Assembly Manual

Pro Basic/Vario Line

Pro Basic 10-05

X =   500mm
Y = 1000mm
Z =   100mm

Milling spindle
Kress FME 800
not included

MECHAPLUS®

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Congratulations to the purchase of a CNC machine of our Pro Line.

Preface

Please read thoroughly the entire manual as it contains important information about the assembly and operation of the CNC machine. Have a look at all parts delivered and tick them off on the provided part list. The CD within the parcel contains additional photos of the assembly process.

If you have any questions, please don't hesitate to contact us: **07952/92 12 79 7**

All screws are to be tightened only slightly. Once the machine has been assembled completely, the screws need to be tighted when all moving parts have been adjusted during the first operation of the machine.

Required tools and materials

- Allen keys 2/3/4/5/6
- Torx T40
- Open-end wrenches size 7/13/14
- Open-end wrench (flat) size 13
- Socket wrench size 5
- Rubber mallet (small)
- Diagonal pliers (small)
- Phillips screw driver (small/medium) PH1
- Calliper
- Tape measure
- Cordless drill/screw driver
- Drill 2,5 mm
- Oil/grease
- Thread locker
- Clamps
- Edding/pencil

Frame assembly

Required tools: Torx T40
                          Cordless screw driver
                          Oil/grease

Required parts: Strut(s) work area
                          Frame parts front/rear face
                          Frame parts corners
                          Frame parts sides
                          18/20 profile connectors
                          4 mounting feet
                          4 plastic caps

Firstly, threads are formed in the frame parts using a screw M8 or a thread moulder M8. This will make it easier to screw in the Torx screws of the profile connectors. Using some oil or grease on the screw/thread moulder will then require less effort to form the threads.

Mount all 18/20 profile connectors into the frame parts *front/rear face*, *sides* and *strut(s) work area* as shown in Figure 1.

Figure 1: Profile connectors mounted on the parts front/rear face, sides and strut(s) work area

Ensure that the sliding blocks slip into a groove and that the headless screws are level with the top side of the sliding blocks. Screw in the Torx M8 screws into the frame parts but leave a gap of approx. one millimetre between frame parts and sliding blocks. The sliding blocks should now "rattle" with a bit of backlash.

Mould the threads in the parts *corners* in the same way as you did at the frame parts. Please **do not** screw in the mounting foots in these parts yet. That will be done later.

Then, lay out all frame parts, the four corners and the strut(s) on an even surface where the entire machine will be assembled. Now, start with one frame part *side* and a *corner*, and slide the profile connectors of the frame part *side* gently into the groove of the corner part until both parts lay even on the surface. Continue with the frame part *rear face* and mount it on the corner part of the already assembled frame. Afterwards, mount the second *corner* part on the other side of the *rear face*. Then, take the remaining frame part *side* and mount it on the previously assembled *corner* part.

You **must** slide the *strut(s) work area* into the lower groove of the frame between the frame part *sides*. Only then should you assemble the remaining two frame parts *corner* and the *front face*.

Once all parts have been mounted together, the headless screws of the profile connectors need to be screwed tightly so that all frame parts are firmly attached to each other.

If there are any gaps between frame parts after all headless screws have been tightened, then the Torx M8 screws of the profile connectors need to be screwed in further.

The frame is now assembled and should look like the one shown in Figure 2. Because the frame is laying on the work area, the mounting feet should be screwed into the frame parts *corner*. After that, the frame can be set on its feet and the plastic caps can be plugged into the corner parts. That completes the assembly of the frame.

Figure 2: Assembled frame of a CNC-machine of the Pro Line 06-05

Guide rails Y

Required tools: Allen keys 5/6
                        Open-end wrench (flat) size 13

Required parts: 2 guide rails Y
                        2 guide bearings
                        12/16 slide nuts M8
                        12/16 screws M8×20 or M8×22

Place 6/8 slide nuts into the lower grooves of both frame parts *sides*. Afterwards put one guide bearing on the *guide rail Y* and mount it with screws M8×20 or M8×22 on the frame part *side*. Repeat this task for the other *guide rail Y* (Figure 3).

To adjust the guide bearings follow these steps: Tighten the screws (with a flat open-end wrench size 13) of the ball bearings. Then, use an Allen key turn the headless screws of the ball bearings while checking the ball bearings. Turn the headless screws just until you cannot turn the ball bearings anymore by hand. The adjustment is completed when the guide bearings can only be moved on the guide rails with some resistance (Give the guide bearing a little push. It should come to a halt within 20 centimetres).
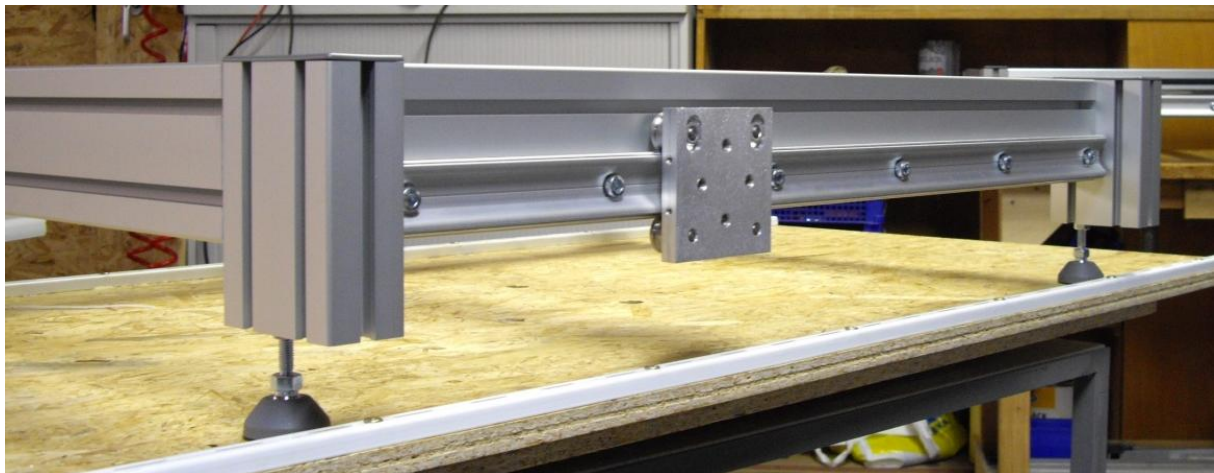
Figure 3: Guide rail Y and guide bearings mounted

Threaded spindle Y

Required tools: Allen keys 1,5/2/2,5/3

Required parts: 2 flange bearings
4 slide nuts M6
4 washers M6
4 screws M6×25
4 spacing rollers 7 mm

Place four slide nuts M6 in the lower groove of the frame part *rear face* and mount two flange bearings with screws M6×25, spacing rollers and washers (Figure 4).

Figure 4: Two flange bearings mounted

Required tools: Allen key 5

Required parts: 2 threaded spindle (long)
4 jackets (for threaded spindles)
12 headless screws M3
Thread locker
4 POM (polyoxymethylen) nuts 12×6

Remove the jackets from the ends of the threaded spindles and turn three headless screws in each of the four jackets. **Screw two POM nuts on each threaded spindle.** (Once the jackets have been put onto the threaded spindles, the POM nuts won't fit anymore!) Give plenty of thread locker on the ends of the threaded spindles (**not** on the headless screws in the jackets), put the jackets back onto the threaded spindles and fasten the jackets with its the headless screws (Figure 5 and Figure 6).

Figure 5: Thread locker on the spindles

Figure 6: Jackets on the threaded spindles and fastened with headless screws

Required tools: File
Allen key 1,5

Required parts: Pre-assembled threaded spindles (long)
2 belt pulleys T5 20z (drilling 12 mm)
8 headless screws M4×6
Belt 650 mm
2 POM nut holders M4

Slide one belt pulley on each threaded spindle. If the belt pulley get stuck on the jackets, remove the top of the headless screws with a file. Put the ends of the threaded spindles holding the belt pulleys into previously mounted flange bearings but **do not** fasten the headless screws of the flange bearings. Lay the belt over both belt pulleys. It is not necessary to tighten the belt at that time.

Slide the *POM nut holders M4* onto the threaded spindles and over the POM nuts. Fasten each holder with two headless screws on the POM nuts (Figure 7).
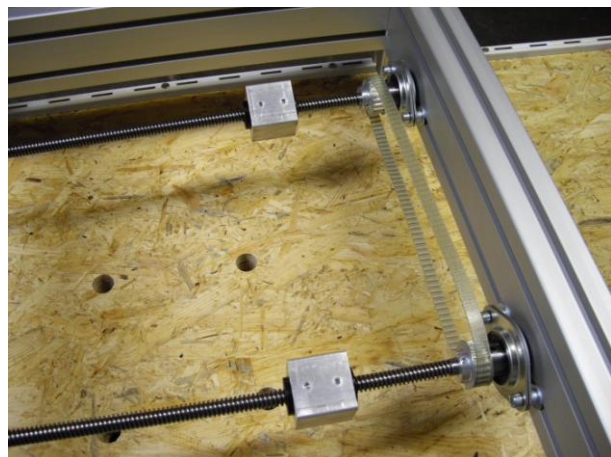

Figure 7: Belt and POM nut holder M4 mounted on threaded spindles

| **Required tools:** | Allen key 5 |
| | Rubber mallet |

Required parts:	2 flange bearings
	4 slide nuts M6
	4 washers M6
	4 screws M6×25
	4 spacing rollers 7 mm
	4 headless screws M4×6 (for belt pulley)
	Belt pulley T5 20z (drilling 12 mm)
	Belt 305 mm

Slide the belt pulley onto one of the threaded spindles already mounted inside the machine's frame and put the belt onto the pulley. Plug the spindles into the flange bearings.

Place four slide nuts in the lower groove of the frame part front face and mount the flange bearings with screws M6×25, spacing rollers 7 mm and washers in the machine's frame.

It may be necessary to hit the flange bearings with a small rubber mallet to adjust the position of the ball bearings and plug in the threaded spindles more easily.

Align the threaded spindles so that they do not touch the frame parts *front face* or *rear face* and fasten the headless screws of the flange bearings on that side of the frame where the motor will not be mounted (Figure 8).

Figure 8: Threaded spindles of the Y-axis mounted

Motor plate Y and motor Y

Required tools: Allen key 5

Required parts: 4 slide nuts M6
                             4 washers M6 (large)
                             4 lock washers 6 mm
                             4 screws M6×40
                             4 spacing rollers 15 mm

Place two slide nuts in each of grooves of the frame part *front face* near that threaded spindle that has a belt pulley on it. Afterwards, mount the *motor plate Y* at the front face (Figure 9). The exact position of that motor plate will be determined later.

Figure 9: Motor plate Y mounted

Figure 10: Close-up of motor plate Y

Required tools: Allen key 3/5
                             Open-end wrench size 7
                             Forceps or flat nose pliers

Required parts: 4 screws DIN 912 M4×45
                             4 spacing rollers 25 mm
                             4 lock washers 4 mm
                             4 screw nuts M4
                             Headless screw M4×6
                             Belt pulley T5 20z (drilling 6,35 mm)
                             Stepper motor 57BYGH450E-23 (large stepper motor)

Slide the belt pulley onto the shaft of the stepper motor, leave a gap of 0.5 to 1 mm between pulley and motor casing, and tighten the pulley's headless screw.
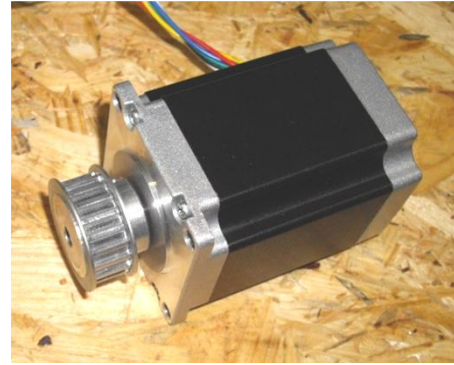

Figure 11: Stepper motor with belt pulley

Mount the stepper motor onto the bottom-left corner of *motor plate Y* using a screw M4×45, spacing roller 25 mm, lock washer 4 mm and a screw nut M4. Please note the direction of the wires coming out of the motor casing (see also Figure 13).
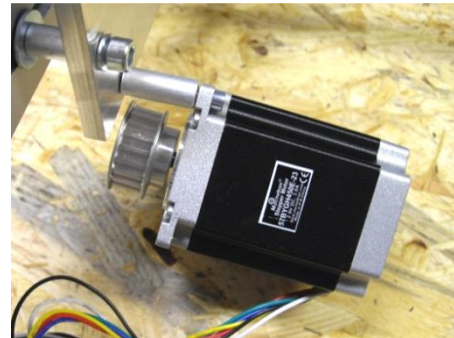

Figure 12: Mounting stepper motor on motor plate Y

Then, lay the belt, that is already on the pulley of the threaded spindle, over the stepper motor's pulley and mount the motor with a second screw M4×45, spacing roller 25 mm, lock washer 4 mm and screw nut M4 on the bottom-right corner of motor plate Y. It may be necessary to move the motor plate closer towards the threaded spindle to get the belt onto the stepper motor's pulley.
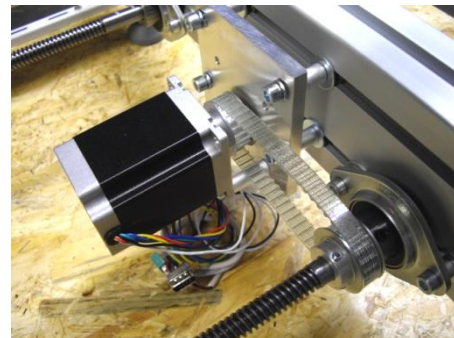

Figure 13: Motor plate Y aligned

Afterwards, the motor can be mounted with the remaining two screws but do not tighten the screws, yet. Align the stepper motor in such a way that the belt pulley does not touch any spacing roller and tighten the screws on the stepper motor slightly. You do not need to tighten the belt at that time. Please leave the screws used to mount the *motor plate Y* onto the *front face* only slightly fastened.

Assembly of gantry

Required tools: Allen key 3/5/6

Required parts: Connecting element gantry sides
8 spacing rollers 25 mm
12 lock washers 4 mm
8 screws M4×40
4 screws M4×16

Place the CNC machine's frame bottom up on a flat surface and align the POM nut holders M4 so that they are the same distance away from the frame part *front face*. It may be necessary to loosen the headless screws in the holders, pull the holders off the POM nuts, move the POM nuts to a suitable position and slide the holders back onto the POM nuts.

Afterwards, mount the *connecting element gantry sides* with screws M4×40, lock washers and spacing rollers on the POM nut holders as shown in Figure 14. Then, each of the guide bearings of the *guide rails Y* are mounted with two screws M4×16 and lock washers on the connecting element.

It may become necessary to move the flange bearings and threaded spindles inside the *front/rear faces* to different positions before the *connecting element gantry sides* can be assembled.

Figure 14: Connecting element gantry sides mounted onto POM nut holders M4 and guide bearings

Required tools: Allen keys 3/5/6

Required parts: 2 D100K (gantry sides)
8 washers
8 screws M8×22

Put the frame back onto its feet and mount the gantry sides, D100K, using screws M8×22 and washers on the guide bearings of the *guide rails Y*. Make sure that both gantry sides point I the same direction and are perpendicular to the frame (Figure 15).
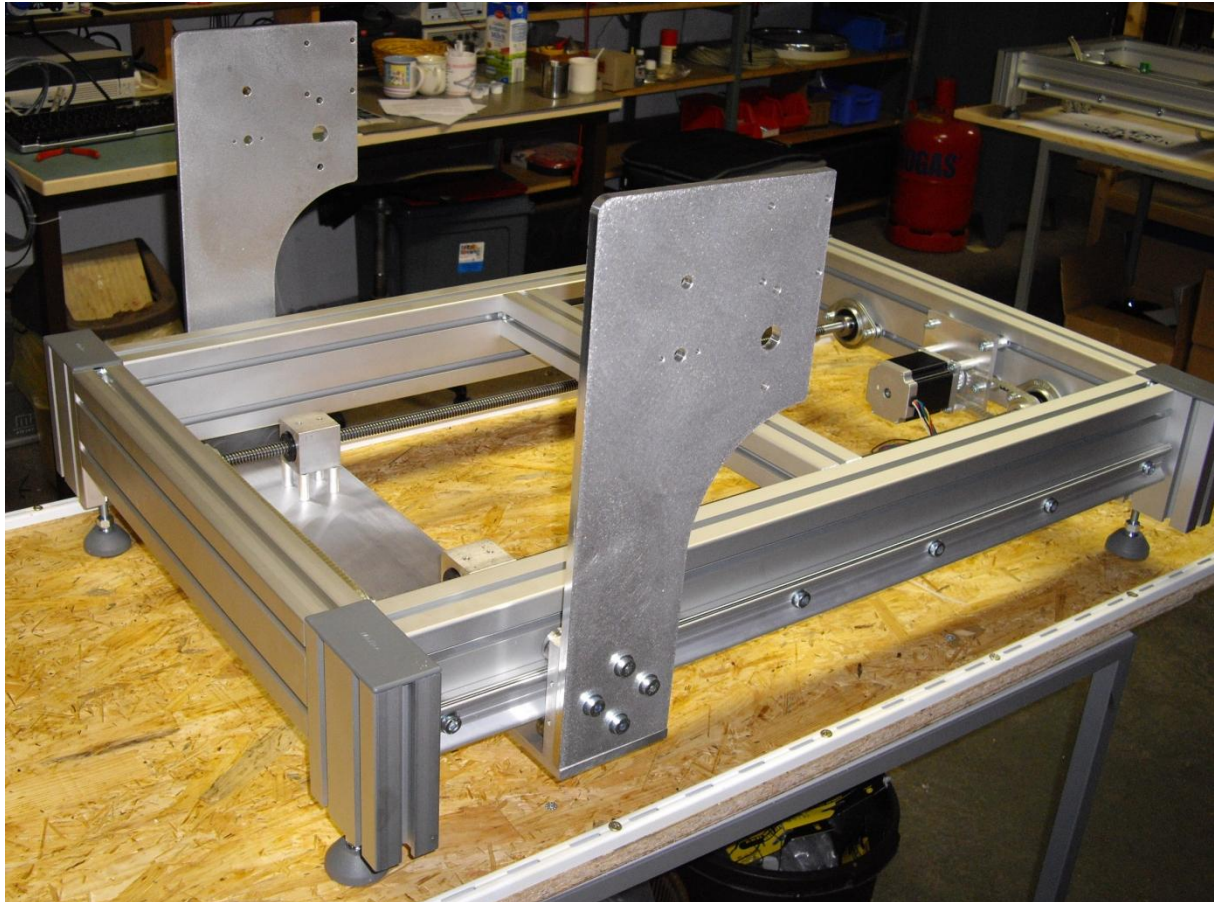

Figure 15: Gantry sides mounted on the guide bearings

Required tools: Allen keys 5/6

Required parts: Gantry
2 guide rails X
2 guide bearings
8 slide nuts M8
8 screws M8×22

Place four slide nuts M8 in one of the grooves of the gantry and mount a guide rail with four screws M8×22 onto it. Repeat this process for the other side of the gantry and tighten all screws with 15 to 20 Nm torque. Ensure that the guide rails are centred on the gantry.

Slide one guide bearing into each guide rail and adjust the ball bearings so that it requires a small amount of force to push the guide bearings along the guide rails (see also page 4; Figure 16).

Figure 16: Guide rails and guide bearings mounted on the gantry

Required tools: Allen key 6

Required parts: Pre-assembled gantry
4 screws M8×40
4 washers M8

Place the pre-assembled gantry between the gantry side parts and mount it with four screws M8×40 and washers (Figure 17).

Figure 17: Gantry with slider rails X and guide bearings mounted

Required tools:	Allen keys 1,5/2/3/5/6
	Rubber mallet
	Thread locker
	File
	Open-end wrench size 10
Required parts:	Threaded spindle 665 mm
	6 headless screws M3×3 (for threaded spindle)
	4 headless screws M4×6 (for belt pulley, POM nut holder M4)
	2 flange bearings
	4 spacing rollers 7 mm
	4 screws M6×25
	4 lock washers 6 mm
	4 screw nuts M6
	2 POM nuts
	POM nut holder M4
	Belt pulley T5 20z (drilling 12 mm)
	Belt 225 mm

Remove the jackets from both ends of the threaded spindle and turn three headless screws into each of the jackets. **Screw two POM nuts on the threaded spindle.** Give plenty of thread locker on the ends of the threaded spindle, put back the jackets onto the spindle and fasten the

jackets with the headless screws (in a similar way you did it with the threaded spindles of the X-axis; see page 5).

Then, slide the belt pulley on one of the spindle's jackets (if necessary, remove the top of the headless screws with a file). Screw two headless screws M4×6 in the POM nut holder M4 and slide it onto the spindle. Lay the belt on the spindle as well and put the threaded spindle in the gantry as shown in Figure 18.
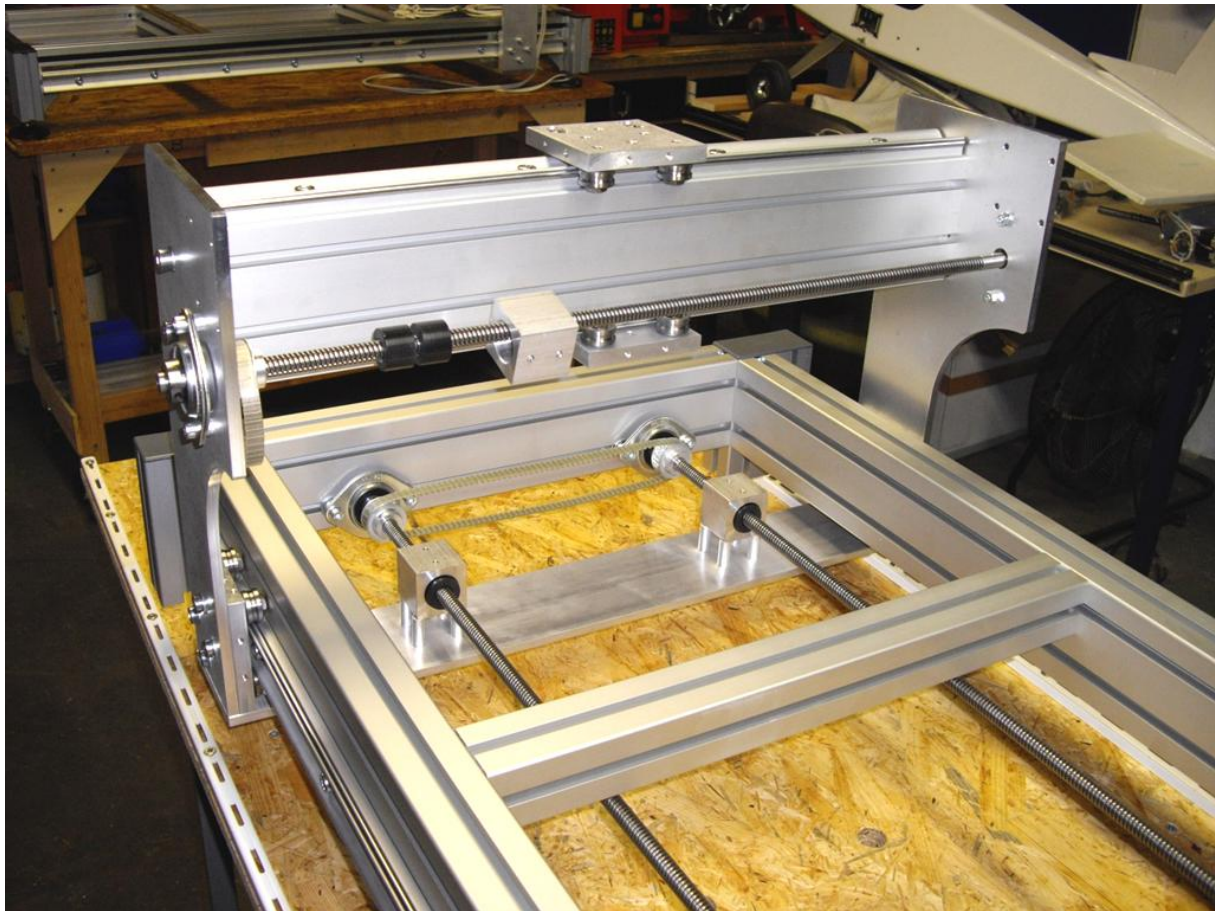
Figure 18: Threaded spindle mounted in the gantry

Mount one flange bearing on one of the gantry side parts with two screws M6×25, spacing rollers 7 mm, lock washers and screw nuts (screw nuts on the inside). Slide the threaded spindle into the ball bearing of the just mounted flange bearing and align the spindle so that the spindle sticks out of both gantry side parts the same length. Fasten the headless screws of the just mounted flange bearing. Once this is done, the second flange bearing can be mounted on the other gantry side part. (Figure 18).

It may be necessary to hit the flange bearings with a small rubber mallet to adjust the position of the ball bearings and plug in the threaded spindles more easily.

Required tools:	Allen key 3
Required parts:	Base plate X rear
	4 screws DIN933 M4×16 (hexagonal socket-headed screws)
	4 screws M4×16
	8 lock washers 4 mm

Mount the *base plate X rear* with four screws DIN933 M4×16 and lock washers on the POM nut holder M4. Using hexagonal socket-headed screws allows it to reach the screw heads with an open-end wrench later. That is most often not possible with Allen head screws.

Afterwards, mount the *base plate* with four screws M4×16 and lock washers on the guide bearings of the *guide rails X*. Then, the POM nuts are aligned in a way so that the POM nut holder can be slid onto them and locked with the headless screws of the holder (Figure 19).
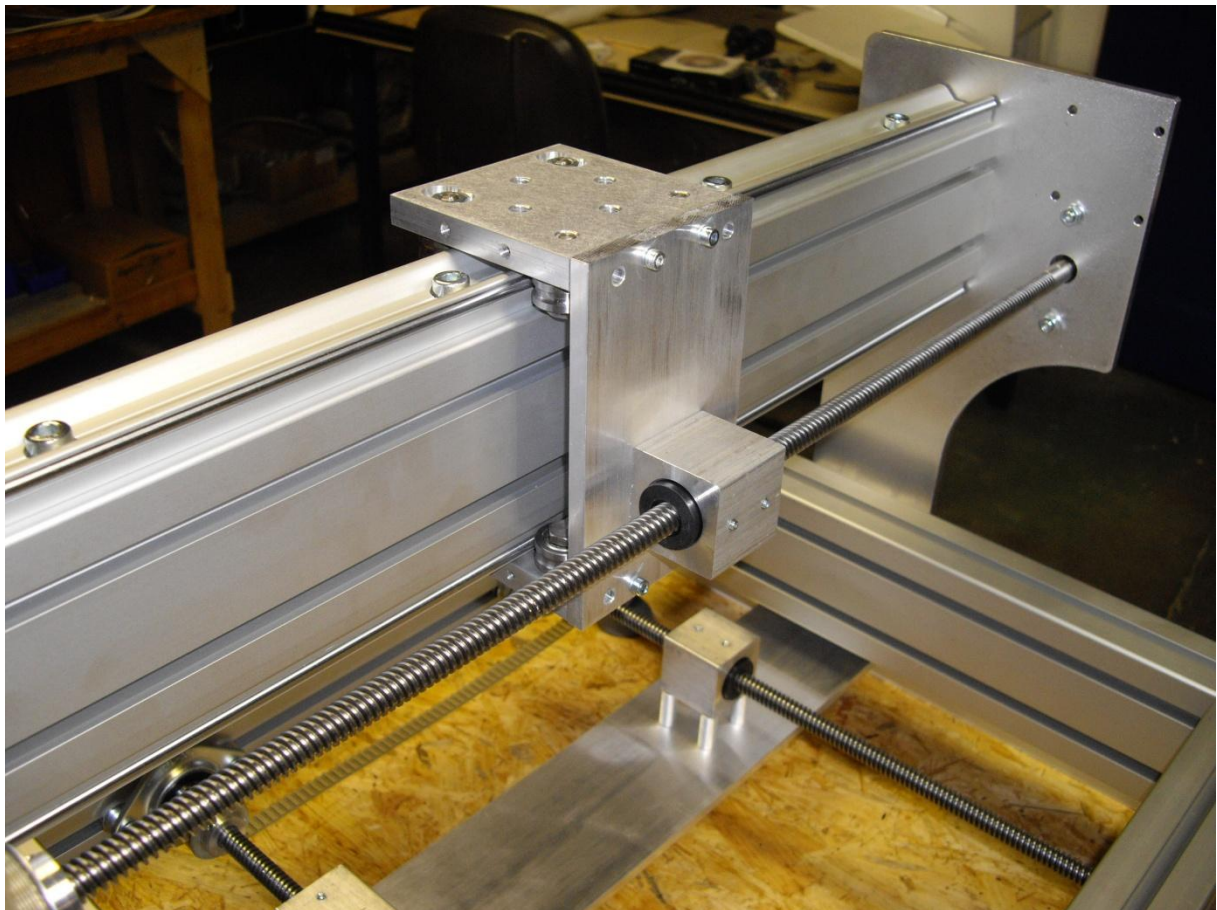
Figure 19: Base plate X rear mounted

Required tools:	Allen keys 3/5/6
	Open-end wrench size 13
	Try square 90°
Required parts:	Base plate X front
	Guide rail Z
	Holding block Z
	4 screws M4×16
	2 screws M4×35
	2 screws M8×22
	2 lock washers 4 mm
	2 screw nuts M4
	2 screw nuts DIN439 M8

Mount the *base plate X front* with four screws M4×16 on the guide bearings of the *guide rail X*. Only then can you mount the *guide rail Z* on the *base plate X front* with two screws M8×22 and screw nuts M8. Afterwards, mount the *holding block Z* on the top of the *base plate X front* with two screws M4×35, lock washers and screw nuts. Ensure that the holding block is mounted in the correct direction and is perpendicular to the *base plate X front* (Figure 20).

Figure 20: Guide rail Z mounted on base plate X front

Motor X

Required tools: Allen keys 3/5
Open-end wrench size 13

Required parts: Stepper motor 57BYGH250D
3 screws M4×45
3 spacing rollers 25 mm
3 lock washers 4 mm
3 screw nuts M4
Belt pulley T5 20z (drilling 6,35 mm)
Headless screws M4×6

Slide the belt pulley on the shaft of the stepper motor and fasten it with the headless screw of the pulley. Lay the belt over the pulley of the stepper motor and mount the motor with only **three** screws M4×45, spacing rollers, lock washers and screw nuts M4 (screw nuts at the stepper motor) on the gantry side so that the wires, coming out of the motor casing, point downwards. Make sure that the spacing rollers do not overlap at the gantry side, otherwise the gantry cover will not fit. Tighten the belt before you fasten the three screws at the stepper motor (Figure 21 and Figure 22).
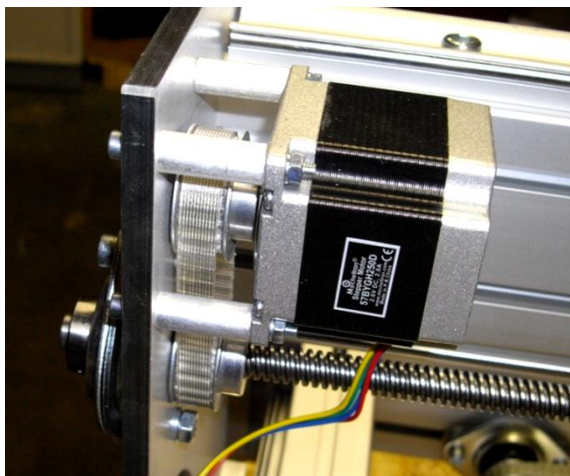

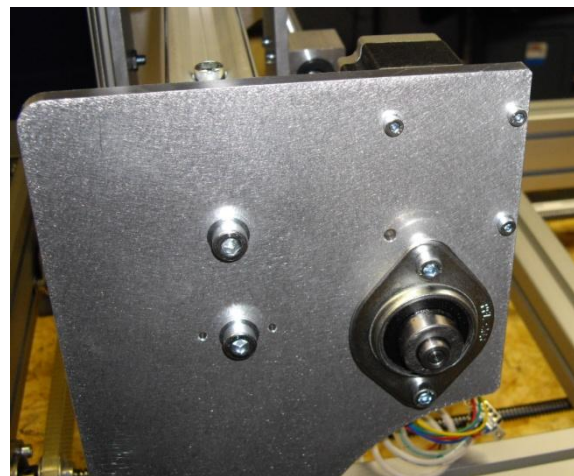**Figure 21: Stepper motor of X-axis mounted on gantry side**

Figure 22: Only three screws used

Required tools: Allen key 3
Flat nose pliers
Diagonal pliers

Required parts: Slide nut M4
Screw M4×20
Washer M4 (large)
2 screws M2×16
2 screw nuts M2
Mounting plate reference switch
4 cable straps
Adhesive-backed cable holder

Bend the metal plate of the stepper motor X as shown in Figure 23 and mount the micro switch on a mounting plate with two screws M2×16 and screw nuts M2. Place a slide nut in the lower groove of the gantry below the stepper motor and mount the micro switch with its plate on the gantry using a screw M4×20 and w washer (Figure 24). Make sure that the cable coming from the micro switch is installed below the threaded spindle.

Adjust the position of the reference switch so that the lower guide bearing can trigger the switch approximately one centimetre before the guide bearing hits the gantry side. Fasten the cable of the reference switch at the front of the mounting plate with a cable strap (threaded through the groove of the gantry). Press the cable tightly on the mounting plate before the cable strap is fastened. Cut the remainder of the cable strap with diagonal pliers.
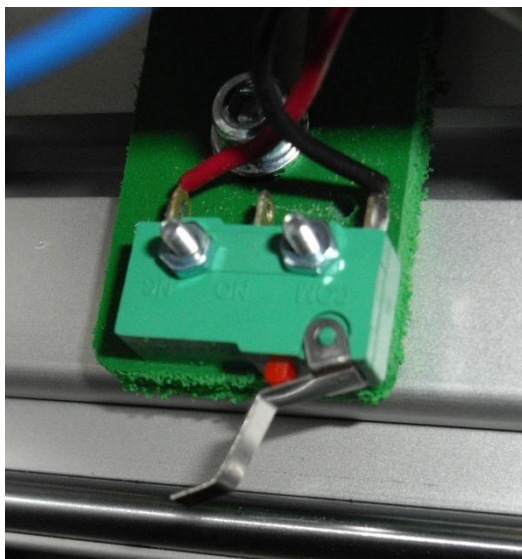
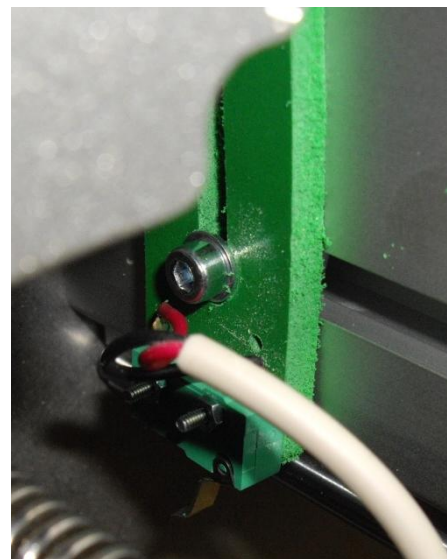**Figure 23: Bent metal plate of a micro switch**

Figure 24: Reference switch mounted

Place one or two adhesive-backed cable holders on the inside of the gantry side below the stepper motor X and the threaded spindle, and fasten the cable coming from the reference switch and the wires of the stepper motor with cable straps. Additionally, the wires from the motor should be fastened with two cable straps at one of the spacing rollers.

Motor plate Z and motor Z

Required tools: Allen key 3
Open-end wrench size 7
Thread locker
Rubber mallet

Required parts:
Motor plate Z	Threaded spindle (short)
Flange bearing	POM nut holder 4,5mm
2 spacing rollers 7 mm	2 POM nuts
2 screws M6×25	3 headless screw M3
3 screws M4×35	4 headless screws M4×6
3 lock washers 4 mm	Belt pulley T5 20z (drilling 12 mm)
2 lock washers 6 mm	
3 screw nuts M4	
2 screw nuts M6	

Mount the flange bearing with two screws M6×25, spacing rollers, lock washers 6 mm and screw nuts M6 on the *motor plate Z* (do not fasten the screws yet). Fasten the jacket at the end of the threaded spindle in the same way as you have done it before (see page 5). Screw both POM nuts on the spindle and mount the POM nut holder 4.5 mm with two headless screws M4×6 on the POM nuts. Slide the threaded spindle into the ball bearing of the flange bearing and put a belt pulley on the spindle at the other side of the motor plate Z. Fasten the pulley with two headless screws.

It may be necessary to hit the flange bearings with a small rubber mallet to adjust the position of the ball bearings and plug in the threaded spindles more easily.

Now, the *motor plate Z* can be mounted on the *holding block Z* with three screws M4×35, lock washers and screw nuts (Figure 25). Make sure, that the heads of the screws are on the top of the motor plate, lock washers and screw nuts on the bottom side of the *holding block Z*.
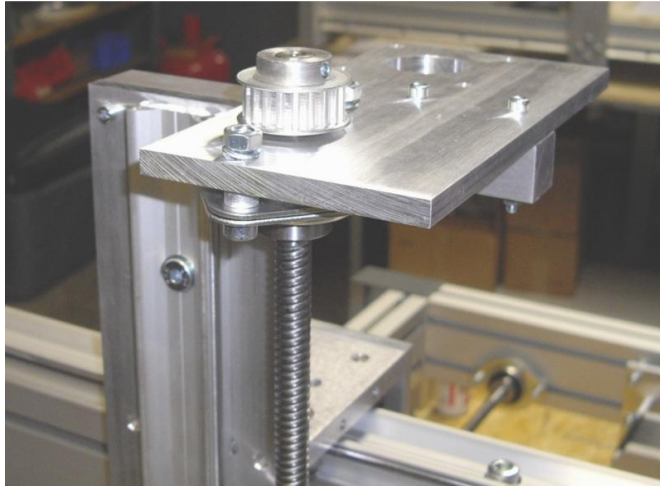
Figure 25: Motor plate Z mounted

Required tools: Allen keys 3/5/6

Required parts:	Base plate Z spindle holder	8 screws M8×22
	Spindle holder II	2 screws M4×50
	2 guide bearings	3 screws M6×25
	2 lock washers 4 mm	Screw M6×40
	3 lock washers 6 mm	8 washers M8

Mount both guide bearings on the *base plate Z spindle holder* with screws M8×22 and washers. Then, slide the pre-assembled base plate on the guide rail Z and mount the POM nut holder of the Z-axis with two screws M4×50 and lock washers at the lower guide bearing.

Now, adjust the ball bearings of the guide bearings so that it requires some force to move the base plate along the guide rail (see also page 4; Figure 26).

Mount the *spindle holder II* with three screws M6×25 and lock washers 6 mm at the bottom of the *base plate Z spindle holder*. Put a screw M6×40 into the hole at the front of the spindle holder's collet (Figure 27).

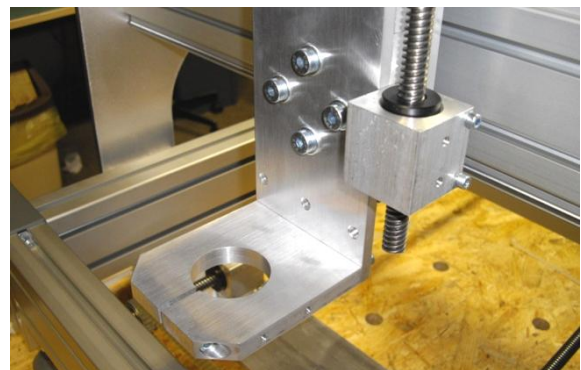**Figure 26: Base plate Z spindle holder mounted on the POM not holder**

Figure 27: Spindle holder assembled

Required tools:	Allen keys 3/5/6
Required parts:	Stepper motor 57BYGH250D
	Belt pulley T5 20z (drilling 6.35 mm)
	Belt 305 mm
	Headless screw M4×6
	3 screws M4×45
	Screw M4×50
	4 spacing rollers 25 mm
	4 lock washers 4 mm
	4 washers M4
	4 screw nuts M4

Slide the belt pulley on the stepper motor and fasten it with the pulley's headless screw. Lay the belt over the pulleys of the threaded spindle and the stepper motor, and mount the motor with three screws M4×45, spacing rollers, washers, lock washers and screw nuts M4. The forth screw, M4×50, is placed at the corner of the motor plate Z because that screw needs to hold one segment of the drag chain.

Adjust the position of the motor and the flange bearing on the motor plate Z so that the belt is slightly tightened and that the belt does not touch any of the screws going through the holding block Z (Figure 28).
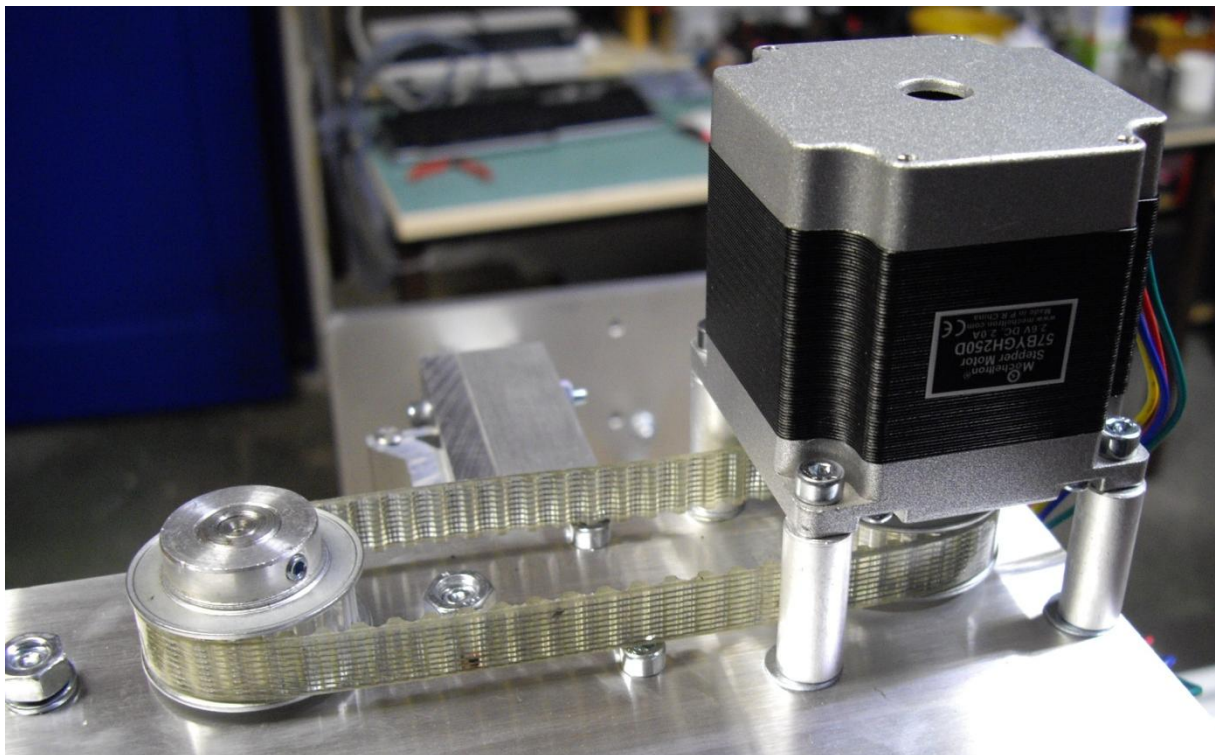

Figure 28: Motor of Z-axis (wires leave the casing at the right-hand side)

Required tools:	Allen key 3
	Screw driver
	Flat nose pliers
	Cordless drill
	Drill 2,5 mm

Required parts:	Screw M4×16
	2 screws M2×16
	2 screw nuts M2
	2 sheet metal screws 2,9×9,5
	2 washers M3 (large)
	Spacing roller 15 mm
	Mounting plate reference switch

Mount a spacing roller with a screw M4 on the upper guide bearing on the guide rail Z. This spacing roller will later trigger the reference switch. Bend the metal plate of the reference switch of motor Z as shown in Figure 29 and mount it along the long side of the mounting plate with two screws M2×16 and screw nuts M2.

Afterwards, the *mounting plate reference switch* is mounted on the *base plate X front* with two sheet metal screws and washers. You need to drill holes with a drill 2.5 mm first (Figure 30).
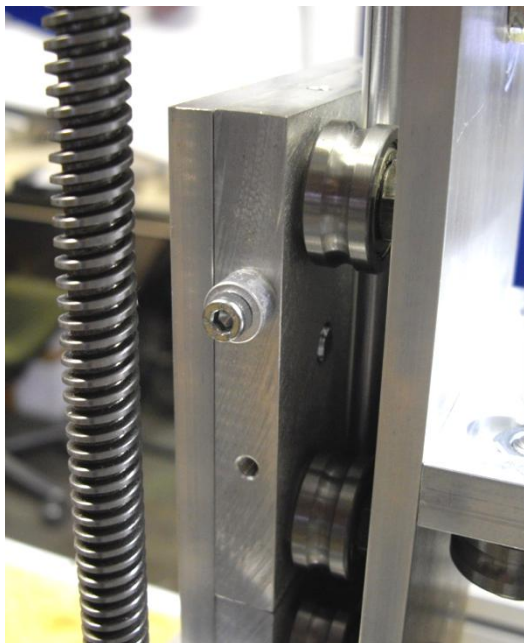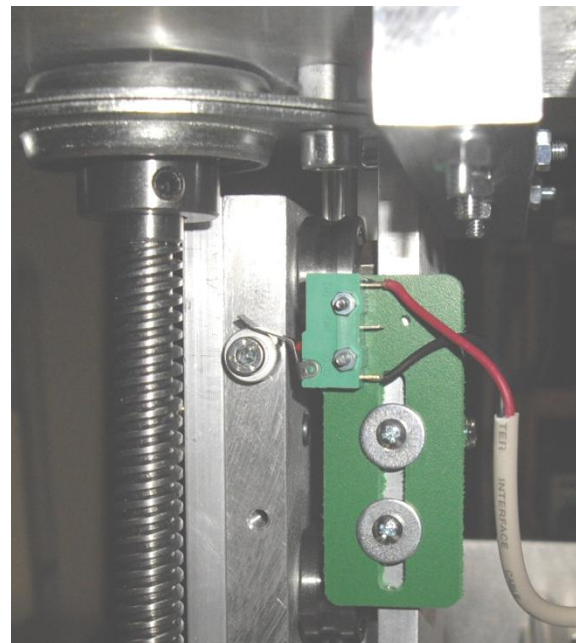

Figure 29: Trigger for reference switch

Figure 30: Reference switch Z mounted on base plate Z

Almost done

Required tools: Allen key 3
                        Screw driver
                        Flat nose pliers

Required parts: Screw M4×16
                        Screw M4×20
                        Slide nut M4
                        Washer M4 (large)
                        Screw nut DIN934 M4
                        2 screws M2×16
                        2 screw nuts M2
                        Mounting plate reference switch

Put a screw nut DIN934 M4 on a screw M4×16 and place that screw at the upper guide bearing of the X-axis as shown in Figure 31. It will serve as cable protection.
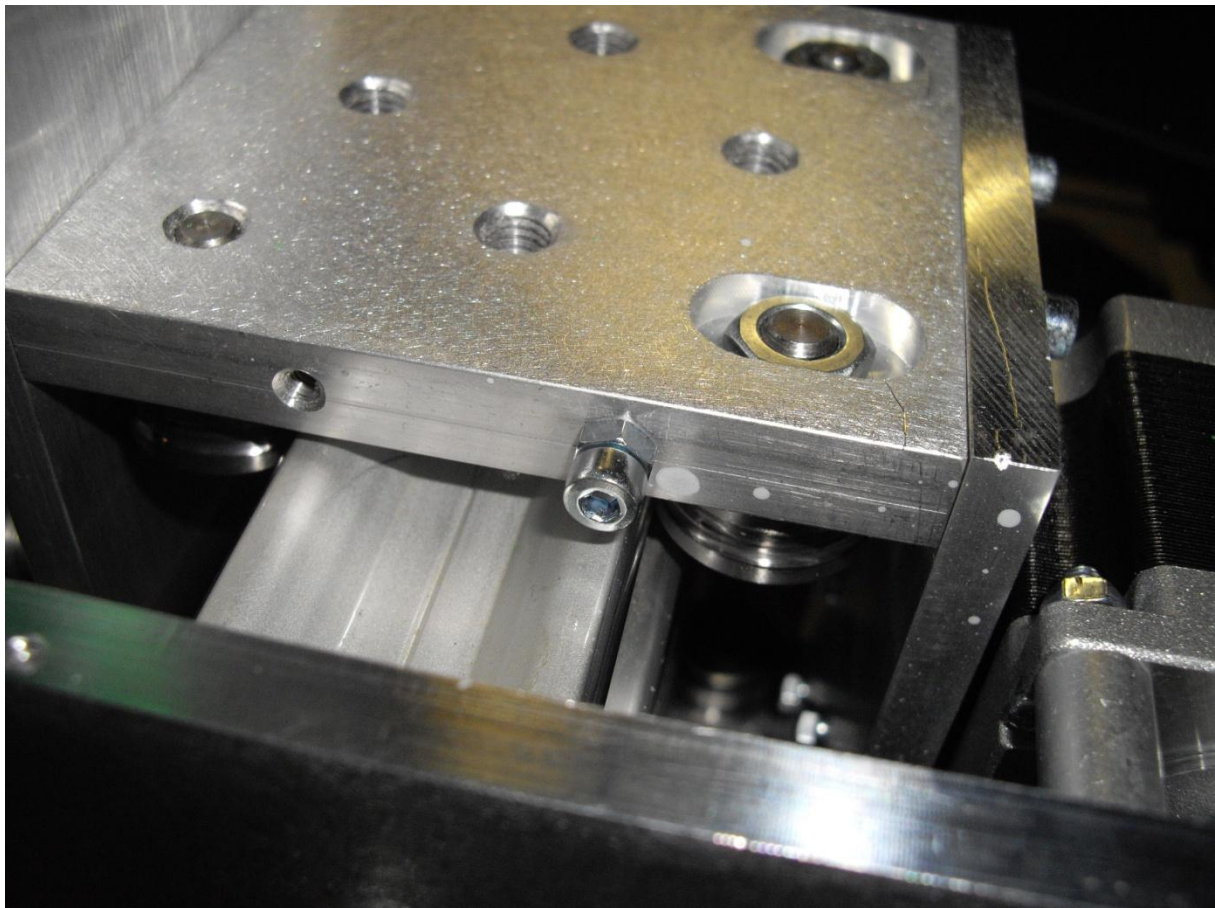

Figure 31: Cable protection at the upper guide bearing of the X-axis

Bend the metal plate of the reference switch of stepper motor Y as shown in Figure 30 before the micro switch is mounted on the short side of a *mounting plate reference switch* with two screws M2×16 and screw nuts M2.

Place a slide nut M4 in the lower groove of the frame part *side* that is closest to the threaded spindle of the Y-axis with the belt driven by the stepper motor. Mount the reference switch with a screw M4×20 and a washer on that frame part. Adjust the position of the *mounting plate reference switch* so that the *connecting element gantry sides* can trigger the reference switch (see Figure 32).
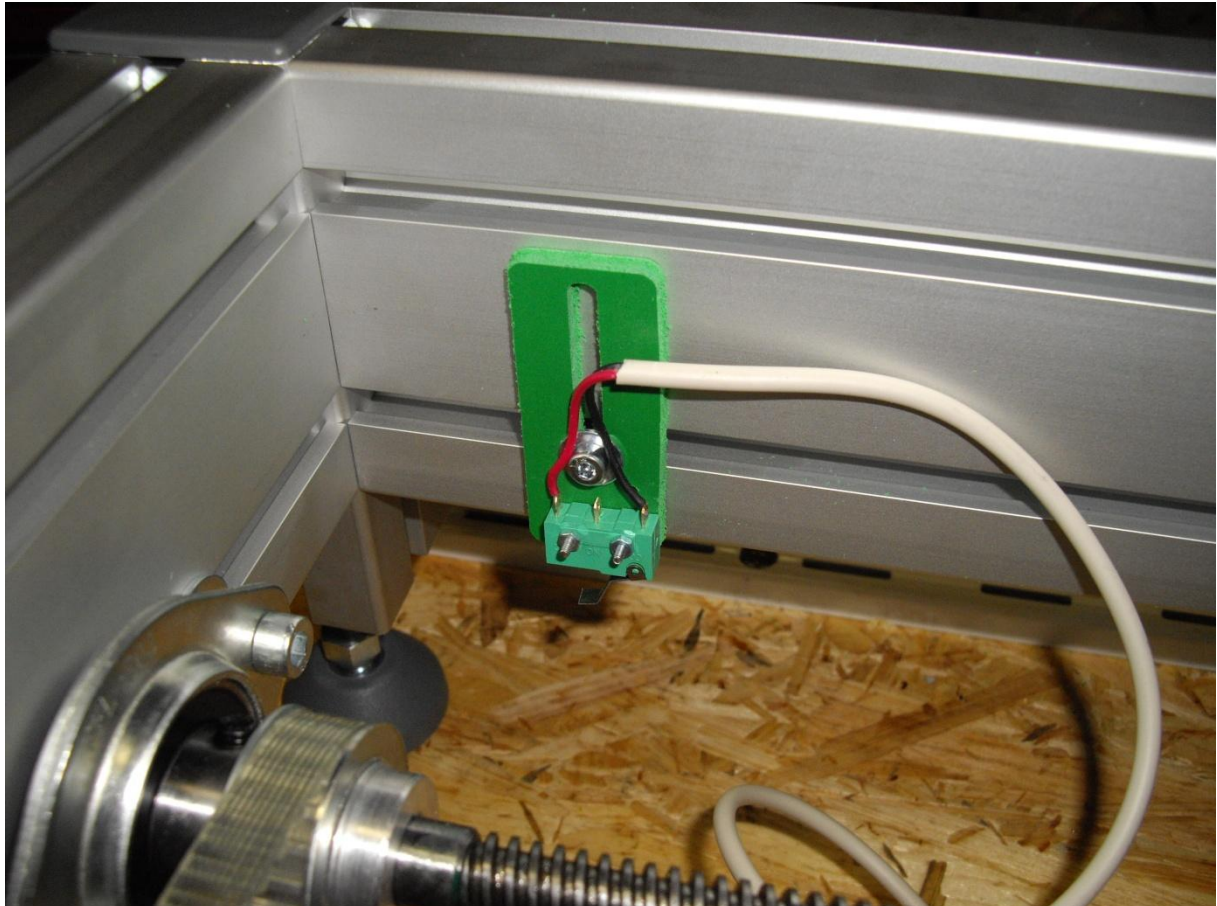

Figure 32: Reference switch Y with mounting holder at frame part side

Required tools:	Screw driver
	Clamps
	Cordless drill
	Drill 2,5 mm
	Diagonal pliers
Required parts:	Gantry cover
	8 sheet metal screws 2,9×9,5

If you haven't secured the cable coming from the reference switch X or the wires of stepper motor X, it should be done now. Make sure that neither the cable nor the wires protrude into the work area of the spindle holder moving along the X-axis. Cut the ends of the cable straps with diagonal pliers (see page 17).

Afterwards, lay one of the plastic *gantry covers* on top of the *gantry sides* (they need to be flush with the gantry sides) and fasten the other gantry cover vertically with two clamps at the front of the gantry. Drill holes with a 2.5 mm drill into the cover at the lower end and into the aluminium of the gantry sides (approx. 4 mm deep). Then, the vertical gantry cover can be fastened with two sheet metal screws.

Repeat the process in a similar manner with the two drillings in the corners of the top gantry cover. Only then should four holes be drilled along the edge where both gantry cover parts meet and fastened with sheet metal screws (Figure 33). Remove the protective sheet from the gantry cover parts Most likely, you will need to remove the cover for the first operation of the machine.
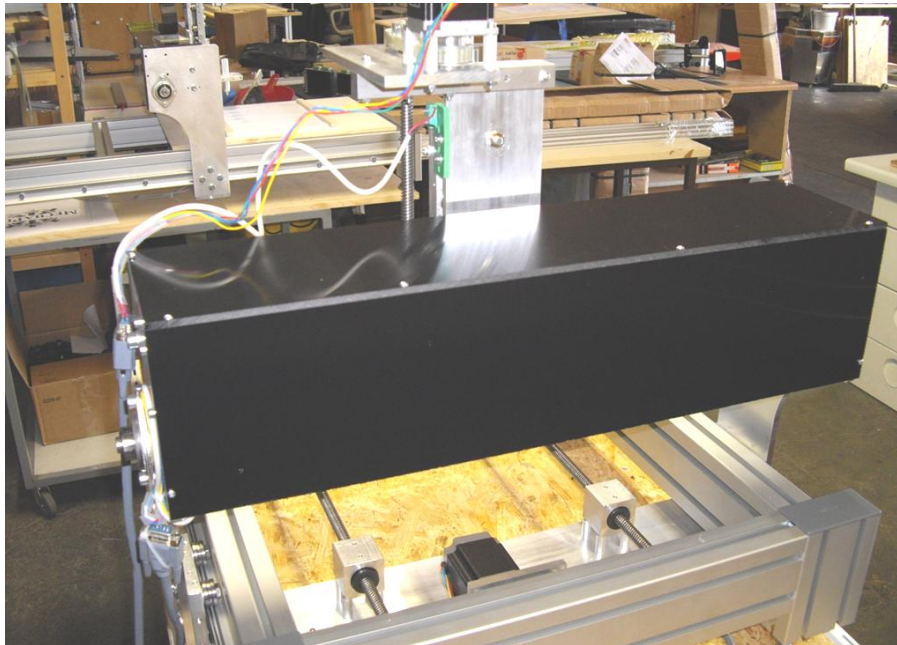

Figure 33: Assembled gantry cover

Required tools:	Screw driver
	Cordless drill
	Drill 2,5 mm
Required parts:	Drag chain (approx. 50 cm)
	End segment drag chain (arresting)
	End segment drag chain (non-arresting)
	2 metal sheet screws 2,9×9,5
	9-pin cable

Mount the *end segment drag chain (arresting)* with a screw M4×50 below the *motor plate Z*. Place the 9-pin cable inside the drag chain and connect it with the 9-pin terminal of the stepper motor Z. Then, connect the drag chain with the already mounted *end segment drag chain (arresting)*.

Attach the *end segment drag chain (non-arresting)* at the other side of the drag chain and mount that end segment on the plastic gantry cover with two metal sheet screws (drill two holes into the top cover with a drill 2.5 mm), so that the spindle holder can freely move along the X-axis and that the drag chain does never protrude over the gantry (Figure 34).
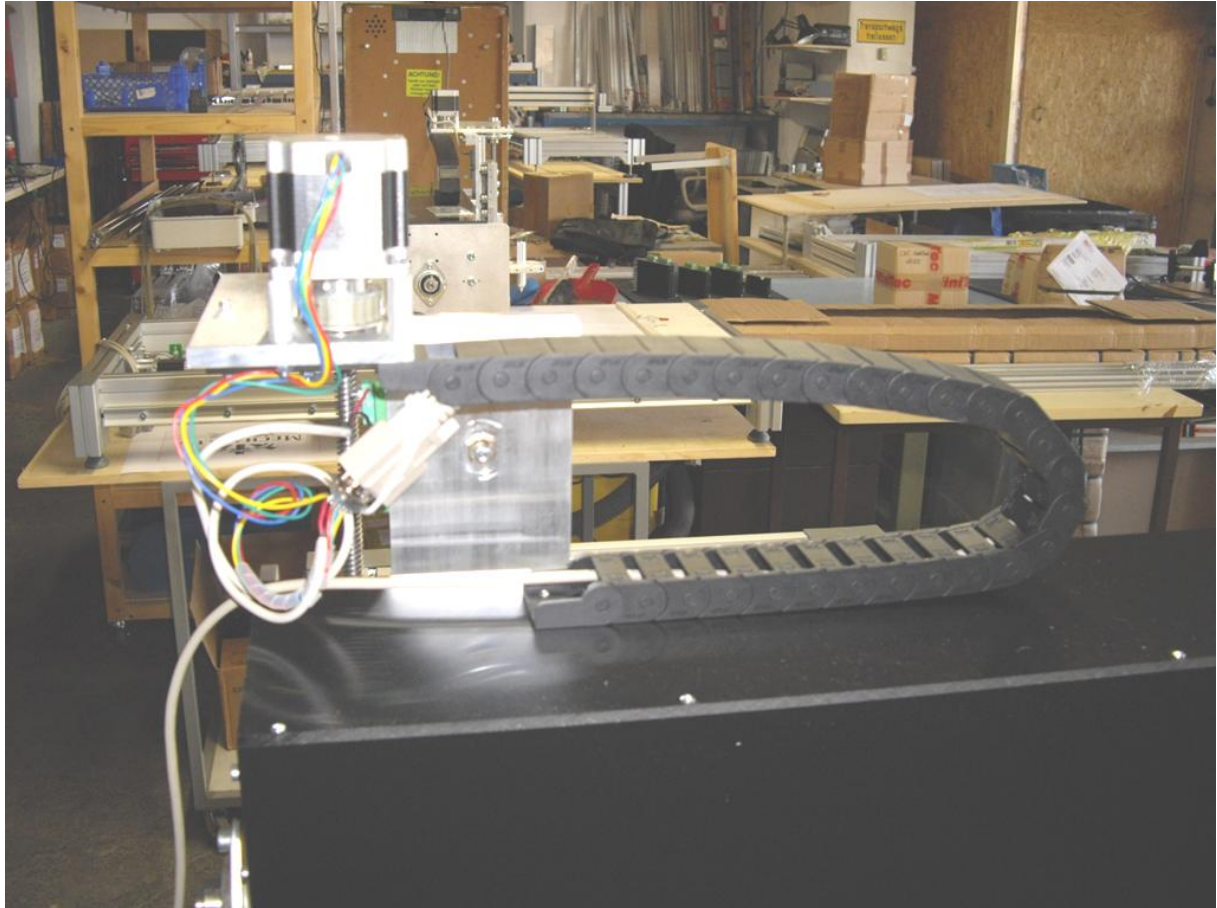

Figure 34: Drag chain mounted on the top gantry cover

Required tools: Diagonal pliers

Required parts: Cable straps
2 9-pin cables
Cable clamp
Screw M4×16

Connect each of the stepper motors X and Y with 9-pin cables. Afterwards, fasten the wires and the cable from motor Z as shown in Figure 35 and those of motor X as shown in Figure 36.
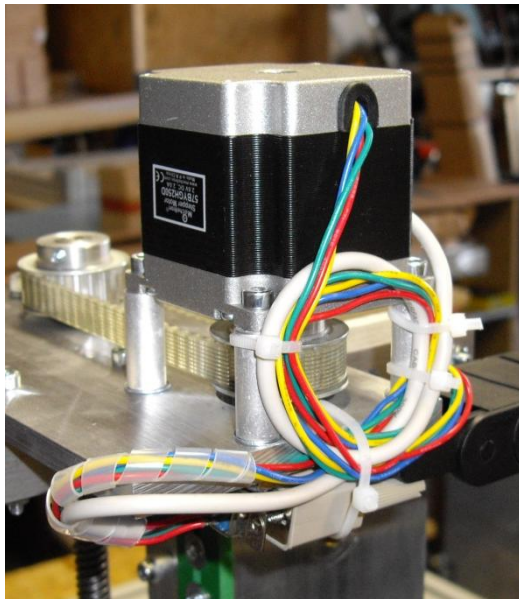

Figure 35: Cables of motor Z fastened

Figure 36: Lay the cables around the flange bearing of the gantry side where motor X is located

Additionally, the cable coming from reference switch X and the wires from stepper motor X need to be fastened with cable straps on the outside of the *gantry side* on which the stepper motor X has been mounted (Figure 36).

The 9-pin cables coming from stepper motors X and Y are fastened with a cable clamp (mounted with a screw M4×16) at the guide bearing of the gantry (Figure 37).
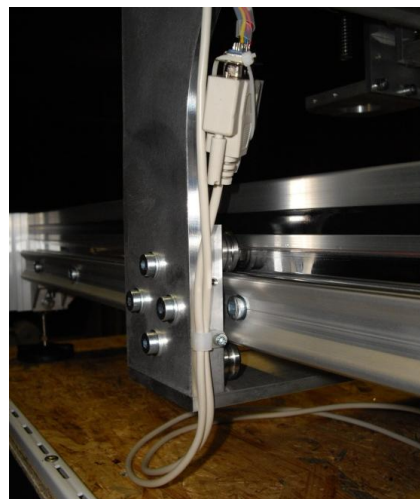

Figure 37: Cable clamp at the guide bearing of the gantry

Initial Operation

When you operate the CNC machine for the first time, it can happen that the gantry is not moving and the belts are slipping over the belt pulleys causing much noise. The usual reason for that is that the threaded spindles and flange bearings are not properly aligned, and the POM nuts are not run in yet. Insufficient lubrication is another common reason for that. The following steps describe in detail how to commence operation of the CNC machine.

Adjusting the Y-axis

Loosen the headless screws of the flange bearings of the Y-axis where no stepper motor is mounted to reduce the mechanical stress on the threaded spindles.

Afterwards, move the gantry along the Y-axis away from stepper motor Y very close to the belt pulleys at the other side of the machine's frame (where the long belt is located). You can try to move the gantry using motor Y via software option "Jog" in menu "Move" (if you are using WinPC-NC). It may be necessary to support the motor by pulling the long belt in the appropriate direction. If the gantry stops or gets stuck despite all attempts, screw one POM nut out of each POM nut holder and loosen the screws M4×40 of the POM nut holders at the bottom side of the *connecting element gantry sides* (see also page 10, Figure 14).

Ensure that the ball bearings of all four flange bearings are correctly aligned. If not, loosen the screws M6 of the flange bearings briefly (it is possible that the flange bearings will move in the correct position due to mechanical stress of the threaded spindles) and fasten them again afterwards.

Once the gantry has reached the end of the machine's frame where the long belt is located, adjust the flange bearings so that they do not cause any pressure on the threaded spindles and tighten the belt. If it is not possible to tighten the belt, loosen the POM nut holders M4 and push them to the outside.

Now, move the gantry to the other side towards the stepper motor Y (probably with only one POM nut in each POM nut holder) and lubricate the threaded spindle while the gantry is moving. It may be again necessary to support the motor by pulling the long belt by hand and adjusting the flange bearings at the motor side with a rubber mallet (slightly loosen the M6 screws of the flange bearings before using the mallet). This may also require to reposition the *motor plate Y* and tightening the belt of motor Y.

When this is done, start a test run at very low speed (i.e. 5 mm/s) for Y-axis only and lubricate the threaded spindle where necessary. Make sure, that you tighten the screws on the bottom side of the connecting element gantry sides (holding the POM nut holders M4). Otherwise, the screws will fall out after a very short time of operation.

Adjusting the X-axis

Loosen the headless screws on one of flange bearings at the X-axis and move the spindle holder via software (menu item "Jog" in menu "Move", if you are using WinPC-NC). Lubricate the threaded spindle while it is moving and adjust the orientation of the flange bearings' ball bearings with a rubber mallet.

Adjusting the Z-axis

Lubricate the threaded spindle of the Z-axis slightly and move the spindle holder along that axis using the option "Jog" in the software.

Positioning the reference switches

Ensure that the reference switches are properly triggered when the gantry or the spindle holders gets close to the end position inside the machine's frame without damaging any cables/wires. If necessary, reposition the reference switches and fasten all loose cables with cable straps along the frame parts or the gantry sides of the CNC machine.

Test run

The CNC machine needs to run at low speeds (5 mm/s up to 15 mm/s) for at least two hours (using the option "Motor test XY-axis") so that the POM nuts have enough time to run in on the threaded spindles.

If you removed one POM nut out of each POM nut holder put them back into the holders once the machine has run properly with just one POM nut in each holder. When all POM nuts have been put back into place, lubricate the spindles again and repeat the test run starting with very low speed (5 mm/s). Increase the speed gradually when the machine runs without any problems at lower speed settings. If the machine is not running smoothly, adjust the threaded spindles and flange bearings again (see page 28).

Tighten the screws of all flange bearings and ball bearings which you have loosened during the adjustment of the threaded spindles and mount the gantry cover on the gantry. If the machine is still rattling during operation, check all screws (stop machine before doing that). It happens quite often that the headless screws of the frame's profile connectors on the top **and**

bottom side are not fastened. Vibrations during the initial operation and test runs can loosen screws causing them to rattle.

If there are any problems or questions regarding the assembly or operation of the CNC machine, please do not hesitate to contact us via phone or e-mail:

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Maintenance Plan

If you have purchased a pre-assembled CNC machine, please check all screws and tighten them if necessary. Do not forget the screws on the bottom side of the machine's frame. The *strut(s) work area* are also not tightened yet.

Guide rails

Wipe the guide rails before and after milling with a slightly oily rag. It should not be possible to turn the ball bearings on the guide bearings by hand (without the guide bearing moving). If you can turn them adjust the ball bearings with the headless screws on the side of the guide bearings (see page 4). Please do not press the bearings on too hard!

Threaded spindles

Lubricate the threaded spindles with oil, **not** with grease. Grease collects dust and becomes a grinding paste. Oil runs and takes the dirt with it instead. Oil the spindles every 10 hours of operating with one or two drops (15W40). Re-adjust the POM nuts every 50 to 100 hours of operation (loosen on one side and press together).