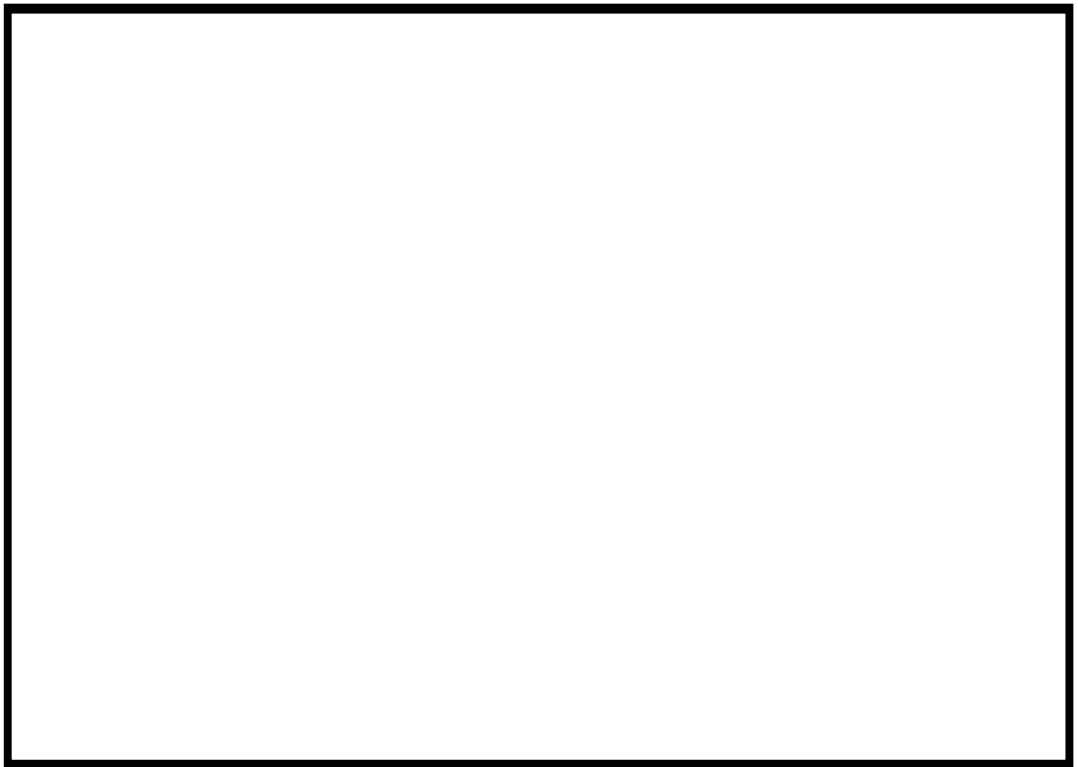

Instructions to

ElTheo for 3D Disto

PMS Photo Measuring Systems AG



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This manual describes the version 1.x of Tachymetriesystemes ELCOVISION EITheo for 3D Disto

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Content

Foreword	1
Overview of This Manual.....	1
Requirements for the operation of EITheo for 3D Disto	1
Quick Guide	2
Start of Program	2
Orienting the 3D Disto	3
Transfer Readings to another program	5
Targets for Various CAD Softwares.....	7
Reference	9
The dialogue page "Stations"	9
Definition of a local coordinate system	10
The Free Stationing	14
Take as current station.....	16
The dialog page "Measurement and Project"	17
3D Disto send data	17
Point number and code	18
Laser	19
Switches the laser of the 3D Disto on/off	19
ALL DIST REC	20
The dialog page "control points"	21
The control point view as list	21
The control point view as graphic	22
Options page of the control points.....	23
The dialog page "Mark out"	25
The "Settings" Page.....	26
The dialogue "Leica GSI configuration"	26
The dialogue "theodolite test"	27

Foreword

Overview of This Manual

This manual describes the program ELCOVISION EITheo for 3D Disto. Some settings for the Leica Windows software are also discussed.

Requirements for the operation of EITheo for 3D Disto

For ELCOVISION EITheo for 3D Disto to work, the Leica Windows program for the 3D Disto must be installed and activated.

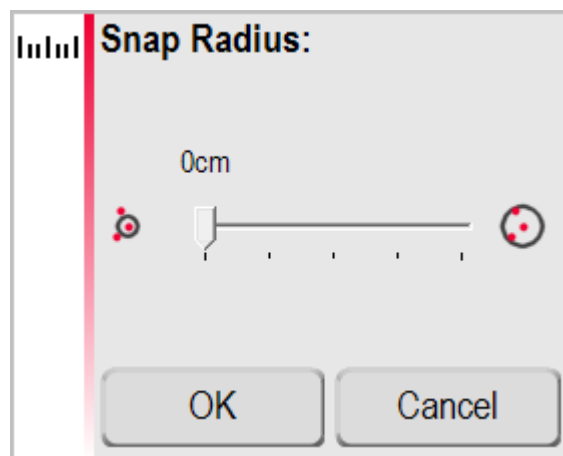
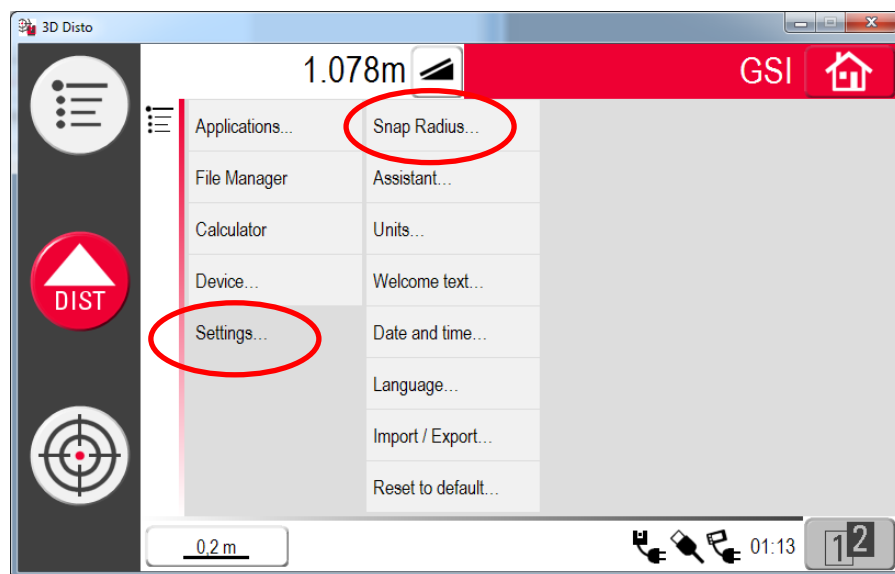
This program must also be started first to ensure the correct initialization of the 3D Distos for operation with ELCOVISION EITheo for 3D Disto.

Quick Guide

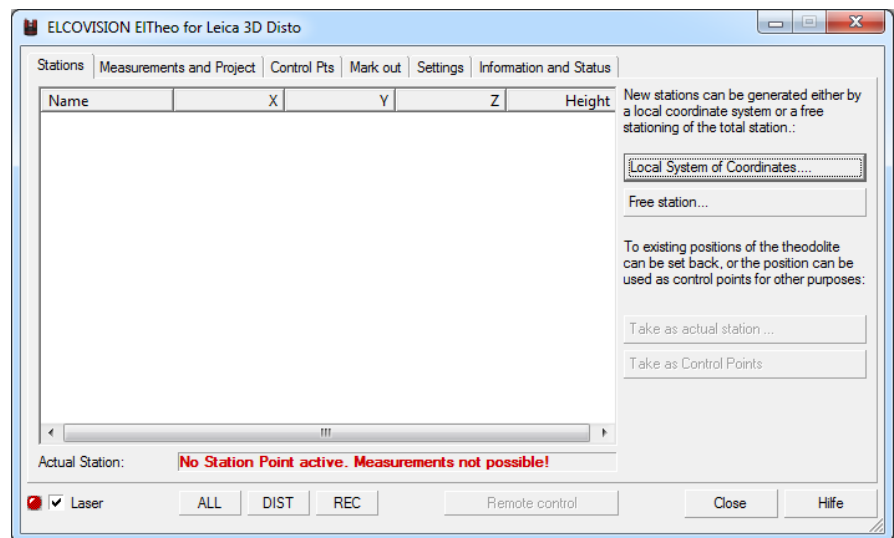
Start of Program

First start the Leica Windows program for the 3D Disto and connect it to the Disto. It is irrelevant whether the 3D Disto is connected via USB cable or WLAN.

Set the snap radius to 0cm: Programs - Settings - snap radius



Start the 3D EITheo Disto



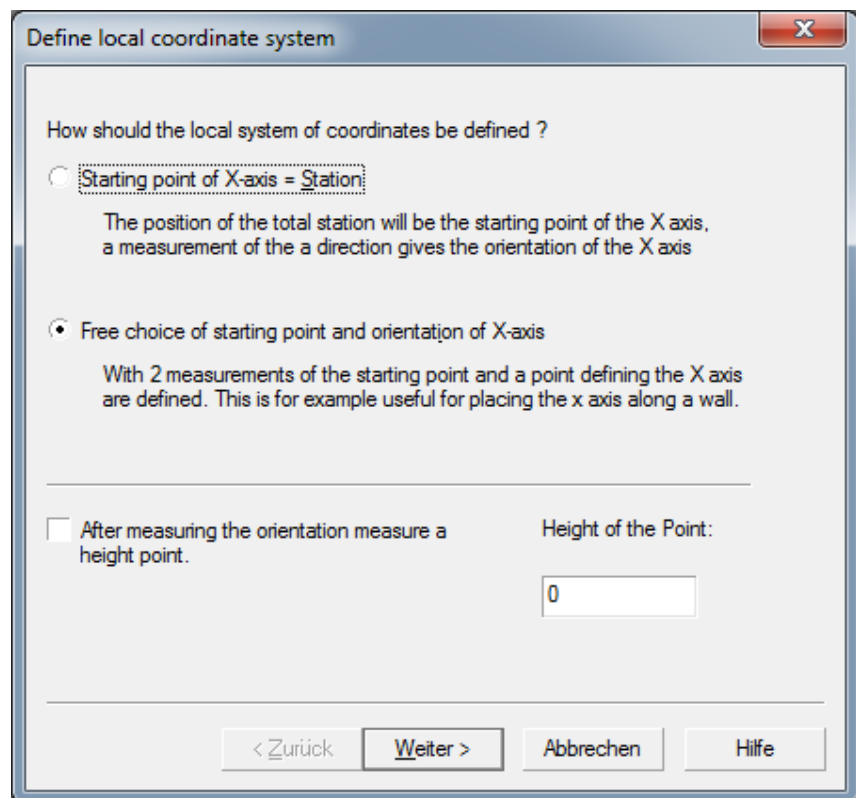
It will automatically connect to the Windows program for the Leica Disto 3D.

Orienting the 3D Disto

For the measurements of the 3D distos to make sense, the Disto must be oriented. The position of the 3D distos in space is determined and a coordinate system is defined at the same time.

Place the 3D Disto in the middle of a room, for example. In this example, the X axis of a local coordinate system is placed against a wall:

Click on **[Local System of Coordinates]**



With [Next >] you get to a page where you can specify the current position more precisely, or simply leave all settings as they are:

The 'Enter Station' dialog box is shown with a title bar containing a close button (X). The main area is titled 'Enter Station'. It contains the following fields and controls:

- Name:** A text input field containing the number '1'.
- Coord. in X:** A text input field containing '0'.
- Coord. in Y:** A text input field containing '0'.
- Coord. in Z:** A text input field containing '0'.
- Height of instr.:** A text input field containing '0', followed by a unit 'm'.
- ☒ **Activate station after finishing that dialogue**

At the bottom, there are four buttons: '< Zurück', 'Weiter >', 'Abbrechen', and 'Hilfe'.

With [Next>] To the measurement dialog:

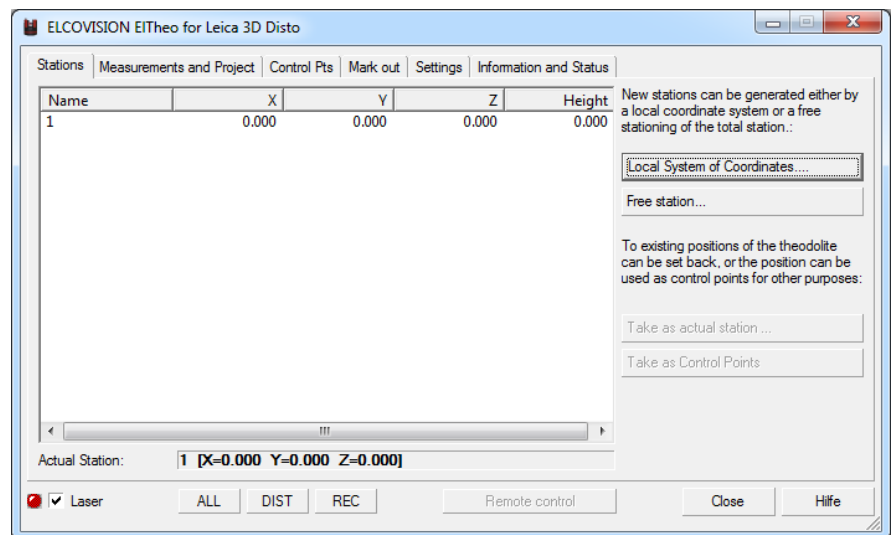
The 'Free definition of x-axis' dialog box is shown with a title bar containing a close button (X). The main area is titled 'Free definition of x-axis'. It contains the following fields and controls:

- Measure both distance and direction to the starting point for the adjustment of the local x axis.**
- Measure the starting point:** A button labeled 'Ok' and a text input field labeled 'Refl.' containing '0.000 m'.
- Measure the direction:** A text input field.
- Measuring the height connection:** A text input field.
- ☐ **Take over the starting point after the orientation of the local x axis as origin of the local coordinate system**
- Shift of origin:** Three text input fields labeled 'X:', 'Y:', and 'Z:', each containing '0.000 m'.
- Three buttons: 'ALL' (highlighted with a dashed border), 'REC', and 'DIST'.
- ☒ **Close dialog after measuring.**
- ☒ **Laser**

At the bottom, there are four buttons: '< Zurück', 'Fertig stellen', 'Abbrechen', and 'Hilfe'.

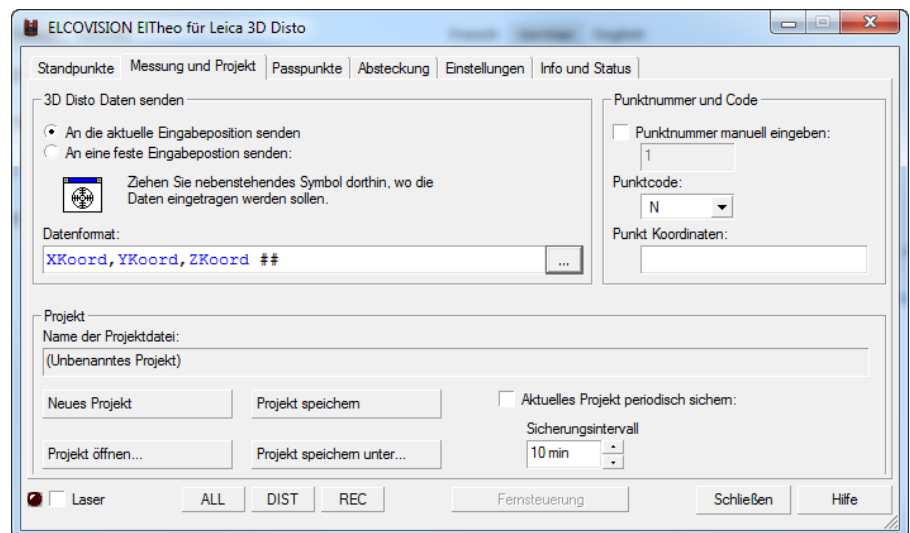
Measure 2 points on the same wall. The two points should be at least 1 m apart, they should also be measured at approximately the same height.

After measuring the two points, a position is now active, the 3D Disto is oriented. From now on measurements can be carried out:



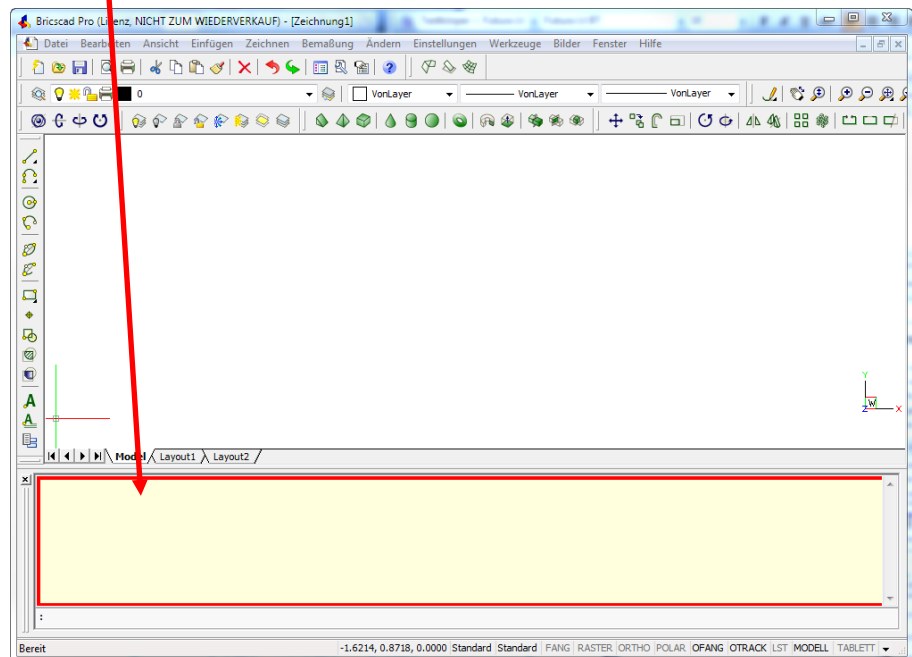
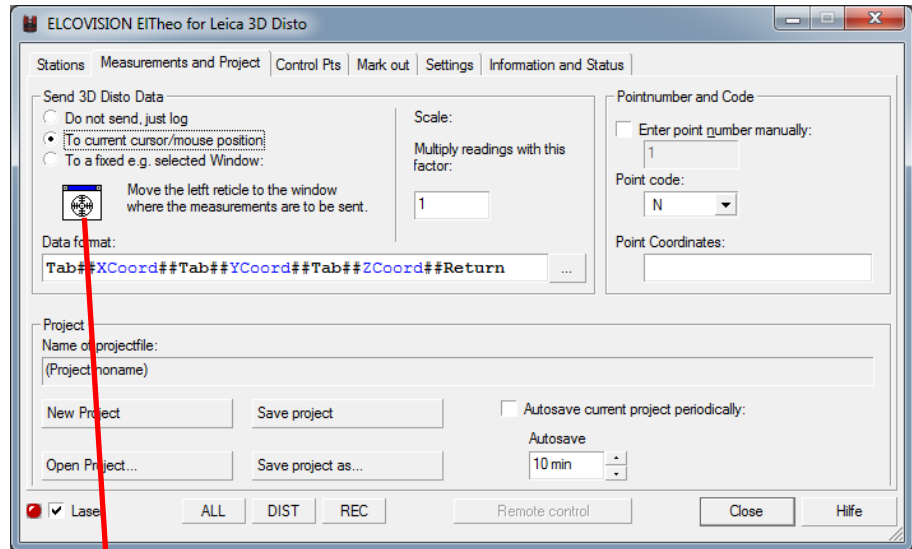
Transfer Readings to another program

First, the correct data format for the program to receive the measurements must be entered in EITheo for 3D Disto. Data formats are already prepared for several CAD programs, but any popular format can be entered. In this example we use the data format used by AutoCAD and BricsCAD:



Click on the [...] Button in "3D Disto Send Data" and select the AutoCAD template.

So that AutoCAD or BricsCAD can transfer the measured values to the current drawing command, the crosshair symbol must be dragged into the window where the measured values are to be written. In the case of AutoCAD and BricsCAD it is the command line:



The currently selected window that will receive the data is highlighted with a red border. When the left mouse button is released, the last selected window is activated, in this case the command line of AutoCAD/BricsCAD

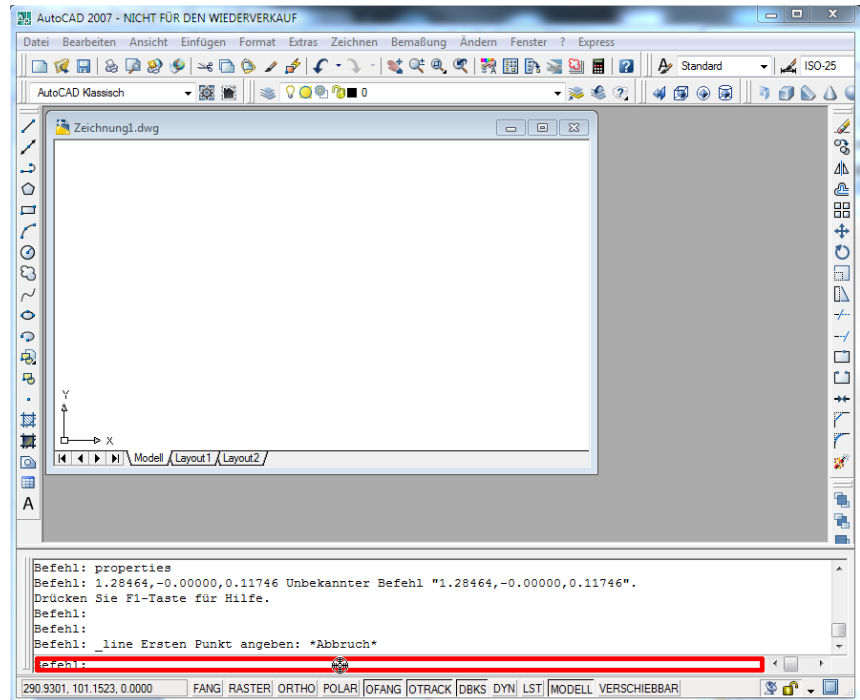
From now on, every measurement of the 3D Distos is transferred directly to the currently running CAD drawing command, the 3D Disto becomes the 3D Digitizer!

For example, if you start the line command in CAD, the CAD draws a polyline with the measured points. When you start the spline command, a spline is placed through the measured points.

Targets for Various CAD Softwares

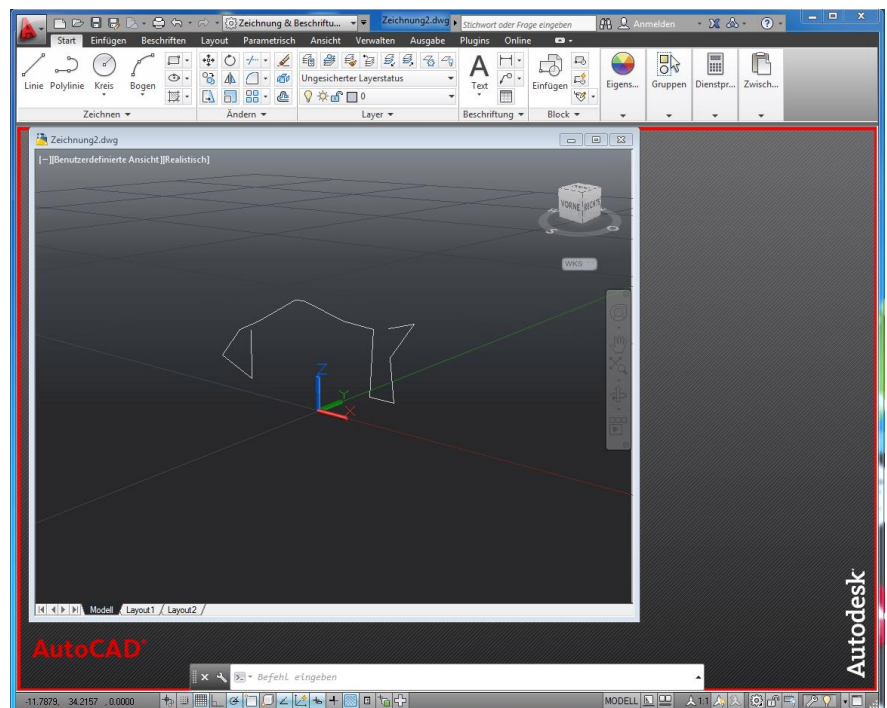
AutoCAD 14-2012

The „command line“ of AutoCAD



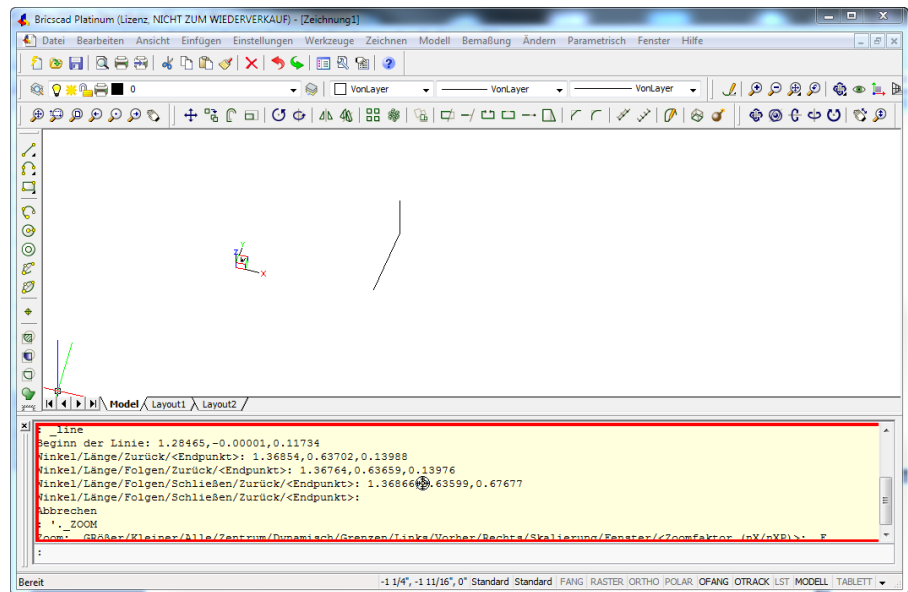
AutoCAD 2013

The „Background Window“ of AutoCAD:



BricsCAD V11-V12

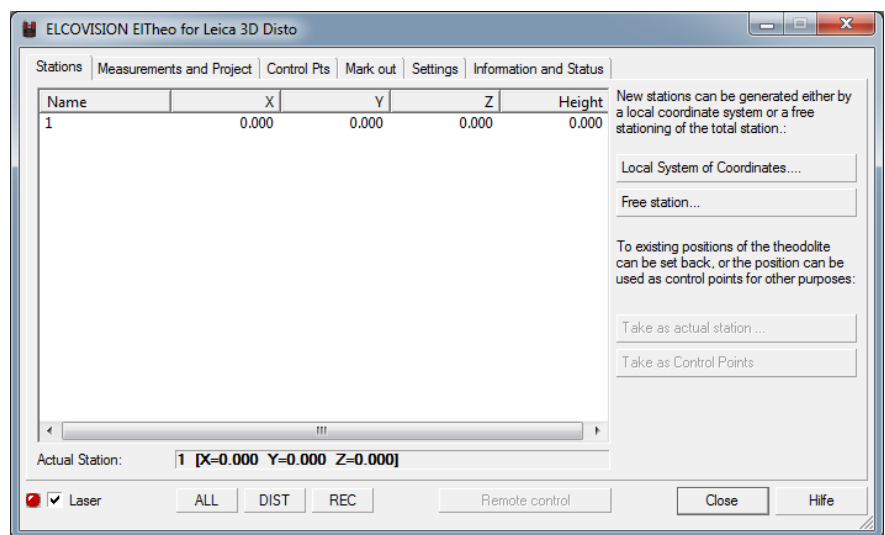
The „command area“ of BricsCAD



Reference

The dialogue page "Stations"

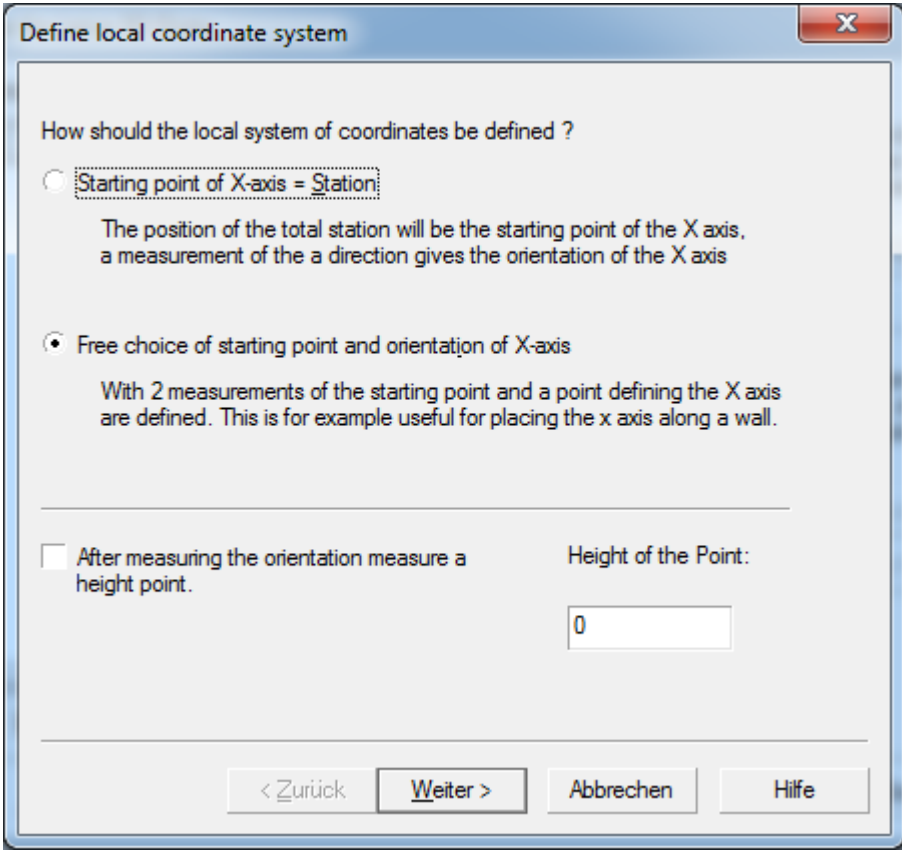
When the "Stations" dialog page is activated, the viewpoints defined and saved in the project are displayed:



On this dialogue page new points of view can be created, or the Disto can be repositioned to a previously existing point of view. With free stationing, the 3D Disto can be set up and reoriented at any point.

Definition of a local coordinate system

There are two choices for defining the local coordinate system.



Define local coordinate system

How should the local system of coordinates be defined ?

☐ Starting point of X-axis = Station

The position of the total station will be the starting point of the X axis,
a measurement of the a direction gives the orientation of the X axis

☒ Free choice of starting point and orientation of X-axis

With 2 measurements of the starting point and a point defining the X axis
are defined. This is for example useful for placing the x axis along a wall.

☐ After measuring the orientation measure a height point.

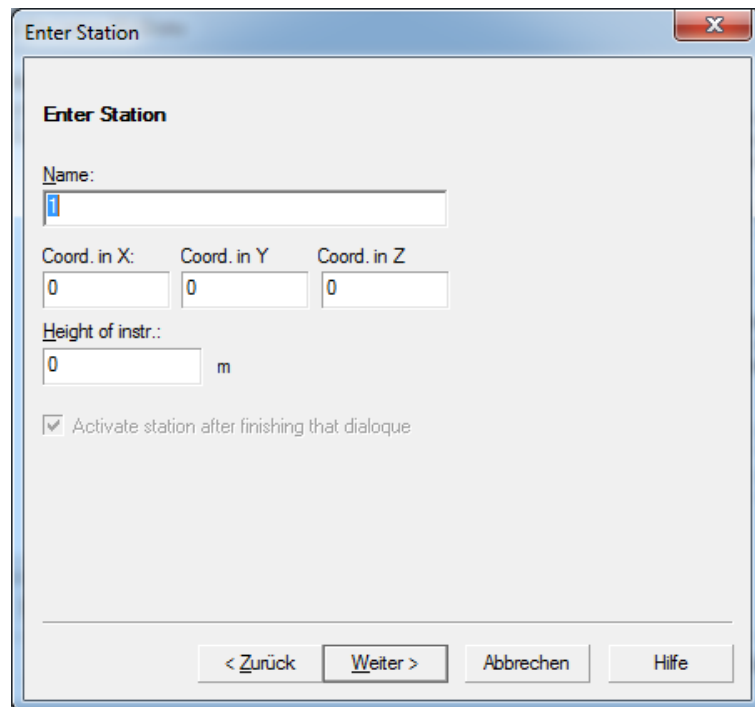
Height of the Point:
0

< Zurück Weiter > Abbrechen Hilfe

Starting point of the X-axis = Station

Here the position of the theodolite is the starting point of the X axis and the direction of the X axis is determined by means of a direction measurement.

Input of the position name, the instrument height and the position coordinates, which can be freely chosen by the user.

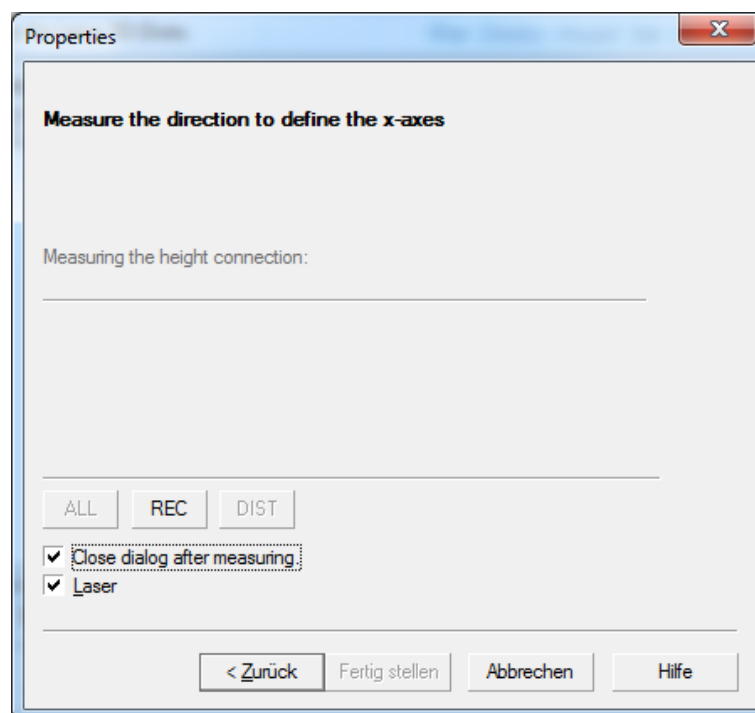


The 'Enter Station' dialog box is shown. It has a title bar with 'Enter Station' and a close button. The main area contains the following fields and controls:

- Enter Station** (Section Header)
- Name:** A text input field with a cursor.
- Coord. in X:** A numeric input field with '0'.
- Coord. in Y:** A numeric input field with '0'.
- Coord. in Z:** A numeric input field with '0'.
- Height of instr.:** A numeric input field with '0' and a unit 'm'.
- ☒ **Activate station after finishing that dialogue**
- Buttons at the bottom: **< Zurück**, **Weiter >**, **Abbrechen**, and **Hilfe**.

If you later need the position as a check point or connection point for a further position, the instrument height (distance floor - tilting axis of the 3D Disto must be entered!

Click on **[Next >]** to open the measurement dialog:



The 'Properties' dialog box is shown. It has a title bar with 'Properties' and a close button. The main area contains the following fields and controls:

- Measure the direction to define the x-axes** (Section Header)
- Measuring the height connection:** A text input field.
- Buttons: **ALL**, **REC**, and **DIST**.
- ☒ **Close dialog after measuring**
- ☒ **Laser**
- Buttons at the bottom: **< Zurück**, **Fertig stellen**, **Abbrechen**, and **Hilfe**.

Here the direction (horizontal direction) in which the X-axis of the new local system is to be placed is determined. This is also called orientation of the coordinate system. The measurement can be started directly on the 3D Disto with the small remote control, or with the Leica 3D Disto Windows software, or by clicking the [REC] button in the dialog.

If you clicked on "Measure a height connection after measuring the orientation of the coordinate system" in the first page of the definition of a local coordinate system, you can measure a point of known height. This shifts the height of the local coordinate system accordingly.

Close dialog after measurement

The completion of this measurement dialog can be carried out automatically with the direction measurement, or by clicking on the button [Finish].

Free choice of starting point and orientation of X-Axis

The 'Enter Station' dialog box is used to define a station. It contains the following fields and options:

- Name:** A text input field with the character '1' entered.
- Coord. in X:** A text input field with '0' entered.
- Coord. in Y:** A text input field with '0' entered.
- Coord. in Z:** A text input field with '0' entered.
- Height of instr.:** A text input field with '0' entered, followed by a unit 'm'.
- ☒ **Activate station after finishing that dialogue**
- Buttons:** '< Zurück', 'Weiter >', 'Abbrechen', and 'Hilfe'.

This type of definition of a local coordinate system allows the user, for example when recording a building facade, to place the origin and the orientation of the X-axis directly in the facade direction.

The 'Free definition of x-axis' dialog box is used to define the local x-axis. It contains the following fields and options:

- Measure both distance and direction to the starting point for the adjustment of the local x axis.**
- Measure the starting point:** Includes an 'Ok' button and a 'Refl.' text input field with '0.000 m' entered.
- Measuring the height connection:** A section header.
- ☐ **Take over the starting point after the orientation of the local x axis as origin of the local coordinate system**
- Shift of origin:** Includes three text input fields: 'X: 0.000 m', 'Y: 0.000 m', and 'Z: 0.000 m'.
- Buttons:** 'ALL' (highlighted with a dashed border), 'REC', and 'DIST'.
- ☒ **Close dialog after measuring.**
- ☒ **Laser**
- Buttons:** '< Zurück', 'Fertig stellen', 'Abbrechen', and 'Hilfe'.

Take the starting point after the orientation of the local X axis as the origin of the local coordinate system?

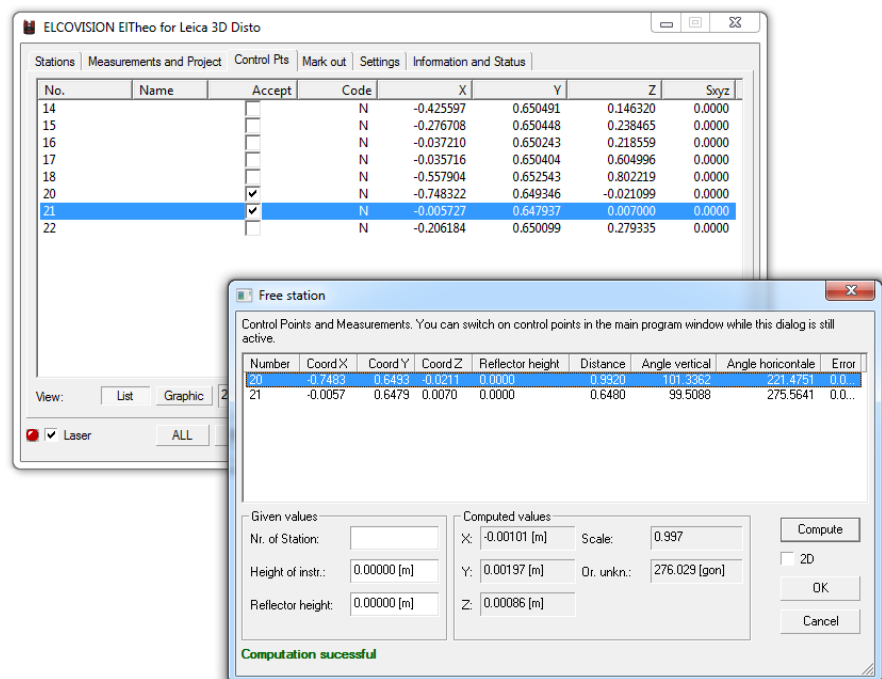
Two measurements must be made to freely place the local coordinate system in space. If the point "Accept starting point after orientation of the local X axis as origin of the local coordinate system" is activated, the starting point becomes the local (0,0,0) point. In addition, the origin can be moved to any desired coordinate. If a height connection point is to be measured, this must be entered at the beginning of the measurement.

The measurements can be triggered directly on the 3D Disto or by clicking the [ALL] button in the dialog.

Refl. elevation

If a reflector is used on the starting point, which becomes the local zero point, its height must be specified. The previously defined position is recalculated and saved.

The Free Stationing



For free stationing there must be at least two known stationing points. The stationing points can be selected from the coordinate list or the corresponding graphical overview. The points of the coordinate list either originate from the measurements already taken or have been added to the project by means of an imported coordinate file.

The example above shows the free stationing with used stationing points from a control point list. First, the position name and the instrument height are entered. The reflector height can be entered for each target point. By activating the 2D condition, the position to be determined is projected into the xy-plane.

Compute

If a 3D point of view is desired, the 2D activation must be removed and the z-coordinate must be determined via the [Calculate]. In addition, the 2D condition offers the possibility of free stationing via a 2D floor plan graphic.

Scale

The scale is a reference measure between the existing point coordinates and the measured values to the coordinates. The scale for each free stationing must be about 1,000. As a guideline, it can be said that at least two digits after the decimal point must have the value "0". If there is a large deviation here, then a measurement error or a point mix-up is probable.

Point Selection

When selecting the stationing points from the control point list or by selecting the points in the graphical point view of the control point graphic, their coordinates are transferred directly into the stationing window. If the stationing points in the control point list have already been activated, they are automatically listed in the window when the free stationing is started. Then the measurements must be carried out for the individual points.

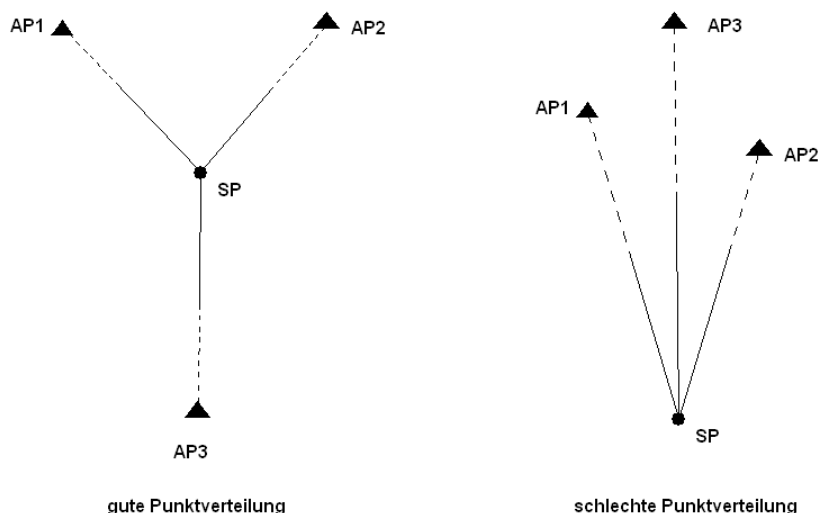
The process of free stationing with selection of the connection points from a CAD drawing is similar: First, the control points must be entered into the ELCOVISION 10 EITheo for 3D Disto via the "Measurement and Project" page, or the CAD can transfer the points directly into the EITheo via the programming interface.

Selection of stationing points

In terms of accuracy, controllability and reliability of free stationing, the number of stationing points (connection points) should be between 3 and 5 selected points.

However, the accuracy of free stationing with more than 5 connection points is only marginally increased. Much more important is the distribution of the connection points with regard to the position. The following graphic shows an example of a good and a bad point distribution.

Freie Stationierung



By using only 2 connection points it is not possible to check the determined position!

Take as current station

By clicking on a position in the list, it can be made the current position. To do this, it must be measured to at least one (better are two or three) connection points using the following dialog. This serves to determine the unknown orientation.

Activate viewpoint after completion of the dialog

The position that is oriented here is then set active. I.e. measurements from this point of view are assumed.

Orientation of station

Control Points and Measurements. You can switch on control points in the main program window while this dialog is still active.

Number	Coord X	Coord Y	Angle horizontale	Error
20	-0.7483	0.6493		
21	-0.0057	0.6479		

Coordinates of station:

X: -0.00101 [m]

Y: 0.00197 [m]

Z: 0.00086 [m]

Height of instr.: 0.00000 [m]

Result of computation:

Result of orientation: 0.00000 [gon]

Standard error: 0.00000

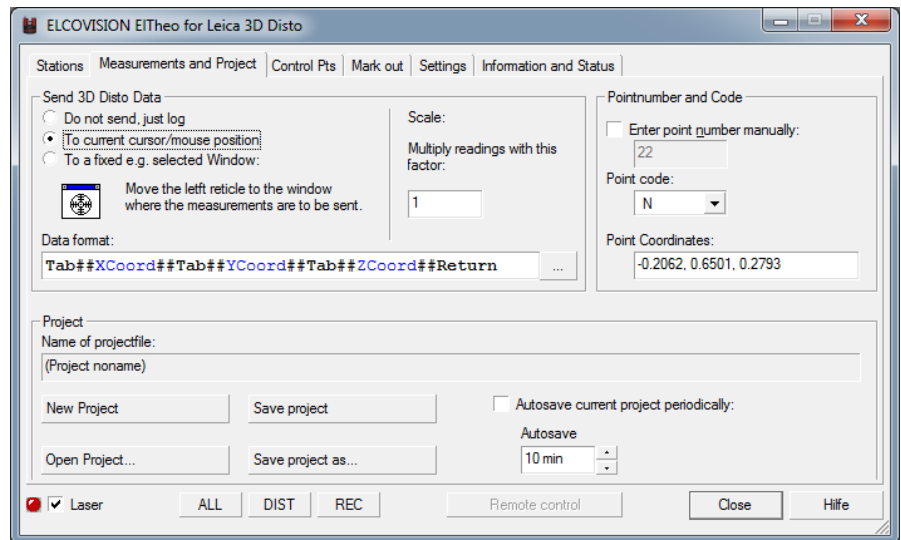
Compute OK Cancel

To complete the orientation, the direction angles (horizontal angles) to the individual connection points must be measured.

Take a control point as your station

Points of view can also be taken from the control point list. In the dialog page Control Points there is a corresponding function here under [Options], which automatically transfers the control point with its coordinates into the position list. The orientation of the point of view is described in chapter "The "Points of View" dialog page.

The dialog page "Measurement and Project"



3D Disto send data

This specifies how measurements of the 3D DISTO are to be sent to other programs:

Send to the current input position

The 3D coordinates of the 3D DISTO be sent to the currently active program, as if they were typed on the keyboard.

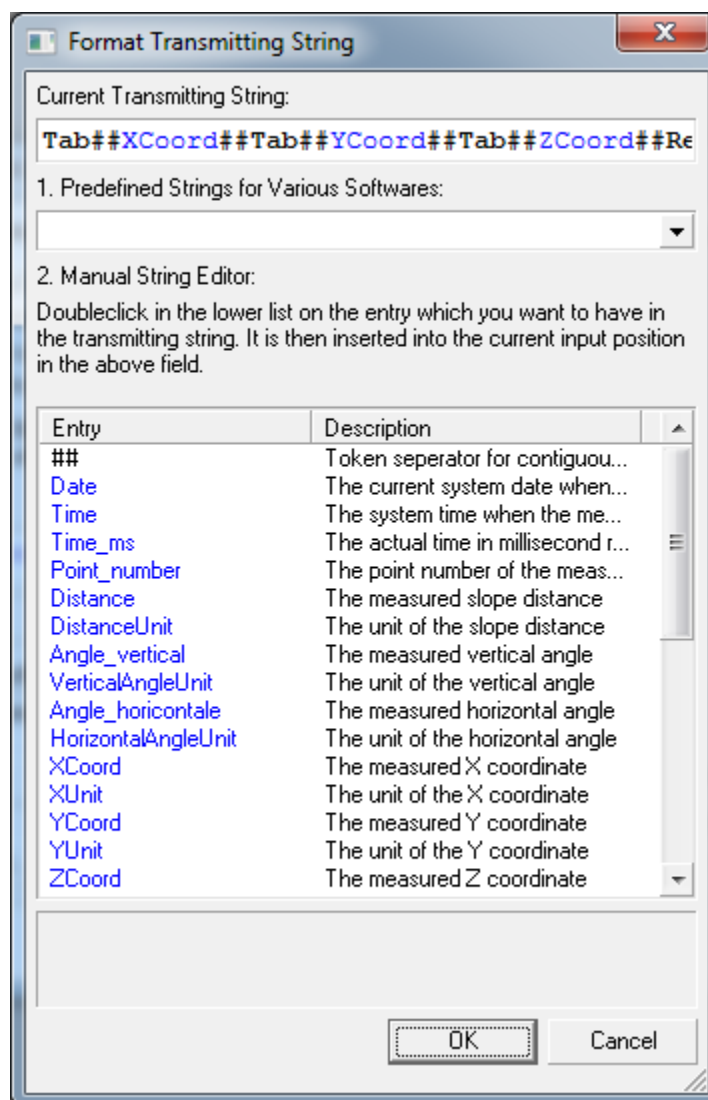
Important: If this method is used, the Leica Windows program or the EITheo for 3D Disto program must NOT be used for remote triggering of measurements, but only the small remote control of the 3D Distos.

Send to a fixed input position

If you grab the crosshairs with the mouse and drag them into any window of another software, all measurements are sent directly to this window, regardless of whether this software currently has the input focus or not.

Format Transmitting String

Any string can be entered here. Clicking the [...] button opens a dialog listing all allowed tokens:



Point number and code

Here a point number is assigned to the individual measured values. The coordinates are stored under this point number in the coordinate file. The point code indicates whether the corresponding point is a new point, a partial control point or a full control point.

The "Point Coordinates" field displays the last measured 3D coordinates. Here you can also enter a coordinate and press [Enter] to transfer it to the control point list.

Project

Here you can find information about the current location of your project, you can save the project or start a new project.

Save current project periodically

If this setting is active, ElTheo saves the current project with all measurements periodically. This prevents you from losing data, e.g. due to a power failure.

New project

If the previously opened project has already been saved, the command [New Project] immediately creates a new unnamed project. If the previously edited project was not saved, the user is prompted to save the project before creating a new project.

Open project...

Via the function [Open project] already created projects can be reopened. The position orientation can then be continued.

Save Project

Saving of the current project with all changes. If the project has not yet been saved, the program automatically jumps to the function[Save project as]. A new project can now be created here.

Save project as...

New projects can now be saved under any project name or an existing project under a new project name.

Laser

Switches the laser of the 3D Disto on/off

ALL DIST REC

With these keys the 3D Disto can be triggered remotely:

ALL

A complete measurement consisting of distance and angle measurement is triggered.

DIST

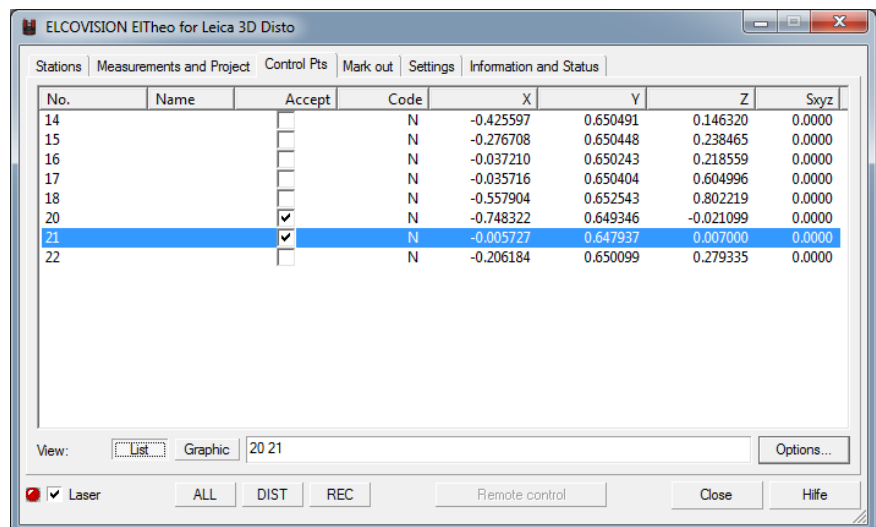
Only one distance measurement is triggered.

REC

Only one angle measurement is triggered.

The dialog page "control points"

The control point view as list



List

The Control Points dialog page is used to manage points. This includes points that were measured in the project. Points can also be imported into the project via an imported control point file. Control points can be full control points (XYZ) with pass information in all three coordinate directions or partial control points (in only one or two coordinate directions). The passport information can be defined by the user. Points without passport information are called new points (N).

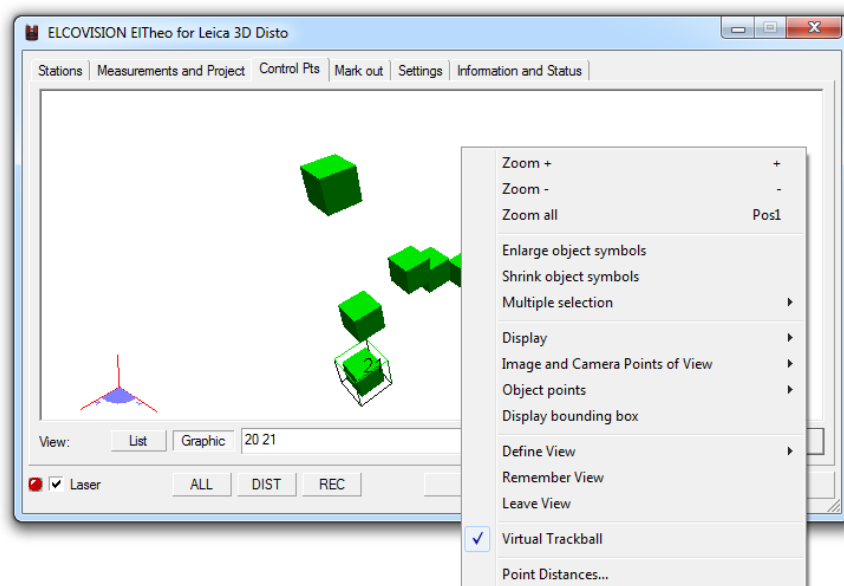
The measured points are already assigned the pass information set in the Measurement dialog page during the measurement. Later, the pass information of individual points can be changed at any time by editing in the control point list.

Imported points from a coordinate file and full control points are assumed to be error-free. New points are assigned the error portions resulting from the measurement.

In the list display of the control points, each column can be sorted in ascending or descending order. Each individual value can be re-edited as required.

The control point view as graphic

For selection of control points (for the point of orientation, layer definitions, etc.), it is often clear, refer to this the graphical view.



In order to optimally display all control points and new points in the graphic, the user gets a context menu with a multitude of change options by clicking with the right mouse button in the overview graphic:

Zoom +

Zooms into the point cloud display. The[+] key of the numeric block of the keyboard or the wheel of a scroll mouse has the same effect.

Zoom -

Zooms out of the point cloud display. The[-] key of the numeric block of the keyboard or the wheel of a scroll mouse has the same effect.

Zoom All

Here an optimal adjustment of the 3D point cloud in the viewport is made.

Enlarge object symbols

The cubes representing the individual objects are enlarged by 10%. This function is also assigned to the[6] key of the keyboard alphanumeric block.

Shrink object symbols

The cubes that represent the individual objects are reduced by 10%. This function is also placed on the [7] Alphanumerikblockes of the keyboard.

Number Points

The object points in the point cloud are shown numbered.

Select points

Selects all points for further selection.

Deselect points

Deselects all points.

Points Invert selection

Inverts the selection of points, i.e. selected points will be deselected and vice versa.

View put

Here is one of the following predefined views of the point cloud can be set: View of the XY, XZ, YZ, YX plane or isometric view.

Perspective view

If this menu item is activated, the point clouds perspective are displayed distorted. This makes them easier to interpret, as you can easily see how the object points are staggered in depth. If this menu item is deactivated, the point cloud is displayed using a parallel projection.

Save View

If the user wants to reuse a certain view later, this field must be clicked in the corresponding view. The current view is then stored in a stack for later return.

View leave

Clicking this point ends the current view, the view changes to the last view anchored under "Remember view".

Mouse trackball

If this menu item is activated, the rotation function described above is assigned to the left mouse button and the move function when deactivated. This menu item is especially intended for users of 2 button mice.

Point measurement

Here a simple point measurement can be started, with which the X,Y,Z and inclined distances of two control points can be determined.

Options page of the control points

Delete List

The Delete list function is used when a large number of new points were measured that were only transferred to a CAD for design purposes and are later not used as control points. Of course, individual items can also be deleted from the list by selecting them and pressing the [Remove] key.

Points Import

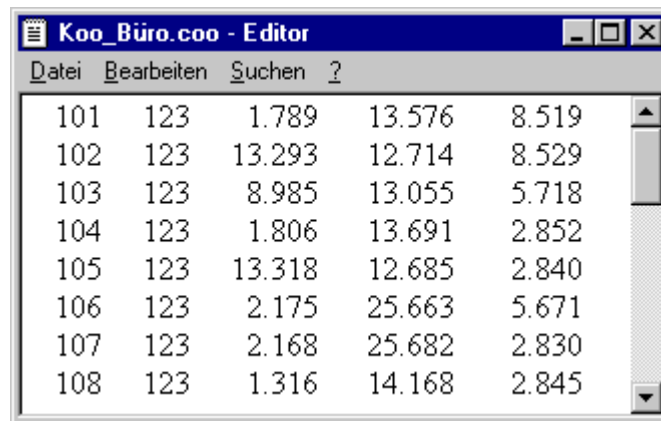
In principle, all types of coordinate lists can be imported into ElTheo. The structure of these lists is important.

The structure must look as follows:

Point ID code X-Y-value value Z-value

The individual values of a line must be separated by spaces or tabs.

Example of a coordinate list that can be read in with ElTheo. Only full pass points can be seen here:



Datei	Bearbeiten	Suchen	?
101	123	1.789	13.576 8.519
102	123	13.293	12.714 8.529
103	123	8.985	13.055 5.718
104	123	1.806	13.691 2.852
105	123	13.318	12.685 2.840
106	123	2.175	25.663 5.671
107	123	2.168	25.682 2.830
108	123	1.316	14.168 2.845

The point number can have alphanumeric designations. Very important is the presence of the point code. The code determines whether the point is interpreted as a full or partial pass point or simply as a new point.

Code 0: New point

Code 123: Full control point

Code 12: Part Pass point in X-and Y-direction

...

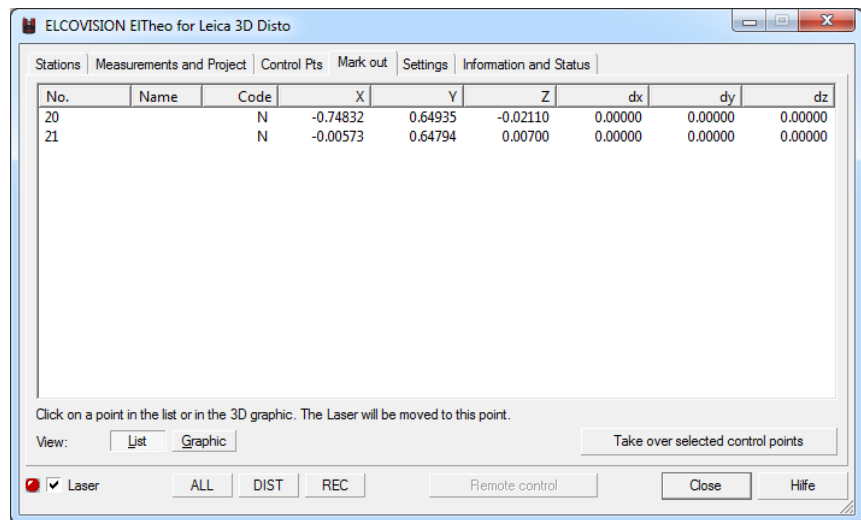
Points save as ...

Here the points contained in the control point list can be saved separately in a coordinate file *.coo.

Make standpoint ...

Selection of a point from the control point list. After the command has been executed, the point is automatically transferred to the position list. After orientation at this point, the measurement can be continued. However, only full control points from the point list can be used as positions.

The dialog page "Mark out"

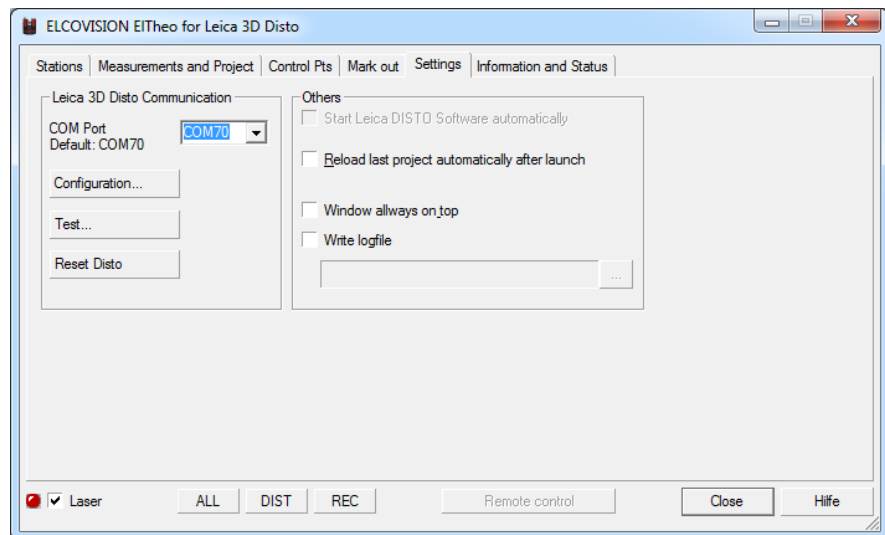


This page is very easy to use for staking out: On the "Control Points" page, first select the points you want to mark out and then switch to this page. By clicking on **[Take over selected control points]** these previously selected points are transferred to the list.

If you now click on a point in the list, the Leica 3D Disto points exactly on this point.

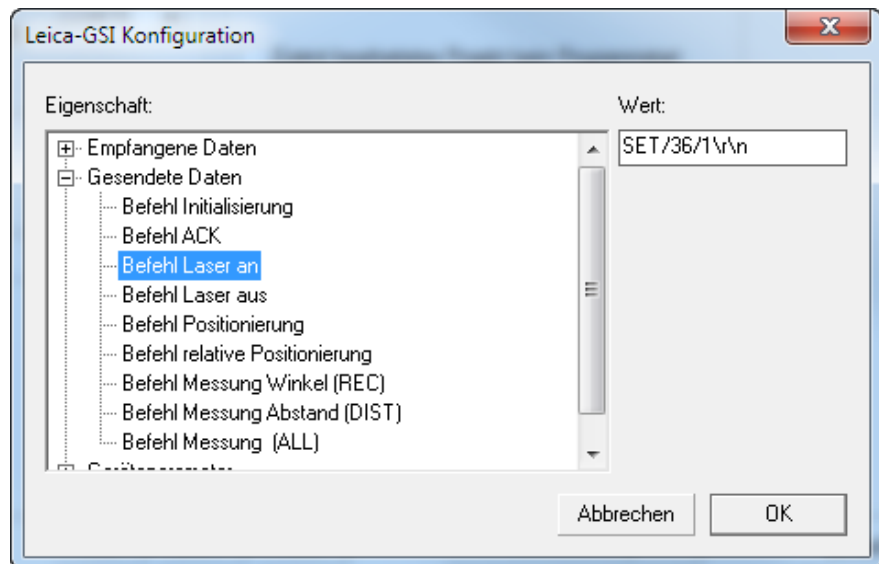
When you trigger a measurement, the fields dx,dy,dz are updated with the difference between the setpoint and the measured point.

The "Settings" Page



If the Leica Windows software for the 3D Disto has been installed without any changes, no further settings are necessary. If necessary, the COM port must be reset.

The dialogue "Leica GSI configuration"



The individual settings refer to the appropriate settings on the theodolite. First, read the manual for your theodolite, if they want to change some settings

This dialogue will be explained an example for all other drivers. On the left side of the dialog you will find a tree with all the configurable values of the driver, the right of it a field in which you can change these values. The values are permanently stored in the registry of your computer. **For all settings when installing the program entered the correct values to these normally need not be changed.**

Received data

These numbers correspond to numbers and codes that are sent from the tachometer to the program ElTheo. These settings should not be altered, otherwise the correct processing of the data is not guaranteed.

Sent data

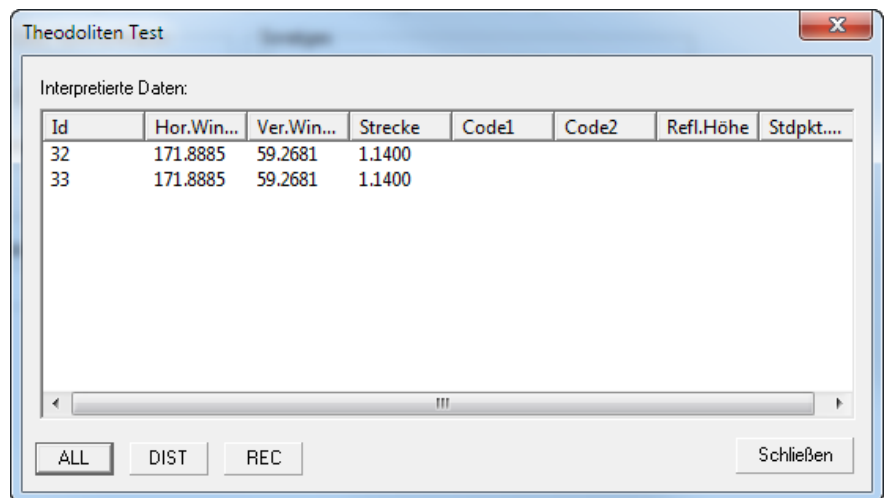
Here are the information that is returned by the program to complete reception of all data on the total station.

Device parameters

Are in use, it must enter the device parameters in the corresponding parallel distance between the laser and the target Tachymeterzielachse axis (eg top-DISTO) is a total station from the older generation with top rangefinder (eg T1000 T460D, etc.).

To point, point- or specify deployment errors can have the meter errors related to the distance and angle measurements can be entered. These are the manuals of the appropriate equipment to remove.

The dialogue "theodolite test"



In this sub-dialogue of the settings can be checked whether a data transmission between the computer and 3D Disto takes place. In the figure above is an example of a correct data transmission is seen. ElTheo automatically converts the links in the geodetic system measured values for values in a mathematical system of law.

Transmitted when triggering a measurement on the tachymeter no or incomplete data, usually the serial port settings are not identical with those of the total station. Check whether the settings are the same, and if they for example the correct cable.

With Bluetooth Devices, the serial settings usually not relevant, as they are entered only pro forma.

