

Why are you using a riflescope?

Apart from enabling you to shoot at distances far in excess of those that you could without magnification, a riflescope can improve your shooting performance by eliminating the errors that can be made when your brain superimposes the front sight, rear sight and the target. Instead of having to focus on three separate objects at different distances, a riflescope produces a single composite image with the target and aiming reference (the graticule) in one image plane. Due to the nature of optics – much like your eyes, normal hunting scopes can only focus at one distance – if the target is nearer or farther than the focussed distance, parallax (the apparent movement of the graticule in relation to the target) results. High-magnification scopes produce more parallax movement at a given distance than scopes of lower magnification – for this reason "high-magnification" scopes (say those with more than 12x magnification) are usually equipped with parallax adjustments.

Modern riflescopes have windage / elevation controls that move the target image in relation to the graticule in order to allow you to make the bullet impact point coincide with the centre of the graticule. Each click of the windage / elevation control shifts the **point of impact (PI)** in the direction indicated by the arrow on the control by 1/4 **minute of arc (MOA)**. In a circle there are 360 degrees, each of which is divided into 60 minutes of arc, thus there are 21600 MOA in a circle. Using the formula $2\pi \times r$ to calculate the circumference of a circle, it can be determined that a circle with a radius of 100 metres has a circumference of 628.3 metres. Divide 628.3 by 21600 to determine the number of millimetres per MOA and you get 29mm, so for each four clicks of adjustment on the windage / elevation control, the PI will shift by 1 MOA which equals 29mm at 100m. Because the PI adjustment is measured in angles, the amount of movement on the target will increase proportionally as the distance to the target increases (see figure 1). In the following table, each click has been rounded down to 7mm for simplicity.

	DISTANCE TO TARGET			
	100m	200m	300m	400m
1 MOA	29mm	58mm	87mm	116mm
1 CLICK	7mm	14mm	21mm	28mm

To make adjustment simpler, you can assume that each MOA equals 1 inch at 100 metres and each click equals 1/4 inch at 100 metres.

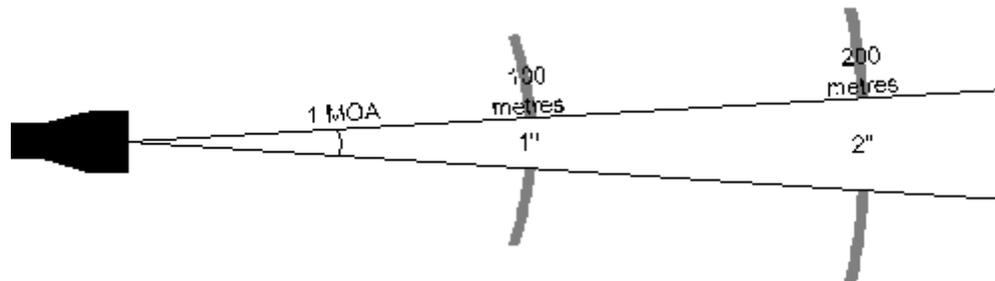


Figure 1

When a riflescope is mounted on a rifle the line of sight through the scope must be made to intersect with the path of the bullet. From the moment the bullet leaves the muzzle, it begins to fall toward the ground at the same velocity as it would if it were dropped from your hand, but because the bullet has forward velocity as well it travels a predictable distance before coming into contact with the ground. The higher the muzzle velocity, the farther the bullet will travel for any given amount of drop. As the

bullet travels through the air, it is acted upon by friction (air resistance) that slows the bullet down – the further the bullet travels, the more friction affects it and the slower it goes, this causes the bullet to travel in an elliptical trajectory rather than a straight line.

Since the bullet leaves the muzzle below the line of sight of the riflescope, the scope must be adjusted so that the line of sight points downward in order to intersect with the bullet's trajectory, and because the trajectory is elliptical, the line of sight will intersect twice – if the scope is zeroed at 100 metres then the line of sight will intersect at 100 metres and at 25 metres. As you will later see, this phenomenon can be exploited to the shooters advantage when zeroing the scope.

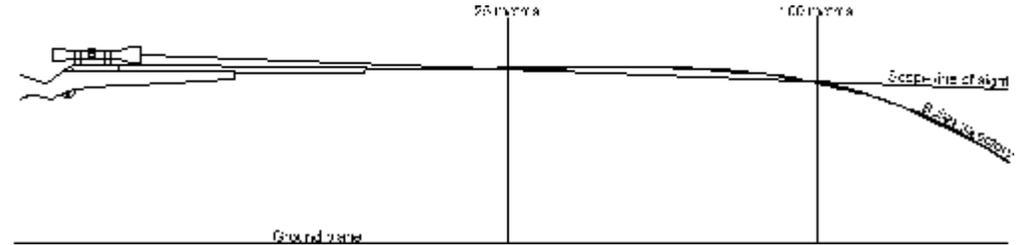


Figure 2.

Choosing a mounting system

Your choice of mounts is as important to accurate shooting as your choice of rifle and scope. We recommend that you choose a mounting system that will withstand the recoil forces generated by your rifle for many years without wear or failure. Lynx rings are precision machined from a single block of steel to provide full radius contact with the scope tube and thus excellent grip without squeezing the tube out of round. Lynx base blocks are precision machined from steel to precisely fit the action of your rifle. The rings are held by both front and rear bases sharing the recoil forces evenly, unlike rotary dovetail systems where the front ring takes all the recoil. Most Lynx mounts have windage adjustment capability that can overcome mounting difficulties caused by mounting holes drilled out of alignment with the bore.

Before mounting the scope

All Lynx riflescopes are factory set for shooters with 20/20 vision. In order to give you the best image and to prevent eye fatigue when shooting for long periods of time, the first thing to do is to focus the scope for your eyes. As you may remember the scope superimposes the target onto the graticule in order to give you one image at which to aim, so the best way to focus the scope is bring the graticule into sharp focus (and thereby bringing the image into sharp focus) while your eyes are relaxed. You would find that if you tried to focus the *image* instead of the graticule, you would have to focus through the scope at an object 100 metres away and it would be far more difficult to be sure that the image is sharp and your eyes relaxed.

Begin by turning the eyepiece of the scope anti-clockwise until it stops, then look through the scope at a well lit featureless area such as a nearby wall or cloudless sky – remember that the object of the exercise is to see **nothing but the graticule** through the scope – you should see a very unsharp graticule. Now without looking through the scope, give the eyepiece a couple of clockwise turns at a time. After each adjustment, look away from the scope or close your eyes for a moment to relax them and prevent them from bringing the graticule into focus. This action should be repeated until the graticule immediately appears crisp and sharp at a quick glance, it may be necessary to check and re-adjust the focus if the scope is being used by another person or if your eyesight undergoes significant change.

Mounting the scope

Consult the instructions that come with your mounts for any information peculiar to them. Make sure that all the mounting holes and surfaces on the rifle, mounts and rings are free from dirt or grease by cleaning them with oil-free acetone or a similar solvent. If necessary nail polish or a weak grade of Loctite can be used on the base to action screws to prevent them from working loose.

Before tightening the rings, be sure to set the correct eye relief for your scope (*see next section*) and align the scope so that the graticule is squarely aligned to the rifle (*see Figure 1*).

Leave at least a 2mm gap between the rings and scope tube contours.

Setting correct eye-relief

Before tightening the rings, slide the scope backward and forward until you can see the full field of view through it whilst holding the weapon in a normal, comfortable manner (*see figure 3*). The following table gives the approximate distance from the eyelens of the scope to your eye when it is correctly mounted. The eyelens of the scope should be as far from your eye as possible, whilst still giving a full field of view.

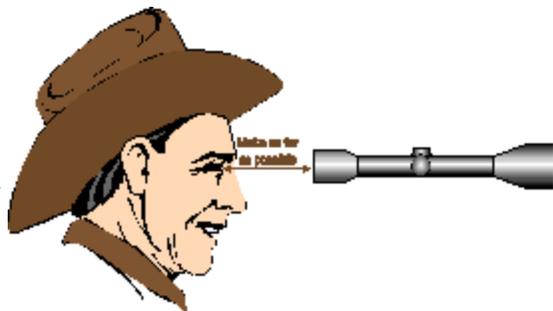


Figure 3

EYE RELIEF

Standard models	90mm to 100mm
Long eye-relief models	±125mm
Pistol scope models	230mm to 610mm

Presighting the scope

If the mounts that were used to secure the scope to the weapon have built-in windage / elevation adjustments like the LYNX system, it is vitally important that the presighting adjustments be carried out on the mounts in order to align the scope's external tube to the weapon's bore. Failure to do so may result in damage to the internal mechanism of the scope.

Presighting will save ammunition, time and frustration. The following two methods are listed in order of ease and accuracy:

Using a collimator

If you have access to a collimator (also known as a bore-sighter), it is probably the quickest and easiest method of pre-sighting the scope. The collimator is clamped to an arbour that is inserted into the barrel of the rifle and emits a grid pattern that appears to be at infinity.

Using first the adjustment on the mounts (if available) then the adjustments on the scope, align the graticule with the centre of the grid pattern emitted by the collimator _ this should put your first shot on the paper of your target.

Boresighting

Boresighting requires no special tools or instruments to perform. Place the rifle on a sand bag or a similar steady rest and sight through the barrel by removing the bolt from the action. Move the rifle until you can see an object at least 25 metres away. Without moving the rifle, adjust the graticule until it is centred on the same object _ use the adjustments on the scope mounts before those of the scope itself.

For lever action and other rifles that do not allow you to look down the bore, a small mirror such as a dentist's mirror can be used to sight through the bore.

Zeroing the scope

Before firing any rounds through the weapon, make sure that all mount and rings' screws are tight, it is also good practice to tighten the screws after shooting a few rounds to make sure they bed properly. The distance at which you zero the scope depends on the distance at which you will be doing most of your shooting _ the final zeroing should not be done at less than 100 metres (and at the highest power setting on variable power scopes).

Aiming through the scope, fire a three shot group at the centre of a target at 25 metres using a bench rest or sand bag to assist your aim. Keeping the weapon aimed in that exact position, look through the scope and turn the windage / elevation controls to place the graticule over the centre of the three shot group.

Depending on the distance at which most of your shooting will take place, fire a three shot group at the centre of a target at 100 or 200 metres. Using the windage / elevation controls, move the point of aim the required direction and distance. Remember that each click will move the bullet impact in the direction indicated by the arrow on the control by 1/4 MOA at 100 metres and 1/2 MOA at 200 metres.

Recentering the graticule

The graticules in all Lynx scopes are optically centred before leaving the factory, but after zeroing a scope using the windage / elevation controls, you cannot be sure how close it is to centre. This can be a problem if you want to re-mount the scope on another rifle or change the mounting system on your existing rifle. The best way to make sure that the graticule is optically centred without special equipment is to do the following: Turn the windage / elevation controls anti-clockwise until they stop. Turn the elevation control clockwise all the way, counting the number of revolutions, and turn it all the way out again. Turn the windage control clockwise all the way, counting the number of revolutions and turn it all the way out again. Finally turn the elevation control clockwise for half the number of revolutions it took to turn it all the way in and do the same with the windage control. You have now set the scope to its *mechanical* centre. To set it to its *optical* centre after setting it to its mechanical centre, place the scope in a V-block fashioned from a wooden or cardboard box, and rotate the scope whilst looking through it at a distant object. If the scope is not optically centred, the graticule centre will describe a circle as the scope is rotated _ use the windage / elevation controls to move the graticule until the graticule centre remains stationary.

Maintenance

Both the objective and eyelens should be kept clean at all times _ the dust caps will keep dust and other contaminants off the lenses when not in use. To clean the lenses first use a soft brush to remove loose dust, blowing gently on the surface while you brush. To get rid of grease, oil or dirt smudges use a cotton bud dipped in alcohol or glass cleaner and gently wipe dry with a dust free tissue. Keep the windage and elevation caps in place except when using the controls to adjust the scope.

Never use the scope as a lever to twist a swing mount into the base when installing the mount for the first time. Damage to scope structure and/or functions may occur.

Overturning the windage / elevation controls may result in damage to the controls or internal elements of the scope. If there is not sufficient adjustment available, please refer to the following troubleshooting section. Note that the windage and elevation controls are related _ the more windage you use the more you limit the elevation movement and vice-versa.

Parallax Adjustment

Some models have been provided with focusable objectives to correct for parallax. To change parallax correction on these models, rotate the objective bell to the desired distance setting. (Non_parallax adjusting models are set at the factory for 100 metres)

Troubleshooting

POSSIBLE PROBLEM	SOLUTION
Scope will not zero _ lack of windage adjustment	
Rifle mounting holes drilled out of alignment	Recentre the graticule and re_mount the scope using a mounting system with windage adjustment capability such as Lynx mounts.
Rifle barrel threaded into receiver ring at an angle	Same as above
Mounts have windage adjustment capability that was not used when zeroing	Recentre the graticule and re_mount the scope. Be sure to use the windage adjustment on the mounts <i>before</i> using the scopes internal adjustments.
Elevation control turned in all the way limiting windage adjustment	Recentre the graticule and refer to the <i>Scope will not zero _ lack of elevation adjustment</i> section below
Scope tube bent due to being dropped of being misused.	Return scope for tube replacement _ not covered by warranty
Scope will not zero _ lack of elevation adjustment	
Receiver diameter out of spec.	Use a brass shim stock under the front base to lower of rear base to raise point of impact.
Rifle barrel threaded into receiver ring at an angle	Same as above
Incorrect height mounts used	Recentre the graticule and use the correct mounts for the rifle.
Windage control turned in all the way limiting elevation adjustment	Recentre the graticule and refer to the <i>Scope will not zero _ lack of windage adjustment</i> section above
Scope tube bent due to being dropped of being misused.	Return scope for tube replacement _ not covered by warranty
Scope and rifle shot well in the past. Recent loss of accuracy	
Erosion of barrel or throat.	Consult with gunsmith.
Scope sliding in rings	Tighten or replace rings. Use loc_tite on ring to scope surfaces.
Bedding screw in stock has loosened.	Retighten screw
Warped stock _ stock coming into contact with barrel.	Consult with gunsmith

Loose mounts	Remove scope and mounts and re_mount scope
Scope faulty	Return scope for repair
Rifle has shot well in the past. Doesn't group well since mounting	
Loose mounts	Remove scope and mounts and re_mount scope
Scope tube touching rifle barrel	Replace rings with higher ones.
Scope faulty	Return scope for repair
Point of impact shifts when changing scope power	
Zeroing was not carried out at high power	Re_zero the scope at high power
Scope faulty	Return scope for repair
Graticule and image not in sharp focus	
Eyeiece not focused for your eyes	Refer to the section entitled <i>Focusing the scope</i>
Parallax not set correctly	In scopes with parallax adjustment, check the setting on the parallax ring. Return other models for repair.
Grease film on eyelens	Clean lens _ refer to the section entitled <i>Maintenance</i> .
Image "milky" _ lacks definition	
Grease film on objective lens	Clean lens _ refer to the section entitled <i>Maintenance</i> .
Moisture inside scope	Return scope for repair

Customer Service

If you have any problem with you scope, or are in need of technical advice or assistance, we invite you to contact us.



Lynx Optics (Pty) Ltd
PO Box 98078, Sloane Park
South Africa, 2152

Tel: +27 (0)11 792 6644
fax: +27 (0)11 792 8923

www.lynx.co.za

info@lynx.co.za

With repairs, please include a note with a full and accurate description of your problem. This will help us locate the fault and expedite the repair timeously.