TARGET KNOB SETTINGS AT 0.1 MIL INCREMENTS

by Major John L. Plaster, USA (ret)

A long-range rifleman recently asked me to provide target knob settings so he could properly adjust the elevation knob on his new Millett LRS scope, which has increments of 0.1 mil-per-click. He wanted to be able to shoot all the way to 1000 yards, and had looked on the Internet but could not find this data anywhere. Instead of providing the data solely for him and his load, I'm going to explain how you can calculate this yourself, for any load and any caliber rifle cartridge.

Why 0.1 Mil Target Knobs?
The 0.1 mil increment is a fairly new development, driven by a desire to synchronize a shooter's mil-dot reticle with his elevation and windage adjustments. Think of it this way: When a spotter looks through a mil-dot reticle and sees a shooter's bullet miss, he does not have to translate a correction from mils to inches or centimeters – he just calls it in mils, and the shooter clicks off the change quickly and with great precision. It's faster and more precise than 'guestimating,' or translating from one kind of measurement to another, and then compelling the shooter to interpret how to adjust his scope. One mil equals 3.6 inches at 100 yards; therefore, 1/10th of that, 0.1 mil, or one click, equals 0.36" – roughly a third of an inch – at 100 yards. That's pretty close to the common ¼ inch increment we find on most riflescopes. But I'm citing that just for background information – the great value of 0.1 mil increments is that you're in synch with your mil-dot reticle. You don't have to keep translating back and forth from mils to inches.

Calculating 0.1 Mil Increments for Target Knobs
To calculate elevation and windage settings using mils, you'll first have to learn what one mil equals at various distances – for instance, since one mil equals 3.6 inches at 100 yards and it's an angular measurement, it gradually expands to 36 inches at 1000 yards. As a minimum you'll need to know exactly what that one mil angular width is at hundreds of yards, as shown here.

One Mil Equivalents at Hundreds of Yards

100	200	300	400	500	600	700	800	900	1000
3.6"	7.2"	10.8"	14.4"	18.0"	21.6"	25.2"	28.8"	32.5"	36.0"

Many shooters want to calculate the settings finer than this, at 25-yard increments, so it's necessary to see what one mil equals at 25 yard increments, which I have posted below. At hundreds of yards, the measurements are the same as above – it's just that I've broken it down into more precise 25-yard increments.

One Mil Equivalents at 25-Yard Increments, 100 to 1000 Yards

100 Yards One Mil Equals 3.6"
125 Yards One Mil Equals 4.5"
150 Yards One Mil Equals 5.4"
175 Yards One Mil Equals 6.3"
200 Yards One Mil Equals 7.2"
225 Yards One Mil Equals 8.1"
250 Yards One Mil Equals 9.0"
275 Yards One Mil Equals 9.9"
300 Yards One Mil Equals 10.8"
325 Yards One Mil Equals 11.7"
350 Yards One Mil Equals 12.6"
375 Yards One Mil Equals 13.5"
400 Yards One Mil Equals 14.4"
425 Yards One Mil Equals 15.3"
450 Yards One Mil Equals 16.2"
475 Yards One Mil Equals 17.1"
500 Yards One Mil Equals 18.0"
525 Yards One Mil Equals 18.9"
550 Yards One Mil Equals 19.8"
575 Yards One Mil Equals 20.7"
600 Yards One Mil Equals 21.6"

625 Yards One Mil Equals 22.5"
650 Yards One Mil Equals 23.4"
675 Yards One Mil Equals 24.3"
700 Yards One Mil Equals 25.2"
725 Yards One Mil Equals 26.1"
750 Yards One Mil Equals 27.0"
775 Yards One Mil Equals 27.9"
800 Yards One Mil Equals 28.8"
825 Yards One Mil Equals 29.7"
850 Yards One Mil Equals 30.6"
875 Yards One Mil Equals 31.5"
900 Yards One Mil Equals 32.5"
925 Yards One Mil Equals 33.3"
950 Yards One Mil Equals 34.2"
975 Yards One Mil Equals 35.1"
1000 Yards One Mil Equals 36.0"

The only other thing you need is the Bullet Path data for your round, expressed as inches of trajectory at various distances. To find your cartridge's Bullet Path data, explore the Internet, look at ammo manufacturers' websites, or use an exterior ballistic software program. I used the Sierra Infinity V6 Program to obtain my data. As you'll see below, first I listed the distance in yards as the left column. The next column to its right lists the Bullet Path for the .308 Winchester, 168-gr. BTHP Match load, based upon a 100-yard zero. (This .308 load is the most popular one used by American police snipers.) The next column lists what 1 Mil equals at each 25-yard distance – using data that I listed above. **No matter the caliber and load you're calculating, always use this data for each distance**. These mil measurements don't change. To make sure that readers understand how to calculate the elevation in mils, I inserted in parenthesis, (Divide by), to show that at each distance, you simply take the Bullet Path (in inches) and divide it by what 1 Mil equals at that distance, also in inches. The result should be expressed as tenths of a mil, which is listed under, "Yields Elevation in Mils." The final step is to take the Elevation in Mils, round it off to the closest 10th of a Mil, and express it as a Target Knob Setting. To keep the setting clear, I express it as Mils and Clicks, so that I know exactly where to set my knob.

Study this data for a moment, and then we'll look at an example.

.308 Winchester, 168-gr. BTHP Match @ 2600 FPS

Distance [Yards]	Bullet Path [inches]	1 Mil a this Yardage	Yields Elevation in mils	Setting on 0.1 Mil Target Knob
100	Zero	(Divide by) 3.6"	Zero	Zero
125	-0.46	(Divide by) 4.5"	0.1 mil	0 Mil / 1 Click
150	-1.31	(Divide by) 5.4"	0.24 mil	0 Mil / 2 Clicks
175	-2.57"	(Divide by) 6.3"	0.40 mil	0 Mil / 4 Clicks
200	-4.24"	(Divide by) 7.2"	0.58 mil	0 Mil / 6 Clicks
225	-6.35"	(Divide by) 8.1"	0.78 mil	0 Mil / 8 Clicks
250	-8.91"	(Divide by) 9.0"	0.99 mil	1 Mil / 0 Clicks
275	-11.94"	(Divide by) 9.9"	1.20 mil	1 Mil / 2 Clicks
300	-15.47"	(Divide by) 10.8"	1.43 mil	1 Mil / 4 Clicks
325	-19.51"	(Divide by) 11.7"	1.66 mil	1 Mil / 7 Clicks
350	-24.09"	(Divide by) 12.6"	1.91 mil	1 Mil / 9 Clicks
375	-29.24"	(Divide by) 13.5"	2.16 mil	2 Mil / 2 Clicks
400	-34.97"	(Divide by) 14.4"	2.42 mil	2 Mil / 4 Clicks
425	-41.33"	(Divide by) 15.3"	2.70 mil	2 Mil / 7 Clicks
450	-48.34"	(Divide by) 16.2"	2.98 mil	3 Mil / 0 Clicks
475	-56.04"	(Divide by) 17.1"	3.27 mil	3 Mil / 3 Clicks

500	-64.46"	(Divide by) 18.0"	3.58 mil	3 Mil / 6 Clicks
525	-73.63"	(Divide by) 18.9"	3.89 mil	3 Mil / 9 Clicks
550	-83.60"	(Divide by) 19.8"	4.22 mil	4 Mil / 2 Clicks
575	-94.41"	(Divide by) 20.7"	4.56 mil	4 Mil / 6 Clicks
600	-106.10"	(Divide by) 21.6"	4.91 mil	4 Mil / 9 Clicks
625	-118.71"	(Divide by) 22.5"	5.27 mil	5 Mil / 3 Clicks
650	-132.29"	(Divide by) 23.4"	5.65 mil	5 Mil / 6 Clicks
675	-146.90"	(Divide by) 24.3"	6.04 mil	6 Mil / 0 Clicks
700	-162.58"	(Divide by) 25.2"	6.45 mil	6 Mil / 5 Clicks
725	-179.40"	(Divide by) 26.1"	6.87 mil	6 Mil / 9 Clicks
750	-197.40"	(Divide by) 27.0"	7.31 mil	7 Mil / 3 Clicks
775	-216.64"	(Divide by) 27.9"	7.76 mil	7 Mil / 8 Clicks
800	-237.19"	(Divide by) 28.8"	8.41 mil	8 Mil / 4 Clicks
825	-259.11"	(Divide by) 29.7"	8.72 mil	8 Mil / 7 Clicks
850	-282.46"	(Divide by) 30.6"	9.23 mil	9 Mil / 2 Clicks
875	-307.30"	(Divide by) 31.5"	9.75 mil	9 Mil / 8 Clicks
900	-333.71"	(Divide by) 32.5"	10.26 mil	10 Mil / 3 Clicks
925	-361.74"	(Divide by) 33.3"	10.86 mil	10 Mil / 9 Clicks
950	-391.46"	(Divide by) 34.2"	11.44 mil	11 Mil / 4 Clicks
975	-422.93"	(Divide by) 35.1"	12.04 mil	12 Mil / 0 Clicks
1000	-456.22"	(Divide by) 36.0"	12.67 mil	12 Mil / 7 Clicks

Using the data above, let's determine the Target Knob Setting for 775 yards. The Bullet Path data told you the .308, 168-gr. bullet is -216.64 inches below your zero at 775 yards. Next, you see that 1 Mil equals 27.9 inches at 775 yards. Dividing the Bullet Path, 216.64, by what 1 Mil is at that distance, 27.9 inches, yields 7.76 mils. Thus, to be dead-on at 775 yards, you set the Target Knob at 7 Mil, plus 8 Clicks, because you rounded off that .76 of a mil. (Remember, on this Target Knob, one click equals 0.1 mil, and it takes ten clicks to equal a full mil.) Keep in mind that all of this data is theoretical – firing it with your scope, your rifle and your ammo may result in slight variances – perhaps a click or two. For even more accurate elevation knob settings, test fire at assorted distances and refine your data. Ultimately, your Target Knob Data should be written on a 3 x 5 card, covered with clear plastic, and carried in the field for quick, exact reference. Now here's an added bonus: You can also use that data card for precise **holdovers** when you have to fire fast – but there's one limitation.
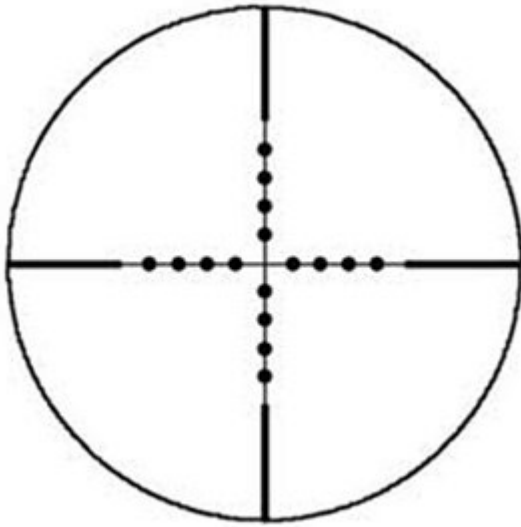
Mil-dot reticle

If you don't have time to adjust your elevation knob, use your mil-dot reticle and hold over the indicated amount. For instance, to quickly engage a target at 500 yards, simply hold 3-1/2 mils over it – which is very close to the actual 3.58 mils you computed, above. Here's another example: At 250 yards, hold one mil high – which is almost exactly the 0.99 mil indicated on the data card. Now here's the limitation: **Using a mil-dot reticle, you cannot hold more than 5 mils over a target.** That's because there are only four dots below the crosshair center, plus the edge of the thick reticle line – these are your 5 Mil aiming points for holding high. Looking at the .308, 168-gr. BTHP data, above, you'll see that you can use mil holdover to a maximum of 600 yards (4.91 mils) because any further distance requires more than 5 mils of holdover. That's a limitation – but at shorter distances, you'll be able to make very fast shots. A 0.1 Mil target knob may at first appear complicated – but once you've used it and become accustomed to it, you'll really appreciate its speed and precision.