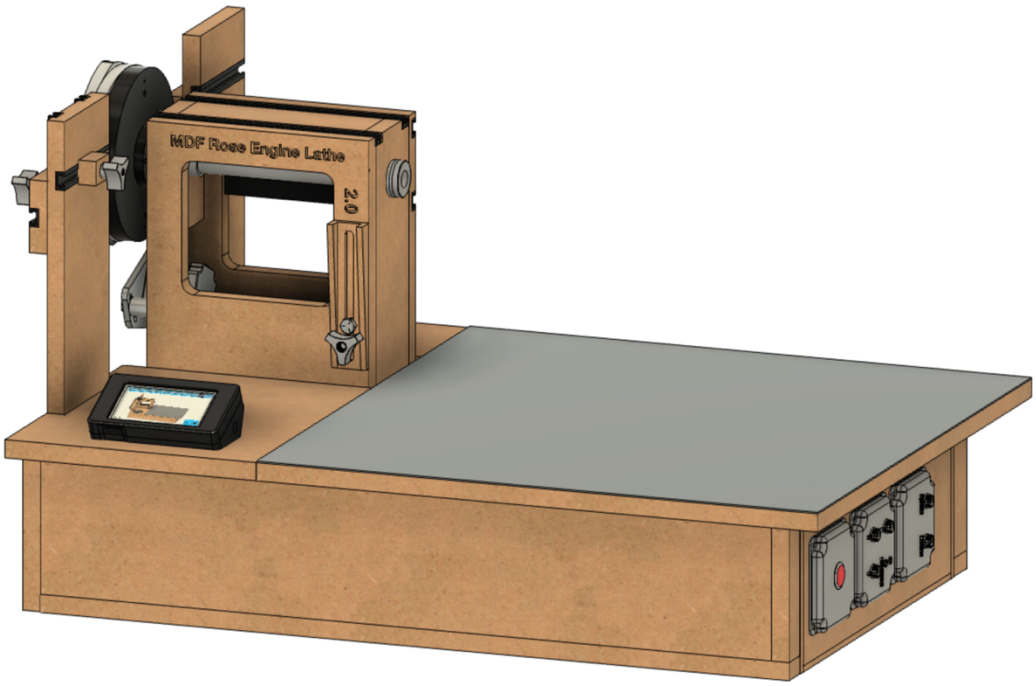
MDF Rose Engine Lathe 2.0
with Stepper Motor Drive



Instructions for Building Jigs, Fixtures, & Add-Ons

Volume 2

Version 1.7
09 February 2023

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

This document is intended to help one familiar with the MDF rose engine to easily build the identified jigs, fixtures, and add-ons. You can purchase these from us at www.ColvinTools.com, or build them yourself.

As you get started with building these jigs, fixtures, or add-ons to the MDF rose engine lathe, please consider making the machine exactly according to the outlined instructions. There are lots of ways you can modify this, and, quite frankly, the MDF rose engine encourages experimentation. But it is best to attempt those modifications after understanding how it works. Some ideas which sound grand may not appear so after understanding how the machine works (we speak from experience).

If you have any questions on the terminology in this document, check out the "Ornamental Turning Book of Knowledge" (www.OTBoK.info).

Throughout this document, I've tried to show the MDF in its native color of tan/brown. There are differences in the images I captured from the CAD drawing made, but those are not representative of the machine's differences.

The added pieces are typically shown in different colors to ensure they stand out from the MDF rose engine lathe.

Unless otherwise noted, the MDF is ¾" thick.

If you have any questions, please contact us at ColvinTools@Gmail.com.

Good luck and we hope you enjoy this machine as much as we.

Rich Colvin & Jack Zimmel

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

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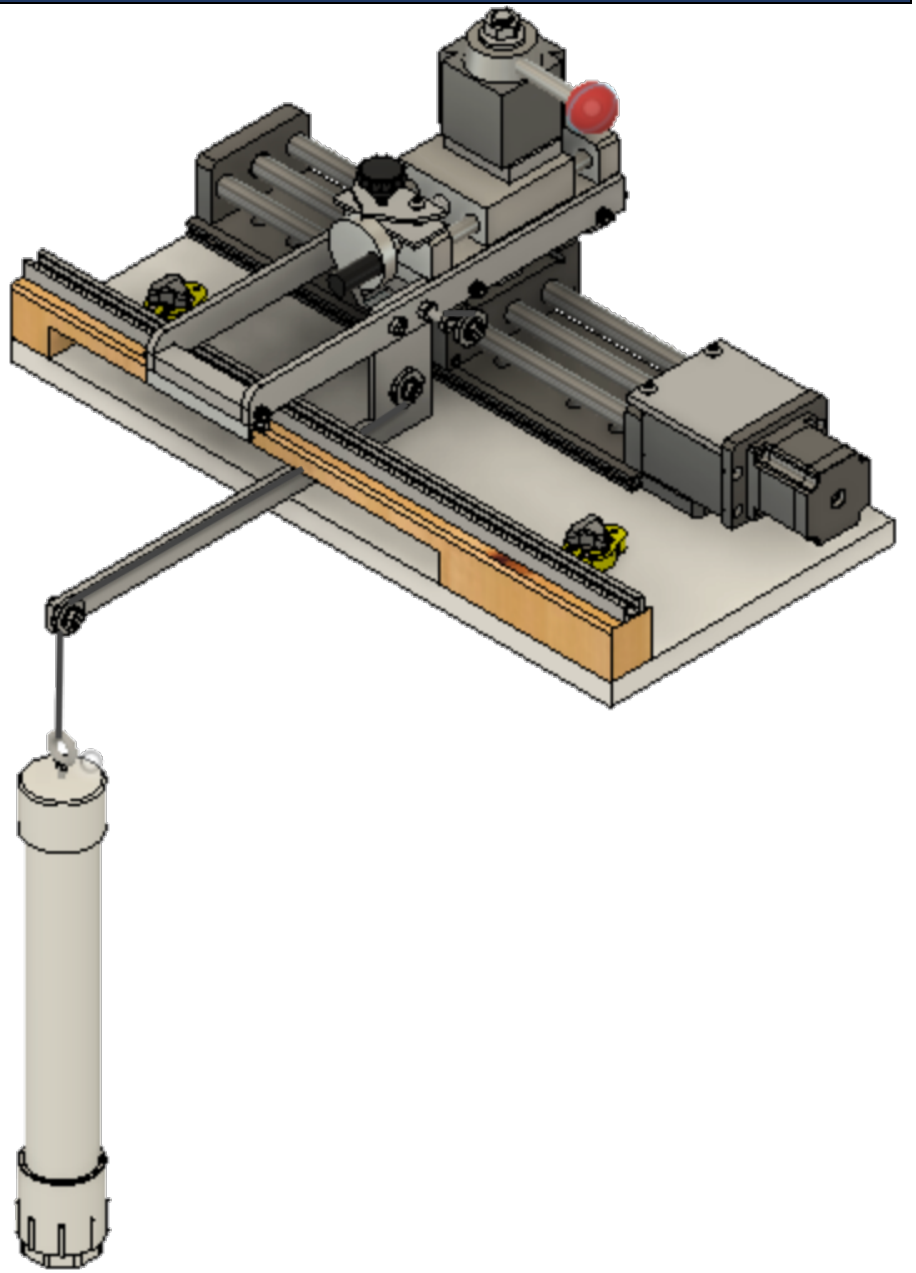
Curvilinear Slide

The curvilinear slide for the MDF Rose Engine Lathe 2.0 is shown in the picture to the right.

It was designed to be used with a weight to keep the template follower engaged with the template. There are 3D-printed templates we have designed, but you can make your own. They are held on a T-Track and can be ¼"' thick. MDF works well for limited-use templates, but more resilient materials are recommended if longer use is expected.



Details for building and assembling this follow the bill of materials.

For the templates which are 3D-printed, the directions are in the MDF Rose Engine Lathe 2.0 Library (https://mdfre2.colvintools.com). The book is the black one on the 2nd shelf. It is titled, "3D Printed Parts".

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Bill of Materials

Parts required for building this are below.

Item #	Item	Qty	Source	Source Part Number	Comments
	Wood, Plate, and Rods				
101	MDF, ¾" thick				
102	2x3 / 2x4 pine board				
103	Aluminum rod, rectangular - 1" x ¼"				
104	Aluminum rod, rectangular – ¾" x ½"				
105	Aluminum plate, ¼" thick				
106	Aluminum plate, ½" thick				
107	T-Track				
	Purchased Components				
201	Linear Stage Actuator	1	Amazon	(Amazon link)	300mm Travel, Ballscrew 1605, Double Optical Axis Linear Rail Guide Slide Stage C7 with Nema23 Motor
202	Linear Stage Table	1	Amazon or eBay	KA80-1402-50 (Amazon link)	
203	Drylin W Double Rail	1	Igus	WS-10-40	
204	Drylin W Assembled Carriage Plate WW	1	Igus	WW-10-40-10	
205	QCTP, AXA with Base	1			
206	MagSwitch 95	2			
	Purchased Parts				
301	Spacer, 7mm internal diameter, 8mm long	2	McMaster-Carr	94669A172	

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Jigs, Fixtures, and Add-Ons

Item #	Item	Qty	Source	Source Part Number	Comments
302	Screw, M6-1.0, 20mm long	4	McMaster-Carr	97763A826	
303	Knob, ¼"-20, 1" long	1	McMaster-Carr	6479K86	
304	Screw, Socket Head, M6-1.0, 15mm long	4	McMaster-Carr	91290A320	
305	Screw, Hex Head, ¼"-20, 1" long	1	McMaster-Carr	92620A540	
306	Screw, Hex Head, ¼"-20, 1 ½" long	1	McMaster-Carr	91257A546	
307	Nut, ¼"-20	3	McMaster-Carr	95462A029	
308	Pulley	3	McMaster-Carr	6447K5	
309	Washer, ¼"	6	McMaster-Carr	90107A029	
310	Spacer, 3/8" Long, ¼" ID	1	McMaster-Carr	92510A764	
311	Particle Board Screws, #6, 3/4" long, round head	6	McMaster-Carr	91555A115	
312	Flat Head Screws for Particleboard and Fiberboard, #8, 2 ¼" long		McMaster-Carr		
313	Screw, M6-1.0, 10mm long	1	McMaster-Carr	97763A826	
314	Screw, M8-1.25, 20mm long	2	McMaster-Carr	91292A147	
315	Lock Washer, M8	2	McMaster-Carr	92148A200	
316	Screw, M4-0.7, 20mm long	1	McMaster-Carr	91290A176	
317	Nut, M7-0.7	1	McMaster-Carr	91828A231	

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Item #	Item	Qty	Source	Source Part Number	Comments
318	Carriage Bolt, ¼"-20, 2 ½" long	1	McMaster-Carr	90185A552	
	Other				
901	Template	1	Designs are at the MDF Rose Engine Lathe 2.0 Library, in the black book on 2nd shelf, 3D Printed Parts		
902	Template follower	1	Ibid #901		
903	Signal Lamp	1	Amazon		LED Signal Tower light powered by 110V / 220V AC
904	Relay	1	Amazon		Single channel relay, 3.3 VC for the switching, and switches 110V / 220V AC. The one I purchased has an optical isolation circuit.

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Instructions

Base

The **base** is made from ¾" MDF. Dimensions are as shown.

The two holes are for MagSwitches (#206).

If MagSwitch MagJig 95s are used, the holes need to be 30mm.

If MagSwitch MagJig 150s are used, the holes need to be 40mm.

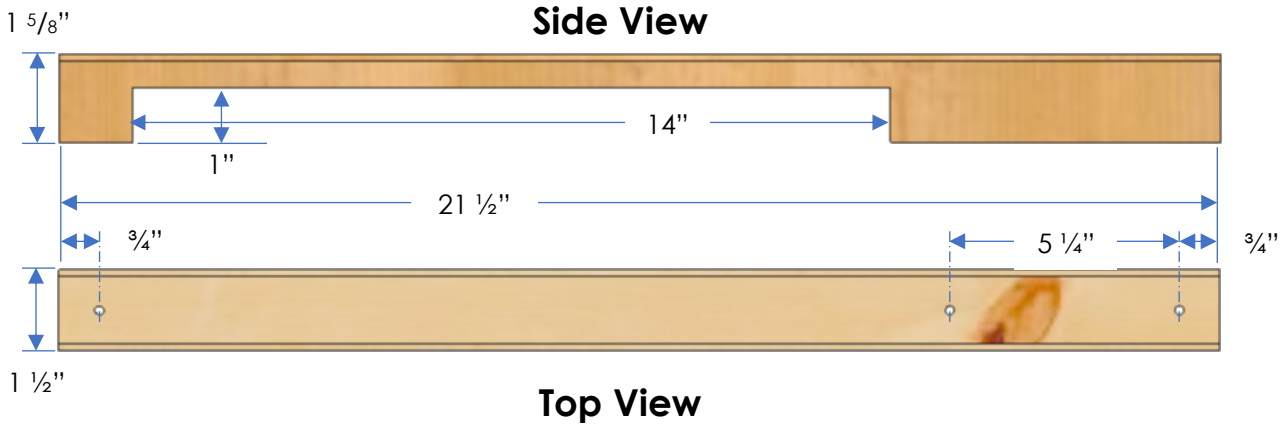
MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Template Bar

The **template bar** is made from a 2x3. Dimensions are as shown.

Drill the three holes #19 or 11/64".

The fillets shown on the top edge are those which are already on the board from the mill. They are not critical.



Attach the template bar to the MDF base using 3 each particle board screws (#312).

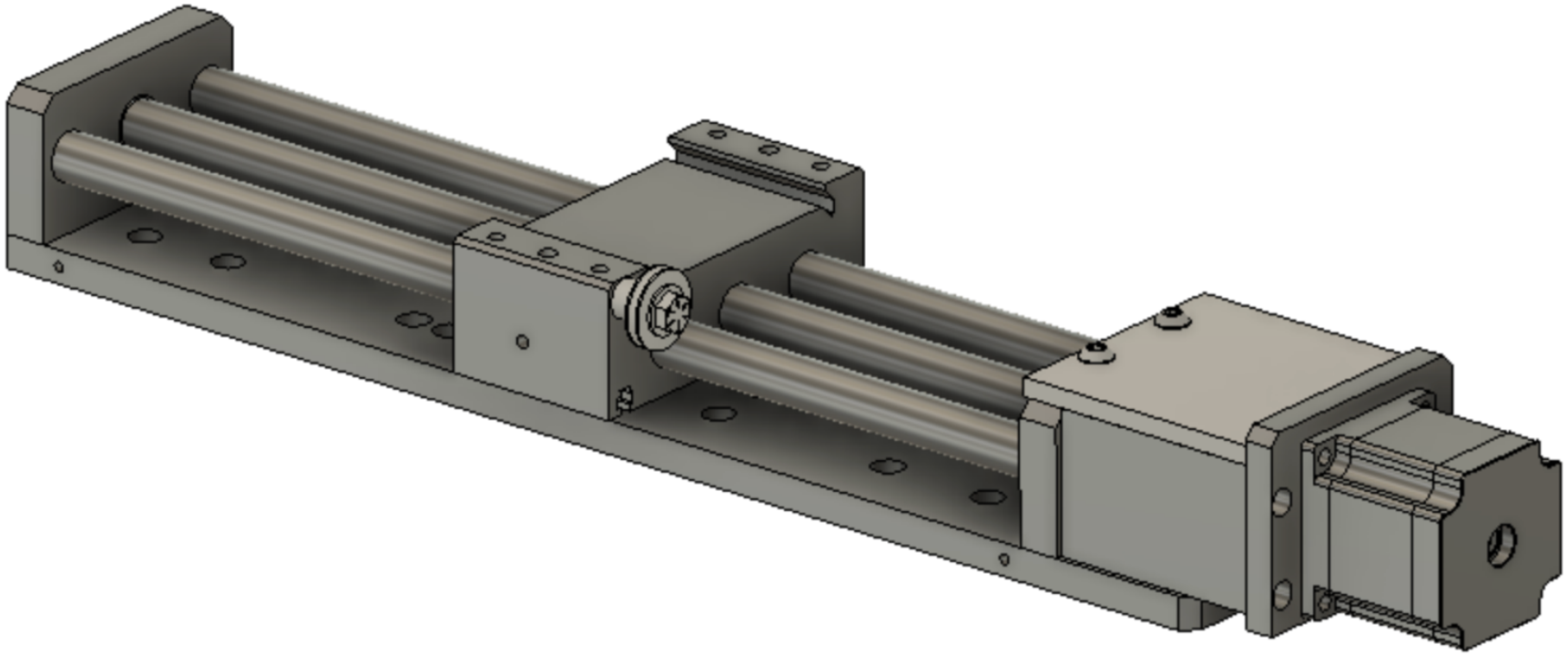
Gluing to the base is a good idea.

The template bar should be aligned to the base as shown.

Add the two MagSwitches (#206).

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

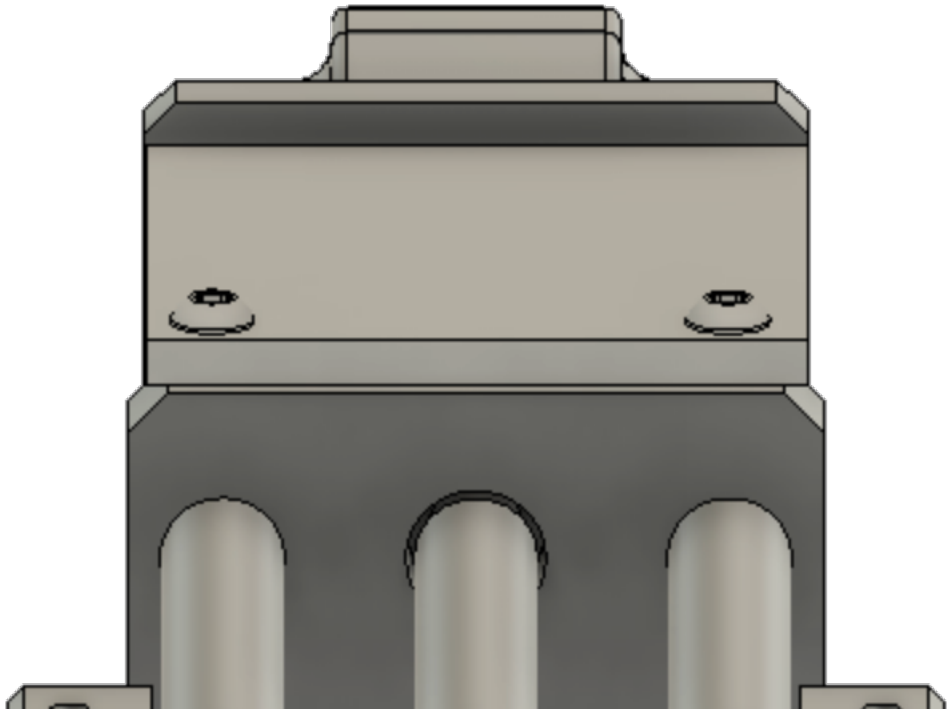
Linear Slide



The linear slide is item #201 in the BOM. Some modifications are made to this, both shown in the revised diagram above. Firstly, there is a T-Track on the bottom edge of this. It can be used for limit switches, but I removed them to provide space for movement, though that may not be necessary.

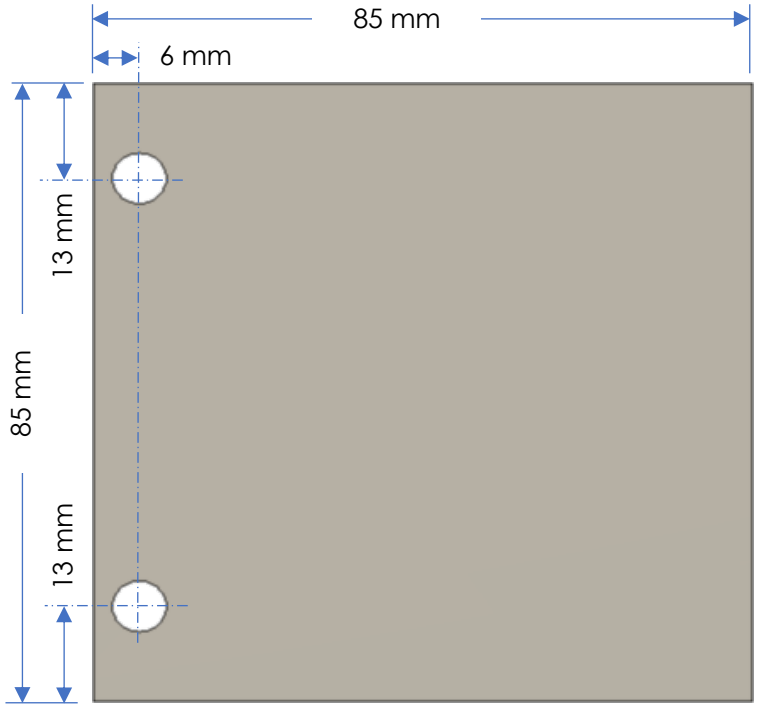
MDF Rose Engine Lathe 2.0

Jigs, Fixtures, and Add-Ons



Add a cover over the drive coupling. This is not critical but is in place to keep some dust out of the area.

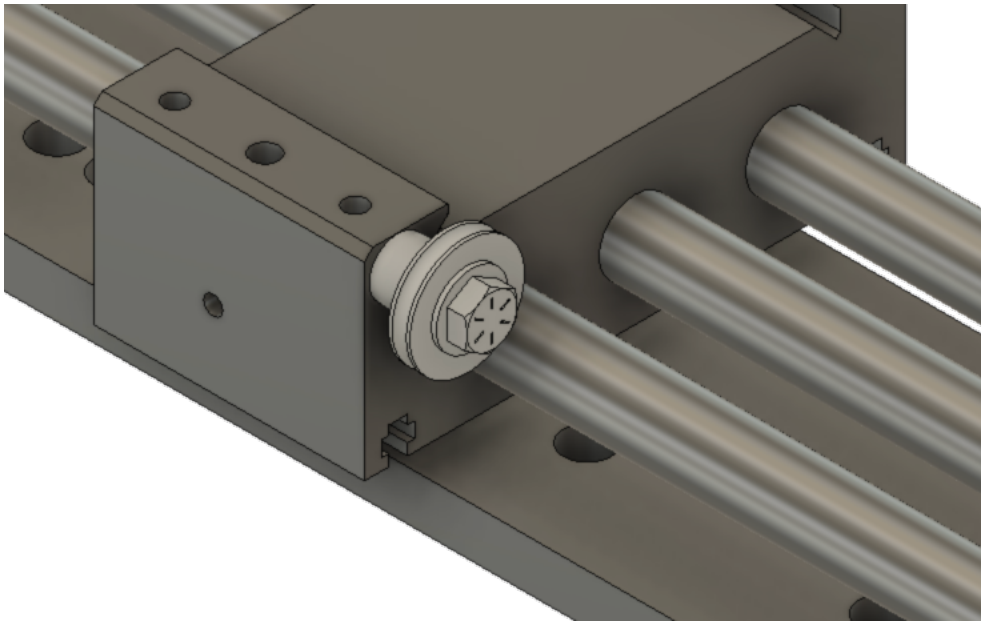
Use ¼" aluminum plate. Cut the plate to match the opening. 85mm x 85mm is a good estimate for the size.



Align the screws over the rods and be sure to not drill the holes too deeply. There should be no interference with the rods. This is shown in the picture to the left.

The holes in the plate are 7mm.

The two affixing screws will need holes drilled into the block below, and these holes tapped for the relevant holes. Screws like #313 are good. In this case, drill 5mm, and tap for M6-1.0.



Drill and tap a hole in the slide for the weight pulley. The screw is a ¼"-20, so drill #7 and tap.

The components attached to the slide are:

#306 – Screw
#308 – Pulley
#309 – Washer (2)
#310 – Spacer

The spacer is used to align this pulley with the two on the follower arm.

I recommend adding a label to this part at some place. On mine, it is in the area where the plate was added. The label should read as noted below.

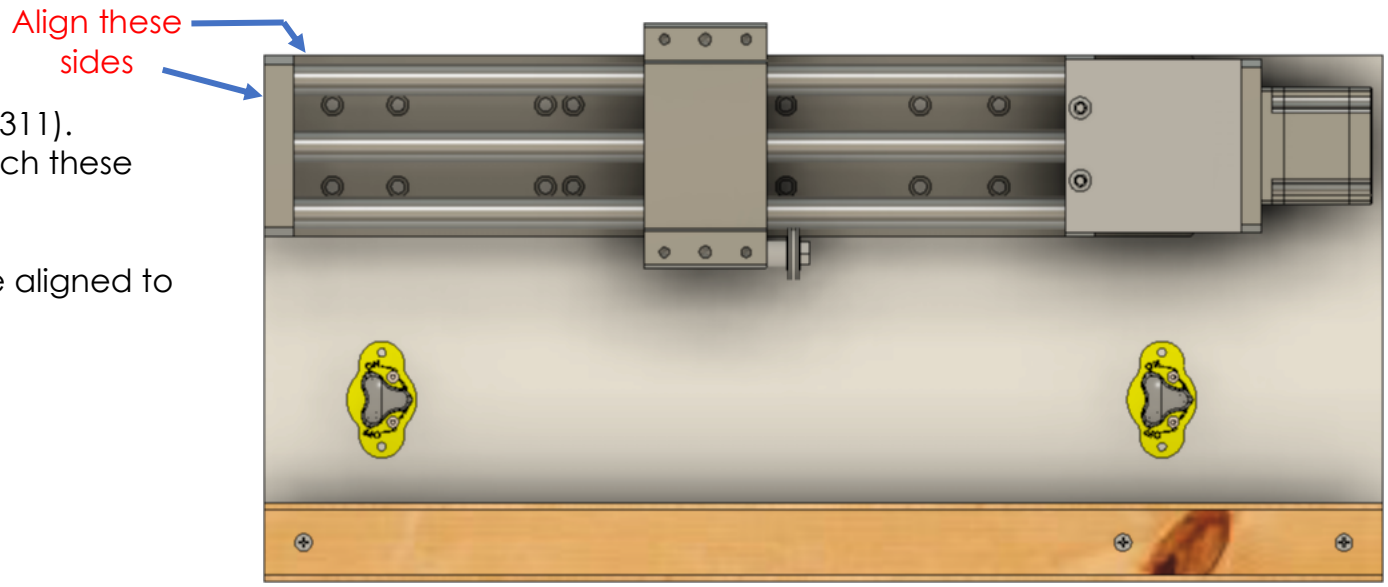
Distance/360
0.19685" / 5mm

This information is needed when setting up the control system for this stepper motor. Having this information on a label on the device is useful in the case where you have other stepper-motor driven items.

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Attach the linear slide to the MDF base using 6 or more particle board screws (#311). DO NOT use glue to attach these pieces together.

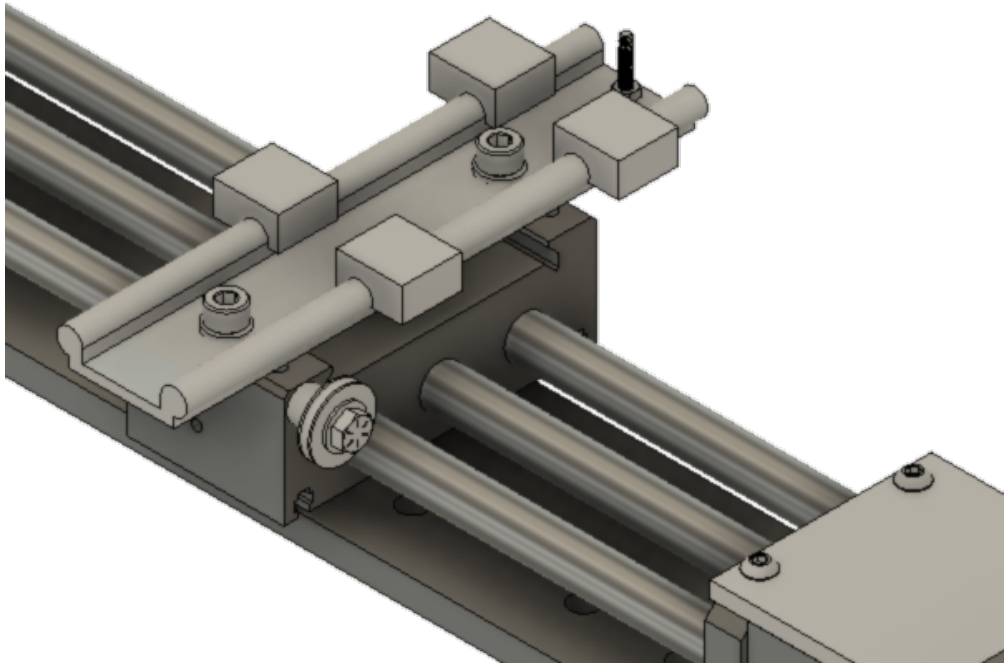
The linear slide should be aligned to the base as shown.



MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Slider Plate

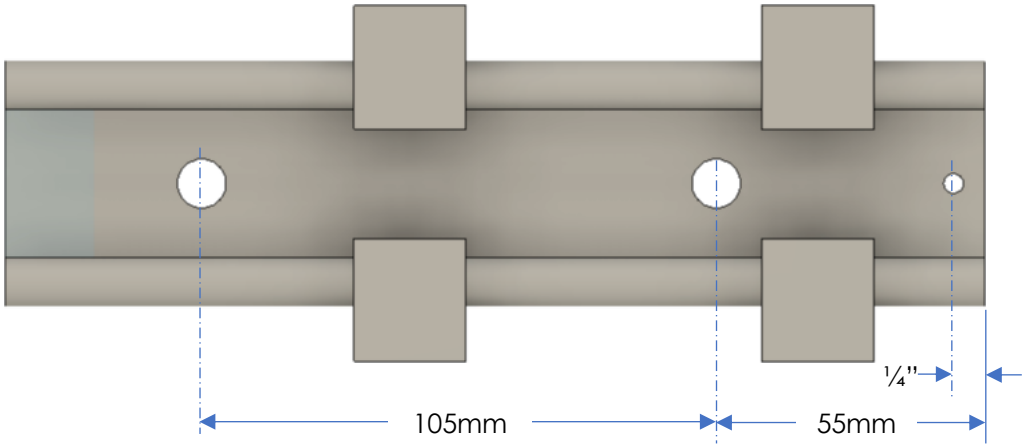
The slider plate is affixed to the slide on the slide of the linear slide. This is shown in the picture to the right. (The screw holes in the sliders are not shown.)



The slider plate needs three holes drilled into it as shown in the picture below. These are centered in the trough.

The two larger holes are drilled for M8-1.25 screws (#314) but make them a bit larger than typically needed. This will allow for adjusting the alignment as needed. 11mm is recommended. Secure this in place using lock washers (#315).

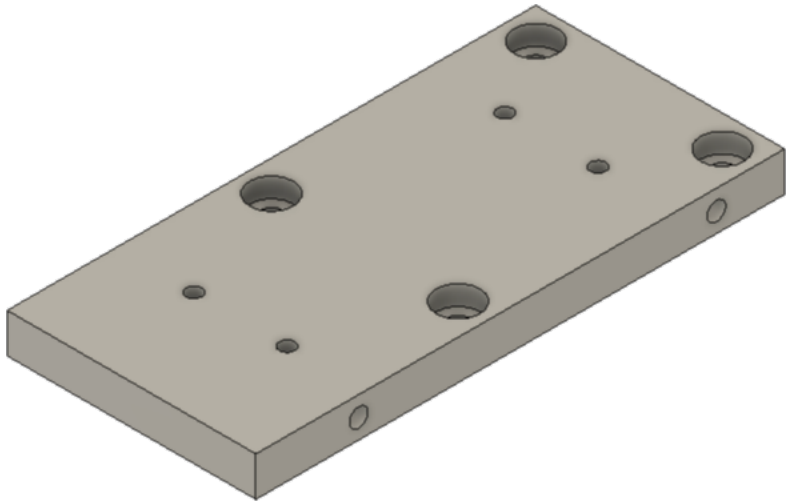
The smaller hole is for an M4-0.7 screw (#316). It should be drilled 5mm. This screw is used to ensure the parts above this don't slide off the back side. Thusly, the screw should be inserted from the bottom and held in place with an M4-0.7 nut (#317).

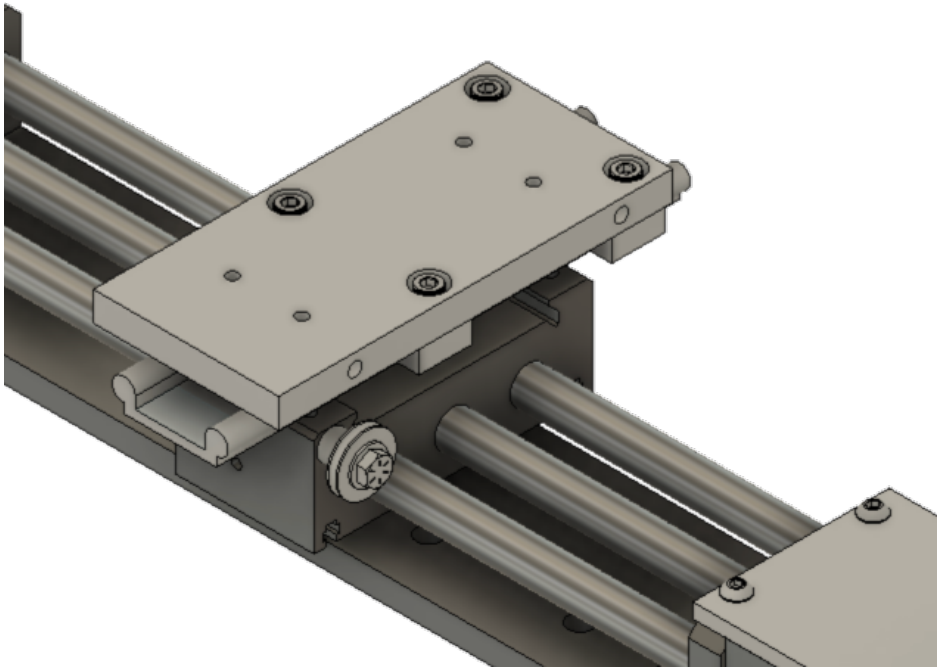


MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

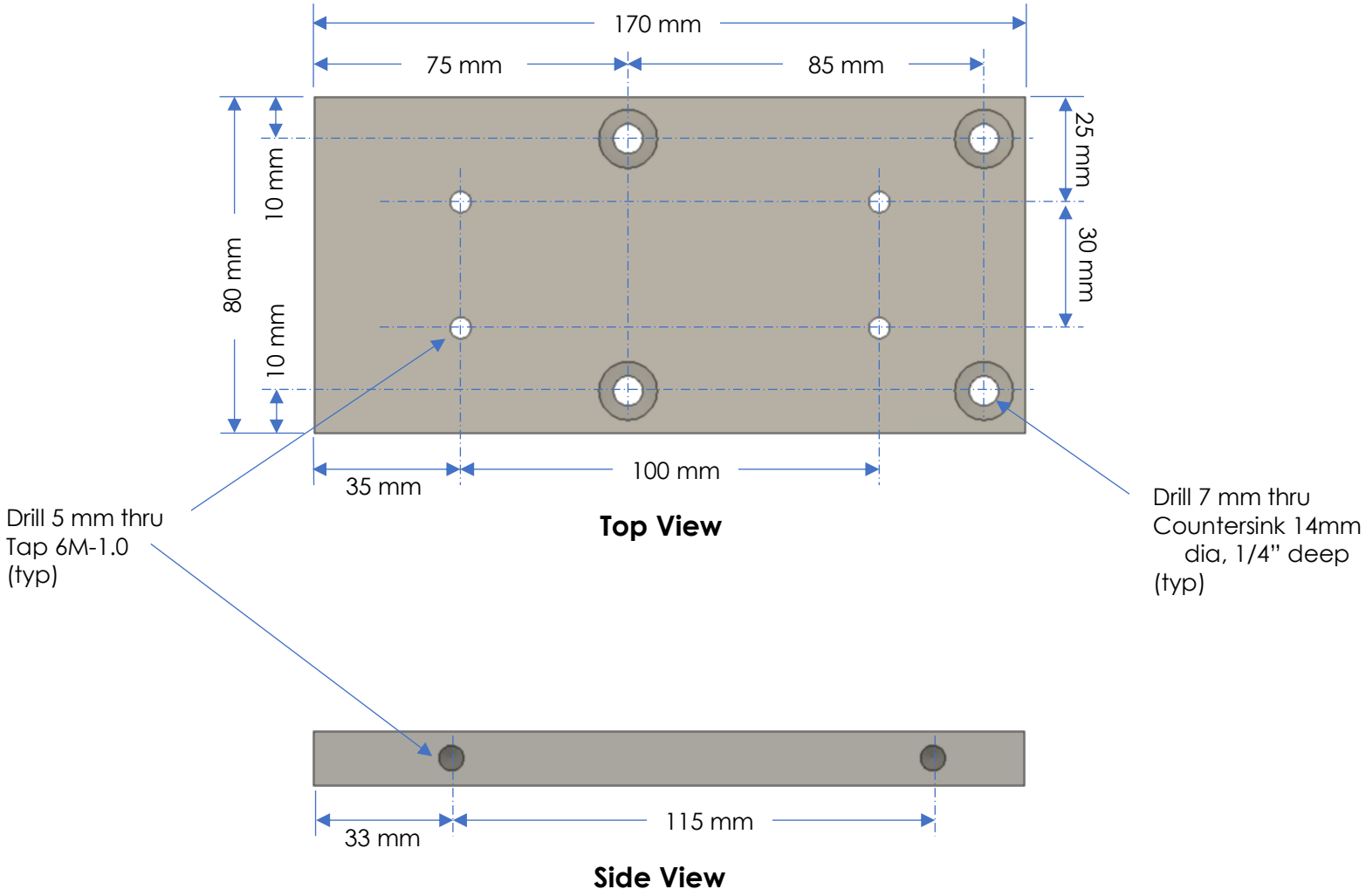
Connector Plate

The connector plate attaches to the slider plate and provides the base for attaching several other pieces. It is made from ½" aluminum plate. It is shown below in orthogonal projection.





MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons



Top View

Side View

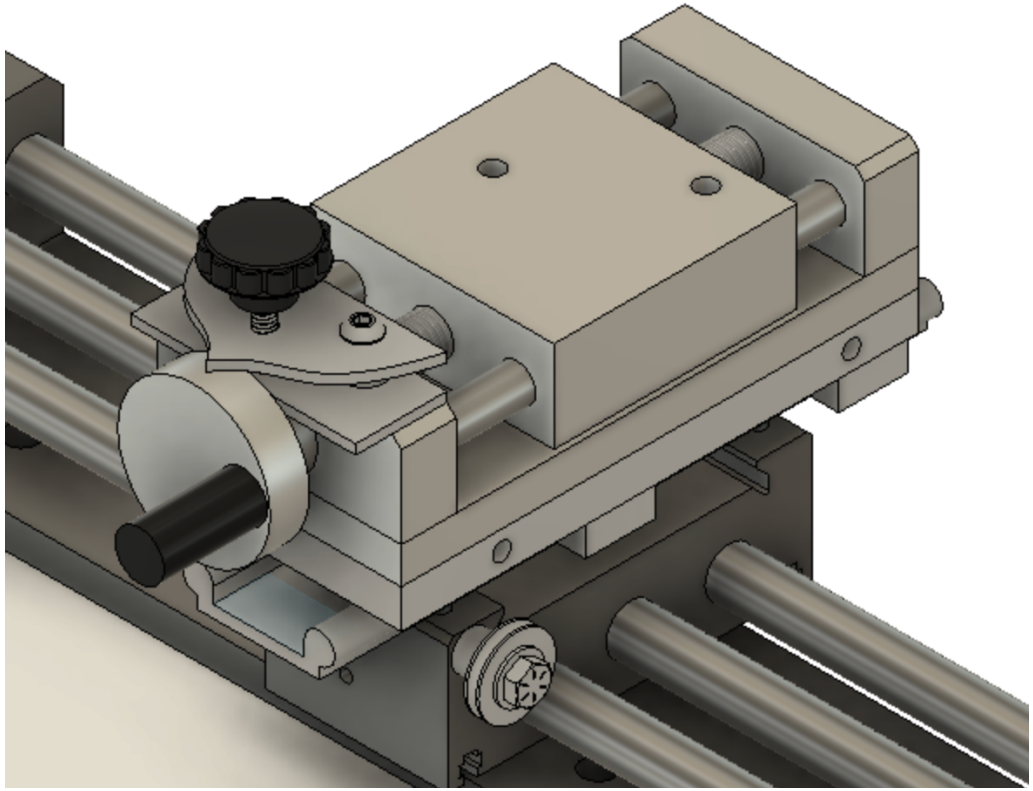
MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

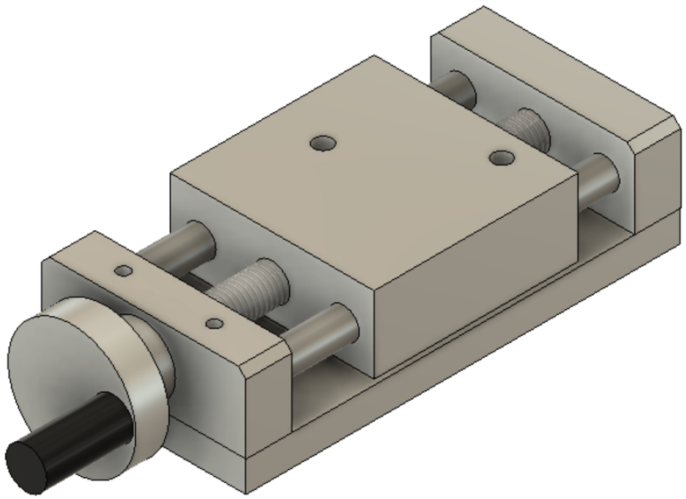
Linear Stage Table

The purchased linear stage table (#202) is attached to the Connector Plate with 4 ea. Socket Head Screws, M6-1.0, 15mm long (#304).

It needs a few modifications before attaching it to the Connector Plate.

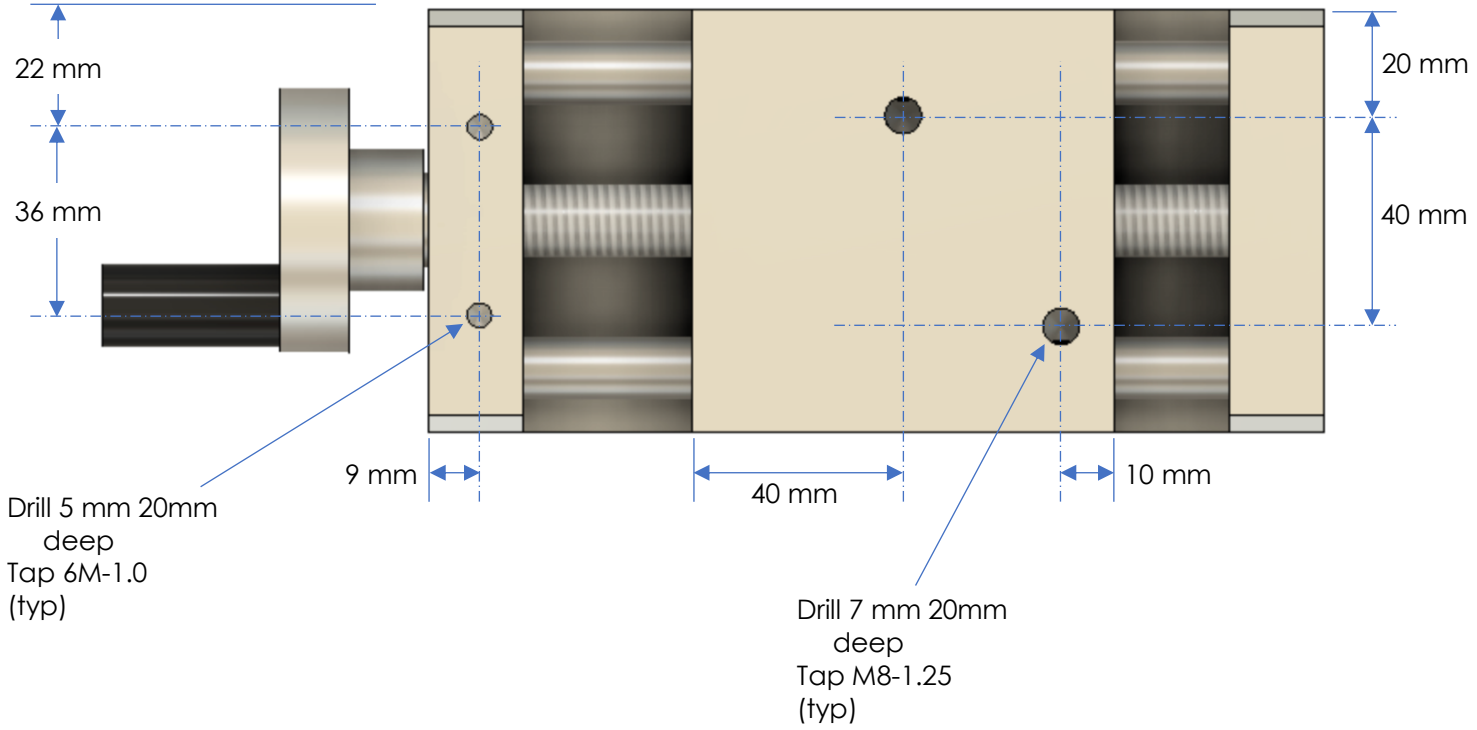
1. Drill and tap holes in the slide to attach the base for the Quick-Change Tool Post.
2. Drill and tap holes to the front to attach two plates for:
    a. Securing the rotation dial, and
    b. Indicating the rotational position of the rotation dial.



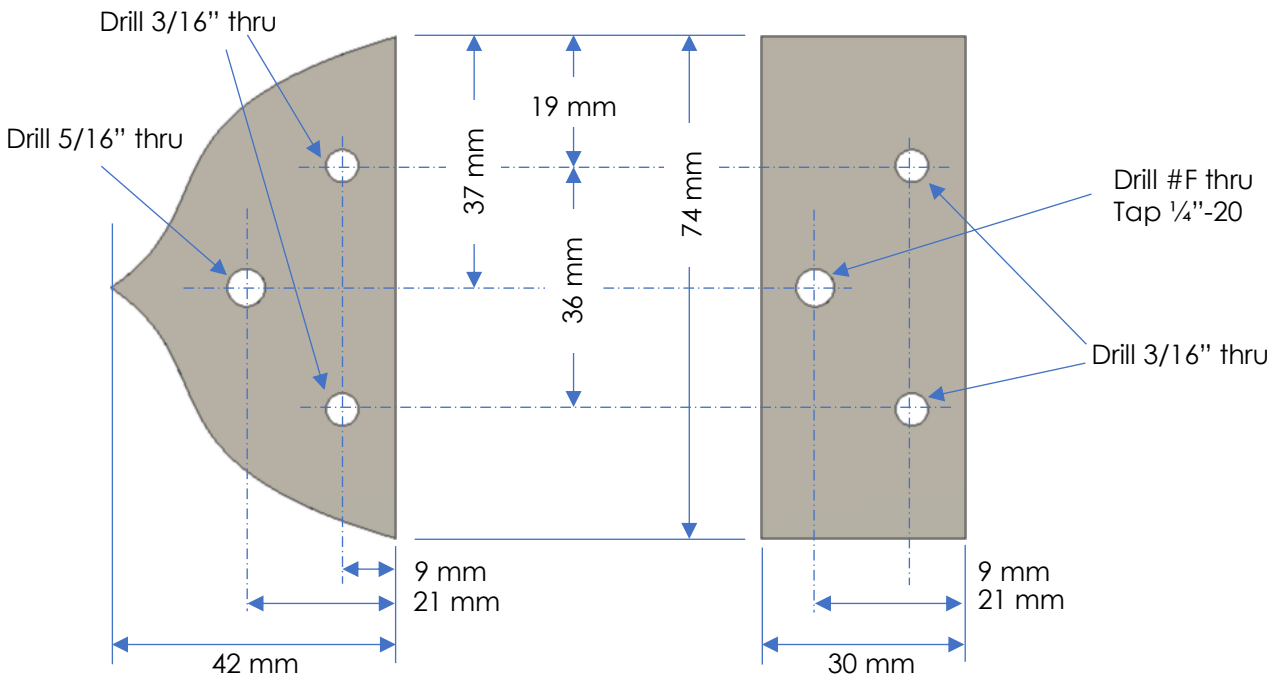


Those changes are shown in the picture to the left.

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons



MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons



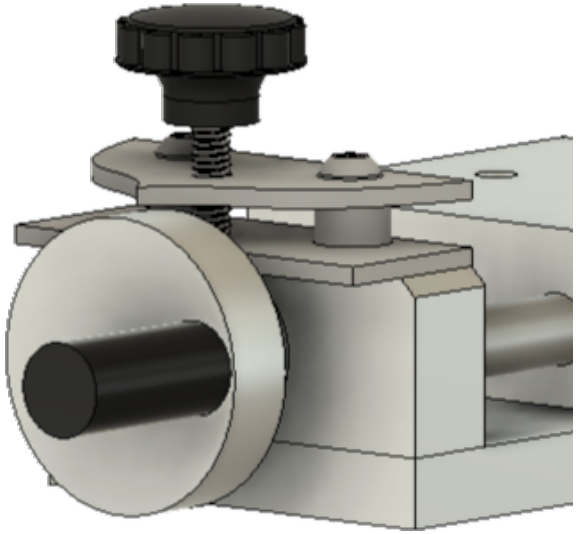
Dial Indicating Plate

Dial Locking Plate

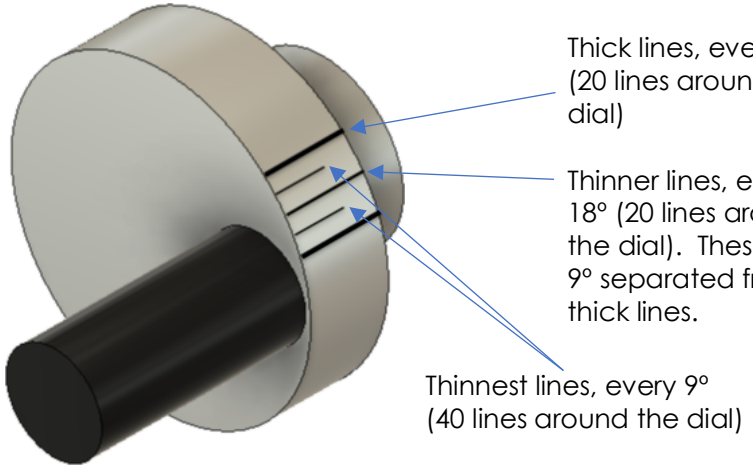
The two plates used for the dial are shown to the left and shown installed in the picture below.

The two plates are attached to the linear stage table using M6-1.0 screws (#302). A spacer (#301) is between the Dial Locking Plate and the Dial Spacer Plate.

The locking knob is #303.

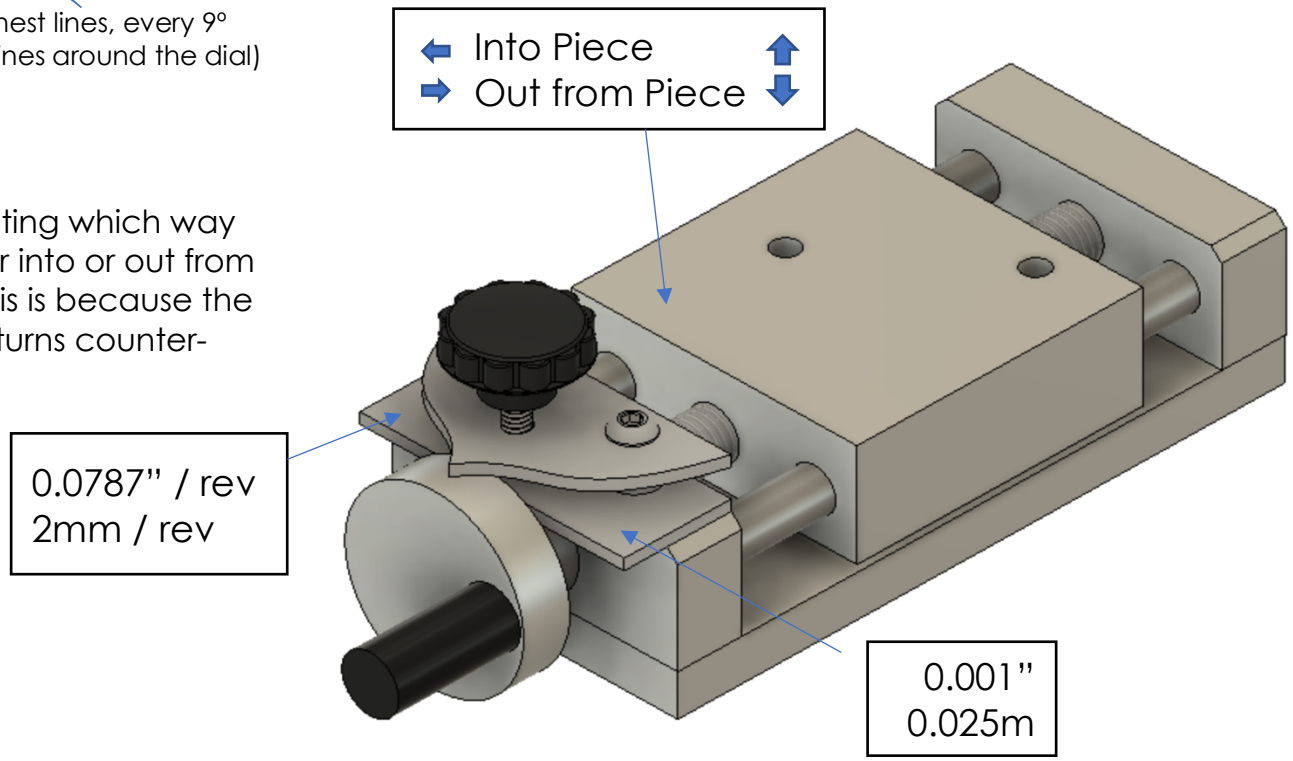


The dial should have indexing lines added. An example is shown below (all the lines are not shown). Placing them at the indicated spacing puts a line every 4.5°.



The result is that there are 80 indicating lines around the dial. The screw used to move the slide is M14-2.0, so each indicating line moves the slide by 0.025mm, which is close to 0.001".

Finally, add labels. The one denoting which way to turn the dial to move the cutter into or out from the piece is particularly useful. This is because the screw is not reverse threads, so it turns counter-intuitively.



MDF Rose Engine Lathe 2.0
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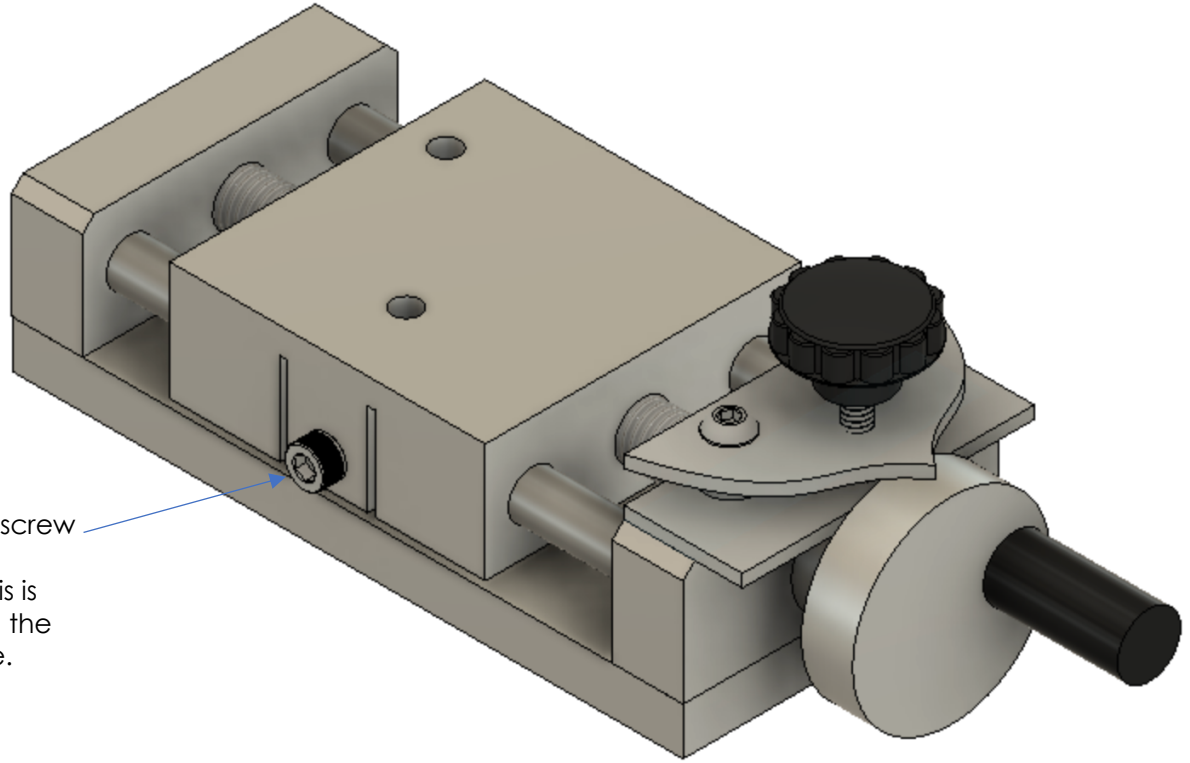


Use an M6-1.0 cap screw here to set tension against the rod. This is similar to tightening the gibs on a cross slide.

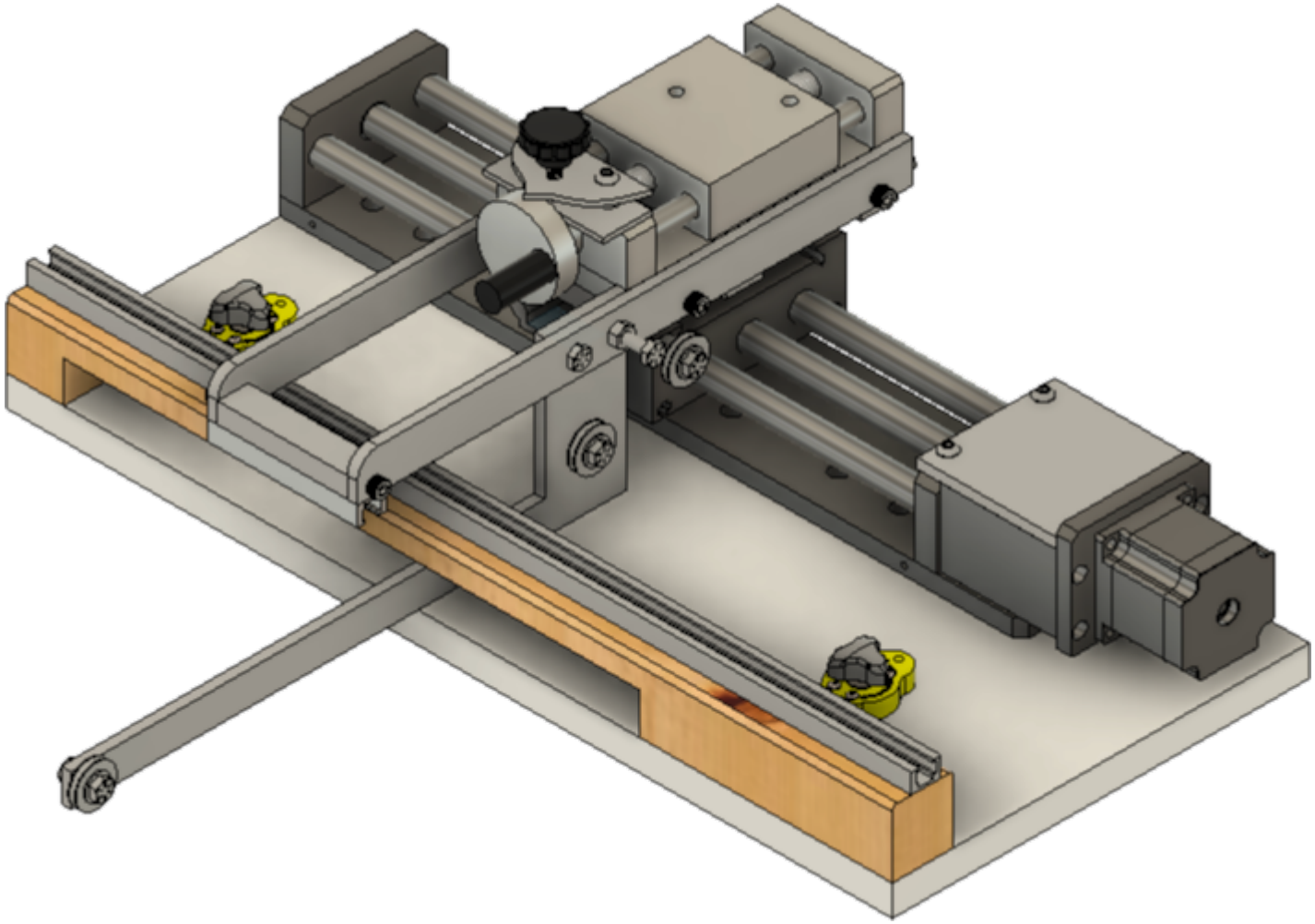
MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Follower Arms

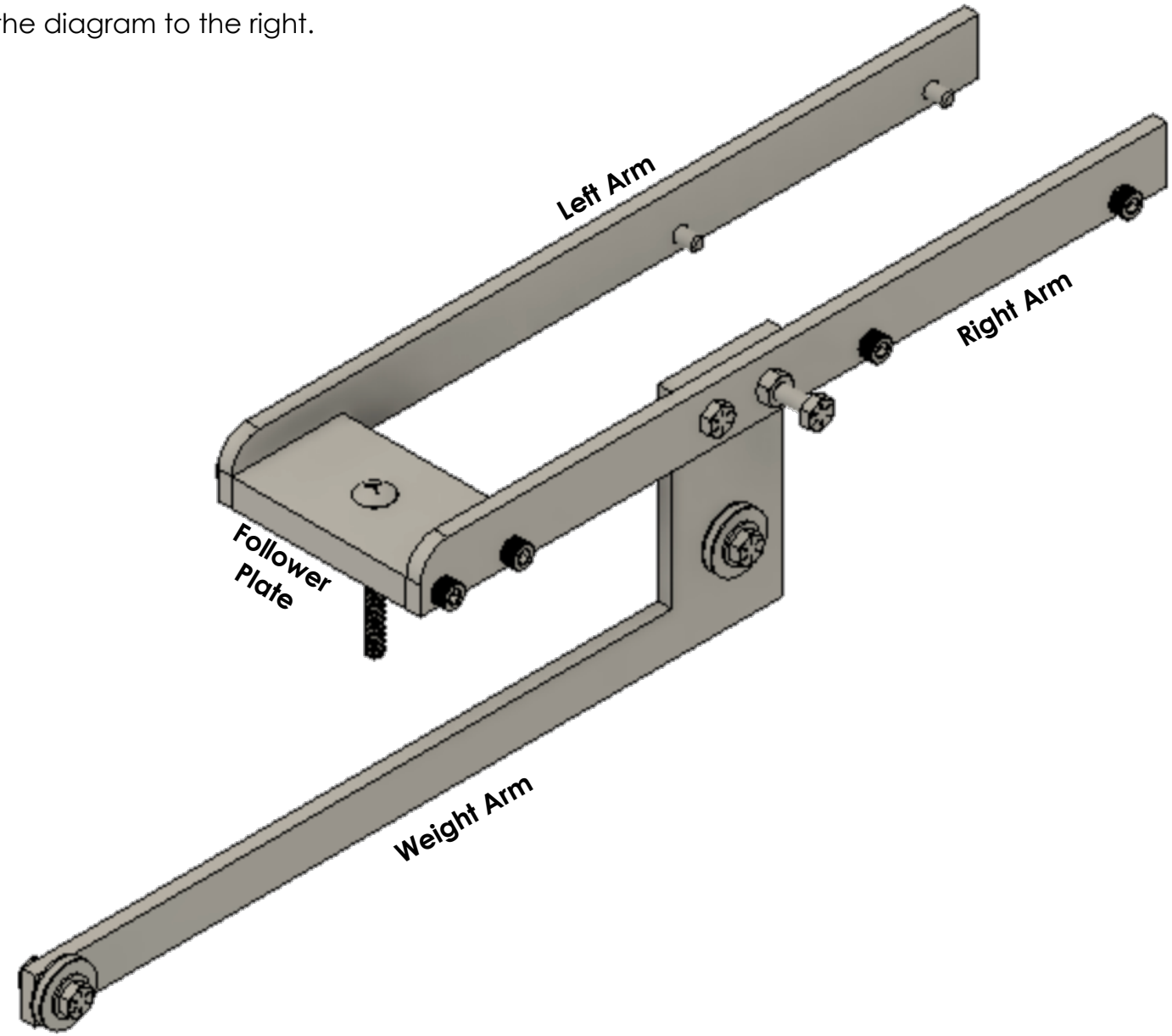
The Follower Arms are used to move the cutter in the path outlined by the template. It also provides pulleys for the weight cable.

These arms are attached to the Connector Plate with 4 ea. Socket Head Screws, M6-1.0, 15mm long (#304).

The pieces are detailed below.



The key parts are shown in the diagram to the right.



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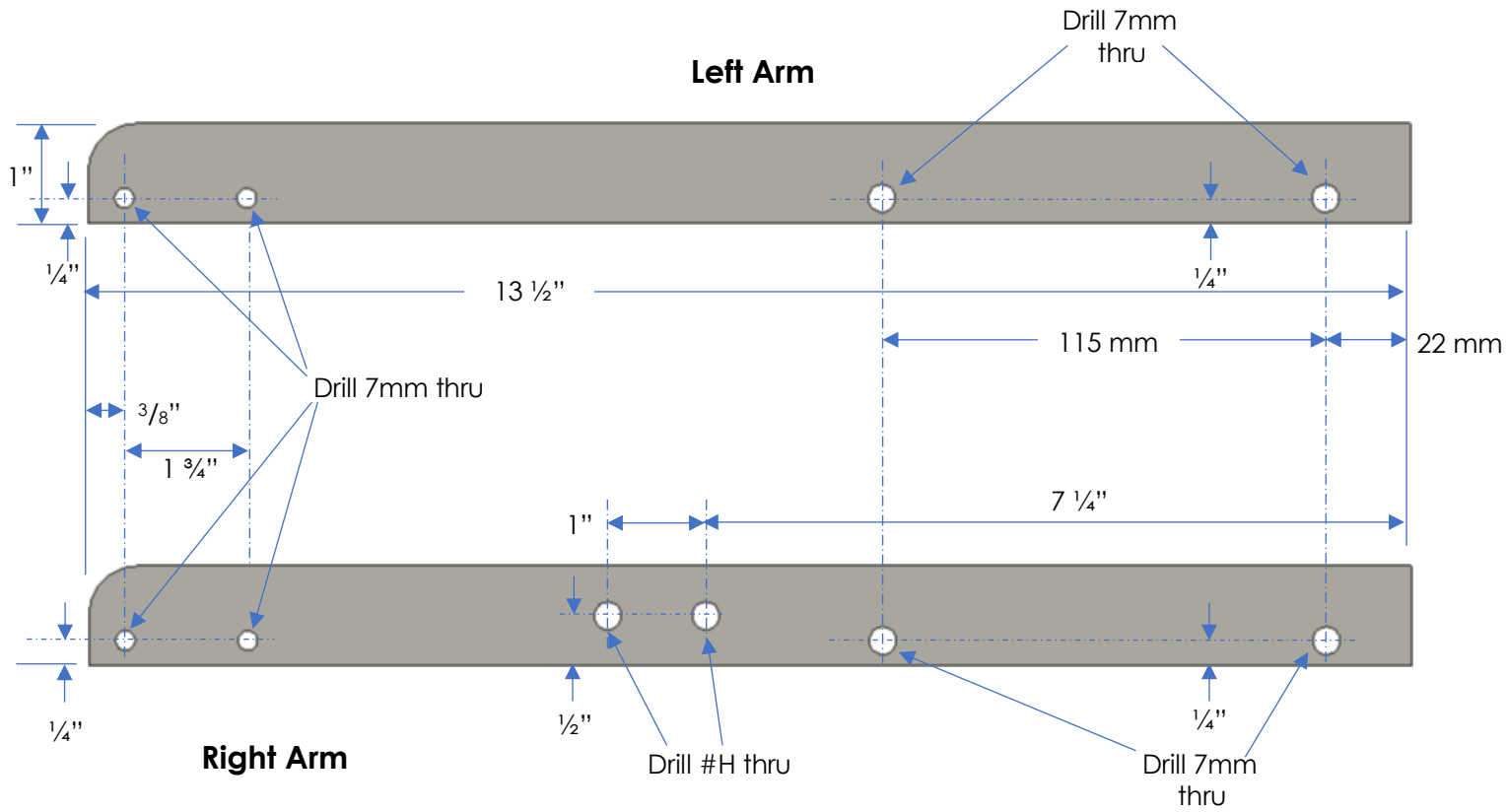
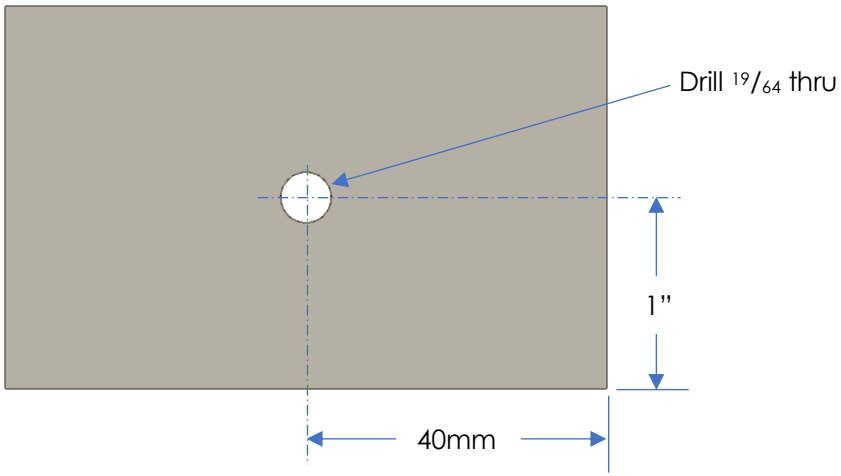
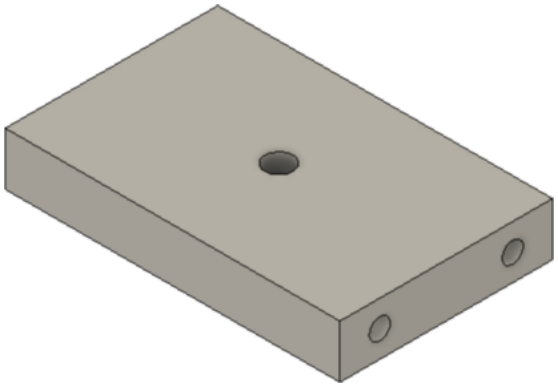
These two parts are made from 1" x ¼" aluminum rod.



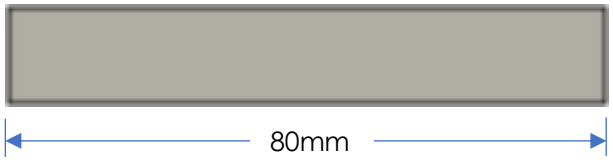
The **Follower Plate** is made from ½" aluminum plate.



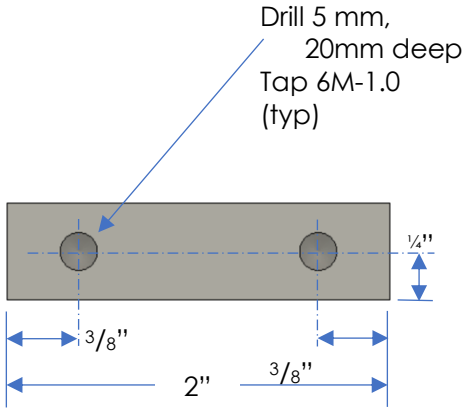
Top View



Orthogonal View



End View



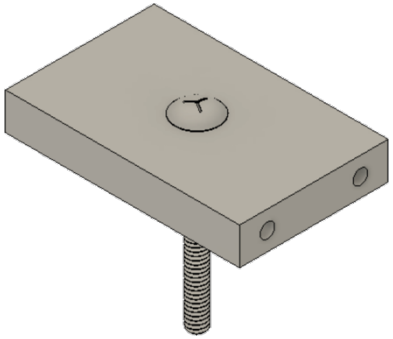
Side View

MDF Rose Engine Lathe 2.0

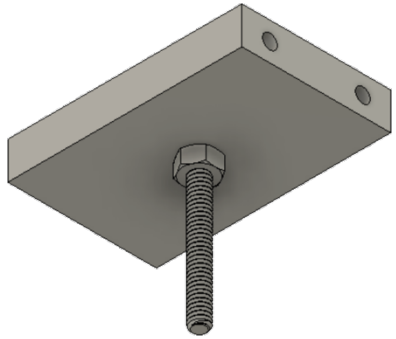
Jigs, Fixtures, and Add-Ons

The Follower Plate has a carriage bolt (#318) and nut (#307) added. The carriage bolt will have to be hammered into place.

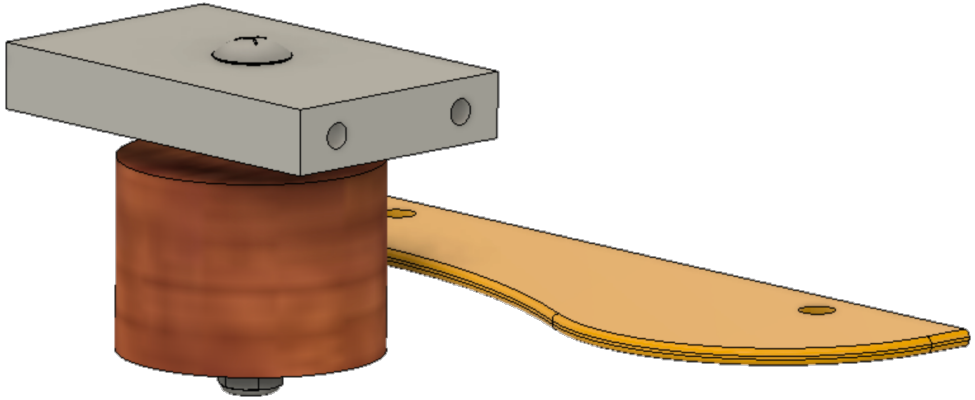
This bolt is used to hold the template follower / rubber. The template follower / rubber can be made in the shape desired by the artist.



Top View



Bottom View

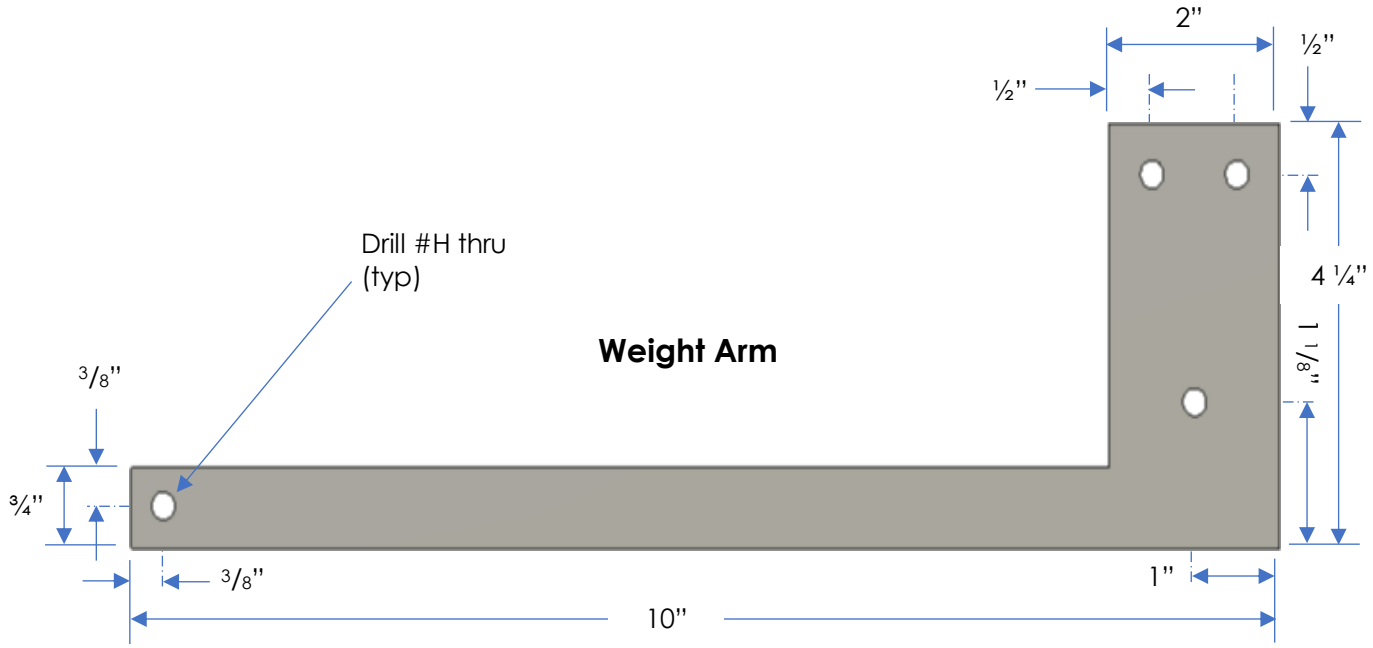


For example, if one needed is 2" diameter, then it is easy to make such a cylinder on a traditional lathe. It is 1 ¾" long, and a hole needs to be bored thru it for the ¼"-20 carriage bolt. Such a hole should be drilled with an H or $^{17}/_{64}$" bit.

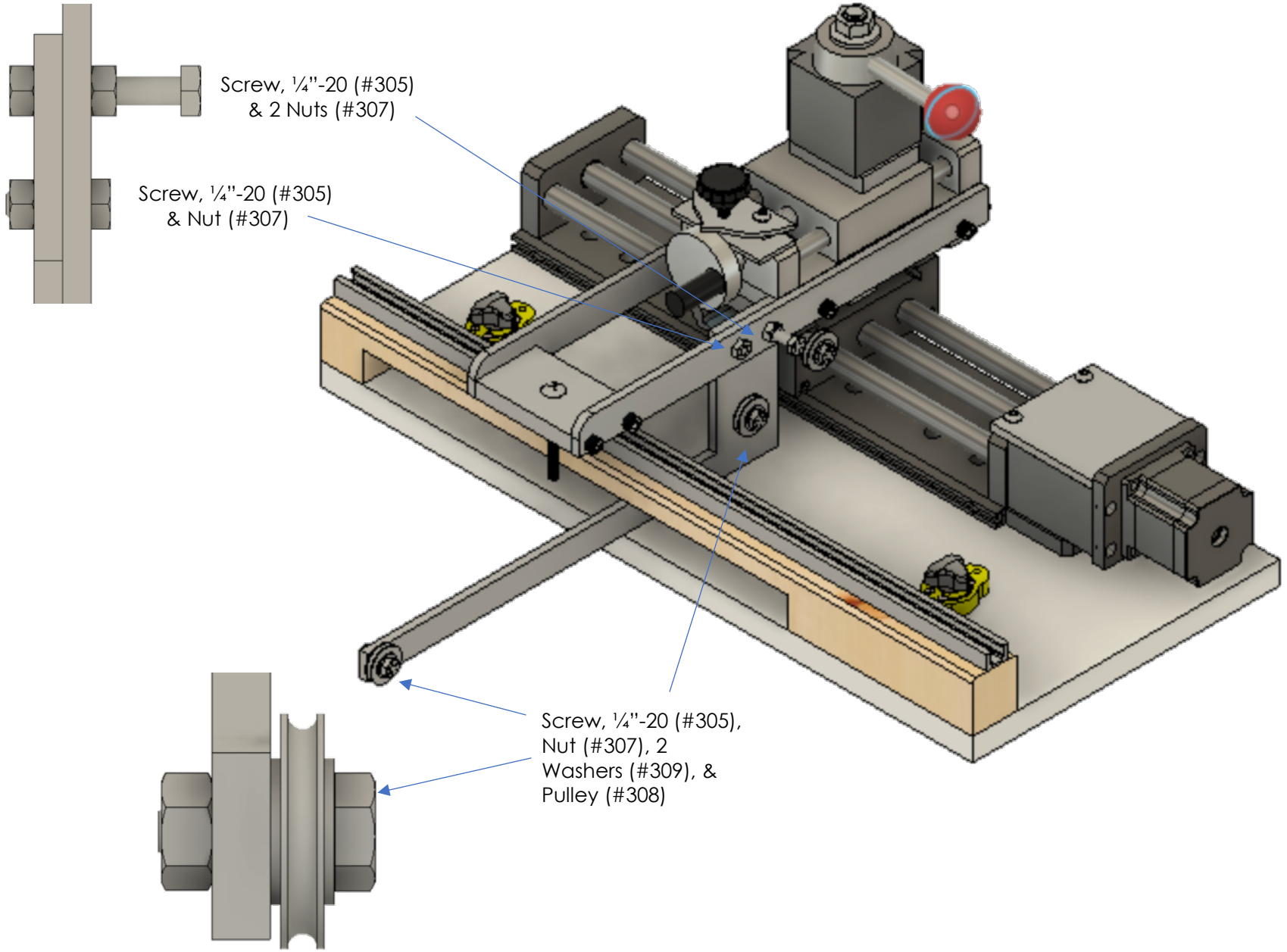
A locknut holds the wooden piece in place.

An example is shown to the left. The brown piece was turned on a lathe, and the yellow template is what it is following.

The Weight Arm is made from ¼" aluminum plate.



MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

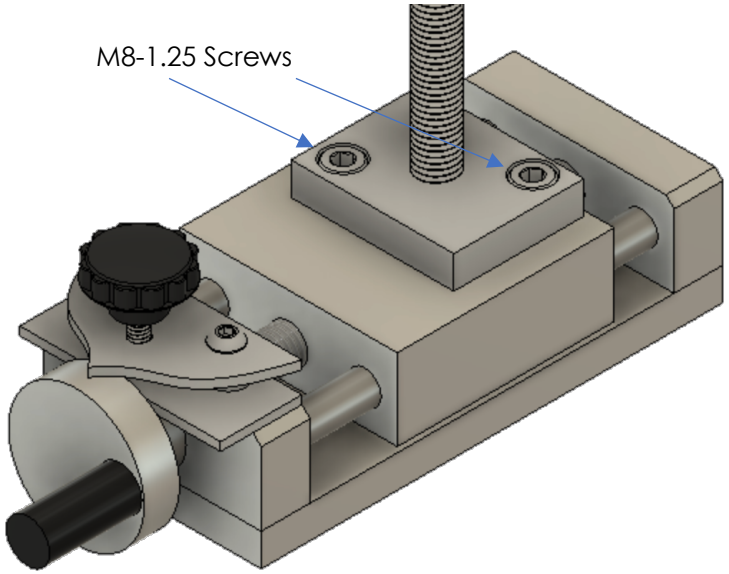


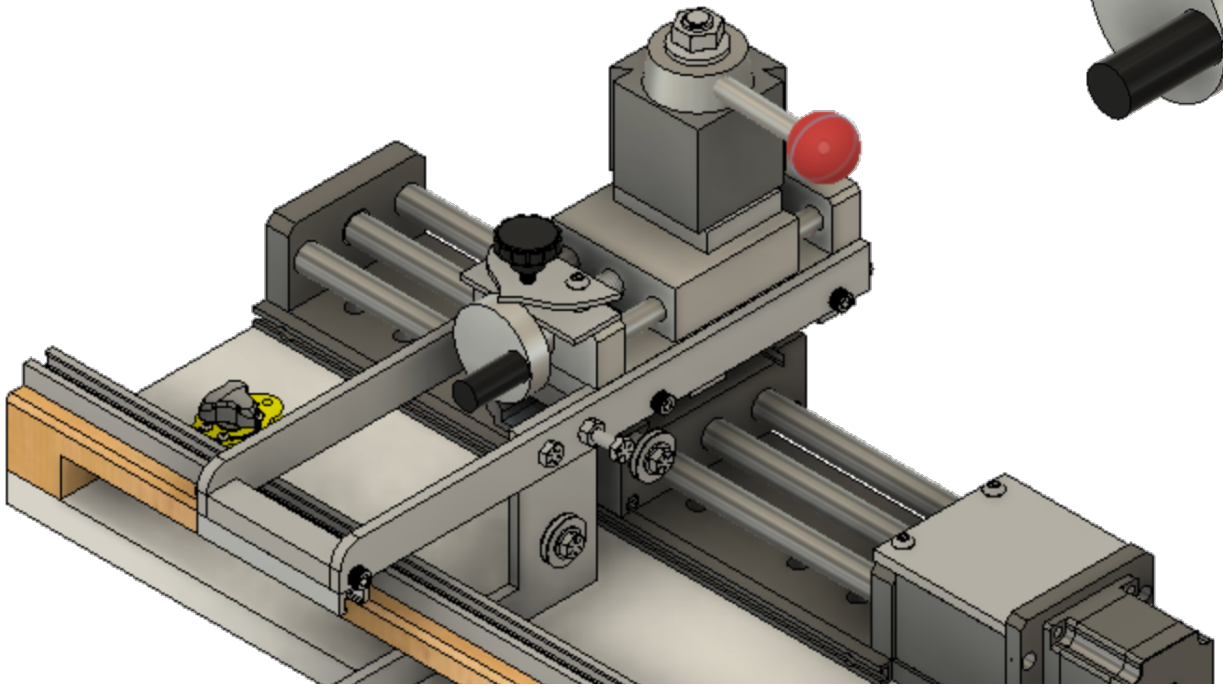
MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Quick-Change Tool Post

The quick-change tool post is attached to the top of the Linear Stage Table using M8-1.25 screws.

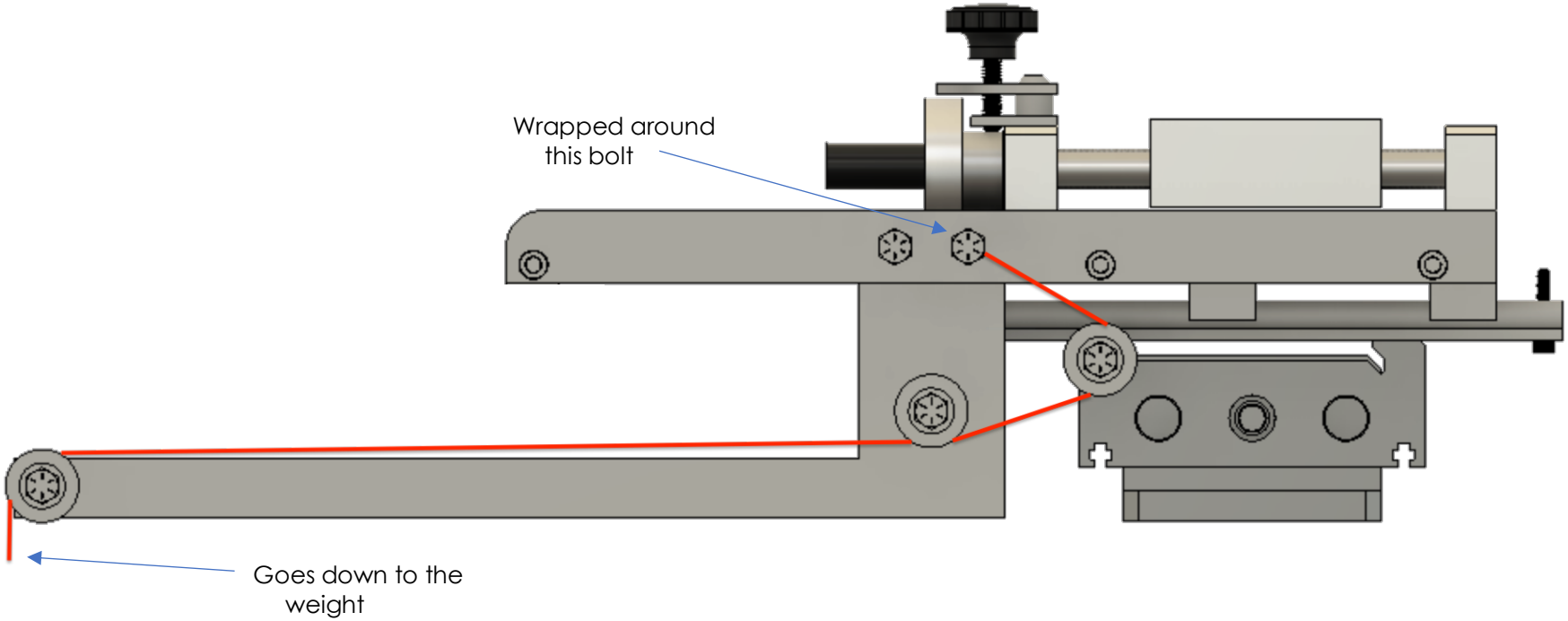
Once the rest of the QCTP parts are installed, it will look like the picture below.





Weight & Cable

The cable for the weight is installed along the path shown in red below.

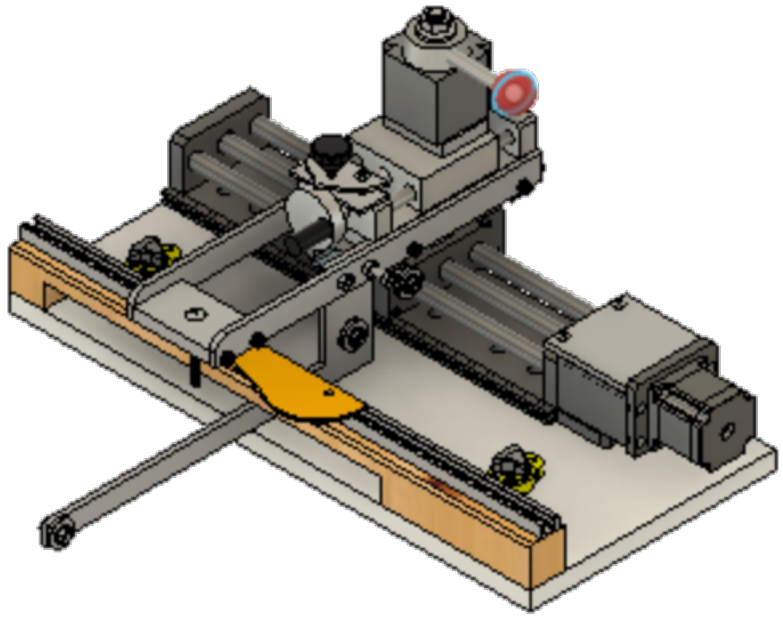


MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

When the weight is attached to the weight arm, it will hang down like the picture to the right.

The weight can be made from many things. What is proposed is to use 1 ½" PVC Pipe, Schedule 40. The one shown has a cap on the top, and a screw-in fitting on the bottom.

The top has an eyebolt in it. A ¼"-20 eyebolt is sufficient. Fill the tube with something to give it a total weight of 5 lbs. You may need to adjust that weight to have it work as expected. When the weight is correct, the slide will be pulled towards the back of the rose engine, keeping it engaged with the template.



MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Wiring Instructions

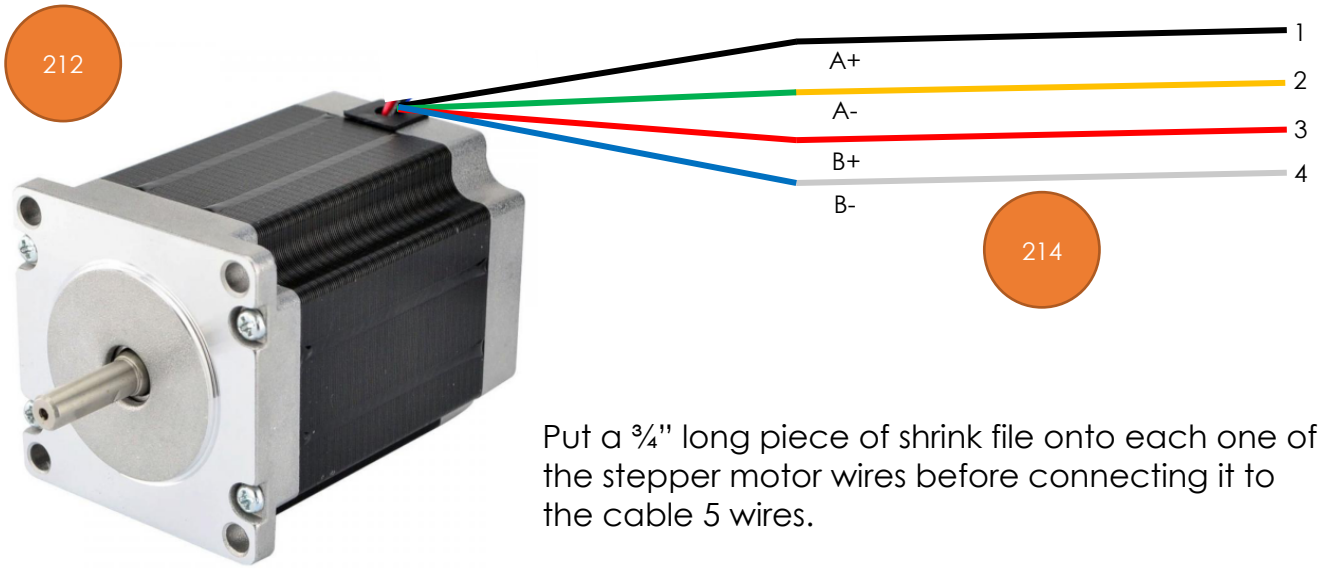
Stepper Motor

The stepper motor is connected to the controls box via a GX-16/4 plug (#213). Stepper motor wire colors shown are for the StepperOnline motors. Check that the one you use matches for the connection needed.

Stepper Motor	Stepper Motor Wire	Cable Wire Color	GX-16/4 Pin
A+	Black	Black	1
A-	Green	Yellow	2
B+	Red	Red	3
B-	Blue	White	4

Yes, I am a Packers fan

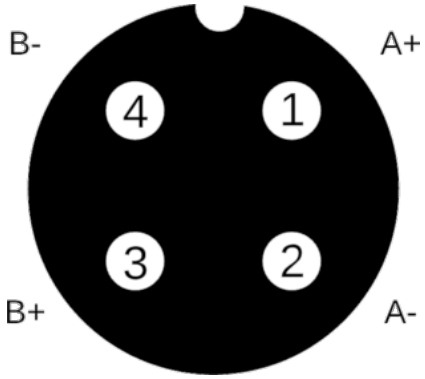
Conductor Type	Stranded copper
Conductor Size	20 AWG
Cable Size	4 conductors / cable
Cable Length	18-24 inches



GX-16/4

213

Put a ¾" long piece of shrink file onto each one of the stepper motor wires before connecting it to the cable 5 wires.

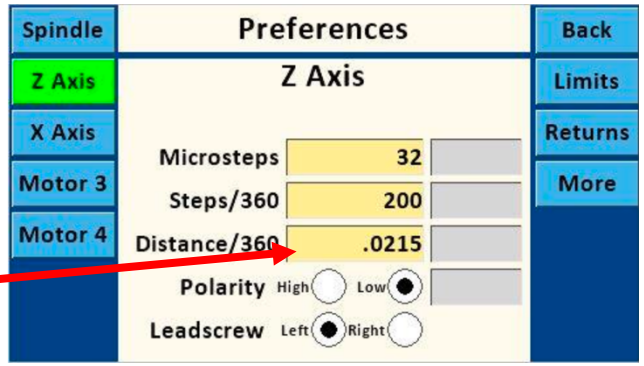


Best Practice: Before soldering the wires together, check end-to-end connectivity

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Further Instructions

I advise adding a label to this jig to make it easier to setup with the Control System for Multiple Stepper Motors. The relevant information for using this with the Z axis below.



Linear Movement

Linear movement is recommended. The values you need are below.

Distance/360	0.31496"
	8mm

MDF Rose Engine Lathe 2.0
Jigs, Fixtures, and Add-Ons

Recommended Additional Instructions

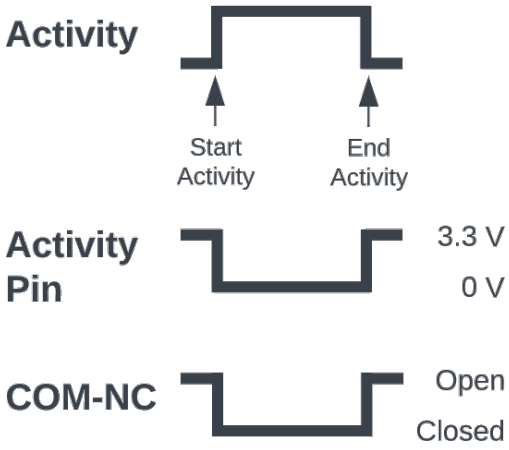
Starting with version 3.0.6 of the Control System for Multiple Stepper Motors, there is an **Auxiliary Pin** function.

When using certain functions (such as Sync and MultiSync), the final pass can take quite a long time -- many hours is not uncommon. This function was requested so that a signal light can indicate when an activity is still underway.

The idea was to have a light (such as the one to the right) lit when activity is underway, and not lit when the activity has stopped. This allows the operator to walk away from the machine when using these long-running operations and monitor the activity periodically by glancing over to the machine to identify if the activity has stopped.

How It Works

The activity diagram on the right shows the timings.



When an activity is initiated on the Nextion touch screen (the top line), the Teensy will take the output for the selected pin from 3.3 VDC to 0 VDC (the second line).

When that activity is completed, the Teensy will take the output for the selected pin from 0 VDC back up to 3.3 VDC.

When that activity is completed (e.g., when using Sync or MultiSync) or stopped by the user, the Teensy will take the output for the selected pin from 0 VDC back up to 3.3 VDC.

This output is then used to switch a relay.

Identifying the Pin Used

Using the Config More panel, a pin is identified for this use (which matches the one wired for this use).

Wiring The Components

The switching side of the relay (left side in the picture to the right) needs to be connected to the printed circuit board.

- **VCC** is connected to any place on the PCB which supplies 3.3 VDC. Do not connect it to the 5 VDC point as that will overload the relay module.
- **IN** is connected to the pin number on the PCB which corresponds to the one identified in the setup (Config More).
- **GND** is connected to any place on the PCB which is the common GND.

The switched side of the relay (right side in the picture to the right) needs to be connected to the power supply for the signal lamp.

- **NC** (normally closed) is connected to the load supply for the signal lamp.
- **COM** is connected to the load from the power supply. This can be switched to turn this function off if it is not needed. The addition of the switch helps the usefulness of this as it is easy to enable or disable without having to go back into the configuration settings. This also makes it so you don't have to remember which pin number was used fo the function.
- **NO** (normally open) is not used.

As shown, Neutral and GND are connected from the power supply to the signal lamp.

Parts

- The relay is a single channel relay which uses 3.3 VC for the switching, and switches 110V / 220V AC. The one I purchased has an optical isolation circuit. It was also purchased from Amazon.

  Do not remove the two jumpers from the board.

- The activity light is an LED Signal Tower light powered by 110V / 220V AC. It was purchased from Amazon.