

CrossFire XR Y-axis Binding - Troubleshooting Rev. B

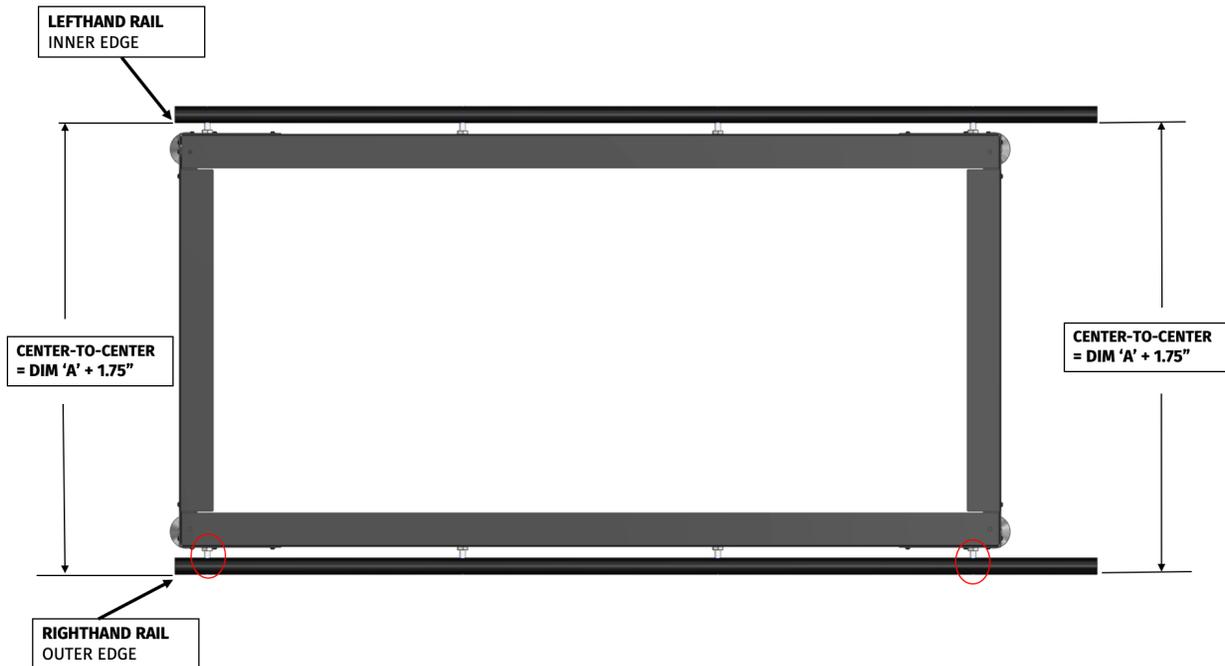
PRELIMINARY CHECKS

1.) Was the table initially squared properly during assembly?

-To check, measure the inside of the frame from corner to corner diagonally as shown in Section 2. Frame Assembly step D1 in assembly manual. Are these diagonal measurements within $\frac{1}{8}$ "?

2.) Check Y-axis rail to rail measurements at the front and the back of the machine and also the spacing between the frame and the rail at each stabilizer.

- Measure tube center to center distance at front and back of the machine by measuring OD to OD (see assembly manual section 6 Install Gantry).
- <https://drive.google.com/file/d/1GM328HtIGfWh2Sc4e6BrXsmRPM2Kjmbf/view?usp=sharing>
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- \How close are the measurements at the front and the back to each other? Are they within $\frac{1}{8}$ "?
 - Is this measurement "DIM A" (roller to roller distance) + $1\frac{3}{4}$ "?



- Measure frame to rail distance at each stabilizer
 - Is the distance along the Y1 side consistently $1\frac{1}{4}$ "?
 - Is the distance on the Y2 side consistent?

3.) Were ballnuts, ballnut felt wipers, and ballscrews liberally greased during assembly

- Use lithium grease and dab on each end and jog back and forth to coat the screw completely.

4.) When the gantry was first placed on rails would it roll freely along the entire length of the machine? If unsure, remove both Y-axis ball screws (making sure to zip tie the ball nuts onto the screw before handling so the nut does not rotate off the screw!) and push by hand the gantry along the entire length of travel. Does it roll freely everywhere? If not, the eccentric bolt used to snug up the bottom V-roller is too tight.

5.) With power off, jog the machine to the middle of Y-axis travel, then kill power to the electronics box. Hand turn each ball nut to get a feeling for how easy the ballnuts should rotate. Then home machine and kill power. Spin both nuts again by hand. Is the rotational resistance the same as in the center of the Y-axis travel? If not, follow the Ball Screw Re-alignment procedure below. Next, turn power back on and home the machine. Then, jog gantry to the front of the machine and turn off power. Spin both nuts again by hand. Is the resistance the same as before? If not, follow the Ball Screw Re-alignment procedure below. Note: if the ball nut is hard to turn even at the center of Y-axis travel, consider reducing the preload on the felt wiper plate by loosening the two low head cap screws.

6.) Grab the ball screw itself and try to twist it. If it twists, tension the lead screw by tightening the cap screw at the far side of the table until it can no longer turn.

7.) Were the limit switch hard stops set correctly according to the video in our assembly guide? If not, go back through this installation. Take note of how easy the ball screw is to turn by hand at both sides of the machine when it is near the limit switch hard stops without the electronics box power on. If one or both sides are hard to turn, it is likely that your ball screws are out of alignment and need to be realigned.

8.) Crack loose the button head screws securing the ballnut mount on the gantry upright 1 full turn to allow for a greater degree of freedom to help mitigate binding.



9.) Is the gantry moving out of square because one side is tracking at a faster rate?

Check for slipping!

To do so, with the machine powered on, grab the ballnut and gently try to rotate it. There should be holding torque in the motors preventing it from turning. You will feel a small amount of flexure in the belt but that should be easily distinguishable from pure lash caused by slipping. If you notice any play you will then need to identify the source.

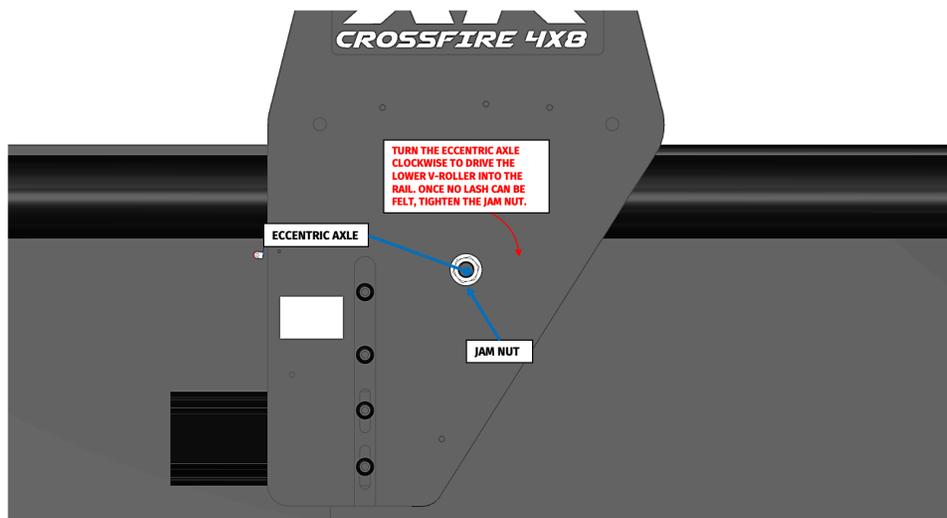
A.) Belt Tension

One potential scenario could be that the belt drive is too loose or that the pulley itself is slipping on the motor shaft. With the gantry towards the rear of the machine and the ball nut itself approximately 6" from the bearing mount hard stop, check the belt tension. To do so, simply use your finger to pull outward on the belt. The belt should be taut but not overtightened, which could result in motor torque loss. When checking for tension the belt should stretch approximately $\frac{1}{4}$ ". Understanding that this is a somewhat subjective measurement and cannot be accurately measured, if there is substantially more or less deflection, tension the belt by loosening, without removing, the two BHCS on the outside face of the gantry upright. Gently press inward repeatedly on the belt to allow the motor to fall into place. Allow only the force exerted by gravity on the motor to tension the belt. Over tensioning the belt will be just as inhibiting to motion as being too loose. While making sure to keep the motor parallel to the ground, retighten the BHCS to complete the tensioning process.



B.) Pulley slipping on shaft

If the belt was sufficiently tight check for slipping along the motor shaft coupling. The quick and easy way to check this is by grabbing the gantry upright and rocking forward and back along the Y-axis. With the enclosure powered on there should be holding torque in the motors that resist any transverse motion in the Y-direction. If you notice lash or the upright is able to move along the Y-axis you most likely have slipping between the pulley and the shaft. **Do not confuse this transverse motion in the Y direction with rotational motion due to improperly tightened eccentrics holding the bottom V-roller against the rail.**



To confirm slipping, move to the rear of the motor to locate the stainless steel circular motor shaft. With a sharpie, place a match mark or small vertical line on the top of the shaft as shown in the photo above. Make sure that you have your jog speed set to 10 IPM in FireControl. Position yourself so that both the mark you placed on the shaft and the belt drive are visible. Jog your motor forward and back. Look for the shaft to spin out of unison with the belt. There may only be a slight delay so using a recording device may aid you in diagnosing this issue. If your shaft is rotating but your belt is delayed or not spinning at all, you'll need to remove the motor and retighten the set screws into the keyway on the shaft. If you have a 1/8" socket and impact gun you can proceed to remove the motor. Otherwise, leave the motor engaged and from the outside secure the ball nut in place with a 30mm wrench. From the other side, loosen the nut securing the pulley. Once the nut is loose, remove the two BHCS holding the motor in place on the outside face of the gantry upright. Grasp the motor while removing these screws to prevent it from falling and damaging the motor cable. With the motor, nut and pulley all removed, unbolt the aluminum shroud to expose the two set screws fixing pulley hub to the shaft.

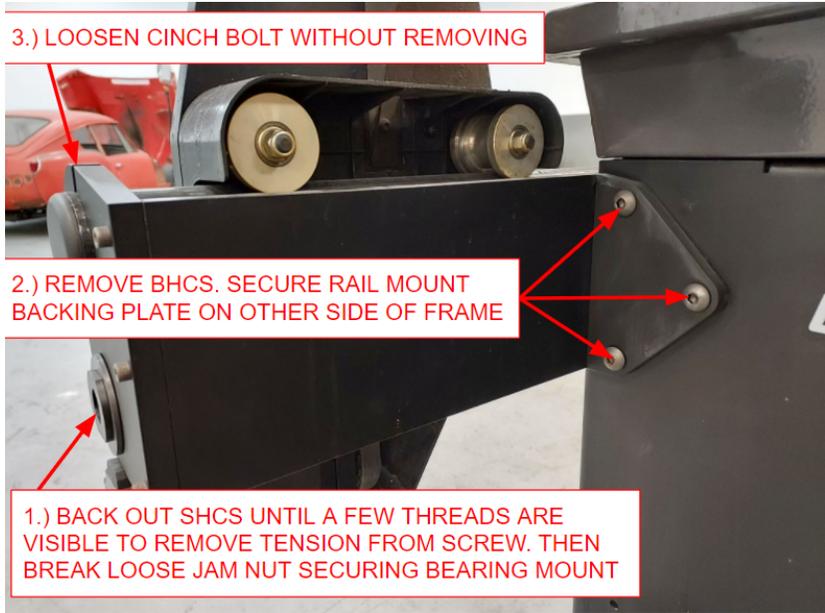


REMOVE NUT WITH 1 1/8" IMPACT. THEN UNBOLT ALUMINUM SHROUD TO EXPOSE SET SCREWS

ONE SET SCREW MUST BE LOCKED INTO THE KEYWAY! Rotate the hub along the shaft until the set screw is oriented on the flat keyway portion of the shaft. One set screw may need to be tightened slightly in order to locate and seat into position. Once you've found the keyway, tighten the set screws into place. Loctite or thread fastener may be used to secure the screws if desired. Reassemble the motor and tension the belt. Remember, over tensioning the belt can rob the motor of torque so be certain to carefully follow the tensioning guidelines set in this manual. Fasten the BHCS to secure the motor to the upright.

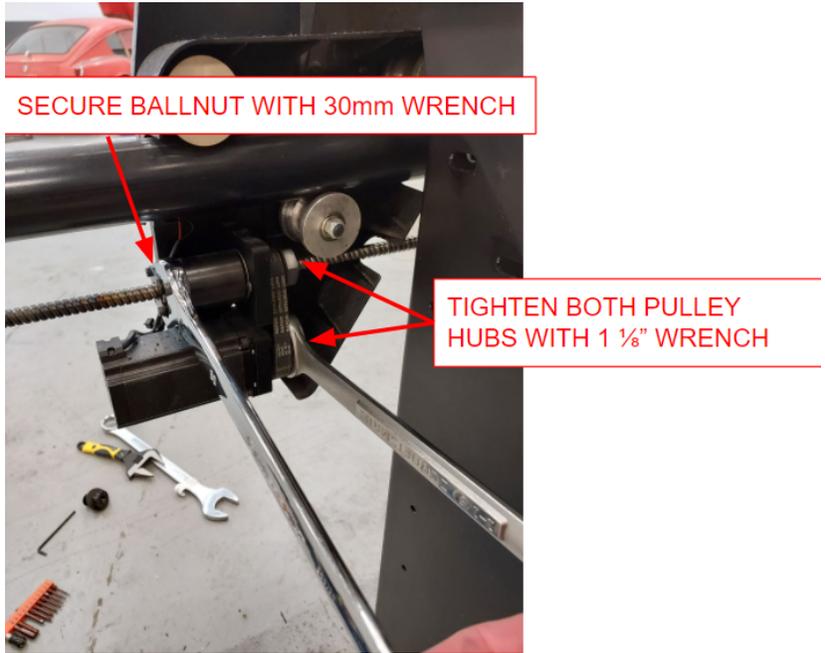
B.) Toothed pulley is loose

Another potential cause may be that the nuts securing the pulley drive system are loose. With the gantry towards the rear of the machine and the ball nut itself approximately 6" from the bearing mount hard stop, remove the tension from the ball screw by using a 3/16" hex key to back out the SHCS at the end of the ball screw until just a few threads are visible. Next, with a 1 1/2" wrench, break loose the jam nut securing the bearing mount. With the ball screw now free floating at one end, finish backing out the SHCS and remove the bearing mount from the rail mount assembly.



Begin removing the rear rail mount assembly by removing the 3 BHCS with a 7/32" hex key. On the back side of the machine frame, remember to support the rail mount backing plate as you remove the screws to prevent it from falling and incurring cosmetic damage.

Next, with a 5/32" hex key loosen, without removing, the cinch bolt securing the rear rail mount assembly to the Y-axis rail. Remove the rear rail mount assembly to expose the Y-axis motor. **BE CERTAIN NOT TO ALLOW THE BALL NUT TO COME OFF THE SCREW. FAILURE TO FOLLOW THIS INSTRUCTION WILL CAUSE THE BALL BEARINGS TO FALL OUT OF THEIR TRACKS AND RENDER THE BALL NUT INOPERABLE.**



Hold the ball nut in place with a 30mm wrench and secure the pulley hubs by tightening the 2 nuts with a 1 1/8" wrench. Be careful not to damage the polymer pulley with excessive force. Replace the rear rail mount assembly. Do not apply excessive force when tightening the cinch bolt against the rail. It needs only to be snugged in order to secure it. Overtightening can cause misalignment.

With the rail mount installed realign and tension your ball screw by following the alignment procedure detailed below. If you are confident that the forward section was aligned properly you may skip those steps and only align the side that was disassembled. **IMPROPER BALL SCREW ALIGNMENT IS THE ROOT CAUSE OF 90% OF BINDING ISSUES! PAY CLOSE ATTENTION TO INSTRUCTION WHILE PERFORMING THESE STEPS.**

BALL SCREW RE-ALIGNMENT

<https://youtu.be/rcFi07eejpo>

Jog gantry to front of machine

- kill power, manually rotate ball nuts so each side of gantry touches front mount
- install ballscrew hangers on the left side equally spaced along the length of the Y1-axis ball screw.
- go to back left of machine and loosen cap screw that is in ballscrew end until threads are visible
- crack loose the large nut so that the rod end bearing mount can float freely in the rail mount hole
- come to front of machine and loosen the same nut to loosen rod end bearing mount and let it orient itself into its natural position then hand tighten nut without disrupting the position of the bearing mount, tighten fully with wrench
- go to the rear of the machine on the same side and hand tighten nut on rod end bearing mount, then tension the screw, remove 3 ballscrew hanger tools and wrench tighten the nut on the rear rod end bearing mount.
- repeat steps on right side
- Jog machine all the way to back
 - kill power, hand rotate ball nuts until bearing mount hits ball nut on each side
 - put the hanger tools back on one side, remove ball screw tension, crack nut loose at rod end bearing at rear, allow rod end bearing mount to find natural position then tighten
 - Tension screw on this side and tighten rod end bearing mount nut.
- repeat steps on opposite side