

DistoX Calibration Manual

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Why a Calibration?

The DistoX consists of three magnetic field sensors and three accelerometers. They allow to determine the precise orientation of the device in space and the direction relative to the earth magnetic field. Due to manufacturing tolerances and external influences, such a system inevitably reveals certain errors. Among them are:

- Offset and gain errors of the sensors.
- Sensors mounted under incorrect angles.
- Angular errors between the sensors and the Laser beam.
- Influences of metal parts (in particular the battery) on the magnetic field.

Fortunately all these errors can be eliminated relatively easily by a bunch of calibration measurements and the corrections calculated from them. This calibration process has to be done on a readily built device. It should be repeated after each battery change because the battery has a large influence on the magnetic field.

Requirements

The following prerequisites must be fulfilled:

- The device must be readily built and working.
- The PocketTopo Program must be running (on a PC or PDA)
- There has to be a working Bluetooth connection to the device.

IMPORTANT:

A undisturbed magnetic environment must be present to do the calibration measurements. It is practically impossible to do a precise calibration in a house or near buildings. Even metal screws in a wooden constructions have an influence! The best environment is either a cave or a forest.

A calibrated reference stretch is NOT needed!

Procedure

For a full calibration the following steps should be done:

- 1) Start the PocketTopo program.
- 2) If not already done, set the Bluetooth port under "Menu:Options:Port".
- 3) Use "Menu:Calibration..." to start the calibration application.
- 4) Use "Menu:Start" on the calibration screen to put the Disto into calibration mode. The display of the Disto shows "CAL" in the first line.
- 5) Execute the calibration measurements (see below).
- 6) Transfer the results to the application. This starts automatically when a connection to the Disto is set up. The results are shown in a chart on the screen.
- 7) Use "Menu:Stop" to leave the calibration mode on the device.
- 8) Use "Evaluate" to analyze the calibration. The third value given in the lower part of the screen is a measure of quality. It should be smaller than 0.5.

- 9) Use "Menu:Update" to transfer the calculated calibration coefficient to the Disto.
- 10) As a quick check measure an arbitrary sketch four times with for different orientations of the device (display up, right, down, and left). The values shown should be consistent to a few tenth of a degree.

Calibration Measurements

The recommended sequence of measurements consists of 56 shots in 14 distinct directions. Each direction is measured four times with different orientations of the device (display up, right, down, and left). To get a good distribution of the directions, it is best to imagine to be in the center of a large cube. The first six directions are taken to the middle of the six faces, that means four of them are horizontal and two are vertical (up and down). The remaining directions are taken to the 8 vertices of the cube. The precise directions are not important as long as they are reasonably spread.

To correct a possible error between the Laser and the sensors, a few directed measurements are needed. Therefore, for the first four directions, the four measurements (display up, right, down, and left) made in each case are measured precisely in the same direction. This can easily be done with the horizontal directions, for instance between two trees or cave walls.

In summary, you have to measure 4 precise directions with 4 measurements each and then another 40 measurements in 10 directions without bearing. The precise number, direction, and sequence of these remaining measurements is unimportant. However, it is still recommended to use a target point and to take some time for each measurement to allow the reading to stabilize.

The device may be switched on and off any time in calibration mode without data loss. So the values can be acquired in the field and analyzed at home.

DistoX Operation in Calibration Mode

The handling of the Disto is essentially the same as usual. The display shows "CAL" in the first line to indicate the calibration mode. The second line contains a counter which reflects the number of measurements already made.

Instead of getting the directional angles from the sensor values, the values itself are saved in calibration mode. The sensor values can be retrieved after each measurement with the Memory key. Memory 1 shows the X direction (Laser direction) of the magnetic field in the first line and of the accelerometer in the second line. Similarly memory 2 and 3 show the Y (cross) and Z (up/down) directions. The remaining memories do not contain any useful information. Older results, calibration values or angles, can no longer be inspected on the device, but they can still be read out over a Bluetooth connection.

In case you are standing in a forest and forgot to put the Disto in calibration mode, there is a possibility to do it directly on the device. Start with pressing the Memory key repeatedly until memory number 10 is shown in the display. At this point the UNIT key is used to switch calibration on and off. As usual the CLEAR key is used leave the memory display. Since the distance unit is altered by the UNIT key, it must be restored later. During calibration, distances have no meaning anyway.

The 56 Measurements



And so on for the remaining seven cube vertices.