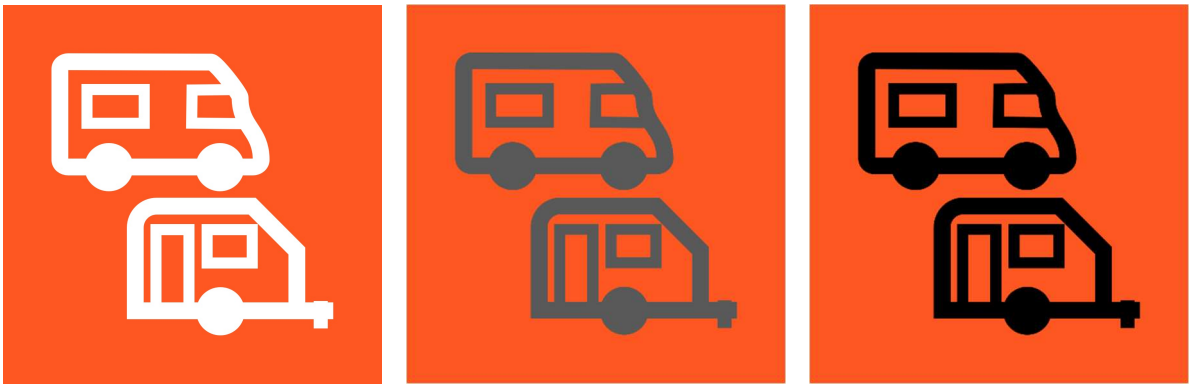

Level Measurement for Mobile Homes and Caravans

Level light
Level pro
Level plus

Operating instructions

Version 5.2.1

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2 Warranty and safety

With our Level apps, you can easily measure the inclination of your motorhome or caravan using a smartphone or tablet. You can also view the data on a smartwatch (Wear OS or Apple Watch) or via Android Auto and Apple CarPlay. The Level apps are available in three different versions: Level light, Level pro, and Level plus.

For the Level light and Level plus versions, the inclination can be measured using an external sensor from the Chinese company WitMotion. This sensor is not included with the product. While compatibility with the sensor has been tested, it cannot be guaranteed. No warranty is provided for these sensors; please consult the sensor manufacturer for information regarding their safe use.

The Level app is a technical software product that has undergone testing by us. Nevertheless, complex products may occasionally contain errors that were not detected during testing. The developer (Dr. Dieter August Ackermann, 65plusIT) assumes no liability for any damages resulting from the use of the Level apps.

3 The Level app

With our leveling app, you can easily measure the inclination of your motorhome or caravan using a smartphone/tablet or an external sensor. The leveling app is available in three different product versions: Level light, Level pro, and Level plus.

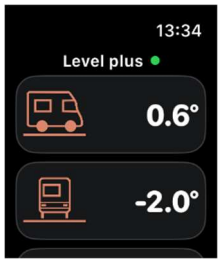
3.1 Product variants

In the 'Light' and 'Plus' versions of the Level app, you can connect external sensors from WitMotion via Bluetooth - in addition to using the internal sensors of your smartphone or tablet. These external sensors handle the vehicle's inclination measurements and can be placed anywhere within the vehicle.

The inclination of your vehicle - from back to front and from left to right - is clearly displayed in degrees within the Level app, on an Apple Watch or a smartwatch running Wear OS, and via CarPlay.

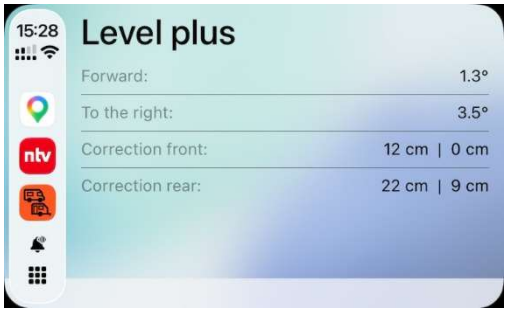
Smartphone

Apple Watch

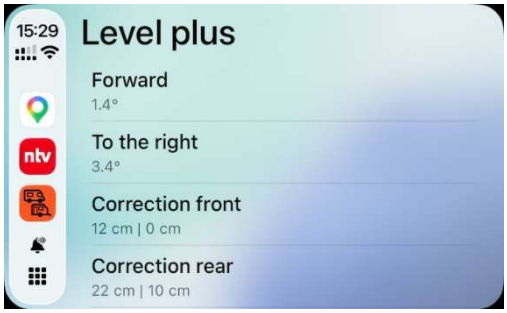


Watch (Wear OS)

CarPlay Display 1



CarPlay Display 2



The Pro and Plus versions then use the displayed angles to individually calculate how many centimetres the vehicle needs to be raised at each wheel in order to be level. As this height correction for motorhomes depends on the distance between the wheels on the front axle, those on the rear axle and the centre distance, these dimensions can be specified individually in the Pro and Plus versions of the Level app. For caravans, the wheelbase of the wheels on the running axle and the distance between the axle and the support wheel are specified. The Light version does not offer this option.

The sensor for external measurement of the tilt angle is not part of the product and must be purchased separately. Compatibility with the WitMotion BWT901BLECL5.0 and WT9011DCL-BT50 sensors has been tested, but unfortunately cannot be guaranteed. For a compatibility test with your smartphone or tablet, you can use the free Level light version of this app.

3.2 Overview of product variants for Smartphones

Product variants	**Level light**	**Level pro**	**Level plus**
Vehicle inclination in degrees front/rear	✓	✓	✓
Vehicle inclination in degrees left/right	✓	✓	✓
Vehicle inclinations also in percent	✓	✓	✓
Measurement with internal sensor	✓	✓	✓
Measurement with external WitMotion sensor	✓		✓
- WitMotion Sensor WT9011DCL	✓		✓
- WitMotion Sensor WT901BLECL	✓		✓
- WitMotion Sensor BWT901BLECL5.0	✓		✓
Individual height correction		✓	✓
Adjustable wheel spacing		✓	✓
Quick start	✓		✓
Display frequency adjustable on smartphone		✓	✓
Display frequency adjustable on smartwatch		✓	✓
Display frequency adjustable on CarPlay		✓	✓
Calibration of the internal sensor (smartphone)		✓	✓
Calibration of the external sensor (WitMotion)			✓
Input calibration values for external sensor		✓	✓
Setting the measuring direction smartphone/tablet		✓	✓
Setting the measuring direction of the external sensor			✓
Language setting	✓	✓	✓

Setting of various primary colors	✓	✓	✓
Adjustment of the display inertia	✓	✓	✓
Privacy policy	✓	✓	✓
Help	✓	✓	✓
Info	✓	✓	✓

3.3 Overview of product variants for Smartwatch (Wear OS) and Apple Watch

Product variants	**Level light**	**Level pro**	**Level plus**
Display of vehicle inclination in degrees front/rear	✓	✓	✓
Display of vehicle inclination in degrees left/right	✓	✓	✓
Display of the height correction		✓	✓

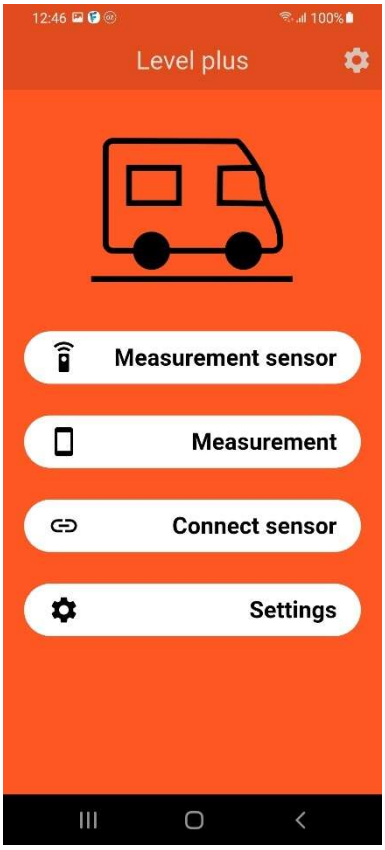
3.4 Overview of product variants for CarPlay and Android Auto

Product variants	**Level light**	**Level pro**	**Level plus**
Display of vehicle inclination in degrees (rear/front)	✓	✓	✓
Display of vehicle inclination in degrees (left/right)	✓	✓	✓
Display of height correction		✓	✓

4 Description of the pages

As most of the pages and functions in the Level light, Level pro and Level plus apps are the same, they are described together here.

4.1 Main page (Home)



After starting the app, you will be taken to the main page (Home). You can only start a measurement with a sensor here if you have previously established a connection to a sensor. To do this, select "Connect sensor".

Otherwise, you can take the measurement using the sensors built into the smartphone or tablet itself.

Several setting options and information are available via the "Settings".

If you want to end a measurement but not the entire app, you should navigate to the Home page so that no more measurement data is processed by the app in the background. This is done by clicking the back icon or the home icon.

4.2 Search for and connect sensor

If you have switched on Bluetooth on your smartphone or tablet and the sensor, the sensor will be displayed here in Level light and Level plus with its internal identifier after a short time.

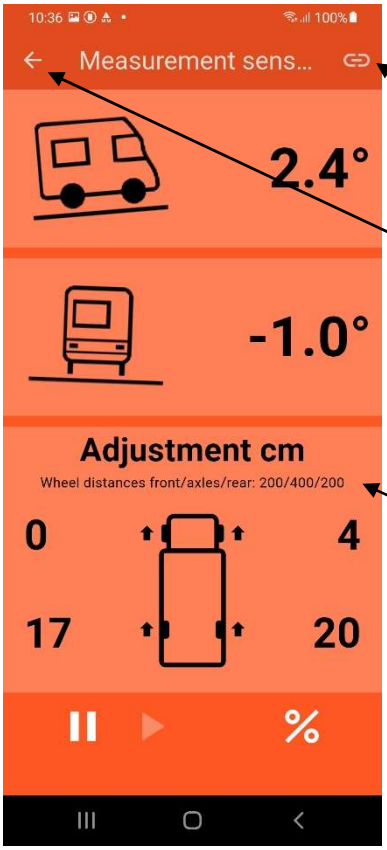
The identifiers for the sensor types are

- WT9011DCL (WT901BLE67)
- WT901BLECL (WT901BLE68)
- BWT901BLECL5.0 (WT901BLE68).

You can establish a connection with the sensor by pressing the button. This may take a few seconds again.

If you uncheck☑ , you will be shown not only Witmotion sensors but all accessible Bluetooth devices when you call up the page again.

4.3 Measurement with Sensor or Smartphone (1)



The upper section displays the vehicle's tilt from back to front and the tilt from left to right in degrees up to the maximum calibration range.

If the connection to the external sensor is lost, the Light and Plus versions of the sensor can be reconnected.

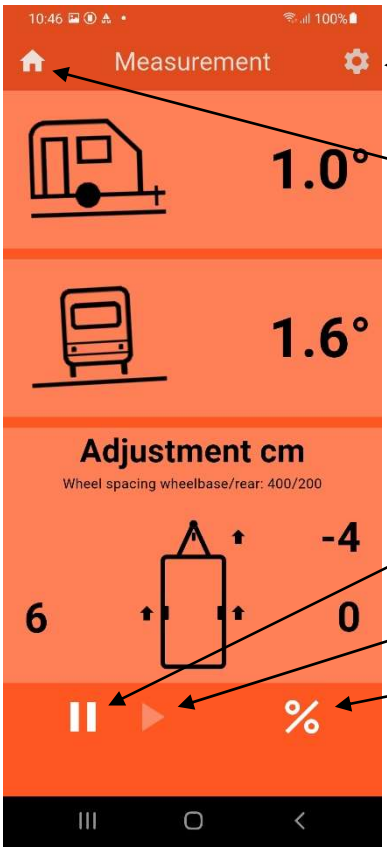
This takes you to the main and menu page after completing the measurement (recommended).

A height correction can be calculated for the individual wheels based on the individually set wheel spacing of the vehicle so that the vehicle is levelled.

The wheel distances for calculating the height correction can be found here.

Individual wheel distances can only be set in the Pro and Plus versions of the app. Demo values are used in the Light version.

4.4 Measurement with Sensor or Smartphone (2)



This takes you directly to the settings in Level pro.

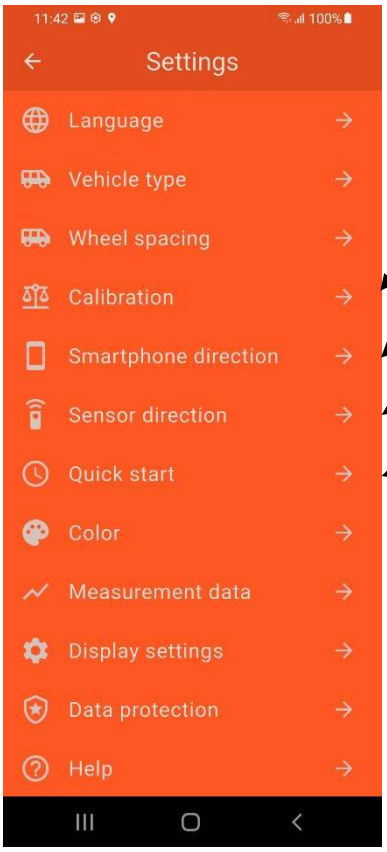
The Home button ends the measurement and returns you to the Home menu.

The Pause button stops the measurement and saves the values.

The Start button resumes the measurement.

The Percent button switches between displaying the inclination angle in 360 degrees and as a percentage during the measurement.

4.5 Settings (1)



You can access the settings from various pages and customise how the app works for you.

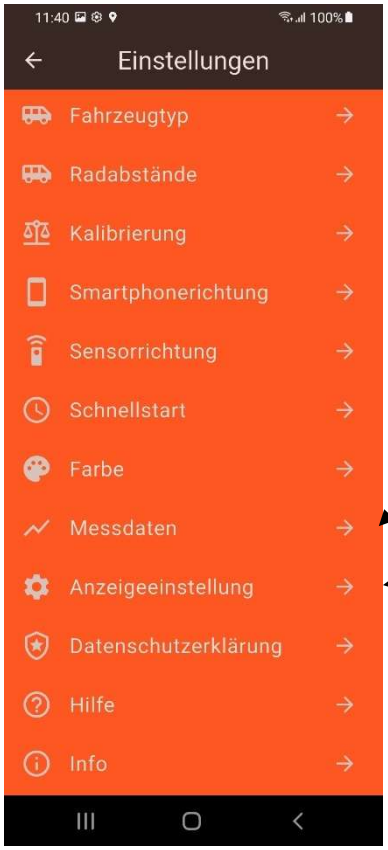
Depending on the version, calibration includes both the external sensor and the internal sensor.

Setting the measuring direction of the smartphone/tablet in the vehicle.

Setting the measuring direction of the external sensor in the vehicle.

The quick start of the app and connecting the sensor is only available in the Light and Plus versions. When you start the app, you are taken directly to the page for measuring with the sensor.

4.6 Settings (2)

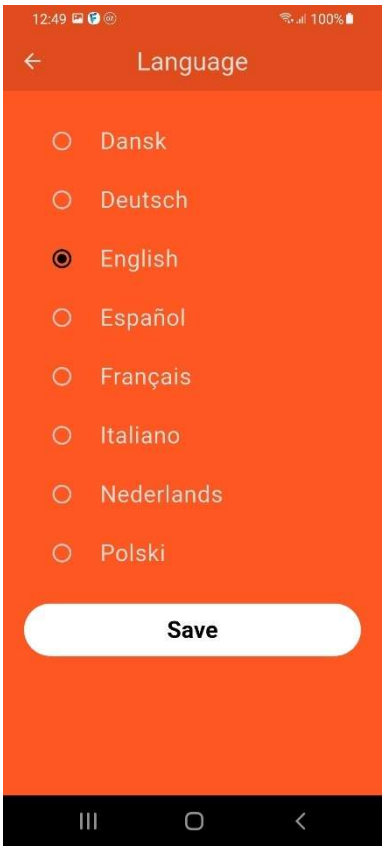


You can access the settings from various locations; here, you can customize how the app functions to suit your personal preferences.

The measurement data settings allow you to adjust the responsiveness (inertia) of the displayed data, as well as the averaging method used for these values.

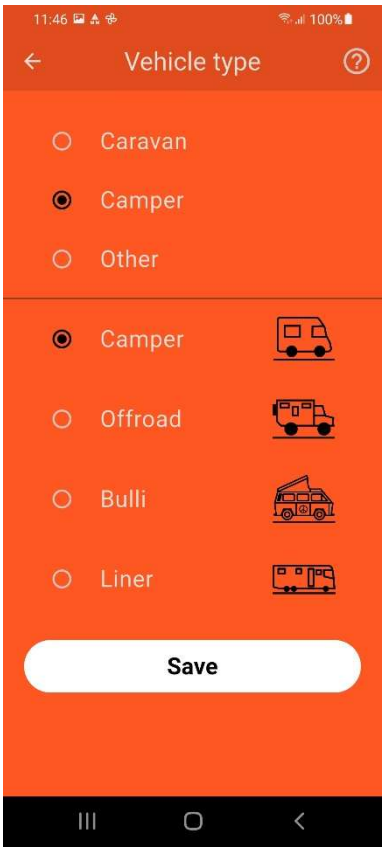
The display settings allow you to define the refresh rate for the measurement data shown on your smartphone, smartwatch, CarPlay, or Android Auto.

4.7 Languages



You can choose between eight different languages and save the selected one.

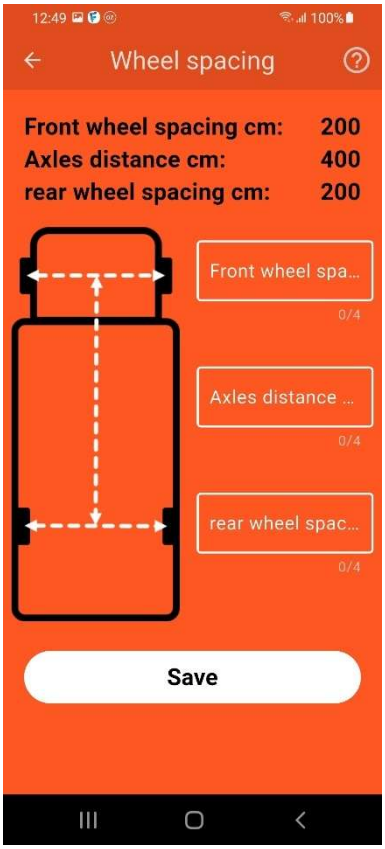
4.8 Vehicle type



In the app, you can switch the vehicle type between Caravan (Eco, Deluxe, Airstream, Retro), Motorhome (Camper, Offroad, VW Bus, Liner), and Other (Jeep, Beach Buggy, Motorcycle, Sailboat) and save this setting.

For motorhomes, the elevation correction is calculated for four control points; for caravans, for three; and for the Other vehicle type, the elevation correction is not displayed on the measurement pages.

4.9 Motorhome wheelbase



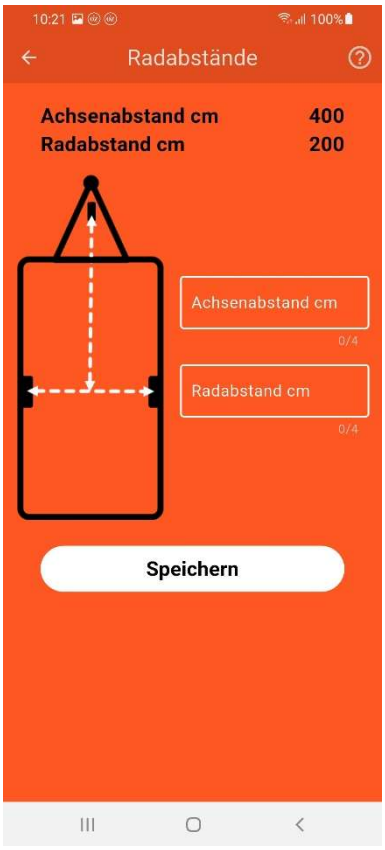
Only in the Level plus and Level pro apps can you enter and save your vehicle's wheelbase, allowing a customized height adjustment to be calculated. The measurement is taken from the center of the tire.

The currently set wheel distances are displayed in the upper area.

The wheelbases of the front axle, between the front and rear axles and the rear axle are recorded and saved in cm.

This is only possible in Level plus and Level pro. In Level light, the height correction is calculated as a demo with fixed wheel distances.

4.10 Caravan wheelbases



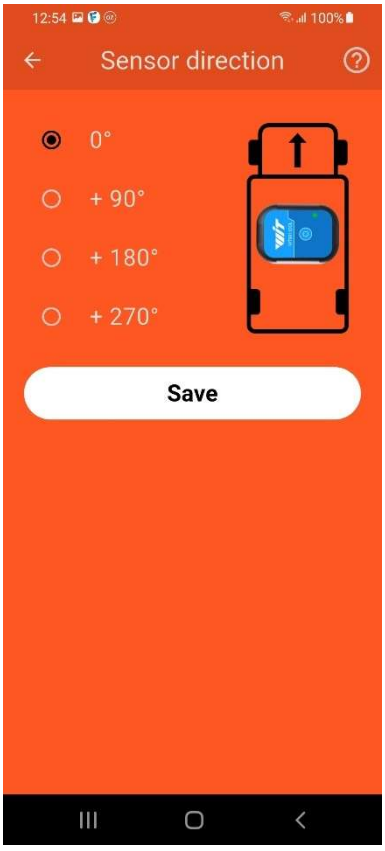
Only in the Level plus and Level pro apps can you enter and save your vehicle's wheelbase, allowing a customized height adjustment to be calculated. The measurement is taken from the center of the tire.

The currently set wheel distances are displayed in the upper area.

The wheel distances of the support wheel and the rear axle and on the rear axle are recorded and saved in cm.

This is only possible in Level plus and Level pro. In Level light, the height correction is calculated as a demo with fixed wheel distances.

4.11 Sensor direction

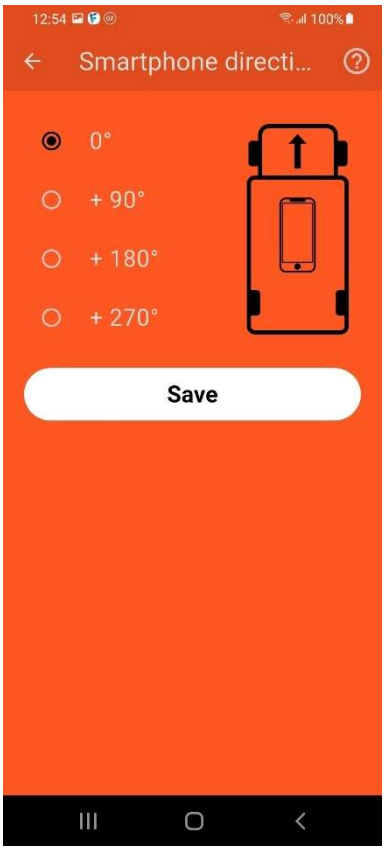


The direction of the sensor for the measurement can be set in Level plus.

By defining the sensor direction, it is possible to position the sensor even more individually in your vehicle. You have four different options for horizontal mounting, whereby the X direction of the sensor is rotated clockwise by 90° in each case.

Further information on mounting the sensor can be found in chapter 5.

4.12 Smartphone direction



The direction of the smartphone/tablet for the measurement can be set in Level plus and Level pro.

By defining the measuring direction of the smartphone/tablet, you have the option of positioning the smartphone/tablet even more individually in your vehicle for the measurement. You have four different options for horizontal measurement, whereby the X direction of the smartphone/tablet is rotated clockwise by 90° in each case.

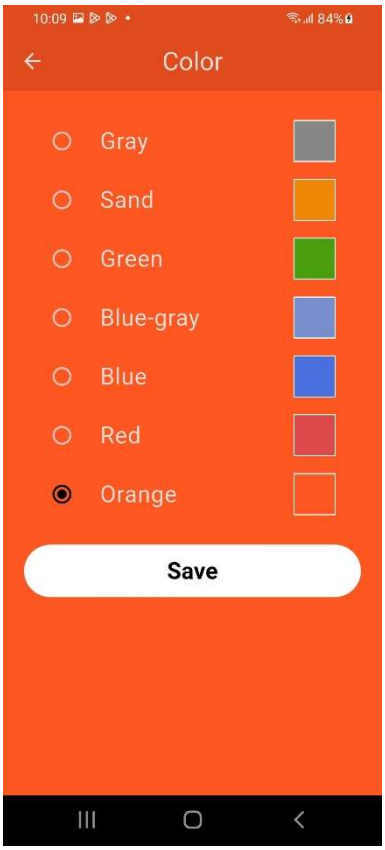
4.13 Quick start

You can set up the quick start for the connected sensor so that the page with the measurement of the sensor is displayed immediately after mounting, connecting and calibrating the sensor in the vehicle after starting the Level app.

Of course, Bluetooth must be switched on in the smartphone or tablet and the sensor must be switched on when the app is started so that the measurement page is displayed after starting the app. However, this can take a few seconds, as the sensor must first be searched for, found and then connected via Bluetooth in the background.

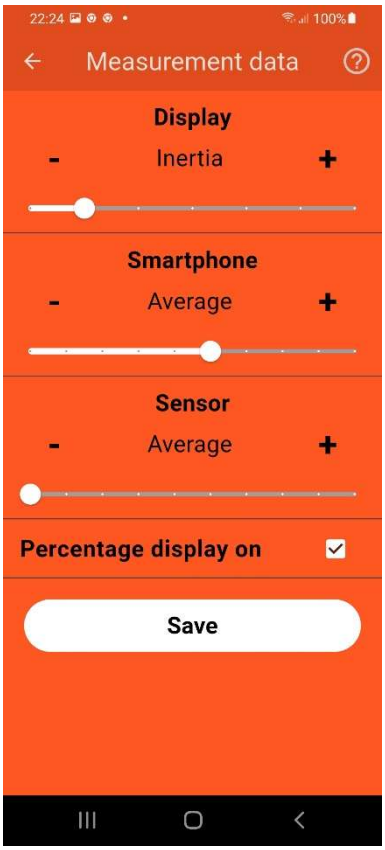
You can switch off the quick start again here with "Reset"

4.14 Colour



Here you can adjust the colour to your individual taste.

4.15 Measurement data (1)



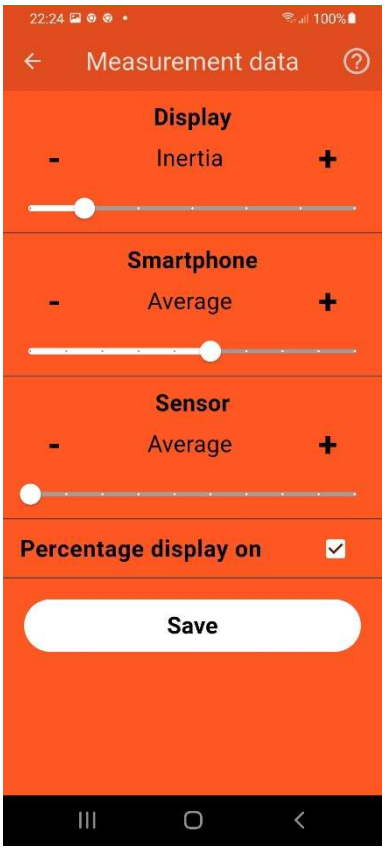
Inertia affects the display of vehicle inclination and altitude correction. You can individually increase the inertia of the measurement data on a scale of 0 to 6, where 0 means no inertia and the display is very sensitive during measurement.

Please note that a large increase in inertia also slightly increases the inaccuracy of the display.

The average allows you to smooth the measurement data from the smartphone and the sensor. The average can be set between 1 and a maximum of 10 of the most recent measurement data. Increasing the average for smartphones often leads to better display results.

When calibrating the smartphone or sensor, the average of the last 10 measurement data is used.

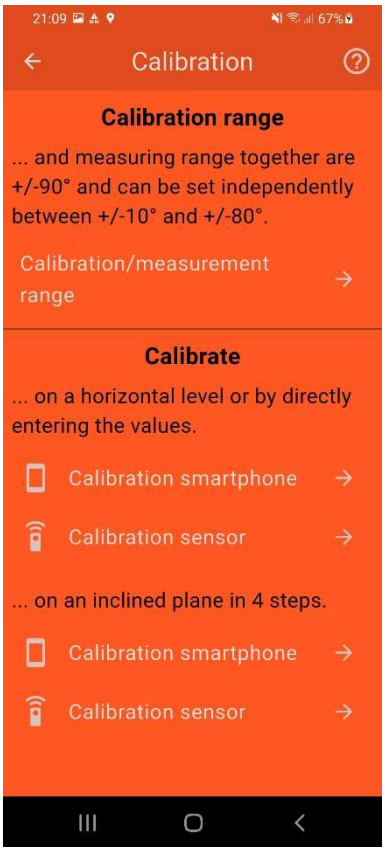
4.16 Measurement data (2)



With "Percentage Display On," you can specify whether or not you want to enable the percentage display in the "Measurement" and "Sensor Measurement" dialogs.

If this checkbox is selected, the percent button will appear in the measurement dialogs to toggle the angle display between degrees and percent.

4.17 Calibration



In Level Plus and Level Pro, you can adjust the calibration and measurement range. Both have a combined range of ±90°, which can be independently adjusted between ±10° and ±80°. This allows you to tailor the calibration and measurement range to your specific needs.

You can choose whether to calibrate your smartphone or sensor on a level surface or enter the values manually.

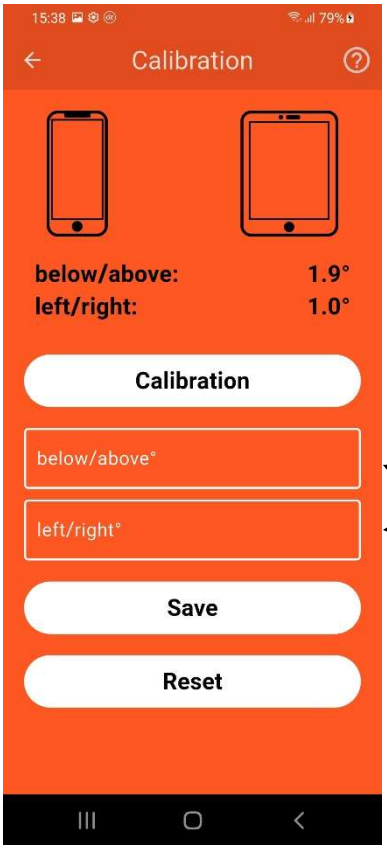
If you only have an inclined, non-level surface available, you can use a four-step wizard that enables calibration even on an inclined surface.

4.18 Calibration and measuring range

The default setting is +/-60° for the calibration range and +/-30° for the measurement range.

In Level Plus and Level Pro, you can adjust the calibration and measurement ranges. Together, they are +/-90° and can be set independently between +/-10° and +/-80°. This allows the calibration and measurement ranges to be tailored to individual requirements.

4.19 Calibration smartphone on a horizontal level



In Level Plus, the smartphone or tablet can be calibrated automatically and manually.

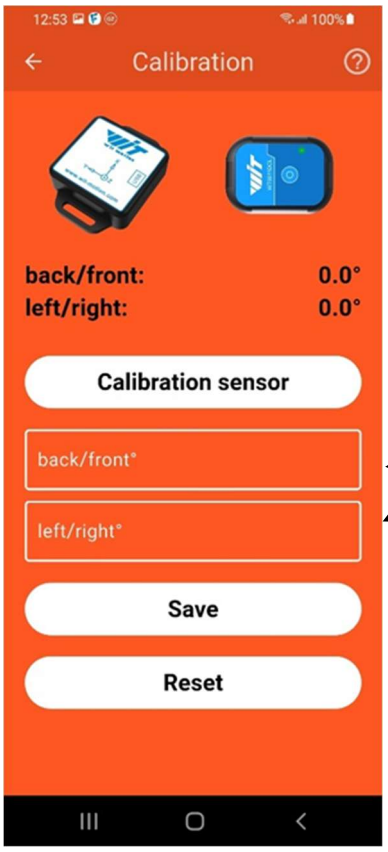
If the device is to be mounted on a non-horizontal surface in the vehicle (max. +/-30°), the device can be calibrated so that this surface is considered horizontal for the device.

The smartphone should be left still for a few seconds before calibration. Therefore, the calibration measurement only takes place after a rest period of 10 seconds. For angle measurements, the average of the last 10 measured values is always used during calibration.

The inclination values can also be entered manually here.

The inclination values are saved by clicking "Save," and the inclination values can be reset to 0 and saved by clicking "Reset."

4.20 Calibration sensor on horizontal plane



In Level Plus, the sensor can be calibrated automatically and manually. If the sensor is to be mounted on a non-horizontal plane in the vehicle (max. +/-30°), the sensor can be calibrated so that this plane is considered horizontal for the sensor.

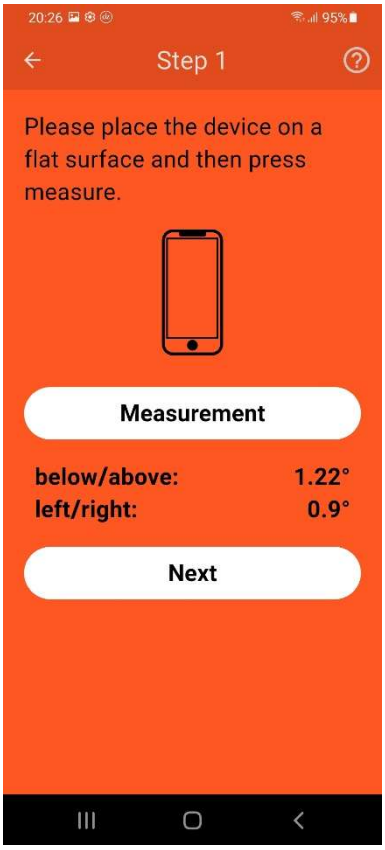
The sensor should be immobilized for a few seconds before calibration. Therefore, the calibration measurement only takes place after a rest period of 20 seconds. For angle measurements, the average of the last 10 measured values is always used during calibration.

The inclination values can also be entered manually here.

The inclination values are saved with "Save," and the inclination values can be reset to 0 and saved with "Reset."

Further information on calibrating and mounting the sensor can be found in Chapter 5.

4.21 Calibrating your smartphone on an inclined plane (Step 1)



An explanation of this process can be found in Chapter 5.5.

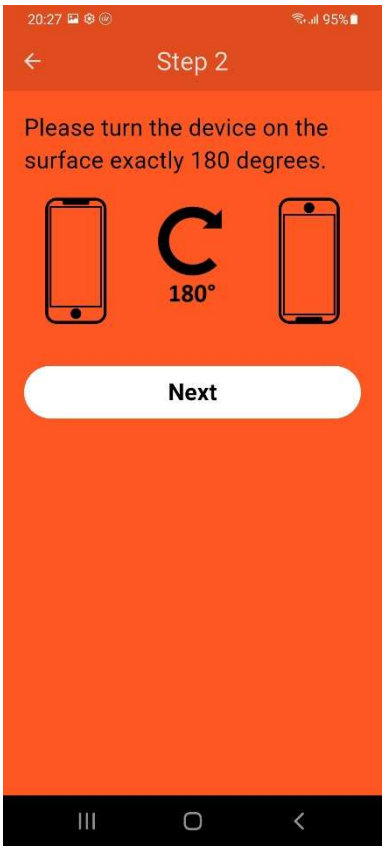
Calibrating the smartphone on an inclined (not necessarily horizontal) surface is performed in four steps.

Find any surface (e.g., a table) with an angle between -30° and +30° and place your smartphone or tablet on it.

Then press Measure. The measurement takes approximately 10 seconds. For angle measurements, the average of the last 10 measured values from the internal angle sensors is always used during calibration.

After completing the measurement, press Continue to Step 2.

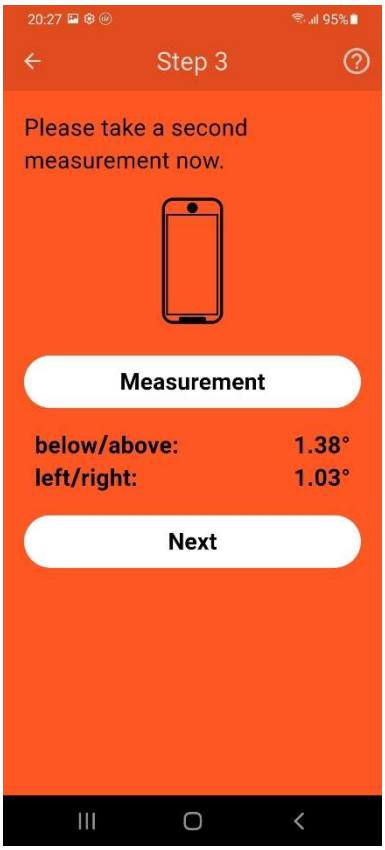
4.22 Calibrating your smartphone on an inclined plane (step 2)



Now rotate the smartphone or tablet exactly 180° on the plane.

Then click Next and go to step 3.

4.23 Calibrating your smartphone on an inclined plane (step 3)

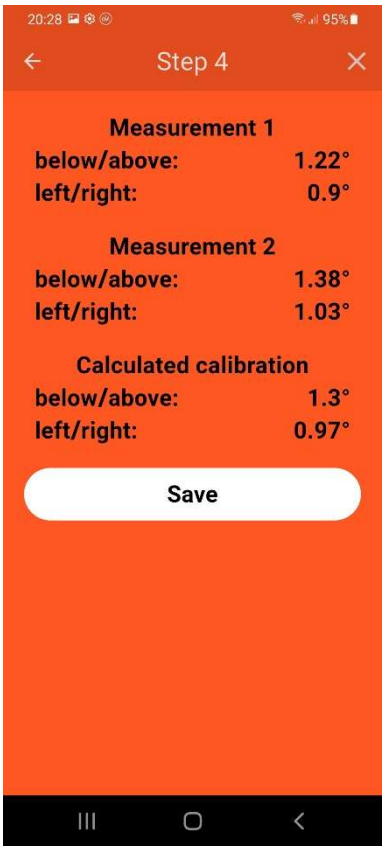


Now measure the angles in the other direction.

Note: A spirit level would show the same deviation in the other direction after rotation.

After measuring, proceed to step 4.

4.24 Calibrating your smartphone on an inclined plane (step 4)

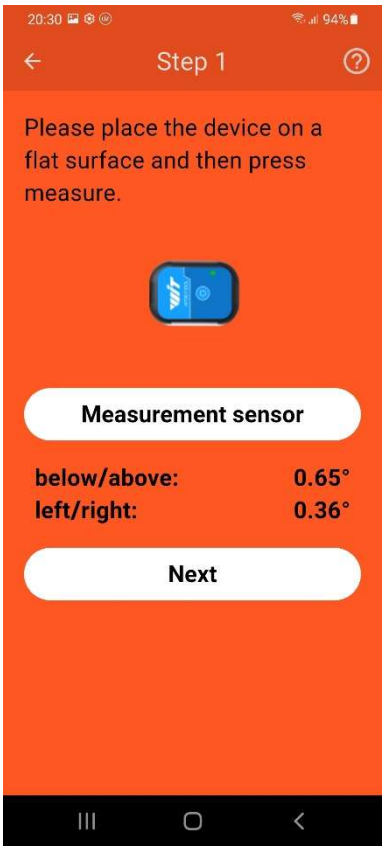


The results of Measurement 1 and Measurement 2 are displayed here. The calculated calibration is the average of Measurement 1 and Measurement 2.

Click Save to accept and save the calculated calibration.

Click X to exit the calibration process without saving the data.

4.25 Calibration sensor on an inclined plane (step 1)



An explanation of this process can be found in Chapter 5.5.

Calibrating the sensor on an inclined (not necessarily horizontal) plane is performed in four steps.

Find any plane (e.g., a table) with an angle between -30° and +30° and place the sensor on it.

Then press "Measure." The measurement takes approximately 20 seconds. The average of the last 10 measured values from the angle sensor is always used for the angle measurement during calibration.

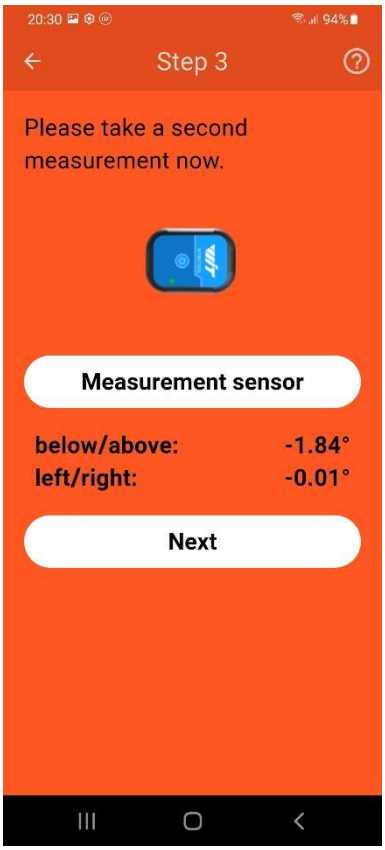
After completing the measurement, press "Continue to Step 2."

4.26 Calibration sensor on an inclined plane (step 2)

Now rotate the sensor exactly 180° on the plane.

Then press Next and go to step 3.

4.27 Calibration sensor on an inclined plane (step 3)

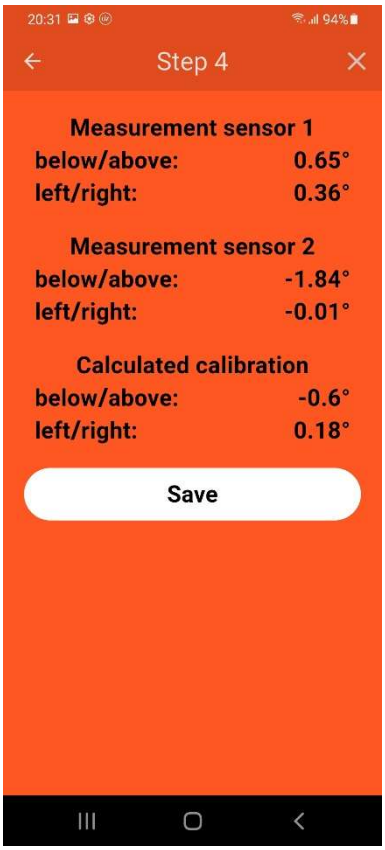


Now measure the angles in the other direction.

Note: An accurate spirit level would show the same deviation in the other direction after the rotation.

After measuring, proceed to step 4.

4.28 Calibration sensor on an inclined plane (step 4)

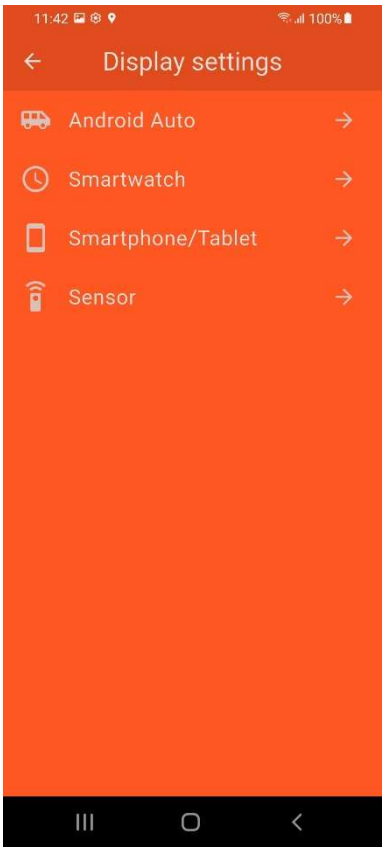


The results of Measurement 1 and Measurement 2 are displayed here. The calculated calibration is the average of Measurement 1 and Measurement 2.

Click Save to accept and save the calculated calibration.

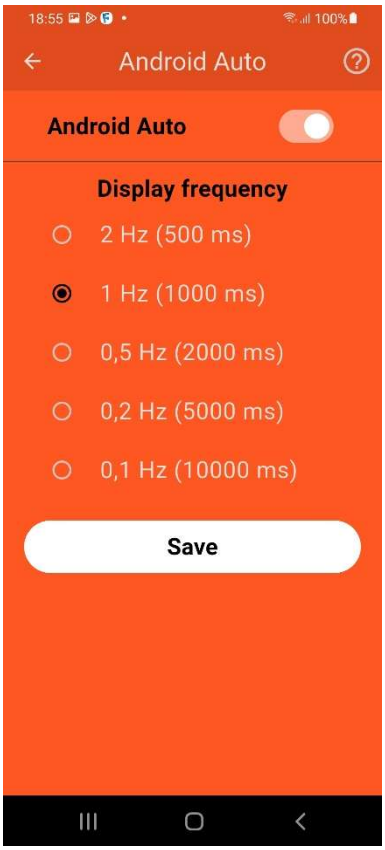
Click X to exit the calibration process without saving the data.

4.29 Display setting



Here you can set the refresh rate for the display of measured values on the “Measurement” and “Sensor Measurement” pages, on your smartwatch (Wear OS or Apple Watch), and via Android Auto or CarPlay.

4.30 Android Auto / CarPlay display setting



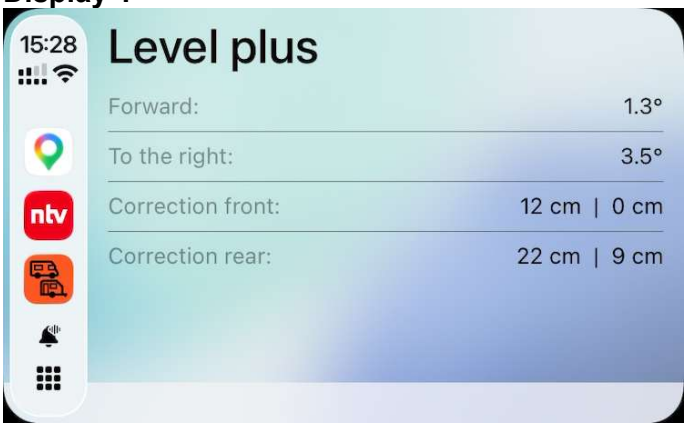
Here you can configure whether you wish to use Android Auto or CarPlay.

You can also set the refresh rate for the display of measured values on Android Auto or CarPlay, ranging from:

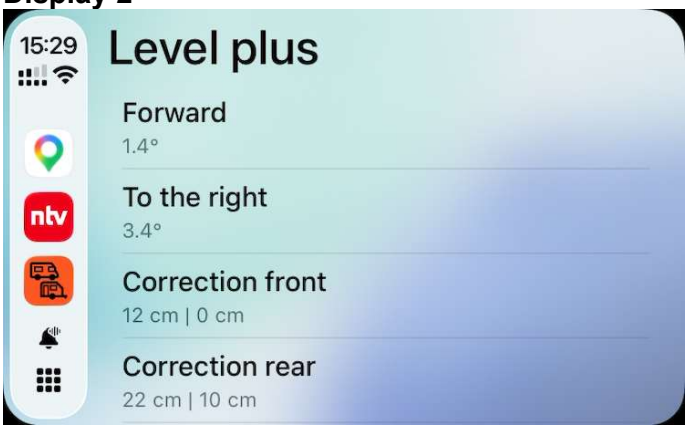
- 2 Hz (update every 0.5 seconds) to
- 0.1 Hz (update every 10 seconds).

The default setting is 1 Hz, which means the display is updated once p er second (1000 ms).

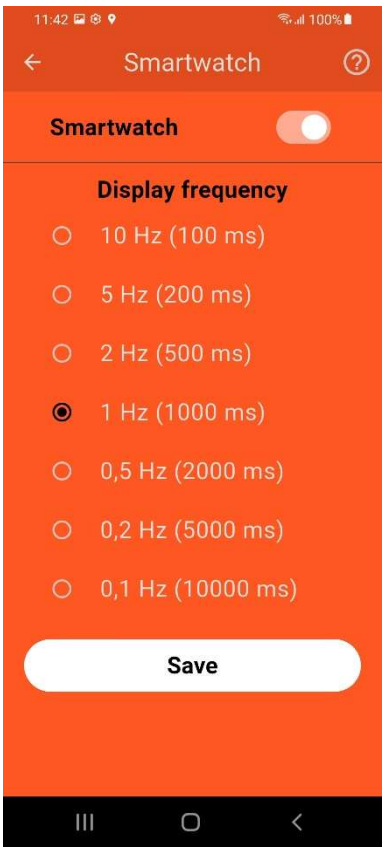
Display 1



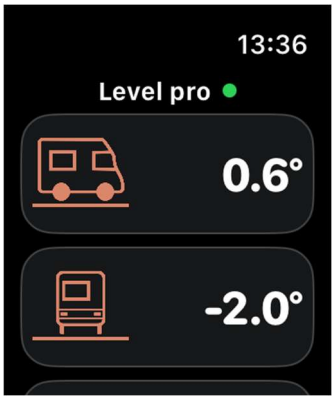
Display 2

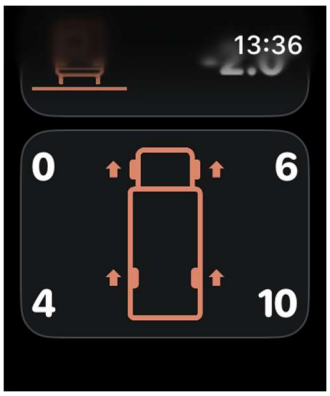


4.31 Display setting for Apple Watch / Smartwatch (Wear OS)



Apple Watch



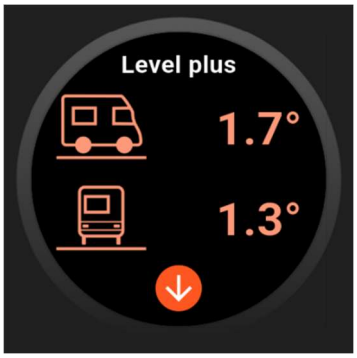


Here you can specify whether you wish to use an Apple Watch or a smartwatch running Wear OS.

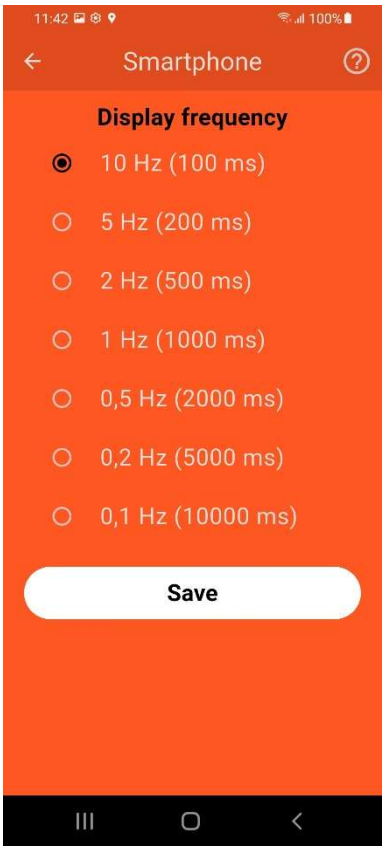
You can also set the refresh rate for the display of measured values on an Apple Watch or a Wear OS smartwatch, ranging from:
• 10 Hz (updating every 0.1 seconds) to
• 0.1 Hz (updating every 10 seconds).

The default setting is 1 Hz, which means the display updates once per second (1000 ms).

Smartwatch (Wear OS)

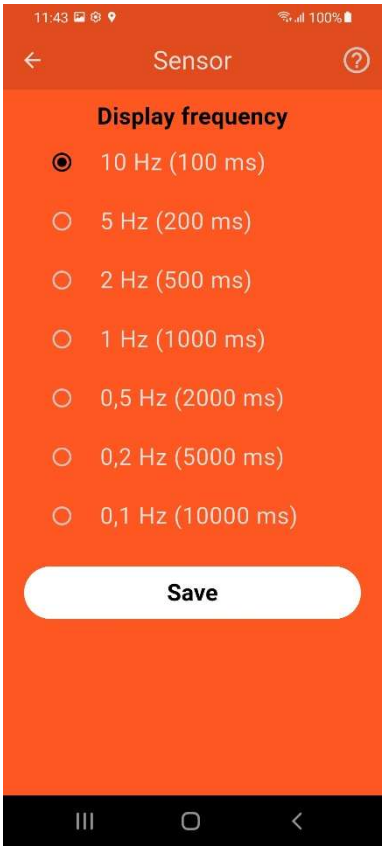


4.32 Display setting for smartphone/tablet and sensor



Here, you can set the refresh rate for the display of measurement values from the smartphone/tablet's internal sensor and the external sensor, ranging from:
• 10 Hz (update every 0.1 seconds) to
• 0.1 Hz (update every 10 seconds).

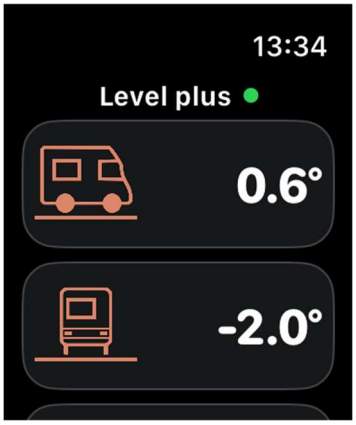
The default setting is 10 Hz, which corresponds to 10 display updates per second (one update every 100 ms).



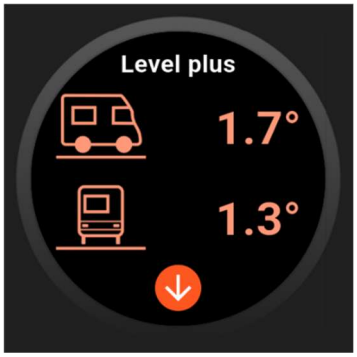
5 Description of the smartwatch

All pages and functions in the smartwatch apps are identical for the Level light, Level pro, and Level plus apps.

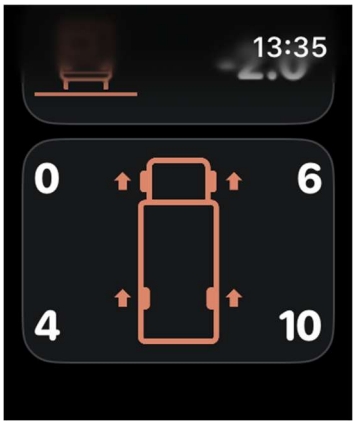
Apple Watch



Smartwatch (Wear OS)



Display of the vehicle's inclination, as shown in the corresponding smartphone app.



Display of the altitude correction as shown in the corresponding smartphone app.

6 Inclination measurements

The inclination measurement records the inclination of the vehicle from rear to front and from left to right and displays this in angular degrees.

The inclination is measured either with the internal sensors of the smartphone or tablet in all app versions and additionally with an external sensor from WitMotion (https://witmotion-sensor.com) in the Light and Plus versions.

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6.1 Measurement with internal sensor

When measuring with the internal sensor, the smartphone or tablet must be placed with the top edge of the device facing in the direction of travel and with the screen facing upwards on the surface that is to be horizontal

If the smartphone or tablet cannot be positioned horizontally because the smartphone or tablet does not have a flat surface to rest on due to a protective cover or elevation on the device itself, or if the measurement in the vehicle should always be taken on the same non-horizontal surface, the smartphone or tablet can be calibrated in the Level pro and Level plus apps. To do this, the vehicle must first be brought into a horizontal position and then the smartphone or tablet must be calibrated at the point where the measurement is always to be taken.

The measuring direction of the smartphone or tablet can be set in the Level pro and Level plus apps.

6.2 Measurement with external WitMotion sensor

The great advantage of an external sensor is that it can be placed anywhere in the vehicle and can transmit the tilt angle to the smartphone or tablet. This means that the inclinations can be displayed on the smartphone or tablet regardless of the position of the smartphone or tablet and you can always see the current orientation of the vehicle. The smartphone or tablet can be positioned so that it is visible to the driver.

The WitMotion sensors are connected via Bluetooth. The connection is currently only available for the sensors

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tested. Both sensors must be purchased separately from WitMotion and are not part of the product. **Compatibility with WitMotion sensors has been tested but cannot be guaranteed.**

The sensors have a small battery that can be charged via USB-C. After switching on, a Bluetooth connection can be established. To do this, Bluetooth must be switched on in your smartphone or tablet.

6.3 Information on the sensors

Further information on the sensors can be obtained directly from the WitMotion links. The sensors can be purchased directly from the Chinese manufacturer or in the well-known online shops, whereby the prices can vary greatly. In some cases, very high shipping costs are also charged. We ordered our test sensors directly from the manufacturer.

Company links

https://witmotion-sensor.com

Links to sensors

https://witmotion-sensor.com/collections/inclinometers

WT9011DCL-BT50 https://witmotion-sensor.com/products/wt9011dcl-bluetooth5-0-compact-size-accelerometer-inclinometer-sensor?variant=44257941225669

WT901BLECL https://witmotion-sensor.com/products/wt9011dcl-bluetooth5-0-compact-size-accelerometer-inclinometer-sensor?variant=44257941258437

6.4 Positioning the external sensor

When placing the sensor in the vehicle, you should ensure that the battery can be easily charged and that you can easily operate the sensor's on/off switch. Alternatively, you can of course leave the BWT901BLECL5.0 or WT901BLECL sensor, which has an on/off switch, always switched on and connect it to a USB-C power supply in the vehicle.

In order for the sensor to measure the vehicle's inclinations correctly, it must be placed on any horizontal surface so that the X-axis points exactly in the vehicle's direction of travel and the Y-axis points exactly to the left. If you choose a surface that is not completely horizontal, you have the option of calibrating the sensor in the Level app. The maximum deviation of the mounting surface or measuring surface from the horizontal surface can be set in the app during calibration and must not be exceeded.

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If it is not possible to place the sensor in your vehicle so that X points in the direction of travel and Y to the left, you can also rotate the sensor horizontally by 90°, 180° or 270°.

6.5 Calibration

The procedure described below for the external sensor also applies to calibrating the smartphone or tablet. There are various options and purposes for calibration.

- **Absolute sensor calibration.** This means that the sensor itself is calibrated to compensate for any manufacturing defects, so that the app displays zero for the front/back and left/right tilt when the vehicle is on a level surface, similar to a spirit level.

- **Calibration of the sensor in conjunction with the vehicle.** This means that the sensor is not considered in isolation, but rather in conjunction with the vehicle, so that the app displays zero for the front/back and left/right tilt when the vehicle is on a level surface.

- **Relative sensor calibration.** Relative calibration aims to ensure that the app displays zero values for the rear/front and left/right tilt when a surface you define in the vehicle (the zero plane), such as the bed, stove, table, sink, shower, or floor, is level, but the measurement is taken on a different surface.

Calibration does not change the sensor itself; it simply saves the calibration settings in the app, which then corrects the displayed measurements.

6.5.1 Absolute calibration of the external sensor

If the sensor itself needs to be absolutely calibrated, independent of its placement in the vehicle, so that it displays zero for the tilt (front/back and left/right) on a horizontal surface, like a spirit level, then there are two methods. For the first method, you need a horizontal and flat surface.

Method 1.1: Absolute Calibration on a Horizontal Surface

Step 1: Place the sensor on a horizontal and flat surface.

Step 2: In the app, go to Settings/Calibration/ and tap "Calibrate Sensor" in the Calibrate section... on a horizontal surface or by directly entering the values.

Step 3: Then tap "Calibrate." After calibration, the calibration values must be saved in the app by tapping "Save."

Method 1.2: Absolute Calibration on a Non-Horizontal Surface

It's often difficult to find a perfectly level surface on which to calibrate the sensor. The method used here doesn't require a perfectly level surface, but only a flat surface that deviates from a level surface by no more than the set calibration range. Two measurements are necessary, and the correction values for calibration are calculated automatically.

To do this, go to Settings/Calibration/ in the app and tap "Sensor Calibration" in the "Calibrate... on an Inclined Plane in 4 Steps" section. Then follow the four steps of the calibration wizard.

Step 1: Place the sensor on a flat surface that deviates from a horizontal surface by no more than the set calibration range and perform a measurement. Then press "Next".

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Step 2: Now rotate the sensor horizontally on the surface by exactly 180° and press "Next".

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Step 3: Now perform another measurement and then press "Next".

Step 4: Now save the calculated values by pressing "Save".

Clear explanation of the calculation

A spirit level measures accurately and is well calibrated if the reading's deviation from the center point remains the same, even when the level is rotated 180 degrees. Anyone who wants to can also test this or calculate it themselves.

Mathematical explanation for the calculation

Tilt-back/front(surface) refers to the inclination of the surface on which the sensor rests in the X direction (back/front).

Calibration-back/front(sensor) refers to the value for the calibration of the sensor back/front.

The following applies to the measured values rear/front(1) from step 3 and rear/front(2) from step 6:

1. rear/front(1) = tilt-rear/front(area) + calibration-rear/front (sensor)

and after rotating the sensor 180 degrees

2. rear/front(2) = - tilt-rear/front(area) + calibration-rear/front (sensor)

By transforming, we obtain:

rear/front(2) = - tilt-rear/front(area) + calibration-rear/front (sensor)

⇔

tilt-rear/front(area) = calibration-rear/front (sensor) - rear/front(2)

by substituting into 1:

rear/front(1) = calibration-rear/front (sensor) - Rear/front(2) + Rear/front calibration (sensor)

⇔

Rear/front(1) + Rear/front(2) = Rear/front calibration (sensor) + Rear/front calibration (sensor)

⇔

2 * Rear/front calibration (sensor) = Rear/front(1) + Rear/front(2)

⇔

Rear/front calibration (sensor) = (Rear/front(1) + Rear/front(2)) / 2

The same applies to the left/right calibration.

6.5.2 Calibration of the sensor together with the vehicle

The sensor should be calibrated together with the vehicle so that it displays zero for the vehicle's tilt (front/back and left/right) in the app when the vehicle is on a level surface. In this case, the sensor does not need to be positioned horizontally in the vehicle. The maximum deviation of the sensor's mounting or measuring surface from the horizontal plane can be set in the app during calibration and must not be exceeded.

Both methods function like methods 1.1 and 1.2, except that they calibrate the entire vehicle in which the sensor is installed, rather than just the sensor itself.

Method 2.1: Relative Calibration on a Horizontal Surface

Step 1: Drive the vehicle onto a horizontal and level surface.

Step 2: In the app, go to Settings/Calibration/ and press “Calibrate Sensor” in the „Calibrate section… either on a horizontal plane or by directly entering the values“.

Step 3: Then press "Calibration". After calibration, the calibration values must be saved in the app by pressing "Save".

Method 2.2: Relative Calibration on a Non-Horizontal Surface

It is often difficult to find a truly level surface on which to calibrate the vehicle and sensor. The method used here does not require a perfectly level surface, but only a flat one.

The procedure is similar to Method 1.2 for absolute calibration, but with the entire vehicle instead of the sensor. Before rotating the vehicle horizontally by 180 degrees, you should mark the exact footprint of the vehicle's wheels.

6.5.3 Relative calibration of the sensor with respect to an area in the vehicle

By manually specifying calibration values, you can define any surface in the vehicle, such as the bed, stove, table, sink, shower, or floor, as your individual zero plane, even if you intend to measure with the sensor on a different surface in the vehicle. To do this, the sensor must first be absolutely calibrated, and then the angles for front/back and left/right between your individual zero plane and the sensor's measuring surface in the vehicle must be determined. Finally, the calibration values are calculated and entered into the app.

Step 1: First, perform an absolute calibration of the external sensor as described in section 5.5.1. Then, note the saved calibration values for front/rear and left/right, for example, by taking a screenshot. These values will later be used for manually calculating the calibration values: front/rear (Step 1) and left/right (Step 1).

Step 2: In the app, under Settings/Sensor Direction, set the sensor direction according to how you intend to position the sensor in the vehicle.

Step 3: In the app, go to Settings/Calibration/ and tap "Sensor Calibration" in the "Calibrate... on a horizontal plane or by directly entering the values" section. Tap "Calibration" and measure the calibration on your personal zero level in the vehicle, such as the stove, bed, table, sink, or floor, according to the set sensor direction. Please do not save the measured values in the app. Note the newly measured calibration values for front/rear and left/right, for example, by taking a screenshot. These values will be needed later for the manual

calculation of the calibration values and are referred to in the formula as zero plane-rear/front and zero plane-left/right.

Step 4: Next, measure the sensor's measuring surface inside the vehicle, following the set sensor direction and with the same vehicle tilt as in Step 3. To do this, go back to Settings/Calibration/ in the app and tap "Sensor Calibration" in the "Calibrate... on a horizontal plane or by directly entering the values" section. Tap "Calibration" and measure the calibration on the sensor's measuring surface. Do not save the measured values in the app. Again, note the new values for front/rear and left/right, for example, by taking a screenshot. These values will be needed later for the manual calculation of the calibration values and are referred to in the formula as measuring surface-rear/front and measuring surface-left/right.

Step 5: Calculate the relative deviations between your personal zero plane in the vehicle and the sensor's measuring surface.

deviation-rear/front = measuring surface-rear/front - zero plane-rear/front
deviation-left/right = measuring surface-left/right - zero plane-left/right

Step 6: Manually calculate the relative calibration values for rear/front and left/right from the absolute calibration in Step 1 and the relative deviations determined in Step 5.

rear/front = rear/front (Step 1) + deviation-rear/front
reft/right = left/right (Step 1) + deviation-left/right

Step 7: Enter the newly calculated values for rear/front and left/right as new calibration values in the app and save them. To do this, go to Settings/Calibration/ in the app and press “Sensor calibration” in the “Calibrate… on a horizontal plane or by directly entering the values” section.

7 Technical details and further information

The Level light, Level pro, and Level plus apps are developed using the Flutter development environment and the Dart programming language. This development environment and its associated APIs are constantly being improved and adapted to the latest technology. **Unfortunately, this means that the current versions of the apps can no longer be used on all older Android versions (e.g., versions prior to 7.0).** You can test whether the apps will run on your device using the free Level light app.

Further information is available at www.65plusit.de.