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# Maintenance & Repair

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## Rear Derailleur Adjustment

**Level of difficulty: Straightforward**

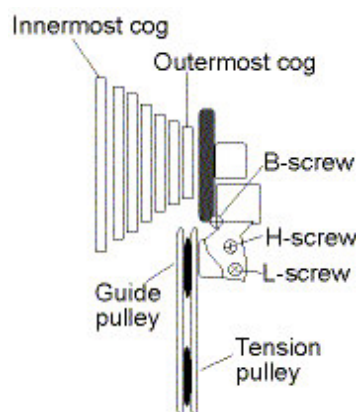
**Typical tools and supplies needed [ 1 ]**

Repair Stand  
 Screwdriver, Phillips # 2 or straight blade  
 Hex Wrenches  
 Light lubricant  
 Fourth Hand Tool  
 Cable cutter  
 Rags

The article will discuss the adjustment of the rear derailleur.

Derailleur bicycles have several sprockets on the rear hub. By using different combinations, the rider will find low gears for going up hill and high gears for going down hill. The gear system needs maintenance and adjustment to perform well. The cable system may also need replacement as it wears. The derailleur limit screws and index setting will need periodic checking. This article will first discuss limit screw setting, and then index adjustments.

### Derailleur Limit Screws (H-screw and L-screw)



**Rear derailleur and cluster jargon**

Rear derailleurs "derail" or shove the chain off of one sprocket and move it to another. The upper derailleur pulley (called the "guide pulley") pushes the chain to the next sprocket. A proper gear adjustment aligns the guide pulley under the sprocket.

Changes to the inner wire tension causes movement in the derailleur. The derailleur body is fitted with a spring that is pulled tight, or relaxed, by the inner wire. Pulling the inner wire moves the derailleur cage and guide pulley in one direction and tightens the spring. Relaxing inner wire tension allows the spring to move the body and pulley in the opposite direction.

It is normal for a chain to make some noise during a shift. The shift may appear subjectively "noisy," "loud," or "rough". Factors like the type of chain or sprocket, the wear on each, and the amount and type of lubrication will affect

the noise a chain makes during shifting. The limit screws typically can do nothing to affect the noise during a shift between cogs. Noise from the chain as it rides on the sprocket is, however, a useful symptom. There is for any given bike a "base level" of noise from the chain as it passes over the sprocket teeth. When the derailleur jockey wheel is out of alignment, the chain may make excessive noise. To demonstrate the "base level" noise, shift the bike to the second sprocket by pulling the inner wire. Continue to pedal and move the inner wire slightly to hear changes in the level of noise. The quietest level of noise may be considered the base level for that bike.

Derailleur pulleys are limited in both inward and outward motions by using the derailleur limit screws. Properly set, the derailleur will shift to both the extreme outward sprocket (the smallest in size) and the extreme innermost sprocket (the largest in size). The limit screws do not control the derailleur on the sprockets between the two extremes. These are set using the barrel adjuster and tension on the inner wire. The limit screws are

usually marked "H" and "L". The "H" controls the outer most limit of the derailleur, and the "L" controls the inner most limit.



**Test the shifting by pulling the inner wire**

Using the shift lever to adjust limit screws can cause confusion and problems because it tends to focus attention on the inner wire tension (indexing) rather than limit screw settings. Instead of using the shift lever, pull the inner wire with one hand to simulate shift lever action. This will help eliminate confusion between indexing problems and limit screw problems. With the bike in a stand, practice shifting with this method before adjusting the limit

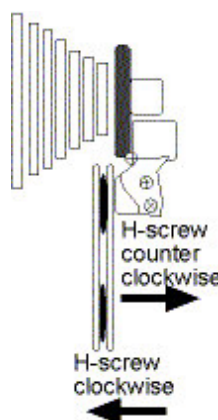
screws.

Turning the limit screws adjusts the limit of travel of the pulleys. Tightening restricts the travel, while loosening allows more travel. The purpose of the following procedure is to find the tightest H-limit screw setting that will allow a good shift to the outermost cog, and the tightest L-screw setting that will allow a good shift to the innermost cog. The location of limit screws on the derailleur body may vary between manufacturers. Always look for the "H" and "L" marked adjacent to the screws.

#### H-limit screw adjustment

- 1 Shift chain to outermost (largest) chainring. Shift chain to outermost rear sprocket (smallest sprocket).
- 2 Check tension on rear inner wire. If inner wire appears to have any tension, it may interfere with the H-screw setting. Turn adjusting-barrel clockwise to eliminate inner wire tension. Proper cable tension (indexing) will be adjusted later.
- 3 Manually turn pedals at a quick cadence, approximately 60 rpm or more.
- 4 Pull inner wire to shift derailleur one sprocket inward. Adjust pull on inner wire until chain rides quietly on second sprocket. Release inner wire quickly to shift back to outermost sprocket and note shift. When adjusting the H-screw, be concerned with two situations:
  - a) The outward shift from the second sprocket to the outermost sprocket.
  - b) How the chain rides on the outermost sprocket.

Do not be concerned with how the chain rides when it is held on the second sprocket.



#### H-limit screw effects

5 If the shift outward seems acceptable, tighten H-screw 1/4 turn clockwise and repeat shift. Even if shift appears acceptable, continue tightening H-screw by 1/4 turn increments and checking shift until shifting is slow or hesitant. Another symptom of a too tight H-limit screw is when the chain is on the smallest cog but makes a rattle from rubbing the second sprocket inward. View this last symptom by looking under the rear sprockets where the chain meets the sprockets. The inner plate of the chain will rub against the next sprocket inward making the noise.

6 When symptoms of a too tight H-screw appear, loosen H-screw 1/4 turn and check shift again. Repeat process of shifting and correcting by 1/4 turn increments. When too tight symptoms disappear, H-screw is at tightest acceptable setting, and limit screw setting is done.

**Note:** "Rapid Rise" derailleurs use a reverse spring application. When the inner wire tension is completely relaxed, the derailleur sits on the inner most sprocket, which is reversed from other common derailleurs. When adjusting the H-limit screw, it is necessary to pull the inner wire until the chain is in the second to outermost sprocket then pull hard to shift to the outermost sprocket. The

same concept is used to adjust Rapid Rise. You want the tightest limit screw setting that allows good shifting to the extreme outer and inner cogs.

### L-Limit screw adjustment

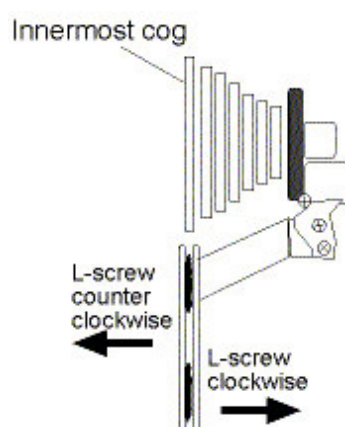
The L-limit stops the derailleur from moving inward (toward the spokes). The limit screw does not make the derailleur move, pulling the inner wire makes the derailleur move. The L-screw allows the pulley wheels to shift the chain to the innermost sprocket and yet not shift off the sprocket into the spokes.

**1** Shift bike to middle chainring (or smaller ring of double chainring bikes) and to second-to-innermost rear sprocket.

**2** Pedal bike at a quick cadence, approximately 60 rpm or more.

**3** Pull inner wire by hand to shift derailleur sprocket inward. When adjusting the L-screw, be concerned with two situations:

- a) The inward shift from the second-to-innermost sprocket to the innermost sprocket.
- b) How the chain rides on the innermost sprocket.



#### L-limit screw effects

**4** If shifting seems adequate, tighten L-screw 1/4 turn, and repeat shift. Continue to tighten L-screw until symptoms of too tight appear. These symptoms are that the chain will not complete shift even with pressure on inner wire, the chain hesitates before shifting inward even with constant pressure on inner wire, or the chain rattles excessively when riding on innermost sprocket

**5** When symptoms of a too tight L-screw appear, loosen L-screw 1/4 turn and check shift again. Repeat process of shifting and correcting by 1/4 turns. When too tight symptoms disappear, L-screw is at tightest acceptable setting, and limit screw setting is done.

After setting the L-screw, check the "B-screw" for an adequate setting. The B-screw controls the derailleur body angle, hence the name, B-screw. Shift to the innermost rear cog, which is the largest cog. View the upper pulley relative to the largest cog. If the pulley is rubbing against this cog, tighten the B-screw to increase upper pivot spring tension, which pulls the pulley back and away from the cog. If there is a large gap between the upper pulley and cog, loosen the screw.

**NOTE:** Shimano "Rapid rise" derailleurs reverse the spring direction. To adjust L-screw, pull on inner wire and shift outward one sprocket, then release inner wire to shift inward. Tighten L-screw until shifting is slow, then turn counter-clockwise 1/4 turn until good shifting is restored.

The process above sets the limits to the tightest setting that still shifts well. This allows the derailleur to wear with use and time, and yet still allow a good setting. After limit screws are set, proceed to index adjustments.

### Checking the Rear Indexing Adjustment

The rear indexing adjustment should only be done after the H-limit and L-limit screws are adjusted. The rear derailleur indexing is adjusted by changing the inner wire tension. For the common rear derailleurs, increasing inner wire tension tends to move the rear derailleur more to the left, or toward the spokes. Less inner wire tension tends to move the derailleur to the right. The inner wire tension will not stop the derailleur at its extreme limits. The H-limit screw stops the derailleur at its right most setting, and the L-limit screw stops the derailleur at its left most setting. (Shimano Rapid Rise derailleurs are a bit different, see procedures at the bottom.)

Modern indexing shift levers use dwell, which is a hesitation between movements in the lever. These hesitations are timed to match the movements of the derailleur and the spacing in the rear sprockets. The design of some derailleur and shift lever brands requires more of a push (or twist) of the lever to complete the shift. The amount of extra push or twist is not consistent between manufacturers and each rider must learn the particular attributes of his or her system.

Changes to inner wire tension are made at the adjusting barrel. Adjusting barrels may be located either at the rear derailleur or at the shift lever. The goal of adjusting the indexing is to find the tightest inner wire tension setting that will allow good shifting to the gears

normally used. This will allow the longest lasting indexing adjustment as the system wears and the cable system stretches with use. To find the tightest inner wire setting, you will purposely make the setting too tight then relax tension slightly. There are two basic symptoms for a "too tight" inner wire. These are a rattling noise from the chain rubbing against the next cog inward, and a slow or hesitant outward shift. These are symptoms for rear derailleurs that sit outward when inner wire tension is released.

## Index Setting

- 1 Set limit screws (if not already done).
- 2 Shift chain to outermost rear sprocket (smallest). Shift chain to outermost (largest) chainring in front.
- 3 Test initial inner wire tension. Pedal a normal cadence and shift rear derailleur with one click on lever. Use care to only move lever one position. If derailleur moves one sprocket, tension is adequate.
- 4 If derailleur fails to shift one sprocket, inner wire may be too slack. Turn barrel adjuster fully into derailleur body (or shift lever) then turn counter clockwise two turns to allow for index adjustments. Loosen inner wire pinch bolt and gently pull on inner wire with fourth hand tool or pliers to remove slack. Tighten inner wire pinch bolt.
- 5 If derailleur will not shift one sprocket after removing slack in "d", return lever back to outermost sprocket position and increase inner wire tension by turning barrel adjuster counter-clockwise 1/4 turn and attempt shift again.
- 6 Shift to second sprocket in rear. Pedal and increase inner wire tension by continuing to turn adjusting barrel counter-clockwise until a definite rattling is heard. Rattle is from chain scraping against next sprocket.
- 7 Once a too-tight rattle is achieved, turn barrel adjuster 1/4 turn clockwise, to release inner wire tension, and pedal again. Listen and look for signs of scraping or rattling. Continue turning barrel adjuster 1/4 turn clockwise at a time until rattle disappears.
- 8 Shift derailleur one sprocket inward at a time, listening for signs of rattle, indicating a too tight inner wire. Turn adjusting barrel 1/4 turn clockwise to eliminate rattle. Note: Do not attempt shift to largest rear sprocket while in largest front sprocket. This gear is normally not used and adjusting tension to this shift may compromise other commonly used gears.
- 9 Shift to innermost (smallest) chainring and check gears again. If no rattling is present, index adjustment is done.

## Shimano "Rapid Rise" Derailleur Indexing Adjustment

Shimano "rapid rise" derailleurs use a return spring that puts the derailleur under the innermost rear sprocket when the inner wire tension is released. As with other indexing derailleurs, the inner wire tension should be set as tight as possible with good shifting. However, the symptoms of a too-tight setting are different, which for rapid rise systems are the derailleur shifting outward slowly, or a rattle from the upper pulley being aligned too far outward. Look underneath the rear sprocket at the alignment of the upper pulley when there is a rattle to see if this is the cause.

- 1 Shift chain to middle ring in front and innermost sprocket in back.
- 2 Pedal and shift lever one position.
- 3 Pedal and turn barrel adjuster counter-clockwise to tighten inner wire tension until chain begins to shift outward.
- 4 Turn barrel adjuster clockwise 1/4 turn until chain runs smoothly on second cog.
- 5 Shift outward one sprocket at a time trying each gear. Turn barrel adjuster 1/4 turn clockwise if too tight symptoms occur.
- 6 Shift to all other normal gear combinations and test adjustment.

**Note:** The indexing procedure here assumes that there are no unusual problems, such as bent derailleurs, bent derailleur hangers or excess inner wire friction from dirt in the housing. Additionally, manufacturers design shift levers and drive train components to work within their system. Mixing brands within the drive train may lead to poor shifting. This is referred to as a compatibility problem.

For help with housing length and sizing, see [Housing Length and Sizing](#).

Content for this page courtesy Park Tool. For more on Park's range of tools and workshop supplies, see: [Park Tool 's website](#).

### Notes

[1] Suggested Park Tools:

PRS and PCS Repair Stands.  
AWS Hex Wrenches.  
BT-2 Fourth Hand Tool  
CN-4 or CN-10 Cable cutter

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