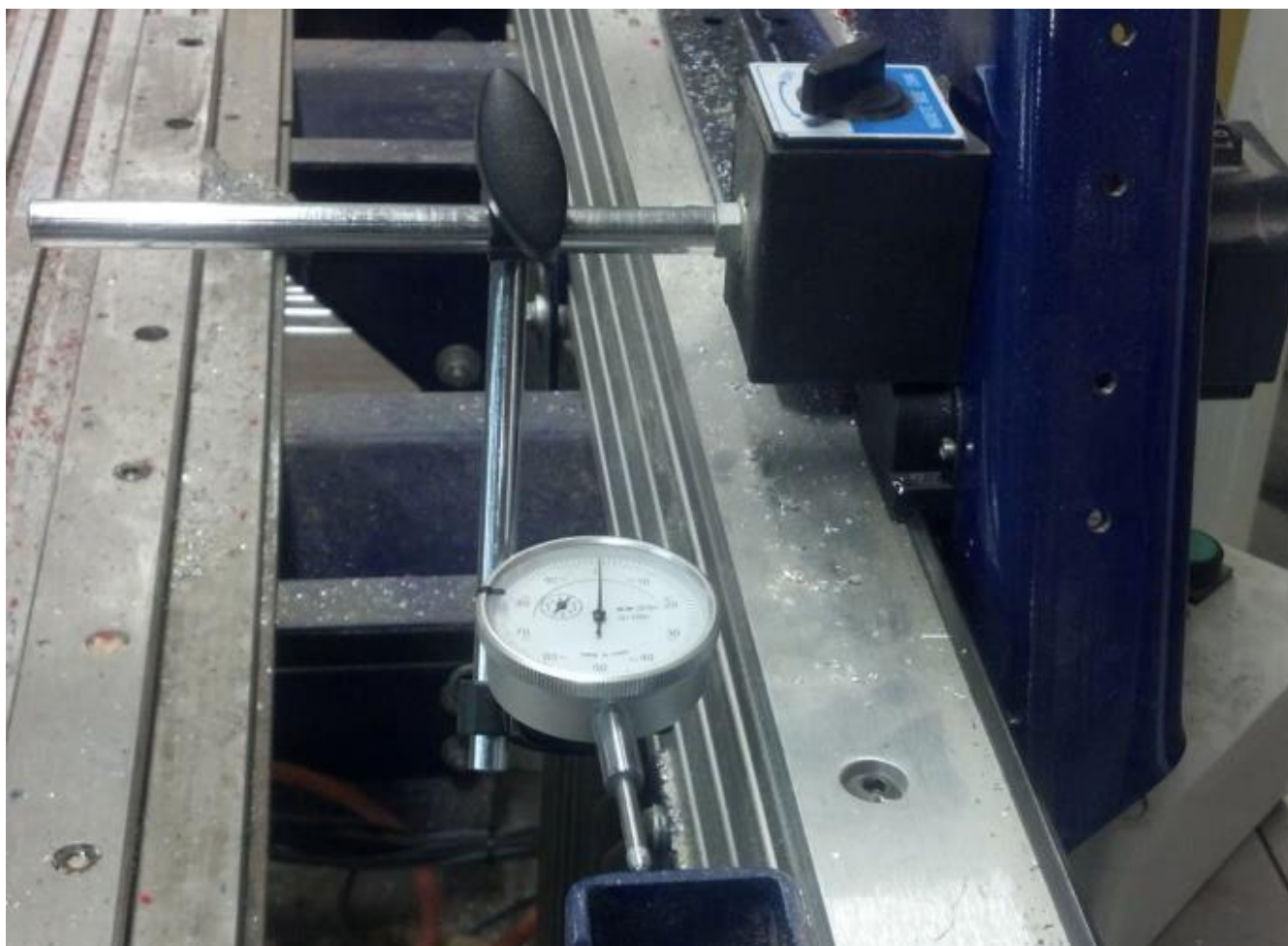




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## Checking Pinion Play





## Process

ShopBot tools equipped with a rack and pinion drive system require regular maintenance to prevent the build up of wear over time, which will result in play.

If the pinion to rack engagement is not maintained on a regular basis, the cutting head can be deflected off the cutting path. This often shows up in the plunge, retract, start, and stop moves during a cutting operation where over/under travel is most easily noticed.

To identify if this play exists, the easiest check is the push/pull test. This is a simple check to see if the pinions are loose.

There are many cases where the machine “feels tight,” but the cuts are still unacceptable. In other cases, the deflection may be just too small to feel.

## Tools Used

- 3/16” allen wrench
- 1/8” allen wrench
- Dial indicator with a magnetic base and adjustable armature

## The Push/Pull Test

With the ShopBot tool powered up (and reset if an alpha tool), the motors will be solidly engaged and not moveable by hand. Ensure the motors are engaged by trying to push the tool. It should not move.

The easiest axis to check is the Y-axis, or the motor that moves the gantry, as this axis uses one motor. Grip the motor assembly by hand and try to push/pull the motor back and forth in the positive and negative direction along the rack. Movement should not be seen or felt when attempting this test.

The second part of the push/pull test requires the motor to be disengaged to gain direct access to the pinion to motor shaft assembly.

For information on unmounting the motors, refer to the “Replacing Pinion Gears” document found on the ShopBot website under the Documentation page, in the “Maintenance and Troubleshooting” section. <http://www.shopbottools.com/ShopBotDocs/files/ReplacingPinionGears.pdf>

Once the motors are unmounted, with the tool powered and reset, try to rotate the pinion back and forth on the motor shaft. Again, no movement or play should be seen or felt between the pinion to motor shaft engagement, or on the motor shaft itself.

If there is play in the pinion to shaft engagement, try adjusting and tightening the set screws.

If there is play in the shaft, this is a more serious issue, there may be wear or damage within the motor gearbox. The gearbox allows for some adjustment to be made, often times any backlash in the motor indicates the need for a replacement.

## Dial Indicator

Deflection can be caused by a loose bearing or a stack-up of tolerances from multiple bearings and are sometimes virtually undetectable without use of a dial indicator. In these cases, play that is not noticeable by using “hand” methods will be visible when using a dial indicator.

**NOTE:** The method shown here is often not any more effective than the push/pull method to measure play in the pinion to motor shaft engagement or in the wheel bearings. This test will measure all play including play in the motor gearbox that is not adjustable.

Before using this method, ensure the set screws on all pinions are tight and that the lower wheel bearings and Z-axis bearings are engaged properly (according to the Maintenance and Troubleshooting documentation found under the documentation heading of the ShopBot Tools website).

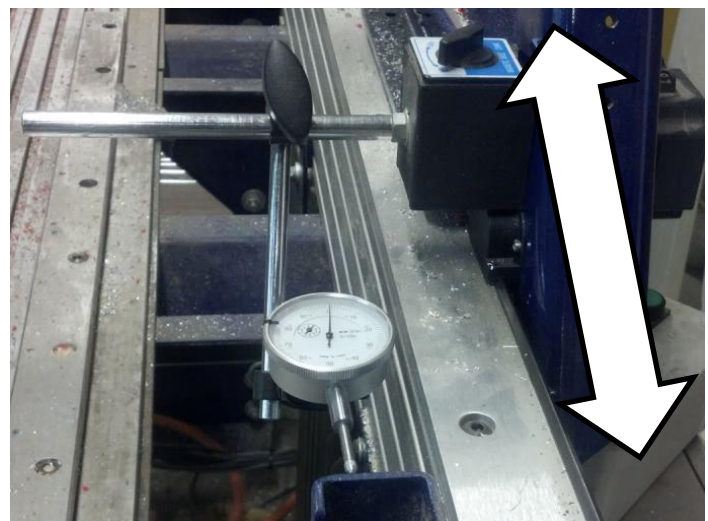
Lower Wheels Document Link:

<http://www.shopbottools.com/ShopBotDocs/files/Adjusting%20the%20Lower%20Wheels%20on%20the%20YZ%20Car.pdf>

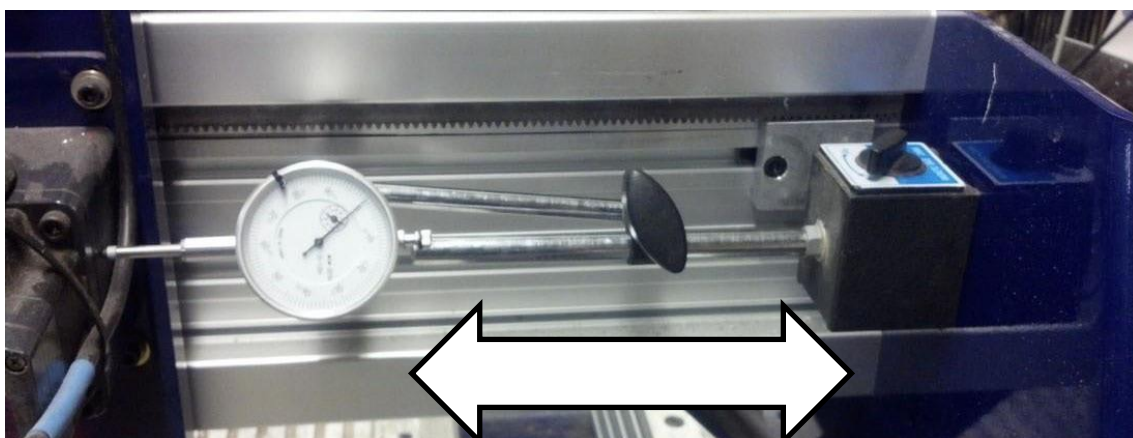
Z-Axis Bearings Document Link:

<http://www.shopbottools.com/ShopBotDocs/files/AdjustPRSZBearings.pdf>

To the right is a picture of the X-axis setup showing the magnetic base attached to the PRS side plate with the dial indicator against a table leg. Push/pull in the X direction on each side plate.

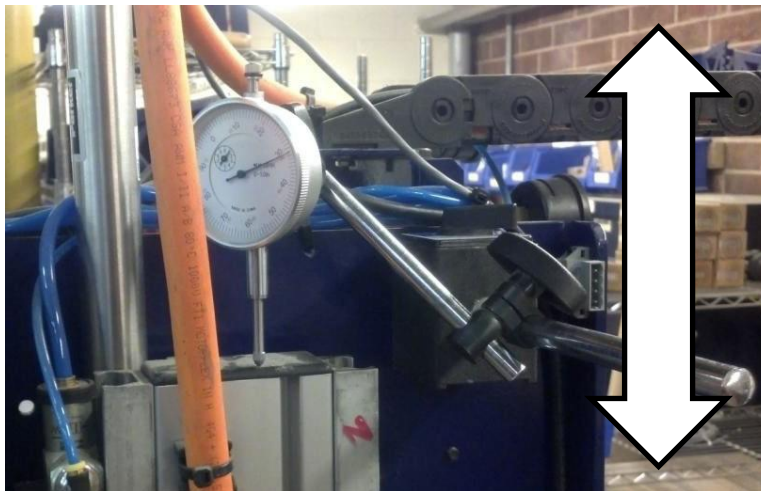


Below is a picture of a Y-axis setup with the indicator base attached to a side plate, and the indicator against the Y-motor. Push/pull on the YZ car in the Y direction.





This setup is used to measure play in the Z-axis in the vertical direction. The base is attached to the YZ-car and the indicator touches the top of the Z extrusion. Grab the spindle or Z extrusion and push/pull in the Z (vertical) direction.



The following two setups have the base attached to a table leg and the indicator is touching a 1/2" drill rod to measure deflection at the bit in the X and Y directions. Push/pull on the bit or collet nut directly at and away from the indicator.



The first three setups are directly aimed at the pinion/rack adjustment. The last two, which will show lateral deflection at the bit, can show play in the lower YZ-car bearings, play in the Z bearings, or a loose spindle mount. To gain an accurate assessment at the bit, all play must be removed in the first three tests prior to setting up for the last two.

In each setup, put approximately 25 pounds of force in the appropriate direction. 25 pounds of force is the equivalent weight of a five gallon bucket half full of water. Make multiple tests with each setup and write down the results from each. This information will be valuable to a user who is unable to diagnose a mechanical play problem and wish to seek help from another user or ShopBot Tech Support.