Manual

GEDO Rec

- A measurement system for track recording -

@Trimble Railway Industry

Version 2.3.0

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1 Introduction

The track surveying system GEDO *CE* with its version GEDO Rec offers you the ability to record the condition of a given track in both horizontal and vertical position. This is accomplished by a measurement trolley or a measurement bar that is equipped with electronic sensors.

The program runs on a Trimble TSC2 or TSC3 control unit that runs a Microsoft® Windows® Mobile operating system. The software supports all Trimble S-Series instruments.

GEDO Rec uses the latest stationing (coordinates, orientation, scale, instrument height) from a file that was exported from the Trimble Access Software (TA Software) and uses it for further coordinate calculation. Optionally the station setup can be done within the GEDO Rec Software as well.

The layout of the software follows the Trimble Access software by means of design and usability. This means that the user can orient himself intuitively within the Software and he can use the instrument's functions as he is used to. For a deeper insight into these functions the unpracticed user should read the Trimble Access user manual.

Basically there are two recording techniques for points. Firstly the single point measurement in which the user decides which points to measure and secondly the continuous measurement mode in which the user defines an interval in which a point is stored automatically.

2 Installation and licensing

2.1 Installation on a TSC2 or TSC3

1. Connect your control unit to a desktop PC. Before installing every file has to be copied to any directory on the device, e.g. *WinCE Device\Temp*
2. Install the file ***SNP_COM_SERVER_TSC2_WM5.cab*** resp. ***SNP_COM_SERVER_TSC3_WM6X.cab***
3. Install the file ***NETCFv2.wm.armv4i.cab*** onto the controller
4. Run the file ***GedoRec_vx.x.x_TSC2.cab*** resp. ***GedoRec_vx.x.x_TSC3.cab*** on the controller. As soon as you open this file, the software and its components will be installed automatically into the folder *\Program Files\GedoRec*. Further a shortcut in the Windows® start menu will be generated.
5. Copy the license file into the created program directory *\Program Files\GedoRec*
6. If you want to use station setup from Trimble Access in GEDO Rec you have to copy the style sheet ***Stationierung.xsl*** or ***Station report.xsl*** into the folder *\Trimble Data\System Files* on your controller.

Then the installation is finished. The program can be started easily by using the Windows® start menu.

All project relevant data will be stored in a separate folder (*\GedoRec Data)* in the root directory (chapter 4).

2.2 Installation on a tablet PC (YUMA)

Before installing every file has to be copied to any directory on the PC, e.g. *C:\Temp*.

1. Extract the zip archive ***SNP_Service_R4.7.16_x32.zip,*** open the directory and run ***setup.exe***
2. Install ***Win7_USB_Installer.exe***
3. Run ***USBRadioDriver.exe***
4. Install ***vcredist_x86.exe***.
5. Start GEDO software installation by running ***GedoRec_vx.x.x_Win32.exe*** and choose directory for installation (by default: *C:\Trimble\GedoRec*). By default a shortcut in the Windows® start menu and a desktop icon are generated. If you run the program for the first time Faro SDK for using a scanner will be installed and four DLLs are registered.

6. Copy the license file into the created program directory defined during installation (by default: *C:\Trimble\GedoRec*).
7. If you want to use station setup from Trimble Access in GEDO Rec you have to copy the style sheet ***Stationierung.xsl*** or ***Station report.xsl*** into the folder *\Trimble Data\System Files* on your tablet PC.

Then the installation is finished. The program can be started easily by using the Windows® start menu or the shortcut on the desktop.

All project relevant data will be stored in a separate folder (*\GedoRec Data**)*** in the top level directory (chapter 4).

2.3 Licensing

If you want to use the program to its full extent a specific licensing file must be stored in the program directory on the controller. There will be a license check at every startup. Without this license file all functions of the program may only be used for testing purposes.

2.3.1 Licensing for a TSC2 or a TSC3

The GEDO Rec license file is linked to the serial number of the controller the program is installed on. An installation on a different control unit requires the acquisition of an additional license.

The following steps have to be executed in order to get the license file:

1. Identify the serial number of the TSC2/3. For this purpose choose the menu entry *Settings* from the *Start* menu. Then select tab page *System* and click *About*. The serial number is then shown on tab page *Device ID* as *Device name*.
2. Send the displayed *Device name* to info@trimble-railway.com and ask for a license file for program GEDO Rec.
3. You will then receive a license file *SerialNumber*.lic. Finally copy this file into the installation directory of GEDO Rec.

2.3.2 Licensing for a Tablet PC

The license for GEDO Rec on a PC is linked to the computer.

The following steps have to be executed in order to get the license file:

1. After first start of program copy the files *hardwareinfo.dat* and *keyfile.txt* from installation directory of GEDO Rec.
2. Send these files to info@trimble-railway.com and ask for a license file for program GEDO Rec.
3. You will then receive a license file *GedoRec.lic*. Finally copy this file into the installation directory of GEDO Rec.

3 Basics

With a positioned total station the prism mounted on the trolley is permanently tracked and its coordinates are measured. This coordinate and the additional information from the gauge sensor, the inclination sensor and the trolley's geometry are used to determine the current state of a centre line (or left line or right line) at discrete points. The lines can only be calculated in post processing. This is because there is no existing geometric reference data of the track and one single measurement to a point offers not enough information to calculate the lines.

Therefore is it necessary to collect certain parameters during the measurement to reduce the measurement to the desired line. These parameters are:

- the position of the prism on the trolley (left / right),
- the position of the **fixed** (not movable) trolley side on the track (left / right),
- and the position of the height reference string of the track (left / right)

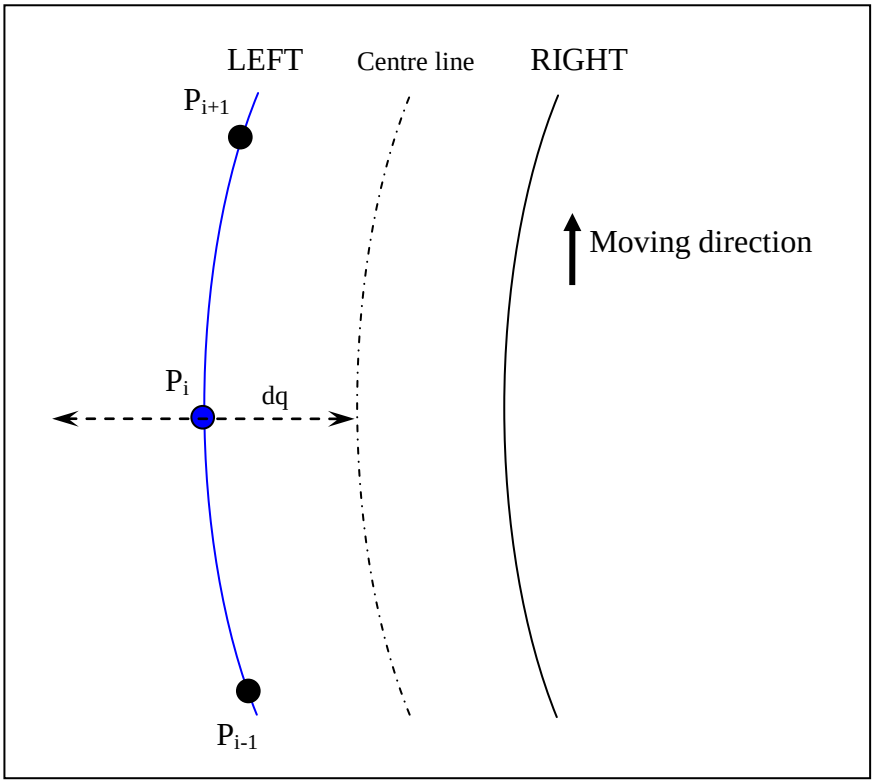
in reference to the main moving direction during the recording.

This moving direction is defined by the first stored point and the point that is the farthest away from it. This means that it is also possible to record points that are in the reverse direction but one must then be aware of the fact that the moving direction might switch, if these backside points are farther away than the points that lie ahead.

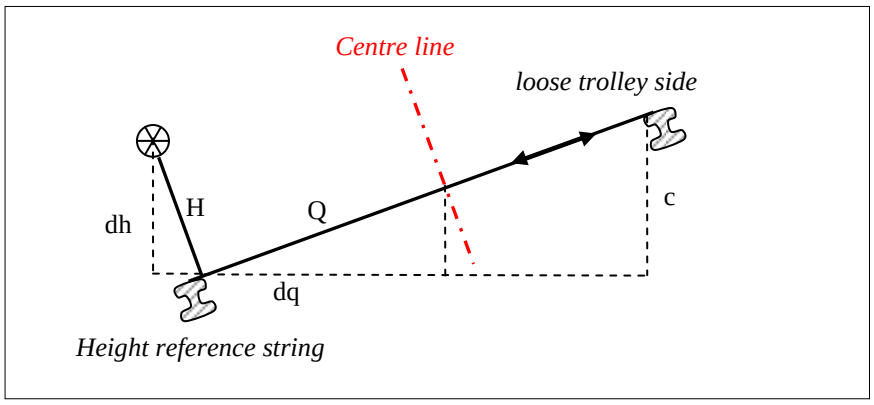
In this case it is not necessary to turn the trolley around as with the given parameters the reduction to the line can be calculated.

During the measurement so called measurement lines are defined. These lines will always be evaluated separately. Therefore it is possible to measure several different parts of the track from one single station, i.e. one side of the track in one certain direction and the other side of the track going backwards again.

For calculating the corresponding line point of a measured point P_i its direct neighbors P_{i-1} and P_{i+1} will be used. Through these three points a circle is calculated and orthogonal to the circle's tangent the offset dq is applied to the point P_i. The sign if the direction of dq results in the made setting of the prism direction. If the prism is located on the left side of trolley then the offset will be applied to the right side and vice versa. For the first stored point in the list the following two points will be used and for the last point in the list the preceding two points will be used to calculate the direction of dq. Of course, the whole calculation is just an approximation of the real track but if the distance between two measured points is small enough (usually 5 meters grid width are common) this approximation is absolutely sufficient.



The orthogonal offset dq results from the cant c and the static elements H and Q that are a result of the trolley's geometry. By trivial trigonometric relations dq can be calculated. One specialty occurs when the fix side of the trolley is located at the height reference string. Then the gauge sensor value is also used to calculate Q (usually: *norm gauge/2*). The height H of the prism above the top of rail is made up by a fix part that can only be changed through the configuration file of the program and a free definable target height that can be set whenever necessary in the program.



4 Project structure

All projects and their associated data are stored in the folder ***\GedoRec Data*** in the top level directory.

A project always consists of a main directory which carries the name of the project itself. Each project folder contains one project file with the ending **.pro* that contains the project-specific settings. Apart from that a measurement-file with the ending **.job* is stored in that directory as well. This file contains all measuring data collected in a GEDO Rec measurement process.

If no project is available a default project with the name *default.pro* is created and loaded automatically by the software.

If the program starts up the previously loaded project will be opened automatically. If this project is no longer available or valid the default project will be opened instead.

If a line is calculated from the measured data and is stored, these output files will be stored in the subdirectory ***\GedoRec Data\[project name]\Export*** of this project.

For easier use it is possible to define multiple measurement trolleys with their specific settings are defined. These are stored in separate files and can be loaded through the software. This trolley definition file must have the ending **.trl* and has to be located in the sub directory ***\Common Files\Gedo\Trolley***.

5 Program start

For a more comfortable start of the software, an automatically generated shortcut in the start menu can be used.

If you do not want to use the stationing procedure of GEDO Rec the stationing of the Trimble Access software must be used instead. It is not possible to use the program without any appropriate stationing. Proceed as follows:

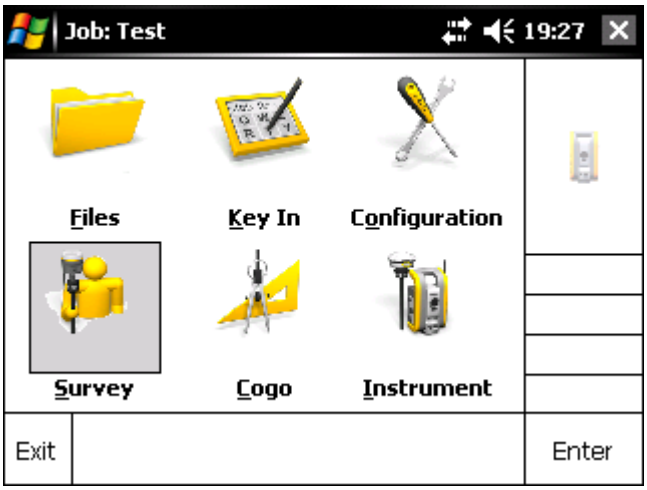
1. Start TA software and do the station setup as usual. The type of stationing can be chosen freely.
2. Export the current station setup into a text file using *Export/Custom format files*. The file format must be ***„Station report“***.
3. After having successfully created the file, the TA software can be closed and GEDO Rec can be started.

GEDO Rec now uses this file to import the current valid station information.

If there doesn’t exist a single station file, a message dialog will show up and the station coordinates and the orientation will be set to zero.

6 Main menu

After a successful start of the program the main menu will automatically show up. The structure and the icons are quite similar to the Trimble Access software. Therefore the navigation is exactly the same as in the Trimble Access software. By clicking the ***Exit*** soft key the program will close.



The menu structure is the following:

- **Files**
  - New project
  - Open project
  - Project settings
    - Job file
    - Measurement trolley
    - Linked files
  - Point manager
  - Export
  - Windows Explorer
- **Key In**
  - Points
- **Configuration**
  - Calibration
    - Inclination sensor
    - Gauge sensor
    - Profile sensor

- Track geometry
- Port
  - Trolley
  - Profiler
  - Instrument
- Export formats
- Controller
  - Units
  - Language (switches the loaded language file)
- Options
- About (Version and license information)

Survey

- Station setup
  - Import
    - From Trimble Access
    - From station buffer
  - Known point
  - Resection
  - Use last
- Control point
  - Define
  - Check
- Survey
  - Start single survey
  - Start cont. survey
  - Gauge and Cant
  - Profile measurement
- Connect to / Disconnect from total station

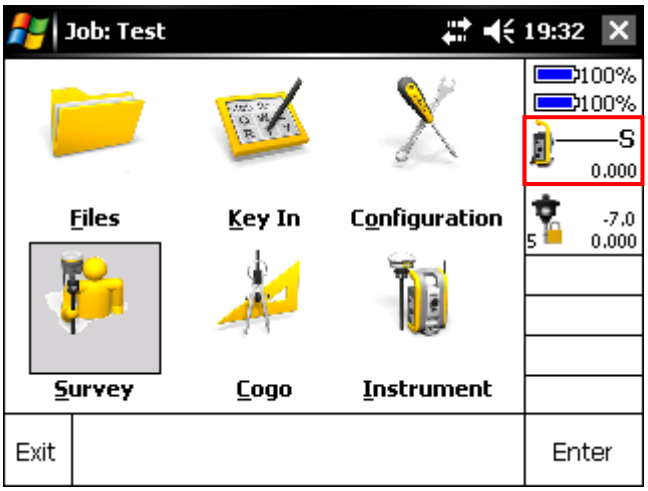
Instrument

- Radio settings
- Target settings
- Weather corrections

- Search window
- Trimble functions

The menu **Cogo** is not allocated to any function.

If the controller is connected to an instrument the current instrument state and settings are displayed in the upper right part of the window and can be changed by clicking on this window part.



During the connection process a bar will show up in the lower part of the window and show the progress of the connection. Later on the angle values will be displayed here.

Directly after a successful connection a dialog with the currently valid station information (see *p. 43*,) will be displayed automatically.

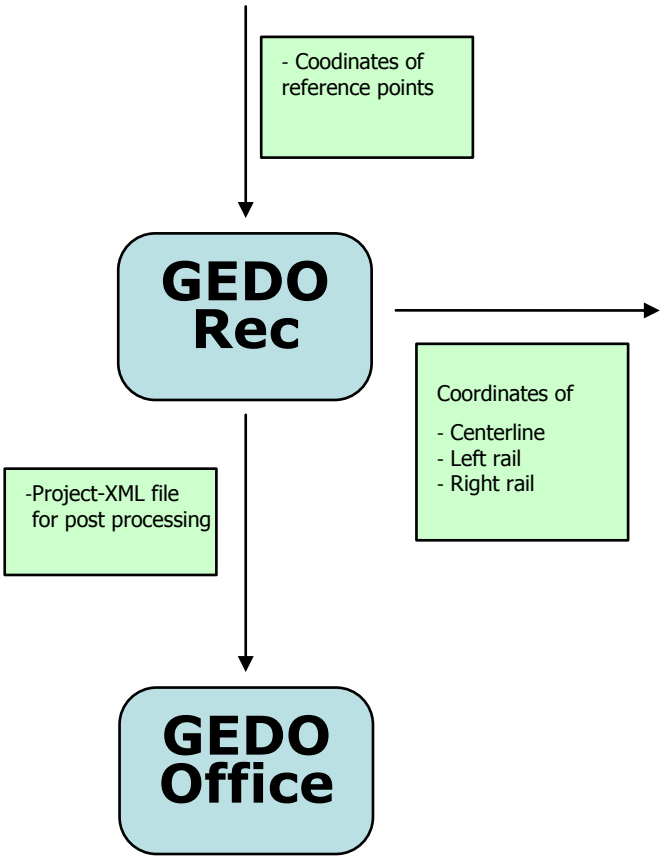
Beside that the instrument will be switched into *AutoLock* mode.

7 The Typical Workflow

In this chapter a typical workflow will be shown. In most instances the workflow will be the same as the following.

1. Create a new project (Ch. 9.1)
2. Choose or create a new measurement file (Ch. 9.3)
3. Link the reference point file to the project (Ch. 9.5)
4. Place the trolley onto the railway
5. Calibrate the inclination sensor (usually done by measurement in two faces) (Ch.11.1.1)
6. Calibrate the gauge sensor (Ch. 11.1.2)
7. Connect the system to the total station
8. Stationing the total station either on a known point or a free stationing (Ch. 13.1)
9. Start measurement (Ch. 13.3)
10. Measure and save points
11. End measurement
12. Export points into the desired format
13. End program

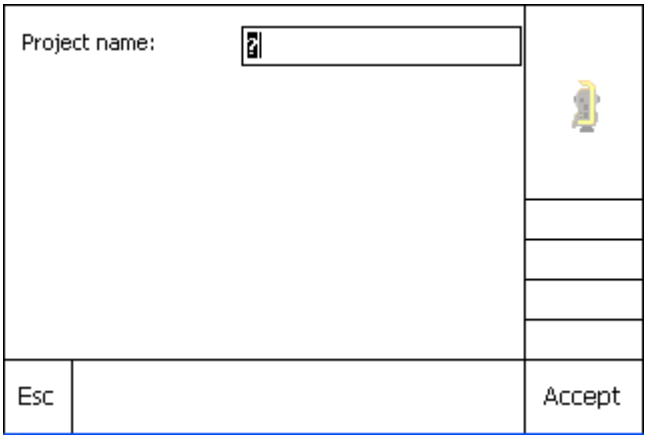
8 Data Flow


- Coodinates of reference points
GEDO Rec
Coordinates of
- Centerline
- Left rail
- Right rail
-Project-XML file for post processing
GEDO Office

9 Context Menu Files

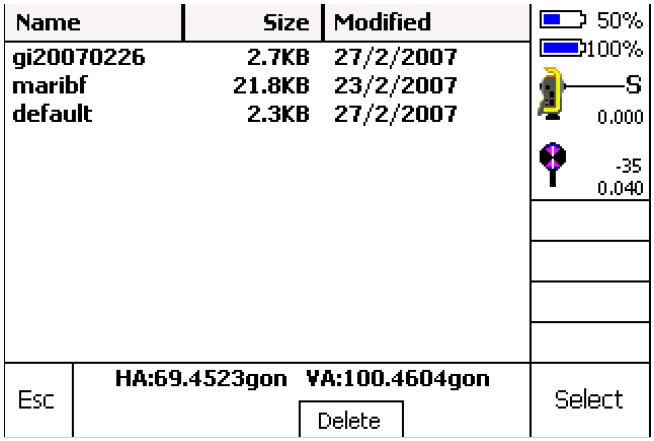
9.1 Dialog New Project

By using the text box **Project name** the user can enter a project name. By pressing **Accept** the new project will be created in the project directory. If the project already exists, the user will be prompted to overwrite this project.



9.2 Dialog Open Job

In a list each available project is displayed showing its size and the date of the last modification. By clicking the **Select** soft key the selected project will be opened.

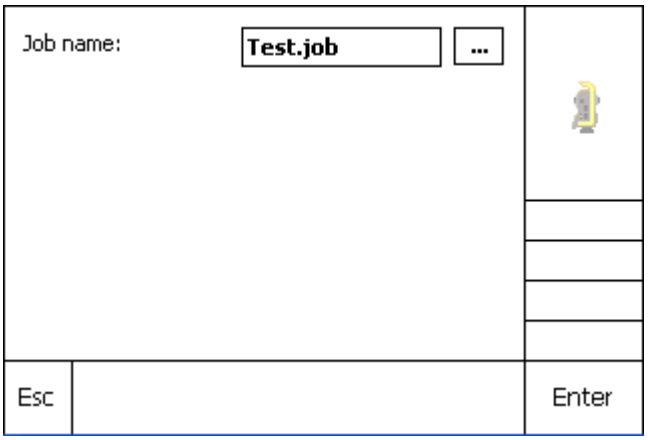


By using the **Delete** soft key the selected project will be deleted permanently. This project cannot be the currently active project.

9.3 Dialog Measurement File

Within one project file you can create any desired number of measurement files (job files). In this way you can divide your project into smaller subsections. For example you can create an own file for every day of measurement. As so you can better organize the following computation.

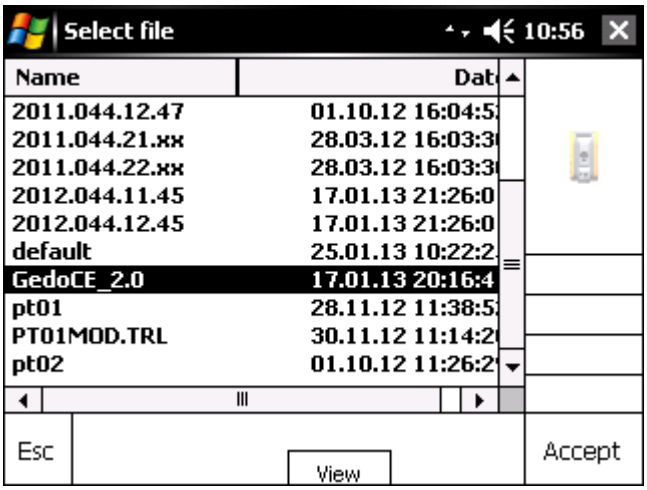
A click onto the button […] opens the *open file* dialog that opens existing files. This dialog is in function and appearance similar to the *linked files* dialog



9.4 Dialog Measurement Trolley

A list shows all trolley definition files with their name and creation date. These files contain the geometric trolley parameters, the scale and calibration values of the sensors as well as some communication parameters. The currently loaded trolley is highlighted if in the list. By clicking the **Accept** soft key the selected trolley file will be opened and loaded.

If a trolley of the latest generation shall be used, the list entry “GedoCE_2.0” has to be selected. In this case the trolley parameters are stored directly on the trolley and no longer in a file.

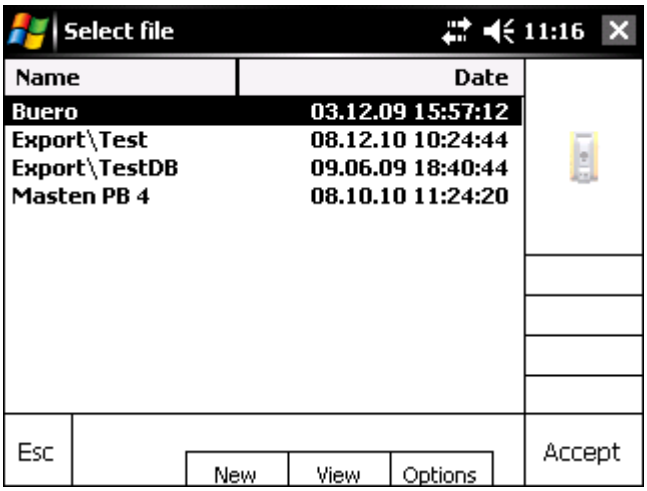


Using the **View** button displays the trolley file content in an external editor.

Attention: Editing a trolley definition file will lead to wrong measurement results!

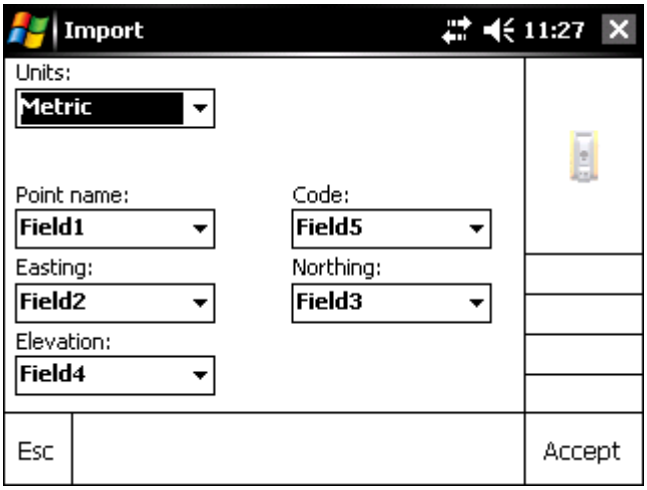
9.5 Dialog Linked Files

Reference point files can be linked to the project by selecting one of the files from the shown list. Only files with the ending **.csv* within the project folder are displayed. Reference points can be used for stationing and for control point definition. As soon as a reference point is used for the first time it is imported into the project.



With a click onto **New**, you can create a new reference point file. **View** lets you see the content of the selected file in the point manager (p. 23).

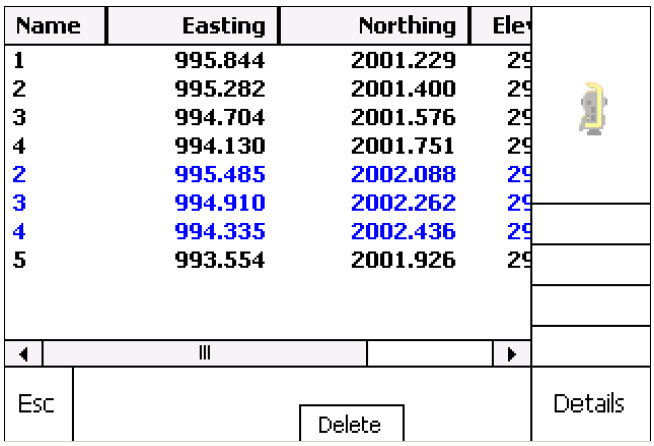
Under **Options** the file format has to be defined.



The units of the given coordinates can be selected (Metric, Internat. Feet, U.S. Survey Feet) as well as the field order the information of a single line is arranged at. One line in a file may consist of up to six fields.

9.6 Dialog Point Manager

The point manager lists all stored points with their coordinates and code in chronological order. The source of this list is the *.job file of the currently loaded project. By pressing the **Delete** soft key selected points can be deleted. These points are only deleted temporarily and will not be deleted permanently until the project is closed. Up to then the point will be displayed in red letters and can be undeleted by clicking the **Delete** soft key again.



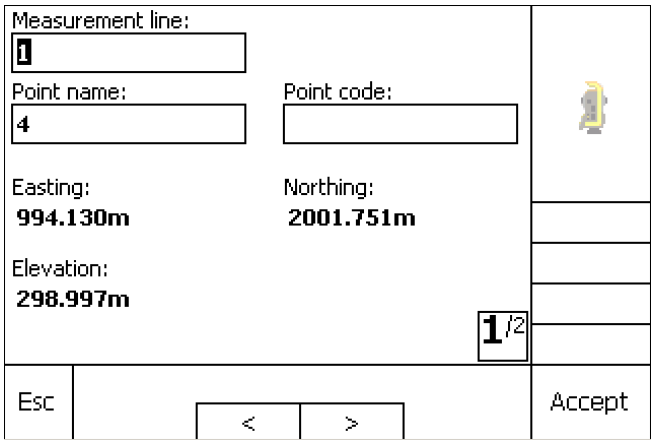
Control point measurements are also displayed in green letters in the list. Topographical points (points outside the measurement line) are marked blue.

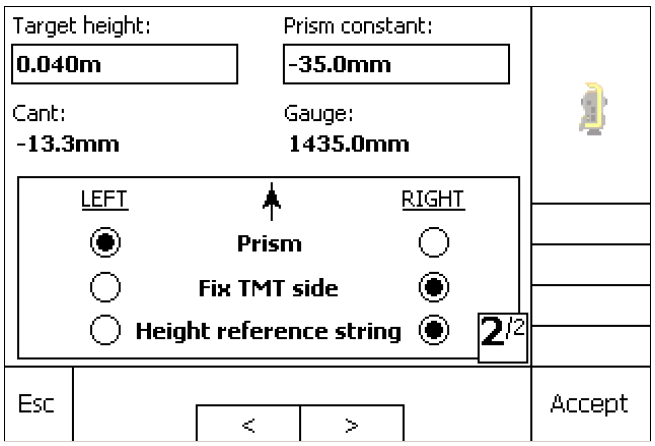
By pressing the **Details** soft key the Point details dialog will be opened. This is only possible for topographical points and line points.

Note: *Within large projects containing a whole bunch of measured points using the point manager is not recommended because the loading and displaying of all points takes a noticeable period of time.*

9.7 Dialog Point Details

In this dialog the details of a measured point can be viewed. Incorrect values can be edited here, too.



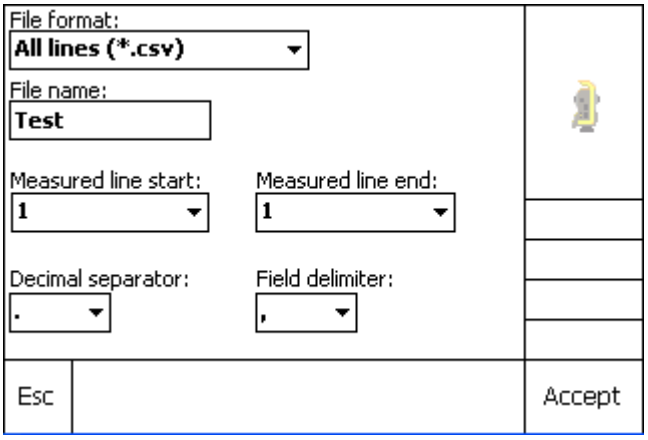


Editable parameters are the name of the measurement line, point name and point code, target height, prism constant and the trolley configuration. By pressing **Accept** the point details will be overwritten and the point manager dialog appears again.

If the user clicks one of the arrow soft keys on the bottom of the dialog the edited point is stored and then accordingly the previous respectively the following point in the list is displayed automatically.

9.8 Dialog Export

Using the Export dialog the user can on the one hand create the lines out of the collected data and on the other hand export these lines in the desired format for further processing. Currently a comma separated format (*.csv), a Zeiss-M5 format (*.dat) and a Geodimeter format (*.are) are available. This list will be extended consequently. To make it easier for the customer to navigate through these formats it is possible to display only frequently used formats and hide other unimportant export formats (→ Dialog Export formats). The user can select whether he wants to export the left track line, the right track line, the centre line or all three lines together in one file. The Zeiss-M5 format and the Geodimeter format however only export the centre line coordinates.



The user has to choose the output file name (as defaults value the project name is recommended), select the measurement lines he wants to evaluate and select the decimal separator and field delimiter. A click on **Accept** starts the export procedure. A bar in the lower part of the window shows the progress.

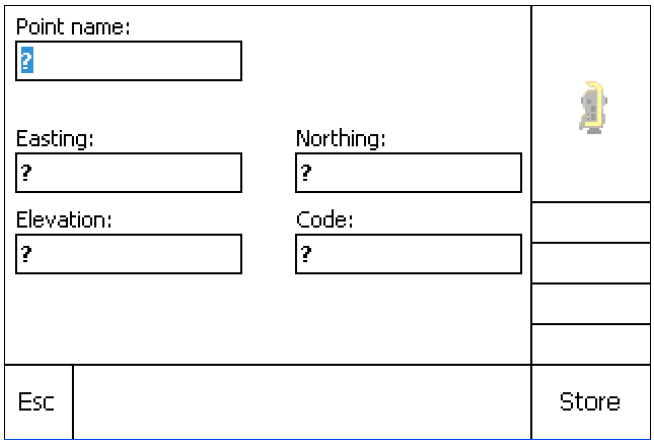
To export topographical points the user has to select ***TopoPoints*** as file format. The data will then be exported automatically into a *.csv format.

Note: *The angle output format will be the one that is set within the program while the export process is executed and NOT the one that was set during the measurement!*

10 Context menu Key In

10.1 Dialog Key In Points

Additionally to the import functionality for reference points the user can add reference points manually to the project. These points can then be used for example for stationing or to defining a control point. For this it is essential that a reference point file is defined. If this is not the case, the user will be prompted to do so.



Note: *Points may also be entered without elevation or code information.*

11 Context Menu Configuration

11.1 Dialog Calibration

11.1.1 Inclination sensor

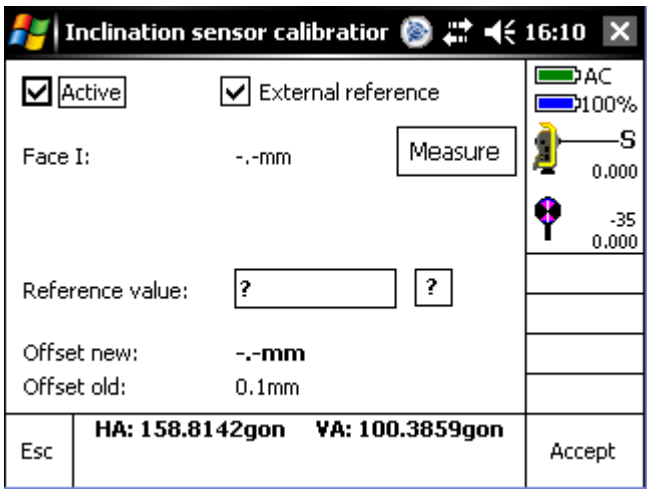
The inclination sensor is calibrated either by comparing the sensor value with an external reference value that is entered into the corresponding text box **or** by measuring the current inclination in two faces turning the trolley around.

If the sensor is not to be used, it can be deactivated by checking the checkbox in the upper left part of the window. All requested sensor values will then be zero.

11.1.1.1 Calibration by external reference

If the checkbox ‘External reference’ is checked the calibration is done by entering a reference value.

Note: ***The reference value must be entered with a positive sign if the movable side of the trolley is on the higher rail and the fix side is on the lower rail. Otherwise the sign must be negative.***

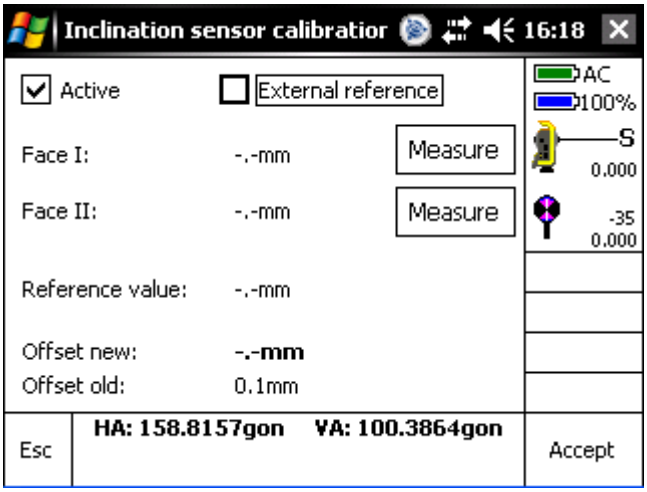


By pressing the soft key ***Measure*** the current sensor value is read out including the currently valid calibration and presented as current value. The default value, for example the value determined by a track rod will be entered in the provided field and therefore the new offset is calculated. ***Accept*** saves the new offset into the corresponding configuration file.

After re-entering the dialog and pressing Measure the current sensor value must correspond to the previously entered reference value. This is a sign that the calibration procedure was successful.

11.1.1.2 Internal calibration

By pressing the soft key ***Measure*** in face I the current sensor value is read out including the currently valid calibration and presented as current value. This must be repeated now turning the trolley around and pressing the ***Measure*** button at face II. The software now calculates the average value and therefore the new offset is calculated. Pressing ***Accept*** saves the new offset into the corresponding configuration file.



Note: *If no sensor value can be received, this may have several reasons: The sensors get no or insufficient power (check the batteries, turn on the box), the wrong serial port is selected or the port parameters are wrong, the Bluetooth connection has a poor reception or is not setup correctly (terminate program, check settings of the operating system).*

11.1.2 Gauge sensor

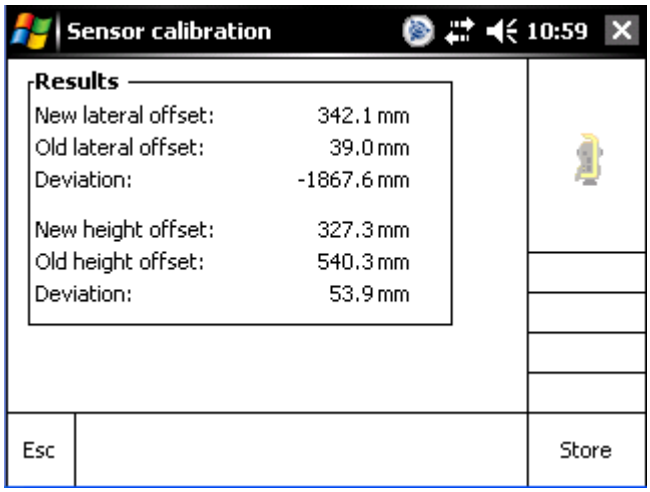
The dialog for the gauge sensor calibration is identical to the inclination sensor calibration in layout and functionality. If the sensor is deactivated, the norm gauge as shown under point 11.2 is always used instead.

11.1.3 Profile measuring unit

The profiler is mounted easily in the middle of the trolley. The mechanism usually is very stable and the repeatability after dismounting and remounting again is less than 0.5mm. Therefore it is not necessary to calibrate the sensor after every remounting. Only before the first usage or after loss of the calibration file the calibration should be redone.

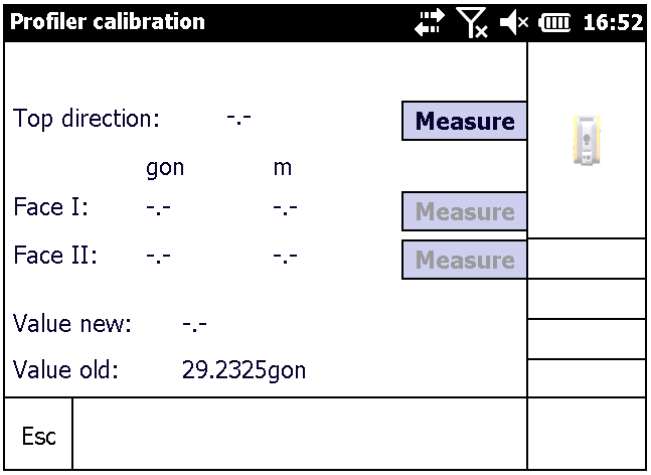
11.1.3.1 Profile measuring unit for GEDO CE 1.0

After the profiler is mounted correctly and connected to the controller the calibration procedure can be started. Therefore the calibration plate is mounted onto the prism holder above the fixed trolley side. Target with the laser pointer the calibration plate and press the **Measure** button. Now the plate is mounted on the movable side and likewise the laser pointer is targeted at the calibration plate. After the **Measure** button is pressed again the result screen is displayed. This dialog shows the new as well as the previous lateral and height offsets. Pressing **Store** will save the settings permanently in the configuration file. **Esc** will cancel the calibration process.



11.1.3.2 Profile measuring unit for GEDO CE 2.0

After the profiler is mounted correctly and connected to the controller the calibration procedure can be started. Besides settings for track geometry have to right and calibration of gauge sensor has to be check.

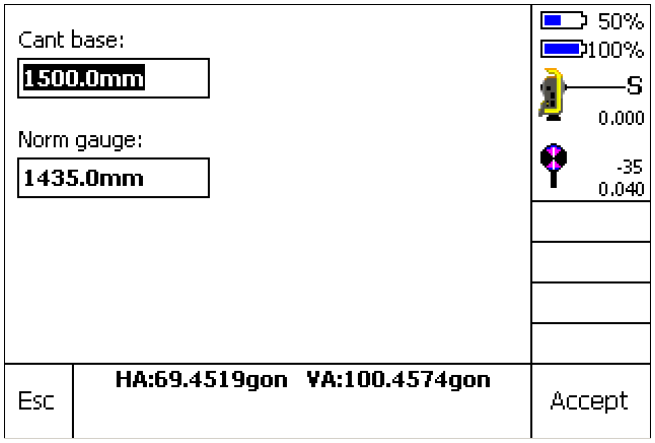


Roughly current orientation of profiler has to be defined after positioning the trolley in the track. Therefore measure with laser at the zenith (straight up, perpendicular to superelevation).

For calibration a point next to the track has to be chosen. It has to be clear to target with the laser. The distance to this point should be at least in the same distance like all other points, which should be documented with the profiler. For calibration accuracy a minimum distance of 2m is required. Furthermore, the direction needs to be different than the profilers' axis, so that the measurement orientation varies at least 5gon from top of the rails parallel horizon and its perpendicular. Measure the appropriate calibration point with current orientation of trolley in face I. Afterwards trolley has to be turned around 180°, laser focused the same target and stored as face II. The dialog shows the new orientation which can be compared with the previous one. Pressing **Store** will save the settings permanently in the profiler. **Esc** will cancel the calibration process.

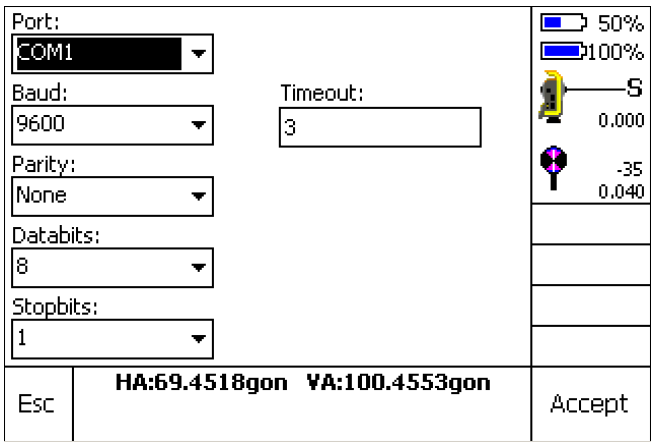
11.2 Dialog Track geometry

In this dialog the standard values for the given track can be edited. The two parameters are on the one hand the cant base to convert the inclination angle into a millimeter value and on the other hand the norm gauge. All values are shown in millimeters.



11.3 Dialog Port

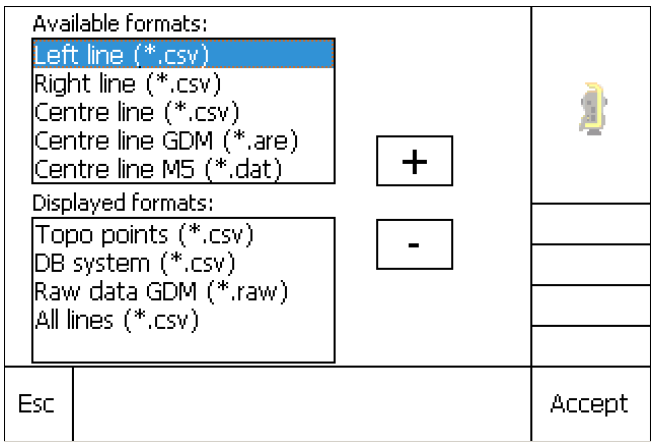
The communication with the sensors can be realized by both a cable connection through the physical port (COM1) of the control unit and a preconfigured Bluetooth virtual port (COM8 oder COM9). Accordingly choose the desired port setting in this dialog. Apart from that the timeout can be set also. The other parameters should not be edited because the sensors are adjusted to these settings.



In addition the port of the profiler (see chap. 13.9 Dialog Profile measurement) can be edited. This just concerns the port name. Besides this the sensor may be activated and deactivated as well.

11.4 Dialog Export formats

For a simplified selection of the export format in the Export dialog the user can define a list of format types to be displayed in the export dialog. By clicking the “+” button the selected format type in the available formats field is added to the list of the displayed formats. By clicking the “-” button the selected format type in the displayed format field can be removed again.



11.5 Dialog Units

The visualization and export format of any angle value can be selected between

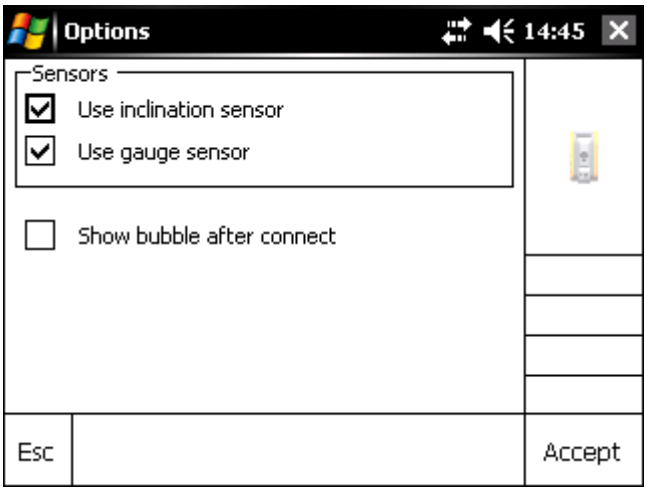
DDD.dddd	decimal degrees
DDD.MMSS	degrees, minutes, seconds
Gons	decimal gon

11.6 Dialog Options

In this dialog the sensors can be activated respectively be deactivated if this is necessary for some case of application.

If you deactivate the inclination sensor, zero (0) is used as the sensor value.

If you deactivate the gauge sensor, the value that was entered in the track geometry dialog is used as the sensor value.

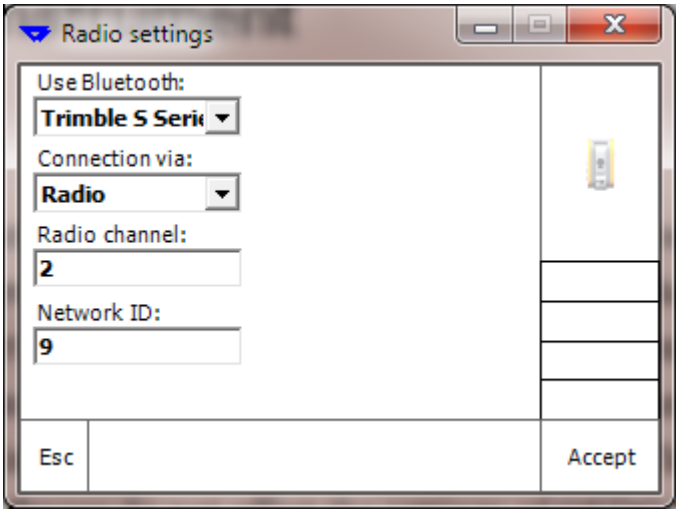


Additionally, if the respective box is checked the electronic level will be displayed after the connection to a total station is established successfully.

12 Context Menu Instrument

12.1 Dialog Radio settings

The communication with the instrument is normally done by using the internal radio of the controller or in case of a laptop the external 2.4GHz Trimble radio. Despite from that USB, Bluetooth or serial connection may be used instead. If using a radio, it is necessary to set the correct radio channel and network ID before connecting to the instrument. The current settings can be seen and/or edited by using the instrument's 2nd face display. Incorrect settings make it impossible to connect to the instrument. The settings made within the Trimble Access software do not affect the settings of GEDO Rec.



Press the **OK** soft key to accept the settings.

Note: *The parameters are only editable if not connected to the instrument.*

12.2 Dialog Target settings

This dialog can be accessed either through the main menu or by clicking on the marked part of the status panel.

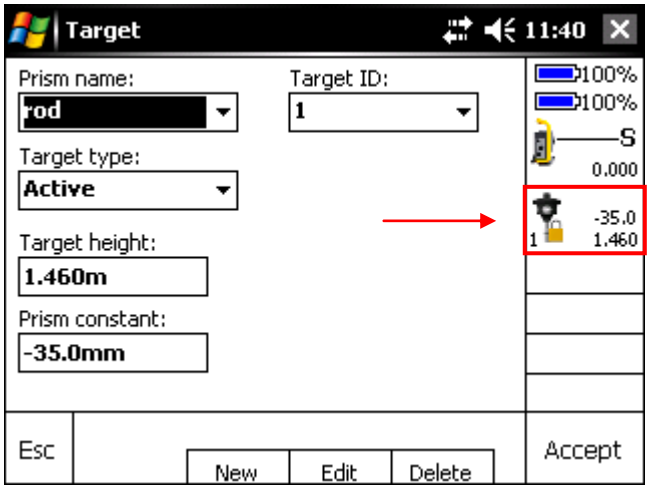
Three parameters are editable for the following measurements: the prism type, the target height (in meters) and the prism constant (in millimeters). The point of origin for the target height is the plane on the trolley pole where the prism is mounted. The rest of the height from the top of the rail is part of the trolley geometry and therefore stored in the trolley file.

Available prism types are:

Passive (no ID) - if a standard prism is in use

Passive (with ID) - standard prism with TargetID (will only be used when searching for a prism)

Active - Trimble MultiTrack® Prism



By clicking the "**New**" soft key a new prism definition can be added to the list. The name must not be equal to an already existing prism.

The "**Edit**" soft key makes it possible to change the name of a prism additionally to target height and prism constant.

Delete removes a prism from the list.

Press **Accept** to apply the settings.

Note: *A prism with the name „**DR**“ can neither be deleted nor has its name changed. It will be selected automatically when the DR mode is activated.*

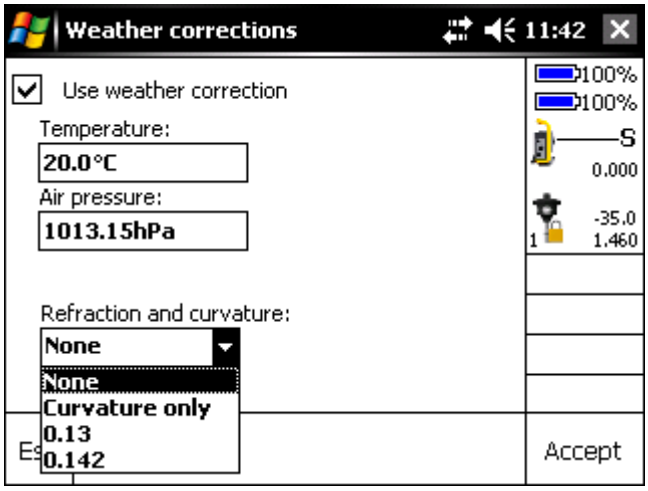
The prism definitions are stored independently of the project and therefore are also available when a new project is defined.

12.3 Dialog Weather corrections

The parameters for evaluating the ppm value from atmospheric influences are determined in the dialog Weather corrections. To do so the following values have to be entered:

- Under ***Temperature*** the current temperature in degree Celsius
- Under ***Atmospheric pressure*** the currently existing barometric pressure in hecto-Pascal.

If the option '***Use weather correction***' is deactivated, no correction will be applied.

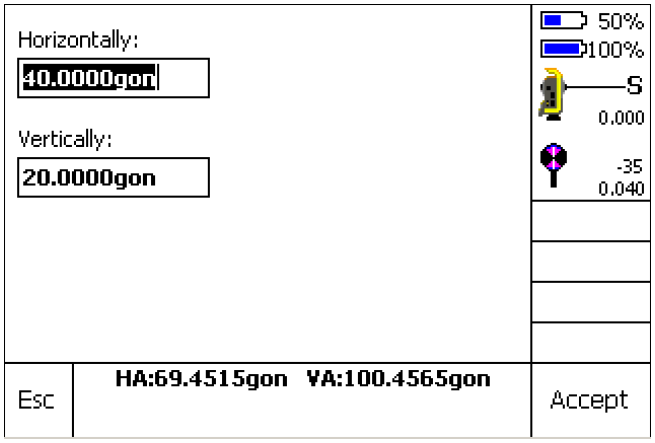


Additionally, measured values can be corrected by effects caused by refraction and earth curvature. Two models with the coefficients 0.13 or 0.142 are available as well as a simple curvature only correction method.

Clicking the soft key "***Accept***" applies the settings. Return to the main menu with "***Esc***".

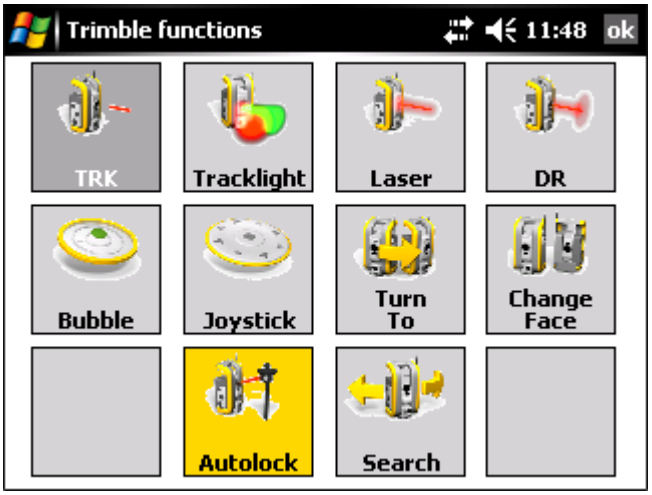
12.4 Dialog Search window

If a search is started, the instrument starts scanning for a prism in a defined window. The size of this window can be edited in this dialog by indicating the horizontal and vertical component of the search window in Gons.



12.5 Dialog Trimble functions

This dialog is almost identical to the one in the Trimble Access software. It controls the instrument's functions. It is as well as the target settings dialog available through the main menu and the status panel.



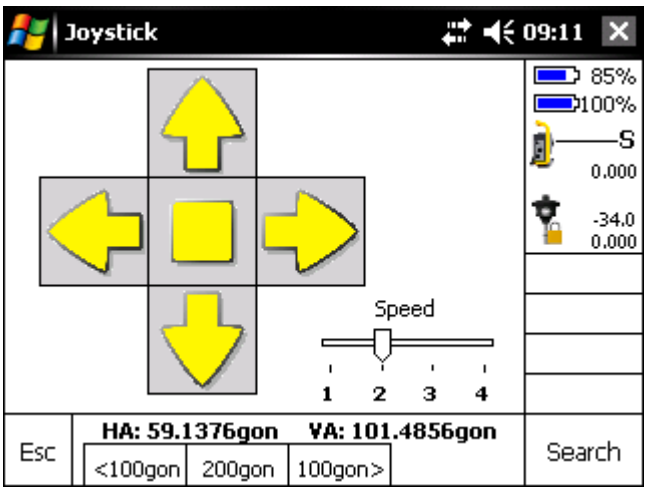
The buttons and their functionality:

TRK	Switch between tracking- und standard measurement mode
Tracklight	Tracklight on/off
Laser	Laser pointer on/off (automatically switches to DR mode)
DR	Switch between prism mode and reflector less measurement mode
Bubble	Shows the compensator values in a circular level
Joystick	Turns the telescope into any desired direction
Turn to	no function
Change Face	Change face
Autolock	Autolock on/off
Search	Starts a prism search in a defined search window symmetrically around the momentary telescope position. If a target id is defined then only the corresponding prism will be found.

12.6 Dialog Joystick

This dialog controls the movement of the telescope. It can be turned at a defined speed level. If an arrow button is pressed the telescope moves into the corresponding direction. The user can also use the joystick keys on the controller instead of the soft keys. Therefore the joystick must have the focus and not the sector size slider. For guidance with the keyboard instrument will turn during the joystick button is pressed and stop its movement when button is let go. Pressing a direction on the display will start the movement and a click onto the button in the middle of the cross will stop the movement.

The **Search** soft key starts a prism search in the designed search window.

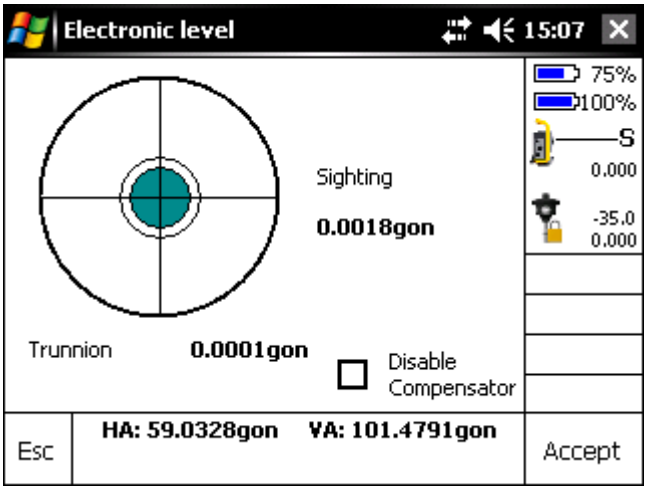


With the help of the soft keys below it is possible to turn the telescope by 100gon to the left or to the right or by 200gon.

12.7 Dialog Electronic level

In this dialog field it is possible to view the current compensator values. The deviations values are shown as numerical values and by a graphical circular level.

The compensator of the total station can be deactivated by checking "***Deactivate compensator***". However, it is not recommended to deactivate the compensator.



Pressing the "***Accept***" soft key applies the settings. Return to the main menu with "***Esc***".

13 Dialog Measurement

13.1 Stationing

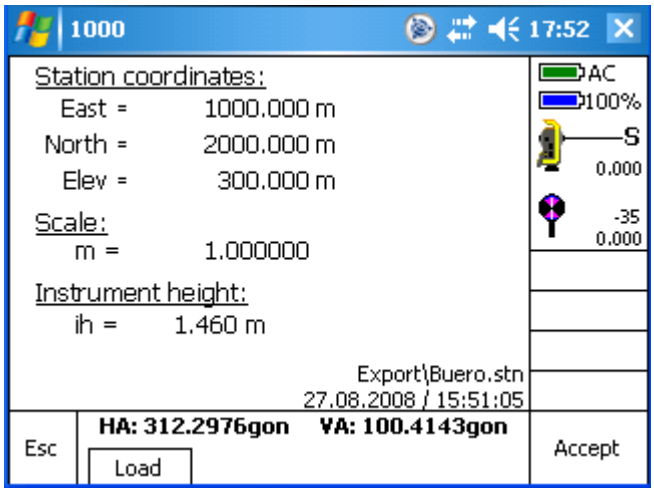
13.1.1 Import from Trimble Access file

In this dialog a station setup from Trimble Access can be imported. The last station setting will be found, that was measured within the Trimble Access software and that has been exported using the right style sheet (***"Station report"***) in a text file with the extension *.stn. The stationing details that resulted from the latest Trimble Access positioning will be shown.

Note: *Once the station info is loaded the currently used stationing will become invalid. It is not possible to undo this process again!*

The stationing coordinates, the scale and the instrument height are displayed. Furthermore, the station name is shown in the menu bar of the program. All these parameters cannot be edited in GEDO Rec and may be changed only by carrying out a new stationing.

For information that the correct file has been loaded, the name of the file and the creation date and time are also shown.

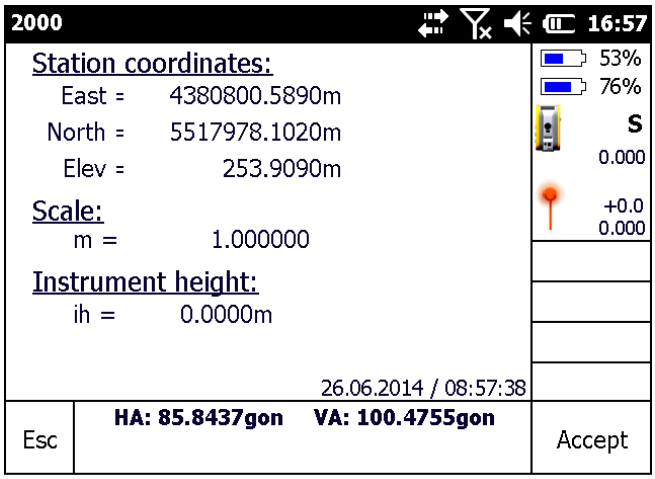


Note: *The software will always load the latest stationing file. Therefore it is recommended to have the system date and time adjusted to the correct time and date. After a reset the system clock may no longer show the correct values!*

13.1.2 Stationing from station buffer

If the instrument has an internal station buffer the result of a stationing, done according to chapter 13.1.3, is stored on the instrument automatically. Using the import function, the stationing could be used with a different controller. This is very helpful for measuring with two instruments for more productivity.

Just like import from Trimble Access file information of station (coordinates, scale, instrument height, date and time of storage) are displayed. The station name is in the headline of the program. All parameters cannot be edited in GEDO Rec and will be overwritten only with new stationing.

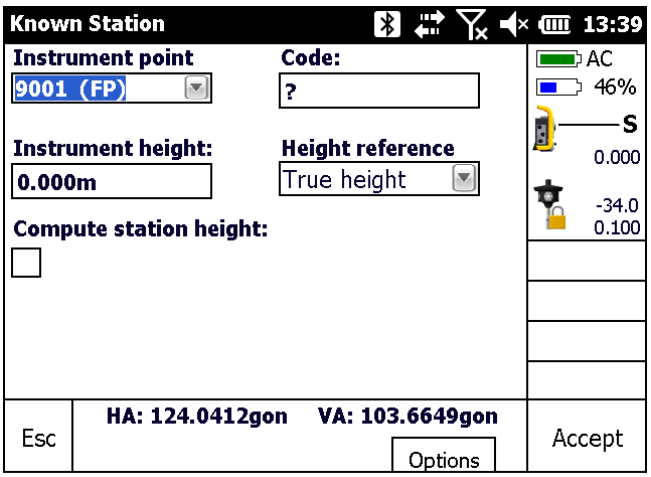


13.1.3 Stationing procedure

GEDO Rec comes along with a stationing routine allowing the user to choose between stationing on a known point and a free stationing. The procedure, however, is the same for both types.

In the start-up screen the user needs to enter a station name and the instrument height. If you are stationing on a known point the entered name must be listed in the reference point list. If a point name is not in the list its coordinates can be typed in or a local station setup will be done. Station setup and following measurements will therefore be done in a local coordinate system. Calculation with global coordinates will be done Analysis using GEDO Office.

If the check box **Compute station height** is active the software will calculate the height out of measurements to reference points, otherwise height given in linked file will be used. **Instrument height** is describing the distance between the instrument's trunnion axis (top mark) and the ground marker. This can be typed in directly as true height or as measured slope distance to the bottom of notch. If bottom of notch is selected the software automatically calculates the true vertical height when changing to next dialogue and displays the calculated value for instrument height.



In the Options dialog the user may select if the station should be calculated with or without a scale. If you select without scale, the scale is set to 1.000000 automatically.

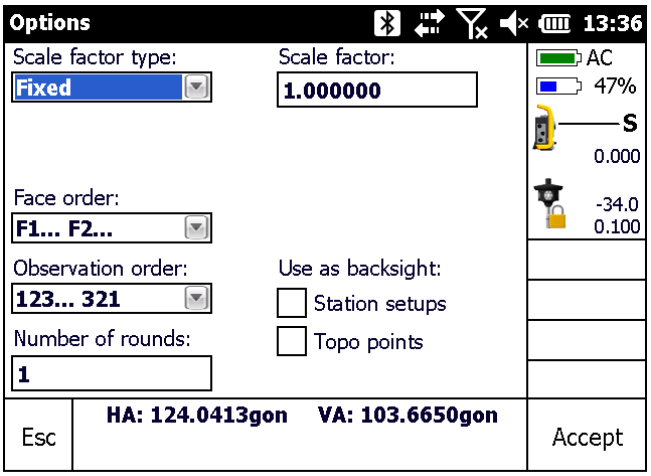
The available resection type is a Helmert resection based on coordinates.

Face order defines if rounds to several targets are measured only in one face, all targets first in first face then in second face backwards or each target is measured in both faces directly (F1 only, F1...F2, F1/F2).

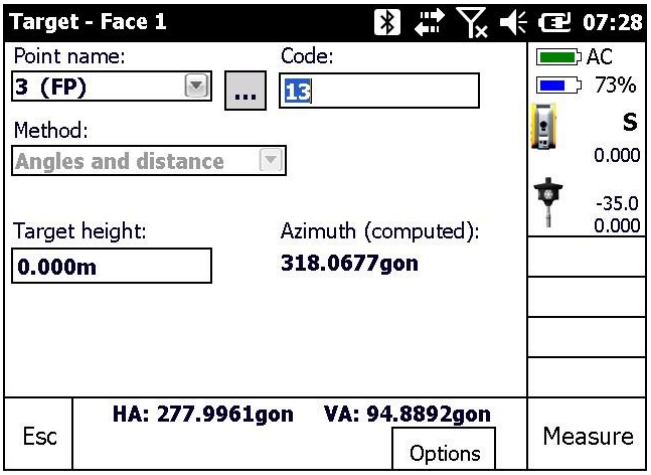
The **observation order** defines if all targets in each round are measured in the same order in both faces or in the opposite way in second face (123...123 or 123...321).

The **number of rounds** may be specified as well. The number must be between 1 and 50.

Normally, the points available for a stationing are fix points linked from a file or entered manually. But sometimes it may be necessary to use measured and stored topographic points or previous station setups (from resection) as well. If the respective check boxes are checked then station setups will be added to the point list marked as SP. Topo points are shown with label TP and Normal fix points are marked as FP.



After all settings have been made and the user continues to the next dialog he has to enter the point name of the first target. The point can also be chosen from the reference point list. **Method** defines if the point is measured with or without distance measurement (and therefore may be used only for orientation calculation). Press **Measure** to start the measurement.

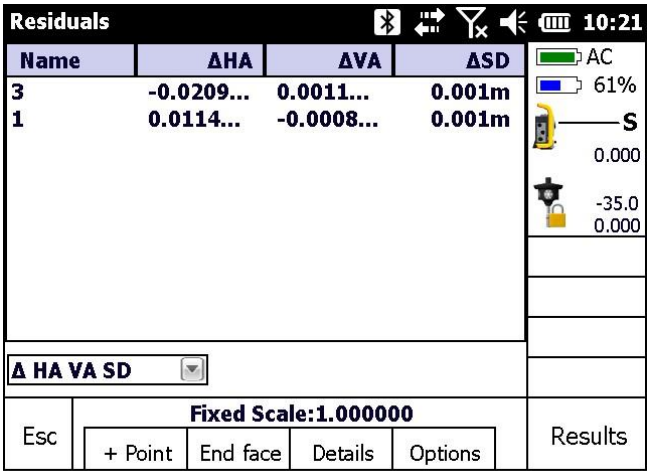


If the stationing type is “on a known point” the **Residuals dialog** will come up automatically after the first successful measurement. If the stationing type is set to “free stationing”, an additional reference point has to be measured before the residuals dialog is displayed.

The residuals dialog shows the residuals for each reference point measurement. The user can switch between two displaying types:

- The differences of raw measured angles and distance values
- Coordinate differences delta East, delta North and delta Elevation

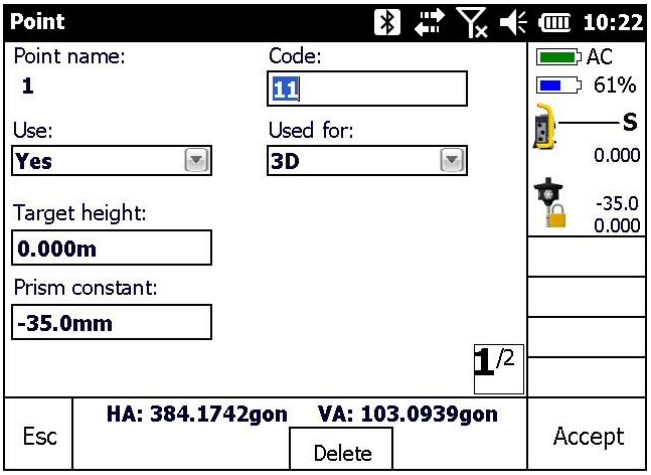
Apart from that the calculated or fixed scale is displayed in the lower part of the window constantly



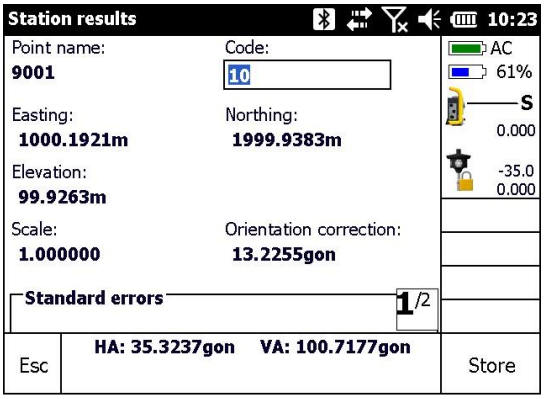
Using **+ Point** adds an additional observation to the list of measured points. Therefore the measurement dialog is displayed again. It is not possible to ad an already used reference point to the stationing unless it is previously deleted (see **Details**).

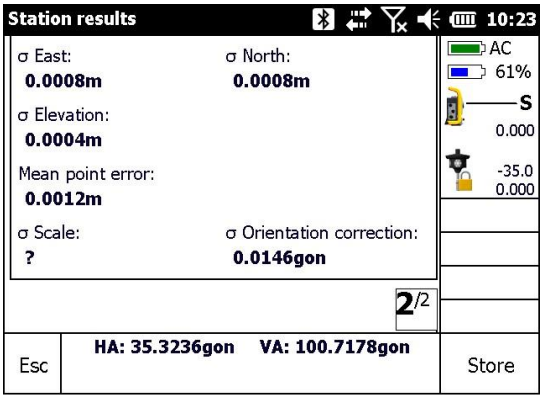
End face starts the automated round measurement as set in the **Options** dialog. After the completion of the round measurements the residuals dialog is shown again.

The **Details** soft key shows the dialog shown below showing details of the respective point in the list. Target height and prism constant can be edited. The point can be deactivated or it can be set to be used as an elevation point (1D), only for orientation (2D) or it can be used for both (3D). The point can also be deleted. On page 2 of the dialog the current standard deviations are displayed.



After all measurements are made and the points are activated or deactivated correctly the user may press on **Results** in the **Residuals dialog**.





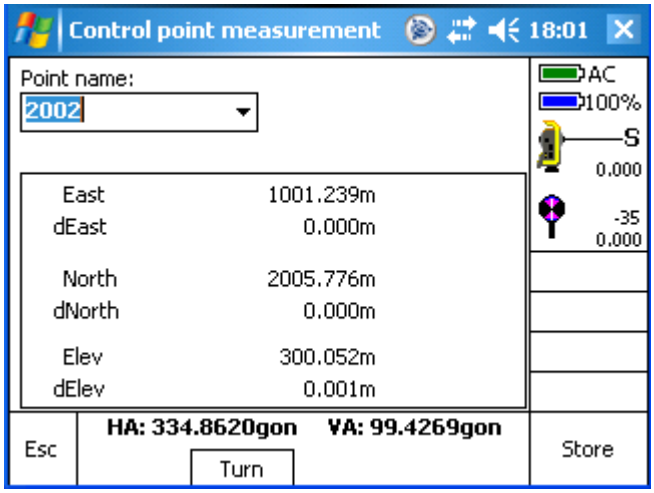
This now displays the results of the stationing, coordinates, orientation correction and the scale. On page 2 you can see the standard deviations for the calculated values. The mean point error is displayed as well.

Press the **Store** button, if the stationing is alright. If the instrument has an internal station buffer the result of a stationing will be stored on the instrument automatically as well. After the stationing is stored the program returns to the main menu and the standard measurement can be started.

13.2 Control point measurement

13.2.1 Dialog Define control points

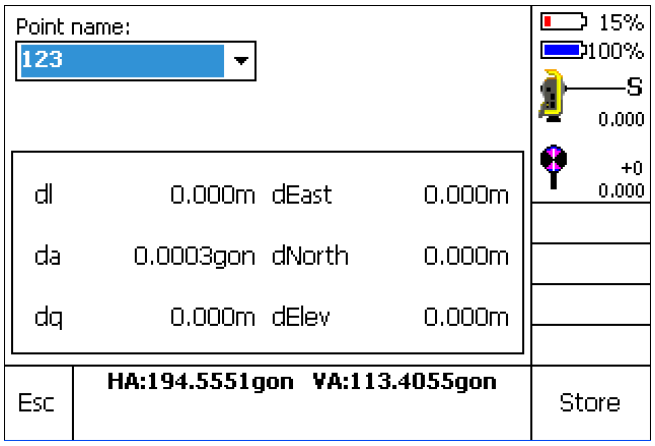
To check if the orientation of the instrument has changed during the measurement a number of points can be defined as control points. Measuring these control points every few Minutes shows if there changes in the orientation. These points can either be imported reference points that can be selected in the reference point list or completely unknown points. After entering a point name in the corresponding text field and setting the target height the **Measure** soft key performs a measurement and stores the coordinates of the point as a reference measurement. After the measurement the coordinates are displayed as information. When measuring towards a reference point the coordinate differences are displayed as well.



By pressing the **Turn** soft key you can turn the instrument automatically towards a selected reference point.

13.2.2 Dialog Check control points

As soon as at least one definition measurement is available the point can be remeasured using this dialog. By pressing the **Measure** soft key the telescope automatically positions itself directing towards the prism, targets the prism and start the measurement. The target height for the control measurement will be set to the same height that has been set for the definition measurement. When you exit this dialog the prism settings will be readjusted to the previous values.



The results are displayed in the next dialog and are saved immediately. The following results are displayed.

- the slope distance deviation **dl**,
- the horizontal angle measurement deviation **da**,
- the orthogonal offset **dq**,
- the coordinate deviations (**dEast**, **dNorth)** and
- the height deviation **dElev**.

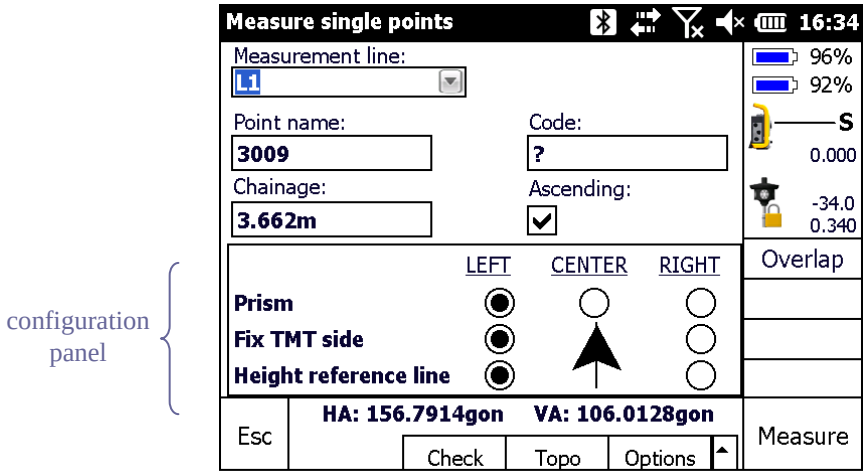
By pressing the **Store** soft key the results are stored in the project file. As long as the currently used station is valid the control points can be remeasured, even if the project or the application was closed for any reason.

13.3 Dialog Single survey

This dialog is used to measure single points. The user can decide if he wants to measure in standard or in tracking mode. The program checks the serial port settings when it is opened. If a port is invalid or unavailable, the dialog cannot be opened.

At the start of every new measurement the name of the current measurement line, the point name and code have to be entered into the designated text fields. Make sure that the target height and prism constant have been entered correctly.

Note: *The user has to check that the measurement line name is correct because otherwise an analysis of the points provides no or the wrong results!*



The **Check** soft key starts the control point measurement (Ch. 13.2.2).

The **Topo** soft key starts a topographical measurement off the track (Ch. 13.5).

The **Options** soft key defines the measurement options (Ch. 13.4)

The **Profile** soft key starts a measurement with the Profiler (Ch. 13.9.1). (via ▲-key)

The **Laser** soft key switches on and off the Profiler's laser pointer (via ▲-key)

The **Overlap** soft key shows the overlapping dialog (Ch. 13.6)

Before starting a measurement the trolley-track configuration has to be set up. Therefore the user has to define

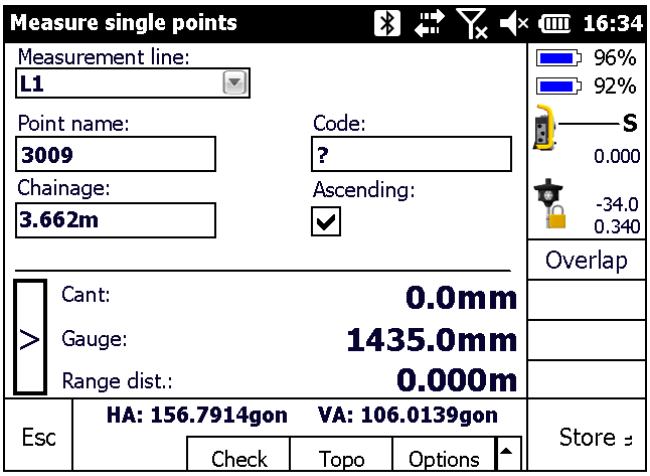
- the position of the prism on the trolley (LEFT – CENTER - RIGHT),
- the position of the fix trolley side and (LEFT - RIGHT)
- the position of the height reference rail (LEFT – RIGHT).

All definitions have to be made according to the moving direction indicated by the arrow. These specifications are extremely important for the calculation of the track lines. An incorrect setting leads to incorrect results inevitably! The CENTER option is only available if a GedoCE_2.0 trolley type is in use. But this position cannot be selected within GEDO Rec. Further with this trolley type prims side is always the fix trolley side.

Additionally a known chainage value can be entered into the designated text field. If the measurement mode is set to “tracking”, the chainage value will be refreshed automatically as soon as the trolley moves on. Here the user also has to specify if the trolley is moved in descending or ascending chainage direction. The resulting chainage value is only an approximation and not the true chainage value.

After all settings are made correctly the measurement can be started by pressing the **Measure** soft key.

The configuration panel will then be replaced by the result panel. By pressing the “>”soft key different result screens can be shown. The first screen shows the sensor values for cant and the gauge As well as the range distance between the current position and the last stored point, the second screen shows the polar measurement elements (horizontal angle, vertical angle and slope distance) and the third screens shows the Cartesian coordinates of the prism.



Clicking the **Esc** soft key cancels the current measurement and brings up the configuration panel again. Clicking the **Store** soft key stores the point and brings up the configuration panel again. If the measurement mode is set to “tracking” the result panel will still be displayed and the next point can be stored right away. The cursor will in both cases automatically jump back to the code field.

By using the **Check** soft key the dialog for checking a control point measurement (-> p.50) will show up.

By using the **Topo** soft key the dialog for measuring external points (-> p. 55) shows up.

The **Options** soft key leads the user to the advanced measurement settings dialog.

The soft key **Profile** on the second page starts a profile measurement at the current trolley position using the last stored point as geo reference. This button is only available if profiler communication is activated.

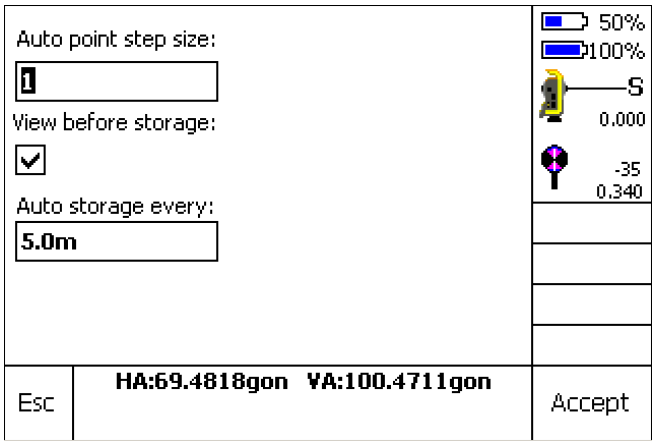
Use the soft key **Laser** to can be activated and deactivated the profilers Laser during absolute line measurement. This will help to position the trolley at the relevant location before starting the profiler measurement. This is only possible for activated profiler.

Note: *If the sensor values are not available, a point cannot be stored. In that case the sensor communication should be checked by using one of the sensor calibration dialogs (-> p. 27).*

13.4 Dialog Options

In this dialog advanced measurement settings can be made. The user can choose if and what size the automatic point step increment should be. Negative numbers correspond to a decrement and the value zero leaves the point name as it is.

By using the checkbox "**View before storage"** the user can choose if the result of a measured point should be displayed before it is stored or if the point should be stored automatically without seeing the results.

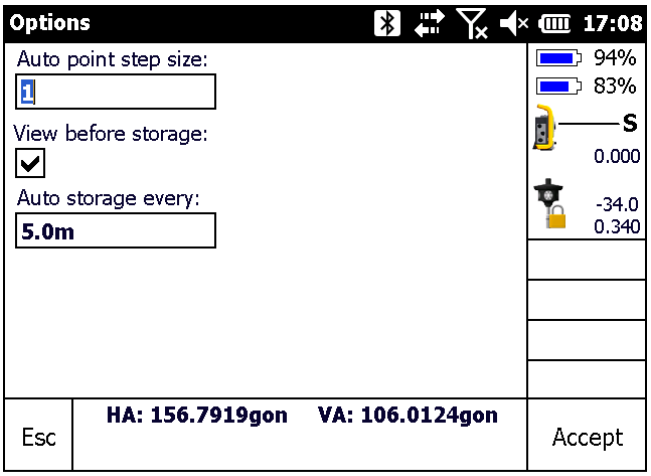


The textbox "**Auto storage every"** sets the step size after which in cases of a continuous survey the point is stored automatically. The minimum value is 0.1 meters. Using the "single survey" method the auto storage textbox will not be visible.

Note: *Measured points as a rule will never be stored in the exact interval. This step size is more of a* ***minimum distance.*** *During a continuous survey the data rate lies around 2.5Hz or 10Hz depending on the instrument. Therefore the actual distance between two stored points depends on the speed of the trolley. Certainly the interval will not be smaller than the storage step size.*

13.5 Dialog Topo points

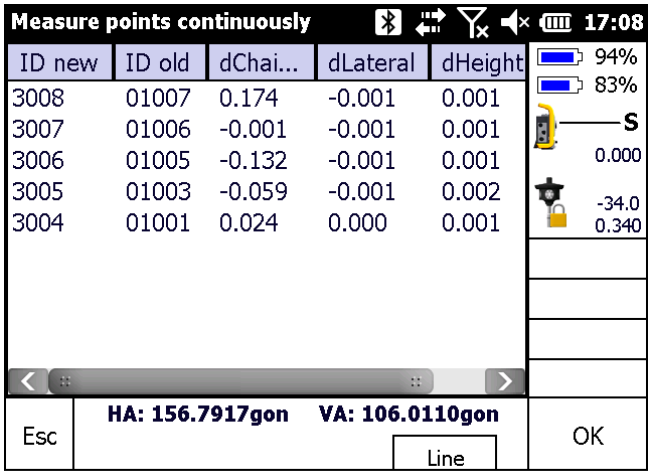
Topographical points that are off the track can be recorded in this dialog. After entering the point name and code into the respective text fields a measurement can be started by using the **Measure** soft key. Analogical to the dialog for the single survey the results will be displayed after a successful measurement and the point can be stored. If the user changed the prism definition during the topographical measurement, the previously used definition is automatically loaded again on quitting the dialog with the **Esc** soft key. Topographical points have to be exported separately.



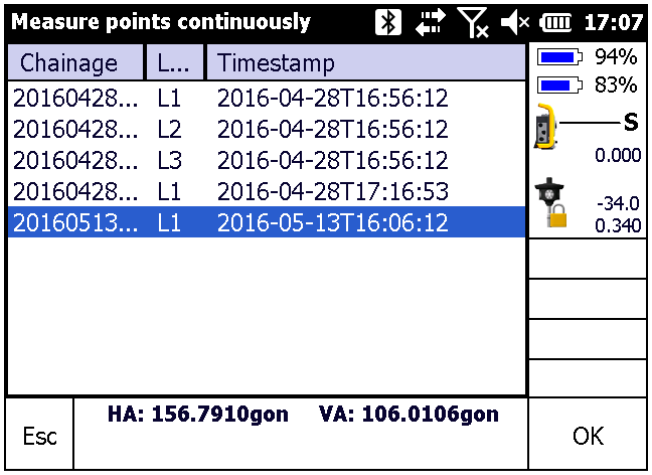
13.6 Dialog Overlap

Measuring extensive objects as of railroads and roads, the object has to be measured using various station setups. Due to network tensions, a from two or more setup points measured point can differ in chainage, lateral distance and height. To have an evaluation criterion concerning the effects of the setup accuracy, in this dialog all residuals of double measured (identical) points are displayed.

The points have to be measured and saved from the current setup point. Closest points in overlapping area are detected as comparable and listed with their offset in chainage, lateral and height between both lines.

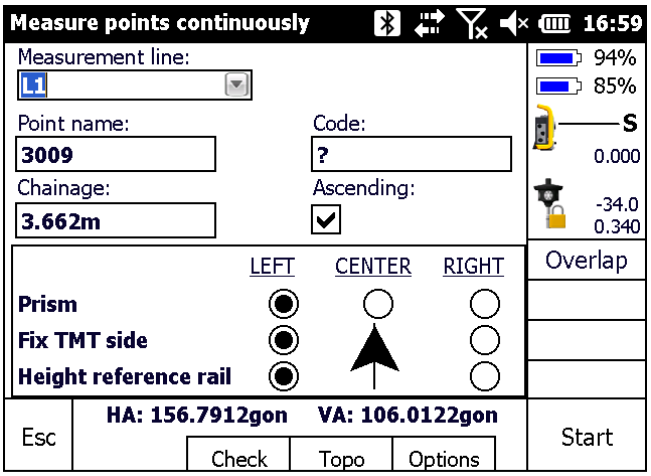


Last measurement line with identical line name will be used automatically for overlapping line. Line dialogue is displayed if a same-named line is not measured until now to select any other line. Use soft key Line to select a different line for comparison with the stations name, line name and timestamp (station setup time) .

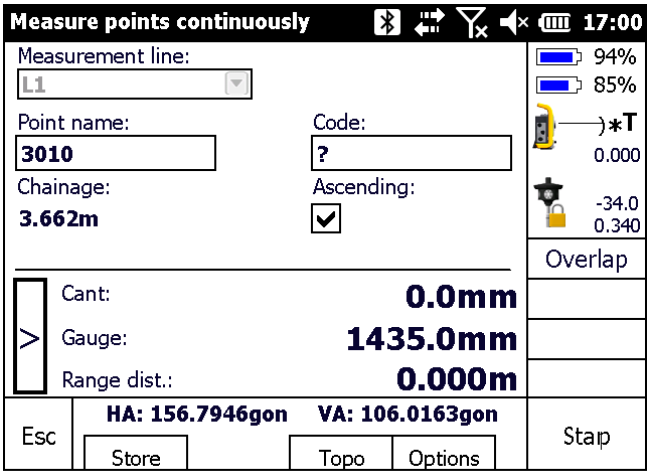


13.7 Dialog Continuous survey

Analogical to the dialog for single point measurement (-> p. 51) this dialog is used to measure points continuously. The points are stored every time they cross the given interval. At the beginning of the measurement the tracking mode is activated automatically. Besides that the specifications and settings are the same as the ones in the single survey dialog.



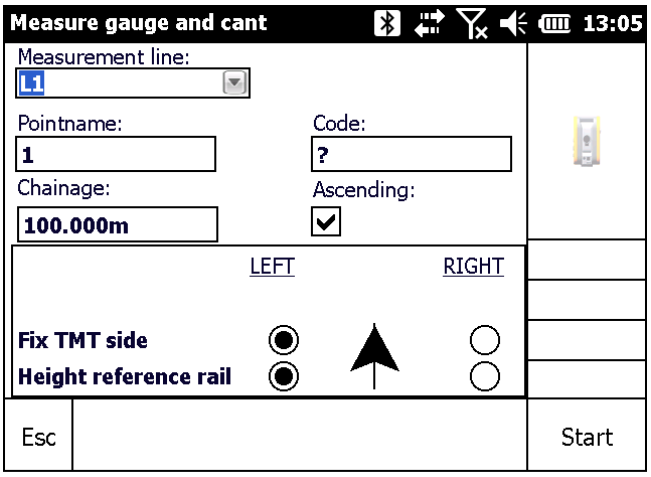
The **Start** soft key starts the measurement. The points are stored as soon as the given intervals are reached or passed. The result display is shown. The measurement line can no longer be edited in this mode. If a point should be stored although it does not fit the grid the user can press the **Store** soft key to store a point off the grid



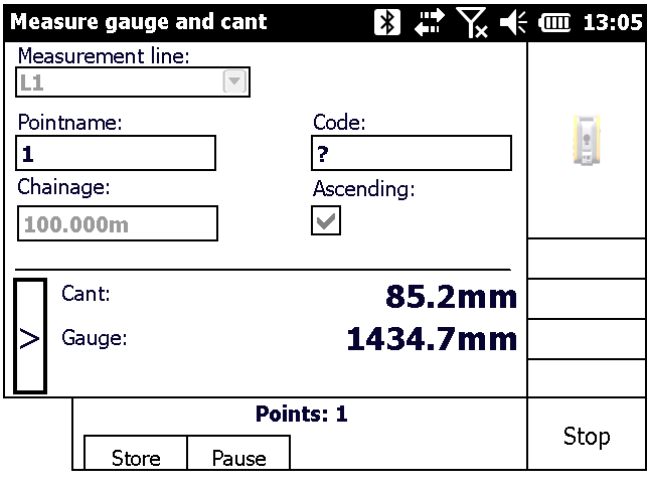
The **Stop** soft key quits the measurement and the configuration display will be shown again.

13.8 Dialog Gauge and Cant

This dialog is for documentation of gauge and cant without getting the position of the trolley. Consequently a track recording without any instrument is possible. Values of sensors are picked up continuously and stored in a separate file.



At beginning of measurement a line has to be defined. Settings for fixed trolley side and height reference rail have to be done as usual. Also specifying a chainage value for start point is recommended. Odometer implemented in wheel of movable trolley side is used for counting station values increasing or decreasing. The distance is measured on one rail so that there could be a difference between counted and real chainage especially in curves.



Use soft key ***start*** to begin the measurement. Values of gauge and cant are stored continuously during moving forward. If a special point should be documented, use Button ***store*** for saving. Pointname and optional Code information will be stored to identify this point. Soft key ***stop*** cancels the measurement. Last trolley position is not last saved position in gcv-file, for example if trolley was moved backwards again or the point does not fall within the range distance. To get this point unique, it has to be stored manually before ending the measurement.

Every start of line creates a new gc2-file. Measured values can be exported as sensor values. Therefore use file format “Sensor values (*.csv)” or “Sensor values CZ (*.csv) in Export menu. Export can be done for one or more lines. Exported points are created by interpolation of chainage values depending on chosen interval. This has to be defined as “Range dist.” of export window. Furthermore all manually stored points are included.

13.9 Dialog Profile measurement

The profile measuring unit consists of a distance meter and an angle sensor that allows to measure points or structures sideways off the track. Therefore it can be used to check clearance profiles. The Profiler measures single points.

The first generation of profiler for GEDO CE 1.0 is also motorized which allows to measure scan mode. Then numbers of points are densely in a row. Of course, this is not a laser scanner so be prepared that the scan speed varies with the width of the scan sector and the rotation speed.

There are two possibilities to do a profile measurement – relative or absolute (geo referenced). Relative means that only local coordinates in the profile plane are stored. If all measured points should receive absolute coordinates then the position and orientation of the trolley must be known and therefore measured with the total station and stored before.

When the profile measurement dialog is opened the laser pointer is automatically turned on. It will be turned off again after the measurement is finished.

Points recorded with profiler can be exported into a separate file. Therefore use export format “Profile points (*.csv)”.

Note: *The profiler can only be mounted on the trolley in one configuration. Do not try to mount it in any other way!*

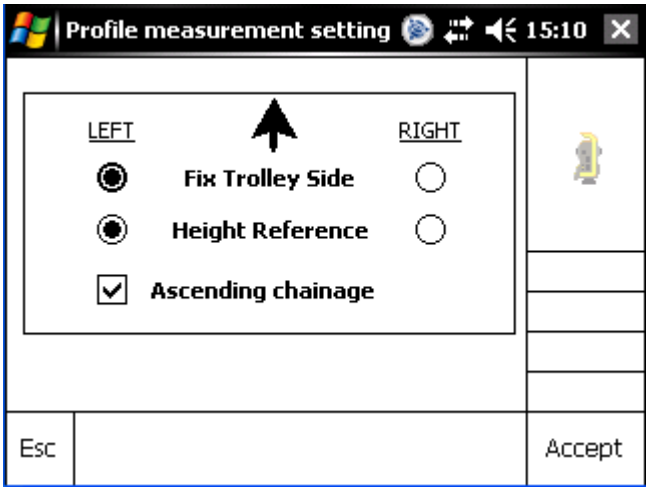
13.9.1 Absolute measurement

An absolute measurement can only be started from the Single measurement dialog (p. 51), if a track point has been measured and stored as reference point. User interface is slightly different according to which trolley is used. Graphics are shown in chapter 13.9.3 (p. 61) respectively 13.9.4 (p.64).

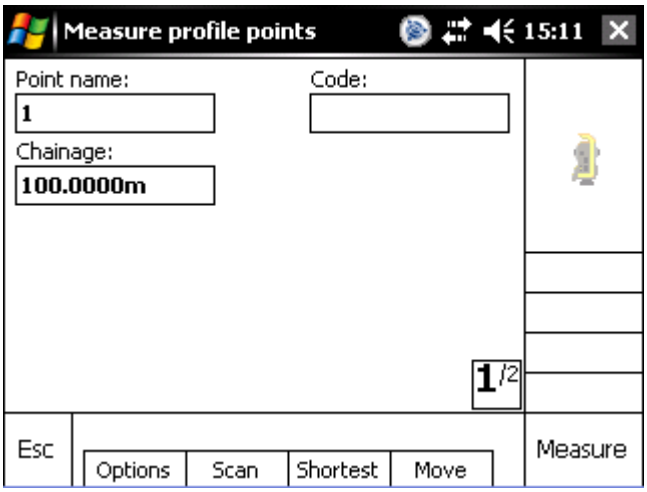
In the measurement dialog the user has to enter a point name that is incremented automatically and a code if needed. The chainage value is deduced from the currently valid reference point and therefore cannot be edited. This is different compared with relative measurement. The **Measure** soft key starts a single measurement and afterwards displays the results. GEDO CE 2.0 trolley movement during the measurement will be observed with the odometer. Absolute reference will be lost when trolley has moved too much.

13.9.2 Relative measurement

The only difference to an absolute measurement is that the trolley position and orientation is unknown. Therefore an additional startup screen will prompt the user to enter the current trolley orientation. The arrow defines the current working direction. **Accept** will apply the settings and display the same screen as the screen for the absolute measurement. The only difference here is that the user has to enter the current chainage value for the profile by hand.

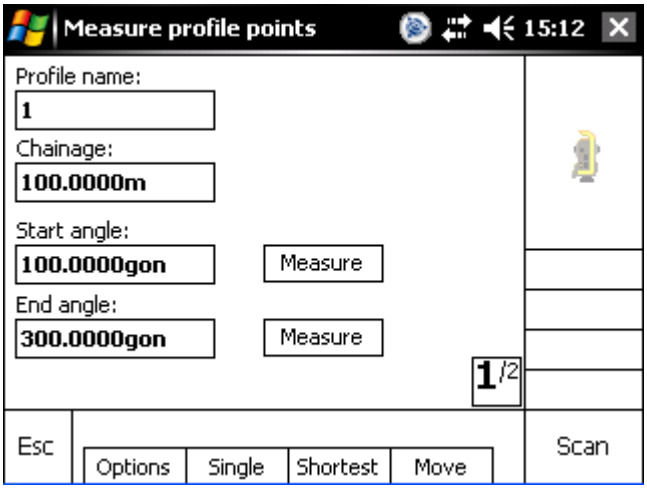


13.9.3 User interface for Profiler with GEDO CE 1.0



The **Scan** soft key located in the lower center of the screen enables the scan mode. As soon as a reasonable start and end angle were defined the scan will be started by pressing the **Scan** soft key.

Note: *The Profiler has dead sector in which it is not possible to scan to keep the cable from curling in. This sector is between 150° and 210°.*



The **Options** soft key opens the Profile options (see p. 63) dialog

The angles can either be entered manually or they can be automatically added by aiming at the respective target directions and pressing the **Measure** button.

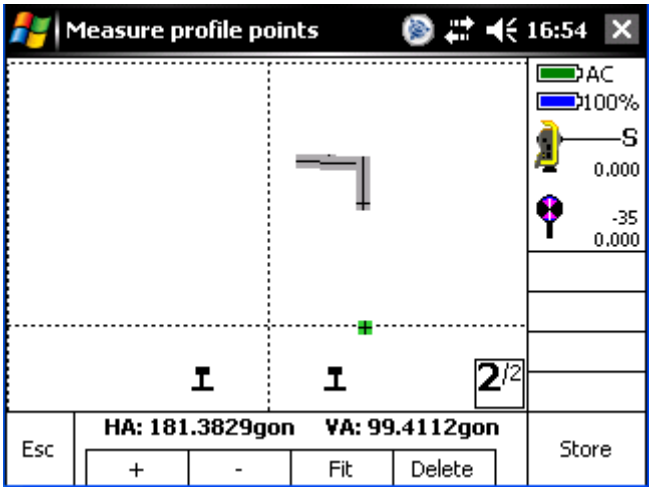
The **Shortest** soft key starts a mode in which the distance meter measures in tracking mode and only the point with the currently shortest distance is shown. The profiler has to be moved by hand. This functionality is used only, if the point of a structure closest to the track is of interest.

The soft key **Move** opens the Move profiler dialog (see p. 64).

After each successful measurement the results are displayed. These are the lateral offset from the trolleys centre line and the height offset above reference rail. Additionally the point is drawn in a simple graph on page two showing all so far stored points in grey and the last measured point in green.

The two rails are outlined and the intersection of the two dashed lines marks the Profiler's point of origin. The frame width is 3 meters by default. There are soft keys to zoom in (+) and out (-) and a soft key (Fit) to fit the frame to the default size again. The drawing can also be moved by moving the mouse over the display.

When the user clicks onto a profile point the point is highlighted red and the point name is displayed. It is also possible to mark more than one point.

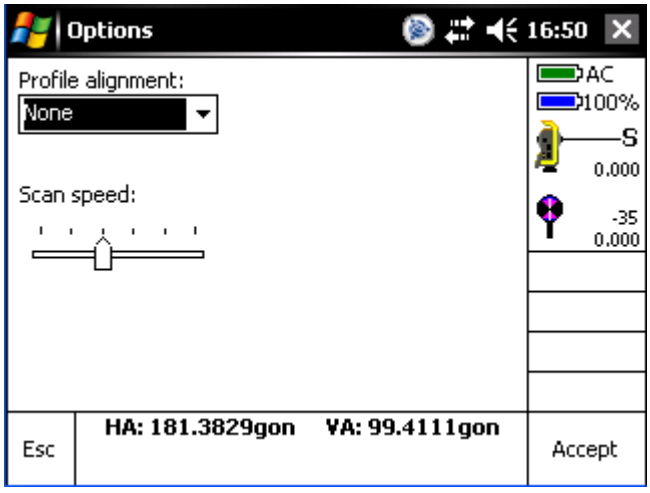


Delete will remove all selected points permanently. The **Store** soft key stores all new (green) points. If only a single point has been measured, the point is stored in the project's job file. If a scan has been performed, the points are stored in a separate file named after the current chainage (KM123+456.789) with the ending **.scn*. All files are stored in the subdirectory *\Scans* in the current project directory.

13.9.3.1 Profile options dialog

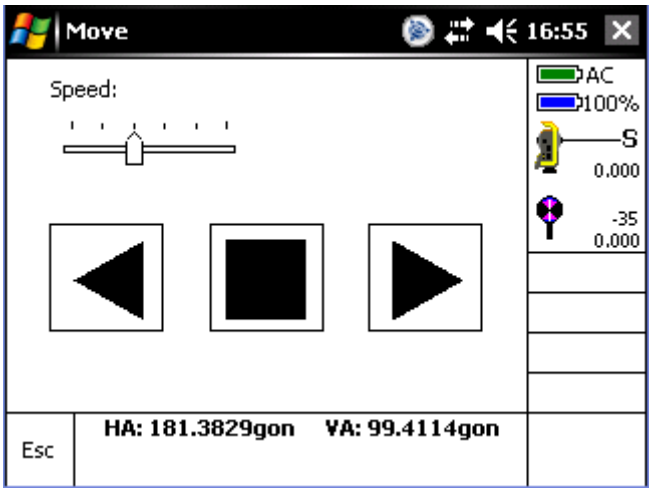
In the profile options dialog the rotation speed of the profiler can be set to six different speeds ranging from very slow to very fast. Of course, the point density will vary depending on the speed.

The profile alignment option isn't available yet.



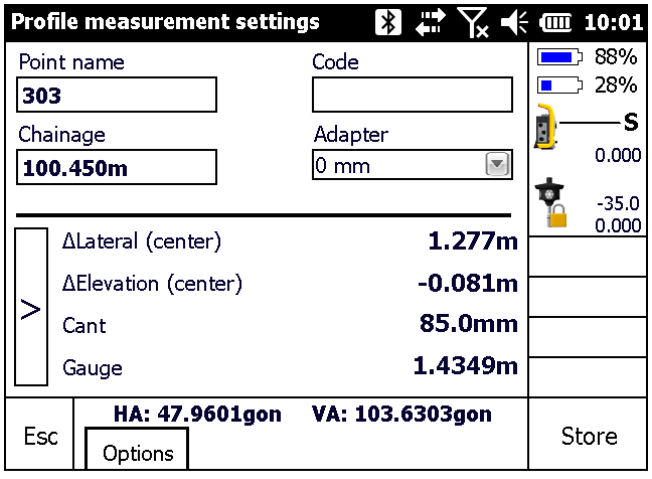
13.9.3.2 Profile move dialog

To make it easier to bring the Profiler into the right position the movement can be controlled using this dialog. The speed can be changed independently from the current set general rotating speed. A click on the right button lets the profiler move clockwise and a click on the left button counter clockwise.



13.9.4 User interface for Profiler with GEDO CE 2.0

User interface for profiler measurement is similar either it is called as relative measurement or as absolute out of single measurement. Only chainage vaule can be defined individual when working in relative mode. Chainage value is also updated automatically by the odometer measurement when the trolley is moving. Picture shows relative measurement with enabled label for chainage value.



Each profile point has to be named. Code is optional.

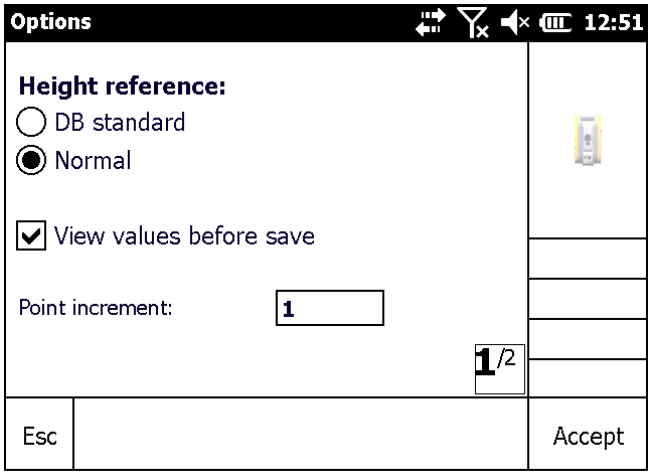
Use soft key **[>]** to change between different offsets to display.

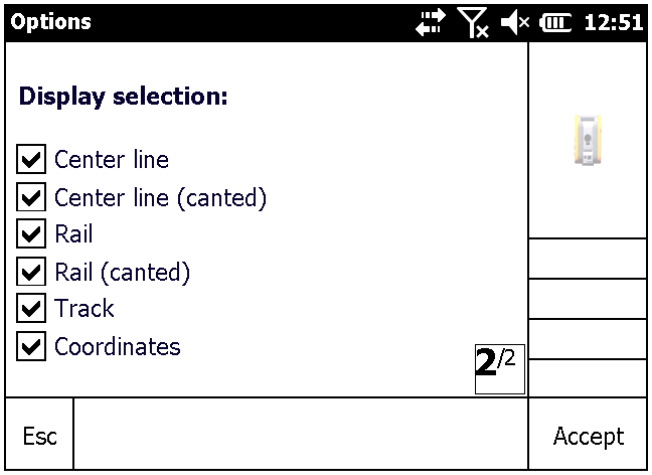
The **Options** soft key opens the Profile options dialog with general settings for profiler measurement.

If the profiler is used with an additional height adapter, this value can be defined in box *Adapter*.

13.9.4.1 Profiler options dialog

The dialog options includes setting for calculation and display within profiler measurement menu. They are spitted into two pages.





First definition is for reference of height offset between rail and measured point. Detailed definition of both options is explained in chapter 0.

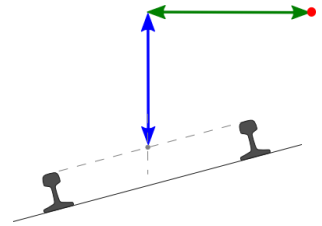
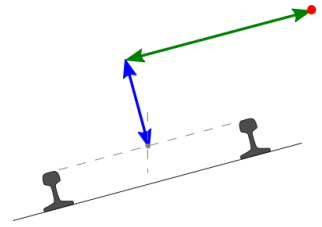
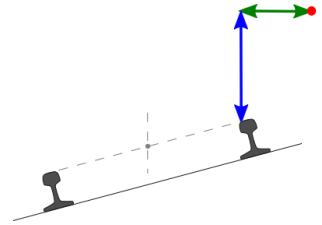
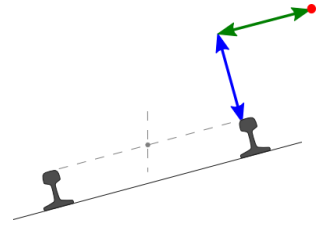
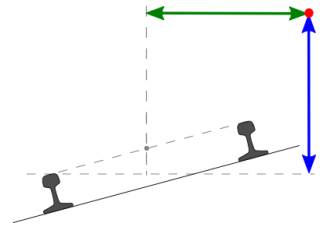
By using the checkbox "**View before storage"** the user can choose if the result of a measured point should be displayed before it is stored or if the point should be stored automatically without seeing the results.

The user can choose what size the automatic point step increment should be. Negative numbers correspond to a decrement and the value zero leaves the point name as it is.

Page two lists all displays which could be switched via soft key [>]. A deactivated element will be skipped. See following chapter 0 for detailed explanation of calculated offsets. Additionally to offsets current gauge and cant will displayed. For absolute measurement also coordinates in global display can be shown.

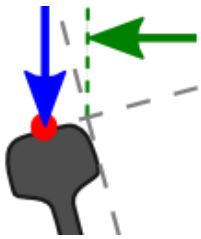
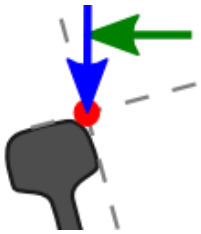
13.9.4.2 Definitions for calculation of offsets

Depending on application different offsets could be interesting. Therefore following variations are integrated.

Center line		*ΔLateral:* horizontal distance to center line *ΔElevation:* vertical distance to center line
Center line (canted)		*ΔLateral:* distance in cant plane to center line *ΔElevation:* distance perpendicular to cant
Rail		*ΔLateral:* horizontal distance to running edge of closer rail *ΔElevation:* vertical distance to closer rail (regarding height reference in options)
Rail (canted)		*ΔLateral:* distance in cant plane to running edge of closer rail *ΔElevation:* distance perpendicular to cant
Track		*ΔLateral:* horizontal distance to center line *ΔElevation:* vertical distance to vertical alignment (regarding height reference in options)

Lateral offsets (shown in graphic as green lines) are defined in ascending chainage direction. A positive value describes a point on the right hand side of reference point (center line or running edge of rail). Points with negative lateral offset are on the left hand side.

Delta height is positive if point is above reference point and negative for below. Reference for height offset is calculated regarding setting in options dialog (chapter 13.9.4.1) for rail and track. Center line as reference is not affected by this stetting. Graphic shows height offset as blue line.

DB standard 	Height reference is middle of head of rail. This is similar to definition of track alignment data and standard in Germany. Lateral Offset is measured in relation to running edge of rail. (similar to “Normal”)
Normal 	Reference for Lateral offset is identical to elevation. Reference point is defined as intersection of top of rails and running edge of rail.

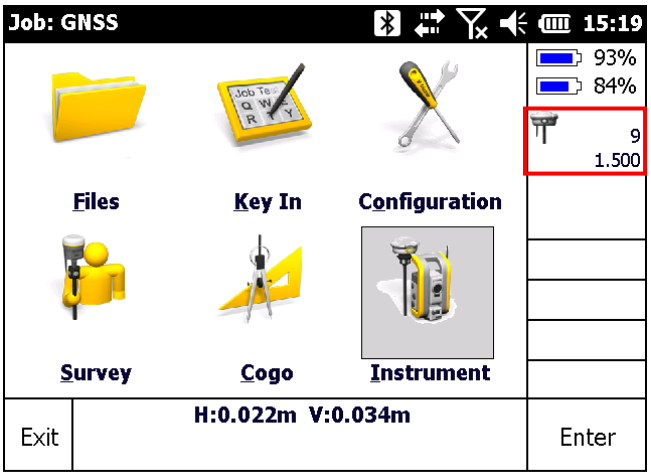
14 GEDO Rec and GNSS

GEDO Rec supports the usage of GNSS receivers through an internal connection to the Trimble Access software. That means that the whole receiver configuration (coordinate system, base-rover or VRS, radio settings or internet connection parameters) is done in Trimble Access. Additionally, a small application must be started instead of *GeneralSurvey* in Trimble Access, named *GedoGNSS*. This application has to run in the background all the time. It is very important to note explicitly that GEDO Rec has no direct connection to or control of any receiver at all. For a detailed description the official Trimble Access user manual should be read.

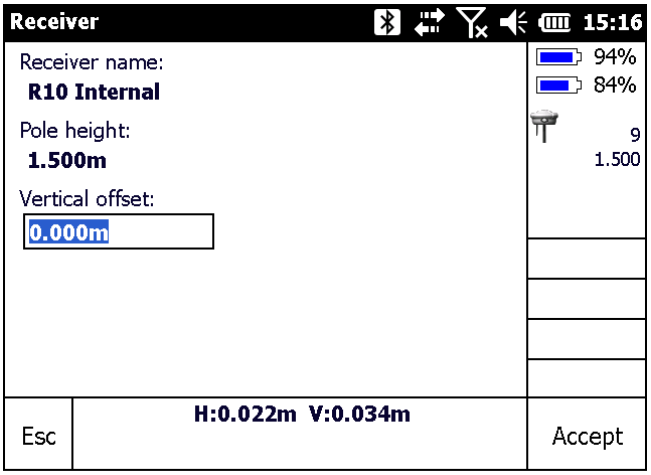
The functionality and usage of GEDO Rec is more or less the same as when using a total station. Just a few things are different and those will be outlined in the following section.

To change the instrument type in GedoRec to GNSS, the menu *Configuration* > *Port* > *Instrument* has to be called and instead of TSMServer ***GNSS*** has to be selected as instrument type.

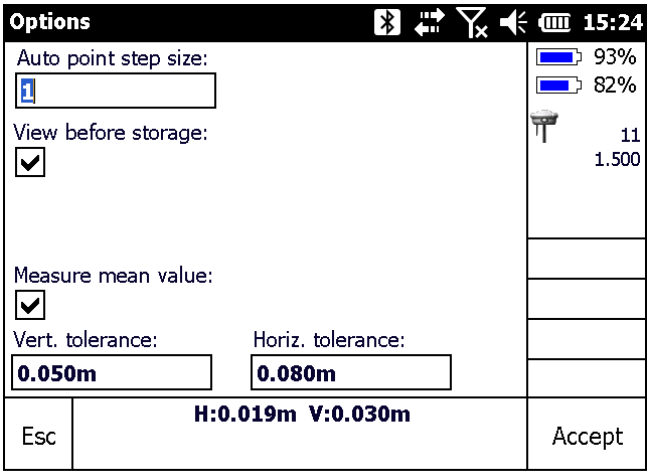
After a successful connection to the receiver or rather the GNSS app in Trimble Access the status bar show the current standard deviations instead of the total station angle values and in the upper right corner the satellite count and antenna height are displayed.



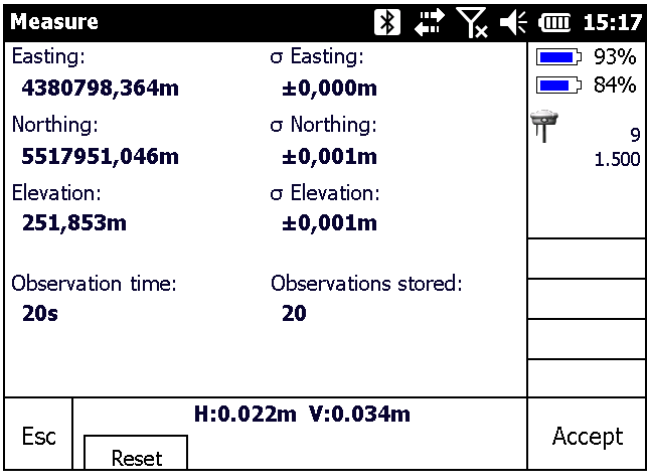
By clicking this field with antenna symbol, the dialog for receiver settings will open analogue to chap. 12.2. The antenna type and the length of the pole that were selected in Trimble Access can be seen and the user may enter an additional height offset. The final pole length will result as the summation of both offsets.



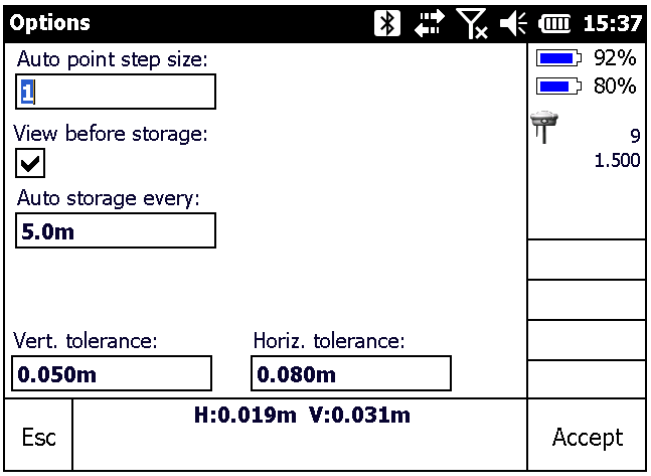
In the options dialog (chap. 13.4) another tiny difference can be found. Tolerances for the maximum allowed standard deviations may be entered. If a GPS measurement exceeds those tolerances it is an invalid measurement and may not be accepted. The accidental storage of a measurement with a weak quality can be avoided.



When the option ***Measure mean value*** in single measurement is active, then several measurements are recorded in a row and the mean value and its standard deviations are computed. As soon as the ***Measure*** button is pressed in one of the measure dialogs (Standard, Topo and Stakeout) another dialog is opened displaying live the current average coordinates and deviations. If the ***Accept*** button is clicked, the dialog is closed and the computed results are transferred back to the respective measure dialog. If the ***Reset*** soft key is pressed, the current values are deleted and the averaging starts again from zero.

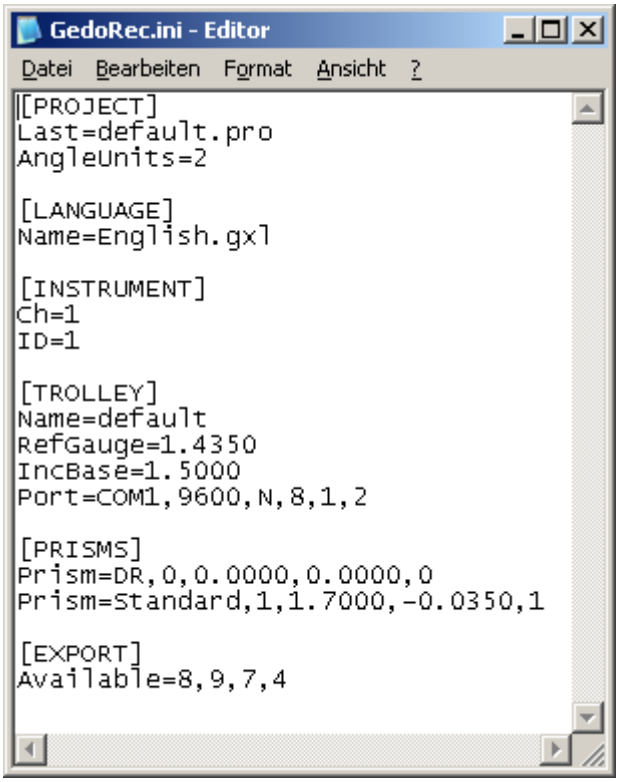


Option dialogue in continous measurement doesn't support the mean value. Instead the distance of auto storage can be defined like in total station measurement.Tracking mode will be started automatically when starting the contious measurement.



15 Files and formats

1. Configuration file GedoRec.ini:



In the configuration file the global settings are stored. This file should only be edited, if it is absolutely necessary. When editing, do so with highest attention as a corrupt file might make a program start impossible.

2. Trolley definition file (*.trl)

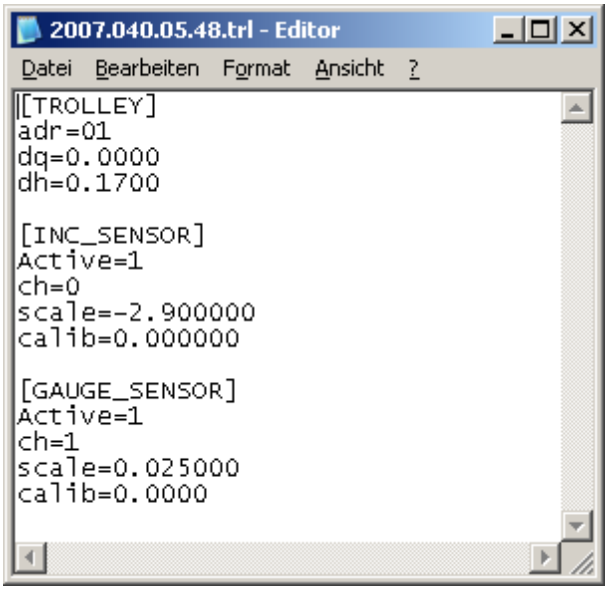
This file contains the trolley settings as geometry, sensor and communication settings.

Except for the two parameters dq and dh in the section [TROLLEY] nothing should be edited in this file.

dq defines the lateral offset of the prism in reference to the inner edge of the rail. It has a positive sign if…????

dh defines the height offset between the upper edge of the rail and the contact face where the prism is mounted on the trolley

All other parameters are either edited through the program or are the same for every trolley.



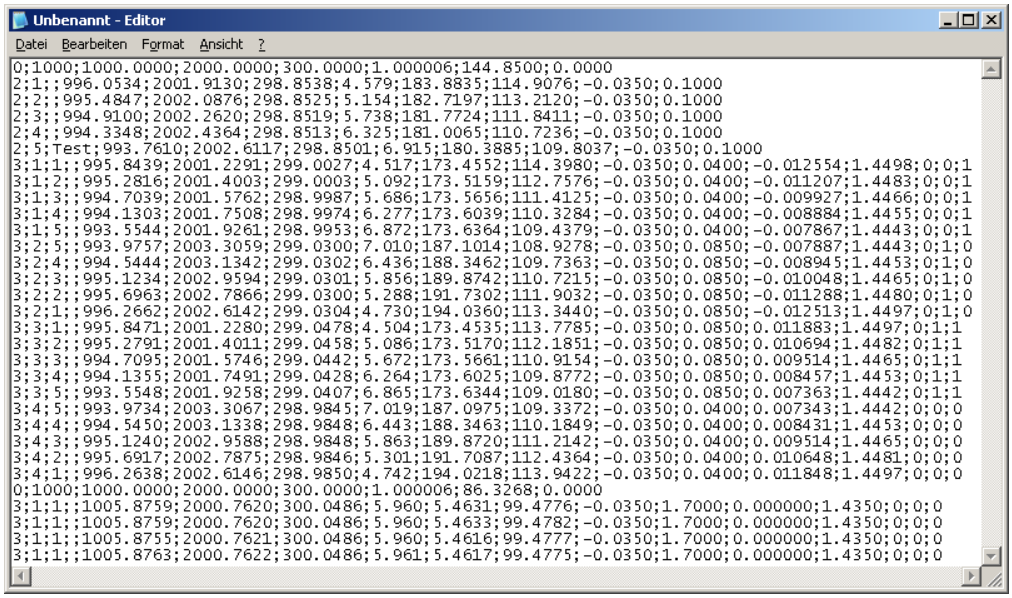
3. Project file (*.pro)

The file contains all project specific settings, i.e. radio channel, auto storage size and so on.

It should not be edited externally.

4. Measurement file (*.job):

In this file all measurements are stored. Every row starts with a leading number that indicates which information the row contains. All station information start with a “0”, control point measurements start with a “1”, topographical measurements start with a “2” and usual line measurements start with a “3”.



Station information (0): *(units in brackets)*

- Station name
- Easting[m]; Northing[m]; Elevation[m]
- Scale
- orientation[gons];
- Instrument height[m]

Control point (1):

- Point name
- Easting[m]; Nothing[m]; Elevation[m]
- Slope distance[m] - *Raw distance without prism constant and scale!*
- Horizontal angle[gons]; vertical angle[gons] of the prism
- Prism ID; prism constant[m]; target height[m]
- Offset Easting[m]; Offset Northing[m]; Offset Elevation[m]
- Offset slope distance[m];
- Offset horizontal angle measurements [gons]
- Orthogonal offset[m]

Topo point (2):

- Point name; point code
- Easting[m]; Nothing[m]; Elevation[m]
- Slope distance[m] - *Raw distance without prism constant and scale!*

- Horizontal angle[gons]; vertical angle[gons] of the prism
- Prism constant[m]; target height[m]

Measured line points (3):

- Measurement line name; point name; point code
- Easting[m]; Northing[m]; Elevation[m]
- Slope distance[m] - *Raw distance without prism constant and scale!*
- Horizontal angle[gon]; vertical angle[gon] of the prism
- Prism constant[m]; target height[m]
- Inclination sensor value [in radiant!!!]
- Gauge sensor value[m]
- Prism Left / Right [0 / 1]
- Fix trolley side Left / Right [0 / 1]
- Height reference string Left / Right [0 / 1].

5. Export file, comma delimited (*.csv):

After a successful export the line point for each measured point is accessible. The individual values are delimited by commas. Each row contains the information (units in brackets)

- Point name; point code
- Easting[m]; northing[m]; Elevation[m]
- Slope distance[m]; horizontal angle [gon]; vertical angle [gon]
  (Raw distance without prism constant and scale)
- Prism constant[m]; target height[m]
- Cant [mm]
- Gauge[m]
- Measurement line name
- Prism Left / Right [0 / 1]
- Height reference string Left / Right [0 / 1].

If all three track lines are exported in one file the values for easting, northing, elevation, slope distance, horizontal angle and vertical angle are written in the order

- left line
- centre line
- right line

batched for every point.

6. Export file, M5 format (*.dat):

After a successful export the line point for each measured point is accessible. Using the common Zeiss M5 format all lines contain the information point name, point code, Easting, Northing and Elevation. The 27 characters of the point name / point code field are split into

- Point name (column: 22; length: 8)
- Point code (column: 31; length: 9)
- Measurement line name (column: 41; length: 8).

7. Export file, topo points (*.csv):

All external points are exported into this comma delimited file. Each row contains the information

- Point name, point code
- Easting[m], Northing[m], Elevation[m]
- Slope distance[m] - *Raw distance without prism constant and scale!*
- Horizontal angle [gons]; vertical angle [gons] of the prism.

16 Appendix

16.1 Formats

Sample file, comma delimited:

giebelstadt.csv - Editor

Datei Bearbeiten Format Ansicht ?

```
99,7013,,15001.4558,4986.9718,99.5497,6.318,322.4853,99.5355,-0.0350,0.0400,0.6,1435.6,0
99,7009,,15001.4998,4987.0320,99.5673,6.318,322.4874,99.5342,-0.0350,0.0400,36.8,1435.5,0
99,7010,,15001.2028,4986.7609,99.5497,6.318,322.4867,99.5346,-0.0350,0.0400,0.4,1435.6,0
99,7012,,15001.1089,4986.7220,99.5497,6.318,322.4866,99.5342,-0.0350,0.0400,0.2,1435.6,0
99,7014,,15001.3897,4986.8955,99.5496,6.317,322.4852,99.5352,-0.0350,0.0400,0.2,1435.6,0
99,7011,,15001.0586,4986.7074,99.5496,6.317,322.4867,99.5345,-0.0350,0.0400,0.2,1435.6,0
99,7015,,15006.0884,4987.9845,99.4861,2.958,261.3133,100.3833,-0.0350,0.0400,0.6,1435.6,0
99,7017,,15006.6099,4988.7964,99.4854,2.957,261.3139,100.3850,-0.0350,0.0400,0.6,1425.4,0
99,7019,,15006.6257,4988.7710,99.4953,2.957,261.3140,100.3848,-0.0350,0.0400,20.0,1435.6,0
99,7018,,15006.6266,4988.7457,99.4858,2.957,261.3139,100.3850,-0.0350,0.0400,0.2,1435.6,0
```

Sample file M5:

giebelstadt.dat - Editor

Datei Bearbeiten Format Ansicht ?

```
For M5|Adr     1|PI1 502          1       |Y      15010.4025 m   |X      4995.1590 m   |Z        98.5271 m   |
For M5|Adr     2|PI1 503          1       |Y      15010.8397 m   |X      4995.5662 m   |Z        98.5261 m   |
For M5|Adr     3|PI1 504          1       |Y      15011.2720 m   |X      4995.9693 m   |Z        98.5253 m   |
For M5|Adr     4|PI1 505          1       |Y      15011.7031 m   |X      4996.3708 m   |Z        98.5240 m   |
For M5|Adr     5|PI1 506          1       |Y      15012.1532 m   |X      4996.7909 m   |Z        98.5233 m   |
For M5|Adr     6|PI1 507          1       |Y      15012.5958 m   |X      4997.2040 m   |Z        98.5223 m   |
For M5|Adr     7|PI1 508          1       |Y      15013.0333 m   |X      4997.6116 m   |Z        98.5210 m   |
For M5|Adr     8|PI1 509          1       |Y      15013.4541 m   |X      4998.0040 m   |Z        98.5202 m   |
For M5|Adr     9|PI1 510          1       |Y      15013.9112 m   |X      4998.4304 m   |Z        98.5197 m   |
For M5|Adr    10|PI1 511          1       |Y      15014.3453 m   |X      4998.8352 m   |Z        98.5198 m   |
For M5|Adr    11|PI1 512          1       |Y      15014.7897 m   |X      4999.2492 m   |Z        98.5196 m   |
For M5|Adr    12|PI1 513          1       |Y      15015.2431 m   |X      4999.6714 m   |Z        98.5196 m   |
For M5|Adr    13|PI1 514          1       |Y      15015.6548 m   |X      5000.0551 m   |Z        98.5196 m   |
For M5|Adr    14|PI1 515          1       |Y      15016.0912 m   |X      5000.4611 m   |Z        98.5205 m   |
For M5|Adr    15|PI1 516          1       |Y      15016.5336 m   |X      5000.8725 m   |Z        98.5220 m   |
For M5|Adr    16|PI1 517          1       |Y      15016.9731 m   |X      5001.2806 m   |Z        98.5229 m   |
For M5|Adr    17|PI1 518          1       |Y      15017.4190 m   |X      5001.6954 m   |Z        98.5238 m   |
For M5|Adr    18|PI1 519          1       |Y      15017.8479 m   |X      5002.0948 m   |Z        98.5243 m   |
For M5|Adr    19|PI1 520          1       |Y      15018.2987 m   |X      5002.5141 m   |Z        98.5248 m   |
For M5|Adr    20|PI1 521          1       |Y      15018.7330 m   |X      5002.9181 m   |Z        98.5263 m   |
For M5|Adr    21|PI1 522          1       |Y      15019.1720 m   |X      5003.3267 m   |Z        98.5273 m   |
For M5|Adr    22|PI1 523          1       |Y      15019.6218 m   |X      5003.7461 m   |Z        98.5277 m   |
For M5|Adr    23|PI1 524          1       |Y      15020.0558 m   |X      5004.1511 m   |Z        98.5284 m   |
For M5|Adr    24|PI1 527          2       |Y      15020.0286 m   |X      5004.1258 m   |Z        98.5283 m   |
For M5|Adr    25|PI1 528          2       |Y      15019.6169 m   |X      5003.7418 m   |Z        98.5279 m   |
For M5|Adr    26|PI1 529          2       |Y      15019.1801 m   |X      5003.3343 m   |Z        98.5271 m   |
```

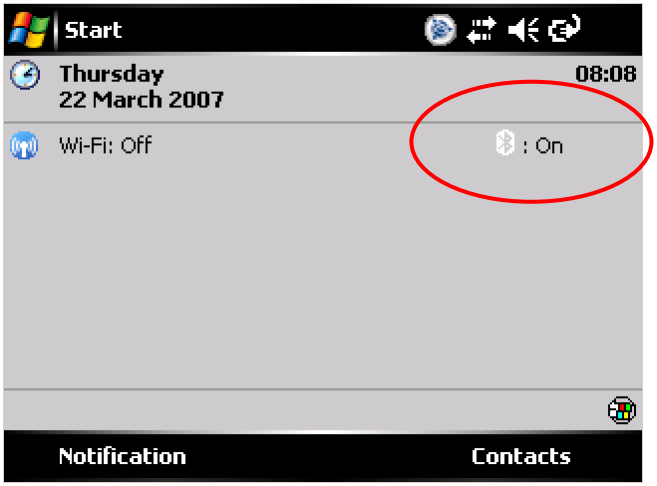
16.2 Release Notes

Detailed updates in GEDO Rec are documented separately. You can get the release notes if necessary. Please send a request to info@trimble-railway.com and ask for Release Notes of GEDO Rec.

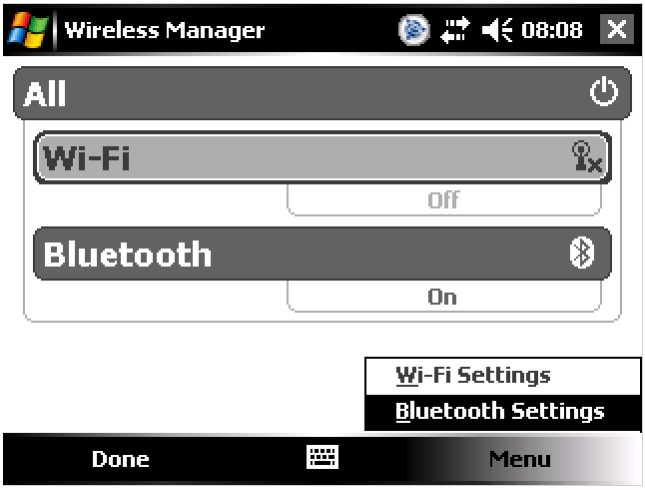
16.3 Bluetooth Installation

Important: **Always make sure that Bluetooth is activated. Otherwise you cannot connect to the Dongle!**

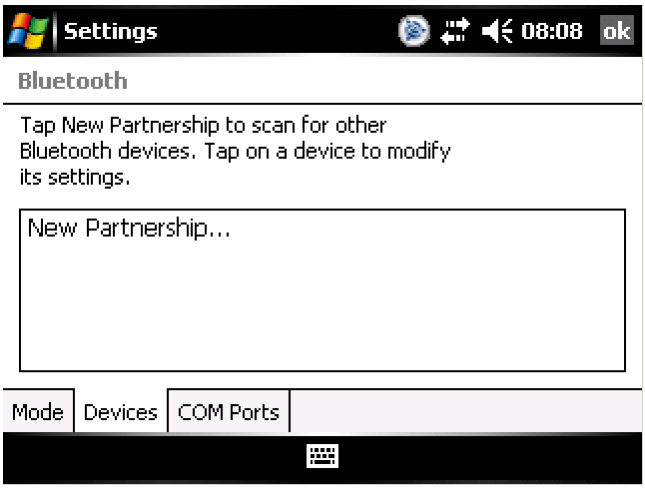
After rebooting the control unit it can happen that the Bluetooth functionality is deactivated. If that happens, it has to be reactivated manually.



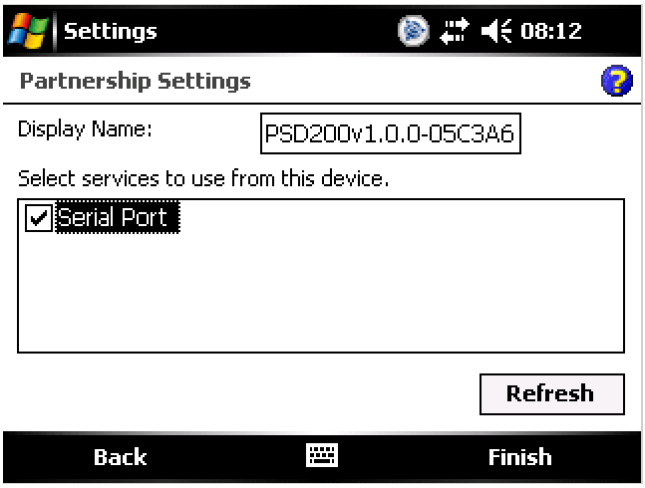
- Press the Bluetooth symbol on the start screen of the controller.
- Then press **Menu** > **Bluetooth Settings**



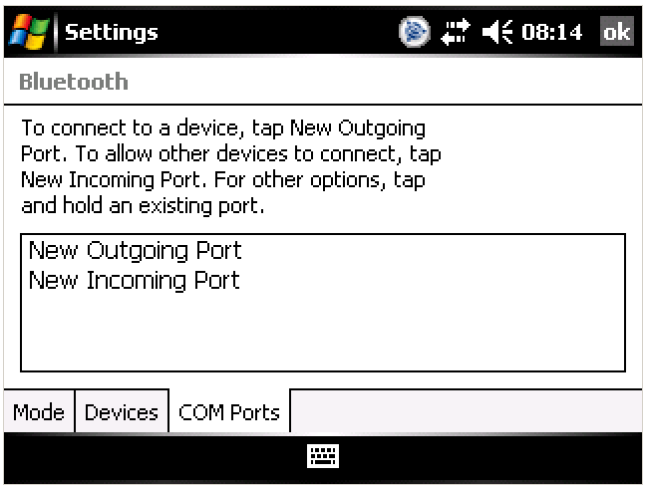
- Then open the **Devices** tab and choose **New Partnership…**



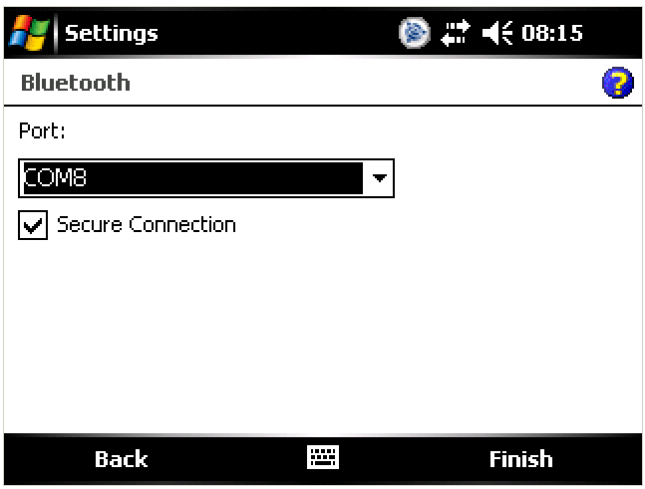
- The controller starts searching for existing Bluetooth devices
- If the trolley is turned on, the Bluetooth Dongle in the trolley should be found within about 20 seconds.
- Choose the Device and press the **Next**
- Enter the password (1234) and press **Next**



- Choose the Serial Port and then press **Finish**. Now the virtual COM port has to be assigned
- Open the **COM Ports** tab and choose **New Outgoing Port**



- Choose here the dongle with the correct name and press **Next**



- Choose the port (we recommend COM8) and press **Finish**

The Connection to the trolley now has been saved within the operating system and the COM port now can be selected within the GEDO Vorsys settings.