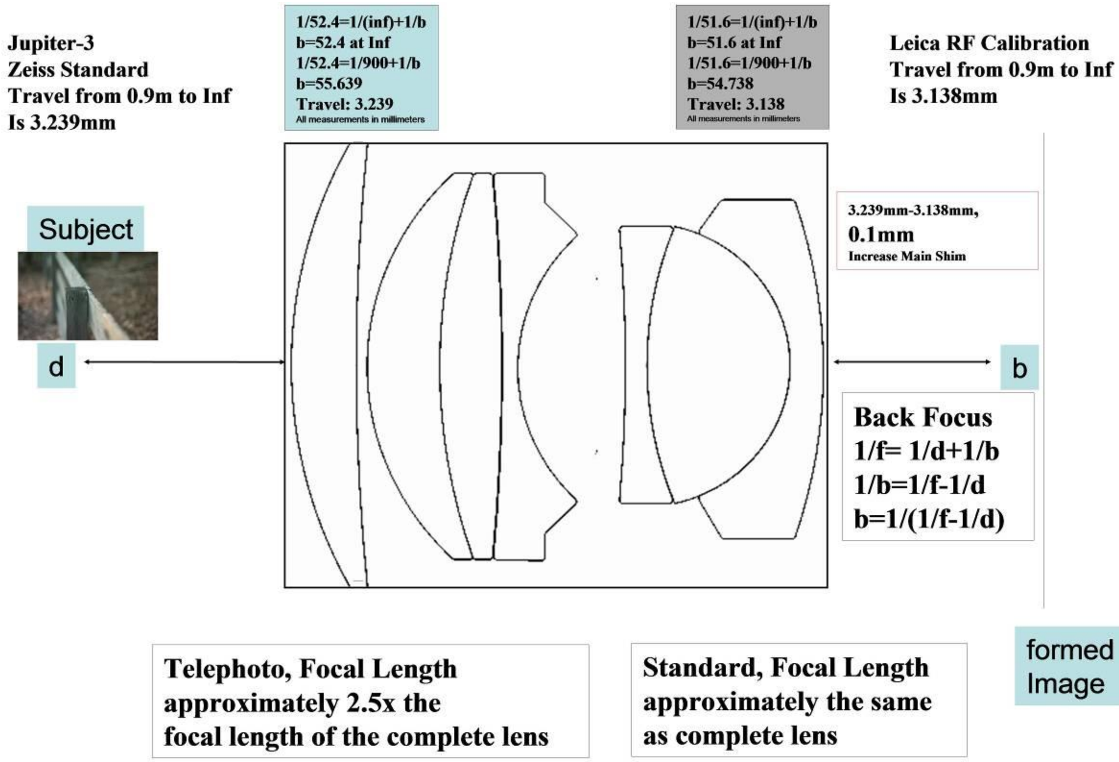
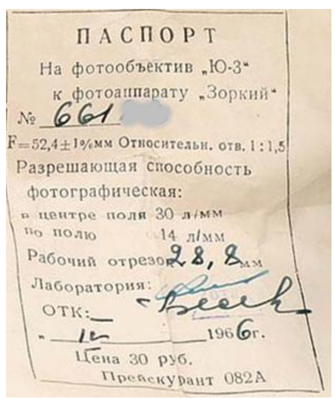
Optimizing the Jupiter-3 for close-up and wide-open use on the Leica



Jupiter-3 Focus Calibration. The Jupiter-3 is a faithful recreation of the wartime Carl Zeiss Jena 5cm F1.5 Sonnar “T”. The original KMZ Jupiter-3’s used German components, and some can be found with Zeiss serial numbers stamped into the fixtures. Jupiter-3’s made in the early 1950s used German glass. Around 1954, supplies of the German glass were running short and a new computation was made using Russian glass. Manufacture transferred from KMZ to ZOMZ in 1956. There were some changes made to the optical fixtures: the shape of the rear triplet and fixture were changed, three screws were used to hold the helical into the mount, and color of the coating changed.

The 52.4mm focal length of the Contax mount Zeiss Sonnar was used for both the Kiev and 39mm thread mount versions of the Jupiter-3. There have been long standing arguments concerning this, but I tend to trust the data sheet from the manufacturer. The optical fixture of the Jupiter-3 screws directly into the inner helical of the focus mount. The inner helical is a solid piece of metal and also serves as the RF cam of the lens. The motion of the optics is 1:1 with the inner helical. When used on a Leica which is calibrated for a nominal 51.6mm, this will lead to focus errors. A simple adjustment to the main shim is usually all that is required to compensate for this difference.

There are cases where Jupiter-3’s work just fine on a Leica camera. Looking at a manufacturer’s data sheet, it is easy to see why.

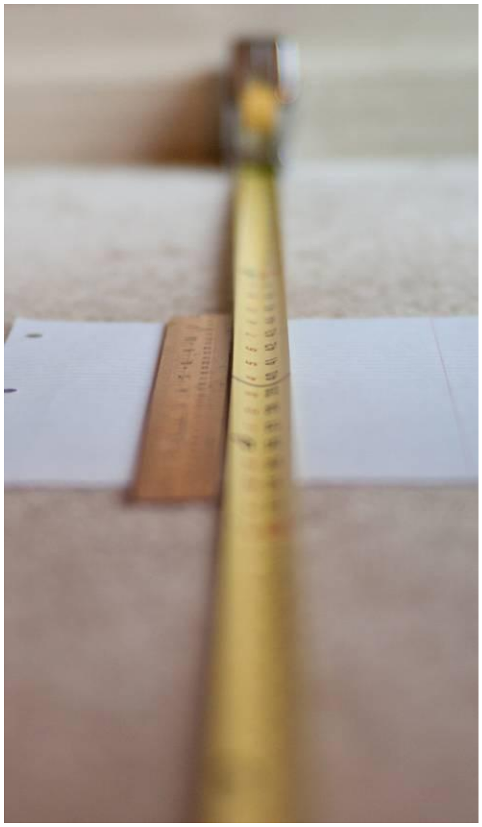

ПАСПОРТ
На фотообъектив „Ю-3“
к фотоаппарату „Зоркий“
№ 661
F=52,4±1%мм Относительн. отв. 1:1,5
Разрешающая способность
фотографическая:
в центре поля 30 л/мм
по полю 14 л/мм
Рабочий отрезок 28,8 мм
Лаборатория:
ОТК:
„ 12 196 6г.
Цена 30 руб.
Прейскурант 082А

The focal length is given as 52.4 +/- 1%. That gives a range of about 51.9mm to 52.9mm. Those on the short end of the range will work well on a Leica. The average will work well once the main shim is adjusted, and those on the upper end will require the focal length to be reduced and then the main shim to be adjusted.

This procedure is to adjust the main shim, which should work well for most lenses. This is a “do as I say, not as I do” procedure and all you will need is your camera and a tape measure/ruler. I use a through the lens viewer from an old camera repair shop, found on Ebay for $15, ie I cheat… But I do use the Leica M9 to double-check that the $15 viewer did the job.

Calculations for computing the shim are given in millimeters, so a metric ruler is the most direct to use. Pick the “sweet spot” for exact focus. 1meter works best for using a Jupiter-

3 wide-open and close-up. This trades close-up performance for distance work. The lens will focus slightly short of infinity. For a lens of the median focal length, F2.8 is best used for infinity. Sonnar focus shift is towards infinity.



For this case, the RF of the camera was focused precisely on the 1m mark. I lined the metric ruler up with “16cm” straight across from the 1m (39.4”) mark on the tape measure. The actual focus is between “19cm” and “20cm”, meaning the lens is back-focusing by about 35mm.

Focal Length (Millimeters)	Distance to Object (Meters)	Back Focus (Millimeters)
52.4	1	55.29759392
52.4	1.035	55.19438225

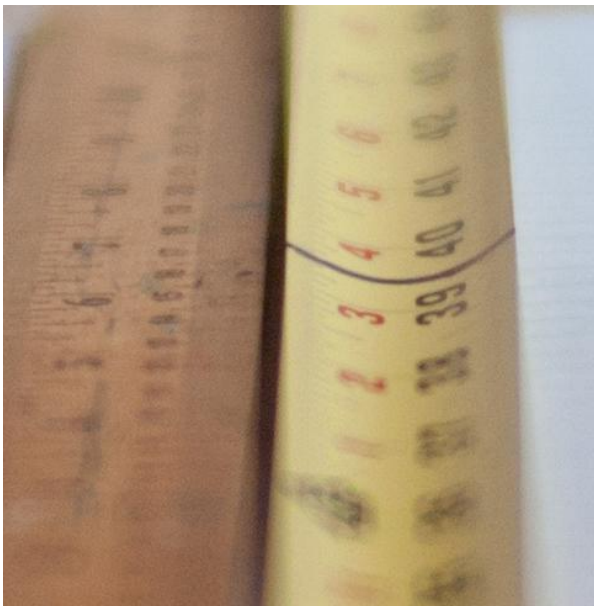
This is where the formula for focal length gets applied.

1/f= 1/d+1/b, where f is the focal length of the lens, d is distance to the subject, and b is the back-focus to the formed image. In “Excel”; solved for back-focus, it is:

“1/((1/(A2))-(1/(B2*1000)))”

where cell A2 is the focal length of the lens in millimeters, and cell B2 is the distance to the subject in meters.

The RF focused at 1m requires that the back focus of the lens be 55.298mm. The lens was actually at 55.194mm. All of this assumes the lens is 52.4mm in focal length, the center of the range. So the difference given is a good starting point for adjusting the lens. In this case, thickening the shim by (55.298-55.194), about 0.1mm is suggested. Try layers of kitchen aluminum foil for making shims; the thickness is about 0.1mm. Use the shim(s) of the lens as a template for cutting the new shims. Or buy lots of parts lenses. One day, I will contact a machine shop to make them. As an alternative, you can use paper for shims. Try different thicknesses; loose-leaf paper measured 0.07mm and ink-jet printer paper measured 0.1mm. Screw the optics module back into the focus mount with the new shims. With a thicker shim, the optics will not screw as far into the mount. A thinner shim; it will screw in farther. Make sure to hand-tighten the optics snugly into the mount. The aperture ring will not come up straight; you will need to “re-index” it after the focus is satisfactory.



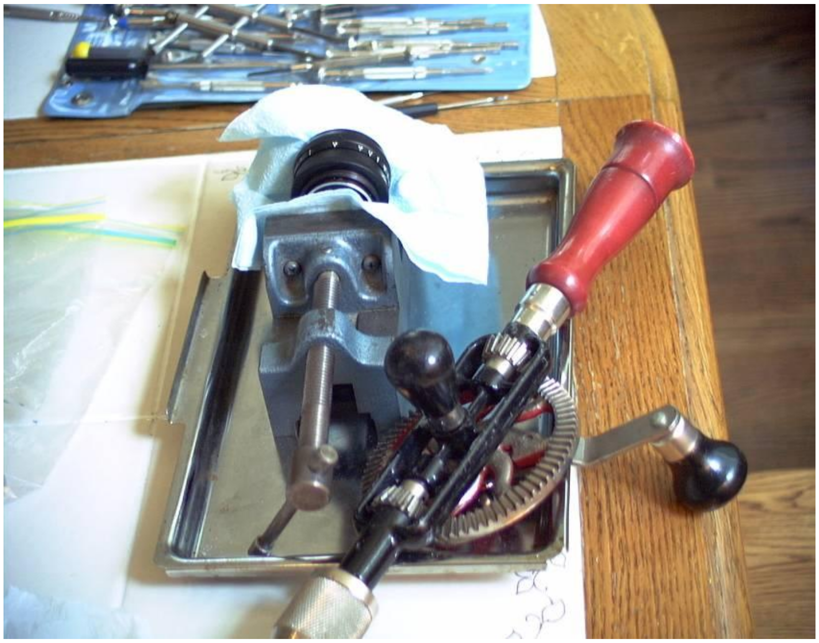
This is about as good as I can get an F1.5 lens on my Leica M8 and M9. You will need to reshoot the ruler, adjust the thickness of the shim accordingly. Reduce the shim slightly if it is now front-focusing, and thicken it a little if it is still back-focusing. The amount of residual error is an indicator of focus deviation from 52.4mm.

The shim is the aluminum ring that controls the stand-off between the optics and the RF Cam of the inner helical. This, and exact focal length of the lens, controls agreement with the camera’s RF. To achieve critical focus at F1.5 an accuracy of 0.02mm is required for the stand-off. The retaining ring that the aluminum shim sits on can be used as a variable shim: consider this “Plan B” for getting exact focus. The ring is held in place by two set screws; with taps underneath to hold into position. The threads are 0.5mm per turn. A 15 degree turn of the ring is about 0.02mm. The trick is to get the ring to hold position while you test the focus. I mark the position with a silver sharpie. Once the correct position is determined, you need to make new taps for the set screws. I use a hand-drill with a triple-zero tap; the same as will be required to re-index the aperture ring. The head of the screws must be flush with the ring in order that it does not destroy the threads of the focus mount as you screw the optics module into place. The screws must be put in evenly and the ring must be well centered: if the ring is off-center the optics module will not screw back into place. This “just works” with a Jupiter-3, the aperture ring itself has enough threads to keep it from wobbling when the retaining ring is backed off.

Once you are happy with the new focus, try the lens at infinity. Typically, the Jupiter-3 will not quite reach infinity when used wide-open. This is due to the focal length being longer than the Leica standard. A Sonnar suffers from focus-shift; when stopped down actual focus shifts towards infinity. This works in your favor. If infinity is unusable, time to shorten the focal length and then start over adjusting the main shim. Next lesson.

Chances are, with the thickness of the shim changes, the Aperture ring no longer lines up with the index mark. Assuming the focus is good at this point: time to re-index the aperture ring. Make sure the lens is screwed in tightly. Mark the filter ring of the optics module where it aligns with the index of the mount. After all of this, you need to take the optics module out of the focus mount. After you finish, you need to get it back to the exact position.

The aperture ring is held in with three small set screws. Take them out. On lenses made before ~1964, the aperture ring is threaded. Some early ones have “wings”, like the 1950 KMZ shown above. Sometime in 1951, J-3’s had their wings clipped. Later lenses depend on the three set screws to hold in position, and on straight. Some force might be required to turn it to the new position. It is easiest to open the aperture blades to F1.5, hold the aperture mechanism in place, and turn the chrome aperture ring to the new index mark. Use tape to hold the chrome ring in place. The most difficult part of working on the Jupiter-3 is about to hit- you have to make small tap holes to put the set screws back into place. The screws must sit almost flush with the aperture ring, or else they will hang up on the focus mount. You’ll wonder why you cannot screw the lens back into place, or the focus grinds when the lens is in one piece. Well, I did… The screws were not in deep enough and they scraped against the focus mount. The best way to make tap holes is to use a hand drill with a triple-zero drill bit. The metal is fairly soft, it is aluminum. The idea is to make a hole for the end of the set screws to fit into.



The tape is to keep the aperture ring from moving as you tap out the holes. Do them sequentially; some trial and error might be required. Once the holes are done, put the set screws back into place. If they are not flush, remove and drill deeper. At this point, put the optics module back into the focus mount and make a final check. Your Jupiter-3 is now optimized for wide-open and close-up work. Make a test with infinity; try at F1.5, F2, F2.8, and F4. The results indicate where on the focal length range your lens falls. Lenses made before 1964 use a separate optical fixture for the rear triplet. It is possible to change the focal length on these Jupiter-3's: moving the rear triplet in reduces the focal length, moving it out increases the length. Next write-up.