

### Measuring Down Weight and Up Weight.

Down weight and up weight are measured in grams, with the action on the bench. When measuring down and up weight, the gram weights are placed on the key, with the center of the weight 1/2" or 13mm back from the front edge of the top surface of the key.

#### Down Weight

To measure down weight, a gram weight is placed on the key at the front and two or three raps or thumps are given to the shop bench, key bed, or action stack with one's fist to break the starting friction. If the gram weight chosen is too light, the hammer will not rise or will barely do so, a heavier weight should be tried. If the gram weight is too heavy, the hammer will rise without the rap or will rise too swiftly. When the hammer rises with a slow, controlled motion following the rapping or thumping, it indicates that the correct gram weight value has been found.

#### Up Weight

The measurement of up weight is done in a similar, but reverse, sequence. Place a gram weight on the front of the key in the same position as for measuring down weight. Depress the key to the point where the jack and/or drop screw is just touching its pad but not deflecting the spring. The key is then released and the motion of the hammer is observed. The correct gram weight has been found when the hammer drops in a slow, controlled motion to a point approximately 1/4" above its rest position. Note: rapping is not used when measuring up weight! Slight variations in these techniques are permissible as long as the chosen method is used in a consistent manner.

### Description of the Polar Rule

The polar rule consists of three discs, bottom, middle, and top. The bottom disc has a friction scale with a down weight arrow at the zero point. The middle disc has the gram weight scale from 0 - 99. The top disc has a friction scale with an up weight arrow at the zero point.

### Measuring Friction Weight

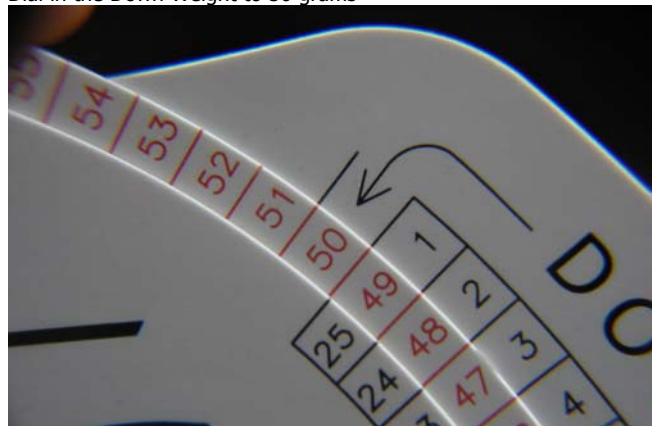
Measure down weight and up weight. Rotate the gram scale disc so the down weight zero point arrow is set to the value of the measured down weight on the gram scale. Now hold together the down weight and the gram scale discs. Rotate the up weight scale disc so the zero point arrow is set to the value of the measured up weight on the gram scale. The friction weight is indicated by the point where the up weight and the down weight friction scales match side by side. In the example shown to the right, the friction weight for a 50/24 key is 13 grams

### Measuring Balance Weight

Using the same procedure as for Friction Weight, the Balance Weight is indicated by the value in between the two opposed and matching friction weight values. In the example shown to the right, a key with 50/24 has a balance weight of 37 grams.

For a key with 50 gram Down Weight - 24 Gram Up Weight:

Dial in the Down Weight to 50 grams

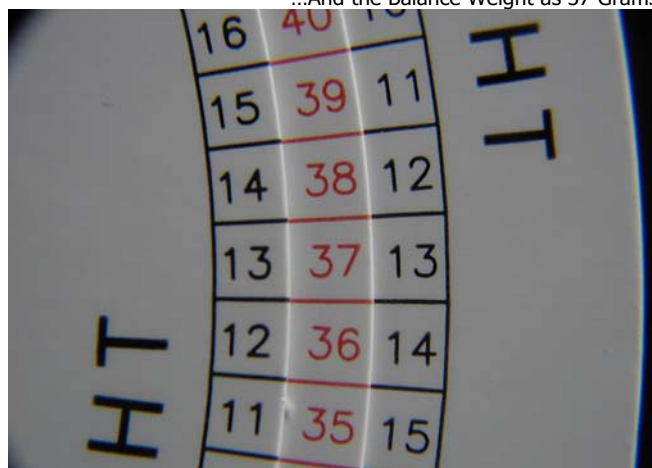


Dial in the Up Weight to 24 grams



Read the Friction Weight as 13 Grams...

...And the Balance Weight as 37 Grams



## Odd/Even – Even/Odd Up Weight Down Weight

When cases were U/D are BOTH odd or even, the resulting balance weight or friction weight will be a whole number. If U/D are odd/even or even/odd the resulting balance weight or friction weight will be a half number. In these cases look for diagonally matching numbers on the friction scales. Take the case of a 50/23 for example:

Friction Weight is 13.5 grams and Balance Weight is 36.5 grams.

## Rating Friction

A Friction table is provided on the front of the calculator for rating friction. Compare the note number to the friction weight and rate friction as low, medium, or high. High zone friction weights are not recommended. Medium or Low zone friction weights are acceptable so long as there is consistency from note to note. Note that friction weight zones are higher in the bass than in the treble due to higher hammer weight in the bass compared to the treble.

## Measuring Keystick Friction Weight Component.

The Friction Weight value indicates the total friction from all the parts that move against each other in the key. The part of the overall friction weight contributed by the just keystick may be measured as follows: Remove the stack and set it aside. Place a weight on the back of key sufficient to hold the key down on the back rail. A key leveling lead works nicely or jiffy leads on the back side of the key. (The amount of weight is not important so long as the key sits down on the back rail.) Measure Up and Down Weight of just the keystick and plug the numbers into the Polar Rule to find the Key Friction Weight.

Keystick friction weight may be rated as follows:

Low = 1 - 3 grams, Medium = 3 - 6 grams, high = above 6 grams.

## Weighing off Keys to a Uniform Balance Weight

Weighing off keys to a uniform Balance Weight instead of a uniform down weight creates better inertia smoothness in the key leading because friction errors are accounted for and down/up weight will stay closer to nominal values over time when friction comes and goes. To weigh off a key to a 35 gram balance weight:

Measure Up/Down and find the friction. Hold the Top and Bottom discs together and move the middle gram scale disc so that the 35 gram value is centered in between the indicated friction weights. For example: a note with 74/48 has a friction of 14 grams when the Balance Weight is set to 35, the new Down/Up values for weighing off the key are 48/22.

## Changing from One D/U to any desired D/U

Calculate the Friction of the desired D/U. Calculate the friction of the old D/U and change old friction to match the desired friction. Then change either key leading or wippen support spring tension to make the desired Up Weight. Check that Down Wt is as desired.

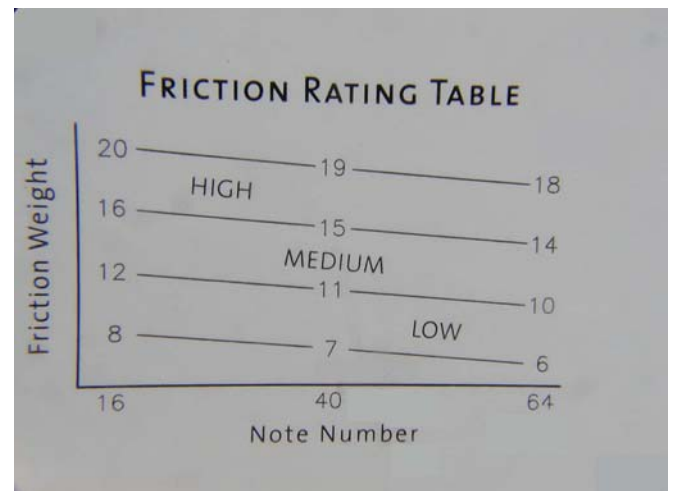
## Measuring Overall Weight Ratio – Short Cut Method

Flip up the hammer and place temporary weights on the key such that the key (and wippen) are zero balanced. Zero balance is found when the key bounces up and down the same way in either direction or when gram gauge readings taken at the front or back end of the key are the same in either direction. Leave the temporary weights on the key, flip the hammer down, then measure D/U and calculate the Balance Weight. Divide by the Strike Weight to determine the Strike Weight Ratio. Recommended minimal sampling is 6 notes.

With a Down/Up of 50/23 find the diagonal matched pair. Here the Friction Weight is 13.5 and the Balance Weight is 36.5

15	38	12
14	37	13
13	36	14
12	35	15
11	34	16

If Note 40 has a 13.5 Friction Weight it is rated as "MEDIUM"



## Want to know more?

*Stanwood Piano Innovations Inc. maintains a free web link for piano technicians at [www.stanwoodpiano.com](http://www.stanwoodpiano.com). The site contains useful reference information including hammer weight standards and rating tables as well as a list of publications with more detailed information about touch weight. Please feel free to call or contact Stanwood Piano Innovations Inc. if you have any touch weight related questions. Check the URL from time to time for new information.*

*Stanwood Piano Innovations also provides a 6 day training course for experienced piano technicians who want to become licensed installers of Precision Touch Designs™ or PTD. The course provides basic knowledge and techniques for analyzing and optimizing weight, leverage, friction, and geometry characteristics in piano actions. PTD is used in conjunction with high quality regulation, tuning, and voicing to create pianos that feel, sound, and play more smoothly, more comfortably, and with a wider range of tone than has ever been possible before. Be the best... use PTD in your work... For more information on becoming a PTD installer, contact:*

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