



# Zephyrus Wind Meter

## Quick Start

1. **Calibration (only the first time):** check/set the **calibration values** of your mobile (see the **settings page** and the **calibration page**)
2. **avoid measurement in presence of loud noises** (heavy traffic, combustion engines, loud talking, shots)
3. keep your fingers away from the mobile microphone (hold it by the top) and keep it in vertical position
4. orient the back of the phone upwind (keeping the display in front of you)
5. click on one of the function buttons: **Dynamic** (100ms , max, min, avg), **Average** (1 sec, max, min, avg), **Spectrum** (**Pro edition**).
6. A long click on the speed number resets the current measurement

7. The pause button stops the measurement, the play button restarts the measurement

## Start Page

### Button functions:

1. **Dynamic**: this mode (100ms) is useful to measure a steady state wind (small fluctuations) or to plot and view on a chart the details of a dynamic wind.
2. **Average**: this mode may be useful to measure a dynamic wind (1 second averaging time), when the previous mode results in fluctuations of 2 m/s or more.
3. **Spectrum (Pro edition)**: this mode is useful to make an analysis of the wind frequency spectrum in **real time** and it is displayed a linear or logarithmic chart;

### Menu functions:

1. **HELP**: it shows the app help
2. **INFO**: link to our site
3. **SETTINGS**: app settings page
4. **HELP US**: email link to our service

## Spectrum page (**Pro edition**)

This page displays the spectrum data of the current wind signal.

The **active elements** of the page are the following: dB label, Hz label, mode label, back/forward buttons, Start/Stop button, chart long click, Menu buttons.

Button functions:

1. **START/STOP**: to start or stop the wind recording; in stop mode it is still possible to measure any frequency component amplitude of the displayed chart just moving the frequency marker
2. **BACK/FORWARD**: in order to move the frequency marker

Label functions:

1. **speed label**: a long click resets the current measurement
2. **Hz label**: a click changes the current frequency marker step
3. **Mode label** : a long click displays a list of selectable modes (Dynamic, Average, Peak, Avg Smoothing, Exp Smoothing)

## Chart functions:

1. **chart long click**: automatic zoom in/zoom out

## Menu functions:

1. **SCALE**: it shows a list of selectable frequency bands (Linear, Logarithmic)
2. **MODE\*** : it shows a list of selectable chart modes (Dynamic, Average, Peak, Avg Smoothing, Exp Smoothing)
3. **HELP**: it shows the User Guide
4. **SHARE**: to share measures (CSV) or screenshot (PNG)
5. **EXPORT**: to export measures (CSV) or screenshot (PNG)

\*Mode details:

1. **dynamic (DIN)**: amplitude of each frequency component of the entire observation period
2. **average (AVG)**: mean value of each frequency component related to the entire observation period
3. **peak**: max value of each frequency component related to the entire observation period
4. **Avg smoothing (ASM)**: SMA model, mean value of the last n observations, n can be specified in settings
5. **Exp smoothing (ESM)**: SES model, the smoothing constant can be specified in settings

## Dynamic Page

This page displays the current **wind speed** (100ms), the **compass** and the **WCT (Pro edition)**. Maximum value and Average value of the entire observation period are also provided. This mode (100ms) is useful to measure a steady state wind (small fluctuations) or to plot and view on a chart the details of a dynamic wind

The **active elements** of the page are the following: speed label, Start/Stop button, Menu buttons.

Button functions:

- **START/STOP**: to start or stop the sound recording

Label functions:

- **speed label**: a long click resets the current measurement
- **WCT label**: a long click displays the Wind Chill Calculator

Menu functions:

1. **UNITS (Pro edition)**: it shows a list of selectable measurement units (m/s, Km/h, knots, mph, Beaufort number)
2. **THRESHOLD**: in order to set, reset or disable the current threshold (if exceeded)

it changes the max value color to red; it is also possible to display the anemometer speed limit with the current settings)

3. **HELP:** it shows the User Guide
4. **WIND CHILL (Pro edition):** calculation of the wind chill
5. **CALIBRATION:** it opens the calibration page of the anemometer
6. **SHARE:** to share measures (CSV) , , screenshot (PNG)
7. **EXPORT (Pro edition):** to export measures (CSV) , chart data (CSV), screenshot (PNG)

## Average Page

This page displays the current **wind speed** (1 sec averaging), the **compass** and the **WCT (Pro edition)**. Maximum value and Average value of the entire observation period are also provided. This mode may be useful to measure a dynamic wind (1 second averaging time), when the dynamic mode results in fluctuations of 2 m/s or more

The **active elements** of the page are the following: speed label, Start/Stop button, Menu buttons.

Button functions:

- **START/STOP**: to start or stop the sound recording

Label functions:

- **speed label**: a long click resets the current measurement
- **WCT label**: a long click displays the Wind Chill Calculator

Menu functions:

1. **UNITS (Pro edition)**: it shows a list of selectable measurement units (m/s, Km/h, knots, mph, Beaufort number)

2. **THRESHOLD:** in order to set, reset or disable the current threshold (if exceeded it changes the max value color to red)
3. **HELP:** it shows the User Guide
4. **WIND CHILL (Pro edition):** calculation of the wind chill
5. **CALIBRATION:** it opens the calibration page of the anemometer
6. **SHARE:** to share measures (CSV) , , screenshot (PNG)
7. **EXPORT (Pro edition):** to export measures (CSV) , chart data (CSV), screenshot (PNG)

## Wind Chill Calculator (**Pro edition**)

In the **Average or Dynamic** page it is possible to access to the Wind Chill Calculator. A **click on the on the top left WCT label (or selecting the proper menu item)** it is possible to open the **Wind Chill Calculator**.

### **Input values:**

**Air temperature:** on smartphones with a temperature sensor (such as Galaxy 4, Galaxy 5, Nexus 5 and others) the value is obtained automatically; it is also possible to modify it manually for specific calculations. With a click on the Air Temperature button it is possible to read the current air temperature (if a sensor is available).

**Wind speed:** the value is obtained automatically from the current measure; it is also possible to modify it manually for specific calculations. . With a click on the Wind Speed button it is possible to read the current wind speed measure.

The **input/output units** (of temperature and speed) are automatically those of the current application.

**The calculator is based on the NWS formula that is suitable for temperatures lower than 10 °C (50 °F) and for wind speeds greater than 5 km/h (3 mph).**

## Settings Page

This page allows to personalize all the app settings (access from the Start Page menu):

1. **Wallpapers**: it is possible to select the favorite wallpaper (default: sky)
2. **Display colors**: it is possible to select the favorite color style (default: light blue)
3. **Speed Units (Pro edition)**: it is possible to specify the default speed unit: m/s, Km/h, knots, mph, Beaufort number
4. **Temperature Unit (Pro edition)**: it is possible to specify the default temperature unit: °C, °F
5. **Dynamic reference line (Pro Edition)**: it is possible to specify the current reference line in dynamic mode: none, AVG, MAX
6. **Measurement direction (Pro Edition)**: possible to set the default measurement direction: **Upwind** (default, suitable for most devices), **Downwind** (it may be useful for some tablets with the microphone positioned on the front side of the device: in this case do not shield the microphone with your body during the measurements)

7. **Maximum SPL\***: it is possible to specify the microphone maximum SPL in dB (default 90, suitable for most mobiles)
8. **Exponent \*** (**Pro edition**): it is possible to specify the speed equation exponent value from a list (default 6, suitable for most mobiles)
9. **Constant \*** (**Pro edition**): it is possible to specify the speed equation free term (default 12, suitable for most mobiles)
10. **Noise level \***: it is possible to specify the background noise level (default 4); **sometimes this level needs a calibration** (see the calibration page for more details)
11. **AGC\*** : it is possible to disable the mobile Automatic Gain Control active only in some mobiles (if the app is sensible to low level talking you must check it and disable AGC!)
12. **Sensibility\*** : it is possible to reduce the sensibility of the microphone (see the calibration page for more details)
13. **Wind Smoothing \*** : it is possible to specify a SMA smoothing factor: it is the mean value of the last n observations (default 1 observation: a greater size implies a higher smoothing but a lower sensibility to wind gusts). It may be

useful to stabilize measures/graphs with variable winds.

14. **Refresh rate** \* \* (**Pro edition**): it is possible to specify the frame refresh rate (FPS) of the spectrum chart (default 5: a higher rate implies a smoother vision and it requires a fast mobile processor)
15. **FFT size** \* \* (**Pro edition**): it is possible to specify FFT (Fast Fourier Transform) window size in bytes (default 2048: a greater size implies higher Hz accuracy and it requires a fast mobile processor to ensure real time processing)
16. **AVG smooth** (**Pro edition**): it is possible to specify a SMA smoothing factor: it is the mean value of the last n observations (default 3 observations: a greater size implies a higher smoothing but a lower sensibility). It may be useful to capture peak sequences.
17. **EXP smooth** (**Pro edition**): it is possible to specify a SES smoothing factor for the weighted moving average (default 0.5: a smaller size implies a higher smoothing but a lower sensibility). It may be useful to capture peak sequences.
18. **Filter cutoff** (**Pro edition**): it is possible to specify cutoff frequency of the wind

band (to avoid some specific interference).

\* Remember that a wrong setting will effect the accuracy of your measurements.

**If you do not have the correct information of your mobile leave the default values or see the calibration section.**

\*\* Remember that increasing the value of this setting (FPS or FFT) requires more processing power for **real time processing**: if you change the default always check the chart behavior: if you notice some pauses in displaying the chart then it is recommended to decrease the setting value.

## Calibration Settings

The **default calibration values are suitable for most smart phones**. Some mobiles are automatically calibrated in the first installation phase (Samsung GT-I9000, GT-9300, GT-S5570, I9505). If necessary it is possible to change the default calibration parameters in the **settings page**. For a perfect calibration you need a professional anemometer, but you can get a fair calibration with the following:

1. **Noise level**: in the settings page set the noise level to 0; start the dynamic function (in m/s) in a **silent room** (no external noises like in a library or a bedroom), read after 10 seconds the average value (fix) : if  $>0$ , set the noise level to the fix rounding up to the nearest integer (in the settings page: **usually this parameter is from 2 to 4**) .
2. **Sensibility** : if the wind speeds are all higher than expected you can reduce the sensibility of the microphone just checking this setting (**default: unchecked**)
3. **Maximum SPL**: if the wind speeds are all **higher/lower** than expected it is possible to **decrease/increase** the

- microphone maximum SPL in dB  
(default 90, suitable for most mobiles)
4. **Exponent (Pro edition):** if low wind speeds are fine but high wind speeds are too high or too low you need to set this parameter (a higher exponent decrease the value of wind speeds, a lower exponent increase the value of wind speeds: **usually this parameter is from 5.75 to 6.25, default 6**)
  5. **Constant (Pro edition):** if your microphone has a special wind shield then this constant may be lower than the default one (**usually you do not need to change this parameter**).
  6. **AGC :** if the application is sensible to low level talking (at a distance > 50 cm from the mic) you need to check it (and disable AGC!); some mobiles erroneously activate it for the application recording source (**default: checked**).

Once you have gone through the settings parameters (usually you need to verify the noise level and Maximum SPL) you can **use the Calibration Page** to complete the calibration of the meter.

## Calibration Page

In this page (to open it use the Dynamic/Average page Menu) you can change the default calibration using the available **sliders** and chart:

**All slider:** it changes the speed measure of all the winds (+-30%)

**Low slider (Pro edition):** it changes the speed measure of the low winds (+-30%)

**Mid slider (Pro edition):** it changes the speed measure of the low winds (+-30%)

**High slider (Pro edition):** it changes the speed measure of the high winds (+-30%)

Tapping on the chart you can select the wind speed that you want to calibrate: when you move the sliders the chart curve and the wind speed change accordingly.

### **Fast way to calibrate the anemometer:**

- a) Set the **noise level** (see calibration settings)
- b) Identify the wind speed that leads to **full scale** the instrument, **tap on the calibration chart on the maximum curve value** and match the known wind using the **All slider**
- c) Measure a known **medium wind**, **tap on the calibration chart on the measured value** and match the known wind with the **Mid slider**

## Troubleshooting

1. **Wrong maximum value:** all your measurement are higher or lower than expected. Enter in the settings menu and select the correct SPL maximum value or open the Calibration page and use the All slider
2. **Wrong calibration:** high level measurements are higher or lower than expected. See the Calibration page.
3. The application is **sensible to low level talking** (at a distance  $> 50$  cm from the mic): go in the settings menu and **disable ACG (check it)**, some mobiles erroneously activate it for the application recording source.
4. **No signals detected below 1 m/s or over 20 m/s:** The smart phone microphones do not work under/over a specific pressure. In the threshold menu you can display the **blue line** of the anemometer **speed limit** (Mic Maximum) that can be detected by your microphone with the current calibration settings. For instance a smartphone with a microphone with a maximum SPL of 90db without any special windshields cannot measure wind

speeds greater than 16 m/s: the background noise level on your signal can introduce a further reduction.