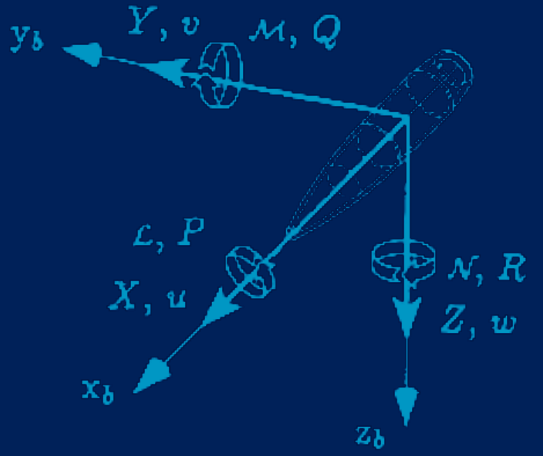
LAPUA



BALLISTICS

GUIDE

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Lapua Ballistics - The ultimate 6DOF ballistics tool for mobile devices

ABOUT THE APP

Lapua Ballistics is the first mobile ballistics app utilizing the 6DOF calculation model, which makes it the most accurate ballistics app on the market. Lapua Ballistics always offers the latest, Doppler proven Lapua cartridge and bullet data for you to combine with your firearm and local weather information. The app also includes the option to define custom bullets manually. At current, the Lapua Ballistics App is available in no less than ten languages: English, German, Norwegian, Finnish, Polish, Afrikaans, Spanish, French, Turkish and Swedish, for Android and iOS mobiles, free of charge.

FEATURES

- Utilizes 6DOF, the most accurate calculation method
- Always available with latest Lapua cartridge / bullet information
- Quick and easy to change inputs like distance, wind speed and angle
- Several result outputs available depending on your needs; numerical, reticle, table and graph views
- Share your calculation results with your friends

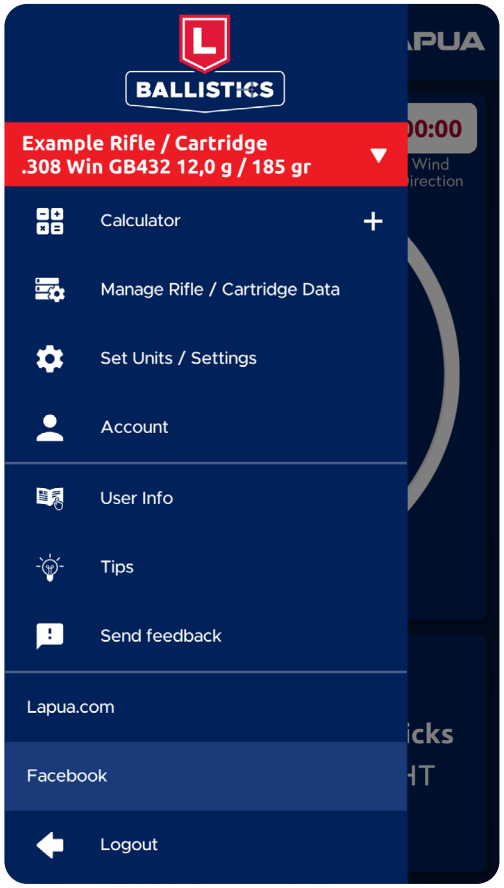
MANAGE RIFLE / CARTRIDGE DATA

- Create your own firearm / reticle combinations
- Choose between metric and imperial values
- Set Point Blank-range to different sight-in distances and impact windows
- Define aiming point to moving target
- Define custom bullets (calculations based on BC G1 or G7 and Siacci method)
- Pre-set max 4 powder temperature - Vo pairs to the same cartridge to correct powder temperature sensitivity
- Sight-in-POI, Coriolis calculation
- Compare up to 3 Lapua cartridge/bullet performances to each other
- Custom trajectory tables

About the app - General instructions

Main menu, Rifle / cartridge settings and Upper and lower views in Calculator mode

- The Main Menu appears when you tap in the three stripes in the upper left corner. At the top of the Main Menu is the Calculator and right below are features that can be activated (or deactivated) in the Calculator.
- By tapping the three lines in the top left corner, the main menu with all settings and information opens.
- By tapping the Example Rifle / Cartridge text rows on top of the upper view and choosing a combination in the menu that opens, you can view, edit or add rifles or cartridges. You can also go to your RIFLE / CARTRIDGE SETTINGS from the Main Menu.
- The Lapua Ballistics CALCULATOR VIEW has upper and lower view sections. You can enlarge the lower part by tapping the section.

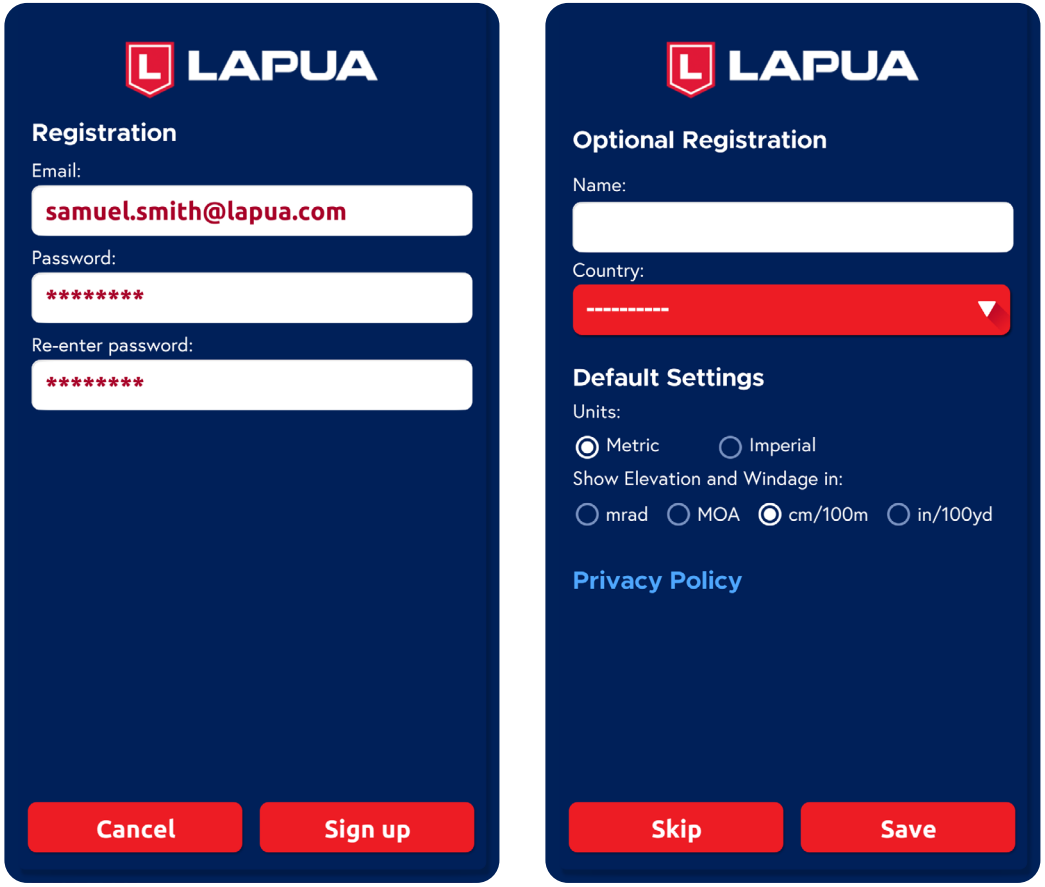




Getting started - Quick guide

Step 1: Register and set default settings

- To be able to use all features and receive all the information regarding the app, tap Sign Up and Accept the terms of use.
- Add your email and password in the registration menu. The app sends an email confirmation to the email you have chosen. Once you have confirmed the email and agreed to our Privacy Policy and Disclaimer, the app will go to the next view "Optional Registration", where you can add your name and country, as well as choose your default settings. You can choose between metric and imperial values and set the correct unit for your scope. These can be changed later. Finally, click Save.
- Note: if you want to get automatic weather information and/or save data to your own files from the app, you need to grant the app access to your location and images/files. The app itself will not utilize this access for anything but for these features.

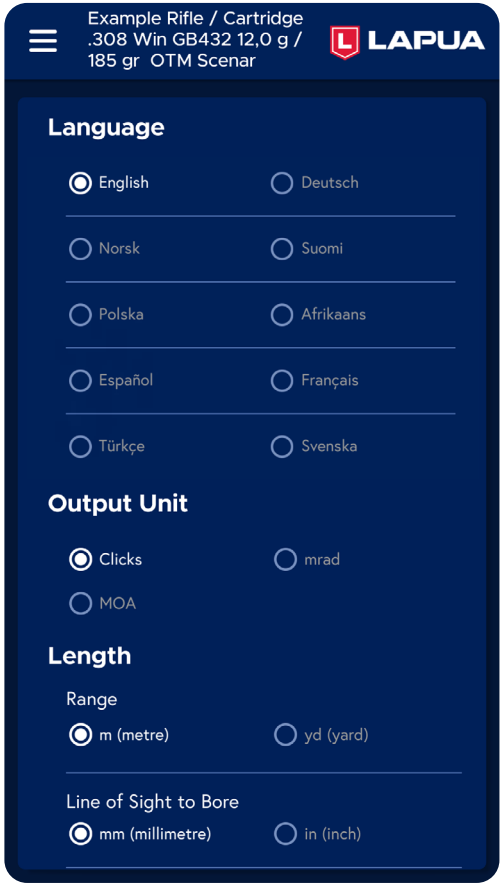


Getting started - Quick guide

Step 2: Set additional units / settings

Next, you can change your additional preferred settings if you need to. From the top left corner, open the menu (three stripes icon), tap Set Units/Settings and select:

- Language
- Units for: Output, Shooting range; Line of sight to bore; Point-Blank Range window size; Bullet velocity; Moving Target Speed; Wind speed; Air pressure; Temperature; Weight; Energy.
- You can also choose the theme for the display (default or dark).
- Enable the use of app Compass. If you enable compass, the app uses it to show shooting direction according to your current direction.
- Finally, you can customize in which order the analysis views are shown.





Getting started - Quick guide

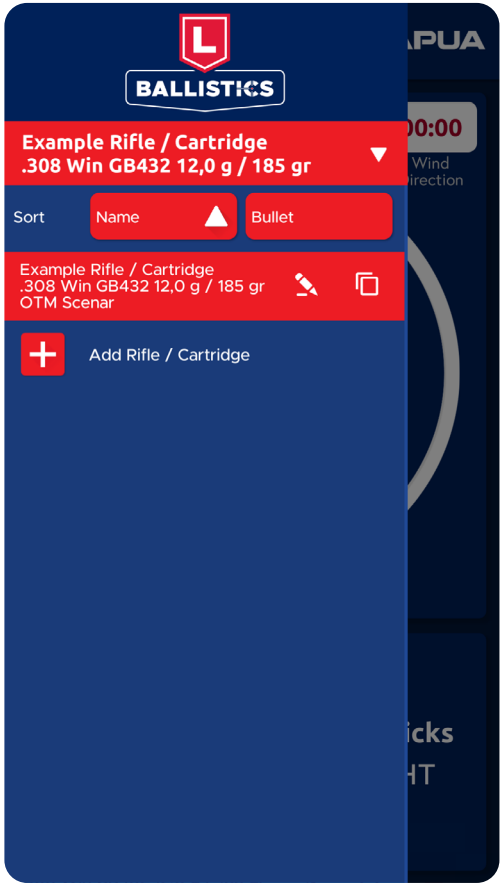
Step 3: Set up your own rifle

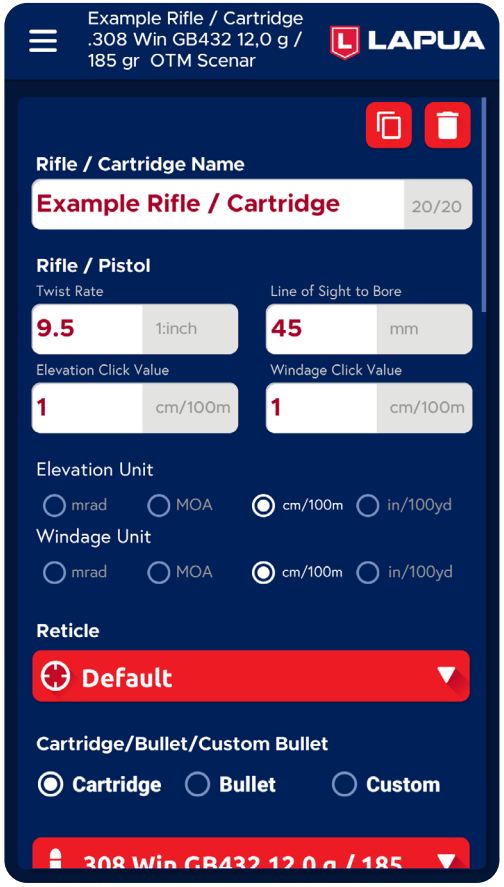
Now you can enter the correct values for your own rifle. Open the menu from the top left corner and select "Manage Rifle / Cartridge data". Click on "Add Rifle/Cartridge", and name your rifle-cartridge combination. Check that your Elevation and Windage units are correct.

Next, set the correct values for:

- Twist rate
- Line of sight to Bore
- Elevation Click Value
- Windage click value

At this point, you can skip adding the reticle settings.





Getting started - Quick guide

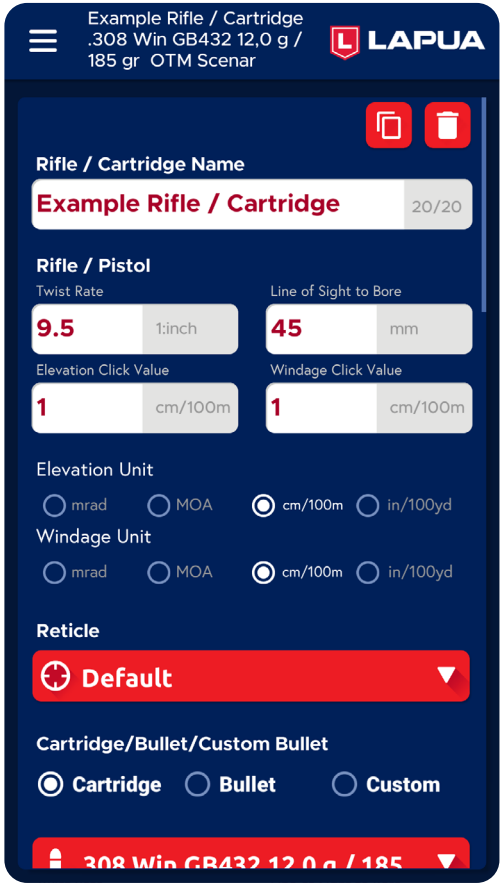
Step 4: Choose a cartridge for your rifle

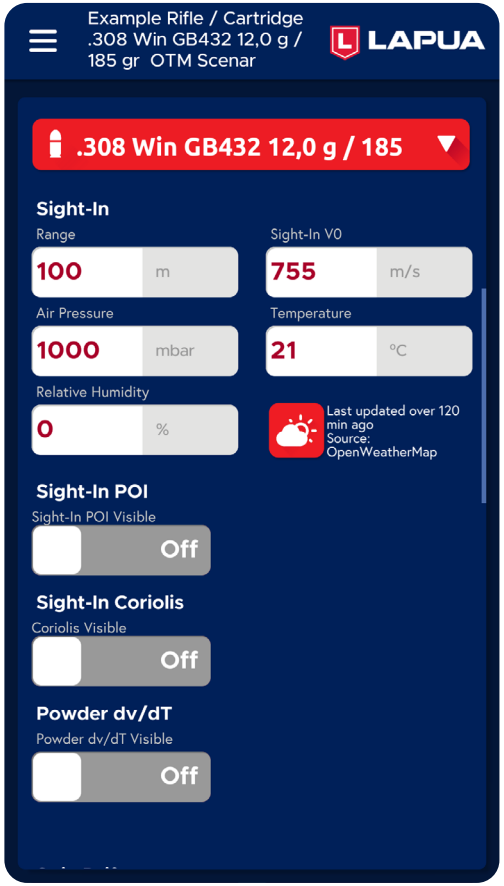
Lapua Ballistics is optimized for the use of Lapua cartridges and bullets, so the easiest way to get started is to choose a Lapua cartridge or bullet for your rifle. Go to the Manage Cartridge / Rifle Data in the main menu and add a new cartridge / rifle combination (or edit an existing one). Pick your cartridge or bullet from the Cartridge / Bullet / Custom drop-down menu. The 'Custom' option is meant for bullets by other manufacturers. Note that all app features are not available for custom bullets.

Next, set the following values for your choice:

- Sight-In range i.e. the distance for which you sight-in your firearm
- Sight-In V0. This value is automatically added for Lapua cartridges, but if you have a chronometer, you can add the exact value. For bullets, you have to add the value. (For more information on Sight-In V0, go to page 12, slide 13)
- Air Pressure, Temperature and Relative Humidity. If you have allowed the app to access your location, you can tap the sun-cloud icon and get these values automatically added from your nearest weather station. You can keep the other values turned off for now. Finally, scroll down and tap Save.

Now your basic setup is ready!
More details on features are available in these instructions.





Rifle / Cartridge settings - Add or edit data

Rifle / Cartridge name

- Name your rifle-bullet combination (ex. "My Long range rifle")

Rifle / Pistol

- Add twist rate and scope data
- Select units for Elevation and Windage

Reticle

- Add and name your scope reticle using the reticle generator (see how to create a reticle on page 10). You can add multiple reticles.

Cartridge / Bullet / Custom bullet

- Select the Lapua Cartridge, Lapua Bullet or Custom Bullet (bullets by other manufacturers) of your choice. Note that all app features are not available for custom bullets.

Sight-In

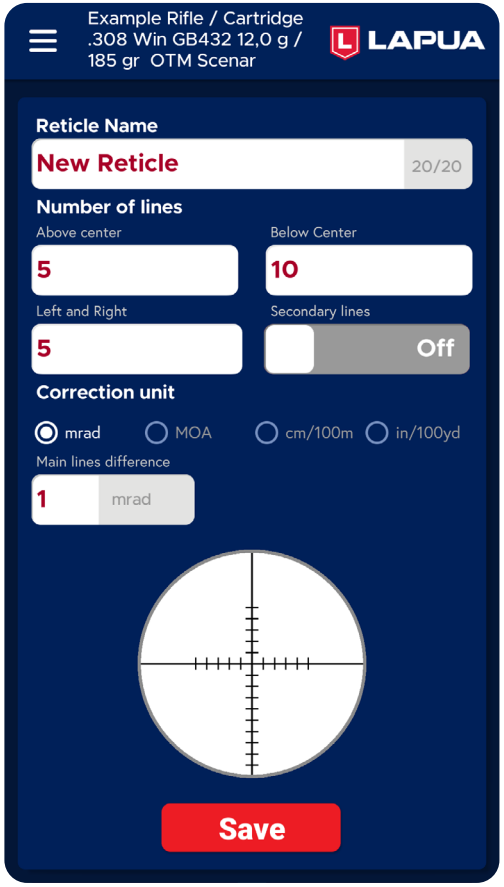
- Input Sight-In data (see Sight-In data details on pages 12 and 13)

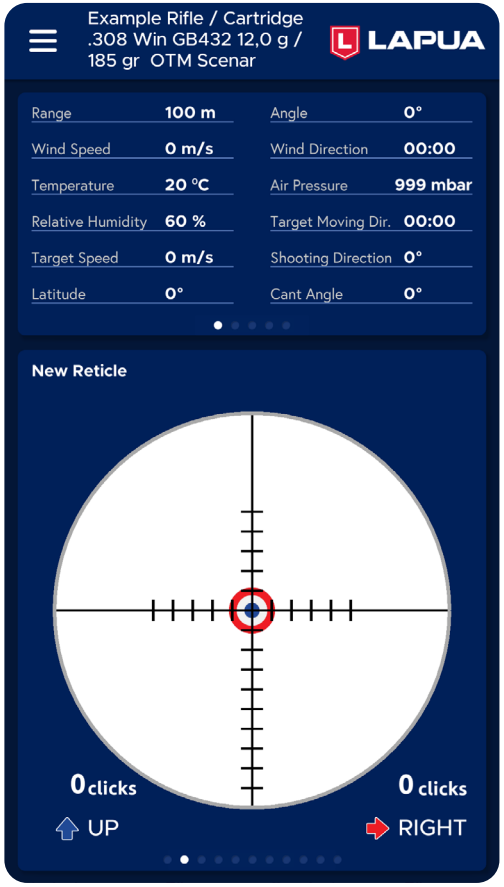
Spin Drift

- Select on, off or Custom. We recommend that you choose option 'On'. For more advanced use, see details on page 14.
- Remember to click SAVE at the bottom of the settings view

Rifle / Cartridge settings - Create your own reticle

- From the Menu, go to "Manage Rifle/Cartridge data" and choose the desired rifle-ammunition combination by tapping the pen symbol
- Scroll down to the Reticle menu, open it and click "Create"
- Name your reticle
- Add the number of main lines for the three directions (above and below center; left and right)
- Choose the correction unit (mrad – MOA – cm/100m – in/100yd)
- Give the difference between main lines in the unit you selected
- If you have secondary lines between main lines, tap Secondary lines 'On'. Your secondary lines will then be visible halfway between main lines.
- Remember to save the changes you've made. Done! Now your reticle is the one displayed in the calculator view.





Advanced features in Rifle / Cartridge settings

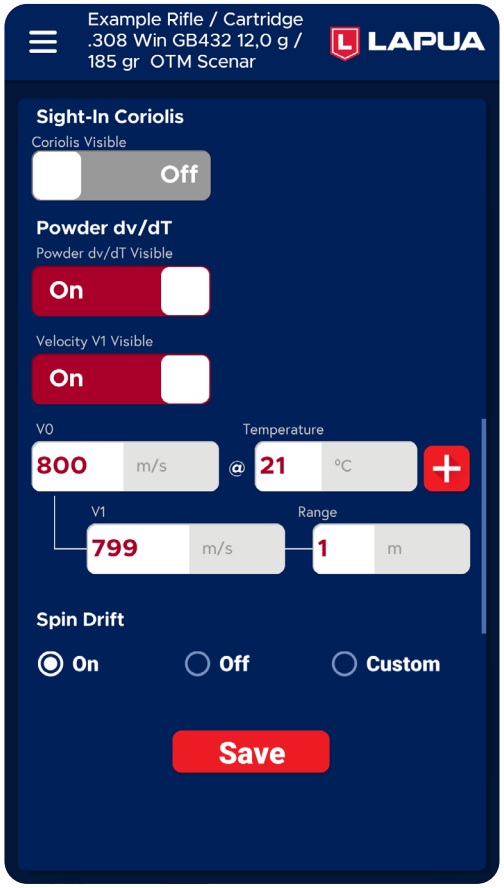
Powder dv/dT Calculation - Rifle / Cartridge settings

Use this feature only if you know or can measure your cartridge muzzle velocity (V0) at different cartridge temperatures. This correction may to some extent be load and powder lot sensitive. For absolute accuracy, measure the exact values for the system that you are using.

V0 Calculation - Rifle / Cartridge settings

Most ballistics programs require the muzzle velocity V (at 0 m/yds) of the bullet as the starting value for ballistic calculation. However, most chronographs have to be installed several meters/yards in front of the barrel muzzle so that the muzzle pressure and muzzle flame don't interfere with the result or damage the chronograph. With the muzzle velocity calculation function, the bullet velocity V measured at a distance of x meters/yards can be converted to the bullet velocity V at the muzzle of the barrel (at 0 m/yds). The function is only intended for short distances, less than (or maximum) 25 m/yds. Using the function:

- Enter the editing mode of the cartridge you are using (pen image).
- Activate the Powder dv/dT Visible button
- Activate the Velocity V1 Visible button
- Enter the distance from the barrel muzzle to the chronograph in the Range window (unit m or yd) and the velocity reading by the chronograph in the V1 window (unit m/s or fps).
- The muzzle velocity of the bullet is shown in the V0 window (unit m/s or fps). With this feature you can calculate the true V0 from the instrumental reading at e.g. V25m
- Input the measured velocity at the distance of your velocity screen / chronograph and you will see the true V0.



Advanced features

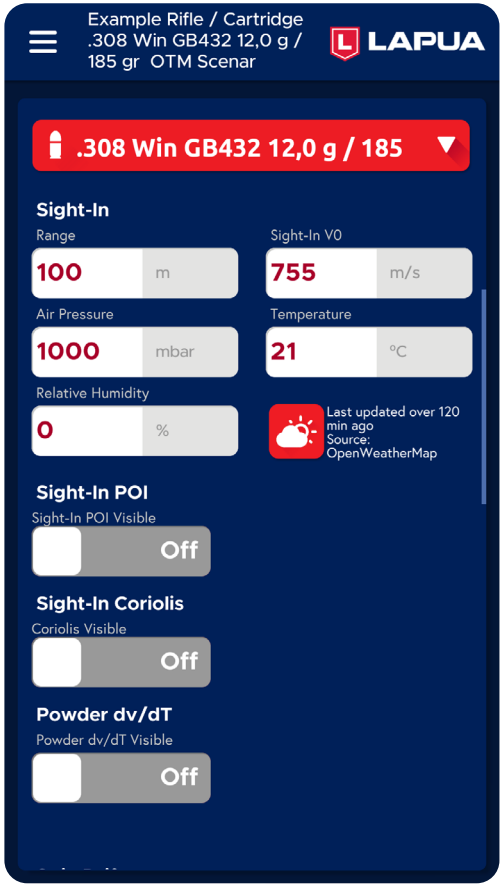
Input Sight-In Data — Rifle / Cartridge settings

Sight-In

- Input Sight-In conditions. Relative humidity has very little effect on results in basic use, so it can be set at a basic static value of e.g. 50 %

Sight-In POI

- Sight-In POI is a tool that can be utilized when you need to use several different types of cartridges in the same firearm without changing the basic sight-in setup of the scope. Knowledge of how different types of cartridges behave in your own rifle extends, for instance, the practice season well into the hunting season, and it means you can use the appropriate ammunition in any situation without having to sight-in the firearm again. When using the Sight-In POI feature, several different cartridge variations can be built around the sight-in settings of the rifle's primary cartridge, depending on what cartridge needs you have.
- Sight-in your scope with the first bullet and adjust the turret scales to zero. Save the cartridge data as e.g. "hunting cartridge".
- Sight-in your scope with your other bullet and set the correction needed to POI (in clicks).
- Save the cartridge data as e.g. "training cartridge". Do not zero the turrets.
- Always set the turrets to the numerical value given by the software - do not "count clicks"!



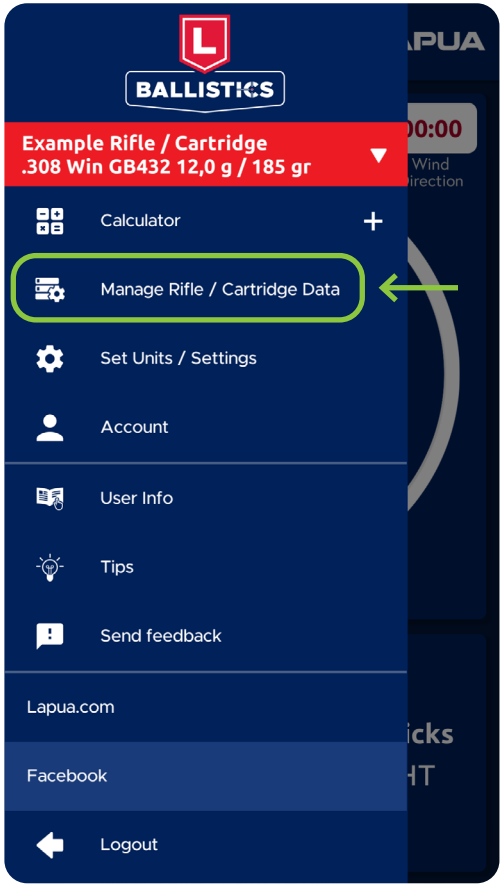
Advanced features

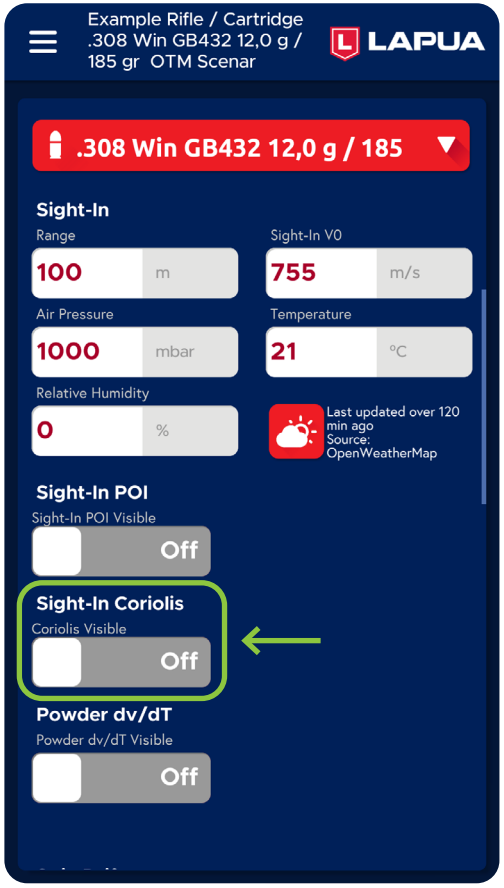
Sight-In Coriolis — Rifle / Cartridge settings

The Coriolis Effect is caused by the fact that different parts of the Earth rotate at different speeds, i.e. the rotational speed is higher at the Equator compared to the poles. In shooting, the Coriolis Effect means in practice that the deviation of the trajectory of the bullet, i.e. the curvature, arises from the difference in rotational speed between the shooter and the target. Put simply, due to the rotational motion of the Earth, the target location moves at a different speed than the firing point during the flight of the bullet. This speed difference is affected by the location and direction of the firing point on the Earth, the firing distance, and the flight time of the bullet.

The effect of the Coriolis phenomenon can already be seen on medium firing distances, but it becomes an essential variable for the hit with shooting distances of 1,000 m/yds and beyond. The Coriolis phenomenon affects the flight of a bullet in the Northern Hemisphere so that when firing north or south, the bullet sways to the right and in the Southern Hemisphere to the left. The more your firing line is in the east-west direction, the less the effect of the Coriolis. The magnitude of the deviation depends on the location latitude and the flight time of the bullet. The max deviation is at the poles and the smallest at the Equator, because the difference in rotational speed between the shooter and the target is at maximum at the poles and zero when firing symmetrically over the Equator.

- Thus, this feature is only needed if you are doing the sight-in for extra long distances (more than 1,000 m/ yds).
- Go to the main menu and check that Coriolis is activated.
  Input Latitude and shooting direction by turning the arrow or typing the numerical value.
- Note! Wind direction is corrected by shooting direction, so when changing shooting direction, either in the Coriolis view or by the Get wind data button, wind direction is corrected accordingly.





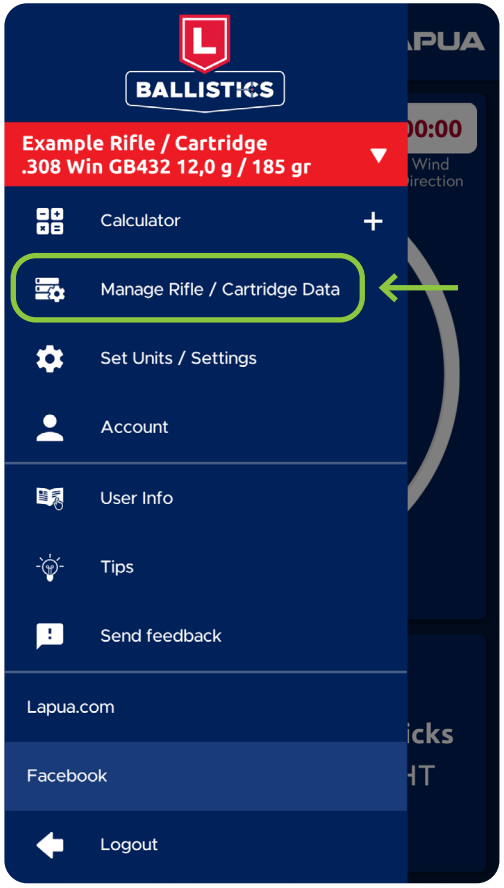
Advanced features

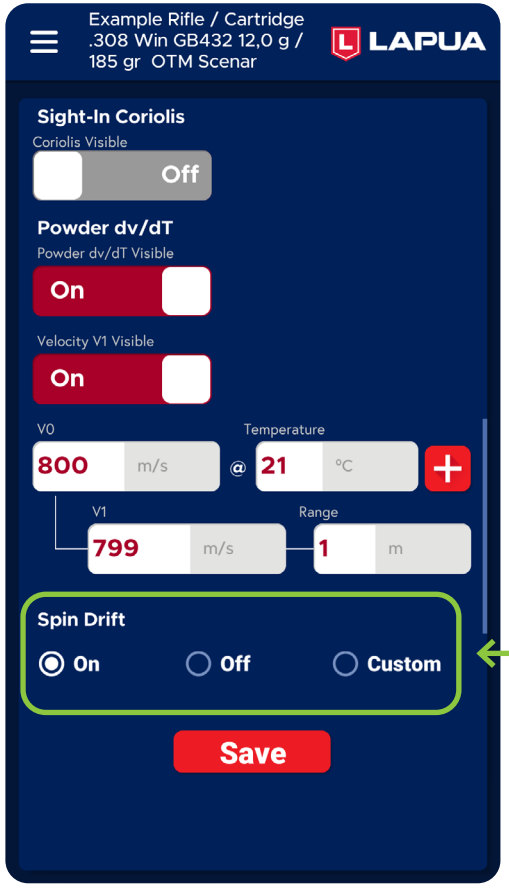
Spin Drift Adjustment — Rifle / Cartridge settings

Spin drift (or gyroscopic drift) causes the bullet to drift slightly horizontally at long shooting distances. The direction of the drift is the same as the barrel twist rotation, i.e. in your typical right-handed rifle it is in the right-hand direction. Spin drift is caused by aerodynamics forcing the bullet tip to turn slightly in the direction of rotation as the bullet tip follows its curved flight path. This rotation of the bullet is very small, usually less than 0.1 degrees, but because it affects the entire flight path, it moves the bullet slightly in the direction of the spin.

The magnitude of the spin drift is most affected by the spin rate, bullet length and flight time (bullet velocity), to a lesser extent also by air density.

The Spin Drift correction can be turned off in the Manage Rifle / Cartridge data menu under the current weapon profile (Sight-In settings), but we recommend that you select 'On' and then leave it as is. In extreme long range shooting (500 m/yds and up), you can fine-tune the spin drift magnitude to match the exact spin drift tested in practice with your firearm and cartridge combination. However, this precise determination of the actual spin drift is very difficult, because the effect of even a very small wind gust is usually many times larger than the magnitude of the spin drift. Therefore, using the factory setting usually gives the most reliable result.





Calculator mode - Lower views & icons

Move between 5 upper views or 11 lower views by sweeping the screen.
NOTE! When sweeping, tap the blue background, not an input section.

Upper views:

- Calculator view with compass, preset ranges and wind direction
- Weather
- Coriolis
- Moving Target
- All Input values

Lower views:

- Scope clicks
- Default scope view
- Elevation / Windage (Table 1)
- Velocity / Energy (Table 2)
- Point-blank Range
- Trajectory (drop)
- Velocity / Distance
- Energy / Distance
- Stability Estimation
- Trajectory table
- Max Range



Calculator mode

Cant angle - Calculator view

Cant angle (rifle tilt) support is needed e.g. when shooting from a horizontal narrow gap. The barrel acts as an axis point for the cant angle calculation.

- Check that Cant angle (available for Lapua cartridges and bullets) is activated in the Main Menu
- Next, add the angle in the main upper view of the calculator.

Moving targets - Calculator view

- Check that Moving Target is activated in the Main Menu

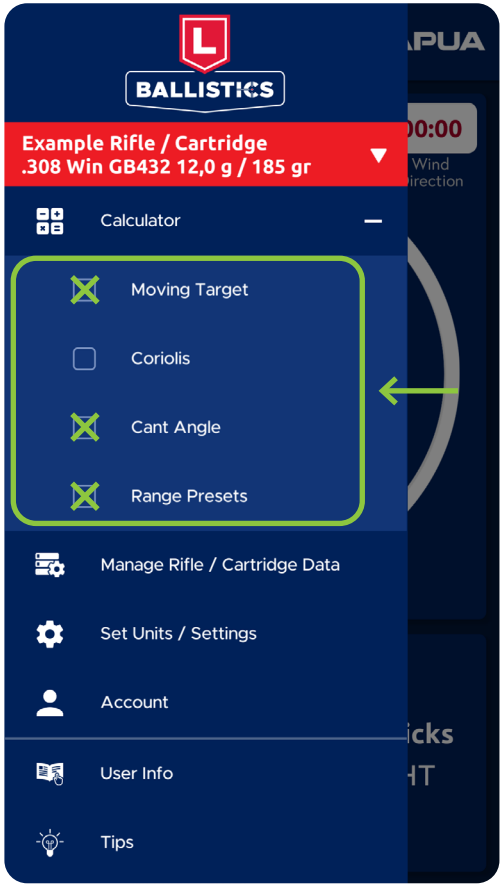
You can shoot moving targets with two methods:

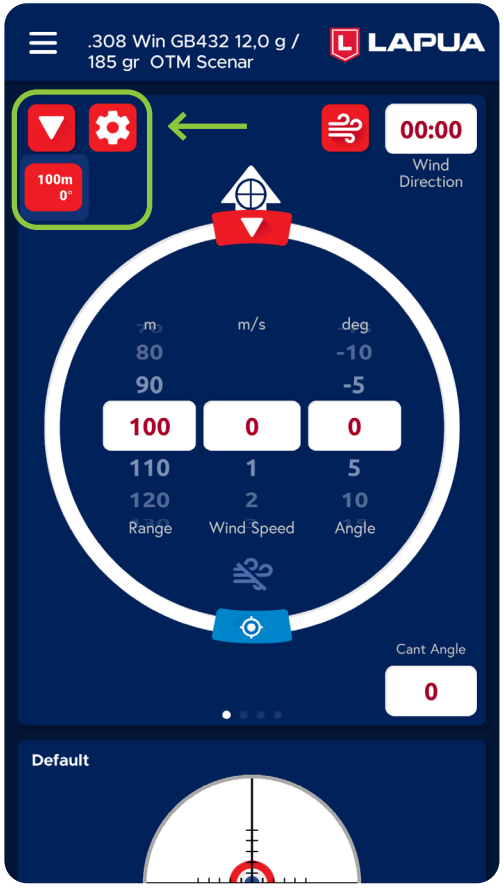
- Make scope adjustment or use the reticle view
- In the Moving Target upper view, input the target speed and adjust the target direction by turning the arrow or typing the numerical value

Range presets - Calculator view

You can add predetermined ranges to easily switch between shooting distances in calculator view.

- Check that Range Presets is activated in the Main Menu
- Go to the main Calculator view, the Range Presets dropdown menu is the red/white triangle icon in the upper left corner
- From the range menu, set the distance of the range and the shooting angle
- You can also activate the compass mode for shooting direction and activate automated weather inputs





Dropdown menu icon

Compare cartridges / bullets - **Calculator view**

This feature is accessible in the lower views of the Calculator. Compare up to three bullets / cartridges you have chosen in the same graphic.

- First, select the first Lapua cartridge from the Rifle / Cartridge Data menu, and check that the basic settings are correct. For example, you can set the desired muzzle velocity for the cartridge / bullet.
- Next, go to the Calculation mode, and swipe to the third lower view and tap to expand.
- Select as comparison item(s) either a custom cartridge you've created, or a factory-loaded Lapua cartridge from the drop-down menu. Expand the lower view of the Calculator screen and swipe right to quickly and easily view the comparison data separated by different colors (here in red and blue).
- To view the comparison horizontally, tap the square button. To return to vertical view mode, tap the square button again.



Swipe here to the
Cartridge Comparison view.
Tap again to expand the view.

Advanced features in Calculator

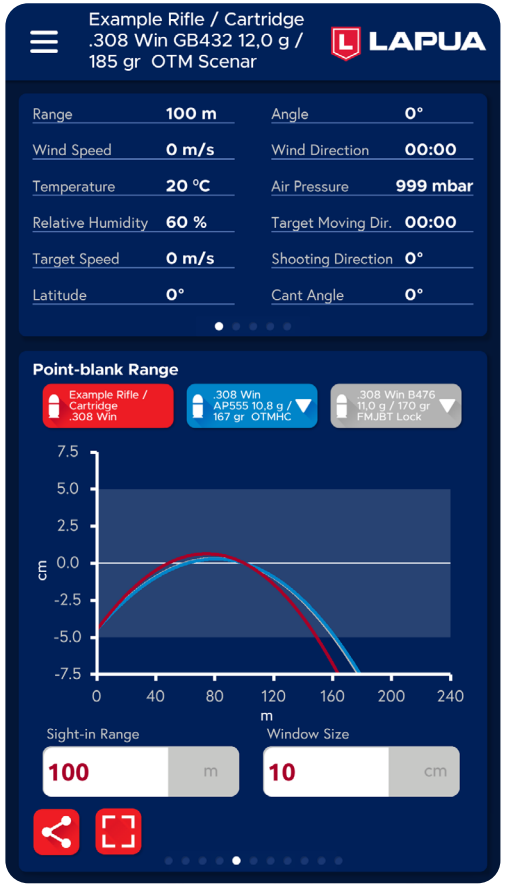
Point-blank Range calculator — **Calculator view**

The Point-blank Range (PBR) calculator is a useful tool for hunting. The feature shows the min to max distance within which the bullet will hit the predefined target area without adjusting the point of aim or scope. Knowing the PBR is useful in situations where you don't have time to make adjustments to your scope or you don't know the exact shooting distance – a typical situation when hunting. By calculating the PBR you can optimize your sight-in distance so that the PBR is as long as possible.

- In the Calculator mode, swipe to Point-Blank Range in the lower views
- Choose desired Window Size for your target (i.e. the area in cm / inches within which the bullet needs to hit the target). Adjust Sight-In Distance to fit the chosen Window Size
- In the upper Calculation view, set the scope correction to the optimized the distance and adjust the scope clicks according to that value.
- The grey area marks the min and max distance at which you can make a perfect shot without adjusting your scope.

Example: the shooter wants the bullet to hit the target (+/- 5 cm) within a 10 cm window size. If the rifle is sighted in at a distance of 100 m, the shooting distance range is 0 to 160 m without adjusting the scope or changing the point of aim. By bracketing, the optimum sight-in distance is found to be 170 m, with the shooting distance range of 0 - 200 m without adjusting the scope of changing the point of aim. The Elevation LOS (Line Of Sight) column in the flight path table indicates the elevation height of the bullet in relation to the line of sight.





Swipe here to the
Point-Blank Range view.
Tap again to expand the view.

Advanced features in Calculator

Stability estimation — **Calculator view**

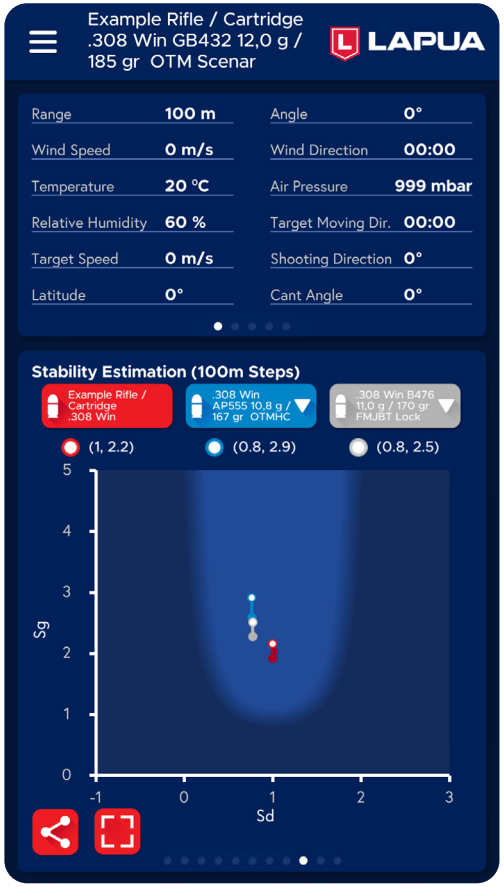
Stability is an essential part of bullet accuracy. Stability is affected by several factors, the most important factors being barrel twist rate and the length of the projectile. To a lesser degree it is also affected by the bullet shape, velocity and environmental conditions. You can estimate bullet stability during the flight path with the stability estimator function.

The bullet stability is not an on/off phenomenon and the main benefit is to use this function to compare different bullets in different shooting conditions (twist rate, velocity, distance, air pressure, etc.) and compere these to live fire results.

You can use the stability indicator to estimate the stability of your system. This 6DOF sd/sg analysis is by far more sophisticated than the simple Greenhills formula of Miller twist rule.

- The curves represent two stability parameters downrange: sg (y-axis) and sd (x-axis).
- Sg is the gyroscopic stability (spin dominated) and sd is the dynamic stability (velocity dominated).
- Dots indicate distance at each 100 m starting from zero (first dot down right) to shooting distance. Please note that the last dots may be outside the graph.
- Values at the shooting distance are also shown as numbers above the graph.
- The light blue area shows the area where the bullet is stable. In the dark blue area, the bullet may not be unstable but the risk is increased.





Swipe here to the
Stability Estimation view.
Tap again to expand the view.

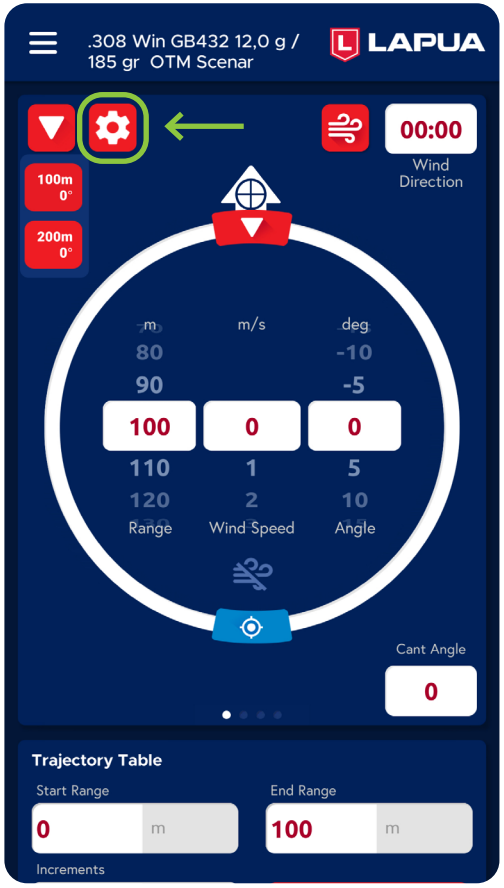
Advanced features in Calculator

Calculate and export trajectory table — **Calculator view**

You can calculate your trajectory table in the lower view:

- Tap 'Calculate'. Pick desired data (max 7) from the triangle icon in the top hand corner
- To export the table, tap the share icon up left. You can either share a screen shot or send the table as a csv (email). The options to send the screenshot depends on your phone apps and settings.

NOTE! To be able to export the .csv file to your email, you need to have your phone's own standard email app in use.





Range m	Elevation LOS cm	Elevation MOA	Elevation Clicks cm/100m	Windage LOS cm	Windage MOA	Energy J	TOF sec
500	-224.88	15.46	45	3.26	-0.22	1448	0.8213
475	-195.9	14.18	41	2.85	-0.21	1518	0.771
450	-169.37	12.94	38	2.48	-0.19	1590	0.7219
425	-145.14	11.74	34	2.13	-0.17	1665	0.6739
400	-123.12	10.58	31	1.82	-0.16	1743	0.627
375	-103.19	9.46	28	1.54	-0.14	1824	0.5811
350	-85.31	8.38	24	1.28	-0.13	1908	0.5363
325	-69.33	7.33	21	1.05	-0.11	1995	0.4924
300	-55.22	6.33	18	0.85	-0.1	2085	0.4495
275	-42.88	5.36	16	0.67	-0.08	2178	0.4076
250	-32.21	4.43	13	0.51	-0.07	2275	0.3665
225	-23.19	3.54	10	0.38	-0.06	2375	0.3264
200	-15.7	2.7	8	0.27	-0.05	2478	0.2871
175	-9.7	1.9	6	0.17	-0.03	2584	0.2486
150	-5.12	1.17	3	0.1	-0.02	2694	0.2109
125	-1.9	0.52	2	0.04	-0.01	2807	0.174
100	0	0	0	0	0	2924	0.1378
75	0.65	-0.3	-1	-0.02	0.01	3043	0.1023
74	0.65	-0.3	-1	-0.02	0.01	3047	0.1014

Max range calculation — **Calculator view**

This feature (available for Lapua cartridges and bullets) shows the maximum range of a projectile for a shooting range defined by the user, and the calculation is based on the current given angle and click values. With this feature you can check the maximum range of a shot in case it would miss the target.

To calculate Max range of a bullet with optimal angle: go to the Max Range analysis view. If not modified, the analysis view can be found in the bottom panel. Swipe to the last analysis view and press Calculate.

6DOF - Six degrees of freedom

WHAT IS 6DOF?

Six degrees of freedom (6DOF) refers to the freedom of movement of a body in three-dimensional space. The position and orientation of a rigid body in space is defined by three components of movement and three components of rotation, which means that it has six degrees of freedom:

- Moving up and down (elevating/heaving);
- Moving left and right (strafing/swaying);
- Moving forward and backward (walking/surging);
- Swivelling left and right (yawing);
- Tilting forward and backward (pitching);
- Pivoting from side to side (rolling).

All these aspects are taken into account in the Lapua Ballistics app when calculating the perfect shot in specific surroundings, with a specific cartridge and firearm.

