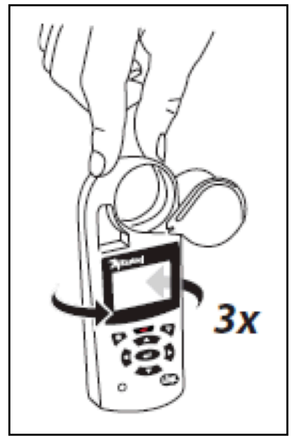
How to get started using your Kestrel

1. **Install battery and turn unit on.**
2. **Calibrate the compass.**
    a. Press the Gear button to open the main menu. Navigate to and select the Compass Calibrate line in the System submenu.
    b. Stand the Kestrel on its end, preferably on a table at least 3 feet away from any metal objects.
    c. Press the center button and begin rotating the kestrel in either direction at a constant speed, counting to between 8-10 seconds per rotation. Rotate at least three times, or until the screen says "Cal Complete".



The accuracy of compass readings will depend on how vertical the Kestrel is held during calibration and when taking a compass reading.

3. **Set latitude**
   In the Ballistics Menu, scroll to **Environment** and press select, then scroll to **Lat…** and adjust the value to match your current latitude. Remember to update Latitude if you make a significant change to your shooting location (a new state or country).
4. **Create a gun and bullet profile.**
   Bullet Data - The most accurate and complete source for long range bullet ballistics data for use with a Kestrel is the Applied Ballistics Bullet Library. This information can be found in the Kestrel LiNK Ballistics App, the Applied Ballistics Profile Loader for Windows, or on the Applied Ballistics website. Data for bullets typically used at short range may not be available in the Applied Ballistics Bullet Library. If your bullet is not listed, the manufacturer's website may be able to provide the necessary data.
    a. Open the ballistics menu and scroll to and select **Manage Guns**, then select **New Gun**.
    b. To name your gun, scroll up to **Gun…** and press select to open the gun naming screen. Use the cursors to create a new name for this gun and bullet combination.
    c. Return to the gun menu and begin inputting values for your gun and bullet combination.
    d. **MV** – Muzzle Velocity. If you have a calibrated chronograph, use it to measure your muzzle velocity. If not, enter your best estimate. You can look for the manufacturers generic estimate (based on an average barrel length) on the ammo box or on the manufacturer's website. Having an exact muzzle velocity isn't crucial at this point as we will discuss Muzzle Velocity calibration later.
    e. **DM** – Drag Model. Select either G1, G7 or a custom drag model (Elite units only) to indicate which drag model your solution will be based on. The G1 and G7 drag models are the aerodynamic profiles of a standard projectile against which your bullet's ballistic coefficient (BC) is being compared, so BC values based on the G1 drag model cannot be

used with the G7 drag model and vice versa. G7 is the preferred drag model for long range shooting but G1 is sometimes the only value available. Custom Drag Models from Applied Ballistics can be chosen in lieu of G1 or G7 (Elite units only). These custom drag models are the actual aerodynamic measurements of your bullet, not comparisons to a standard, and therefore more accurate than the G1 or G7 drag models. When custom drag models are used, the BC of the bullet and of the drag model are equal so the BC value is shown as 1.

f. **BC** – Ballistic Coefficient. The ballistic coefficient is a ratio of how aerodynamic your bullet is versus the drag model it is being compared to. If only one BC value is given by the manufacturer, it is typically based on the G1 drag model. If a G1 BC is all that is available you can enter it in BC with DM set to G1 and then switch DM to G7 which will convert the G1 BC to a G7 based BC, allowing you to run the solver using the G7 drag model.
g. **BW** – Bullet Weight. Measured in grains or grams, this is usually given as part of the bullet's name. The bullet weight of a 180 grain .308 round is 180 grains.
h. **BD** - Bullet Diameter. Ensure you are using correct measurements. The names of many calibers are not accurate representations of the actual bullet diameter. (30 caliber rounds are actually .308", not .300", 260 Remington is .264", etc.)
i. **BL** - Bullet Length. The default setting of Bullet Length is to automatically calculate a value based on Bullet Weight and Diameter. Auto calc can be turned off in the sub menu if it does not accurately estimate the length of the bullet used.

Rifle/Scope Data – In addition to Muzzle Velocity, additional information about your rifle and scope is needed to calculate a ballistic solution.

j. **ZR** – Zero Range. This is the distance to the target at which the rifle was zeroed. If the rifle is zeroed at longer ranges (200-300 yards) environmental changes cannot be ignored which is why zeroing at shorter distances (100y or 100m) is recommended. If a standard firing range is not available, the accuracy of a good laser range finder used in long range shooting should be sufficient for measuring this distance.
k. **BH** – Bore Height. Also known as Scope Height, this is the distance from the center axis of the scope to the center axis of the barrel. Measuring the vertical distance from the center of the windage turret to the center of the bolt is an easy way to find Bore Height. Being accurate to within 1/4" is all that is necessary.
l. **ZH/ZO –** Zero Height (elevation) and Zero Offset (windage) are used when the addition of a suppressor, a change in ammunition, or the addition of night vision optics changes the point of impact of your zero. For example, if adding a suppressor shifts the point of impact of your zero up one inch and to the left half an inch, input **1** for **ZH** and **-0.5** for **ZO.**

m. **RT** – Rifle Twist. This is the distance along the barrel it takes for the rifling to complete one rotation. If the Rifle twist is not known, it can be measured by pushing a tight fitting patch through the barrel and measuring the distance required for the cleaning rod to make one full rotation.
n. **RTd** – Rifle Twist Direction. Typically rifling is twisted to the right (Clockwise from the position of the shooter) but a limited number of left twist barrels do exist.
o. **Eunit/Wunit** – Elevation/Windage Unit. These are the units of measure used in the elevation and windage turrets of the scope.
    i. **Mil** –Miliradian
    ii. **TMOA** – True Minute of Angle (typically written MOA) where 1 MOA equals 1.047" at 100yds
    iii. **SMOA** – Shooters MOA, a less frequently used approximation of MOA where 1 MOA is rounded to exactly 1 inch at 100 yards.
    iv. **Clck** – A user settable value representing the angle adjustment made by each "click" or detent of the turret when turned.
p. **Eclck/Wclck** – Elevation/Windage Click Setting. If Euint or Wunit are set to **clik**, the Kestrel will provide solutions indicating the number of "clicks" the turret needs to be turned to dial the solution. The percent of a full Mil or MOA represented by each "click" of the turret must be set by the user.

5. Capture Target information.

In the main Ballistics Screen, scroll to **Tgt…** and press select. Input information about each of the following target variables.

a. **TR** – Target Range. This is the line of sight range to the target.
b. **DoF** – Direction of Fire. Measured in degrees or hours from North, this variable can be manually input or captured automatically.
    i. Capturing Direction of Fire– To capture Direction of Fire automatically, enter the DoF submenu and select **Capture.** While pointing the back of the Kestrel towards the target and holding the Kestrel vertical, press the select button.
c. **Ideg** – Inclination angle is the angle above or below the horizon to the target. In many circumstances, until the inclination angle is larger than 5-7 deg, it can safely be ignored. If an inclination angle other than 0 deg is input, a "*****" will appear next to the target range displayed on the main ballistics menu. This is to remind you to update or remove the inclination angle on subsequent shots.

6. Capture Wind information.

In the main Ballistics Screen, scroll to **Wind…** and press select. Input information about each of the following wind variables. While measuring the wind, keep the Kestrel high above the ground and pay attention to terrain features and obstructions that may put you in "dirty" or unrepresentative air. A bad wind call is the most common reason a shooter will miss so take care to measure these values as accurately as possible. If you can tell that downrange wind conditions change along the path of the bullet, take those conditions into account when applying a wind hold but remember the wind at the gun will typically have the strongest impact on the flight of the bullet.

a. **WD** – Wind Direction At The Gun. Measured in degrees or hours from the direction of fire, this variable can be input manually or captured automatically together with the other wind variables when making a wind capture.
b. **WS1** – Average Wind Speed At The Gun. This variable can be input manually or captured automatically together with the other wind variables when making a wind capture.
c. **WS2** – Maximum Wind Speed At The Gun. This variable can be input manually or captured automatically together with the other wind variables when making a wind capture
    i. Capturing Wind - To capture all the wind values together automatically, enter any of the submenus for **WD**, **WS1**, or **WS2** and select **Capture**. Next, point the back of the Kestrel into the wind and while holding the Kestrel vertical, press the select button and hold your position for at least 5 seconds, then press select again.

Note: Remember, because the wind direction (**WD**) is relative to the direction of fire (**DoF**), if you change your direction of fire, you need to update the inputs for both **DoF** and **WD**.

7. **Capture Environmental Data.**
The Kestrel Ballistics Meter feeds temperature, pressure, and humidity data directly into to the Applied Ballistics solver. While the Kestrel has a Weather Mode with Altitude, Barometric Pressure, Station Pressure, etc., solutions from the ballistics engine take inputs directly from the sensors so there is no need to adjust any settings in Weather Mode to get an accurate solution in Ballistics Mode.

In the Ballistics menu under **Environment**, the first option is **Update Yes/No.** When update is set to yes, the ballistics engine will continually pull in new environmental data and updating the solution accordingly. If the Kestrel is placed on a hot rock or if the sensor is exposed to direct sunlight, the sensors may read values dramatically different from conditions impacting the flight of the bullet. If the Kestrel is not exposed to good, ambient airflow, it is recommended that environmental conditions be captured and then environmental update be turned off.

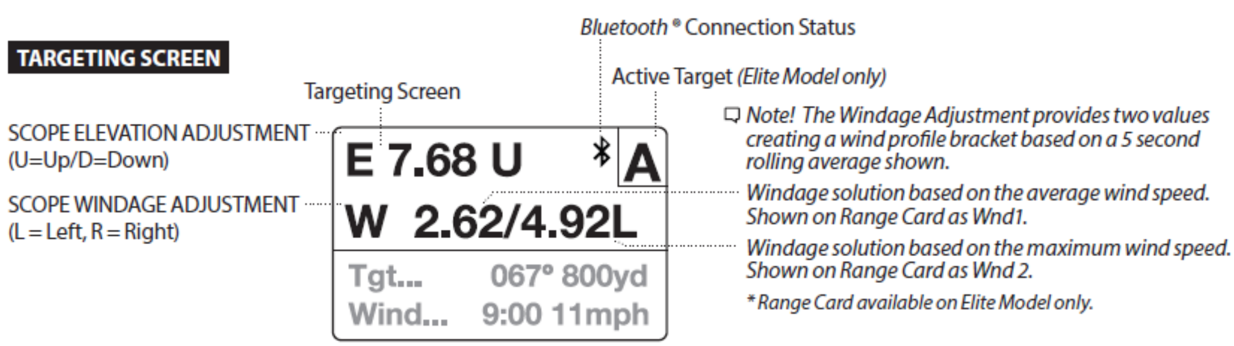
To make an environmental capture, turn **Update** to **Yes**, then expose the sensors to ambient air flow by waving it back and forth or swing it by the lanyard till environmental values stop updating. If the Kestrel has been recently moved from one set of conditions to another (removed from a warm pocket or car into cold air, picked up off the hot ground, etc.) this could take a few moments. To finish making the capture, quickly set **Update** back to **No**. Repeat this process any time conditions change or about every thirty minutes.

8. **Vane Mount Use – Continuous Capture**

For hands free use of a LiNK enabled unit, the Kestrel can be paired with a mobile device for use with apps (Kestrel LiNK Ballistics) or with a LiNK enabled Laser Range Finder. To utilize the full capability of the unit, the Kestrel can be placed in continuous capture mode in the Rotating Vane Mount on a tripod (available separately) which will place the Kestrel in good airflow and allow it to update wind speed and wind direction in real time. To put the Kestrel in continuous capture mode first select a gun profile and input Direction of Fire as explained earlier. Then highlight **Wind…** on the Ballistics Menu and press the capture button (top-center). The word **Wind…** will change to **W>…** and the buttons on the Kestrel will be locked until the capture button is pressed again. Putting the Kestrel in continuous capture mode does not override the environmental update setting (which could be set to on or off) but will update the ballistics solution based on real-time wind values.

Note: Spin Drift causes a horizontal shift in point of impact caused by the change to the bullets axis of rotation as it follows the arch of its trajectory. Aerodynamic Jump causes a vertical shift in point of impact due to wind moving perpendicular to the flight of the bullet. Its impact increases when shooting in increased crosswind conditions. The Coriolis Effect can cause either a vertical or horizontal shift in point of impact, or a combination of the two depending on the direction of fire and the rotation of the earth underneath the bullet while in flight. Both the Sportsman and Elite Kestrel models account for Spin Drift, Aerodynamic Jump and Coriolis in their solutions. Always remember to input the correct direction of fire, wind direction and wind speed before taking a shot to make sure the Kestrel is giving you both an accurate elevation and windage hold.

Now that all the gun, bullet, target, wind, and environmental inputs have been set in the Kestrel, the solution provided on the targeting screen will be based on your environment and shot. Take a minute to familiarize yourself with the values on the screen and how to implement them in your scope. Please note that solutions on the Kestrel's targeting screen are given referencing point of aim, so W 3.20L indicates a change in point of aim is needed 3.20 to the left of the target.



9. **Calibrate Muzzle Velocity - Check Solution Within Supersonic Range**

To check the muzzle velocity we input at the beginning is accurate and to correct for sources of error from other inputs, the next step is to run the Muzzle Velocity Calibration routine.

a. In the **Gun** submenu, scroll to **MV** and press select, then scroll to and select **Cal MV.**
b. In parentheses at the top line of the Cal MV screen is the distance at which the bullet reaches Mach 1.2 or the distance to the supersonic/transonic boundary. This is the recommended range at which to calibrate MV. Calibration should take place within 90%-100% of the recommended range. Calibrating at less than 80% of the recommended range or at distances beyond the recommended range will result in an invalid calibration.
c. The second line says **Range…**. Scroll left or right to input the actual range at which you are calibrating.
d. The third line is **Drop…**. This is the point of impact calculated by the Kestrel based on the muzzle velocity estimate and other inputs (including WD and DoF) already entered into the Kestrel. Input the equal but opposite elevation hold to correct for the calculated drop into your scope. For example, a point of impact **Drop…** of 10 mils would require inputting an elevation solution of 10 mils Up. Take a few shots to establish the actual point of impact at the calibration range, and then adjust **Drop...** to match. For example, if the point of impact is 0.5 mils high, subtract 0.5 mils from **Drop…**. If the correct wind values have been input, you can ignore how much the bullet missed to left or right.
e. Adjusting **Drop…** will calculate a new muzzle velocity (**MV**) which will be indicated by a +/- depending if the new MV has been calibrated up or down. Pressing exist and accepting the new muzzle velocity will automatically update your gun profile with the new **MV** value.
f. After calibrating muzzle velocity near the transonic boundary, confirm your data by returning to the targeting screen and entering new target information for a target roughly half the distance to your calibration range. Take a few shots and make sure your elevation holds are still correct.

10. Calibrate DSF (Drop Scale Factor) - Check solution in Trans/Subsonic range (Elite units only)

DSF calibration creates a scaling factor tied to a specific Mach number which adjusts the calculated drop of the bullet. DSF calibration impacts ballistic solutions in the transonic and subsonic range of the bullet only. DSF calibration is of particular use when shooting beyond the supersonic range of a bullet while using a G1 or G7 standard drag model but is typically unnecessary if using a custom drag model.

a. To calibrate DSF, first ensure MV has been calibrated correctly, then enter the **Gun** submenu, scroll down to **Cal DSF…** and press select.
b. Just like in the **Cal MV** menu, the top line of the Cal DSF screen shows the recommended range at which to calibrate DSF which is the distance at which the bullet reaches Mach 9. Calibration should take place at a range at least 90% of the distance to the recommended range. Calibrating at less than 80% of the recommended range will result in an invalid calibration.

c. The second line says **Range…**. Scroll left or right to input the actual range at which you are calibrating.
d. The third line is **Drop…**. This is the point of impact calculated by the Kestrel based on the inputs (including WD and DoF) already entered into the Kestrel. Input the equal but opposite elevation hold to correct for the calculated drop into your scope. For example, a point of impact **Drop…** of 10 mils would require inputting an elevation solution of 10 mils up. Take a few shots to establish the actual point of impact at the calibration range, and then adjust **Drop...** to match. For example, if the point of impact is 0.5 mils high, subtract 0.5 mils resulting in a new **Drop…** of 9.5. If the correct wind values have been input, you can ignore how much the bullet missed to left or right.
e. Adjusting **Drop…** will calculate a new Drop Scale Factor (**DSF**) value which will be indicated by a +/- depending if the new DSF value has been calibrated up or down. Pressing exist and accepting the new DSF value will automatically add it to the list of up to 6 DSF calibration points that can be created to calibrate DSF through the transonic and subsonic range of the bullet. A single DSF calibration exercise can create more than one DSF data point. If a new DSF value is created, any DSF values measured at lower Mach numbers (typically shorter distances) will automatically be deleted. All DSF values can be viewed and deleted in the **View DSF…** table.
f. After calibrating DSF beyond the transonic boundary, confirm your data by continuing to shoot at further targets. If holds become inaccurate at a longer range, run the Cal DSF function again to add a new DSF calibration point at a lower Mach number.

Congratulations, you have now calibrated your Kestrel and will receive accurate solutions through the supersonic (Sportsman Models) and Transonic/Subsonic (Elite Models) range of your bullet in any weather or at any altitude without needing to re-zero or adjust your solution.

Once you are familiar with the basic operation of your Kestrel, you can begin to explore some of the more advanced features such as:

- Using the Range Card and Ballistics Table (Elite Models Only) to quickly engage targets at multiple ranges and learn relevant ballistics information for your shot.
- Setting Muzzle Velocity Temp Tables to automatically adjust your muzzle velocity based on ambient temperature conditions.
- Set multiple targets (Elite Models Only), each with their own DoF, Wind value, and inclination angles for quickly engaging targets in multiple directions.
- Create multiple guns to easily switch between rifles or to test a new load.
- Set Zero Offset values to quickly adjust to shooting suppressed or with night vision optics.
- Using the Wind Speed measurement in Weather Mode to train yourself to read wind speed in your environment and make improved downrange wind calls.

For more information on the influence of wind at the gun vs wind at the target see:
http://www.nvisti.com/wp-content/uploads/2014/06/NVDOC1403-Wind.pdf