

Materials Lists

There are two lists, a condensed one on page 108, and a longer one with comments that starts on this page. The Quantity and (May Buy) column lists the amount needed in inches. The likely available size is in parentheses (listed in feet).

Notes	Quantity (May Buy)	Material	Where Used, and Comments
Aluminum. All Available from Onlinemetals.com.			
	~7" (1')	¼" x 2½" Flat Bar 6061 T6511	Z top, Z heat sink. Leftover 6" flat bar can be used instead of the 2½" stock. The 2½" stock requires fewer cuts.
	26" (3')	¼" x 6" Flat Bar 6061 T6511	Gantry ends, carriage plate
	~4" (1')	1" x 1" x ⅛" Angle 6061 T6	Leadnut brackets. Can also be 6063 T52
	60" (5')	2" x 3" x ¼" Angle 6063 T52	X rail supports
	24" (2')	2" x 3" x ⅛" Rect. Tube 6063 T52	Legs, rectangular tube
	12" (1')	2" x 1" x ⅛" Channel 6063 T52	Z body
	24" (2')	4"x1.647" x 0.247" Channel 6061T6	Gantry beam
	~30" (3')	⅜" Rod, Al. 6061 T6511, or Wood	Offset bushings. (Extra length for clamping)
Steel. Purchase Locally for Quality Check.			
	72" (2 @ 3')	½" x ½" x ⅛" Angle	Angle for Y and Z rails, flat bar for X rails. The edges need to be smooth so the bearings will ride well. Online orders have arrived bent.
	60" (2@3')	⅛" x ¾" Flat Bar	
	26" (3')	⅜" Rod	Pinion axle. Needs to be straight.
Wood			
	~102" (2 @ 8')	2x3 Board	Base frame. Actual size is 1½" x 2½". A 2x4 will also work.
	~180" (2 @ 8')	1x4 Board	Tee slots, leg caps. Actual size ¾" x 3½". This size chosen for ease of use. Other sizes can be ripped as desired.
	~30"x 30" (½ Sheet)	¾" Plywood	Base, fenders, knobs. Plywood is stiffer than MDF. Smooth rigid stock is best.
Machine Screws, Bolts, Threaded Rod			
	3	#8-32 x ¼" Round Head	Pinion Dust Cover 2, Z limit stop 1.
	2	#8-32 x ⅜" Flat Head	Router band 2; flat head needed for clearance behind router. Round head could be filed.
	5	#8-32 x ⅜" Round Head	Z rails 4, Z guide strip end 1.
	36	#8-32 x ¾"	Y rails 10, Z rails 2, leadnuts 8, Y bearing flange 2, limits 3, stepper mounts 7, wire cover 2, X stops 2.
	7	#8-32 x 1"	Cord mast 1, fenders 4, Kwik Klip clamp 2.
	14	#8-32 x 1¼"	Rack mount 12, X limit switch 2. Could buy this length in bulk for the shorter screws, and cut as needed.

	1	#8-32 x 1½"	Z limit tubing support 1
	2	#8-32 x 2"	Y limit stop 2
	4	#10-24 x 2½"	Z Stepper 4
	1	¼-20 x ¾"	Router base 1
	1	¼-20 x 1"	Router strap 1
	6	¼-20 x 1¼"	V bearing X axles 6
	1	¼-20 x 1½"	Belt tensioner 1
	8	¼-20 x 1½" Full Thread	V bearing Y and Z axles 8
	4	Set Screws #10-32 x ⅛"	Pinions 2. Can be #8-32 or coarser thread, but fine thread larger diameter tends to hold better. Need to be short so they do not hit the aluminum rack support. ¼" can be filed to length on the socket end, not the cupped end. 12 tooth pulley 2 replace originals.
	2	#10-24 Eye Bolt	Secure Z top plate
	~8" (1')	#10-24 Threaded Rod	Gantry studs
	58"	¼-20 Threaded Rod	Tie rail supports to bed. (10 @ 5¾")
	3	Small Machine Screws ~3-5 mm, #4 -6	Tie clamps to steppers. The size varies with the steppers. Computer cabinet screws often fit.
Nuts			
	64	#8-32	Rack rails 16, Y rails 10, Z rails 6, steppers 8, mast 1, Y limit probes 2, leadnuts 8, Y bearing flange 2, Z limit tube hanger 2, Z tube end clamp 1, router band 2, Z band wing nut 1, Kwik Klip clamp 5.
	22	#10-24	Z stepper 14, gantry end 6, eye bolt 2.
	34	¼-20	Legs 10, X rail bearings 6, carriage V 16, tensioner 1, router band 1.
	1	Wing Nut #8-32	Z Cable guide strip
	10	Tee Nuts ¼-20	Tie racks angles to bed
	5	#10-24 Cap Nuts (Optional)	Gantry studs
	10	¼-20 Cap Nuts (Optional)	Leg studs
Flat Washers			
	50	#8	Steppers 8, mast 2, Y rails 10, limit housings 5, limit tube supports 3, clamps 6, back cover 2, bearing flange 2, leadnuts 8, Z cable guide 2, router band 2.
	22	#10	Gantry studs 6, Z stepper 14, eye bolts 2. A 100 count box of #10 could be used for all #8 and #10 washers.
	72	¼"	V Bearings X 12, Y 16, Z 20, legs 10, tensioner 4, X ⅞ bearings 8, router band strap 2.

Lock Washers			
	17	¼" Lock Washer	Router base 1, router band 1, X bearings 6, Y and Z bearings 8, X tensioner 1. All are optional.
	~3	⅜" Finned Lock Washer	Leadscrew bearing to pulley spacer. Keeps pulley from scraping bearing. Needs to be as thin as possible to keep pulleys near the end-plate. May need one with coupler and collar clamps.
	~2	⅜" Split Lock Washer	Pinion spacer. Use pliers to align the cut edges so they are flat. Their small outside diameter usually clears the X rails and does not scrape the bearings.
Drywall Screws			
	31	1¼"	Tee Slots
	>12	1⅝"	Ply to 2x3 frame. A 1 pound box of 1⅝" will supply enough for all drywall screws. The extra length will protrude through the bottom of the plywood with the tee slots.
Dowels			
	6"	¼" Wood	Cord mast. Can be different diameter. Leftover bushing stock, threaded rod, or pencil, etc. will work. Must fit spring.
	2"	½" Wood	Tensioner bushing
Bearings			
	12	RM2ZZ ⅜" Bore V Bearings	Ride all rails. From vxb.com
	8	R6 ⅞" x ⅜" Bearings	Leadscrews, pinion axle, and X rails. Can have metal shields or rubber seals. (ZZ or 2RS) Standard size, multiple suppliers, e.g. skatebearings.com
	2	R8 1⅝" x ½" Bearings	Pinion belt tensioner. See above note. R6 bearings can be used here, but belt manufacturers recommend >1" idler diameter.
XL ⅜" Belts & Pulleys			
	1	15 Tooth XL Pulley ⅜" Bore	Leadscrew. All of the pulleys can be aluminum, steel, or plastic with a metal insert. It is better if they have two flanges and a hub.
	1	15 Tooth XL Pulley ¼" Bore	Leadscrew stepper, must fit stepper shaft diameter.
	1	12 Tooth XL Pulley ¼" Bore	Pinion stepper, must fit stepper shaft diameter.
	1	36 Tooth XL Pulley ⅜" Bore	Pinion axle
	1	40 Tooth ⅜" wide XL Belt	Leadscrew drive. There are many options of material and cord. Neoprene, urethane, polyester, fiberglass, etc. Neoprene is quieter and more flexible than urethane, but all options have served well.
	1	65 Tooth ⅜" wide XL Belt	Pinion drive. See above note.

Racks and Pinions			
	2	Pinions Spur Gears	X axis. 15 Teeth, 20° pressure angle, 20 pitch, 3/8" bore, 0.75" pitch diameter. mcmaster.com #5172T11
	2	2' Racks	X axis. 1/2" x 1/2" , 20 Pitch. mcmaster.com #5174T1
Leadscrew & Leadnut Parts			
	1	36" x 3/8-8-4 Start 2 Turn Leadscrew	Y and Z axes. One 36" screw is cut into two sections. Two or five turns per inch work well. Two turns are faster, but can allow a disabled Z stepper to drop a heavy router. This has not been a problem with a trim router.
	2	3/8-8-4-2 Leadnut	Y and Z axes. Leadnuts, clamps and couplers must all exactly match the threads of the leadscrew. Dumpstercnc.com has served well for these parts.
	2	3/8-8-4-2 Collar Clamp	Y and Z axes. A section of hose held in place with a band clamp can replace this.
	1	3/8-8-4-2 x 1/4" Leadscrew to Stepper Coupler	For 1/4" shaft Z stepper. Can also use spider couplers or flex couplers. The price and simplicity of the one shown in these plans is appreciated.
Wire Protection Components			
	~6	Zip Ties, Small Sized	Tie Z stepper cable to plastic guide. Could use twist ties, tape, etc.
	~6"	Stiff Wire	Router cord standoff from mast. Fence wire, coat hanger, solid electrical wire, etc.
	1	Coil Spring	Cord mast. Spring needs to fit the mast. A range of sizes will work.
	27" x ~5/8"	Plastic Strip	Z cable guide. It keeps the cable from falling and kinking. This can be any flexible plastic or metal strip. Band strap, vinyl siding nailing strip, siding coil stock, flashing, drywall corner bead, wire loom-ing, tubing, etc.
	~3'	3/8" Corrugated Split Conduit	This product flexes well and is split so the wires can be removed easily. It is sold in automotive stores and in home entertainment sections of department stores.
	2 @ 1/2" 1 @ 3/8"	Cable Clamp Adjustable "Kwik Klip"	These are found in the electrical section of home supply stores with cable clamps. Their ability to be opened makes it possible to easily remove the wires for machine disassembly. 1/2" is used for the stepper cables in their split conduit. 3/8" is used to secure the limit switch wires near the junction box. It may be necessary to tape-wrap the tubing so it will fit tightly in the clamp.

Limit Switch Components			
	1 + 4	Limit Switches	SPDT Snap switches with levers. Body size is 0.78" x 0.25" Roller switch better for Z. Radio Shack # 275-017 (Roller) Straight levers for others. Mouser # 101-1203 (Straight lever)
	~12'	Vinyl Tubing ¼" OD x 1.70 ID	Wire cover. This tubing keeps the Z limit wire pair that is behind the carriage from falling into the lead-screw. It also protects the other exposed limit wiring. Sold in home centers. Stiffer sheathed cable may eliminate the need for this tubing.
	1	Junction Box	"Surface Mount Phone Jack." Serves well as raw material for small junction box. Has to be drilled, etc.
	1 Set	Plug and Socket	For limit wires. Optional, could alternatively use wire nuts, terminal strip, or solder. The plug permits easy disassembly. A large range of plugs and sockets will work.
	~15'	Wire 22 Ga. Stranded 2 Conductor	This wire needs to be flexible, so stranded rather than solid wire is preferred. Shielded-sheathed wire is best, but most anything will do, though unshielded wire may pick up electrical noise and give false signals. Opto couplers address this. Rough lengths follow. Z 28", Y 2 @ 16", X 2 @ 20", gantry traveler ~24", to parallel port ~50"
		Electrical Solder	Connect limit switches and wiring.
		Electrical Tape	Insulate limit switches
		Heat Shrink Tubing	Insulate limit wires
Miscellaneous			
	Small Bottle	Wood Glue	Glue 2x3 to plywood. Carpenters' yellow glue serves well.
	1 Tube	Loctite Green Thread Locker	Not permanent, wicks into joint and can be applied after assembly.
	1 Small Board	¾" Kitchen Cutting Board	Limit switch housings and Y bearing flange. This is an inexpensive source for plastic stock. Delrin is better but costly. The bearing flange can be ¾" or thicker. The limit switch housing g-codes are for ¾" thick stock; ¼" stock is too thin.
		Thin Plastic or Metal	Shims, cable camps, dust guards. The stock can be from food containers, flashing, siding coil stock, etc.
	2	¼" Copper Coupler	Pinion spacer. Found in plumbing section of home centers. Two spacers are needed. Can be couplers or bushings.
	2	¾" Compression Bushing	

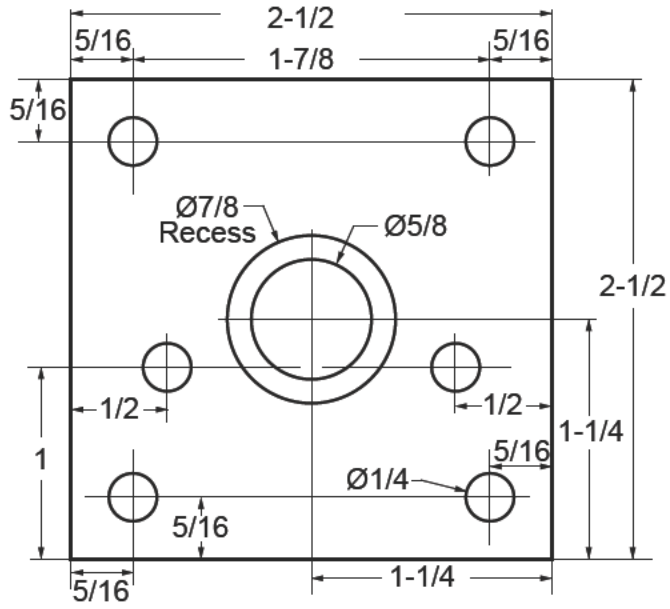
Condensed Materials List

Notes	Quantity (May Buy)	Material
Aluminum. All from Onlinemetals.com.		
	~7" (1')	¼" x 2½" Flat Bar
	26" (3')	¼" x 6" Flat Bar
	60" (5')	2" x 3" x ¼" Angle
	~4" (1')	1" x 1" x ⅛" Angle
	24" (2')	2" x 3" x ⅛" Rect. Tube
	12" (1')	2" x 1" x ⅛" Channel
	24" (2')	4"x1.647" x 0.247" Channel
	~30"(3')	⅜" Rod, Al. or Wood
Steel. Purchase Locally for Quality Check		
	72" (2@3')	½" x ½" ⅛" Angle
	60" (2@3')	⅛" x ¾" Flat Bar
	26" (3')	⅜" Rod
Wood		
	~102"(2@8')	2x3 Board
	~180"(2@8')	1x4 Board
	(½ Sheet)	¾" Plywood ~30" x 30"
Machine Screws, Bolts, Threaded Rod		
	3	#8-32 x ¼" Round Head
	2	#8-32 x ⅜" Flat Head
	5	#8-32 x ⅜" Round Head
	36	#8-32 x ¾"
	7	#8-32 x 1"
	14	#8-32 x 1¼"
	1	#8-32 x 1½"
	2	#8-32 x 2"
	4	#10-24 x 2½"
	1	¼-20 x ¾"
	1	¼-20 x 1"
	6	¼-20 x 1¼"
	1	¼-20 x 1½"
	8	¼-20 x 1½" Full Thread
	4	Set Screws #10-32 x ⅛"
	2	#10-24 Eye Bolt
	~8" (1')	#10-24 Threaded Rod
	58"	¼"-20 Threaded Rod
	3	Screws ~3-5 mm, #4 -6

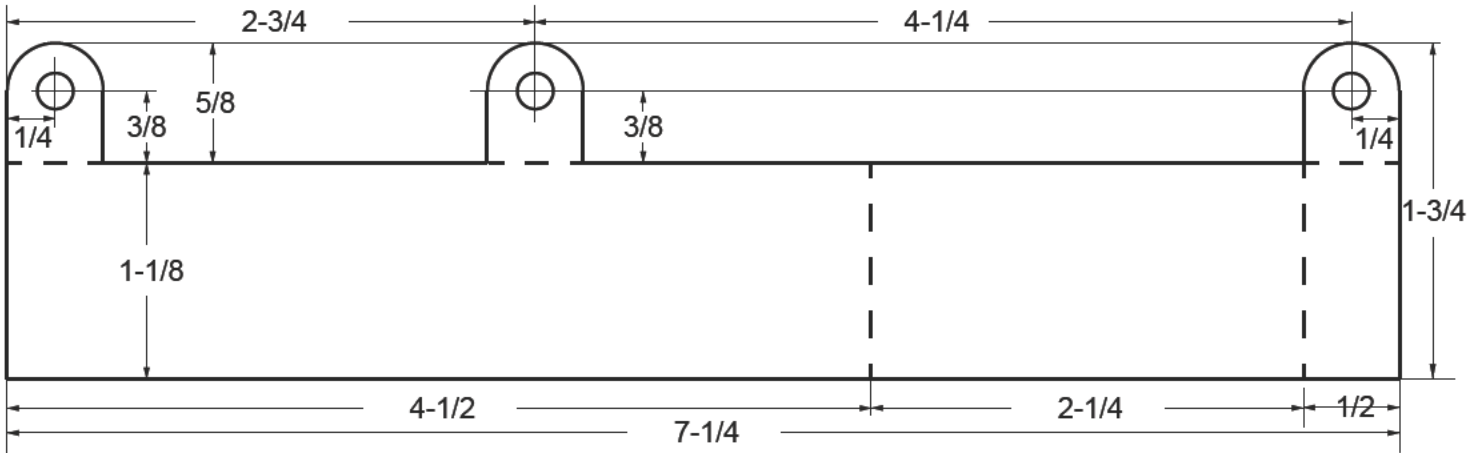
Notes	Quantity	Material
Nuts		
	64	#8-32
	22	#10-24
	34	¼-20
	1	Wing Nut #8-32
	10	Tee Nuts ¼"-20
	5	#10-24 Cap Nuts (Optional)
	10	¼-20 Cap Nuts (Optional)
Flat Washers		
	50	#8
	22	#10
	72	¼"
Lock Washers		
	17	¼" Lock Washer
	~3	⅜" Finned Lock Washer
	~2	⅜" Split Lock Washer
Drywall Screws		
	31	1¼"
	>12	1⅝"
Dowels		
	6"	¼" Wood
	2"	½" Wood
Bearings		
	12	RM2ZZ ⅜" Bore V Bearings
	8	R6 ⅞" x ⅜" Bearings
	2	R8 1⅞" x ½" Bearings
XL ⅜" Belts & Pulleys		
	1	15 Tooth XL Pulley ⅜" Bore
	1	15 Tooth XL Pulley ¼" Bore
	1	12 Tooth XL Pulley ¼" Bore
	1	36 Tooth XL Pulley ⅜" Bore
	1	40 Tooth ⅜" Wide XL Belt
	1	65 Tooth ⅜" Wide XL Belt
Leadscrew & Leadnut Components		
	1	36" x ⅜"-8-4-2 Leadscrew
	2	⅜"-8-4-2 Leadnut
	2	⅜"-8-4-2 Collar Clamp
	1	⅜"-8-4 -2 x ¼" Leadscrew to Stepper Coupler

Continued on next page.

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Racks and Pinions		
	2	Pinions Spur Gears, mcmaster.com #5172T11
	2	2 ft. Racks, mcmaster.com #5174T1
Wire Protection Components		
	~6	Zip Ties, Small Sized
	~6"	Stiff Wire
	1	Coil Spring
	27" x ~5/8"	Plastic Strip
	~3'	3/8" Corrugated Split Conduit
	2 @ 1/2" 1 @ 3/8"	Cable Clamp, Adjustable "Kwik Klip"
Limit Switch Components		
	1 + 4	Limit Switches: Roller Lever, Straight Lever
	~12'	Vinyl Tubing 1/4" OD x 1.70" ID
	1	Junction Box
	1 Set	Plug and Socket
	~15'	Wire 22 Ga. Stranded 2 Conductor
		Electrical Solder
		Electrical Tape
		Heat Shrink Tubing
Miscellaneous		
	Small Bottle	Wood Glue
	1 Tube	Loctite Green Thread Locker
	1 Small Board	3/8" Kitchen Cutting Board
		Thin Plastic or Metal
	2	1/4" Copper Coupler or 3/8" Compression Bushing



Z top plate template. Bottom view.
From page 67.



Dust guard template.
From page 95.