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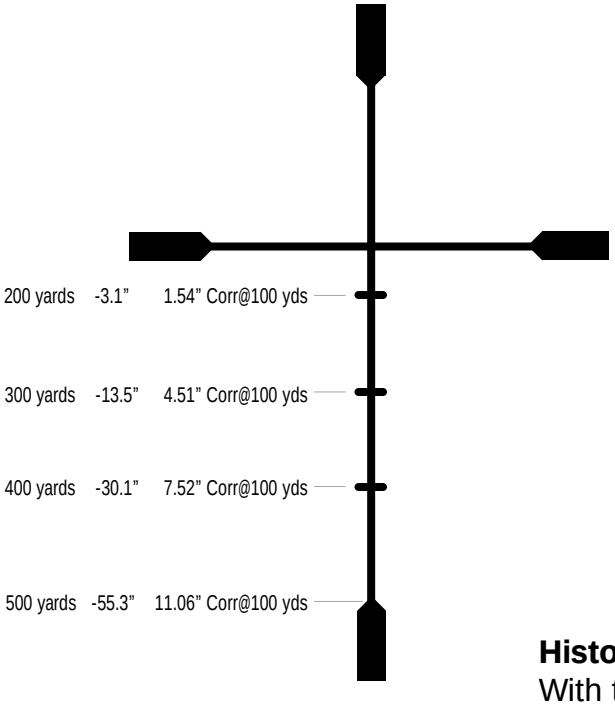
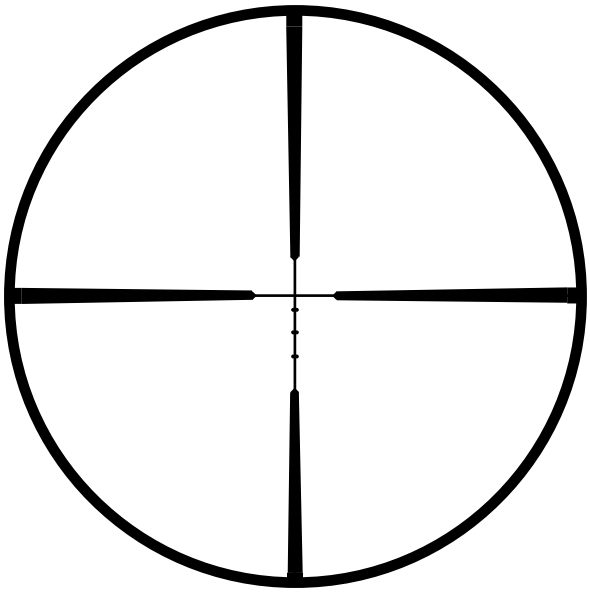
Tech Notes

Ballistic Plex™ Reticle





History

With the advent of laser rangefinders, more long range rifle designs, more accurate ammunition, more and more American sportsmen started pursuing long range marksmanship. Vital to success in shooting at long distances is in how accurate one can judge hold-over. So Burris has created a couple of trajectory compensating scope reticles to aid hunters in dramatically increasing their long range accuracy.

Prior to the **Ballistic Plex** reticle, in 1999 Burris introduced the **Ballistic Mil-Dot™** reticle in a 6X-24X Signature Series® scope, primarily with the varmint hunter in mind. Although the Ballistic Mil-Dot was calibrated for flat shooting varmint loads, it also closely matched many Magnum big game cartridges and was popular in both varmint and big game circles. Still, a considerable number of hunters asked for trajectory compensation in more moderate magnification scopes and for more traditional cartridges. Also paramount was simplicity and an uncluttered view.

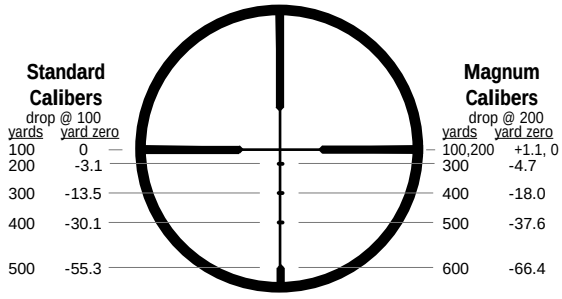
In the year 2000, Burris introduced the **Ballistic Plex** reticle. Starting with a standard Plex reticle, two slight modifications were made. Most obvious is the addition of ballistic reference lines to the lower vertical crosshair. Less obvious is the thickening of the outer section of the crosshair with a slight taper from the center to the outside edge to aid in low light shooting.

Ballistic Plex
Design Considerations -

Step one in the development of the Ballistic Plex reticle was in contacting the major ammunition manufacturers to determine the most popular factory cartridges. To no surprise, .243 Win 100 grain, .270 Win 130 & 150 grain, and 30-06 150 and 165 grain were clearly the most popular and overall accounted for 70% -80% of the big game ammunition sales. Burris researched the trajectory curves of these loads from several manufacturers and found that the curves were very similar between loads. The Sierra Infinity™ Ballistics software program was utilized for all calculations and verified by field shooting. An average trajectory curve made lots of sense, and from this, the Ballistic Plex reticle was designed.

As nearly 100% of big game shots are taken inside of 500 yards, providing compensation beyond 500 yards was deemed unnecessay and contradictory to the mission of simplicity. Therefore, the center of the reticle is used as a 100 yard zero, with 200, 300, and 400 yard ballistic lines, and the use of the intersection of the thin and thick section of the Plex crosshair as a 500 yard zero.

Some would contend (and Burris would agree) that even these cartridges are so flat shooting out to 200 yards, that a separate 200 yard reference is unnecessary. However, significant consideration was given to making the use of the reticle intuitive and not subject to the failings of memory for occasional shooters. As designed, counting the ballistic lines is easier starting at 100 yards as the center reference, rather than “remembering” to start counting at 200 and discounting 100 yards. For those who subscribe to the 200 yard zero, a bit of work with the Sierra Infinity Ballistics software program (or other similar ballistics programs) will still allow the shooter to calibrate and optimize the reticle to his particular cartridge, environmental parameters, and shooting style.



Factory Calibration

Burris Ballistic Plex scopes are of the American-standard non-magnifying reticle design. As you change the magnification, the reticle remains constant in size as the image changes in size. Therefore, the *reticle’s size in relation to the image size* (reticle subtension) *changes,* so the amount of trajectory compensation changes as the magnification changes. This necessitates that the scope be set at a specific magnification to be correctly calibrated for trajectory compensation. By design, and with simplicity in mind, the original 3X-9X Fullfield II scopes are calibrated at 9X -- the highest magnification for the scope. On subsequent scopes with higher magnification, Burris may elect to calibrate a higher magnification scope at an intermediate magnification by installing a calibration dot on the power ring.

The term “Corr@100” is often used in this article and refers to Correction at 100 yards. This refers to how high a bullet must be at 100 yards in order to impact on target at a target further down range. Some would refer to this as synonymous with Minute of Angle (MOA), which is very similar, however would be misused slightly in this discussion. For your reference, one minute of angle is 1.047 inches at 100 yards. 1.000 inches @ 100 yards versus 1.047 inches at 100 yards is small, yet it translates into 1.5 to 3 inches of point of impact variation at 500 yards for most big game cartridges.

Adaptability

There are basically five ways to fine tune the calibration of the reticle to a specific trajectory curve. Any method can be used based on your preferences, however one method may produce the most accurate results compared to the other methods.

1. Sight in at 100 yards. Using a ballistics software program, run a ballistics chart for your cartridge using 5 or 10 yard increments. If the software package does not calculate the Correction at 100 Yards (Corr@100) for each yardage, you can perform this task easily with a spreadsheet. Simply type in the yardages and the Bullet Path like in **Example 1**. The third column is calculated as follows: Corr@100 for Cartridge = "Bullet Path" divided by "yards" times "100". Simply match up the Corr@100 for the Ballistic Plex with the Corr@100 for the Cartridge. For instance, instead of the 400 yard ballistic line being dead-on at 400 yards, a less flat shooting cartridge may be dead on at 375 yards, an so forth. **See Examples 1 & 2.**

2. Sight in at 400 or 500 yards using the 400 or 500 yard ballistic line. This will decrease the long range error throughout your self-prescribed yardage limit. This method has the same effect as sighting slightly high or low at 100 yards as is discussed in section 3 below. **See Example 3.**

3. Another alternative is to do some experimentation with ballistics software programs trying several different sight-in yardages from 75 to 190 yards checking each time how closely your 400 or 500 yard trajectory table matches the amount of drop built into the reticle. It can turn out that flatter shooting cartridges may need to be sighted in 1/2 to 1" low at 100 yards to best match the rest of the yardages on the reticle, or 1/2" to 1" high at 100 yards for cartridges with more drop than that calibrated into the reticle. **Example 2** shows that a 100 yard zero results in nearly perfect calibration out to 300 yards, however 400 and 500 yard calibrations are significantly off. Fine tuning in **Example 3** shows that by simply sighting in .9 inches high at 100 yards (the same as a 158 yard zero), allows the calibration to match the reticle to very acceptable hunting accuracy out to 400 yards and is just a bit low at 500 yards which can easily be compensated for by sight holdover.

4. If your cartridge has much more drop than the example cartridges, you can re-calibrate the reticle to a lower magnification. Based on actual shooting or trajectory charts, calculate the Corr@100 yards necessary for 500 yards, for instance. The Ballistic Plex is factory calibrated for 55.3 inches of drop at 500 yards from a 100 yard zero. Therefore 55.3 inches divided by 5 is 11.06" Corr@100 in order to hit the target at 500 yards. Therefore, you would need to hold over 11.06" inches at 100 yards to be dead-on at 500 yards. Lets say that with a 100 yard zero, your specific cartridge drops 64.3

Example 1:

.308 Win @ 100 yard zero

Remington 150 gr PSPCL @ 2820

yards	Bullet Path	Corr@100 Cartridge	Corr@100 Ballistic Plex
170	-2.04	-1.20	
180	-2.58	-1.43	
190	-3.18	-1.67	-1.54
200	-3.84	-1.92	
210	-4.58	-2.18	
220	-5.38	-2.45	
230	-6.26	-2.72	
240	-7.2	-3.00	
250	-8.22	-3.29	
260	-9.32	-3.58	
270	-10.5	-3.89	
280	-11.76	-4.20	
290	-13.09	-4.51	-4.51
300	-14.52	-4.84	
310	-16.02	-5.17	
320	-17.62	-5.51	
330	-19.31	-5.85	
340	-21.09	-6.20	
350	-22.96	-6.56	
360	-24.93	-6.93	
370	-27.01	-7.30	
380	-29.18	-7.68	-7.52
390	-31.46	-8.07	
400	-33.85	-8.46	
410	-36.34	-8.86	
420	-38.95	-9.27	
430	-41.68	-9.69	
440	-44.53	-10.12	
450	-47.5	-10.56	
460	-50.59	-11.00	-11.06
470	-53.81	-11.45	

*Corr@100 Cartridge = Bullet Path) yards x 100

Example 2:

.308Win at 100 yard zero

yards	Reticle Drop	150gr 2820fps Drop	Drop variance from reticle	actual yardage zero
100	**0.00**	**+0.0**	*+0.0*	*100*
200	**-3.1**	**-3.8**	*-0.7*	*185*
300	**-13.5**	**-14.5**	*-1.0*	*290*
400	**-30.1**	**-33.9**	*-3.8*	*375*
500	**-55.3**	**-64.3**	*-9.0*	*460*

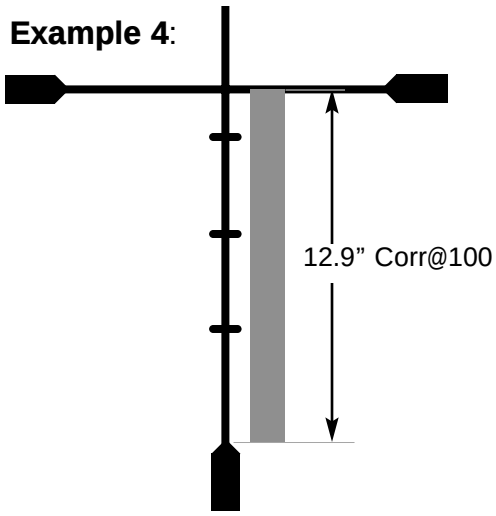
Example 3:

.308Win at 158 yard zero

yards	Reticle Drop	150gr 2820fps Drop	Drop variance from reticle
100	**0.00**	**+0.9**	*+0.9*
200	**-3.1**	**-2.0**	*+1.1*
300	**-13.5**	**-11.7**	*+1.8*
400	**-30.1**	**-30.1**	*+0.0*
500	**-55.3**	**-59.6**	*-4.3*

inches at 500 yards as in **Example 2**. This would require 64.3 divided by 5, or 12.9 inches Corr@100 yards to be dead-on at 500 yards. Fortunately, Burris Ballistic Plex scopes feature a non-magnifying reticle design. As you change the magnification, the reticle remains constant in size while the image size changes. The *reticle's size in relation to the image size* (reticle subtension) *changes,* and therefore the amount of trajectory compensation changes as magnification changes. The scope must be set at a specific magnification to be correctly calibrated for trajectory compensation. On 3X-9X Fullfield II scopes, the reticle calibration is set at 9X -- the highest magnification. Going back to the 12.9 inches at 100 yards example, simply place grid paper or a ruler at 100 yards and then turn the power ring until you bracket 12.9 inches between the center of the reticle and the 500 yard reference as shown in **Example 4**. In **Example 5**, the power ring would be roughly at 8X magnification, providing a dead-on reference for 500 yards, and highly accurate 200, 300, and 400 yard references. Be sure to somehow mark a new calibration dot or line on the power ring so you can return to the perfect calibration in the future.

Example 4:



5. If your cartridge has much less drop (is flatter shooting) than the example cartridges, you may want to use the center of the reticle as both a 100 and 200 yard aiming reference. This would make the first ballistic line roughly a 300 yard reference, the second line a 400 yard reference, and so on. A good rule of thumb would be to sight in with the second ballistic line at 400 yards which would usually be between a 125 to 175 yard zero with the center of the reticle. **See Example 6**. Also notice that the Reticle Drop figures start at 300 and go to 600, and differ from the other charts which use the first ballistic line as a 200 yard reference.

Example 5: roughly 8X Magnification
.308 Win at 100 yard zero

yards	Calibrated Reticle Drop	*Re-Calibrated Reticle Drop*	150gr 2820fps Drop	variance from recalibrated reticle
100	**0.0**	*+0.0*	+0.0	*+0.0*
200	**-3.1**	*-3.6*	-3.8	*-0.2*
300	**-13.5**	*-15.7*	-14.5	*+1.2*
400	**-30.1**	*-35.0*	-33.9	*+1.1*
500	**-55.3**	*-64.3*	-64.3	*+0.0*

Charts and Ballistics Programs Are Close.
Actual Shooting is Better.

The nature of ballistics is such that everything is theoretical and if any one of the variables change, so does the ballistic table. At long ranges, changes in environmental factors can add up to significant variances. Temperature affects both muzzle velocity and air density. Changes in humidity, barometric pressure, and altitude can all add up to several inches of trajectory variance at longer ranges. The height that the scope is mounted above the bore should be factored into generating theoretical trajectory charts. Finally, if at all possible, one should shoot at each 100 yard increment at the altitude and environmental conditions he is likely to experience while hunting or competing in order to both develop a trajectory chart and to verify impact for each ballistic line of the Ballistic Plex reticle.

Example 6:
7mm Mag at 170 yard zero
Handloaded Ammunition

yards	Reticle Drop	150gr 3140fps Drop	Drop variance from reticle	actual yardage zero
100	**+0.0**	+0.7	*+0.7*	*170*
200	**+0.0**	-0.9	*-0.9*	*170*
300	**-4.7**	-7.0	*-2.3*	*260*
400	**-18.0**	-18.0	*+0.0*	*400*
500	**-37.6**	-34.4	*+3.2*	*525*
600	**-66.4**	-57.0	*+9.4*	*655*

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