



Ramp Focal Gauge for Laser Cutters/Engravers

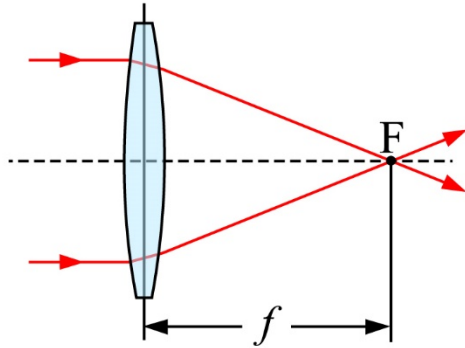
Instructions Manual

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## Introduction

In laser cutting and engraving process, it's crucial to focus your beam to the smallest possible point on the material for best results. This smallest point is called focal length of the lens. As wide beam of light (in case of CO2 lasers it's infrared) goes thru the lens, converges and concentrates at some point "F" away from the middle of the lens at distance "f".



When you get your machine it usually already has a lens and it will specify its focal length. In most cases it's 2" lens (50.8mm).

However, knowing your lens focal length is not enough because lens is installed inside laser head some distance away from tip of the nozzle. So focal length of the lens doesn't help us much in this case, since we really interested in how far to position tip of the cone from the material. Sure, if you know exact distance of lens from the tip ("Ft") you can calculate distance from nozzle to material ("Fm") by subtracting it from your focal length (i.e.  $F_m = f - F_t$ ).

However, in most cases laser operators will find out focal distance in experimental way.

One such way is to keep adjusting height of the z-table, firing laser and checking dot size, until it appears smallest. This takes a while and very imprecise.

Much better way is to use so called "ramp test". One will perform ramp test by placing a piece of wood sloping down (hence the ramp) and burning a long line as laser head moves over it. Then you would inspect this line and see at which point it looks the thinnest. Then you would move your laser over this point and measure distance to the tip of the laser head.

Developed at Lensdigital LLC, Ramp Focal Gauge, greatly improves and simplifies this method by making it much easier and convenient to measure your laser focal distance. You will NOT need calipers, rulers or any other tools, as this gauge will show you results in clear text.

## Quick Start

Let's very quickly see what's included and how the process works and then we'll cover it in more detail.

### What's included in package

- Plastic Ramp Focal Gauge
- Several (1/8" thick) wooden inserts (you can always make more, template is included)
- RDWorks template file
- DXF template file

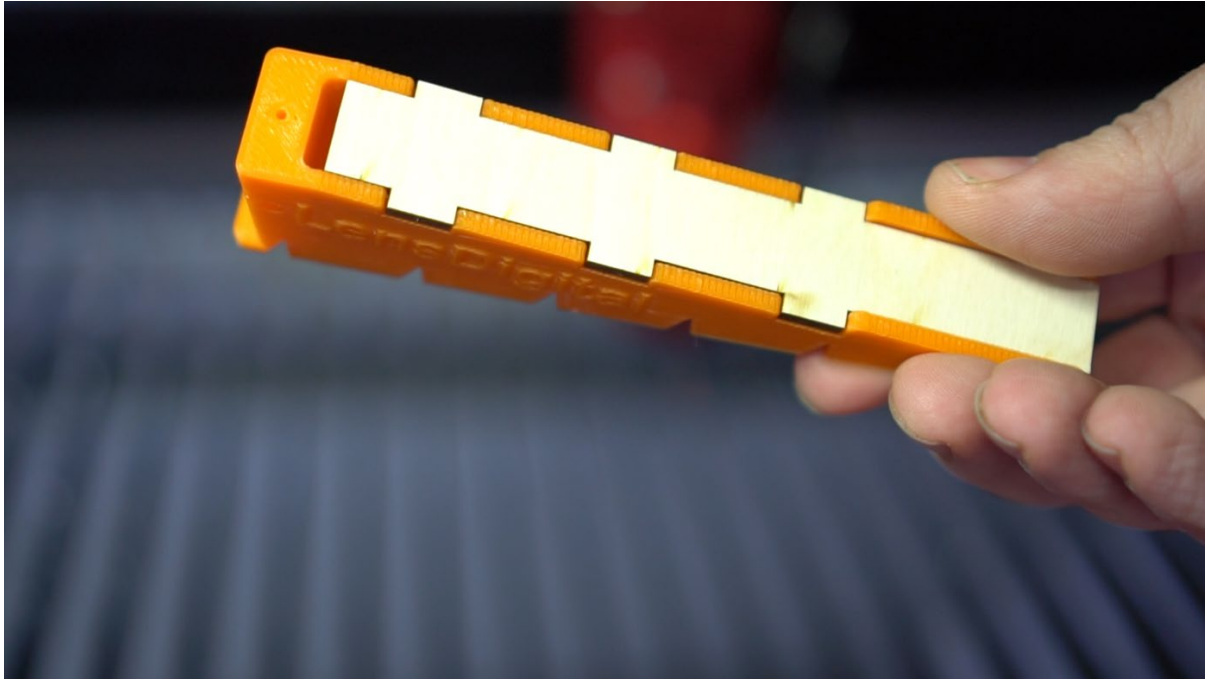
### Quick process overview

1. First you load new wooden insert into the plastic gauge.
2. Then you position your laser head directly over indicator hole, and lower it until head is slightly above the gauge (at fixed offset of 0.5mm).
3. Load provided RDWorks template into laser and engrave indicator lines and numbers.
4. Gauge will clearly show you distances burned into wood. Thinnest and cleanest one will be the number you can use as your focal distance. Plus offset.
5. Enter focal distance into your machine's memory if using autofocus or make quick distance reference tool/jig if focusing manually.

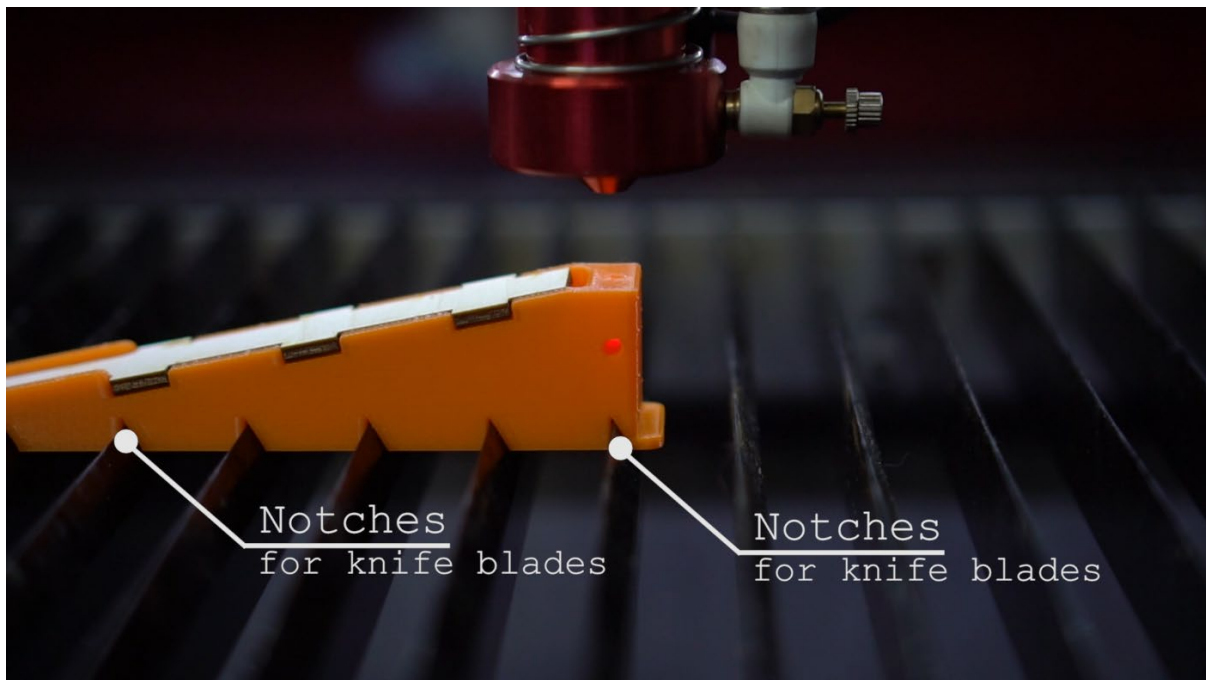
Now let's look into the process in detail...

## Detailed Instructions

### Install and position gauge



First install wooden insert into the gauge, make sure it's all the way in.



Place insert on your laser table lengthwise. If your table has “knife blades”, gauge will snap into them securely. If you don’t have “knife blades” just place it on something flat. Make sure to align it with “Y” movement (right to left if looking from the front) of the laser head.

Lower your laser bed from control panel until you have enough clearance to position gauge under laser head.

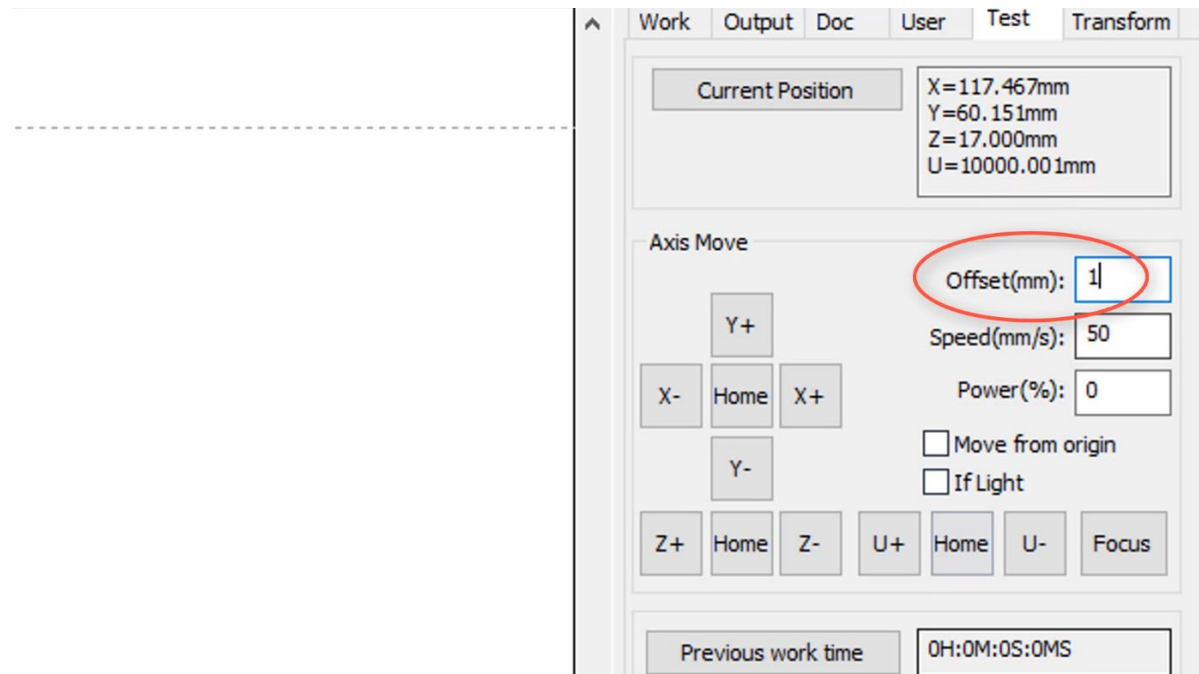


Move your laser head until beam is roughly near the top hole of the gauge.

**DO NOT** use your laser's control panel for REST of the positioning. Instead use "test" tab in RDWorks to precisely position laser head.

Use RDWorks to manually position laser head

Here's how to use RDWork to manually move your laser.



Navigate to **Test** Tab.

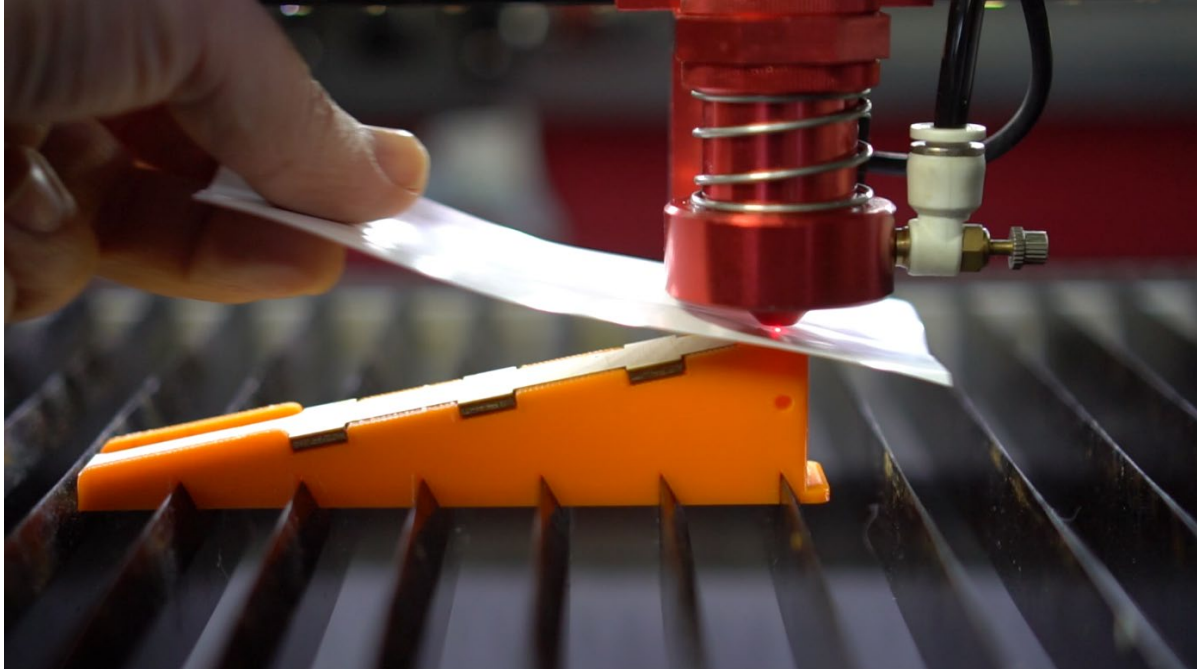
**Current position** button will read and show location of your laser head.

**Offset** value will control how far each press of the button takes you.

**X-** and **X+** move head left and right, and **Y+** and **Y-** will move it backwards or forward.

**Z+** will move bed down, increasing distance from laser head. **Z-** will move bed up decreasing distance. Once you positioned red beam to be exactly in the top hole (and side indicators light up with reflected red laser), adjust Z height until laser head barely touches top of the plastic gauge.

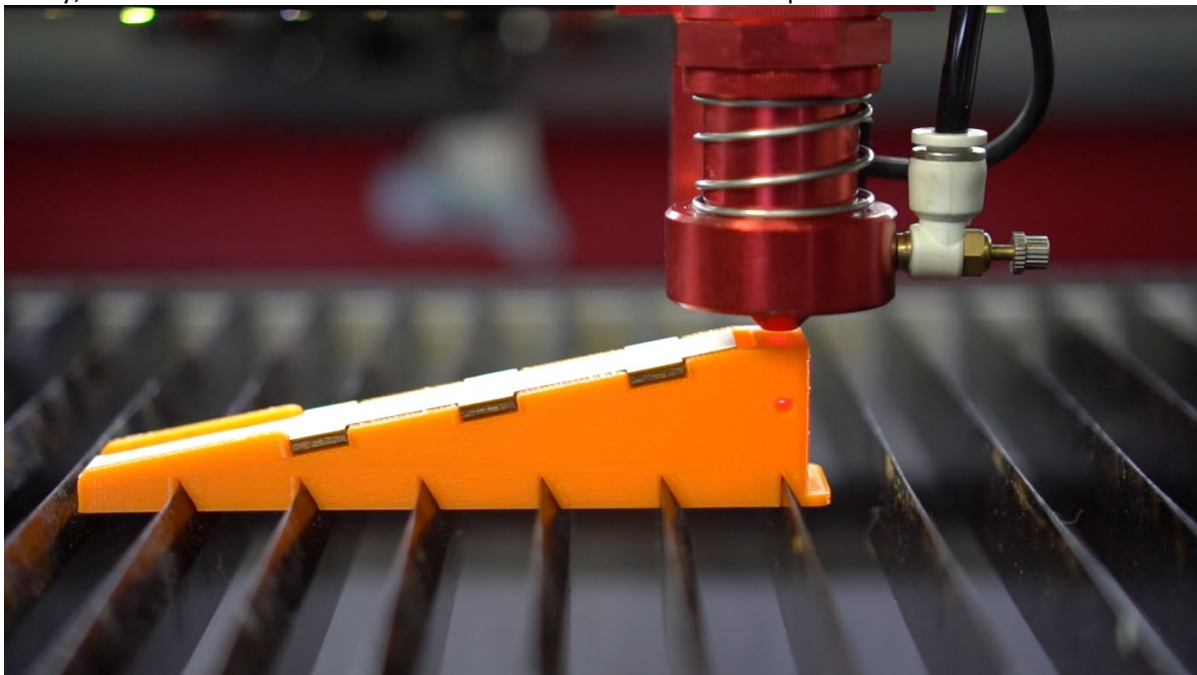




Use piece of paper to check height. If you feel head starting to touch paper stop. If it's holding paper strongly back off by a very small amount like 0.2 mm.

### Final Position Adjustment

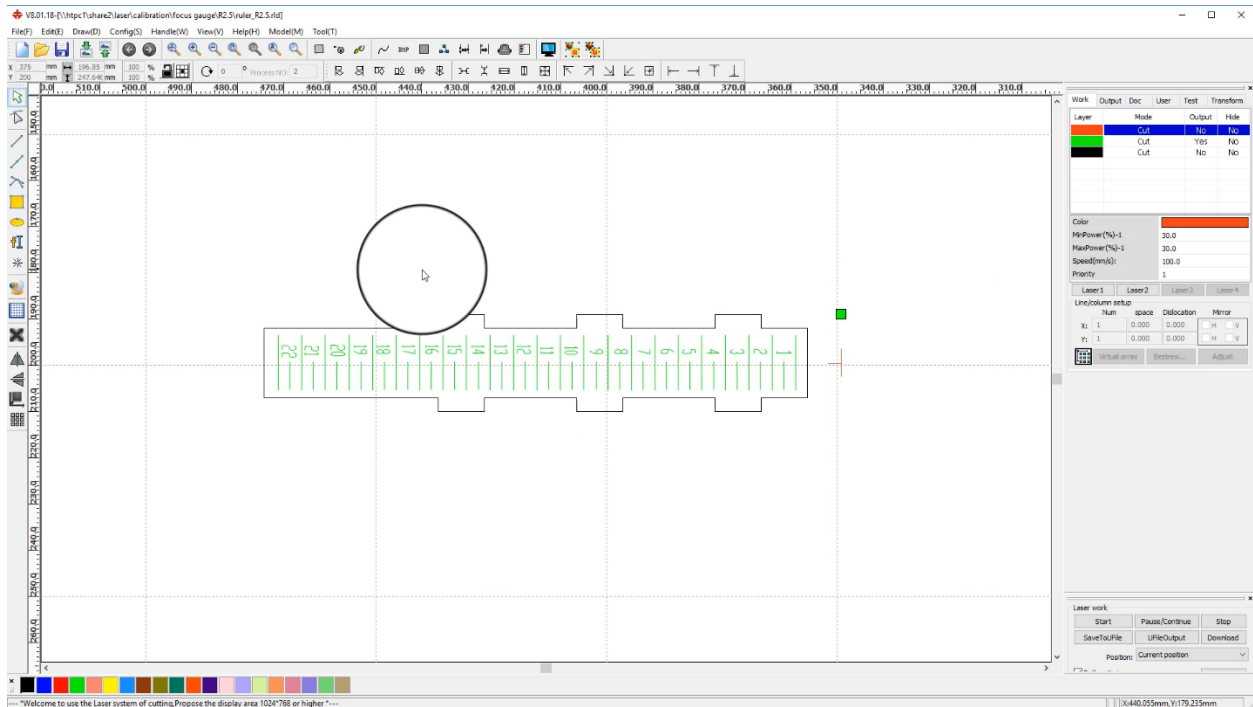
Once head is in correct position **lift it by half a millimeter**, so it doesn't catch wooden insert. Don't worry, we'll take this 0.5mm offset into account at the end of the process!



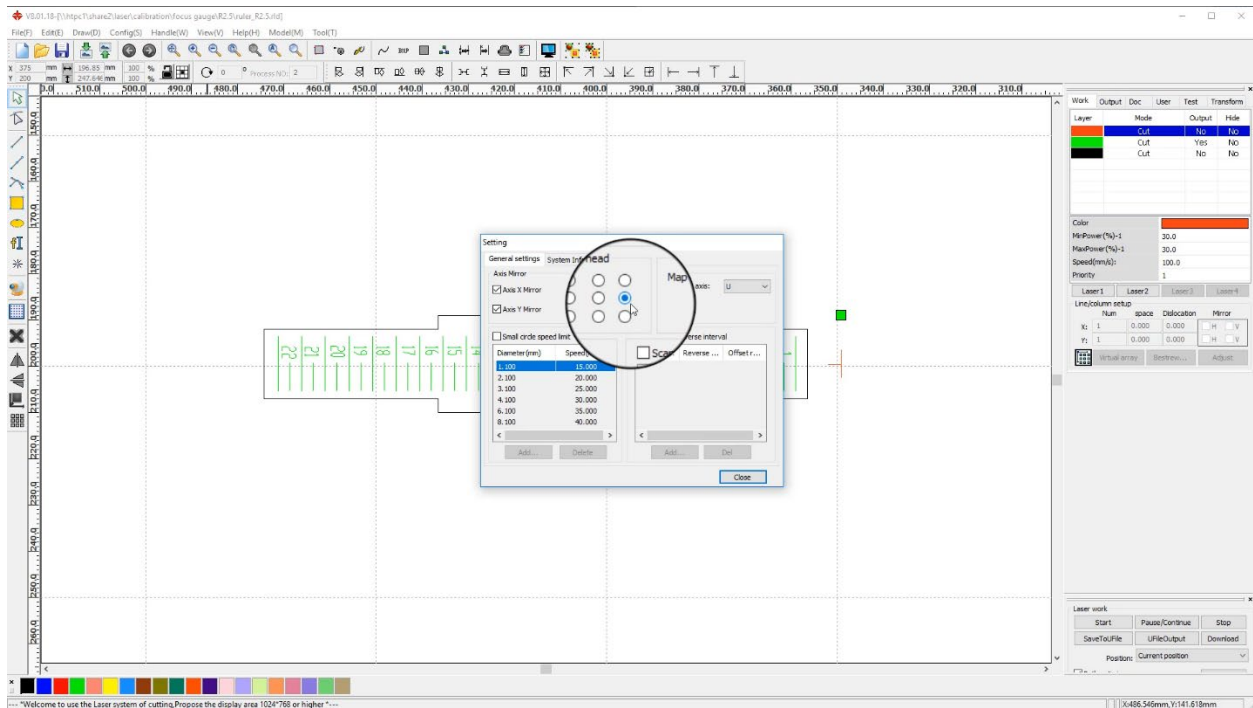
Hit **Origin** button on your control panel to set starting position here.



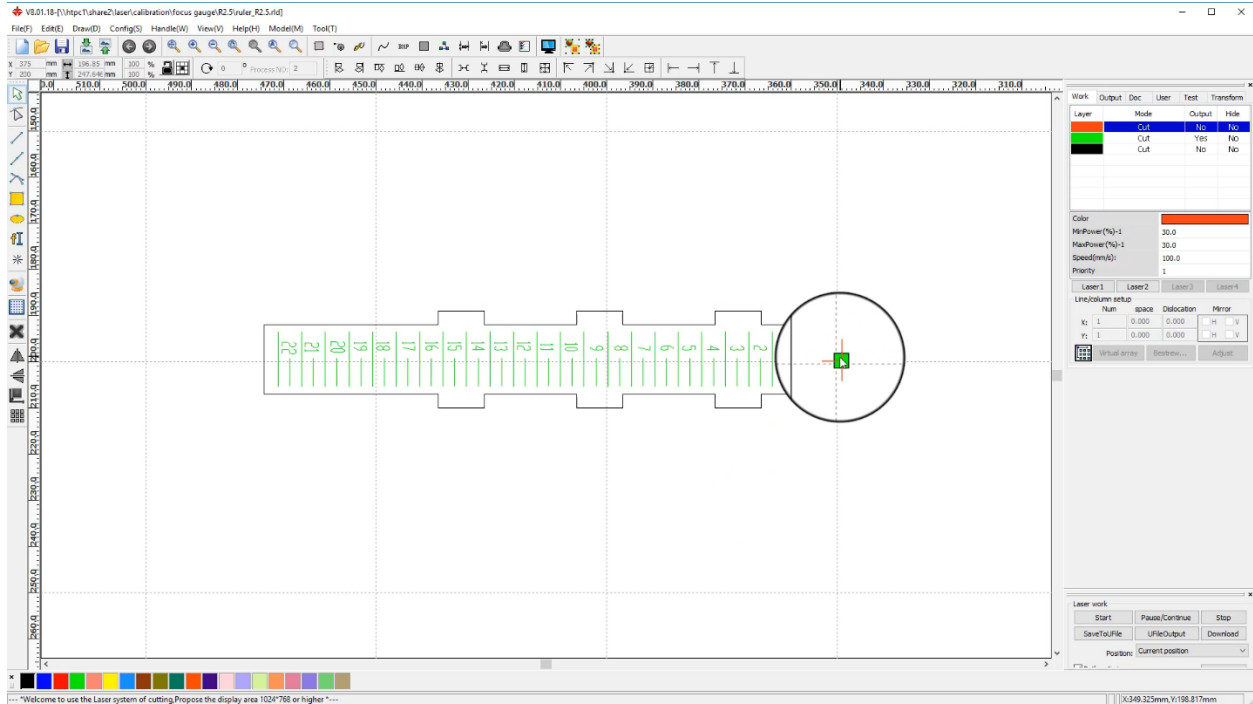
Prepare template in RDWorks.



Load provided rld file. If for some reason your version of RDWorks can't open this file, you will need to import provided DXF and change layers as shown below.

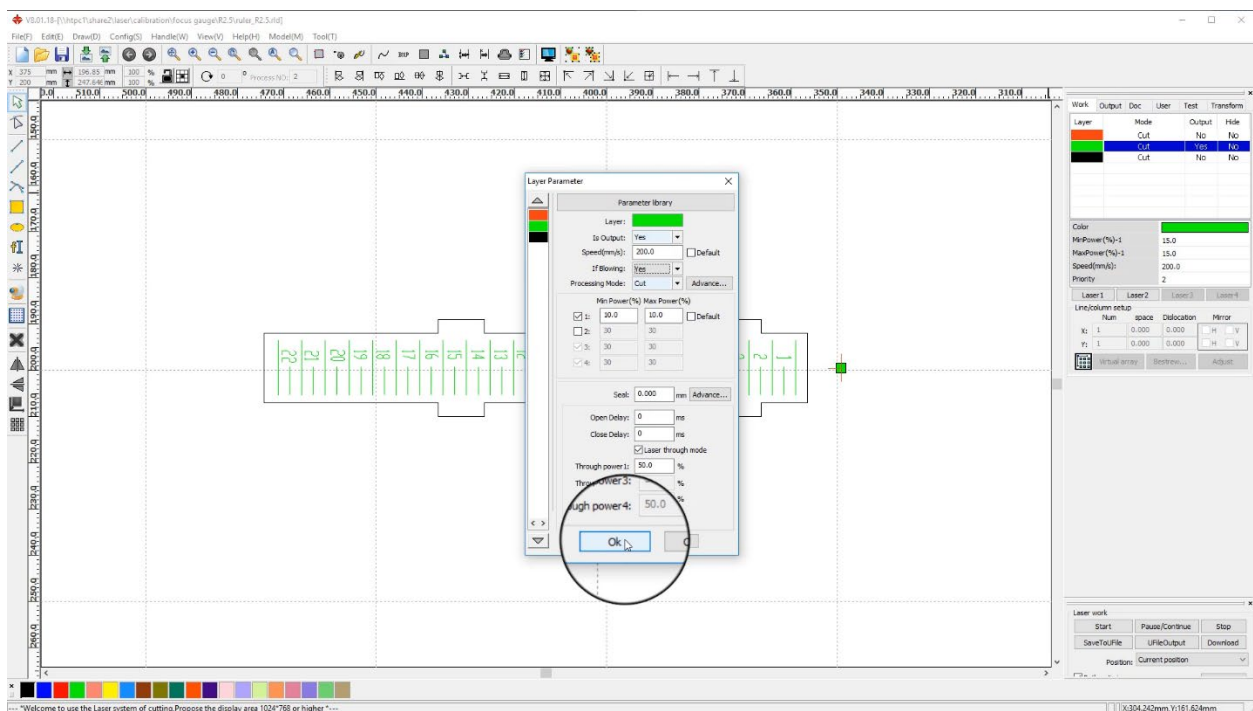


First let's change Laser Head **origin** by going to **Config Menu** and clicking on **Settings**. Choose mid right point and close.



This will start engraving process from the correct point in your file at the middle of red mark.

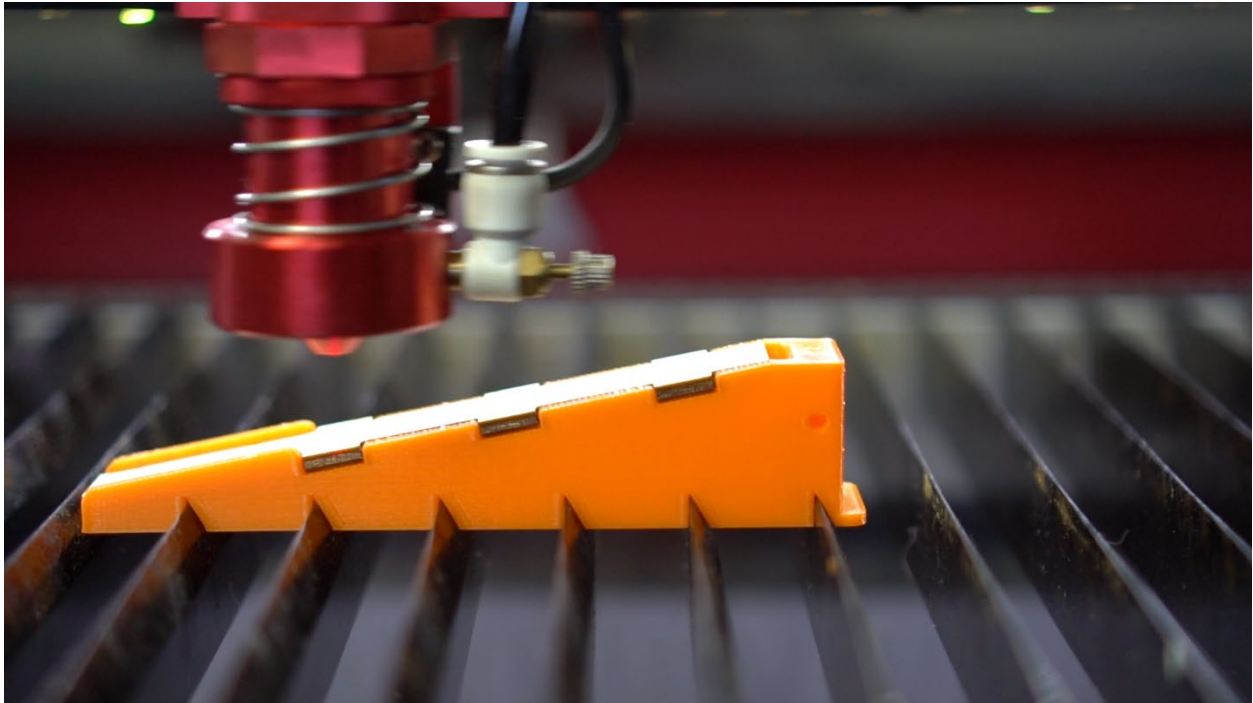
Closer look at the layers.



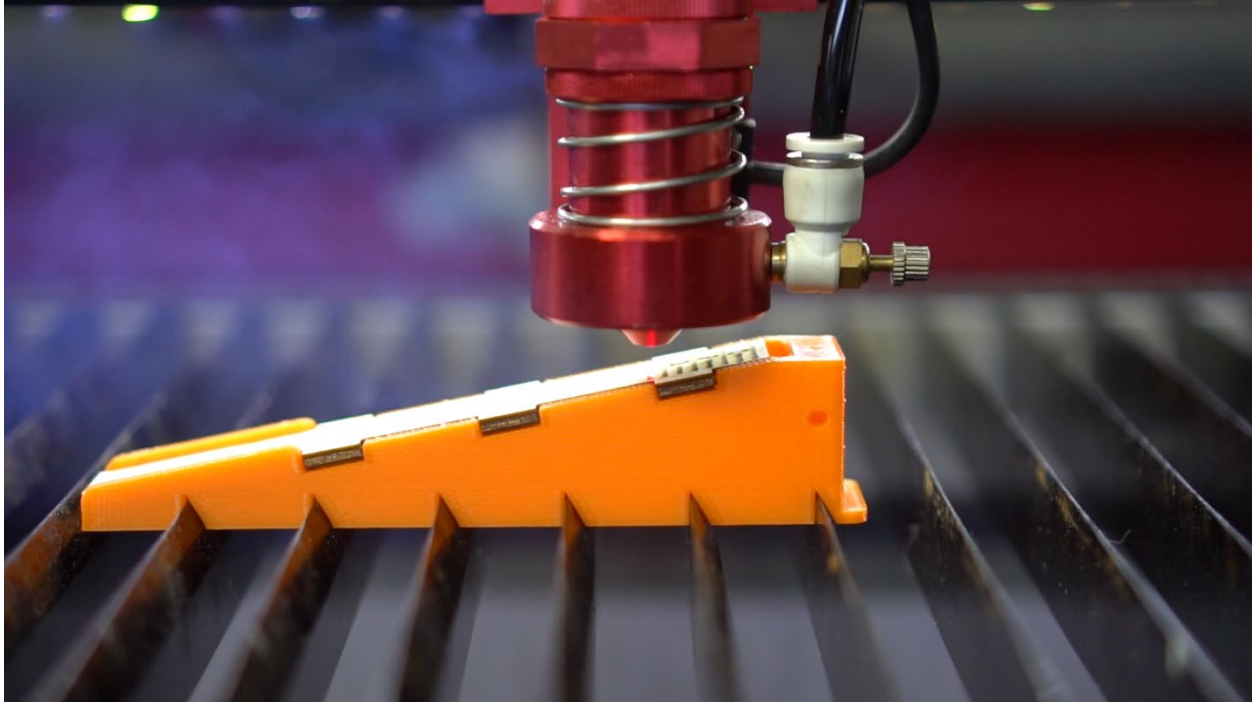
Output on all but **green layer** should be turned off. **Red layer** is needed to position laser head correctly before it starts moving. Green is the ruler lines and numbers that will be engraved.

Depending on power of your laser, you should set it to a very **fast speed** and **lowest possible power** just so it marks the wood without cutting into it. 200 speed with 10% power is a good starting point.  
**IMPORTANT:** Even though we “engraving” text, we want to use “Cut” settings instead of “Scan”.

**Black layer** is outline of the insert. Enable it only if you want to cut out new one (don't forget to turn off output of other layers if you cutting).

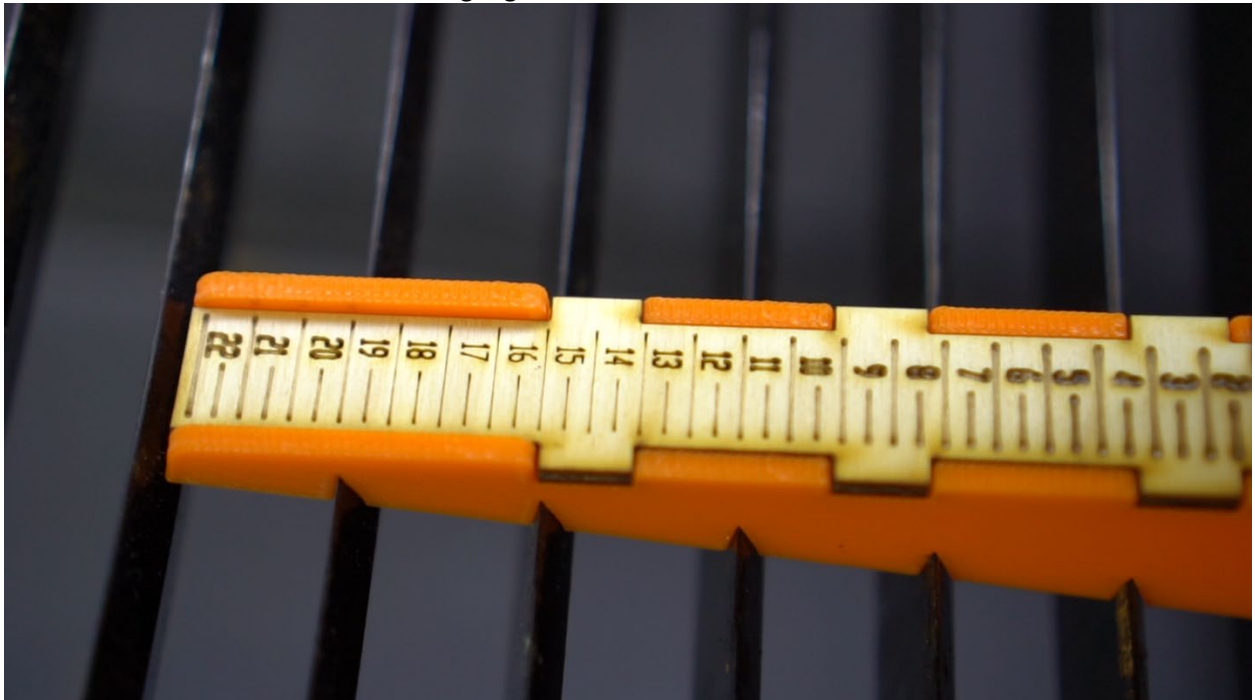


Load file into your machine and do a quick frame test. Make sure laser outlines wooden insert perimeter only!



Start engraving process.

After it's done take a close look at the gauge.



### Analyze Results

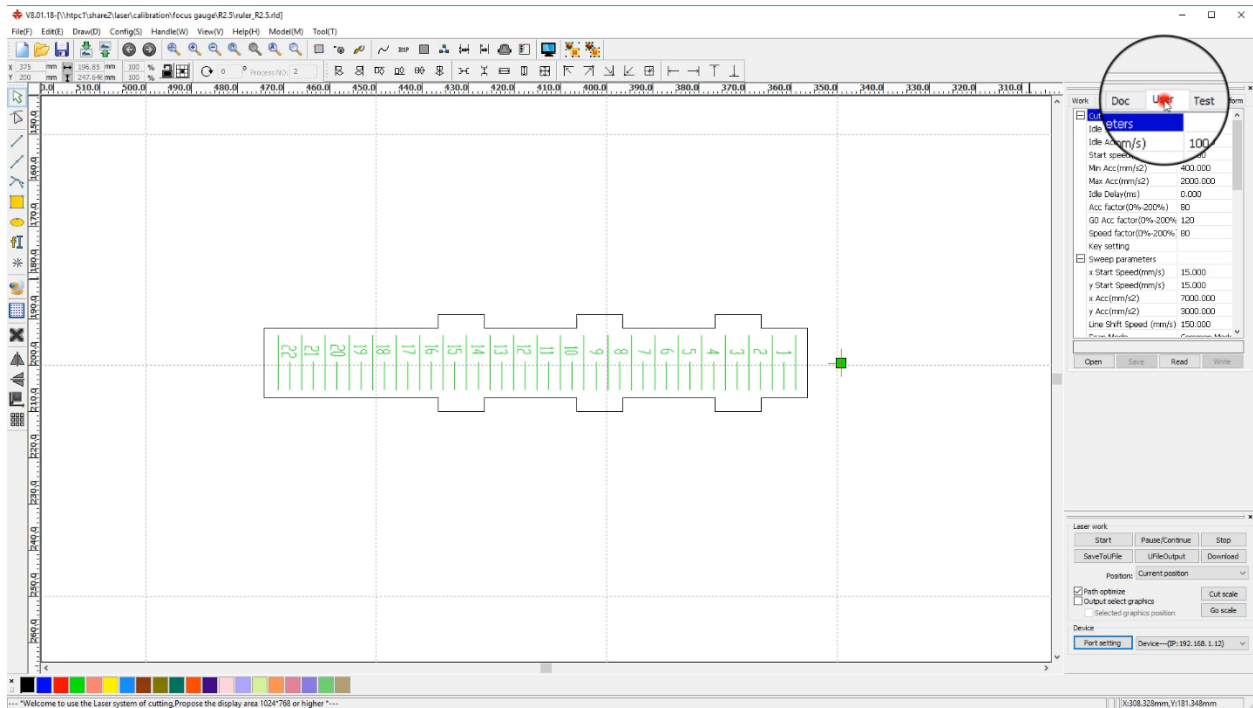
Number and lines that are thinnest and clearest are your focal distance. (Lines between numbers are half millimeter marks).

Also don't forget half a millimeter offset we used when we lifted laser head during alignment. Just add 0.5 to your focal distance.

For example, let's say you have 2.5-inch lens, and 16 to 17 numbers show cleanest engraving. Pick 16.5 and add 0.5, and you get 17mm. This is your focal distance.

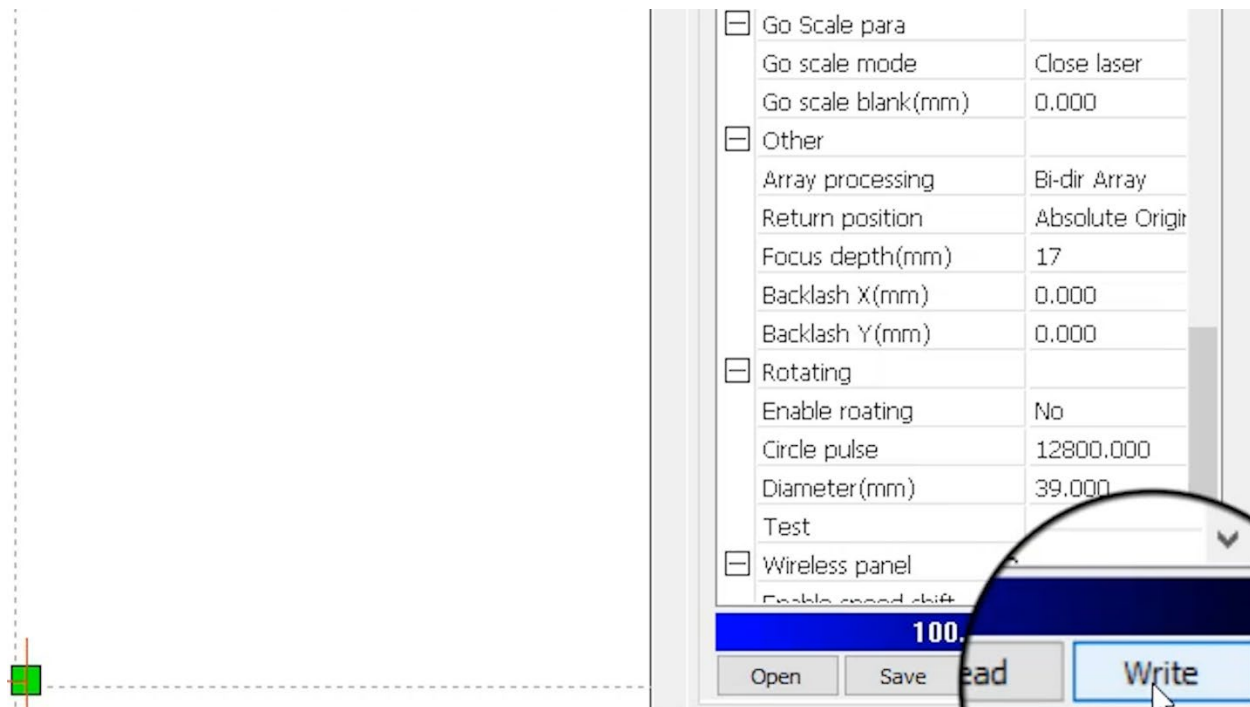
## Load Results into machine controller

Go ahead and save it to your machine as offset for the Autofocus.



You can do it by going to **User tab** in RDWorks. Load settings from machine first by pressing "**Read**" button.

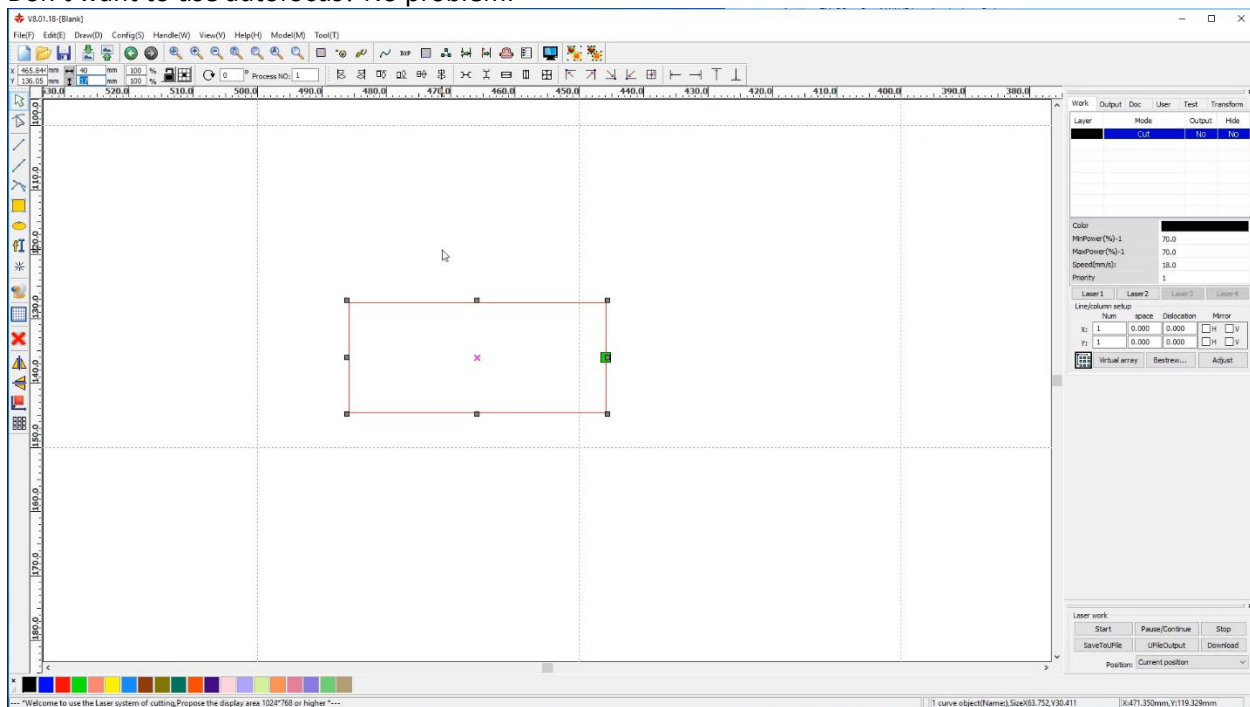




Find and change Focus Depth settings to your value. Press **“Write”** button to save settings.

## Manual Focus Jig

Don't want to use autofocus? No problem.



Now that you know your focal distance it's easy to make a permanent focusing tool/jig by cutting a square shape 17mm (or whatever your number was) tall out of any material you like, like wood or acrylic.



## Optional Fine tuning.

Focal gauge will show you focal distance that's pretty good but not absolutely perfect. Use this value as starting point and fine tune your focal distance by raising or lowering your laser head by 0.2 mm and engraving some vector text and comparing results. Write down setting that provides cleanest text. For example, if you got value of 17mm using focus gauge you might find that at 16.8mm you get even crispier results. 16.8mm will be your ideal focal distance.

## Support

E-mail support is available on our website: <https://www.lensdigital.com>

Go to Contact Us page and drop us a line if you have a question or suggestion!