



# Ballscrew - How it Works and Troubleshooting Guide

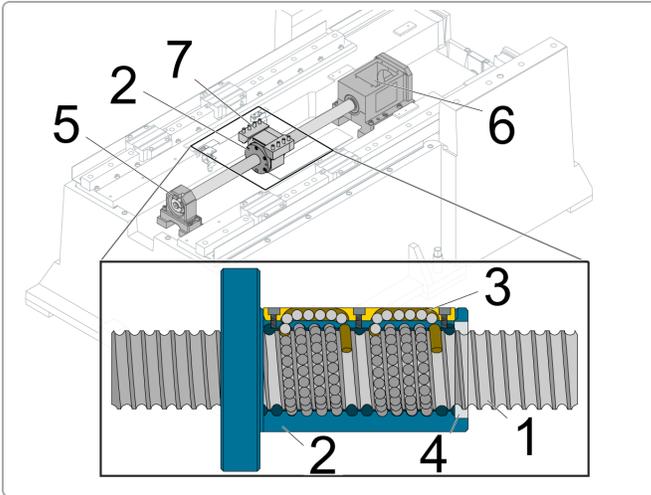
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## How it Works



1. Ballscrew
2. Ballnut
3. Balls circulate through the ballnut
4. Wiper
5. Support-bearing housing
6. Motor housing
7. Ballnut

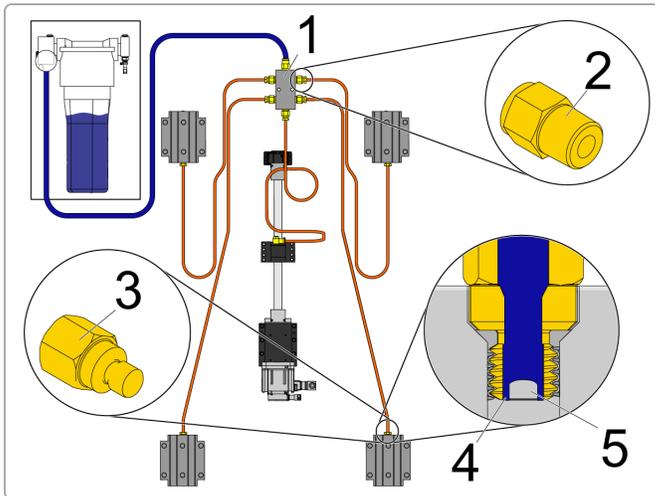
A ballscrew is a mechanical linear actuator that translates rotational motion into linear motion. The ballscrew [1] has a threaded shaft. The ballnut [2] travels along the length of the threaded shaft. The ballnut housing [7] carries the assembly on that axis; i.e. the table or spindle head (mills).

The ball bearings circulate around the threaded shaft of the ballscrew [1] in the ballnut [2] as it travels along the threaded shaft. The lubrication system on the machine feeds oil or grease into the ballnut [2] to lubricate the length of the ballscrew [1]. The ballscrew is coupled to a servo motor with a solid or flex-pack coupling. The style depends on machine model.

**⚠ Danger:** Before you enter the machine enclosure make sure to set the main circuit breaker to the OFF position and lock the main circuit breaker. Use an approved lock with an approved safety tag.

Symptom	Possible Cause	Corrective Action	Section
Alarm <b>103</b> SERVO ERROR TOO LARGE	There is insufficient lubrication.	Check the ballscrew for correct lubrication.	1
Alarm <b>104</b> SERVO ERROR TOO LARGE	The ballscrew or ballnut is damaged.	Check the ballscrew and ballnut for damage.	2
Alarm <b>105</b> SERVO ERROR TOO LARGE			
The axis motion is very rough when the axis is jogged.	The ballscrew support bearings are damaged.	Check the ballscrew support bearings for damage.	3
There is unusual noise when the axis move.			
The axis position does not repeat within specification.	There is insufficient lubrication, or the lubrication is contaminated.	Check the ballscrew for correct lubrication.	1
or			
Inconsistent accuracy, positioning, backlash.	The ballscrew or ballnut is damaged.	Check the ballscrew and ballnut for damage.	2
	The ballscrew coupling is damaged.	Check the ballscrew coupling for damage.	4
	There is excessive thermal growth.	Correct your application.	5

## Section 1



fittings [2] in the axis manifolds [1]. The linear guide trucks and ballnuts use restrictor fittings [3]. The restrictor fitting has a gap [5] between the threads and the set screw [4]. This forces the manifold-fed grease to pass through the gap [4] to lubricate the axes.

**Symptom:** Alarm **103**. Alarm **104** . Alarm **105**. The axis motion is very rough when the axis is jogged. There is unusual noise when the axis moves.

**Possible Cause:** There is insufficient lubrication.

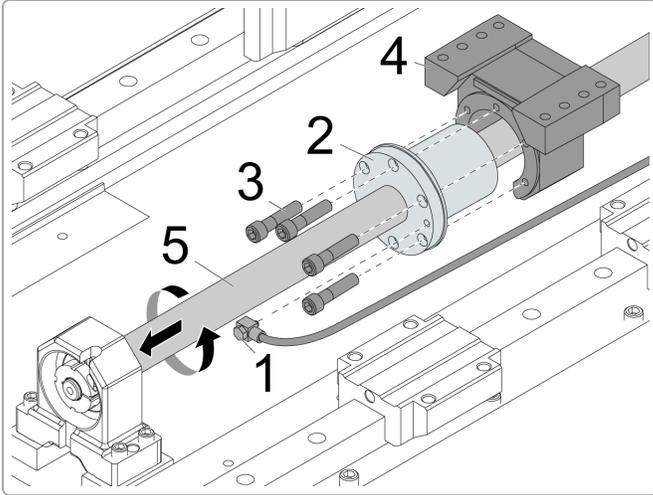
**Corrective Action:**

Make sure there is a light coat of oil or grease on the surface of the ballscrew. If there is not, inspect the entire lubrication system for leaks and clogs, including all tubes, hoses, and fittings. Check for leaks on each axis: A leak at one axis will cause a lack of lubrication at a different axis. Check for oil or grease puddles to help locate the source of the leak.

**Note:** The Haas Liquid Grease lubrication system uses adapter fittings [2] in the axis manifolds [1]. The linear guide trucks and ballnuts use restrictor fittings [3]. The restrictor fitting

Make sure the ballscrew uses the correct lubrication. Refer to [Lubricant, Grease, and Sealant Tables for Haas Machine Components](#). Go to [diy.haascnc.com](http://diy.haascnc.com) to troubleshoot the lubrication system.

## Section 2



**Symptom:** Alarm 103. Alarm 104 . Alarm 105. The axis motion is very rough when the axis is jogged. There is unusual noise when the axis moves. The axis position does not repeat within specification.

**Possible Cause:** The ballscrew or ballnut is damaged.

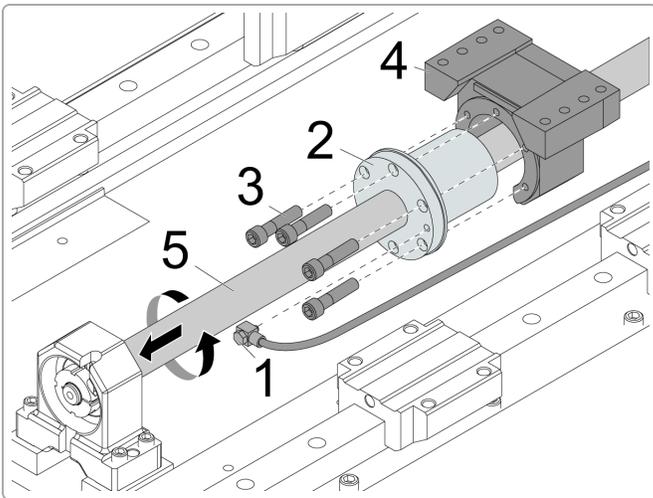
**Corrective Action:**

Disconnect the lubrication fitting [1] from the ballnut [2]. Remove the screws [3] that attach the ballnut [2] to the ballnut housing [4].

Separate the ballnut [2] from the ballnut housing [4]. Rotate the ballnut [2] by hand and hold the ballscrew [5] so it does not rotate, and the ballnut [2] will move away from the ballnut housing [4].

The ballnut [2] should rotate smoothly. If there is resistance or if it binds, the ballscrew [5] and ballnut [2] are faulty.

## Section 3



**Symptom:** Alarm 103. Alarm 104 . Alarm 105. The axis motion is very rough when the axis is jogged. There is unusual noise when the axis moves.

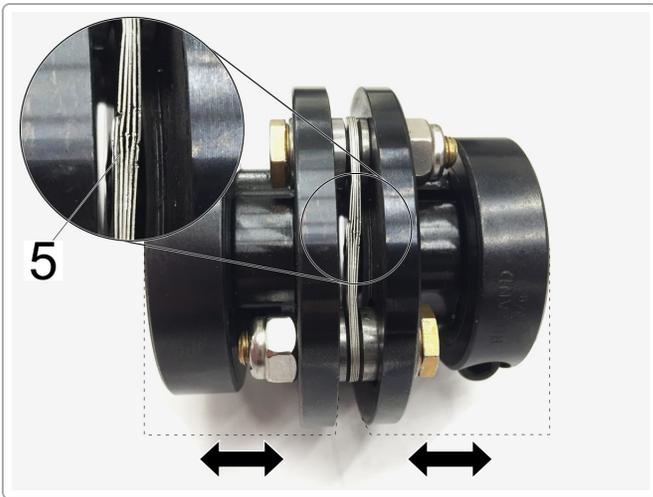
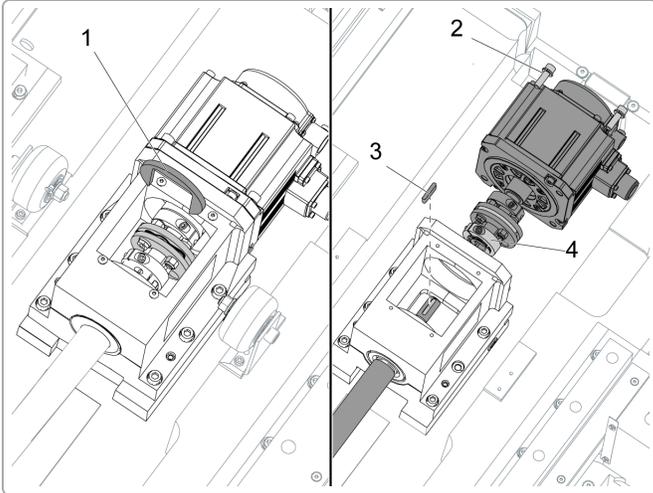
**Possible Cause:** The ballscrew support bearings are damaged.

**Corrective Action:**

Disconnect the lubrication fitting [1] from the ballnut [2]. Remove the screws [3] that attach the ballnut [2] to the ballnut housing [4].

Rotate the ballscrew [5] by hand. If there is resistance or if it binds, the bearings are faulty. Remove the ballscrew [5] and check the support bearings and bearing pack to determine which components need to be replaced.

## Section 4



**Symptom:** The axis position does not repeat within specification.

**Possible Cause:** The ballscrew coupling is damaged.

**Corrective Action:**

Refer to the Ballscrew Backlash Test procedure on [diy.haascnc.com](http://diy.haascnc.com) that is appropriate for your machine.

Power off and lock out the machine. Remove the necessary covers to access the problematic axis. Remove the axis motor cover.

Install the coupler-installation tool [1] on the motor coupling. Turn the ballscrew so you can see the screw [4] for the motor-coupling clamp.

Remove the (4) motor screws [2]. Loosen the screw [4] on the motor-coupling clamp. Remove the motor with the motor-coupling assembly. Remove the ballscrew key [3]. Inspect for damage or wear on the key or keyway.

Make sure the flex pack [5] in the coupler is not damaged. It should be straight, and tightly compressed together.

**Note:** If the axis motor is disconnected from the ballscrew, the grid offset and the work offset (such as G54) must be reset. Go to [Axis Servo Motor - Set Grid Offset Parameter](#) that is appropriate for your machine.

Refer to the ballscrew replacement procedure on [diy.haascnc.com](http://diy.haascnc.com) that is appropriate for your machine for detailed instructions on how to remove and install the coupler.

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## Section 5

**Symptom:** Inconsistent accuracy and positioning.

**Possible Cause:** Excessive thermal growth.

Thermal growth is a normal part of machining. When you start up a cold machine, thermal expansion takes place on the ballscrews as they warm up for use. Excessive thermal growth from certain applications can cause accuracy and position errors in ballscrews.

**Corrective Action:**

You must warm up the machine axes to bring the ballscrews to a normal temperature for operation. You can warm up the machine automatically by changing certain settings: Use either Settings #158-160 or Settings #109-112. Do not use both.

- **Settings #158-160:** These settings can be set from -30 to +30 and will adjust the existing screw thermal compensation by -30% to +30% accordingly.
- **Settings #109-112:** This (*Setting 109*) is the number of minutes (up to 300 minutes from power-up) during which the compensations specified in Settings 110-112 are applied.

If your application involves moving a single axis repeatedly back and forth over a small area of the ballscrew, the ballnut will heat up the ballscrew and cause excessive thermal expansion. It will also not get properly lubricated because of the short stroke. Every few minutes you need to move a few feet to cycle the grease through the ballnut.

**For lathes:** Go to the **[DIAGNOSTICS]** screen. Check the **X Axis Temp**. If the measurement fluctuates or has no value, you must inspect the thermal sensor on the ballnut.