

Long Range Shooting Secrets

Scope Tips

Rifle scopes have been around for a long time, however, recent advances in technology have improved performance in all respects. The 3:1 zoom barrier for variable power optics is now about 4:1. Light transmission and recoil resistance has vastly improved. We also enjoy more selections of finishes, power ranges, mounts, and diameters. Long range shooters have placed demands on manufacturers to produce scopes in higher powers, finer and more useful reticles, more accessible and repeatable zero knobs, and better eye relief. It's not unusual to spend more money on optics than on a rifle.

Scopes became popular for hunting and were designed on the 1 power per 25 yards concept (for deer sized game). That concept remains today. The most popular scope on the market is a 3-9X variable or 75 to 250 yds range. This matches the effective hunting range for most standard high power rifles.

Power is the rating for how much the optics magnifies the image. These ratings are usually overstated. Example: a scope rated for 3-9X may really be 3.4-8.5X.

Eye relief is the distance your eye must be from the lens to get a full view through the scope and is usually stated in a range of inches. Example: a scope with an eye relief of 3-4.2 inches would allow a full view when your eye is between 3 and 4.2 inches from the lens. **The higher the power, the narrower the eye relief range will be and the harder it is for the shooter to sight through the scope and pick up a target.**

Light transfer (or brilliance) is the ability for a scope to transfer light from the front lens to the eye. The more lenses in the scope or the smaller the lenses, the greater the light loss. Variable power scopes lose more light than a fixed power scope because they have more lenses. Light transfer is very important when shooting in lower light conditions.

Clarity and distortion is a product of lens quality. The clearer and more distortion free the view, the better the scope and usually the more expensive it will be. The *Objective lens* (front lens) size has a lot to do with light transfer, clarity, and distortion. The bigger the objective lens, the better, to a point. Larger lenses require higher mounts to clear the barrel.

Field of view is the width of the view in yards, at 100 yds distance. The wider the better and the easier it will be to spot the target. The more powerful the scope, the narrower the field of view.

Parallax is the least understood and a most important scope parameter. Explanation: Place your rifle in a vise or cleaning jig where it can be aimed down range, hands off. Adjust position until crosshairs are dead on target. Look through the scope and move your head around. Parallax is evident when the crosshairs appear to move on the target when the rifle is stationary and your eye moves. All scopes have some parallax, however it becomes more evident at 9X and above. The more powerful the scope, the more parallax you will experience. This is bad because you must have the same exact hold and view for each shot to keep the rifle on target. Many scopes above 9X have a parallax correction ring on the objective lens that is calibrated in yards/meters. If your target is at 200 yds, make sure the ring is set for 200 yds, otherwise you will still get parallax. This will keep you busy when varmint hunting. **Many shooters think their rifle shoots bad groups when the blame is really on scope parallax.**

Wiggle is a distractive side affect of scopes. When the shooter wiggles a little, the scope seems to amplify the movement down range. You can even see the effects of your heartbeat. The more powerful the scope, the more you will notice wiggle and the more it distracts you.

Thermal distortion is a phenomenon caused from heat rising from the ground and creating a wavy movement in the scope. Long range shooters sometimes use this for judging wind directions. Mostly, it is an annoyance that distorts the distant target. Thermal distortion is more distracting with higher power scopes.

Reticles are the aiming device in a scope commonly called cross hairs. Ideally, you want them heavy enough to see in subdued light and thin enough so they won't blot out the target. A good compromise is the dual reticle where the center lines are thin and the outer lines are heavy. Tactical scopes have mil-dot or other lines calibrated in minutes of angle (MOA). Knowledge of ballistics will enable the shooter to compensate for distance and windage using the calibrated marks for hold over.

Zero knobs are the screw adjustments, one on top, the other on the right side that are used to set the reticle where point of aim is the point of impact. The main difference between a tactical scope and a hunting scope is the reticle and zero knobs. Hunting scopes have a removable cap that allows access to the adjusting screws made for a screwdriver or coin. Target and tactical scopes have exposed knobs that can be adjusted with fingers. Most adjustments have click stops so the shooter can count the clicks when moving the screw. The finer the adjustment, rated in clicks per MOA, the more precise you can adjust zero. Four clicks or more per MOA is recommended. Most zero knobs have a dial that can be set to a zero mark after sight in. This mark becomes the reference point if the knobs are moved to compensate for windage or elevation. *Repeatability* with zero adjustments is very important. If you move up 8 clicks, left 8 clicks, down 8 clicks and right 8 clicks, the point of impact should be exactly where it was to start with. Many scopes will not pass this test.

The *focus adjustment* is usually the rear lens group that is threaded on the tube and locked in place with a threaded ring. To focus a scope, loosen the lock ring and back it off several turns. Look down range and rotate the lens group in/out until you find a point where the reticle and target are both in focus. Close your eye for a few seconds and do it again. When you find the focus point, tighten the lock ring. Always focus the scope before shooting for zero. Some scopes have a focus knob located on the side. This is really a parallax adjustment.

Most shooters "over scope" their rifles (too much magnification). They end up with the worst attributes so they buy a more expensive one thinking it will solve their problems. Remember, eye relief, light transfer, clarity, distortion, field of view, parallax, wiggle, and thermal distortion are all made worse by higher magnification and variable power. Give me a 6 or 8X fixed power, 30mm tube, with target knobs and good glass. The scope is only as good as the *mounts*. Buy the best rings and base you can get. Mounts can shoot loose, even if loc-tight is used (recommended), especially on those heavy recoil calibers. Weaver style tip offs are OK on a 223 Rem but should be avoided on anything bigger. Use rings that will position the front lens group so a lens cap will fit between the barrel and scope. Higher base and rings will cause more whiplash and will shoot loose easier.

Scopes can cost from \$40 to \$2000. Let your billfold be your guide. You get what you pay for. Don't expect Zeiss performance from a Tasco. IOR Valdada give excellent performance for their price. A good selection of scopes are available from [Cactus Tactical](#) at very competitive prices.

Next in series: **Long Range Shooting Secrets – Caliber Tips**