

# DistoX2 User Manual

Leica Disto X310 based DistoX

Firmware Version 2.4

2015/02/22

## Introduction

DistoX is an electronic surveying device for cavers. It consists of a Leica Disto X310 or E7400x (US version of the X310) distance meter with a built in replacement board. The board extends the functionality of the Disto by a three axis electronic compass/clinometer and a Bluetooth connection to enable wireless readout of the results. The three axis compass allows measurements of arbitrary directions with arbitrary orientations of the device without degradation of the precision.

## Disto Functions

The Disto behaves similarly to the original X310. The display shows the Azimuth in the first, the inclination in the second, and the distance in the bottom line. It stores up to 1000 measurements to be inspected later or transferred over the Bluetooth connection.

Main Functions:

DIST: power on / start Laser / measure distance

CLR: cancel current operation, switch Laser off

REF (  ): change distance reference

TIMER: start timer (automatic measurement)

MEM (  ): show memory entries

SMART (  ): show extended measurement information (see below)

FUNC: show device information (see below)



## Restrictions

The following X310 functions are not available:

Min, Max, Add, Subtract, Area, Volume, Triangle, Stake out, Smart horizontal.

## Caution:

There is no automatic recognition of the position of the endpiece. Press the REF and FUNC keys to switch between rear case and endpiece reference.

## Options and Configuration

The following keys and key combinations can be used to change various options when pressed for 2 seconds.

MEM:	change distance unit
REF:	switch to permanent front reference
CLR:	power off
MEM and SMART:	angle unit: degrees/grad
MEM and FUNC:	silent mode on/off
MEM and MINUS:	backsight mode on/off
REF and MINUS:	beep on/off
REF and PLUS:	display illumination on/off
REF and FUNC:	back reference: case/endpiece
CLR and SMART:	calibration mode on/off
CLR and MEM:	clear unspent memory
CLR and FUNC:	Bluetooth on/off
CLR and MINUS:	locked power off
SMART and MINUS:	triple shot check on/off

The distance and angle units are used for the numbers in the display only; they have no influence on the stored and transmitted values.

### Backsight Mode

If the backsight mode is turned on, the measurements are reported as if they were measured in the opposite direction. The sign of the inclination is reversed and  $180^\circ$  is added to the azimuth. On the display a down arrow is shown near the Laser symbol when the option is turned on and whenever a backsight measured memory value is shown.

### Triple Shot Check

If the triple shot check option is turned on, the device checks for three nearly identical measurements in a row. If a triple is detected the device beeps twice and shows an 'identical' sign ( $\equiv$ ) to the right of the measured values. Three shots are considered nearly identical if the pairwise comparison results in a distance difference  $< 5\text{cm}$  and a directional difference  $< 3\%$  ( $1.7^\circ$ ). PocketTopo uses the same measure to distinguish survey shots from splay shots. A small triangle ( $\blacktriangledown$ ) is shown in the lower left corner of the display if the check is switched on.

### Factory Reset

Press CLR, FUNC, and MEM for 5 seconds to reset the device to the original state. The memory is erased completely, the user options are set to default values, and the calibration coefficients are reset to a neutral calibration. To preserve the calibration, read the calibration coefficients from the device, reset the device, and write the coefficients back to the device.

## **Extended Measurement Information**

The SMART key can be used to show extended information about a measurement. Repeated key presses cycle through the following parts. After the last part, the display returns to the standard contents.

Normal Measurements:

- 1) Azimuth, horizontal distance, vertical distance, total distance.
- 2) Roll angle and dip angle (inclination of the magnetic field).
- 3) Magnitude of the magnetic field and the acceleration/gravity.
- 4) Raw sensor values (x,y,z) of the on board acceleration sensor. \*)
- 5) Raw sensor values (x,y,z) of the separate acceleration sensor. \*)
- 6) Raw sensor values (x,y,z) of the magnetic field sensor. \*)

Calibration Measurements:

- 1) Combined acceleration sensor values (x,y,z).
- 2) Magnetic field sensor values (x,y,z).
- 3) On board acceleration sensor values (x,y,z). \*)
- 4) Separate acceleration sensor values (x,y,z). \*)

\*) These parts are not available when reading from memory.

## **Bluetooth Connection**

When Bluetooth is switched on, the device is discoverable and connectable at any time. It appears as "DistoX-nnnn" where nnnn is the serial number of the device. It provides a serial connection (SPP) named "serial". The device needs no pairing key. If the connecting device request one, it is "0000" (four zeroes).

To read the results from the device, a special program is needed (PocketTopo). This runs either on a PC or on a PDA. To Allow the program to connect to the Disto, the Bluetooth port must be selected under Menu:Options:Port. The port is listed in the Bluetooth manager as the "outgoing serial port" for the device.

When Bluetooth is switched on, a Bluetooth symbol appears at the top of the display. The symbol flashes whenever another device is connected. Except when a memory entry is shown, the display shows the number of unsent measurements in the top right corner.

It is possible to switch the Laser on or off over Bluetooth and to remotely trigger a measurement. The corresponding commands are in the Bluetooth menu.

The Disto does not automatically switch off as long as there is an active Bluetooth connection.

## **Silent Mode**

In Silent mode the device does not transfer measured data even if a PDA is connected. The data is still saved to memory but immediately marked as sent. The display shows three dashes (---) in the top right corner when in Silent Mode. Press MEM and FUNC for 2 seconds to switch silent mode on and off.

Pressing CLR and MEM for 2 seconds marks all measured data as sent without entering Silent mode.

## **Charging the Battery**

To charge the battery, a 5V source must be connected to the charging connector in the battery compartment. Any phone charger with a micro USB connector will do the job.

The battery indicator in the display shows the actual battery level. It flashes when a charger is connected and stops flashing when the battery is fully charged.

## **Device Information**

The FUNC key can be used to show a sequence of information screens. FUNC key in idle mode shows the first screen. FUNC again navigates from one screen to the next. Use the SMART key to return to the previous screen.

### **Screen 1: Battery**

Shows the actual battery voltage and the battery chemistry used for the battery level indicator: "LI" for LiPo or "AL" for Alkaline.

Press the FUNC and SMART keys for 5 seconds to change the battery chemistry. Be sure to use the correct setting:

LI (default) for a built in rechargeable battery or AL for AAA primary cells.

### **Screen 2: Versions**

Shows the hardware and firmware version numbers and the serial number of the device.

### **Screen 3: Display Illumination**

Shows the display illumination level (1 - 10).

To change the level first press the PLUS and MINUS keys for 2 seconds to allow editing.

Then press the PLUS or MINUS key to change the value.

To switch the illumination off completely, use REF + PLUS option mentioned above.

### **Screen 4: Endpiece Offset**

Shows the actual endpiece offset in mm (-128 - 127).

To change the level first press the PLUS and MINUS keys for 2 seconds to allow editing.

Then press the PLUS or MINUS key to change the value.

Changing the offset is useful for self-made endpieces or other cases where a non-standard reference is used.

## Hints

Hold the device with both hands and support them against the wall if possible.

To complete a measurement, the DIST button may be held pressed until the measurement is done and the Laser switches off. This helps making measurements without shaking the device.

Take care with metal objects! Each kind of ferromagnetic metal near the device leads to wrong measurements. This no longer only holds for the helmet, but also for other objects carried at the body like SRT gear (steal karabiners), carbide container, belts, or tools, which all can get to near to the device.

For precise measurements it is recommended to mark the rear 'exit point' of the Laser beam (picture). Place this point as near as possible to the survey point.



Switching the display illumination off completely saves a lot of power.

For best performance, the device should be calibrated in regular intervals.

## Error Codes

If an error occurs during a measurement the text “**Info**” appears on the screen together with one of the following error codes:

- 252: Temperature too high
- 253: Temperature too low
- 255: Received signal too weak
- 256: Received signal too high
- 257: Too much background light
- 260: Laser beam interrupted

If the “**2nd**” symbol is shown at the top of the display, one of the two acceleration sensors does not work correctly. The device still works with only one sensor but precision is compromised and the calibration is no longer valid if it was made with both sensors.

## Technical Data

### Range

Distance: 0.05 – >100m  
Azimuth: 0 - 360°  
Inclination: -90° - +90° (no steepness limit)  
Roll angle: -180° - +180° (fully tilt compensated)

### Precision

Distance: 2mm (0.05 – 10m)  
Angles: 0.5° RMS (after proper calibration)

### Features

Selectable Units: m / ft / inch, ° / grad  
Memory capacity: 1000 measurements  
Laser Type: 635nm, 1mW, class II

### Mechanical

Size: 55 x 31 x 122mm  
Weight: 150g  
Protection: IP65

### Electrical

Battery voltage: 1.5 – 5.5V  
LiPo charger input: 4.5 – 6V

<b>Power consumption</b>	Bat = 4V:	Bat = 3V:	original X310, Bat = 3V:
Idle (incl. Bluetooth):	4mA	5mA	36mA
Illumination on:	9mA	11mA	43mA
Laser on:	88mA	110mA	120mA