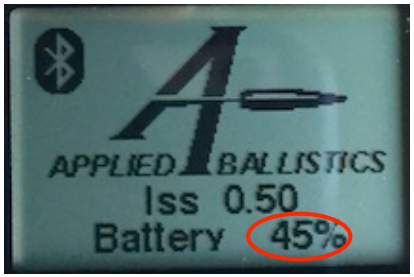
Set up and use of the Kestrel K5 Applied Ballistics system

Turn on



Battery level will be inaccurate if the wrong type battery is selected in system. System defaults to lithium battery. Only Lithium should be used. Alkaline may leak and damage the system if the unit is stored in kit with a button depressed over a period of time.

Powers up in AB mode

Backlight; Space; Double tap to shortcut between WX and AB mode without going through menu – shortcuts to the last screen you left in weather mode – recommend you jump back and forth to wind and AB mode.

Exit/menu

Up

Left

Enter

On/Off

Capture / Delete

Right

Down

AB mode

Home screen

Based on the Weapon selected

Elevation based on Range, Environment settings, winds, DOF. MILS or MOA based on operator units selection

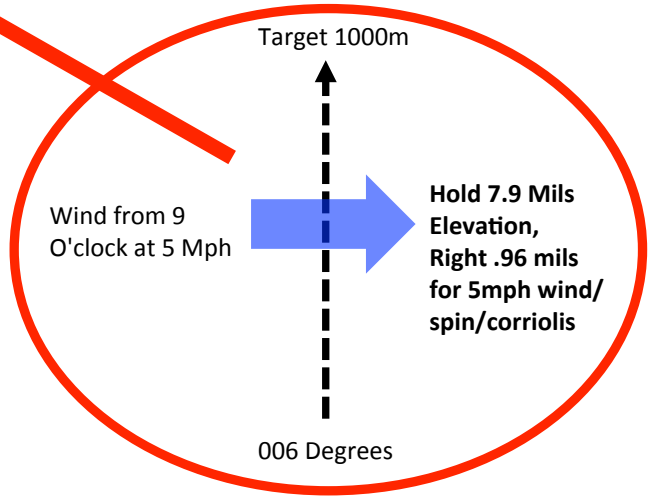
Windage based on Range, environmental settings, winds, DOF. MILS or MOA based on operator units selection

Tgt = Target data – here it displays 006 deg magnetic azimuth DOF to a 1000m target

W = Wind 1 (0.96 mils – 5mph) / Wind 2 (2.32 mils 10mph) hold L for the 1000m

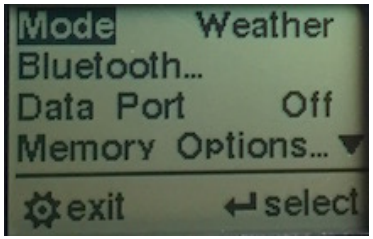
Target A - default when using manual input ranges. Can select A-F in settings when fixed target sites are used.

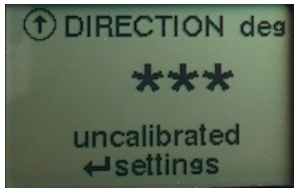
Wind setting – displays wind from 9 o'clock, Wind 1 of 5mph, Wind 2 is under wind settings



MENU → Weather mode

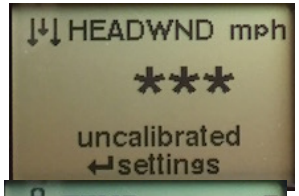
Menu → System → Measurements, to turn off screens not needed

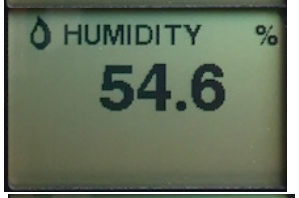


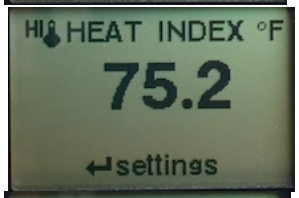


Wind - shortcut jump between AB and WX to this screen – likely the only screen and weather function you will ever use

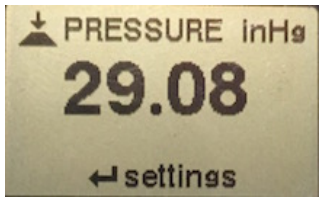
ALL OTHER WX needs are in the AB mode under Environment

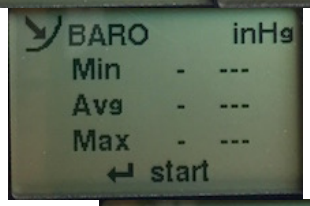


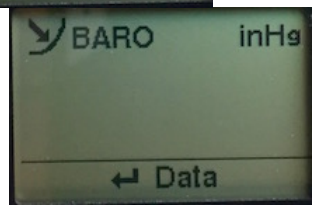




The PRESSURE screen shows Station Pressure and you cannot manipulate it – it is the pressure used in the balletic engine to ensure you are using Station Pressure to determine Density Altitude vice mistakenly using local pressure







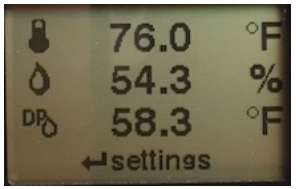
Each Weather screen has two additional screens, a Min, Ave, Max screen and a historical graph – simply right and left arrow to get back to main screen

Adjust to actual Local pressure to get accurate altitude

User Screen 1

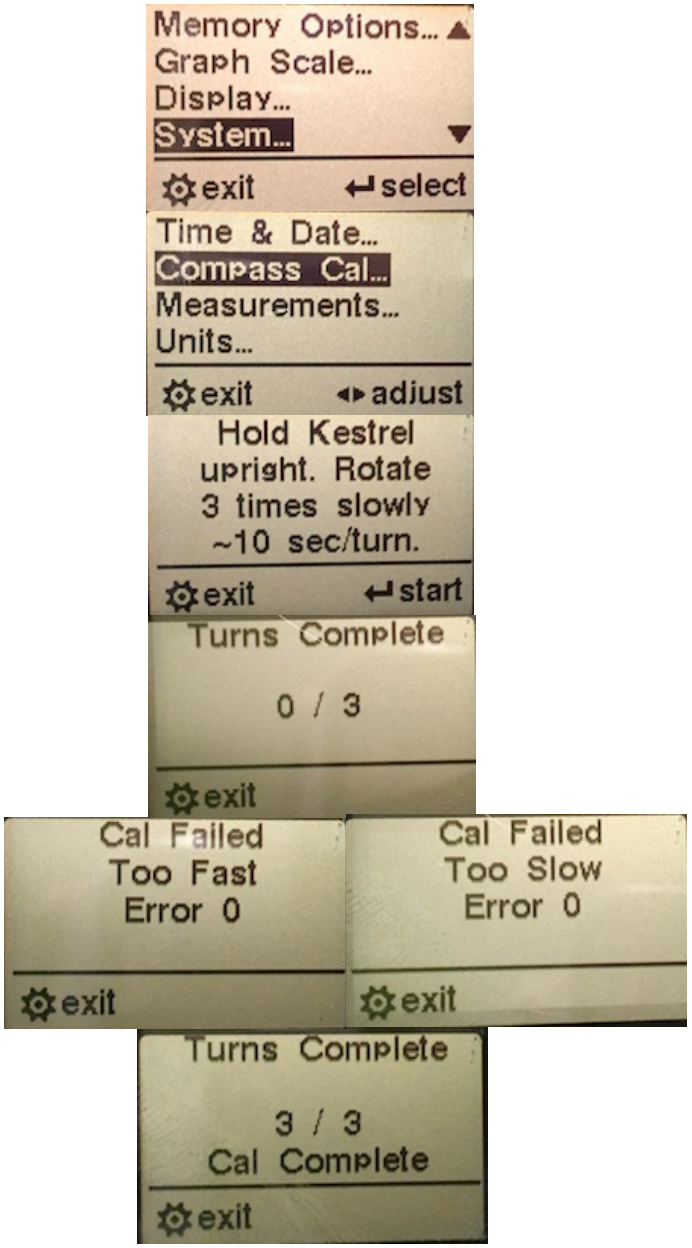
enter settings - select data lines desired

User Screen 2



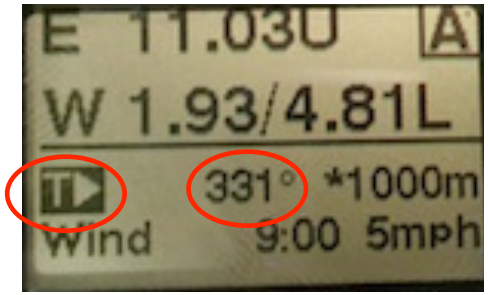
User Screen 3

Compass Calibration

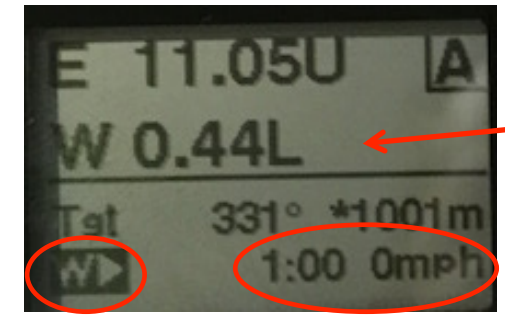


Capture DOF/Wind

Highlight Target – hit capture button – TGT changes to T with Arrow – keep oriented on target until you are satisfied with the reading then hit capture again to lock in azimuth. All shooting solutions will use this azimuth until you change it



Highlight Wind – hit capture button – point into wind – read for 5 to 10 seconds and hit the capture button to lock in data. You have now recorded the winds Angular difference from DOF, the cosine will be applied against the wind read for the 5 to 10 seconds. The 2 wind readings will now be the low and high wind seen during the 5-10 Second reading. All shooting solutions will use this data until you change it

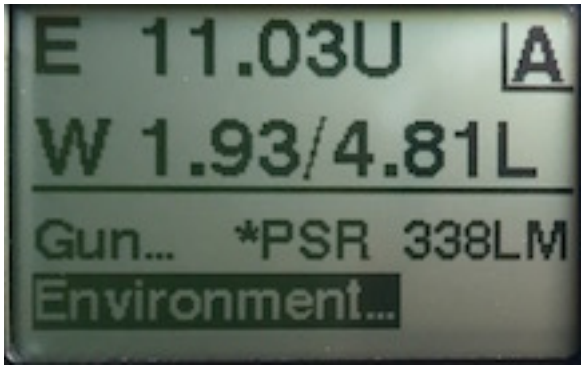


In this case, 0 winds, .44mils left is spin drift and corriolis correction for this range

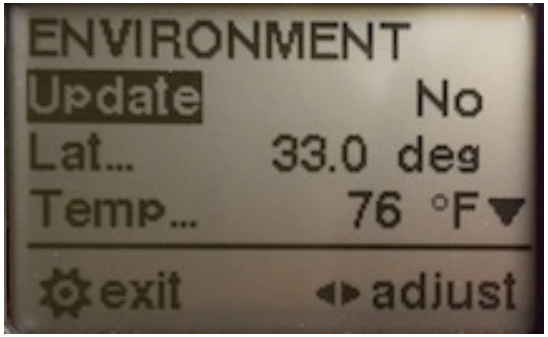
REMEMBER – this data is only from your firing position and not down range winds – it is a good start point to determine shooter value winds.

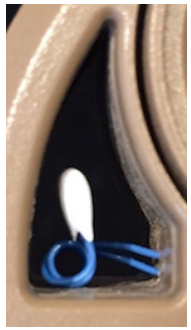
Environment inputs

With Environment highlighted hit enter to set parameters

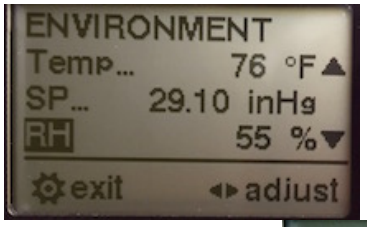


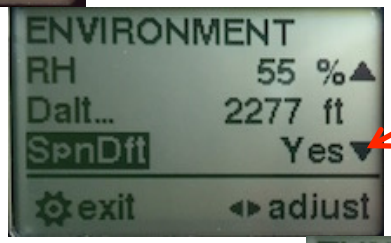
When you select update Yes the Kestrel is reading the environment real-time and will give real-time data to the ballistic engine. To guard against heat or cold syncing spin the kestrel at the end of the lanyard to expose the wire sensor to actual air temp and then turn off update. While shooting update as environment changes.



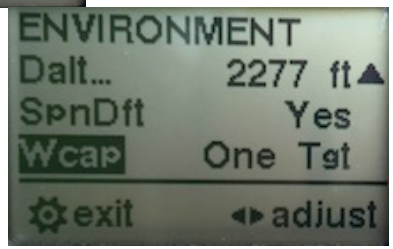


When the Environment is in update No the user can manipulate variables to see affects in different conditions. This is a good tool to answer questions on what environmental affects will do to the shooting solution. Simply change the variables and go back to the AB home screen to see how new variables affect the shooting solution.





When Spin drift is Yes the Kestrel automatically calculates spin drift into the wind solution. Turn off and spin drift is not calculated into the shooting/wind solution

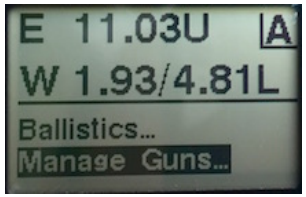


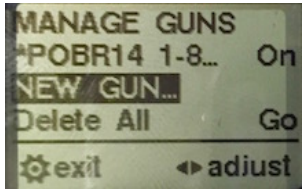
There is no need to enter into the Kestrel weather mode for environment information beyond reading wind speeds. All environmental necessities for shooting are located here under environment.

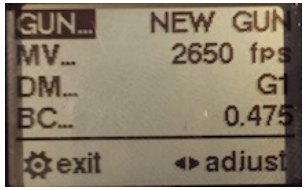
Building a new gun

As of 7 Dec 2015

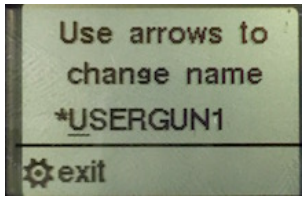
On the home screen arrow down to Manage Guns, enter

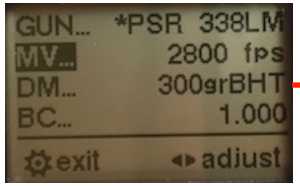




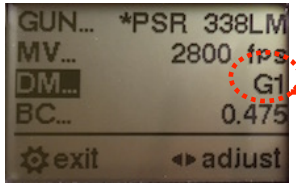


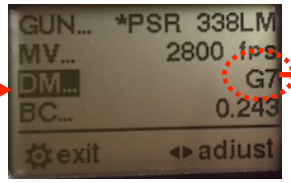
Up to gun, Enter, Name

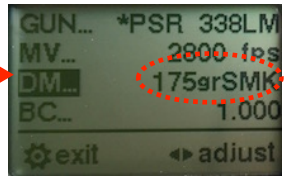




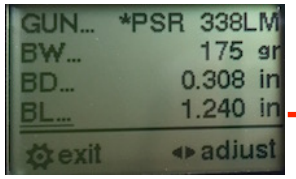
Choose fps or msec

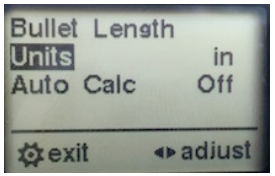




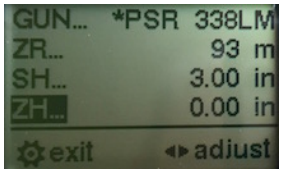


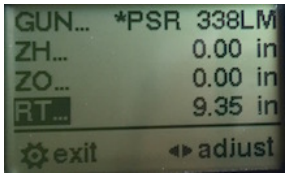
If you choose a custom curve Drag Model (DM) profile it locks BC, Bullet Weight, Bullet Length

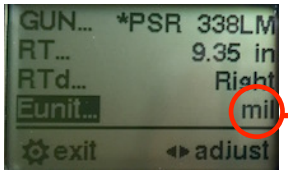




Use Auto Calc if you do not know the length of your bullet







BW = Bullet Weight

BD = Bullet Diameter

BL = Bullet Length

ZR = Zero Range

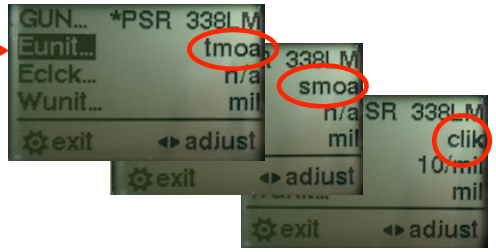
BH = Bore Height – Center of barrel to center of scope

ZH = Zero Height –offset from zero for Sup / alt ammo

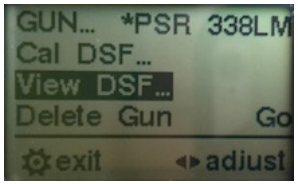
ZH = Zero Offset –offset from zero for Sup / alt ammo

RT = Rate of Twist

RTD = Rate of Twist Direction



Select units for Scope/Reticle

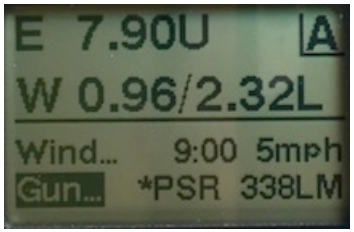


Truing MV and DSF Calibration discussed in later slides

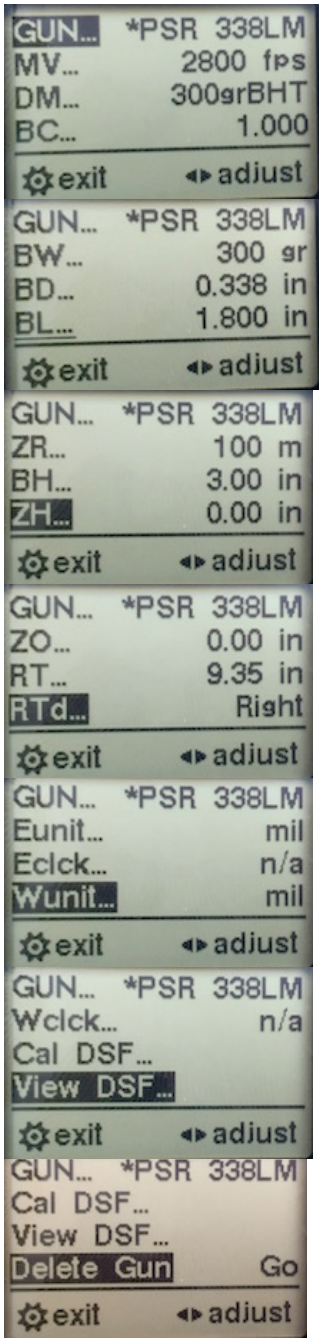
Modifying, Selecting your gun

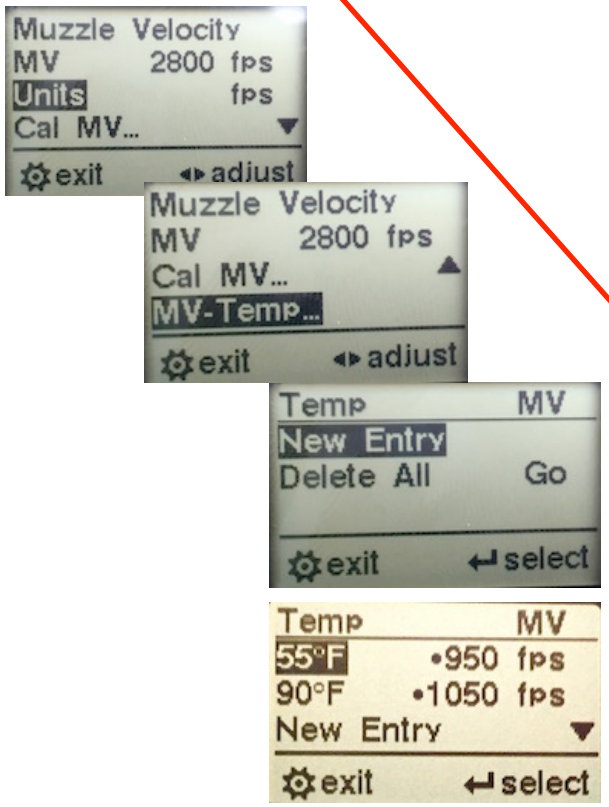
As of 7 Dec 2015

On the home screen select and enter Gun



All guns that are **On** run in conjunction with your primary gun and can be selected by right and left arrow when **Gun** is highlighted in the home screen – recommend all guns not in use are turned off so you do not "fat finger" the button and mistakenly change guns during applications





To build a powder temp table select MV – MV Temp. Enter temp/velocity which will be used in conjunction with selected gun

BW = Bullet Weight

BD = Bullet Diameter

BL = Bullet Length

ZR = Zero Range

BH = Bore Height – Center of barrel to center of scope

ZH = Zero Height –offset from zero for Sup / alt ammo

ZH = Zero Offset –offset from zero for Sup / alt ammo

RT = Rate of Twist

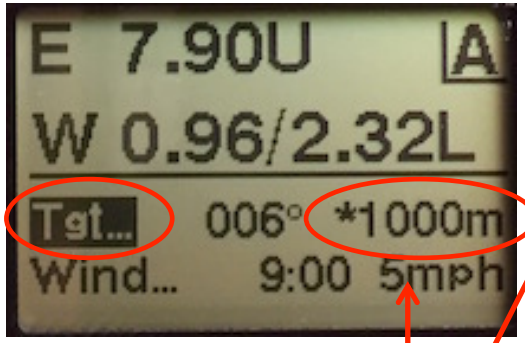
RTD = Rate of Twist Direction

Truing MV and DSF Calibration discussed in later slides

As of 7 Dec 2015

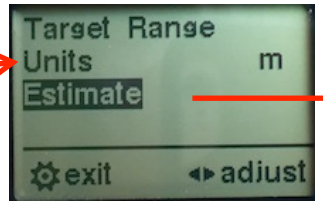
Target inputs

When Tgt is highlighted hit enter to set parameters

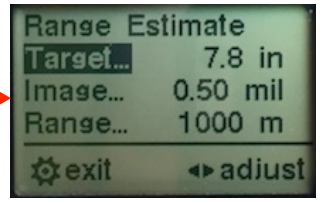


Range can be adjusted using the left and right arrows on this main screen but the range will move slowly as the system is calculating as you adjust. If you adjust range inside the target mode it moves quickly without calculations until you stop.

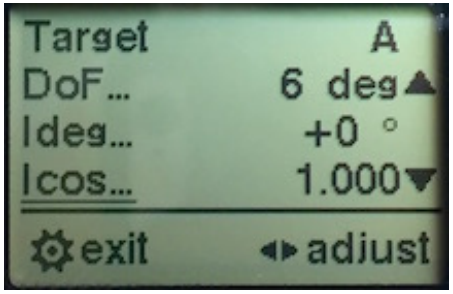
enter TR to change / convert yards /meters



enter Estimate to determine range to target based on target size and measured mils/MOA



Hit escape – you will be prompted to save range to target range or forget range found using estimate



Set magnetic Azimuth to target – this is for Corriolis calculation

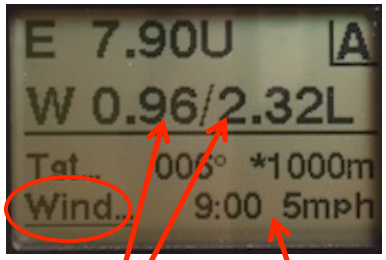
Set up or down angle (Ideg – inclination degrees) to Target – Icos – inclination cosine will populate automatically once you input angle - REMEMBER if you do not remove this angle it will be calculated in all range solutions!

Set target Speed and Direction of travel. Actual holds for movers are found under the range card function

Set "O'clock" **wind is coming from**. Set desired wind speed 1 and 2 that will be displayed on the main screen in AB mode. You can set these same variables under the wind function as well. If you capture winds these values will be overwritten

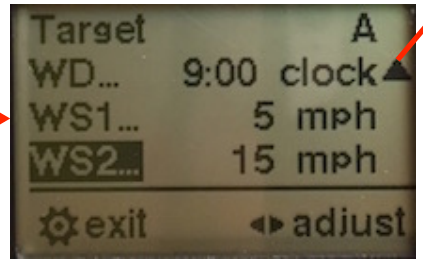
Manual and Capture Wind inputs

When Wind is highlighted/ underlined hit enter to set parameters



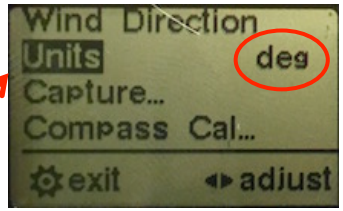
Wind speed value 1 and 2 at 1000m for the weapon selected

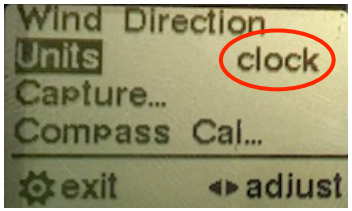
Only wind direction and wind speed 1 displayed but wind speed 2 value is displayed under Wind



Manually set wind direction and desired wind speed 1 and 2 values – these manually set variables will be used for calculating wind value at input range

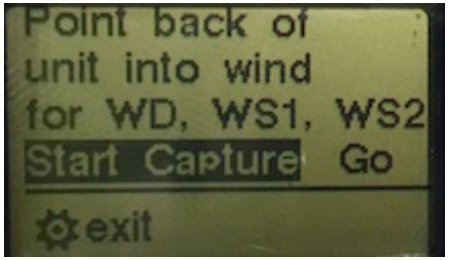
If you capture winds it will overwrite manual set values



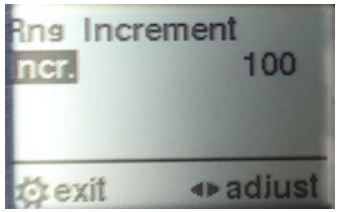


Enter when WD is highlighted to set wind direction value, capture wind, or calibrate or recalibrate compass

Enter Capture to capture current wind speeds, high and low and direction in reference to set Direction of Fire (DOF). This will override any manually or previously set winds

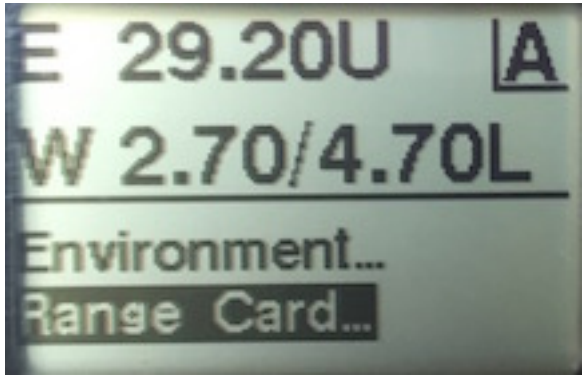


This can also be accomplished from the Home screen as discussed in Compass calibration

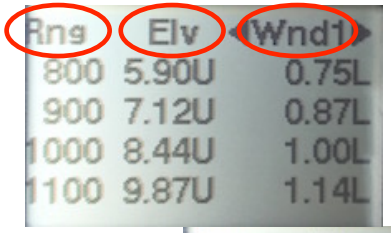


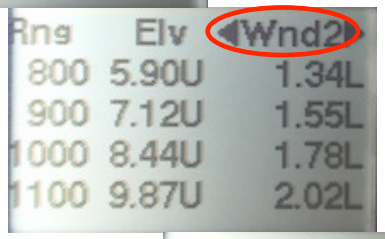
Enter to select increment 10, 20, 25, 50, 100

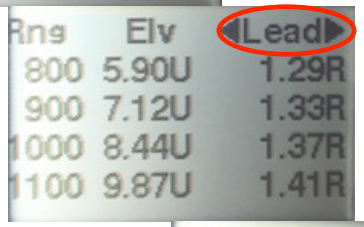
Range Card Function

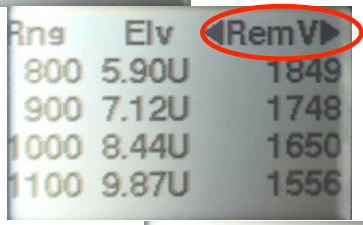


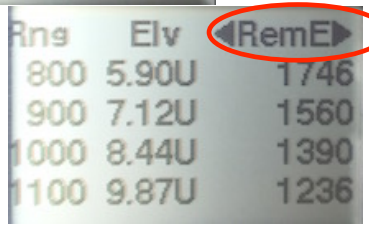
Enter Range Card when highlighted and use the left and right buttons to scroll through – change the last column to the range cards available data

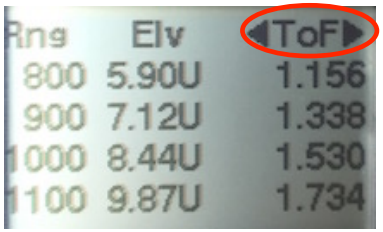


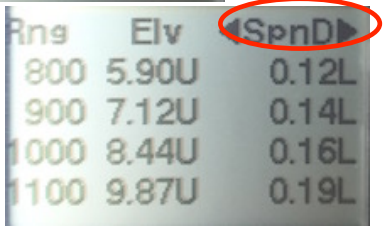




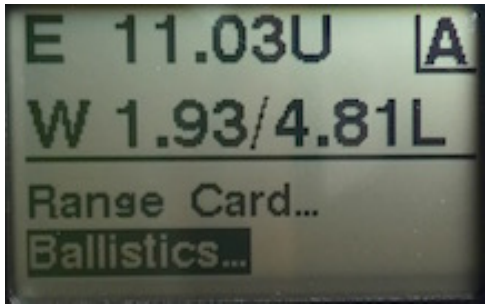








Ballistic Data



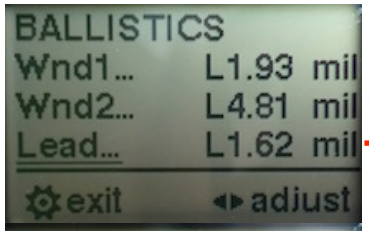
Enter Ballistics when highlighted and use the Up and Down buttons to scroll through ballistic data for the range designated

In ballistics, unlike in range card, you get the exact variables for the exact range vice in range increments

Set Target range

Elevation based on all settings

Wind 1 based on settings



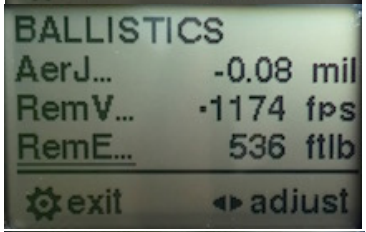
Wind 2 based on settings

Lead based on settings

Vertical Corriolis component - auto added into elevation

Horizontal Corriolis component - auto added into Wind

Spin Drift based on settings



Aerodynamic Jump

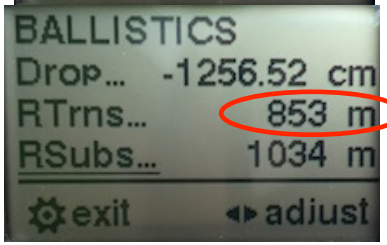
Remaining Velocity at 1000m

Remaining Energy at 1000m

Time of Flight to 1000m

Maximum Ordinate – highest point the bullet passes in the trajectory (50% of range plus 10% or in this case 550m)

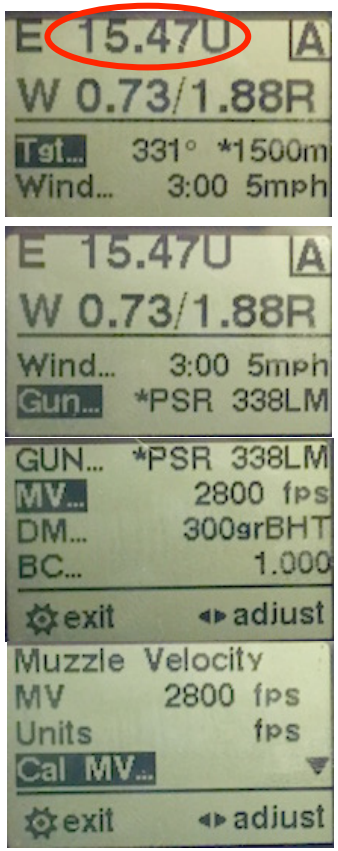
Total drop if the round drop is measured from the muzzle

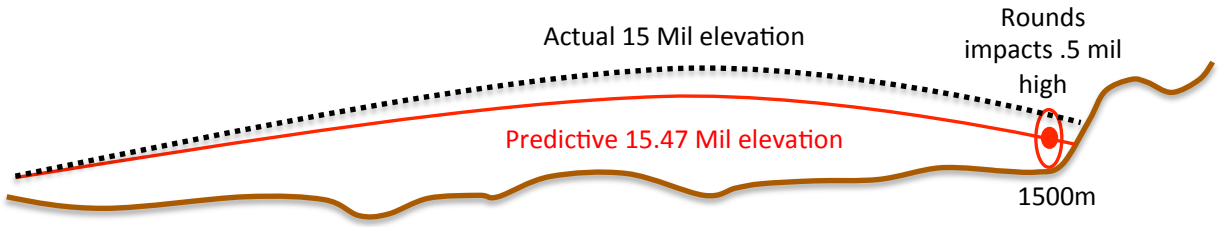


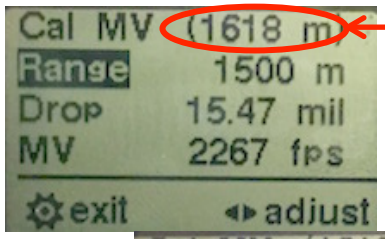
Bullet reaches Transonic, Mach 1.2, based on all settings
TRUE MV HERE +/- 10% of this range

Bullet reaches Subsonic, Mach 1, based on all settings
TRUE DSF beyond this range

Truing Muzzle Velocity (MV) at the Transonic threshold

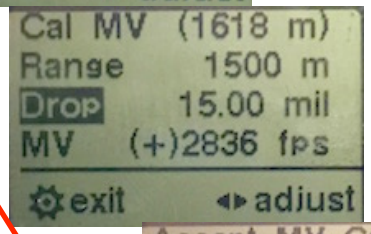






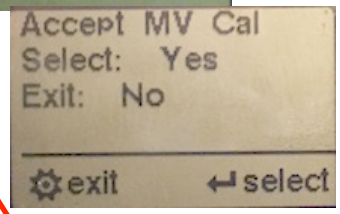
Rounds Reaches Trans based on current weapon and environmental settings

Target Range and Drop predicted based on Settings

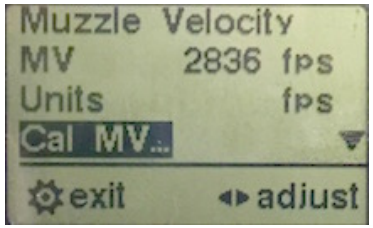


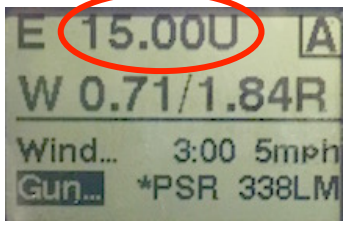
Actual Drop based on bullet impact

New Muzzle Velocity based on drop



Accept data and your Algorithm is trued. Escape to home screen and the new data is displayed



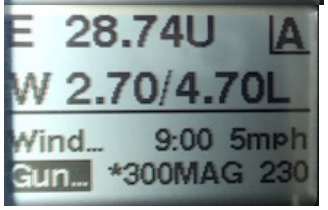


It is critical that your Zero elevation is precise and set correctly under gun ZR settings, and you can determine Mean Point of Impact of your downrange shots to an accuracy of 0.1 mil.

If your Scope Turret has not been verified to deliver correct adjustments you cannot dial in elevation corrections for truing – use the gridded reticle for the accurate hold.

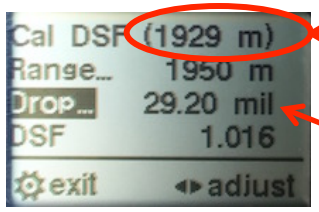
DSF calibration - Subsonic

Target Range and Drop predicted based on Settings



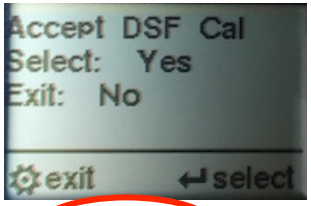
Select Gun enter

Select Cal DSF enter

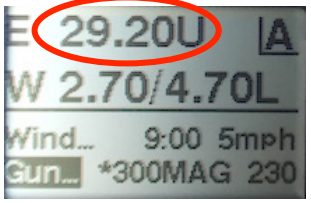


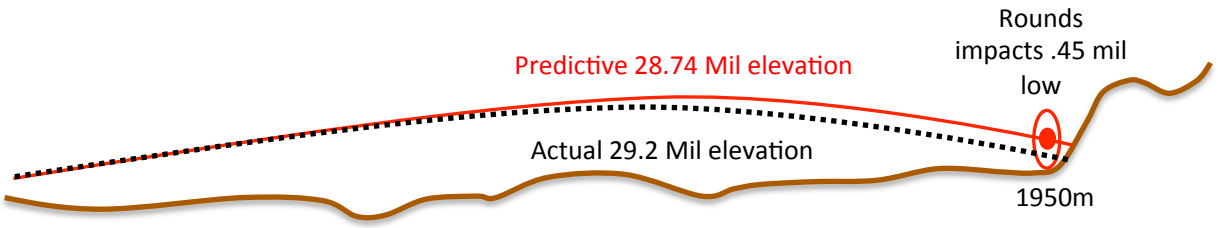
Rounds Reaches 0.9 Mach based on current weapons and environmental settings

Actual drop based on bullet impact

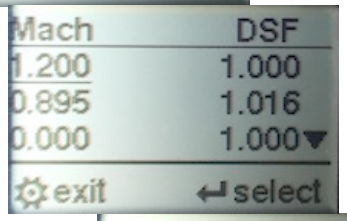


Accept data and your Algorithm is trued. Return to home screen and the new data is displayed





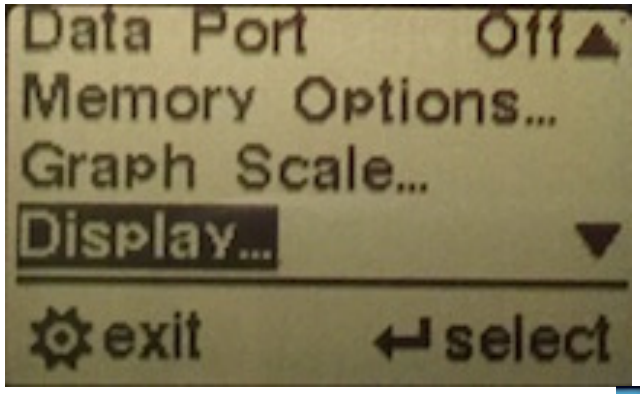
Select View DSF enter

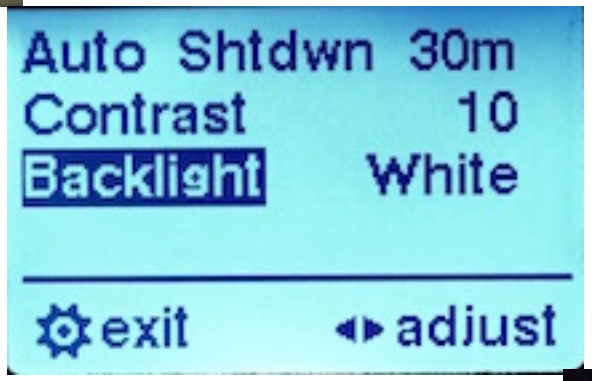


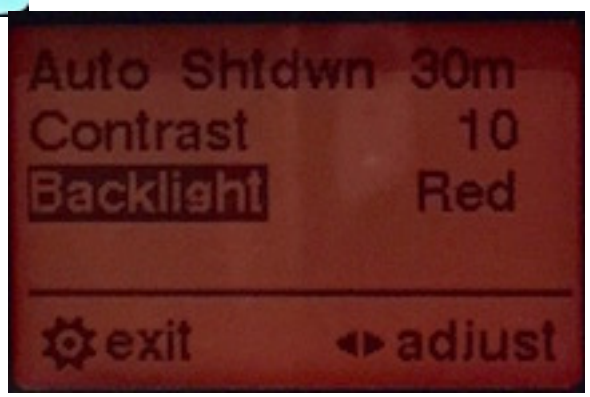
DSF Table set up for selected gun

Scroll to the bottom to clear DSF Data when desired

MENU → Display



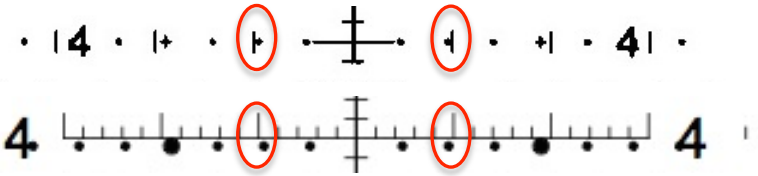




Use the Kestrel Determine Tremor 2/3 wind dot Value

T2

T3



2nd wind dot at .95 mil left and right of center stadia

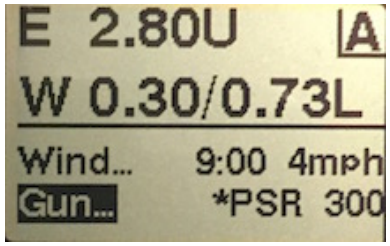
- Turn off spin drift
- 2 wind dots is .95 mil at 4 mils
- Determine the range that gives a 4 mil elevation for your rifle and ammo
- Determine wind speed that gives a .95 mil correction at 4 mils elevation
- Divide this by two and you have wind dot value for your gun/load

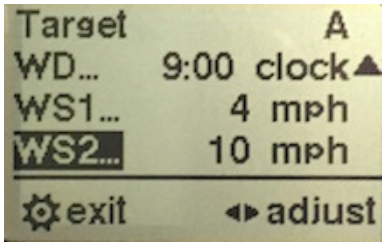
Use the Kestrel to determine your Guns Aerodynamic jump

- Turn off spin drift
- Set range at 100m
- Adjust wind speed (3 or 9 o'clock)
- Adjust the wind speed until you get 0.1 mil elevation change.
- The Wind speed that results in 0.1 mil elevation value equals crosswind your crosswind jump variable/speed. For example if its 8mph then for every 8 MPH you get 0.1 mil jump.
- Apply to your shooting solution using LARS (Left Add Right Subtract)
  - Wind from the left add crosswind jump
  - Wind from the right subtract crosswind jump
  - REMEMBER – Cosines matter!

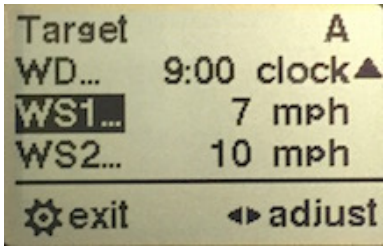
Use the Kestrel to determine your Guns Wind Bracket value for the Accuracy1st wind formula

- **Baseline 500m = .5 mils of wind – what value of wind at 500m gives you .5 mils wind drift? That is your rifle wind bracket**
- **Turn off spin drift**
- **For the rifle and ammo selected set range to 500m**
- **Adjust wind direction to (3 or 9 o'clock)**
- **Adjust the wind speed 1 until you get 0.5 mil wind correction**
- **What is that speed? That is your Wind bracket value for your weapon and ammo**

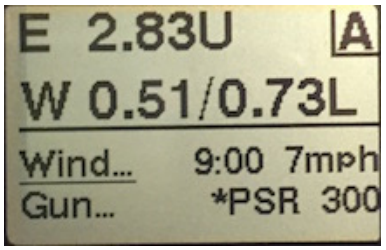




Example: 300mag, 230grBH, 2770fps, DA 0ft
Range 500m, 9 O'clock wind 4 MPH wind = .30mil



Adjust wind to 7 mph return to home screen



7 mph = .51 mil value at 500m, This guns wind **Bracket = 7 Mph**

Review - Normal use

- Turn on
- Do an environmental update – turn on and off to prevent heat or cold loading the device
  - SWING IT AT THE END OF THE LANYARD TO GET TRUE AIR TEMP

- Select gun –TURN OFF GUNS NOT IN USE
- Find target at transonic +/- 10% (for high BCs > G1 .65 can push into trans 20-40%)
- Input range to target within 1 m – Double check the range, bracket with the LRF
- Shoot data – you need to see exact bullet impact to determine MPI for group
  - Remember effects of Aerodynamic Jump on truing – Left add, Right Subtract gun jump per AJ variable for your rifle and ammo – LARS
  - It is critical you determine actual bullet strike elevation within 0.1 mil
  - Calibrate MV to true the algorithm – change the predictive polynomial curve to your actual curve
  - Change ammo, change lots, you must re-true
  - This data is only for the weapon and ammo being trued
- Calibrate DSF for ranges beyond Subsonic
- Change DOF when shooting over 600m – capture wind direction and speed
  - Corriolis, spin drift, Aero Jump
- Once trued simply range target to within 1 m and shoot the data
  - Ensure you conduct environmental updates as environment changes
  - For extreme range shots ensure you update for shot as well as input actual DOF and Latitude, wind speed, and wind direction

- Spin drift on/off – turn it off and winds are pure for determining wind dot value
- When you swap batteries you do not loose your data, but Range defaults to 500m, Latitude defaults to 38th parallel, and the environment update is on.