User manual

TopoL® Mobile 3.0

TopoL Software, s.r.o.

Content

Basics

TopoL Mobile is cheap and simple GIS solution for field data collection and navigation with GNSS. It runs under Windows CE operating system on Pocket PC.

The user can display both vector and raster data. Number of layers is not limited. It works with ArcView Shapefile format and raster data in format MapLib. This file can be created with TopoL Mobile desktop studio. It is one file which, which includes any number of rasters as single layers. This is to have easy and simple data manipulation in the field.

TopoL Mobile includes tools to connect to GNSS and to display all parameters sent by GNSS (position, number and position of sattelites, signal quality, HDOP, PDOP etc.). TopoL Mobile enables to navigate to defined position, to move automatically the viewport by GNSS position, to make the measurement of point, lines and areas with automatic calculation of line length and area size and perimeter.

During GNSS measurement one of several methods can be used. The position is registered always when data received, the position is registered after defined number of data received, time or distance passed, the position is registered as an average of defined data received or as an average of data received during defined time period. New point, line or area are saved in ArcView shapefile or dxf format or as an ASCII file. The user can define that he wants to have database attributes attached to each new object. They can create the database template with names and types of database attributes and with their definitions (the user cvan save any value into that attribute, value from defined interval or set of values).

TopoL Mobile is programmed in Microsoft Visual Studio .NET and is based on .NET Compact Framework technology. It is offered as Light, Standard and Profi variant. Light variant can only measure new objects, these new object cannot have database attributes, it cannot open raster data and it does not include navigation. Standard variant cannot have more than one database attribute, Profi version has got all features as described.

Installation

TopoL Mobile user interface

Pocket PC computers have got small screen resolution and they usually do not have keyboard (we can use only virtual keyboard). The programs are controlled with pen on touch screen. TopoL Mobile has got no menu. Single functions and settings are organized in five thematic folders (Map, GNSS, Measure, Navigate and TopoL). To change the folder we have to click on its name.

Map

Folder Map includes the map Windows, where raster and vector layers are displayed. There are also buttons to call other functions.
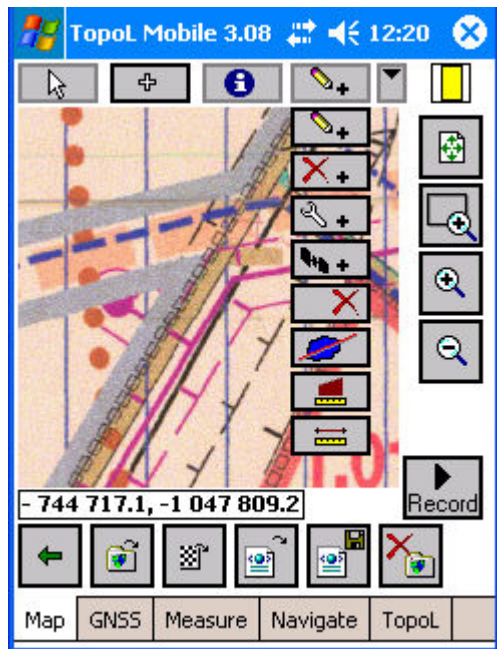
In the upper part of the screen we can find buttons, which define pen functionality.

None – when this option is active, TopoL will display coordinates of defined position in the line under map window

Pan map – when this option is active, TopoL will pan the viewport of so that defined position will be in the center

Info about object - when this option is active, TopoL will search for displayed objects in the defined position and if it finds any it will display their properties. It means the name of the layer, internal ID and optional attributes. If it is area object it will display also area size and perimeter. I fit is line object it will display its length

New position - when this option is active, and we are in recording of the objects, TopoL will register new position (new point object or new vertex of line or area object)

Delete vertex – when this option is active, we can click on the line or area, the verteces are highlighted and when we click on the vertex, it is deleted

Move vertex – when this option is active, we can click on the line, area or point, the verteces or the point is highlighted. In case of line and area we have to select the vertex to be moved. Then when we click its position is moved into this place.

Remeasure vertex - when this option is active, we can click on the line, area or point, the verteces or the point is highlighted. In case of line and area we have to select the vertex to be remeasured. Then when we click the button Record TopoL Mobile will start the measurement of new position.

Delete object - when this option is active, we can click on the line, area or point and it is deleted

Devide area - when this option is active, we can click on the area, the verteces are highlighted. When we select two verteces the area is divided

Display length of intersection with area – we can click on the area, the verteces are highlighted. When we select two positions outside the area, the length of intersection with the area is displayed.

Measure distance – we can click to the map and keep the pen pressed, the distance from original position is displayed.

We can find GNSS signal indicator in the upper right part of the screen.

When the system does not have GNSS signal it is red. It rotates when the system gets the position and it has got blue (RTK signal), green (DGPS signal) or yellow (only GPS signal) color.

In the right part of the screen we can find buttons, which enable to change the viewport in map window.

Zoom all – it changes the viewport so, to display all displayed data. There is an exception in the case raster map is displayed. Because of speed of raster map displaying simple method is used. It is based on the basic formula 1 screen pixel = 1 raster pixel. Maximal viewport change is 1 screen pixel = 1/10 raster pixel or 1 screen pixel = 10 raster pixels. If we want to display huge raster and we call the function Zoom all, we can have the ratio more than 10 raster pixels = 1 screen. In that case the ratio is changed to 1 screen pixel = 10 raster pixel and we will not see the whole raster. This problem can be solved in that way that we create a MapLib from tiles of huge raster in full resolution and from one whole raster in low resolution. If we want to display a detail we work with tiles if we want to see whole raster we use the overview.

Zoom by rectangle – this command enables to define the rectangle, which is displayed. If the raster map is displayed, there is an exception that we can zoom up to certain ratio.

Zoom plus – this command enables to zoom in by one step, the center of the viewport is kept. If the raster map is displayed, there is an exception that we can zoom up to certain ratio.

Zoom minus - this command enables to zoom out by one step, the center of the viewport is kept. If the raster map is displayed, there is an exception that we can zoom up to certain ratio.

In the bottom part of the screen we can find buttons to control the data displayed in map window. These buttons are here instead of menu and submenu. It means that when we press them certain function is called or the buttons are changed („submenu" is displayed). For example when we press the button New vector layer, the buttons are changed and we can see buttons New point layer, New polyline layer and New polygon layer. The buttons are big enough to hit them with a finger when we loose the pen
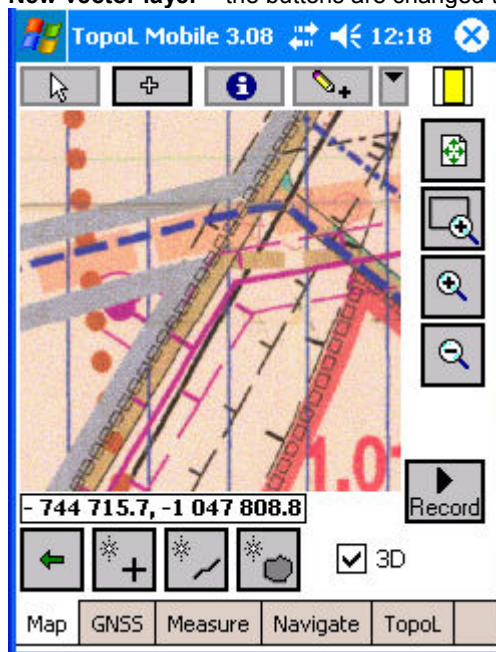
Basic button status is:

New map – all vector and raster layers are closed

New vector layer – the buttons are changed to enable new layer creation

New vector layer button status is:

Back to basic offer – the buttons are changed to basic status

New point layer – the dialog to define the name of new layer is open. The data created will be in WGS84 coordinate system. New objects can have database attributes. That depends on the Database template definition in folder TopoL. (Only objects without database attributes can be created in Light version).

New polyline layer – the dialog to define the name of new layer is open. The data created will be in WGS84 coordinate system. New object can have database attributes. That depends on the Database template definition in folder TopoL. (Only objects without database attributes can be created in Light version).

New polygon layer – the dialog to define the name of new layer is open. The data created will be in WGS84 coordinate system. New object can have database attributes. That depends on the Database template definition in folder TopoL. (Only objects without database attributes can be created in Light version).

3 D This option enables to save also Z coordinate in all output formats (SHP, DXF, TXT).

Open data - the buttons are changed to enable data opening.
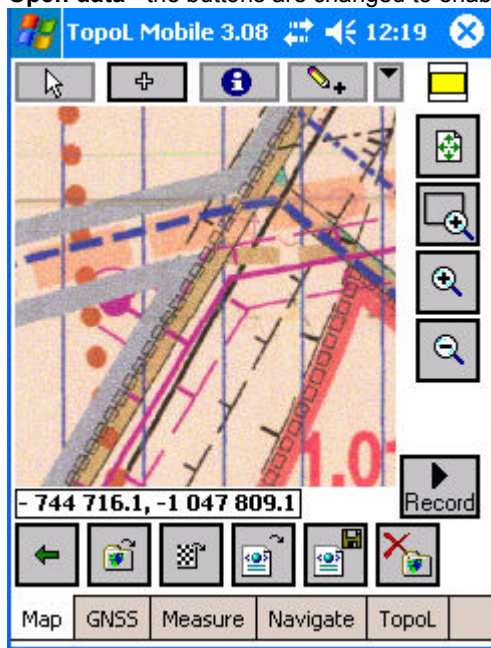
Open data button status is:

Back to basic offer – the buttons are changed to basic status

Open ShapeFile – opens the dialog where the shapefile to be displayed can be selected. The ShapeFile can be in WGS84 coordinate system or in UTM projection on WGS84 ellipsoid. Correct UTM zone has to be defined in TopoL folder.

Open MapLib file – opens the dialog where the MapLib to be displayed can be selected. (This function is not available in TopoL Mobile Light). This file can be created by TopoL Mobile Desktop, which is delivered together with TopoL Mobile.

Open project – we can save the list of open vector data with their display setting into xml file by the function Save project. By the function Open project the vector data can be open again and their displaying can be set up as defined in the file.
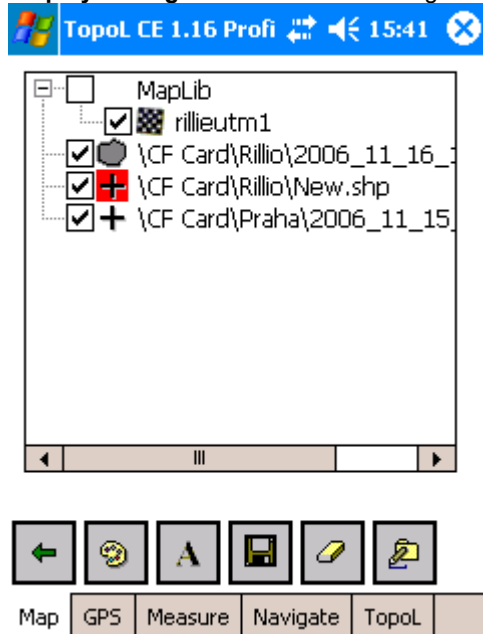

Save project – this command saves the list of open vector data with their display setting into xml file.

Delete ShapeFile – this command deletes shafile and corresponding dxf and txt files from disk. If the file is open it is closed as well.

Display setting – the buttons are changed to enable data display setting.

We can easily switch on/off displaying of raster and vector data. Raster layers are in MapLib node. Vector layers are represented by their full path. The icons indicate the type of data. Red icon means that the layer is set for editing. This screen also enables:

Back to basic offer – the buttons are changed to basic status

Set up color of vector layer – opens the dialog to set up the color of vector layer. In the case of polygon objects we can also set up the color of polygon border line. We have to select the layer in the list prior the pressing of this button.
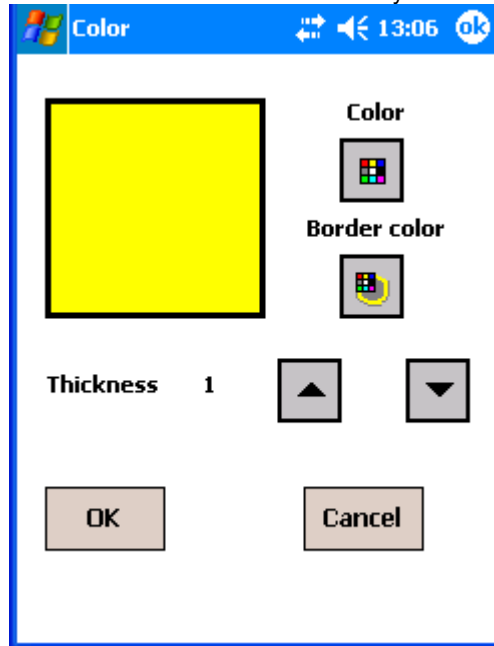
We can select one of 12 colors, which are changed in loop by pressing the button.
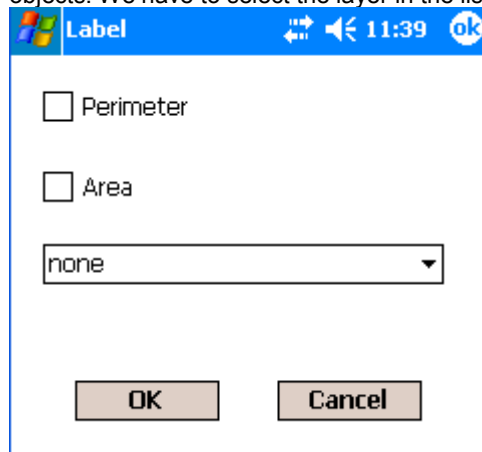
Change color of the objects

Change polygon border line color

The thicknes of object lines can be changed as well.

Set up labels of vector objects – opens the dialog to define the label of single objects. We have to select the layer in the list prior the pressing of this button.

If the objects of selected layer have got database attributes we can display them as labels in map windows. We can also display the length of line objects or area size and perimeter of polygon objects. We do not want to display any label no checked box can be activated and none has to be selected in combo box. If database attribute is selected in the combo box and one of the check boxes is activated the check box has got higher priority.

Example of label in map window.
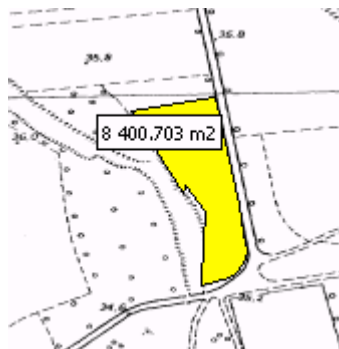
Save vector layer – saves the data. We have to select the layer in the list prior the pressing of this button. When we collect new objects when we finish the object and the definition of its attributes the data are saved automatically. It is to avoid the loose of the data in the case of computer collapse. When the database attributes are changed by the function **Info about object**, data are not saved automatically and we have to save them by this command.

Cleanup vector layer – deletes all objects in selected vector layer. It will delete them only the memory not in the file but when the file is saved (for example automatically when new object is colected) only objects from memory are saved to the file.

Set for editing – sets selected vector layer for editing. When we start the collection of new object it will be into this layer and of its type.

Map window properties – the screen is changed to enable some setting of map window
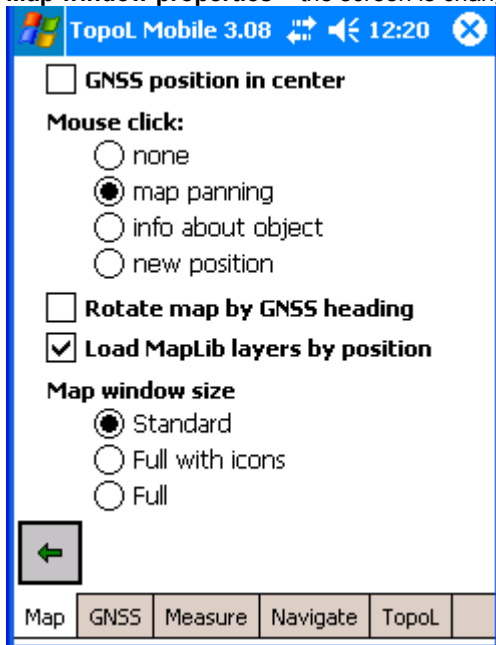
GNSS position in center – if this option is activated, the map window viewport is changed when ever the GNSS position is received so that this position is in the center (function follow GNSS position).

Mouse click - define pen functionality.
    None – when this option is active, TopoL will display WGS84 coordinates of defined position in the line under map window

Pan map – when this option is active, TopoL will pan the viewport of so that defined position will be in the center

Info about object - when this option is active, TopoL will search for displayed objects in the defined position and if it finds any it will display their properties. It means the name of the layer, internal ID and optional attributes. If it is area object it will display also area size and perimeter. I fit is line object it will display its length

New position - when this option is active, and we are in recording of the objects, TopoL will register new position (new point object or new vertex of line or area object)

Rotate map by GNSS heading – when this option is activated, the map is rotated to north whenever the azimuth of GNSS movement is received.

Load MapLib layers by position – Enables to switch between layers of MapLib automatically by position. If we want to display huge raster it is recommended to create a MapLib from tiles of huge raster. When this option is switch on and we click on the map window or we receive GNSS position TopoL Mobile checks if current raster raster layer is "under" this position and if not it will search for another one from the list of layers in MapLib and if it finds it, it will be displayed automatically.

Map window size – enables to change the size of the map area where raster and vector data are displayed
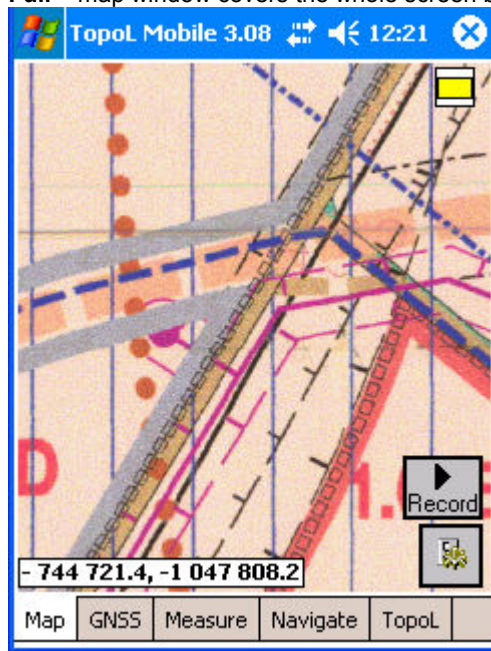
Standard – map window does not exceed to the area of tool icons
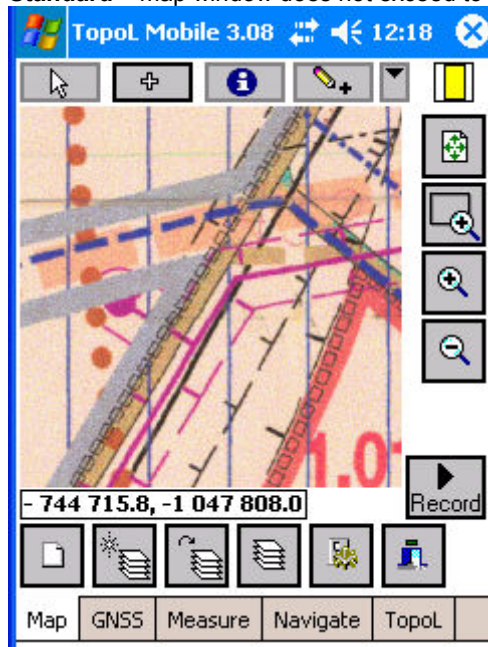
Full with icons – map window covers the whole screen and tool icons are visible
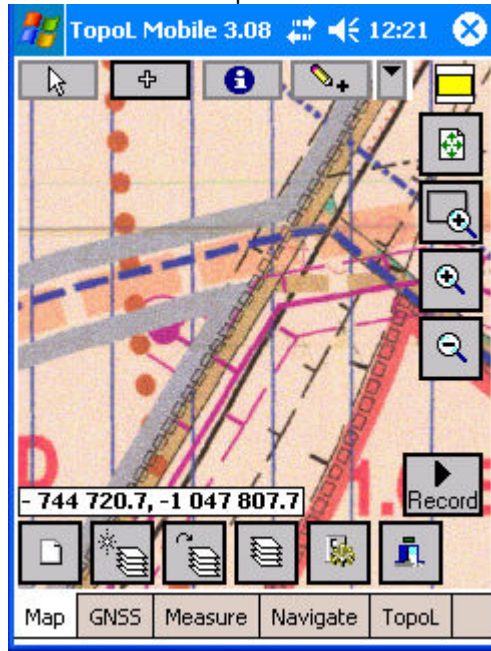
Full – map window covers the whole screen but only map window property icon is visible

Back to basic offer – the buttons are changed to basic status

Exit – exits TopoL Mobile application.

GNSS

In folder GNSS we can find the functions to start GNSS communication and to display incoming values from GNSS. TopoL Mobile communicates with GNSS using the library GNSSTools of Franson company from Sweden. This library enables to connect any GNSS integrated into Pocket PC or connected with Blootooth or cable.

In bottom part of this folder we can find buttons to control basic functions of GNSS.


Options – basic status of GNSS folder enables to start and stop communication with GNSS and to display basic information coming from GNSS.

Basic screen includes:

Port – enables to set up the port, to which the GNSS is connected. If we use the option Auto, TopoL Mobile will try to detect the port itself.

Baud – enables to set up baud rate of GNSS connection. If we use the option Auto, TopoL Mobile will try to detect the rate itself.

Start – When we press this button TopoL Mobile will try to open the port, to which GNSS is connected and will try to read the infortion coming on this port. If the port is open the caption of this button is changed to **Stop**. Then when we press this button the port is closed and the communication stops.
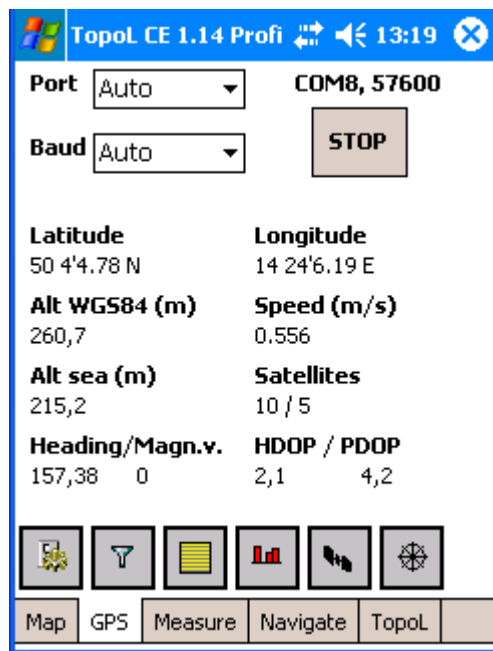
Other labels display basic information coming from GNSS (WGS 84 **Latitude** and **Longitude**, **Altitude**, **Speed**, **Heading**, **number of satellites**, **HDOP** and **VDOP**).

Data valid only if – Enables to define the conditions under which the incoming positions are valid.
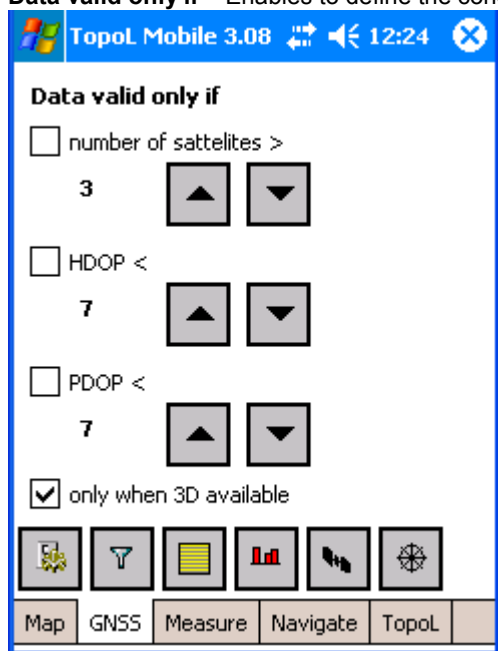
number of satellites – enables to define minimal number of satellites necessary to have the incoming position valid

HDOP - enables to define maximal value of HDOP necessary to have the incoming position valid

VDOP - enables to define maximal value of VDOP necessary to have the incoming position valid

Only when 3D available - enables to define if the incoming position is valid only when DGNSS signal is available (we can collect 3D data)

NMEA monitor – enables to display the list of incoming NMEA sentences from GNSS. With button **Save** we can save this list into ASCII file and with the button **Clear** we can clear this list.
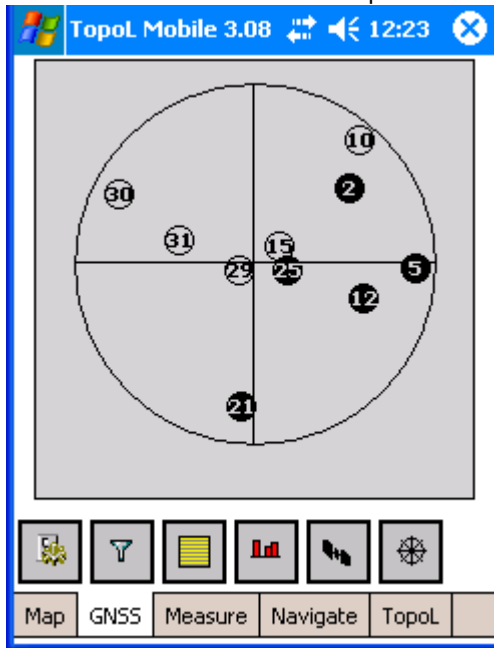

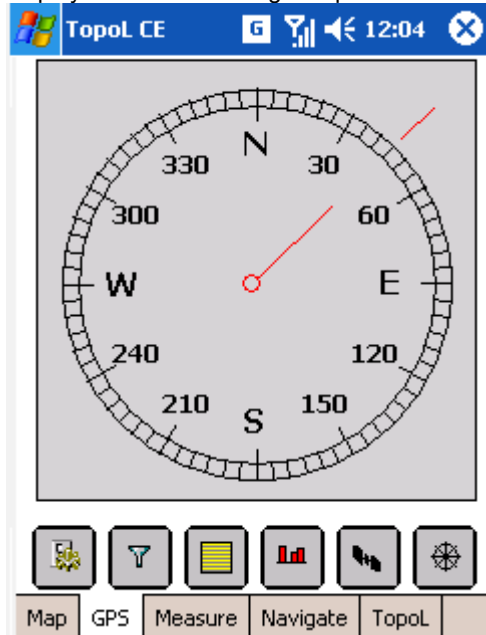**Signal** – It displays the strength of the signal on single satellites in graphical way.
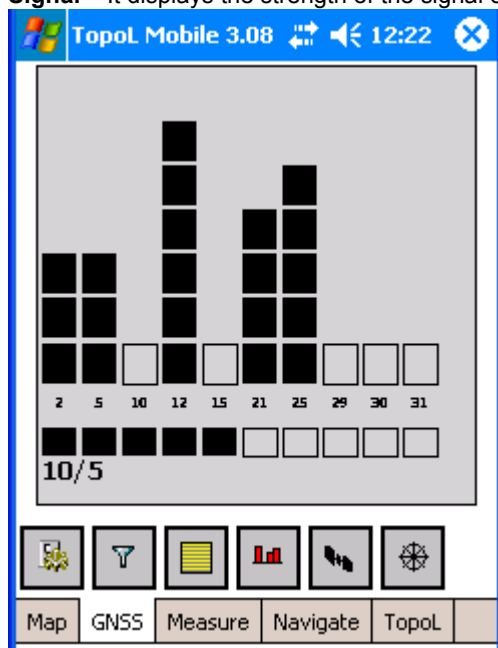
Satellites – Enables to check the position of satellites on sky.

Compass – enables to display the heading of GNSS movement. In the case of navigation it also displays direction to navigated point.
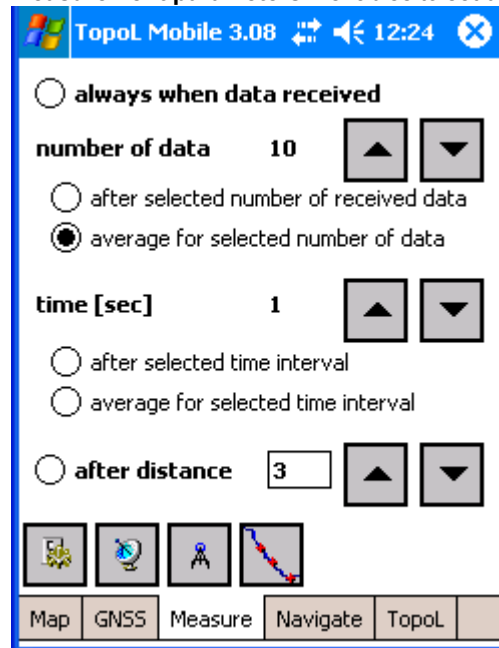
Measure

In folder Measurement we can find options to set up measurement parameters.

In bottom part of the screen we can find buttons to switch between different screens of this folder.

Measurement parameters – enables to set up measurement parameters

always – when this option is activated TopoL Mobile will register new position whenever the position comes to TopoL Mobile and is valid according Data validity definition if folder GNSS.

After selected number of received data - TopoL Mobile calculates number of valid received data and when the defined number of data is achieved TopoL Mobile will register new position (we can for example register each fifth valid position). It can decrease the number of points or verteces if we do not need them. Usually GNSS sends 1 position per 1second. If we move slowly or we collect the data for small scale maps we would have too many points.

Average for selected number of data - TopoL Mobile calculates number of valid received data and when the defined number of data is achieved TopoL Mobile will register new position as an average of these data (we can for example register average of five valid position). It enables to increase the precision of register position. When the coordinates (of a point or a vertex) are finished, TopoL Mobile goes to pause mode automaticaly. So the user can move to new position and has to press the button Go to start new point or vertex.

After selected time interval - TopoL Mobile measures time from last registered position and it will register new position when defined time interval elapsed (we can for example register one position per five seconds). It can decrease the number of points or verteces if we do not need them. Usually GNSS sends 1 position per 1second. If we move slowly or we collect the data for small scale maps we would have too many points.

Average for selected time interval - TopoL Mobile measures time from last registered position and it will register new position as an average of received valid potions when defined time interval elapsed (we can for example register one position as average per five seconds). It enables to increase the precision of register position. When the coordinates (of a point or a vertex) are finished, TopoL Mobile goes to pause mode automaticaly. So the user can move to new position and has to press the button Go to start new point or vertex.

After distance - TopoL Mobile calculates the distance from last registered position and it will register new position when the distance is more than defined value (we can register one position each 3 meters). It can decrease the number of points or verteces if we do not need them. Usually GNSS

sends 1 position per 1second. If we move slowly or we collect the data for small scale maps we would have too many points.

Shift position of antenna – it enables to shift registered position by defined values from the postion of antenna. The position can be shifted in the direction of GNSS movement (**backward**, **forward**) or in direction perpendicular to this movement (**left**, **right**).
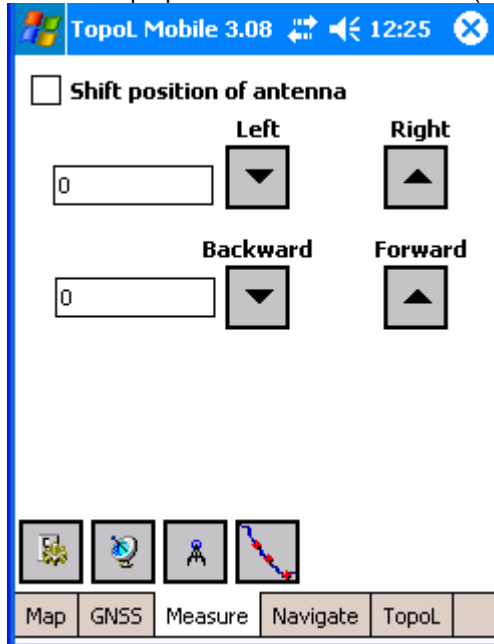
This is useful when for example when we want to measure the border of field but we cannot follow it

Measured values – it displays the list of registered positions. We can find here the name of the layer, internal ID of objects and the list of coordinates.
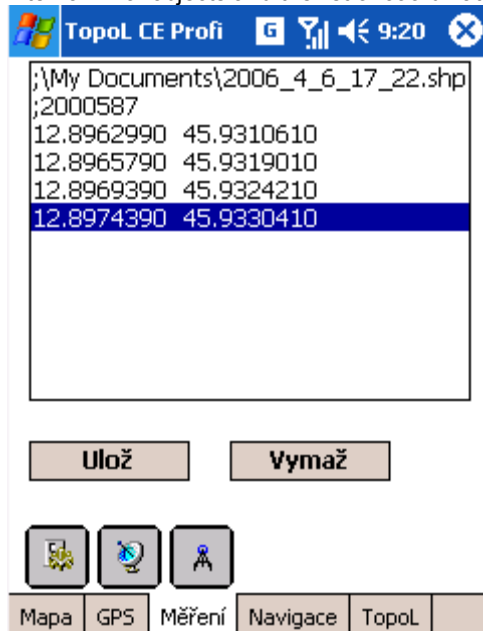
We can save or clear this list.

Tracking – When this option is ON and the GNSS position is coming, TopoL Mobile saves the current position after defined period to ASCII file TopoLMobile.Track. These points can be loaded for example to TopoL xT to see the path of the user.
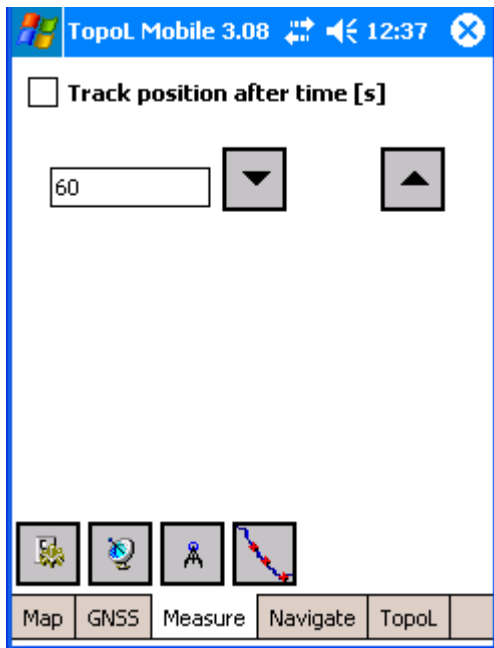
Navigate

In this folder we can find the parameters to set up and start the navigation. These functions are not available in Light version of TopoL Mobile.
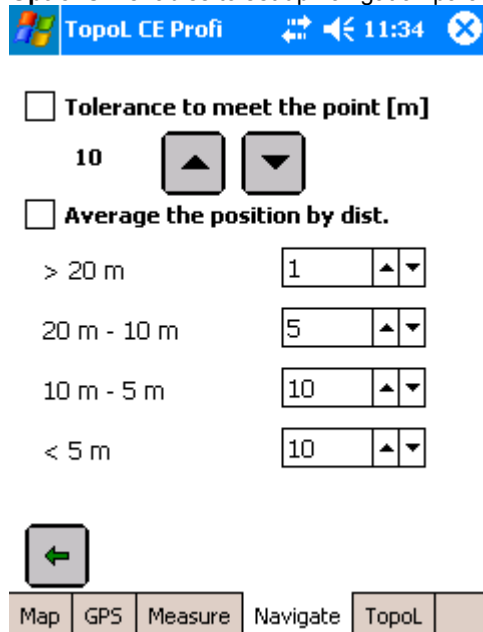
Basic screen includes the list of navigation points and the buttons in the bottom part of the screen.
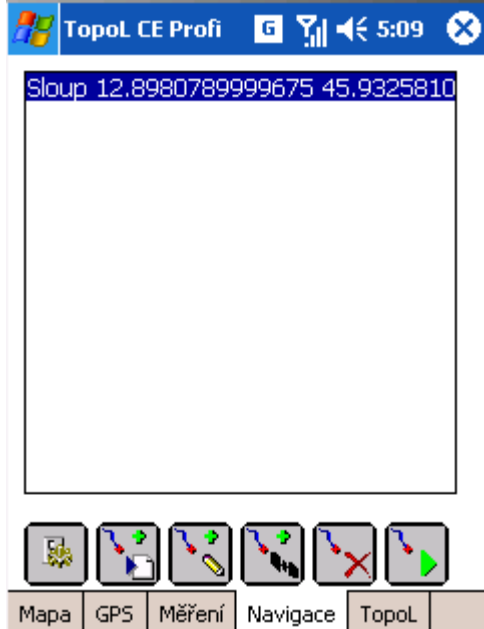
The buttons represent these functions:

Options – enables to set up navigation parameters.

Tolerance to meet the point – when this option is activated and our distance to navigation point is less than defined value, TopoL Mobile will automatically take next navigation point from the list and will start to navigate to that point.

Average the position by dist. - TopoL Mobile enables to average the position when we coming closer to the navigation point. In the case of poor signal (for example in the forest) the position "jumps" and we would not able to follow indicated direction. In this case TopoL Mobile enables to

average number of defined positions and to make the direction and distance to navigation point more precise. Number of defined positions depend on distance from navigation point as indicated on picture.

Load navigation points – enables to load navigation points from ASCII file. This file has to have predefined format. The first word of the line represents the name of the point, the second one longitude or easting and the third one latitude or northing. Coordinates have to have decimal point and single words has to be delimited by space, coma or semicolon. These characters cannot be used in navigation point name.

Example for WGS84:
```
sloup; 12.901883;  45.930951
mezník; 12.901878;  45.930975
```

Example for JTSK:
```
krmelec −638775.141 −1165326.567
brod −639023.456 −1163873.200
```

Navigation point from map – enables to add the point which coordinates are defined by clicking on the map window. When we press the button TopoL Mobile switches to Map folder automatically and we have to define the position of the point in the map. When we define the position the dialog with coordinates in map window coordinate system is displayed and we have to define the name of new navigation point which is added to the list..

Navigation point by GNSS - enables to add the point which coordinates are defined by received position from GNSS. When we press the button TopoL Mobile switches to Map folder automatically and TopoL Mobile will register the position of the point. When the position is defined the dialog with coordinates in map window coordinate system is displayed and we have to define the name of new navigation point which is added to the list.

Delete navigation point – enables to delete the navigation point from the list. The point has to be selected in the list first.

Start navigation – starts the navigation. TopoL Mobile will start the navigation to the point selected in the list. In no point is selected TopoL Mobile will take the first point. When we press the button the TopoL will switch to Map folder automatically.
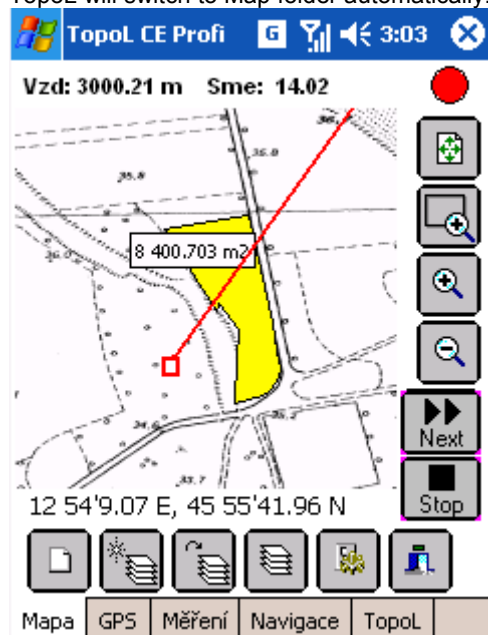
In upper part of the screen TopoL Mobile displays the distance and azimuth to navigation point. The point is displayed in the map and together with its name and the line indicating the direction. In the right part of the screen two new buttons are displayed. The button **Next** enables to skip current

navigation point and starts the navigation to next point. The button **Stop** stops the navigation. When the navigation stops, these buttons are hidden again.
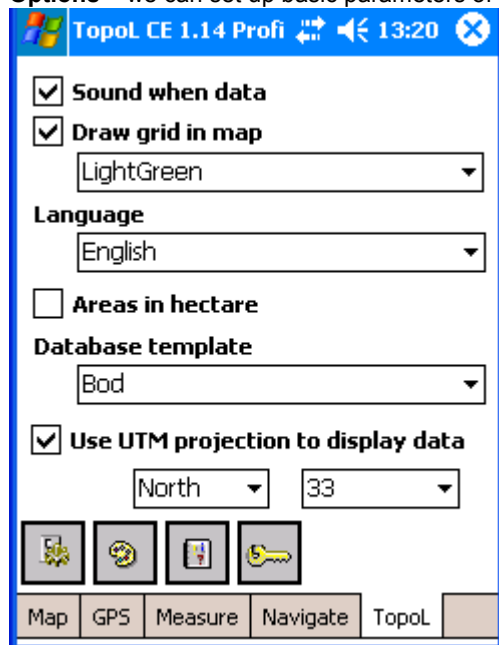
TopoL

In this folder TopoL we can find basic setting of TopoL Mobile.

In bottom part of the screen we can find these buttons:.

Options – we can set up basic parameters of TopoL Mobile

Sound when data – when this option is activated TopoL Mobile will play a sound when new valid position is received. It enables us to control the quality of received data. When the do are not coming we can recognize it easily.

Draw grid in map – when this option is activated the grid is displayed in map window by defined color. The grid size is calculated automatically by TopoL Mobile and the size depends on scale. It is displayed in bottom right corner of map window.

Language – enables to set up the language of TopoL Mobile user interface.

Areas in hectare – enables to set up the units of calculated area size. When this option is activate the size is in hectares otherwise it is in square meters.

Database template – new objects can have database attributes. Which attributes they will have can be influenced by this option (Only objects without database attributes can be created in Light version). We can select one of these options in combo box

None – objects will have only attribute ID

Standard – point objects will have attribute ID, X, Y, Z, FIXTYPE, line objects ID and LENGTH and polygon object s ID, PERIMETER and AREA

Comment - point objects will have attribute ID, X, Y, Z, FIXTYPE and COMMENT, line objects ID, LENGTH and COMMENT and polygon objects ID, PERIMETER, AREA and COMMENT. The attribute COMMENT is of string type.

The attribute FIXTYPE is filled with type of GPS signal which is 0 (no signal, point defined with pen, 1 GPS signal, 2 DGPS signal, 3 RTK).

TopoL xT (GIS of TopoL Software) enables to define structure of project by command Project – Define project structure. Here we can define feature classes of objects. Feature classes can be of point, polyline and area type. They can be created by command Definition – New table of points, New table of lines, New table of areas. When we define new feature class we have

to define its description and then we can define user defined database items of this feature class by command Definition – New definition structure of database table. Here we can define the name and type of database attributes. We can also define restrictions for defined attribute. The attribute can be restriction (we can enter any value of defined type), it can be restricted by interval of defined values (we can enter only value from defined interval) or it can be restricted by enumeration values (we can enter only a value from a list). When all desired feature classes are defined we can export this definition into xml file by command Import, Export – Export to XML. When the name of this exported xml file is "TableDef.xml" and we copy it to the directory where TopoL Mobile is installed, the list of feature classes with user defined attributes are added to the combo box Database template in TopoL folder of TopoL Mobile. This works in Profi version only.

Use UTM projection to display data – Displayed ShapeFiles can be in WGS84 coordinate system or in UTM projection on WGS84 ellipsoid. If the data are in UTM projection we have to define the zone of the projection in this combo box. .
If this option is activated the data are displayed in this predefined zone. If the data are in WGS84 the transformation of coordinates is made on fly. If this option is switched off and the data are in UTM they also have to be transformed on fly. It means that when we have got huge ShapeFiles we have to choose correct setting to speed up the displaying. When the raster is displayed the coordinate system used for displaying is the same as the coordinate system of raster.
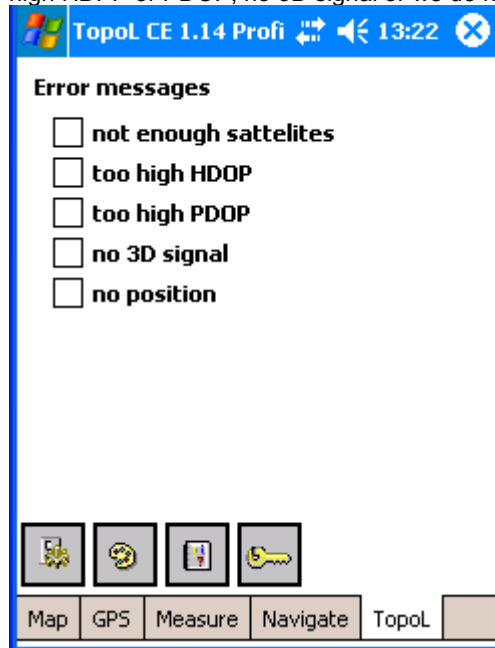
System color setting – enables to set up some TopoL Mobile system colors.


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Error messages – enables to display error messages when we do not have enough sattelites, to high HDPP or PDOP, no 3D signal or we do not get GNSS position.

New objects measurement

The accuracy of the measurement depends on the GNSS used and quality of the signal. But we can influence the measurement quality by setting the parameters of data validity in GNSS folder. We can also obtain higher quality if we use averaging in folder Measurement.

When we want to start measurement we have to create new layer first. Then there is new button **Record** on the right side of the map screen displayed.
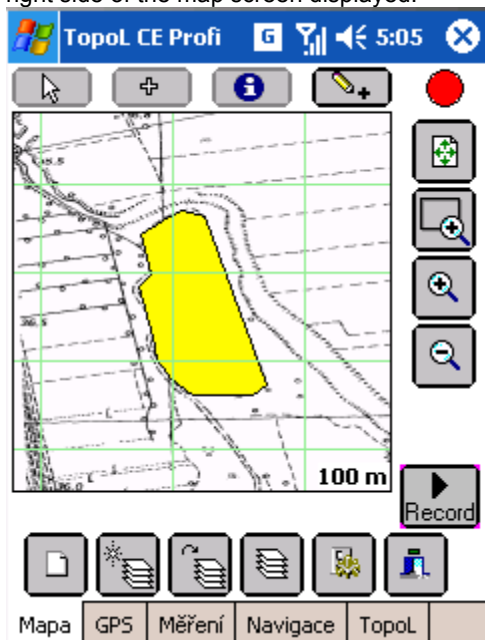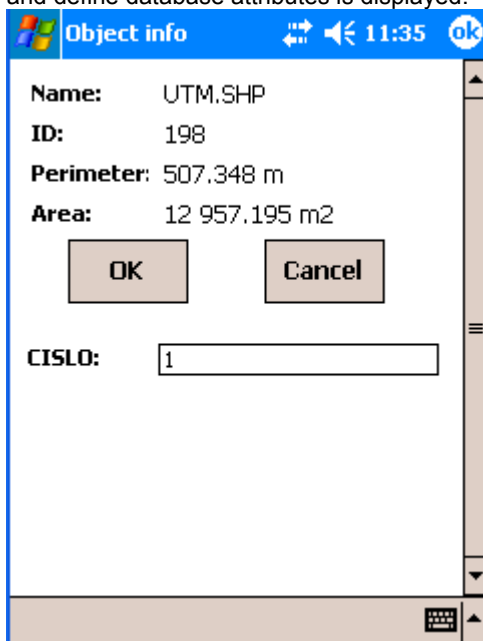

When we press this button the measurement of new point, polyline or polygon object is started. The status of this screen is changed.
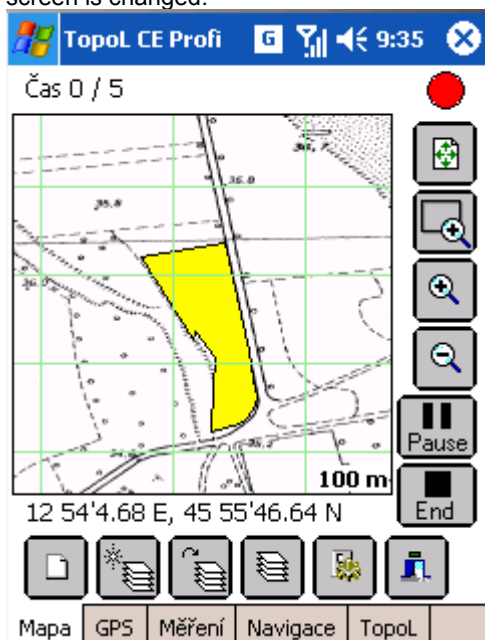
In the upper of the screen we can see the measurement status depending on the type of measurement. We can see on the picture that we register one point per 5 seconds and that now no second elapsed. In the right part of the screen we can find the button **Pause** and the button **Stop**. The button **Pause** enables to pause the measurement when we have to bypass some fence or when averaging is used and we have to move to next point. The button **End** will finish measurement. When we measure polyline or polygon objects this also means that we want to confirm the object.

When we are collecting point objects with database attributes, polyline or polygon objects the dialog to display and define database attributes is displayed.

If some database attributes has got the restriction defined (by interval or by enumeration), TopoL Mobile will not allow us to enter other than allowed values. This restriction is also very useful in the case of string values when typing is very difficult on Pocket PC computers. In that case all allowed values can be listed in the combo box and we can easily select the correct text.

When the dialog is confirmed the data are saved in ArcView ShapeFile format (including database attributes), DXF format (without database attributes) and ACII file (without database attributes).

When we measure point objects there is also button **Exit,** which enables us exit the measurement from this dialog.