



The 4500 NV Pocket Weather Tracker by Nielsen-Kellerman.

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Back ground

Why do I need a weather meter?

Al though the typical law enforcement sniper engagement is well under 100 yards, first responders need to be prepared to play in a game where the cards dealt are not always under your control. Waiting for a federal agency or military team to arrive may not be the best option, and the best way to train is for the worst case scenario.

The law enforcement or military sniper needs to operate under any condition and train for all situations. As a S.W.A.T. sniper for a local police department you may be called on to cover an entry team preparing to board an aircraft and your closest point of approached may be 200 or 300 yards away. It is at this range that ballistics begins to come into play for most any caliber and beyond 300 yards ballistics is critical to a well placed shot.

Altitude, temperature, barometric pressure, and relative humidity are critical pieces of data. As is wind speed and direction. What used to be a good three hundred yard zero may now be a full minute or more off. At a range of 300 yards a one minute error makes a three inch difference in the point of impact and if your target needs to have his or her nervous system traumatized a one minute change in point of impact may be equal to a miss. Therefore, understanding ballistics, the performance of your platform and maintaining an accurate log book are critically important to a sniper's success, and regardless of where you work a weather meter is an indispensable tool and one that should be in your kit.

What should I look for in a weather meter?

For tactical applications, a weather meter should provide you with a minimum of wind speed, temperature, altitude, relative humidity and barometric pressure – relative humidity being the least important of the five required measurements. Your weather meter should also be robust enough to withstand hard knocks and harsh operating conditions, but above all it needs to be accurate. A customizable display is also important, in this writer's judgment, because you and your partner need to be covering the target and not flipping through menus on an LCD display. The display should also be large enough to read under all lighting conditions with backlighting that preserves your night vision.

Nielsen-Kellerman

The name of Nielsen-Kellerman Company has been around for a number of years. The company designs manufactures and distributes waterproof instruments used for all types





of applications and in numerous activities, where knowledge of atmospheric is important to the performance of the individual participants. Their product line includes Kestrel® Pocket Weather Meters, Interval® Timing Systems and NK Electronics for Rowing and Paddling. Nielsen-Kellerman instruments can be found in racing pits as well as the battlefields in Iraq and Afghanistan.

The company has been in business for over twenty-five years and has built a reputation on customer service and product excellence. Nielsen-Kellerman products are made in the United States and carry a two year warranty.

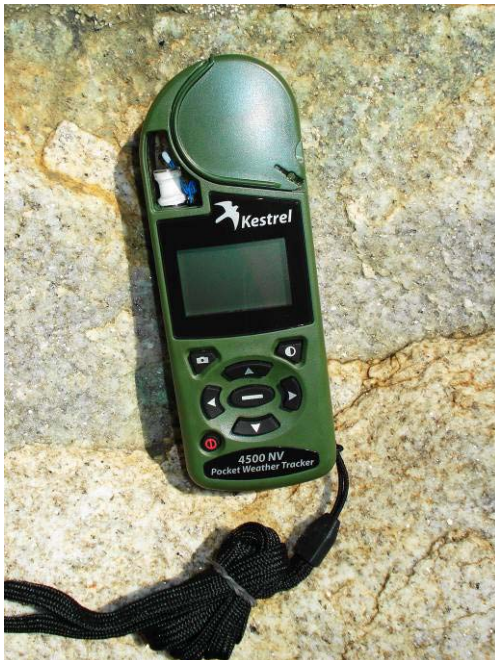
I also have to say that the folks at NK are just fantastic to work with. After looking over their latest high end weather meter, the 4500NV, at SHOT 2007 in Orlando, I decided to do a comprehensive review of their flagship pocket weather meter. I contacted Christy in their sales and marketing group to request a sample for my review, and in a few weeks, I had a sample at my doorstep.

Much to my chagrin, the first meter they sent had a bad barometric pressure sensor. When I discovered the problem, I called NK and spoke with Angie in their technical support group followed by Michael, the product manager, and after a brief and very pleasant conversation, Michael directed one of his team mates to send a replacement. The new meter arrived and the problem was solved. It was an excellent experience and confirmed that NK's commitment to customer service is more than lip service.

On behalf of Sniperworx e-magazine I'd like to thank all the great folks at NK and especially Christy, Angie and Michael for making this review possible.

Review

First Impressions



NK's top of the line meter offers the same form factor as its older sibling, the Kestrel 4000. Control and component locations are exactly the same so there is nothing new to get used to. I always find this to be a good feature because it gives the operator an opportunity to gain proficiency across different models. However, the 4500NV has some major and significant new features not found in any of their other models. To start with, the 4500 NV offers a built in electronic compass, the compass can be configured to indicate true bearings as well as magnetic.

The inclusion of the compass makes it possible for the operator to accurately determine direction as well as speed. Traditionally, sniper's have used clock references to adjust for wind. For example, wind of 10 mph at 9 o'clock. With the 4500NV the operator now knows that wind is 10 mph from 270°. This is a valuable piece of information and a significant advantage in arriving at a good firing solution. The data





collected by the meter can be used by a number of ballistic programs like the Horus Vision's Atrag.

In addition to the basic wind functions the 4500NV also provides crosswind, headwind and tailwind data. This enables the sniper team to better assess the crosswind impact on the firing solution. So, in one package, the 4500NV provides everything that a sniper needs to arrive at an accurate firing solution. I'll have a bit more to say about the crosswind feature later in the article.

The unit supplied was OD green and shipped with batteries, a lanyard and a cloth storage pouch. The package also contained a battery shim. The shim functions to keep the batteries from moving inside the battery compartment; this is an important because batteries have a magnetic property of their own and if the batteries were allowed to rotate, that rotation would affect the compass calibration and induce an error. In fact, if the battery compartment is opened after the compass calibration is performed or if the batteries are replaced the meter's compass needs to be recalibrated. I might add here that the calibration process is very straight forward and takes no time at all to perform.

The meter's display is approximately .8 inches high and 1.25 inches wide. The characters are easy to see, even for individuals requiring eyesight correction, and the display is also backlit. I used the meter at night without any loss of night vision.¹

The 4500NV weighs a mere 3.6 ounces, is approximately 5 inches high and just under 2 inches wide, easily fitting in a cargo pocket or pouch. Kestrel also offers, as an option, a MOLE pouch for your meter. As of this writing the available colors are khaki, olive drab and black. Finally, each NK meter is shipped with a Certificate of Conformity that authenticates its origins and provides detailed specifications including accuracy figures.



Figure: Screen Shots of the Direction, Headwind and Crosswind functions.

Day 1

If you're like me, the less time you spend reading operating instruction the happier you are, but I'll break from that norm to suggest that you spend some quality time with the instruction manual because it will serve you well. Reinforcing that point, had I not taken the time to read the owner's pamphlet, I would have surely discarded the battery shim thinking that it was part of the packaging –and speaking of packaging, make sure that you

¹ Note that the NV designation does not mean that the Kestrel 4500NV is night vision equipment capable.



keep the original box that your unit came in because you will need it to perform the compass calibration- it's not a requirement but it make things much easier.

In addition to reading the manual there are other "due diligence" activities that you need to complete. The most involved of these is the compass calibration so I'll start there.

The first thing you'll need for a good compass calibration is a good location.

I live in the heart of Atlanta so I'm surrounded by high rise buildings of all shapes and sizes. There is more steel and iron around me than you can shake a stick at so finding a wide open space was not the easiest thing in the world. Fortunately, I also live just a few blocks from Piedmont Park and this is about as good as it gets for a compass calibration in metro Atlanta.

Next, I recommend that you have the following materials with you: a quality Lensatic compass, this serves as your reference instrument. You will also need a note pad. On that pad you'll want to create 4 columns, one for the reference target label, one for the Kestrel 4500NV compass reading, one for your reference compass and the last column label difference. With those things out of the way, you are ready to perform the compass calibration, but before you begin, let me caution you by saying that while performing the compass calibration, you will need a way to keep the 4500NV meter perfectly level side to side and front to back. The best way to do this is to use the original product packaging as it will give you a steady platform. NK has included a foam cutout to hold the meter in place during the procedure. I ended up drilling two holes in the bottom of the original product packaging so that I could attach a camera tripod shoe to the base; I then mounted the meter on my tripod so that I had a perfectly level platform for the calibration. It also made it very easy to rotate the meter smoothly during the calibration process. So, by all means, keep the original packaging; this is also the manufacturer's recommendation. You are now ready to proceed with the compass calibration. By the way, if this all sounds very complicated to you, fear not as there is a simpler process; however, my approach will probably give you the greatest accuracy.

The first step, in the calibration process, is to select your reference targets. Use prominent fixed structures or landmarks that you can take compass bearings to. I recommend a minimum of four reference targets. The reason for doing that is very simple.



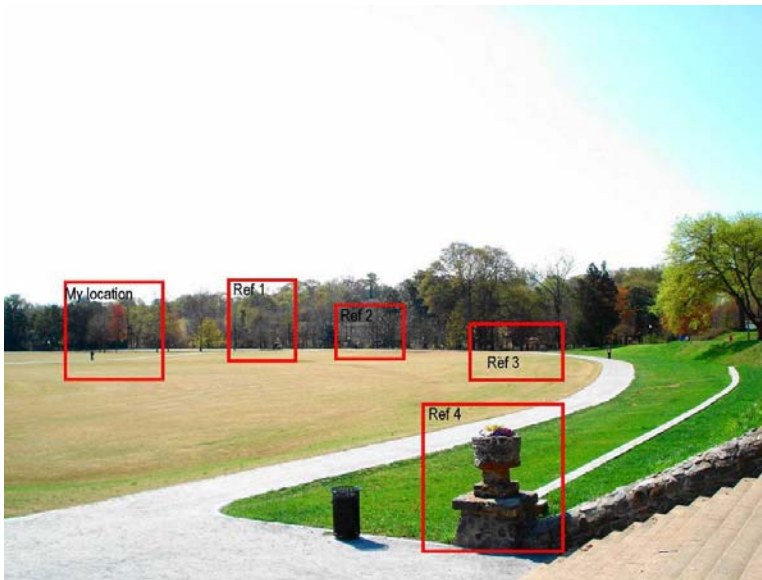


The Cartesian coordinate system has 4 quadrants as you can see from the diagram below,

<p>270° - 360° Quadrant IV</p>	<p>0° - 90° Quadrant I</p>
<p>180° - 270° Quadrant III</p>	<p>90° - 180° Quadrant II</p>

and by selecting a target in each quadrant, you can readily assess if there are any significant errors in your compass calibration. The objective when running the calibration process is to end up with less than a 3° difference between your reference compass and the wind meter's compass.

If it is not practical to find a target in each quadrant, as was my case, you will also want to choose reference targets that are a least 30 degrees apart; it makes the process less error prone. I chose four targets as designated in the picture below.



Once you have selected your targets, take a bearing, from your position, to each one using your reference compass and note that bearing in your note pad. You are now ready to perform the meter's compass calibration. To calibrate the weather meter's compass you are required to rotate the meter along its longitudinal axis three times at a rate which does not exceed 360 degrees in ten seconds. If you exceed that rate of rotation by a significant amount, the meter's logic will let you know that your rate is too high and it will abort the calibration process. The same holds true if your rate of rotation is too slow.





To begin the calibration enter the system menu and select the compass calibration option. To start the process press the select key and begin rotating the meter. During the calibration process, the meter displays a counter that lets you see the completed rotations and the number remaining. Assuming that your meter was level and the rate of rotation was acceptable, you will next see the display indicate that a calculation is being performed followed by a message indicating that the calibration has completed. You are now ready to begin taking compass bearings to your reference targets.

The key here is to be consistent. Take your measurements at the same reference point as what you did with your lensatic compass. A better way to say that is use the same spot



on your reference target to take your reading. I also needed a way to aim the test meter accurately, so in order to achieve good results I used a spot on the meter that acted as the blade on the front sight of a pistol. This is a small lip on the impeller cover that rises just above the top of the meter. All you need to do is make sure that the impeller cover is completely closed. I've illustrated this point with the picture on the left. Using this technique, I took bearings to the reference targets and recorded the magnetic bearings. I then

calculated the difference between Kestrel's meter and my reference compass for each reference target. I added these values up and divided by 4 to get an average. I repeated the process three times to see if there were improvements as I gained experience performing my procedure and by the third time I was at + or - 3 degrees between the two compasses. This isn't perfect, and I would never launch the space shuttle with this error but for our purposes it works quite well.

Now, for those of you that found this procedure entirely too rigorous, here's what you do. Place the meter in its original packaging. Use the foam cutout provided to secure the meter in the packaging. Next, go to system menu and start your calibration by holding the meter at about waist level so that you can look down on the top of the meter to ensure that it is as level as you can get it; now rotate your body along your longitudinal axis three times at the appropriate rate of speed. Voila your compass is now calibrated!

With the compass calibration out of the way, I was now ready to set the reference altitude for my location. For this procedure you **DO NOT** use the system menu. The instrument is calibrated at the factory.

To set the reference altitude, simply move through the display screens until you get to the barometric pressure screen, then press the select button and you can now set the reference altitude for your location. This is a step that must be performed for all your areas of operation. You can obtain an accurate reference altitude from your GPS receiver or a topographical map. The point is that it must be done every time you move to a new location; by doing so you ensure that your barometer is correctly updating your altimeter as you move about in that area. My reference was 981 feet above sea level.

Before leaving the Baro screen note the indicated barometric pressure at your position. Now you can move to the Altitude screen, press the select button and set the barometric



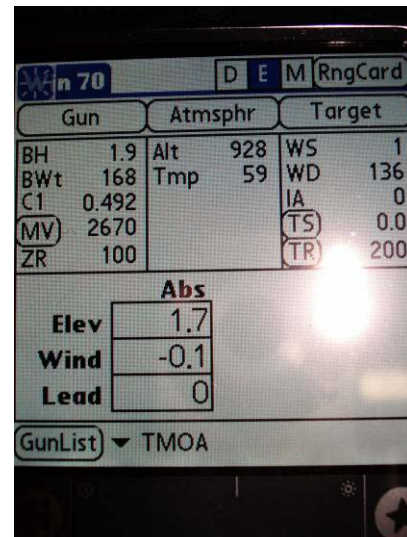


pressure. Note that you use the barometric pressure that was indicated in the Baro screen, your meter is now ready for use. One more note, unless you are the weather dude at CNN, you don't need to worry about calibrating the meter's relative humidity sensor. This is a complex procedure that requires a humidity calibration kit and it's beyond the scope of this article. Besides, relative humidity is the least critical component of an accurate ballistic calculation. As it comes from the factory, the relative humidity is accurate to $\pm 3\%$. When measuring relative humidity there are two things that you need to keep in mind and they are; do not make your measurements in direct sunlight and be sure that there is some amount of airflow. If there is no airflow allow 20 minutes or so for the sensor to stabilize.

With references set and the compass calibration complete I was now ready to use the meter with my ballistic program. For that, I chose the Atrag program sold by Horus Vision. I plugged in the values from the Kestrel meter and examined the results. As you can see the target I selected required 1.7 minutes of elevation and 0.1 minutes of left wind. My wind speed was 1 mph from 136° . Note that I chose a 200 yard target range just for illustration purposes and not for actual live fire. I was ready for the range and live fire results.

In order to validate the reliability of the cross wind function I decided to make a trip to the Hard Rock Range located in Society Hill, Alabama.

Hard Rock is windage hell. The range is owned and operated by a man that I've grown to admire greatly over the years, Capt. Jim William Huskey. Jim Huskey is with the Opelika Police Department and has trained just about every Alabama police sniper. His experience includes military and federal law enforcement training as well. He is a gentleman in every sense of the word and a great human being. His knowledge of sniping is encyclopedic. When he laid out the Hard Rock range, he made sure that every conceivable manner of crosswind was present: left to right then switching from right to left then further down range yet another direction. If you can read the Hard Rock wind consistently and reliably you truly have something to boast about. Heat and humidity are intense as is the mirage which is thick enough to cut with a knife. It's a training environment that you have to experience at least once in your life time.



Day 2 – Hard Rock Range

I arrived at the Hard Rock Range on Friday morning, May 25, 2007 and by 10:00 a.m. CST I was ready to start testing. The temperature was 80° F, humidity approaching 60% and my altimeter reading was 30.10 in Hg and steady which translated to an altitude of 486 feet. I confirmed the reference altitude with some of the other shooters present and they all felt that it was close enough for hand grenades and horseshoes. My plan was to begin shooting at 100 yds. then 200 yds. followed by 600, 700, 800, with the final shots made at 1000 yds. I set up my equipment and measured the bearing to the targets down



range. That reading was 308° with a crosswind measurement of 1.2 mph. I loaded these values in the Atrag program and fired shots at the 100 yd and 200 yd targets. I bulls eyed both 100 and 200 yard targets. I then moved to the 600 yard target and this is where the firing solution fell apart. My windage was off by 1.5 minutes and my elevation was off by an equal amount. After reviewing my data, I found the reason that my elevation was off was that I used a muzzle velocity of 2670 when I should have used an MV of 2600. This was my bad; however, the windage was consistently off and at 700 yards I could not determine if I was actually hitting the target. Needless to say, I was disappointed. But perhaps, my expectations of the crosswind function were unrealistic. After discussing the problem with some of the shooters at Hard Rock that day I came to realize that the later was indeed the case. Hard Rock, was simply too complex to be dealt with by a single instrument. This confirmed a very important point, one that I've always known to be true. No instrument, passive or active will ever replace the judgment and experience that comes from frequent practice and a well trained and experienced sniper. There simply is no substitute for that. However, does that translate to a thumb down for the Kestrel 4500NV? I think not!

Were I in an open field with limited tree cover and no obstructions to create swirling winds I would have had excellent results. However, in long range shooting scenarios of 600 yards or more, a lot happens to that bullet in-flight and there simply is no accurate way to assess that impact from the shooter's position with a passive handheld device. So it wasn't the tool that failed but the failure belongs to the evaluator who applied the tool incorrectly.

Conclusion

Kestrel's 4500 NV is a reliable and comprehensive tool that belongs in your kit. When properly applied, in open areas and for short range shooting scenarios – 300 yards or less - it will give you reliable crosswind data that can be used to accurately determine a firing solution. The addition of the electronic compass makes it possible for the shooter to accurately determine primary wind direction and speed with considerable accuracy. More so than estimating wind direction using the clock method. This alone is worth upgrading from a Kestrel 4000 for tactical applications.

Can it be improved? The answer is categorically yes. I for one would like to see Kestrel produce a meter that is solar powered so that the inherent issues with using batteries can be eliminated. I would also like to see a more precise way – perhaps a peep sight – to take compass bearings. As the product stands today, there is no consistent way to take a bearing to an intended target. Finally, I would like to see support for the Palm OS so that products like Horus Vision's Atrag can directly import data into their program (I think I'll place a bug in Art's ear on that issue).

All in all, go out and buy one. It is a quality product backed by an excellent warranty and a group of folks that are truly committed to quality customer service.

