

## MOA vs. Milliradian

### ANGULAR MEASUREMENTS

This area is one of the most unknown to newcomers of precision rifle shooting today.

The question is – “MOA or Milliradian?” Which one do I go for? Most will opt for the MOA or minute of angle turrets on their choice of scopes because of the abundance in the American market. Let’s face it, the Yanks love them. They certainly do have their place in precision shooting but then so do Milliradian turrets. Before I go any further I will explain the difference.

#### MOA (Minute of Angle)(1)

An imperial angular measurement meaning “Minute of Angle” representing  $1/60^{\text{th}}$  of a degree of a 360 degree circle. That is  $1/21,600^{\text{th}}$  of a circle. One  $21,600^{\text{th}}$  of this pie slice equals 1.047 of an inch or 26.6mm at 100yards and 1.145 of an inch or 29.08mm at 100m. Divide these by 1/4 or 1/8 and you have nice fine adjustments for Benchrest shooting and F Class shooting but confusing for a lot of us who have a Milliradian (mildot) reticles in our scopes. If we see our own fall of shot and reference this to the mildot/mil hash reticle pattern there is difficulty transposing this into the amount of clicks or MOA when mechanical adjustment is required.

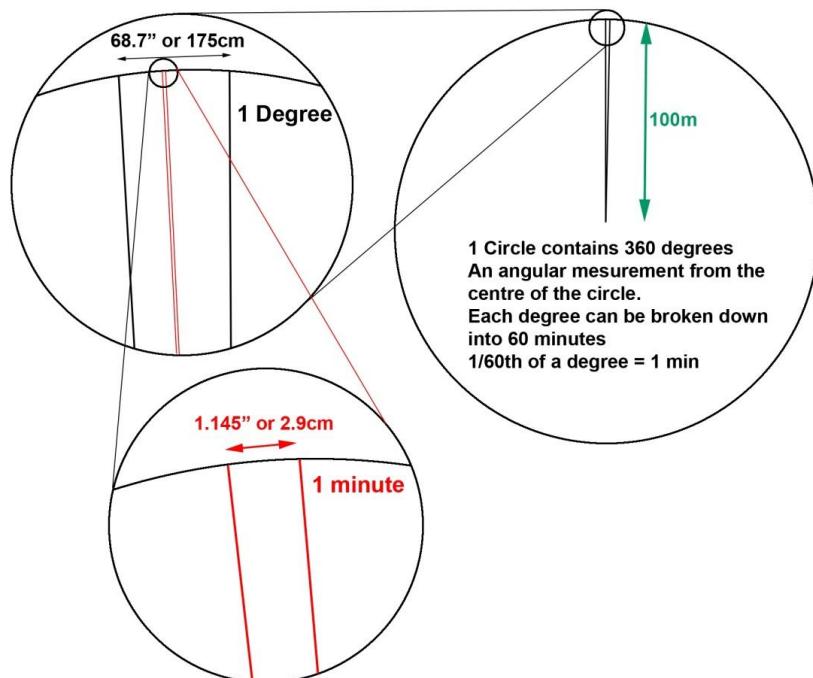


Figure 1.

A quick and easy way to tell if a scope is  $\frac{1}{4}$  MOA is to look at the numbers and hash marks on the external turret (if it has one). There should be 3 dashes between each number.



Figure 2. US Optics Telescopic Sight

## Mils (Milliradians)(2)

A mil or Milliradian is a metric measurement derived from an algorithmic equation that is used to determine the ratio of a circle's radius to its circumference. Most people have heard of  $\pi$  (Pi) and its irrational number that never ends. This number being ;

3.14159265358979323846264338327950288419716939937510...

This number means the diameter of a circle fits around its circumference this many times. The radius of a circle (half the diameter) fits around the circumference twice this amount, so this number would now be 6.283185 etc etc..

Rounded off, this reads 6.283. The term "Milli" in the math's word really means  $1/1000^{\text{th}}$  and not "million". If one radian fits around a circle 6.283 times then 1 Milliradian fits 6283 times around a circle. One Milliradian as an angular measurement equates to 10cm at 100m.

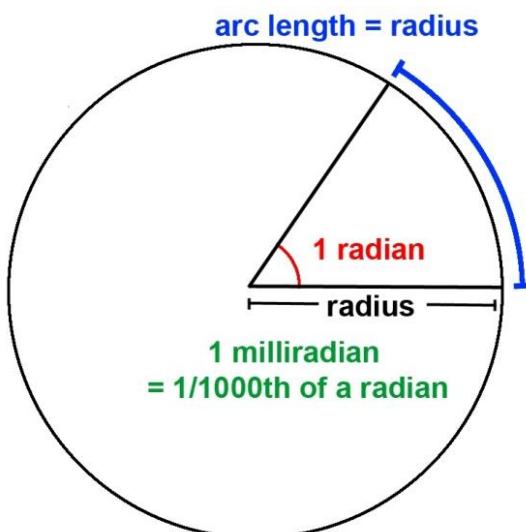


Figure 3.



Figure 4. Schmidt & Bender PMII Telescopic Sight

A scope that has 1/10<sup>th</sup> Milliradian clicks moves the bullet impact 1cm at 100m. A Milliradian turret will have 4 or 8 hash marks between each number, depending on the model.

Now a lot of scopes come out now with mildot and mil-hash reticle patterns. These are in fact “Milliradian” values as just described above so why not have a scope that both the reticle values and turret values “match”. Ten clicks on a Milrad turret equate to 1 mildot in the reticle.

Scope manufacturers who such as Nightforce and the new Vortex lines have got it right. When producing scopes with

MOA value turrets, you can have MOA reticle patterns to match. In fact Vortex Viper and Vortex Razor HD only have matching reticle / turret combinations.

A word of warning though! If your reticle pattern is not in the 1<sup>st</sup> focal plane, the reticle value will not be true if the magnification is changed. Manufacturers of variable scopes containing these reticles in the 2<sup>nd</sup> plane usually state the values are only true when on a certain power setting. i.e. Nightforce NXS (Maximum Power) and Leupold (10x).

### Turret Uses

When participating in F Class and Benchrest shooting, 1/4 MOA and sometimes 1/8 MOA turrets are preferable for those fine adjustments required. Having 1/10 Milliradian adjustments can be a little coarse.

For hunting and long range practical shooting (multi-distance field), Milliradian turret adjustments coupled with Milliradian style reticles are an advantage. These turrets generally come in single and double turn drums allowing the shooter to quickly adjust the elevation required before the shot is taken. Let's face it, trying to shoot a 30cm metal disc at 1000m can be difficult depending on the environmental conditions and the cartridge used. One click moves the point of impact (POI) is 10cm at this distance and that can be considered coarse, but so is a 4 m/s crosswind causing a 70cm drift in the POI.

Glen Roberts  
Chief Instructor  
Precision Shooting Australia  
[www.precisionshooting.com.au](http://www.precisionshooting.com.au)

## References

1. Linger R. *Minute of Angle*. 2010 [cited 2011 July 18]; Available from: <http://riflestocks.tripod.com/moa.html>.
2. Williams J. *Mildots and Minutes of Angle*. 1999 [cited 2011 July 18]; Available from: [http://www.snipercountry.com/articles/mildot\\_moa.asp](http://www.snipercountry.com/articles/mildot_moa.asp).