What Magnification Do I Need?

Matthias | JungleShooterX@gmail.com | 2020-06

Fixed Magnification vs. Variable Magnification ("Zoom")

Scopes with a *fixed* magnification can be somewhat cheaper and sturdier, and purists swear by them. However, the lack of different magnifications at the twist of the wrist severely limits their usability for different shooting situations: long range vs. short range vs. extreme long range; or target shooting vs. hunting. As the quality of scopes over the last decade has greatly improved a fixed magnification seems like an unnecessary limitation. The ***Magnification and Field of View Diagram*** below displays common magnification ranges.

If you decide on a fixed magnification scope the discussion below can still be helpful in determining that magnification.

How Much Magnification Range

Variable scopes have different magnification ranges. Some have narrow magnification (i.e., *three*-fold of a 3-9x scope), others a much wider range (i.e., *eight*-fold of a 3-24x).

Width of the Magnification Range		**Typical Scope Magnification Ranges** (gray = not very common)	**Frequency of this Width**
narrow	three-fold	2-6x | 3-9x | 4-12x | 6-18x | 12-36x	frequent
intermediate	four-fold	1-4x | 3-12x | 4-16x | 5-20x | 6-24x | 8-32x | 10-40x	
	five-fold	2-10x | 3-15x | 4-20x | 5-25x | 6-30x | 7-35x | 10-50	
wide	six-fold	1-6x | 3-18x | 4-24x | 4.5-27x | 5-30x | 10-60x	fairly common
	seven-fold	3-21x | 4-28x | 5-35x	rare – and expensive
extra wide	eight-fold	1-8x | 3-24x | 4-32x | 5-40x	
	nine-fold	3-27x	
	ten-fold	2-20x | 3-30x | 4-40x | 5-50x	

Advantages of a Wider Magnification Range

To cover all possible shooting situations one could be looking for a 1x-60x scope, a sixty-fold magnification range. 1x magnification provides a very wide field of view for those close range shots. And 60x provides great magnification for the extreme long range shots.

However, the disadvantages of such a scope (if it even existed) would be formidable. So, *the versatility of a wide magnification range has to be balanced out* with other factors.

Disadvantages of a Wider Magnification Range

- *A general trend* to be more expensive if the quality level is kept the same as a narrower magnification range scope.
- *A general trend* to be have lower glass and/or turret quality if the price level is kept the same as a narrower magnification range scope.
- The weight of the scope increases with wider magnification ranges.

- *Important, but only relevant for first focal plane scopes (FFP):*

  On an FFP scope the reticle seems to grow larger* as the magnification is increased. And it becomes smaller as the magnification is decreased. On a three-fold magnification range scope like a 4-12x the reticle and its hash lines are the largest at 12x. When decreasing the magnification down to 4x the reticle now is only *a third of the size* than it was as 12x.

  *[Note: The reticle actually stays the same size *in relation to the objects* seen in the scope image.]

  This usually means that the hash lines used for holdoffs become very small and thus are hard or even impossible to use. That sounds really negative, but it is actually not all that negative:

  –The crosshairs are still visible to take aim. However, it helps a lot if the reticle is designed with thick bold outside posts!

  –The lower magnifications would normally be used for very close range shots. At such close ranges the holdoffs can be much coarser (e.g., at 50y range a 1" correction of the POA requires a 2 MOA holdoff, but the same 1" correction at 10y range amounts to a full 10(!) MOA holdoff).

  –To make the reticle lines and the hash lines better visible you can turn on the illumination.

  Now, the above scope 4-12x has a *three*-fold magnification range where the reticle size was reduced by a factor 3 when in the lowest magnification. Compare that to a *seven*-fold scope: here the reticle is reduced by a factor 7 – and thus will appear much smaller than in the three-fold scope, about half the size.

  This should be taken into consideration: the need for *versatility* through a wide magnification range – has to be balanced with the need *to be able to see and use the hash lines* when a lower magnifications.

  Also consider that *some* models of reticles grow at higher magnifications so much that the outer hash lines disappear. So, if the reticle – when fully in view – shows 10 MIL of elevation holdover, it might only show 6 MIL when at maximum magnification. If this is important to you, find owners of this scope on the forums to give you this information, or find a scope review on YouTube that shows the reticle at different magnifications.

Choosing First the *Bottom* End Magnification vs. the *Top* End Magnification

For a variable magnification scope, should you choose first your top end magnification, or your bottom end? Your decision will depend on the type kind of shooting you're planning to do with the scope. Now you could choose to **only do *one* type of shooting** with this scope – because you have other scopes/ guns for other types of shooting (or you only do this one type of shooting). Or you could choose to have a **double-purpose** or **all-round scope** that is usable for various shooting types.

There are many different types of shooting – and some of them will determine whether to decide on the top end magnification first, or on the bottom end first:

- **Shooting Type 1:** You want to participate in **field target (FT) competitions** and hope to win. There are a handful different types of FT competitions, and the requirements for scopes vary wildly. This is a highly specialized area, so I leave that to the FT guys and gals.
  Here are some links to discussions and articles about scopes for FT:
  https://www.pyramydair.com/blog/2009/02/scopes-for-field-target-part-3
  https://www.pyramydair.com/blog/2007/09/introduction-to-field-target-part-7-the-scopes-part-1
  https://www.pyramydair.com/blog/2007/09/introduction-to-field-target-part-8-the-scopes-part-2
  https://www.gatewaytoairguns.org/GTA/index.php?topic=173899

- **Shooting Type 2:** You want to **measure the distance to your targets using the scope's parallax**. Parallax ranging requires a high magnification, so this is priority. The higher the magnification the farther out you can accurately range.

- **Shooting Type 3:** If you **rarely ever hunt** with the scope – and mostly **shoot leisurely at paper targets** from a bench or **simply plink**, you might as well get a fixed magnification scope (usually cheaper, or better quality for the money). In any case, the top end magnification is critical for the longest range at which you will engage paper and plink targets – so that goes first. As the adage goes, "aim small – miss small" – so a large top end magnification is probably best.

- **Shooting Type 4:** You want to **hunt a good deal with the scope**. Most hunting presents a *hurried type of shooting,* as quarry usually don't give you the time to leisurely find your quarry in the tiny sector of reality that you can see through your scope. *Rapid target acquisition* is important – and that requires a wide enough field of view through your scope to find the quarry quickly and set up the shot. Quick moving quarries, in low light conditions, with a busy backdrop, at close range, popping up suddenly (during a stalk) – any of these circumstances make rapid target acquisition harder, and a combination of these even more so....
  In this case it might be better to choose the *bottom end magnification* first. Reason: The bottom end determines how wide your field of view (FoV) is at most, i.e., how big of a segment you see of the woods or pasture or dimly lit barn through the scope. The smaller that segment is (the FoV) the harder it is for you to actually "find" the quarry in the scope – rapid target acquisition requires a wider FoV – which comes with a lower bottom end magnification.

Conclusion

Depending on your type of shooting, you can now chose to read first the section *Bottom End Magnification* or the section *Top End Magnification*. ☻

Determining What Bottom End Magnification – and Field of View (FoV) You Need

Should you choose first your *bottom* end magnification, or your *top* end? If you plan to mainly shoot at paper targets from a bench, or only shoot in certain field target competitions where you use the parallax for range estimation, or don't want to use a laser ranger finder – in that case I would choose the top end magnification first. Reason: cf. under *Top End Magnification.*

If you plan to hunt a good deal with the scope it might be better to choose the bottom end magnification *first.* The reason in a nutshell is rapids target acquisition for hurried shooting.

When the Field of View (FoV) Is Important

Before we can get into the bottom end magnification, we need to determine the FoV. As discussed in the previous section, the wider the FoV at a given magnification the better because you simply see a wider segment of reality through the scope. This helps to make rapid target acquisition, which is critical in *hurried shooting* like most hunting.

A wider FoV helps you to find your quarry quicker with the scope – for the first shot and any follow-up shot. Quick quarry acquisition is needed for stalk hunting where quarry can pop up anywhere close-by and requires an immediate shot. A wider FoV is even more needed if the quarry is moving, or the backdrop is busy, or you are in low light. Close range ratting and pigeon pesting in barns are typical hunting situations requiring a wide FoV. Also, a wider FoV allows you to see more of nature and thus get better clues about the wind, all the while keeping the crosshairs on the quarry.

Of course, the "ideal" scope would give us a very wide FoV, as in a 1x or 2x magnification at the bottom, and at the same time also a very high magnification (say 32x) at the top – then we would have an all-round scope for any shooting situation. However, this kind of scope would be extremely expensive and extremely heavy if we also wanted a clear and bright image.

How to Find Your Personal *Minimum FoV*

So, you probably should figure out how wide of a FoV you'll want to have at the very minimum – and that's a very personal decision! To figure that out you could try to "dry hunt" with various scopes of different field of views***** (check each scope's specs for the FoV). "Dry hunt" in a hunting location typical for you and imagine how you suddenly have to acquire a quarry that popped up, or engage quarry at varying locations under time pressure. Experiment and see at which FoV you feel your quarry acquisition is quick enough. That minimum FoV becomes a search criteria for your scope search and will ultimately determine your magnification range.

Another help to find your preferred minimum FoV is the *Magnification and Field of View Diagram* below. It shows (for most typical magnifications) how wide the FoV is in feet at 10y, 25, 50y, and 100y (also provided in metric). This can get you an idea of how wide (or narrow) a FoV you can expect at different ranges and magnifications.

*****[Note: You could use a variable magnification scope and change the magnification to try different field of view – however, for this to work you'd have to know what FoV scope has at the

different magnifications you're using – and usually the mnfctr. only provides the FoV for the min. and max. magnification.]

My Very Own Personal *Minimum FoV*

This of course is highly subjective, and depends on the type of shooting! For a scope that is used for *hurried close range hunting* (not just target shooting or leisurely long range shots) *my personal minimum FoV* is as follows: Scopes with a FoV of 30ft or more at 100y I consider *fine.* Based on my personal preferences, I divide the FoV numbers (ft at 100y) into 6 segments, from **bold green** (=ideal), to orange (=marginal), to **bold read** (=not good enough for me). The *Magnification and Field of View (FoV) Diagram* and the *Scope Specs Table* use the same classification and color coding:

42ft or more | 41-36ft | 35-30ft | 29-23ft | 22-17ft | **16ft or less**

How to Find Your Personal *Minimum Bottom End Magnification*

A scope gives you the widest FoV when set to its bottom end magnification. Note however that the actual FoV is particular to each scope, even between scopes that all have the same magnification. For example, in the *Scope Specs Table* there is a 3-18x scope that has a FoV at 100y of 43ft (at 3x) and 7ft (at 18x). Another scope has the same magnification range (3-18x) but a much narrower FoV at the bottom magnification: *33ft* (3x) and 6ft (18x).

Therefore, in the *Magnification and FoV Diagram* find the magnification that typically corresponds to your personal minimum FoV. Then look for scopes that have that bottom end magnification, *and one or more numbers below that.*

Example: You determined your personal minimum FoV = 30ft (@ 100y)

This corresponds to a 4x magnification, *approximately*.

Look at scopes that have that magnification, and also those that have 5x (as some 5x come with a rather wide FoV). Of course you could also consider magnification smaller than 4x.

Check the FoV specs of each scope you're interested and make sure the FoV is within or close to your personal minimum FoV.

The *Scope Specs Table* makes this search easy, as it lists the FoV side-by-side for all scopes listed.

Note

For scopes the FoV spec is usually given in feet at a range of 100 yards (or in meters at 100m range). Binoculars, rangefinders, and spotting scopes tend to measure FoV in feet at 1000 yards. Sometimes they give the FoV in angular degrees. To convert an angle to *feet at 100 yards*, multiply the angle by 5.25. Example: A scope has a FoV of 6.0°, so: 6 x 5.25 = 41.5ft FoV at 100y.

Determining What Top End Magnification You Need

Should you choose first your *top* end magnification, or your *bottom* end? If you plan to hunt a good deal with the scope it might be better to choose the bottom end magnification *first.* Reason: cf. under *Bottom End Magnification.*

If you almost never will hunt with the scope (i.e., hurried shooting) – and will only shoot at paper targets from a bench, or only shoot in certain field target competitions where you use the parallax for range estimation, or don't want to use a laser ranger finder – in that case I would choose the top end magnification first.

There are at least **four different purposes** for which a higher magnification is useful and to be preferred over shooting with open sights or a "magnification of 1x": (a) shooting, (b) spotting, (c) range estimation, and (d) seeing the mirage to estimate wind.

(a) For Shooting

It allows the shooter to see the target large enough to hit it.

Scope magnifications for *shooting* do not have to be very large, often a 3-9x covers many close to midrange shooting situations. However, for shooting small targets at long range (say 60y+) and extreme long range (100y+) larger magnifications are helpful, especially if the targets are stationary paper targets or figures instead of moving quarry: 14x, 18x, 24x, and even 32x are appropriate. As the sniper adage goes: "Aim small, miss small."

Here is one of the differences between hunting with airguns and hunting with powder burners: Except for big bore airguns the quarry for typical airgun hunting (pigeons, squirrels, rabbits) have very small kill zones – thus requiring a higher magnification. The deer and boars offer the powder burner hunter much larger kill zones, so magnification is less important.

(b) For Spotting

Either *for target spotting:* It allows the shooter to see if s/he hit the target and where, and make adjustments, or keep score. Holes made by a .177 caliber pellet at 100 yards are a lot harder to spot than .25 caliber holes at 50 yards! Or *for quarry spotting:* It allows the shooter to find and identify his/her quarry, we wouldn't want to shoot a local song bird mistaking it for a pest bird.

Not everybody wants or needs this, and spotting also depends on the quality of the shooter's eyesight and the quality of the glass.

Alternative methods for *both target spotting and quarry spotting:* Use good binoculars or spotting scopes that serve the same purpose and are usually better suited. However, they are an additional piece of equipment to lug around and have a significant additional cost.

More alternative methods for *target spotting:* Use target cards without a large black bull's eye (purchased, or DIY); use reactive targets (target cards that change color when hit, "splatter targets" [commercial and DIY], or objects that move or disintegrate). Also, a camera with a powerful tele zoom (digital zoom of 1000 mm DSLR-equivalent or more) could be used for spotting (i.e., take a photo after each shot and then look at the photos on the camera). Most basic: improve eye sight though glasses or an eye operation.

The magnification needed for *target spotting* has to be much larger than the magnification needed for *shooting!* The quality of the glass is quite important for spotting, and a *lower magnification* scope with *clearer* glass can be as good or better than a *higher magnification* scope with *less clear* glass – the glass quality drives the price up steeply.

(c) For Range Estimation (Ranging, Range Finding, Parallax Ranging)

It allows the shooter to range (measure) the distance to the target.

The ranges marked by the scope manufacturer on the parallax turret or the adjustable objective are usually not very precise and lack detail. Therefore the shooter attaches a *side wheel* to the parallax turret (available as accessory, to make the turret artificially larger) (most shooters find scopes with front adjustable objectives not very suitable for parallax ranging as the shooter has to dismount the rifle to check the range).

Calibration of the side wheel: After setting out distance indicators at each meter/ yard of distance from the scope, the shooter adjusts the parallax to each distance indicator. Each time the scope image is at its sharpest on a certain distance indicator, the shooter marks that distance on a strip of paper taped onto the side wheel (side wheel tape).

Some scopes have a parallax turret that adjusts from 10y to 55y within only a quarter turn of the turret (90°). Other scopes adjust with half a turn (180°) or more of the turret. The latter has more degrees of revolution to make the parallax adjustments and therefore has a finer adjustment, resulting in more accurate range estimates.

Shooters have reported that certain scopes are more suitable for ranging than others, as some have a shallower depth of field (DoF) that requires more precise parallax settings. They "pop" into focus and out of focus, making the setting of the parallax more precise. For advice if a certain scope is suitable for range estimation and field target you could ask on the FT forums.

Parallax ranging is basically a requirement for shooting in certain field target competitions. Beyond that, it is not as important, as target shooting often occurs at known distances, and for all other circumstances laser range finders are much more accurate. Besides, hunting does not require the same precision as target shooting. As Tom Gaylord says: "A varmint hunter can miss his mark by a half-inch and never be the wiser. But a field target competitor has to hit within hundredths of an inch of where he aims at all times. So it matters to him whether the target is 44 yards or 47 yards away."[4]

Note also that accurate ranging is most important for: low powered airguns; for long and extremely long distances; and for very heavy pellets; combinations of these compound the need for accurate ranging immensely.

At the same time note that parallax ranging usually only works to about 50 yards/meters, so beyond that this method loses accuracy rapidly – just when we need *more* accurate ranging, the parallax ranging gives us *less....*

Alternative Methods to Parallax Ranging

- *Reticle ranging,* by measuring objects in the target zone that are of known length, with the help of the distances between the hash lines/ dots in the reticle. For reticle ranging it is a huge advantage if the reticle is a first focal plane type (FFP) rather than a second focal plane (SFP). This is not a very precise method, but surely better than a simple guess. Most would probably consider this ranging method an emergency method.
- *A laser range finder* is much more(!) accurate, and reaches easily out to 100 or 200 yards/meters and beyond, depending on the conditions and the model. Using a laser range finder is an additional step in setting up a shot, an additional piece of equipment to lug around, with additional cost (on average at least $80-150). However, the added accuracy when shooting out to 60 or 100y, or when shooting low powered 12 FPE guns out to 50y seems well worth it.

- Tom Gaylord's Recommendations for Magnifications for Ranging

  Applicable for .177 caliber, 12FPE guns (for 20FPE guns in .177, or for 30FPE in .22, the point blank range is much larger and thus the ranging is not as critical at those ranges):

  30y ➔ 18x: "A 6-18x scope stops working for rangefinding at about 30 yards."[1]

  35-40y ➔ 30x: "With 30x, I can do that out to 35-40 yards, depending on the light."[3]

  55y ➔ 40x: "To determine range using the scope's parallax adjustment takes at least 40x to go out to 55 yards successfully. So, use nothing less than an 8-32x with a 56mm objective lens and a 30mm tube if you want to win."[2]

Sources:

[1]Scope. Requirements List for Field Target (Air Rifle) Scopes. Tom Gaylord (2009). 'Scopes for Field Target.' #03.pdf
https://www.pyramydair.com/blog/2009/02/scopes-for-field-target-part-3/

[2]Scope. Detailed Overview Air Rifle Scopes. Tom Gaylord (2008). 'Scopes -- Part 2 -- Scope Mounts -- How Well Do They Need to Fit'.pdf
https://www.pyramydair.com/blog/2008/01/scopes-part-2scope-mounts-how-well-do-they-need-to-fit/

[3]Scope. Requirements List for Field Target (Air Rifle) Scopes. Tom Gaylord (2007). 'Introduction to Field Target -- Part 7 -- The Scopes -- Part 1'.pdf
https://www.pyramydair.com/blog/2007/09/introduction-to-field-target-part-7-the-scopes-part-1/

[4]Scope. Requirements List for Field Target (Air Rifle) Scopes. Tom Gaylord (2009). 'Scopes for Field Target.' #02.pdf
https://www.pyramydair.com/blog/2009/02/scopes-for-field-target-part-2/

(d) For Seeing the Mirage, for Estimating Wind

For very long range shots a larger magnification a fairly high magnification allows the shooter to see better how the air moves (the "mirage", i.e., heat waves of the air) and thus to better estimate both wind direction and wind speed.

Caveat on Shooter's Visual Acuity

As shooters advance in age and their eye sight deteriorates, higher magnifications and clearer glass is required.... Just because a 25-year old says that 12x magnification is sufficient to see .22 pellet holes in paper at X yards of range does not mean that 12x magnification is going to be enough for the 55-year old.

Consideration on the Glass Quality

The quality of the glass is quite important for being able to discern fine details at long range as when quarry or target spotting. It is quite possible that a *lower magnification* scope with *clearer* glass can be as good or better than a *higher magnification* scope with *less clear* glass. However, the glass quality drives the scope's price up steeply. In the not too distant past scopes from China had low quality glass. However, in recent years the quality of some brands and some models has improved greatly.

Disadvantages of a Higher Magnification

- The larger the top end magnification on a scope the larger the bottom end magnification. If you want a really high top end it will be difficult to find many scopes that also offer a low bottom end (because the most common scope magnification ranges are usually 3-fold to 5-fold).
- In most scopes (except scopes from the upper tiers) the image deteriorates when getting toward the top end of the magnification: darker (bad for low light shooting), less resolution, more blurry, more optical aberrations. Of course, by decreasing the magnification this can be reversed.
- A more pronounced *scope quiver* – the shaking and wavering of the scope image when shooting offhand or even when the gun is not fully rested on front and rear bags. So, for shooting without a stable rest a large magnification can easily be too large (but of course, since it's a

variable magnification scope we can decrease the magnification, and it's nice to have the extra magnification at your fingertips when appropriate).

- A shallower depth of field (DoF) that requires more precise parallax settings to get a sharp image. This is actually an advantage if the shooter wants to use the scope's parallax for range finding.

- A higher magnification requires a larger objective diameter, which has further consequences:
- More weight
- A trend toward a somewhat higher price
- Without getting into the details, the higher the magnification the less tolerant the scope is as to where the shooter's eye needs to be to actually see the scope image (because the *eye box* is smaller). For hurried shooting the shooter might lack the *time* and the *patience* to find and maintain the eye inside the eye box. Bob Sterne recommends a 50mm objective to be comfortable when using 16x magnification or less. For the same 50mm objective a 24x magnification is only acceptable. And a 32x is indeed very small and finicky.

Conclusion on the Top End Magnification Discussion

So, what magnification do you need at the very least? You need it large enough to see the target, maybe even large enough to see your hits on target, or even to be able to do range estimation.

More magnification isn't necessarily better, as this can make the scope heavier and possibly more expensive. When using the scope at the high magnification setting the image can become darker and have less resolution, and scope quiver gets more pronounced. The depth of field is shallower and the eye box finickier.

You might happen to want a rather high *top end* magnification but also want a rather low *bottom end.* This wide magnification range will then only give you a very limited amount of choices. For example, 6-24x is very common, 5-25x less so, and 4-24x are not that many around, and they are usually expensive. There are many more 3-9x than 3-18x, but 3-21x is very rare. By compromising on either end of the magnification range (or both) you will increase your options.

The most realistic way to test what magnification range you might need for what ranges and targets is to try one at a shooting range; or you could ask your close-by shooting friends or people on the forums – you meet up with someone with a scope with the magnification range you want to try out. You can also use the *Magnification and Field of View Diagram* to get an idea of the different magnifications.

For me personally I like to use my scope not just to hit the target, but to spot my .22 caliber hits on paper. I don't much mind weight and size. So, considering the age of my eyes and the quality of glass that I can get for around $500: • for shots around 50y I like at least 12x as top end magnification | • for 100y I like at least 18x, but 24x would be much better. Your mileage can (and mostly likely will) vary.

Magnification and Field of View (FoV) Diagram

About the *Magnification and Field of View Diagram*

- The diagram relates a scope magnification with typical field of view (FoV). These are only rough estimates(!) – each scope is different, so you should check the individual scope specs. The FoV value displayed for each magnification is based on surveying the FoV specs of $200-500 scopes for airgunning (cf. survey table after the diagram below).
- The diagram displays common magnification ranges. *The longer* the magnification range *the more versatile* the scope, generally speaking. However, constructing a scope with a wide range is more expensive, so either the price will go up or the quality will go down. Also, the scope usually gets heavier.
- Note that the numbers that describe the magnification range of a scope are *not linear:* The difference in magnification between a 2x and a 4x is much larger than between a 30x and a 32x, even though they both are only 2 numbers apart.

As the diagram shows: the size increase of the image of a squirrel at 2x magnification over its life size at that distance is *twice* the size (of course). When comparing the squirrel's scope image in 4x with the image in 2x, again it's twice the size. 8x shows the squirrel twice the size as in 4x. To make it again twice the size you'd have to go to 16x magnification (that's 16x larger than life size). And for another doubling in size you'd need to jump all the way to 32x. For comparison: The size increase of the squirrel image seen at 30x and the image seen at 32x is not much (*only ⅛x larger*), whereas going from 2x to 4x makes it *2x larger*.

- The FoV data is given both in imperial and metric measurements.
- The section *Recommended Minimum FoV for Hurried Shots* is my very personal opinion only, and depends on they type of shooting and personal preferences. For a scope that is used for *hurried close range hunting* (not just target shooting or leisurely long range shots) *my personal minimum FoV* is as follows: Scopes with a FoV of 30ft or more at 100y I consider *fine.* Based on my personal preferences, I divide the FoV into 6 segments, from **bold green** (=ideal), to orange (=marginal), to **bold read** (=not good enough for me). The *Scope Specs Table* uses this same classification and color coding.

42ft or more | 41-36ft | 35-30ft | 29-23ft | 22-17ft | **16ft or less**

JungleShooterX@gmail.com

Magnification and Field of View (FoV) Diagram

Matthias | 2020-06

Magnification	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	20	22	24	26	28	30	32
Magnification	1	2		4				8								16								32
"times life size"	1x	2x	3x	4x	5x	6x	7x	8x	9x	10	11	12	13	14	15	16	18	20	22	24	26	28	30	32
Size Increase of the Image	=Life view w/ unaided eye	=twice the 1x magni		=twice the 2x magni				=twice the 4x magni							=twice the 8x magni				24 | 25 | 26		twice the 16x magni	

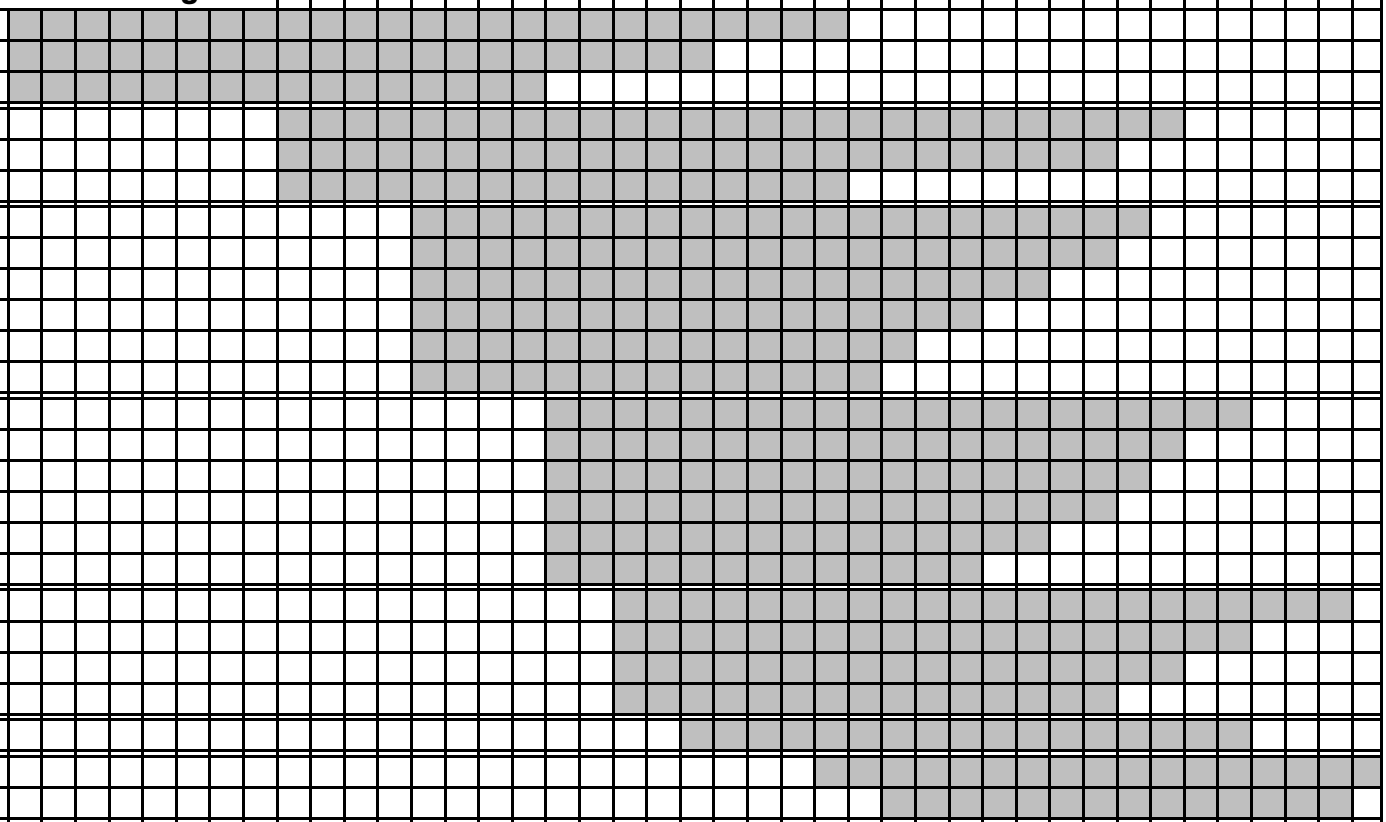
Typical Field of View (FoV)*

FoV in ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
FoV @ 100y	105	46	37	29	18	14	9	7	5	4
FoV @ 50y	52	23	18	14	9	7	4	3.1	2	2
FoV @ 25y	26	11	9	7	5	4	2	2	1	1
FoV @ 10y	10	4.6	3.7	2.5	1.9	1.3	0.9	0.7	0	03
FoV in m	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**	**m**
FoV @ 100m	35	15	12	10	6	4.7	3	2.3	2	1
FoV @ 50m	17	7.5	6	5	3	2.3	1.5	1.1	1	1
FoV @ 25m	8.8	3.8	3	2.5	1.5	1.2	0.8	0.6	0	1
FoV @ 10m	4	2	1	1	1	1	0	0	0	0

Recommended *Minimum FoV* for Hurried Close Range Shots (Stalking) (my *personal* opinion)

FoV in ft	ft	ft	ft	ft	ft	ft
FoV @ 100y	42	41-36	35-30	29-23	22-17	16
FoV @ 10y	4.2	4.1-3.6	3.5-3	2.9-2.3	2.2-1.7	1.6
FoV in m	**m**	**m**	**m**	**m**	**m**	**m**
FoV @ 100m	14	14-12	44174	10-7.5	7.4-5.5	5.5
FoV @ 10m	1.4	1.4-1.2	1.2-1	1-0.8	0.7-0.6	0.5

Magnification Ranges



Magnification	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	20	22	24	26	28	30	32
Magnification	1	2		4				8								16								32
"times life size"	1x	2x	3x	4x	5x	6x	7x	8x	9x	10	11	12	13	14	15	16	18	20	22	24	26	28	30	32
Size Increase of the Image	=Life view w/ unaided eye	=twice the 1x magni		=twice the 2x magni				=twice the 4x magni							=twice the 8x magni				24 | 25 | 26		twice the 16x magni	

*These are only rough estimates – each scope is different, cf. the individual scope specs! The FoV value displayed for each magnification is based on surveying the FoV specs of $200-500 scopes for airgunning.

Survey of the Typical Field of View (FoV) at Different Magnifications

I informally surveyed about 180 scopes, almost all of them with: variable magnification, 10y-side parallax, holdoff reticle, and exposed turrets.

Note that – at the same magnification – a scope with a wider FoV is better than one with a narrower FoV.

Bottom End Magnification	***Typical* FoV (the majority of scopes has this FoV)**	***A Few* Scopes Have a FoV Outside of the Majority**
1x	a wide range around 100ft, with some in the 80's and 120's	very far spread out
2x	44 to 49ft	38, 54, 58, pretty far spread out
3x	35 to 38ft	29 to 44ft, and even 47, 61, and 64ft
4x	27 to 31ft	22 to 33 ft
5x	20 to 25ft (there are few 5x scopes)	—
6x	17 to 19ft	14 to 22ft
8x	13 to 15ft	—
Top End Magnification	**Typical FoV (the majority of scopes has this FoV)**	**A Few Scopes Have a FoV Outside of the majority**
12x	9ft	6 to 11ft and even 17 and 18ft
16x	6 to 8ft	—
18x	6 to 7ft	—
20x	4 to 6ft	—
24x	4 to 5ft	6ft
30x and 32x	3 to 4ft	5ft