79 kg	approx. 90 kg	approx. 96 kg	approx. 102 kg
Linear guides:	HIWIN linear guides 20mm   Medium preload carriages   Manufactured according to special specifications for HIWIN Germany.								
Clamping plate:	Aluminum T-slot plate included.								
<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:	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 a set 3200 microsteps of the output stage. *2) with 48 V supply voltage and high-quality output stages.								

## Introduction

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



Fig. 1: Completed Compact-Line

## Required tools

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

- Common hand tools, such as Allen keys, screwdrivers, plastic hammer, etc.
- A work surface that is as flat as possible and the same size as the base frame
- Flat or try square, at least 300 mm long in tolerance class 1 or better
- Dial indicator with stand / holder
- Torque wrench from 6 Nm to at least 25 Nm<sup>1)</sup>

<sup>1)</sup> To avoid distortion caused by unevenly tightened screws, the use of a torque wrench for load-bearing screws M5 to M8 is recommended. Adhering to the prescribed screw tightening torque also prevents unintentional loosening during later operation of the machine.

## Optional accessories

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

- milling spindles
- base
- enclosure
- vacuum table
- control electronics
- control software
- minimum quantity lubrication

### Note:

*All directions (left, right, front, back, up and down) in this manual are based on the view as shown in the figure above.*



### 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.

## 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.

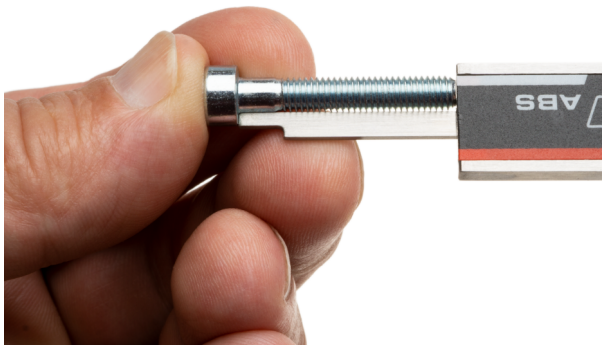
#### Examples:

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.


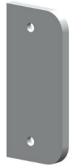





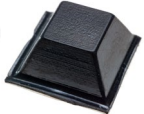

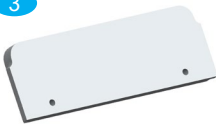
































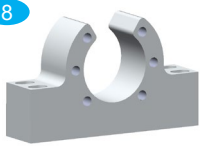



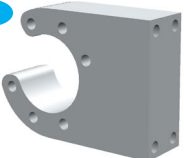

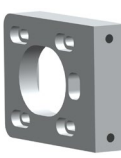

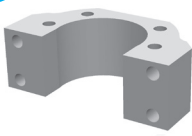


### Exception countersunk screw

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

<sup>1)</sup> See page 6 for gantry elevation parts

Illustration	Description	Number	Illustration	Description	Number
 	end plate Y right CL.FT.015.01	1	 	guide plate Z CL.FT.001.01	1
 	end plate Y left CL.FT.016.01	1	 	rubber pad (self-adhesive) AL.EZB.0109	5
 	stop plate Z <sup>1)</sup> CL.FT.002.01	1	 	claw coupling MZK.080.100.V25	2
 	drive X: fixed brg.  CL.ZAN.FL16.H ball screw  s. S. 6 recirculating ball nut  flt. brg.  CL.ZAN.LL16.H	1	 	carriage ZFW.HGH20CA.ZA	10
 	drive Y: fixed brg.  CL.ZAN.FL16.H ball screw  s. S. 6 recirculating ball nut  flt. brg.  CL.ZAN.LL16.H	1	 	linear rail X: CL 04XX: 589 mm lg. CL 06XX: 789 mm lg. CL 08XX: 989 mm lg. see page 6	2
 	drive Z <sup>1)</sup> : fixed brg.  CL.ZAN.FL16.H ball screw  s. S. 6 recirculating ball nut  CL.ZAN.KGS1605.0270KH	1	 	linear rail Y above: CL XX03: 420 mm lg. CL XX04: 520 mm lg. CL XX05: 620 mm lg. see page 6	1
 	bracing Z <sup>1)</sup> : left  CL .FT.004.01 right  CL.FT.005.01	1	 	linear rail Y below: CL XX03: 479 mm lg. CL XX04: 579 mm lg. CL XX05: 679 mm lg. see page 6	1
 	flange bracket X CL.FT.007.01	1	 	linear rail Z 1): 220 mm lg. 320 mm lg. CL.ZFS.HGR20R.0220 CL.ZFS.HGR20R.0320	1 1
 	flange bracket Y CL.FT.008.01	1	 	motor flange Y CL.FT.014.01	1
 	flange bracket Z CL.FT.009.01	1	 	motor flange Z CL.FT.006.01	1

1) Teile zur Portalerhöhung siehe Seite 6


Illustration	Description	Number
	plate Z CL.FT.003.01	1
	portal beam below see page 6	1
	portal cheek: 1) : left  CL.FT.010.01 right  CL.FT.011.01	1 1
	Reference switch with shim EZB.T1 / AL.IS.001	3
	switch carrier X CL.FT.013.01	1
	switch carrier Y CL.FT.012.01	1
	sled Y CL.FT.017.01	1
	face plate in the back see page 6	1
	front plate see page 6	1
	table top (pre-assembled) see page 6	1

Illustration	Description	Number
	angle 40x40 with cover cap AL.PR.WS.084040	6
	angle 45x45 AL.PR.WS.104545	4
	portal beam (pre-ass.) see page 6	1
	timing belt Y CL.ZAN.HTD3M100.300	1
	belt wheel 36 teeth bore 8 mm AL.ZAN.HTD3M36.15.08	1
	belt wheel 36 Zähne bore 10 mm CL.ZAN.HTD3M36.15.10	1
	foot holder CL.FT.018.01	1
	drag chain holder CL.FT.032.01	1
	mounting bracket for drag chain CL.PR.BW.604020	1
	cylindrical pin DIN6325 5x18 M6	9

Illustration	Description	Number
	cylinder screw DIN912 M3x16 <b>A1</b> M4x12 <b>B1</b> M4x16 <b>B2</b> M4x20 <b>B3</b> M5x12 <b>C1</b> M5x16 <b>C2</b> M5x18 <b>C3</b> M5x20 <b>C4</b> M5x25 <b>C5</b> M8x16 <b>D1</b>	
	hammer nut Nut 8 M5 <b>H1</b> Nut 10 M5 <b>J1</b> Nut 10 M8 <b>J2</b>	
	nut DIN934 M4 <b>K</b>	
	pan head screws DIN7380 M12x30 <b>N1</b>	
	cylinder screw DIN6912 M6x16 <b>E1</b> M6x20 <b>E2</b> M6x40 <b>E3</b> M8x12 <b>S1</b> M8x16 <b>S2</b> M8x20 <b>S3</b>	

Illustration	Description	Number
	countersunk screw DIN7991 M4x10 <b>F</b>	
	hammer head screw M8x25 <b>G</b>	
	flange nut DIN6923 M8 <b>T</b>	
	washer DIN125 3,2 <b>U</b> 4,3 <b>V</b> 5,5 <b>W</b> 8,4 <b>X</b>	
	washer DIN9021 5,5 <b>Y1</b> 8,4 <b>Y2</b>	

**Note**

The same number of standard parts is always enclosed for all machines. In the case of smaller sizes, standard parts may be superfluous.



### Order numbers of size-dependent parts

		Machine			
Description		CL 04XX	CL 06XX	CL 08XX	CL 10XX
4	ball screw X incl. nut (16 x 10)	CL.ZAN.KGS1610.0600KH	CL.ZAN.KGS1610.0800KH	CL.ZAN.KGS1610.1000KH	CL.ZAN.KGS1610.1200KH
4	ball screw X incl. nut (16 x 5)	CL.ZAN.KGS1605.0600KH	CL.ZAN.KGS1605.0800KH	CL.ZAN.KGS1605.1000KH	CL.ZAN.KGS1605.1200KH
15	linear rail X	CL.ZFS.HGR20R.0588	CL.ZFS.HGR20R.0788	CL.ZFS.HGR20R.0988	CL.ZFS.HGR20R.1188
		CL XX03	CL XX04	CL XX05	CL XX07
5	ball screw Y incl. nut (16 x 10)	CL.ZAN.KGS1610.0450KH	CL.ZAN.KGS1610.0550KH	CL.ZAN.KGS1610.0650KH	BL.ZAN.KGS1610.0850KH
5	ball screw Y incl. nut (16 x 5)	CL.ZAN.KGS1605.0450KH	CL.ZAN.KGS1605.0550KH	CL.ZAN.KGS1605.0650KH	BL.ZAN.KGS1605.0850KH
16	linear rail Y above	CL.ZFS.HGR20R.0419	CL.ZFS.HGR20R.0519	CL.ZFS.HGR20R.0619	CL.ZFS.HGR20R.0819
17	linear rail Y below	CL.ZFS.HGR20R.0478	CL.ZFS.HGR20R.0578	CL.ZFS.HGR20R.0678	CL.ZFS.HGR20R.0878
22	portal beam below	CL.FT.026.01	CL.FT.027.01	CL.FT.028.01	CL.FT.055.01
28	face plate in the back	CL.FT.020.01	CL.FT.021.01	CL.FT.022.01	CL.FT.053.01
29	front plate	CL.FT.023.01	CL.FT.024.01	CL.FT.025.01	CL.FT.054.01
33	portal beam pre-ass.	CL.FT.033.01	CL.FT.034.01	CL.FT.035.01	CL.FT.052.01

		CL 0403	CL 0404	CL 0405	CL 0604
30	table top (pre-assembled)	CL.FT.036.01	CL.FT.037.01	CL.FT.038.01	CL.FT.040.01
		CL 0605	CL 0804	CL 0805	CL 1005
		CL.FT.041.01	CL.FT.043.01	CL.FT.044.01	CL.FT.045.01
		CL 1007			
	CL.FT.056.01				

### Order numbers for gantry elevation parts

- Portal cheek left CL.FT.046.01
- Portal cheek right CL.FT.047.01
- Plate Z axis CL.FT.048.01
- Bracing Z-axis left CL.FT.049.01
- Bracing Z-axis right CL.FT.050.01
- Ball screw including nut CL.ZAN.KGS1605.0320KH
- Linear guide rail short CL.ZFS.HGR20R.0274
- Linear guide rail long CL.ZFS.HGR20R.0370

## 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.

## Preliminary work

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

#### Install grease nipples (all drives)

- Equip all recirculating ball nuts with 90° angled grease nipples (see figure 2, red arrow). Do not fully tighten grease nipples yet so that you can align them later.

#### Mount fixed bearing (all drives)

- Push the first bushing onto the ball screw.
- Push the fixed bearing unit onto 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.

#### Install floating bearing (only X/Y drive)

- Press the roller bearing into the housing of the floating bearing unit.
- Y-drive only: Push the floating bearing unit onto the ball screw and attach the retaining ring to the end of the ball screw.

**Attention!** Install the floating bearing unit of the X-axis only after it has been passed through the front plate (see page 11).



### Caution!

The pre-assembled recirculating ball nuts must not be unscrewed from the recirculating ball spindles!

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

In order not to damage the roller bearings during assembly in the floating or fixed bearing units, only the outer bearing rings may be pressed/hit. Use a suitable drive sleeve (tube) and oil the outer bearing ring before assembly!

#### **i** Note

*Floating and fixed bearings are easy to distinguish: the fixed bearings have four mounting holes, the floating bearings only two.*

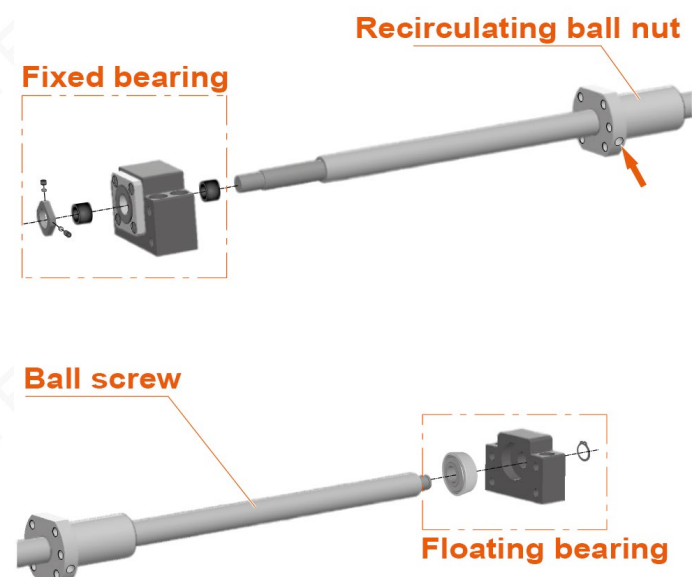


Fig. 2: Assembly of the grease nipples and spindle bearings. Do not mount the floating bearing unit of the X axis until installation (p. 11)!

## Assembly X axis

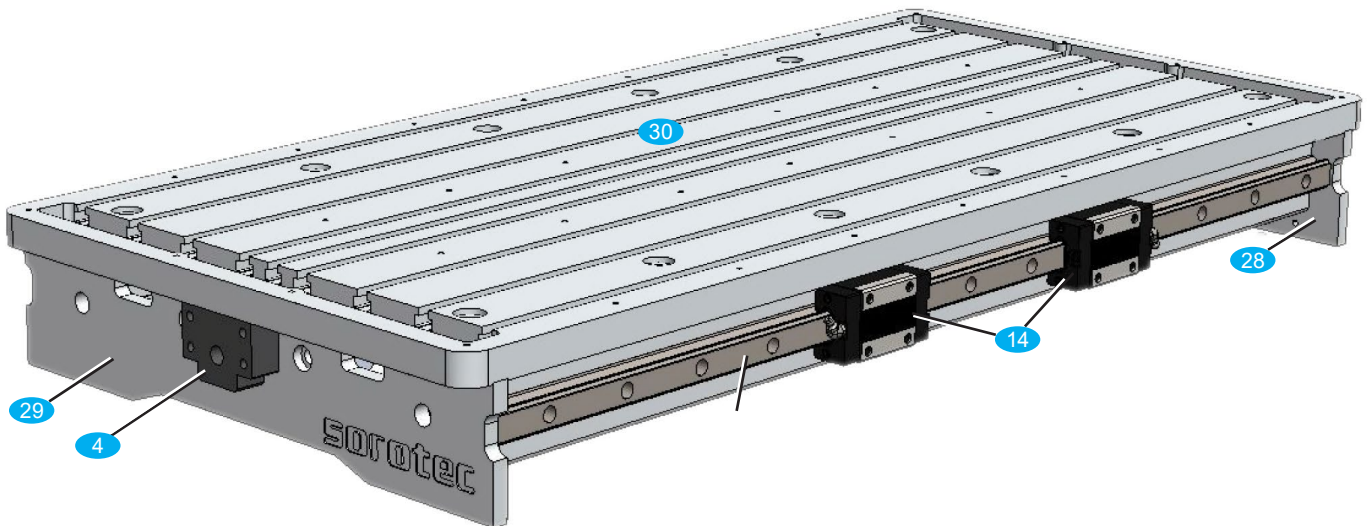


Fig. 3: Slot table with drive and guide parts

- Screw the linear rail (15) to the profile with cylinder head screws M5x20 (C4) and slot 10 T-nuts M5 (J1); the reference edge of the linear rail marked with an arrow must be in contact with the milled stop edge of the profile over its entire length (see Figure 4).
- Tighten the screws evenly starting in the middle and working outwards. Tightening torque: 6 Nm
- Repeat the work steps with the second profile and second linear rail.

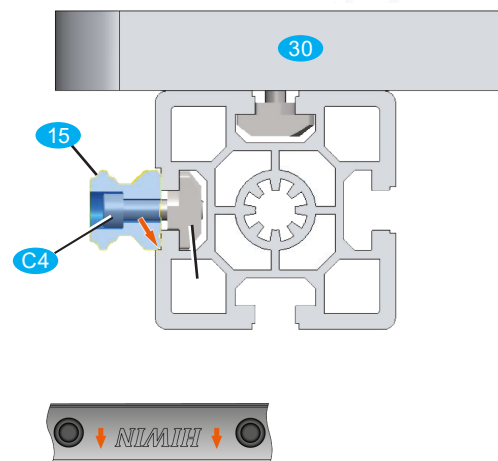


Fig. 4: Assembly of linear rails; Note the stop edge

### **i** Note

*The sealing plugs for 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

*When installing a bracket (32) on a component without fastening grooves, the centering tabs on the bracket must first be removed (red arrows in Figure 5). This can be done by breaking off with a screwdriver, filing or grinding.*

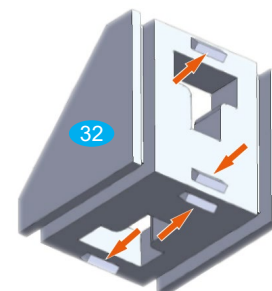


Fig. 5: Centering tabs on mounting bracket

*These brackets are not installed on narrow machines with the width „03“! Accordingly, the work steps for bracket assembly are omitted.*

• Slide two carriages **14** onto the linear rails on each side; the following should be noted:

- Ground, blank surfaces on the long sides of the carriage point upwards towards the tabletop.
- Equip the carriage with straight grease nipples so that they point outwards (red arrows in Figure 6).

• Screw the end plates **28** / **29** to the profiles with 2 flat-head screws M12x30 **N1** each; Slightly counter-tighten the screws.

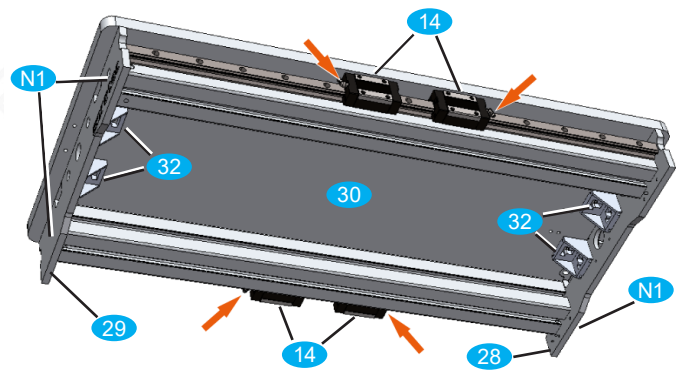


Fig. 6: Carriage X, end plates and brackets

### **i** Note

„At the back“ of the Compact-Line slot table is where there are four threaded holes on the underside for mounting the fixed bearing of the X-spindle.

- Screw the bracket **32** to the underside of the table top with M8x16 screws **S2** and washers **X**; Slightly counter-tighten the screws.
- Screw the brackets **32** to both end plates **28** / **29** with cylinder head screws M8x20 **S3** and flange nuts **T**; Slightly counter-tighten the screws.
- Tighten the mounting screws in the following order:
  - pan head screws (end plates on profiles of the table top)
  - cylinder screws (angles on table top)
  - cylinder screws / flange nuts (angles on end plates)

• Guide the ball screw **4s** through the hole in the front plate and screw the fixed bearing **4f** to the table top with 4 cylinder screws M6x40 **E3**; Slightly counter-tighten the screws.

• Slide the floating bearing unit **4l** onto the free end of the ball screw and screw it to the table top with two cylinder screws M6x40 **E3**; Slightly counter-tighten the screws.

• Install the snap ring on the end of the ball screw.

### **i** Note

The fastening screws of the bearing units are only tightened after alignment. When installing the reference switch, observe the additional instructions **for the housing** from the electrical assembly kit, adjust the screw length if necessary.

• Equip the switch carrier X with two cylinder screws M8x12 **S1** and washers **X**, loosely unscrew the hammer nuts **J2** at the rear.

• Position switch carrier X **25**, threading hammer nuts into the T-slot of the profile. Slightly tighten the screws to turn the hammer nuts 90° in the T-slot.

• Place the reference switch **24** with underlying shim and screw it to the switch carrier **25** with washers **U** and cylinder head screws M3x16 **A1**.

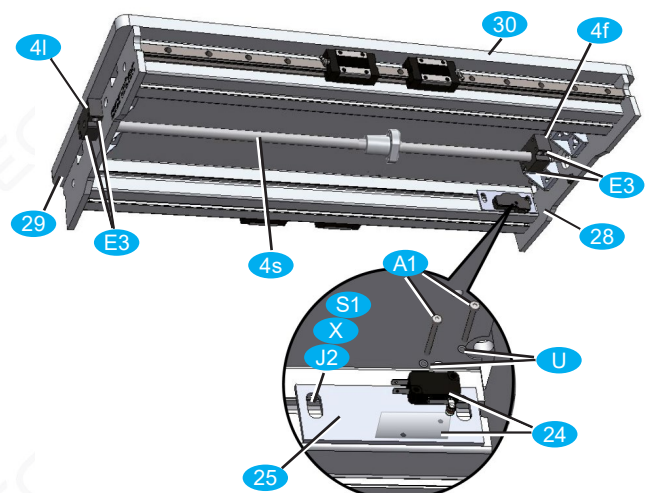


Fig. 7: X-axis spindle and reference switch

## Assembly Y axis

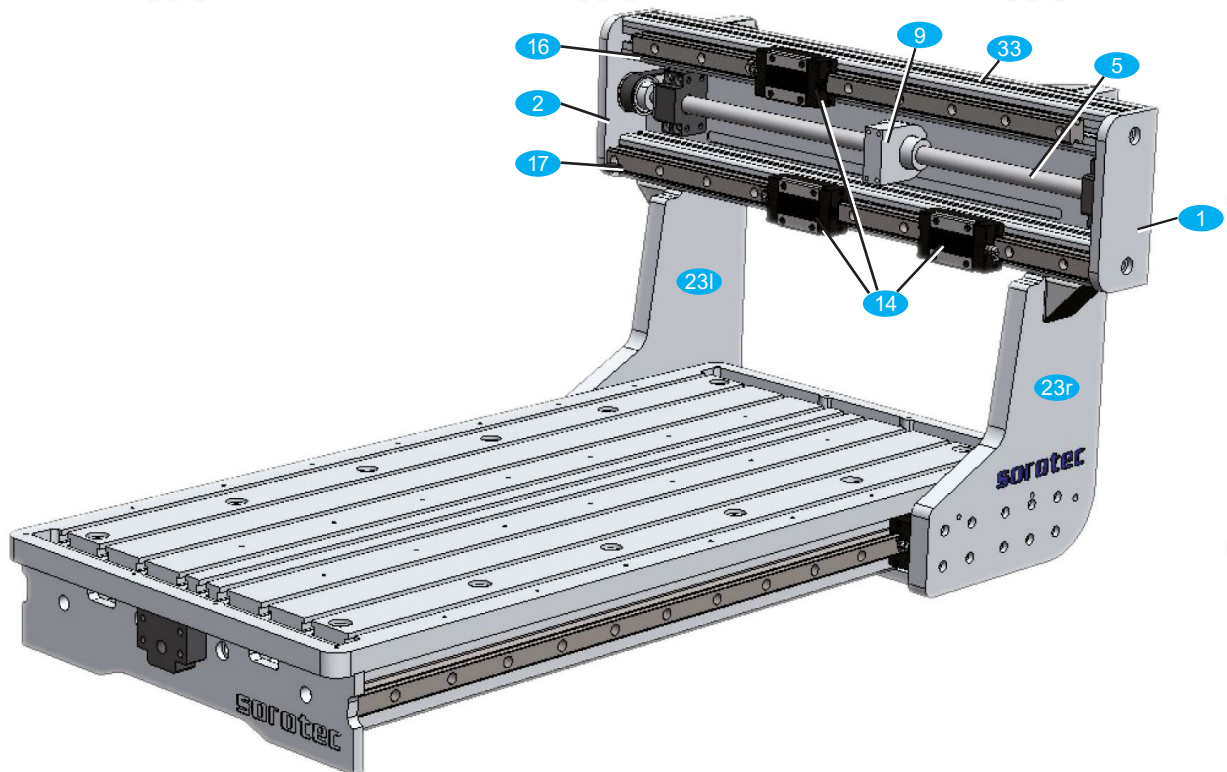


Fig. 8: Portal and Y axis

- Drive the cylindrical pins **Z** into the portal cheeks **23l** / **23r** until they protrude 3 ... 4 mm on the inside (see magnified picture 9).
- Place the portal panels with the cylinder pins on the carriages and screw tight with cylinder screws M5x20 **C4**. Tightening torque: 6 Nm
- Insert the gantry beam **22** into the recesses of the gantry stringers as shown in Figure 9 and screw in place with cylinder screws M6x16 **E1**; Slightly counter-tighten the screws.
- Degrease the surfaces to be glued and stick one rubber pad **12** to the front and one to the rear of the front panel (not shown).

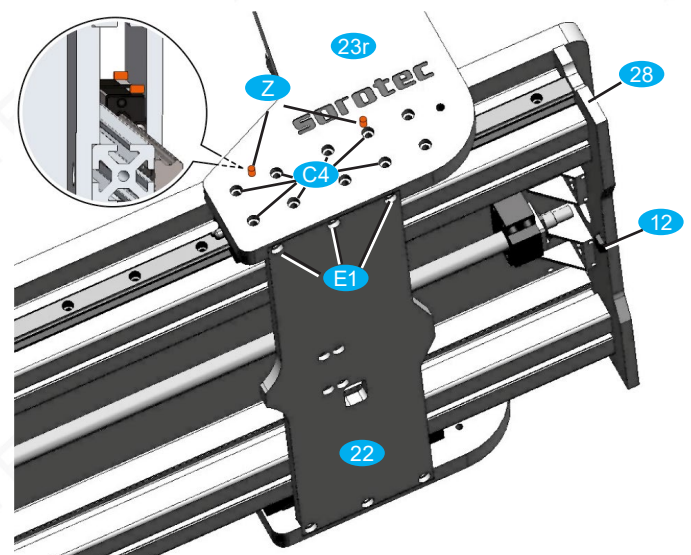


Fig. 9: Installation of portal stringers and beam

- Equip linear rails **16** / **17** from above with cylinder screws **C3** and screw on slot 8 hammer nuts **H1** below.
- Place the linear rails on the profiles of the portal beam **33** in such a way that the reference edges of the linear guides marked with arrows point to the milled stop edges (see Figure 10).
- Center the linear rails on the profiles and slightly counter-tighten the screws to turn the hammer nuts by 90° in the T-slot.
- Screw the linear rails to the profiles; the reference edges of the linear guides must lie against the milled stop edges of the profiles along their entire length. Tightening torque: 6 Nm
- Insert the sealing plugs into the holes in the guide rails. Make sure they sit flush.

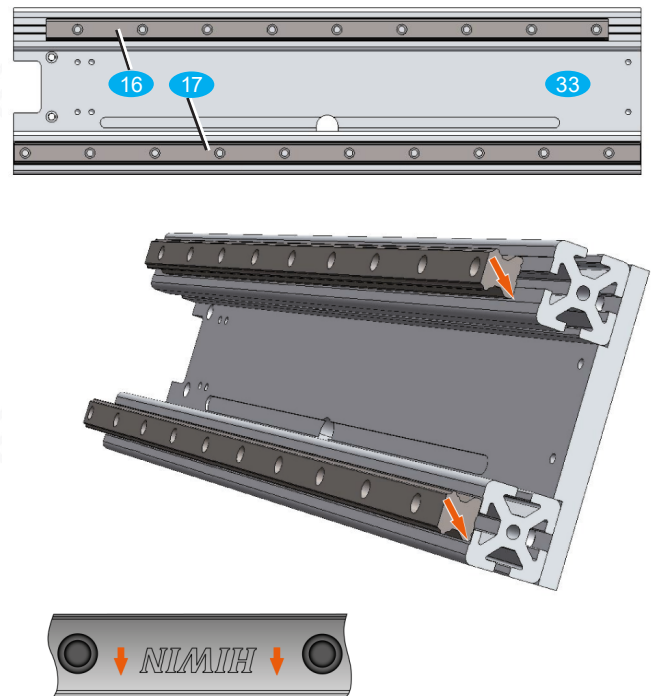


Fig. 10: Reference edges of the linear rails

- Screw two brackets **31** to the lower profile of the portal beam with cylinder head screws M5x16 **C2** washers **W** and T-nuts slot 8 **H1** (magnifying glass below in picture 11); Slightly counter-tighten the screws so that the angles can still just be moved on the profile.
- Equip four brackets **31** with one cylinder screw M5x25 **C5** and one washer **W** each and loosely screw on a hammer nut **H1** lat the back.
- Insert hammer nuts through the slot on the back of the portal beam into the profile and screw the angle (magnifying glass above in picture 11); Slightly counter-tighten the screws so that the angles can still just be moved.
- Place the portal beam on the two portal walls as shown in Figure 11 and screw all angles to the portal walls with cylinder screws M8x16 **D1**; Slightly counter-tighten the screws

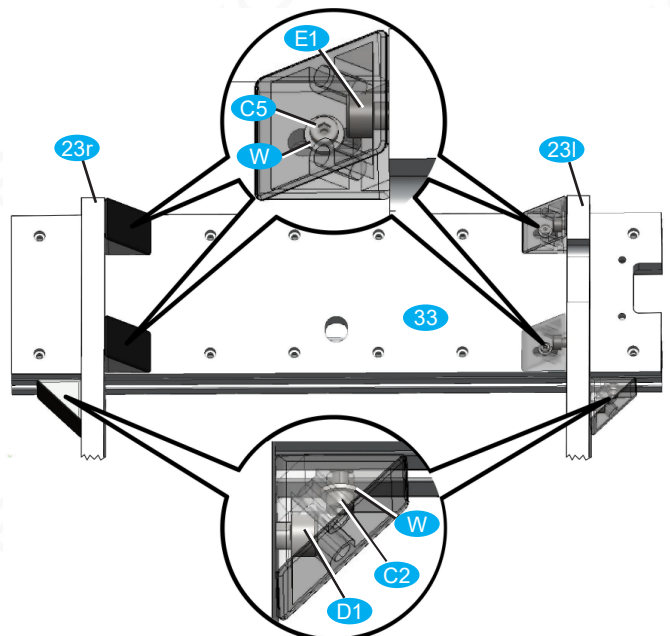


Fig. 11: Installation of the portal beam on the portal cheeks

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

- E1** Connections portal beam / portal cheeks
- D1** Connections angles / portal cheeks
- C5** Connections angles / portal beam
- C2** Connections angles / profile

- If necessary, loosen screw connections and tighten slightly.
- Move the portal several times from one end of the base frame to the other end while gradually tightening the screws. The order is the same as for the loose check:

- E1** Connections portal beam / portal cheeks
- D1** Connections angles / portal cheeks
- C5** Connections angles / portal beam
- C2** Connections angles / profile

- Check whether the portal can be moved easily over the entire travel path after tightening all screws.

- Press the cover caps onto the angles.

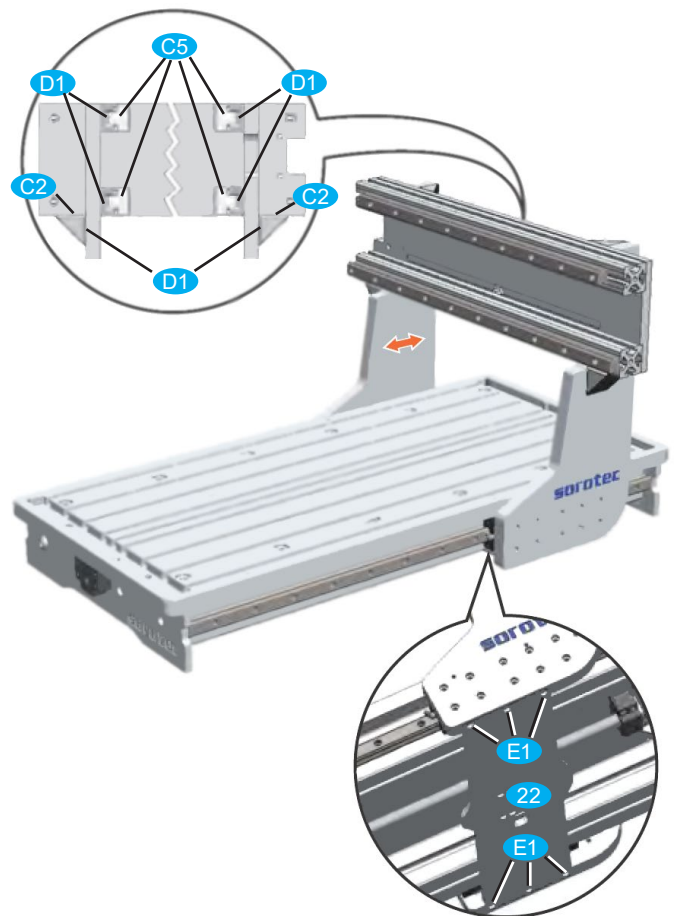


Fig. 12: Tighten the portal screw connection

- Tighten the X-axis ball nut grease fitting so that it faces the opening in the gantry beam (red arrows in Figure 13).

- Screw the recirculating ball nut **4k** to the flange block X **8** using cylinder screws M5x20 **C4**; Slightly counter-tighten the screws.

- Move the portal until the flange block X is located above the lower portal beam **22**.

- Screw the flange bracket X to the portal beam using cheese head screws M5x18 **C3**; Slightly counter-tighten the screws.

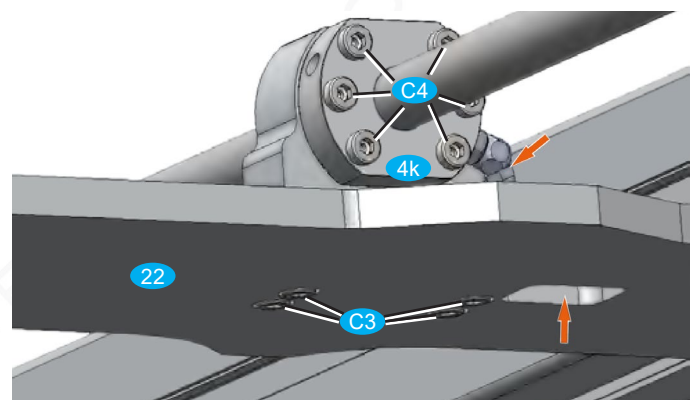


Fig. 13: Screw connection of X-spindle nut and beam



- Move the gantry forward as far as possible by turning the ball screw **4s** (red arrows in Fig. 14).
- Tighten the floating bearing **4l** mounting screws **E3**. Tightening torque: 10 Nm.
- Tighten the retaining screws **C4** of the recirculating ball nut **4k** on the flange bracket X **8**. Tightening torque: 6 Nm.
- Carefully tighten the fastening screws **C3** of the flange bracket X on the beam.

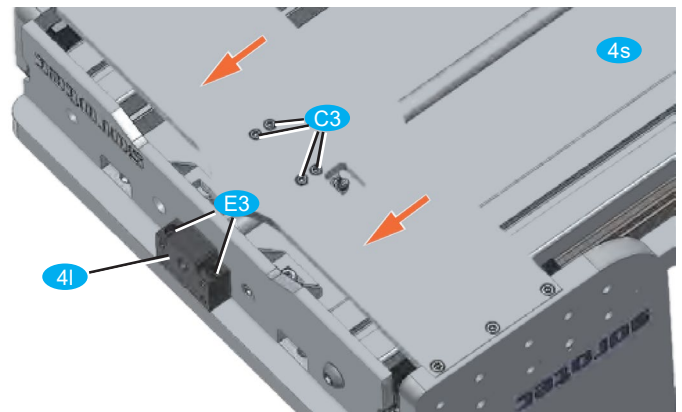


Fig. 14: Tightening the X-spindle screw connections

- Move the gantry backwards by turning the ball screw (red arrow in Figure 15) until the fastening screws of the fixed bearing are just accessible.
- Tighten the fixed bearing mounting screws. Tightening torque: 10 Nm

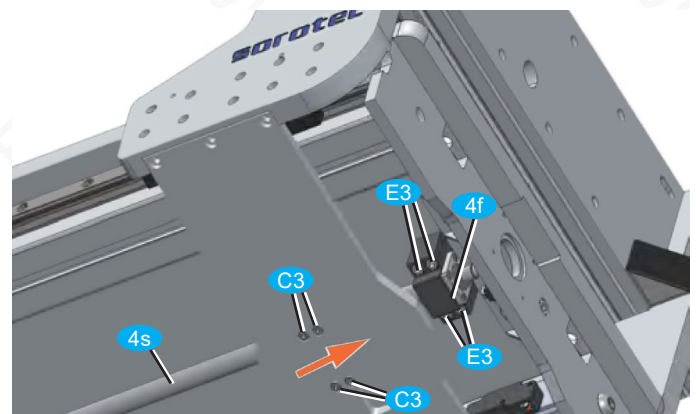


Fig. 15: Tightening the X spindle fixed bearing

- Drive the cylindrical pins **Z** from the back into the sled Y **27** until they protrude by about 3 ... 4 mm.

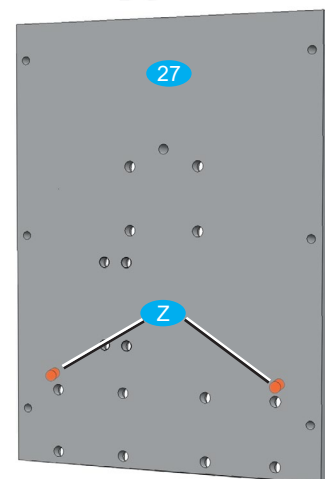


Fig. 16: Cylindrical pins in sled Y

- Slide one carriage **14** onto the upper linear rail **16** and two carriages **14** onto the lower linear rail **17**; the following must be observed:
  - Ground, blank surfaces on the long sides of the carriage point upwards
  - Equip the lower carriage with straight grease nipples so that they point outwards (red arrows below in Figure 17).
  - Equip the upper carriage with a 45° grease nipple so that it points upwards to the left (red arrow above in Figure 17).

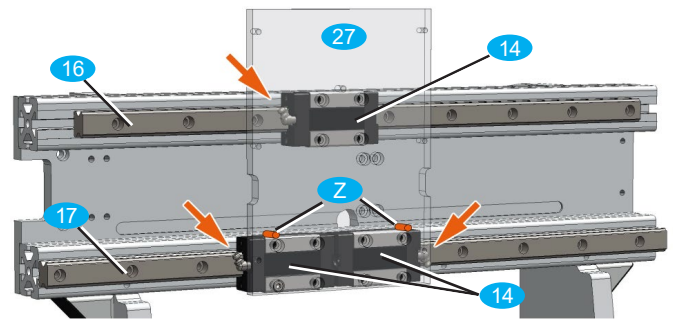


Fig. 17: Mounting sled Y on the portal

- Place sled Y **27** with the cylinder pins on the lower carriage and screw with cylinder screws M5x12 **C1** verschrauben. Tightening torque: 6 Nm
- Screw carriage Y to the upper carriage; Slightly counter-tighten the screws.
- Move carriage Y back and forth several times as far as possible to the left and right on the linear rails; while doing so, gradually tighten the fastening screws of the upper carriage. Tightening torque: 6 Nm

- Guide the ball screw **5s** behind the sled Y **27** as shown. Screw loose bearing **5l** with 2 and fixed bearing **5f** with 4 cylinder screws M6x40 **E3** to the portal beam **33**; Slightly counter-tighten the screws

- Tighten the grease fitting on the ball nut **5k** so that it faces the opening in the gantry beam (red arrows in Figure 18).

- Screw the recirculating ball nut **5k** to the flange bracket Y **9** using cylinder screws M5x20 **C4**; Slightly counter-tighten the screws.

- Move sled Y so that the carriage can be mounted to the flange block Y with cylinder screws M5x16 **C2**; Slightly counter-tighten the screws.

- Move sled Y to the fixed bearing by turning the ball screw until the fixing screws of the fixed bearing are just accessible.

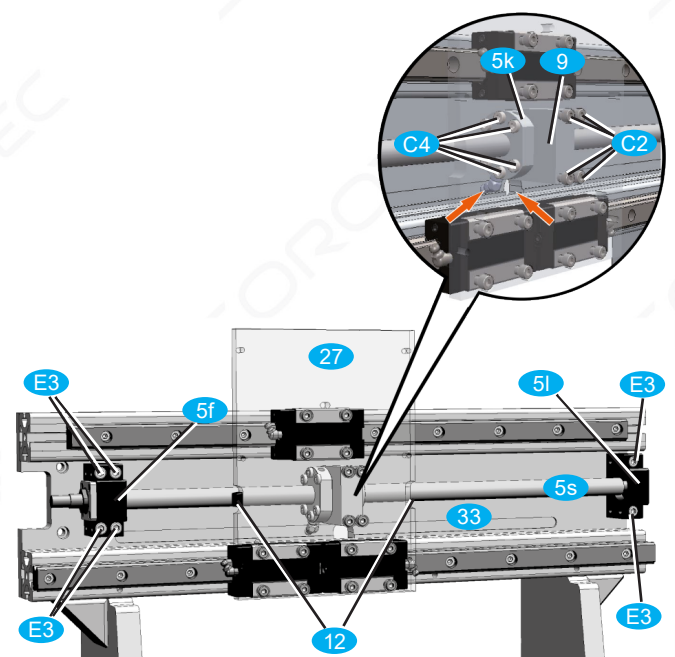


Fig. 18: Installation of the Y spindle

- Tighten the fixed bearing mounting screws **E3**.  
Tightening torque: 10 Nm
- Carefully tighten the retaining screws **C4** of the recirculating ball nut on the flange bracket Y.  
Tightening torque: 6 Nm
- Move sled Y towards the loose bearing by turning the ball screw until the fastening screws **E3** of the loose bearing are just accessible.
- Tighten the floating bearing mounting screws.  
Tightening torque: 10 Nm
- Degrease the adhesive surfaces and stick the rubber pads **12** on both sides of the sled Y (see Figure 18).

- Screw end plate Y right **1** to the portal beam using cheese head screws M8x20 **S3**.

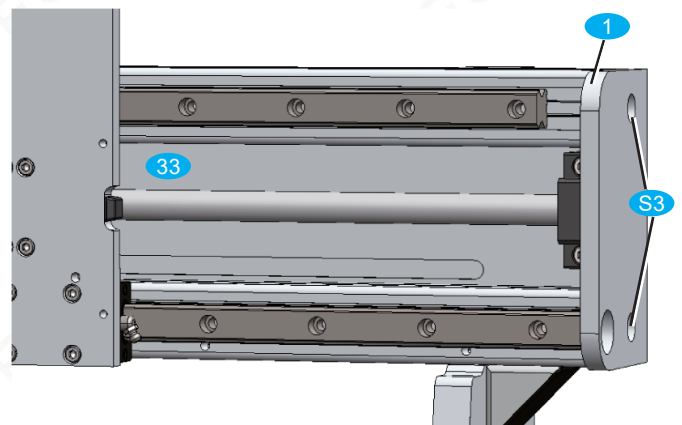


Fig. 19: Assembly of the right end plate

- Screw the motor flange Y **19** to the portal beam **33** using cylinder screws M6x20 **E2** it is important to ensure that the recesses in the motor flange (red arrows in Figure 20) point outwards and that the motor flange is aligned at an angle.
- Push the toothed belt wheel **36** as far as possible onto the shoulder of the ball screw and fix it with the locking screw.
- Screw end plate Y left **2** to the portal beam using cylinder screws M8x20 **S3**.

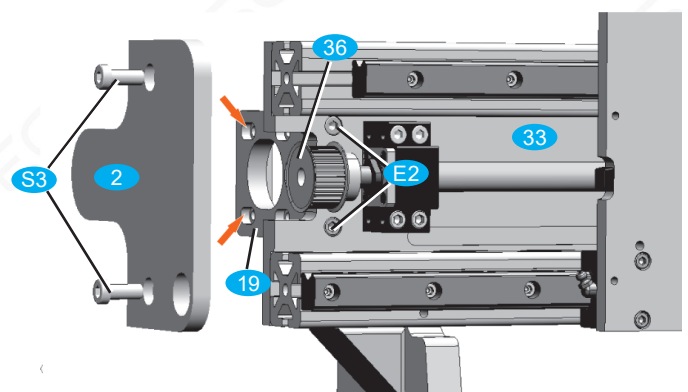


Fig. 20: Assembly of motor flange Y and left end plate

**i Note**

The switch carrier Y is mounted on the left outside on the profile of the portal beam. When installing the reference switch, observe the additional instructions for the electrical installation kit, if necessary.

- Equip the switch carrier Y with two screws **C1** and loosely screw on the hammer nuts **H1** at the back.
- Position switch carrier Y **26**, threading hammer nuts into the T-slot of the profile. To turn the T-nuts 90° in the T-slot, tighten the screws slightly.
- Place the shim between the reference switch **24** and the switch carrier Y **26** and screw it flush with the outer edge of the profile using cylinder screws M3x16 **A1** and washers **U**.

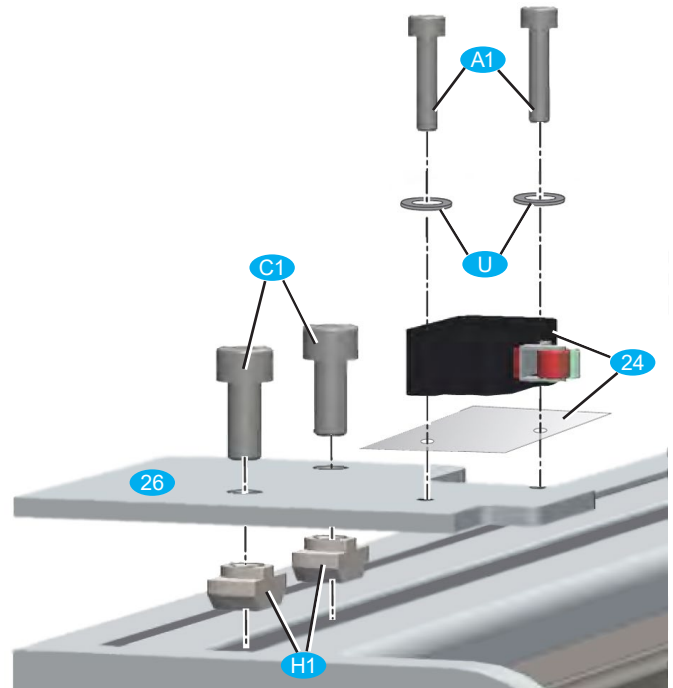


Fig. 21: Mounting reference switch Y-axis

## Assembly Z axis

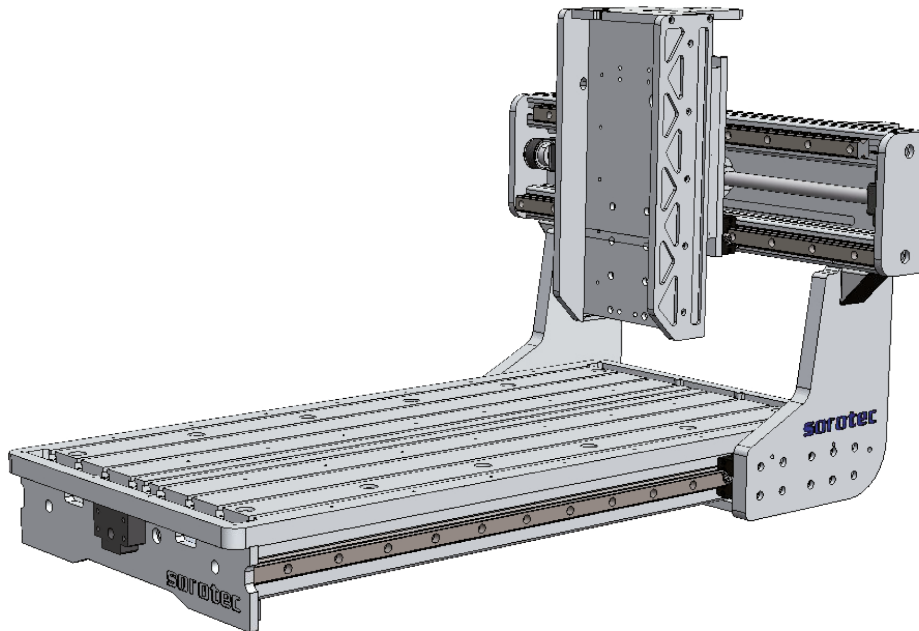


Fig. 22: Completely assembled Z-axis on the mechanically fully assembled Compact-Line

- Drive the cylindrical pins **Z** into the guide plate **Z** **11** until they protrude by about 3 ... 4 mm.

**i** Note

*The fastening screws of the carriages are only tightened during alignment.*

- Screw the carriage **14** to the guide plate with cylinder screws M5x16 **C2**. The following must be observed:

- ground, blank surface on the long sides of the carriage point to the outer edges of the plate
- The lubricating nipples on the carriages point outwards. If necessary, turn the lubricating nipples or screw them to the opposite end

- Slightly counter-tighten the screws
- Slide the linear rail **18** into the two carriages as shown in Figure 23. Press the carriage with the linear rail against the cylindrical pins and screw the two carriages tight in this position. Tightening torque: 6 Nm
- Remove cylindrical pins (were only required for alignment during assembly).
- Degrease the adhesive surface and stick a rubber pad **12** to the guide plate Z.

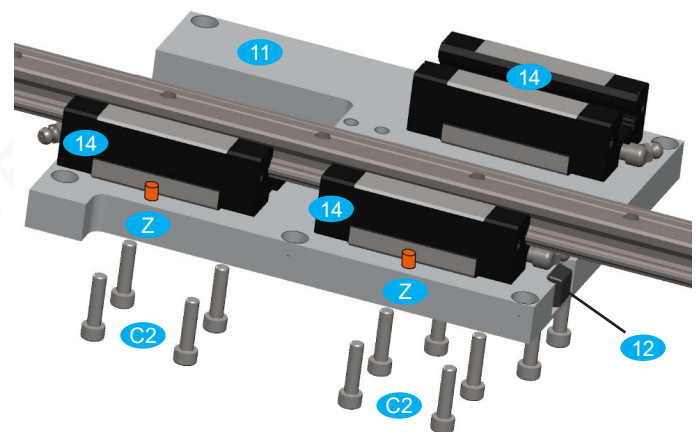


Fig. 23: Assembly of the carriages

- Place the linear rails **18** on the plate **21** so that the reference edges (above the „HIWIN“ lettering, see Figure 24) of the linear guides point to the milled stop edges of the plate Z (red arrows).

- Screw linear rails with cylinder screws **C4**; Slightly counter-tighten the screws.

- Starting in the middle, tighten the screws evenly outwards; the reference edges of the linear rails must lie against the milled stop edges of the plate **21** over their entire length. Tightening torque: 6 Nm

- Seal the holes in the rails with plugs.

- Slide the carriages with the guide plate **11** onto the linear rails of the plate **21**.

- Slide the guide plate **21** back and forth several times over the entire travel on the linear rails; while doing so, gradually tighten the fastening screws of each individual carriage. Tightening torque: 6 Nm

- Screw the flange bracket **10** to the guide plate **11** cylinder screws M5x16 **C2**; Slightly counter-tighten the screws.

- Insert the spindle **6** with the recirculating ball nut into the flange bracket **10** as shown.

- Put on the fixed bearing **6f** and screw it to the plate **21** with four screws M6x40 **E3**; Slightly counter-tighten the screws.

- Tighten the ball nut grease fitting so that it faces the hole in the plate **21**. Screw the recirculating ball nut **6k** to the flange bracket **10** with M5x20 screws **C4**. Tightening torque: 6 Nm

- Carefully tighten the fastening screws on the flange bracket **10**.

- Move the guide plate **11** as far as possible towards the fixed bearing by turning the ball screw.

- Tighten the fixed bearing mounting screws **6f**. Tightening torque: 10 Nm

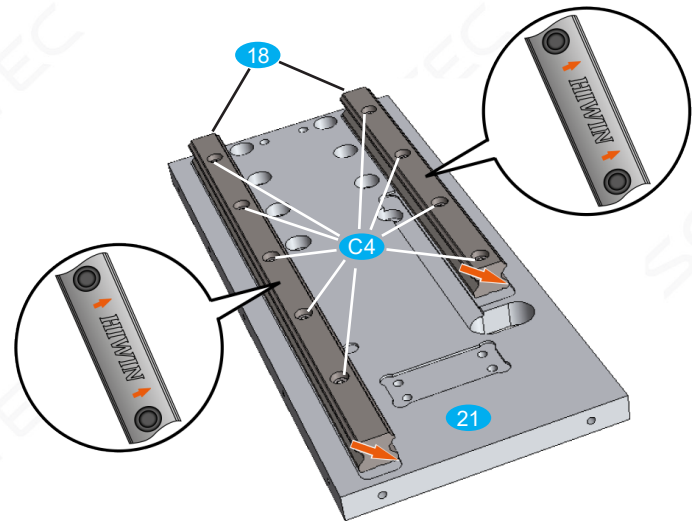


Fig. 24: Assembly of the linear rails

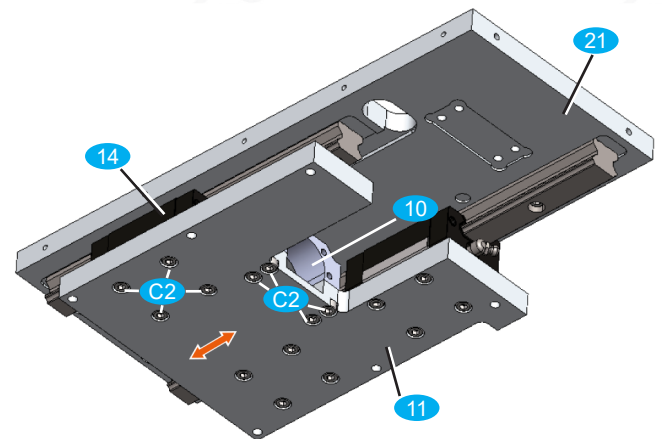


Fig. 25: Assembly of the guiding group

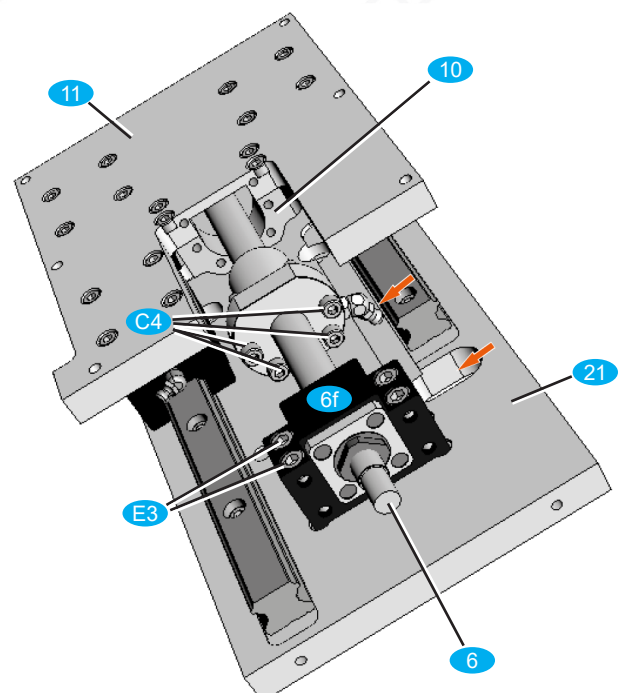


Fig. 26: Spindle grease fitting towards port (red arrows)

- Screw the pre-assembled Z-axis to the Y-sled with M5x18 screws **C3**; Slightly counter-tighten the screws.



### Attention!

Without the stop plate installed in the next step, the Z axis can be moved up too far! The spindle nut and the guide carriages can become dislodged and damaged!

- Mount the stop plate **3** with M5x16 screws **C2** on the underside of the plate **21**; Slightly counter-tighten the screws.

To align the Z-axis, a dial indicator must be attached to the plate **21** and a try square must be attached to the table. Rotating the ball screw of the Z-axis moves it up and down.

- Align the Z-axis so that the dial gauge does not deflect when moving up and down the Z-axis. In this position, tighten the fastening screws. Tightening torque: 6 Nm

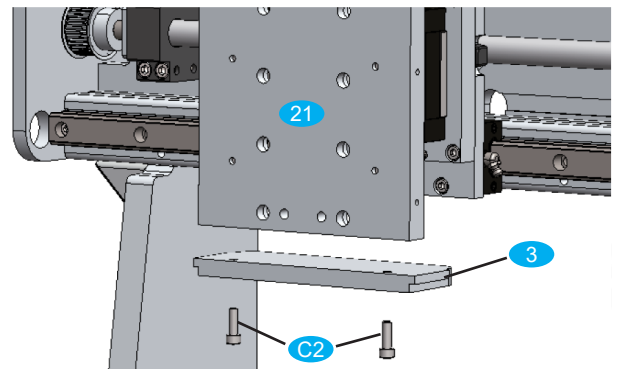


Fig. 27: Assembly of the stop plate

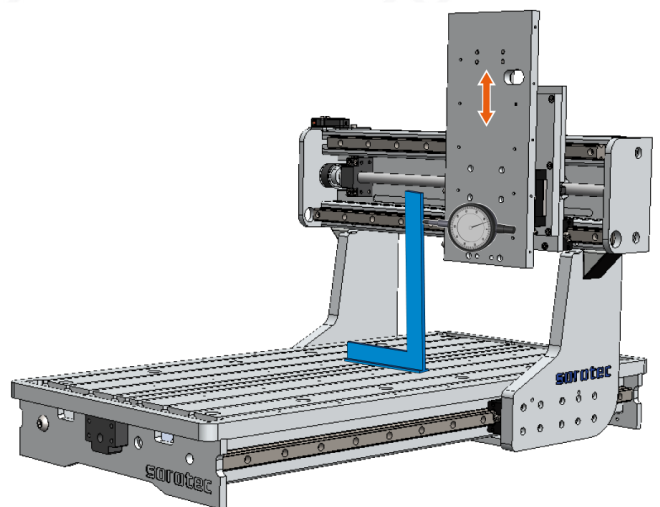


Fig. 28: Aligning the Z axis on the machine

- Attach the motor flange **20** to the plate **21** using M5x16 screws **C2**; Slightly counter-tighten the screws
- Mount the bracings **7** on the plate **21** and on the motor flange **20** using M4x12 screws **B1**.
- Tighten the fastening screws (motor flange **20** to plate **21**).
- Tighten the fastening screws (braces **7** on the plate **21**).
- Mount the reference switch **24** together with the shim with washers **U** and M3x16 screws **A1** on the left brace **7l**.

### Note

In the following figure, only the Z-axis is shown for a better overview.

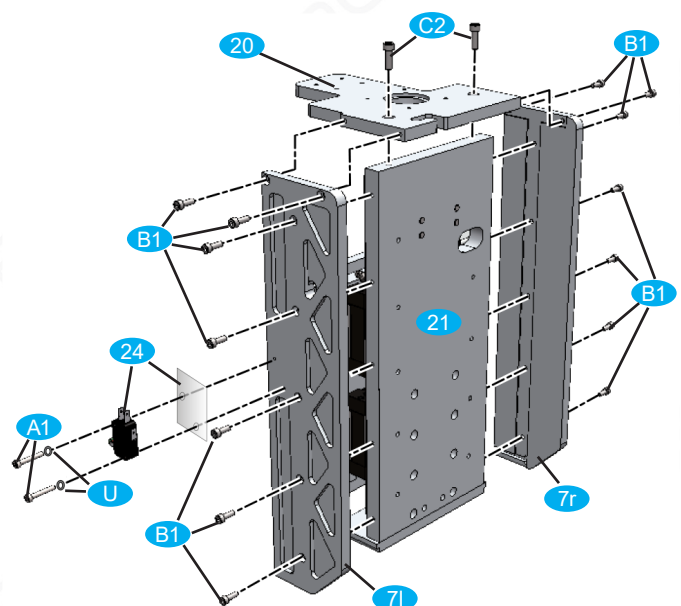


Fig. 29: Assembly of motor flange and stiffeners

## Assembly of the axis drives

### X axis

- Push 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 rear end plate **28**.
- Fix the stepper motor with the safety screw of the claw coupling.

#### **i** Note

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

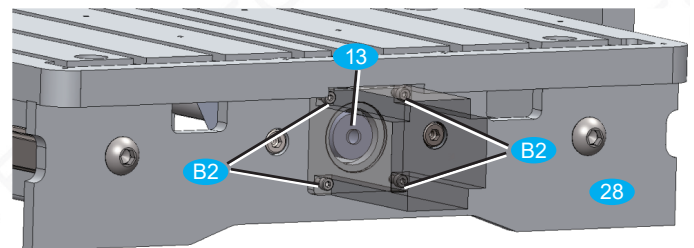


Fig. 30: Assembly stepper motor X axis

### Y axis

- Temporarily remove end plate Y left **2**.
- Screw the stepper motor to the motor flange Y **19** (either with M5x25 screws **C5** OR with M4x16 screws **B2**, washers **V** and nuts **K**); Slightly counter-tighten the screws.
- Push the toothed belt wheel **35** onto the output shaft of the stepper motor, align it with the toothed belt wheel **36** on the ball screw and fix it with the locking screw.
- Put on the toothed belt **34** and tension it by moving the stepper motor; Tighten the stepper motor mounting screws.
- Screw the end plate Y left back to the portal beam.

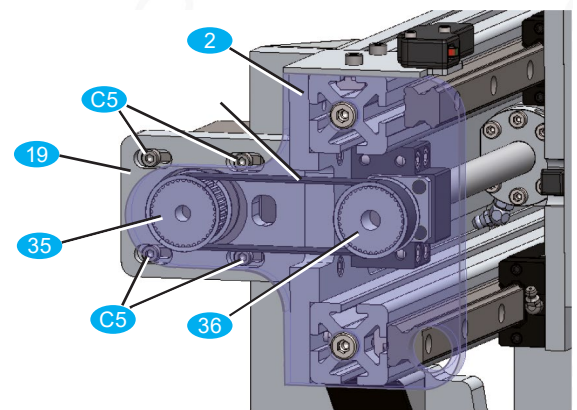


Fig. 31: Assembly stepper motor Y axis

### Z axis

- Push 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 motor flange Z **20** using M4x16 screws **B2**.
- Fix the stepper motor with the safety screw of the claw coupling.

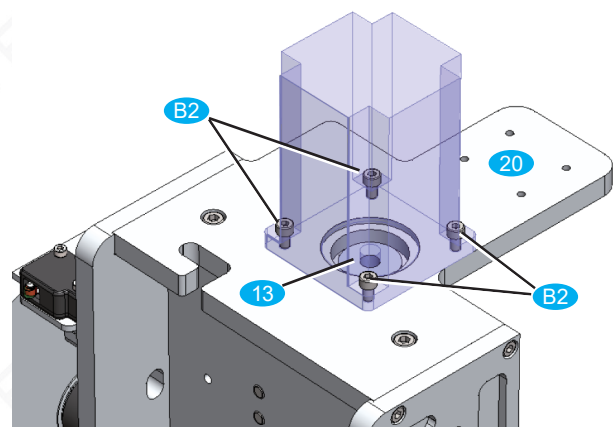


Fig. 32: Assembly stepper motor Z axis

#### **i** Note

Claw couplings can cause loud noises during operation. In this case, lubricate the plastic buffer with a little Vaseline. Never use normal grease or lubricating oil! Ordinary lubricants attack the plastic and can destroy it.