

Step Number	Step Title	Parts list		Tools list		Remarks
		Quantity	Part name [1]	Quantity	Tool name	
1.1	Preparing the Base - structure	6	Steel Pipe Side	1	Screw Lock	Wear protective gloves; the steel pipe have sharp edges.
		3	Steel Pipe Bottom	1	Square	Align well the parts with a square.
		3	Steel Pipe Top	1	Gloves	Add one drop of Screw Lock when tightening the screws.
		24	Connector	1	Allen Key	First fit all the screws of the connectors loosely to pake sure they match the holes. If not, enlarge the holes of the connectors.
		144	B-screw M8-10	1	Ruler	The left end of the Steel Pipe Top needs to protude approximately 14 cm from the Steel Pipe Side.
1.2	Preparing the Base - wheels and caps	6	Wheel	1	Screw Lock	Add one drop of Screw Lock when tightening the screws.
		24	B-screw M8-10	1	Rubber Hammer	Wear protective gloves; the steel pipe have sharp edges.
		12	Square Cap	1	Allen Key	Fit the Square Caps on the edges of the top and bottom pipes with a rubber hammer.
						Lower the feet of the wheels to the maximum.
1.3	Preparing the Base - brackets	6	Bracket 90	1	Allen Key	Do not completely tighten the brackets yet for further alignment.
		24	B-screw M8-16			
2.1	Prepare the Y-axis - pre-attaching	2	Profile 45-180-3000	1	Allen Key	Do not tighten the screws yet for further alignment.
		2	Y Linear Guide			The arrows of the linear guides should point down.
		6	Rack			
		148	C-screw M6-20			
		148	T-nut 10 M6			
2.2	Prepare the Y-axis - aligning linear guides	4	Carriage	1	Caliper	Use a caliper to align the linear guide. Fix it 11 mm from the edge of the profile. The ends of the linear guide should not protude from the profile.

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						Tighten the first and last screws first and then the middle.
						Carefully insert 2 carriages in each linear guide. Make sure they will not slide out.
2.3	Prepare the Y-axis - aligning racks			1	Rack Template	Tighten the first and last screws first and then the middle.
				1	Caliper	Use a caliper to fix the racks with 13.97 mm distance from the linear guide.
2.4	Prepare the Y-axis - T-nuts	40	T-nut 10 M8	1	Allen Key	Insert 20 T-nuts in each profile, 10 in each bottom slot.
		3	Y-axis Cap			
		1	Y-endstop Holder			
		2	B-screw M12-20			
		1	T-nut 10 M6			
		1	B-screw M6-16			
		1	Wire Fixer			
3.1	Prepare the X-axis - pre-attaching	1	Profile 80-200-1700	1	Allen Key	Do not tighten the screws yet for further alignment.
		2	X Linear Guide			The arrows of the linear guides should be pointing to the same direction.
		58	C-screw M6-20			
		58	T-nut 8 M6			
3.2	Prepare the X-axis - aligning	4	Carriages	1	Caliper	Use a caliper to align the linear guide. Fix it 8.6 mm from the edge of the profile. The ends of the linear guide should not protrude from the profile.
						Tighten the first and last screws first and then the middle.
						Carefully insert 2 carriages in each linear guide. Make sure they will not slide out.
4	Prepare X Ball Screw	1	Screw Block X	1	Allen Key	
		6	C-screw M6-20			
		1	X Ball Screw			

Step Number	Step Title	Parts list		Tools list		Remarks
		Quantity	Part name [1]	Quantity	Tool name	
5.1	Fix Y-axis 1	1	Prepared Y-axis left (Step 2)	1	Allen Key	Step done more confortably in 3 people, with min 2 people.
		1	Prepared Base (Step 1)			While one person holds one end of the Prepared Y-axis left, the other one tightens the other end to the bracket of the base (should be held by a wall or another person), using the last 4 T-nuts.
		4	B-screw M8-16			The linear guides should be facing outwards.
5.2	Fix Y-axis 2	2	Prepared Base (Step 1)	1	Allen Key	Insert the base under the other end of the Prepared Y-axis left and tighten it to the brackets using the last T-nuts.
		8	B-screw M8-16			Insert the middle and tighten it to the middle 4 T-nuts, leaving 4 T-nuts free inbetween the brackets.
5.3	Fix Y-axis 3	1	Prepared Y-axis right (Step 2)	1	Allen Key	Place the Prepared Y-axis right on top of the 3 base and tighen it to the brackets, leaving 4 free T-nuts inbetween.
		12	B-screw M8-16			The linear guides should be facing outwards.
5.4	Aligning the Base			1	Ruler	Lightly loosen one bracket at a time and, using a square, fix them 90 degrees to the Y-axis.
				1	Square	The first and last base should have a distance of 20cm from the edge of the Y-axis profile.
				1	Rubber Hammer	Align the middle base last. It should have a distance of approximately 115 cm of the first and last base.
						If necessary, use a rubber hammer for fine adjustments.
5.5	Adjusting the height					Adjust the height of the wheels making sure all of them are pressured against the floor.
6.1	Fix the X-axis - Left Shoulder	1	Prepared X Ball Screw (Step 4)	1	Lubricant	Step done in 3 people.

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		Quantity	Part name [1]	Quantity	Tool name	
		1	Left Shoulder	1	Hammer	Place a soft material such as a MDF plate on the floor and lay the Left Shoulder with the inner surface up on top of the two Support Pipe .
		2	Support Steel Pipe			Insert the X Ball Screw vertically in the bearing, using lubricant and a hammer if necessary.
6.2	Fix the X-axis - Right Shoulder	1	Right Shoulder	1	Lubricant	Lay the Right Shoulder with the inner surface up on top of a soft material such as a MDF plate.
				1	Hammer	Hold vertically the X Ball Screw with the Left Shoulder attached and insert it in the Right Shoulder using lubricant and a hammer if necessary. Be carefull to hold the parts perpendicularly and not force the Ball Screw or bearings.
6.3	Fix the X-axis - Attaching shoulders	16	C-screw M6-40	1	Allen Key	Fix the X-axis shoulders on the Y-axis linear guides without tightening the screws.
		16	Washer M6			
6.4	Fix the X-axis - profile	1	Prepared X-axis (Step 3)	1	Allen Key	With the screws of the shoulders loose, insert the Prepared X-axis in the Left Shoulder. Fix 2 screws on the Prepared X-axis. Insert it in the Right Shoulder and fix and tighten all screws.
		16	C-screw M8-40			
		16	Washer M8			
7	Align the Y axis			1	Allen Key	Slowly move the X-axis in the Y-axis length, tightening all the screws of the brackets to the Base.
8	Middle Support	2	Support Steel Pipe	1	Allen Key	Fix the Support Steel Pipe with approx. 53 cm from the base steel pipes.
		4	Bracket 90	1	Rubber Hammer	
		16	B-screw M8-16			
		4	Square Cap			

Step Number	Step Title	Parts list		Tools list		Remarks
		Quantity	Part name [1]	Quantity	Tool name	
9	Fix the Y-chain Holder	1	Chain Holder 130	1	Allen Key	The Chain Holder 130 should be fixed on the back of the machine.
		1	Chain Holder 150			
		10	B-screw M8-10			
		10	Washer M10 Large			
10.1	Prepare the Z-axis	1	Z-plate	1	Allen Key	The arrows of the linear guides should point outwards.
		2	Z Linear Guide			
		20	C-screw M6-25			
10.2	Prepare Z Middle Plate	16	C-screw M6-40	1	Allen Key	Do not fully tighten the carriages yet for further alignment.
		1	Middle Plate			
		4	Carriage			
		16	Washer M6			
		1	Screw Block Z			
		4	C-screw M6-30			
		4	Washer M6			
		1	C-screw M8-10			
		1	Washer M8			
10.3	Align the Z-axis	1	Prepared Z-axis (Step 11.1)	1	Allen Key	Carrefully slide the Z Middle Plate to insert the Z-axis linear guides into the carriages in place of the plastic guides.
		1	Prepared Z Middle Plate (Step 11.2)			Tighten the linear guide screws with the carriage as close as possible to each screw. Be careful to not let the carriage out of the linear guide.
						Tighten all the screws of the carriages.
						After all screws are tightened, slide the Z Middle Plate with carriages out of the linear guides, substituting them back with the plastic ones.
10.4	Fix Z Top Bearing Holder	1	Z Top Bearing Holder	1	Allen Key	Do not tighten the screws yet for further alignment.
		4	C-screw M8-40			

Step Number	Step Title	Parts list		Tools list		Remarks
		Quantity	Part name [1]	Quantity	Tool name	
11	Fix the Z Middle Plate	1	Prepared Z Middle Plate (Step 12)	1	Allen Key	Fix the screws on the Screw Block X first
		16	C-screw M6-40			
		16	Washer M6			
		4	C-screw M6-30			
12.1	Fix Z Ball Screw	1	Z Ball Screw	1	Allen Key	
		6	C-screw M6-20			
12.2	Fix Z-axis					Carefully insert the Prepared Z-axis linear guides in the Middle Plate carriages, removing the plastic guides.
		1	Z Spacer Bearing			
		1	Prepared Z-axis (Step 11)			
12.3	Fix the Bottom Bearing Holder	4	C-screw M5-50	1	Hammer	Use lubricant and a hammer if necessary.
		1	Z Bottom Bearing Holder	1	Lubricant	Align and tighten the screws of both bearing holders.
				1	Allen Key	
13	Fix the Z Top Plate					To tighten the Ball Screw Lock Nut, hold the Ball screw with a big plier and a soft material inbetween to not scratch it (e.g. cardboard). Then use the Ball Screw Lock Nut Wrench to tighten it.
		1	Z Top Plate	1	Ball Screw Lock Nut Wrench	
		4	C-screw M6-30	1	Allen Key	
		1	Ball Screw Lock Nut			
14.1	Fix the X-motor 1					To tighten the Ball Screw Lock Nut, hold the Ball screw with a big plier and a soft material inbetween to not scratch it (e.g. cardboard). Then use the Ball Screw Lock Nut Wrench to tighten it.
		1	X Bearing Left Outside	1	Ball Screw Lock Nut Wrench	
		1	Ball Screw Lock Nut	1	Lubricant	Tighten the Ball Screw Lock Nut to the maximum making sure the Ball Screw can still move freely.
		1	XZ Coupler			
14.2	Fix the X-motor 2	1	XF Spacer	1	Allen Key	
		1	XB Spacer			
		1	X-motor			

Step Number	Step Title	Parts list		Tools list		Remarks
		Quantity	Part name [1]	Quantity	Tool name	
		4	C-screw M6-120			
		4	Washer M6			
		1	X-endstop Sensor			
15	Fix the Z-motor	1	Z-motor	1	Allen Key	
		1	ZR Spacer			
		1	ZL Spacer			
		1	XZ Coupler			
		4	C-screw M6-100			
		4	Washer M6			
16	Fix the Spindle	1	Spindle	1	Allen Key	
		8	C-screw M6-25			
		1	Tool Sensor			
		2	Z Side Cover			
		6	B-screw M6-16			
17	Fix the Z-endstop Sensor					Position the Z-endstop Sensor with the surface aligned to the bottom of the Z Top Bearing Holder.
		1	Z-endstop Sensor	1	Allen Key	
		1	Z-endstop Sensor Holder	1	Wrench	
		2	B-screw M5-20			
		1	C-screw M8-25			
		1	Washer M8			
		1	Nut M8			
18	Fix the Z Cable Cover	1	Z Cable Cover	1	Allen Key	Pass the cables before attaching the cover.
		2	Cable Gand			Remove the rubber ring of the front cable gland. Pass the Spindle and Tool Sensor cable through the front cable gland and the Z-motor cable through the top cable gland.
		3	C-screw M4-45			

Step Number	Step Title	Parts list		Tools list		Remarks
		Quantity	Part name [1]	Quantity	Tool name	
		1	Cable Wrapper			
		1	Tool Sensor Holder			
19	Fix the X-chain	1	X-chain	1	Allen Key	Pass the cables of the Spindle, Tool Sensor, Z-endstop and Z-motor through the X-chain before fixing it.
		3	C-screw M4-16			Tape the ends of the cable together with a masking tape to facilitate the passing of the cables through the chain.
		6	Washer M4			
		3	C-screw M4-12			
20	Prepare Y Bearing Holders	2	Shaft 100	1	Screw Lock	The shaft should be approximately 50 mm out in the inner side of the Y Bearing Holder.
		2	Pinion	1	Allen Key	The Pinion should be in a distance of 56 mm out of the inner side of the Y Bearing Holder.
		2	Y Bearing Holder			Apply screw lock in the set screws of the pinion to tighten them.
21	Fix the Y Bearing Holders	2	Prepared Y Bearing Holder (Step 18)	1	Allen Key	Tighten the screws while pushing the Y Bearing Holder upwards.
		8	C-screw M8-40			
		8	Washer M8			
		2	Y-coupler			
22	Fix the Y-motors	1	Y-motor Left	1	Allen Key	The wires of the motors should point down.
		1	Y-motor Right			
		4	Y-motor Spacer			
		8	C-screw M6-90			
		8	Washer M6			
23	Fix the Shoulder Front Pipes	2	Shoulder Front Pipe	1	Rubber Hammer	Fix the caps with a rubber hammer before attaching the pipes.
		4	Shoulder Cap	1	Allen Key	Remove the nut from the cable gland to attach it.
		12	B-screw M10-100	1	Wrench	

Step Number	Step Title	Parts list		Tools list		Remarks
		Quantity	Part name [1]	Quantity	Tool name	
		1	Cable Gland			
24.1	Prepare the Shoulder Right Back Pipe	1	Shoulder Right Back Pipe	1	Wrench	
		2	Cable Gland			
		1	Right Back Bottom Cap			
24.2	Fix the Shoulder Right Back Pipe	6	B-screw M10-100	1	Tweezers	Pass the Y-motor Right cable through the pipe before attaching it.
		1	Shoulder Cap	1	Allen Key	Pass the Y-motor Right cable inside the X-axis profile. Use tweezers on the other side.
				1	Rubber Hammer	
25.1	Prepare the Shoulder Left Back Pipe					Pass the Spindle cable through the first cable gland, the Tool Sensor, Z-endstop Sensor and Z-motor cables through the second, and the Y-motor Left, Y-motor Right and X-endstop Sensor cables through the third. Make sure they are well organized.
		1	Shoulder Left Back Pipe	1	Wrench	
		1	Left Back Bottom Cap	1	Rubber Hammer	Remove the rubber ring of the cable gland.
		3	Cable Gand			
25.2	Fix the Shoulder Left Back Pipe	1	Shoulder Cap	1	Rubber Hammer	
		6	B-screw M10-100	1	Allen Key	
		1	Y-chain End Holder			
		2	B-screw M6-10			
26.1	Fix the Y-chain front end	1	Y-chain	1	Allen Key	
		4	C-screw M5-50	1	Wrench	
		4	Washer M5			
		4	Lock Nut M5			
26.2	Fix the Y-chain back end	4	C-screw M5-30	1	Allen Key	Pass all cables though the chain before fixing it.
		4	Washer M5	1	Wrench	
		4	Lock Nut M5			

Step Number	Step Title	Parts list		Tools list		Remarks
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27	Fix the Y-endstop Sensor					Fix the Square Wire Fixer under the Chain Holder 130 and fix the Y-endstop Cable to the Wire Fixers. Then pass the cable though the hole of the Chain Holder 150 to insert it in the chain.
		1	Y-endstop Sensor	1	Cutter	
		3	Square Wire Fixer			
		4	Cable Tie			
28	Cable Management 1	1	Cable Wrapper Big	1	Cutter	
		2	Cable Tie Big			
29.1	Electronic Cabinet 1	1	Cabinet	1	Allen Key	
		1	DIN Rail	1	Wrench	
		3	C-screw M4-8			
		3	Lock Nut M4			
		3	Washer M4			
		1	VDF (Variable Frequency Drive)			
		4	C-screw M5-16			
		4	Washer M5			
		4	Lock Nut M5			
29.2	Electronic Cabinet 2	1	12V Power Supply	1	Allen Key	
		2	C-screw M3-6			
		4	24V Power Supply			
		16	C-screw M4-4			
		16	Washer M4			
29.3	Electronic Cabinet 3	4	Motor Driver	1	Allen Key	
		8	C-screw M4-12	1	Wrench	
		8	Washer M4			
		8	Lock Nut M4			
		2	Differential			
		4	Breaker			
		2	Relay			
29.4	Electronic Cabinet 4	3	Cable Rail 80	1	Allen Key	

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		Quantity	Part name [1]	Quantity	Tool name	
		1	Cable Rail 54	1	Wrench	
		4	Cable Rail 19			
		4	Cable Rail 27			
		28	C-screw M4-10			
		28	Washer M4			
		28	Lock Nut M4			
29.5	Electronic Cabinet 5	4	Cable Gland Small	1	Allen Key	
		2	Cable Gland M20	1	Wrench	
		2	Washer M20			
		2	Power Plug			
		4	Countersunk Screw M3-8			
		4	Lock Nut M3			
		1	USB Connector			
30	Cable Management 2	6	Lable			Pass the sensors cables through the first cable gland, the Spindle cable through the last and the motors' through the middle ones. Add lables in the inner side of the cabinet.
31.1	Wiring AC 1	2	Mains Cable	1	Allen Key	Fix the cables to the Power Switches and Power Plug before fixing them to the cabinet.
		2	Power Switch	1	Wrench	
		1	Emergency Button	1	Screwdriver slotted small	
		1	Cable Gland M12	1	Screwdriver Phillips	
		2	C-screw M4-10			
		2	Washer M4			
		2	Lock Nut M4			
		1	Emergency Button Cable			
		1	Machine Switch Cable			
		1	Spindle Switch Cable			
		1	Connector 3 Slots			

Step Number	Step Title	Parts list		Tools list		Remarks
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31.2	Wiring AC 2	1	Diferencial 1 Out Cable	1	Screwdriver slotted small	
		1	Diferencial 2 Out Cable	1	Screwdriver Phillips	
		1	Diferencial 2 In Cable			
		1	Breaker 2 Out Cable			
		1	Breaker 4 Out Cable			
		1	Relay 1 A1 Cable			
		1	Relay 2 A1 Cable			
		1	Connector 3 Slots			
		1	Connector 4 Slots			
		1	Relay 1 A2 Cable			
		1	Relay 2 A2 Cable			
		1	Relay 2 Out2 Cable			
31.3	Wiring AC 3	1	VDF Cable	1	Screwdriver slotted small	
		3	Connector 3 Slots	1	Screwdriver Phillips	
		1	Earth Frame Cable			
		2	Connector 5 Slots			
		1	L Connector Cable			
		1	N Connector Cable			
		1	Earth Cable			
		1	24V Power Supply 1 Cable			
		1	24V Power Supply 2 Cable			
		1	24V Power Supply 3 Cable			
		1	24V Power Supply 4 Cable			
		1	12V Power Supply Cable			
32	Wiring DC 1	1	Board Power Cable	1	Screwdriver slotted small	
		4	Driver Power Cable	1	Screwdriver Phillips	

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		2	XZ Driver Logic Cable			
		1	Y Driver Logic Cable			
		1	USB Cable Inside			
33	Cable management	1	Large Cable Wrapper			Wrap the cables from the Y-chain to the electronic cabinet.
						Cover the wires ducts.
34	Install the Controller	4	C-screw M3-14	1	Allen Key	
		1	Controller	1	Wrench	
		1	Controller Support			
		2	C-screw M6-16			
		2	Lock Nut M6			
		1	Cable Gland M20			