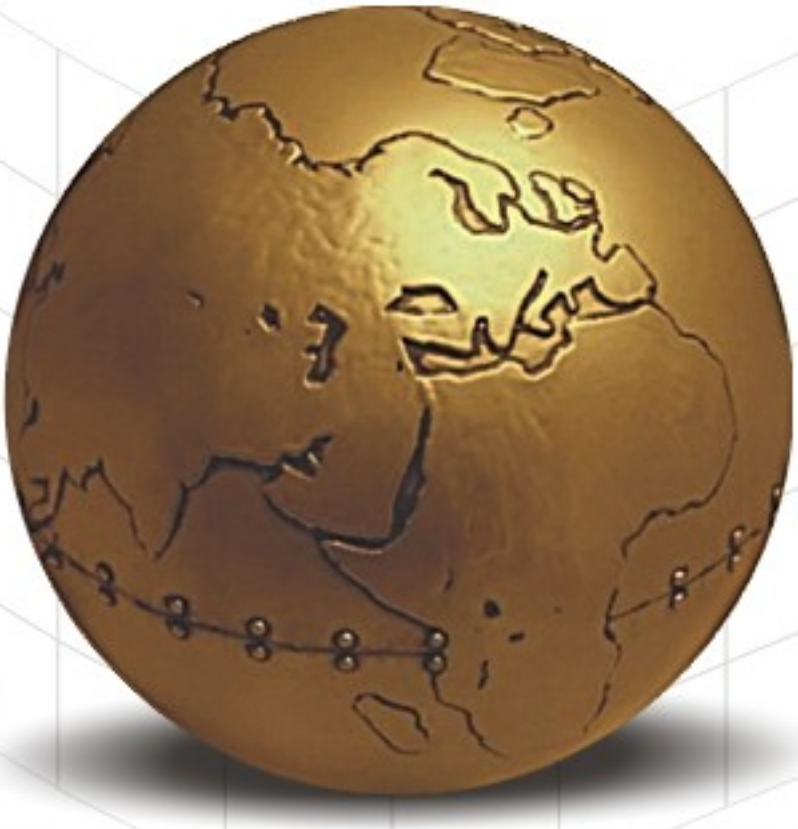
GPS TrackMaker®

Reference Guide



Version Pro – 4.5
Version Free – 13.5
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Suggestions or Comments:
http://www.gpstm.com

Summary

1 Preliminary

1.1 What is GPS TrackMaker®

The **GPS TrackMaker®** program for Windows® 98SE/2000/ME/XP/Vista allows bi-directional data communications between GPS receivers and your computer, including full data editing and storage options.

GPS means *Global Positioning System*; a system with more than 24 satellites in orbit that send information to the Earth. GPS receivers can receive those signals continuously and, if receiving at least 3 satellites, the GPS calculates the position and direction of travel on ground. The accuracy of the GPS information increases with the number of satellites received.

Satellite data stored in the GPS receiver can be transferred to a PC as Waypoints, Tracklogs and Routes. The **GPS TrackMaker®** program recognizes this data, allowing the User to edit them with a simple graphical interface.

The main features of GPS TrackMaker® program are:

- Fast vectorial background maps
- Communicates directly with many popular GPS receivers using your data cable and an available serial port.
- Creation, editing and deletion of Tracklogs, Waypoints and Routes on a graphical, easy-to-use interface.
- Internal database with more than 250 different parameters of map datum.
- Data can be edited and saved, using several vector file formats.
- Automatic Tracklog labeling.
- Insert digital images such as maps and photos directly onto the grid and use them for navigation over the chart, with full zoom and drag features.
- Calculation of cartographic length, average and instant speeds on Tracklogs.
- Speed and length with several units of measurement.
- Zoom in, Zoom out and specific area Zoom functions.
- Move the whole drawing just by pressing the right mouse button.
- Management of more than 200 different color icons.
- Display Waypoints on screen in several different styles.
- Selectable colors for background, grid, Waypoints and Tracklogs.
- Allows selective deletion of data, either by exclusion or inclusion.
- GPS Macro function, specially created to eliminate Waypoints located away from a User's defined Route; (Useful for those who intend to travel using a GPS receiver).
- Files Recognition of Garmin® PCX5, Waypoint+, Map/Info, Arc/Info (E00) and others formats.
- Real Time Navigation (RTN) Function
- Map Catalog Function that allows you to easily create a digital catalog of maps.
- *Autoload* Function that allows you to load maps from the catalog in Real Time Navigation (RTN)
- Support for several rectangular coordinate systems, including UTM, British National Grid, Irish National Grid, Swiss Grid, Swedish Grid, New Zealand Grid, Finnish Grid, Dutch Grid, etc.
- *True-Grid* mode that allows you to show rectangular coordinate systems without deformation.
- Support for filled and scaleable Tracklogs.
- Scalable Waypoint Text : the text increases or decreases with the scale.
- Support for date, Altitude and rotation in Waypoints.
- Support for date and altitude in Tracklogs.
- Functions *Undo*, *Copy*, *Cut* and *Paste*.
- Allows you to send only selected data to the GPS.
- Dragging of Waypoints, Tracklogs, Routes and Pictures using the mouse.
- Support for Garmin® handheld GPS.
- Support for Magellan® handheld GPS.
- Support for Lowrance/Eagle® handheld GPS.
- Support for GPS MLR® handheld GPS.
- Support for GPS Brunton®/Silva® handheld GPS.
- Support for *GTM Tracker* - GPS Vehicle Tracker
- NMEA0183 protocol for real time navigation.
- Support for several languages

If you own **GPS TrackMaker Professional®**, you will also have specific functions for area calculation, support for AutoCAD® DXF files, support for ArcView® Shapefiles, data treatment in tables, etc. Every time that the symbol to the side appears, the functions are exclusive to GTM PRO®. They are not available in the free version.

Additional functions in GTM PRO® include:

- Allows to create complete projects of maps.
- Advanced functions for professional use.
- Total support for images TIFF, PNG, BMP, JPG and GIF.
- Geocoded images GeoTiff and DRG
- Export map images to several raster formats
- Rotation and clipping of background images, allowing a better calibration
- Complete data editing in table sheets similar to Microsoft Excel®
- Calculation of azimuths with hundredth-second accuracy.
- Calculation of lengths with millimeter accuracy.
- Exclusive function *Expand Zone* that allows a better calibration of images
- Print Preview function
- Area calculation defined by Tracklogs in different measurement units.
- Local topographical area and cartographic area calculation.
- Local topographic length and cartographic length calculation.
- Length Calculation factoring altitude changes for the horizontal projection.
- Topographical conversion function for data obtained by a GPS device.
- Import and export data for AutoCAD®, in DXF format.
- Import and export data for ArcView®, in SHP format.
- Import and export data for MapInfo®, in MID/MIF format.
- Export data to XLS (Excel®) or DBF (dBase®) file formats.
- Import and export data for Microsoft Excel® and Microsoft Word®
- Creation of multiple Waypoint styles, to obtain more detailed maps.
- Exclusive background filled Tracklogs to be used with images.
- Datum defined by User.
- Rectangular Grid systems defined by user.
- LTM (Local Transverse Mercator) and RTM (Regional Transverse Mercator) grids.
- Exclusive Tracklog union tool.
- Exclusive Rectangular Clipping Tool
- Average calculation of the geodesic position from Waypoints, Tracklogs and Routes
- Calculation of horizontal distances and altitude differences.
- Data Rotation.
- Altitude Profile with advanced functions.
- Creation of Altitude Profile Tracklogs
- Support for Contour Lines
- Accents removal Tool
- Calculation of Scale Factor and UTM Meridian Convergence
- Multiple vehicle tracking at the same time.
- Detailed report of streets and avenues where the vehicle passed.

1.2 Hardware Key

The information below applies only to GTM PRO® Users.

The Hardware Key or *dongle* is an electronic plug that works as an unlock password of the GTM PRO®. The plug is easily connected to the printer port or USB port, and must be present when GPS TrackMaker Professional® is being executed.

The plug doesn't interfere in the operation of printers, scanners or other devices.

The license by Hardware Key is used by GPS TrackMaker Professional® 4.0 or above.

To purchase the Hardware Key, please contact the store where you purchased GTM PRO® or the Author at **http:www.gpstm.com**

1.3 License Agreement for GPS TrackMaker® Program

When installing or using this program, the User agrees to accept all terms and conditions of this license agreement. If the User does not agree with all conditions, he must uninstall the program using the *Add or Remove Programs* tool in the Windows® *Control Panel*.

LICENSE AGREEMENT FOR GPS TRACKMAKER®
REDISTIBUTION IS NOT PERMITTED WITHOUT EXPRESS AUTHORIZATION

The parties in this license agreement are:

AUTHOR: Odilon Ferreira Junior, individual resident in Belo Horizonte – MG - Brazil
Home-Page : **http:www.gpstm.com**

USER: Individual or entity that acquired the program by any means.

OBJECT OF THE CONTRACT

License to use **GPS TrackMaker®** program.

LICENSE GRANT

The User can install, use, access, exhibit, execute, any previous version of **GPS TrackMaker®** in just one computer, work station, terminal, notebook, or other digital electronic device.

The User can also store or install a copy of the Program in a storage device, such as a net server, used only to run the Program in other computers in an Intranet. Though, the User must acquire a special license for each computer in which the Program is executed starting from the storage device.

The license of the Program cannot be shared or used simultaneously in different computers. The User can run additional copies of the software up to the number of copies specified as *Licensed Copies*.

All rights not expressly granted are reserved to the Author.

WARRANTY

The Author or the responsible person for the sale and distribution of the Program can provide the User support services, if previously stipulated. The use of the Support Services is regulated by the own salesperson's, or the Author's guidelines and must be previously understood by the user.

Any supplementary code for the Program provided to the User as part of the Support Services must be considered part of the Program and it will be subject to the terms and conditions of this Contract.

Technical information provided as part of Support Services can be used for commercial purposes, including development and product support.

If the Program proves defective because of misapplication, it will be the User, and not the Author or Distributor, that will assume the total cost of any service or repair. The routines and calculations implemented in the Program have inherent limitations and the User must determined if the Program meets their requirements.

RESTRICTIONS OF THE LICENSE GRANT

The User may:

- Use the Program in only one individual computer;
- Copy the Program, for archival purposes, providing that each copy contains all property and ownership advises of the original Program.

The User may not:

- Allow other people to use the Program except under the terms of this agreement;
- modify, translate, do reverse engineering, decompile, disassemble (except if expressly authorized by the author) or create commercial products based on the Program or parts of it;
- make copies of the program, except as described above;
- rent, sell, lend, give the Program or do any thing that interferes with author's rights;
- remove any ownership advises or intellectual property labels from the program;
- use the program for tracking purposes (AVL) with devices which were not approved by the Author.

PROPERTY RIGHTS

Ownership and intellectual property rights will continue to belong to the author. This Program is protected by copyright laws and other intellectual property laws, and by international treaties. License granted by this contract does not give the User any rights on its contents.

DURATION

This agreement is valid while the User possesses the Program. The agreement is automatically cancelled if the User does not fit the limitations described in this document. Upon termination, the User must destroy all copies of the Program and Documentation.

EXPORTATION CONTROL

Any citizen in the world, respecting the terms and restrictions of this agreement may use the Program.

LIMITATION OF LIABILITY

Under any circumstance the author will not be responsible for damages that may be caused to the PC, GPS receiver, or to any equipment connected to them.

HIGH RISK ACTIVITIES

The Program is not fault tolerant and is not designed or manufactured to be used in control equipment, or in hazardous environments requiring fail-safe performance, such as in the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, direct life support machines, or weapons systems, in which the failure of the Product could lead directly to death, personal injury, or severe physical or environmental damage (*High Risk Activities*). Accordingly, the author specifically disclaims any express or implied warranty of fitness for High Risk Activities.

TECHNICAL SUPPORT LIMITED

The technical support given by the author is limited to installation troubles or eventual malfunction of the program. The present license does not cover technical support for the normal use of the program, notions of cartography and computer science, notions of topography and survey and other aspects that depend on previous knowledge or training courses. Technical support for such subjects should be contracted separately.

DONGLE WARRANTY

The hardware key (dongle) is warranted to be free of defects for a limited period of one year from the date of purchase. In the event of a defect during the warranty period, the author will replace the defective product after it is returned by the User. This Warranty is limited to replacement of the defective product only and shall not cover any other damages. The Freight costs of any product sent to the Author shall be paid by the User, including the costs of return. With respect to the use of this product, in no event shall the author be liable for any loss of profit or any other commercial damage, including but not limited to special, incidental, consequential and other damages or costs incurred.

MISCELANEOUS

The relationships are regulated by this Agreement, and not by any printed License Agreements that may be eventually attached to the Program.

If any term of this agreement is declared impracticable, that term will be changed only up to the point so it becomes practicable. Belo Horizonte County – Minas Gerais – Brazil will arbitrate any disputes.

2 Files Management

2.1 Merging Files in GPS TrackMaker®

To merge files, press the  button.

The *Merge File* option allows you to merge several files into just one file. So, if the User has a file of Waypoints and wants to see it together with another file (with Tracklogs, for example), they must use Merge function to combine them. When saving the final file, the User should change its name to prevent overwriting the first file opened.

Warning: avoid merging files with map images in different datums. The final file is configured to the first datum, showing the images on wrong positions. Be sure all map images are in the same datum. This warning does not apply to files without background images.

2.2 Files in GTM Format

The **GPS TrackMaker®** default file format has the extension GTM (initials for GPS TrackMaker). This format stores all Waypoints, Tracklogs and Routes as well as information related to the screen display, background and grid color, Waypoint text, User-defined text, etc. Digitized images are also included in the GTM file.

The GTM file was developed for compact data storage and enhanced recording speed when compared to Text formats. This is a binary format with the following structure:

Saving the Characteristics of Each Image

The data of each image is saved sequentially in the GTM file with variables of 6 decimal places.

Saving the Waypoints

Waypoints are saved sequentially in the GTM file with the latitude and longitude values always in decimal degrees with 13 decimal places of precision. The altitude in relation to the sea level is also saved with 13 decimal places of precision.

Saving Tracklogs

Tracklogs are saved with latitude and longitude values in decimal degrees with 13 decimal places of precision. The altitude in relation to the sea level is saved with 6 decimal places of precision.

Saving Routes (Routes)

Routes are saved using the same format as Waypoints.

Saving Digitalized Images of Maps and Photos

Images are saved byte to byte in the end of the GTM file. The image file is attached in the original extension that it was loaded. Thus, images in GIF or JPG format will occupy less space than BMP files inside the GTM file.

Note: At http:www.gpstm.com you will find a detailed specification of the GTM format.

2.3 Files in GTZ or GZ Format

Files in GTZ or GZ format created by **GPS TrackMaker®** are compressed GTM files. Files in GTZ or GZ format maintain the same accuracy as GTM files, but with half of the size of GTM files. Basically they are appropriate for those Users who want to transfer data to the Internet or save disk space. The compact data storage of GTM files reduces the risk of data corruption when downloading files from the Internet.

GTZ or GZ files can be opened directly in **GPS TrackMaker®**, No decompression program is needed.

The Author suggests using the GZ format for saving **GPS TrackMaker®** files on the Internet. This procedure, reduces the size of the GTM file, and also will reduce the probability of data corruption when downloading the file.

2.4 Files in Text Format

One of the great features of **GPS TrackMaker®** program is the ability to save files in text format (*TXT*). This format is useful for those who want a detailed analysis of data, as well as making it easier to interface with another program, once data recognition becomes an easy task.

Text file output is in the following format:

Version

The version of text file is the first data to be saved. The version of text file is separate, and may not coincide with the version of the Program.

Datum

The datum is the second data to be saved in text file, as shown below. The name comes first, and its function is purely indicative. The program will only recognize the index number that follows the comma. The internal datum table used by **GPS TrackMaker®** can be seen in the Datum Table **.**

Datum Name, index number, Semi-axis of Earth (m), Flattening, DX, DY, DZ

When reading the Datum, the program only recognizes the field *index number*. The other fields are kept only to illustrate.

User Grid

GTM PRO uses this field® to register the characteristics of an user defined coordinate system. It will be present only if the data is saved in *Use Grid*.

USER GRID, Grid Number, Central Meridian, False Easting, False Northing, Scale

Waypoints

The second group of data saved in text file is the Waypoint:

w, Notation, Name, Lat, Lon, Comments, date, time, altitude, dspl, icon, Rotation, Zoom

w: flag indicating that data is related to a Waypoint
Notation: Type of Notation as defined in *Options* menu
Name: 6-character string
Latitude: Variable size string in the notation specified in *Options*
Longitude: Variable size string in the notation specified in *Options*
Comments: 40 characters string
Date: date in MM/DD/YY that the Waypoint was created
Time: hour, minute, second that the Waypoint was created
Altitude: altitude in meters
Dspl: indicates the display of the Waypoint on screen:
- *0* – Symbol with name
- *1* – Symbol Only
- *2* – Symbol with comments
- *3* – Symbol with comments defined by User

Icon: internal code of the icon symbol, according to the Icon Table
Rotation: angle of text rotation in degrees x 10
Zoom Level: Maximum zoom which the Waypoint appears on screen. See *Zoom Table*.

Tracklogs
After Waypoints, the Tracklogs are saved as follows:
t, Notation, Latitude, Longitude, date, time,altitude, flag

t: flag indicating that the data is related to a Tracklog
Notation: Type of Notation as defined in *Options* menu
Latitude: Variable size string in the notation specified
Longitude: Variable size string in the notation specified
Date: date in Month / Day / Year format
Time: time in Hour: Minutes: Seconds format
Altitude: altitude in meters
flag: Boolean number that identifies the Tracklog:
- *0* – means a continuation for the same Tracklog
- *1* – means the beginning of a new Tracklog

Name, Colors and Styles of Tracklogs

After saving Track points, the names, colors and styles of Tracks will be registered. Styles indicate how Tracklogs will be shown in the screen of the program.

n, Track Name, Track Color, Track Style, Zoom

Routes

The Routes are saved in the following format:

rn, Route Number, Route Name

rn: flag indicating the beginning of a new Route
Route Number: Integer value of the Route Number

Route Name: String up to 30 characters

r , Notation, Waypoint Name , Latitude , Longitude , Comments , dspl , icon

r *:* flag indicating that the data is related to a Route
Notation: Type of Notation defined in *Options* menu
Waypoint Name: 6-character string
Latitude : Variable size string in the notation specified in *Options* of the latitude of the Route's Waypoint
Longitude : Variable size string in the notation specified in *Options*, reflecting the longitude of the Waypoint of the Route
Comments : 40-character string of the comment of Waypoint of the Route
dspl : byte that indicates the Waypoint's display scheme on the screen of the GPS:
- *0* – Symbol with name
- *1* – Symbol only
- *2* – Symbol with comments
- *3* – Symbol with comments defined by User

Icon : internal code of the icon symbol, according to the Icon Table

Images

Background images can be saved in TXT files, if *Save Images in TXT file* option is selected under *Options -> Images* in the *Tools* menu.

The images are saved with the following attributes:
i , Notation, Latitude1 , Longitude1, Latitude2 , Longitude2, Path, Text
i *:* flag indicating that the data is related to a Image
Notation: Type of Notation defined in *Options* menu
Latitude1/longitude1: Coordinates of upper-left corner of the image
Latitude2/longitude2: Coordinates of lower-right corner of the image
Path : Complete path of the image
Text : Text of the image

Zoom Table

Zoom values are defined between 0 to 12 and indicate the maximum scale which the element appears on screen.

12 = 100m : Street 11 = 300m : Avenue 10 = 500m : Highway 09 = 2Km : Neighborhood	08 = 10Km : Urban Area 07 = 30Km : Metropolitan Area 06 = 70Km : City Small 05 = 100Km : City Medium	04 = 250Km : City Large 03 = 500Km : State Medium 02 = 1000Km : State Large 01 = 2000Km : Country 00 = Permanent

Important Notes

Text files saved by **GPS TrackMaker®** do not indicate data related to background and grid colors, Waypoint text characteristics, text defined by User or coordinate characteristics indicated on the grid. This data is stored only in GTM and GTZ (GTM compressed) files.

2.5 GPX File Format

The GPS Exchange Format is a light-weight XML data format for the interchange of GPS data (Waypoints, Routes, and Tracklogs) between applications and Web services on the Internet.

GPS TrackMaker® supports GPX 1.1, being able to export and import Tracklogs, Routes and Waypoints.

To export to GPX format, click on Files -> Save File as -> choose *GPS Exchange Format*.

To import a GPX file, click on Files -> Open File -> Choose *GPS Exchange Format*.

2.6 Importing GeoTiff Images

 This option is available only in **GPS TrackMaker Professional®**.

Geotiff is a georeferenced version of the popular TIFF format of raster images. This means that the calibration data are already inserted in the image file. Just open the TIFF to the GTM PRO® calibrates the image automatically, placing it in the correct position.
If a GeoTiff is opened and the calibration data are correctly recognized, GTM PRO® will create a specific *User Grid* for the image. Extra information contained in the TIFF file will be transferred to the *Image Comment* field and can be viewed through Map Image Properties window .

GTM PRO® supports GeoTiffs saved in the following projections:

- Geographic
- Transverse Mercator
- Oblique Mercator/ Rosenmund
- Gauss Krugger
- New Zealand Map Grid

If GTM PRO® is not able to recognize the calibration data contained in the GeoTiff, the Import Tool window will be opened, showing a list of probable coordinate systems. Usually, when the Import Tool is opened, a new calibration will be necessary.

Only GeoTiff saved in metric and angular units are supported. Systems that use *feet, yards* or other units are not supported.

To open a GeoTiff file, click in *File > Open File > Geocoded Target Images*. Geotiffs are saved in the TIF and TIFF extensions.

Note: Geotiffs are opened exclusively through *Open File* menu. If you use the *Insert Image* menu to open a GeoTiff, the image will be imported as a common TIFF not geocoded.

2.7 Importing DRG Images

 This option is available only in **GPS TrackMaker Professional®**.

Digital Raster Graphics (DRG) are raster images with an extra text file where are registered the parameters of calibration. Usually DRG are paper charts that were scanned and georeferenced. The most of available DRG files are topographic charts from U.S. Geological Survey (USGS) , georeferenced in the UTM system.

To open a DRG file, click in *File > Open File* and choose the following options:

- Geocoded Tagged Image (TIF and TFW)
- Geocoded JPEG Image (JPG and JGW)
- Geocoded GIF Image (GIF and GFW)
- Geocoded BMP Image (BMP and BPW)

The text files used to calibrate the image (TFW, JGW, etc) don't possess information about the datum and the rectangular zone. When a DRG is imported, it is necessary to indicate the correct datum and the zone of the image.

TIP: Usually zone and datum are indicated close to the map legends.

Special Case of TIFF files

DRG files in TIFF format may have in the image file the complete data for calibration. So, the use of the TFW file is not necessary. These files are called GeoTiff and are opened by GTM PRO®. For further information, see the topic Importing GeoTiff Files.

2.8 Importing DXF Files (AutoCad®)

 This option is available only in **GPS TrackMaker Professional®** .

The import of DXF format can be done with data saved in geographic coordinates, rectangular systems and local grid.

To import data in DXF format, choose *File > Open File > AutoCAD DXF files*.

When importing, you must correctly indicate the datum in which the data will be saved. Through the Import Tool, you can choose the rectangular coordinate system or the starting point for data saved in a metric grid.

Importing DXF format, only the graphic elements in the *Entities* section are recognized, the *Layers* indications and other saved sections are not considered.

The following graphic elements are converted:

As Waypoints:

- POINT: Only the coordinates are registered
- TEXT: The text is registered as Waypoint comments
- MTEXT: Multiple lines are registered in *Text Box* Waypoint style

As Tracklogs:

- POLYLINE
- LWPOLYLINE
- LINE
- SPLINE (it doesn't consider curves)

The data will be imported considering the Z coordinate, which will be stored in the *Altitude* field from Waypoints and Tracklogs.

Use the *Convert Text to Lower Case* tool to change the imported text to lower case, for easier reading on the screen. For that, see the section Converting Waypoint Text to Lower case.

2.9 Exporting DXF Files (AutoCad®)

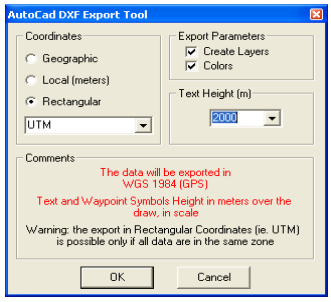
This option is available only in **GPS TrackMaker Professional®**

To export data to DXF format for AutoCAD® programs, choose *File > Save File as > AutoCad File*.

GPS TrackMaker® will make the export adopting the following criterion:

- Tracklogs and Routes will be exported as *Polylines*
- Waypoints will be exported as text and small circles, with a central point.
- The export datum will be the current datum of **GPS TrackMaker®** program

When exporting, the program will open a window with the following options:



Coordinates

Geographic: Selecting this option, the data will be exported to geographic coordinates, in decimal format and with twelve decimal places of accuracy.

Local: This option is useful when the User wants to export the data to a unusual metric system of coordinates, with origin (coordinates 0,0) defined in the lower left side of a rectangle bound to the data. This option will stay enabled, even if the data is in different zones. Though, the User must be careful when using it in the export of data that surpasses 6º of horizontal extension, because the errors in the edges can affect the data accuracy.

Rectangular : Data Export in metric system, in rectangular coordinates, with two decimal places of accuracy. This option will only be enabled if the data is in the same zone as one of the rectangular systems from **GPS TrackMaker®** coordinates. The zone indication will be omitted when exporting. For further information about rectangular coordinates systems, see Configuring Coordinates System.

Export Parameters

Create Layers: Whenever possible, this option should be selected to create five different layers that will facilitate a better visualization in AutoCAD®. The Created layers will have the following names:

- ***Comments****:* Layer of Waypoint comments
- ***Names****:* Layer of the Waypoint names
- ***Routes****:* Layer of the Routes
- ***Tracklogs****:* Layer of the Tracklogs
- ***Waypoints****:* Layer of circles and indicative points of Waypoint icons

Colors: Creates the export with the same colors indicated in **GPS TrackMaker®**. If this option is not selected, the data will be exported in black or white color, depending on the background color defined in AutoCAD®.

Text Height

Choose the maximum height of the text and of the icon from exported Waypoints, avoiding confusion when the *Zoom* tool is used in AutoCAD® environment. The height is indicated in meters and it will be shown to scale, even if the data is exported using geographic coordinates.

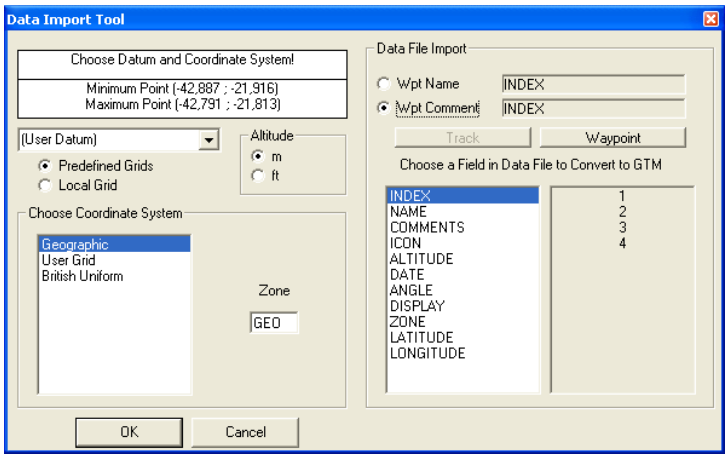
2.10 Importing Shapefiles (ArcView®)

The import of Shapefile (SHP format) files is possible in **GPS TrackMaker®**. This format is used by Arc/View® from ESRI™ and other GIS programs.

To import data in SHP format, choose *File > Open File > Arc/View Shapefiles*.

When importing, it is necessary to indicate the datum in which the data is saved. Through the Import Tool, you can choose the rectangular coordinate system or the starting point for data saved in a metric grid.

Also configure the *Altitude* option to the correct unit. Feet or meters can be chosen.



Each SHP file has a database file in DBF format that can also be read by **GPS TrackMaker®**. When importing, the *Import Tool* window will show a specific field for the DBF file, and you can choose which field of the DBF file will be transferred for Tracklog names, and also, for the Waypoint names, and for the Waypoints comment.

The following shapes are supported:

- Point
- PolyLine
- Polygon
- PointZ
- MultiPoint
- PolyLineZ
- PolygonZ

2.11 Exporting Shapefiles (ArcView®)

This option is available only in **GPS TrackMaker Professional®** .

To export data to the Shapefile format of ArcView® programs, choose *File > Save File as > Shapefile ArcView file*.

The export datum will be the current datum of the **GPS TrackMaker®**. The respective DBF and SHX files will also be created with the SHP file.

When exporting, the program will open a window with the following options:

Coordinates

Geographic: Selecting this option, the data will be exported in geographic coordinates, in decimal format and with twelve decimal places of accuracy.

Local: This option is useful when the User wants to export the data to a unusual metric system of coordinates, with origin (coordinates 0,0) defined in the lower left side of a rectangle bounded to the data. This option will stay enabled, even if the data is in different zones. Though, the User must be careful when using it with data that exceeds 6º of horizontal extension, because the errors in the edges can degrade data accuracy.

Rectangular: Data exported in metric system, in rectangular coordinates, with two places of accuracy. This option will only be enabled if the data is in the same zone as one of the rectangular systems of coordinates of **GPS TrackMaker®**.

The zone indication will be omitted when exporting. For further information about rectangular systems of coordinates, refer to Configuring the Coordinates System.

Type of data to be Exported

Waypoints: will be exported as *Points*, with the registration of all Waypoint attributes

Simple Tracks and Routes: will be exported as *Polylines*

Filled Tracklogs: will be exported as *Polygons*

2.12 Exporting XLS Files (MS Excel®)

 This option is available only in **GPS TrackMaker Professional®** .

To export data to XLS (spreadsheets of Microsoft Excel®) format, choose *File > Save File as > Microsoft Excel 2.1 Table*.

The export datum will be the current datum of the **GPS TrackMaker®** program.

Waypoints, Tracklogs and Routes will be exported in three single XLS files.

The export is made in Microsoft Excel® 2.1 format that possesses a limitation of approximately 32700 lines in each table.

Exported attributes:

Isolated Waypoints or in Routes

- Index number
- Name
- Coordinates with the current Notation of GPS TrackMaker®
- Altitude in meters or feet
- Date and hour with the current notation of the computer's regional settings
- Comments
- Icon number according to the Icon Table
- Angle of rotation of Waypoint Text
- Waypoint's display on the screen
  - *0* – Symbol with name
  - *1* – Symbol only
  - *2* – Symbol with comments
  - *3* – Symbol with comments defined by User

Tracklogs

- Tracklog name
- Index number
- Coordinates with the current Notation of GPS TrackMaker®
- Altitude in meters or feet
- Date and hour with the current notation of the computer's regional settings

Routes

- Route Name
- Waypoint's attributes

2.13 Exporting DBF Files (dBase®)

 This option is available only in **GPS TrackMaker Professional®** .

To export data to DBF (dBase®) format, choose *File > Save File as > dBase IV Database*.

The export datum will be the current datum of the **GPS TrackMaker®**.

Three files will be created for Waypoints, Tracklogs and Routes respectively.

Exported attributes:

Isolated Waypoints or in Routes

- Index number
- Name
- Coordinates with the current Notation of GPS TrackMaker®
- Altitude in meters or feet
- Date and hour with the current notation of the computer's regional settings
- Comments
- Icon number according to the Icon Table
- Angle of rotation of Waypoint Text
- Waypoint's display on the screen
  - *0* – Symbol with name
  - *1* – Symbol only
  - *2* – Symbol with comments
  - *3* – Symbol with comments defined by User

Tracklogs

- Tracklog name
- Index number
- Coordinates with the current Notation of GPS TrackMaker®
- Altitude in meters or feet
- Date and hour with the current notation of the computer's regional settings

Routes

- Route Name
- Waypoint's attributes

2.14 Importing and Exporting Files in PCX5 Format

Importing Files in PCX5 Format

Files in GRM, TRK, WPT and RTE formats are recognized in the following notations:

- dd.ddddd
- dd mm ss.ssss
- dd mm.mmmm
- UTM.
- British Grid
- German GR
- Irish Grid
- Swiss
- Swedish R90
- Taiwan 67 Grid

To import, choose *Files > Open File >PCX5 Files* option to view files with PCX5 program extensions.

Note that in data import, the Waypoint text will be configured to capital letters. Use the *Convert Text to Lower Case* tool to change the imported text to lowercase, for better readability on the screen. See topic: Converting Waypoint Text to Lower case.

Saving Files in GRM Format from PXC5

GPS TrackMaker® allows you to save files in GRM (Garmin® PCX5) program format. GRM format saves Tracklogs, Routes and Waypoints into the same file.

The data will be always saved in *dd.ddddd* notation and WGS 84 datum.

To save data in GRM format, just to choose Files > Save as > Garmin PCX5.

2.15 Importing Files in E00 Format

File import in E00 format is possible in **GPS TrackMaker®**. The program Arc/INFO® uses this format.

In **GPS TrackMaker®** the import of E00 format can be done with data saved in geographic coordinates, rectangular system supported by TrackMaker, or User's grid.

To do the import, when opening the file, choose the *Arc/INFO Export Files* option to view the files with the E00 extension.

When importing the data, indicate the datum for the data to be saved. Through the Import Tool, you can choose the rectangular coordinate system or the starting point for data saved in a metric grid.

Note that for data in the E00 format, the text will be converted to uppercase. You can use Convert Text to Lower case tool to change the imported text to lowercase, for better readability on the screen.

2.16 Importing MIF/MID Files (MapInfo®)

The import of MIF/MID format can be done with data saved in geographic coordinates, rectangular coordinates or in user's grid.

To import, when opening the file, just choose the *MapInfo Files* option to view files in MIF/MID extension.

GPS TrackMaker® recognizes most of the datum parameters automatically supported by MapInfo®, indicating which is the most appropriate datum for the import. If the MIF/MID file is recorded in geographical coordinates, the import will be direct.

However, for data saved in unknown rectangular systems, you must correctly indicate the datum in which the data was saved. Through Import tool you can also choose the rectangular system of import or the origin point for data saved in a specific metric grid.

When importing MIF/MID files, the following graphic elements are recognized:

- LINE, POLYLINE e MULTIPLE POLYLINE as simple Tracklogs
- REGION as filled Tracklogs
- POINT as Waypoints

The imported icons are:

Each MIF file has a database file in MID format that can also be accepted by **GPS TrackMaker®**. When importing, the Import tool window will show a specific field for the data from MID file, being possible to choose which text field will be transferred to Tracklogs names, and also, to the names and Waypoint comments.

2.17 Exporting MIF/MID Files of MapInfo®

This option is available only in **GPS TrackMaker Professional®**.

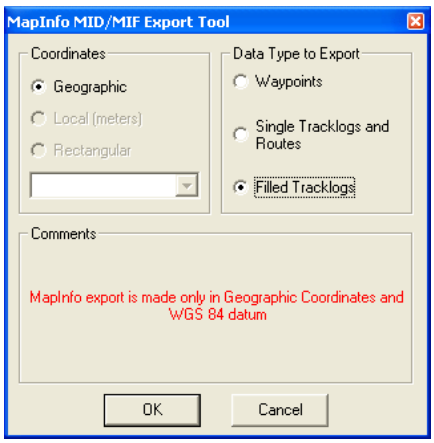
To export data in MIF/MID format of MapInfo®, click in *File > Save File as > MapInfo Files*

GPS TrackMaker® exports to MIF/MID format using the following rules:

- Tracklogs and Routes are exported as *Polylines*
- Filled Tracklogs are exported as *Region*
- Waypoints are exported as Point with support for some icons

The exported icons are:

Exporting MapInfo® files, GPS TrackMaker® will open a window with the following options:



Coordinates

The data are always exported in geographical coordinates, using decimal format with twelve decimal places. The export datum is always WGS 84.

Data type to Export

Waypoints, Routes, single Tracklogs and filled Tracklogs are exported in separated MIF/MID files.

2.18 Files Saved in Multi Media Cards (MMC and SD)

Some GPS devices supports MultiMedia Cards (MMC) and Security Digital Media Cards (SD) allowing to store a lot of Tracklogs, Routes and Waypoints. These cards need usually an USB Media Reader/Writer to transfer the data to/from the computer.

GPS TrackMaker® can recognize files stored in MMC or SD of the following GPS devices:

Lowrance iFinder® and Similar Models

The iFinder® and similar models have the capacity to store more than 50000 trackpoints, 1000 waypoints and 1000 icons that can be recorded in a single file with the USR extension.

iFinder® is able to record several USR files in a single card (MMC or SD).

To open USR files, click in *Files > Open File > Lowrance MMC Files*.
To save USR files, click in *Files > Save file as > Lowrance MMC Files*.

Magellan Meridian®, Sportrak® and Similar Models

Meridian®, Sportrak® and Explorist® families can save Tracklogs, Routes and Waypoints directly in MultiMedia Cards and Security Cards, saving in separate files. In some models, the files are saved without a defined extension.

Waypoints and Routes can be saved in a single file.

Tracklogs can be saved in separate files, having each file, a single Tracklog. They also can be saved in a single file, but the date information will be lost.

To open Magellan files saved in MMC and SD, click in *Files > Open File > Magellan MMC Files*.
To save Magellan files, click in Files > Save File as > Magellan MMC files.You must choose which data type will be saved in Magellan format.

2.19 Data Import Tool

In GPS TrackMaker®, file import can be done with data saved in geographic coordinates, saved in a rectangular coordinate system supported by GPS TrackMaker® and saved in a local grid.

The import window will appear when the User opens the file to be imported.

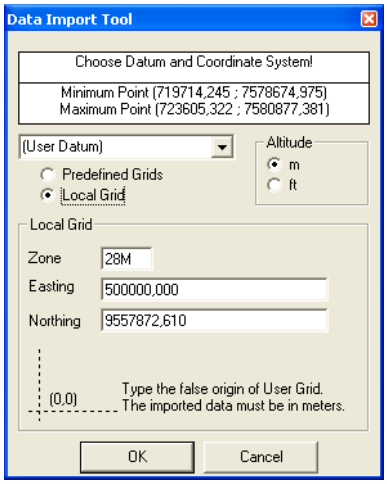
Most of the imported files don't have the datum indication in which the data will be saved. So, you must correctly indicate the datum and the zone, in cases of file import in rectangular grids such as UTM. See Datum Table to learn which are the available datum systems in GPS TrackMaker®. Also see Configuring the Coordinate System.

The wrong indication of the datum doesn't harm the import. But differences of some dozens or hundreds of meters between the real position of the data and the indication in GPS TrackMaker®'s screen can appear.

Importing data in Geographic Coordinates

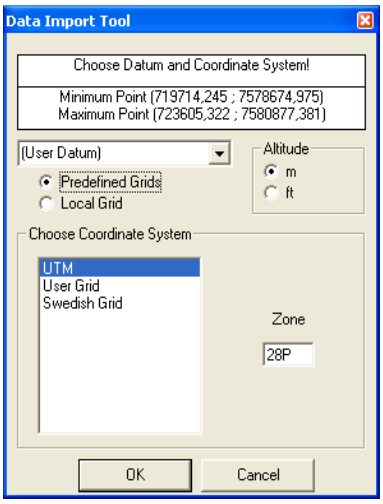
Before the file import, GPS TrackMaker® analyzes the maximum and minimum limits of the data. If the values are compatible with geographic coordinates, a window will be opened, asking for the choice of the datum in which the data will be saved and the appropriate coordinate system. To import geographic coordinates, choose *Geographic*.

Importing data in a Specific Local Grid



If the *Local* option is selected, the data will be imported, adopting a specific metric grid of an origin defined by the User.

So, avoid using data that has a horizontal width greater than 6º, because deformations created by Meridian Convergence (Grid Declination) can appear.



Importing data saved in a Rectangular System

Before the file import, GPS TrackMaker® analyzes the maximum and minimum limits of the data. If the values are compatible with some rectangular system supported by TrackMaker, the window to the side will be opened, asking for the datum in which the data will be saved, the zone and the indication of the supposed rectangular coordinate system. Choose one of the rectangular systems indicated in the list.

When importing files using rectangular grids, the wrong indication of the zone will harm the import, leading the program to recognize the coordinates of each point in an unusual way. In this case, the User must identify the data irregularity, re-doing the import in the appropriate zone. The wrong indication of the zone can displace the data hundreds or even thousands of kilometers off its real position.

2.20 Converting Blocks of Files

Sometimes it is necessary to convert all files saved in a directory to another file format. To avoid the use of "*Open File*" and "*Save File as*" repeatedly, GPS TrackMaker® offers the option to convert blocks of files automatically. To access it, click on *Files -> Convert Files* menu.

Origin Directory and File Format

Press  to choose the origin directory and the file format to be converted.

Target Directory and File Format

Press  to choose the target directory and file format.

File Conversion

After choosing the directories and the file formats, press  to start the automatic process of conversion. The names of the converted files will be shown on screen.

All files with the same extension located in the source directory will be converted to the destination format. Press  to stop the process.

Important: some files such as SHP, E00, MIF and others request some parameters of importation and exportation when opened or saved. The process of conversion will open continually the windows of importation and exportation for each file converted.

2.21 Automatic File Backup

The automatic backup increases the security against data loss caused by errors when editing or by problems in your computer. To enable it, click in ***Tools -> Options*** and mark the option ***Use Recycle Bin as backup area***.

Once enabled, whenever a file is replaced by a newer version, a copy of the old file will be sent to the Windows Recycle Bin.

To restore the old file, open the Windows Recycle Bin, right-click on the file name and choose ***Restore***. The backup files are removed when the Recycle Bin is emptied.

3 Waypoints

3.1 Creating, Editing and Deleting Waypoints

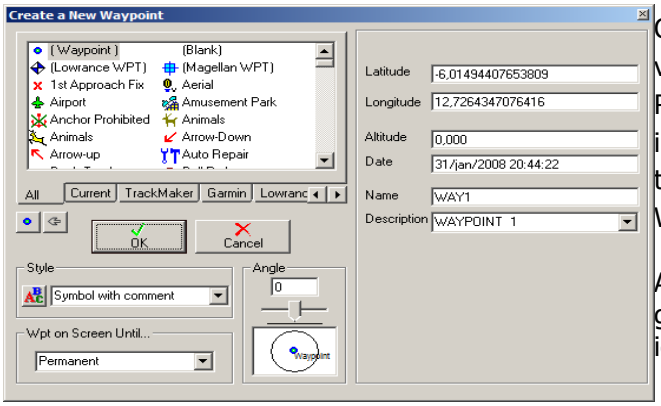
Waypoints are geodesic points stored in the GPS receiver's memory and can be transferred to the PC using the GPS TrackMaker® program. Usually they represent specific places, such as cities, squares, bridges, crossings, etc. A Waypoint has the following components:

- Latitude
- Longitude
- Name up to 10 characters
- Comments up to 255 characters
- Rotation angle of the Waypoint Text
- Creation date
- Altitude of the Point
- Visualization in the screen
- Specific graphic symbol

After being transferred to the PC, all Waypoint data can be easily modified using the GPS TrackMaker® program.

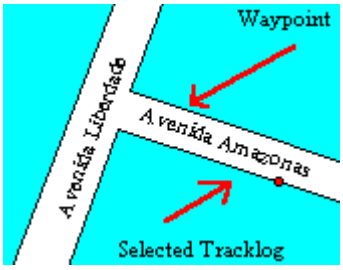
To show or hide all Waypoints, click on the button or press **<CTRL W>.**

Creating a Waypoint



Creating a Waypoint in GPS TrackMaker® program is a very simple task. Just press the *Pencil* tool or the Route Creation Tool located on the drawing tool bar or in the *Tools* menu and, using the left mouse button, click at the point on the screen where you want to create a new Waypoint.

A creation window will be displayed allowing to change the geodesic coordinates of the point, the display scheme , the icon, the name and comment and other fields.



To facilitate the creation of Waypoints with text rotation, select a Tracklog or Route segment and then create the Waypoint, The angle of the text will be the same as the Tracklog or Route. This feature facilitates the creation, for example, of urban maps, where the name of each street or avenue has the inclination of the street or avenue. In the example, Waypoints were created without icons.

Each Waypoint has a screen visualization style that can be modified through the **Waypoint Styles** button. The four basic styles defined in **GPS TrackMaker®** are:

Symbol with Name: The reduced name is shown in the screen together with the icon
Symbol Only: Only the icon is shown in the Screen
Symbol with Comments: The comment is shown in the screen together with the icon
Text box: Special visualization mode that shows comments on the screen in multiple lines. The icons and the text rotation are not shown in this visualization mode.

Waypoint on Screen until...

In this field, the User can define the parameters of the scalable Waypoint.

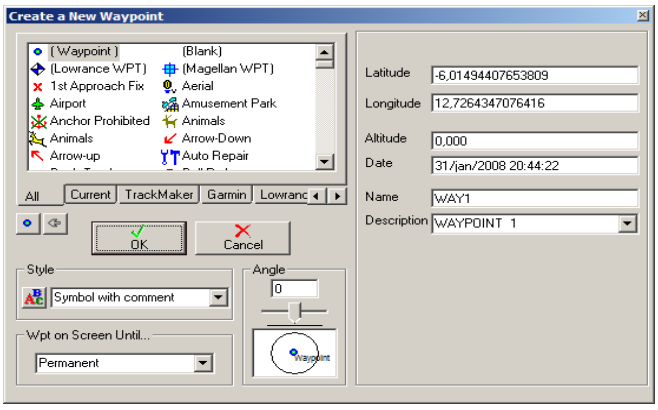
The text box has a Predefined list of values to the scalable Waypoints:

Permanent:Text that always stays on the screen
Country: Used in the indication of names of large size countries
State Large: Names of large size states or medium size countries
State Medium: Names of medium size states or small size countries
City Large: Names of large metropolises
City Medium: Names of medium size cities
City Small: Names of small cities or villages
Urban Area: Indication of metropolitan areas
Neighborhood: Suburbs or small details on map
Highway: Value suggested for highways or for small details on maps
Avenue: Avenues and small details on maps
Street: Suggested value for very small details on maps

Creating a default Waypoint

If you need to use frequently a Waypoint with the same icon and text style, it is a good idea to create a *default Waypoint.* Every time a Waypoint is created, the default style will be applied. To define a default Waypoint, choose a icon and define the text style and the rotation angle and press 

Editing an existing Waypoint



To Edit a Waypoint is as easy as creating it. First, press located on *Drawing Toolbar*. With the *Detect Elements* button pressed, place the mouse pointer over the Waypoint icon until a small circle appears around the icon. Then click with the right mouse button until a Waypoint Edit window is displayed. Do the necessary changes and press OK.

Waypoint edition can be made easily through spreadsheets of GTM PRO®. See the topic Data Edition in Table.

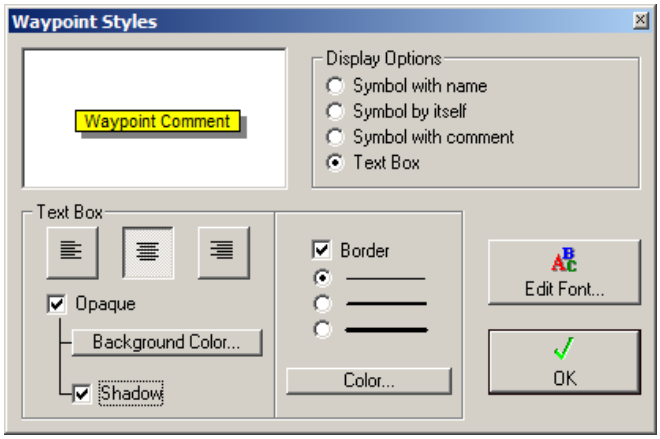
Deleting a Waypoint

To delete a Waypoint, first select it. For that, see Selecting Data.

Once the Waypoint is selected, press DEL to delete it from the memory.

3.2 Editing Waypoint Styles

The Waypoint Style window can be opened through the Waypoints Editing window, by pressing the button . To know more about the Waypoint Editing window, see the section Creating, Editing and Deleting Waypoints.



The Waypoint Style window has the following fields:

Visualization Area of Waypoint Text

This field displays how the Waypoint text will be shown in screen. The characteristics of the font used can be changed through the <**Edit Font**> button. The background color of the text box is also displayed when this option is chosen in the styles list.

Options for Text Box

The Options for Text Box are enabled only when the User chooses the Text Box option in the style list. Text box is a special visualization mode that shows Waypoint comments in multiple lines on the screen. The icons and the text rotation are not shown in this visualization mode, and only the first line is sent to GPS, because most receivers are only capable of saving one line.

The ***Opaque*** option allows to apply a color background in the Text Box.

The <**Color**> button allows changing the background color of the Text Box.

The ***Shadow*** option allows to apply an 3D effect in the Text Box, with a shaded on background.

The ***Border*** option allows to define the thickness and the color of the border line of the Text Box.

Predefined Styles List

The list of Predefined styles is similar to the available list in a Garmin® GPS, with additional Styles available in the **GPS TrackMaker®**. To modify the characteristics of each style, click on the Style and modify the configurations in the other fields.

Predefined styles are:

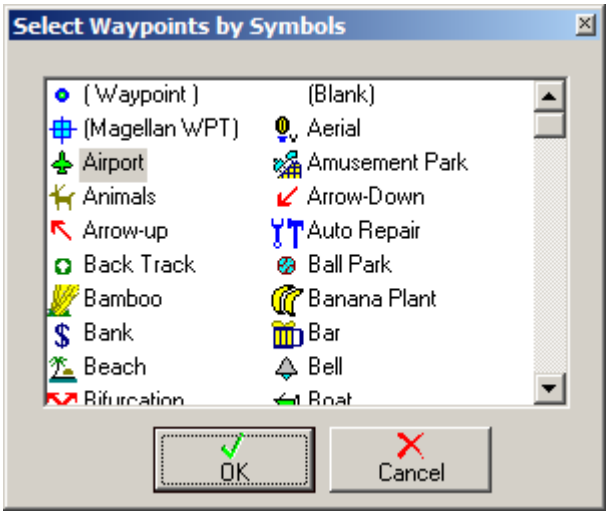
Symbol with Name: Shows the icon with the Waypoint name
Only Symbol: Shows only the icon
Symbol with Comments: Shows the icon with the Waypoint comment
Text Box: Shows the comments in a Text Box without the icon

 **<Edit Font> Button**

Press this button to modify the font characteristics from the selected style in the styles list. Font name, size, color, boldface, italics, underline, etc can be modified.

3.3 Selection of Waypoints Through Icons

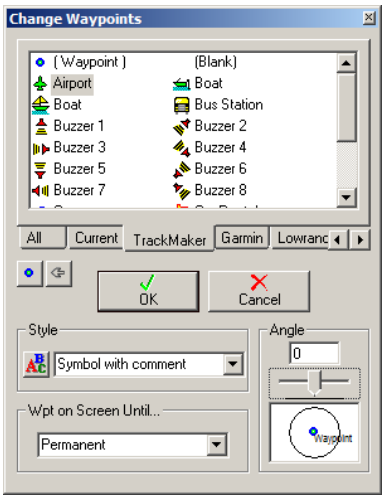
To select Waypoints through icons, press the button located on the Tool Bar. A window indicating only the icons used in the file will appear. Just click on one of the icons and the program will select all the Waypoints that have that same icon.



3.4 Modifying Several Waypoints at the Same Time

To change the icon and the view mode of several Waypoints at the same time, first select the desired Waypoints through selection tools already described in Selecting Data.

With Waypoints selected, press the button on the Tool Bar, and choose a new icon or a new visualization mode. Press <**OK**> and all selected Waypoints will have that chosen icon or chosen view mode.



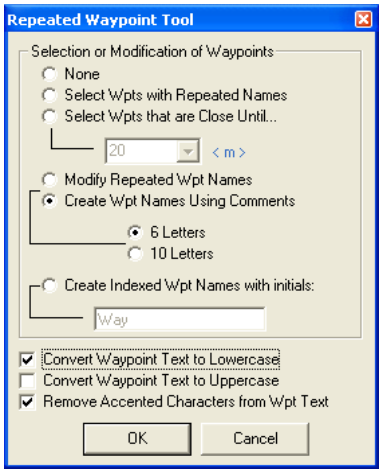
The available view modes are:

- **Symbol with Name** : shows the icon with Waypoint name
- **Symbol by Itself**: it shows only the icon
- **Symbol with Comment** : it shows the icon with Waypoint comment
- **Text Box**: it shows the icon with Waypoint comment in special text configured in *Options* in *Tools* menu

3.5 Treating Repeated Waypoints

Frequently, after many downloads from the GPS or after merging files, the program stores a lot of repeated Waypoints, harming the data manipulation.

To eliminate repeated Waypoints or to modify them, press the button on the Tool Bar or select the *Repeated Wpts Tool* option in the *Tools* menu.



Selecting Waypoints with Repeated Names

With this option enabled, all Waypoints with the same name will be selected.

Selecting Close Waypoints

This option will select all the repeated or close Waypoints, allowing the User to verify which Waypoints are in a same point or very close.
The User can define the maximum distance in meters or yards between two Waypoints so that the correct Waypoints are selected. Sometimes repeated Waypoints are close, but have minor variation in their coordinates. Choosing the distance, the User can define a maximum selection area. This way, any Waypoint that is in this range will be selected, without depending on having the same icon, name or comment.

Modifying Repeated Names of Waypoints

Several GPS models don't accept repeated names for Waypoints. Choosing this option, the program will modify all the repeated names of Waypoints, creating an index number in the end of each repeated Waypoint, as follows: *WAYPON, WAYPO1, WAYPO2...*

The index number will be inserted respecting the maximum size of 6 or 10 characters of the Waypoint name.

Creating Names of Waypoints from the Comments

This option creates names for Waypoints, from its written comments. Several GPS models don't have the field *Waypoint Comment*, having only the field *Waypoint Name*. For these models, the name must contain a clear indication of Waypoint, so that it is possible to uniquely identify it without the need of the *Waypoint Comment* field.

The examples below indicate how **GPS TrackMaker®** creates names from the Waypoints comments:

- New York Downtown (NYDOWN (6 characters) / NYDOWNTOWN (10 characters)
- San Jean Pied Port (SJPPOR (6 characters) / SJPPORT (10 characters)
- San Pedro de Atacama (SPATAC(6 characters) / SPATACAMA (10 characters)
- Sao Sebastiao de Aguas Claras (SSACLA (6 characters) / SSACLARAS (10 characters)

Creating Indexed Names of Waypoints

This option creates an indexed list of names for the Waypoints. It is necessary to choose the initial name.

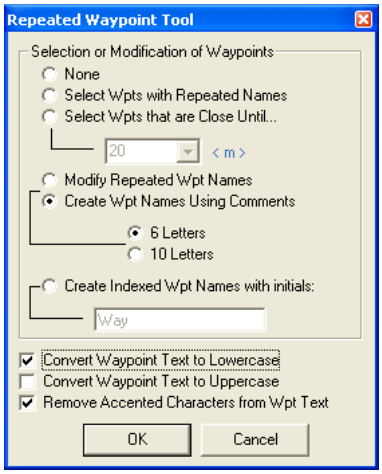
Example: for *WAY*, the names will be *WAY1, WAY2,WAY3…*

Convert Text to Lowercase: Selecting this option causes the text of all Waypoint comments in the computers memory will be converted to lowercase with its first letter in uppercase, for better readability on the screen.

Convert Text to Uppercase: In the same way, the text of names and comments of all Waypoints can be converted to uppercase.

3.6 Converting Waypoint Text to Lowercase

To convert Waypoints text to lowercase with first letter in capital, press the button on the Tool Bar and select the *Convert Text to Lowercase* option, and then press the **OK** button.



The comment texts of all Waypoints in the memory of the computer will be converted to lowercase with its first letter in uppercase, for better readability on the screen.

In GPS TrackMaker Professional®, click on *Tools -> Waypoints -> Convert Txt to -> Lowercase.*

4 Tracklogs

4.1 Creating, Editing and Deleting Tracklogs

Tracklogs are sequences of specific geodesic points stored in the memory of a GPS receiver and can be transferred to the PC using the GPS TrackMaker® program. Usually they represent trails done with the GPS, such as highways, avenues, streets, hiking trails, fences, walls, etc. It's like leaving a trail of breadcrumbs as you're traveling. A Tracklog can be represented by one or more straight segments, ending in points called *Tracklog Points* They are composed of:

- Latitude
- Longitude
- Date and time when the Tracklog was registered by the GPS receiver
- Altitude in relation to the sea-level

After being transferred to the PC, all Tracklog data can be modified using the **GPS TrackMaker®** program. Tracklogs are represented by continuous segments of straight lines with colors and styles defined by User.

To show or hide Tracklogs, click on the button  or press **<CTRL T>.**

Creating a Tracklog

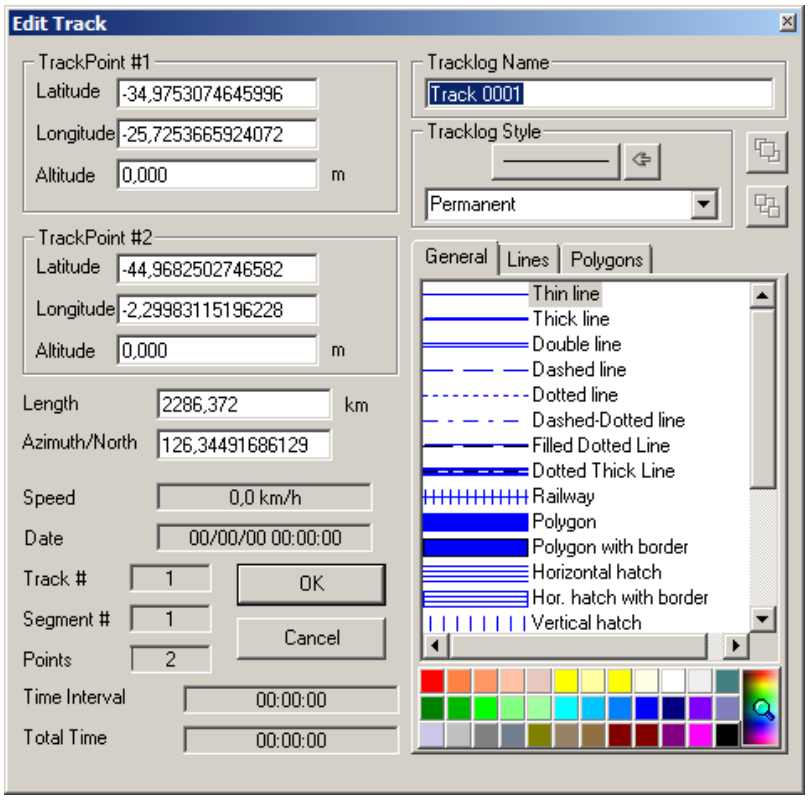
To create a Tracklog in **GPS TrackMaker®** program is a very simple task. Just press the *Pencil* tool located on toolbar or  in the *Tools* menu, and with the left mouse button, click and hold on the point of the screen where you want to begin the Tracklog and drag it to the point where you want to mark the end of the track. Then release the mouse button. Date is not implemented on the Tracklog records, because it could cause mistakes, indicating wrong speeds on the segment.

You can also use the Drawing Tools to create Tracklogs in many forms.

 Tracklogs can be created through spreadsheets of GTM PRO®. See the topic Data Edition in Table.

Editing a Tracklog

To edit Tracklogs, press *Detect Elements* Button  and Selection Tool  Click on a Tracklog segment and wait until it's color changes. Then, press the right mouse button so the editing window will appear.

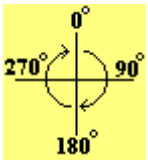


In this window, the following data related to the track can be changed:

- **Geodesic coordinates (latitude/longitude) of the segment points**
  To change the coordinates, verify the Coordinate System, defined under *Options*, in the *Tools* menu.

- **Length of the segment**
  Changing the length causes the change of the geodesic coordinates of the second point of the Tracklog segment, which is done automatically by the program. Verify the Length Unit of Measurement defined under *Options* in the *Tools* menu.

- **Azimuth of the segment (Bearing)**



The azimuth must be between 0º and 360º (as shown). The reference will be the true axis North-South when the program is configured for geographic coordinates (Azimuth/North). In rectangular systems such as UTM systems, if the segment is contained in only one zone, the reference will be the north-south axis of the grid (Azimuth/Grid). A change of the angle will necessarily imply the modification of the geodesic coordinates of the second point of the segment

To change the notation of the azimuth, see Configuring Azimuth Angle.

- **Tracklog Name**
  Each Tracklog can have a name for identification or a small text that individualizes it. This name or text can be searched through dialog box *Tracks and Routes* located in Tool Bar 2.

- **Tracklog Style**
  The User can choose one of several available styles. For convenience, the program provides a defined list with suggestions of several styles, as indicated below:
  - Blue Major Highway
  - Red Major Highway
  - Principal Road
  - Arterial Road
  - Principal Street
  - Paved Street
  - All Weather Unpaved Road (unpaved road in good conditions)
  - 4WD Trail (precarious unpaved road)
  - Hiking/Bike Trail
  - River/Canal
  - Big River
  - Intermittent River
  - Railway
  - Freight Railway
  - Tourist Railway
  - Forest Boundary
  - Ferry Boat Line
  - Contour Line (Main)
  - Contour Line (Secondary)
  - Contour Line (Detail)
  - Depth Contour Line (Main)
  - Depth Contour Line (Secondary)
  - Depth Contour Line (Detail)
  - County Boundary
  - Interstate Boundary
  - International Boundary
  - Green Map Border

The Filled Predefined Tracklogs are:

- Hidrography I
- Hidrography II
- Earth Surfaces
- Wetland
- Metropolitan Area
- Building Area
- Military Area
- Airport Area
- Cemetery Area
- National/State Park
- Urban Area
- Desert Area
- Swamp Area
- Glacier Area
- Mountainous Area
- Yellow Map Background

- **Tracklog Color**
  The Tracklog color can be modified, through the *Tracklog Color* Button.

- **Tracklog Style Default**
  To apply the style default, press the *Default* button.

- **Defining a Tracklog as default**
  Press the button  to define the selected Tracklog as default. This default will be used each time the *Default* button is pressed.

- **Sending Tracklog to back**
  With the button  pressed, the edited Tracklog will be totally sent to the back of the other Tracklogs. However, the change will be made only after pressing OK button.

- **Bringing Tracklog to front**
  With the button  pressed, the edited Tracklog will be totally sent to the front of the other Tracklogs. The change will be made only after pressing OK button.

- **Scale - Scalable Tracklogs**

You can set the level of zoom for which the selected Tracklog remains displayed. When the set value is exceeded, the Tracklog will no longer show but will still exist.

Text Box has a predefined list of values for scalable Tracklogs:

Permanent: Tracklog always stays on screen
Country: Used to designate boundaries of large size countries
State Large: Designates large size states or medium size countries
State Medium: boundaries of medium size states or small size countries
City Large: boundaries of large metropolises
City Medium: boundaries of medium size cities
City Small: boundaries of small cities or villages
Urban Area: boundaries of metropolitan areas
Neighborhood: Suburbs or small details in map
Highway: Value suggested for highways or for small details in maps
Avenue: Avenues and small details in maps
Street: Suggested value for very small details in maps

You can view the following data in the edit window:

- Date in which the Tracklog was recorded by the GPS receiver (Date)
- Tracklog number (Track #)
- Tracklog segment number (Segment #)
- Time spent (in days, hours, minutes and seconds) on the accomplishment of the Tracklog (Time Interval)

Complete Tracklog edition can be made easily through spreadsheets of GTM PRO®. See the topic Data Edition in Table.

Deleting a Tracklog

To delete a Tracklog or one of its segments, first select it. For that, refer to Selecting Data
Once the Tracklog or segment is selected, just press DEL to remove it from memory.

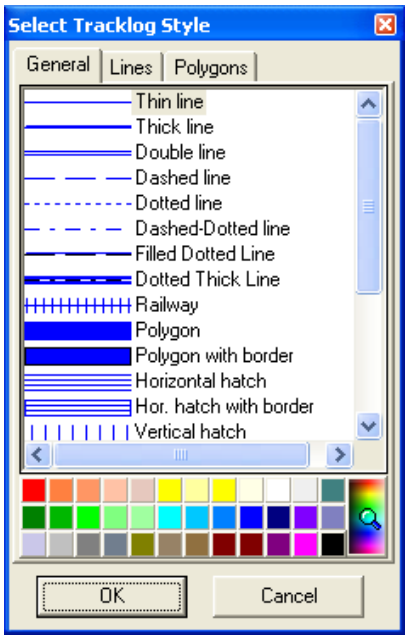
Uniting Tracklogs

Tracklogs can be united easily with the Drawing Tools. Visit the topic Uniting Tracklogs and Routes with the Drawing Tools.

4.2 Selecting Tracklogs by Style

This function is useful when used with the Editing Several Tracklogs at the same time.

To select Tracklogs by style, press the button in the Toolbar. A window will appear asking which style and color of Tracklogs will be selected. After choosing one of the styles and its color, press the **<OK >** button. The program will select all Tracklogs with that same style.



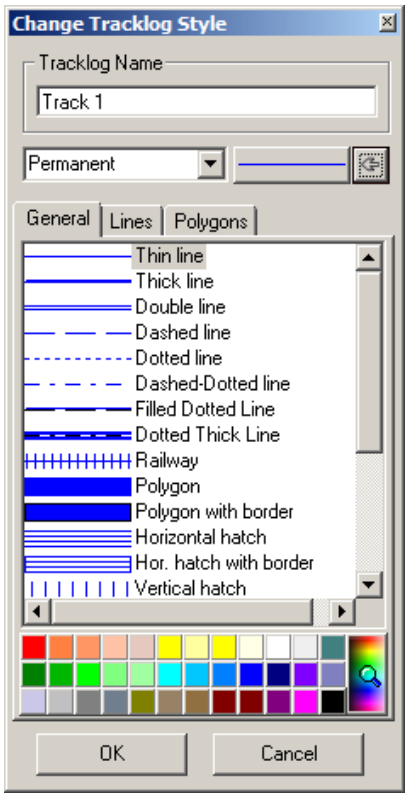
To aid in the procedure, select a Tracklog (see Selecting Data) before pressing the button . If done, the style of the selected Tracklog will be automatically shown in the Selecting Tracklogs by Styles window.

Don't forget that to show Tracklogs by styles, the button located in the Tool Bar must be released; otherwise, Tracklogs will be shown in different colors.

4.3 Editing Several Tracklogs at the Same Time

To change the color, style and name of several Tracklogs at the same time, select the desired Tracklogs through the selection tools already described in Selecting Data. Then press the button on the Tool Bar.

The Tracklog style editing window will appear with the following options:



Tracklog Name

Each Tracklog can have a name for identification or a small amount of text that individualizes it. This name or text later can be searched through the *Tracklogs and Routes* box on the Tool Bar.

Tracklog Style

You can opt for one of the several available styles. To facilitate the choice, the program gives a defined list with suggestions of several styles, as indicated below:

- Blue Major Highway
- Red Major Highway
- Principal Road
- Arterial Road
- Principal Street
- Paved Street
- All Weather Unpaved Road (unpaved road in good conditions)
- 4WD Trail (precarious unpaved road)
- Hiking/Bike Trail
- River/Canal
- Big River
- Intermittent River
- Railway
- Freight Railway
- Tourist Railway
- Forest Boundary
- Ferry Boat Line
- Contour Line (Main)
- Contour Line (Secundary)
- Contour Line (Detail)
- Depth Contour Line (Main)
- Depth Contour Line (Secundary)
- Depth Contour Line (Detail)
- County Boundary
- Interstate Boundary
- International Boundary
- Green Map Border

The Filled Predefined Tracklogs are:

- Hidrography I
- Hidrography II
- Earth Surfaces
- Wetland
- Metropolitan Area
- Building Area
- Military Area
- Airport Area
- Cemetery Area
- National/State Park
- Urban Area
- Desert Area
- Swamp Area
- Glacier Area
- Mountainous Area
- Yellow Map Background

Tracklog Color

The Tracklog color can be modified, through the ***<Tracklog Color>*** button.

Scalable Tracklogs

The parameters of the Tracklog scale can be defined through the scale box. The scalable Tracklog stays on screen until the defined scale is exceeded. Then the Tracklog will be hidden. For further information, see Scalable Tracklogs.

Default style of the Tracklog

To apply the default style, just press the button with the image of the Tracklog Default.

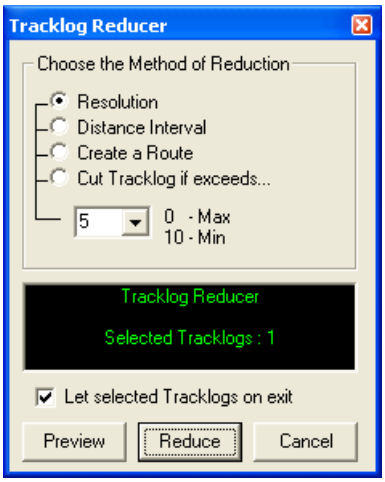
Defining a Tracklog as Default

To define the chosen Tracklog as default, press the  button. This pattern will be used every time that the program creates a new Tracklog or imports it from a file that is not standard GTM.

TIP: to show Tracklogs by style, the button  located on the Tool Bar must be released, otherwise, Tracklogs will be shown in different colors.

4.4 Reducing Tracklog Size

Tracklog Reducer function, accessed through the button allows you to reduce the size of a Track, reducing track point's number in accordance with the reduction level chosen by the User, letting you transfer a more compact Tracklog to the GPS, that occupies less memory.



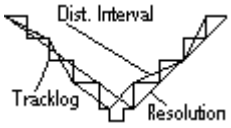
It is obvious that any reduction of a Tracklog can cause loss of precision, however, you must estimate if that loss will harm the navigation. Most of the time that won't happen.

The *Tracklog Reducer* function won't delete the old Track, allowing you to compare and to estimate if the reduction is adequate.

To access the reduction Tracklog window, first it is necessary to select one or several Tracklog segments using one of the selection tools indicated in Selecting Data. Then, press the button in Tool Bar or choose *Tracklog Reducer* option in *Tools* menu.

The reduction window will open with the following options:

- **Reduction Levels**: 0 - maximum level ▪ 10 - minimum level
- **Resolution**: This option allows the maximum reduction possible, best for large Tracklogs with several Trackpoints. The program verifies if Trackpoints are aligned into the same horizontal plane, reducing the several segments of lines that present little pronounced deflection to just two points.
- **Distance Interval**: Basically in this option, the program establishes a maximum fixed distance defined by the reduction level and it divides the Tracklog, establishing distance intervals relatively fixed. It is a reduction technique that presents a larger amount of Trackpoints in relation to the *Resolution* system, allowing for a better precision.
- **Create a Route**: In this option, the program creates a Route following the Tracklog, having as many Route points as are established by the User. This option is especially useful when the User doesn't need a lot of precision in Tracklog indication, setting the whole memory of the GPS free so new Tracklogs can be stored.
- **Cut Tracklog if exceeds:** this option limits the maximum number of vertexes, dividing the Tracklog in smaller parts with maximum number of vertexes specified in the text box. This option doesn't affect the details and the precision of the Tracklog.
- **Selects Old Tracklog on Exit**: Enabling this option, the program will select the old Track on exit, allowing you to delete the Tracklog when exiting from the Tracklog Reducer window.



The illustration on the side shows the differences between the *Resolution* method and the *Distance Interval* method. The *Resolution* method just considered 3 points for the reduction while the *Distance Interval* method considered 7 points. The Tracklog was reduced to 14% of the original size in the first method and to 32% in the second method.

Before doing the reduction, press the ***Preview*** button and it will show a report indicating the number of selected Tracklogs, the total number of Trackpoints of the selected Tracklogs, the total of Trackpoints after reduction, and the reduction rate as a percentage.

The reduction will only happen if the <**OK>** button is pressed.

4.5 Showing Tracklogs by Colors

To show Tracklogs in different colors, instead of styles, just press the button 

The advantage of this view mode is to distinguish the several segment groups of each Track. The screen will also refresh faster in this mode than in the tracklogs by styles view mode.

4.6 Tracklog Union Tool

In GTM PRO® you can use the *Tracklog Union* tool to combine different Tracklogs that have common extremities. Just select the Tracklogs that you want to combine and then press the <**CTRL U**> or the button 

The *Tracklogs Union* tool is very useful when you want to have just one Tracklog for filling purposes. The illustration to the side is an example of some Tracklogs with common extremities before and after the use of the Tracklogs Union tool. Notice that after the union, only one Tracklog remains created from the union of the other Tracklogs.

To facilitate the visualization of several different Tracklogs that have common extremities, it is advisable to keep the button  pressed.

Configuring the *Tracklog Union* Tool

Clicking on the arrow beside the button  , the following options are accessed:

- ***Distance of Union*** **:** choose the maximum distance that the extremities are united. Zero indicates that the extremities only will be united if the points are coincident.

Unite Tracklogs:

- ***With Same name :*** Only Tracklogs with same name are united.
- ***With same Style :*** Only Tracklogs with same style are united.
- ***With same Color :*** Only Tracklogs with same color are united.

If two or more options are selected, the union is made only if all conditions are true.

TIP: for further information about Tracklog/Route union, see Uniting Tracklogs and Routes with the Drawing Tools.

4.7 Uniting Tracklogs and Routes with the Drawing Tools

Different Tracklogs can be united with the following Vector Drawing Tools.

Pencil Tool

Handfree Drawing Tool

Line Drawing Tool

To unite Tracklogs, press the *Detect Elements* button and one of the tools listed above. Place the mouse arrow on the extremity of a Tracklog, press the left button and drag the mouse to the other extremity of Tracklog. To conclude the union, release the left button if you are using the pencil tool or click again for the other tools.

To unite Routes, press the *Detect Elements* button and the Route Creation Tool button . Place the mouse arrow on the extremity of a Route, press the left button and drag the mouse to the other extremity of Route. To conclude the union, release the left button.

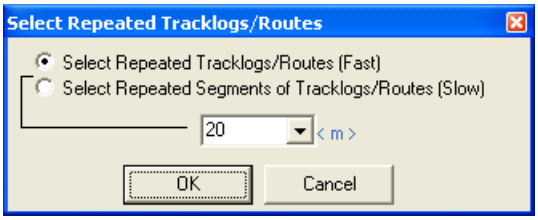
If you wish to open a window to confirm the union, see the topic Configuring the Behavior of the Program.

Note: Tracklogs and Routes cannot be united.

4.8 Selecting Repeated Tracklogs

Frequently, after several downloads from GPS or after the use of *Merge File*, the memory is filled with a lot of repeated Tracklogs, harming the data manipulation.

To select repeated Tracklogs to delete or edit them, press or click in Tools> Tracklogs/Rotes > *Select Repeated Tracklogs*.



Select Repeated Tracklogs/Routes
This option allows a fast search of repeated Tracklogs and Routes, considering only some basic information as number of points, initials and final coordinates, similar length, etc.

Select Repeated Segments of Tracklogs/Routes

Option for complete comparison of repeated Tracklogs/Routes, allowing to select repeated segments of Tracklogs and Routes. Information about distance and length of each segment are considered, leaving the comparison process slow.

Configuring the Maximum Distance of Comparison

The verification of repeated Tracklogs/Routes is made with a defined tolerance in meters or yards. Larger the value, more Tracklogs/Routes can be selected.

Zero or *Exact* defines the selection of repeated Tracklogs/Routes located exactly in the same position, without any degree of tolerance.

Aborting the Process

Press ESC Key to abort the verification process.

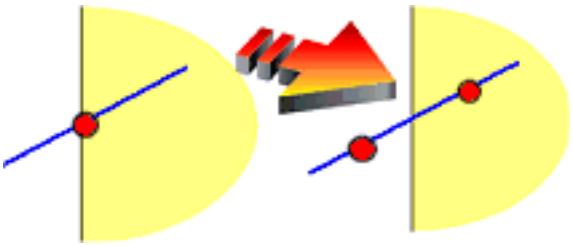
4.9 Scalable Tracklogs

It is possible to set the distance level for which the selected Tracklog remains displayed. When the set value is exceeded, the Tracklog will no longer show but will still exist. The Text Box has a predefined list of values for scalable Tracklogs. They are only examples, and the User must adapt to his needs.

Permanent: Tracklog that always stays in the screen
Country: Used in the indication of boundaries of large size countries
State Large: Boundaries of large size states or medium size countries
State Medium: Boundaries of medium size states or small size countries
City Large: Boundaries of big size metropolises
City Medium: Boundaries of medium size cities
City Small: Boundaries of small cities or villages
Urban Area: Boundaries of metropolitan areas
Neighborhood: Suburbs or small details in map
Highway: Value suggested for highways or for small details in maps
Avenue: Avenues and small details in maps
Street: Suggested value for very small details in maps

4.10 Fragment Tracklog Tool

Fragment Tracklog Tool is used to divide Tracklog that cut other Tracklogs, allowing the edition and deletion of part of segments. In the intersection points of the Tracklogs, new points are created, fragmenting the segment in two or more parts.



The side picture shows the intersection of two Tracklogs before and after the Fragmentation. Note that after fragmenting, the segment was divided in two parts, creating an extra point exactly in the intersection.

To use the Fragment Tracklog Tool, first select the Tracklogs and click in *Tools > Tracklogs/Routes > Fragment Tracklog* menu or click in . After using fragment tool, only the fragmented Tracklogs will remain selected.

4.11 Applying Altitudes in Contour Lines

This option is available only in **GPS TrackMaker Professional®**.

Contour lines are imaginary lines that represents the same altitude on the terrain. Using GPS TrackMaker®, it is possible to create Tracklogs with the same altitude to represent the Contour Lines of the terrain. For that, it is necessary to apply a same altitude in the whole Tracklogs.

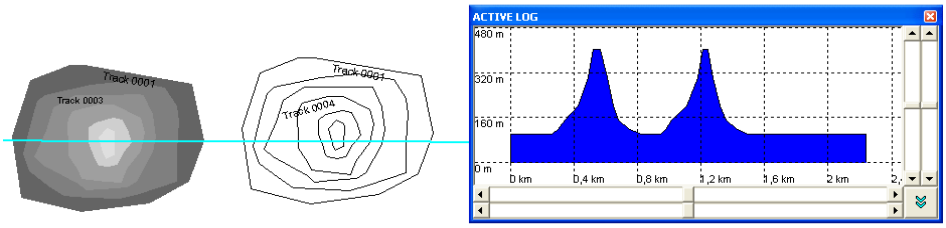
To create a Contour Line, select the Tracklog which will be applied the altitude and click in Tools > Tracklogs/Routes > Apply Altitudes in Contour Lines or click in . Then type the altitude and press **<OK>**.

Also see Creating Altitude Profile Starting From Contour Lines

4.12 Creating Altitude Profile Starting From Contour Lines

This option is available only in **GPS TrackMaker Professional®**.

Contour lines are imaginary lines that represent the same altitude on the terrain. The altitude is the vertical distance above the mean sea level.



GTM PRO® allows the creation of altitude profiles starting from contour lines represented by Tracklogs. To create the altitude profile from a group of contour lines, create a Tracklog with the *Pencil* tool , with just one segment crossing the contour lines. Then, select the created Tracklog and click in or in *Tools* > *Tracklogs/Routes* > *Create Tracklog of Altitude Profile*.

The Tracklog will be fragmented in the intersection points of the contour lines, registering the altitudes of each contour line. The Altitude Profile window will be opened, showing the altitudes of the Tracklog.

Also, see Applying Altitudes in Contour Lines

4.13 Vector Drawing Tools

Pencil Tool

 - draws isolated segments of Tracklogs and creates Waypoints.

To create a segment of Tracklog, press the left button and drag the mouse to the new position. Release the left button to create the segment. For further information, see Creating, Editing and Deleting Tracklogs.

To create a Waypoint, see Creating, Editing and Deleting Waypoints.

Route Creation Tool

 - draws isolated segments of Routes and creates Waypoints.

To create a Route segment, place the mouse arrow on a Waypoint or on the extremity of a Route, press the left button and drag the mouse to other Waypoint or other extremity of Route. Release the left button to create the Route segment.

A Route can be created only if in its extremities there is another Route or a Waypoint. See the topic Creating, Editing and Deleting Routes.

To create a Waypoint, see Creating, Editing and Deleting Waypoints.

Handfree Drawing Tool

 - draws freely Tracklogs with multiple points.

Press the left button of the mouse and draw freely the Tracklog, maintaining the left button pressed. To conclude the Tracklog, release the left button. The number of points will be shown in the status bar at the bottom of the screen.

Line Drawing Tool

 - draws Tracklogs with multiple points with segments of lines.

Click on time with left button at the beginning point and drag the mouse to the new position. It is not necessary to drag the mouse with the left button pressed.
Each click with the left button creates a new vertex of the Tracklog.
To conclude the Tracklog, click with the *right* button of the mouse.

Shape Drawing Tool

Shape Drawing Tools allow to create Tracklogs with predefined forms. The drawing is made in two stages:

1 – Press the left button and drag the mouse to the new position, maintaining the left button pressed. To conclude the drawing, release the left button.

2 – Moving the mouse, the drawing will be rotated. Clicking with the **left** button of the mouse, the drawing will be concluded with e chosen angle. Clicking with the **right** button, the drawing will be concluded without rotation.

TIP: to draw regular forms, drag the mouse with the **<SHIFT>** key pressed.

The available Shape Drawing Tools are:

 Rectangle

 Rounded Rectangle

 Elipse

 Triangle

 Pentagon

 Hexagon

 Octagon

Open Window When Creating a New Tracklog

The  button opens the window of Tracklog Edition when the first Tracklog segment is created, allowing to change the Tracklog name and other attributes. This resource is useful when creating urban maps, allowing to type names of streets and avenues in the moment they are created.

4.14 Tracklog Labeling

Automatic Tracklog Labeling allows to view the name of the Tracklogs on screen, avoiding name overlaps. This function is useful to view urban maps, showing streets and avenues with their names automatically. Usually the name is shown beside the largest Tracklog segment.

To enable the Tracklog labeling, click in button  and choose *Tracklog Labeling* option.

Eventually, if a name does not appear, use the button  to zoom in the Tracklog.

To configure the size and color of the label text, click in *Tools > Options > General > Track Labels*. The characteristics of the label text are saved in GTM files.

Note: The names of Routes will be shown the same way of the Tracklogs.

5 Routes

5.1 Creating, Editing and Deleting Routes

Routes are sequences of Waypoints stored in the memory of a GPS receiver as straight segments and they can be transferred to the PC using the **GPS TrackMaker®** program. Usually they represent the Route to be traveled by the User. Using Routes, the GPS defines a whole navigation system, indicating which direction the User must take.

A Route has the following structure:

- **Route name**
- **Route number**
- **Sequence of the Waypoints of the Route**

The **GPS TrackMaker®** program treats Routes in many aspects the same way as it treats Tracklogs. However, there are some basic differences that must be noted. After transfer to the PC, GPS TrackMaker® can modify most of the Route data. Dashed segments (in 10 possible colors) represent the Routes.

To hide or to show Routes, click on the button  or press **<CTRL R>.**

Creating a Route

A Route can be created only if in its extremities there is another Route or a Waypoint; if not, a Tracklog will be created. A Route is more complex than a Track, as it contains all Waypoint information for each extremity, as well as the Route name.

Creating or editing a route in **GPS TrackMaker®** is very similar to creating a Tracklog. The program shows Routes on the screen, independently of showing the Waypoints of its extremities. Actually, the Waypoints from Routes are stored independently of other Waypoints on the screen. So, if you want to edit a Waypoint from a Route, you must edit the Route itself, modifying the internal Waypoints.

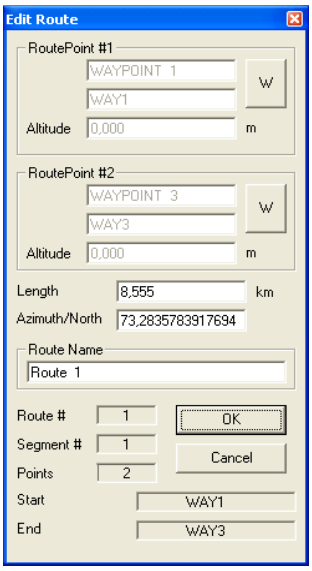
Important: the Waypoints of Routes are always internal and independent from other Waypoints.

To create a Route, press  located on Drawing Toolbar. Click with the left mouse button on a Waypoint or on the extremity of another Route and drag the mouse to the next Waypoint or Route extremity. The Routes are shown with dashed segments.

 Routes can be created through spreadsheets of GTM PRO®. See the topic Data Edition in Table.

Editing a Route

Route editing is done only on isolated segments. Press *Detect Elements* button and Selection Tool and move mouse pointer close to a Route segment and wait until its color changes. Then, press the right mouse button so the editing window will appear.

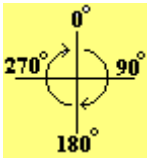


<u>In this window, the following data related to the Route can be changed:</u>

- **Length of the segment**

Changing the length causes the change of the geodesic coordinates of the second point of the segment, which is done automatically by the program. Verify the Length Unit of Measurement defined under *Options* in the *Tools* menu

- **Azimuth of the segment (Bearing)**



The azimuth can be defined by the User and must be between 0º and 360º (as shown). The reference will be the true axis North-South when the program is configured for geographic coordinates (Azimuth/North). In rectangular systems such as UTM systems, if the segment is contained in only one zone, the reference will be the North-South axis of the grid (Azimuth/Grid). A change of the angle will necessarily imply the modification of the geodesic coordinates of the second point of the segment.

To change the notation of the azimuth, see Configuring Azimuth Angle.

Route name

Each Route has a name to identify it. When a new Route is created, the program automatically creates a name like *Route #1, #2, #3...* The Route name can be changed, observing the maximum of 30 characters.

Features of the Route Waypoints

Each Route segment has a Waypoint in its extremities. To modify these Waypoints, just press the buttons <**W**> of the vertexes #1 and #2 of the Route segment. Editing is done inside of the Waypoint editing window, described in the section Creating, Modifying and Deleting Waypoints. To modify the geodesic coordinates of every Route Waypoint, be aware of the coordinate system, defined under *Options* in the *Tools* Menu.

The following data in the edit window can be viewed:

- Name of each Waypoint of the Route
- Comments for each Waypoint in the Route
- Route number (Route #)
- Route segment number (Segment #)

Speed and time indications are not available for the Routes. Remember that only the Tracklogs have this data.

Routes can be easily edited through spreadsheets of GTM PRO®. See the topic Data Edition in Table.

Deleting a Route

To delete a Route or a segment, first select it. For that, please refer to Selecting Data
Once the Route or part of it is selected, just press DEL to remove it from memory.

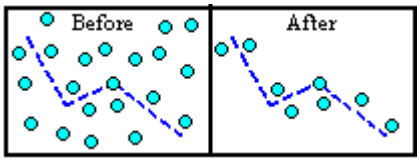
Uniting Routes

It's possible to easily unite Routes with the Route Creation Tool. Press  and click with left button on the extremity of the Route, dragging the mouse to another extremity of other Route.

5.2 Selecting Waypoints far from Routes

This function is available in *Tools* menu and allows removing all Waypoints located away from the Routes. So the GPS can be loaded only with the most interesting Waypoints closest to the Route.

Many GPS receivers have a limited memory for Waypoints. This function allows loading the receiver with Waypoints located at a chosen distance to the Routes up to 200 km or 125 Miles. The advantage is that the User can schedule a trip, loading only interesting locations into the receiver.



After loading the file, just draw the Routes that you want between the Waypoints and call the *Select Wpts far from Routes* in the *Tools* menu. Then choose the maximum distance of the Route within which the Waypoints won't be selected.

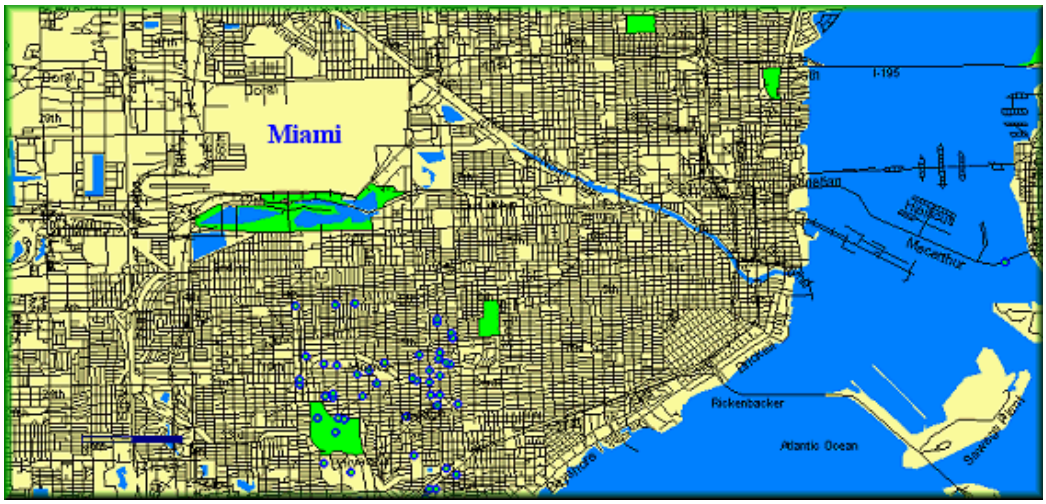
Press **<MARK>** button so the number of selected and non-selected Waypoints will be indicated. Note that the selected Waypoints can be removed using the DEL key or through the {bmc bt_delete.bmp} button in Toolbar. The non-selected Waypoints will remain on screen and can be transferred to the receiver using the respective *Interface*. Observe the maximum distance chosen: as larger the distance, more Waypoints will remain non-selected.

If *Mark wpts out of quadrant* box is enabled, only the Waypoints located outside of the Route quadrant will be selected.

In GTM PRO®, press to select Waypoints far from Routes.

6 Maps

6.1 Overview



Vectorial Maps of Background are available in GPS TrackMaker® #13 and GTM PRO #4.0 or above. Basically they are maps that open very very fast on screen, facilitating the location of Waypoints, Tracklogs and Routes.

Because they open very fast on screen, the maps are also useful in real-time navigation if compared with raster images. Raster images demand a great amount of memory and are slower to load.

The Vectorial Maps of Background have the following characteristics:

- Open very fast on screen.
- The maps are automatically loaded when the program is opened.
- The maps consume very less memory if compared with raster images.
- The maps are totally independent and don't use reserved memory for Tracklogs, Routes and Waypoints.
- Allow the detection of elements with the mouse pointer.
- Non-editable maps. Once created, they cannot be modified.
- Have the extension MAP for maps and PJC for Project of Maps.
- The maps are loaded on demand. Only the maps shown on screen are loaded on memory.
- Automatic labeling. Names of streets, avenues, buildings, rivers, lakes and other elements are automatically shown.
- Support for graphical accents and special characters.
- Allow fast text search.
- Support for all styles of Tracklogs with 16 millions of colors.
- Support for all Waypoint icons available in GPS TrackMaker®.
- Allow rotation of Waypoint text.
- Support for scalable Waypoints and Tracklogs.
- The trackpoints are limited in 4000 points.
- Complete support for *True Grid* mode. Once created, the MAP file is automatically shown in any coordinate system and datum supported by GPS TrackMaker®.
- The MAP files are encrypted and allow restrictions by password or hardware key.
- The maps can be shown in gray scale to avoid confusion with Tracklogs, Routes and Waypoints.
- Multiples projects of maps can be registered.
- GPS TrackMaker® is able to create MAP files.
– GTM PRO® is able to create MAP files and complete projects of maps with extension PJC

Visit http://www.gpstm.com to get free projects of maps for GPS TrackMaker®.

6.2 Accuracy of MAP Files

A small price is paid when using MAP files. Unlike GTM files that allow full edition and register the coordinates with 13 decimal places, the MAP files may present small errors of accuracy that depends how the file was created.

For Waypoints, the maximum error is 10 inches (25 cm) close to the Line of Ecuador.

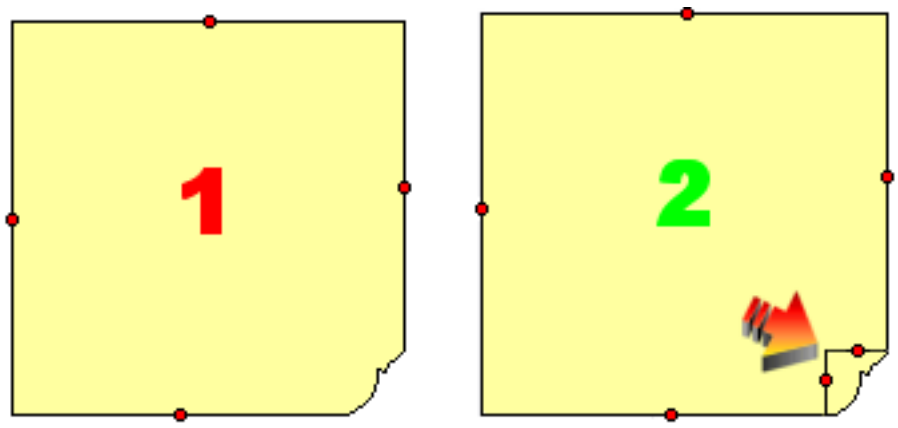
For Tracklogs, the error depends on the maximum size of the largest segment. See the table below:

Maximum Size of the Largest Segment	Maximum Error
8,958 yards	10 inches
17,917 yards	20 inches
26,875 yards	30 inches
35,834 yards	40 inches
...	...
2,284,513 yards	69.72 yards
Above 2,284,513 yards	1328 yards

The maximum error may occur in equatorial region. As closer as Earth's poles, smaller will be the error.

To minimize the error in Tracklogs, avoid to create big segments together with small segments. Big segments increase the error in the small segments.

The polygon 1 in the picture below must be avoided. To get a best result, transform it to the polygon 2 that is more homogeneous.



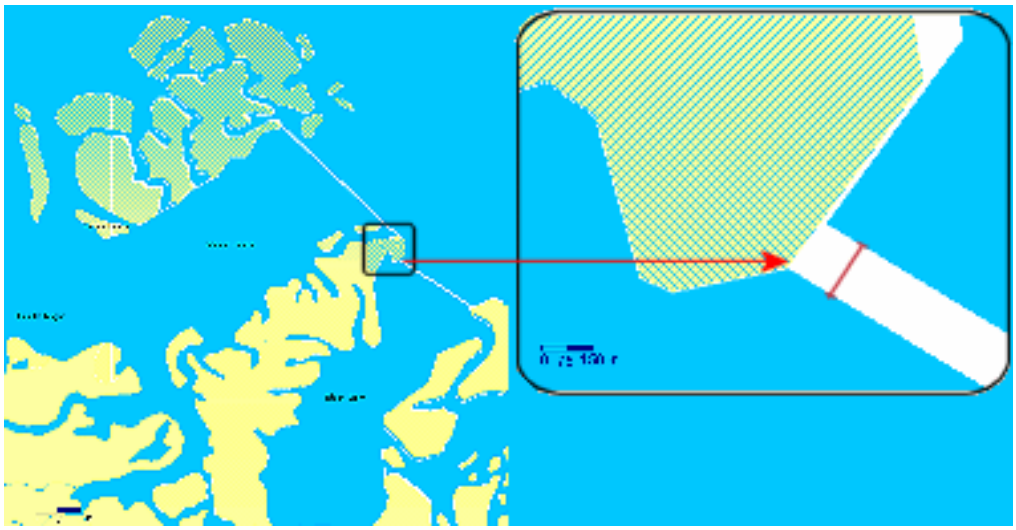
Another way to eliminate big segments united to small segments is to use the toll called Homogenize Points of Tracklogs located in *Tools -> Tracklogs and Routes.*

Finally, remember that all information above applies only to MAP files and not to GTM files.

6.3 Homogenizing Points of Tracklogs

A small price is paid when using MAP files. Unlike GTM files that allow full edition and register the coordinates with 13 decimal places, the MAP files may present small errors of accuracy that depends how the file was created.

For further information, see Accuracy of MAP Files.

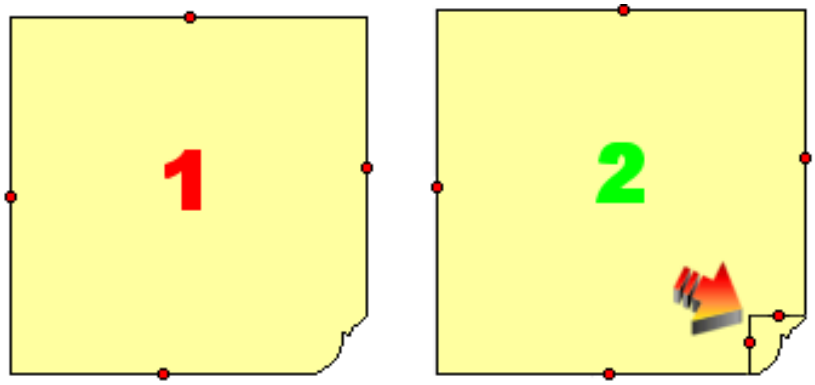


MAP files created with Tracklogs that have big segments united to small segments may present small errors in polygon such as indicated in the picture below:

Homogenize a Tracklog is the same that divide the big segments into small segments, compatible with the size of most of the other segments. This process minimizes the errors in Map files.

First select the Tracklogs to homogenize. Then, click on *Tools -> Tracklogs and Routes -> Homogenize Points of Tracklogs*.

Tip: before using the *Homogenize Tool*, try to divide the polygons that have big segments united to small segments such as indicated in the picture below. For lines, try to separate the big segments from small segments.



Remember that the *Homogenize Tool* is useful only for MAP files.

6.4 Creating MAP Files

MAP files are non-editable maps that open very fast on background of the screen. To see the characteristics of MAP files, take a look at the topic Overview.

The steps to create a MAP file are:

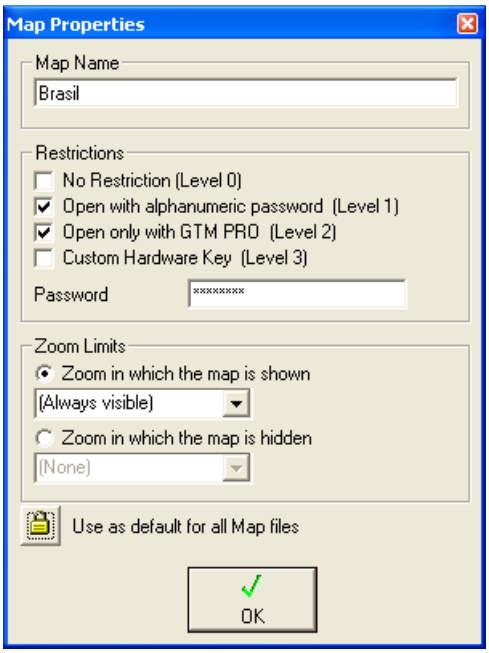
- Create a map with the Drawing Tools.
- Apply the appropriate level of zoom to each drawing element.
- Each Tracklog may have up to 4000 track points. For polygons (filled Tracklogs) with more than 4000 points, use the Rectangular Clipping Tool to reduce the number of points. For lines, use the Tracklog Reducer Tool.
- Divide the Tracklogs considering the size of segments. Separate the Tracklogs with big segments from Tracklogs with small segments. For further information, see Accuracy of MAP Files.
- Select all Tracklogs and use the Homogenize Tool.
- Configure the Map Properties.
- To save in MAP format, click on *Files -> Save File as ->* and choose *GPS TrackMaker Map Format.*

Important: After created, MAP files cannot be imported to be edited. So, they cannot be used to replace GTM files. It is always recommended to save a copy in GTM format for future modifications.

6.5 Configuring Map Properties

The Map Properties applies only to MAP files. However, the parameters of configuration are also saved in GTM files. The properties have effect only when a MAP file is opened on screen.

To access the window of properties, click on *Maps -> Map Properties.*



Map Name

Map Name is the internal name of the map. Allows to identify the map with more details and can be different from the file name.

Restrictions

These options are available only in GTM PRO®.

No Restriction (level 0): It is the default option. Allows to open MAP files without any type of restriction such as password, program type or hardware key. The free version of GPS TrackMaker® save all MAP files with this option.

Open with Alphanumeric Password (Level 1): when a MAP file is opened, the program will ask for the password. If the password is typed correctly, the map will be shown. Projects of Maps that have at least one file with password restriction will ask for the password only when opened for the first time.

Open only with GTM PRO (Level 2)*:* companies that sell GTM PRO® can use this option to sell the program with special maps.

Custom Hardware Key (Level 3)**:** this option is the maximum level of security, allowing to open MAP files only if a custom hardware keys is connect to the computer. It's an option for map developers that want to distribute maps with GTM PRO® in a safe way. Custom hardware keys can be ordered directly to the Author though the website **http://www.gpstm.com**. The minimum order is 50 pieces.

Password: Required by level 1 and level 3.

Zoom Limits

Unlike the scale applied directly to Waypoints and Tracklogs, the zoom limits are applied to the whole MAP file. This resource allows, for example, to create a general map with few details that is hidden in a specific zoom level. At the same time, detailed maps may be shown in the same zoom level.

Zoom in Which the Map is Shown

Determines the level of zoom in which the map is shown on screen. Usually it is applied to detailed maps, with many drawing elements that must be shown only in lower levels of zoom.

Zoom in which the Map is Hidden

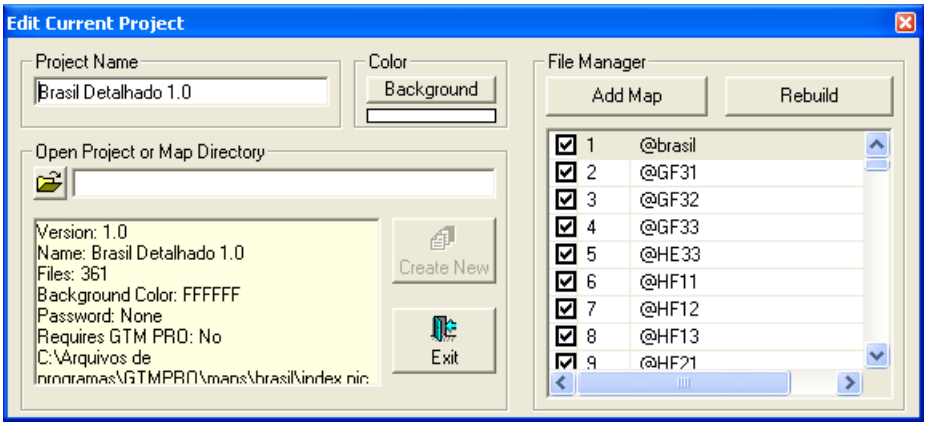
Determines the level of zoom in which the Map is hidden on screen. This limit of zoom is mainly used in maps for big scales and with few details that must be hidden in the moment that the detailed maps are shown.

6.6 Creating and Registering Projects of Maps

A Map Project is a file with PJC extension that registers the sequence of MAP files that will be shown on screen. The PJC file can be registered in GPS TrackMaker®, being shown in the listing box of toolbar 2.

Once the project is registered, the access to the maps will be available as soon as the program is opened. Just click on the project to visualize the maps on screen.

The PJC file must be in the same directory of the MAP files. The free version of GPS TrackMaker® allows only to register PJC files. The PRO version has complete support for creation and edition of PJC files.



Registering a Project with PJC Files

- Click on *Maps -> Register New Project.*
- *Click on the* button  *- Open Project or Map Directory.*
- Click on the PJC file and press *Open.*
- The list of maps will appears in the *File Manager* and the maps will appear on screen.

Creating a Project with MAP Files

This option is available only in GTM PRO®.

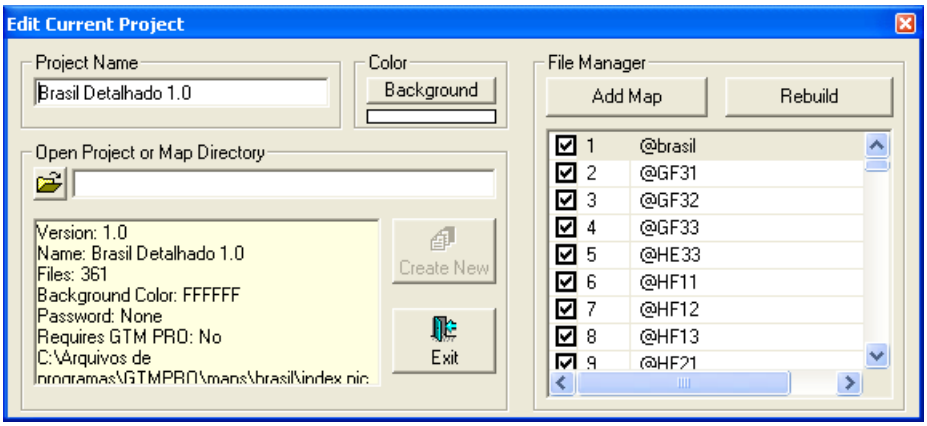
- Be sure that all MAP files are in a same directory.
- Click on *Maps -> Register New Project.*
- Click on the button  *– Open Project or Map Directory.*
- Click on any MAP file and press *Open.*
- Type a name for the project.
- Choose the background color for the project. White is the color default.
- Press *Create New* button to create the new project.
- The list of maps will appears in the *File Manager* and the maps will appear on screen.

To edit or delete files in the *File Manager*, see Editing Projects of Maps.

6.7 Editing Projects of Maps

This option is available only in GTM PRO®.

To edit the current project of maps, click on *Maps -> Edit Current Project.*



The window of edition will be opened with the following options:

Project Name

To change the name of the current project, type the new name and press ***Rebuild.***

Background Color

To change the background color, press ***Background*** button and choose the new color. The color default is white.

File Manager

The File Manager shows the list of MAP files of the Project.

To modify the file position in the list, click on the file and drag it to the new position. Then, press the ***Rebuild*** button. Files that have overlapped polygons in a same level of zoom must be reordered to show the polygons correctly on screen.

To delete a file from the list, just uncheck the file and press ***Rebuild*** button.

To add a new MAP file to the list, press the ***ADD*** button and select the MAP file.

6.8 Removing Projects of Maps

To remove a project, click on *Maps -> Remove Project.* Then, choose the project and press 

When you remove a project, it is removed only from GPS TrackMaker®. The MAP files and the PJC file are not deleted from hard disk and can be registered again later.

6.9 Detection of Elements

To activate the detection, click on Maps -> Detect Elements.

The detection of elements works like the Detect Element Tool. Basically it is used to facilitate the creation of Waypoints and Tracklogs on the elements of the map.

This tools is also useful to show the name attributed to the element of the map when the mouse pointer is placed on the map element.

6.10 Optimizing Map Speed

The MAP files open quickly in the screen in any coordinate system and datum supported by GPS TrackMaker®, including the True Grid mode for rectangular systems such as UTM and others.

However, the best speed is obtained with the WGS84 datum and geographical coordinates in decimal notation.

Clicking on *Maps -> Optimize Speed*, the datum will be changed to WGS 84 and the coordinates system will be changed to geographic coordinates with decimal notation, increasing the speed of the Map file on screen.

6.11 Protecting Projects of Maps

To protect a project of maps against accidental removal, click on Maps -> Lock Project. Then, choose the project and click on the padlock to lock the project.

 The locked projects are shown with a red padlock.

6.12 Maps in Gray Scale

Press the button  to see the background maps in gray scale.

This resource improves the visualization of Tracklogs, Routes and Waypoints on the map, avoiding confusion of data.

Tip: you can also press the button  to see the Tracklogs by colors on the gray scale map.

7 Manipulating Data

7.1 Cutting Data

To cut data, moving it to the Windows® clipboard, just select the Tracklogs, Routes and Waypoints that you want and then press <**CTRL X**> or click on the *Cut* option in the *Edit* menu. Even if a single segment of Tracklog or Route is selected, all the segments of the Tracklog (or Route) will be transferred to the Windows® clipboard.

7.2 Copying Data

To Copy the data to the Windows® Clipboard, just select the Tracklogs, Routes and Waypoints that you want, and then press <**CTRL C**> or click on the *Copy* option in the *Edit* menu. It is important to note that in Tracklogs and Routes, all the segments of the same Tracklog (or Route) will be copied and not the selected isolated segments.

Copying the Image from Screen to Clipboard

When the User copies the data, the image that is on the **GPS TrackMaker®** screen will also be transferred to the Windows® clipboard allowing you to edit graphics through other programs like Paint® from Windows®, PhotoShop®, PhotoPaint®, etc. The image can also be seen through the *clipbrd.exe* program that is part of the Windows® operating system.

To copy the image from clipboard to one of the graphic programs indicated above, just open a new file and press <**CTRL V**> (paste).

The image can be pasted in programs such as MS Word®, pressing *Special Paste > Images*.

7.3 Pasting Data

To paste the data from the Windows® clipboard in **GPS TrackMaker®**, just press <**CTRL V**> or click on the *Paste* option in the *Edit* menu. It is important to note that in Tracklogs and Routes, all the segments of the same Tracklog (or Route) will be pasted, even if only isolated segments have been copied.

To paste images to the **GPS TrackMaker®** screen, see Pasting Images on Screen

In GTM PRO®, the User can paste the data pressing the button  .

7.4 Pasting an Image on Screen

In the same way that the image in **GPS TrackMaker®**'s screen can be pasted to the Windows® Clipboard Area (refer to Pasting Data), an image in Clipboard can be pasted to **GPS TrackMaker®**'s screen.

For that, choose *Edit > Copy Image* menu or press <**CTRL INS**>. BMP, ICO, WMF and EMF images are supported.

This function is useful to copy images directly from another program or Internet maps to **GPS TrackMaker®**'s screen.

Georeferencing an Image of the Screen

Pressing **<CTRL C>** (Copy Data) and then pressing **<CTRL INS>**, you will get a copy of the screen in BMP format that will be automatically georeferenced in the same position in that the original started in.

7.5 Dragging Tracklogs, Routes and Waypoints with the Mouse

To drag Tracklogs, Routes or Waypoints with the mouse, first select the data through one of the selection tools written in Selecting Data. Then, place the arrow of the mouse on one of the segments of the Tracklog or Route or on one of the selected Waypoints, press the left button and drag the data where you want to place it.

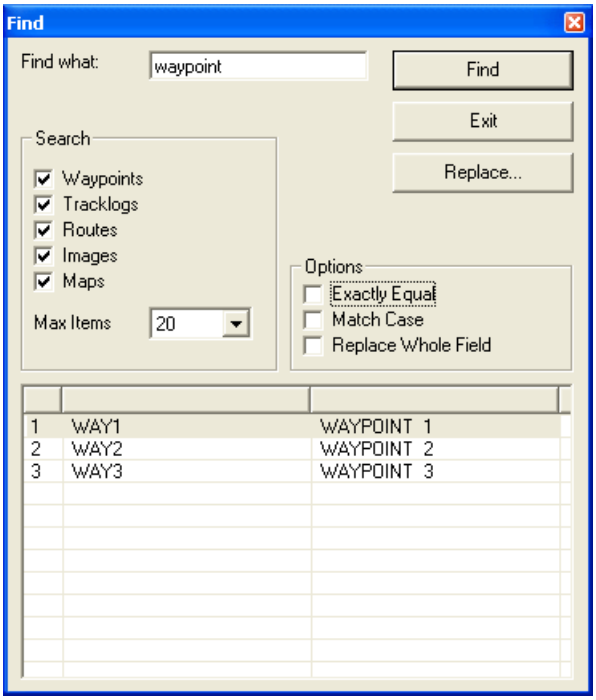
To drag vertexes of Tracklogs and Routes, see Dragging Vertexes and Waypoints.

7.6 Undo the Last Action

To undo the last action, press <**CTRL Z**> or click on the *Undo* option in the *Edit* menu. To return to the initial situation, press <**CTRL Z**> again.

In GTM PRO®, press .

7.7 Finding and Replacing Data



Finding Texts

Click on *Edit -> Find* or press CTRL F to locate texts in Waypoints, Tracklogs, Routes, Images and Maps. As soon as the search results is shown, click on the element in the listing box to see it on screen.

Replacing Texts

Click on *Edit ->Replace* or press CTRL H to replace texts in names and comments of Waypoints, names of Tracklogs, names of Routes and comments fo images.

Search Options

Search: mark the elements where you want to search the text. Also indicate the number of items that will be shown in the list box.

***Exactly Equal*:** if checked, only the elements that have the entire text equal to the search text will be shown.

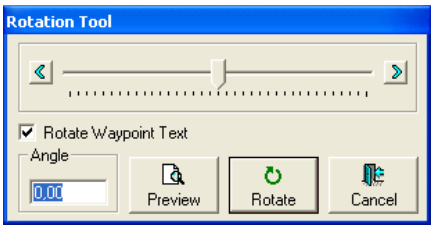
Match Case: if checked, case will be considered significant when comparing text of the elements with the search text. Otherwise, case will be disregard.

Replace Whole Field: if checked, the entire field contents will be replaced with the replacement text regardless of how much of the field matches the search text. Otherwise, only the matching text is replaced.

Important: texts of background maps cannot be replaced or modified.

7.8 Rotating Waypoints, Tracklogs and Routes

This option is available only in **GPS TrackMaker Professional®** .



To rotate Waypoints, Tracklogs and Routes, select them according to Data Selection and click in *Rotate Data* button on the Tool Bar or in the *Tools* menu.

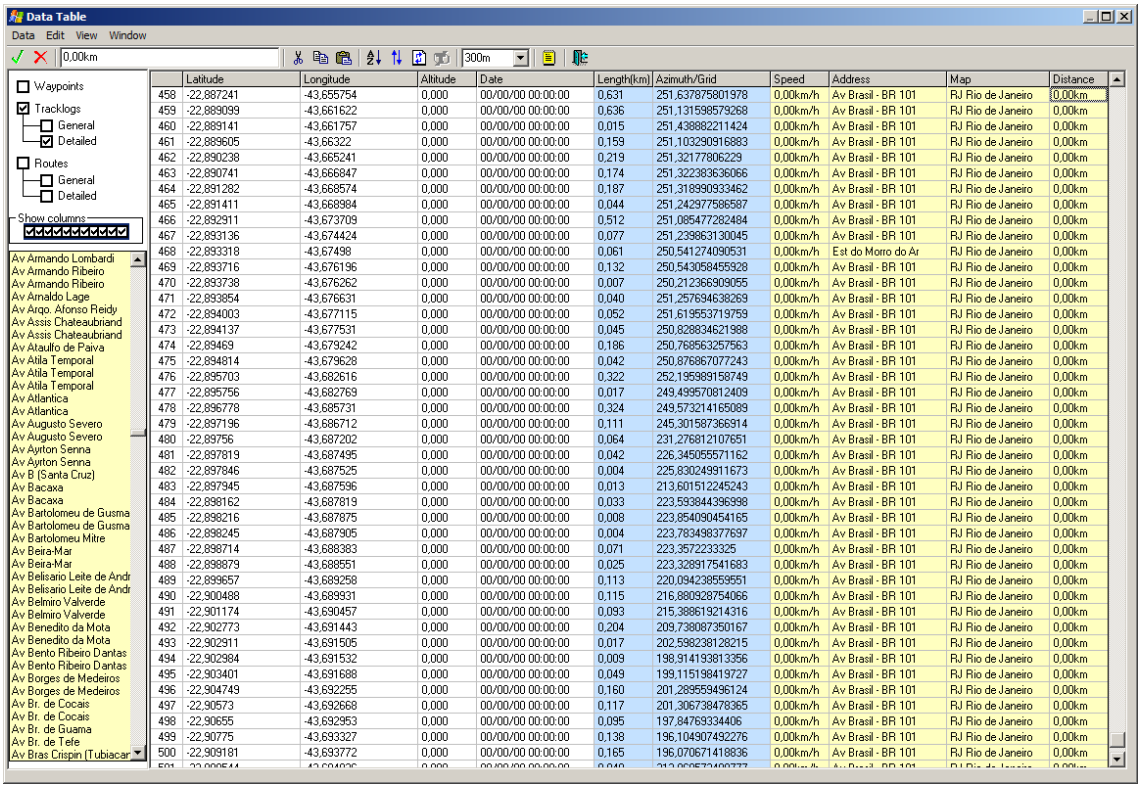
The rotation angle can vary from –180 to 180 degrees, and it can be defined through the text box or through the slider bar.

<Verify>: Allows the previous verification of the rotated data in the screen.
<OK>: Executes the rotation of the data.
<Exit>: Cancels the rotation of the data.

7.9 Data Edition in Table

In GTM PRO®, it is possible to edit data directly in tables. You can copy and paste the data in text format relative to coordinates, altitudes, dates, names, comments, etc of Waypoints, Tracklogs and Routes. Useful in spreadsheet programs like Microsoft Excel® and in word processors programs like Microsoft Word®.

To access the data table, press the button .



Double click on a table cell shows the point or the complete element on the map.

The columns can be shown or hidden by clicking on the *Show Columns* options.

While editing, if incompatible values are typed, the change won't be accomplished. Each column of the Table represents the type of the data, and each row represent the relative data of Waypoints, TrackPoints and RoutePoints.

To edit the data in the table, click on a cell and change the value in the text editing window that appears on top of the table. To confirm the change, press <**ENTER**> or . To cancel the change, press .

The *Data Table* has three types of cells:

White: the values can be changed, without modifying other rows.

Blue: The values can be changed, but other rows are also changed. For example, if the azimuth is changed, the coordinates in the next rows are changed.

Yellow: The values cannot be changed, but they can be copied.

Editing Waypoints

To display the list of Waypoints, click on the *Waypoints* option located beside the table. The following fields of each Waypoint can be changed:

- Latitude
- Longitude
- Name with up to 10 characters
- Comments with up to 255 characters
- Waypoint Creation Date
- Altitude of the point
- Icon
- Style
- Rotation angle

Editing Tracklogs

Editing General Parameters of the Tracklogs

To display the parameters of all Tracklogs, click on the *Tracklogs-General* option located beside the table. The following fields can be changed:

- Name
- Style
- Color
- Scale

The following fields in yellow cells can be viewed:

- Number of points
- Total Length
- Start date
- Finish date
- Total time in the Tracklog

To change graphically the style, color and scale of the Tracklog, select the rows and press  .

Editing Isolated Tracklogs

To display the list of *TrackPoints* of each Track, click on the Tracklogs-Detailed option beside the table, and choose the Tracklog to be edited, clicking in the available list. The following fields of each Tracklog can be modified:

- Latitude
- Longitude
- Date of each Trackpoint
- Trackpoint Altitude
- Segment length
- Segment azimuth

The following field is shown in yellow cells:

- Speed on the segment

The *length* and *azimuth* shown in blue cells can be changed, but affect the coordinates, length and azimuth of the next segment. The *speed* cannot be changed.

Editing Routes

Editing General Parameters of the Routes

To display the parameters of all Routes, click on the *Routes-General* option located beside the table. The following fields can be viewed:

- Route Name
- Number of Points
- Total length
- Start Waypoint
- End Waypoint

Only the Route Name can be changed. The others fields in yellow cells can be copied.

Editing Isolated Routes

First select the *Routes-Detailed* option located beside the table, and then choose the Route to be edited, clicking in the available list. The following fields of each Route can be modified:

- Waypoint name with up to 10 characters
- Latitude
- Longitude
- Altitude of the Point
- Comments with up to 255 characters
- Icon of Waypoint
- Style of Waypoint
- Segment length
- Segment azimuth

Length and azimuth shown in blue cells can be changed, but affect the coordinates, length and azimuth of the next segment.

Searching Addresses

if a street level map is loaded, it is possible to create complete reports with addresses where the GPS or vehicle equipped with the tracking module passed.

Follow the steps below to create a detailed report:

- Choose the spreadsheet of Waypoints or Tracklog which the report will be created.
- Choose the maximum distance of search. As larger the distance, more time is required to search the maps.
- Click on  button or press F6 to start the addresses search.

Sorting the Table

To sort the table in ascending order, first click on the column cell to be sorted. Then, press  to sort the whole table in ascending order. To return the table to the initial sort order, just release  again. The Table arrangement can also be done through the *Sort* option in the *Data* menu.

Reversing the direction of Tracklogs and Routes

To reverse the direction of Tracklogs and Routes, press the  button . The reversion can also be done choosing *Invert Sequence* in *Data* menu.

Refreshing the Table

To refresh the data in the table, press  , F5 or choose *Refresh* in the *Data* menu. All changes will be displayed.

Pasting and Copying Data for Microsoft Excel® and Word®

To Copy the data from the table to another program, first select the cells to be copied and then press <**CTRL C**> or the button 
To past data in the table, press <**CTRL V**> or 

The functions Copy and Paste can also be accessed through the *Edit* menu.

Inserting and deleting Rows

It is possible to insert one or more rows in Waypoint, Tracklog and Route tables, through the *Insert Row* and the *Insert Multiple Rows* options in the *Edit* menu. New rows will be inserted in white and if no data is inserted, they will be deleted when closing the table.

The *Delete Rows* option in the *Edit* menu deletes all selected rows. Tracklogs and Routes must have at least 2 points, so, the Tracklog or Route table will be deleted if only one point remains.

Inserting and deleting Tables

To insert tables, choose the *Insert Table* option in the *Edit* menu. For Waypoints, if the table already exists, new lines will be added in its end. For Tracklogs and Routes, new white tables will be shown.

To delete a whole table, select *Delete Table* in the *Edit* menu.

TIP: tables can be created and deleted when rows are inserted and deleted in the general tables of Tracklogs and Routes.

Printing the Table

To print the current table, click on *Data > Print Table* menu.

Undo all Changes

All changes made to Waypoints, Tracklogs and Routes Table will be undone if the *Undo all* option in the *Edit* menu is selected.

7.10 Reversing the Direction of Tracklogs and Routes

To reverse the direction of a Tracklog or Route, first select them according to Data Selection and then click on  *Reverse Tracklogs and Routes* option in the *Tools* menu or on the button in the tool bar.

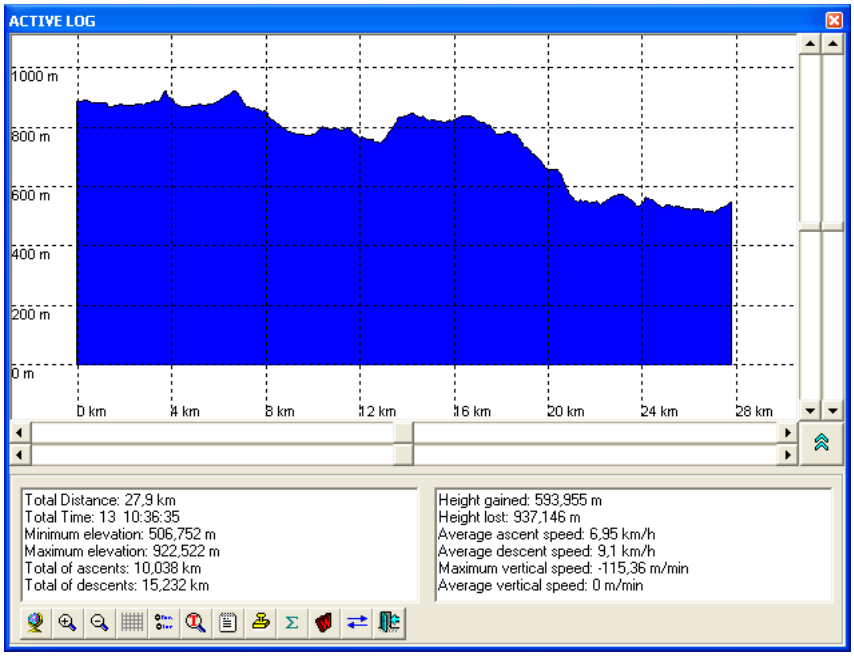
The reversion is useful to Routes being sent back to the GPS and used for navigation.

8 Special Functions

8.1 Altitude Profile

The Altitude Profile is a graphic that shows the altitudes of a Tracklog in its whole length and the nearest Waypoints.

To show the Altitude Profile, select the Tracklog and then press . The window below will be shown:



Grid lines color and Altitude Profile background color are the same of the main map.
To configure other elements from the Altitude Profile, see Configuring the Altitude Profile.

Zoom

F2 and F3 keys activate *Zoom In* and *Zoom out* respectively.

F4 or centralizes the Profile on screen.

Using the Mouse

Dragging the mouse with the right button pressed, the Profile will move to the chosen position. Pressing the left button, a small pin will mark the distance x altitude of the chosen point.

Horizontal and Vertical Displacement

The horizontal and vertical displacement can also be made by the upper horizontal scroll bar and by the left vertical scroll bar respectively. The keyboard arrows will also be used.

Horizontal and Vertical Amplitude

The amplitude control stretches and compresses the Profile to show properly the altitudes. The control of the horizontal and vertical amplitudes is made respectively by the lower horizontal scroll bar and by the right vertical scroll bar. The keyboard arrows will also be used, with SHIFT key pressed.

GTM PRO® has an extra window with several numeric information and several buttons with the following functions:

 Hide/Show the extra window of GTM PRO®

 Centralize the Profile on screen

 Zoom in **<Page Down> , <+> or <F2>**.

 Zoom out **<Page Up>, <-> or <F3>**

 Hide/Show grid lines <**CTRL G**>

 Hide/Show nearest Waypoints

 Search a Tracklog by name

 Show the numeric data of the Profile in the Report window

 Stamp Tool

 Recalculate the numeric values of the Profile

 Mark a Waypoint on the Profile

 Reverse the Altitude Profile

 Exit

Sending the Profile Image to the Main Map

With the Stamp Tool  it is possible to transfer the vector drawing from the Altitude Profile to the main screen of the map, allowing treating it as an image and printing it with the main map.

Marking a Waypoint on the Profile

To mark a Waypoint on the Altitude Profile, press the left button and drag the mouse to the chosen position. A small pin will be created. Then press  to create the Waypoint in the place marked by the pin.

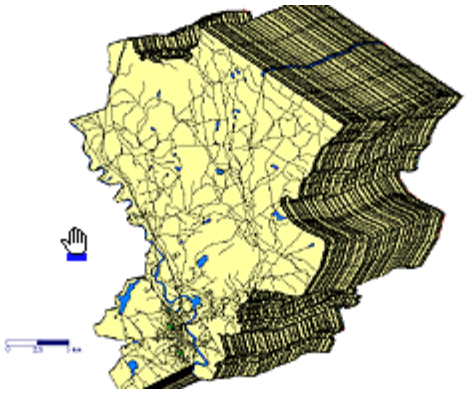
You can also mark a Waypoint by clicking on the pin with the mouse right button.

Numeric Information about the Profile

GTM PRO® supplies several information about distances, altitudes, speeds, etc.
Using GTM PRO®, you will have:

- Total distance
- Total time
- Minimum and Maximum elevation
- Total of ascents and descents
- Gained and lost Altitudes
- Average speeds of ascend and descent
- Maximum vertical speed
- Vertical average speed

8.2 Dragging the Screen



The **GPS TrackMaker®** program allows dragging the screen to another position using the mouse. Just hold down the right mouse button and move it to any position on the screen. All data will be moved together.

Drag function is also enabled to work on digitized images of maps or photos, inserted in the background of the screen. However, when dragging these images they will be temporarily invisible on screen in order to avoid the delay of the redrawing of these images, effecting dragging performance.

To see digitized images when dragging, configure the visualization mode in *Tools > Options > Images*. For further information, see Configuration of Images.

8.3 Dragging Vertexes and Waypoints

To drag vertexes of Tracklogs or Routes and isolated Waypoints, press the button  and then place the mouse arrow on a vertex of the Tracklog or Route or on a Waypoint. Press the left button and drag the mouse to the new position, maintaining the left button pressed.

To drag complete Tracklogs and Routes or group of Waypoints, see the topic Dragging Tracklogs, Routes and Waypoints with the Mouse.

8.4 Zoom Tools

Zoom tools allow to approach or move away from the image view. The more distant the view, the more area you will be able to see on screen. As you zoom in closer to the image, the precision for creating, editing and deleting data increases. The **GPS TrackMaker®** program features several Zoom types:

General Zoom

Zoom in function: This function is accessible through the button  located in the toolbar. When pressing this button the center of the screen will approach. The same result can be obtained pressing **F2**.

Zoom out Function: This function is accessible through the button  in the toolbar. When pressing this button the center of the screen will move away. The same result can be obtained pressing **F3**.

Limited Zoom

Zoom can be limited only to a portion of the screen. For that, press the Magnify  on the toolbar. Then, drag the mouse with the left button pressed. A rectangle will be formed between the initial and final points, indicating the new limits of the screen.

The button  can also be activated through **F5** shortcut key.

General View

The General View button  is located on the toolbar. When pressing it, the User will have a general view of the data on the screen. If there is no data, the program will redraw the screen to the coordinates that allow a view of the American and European continents.

The General View button  can also be activated through the **F4** shortcut key.

Warning: Zoom over the background image is limited by the following parameters: *Zoom in* is allowed up to a minimal surface corresponding to 1.6% of the original size. Below this value, the image won't be shown on screen. In the *Zoom out*, the map will be represented by a small gray rectangle if the image surface is under 1.6 % of the screen area.

8.5 Detecting Elements

General Information

Detect Elements button  is provided to enable approach recognition of the mouse pointer to Waypoints, Tracklogs and Routes. This allows the program to find which element the User wants to select, edit, or combine, (in the case of a new Tracklog or Route).

So, with the button  pressed, the following functions will be enabled:

- Waypoint highlight, represented by a small circle over the icon
- Tracklog or Route segment highlight, represented by the segment color change.
- Waypoint and Tracklog or Route segment editing with the right mouse button.
- Tracklog or Route union. A small circle will appear in the extremities of the segment, indicating that the program will make the connection at that point.
- Enables the *Pop-Up* menu of digitized images.

The button  turned off allows to draw isolated Tracklog or Route segments when the screen is full, without combining them with other segments or Waypoints.

Limitations

The **GPS TrackMaker®** program is designed to be used in fast PCs as well as in slower machines. With the button  pressed, each movement of the mouse pointer over the screen causes the PC to make thousands of comparisons using complex geometry calculations to recognize the approach of the mouse pointer to Waypoints and Tracklog or Route segments. All those calculations demand execution time in the processor. With lots of data in the screen, the recognition could become too slow, even in fast PCs.

If the screen is full, with thousands of Tracklogs, Waypoints or Routes, and it is causing significant delay in the detection of the elements in screen, use the zoom function to reduce the amount of visible data in the screen. This procedure will increase the speed of detection of the elements in the screen.

8.6 Selecting Data

Item selection in **GPS TrackMaker®** allows to delete data from memory as well as calculate area and distance, drag Tracklogs, Routes and Waypoints in the screen, modify data, etc. Many other functions use selected data.

When a Waypoint is selected a small red/gray square will appear over the icon.
For Tracklogs and Routes, a small red circle in the center of each segment represents selection.

Selection of All Data in Memory

To select all data, press **<CTRL A>** or choose the *Select All* option in the *Tools* menu.

Item Selection

There are six different types of item selection:

Direct Selection

For this type of selection, the *Detect Elements* button  in the Drawing Toolbar must be pressed.

Press  and click with the left mouse button over a Waypoint icon, or a Tracklog or Route segment. For Waypoints, you must wait until a small circle appears over the icon and then click. For Tracklogs and Routes, you must wait until the segment changes its color.

To select all segments of a Tracklog or Route, just double-click in one of the segments. This procedure is useful when calculating Tracklog or Route areas or lengths.

Selection by Description

Using the list boxes in the second tool bar, it is possible to select items by selecting the Waypoint name or comment, Tracklog number or Route name. Just locate the description in one of the two list boxes and then click on it. The program will redraw the screen to show the Waypoint, Tracklog or Route chosen.

This procedure is useful to locate specific Waypoints, Tracklogs or Routes when there is a lot of data on screen.

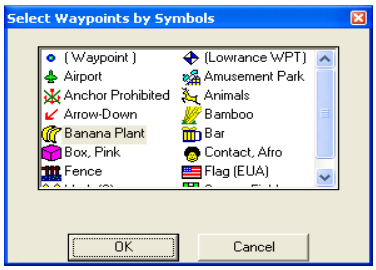
Selection by Inclusion

Press and drag the mouse with the left button pressed over the area that you want to select. This selection can only be done if the *Detect Elements* button in the Drawing Toolbar is enabled. When the mouse button is released, everything that is inside of the rectangle will be selected.

Selection by Exclusion

Many times, it's necessary to delete most of the data in the screen, with the objective of transferring to the GPS receiver just a few Waypoints, Tracklogs and Routes. **GPS TrackMaker®** allows the selection by exclusion, through the following steps: with *Detect Elements* button pressed, press and hold down the SHIFT key and drag the mouse with the left button pressed. Everything that is outside the rectangle will be selected, allowing deleting the data by exclusion.

Waypoint Selection by Icons



To select Waypoints by icons, press located on the Toolbar. A window will appear indicating only the icons used in the file. Click in one of the icons and the program will select all the Waypoints that have that same icon.

Selecting Tracklogs by Style

To select Tracklogs by style, press located on the Toolbar. A window will appear asking which style and color of Tracklogs to select. After choosing one style and its color press the <OK> button. The program will select all Tracklogs that have that same style.

Inversion of the Selection

The selection by exclusion can also be done through the *Invert Selected Points* button, located on the Tool Bar. When pressed, all selected points related to Waypoints, Tracklogs and Routes will be automatically deselected, and all non-selected points will be selected, even if they are not being shown in screen. If no data is selected and the button is pressed, the result will be the same as the *Select all* function, accessed through **<CTRL A>**.

8.7 Removing Accents

 This option is available only in **GPS TrackMaker Professional®**.

This tool removes all common graphic accents of Portuguese, Spanish, French and German, present in Waypoints, Tracklogs and Routes. To use it, click in *Tools > Remove Accents* and choose:

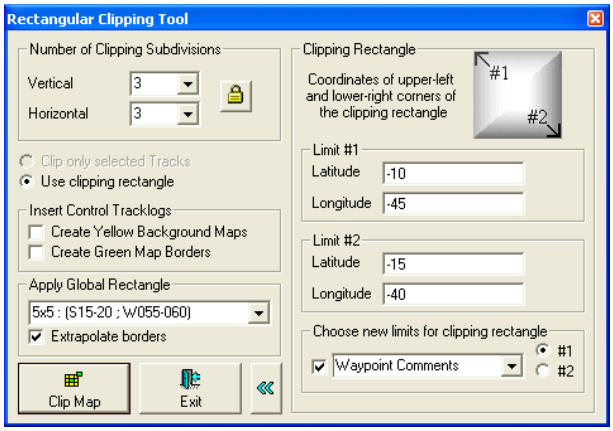
Waypoints: remove accents from names and comments.
Tracklogs: Remove accents from names.
Routes: remove accents from Route names and Waypoint (Routepoints) names and comments.

8.8 Rectangular Clipping Tool

This option is available only in **GPS TrackMaker Professional®**.

The Rectangular Clipping Tool is an advanced resource that allows clippings in Tracklogs and Waypoints, dividing the selected areas in rectangles.

To use it, select the Tracklogs and Waypoints and click in *Tools > Rectangular Clipping*.



Clipping Options

Number of Subdivisions

Choose the number of horizontal and vertical subdivisions that will be created after clipping. The button configures the same number for vertical and horizontal subdivisions.

Clip only Selected Tracks

If checked, only the selected Tracklogs will be clipped.

Use Clipping Rectangle

Only the data located inside the clipping rectangle will be preserved and clipped conform the number of subdivisions. All elements outside the rectangle will be eliminated.

Insert Tracklogs of Control

Selecting this option, Tracklogs with the styles *Green Map Border* and *Yellow Map Background* will be created, facilitating the visualization of the clipping areas.

Apply Global Rectangle

Your can choose predefined global clipping rectangles located in the same region of the selected data. Global rectangles are subdivisions of the globe with 1x1º, 2x2º, 3x3º, 5x5º and so on. It is a good option if you need to divide great areas for mapping.

Extrapolate Borders

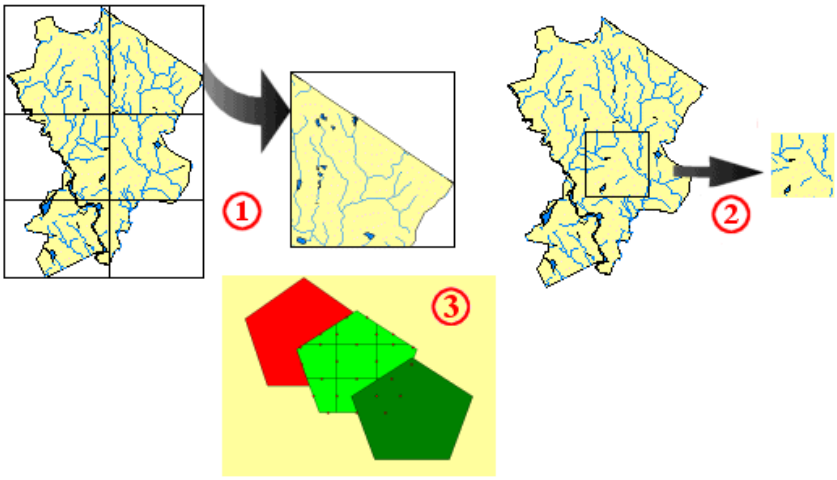
If checked, the dimensions of clipping rectangle will be increased some hundreds of meters. It is a good technique to avoid discontinuity of the maps, allowing a small border overlapping.

Clipping Rectangle

By pressing the  button , the windows is expanded, showing the coordinates of the upper-left and lower-right side of the clipping rectangle. New coordinates can be inserted or Waypoints can be selected to indicate the new limits of the rectangle.

To conclude the clipping, press 

Examples



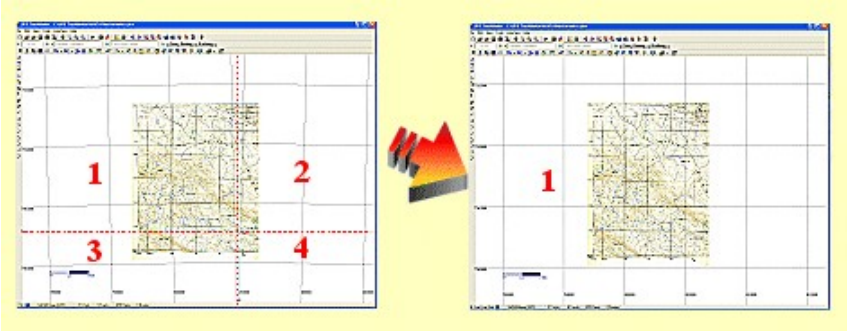
Example 1: in the first example, the whole map was selected by pressing **CTRL A** and the clipping was accomplished with 2 horizontal subdivisions and 3 vertical subdivisions.

Example 2: in the second example, a rectangular Tracklogs was created in the middle of the map and selected with a double click. The clipping was made with 1 horizontal subdivision and 1 vertical subdivision. Note that only the clipped area remains on screen. The rest of the image is deleted.

Example 3: only the green pentagon was selected and clipped with the option "Clip only Selected Tracks", with 3 horizontal subdivisions and 3 vertical subdivisions.

8.9 Expanding Rectangular Zones

This option is available only in **GPS TrackMaker Professional®**.



Some coordinate systems supported by GTM PRO® possess multiple zones, separated by red dashed lines. When two or more zones are shown on screen, the *True Grid* mode is automatically disabled and the program returns to the *Normal* mode.

See the picture above: the left map is located in four different UTM zones after calibrated. The most part of the map is located in the zone 1 and only a small part is located in the other zones. To be visualized correctly, it is necessary to activate the *True Grid* mode, but this task is impossible with four zones on screen.

To solve this problem, GTM PRO® allows to expand one of the zones, creating a User Grid with the same coordinates of the chosen zone. Thereby, the map image will be correctly visualized under the *True Grid* mode because the zone is expanded beyond their limits. In the example of the picture, the area 1 was expanded, allowing to visualize correctly the whole map.

It is possible to expand zones in the following coordinate systems:

- UTM
- RTM
- LTM
- British National Grid
- Irish National Grid
- German Grid
- Grid of Colombia

Expanding Zones through Zoom Tool

- Press the Zoom Tool located in the Tool Bar.
- Click with the left button of the mouse on the zone to be expanded.
- A pop-up menu will appear close to the pointer of the mouse.
- Choose *Expand Zone*

Expanding Zones through pop-up menu of the Image

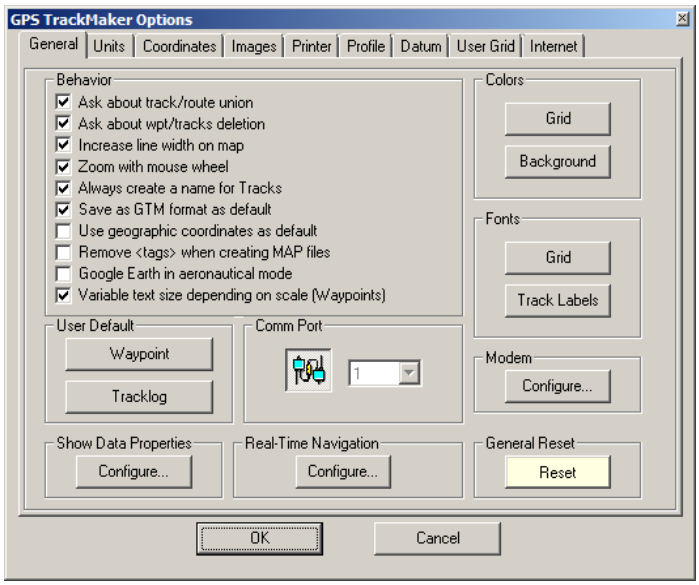
- Press the *Detect Elements* button and the Selection Tool button .
- Click with the left button on the part of the image located in the zone to be expanded.
- A pop-up menu will appear close to the pointer of the mouse.
- Choose *Expand Zone*

For further information, see True Grid Mode.

9 GPSTrackMaker's Configuration

9.1 Configuring the Behavior of the Program

The *Options* window accessed through *Tools* menu allows to configure the program's behavior for three different events:



Ask About Tracklogs/Routes Union

This is a check box that determines the behavior of the program when using the *Pencil* tool to draw a Tracklog or Route that finishes at another Tracklog or Route. There will be two situations:

Enabled : The program will always ask whether to connect the two Tracklogs or Routes every time you draw a segment that finishes at another Tracklog or Route.
Disabled : The program connects the Tracklogs or Routes without asking the User.

Ask about Wpt/Tracklog deletion

This check box controls the behavior of the program when you select several elements on the screen and try to delete them. Two situations can exist:

Enabled : The program always asks which items to delete. You can delete only the Waypoints, or only Tracklogs or Routes, or delete all selected data. This is a true selective deletion option.
Disabled : The program deletes all selected items without asking.

Increase Line Width on Map

This option will only be available if the button  is pressed.
When inserting a digitized map into the background of the screen, a lot of times it is necessary to increase the line width of Tracklogs and Routes to facilitate a better visualization. The User can opt to leave this option:
Enabled: In this case, every time that you insert a map image in the background of the screen, the program will automatically increase the line width of Tracklogs and Routes. The User must be aware because the increase of the Routes line width will imply the change of the dotted line for the continuous pattern of the line.
Disabled: the program won't increase line width.

Zoom with Mouse Wheel

Some mice have a small wheel between the two mouse buttons than can be used to active *Zoom in* and *Zoom out*. As default, this option remains activated, however if the mouse wheel provokes any instability in the program, the option must be disabled.

Enabled: *Default option***.** The mouse wheel will act as *Zoom In* and *Zoom Out.*
Disabled: This option is only recommended if the mouse wheel provokes any instability in the program.

Always Create a Name for Tracks

Enabled: In any process of creation of new Tracklogs and importing files that don't have tracklog names, the program will create automatically names for Tracklogs, like Track 001, Track 002 …
Disabled*:* no name is created, leaving blank the name of Tracklogs. This options is useful to create map files.

Save as GTM Format as Default

Enabled: every time you click on *Files -> Save As*, the GTM format will appear as default. It is a safe option because if the file is saved in a format that doesn't allow edition, MAP format for example, the file cannot be edited later.
Disabled: *the last file opened will be shown*

Use Geographic Coordinates as Default

Enabled: Whenever the program is opened, the coordinate system will be defined as geographical coordinates with decimal degrees notation.
Disabled: Default option. The last coordinate system will be used.

Remove <tags> when creating MAP files

Enable this option if you wish to eliminate tag texts located in Tracklog names and Waypoint comments. Usually these tags are created when a Mapdekode file is opened.

Google Earth in aeronautical mode

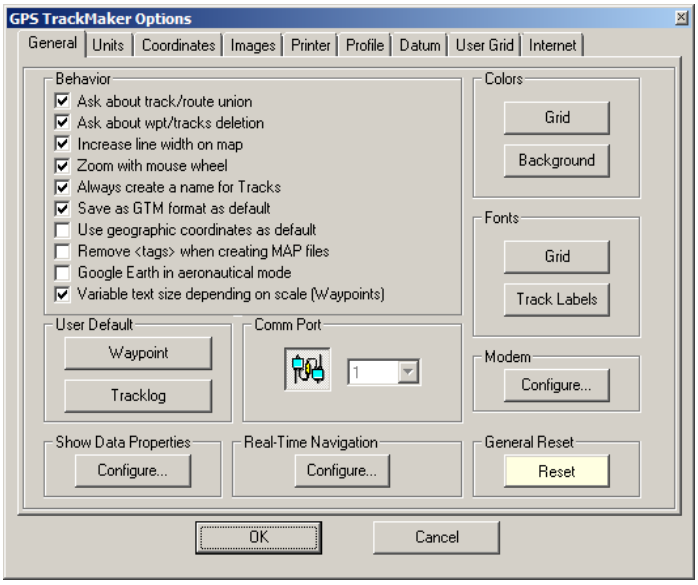
Enable this option to use absolute altitudes when creating KML files or navigating in real-time with Google Earth.

Variable text size depending on scale (Waypoints)

Mark this option to decrease the size of Waypoint texts according the scale. It is necessary to apply a zoom level different from *Permanent* to the Waypoint.

9.2 Choosing Grid and Background Color

Through the *Options* window, accessed on the *Tools* menu, the User can configure the background and grid colors.



Grid

Line color and grid number can be defined by pressing the *Grid* button located in the *Options* window.

Background

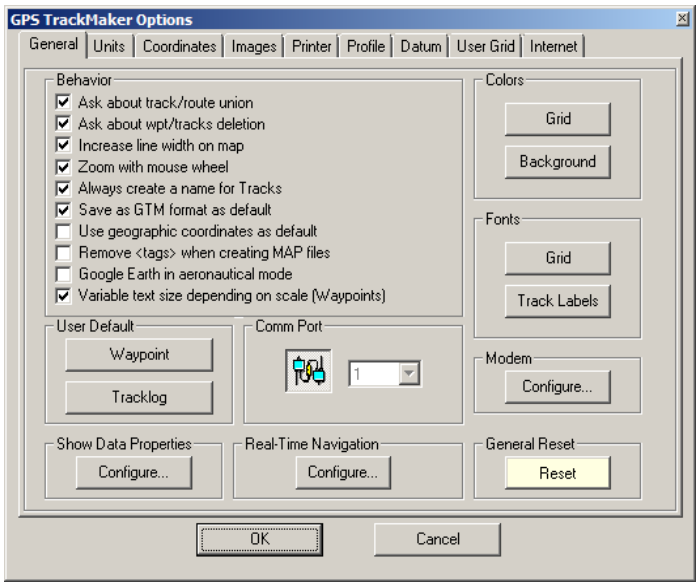
The background color can be defined using the **<Background>** button in the *Options* window.

9.3 Choosing the Communication Port

The communication between PC and GPS receivers is done through the serial ports of the PC. Note that many PCs might not have an available port, which will make the connection impossible. The serial ports are normally located in the back of the PC cabinet and the connection is done using DB-9 (9-pin connector) or DB-25 (25-pin) connectors.

The cables used to make the connection between the GPS receiver and PC are specially designed for each GPS receiver and require a special connector.

It is possible to determine the number of the communication port as it follows:



Through Tools > Options menu

By default, the program automatically detects the available communication port. However, some external devices, such as a three buttons mouse and synchronism programs for Palms and HPC, can generate some conflict during detection and it can lock the computer. To avoid this, you should disable the ***Auto-detection***  option in the ***Options*** window, and choose one of the serial ports available.

Communication Interface Window

In the ***Interface*** window, the program will show the available serial ports and you can choose the most appropriate port. Note that some devices (like modems) use communication ports, so you must determine which port is available so that there is no communication conflict. To know more about the connection of GPS to the computer, see Connecting the GPS to the Computer

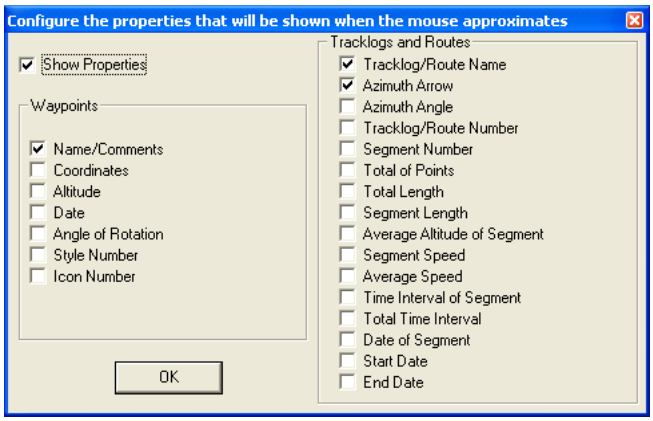
Modem Communication Port

The communication port for the internal or external modem used by the GTM Tracker Interface is configured as a GPS communication port.

9.4 Configuring the Data Shown by the Mouse

With the *Detect Elements button* pressed, every time that the mouse arrow is close to Waypoints, Tracklogs or Routes, a small yellow box shows the data of the element.

To configure which data will be shown close to the mouse arrow, click in *Tools > Options > Show Data Properties > Configure*.



Waypoints

- Name or comment
- Coordinates in the current notation
- Altitude
- Date
- Angle of text rotation
- Style number (S)
- Icon number (I)

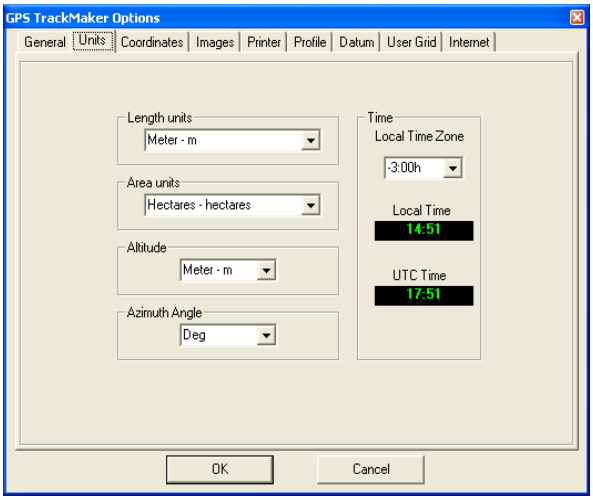
Tracklogs/Routes

- Tracklog/Route name
- Azimuth arrow (bearing)
- Azimuth angle
- Tracklog number (T#) / Route number (R#)
- Segment number (S#)
- Total of points (Tp)
- Total length (Tl)
- Segment length (Sl)
- Average altitude of the segment (Alt)
- Segment speed (Spd) *
- Average speed in the whole Tracklog (Asp) *
- Time interval of the segment (TS) *
- Total time interval in the Tracklog (Tt) *
- Date of the segment *
- Start date of the Tracklog (Sdt) *
- End date of the Tracklog (Edt) *

* Not available for Routes.

9.5 Configuring the Length Unit of Measurement

In *Tools > Options > Units* your can choose several units of measurement that will be used to calculate the length of Tracklogs and Routes. Changing the length unit of the measurement also changes the speed units, as follows:



- For units in English measures (like yd, mi., and nmi.), speed will be indicated in *mi/h* (miles per hour) or *Nmi/h* (knots). Otherwise, they will be in *km/h* (kilometers per hour)
- In the same way, windows that show or require data with distance set for English units, the distance will be indicated in miles. Other cases, it will be in kilometers.

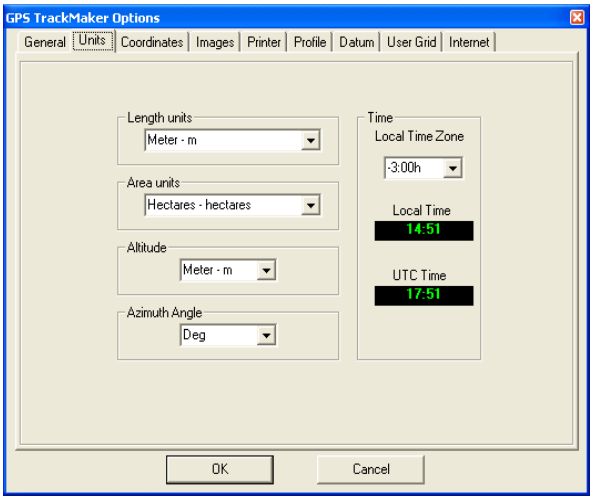
The units of measurement for lengths available in TrackMaker program are:

Unit	***Symbol***	***unit in meters***
Meter	m	1
Kilometer	Km	1000
Feet	ft	0.3048
Yard	Yd	0.9144
Mile	Mi	1609.344
Nautical Mile	Nmi	1852
Varas *	Varas	1.1
Bracas *	Bracas	2.2
Leguas *	Leguas	6600

*Old units – restrict use

9.6 Configuring the Speed Unit

The configuration of the speed unit is made choosing the length unit in *Tools > Options > Units*.

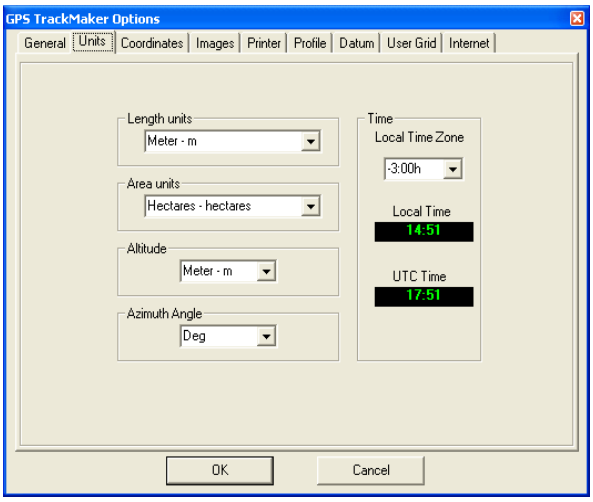


- If you choose an English unit such as **ft, yd** and **mi**, the speed unit will be **mi/h** (miles per hour)
- Choosing **nmi** (nautical miles), the speed unit will be **kt (knots)**
- Choosing other options, the speed unit is configured to **km/h** (kilometers per hour)

9.7 Configuring the Surface Unit of Measurement

This option is available only in **GPS TrackMaker Professional®**.

In *Tools > Options > Units* you can choose several units of measurement that will be used to calculate the surface limited by Tracklogs. The measurement units for surfaces available are:



Surface Unit	***Symbol***	***unit in m²***
Square meters	m²	1
Square Kilometers	km²	1000000
Ares	ares	100
Hectares	hectares	10000
Square feet	ft²	0.09290304
Square Yards	yd²	0.83612736
Square Miles	mi²	2589988.110336
English Acre	acres	4046.856422
Square Bracas*	braca²	4.84
Alqueires (SP)*	alqueires	24200
Alqueiroes (MG)*	alqueiroes	48400
Square Legua*	legua²	43560000

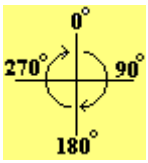
*Old surface unit of measurement – restrict use

9.8 Configuring the Azimuth Angle

This option is available only in **GPS TrackMaker Professional®**.

The notation of the azimuth angle can be changed in *Tools > Options > Units > Azimuth Angle.* The following notations are supported:

- **dd.ddddd**: degrees with 13 decimal places.
- **dd mm' ss"**: Degrees, minutes and seconds.
- **dd mm'**: Degrees, minutes and its decimals.

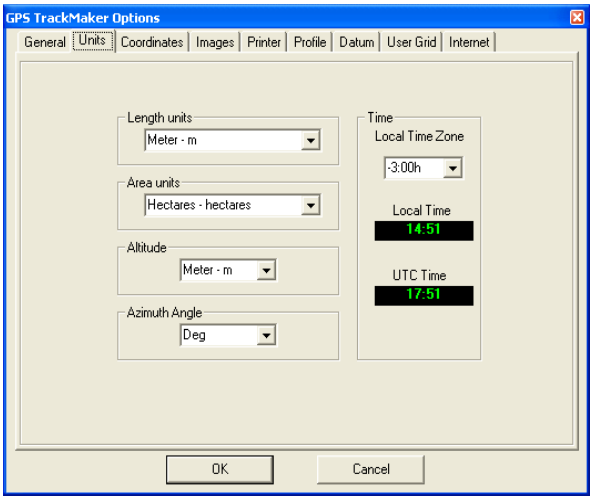


The azimuth (bearing) must be between 0º and 360º (as shown). The reference will be the true axis North-South when the program is configured for geographic coordinates (Azimuth/North). In rectangular systems such as UTM, if the segment is contained in only one zone, the reference will be the north-south axis of the grid (Azimuth/Grid).

9.9 Configuring Local Time

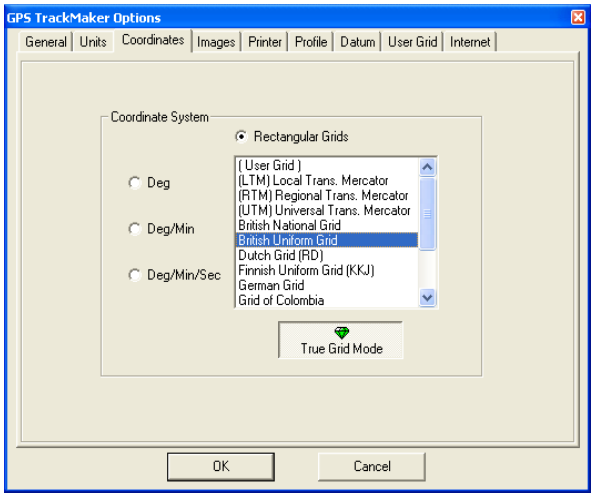
The GPS receiver transfers to PC the UTC time (London Time) and the User must configure the time difference between the local time and UTC in *Tools > Options > Units > Local Time Zone*.

Places located west of the Greenwich Meridian (0º) will have negative time differences, and places located east will have positive differences.



9.10 Configuring the Coordinate System

The **GPS TrackMaker®** program supports several coordinates systems such as shown below.



Geographic Coordinates (Angular Coordinates)

Geographic Coordinates (or angular coordinates) are the basis for the familiar latitude and longitude lines found on most maps. Lines of latitude are circles that are parallel to the equator and one to another. That's why lines of latitude are also called *parallels*. Lines of longitude are half-circles that extend from the North Pole to the South Pole. Lines of longitude are also called *meridians*.

For latitudes to the south of the equator line (0º), and for longitudes to the west of Greenwich (0º), the values are negative.

The **GPS TrackMaker®** program presents geographical coordinates in degrees, through 3 different notations:

Deg (dd.ddddd : decimal degrees): Default notation of the program, using 13 decimals. Depending on the Windows®' *Regional Settings*, there would be a dot or comma for the decimal values.
Example: latitude -19,9478667572357 longitude -43,9863802100454

Deg / Min / Sec (degrees, minutes, seconds): Notation that represents the value of the coordinates in degrees-minutes-seconds. "dd" represents the degrees (from –180 to 180), "mm" represents the minutes (0 to 59) and "ss" represents the seconds and its decimals (0 a 59.999999"). When writing this notation, insert a space after the hours, an apostrophe " ' " after the minutes and double apostrophes " '' " after the seconds.
Example: latitude 19 56' 52,32033'' longitude -43 59' 10,96876''

Deg / Min (degrees and minutes): Notation that represents the value of the coordinates in degrees-minutes, where "dd" represents the hours (or degrees, from –180 to 180), "mm" represents the minutes and its decimals (0 to 59.999999999'). When writing this notation, the User must insert a space after the degrees and an apostrophe " ' " after the minutes.
Example: -19 56,87201' -43 59,18281'

Rectangular Systems

UTM Coordinate System

UTM: **GPS TrackMaker®** allows the visualization of data in *True Grid* mode. More information, see True Grid Mode

The UTM system was created to determine the rectangular coordinates in military charts, in large scale, for the whole world. It is a practical method to calculate the transformations of plane coordinates in geographic and vice-versa, or the conversion of plane coordinates on the ellipsoid according to ellipsoidal sides and angles, or the calculation of the meridian convergence and of the azimuths and plane and ellipsoidal sides.

The UTM systems determines that the Earth is divided in zones, limited by 60 sections of 6 degrees of longitude, with its origin in Greenwich anti-meridian (180º), and growing from west to east until its union at this same point.

For the extent in latitude, the section begins in 80ºS parallel going up to the 84ºN parallel. For the longitude, there are 60 sections, for latitude, the division corresponds to zones of 4º. A number followed by a character, as shown below, represents each zone:

...	19	20	21	22	23	24	25	26	27	28	...
M											-8º
L											-16º
K					23K						-24º
J											-32º
H											-40º
G											-48º
F											-56º
...	-66º	-60º	-54º	-48º	-42º	-36º	-30º	-24º	-18º	-12º	…

Example : The coordinates -19,9478667572357 and -43,9863802100454 (dd.ddddd) represent in UTM : Zone 23K, horizontal coordinate S7794181,82477, Vertical coordinate W606056,63507 (Conversion made in WGS 84 datum)

The character W, E, S and N are only indicatives and will be discarded if User inserts them.

The program shows at screen up to 4 consecutive zones, giving a global view. Above 4 zones, the program will show only the meridians and the separation parallels of each zone in red color.

LTM and RTM Coordinate System

LTM system (Local Transverse Mercator) and RTM system (Regional Transverse Mercator) are available only in GTM PRO®, and they are used basically in specialized works of topography and geodesy.

Other rectangular systems supported by GPS TrackMaker® :

Before using the systems indicated below, configure the program to the local datum. See Configuring the Datum. For some systems that have a specific datum, the program will recommend the change.

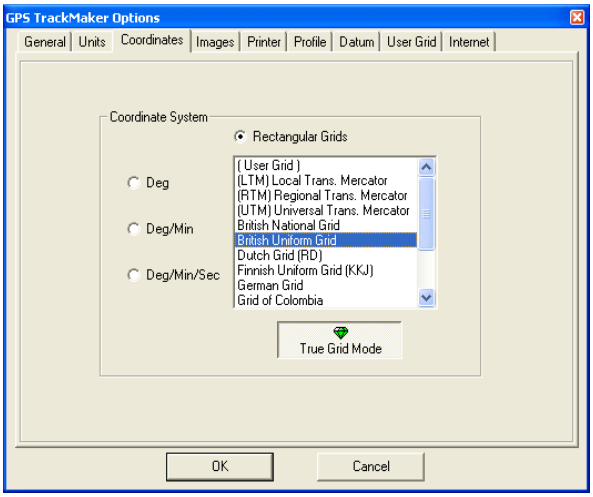
- New Zealand Map Grid
- Swiss Grid
- Finnish Uniform Grid
- Swedish National Grid
- British National Grid
- British Uniform Grid
- Irish National Grid
- German Grid
- Taiwan 67 Grid
- Dutch Grid
- Grid of Colombia (GTM PRO®)

True-Grid Mode

 Pressing this button, the data indicated in rectangular coordinates is shown in *True-Grid* mode. For further information, see True Grid Mode.

9.11 True Grid Mode

Rectangular systems divide the earth into zones, presenting it in sections, which can be an obstacle for User in the beginning. However, for UTM and others rectangular systems, **GPS TrackMaker®** allows a detailed presentation on screen of up to 4 serial zones, allowing a global view. Above 4 zones, the program will only show the meridians and separation parallels of each zone in red. For more about UTM and others rectangular system, see Configuring the Coordinate System



Normal Grid Mode

When a rectangular coordinate system is chosen in the *Tools > Options* menu, without enabling *True Grid* button , the program enters normal mode.

To assist in viewing several zones, this method is used to draw on screen the coordinates in geographic coordinates (angular coordinates) and grid lines with the positions defined by the rectangular system. This method, in spite of allowing a general view of several zones, brings the inconvenience of not being very accurate, because rectangular systems present small variations in the extremity of the zones. These variations are called *Meridian Convergence* or *Grid Declination*.

The advantages of normal mode are:

- Allows for quick viewing on the screen
- Visualization of several zones in the rectangular system

Disadvantages:

- Presents variations on screen, introduced by Meridian Convergence (Grid Declination).

True Grid Mode

GPS TrackMaker® can view data in True Grid Mode. This view mode is enabled when the *True Grid* button is selected.
In *True Grid* mode, when the program verifies that screen limits are in a same zone, it will internally change the whole visualization structure, modifying the screen for True Grid Mode, doing the conversion of all data on the screen for the respective rectangular system. The indication *TRUE* will appear in left side of the status bar at the bottom of the screen, together with an icon .

Thus, all Waypoints, Tracklogs and Routes coordinates, will first be converted to the rectangular system and then they will be shown on the screen or printer.

The great advantage of *True Grid* mode is to facilitate a greater precision in data visualization on the screen, without deformations created by Meridian Convergence. In rectangular systems, scanned and inserted maps in the background of the screen will also be more precise for Waypoints, Tracklogs and Routes.

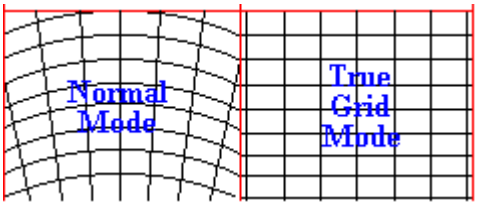
The advantages of True Grid Mode are:

- Facilitates the visualization and data handle more precisely regarding in normal mode. The deformations created by Meridian Convergence are eliminated.
- Scanned Maps in rectangular systems inserted in the background of the screen will have greater precision.

Disadvantages:

- True Grid Mode becomes slower, because all data is converted to the respective rectangular system before being displayed.
- It will be activated only when there is just one zone on screen.

Comparison between Normal Mode and True Grid Mode



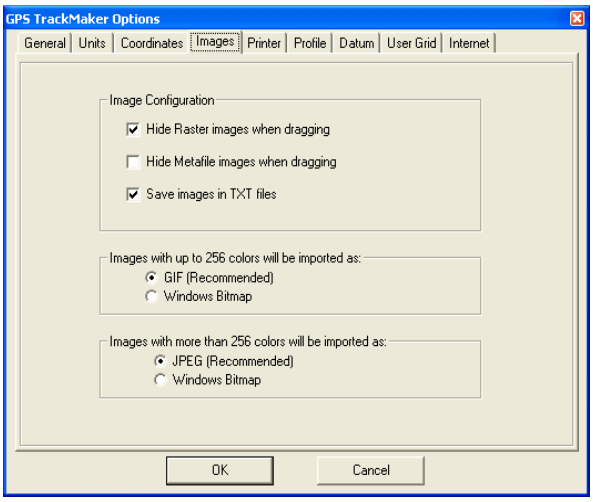
The illustration indicates the difference displayed between Normal Mode and True Grid Mode. Notice that the display in Normal Mode presents a small rotation created by the Meridian Convergence (Grid Declination). In True Grid Mode, there isn't any rotation.

Expanding Zones

GTM PRO® has a resource called *Expand Zones* allowing to expand a single rectangular zone, extrapolating the limits of the *True Grid* mode. For further information, see Expanding Zones.

9.12 Configuring Images

In *Tools > Options> Images* you can configure the behavior of the program for background images as it follows:



Hide Raster Images when Dragging

Images Raster usually are big and can take some time to be printed on screen. Like images BMP, JPG and GIF of maps that usually have some dozens of megabytes.

With this option selected, Raster images will be hidden when you click with the right button of the mouse to drag the screen. In slow computers, it is advisable to select this option.

Hide *Metafile* Images When Dragging

Metafile Images usually are smaller than Raster images and not cause big problems of time to be printed on screen. WMF and EMF are an example of Metafiles (Cliparts® of MS Windows®).

With this option selected, *Metafile* images will be hidden when you click with the right button of the mouse to drag the screen. This option must be selected only when the User uses big Metafiles that take some time to be printed on screen. Otherwise, it is advisable not to select this option.

Save Images in TXT Files

Selecting this option, the program will save images inserted in the background of the screen with the file standard TXT from GPS TrackMaker®.

It is advisable to keep this option selected.

Options Available in **GTM PRO®**

Images with up to 256 colors will be imported as...

GTM PRO® is able to import TIFF, PNG and PCX formats that are converted to JPG, GIF or BMP formats supported by the free version.
To define in which format the images with up to 256 colors will be converted, select:

- GIF (recommended) to obtain compressed images with small sizes
- BMP to obtain images without compression

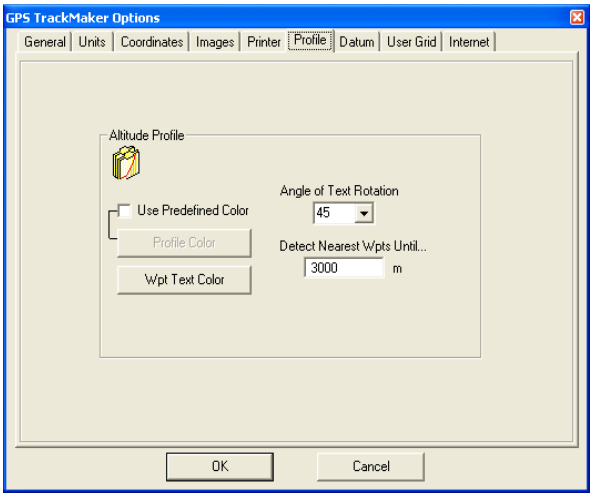
Images with more than 256 colors will be imported as...

To define in which format the images with more than 256 colors will be converted, select:

- JPG (recommended) to obtain compressed images with small sizes
- BMP to obtain images without compression

9.13 Configuring the Altitude Profile

To open the configuration window of Altitude Profile, click in *Tools > Options > Profile*.



Use Predefined Color

This option defines the color of the Profile.

Enabled: Allows to choose the color of the profile.
Disabled: the Profile will have the same color of the Tracklog (default).

Text Color

Defines the text color of the nearest Waypoints.

Angle of Text Rotation

Defines the angle of text rotation of the nearest Waypoints. The default value is 45º.

Detect Nearest Waypoints Until.

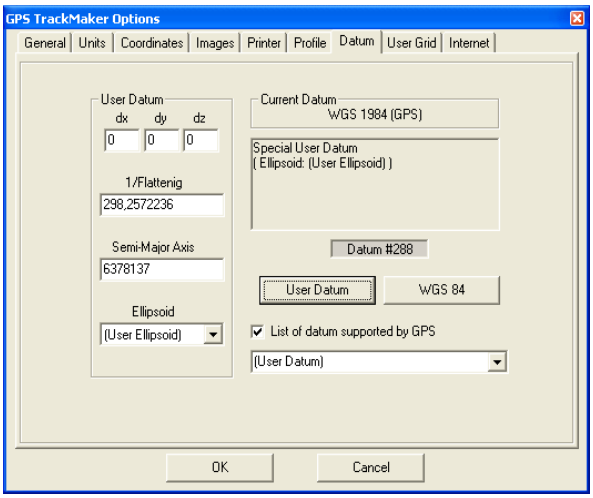
Defines the maximum distance between the Tracklog and the nearest Waypoints. The default value is 3000m (9840 ft).

9.14 Configuring the Datum

The Datum is a reference surface that has 5 parameters :

- Point of the ground;
- geoidal height;
- reference ellipsoid;
- geodesic coordinates of each starting point ;
- azimuth from this point.

The GPS TrackMaker® program makes the conversion of more than 280 different parameters of datum, as shown in Datum Table.



Choosing *List of datum supported by GPS* option, the list of datum supported by most of Garmin® and Magellan® GPS will be shown.

Keep in mind that each map may have been built using a specific datum. Then, in order to keep compatibility among the different maps, it is necessary to change the datum used by the GPS TrackMaker®. In *Tools > Options > Datum*, choose the datum option that corresponds to the map used.

In GTM PRO® it is possible to create a *User Datum*. For further information, see Datum Defined by User.

Example:

Data are collected with the GPS then transfers them to GPS TrackMaker®, which is configured for the WGS 84 Datum.

Then, a topographic chart created in the *Corrego Alegre* datum is inserted in **GPS TrackMaker®**. Usually, the datum is indicated in the bottom of the map charts.

When transferring to the map the data obtained with the GPS, probably the points will be located up to a few hundreds of meters away from the real position.

In order to prevent this error, change the datum in the GPS TrackMaker® to *Corrego Alegre* All coordinates coming from the GPS will be converted to the map datum (*Corrego Alegre*).

As an example, the table below shows the value in decimal degrees for the same point, using different parameters of datum:

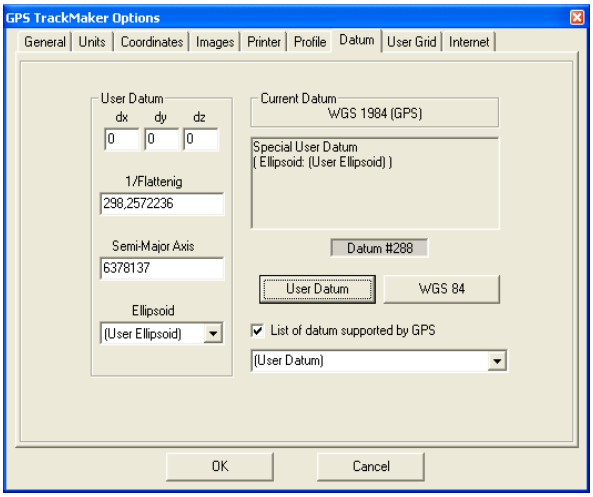
Datum	Latitude	Longitude
WGS 84	0.00000	24.00000
South American 69	0.00037	23.99978
Pico de las Nieves	0.00115	23.99963
Campo Inchauspe	0.00081	23.99834
Corrego Alegre	0.00005	23.99784

If you don't need a specific datum, use **WGS 84** datum, which is the default of GPS TrackMaker®. This is also the default datum for GPS receivers. Using this datum, you prevent the computer of wasting time for the data conversion every time a file is opened and send or receive data from the GPS.

TIP: You can use any datum in your GPS.. During the transfer to GPS TrackMaker®, generally the data is converted by the GPS to **WGS 84**. If it is not necessary to use a specific datum, configure the GPS to WGS 84.

9.15 Datum Defined by User

In GTM PRO®, the User can configure their own datum that will be called *User Datum*. This is done through the *Options* window accessed through the *Tools* menu, or by pressing the button



In the *Options* window, click on the *Datum* tab and on the <**User Datum**> button, so that the five fields of the datum configuration be enabled.

DX, DY and DZ Field

These fields represent the conversion differences (delta) between User's datum and the default WGS 84 datum. They are specific values using the Molodensky pattern formula for datum conversion. To obtain a complete list of DX, DY and DZ fields, see Datum Table

1/Flattening

It is the inverse of the flattening value of the Earth's ellipsoid. Each datum has its own flattening value. The values accepted by **GPS TrackMaker®** for the inverse of the flattening are between 280 and 310.

Major Semi-axis

Field destined to the length of Earth's larger semi-axis. The values chosen by the User must be between 6376000 and 6379000 meters.

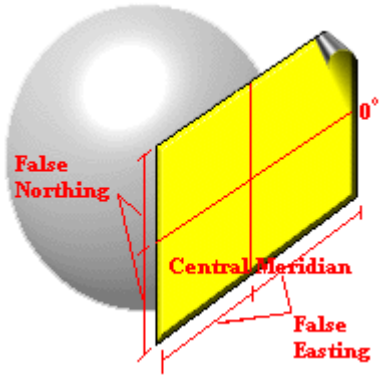
Predefined Earth Ellipsoid

If the User doesn't want to define the fields for the flattening and the larger semi-axis of the Earth, they can choose between the several reference ellipsoids contained in the Predefined ellipsoid list. To learn which are the Predefined ellipsoids of **GPS TrackMaker®**, consult the Datum Table.

9.16 Grid Defined by User

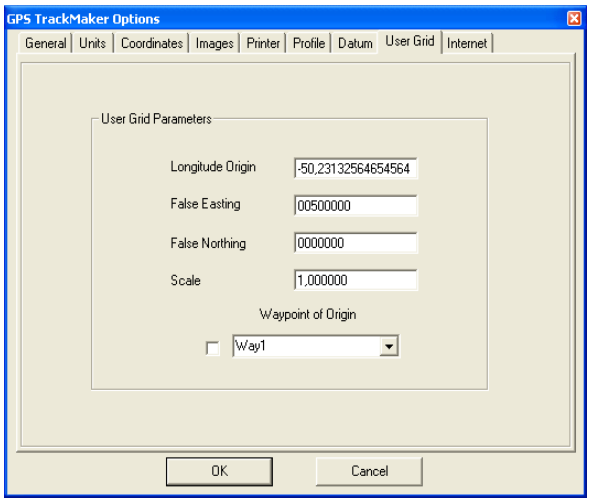
This option is available only in **GPS TrackMaker Professional®** .

Introduction



The *Grid defined by User* allows the creation of a metric coordinates system, similar to a UTM zone, but with coordinate values defined by the User. Like the UTM system, the User Grid will extend from the 84N parallel to the 80S but it will have only one zone with a maximum width of 36 degrees, that is to say, a maximum of 18 degrees for each side of the central meridian. The definition of the parameters is done in *Tools* > *Options* > *User Grid*. To enable choose *Coordinates* > *User Grid* option in the list of rectangular grids.

Parameters



Central meridian (Longitude Origin)

The central meridian or Longitude origin is the first parameter to be defined. The value must be typed in geographical coordinates, being limited between -180º and 180º. The central meridian will determine the zero origin of the X-axis or Easting of the system of the user's coordinate.

False Easting

After choosing the central meridian, the second step is to choose the false origin of X-axis. The false origin is represented in meters and it corresponds to the initial value of the X-axis (Easting) on the central meridian. So, if the chosen value was 50000 meters, this will be the initial value of the X coordinate (or Easting) on the central meridian. Negative values are supported.

False Northing

In the definition of the User's Grid, it is not necessary to indicate any parallel (latitude), because the origin (point zero) of the vertical Y-axis always will be the equator line (0º). However, in most cases, the definition of a false origin of the Y-axis is necessary to best represent the data. Thus, False Easting will be the initial value, in meters, of the Y-axis on the Equator Line. If the User chooses, for example, the value 500000 meters, this will be the initial value of the Y coordinate (or Northing) on the Equator Line. Negative Values are supported.

Scale Factor

Maybe this is the most difficult parameter to define. It is a multiplication constant of each coordinate of the User's Grid, to minimize the deformations due to the Transverse Projection of Mercator. This projection is used in User's Grid, with a growing scale error of the central meridian for the extremities of the zone. Thus, the Scale Factor reduces the difference between the scale error of extremities and of the central area of the zone. The Scale Factor is a number close to 1 (one), and this is the default value. The Scale Factor for UTM system is 0.9996.

Choosing a Waypoint as Origin

The definition of the parameters of User's Grid is not always an easy task, especially when you want to define the origin point (0,0) in a specific place. To solve this problem, **GPS TrackMaker®** allows you to choose a Waypoint to be the origin (0,0), just click on list box. When the Waypoint is chosen, the program will immediately calculate the parameters of the User's Grid, and the origin will be the Waypoint.

Warnings:

Changing the datum will affect the coordinate values of the User Grid. Use the specific datum of your region.

Even though **GPS TrackMaker®** allows the visualization of an area of 18º on each side of the central meridian, the User must use only up to 3º on each side to avoid bigger scale errors.

Adopting the Scale Factor 1 (one), the area next to the central meridian will provide values of cartographic area and cartographic length relative to the ellipsoid of the datum in use.

9.17 Displaying Grid Lines

Grid lines are horizontal and vertical dashed lines displayed on screen when the option *Grid* in the button  is enabled.

Grid lines are shown in several Coordinate Systems supported by the program. In UTM and other rectangular coordinate systems, up to 4 zones can be shown simultaneously. Limit coordinates for each zone are displayed in red.

The shortcut key **<CTRL G>** also shows or hides grid lines.

9.18 Showing Scale on Screen

Notes about scale

Scale is a relation of distance between two points of the map with the corresponding distance on the Earth's surface. It is generally indicated by a fraction or a relation between linear distances indicated on the map and corresponding distances on the Earth's surface.

Numeric scales can be represented by a direct relation of multiplication or through a relation of distance. **GPS TrackMaker®** uses the second method, because it is more intuitive and easy to understand. Thus, the scale of 1:100 km indicates that 1 cm on the map is equal to 100 km on the Earth's surface.

For the English system (yards, miles, etc), the relation will take inches as a base. This way, the scale 1:50 miles indicates that 1 inch on the map (2,54 cm) corresponds to 50 miles on the Earth's surface.

Scale indication at GPS TrackMaker®

To enable scale indication on screen, choose *View* > *Scale* or press **<CTRL E>**.

Scale indication will appear in the upper left corner of the screen, as indicated in the illustration. For scale calculation, the program always considers the linear horizontal length of the center of screen. Thus, in larger scales (1:500km, 1:1000 km, etc), distortions can occur among the values indicated in scale and the real scale in areas around the screen's edges.

Scales can be changed in the *Scale* box in Tool Bar. Just click on one of the scales indicated in the box so the screen will be modified to the respective scale. Zoom Tools will also modify the scale indicated on the screen.

9.19 Changing the Language

To modify the language, choose one of the available options in *Help* > *Language* menu. The sentences of each supported language are registered in the file called *Language.dat* located in the same directory of GPS TrackMaker®.

Verify the list of supported languages at **http://www.gpstm.com**

10 Calculations with Tracklogs, Routes and Waypoints

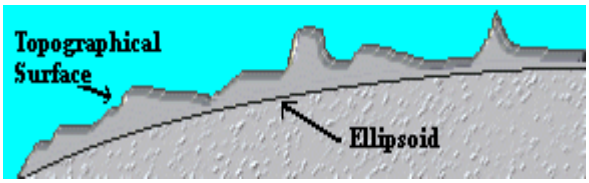
10.1 Topographic Surface x Cartographic Surface

This topic refers to exclusive functions of GTM PRO®.

Introduction

Survey work done with a GPS will not always correspond exactly to the local surface. It happens because the handheld GPS can't measure the direct distance between two points, like other topographical equipment such as Total Station and Theodolite.

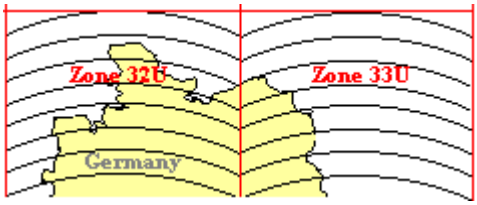
The GPS provides **GPS TrackMaker®** with the geographic coordinates of the ellipsoidal Earth surface, that must be converted for an appropriate rectangular coordinate system (UTM for example), only after that, the distances and the area are calculated. However, these distances will be related to the chosen cartographic surface and not to the local topographical surface.



Several rectangular coordinate systems have the Earth's ellipsoid as a base that in most cases doesn't coincide with the local topographical surface. The dimensions and the ellipsoid shape can be defined choosing the most appropriate datum for the region.

The cartographic grids try to represent the Earth's curvature as a plane, suffering the influence of an angular deformation called Meridian Convergence.

Meridian Convergence is the angle formed between the grid north and true north. Taking the UTM system as a base, the closer to the central area of a UTM zone, smaller the value, getting to zero in the central meridian of the UTM zone.

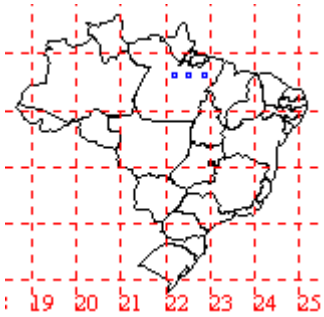


The side picture shows the north of Germany with its two UTM zones. As an example, the meridian convergence is shown bigger than it really is, indicating that in the central area of the zone the convergence angle is zero and it is maximum in the extremities of the zone.

Notice that the same geometric picture in a UTM grid can present small shape variations if it is measured by a GPS in the center of UTM zone or in its extremities. This variation can be seen in the area calculation and in length calculation.

That's why, it is necessary to distinguish between the cartographic surface and the local topographical surface. The cartographic surface is obtained through complex mathematical formulas that consider the shape and the Earth dimensions while the topographical surface considers the measures obtained directly in the local area, representing the reality more correctly.

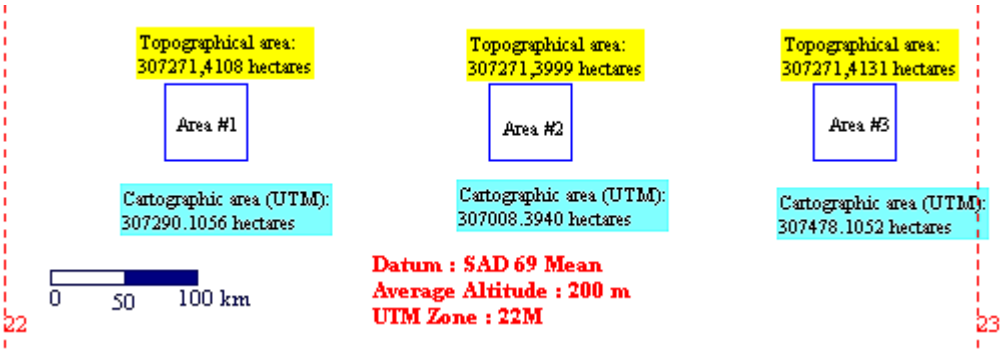
Example



Certainly the best way to understand the difference between the local topographical surface and the cartographic surface is with a practical example. The side picture shows three-square areas with identical angular dimensions, located in the extremities and in the center of the UTM 22M zone, in Para State/Brazil.

The three areas have sides with angular dimensions of 0.5 degree (SAD69) and they are aligned in the same latitude, according to the table of dimensions below:

Area #1		**Area #2**		**Area #3**	
Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
-3.5	-53.0	-3.5	-51.0	-3.5	-49.0
-3.5	-52.5	-3.5	-50.5	-3.5	-48.5
-3.0	-52.5	-3.0	-50.5	-3.0	-48.5
-3.0	-53.0	-3.0	-51.0	-3.0	-49.0



Being that the three areas are located in the same latitude and having the same angular dimension, we could expect that it would have the same area. However, when we calculate the cartographic area in a UTM system, we get the following results:

- Area #1 = 307290.1056 hectares
- Area #2 = 307008.3940 hectares
- Area #3 = 307478.1052 hectares

Using UTM grid to calculate the cartographic area, we get values with considerable differences, even when the three areas are equal! This doesn't happen if the calculation is done through topographical area:

- Area #1 = 307271.4108 hectares
- Area #2 = 307271.3999 hectares
- Area #3 = 307271.4131 hectares

The small difference in the topographical area calculation happens because of internal rounding errors due to the formula's complexity. The topographical area was calculated using the *SAD69 Average* datum, with an average altitude of 200 meters. The altitude is provided by the GPS, that is to say, in relation to the Earth's ellipsoid.

NOTE: The file with this example is called *area_topo.gtm* and it is in the CD of GTM PRO® program or in the home-page: http://www.gpstm.com

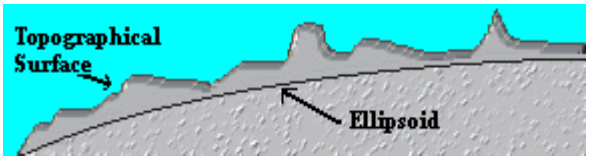
Calculating Topographical Distance and Area at GTM PRO®

GTM PRO® calculates distances for topographical areas like it calculates distances for cartographic areas. The difference is that the User will have to choose between the Tracklogs altitude or choose NA average altitude for the calculation.

10.2 Conversion to the Local Topographical Surface

This option is available only in **GPS TrackMaker Professional®** .

Introduction

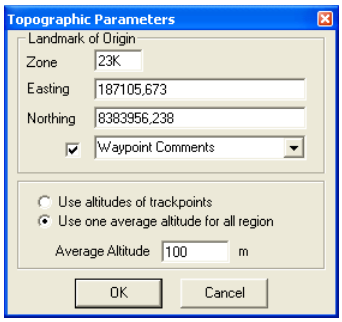


This function assists in taking Tracklogs, Routes and Waypoints to the local topographical surface using the UTM system as support. With the topographical conversion, slight deformations are minimized due to the meridian convergence and because of the difference between the topographical and cartographic lengths, getting a real drawing of the data obtained with the GPS. For further information about the difference between the cartographic and topographical surfaces, see Topographical Surface x Cartographic Surface

The topographical conversion is very useful when the user wants to combine survey work done with the GPS with topographical survey work that already exists, accomplished with Theodolite or Total Station. When the conversion is done, the azimuths will have the true north as origin, not the north of the grid, and the distances will be closer to reality.

To do the topographical conversion, select Waypoints, Tracklogs or Routes according to Data Selection, and then click on the *Topographical Conversion* option in the *Tools* menu.

The window below will appear, offering the following options:



- **Point of Origin**: To eliminate the influence of the local meridian convergence and other angular deformations, the selected data must be rotated. For that, it is necessary to choose an origin point that will stay fixed while the other data is rotated around it. Generally, the point of origin is an official point with known coordinates and created by accurate instruments. Though, another point can be chosen as origin limit. By default, **GPS TrackMaker®** chooses the first point of the first selected Tracklog as origin.

- **Tracklogs Altitude**: Selecting this option the calculation will be done considering the individual altitudes of each Tracklog and Waypoint segment. This option is useful when the handheld GPS sends the Tracklogs altitude to the computer, or when the points of the Tracklogs have the altitude field filled in.

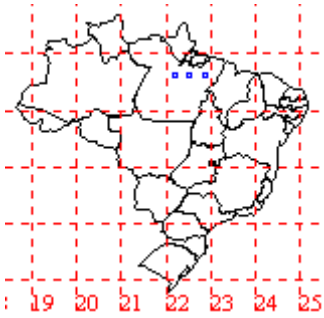
- **Local Average Altitude**: This option is useful when the user wants to use an average altitude for the area, or when there are no altitude registrations in the Tracklogs. A suggested average altitude will always be indicated in this field, based on the altitudes of the selected Tracklog.

Warning: The topographical area calculation will depend on the correct indication of the local altitude. The altitude is the altitude provided by the GPS, that is to say, according to the Earth's ellipsoid. Also, use the specific datum of your region.

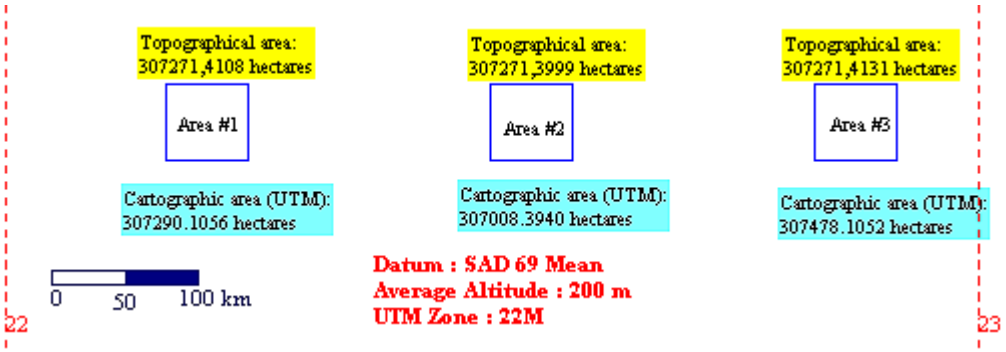
Important: After conversion, the coordinates of the points in UTM system will be converted to the local topographical surface. Because of that, the new coordinates **must not be sent back to the GPS,** because they won't be in the UTM system anymore, but, they will be in the local topographical surface.

They should not be taken as geodesic coordinates anymore, but as local topographical coordinates.

Example



The best way to understand the topographical conversion is with a practical example. The side illustration shows three-square areas with identical angular dimensions, located in the extremities and in the center of the UTM zone 22M, in Para State/Brazil.



The area #1 will be the subject of the topographical conversion. It has angular dimensions of 0.5 degree (SAD69) perfectly aligned with the true north, as indicated below:

	Latitude	Longitude	Azimuth (True North)
Vertex 1	-3.5	-53.0	
Vertex 2	-3.5	-52.5	90º
Vertex 3	-3.0	-52.5	0º
Vertex 4	-3.0	-53.0	270º
Vertex 1	-3.5	-53.0	180º

These same points if converted for UTM system, will present different azimuths, because they will be relative to the cartographic UTM grid. Besides, they will present cartographic distances:

	Northing	Easting	Azimuth (North of Grid)
Vertex 1	9612901.869	277816.512	
Vertex 2	9613005.503	333377.182	89.89º
Vertex 3	9668291.453	333295.107	359.91
Vertex 4	9668202.566	277707.029	269.91
Vertex 1	9612901.869	277816.512	179.89

After the topographical conversion, the angles will be adjusted for the true north and the distances will be adjusted for the local topographical surface. The table below shows the new values after the topographical conversion:

Point 1	9612901.869	277816.513	
Point 2	9612887.072	333375.263	90.02º
Point 3	9668179.140	333403.647	0.03º
Point 4	9668192.888	277816.506	270.01º
Point 1	9612901.869	277816.513	180.00º

The parameters were:
- Datum: SAD 69 Average
- Point of Origin: Point 1
- Average Altitude : 200 meters

Note that the azimuth of the segment that contains the origin point (Point 1) have the same value of the azimuth according to the true north. The other azimuths were close to the original values, but they were not equal due to the change of the cartographic lengths to topographical in relation to the origin limit.

The coordinates obtained after the conversion are not cartographic, therefore, they cannot be sent back to GPS anymore. A way of improving the data presentation would be to choose the Point 1 as origin, subtracting the values of the coordinates of the Point 1 from the other points. This process could be done outside of the **GPS TrackMaker®**, through some electronic table sheet program (ex: Microsoft Excel®):

Vertex 1	0 m	0 m
Vertex 2	-15 m	55558 m
Vertex 3	55277 m	55587 m
Vertex 4	55287 m	0 m
Vertex 5	0 m	0 m

NOTE: The file with this practical example is called *area_topo.gtm* and it is on the GTM PRO® CD and in the home-page of the program: http://www.gpstm.com

Warnings:

Sub metric accuracy will be obtained only by topographical equipment like Total Station or Differential GPS that cost much more than a handheld GPS. So, for works that demand accuracy, handheld GPS units must only be used as a support tool and not as the main instrument.

Changes in the datum can produce differences in length calculations. This happens because each datum may have a proper value from the Earth semi-axis and of its flattening, it can be seen in Datum Table. Use the specific datum of your region.

10.3 Calculating Cartographic Length of Tracklogs and Routes

Cartographic length is calculated directly on the cartographic grid, and considers only Earth dimensions, not local characteristics like altitude and meridian convergence. For further information about the difference between cartographic surface and topographical surface, see Topographical Surface x Cartographic Surface

GPS TrackMaker® calculates the cartographic length in the following rectangular systems:

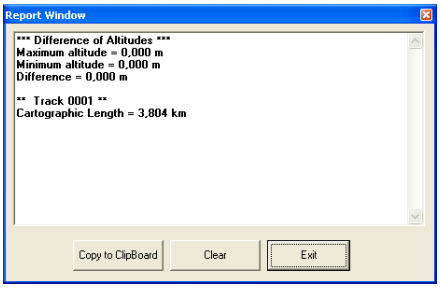
- UTM
- British Uniform Grid
- Swiss Grid
- Irish National Grid
- Finnish Uniform Grid
- Dutch Grid
- British National Grid
- New Zealand Grid
- Swedish Grid
- German Grid
- Taiwan 67 Grid

GPS TrackMaker Professional® also calculates in the following systems:

- User Defined Grid
- RTM (Regional Transverse Mercator)
- LTM (Local Transverse Mercator)
- Grid of Colombia

Warning: use the specific datum of your region.

If the program is configured to geographical coordinates, the cartographic area will be calculated based on the UTM system.



To calculate the cartographic length, select the Tracklog or Route as shown in Selecting Data and click on the *Cartographic Length* button on the Toolbar or in the *Tools* menu. The value will be indicated in the status bar at the bottom of the screen, in the Length Unit of Measurement, as well in the Report window.

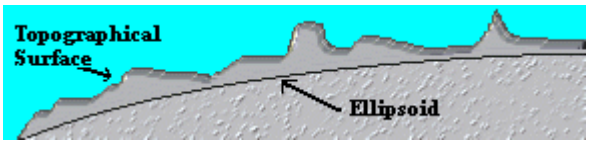
TIP: The calculated length can be indicated on the screen as a Waypoint. When creating the Waypoint, just click on the *comments* textbox and, using the arrow keys, select the value. When length and area are calculated, the values are registered (hidden) in the textbox of the Waypoint *comments*.

Warnings :
Sub metric accuracy is only obtained with topographical equipment like Total Station or Differential GPS that cost much more than a small handheld GPS. So, for tasks that demand accuracy, the handheld GPS must be used only as a support tool and not as main equipment.
Many handheld GPS don't transfer altitudes (relative and absolute) of each point to the program. So, the distance calculation cannot consider the natural ground elevations. In these cases, the values refer only to the horizontal distances.

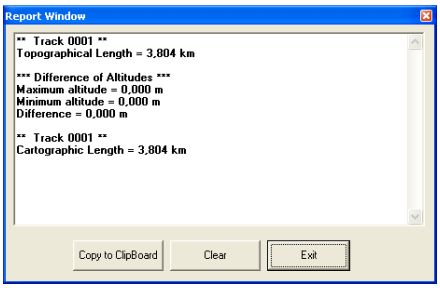
Changes in the datum can produce differences in length calculations. This happens because each datum may have a proper value from the Earth semi-axis and of its flattening, it can be seen in Datum Table. Use the specific datum of your region.

10.4 Calculating Topographical lengths of Tracklogs and Routes

This option is available only in **GPS TrackMaker Professional®** .

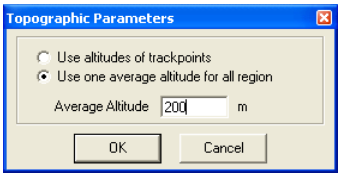


The calculation of topographical distance benefits the local topographical surface, the Tracklog, or the Route to be measured, making length values more accurate than the value obtained in the cartographic grid. For further information about the difference between such surfaces, see Topographical Surface x Cartographic Surface



To calculate the topographical length, select the Tracklog or Route according to the Data Selection section and click on the *Topographical Length* button on Tool Bar or in the *Tools* menu.

The window of altitudes will appear, offering two options for the calculation:



- **Tracklogs Altitude**: Selecting this option the calculation will be done considering the individual altitudes of each Tracklog segment. This option is useful when the handheld GPS the Tracklogs altitude sends to the computer, or when the points of Tracklogs have the altitude field filled in.

- **Local Average Altitude**: This option is useful when the user wants to use an average altitude for the area or when there are no altitude registrations in the Tracklogs. A suggested medium altitude will always be indicated in this field, based on the altitudes of the selected Tracklog.

Remember: The topographical length calculation will depend on the correct indication of the local altitude. The altitude is the altitude provided by the GPS, or that is to say, in relation to the Earth's ellipsoid. Use the specific datum of your area.

The resulting calculation will be indicated in the *status* bar in the lower part of the screen, in the respective Area Unit, as well as in the Report window.

The calculated length can be indicated on the screen as a Waypoint. When creating it, just click on the text box of the Waypoint *comments*, and with the arrow keys, choose the value. When the length and the area are calculated, the values are registered hidden in the text box of the Waypoint *comments*.

Warnings: Sub metric accuracy is only obtained with topographical equipment like Total Station or Differential GPS that cost much more than a small handheld GPS. So, for tasks that demand accuracy, the handheld GPS must be used only as a support tool and not as main equipment.

Many handheld GPS don't transfer altitudes (relative and absolute) of each point to the program. So, the distance calculation cannot consider the natural ground elevations. In these cases, the values refer only to the horizontal distances.

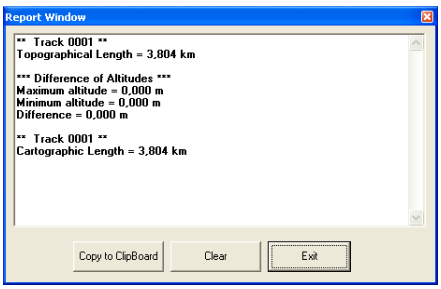
Changes in the datum can produce differences in length calculations. This happens because each datum may have a proper value from the Earth semi-axis and of its flattening, it can be seen in Datum Table. Use the specific datum of your region.

10.5 Horizontal Length of Tracklogs and Routes

In GTM PRO®, to calculate the length of the horizontal projection, select the Tracklog or Route according to Data Selection and click on the *Horizontal Cartographic Length* button or the *Horizontal Topographical Length* button located on the Tool Bar. The value will be indicated on the status bar at the bottom of the screen, in the respective length unit.

The horizontal length disregards the Altitude values, considering only the horizontal projection of the Tracklogs and Routes. To calculate the length accounting for the altitudes, see Calculating Cartographic Length of Tracklogs and Routes.

The horizontal length can be seen in the Report window.



10.6 Calculating Cartographic Areas

This option is available only in **GPS TrackMaker Professional®** .

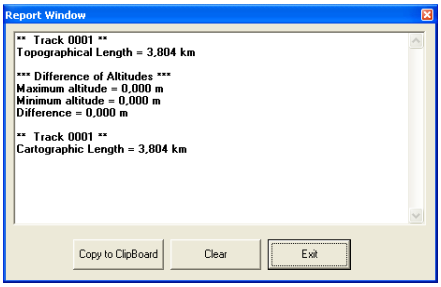
The cartographic area is calculated directly on the cartographic grid, considering only Earth dimensions, not accounting for local characteristics like altitude and meridian convergence. For further information about the difference between cartographic surface and topographical surface, see Topographical Surface x Cartographic Surface.

GPS TrackMaker® calculates the cartographic area in the following rectangular systems:

- User Defined Grid
- UTM (Universal Transverse Mercator)
- RTM (Regional Transverse Mercator)
- LTM (Local Transverse Mercator)
- British National Grid
- British Uniform Grid
- New Zealand Grid
- Swiss Grid
- Swedish Grid
- Irish National Grid
- German Grid
- Finnish National Grid
- Grid of Colombia
- Taiwan 67 Grid
- Dutch Grid

If the program is configured to geographical coordinates, the cartographic area will be calculated based on the UTM system.

Note: use the specific datum of your area.



To calculate cartographic areas delimited by Tracklogs, select the Tracklog as shown in Selecting Data then click on the *Cartographic Area* on the Toolbar or in the *Tools* menu. The value will be indicated in the status bar at the bottom of the screen, in the Area Unit of Measurement, as well as in Report window.

TIP: The calculated area can be indicated in the screen as a Waypoint. Just click on the *comments* textbox when creating the Waypoint, and using the arrow keys, select the value. When length and area are calculated, they are recorded (hidden) in the textbox of the Waypoint *comments*.

Ellipsoidal Area: the cartographic area is only calculated, if all points of Tracklog are in the same zone. If any point is located in other zone, GTM PRO® will calculate the Ellipsoidal Area. This area is calculated considering a tangent surface from Earth Ellipsoid, ignoring the scale factor.

Warnings:

Area calculation is possible only if the segments are located between parallels **80ºS** and **84ºN**.
The picture shows how the program calculates area for open geometric figures. The end segments are always considered closed for area calculations.

Avoid Tracklog segment crossings. The figure shows the results if this is done. The area calculated by the program will be not the real area.

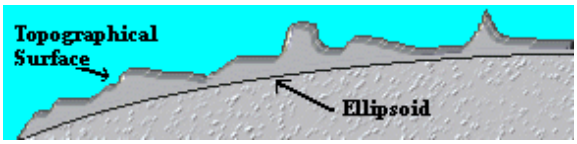
Sub metric accuracy is only obtained with topographical equipment like Total Station or Differential GPS that cost much more than a small handheld GPS. So, for tasks that demand accuracy, the handheld GPS must be used only as a support tool and not as main equipment.

The area calculation is accomplished without considering the altitude differences. So, only the horizontal projection will be considered for area calculation purposes.

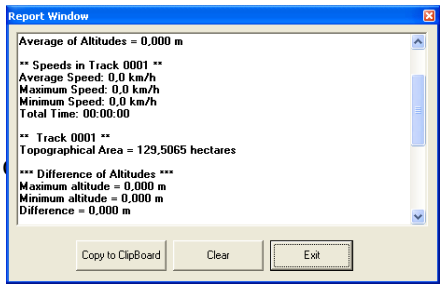
Occasional changes in the datum can produce variations in the area calculation. This happens because each datum may have a proper value from the Earth semi-axis and of its flattening, it can be seen in Datum Table. Use the specific datum of your area.

10.7 Calculating Topographical Areas

This option is available only in **GPS TrackMaker Professional®** .

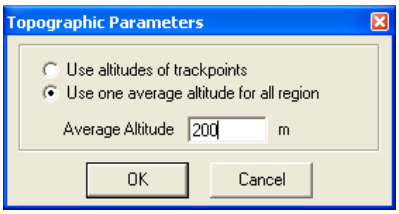


The calculation of topographical area brings the area to be measured to the local topographical surface, this way; you obtain area values more accurately than the values obtained in cartographic grids. For further information, see Topographical Surface x Cartographic Surface.



To calculate areas delimited by Tracklogs, select the Tracklog according to the Data Selection section and click on the *Topographical Area* button n the Tool Bar or in the *Tools* menu.

The altitude window will appear, offering two calculation options:



- **Tracklogs Altitude**: Selecting this option the calculation will be done considering the individual altitudes of each Tracklog segment. This option is useful when the handheld GPS sends the Tracklogs altitude to the computer, or when the points of the Tracklogs have the altitude field filled in.

- **Local Average Altitude**: This option is useful when there are no registrations of altitudes in the Tracklogs. A suggested medium altitude will always be indicated in this field, based on the altitudes of the selected Tracklog.

Remember: Topographical area calculation will depend on the correct indication of the local altitude. The altitude is the altitude provided by the GPS, that is to say, in relation to the Earth's ellipsoid. Also, use the specific datum of your area.

The resulting calculation will be indicated in the *status* bar in the lower part of the screen, in the respective Area Unit, as well as in the Report window.

The calculated area can be indicated in the screen as a Waypoint. When creating it, just click on the text box of the Waypoint *comments* and with the arrow keys, choose the value. When the length and the area are calculated, the values are registered hidden in the text box of Waypoint *comments*.

Warning: Area calculation is possible only if the segments are between the 80ºS parallel and the 84ºN parallel.

The picture shows how the program calculates area for open geometric figures. The end segments are always considered closed for area calculations.

Avoid Tracklog segment crossings. The figure shows the results if this is done. The area calculated by the program will be not the real area.

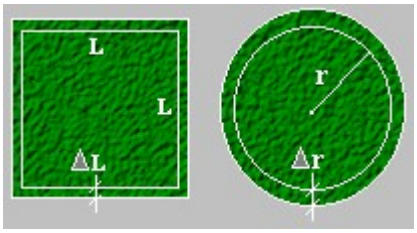
Sub metric accuracy is only obtained with topographical equipment like Total Station or Differential GPS that cost much more than a small handheld GPS. So, for tasks that demand accuracy, the handheld GPS must be used only as a support tool and not as main equipment.

The area calculation is accomplished without considering the altitude differences. So, only the horizontal projection will be considered for area calculation purposes.

Occasional changes in the datum can produce variations in the area calculation. This happens because each datum may have a proper value from the Earth semi-axis and of its flattening, it can be seen in Datum Table. Use the specific datum of your area.

10.8 Estimate of Area Calculation Error Using Handheld GPS

The GPS technology allows accuracy from 5 to 15 meters with a handheld GPS. However new technologies are emerging and they are able to reduce the horizontal error for values from 1 up to 3 meters. Survey works with a handheld GPS must be accomplished with caution because the error is still significant for small areas.



As an example, two tables are shown below indicating the percentage of error that the user gets in the area calculation of a square and a circumference if we admit an error of 5 meters outside the drawing. This error can be in any direction.

Square Area with a medium error of 5 meters

1 ha	10%
25 ha	2%
100 ha	1%
2500 ha	0,2%
10000 ha	0,1%
40000 ha	0,05%

Circular area with medium error of 5 meters

3,14 ha	10%
28,0 ha	5%
78,0 ha	2%
314 ha	1%
7800 ha	0,2%
31400 ha	0,1%

The tables above show that the larger the measured area with the handheld GPS, the smaller the percentage of error. So, the User must verify if the handheld GPS will be useful in the area calculation. For works that demand accuracy, the best thing to do is use the handheld GPS just as an auxiliary instrument.

Procedures to reduce the error when registering data

Whenever possible, check if the area to be measured with the handheld GPS have GPS signals available that improve the accuracy, as an example, WAAS or DGPS. For DGPS an external receiver will be necessary. If you region is not covered by WAAS, **disable** it in you GPS.

The larger the area, the better the accuracy of the measure with a handheld GPS. For areas smaller than 5 hectares (50000 m²), the error can be considerable.

Try to do the land demarcations with Waypoints. Don't trust the Tracklogs registered by GPS because they to not always provide a safe registration of the correct position of each vertex of the area. In the office, create the Tracklogs with the pen tool of GTM PRO®, and join the Waypoints registered in field.

When collecting, check if there are signals for at least 5 satellites. Also verify the EPE value. If it is under 10 meters, you will have a good register.

In GTM PRO®, calculate the topographical areas instead of cartographic areas. They best represent the reality of data in field.

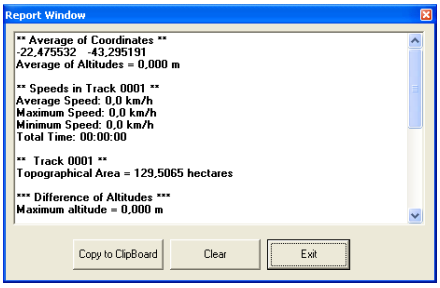
If your GPS doesn't register the altitudes of Waypoints or Tracklogs, remember to write down the local altitude because it will be useful in the topographical area calculation.

Whenever possible, in the reports, write the word "approximately" down before the calculated values from handheld GPS.

10.9 Calculation of Arithmetic Average of the Points

In GTM PRO® you can calculate the arithmetic average of Tracklogs, Routes and Waypoint coordinates. Just select the data for which you want to extract an average and then press the button M . A new Waypoint located exactly in the average latitude and longitude of the points will be created, indicating in the comments the amount of points considered in the calculation.

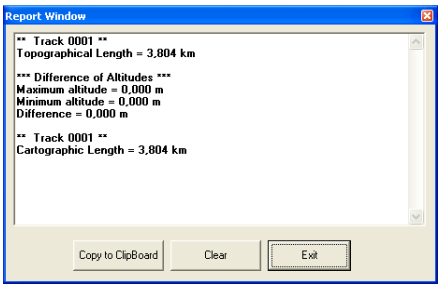
The average can also be seen in the Report window, when calculated.



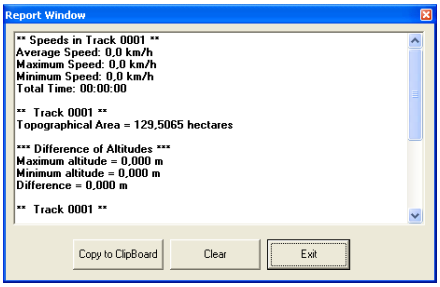
10.10 Calculation of Maximum Difference of Altitudes

In GTM PRO® you can calculate the maximum altitude, minimum altitude and maximum altitude difference from Tracklogs or Routes. Just select the data in which you want to extract the altitude difference and then press the button .

In the Report window, the maximum altitude, minimum altitude and the maximum difference from altitudes will be shown.



10.11 Speed and Total Time in Tracklogs



By pressing the button it is possible to calculate the maximum, minimum and medium speed, and the travel time spent in the Track. Select the Tracklog according to the Data Selection, and click on the *Speed in Tracklogs* button on the Tool Bar or in the *Tools* menu. The value will be indicated in the Report window.

10.12 UTM Scale Factor and Meridian Convergence

This option is available only in **GPS TrackMaker Professional®**.

UTM Scale Factor

Scale factor represents the scale distortion on a rectangular zone. The more distant of the central meridian, bigger will be the deformation in the scale. For UTM system, the more distant from the value 0.9996, bigger will be the deformation in the scale.

To calculate the UTM scale factor, first select the desired Waypoints through selection tools already described in Selecting Data. Then choose *Tools > UTM Calculations > Scale Factor*. The values will be shown in the Report Window.

UTM Meridian Convergence

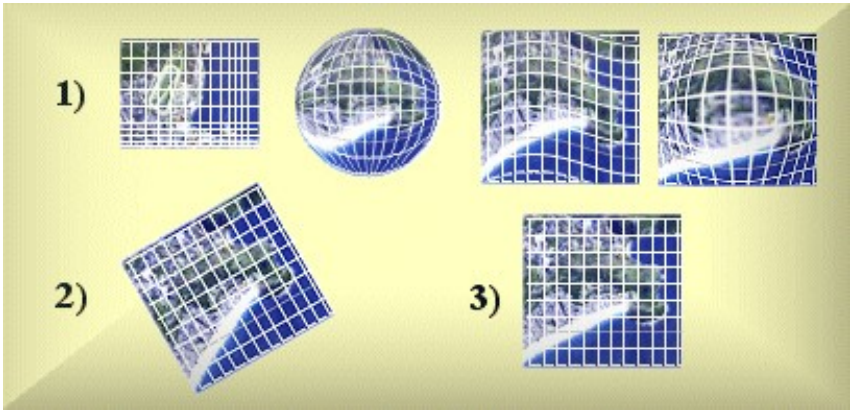
Meridian Convergence is the angle formed between the north grid and true north. Taking the UTM system as a base, the closer to the central area of a UTM zone, smaller the value, getting to zero in the central meridian of the UTM zone.

To calculate the UTM meridian convergence, first select the desired Waypoints through selection tools already described in Selecting Data. Then choose *Tools > UTM Calculations > Meridian Convergence*. The values will be shown in the Report Window in degrees, minutes and seconds.

11 Inserting a Map's Image in Background

11.1 General Information About Map Images

GPS TrackMaker® uses a process of calibration with two stages:



1 – Image rotation to match the angle of the map grid with the program grid.
2 – Image calibration with two points, changing the position, height and width of the image.

This method allows that many digitized map images or pictures be inserted as backgrounds.
So, it is possible to create complete mosaics of background images, being one of the most important advantages of GPS TrackMaker®.

- In order for the program to configure a background map image correctly, it is necessary that the meridians and the parallels be of equal distance, parallel and relatively rectilinear
- See the figure above. The images of the item 1 are not appropriate for calibration in GPS TrackMaker®. The first image has parallel grid lines, but note that the distance among the lines is not uniform, generating scale deformations. The other images cannot be calibrated because the grid lines are not straight or parallel.
- The image of the item 2 has the same scale in all its extension and the grid lines are parallel but it is not possible to calibrate the image using two points because it is rotated. This image can be calibrated in GPS TrackMaker® but first it must be rotated to match with the grid of the program.
- The image of the item 3 doesn't need to be rotated and can be calibrated using two points.
- The free version of GPS TrackMaker® doesn't rotate images. So, before calibrating, the images must be rotated in some graphic program like PhotoPaint® or Paint Shop Pro®.
- Big images may leave the program slow or may cause instability in the system.
- The PC screen resolution is 96 DPI. In order for the map size to approximate the actual displayed size, you should digitize it using a resolution close to that (ex.: 100 DPI). You should avoid resolutions above 300 DPI, because the image size would be too large.
- Take care when using compressed formats such as GIF or JPG. These files seem to be small when saved in disk, but when decompressed in the memory of the computer they become very big. To know Real size of a compressed image, export it to BMP format without compression.
- The capacity to handle images depends on the available memory of PC. For example: a GIF image with 5MB may have 100MB after decompressed in the memory. Other programs such as MS Windows also use the available memory, so, it would be necessary at least 256MB of memory to handle a GIF image with 5MB.
- Monitors with resolution of 1024 x 768 pixels or above are recommended to view background images. Resolution below 800x600 pixel is not recommended.

- When a GTM file is saved, the images are attached to it. The images are saved in its original format; so, GIF and JPG formats require less space than BMP in GTM file.
- Map images with different datums must be saved in separated files.

TIP: GIF images are opened 10 times faster than JPG images but are limited to 256 colors. The GIF format is not appropriate to aerial photos or satellite photos.

GPS TrackMaker Professional® has special tools to rotate and cut background images, accelerating the calibration process. See the topics Rotating Images and Clipping Images.

11.2 Rotating Images

This option is available only in **GPS TrackMaker Professional®**.

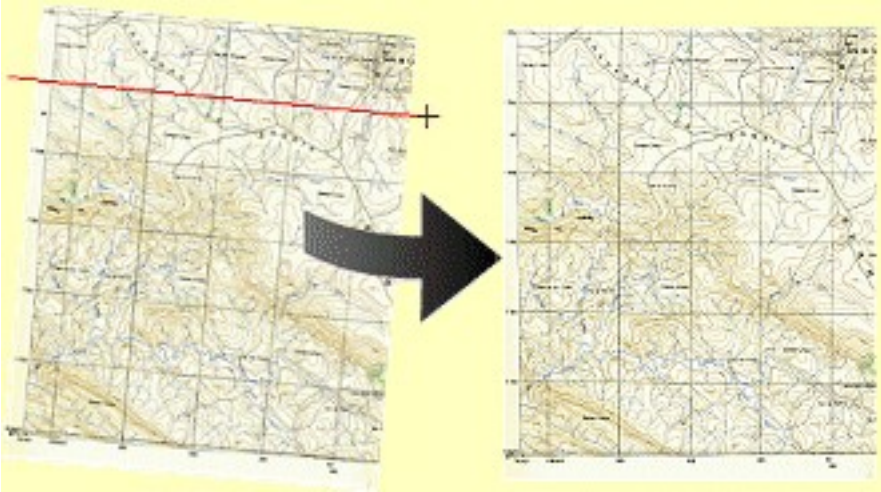
GPS TrackMaker® uses a process of calibration with two stages:

1 – Image rotation to match the angle of the map grid with the program grid.
2 – Image calibration with two points, changing the position, height and width of the image.

Only Raster images are rotated. Vector images like WMF, EMF and icons cannot be rotated. It is possible to rotate images with hundredth-degree accuracy.

Image Rotation Tool

Image Rotation Tool located in the tool bar can easily rotate map images with grid lines. This tool allows to create a segment of line on the grid lines of the image, calculating the correct angle of rotation.



Press the button and click with the mouse left button on the beginning of the grid line on the image. Drag the mouse to the other extremity of the grid line and click again in the left button. It is not necessary to drag the mouse with the button pressed. The Image Rotation Window will be opened, indicating the correct angle of rotation. Press the button to conclude the rotation of the image.

Simple Rotation

Another way to rotate the image is by typing the angle of rotation:

- Press the *Detect Elements* button and the Selection Tool button.
- Click with the left button of the mouse on the image.
- A pop-up menu will appear close to the pointer of the mouse.
- Choose the *Rotate Image* option.
- The Image Rotation Window will be opened.
- Type the angle and press

TIP: If the image was incorrectly calibrated and needs a new calibration, first restore its original aspect ratio. For further information, see Restoring the Aspect Ratio of the Image.

11.3 Calibrating Map Images

How to Calibrate a Map Image

To configure the program for the map coordinates inserted in the background of the screen, first load an image through *Tools > Insert Map Image* button or by pressing **F7**. The map will appear in the center of the screen, the button will be enabled and the button will appear to its side.

GTM PRO® will also show the Map Rotation Tool and the Map Clipping Tool .

GPS TrackMaker® uses a process of calibration with two stages:

1 – Image rotation to match the angle of the map grid with the program grid.
2 – Image calibration with two points, changing the position, height and width of the image.

The rotation stage is available only in GTM PRO®. To calibrate images in free version of the program, be sure the image is already rotated.

Rotating the Image before calibrating with two points

If the inserted image is rotated, it won't be possible to calibrate it with two points. It is necessary to rotate the image to match the image grid with the grid of the program.

To know how to rotate images in GTM PRO®, see the topic Rotating Images.

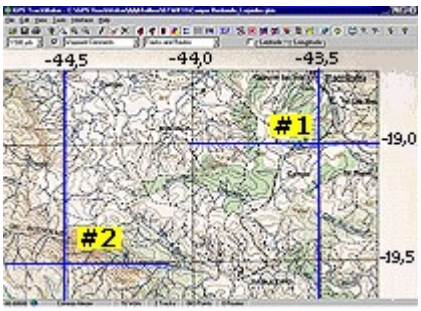
Calibrating the Map through the Points of the Extremities of the Image

After rotated, an easy way to calibrate map images is through the indication of the coordinates of the upper-left and lower-right corners of the image. This method, in spite of being easier, can't provide good precision because its not always that it is possible to obtain the values of the extremities of the map in a precise way, mainly when there are borders at the map or generated in scan process.

To know how to calibrate an image this way, see Calibrating Images through Extremities Points.

Calibrating the Map through Two Generic Points with Known Coordinates

This is the usual way to configure map images and it must be used after loading or after rotating the image. The practical example below illustrates how to configure a map through two generic coordinates:



First press the button  to enter in map configuration mode:

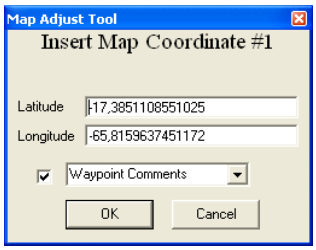
Configure the program for the coordinate system listed on the map. In the example given, the program should be configured to geographic coordinates in decimal degrees (dd.ddddd). The map datum is *SAD 69 Mean*, therefore, GPS TrackMaker® must also be configured for this datum.

TIP: to know in which datum the map was created, see the text together with the map scale. Usually the indication of the horizontal datum is close to the scale map. Only the horizontal datum is used.

Mark the first point (#1) on the map where there are known coordinates, placing the pointer of the mouse on the point and pressing the left button of the mouse.

A window will open, asking for the true coordinate of that point. In the example given, for the point #1, type:

Point #1
Latitude: -19,00
Longitude:-43,5



Attention: Verify the configuration of Microsoft Windows® for comma or decimal separators. If the MS Windows® is configured for English System, type –19.00 and –43.5

The next step is to choose a second point and repeat the same procedure. In the example, mark the second point (#2) where there are known coordinates, typing the following values in the configuration window:

Point #2
Latitude: -19,5
Longitude:-44,5

Important: For a better precision, mark the second point as far as possible from the first point, and avoid choosing points that are in a same horizontal or vertical straight line.
Immediately after choosing the second point, the program will reconfigure the screen and it will delete the perpendicular straight line close to the pointer of the mouse, exiting the configuration mode.

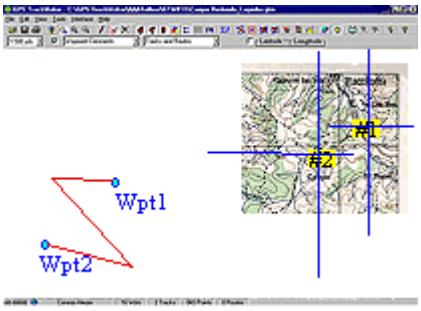
When calibrating the map for the screen coordinates, be careful not to reverse the location of the indicated points. Keep in mind that the indication pattern of the coordinates is always:

- Latitudes: always growing from south to north (from bottom to top)
- Longitudes: always growing from west to east (from left to right)

Not obeying this rule will cause an error message after marking the second point.

To hide or show the map image, click on *Show Maps* button located on the Tool Bar.

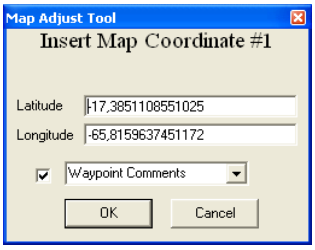
Calibrating the Map through Two Waypoints



Other way to configure map images with generic points is through two Waypoints. In the example, the map image was inserted anywhere on the screen. In the map image there are two points **#1** and **#2** that correspond to Waypoints **Wpt1** and **Wpt2** marked in the GPS. Before configuring, the program doesn't know that Waypoints **Wpt1** and **Wpt2** corresponds to the points **#1** and **#2** in the map image.

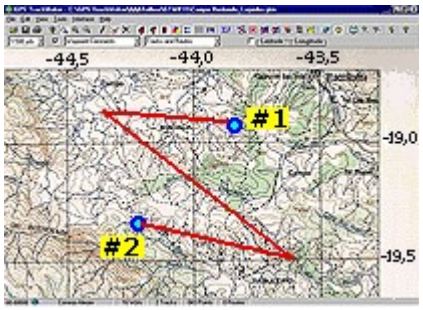
To start the calibration press the button . Two perpendicular straight lines will appear close to the pointer of the mouse.

Mark on the map image the first point **(#1)**, placing the pointer of the mouse over the point and pressing the left button of the mouse.



The configuration window will open, asking for the coordinate in that point. In the list box look for Waypoint **Wpt1**. Click on it and press the **<OK>** button.

Next, choose the second point and repeat the same procedure. In the example, the User would mark the second point **(#2)** on the map image, and in the configuration window, look for Waypoint **Wpt2**. Click on it and press **<OK>.**



After inserting the second point, the program will reconfigure the screen and it will erase the perpendicular straight line close to the pointer of the mouse, leaving the configuration mode. The illustration shows the final position and size of the map on the screen after the configuration. Note that Waypoints **Wpt1** and **Wpt2** coincide with the points **#1** and **#2** marked in the map.

To hide or show the map image, click on *Show Maps* button on the Toolbar.

Removing the Image

There are two ways to remove an inserted image:

Through Map Image Properties Window

The scanned image can be removed by accessing the *Image Properties* window in the *Tools* menu. Then, choose the image to be removed by pressing the arrow keys up or down, or selecting the index number of the image. After choosing the image, press the *Remove* button to remove the image.

Through the Pop-Up Menu

To remove an image through the Pop-Up menu, follow these steps:

- Press the *Detect Elements* button and the Selection Tool button.
- Click with the left button of the mouse on the image to be removed.
- A pop-up menu will appear close to the pointer of the mouse.
- Choose the *Remove Image* option.

Fine Adjust - Moving Only the Map in relation to the Coordinates System

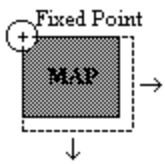
With the button pressed, the map can be moved in relation to the coordinates system of the program. Press the right button of the mouse and drag it, so that the map follows it.

The movement of the map will not be a far as the movement of the mouse, to facilitate a more precise adjustment. Generally, this feature is used after accomplishing the configuration for two well-known points, to adjust the map inside the coordinate system of the program.

For a better adjust, enable the grid lines. For that, press **<CTRL G>**.

Fine Adjust - Expanding and Compressing the Map

Another way to fine adjust the map is through the change of the height and width of the scanned image. For that, press the right button of the mouse together with **<SHIFT>** key and move the image. The button must be pressed.



As indicated in the illustration, when there is expansion or the compression of the map, the upper left border of the image will stay in the same position, it won't be changed. The movement of the mouse will only act on the width and height of the image. The amount variation needed for those adjustments are thereby reduced, facilitating a more precise adjustment.

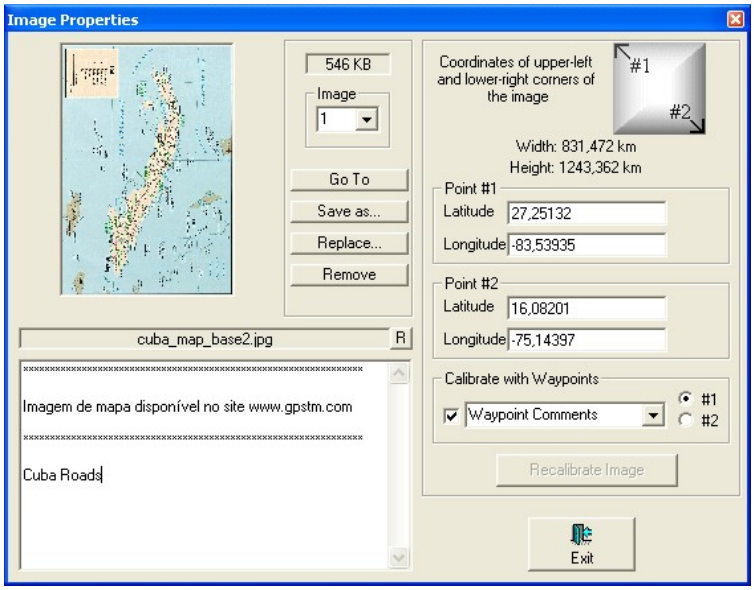
Making a New Calibration

Many times, the calibration doesn't coincide with the coordinates of the scanned map or it is not precise enough. To make a new map configuration, press the button , repeating the steps described above.

11.4 Calibrating Images Through the Points of Extremities

An easy way to calibrate map images is through the indication of the coordinates of the left superior side and right inferior side of the image. This method, in spite of being easier, may not provide good precision because its not always that it is possible to obtain the values of the extremities of the map in a precise way, mainly when there are borders at the map or excesses generated in scan process.

The Calibration through extremities is made in *Properties of Image* window that can be accessed from *Tools* menu or clicking with the left button of the mouse on image. It can also be accessed through button.



Inserting the coordinates manually

To calibrate the image, first verify the system of coordinates and the notation and then insert the values of the coordinates of the point #1 and point #2, that respectively correspond to the upper-left and lower-right corners of image. Then, press the button **<Recalibrate Image>**. If inserted points are compatible, a message will appear informing that the calibration was successful.

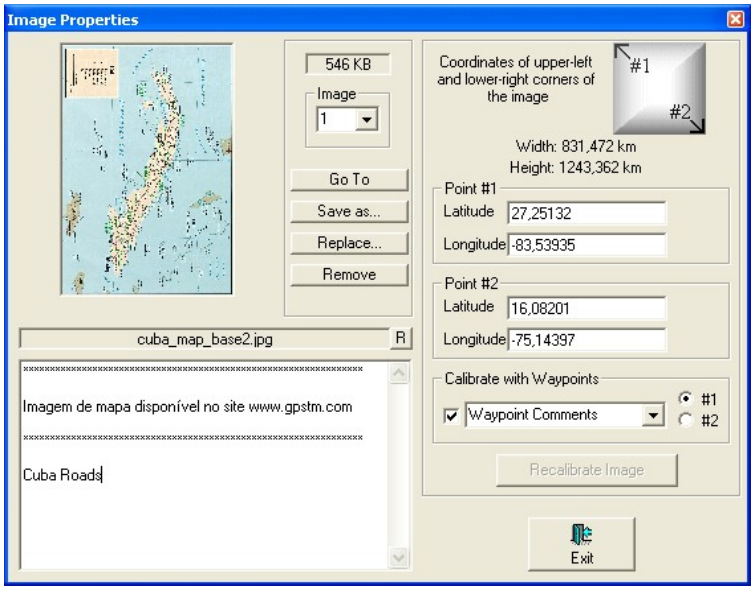
Calibrating with 2 Waypoints

Instead of inserting the coordinates manually, it is possible to use the coordinates of Waypoints to define points #1 and #2. For that, click on options *#1* or *#2* in the *Calibrate with Waypoints* box and then choose the Waypoint that corresponds to that point. Repeat the procedure for the second point and press **<Recalibrate Image>** button.

To alternate the search of Waypoints of names or comments, click on the box on the side of the Waypoint list.

11.5 Showing Image Properties

The *Map Image Properties* window can be accessed through the *Tools* menu, by clicking with left mouse button on the scanned image inserted in the background of the screen, or pressing .



This window shows all scanned images inserted in the background of the screen and its respective characteristics, allowing to find the position of the image on the screen, save it to hard disk, remove it from memory, modify comments, modify the image file name or modify the configurations of calibration.

To view images, just press the arrow keys up or down, or type the index number of image.

The *Map Image Properties* function will show:

- Map image or scanned Photo
- Index of each scanned image
- Size of the image file in KB
- File name of the scanned image
- Image comments
- Virtual Width and height of the image on the screen
- Points of calibration of upper-left and lower-right corners

Available Buttons:

- **<Go To>**: Shows the image centered on screen.
- **<Save As>**: Saves the image in disk
- **<Replace>**: Replaces the image to another, maintaining the same coordinates of the first image
- **<Remove>**: Removes the image from the memory
- **<Exit>**: Closes the window
- **<Recalibrate Image>** : Makes a new image calibration through the indicated points

In GTM PR®, the **<Save as>** button allows to save the image in its original format or to convert the image to other formats. See the topic Saving Images.

Opening *Map Image Properties* window through the *Pop-up* menu

To open the *Map Image Properties* window through the *pop-up* menu, follow these steps :

- Press *Detect Elements* button and Selection Tool button .
- Click with left mouse button on the image.
- A *pop-up* menu will appear next to the mouse pointer.
- Choose *Map Image Properties*.

Modifying File Name of the Image

When a scanned image is inserted on screen, the file name is registered and it can be seen through the *Map Image Properties* window. To modify the image name, click on the button located on the side of the field where the name of scanned image appears.

Inserting an Image Comment

Each image can have its own comment text with up to 32600 characters. This allows to register the characteristics of the image.
To modify the image text, click on text box and write the comments. The registration of the comments will be accomplished through the **OK** button or simply by changing the images through index number, or through the up and down arrow keys on the keyboard.

Recalibrating the Image

To know more about the recalibration of images, see the topic Calibrating Images through the Points of Extremities.

11.6 Bringing Image to Front

GPS TrackMaker® allows to insert several images of maps or photos in the background of the screen. The Tracklogs, Routes and Waypoints are shown on the screen over these images.

Any new inserted image will always be put on top of the other images. To bring a scanned image to front, leaving it superposed over the other images, you must follow these steps:

- Press *Detect Elements* button and Selection Tool button .
- Click with the left mouse button on the image.
- A *pop-up* menu will appear next to the mouse pointer.
- Choose *Bring to Front*.

11.7 Sending Image to back of the others

It is possible to insert several images of maps or photos into the background of the screen. Tracklogs, Routes and Waypoints are shown on screen over these images.

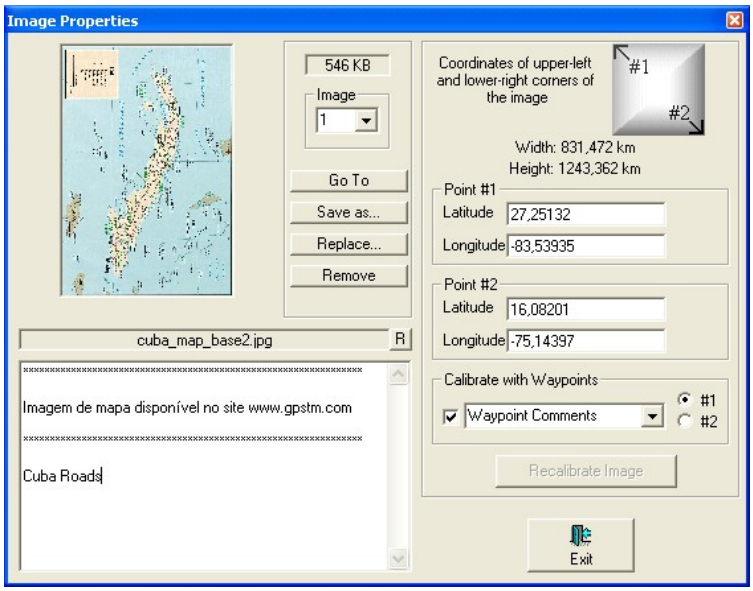
To send an image to back of the other images, follow these steps:

- Press *Detect Elements* button and Selection Tool button .
- Click with the left mouse button on the image.
- A *pop-up* menu will appear next to the mouse pointer.
- Choose *Send to Back* option.

11.8 Removing Images

There are two ways to remove a background image:

Through *Map Image Properties* window



You can remove the scanned image by accessing the *Map Image Properties* window in the *Tools* menu. Then, choose the image to be removed, using the up or down arrow keys, or by typing the index number of image. After choosing the image, press the ***Remove*** button so it will be removed from the memory of the program. See Showing Image Scanned Properties

Through *pop-up* menu

To remove an image through *pop-up* menu, follow these steps:

- Press *Detect Elements* *button* and Selection Tool button.
- Click with the left button of the mouse on the image.
- A *pop-up* menu will appear next to the mouse pointer.
- Choose ***Remove Image***.

11.9 Saving the Image

In GTM PRO®, the **<Salve as>** button saves the image in its original format or converts the image to the following formats:

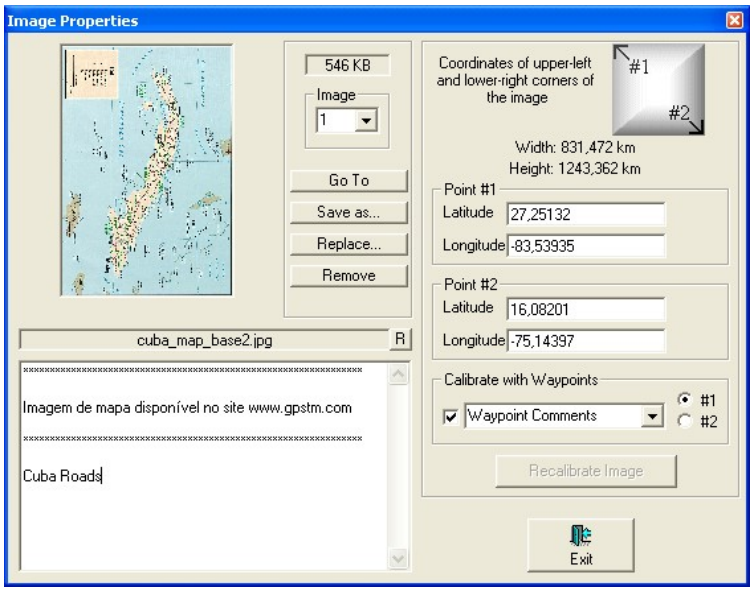
- BMP - Windows and OS/2 Bitmap
- JPG - JPEG Compliant
- GIF - Compuserve Graphics Interchange
- TIF - Tagged Image File Format
- PNG - Portable Network Graphics
- PCX - ZSoft PaintBrush

Icons and vector files such as WMF and EMF are always saved in its original formats.

Attention: free version of GPS TrackMaker® saves images only in its original formats.

There are two ways to save the scanned image:

Through *Map Image Properties* window



Scanned images can be saved to disk by accessing the *Map Image Properties* window in the *Tools* menu or button. Then, choose the image to be removed by pressing the arrow keys up or down or selecting the index number of the image. After choosing the image, press the *Save as* button. See Showing Image Scanned Properties.

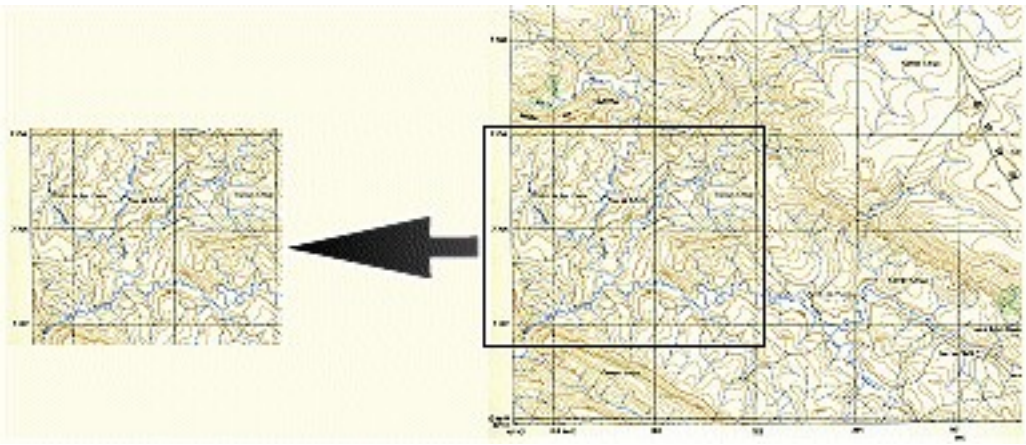
Through *pop-up* menu

To save in disk an image through *pop-up* menu, follow these steps:

- Press *Detect Elements* *button* and Selection Tool button.
- Click with the left mouse button on the image.
- A *pop-up* menu will appear next to the mouse pointer.
- Choose ***Save Image as***.

11.10 Clipping Images

This option is available only in **GPS TrackMaker Professional®**.



To clip a background image, press the button, click with the left button and drag the mouse maintaining the button pressed. To finish the clipping rectangle, release the left button. The image will be clipped, remaining on screen only the area of the rectangle.

The calibration parameters of the image will be preserved.

To undo the clipping, press **CTRL Z.**

Note: Only raster images are clipped. Vector images such as WMF and EMF and icons cannot be clipped.

11.11 Restoring the Aspect Ratio of the Image

This option is available only in **GPS TrackMaker Professional®**.

The restoration of the image aspect ratio must be accomplished before rotating it, removing eventual angle deformations of grid lines contained in the image.

This resource is used for images that were not calibrated correctly and need a new rotation to be later recalibrated with two points.

To restore the aspect ratio, follow the steps below:

- Press the *Detect Elements* button and the Selection Tool button.
- Click with the left button on the image.
- A pop-up menu will appear close to the pointer of the mouse.
- Choose *Restore Aspect Ratio.*

12 Interface of GPS's Comunication

12.1 Connecting the GPS to PC

The *Interface* menu allows the connection GPS-PC through RS-232 serial communications port. Bi-directional transfers of data are supported for Waypoints, Routes and Tracklogs, and unidirectional transfers for the clock and turning off the GPS through the computer, for the Garmin® models.

GPS TrackMaker® allows bi-directional communication with the following GPS models:

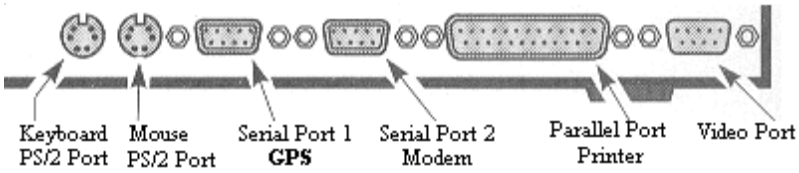
- Garmin®
- Lowrance®
- Eagle®
- Magellan®
- MLR®
- Brunton®
- Silva®
- GTM Tracker®

For other GPS models not implemented yet, the communication can be done in the NMEA 0183 protocol, but only in real time navigation. To learn more about NMEA protocol, refer to Interface NMEA 0183.

Warning: By default, the program automatically detects the first four available communications port. However, some external devices like three button mouse can generate conflicts when detecting and it can lock-up the computer. To avoid this situation, disable the *Auto-detection* option in the *Options* window, and choose one of the available serial ports.

Connecting the GPS to the Computer

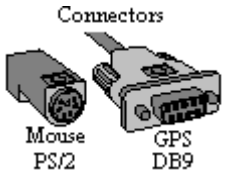
Many Users are not able to connect the GPS to the computer, because they don't know how the serial communication ports work.



The illustration above shows the back-side of a computer with the ideal configuration for connecting a GPS unit. The User should verify which serial port is available for GPS connection. In the example above, the serial port 2 is being used by the internal Modem. Even if the **GPS TrackMaker®** program reports that port 2 is temporarily free, the internal connection of the Modem can generate conflict. In the example above, only serial port 1 is available for connecting the GPS.

Message *No Data on Serial Port*

Many users still own computers that use a serial port to connect the mouse. In these cases the mouse is usually assigned to serial port #1. One of the most common mistakes is to try to disconnect the mouse with the computer turned on, and connect the cable of GPS where the mouse was plugged in. With this procedure the program will report *No Data on Serial Port*. It happens because the computer continues recognizing the GPS as a mouse, causing conflict, and blocking the communication.
To avoid this problem, try one of these procedures: turn on the computer with the mouse disconnected and then connect the GPS. This procedure is not the most appropriate, because you will have to start **GPS TrackMaker®** program through the keyboard, and it is not an easy task. Besides, you would also have to configure Windows® in *Control Panel*, removing the driver information for the mouse on the available serial port.



The second procedure is to change the serial mouse with the DB9 connector for another mouse with a PS/2 connector. This is the appropriate procedure, because it leaves the communications port free for the GPS. Many computers also have USB communication ports. A special USB mouse can also be acquired to free the serial communications port. The side illustration shows the PS/2 connector of the mouse and the DB9 connector of the GPS communications cable.

Finally, one of the most common mistakes of GPS Users it is to try to communicate with the GPS configured to another communications protocol (NMEA for example). This configuration is changed in the *Interface* menu of the GPS device.

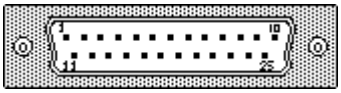
Conflict with Synchronization Programs for PALM, PDA, Cellular and other Equipments

Other common problem connecting the GPS to the computer is the unavailability of serial ports because of conflict generated by synchronization programs for Palms, PDAs, cellular telephones and other equipments. These programs constantly verify the serial ports status, blocking the connection with the serial port for the GPS recognition.

In general it is not necessary to uninstall these programs to use GPS TrackMaker®. Just disable the auto-detection function (or other similar) to release the communication port. If the synchronization program doesn't allow to disable the auto-detection, the solution is to uninstall it or to use the synchronization through USB.

Computers with Connectors DB25 instead of DB9

Users that own computers with communication ports that use DB25 connectors experience another problem. The cables are generally supplied with DB9 connectors and it makes the connection with the computer a difficult task.



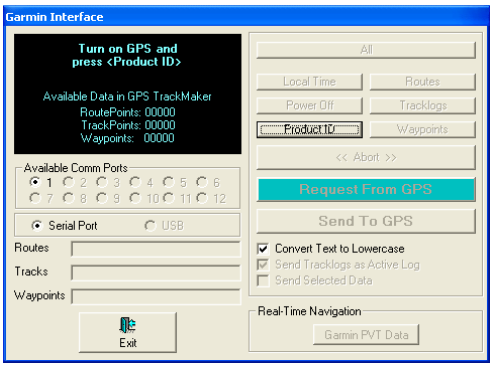
The first step to try to solve this problem is not to mistake the parallel port of the printer with the serial connector DB25 shown on the side. To distinguish the two connectors, see if the connector of the computer has pins or holes. If it has pins, it is the serial connector DB25. If it has holes, it is the parallel connector of the printer.

The simplest way to connect the GPS unit to a computer with a DB25 connector is to purchase a DB25 to DB9 adapter. They can be purchased almost everywhere that computer cables are sold.
If the User wants to build their own cable, the table below indicates the compatibility of pins of connectors DB9 and DB25 of the serial ports:

Signal	DB-9	DB-25
CD	1	8
RXD	2	3
TXD	3	2
DTR	4	20
GND	5	7
DSR	6	6
RTS	7	4
CTS	8	5
RI	9	22

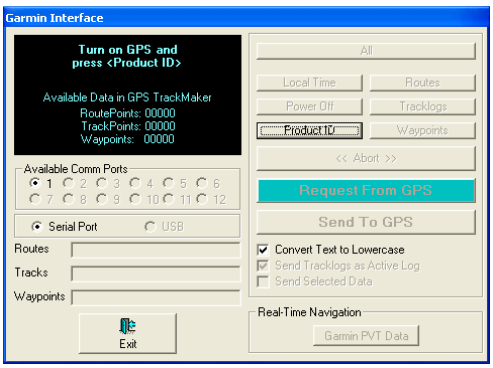
12.2 Setting the PC Local Time Clock through GPS

This function is available only to Garmin® models.



To set the PCs internal Clock, just click on the **<Local Time>** button located in the *Garmin Interface* window so the date and time stored in the GPS will be transferred to the PC clock. For that, it is necessary that the program recognizes the receiver; if not, this button will be disabled. To configure the local time, see Configuring Local Time.

12.3 Sending and Receiving Waypoints, Tracklogs and Routes



The communication between the PC and the GPS is very easy with the **GPS TrackMaker®**. Just open the specific window for your GPS model, clicking on the *Interface* menu. Then, turn on the GPS.

The first step to initiate the communication is to inform the computer which GPS model is connected to the serial port. To do this, press the **<Product ID>** button. If communication is established, the program will indicate the GPS model name and the software version and will enable the **send/receive** data buttons.

If the communication cannot be established, the message *Acquiring ID* will remain on the screen, and you should review the cable connections and the GPS configuration. If the program does not support the GPS, the message *Unknown GPS* will be displayed.
Once the GPS is detected and the **send/receive** buttons are enabled, the User can choose the **send/receive** function that they want to use.

Sending data to GPS

To send data to the GPS click on the **<Send to GPS>** option and choose one of these options: **<Waypoints>**, **<Tracklogs>** and **<Routes>**. You can also click on the **<All>** button to send all data.

When sending Waypoints, the program changes all lowercase into uppercase and removes all accents. This procedure is necessary because the GPS does support lowercase or accents in storing names and comments of Waypoints.

To send only the selected data to the GPS, mark ***Send Only Selected Data*** option. To learn more about how to select data, see Selecting Data. Selected Tracklogs and Routes will be completely sent, even if only some segments are selected. If no data is selected when opening the Interface window, the ***Send Only Selected Data*** option will be disabled.

For Lowrence® models, it is possible to send the icons. The **GPS TrackMaker®** program sends the Waypoints as icons.

Receiving data from GPS

To receive data from GPS, click on the **<Request from GPS>** option and choose one of these options: **<Waypoints>**, **<Tracklogs>** and **<Routes>**. Click on the **<All>** button to receive all data.

For Lowrance® models, it is possible to receive the icons stored in GPS' memory. The program receives the icons from GPS, transforming them to Waypoints.

Stopping the communication

To stop sending or receiving data, just click on the **<Abort>** button . The communication will be stopped at that point.

Turning off the GPS through PC (Garmin® Models Only)

Clicking on the **<Power Off>** button will power off the GPS receiver.

12.4 NMEA0183 Interface

Basic concepts

In 1980, a group of professionals joined to develop a *standard* communication protocol for nautical equipment. The result was the *National Marine Electronics Association* or simply NMEA0180 standard.

A short time later, in order to accommodate the use of equipment that existed in the market, the NMEA0183 protocol was developed, and it is now used as standard in almost in all GPS equipment.

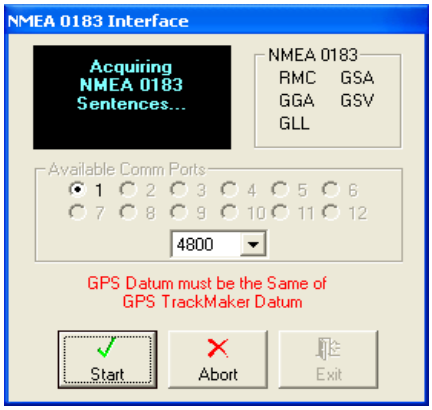
NMEA 0183 communication protocol is based on sending unidirectional data between the GPS and the computer, through sentences in ASCII format with specific codes.
Data in the NMEA0183 protocol is continually transmitted. That's why, when the User enables the GPS to NMEA, the GPS communication port will constantly transmit NMEA data, precluding any other kind of communication with the GPS. In Garmin® models, for example, after configuring the communication protocol to NMEA, any other kind of communication becomes impossible. It means that the User can't download or send Waypoints, Tracklogs and Routes to the GPS through the *Garmin Interface* window.

NMEA0183 Protocol at GPS TrackMaker®

GPS TrackMaker® uses NMEA0183 protocol only in *Real Time Navigation* (RTN) mode. It means that the User can't transfer data between the GPS and the Computer if the computer is not in real time navigation mode.

Warning: Before using the NMEA protocol, configure the GPS to *NMEA0183* protocol and select the same baud rate in GPS and in the program.

Activating the Communication in NMEA Protocol



To activate the NMEA0183 communication protocol, follow these steps:

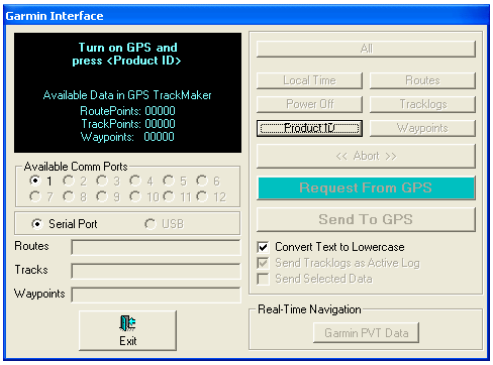
- Connect the GPS to the computer.
- Configure the GPS to NMEA0183 communication protocol.
- Choose the same Datum for the GPS and for the **GPS TrackMaker®** program. This procedure is essential!
- Click on the *NMEA0183 Protocol* option in the *Interface* menu, to open the communication window.
- Press the *Start* button and wait until the program recognizes the data patterns.

When the program detects the pattern of sentences, the *Real Time Navigation* mode is automatically enabled.
More information about real time navigation, see Activating Real Time Navigation.

13 Real Time Navigation (RTN)

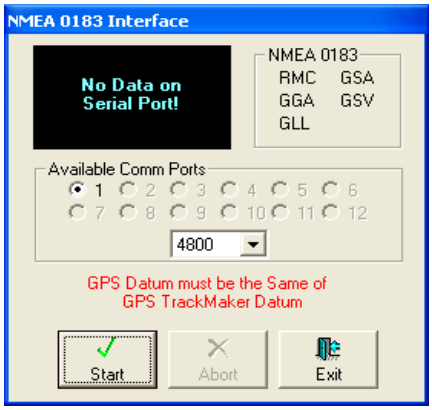
13.1 Activating Real Time Navigation (RTN)

Real Time Navigation (RTN) is a function in **GPS TrackMaker®** that facilitates the connection of a GPS to a portable computer, transferring (in real time) the geodesic coordinates provided by the GPS. This allows you the option to view your position in real time, on any maps you may have inserted.

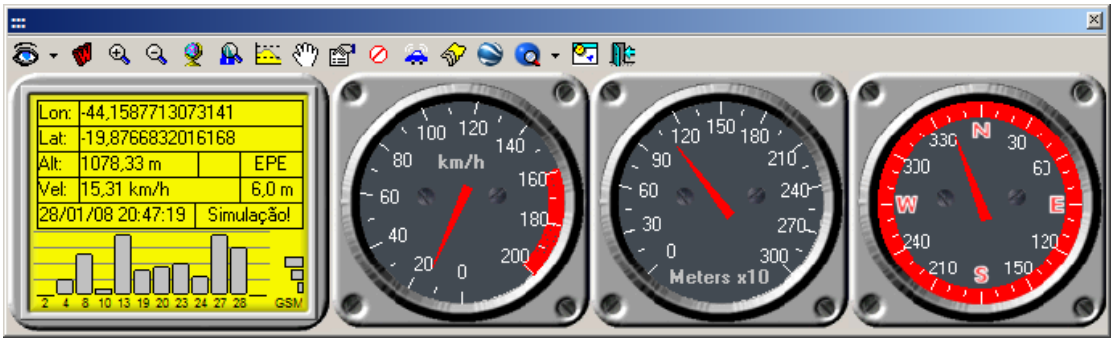


To activate real time navigation in Garmin® Models, open the ***Garmin Interface*** window through the *Interface* menu, and do the GPS recognition through *Product ID* button and then press *Real Time Navigation* button.

Through the NMEA window it is also possible to activate the real time navigation. Open the ***NMEA*** window through *Interface* menu, and then configure the GPS to NMEA protocol and then press the <**Start**> button.



In RTN, the Toolbars are replaced by a window that shows the *Navigation Console* with LCD Panel, the Speedometer, the Altimeter and the Compass:



The LCD Panel displays:

- Coordinates: Latitude and longitude in the chosen Coordinate System
- Alt: Altitude in meters or feet, at medium sea level
- EPE: Estimated error of the position, in. The lower this number, the better the accuracy of the geodesic position indication.
- Speed: Instantaneous speed at that moment. It is indicated in km/h or mi/h.
- Date: Date provided by GPS in *day-month-year* format.
- Hours: Local time in *hours:minutes:seconds* format
- Status: Status Message of Satellites

The Status messages are:
- Simulation!: Indicates that **GPS TrackMaker®** is in simulation mode
- No data on Serial Port: Indicates that the computer is not receiving data from GPS
- Failed Integrity Check: Problem in data correction
- Invalid or Unavailable: No available satellites
- 2D Navigation: Navigation in two dimensions (without altitude reading)
- 3D Navigation: Navigation in three dimensions
- 3D Diff. Navigation: Navigation in three dimensions in differential mode

 The vehicle will appear in the center of the screen, indicating the current position provided by the GPS.

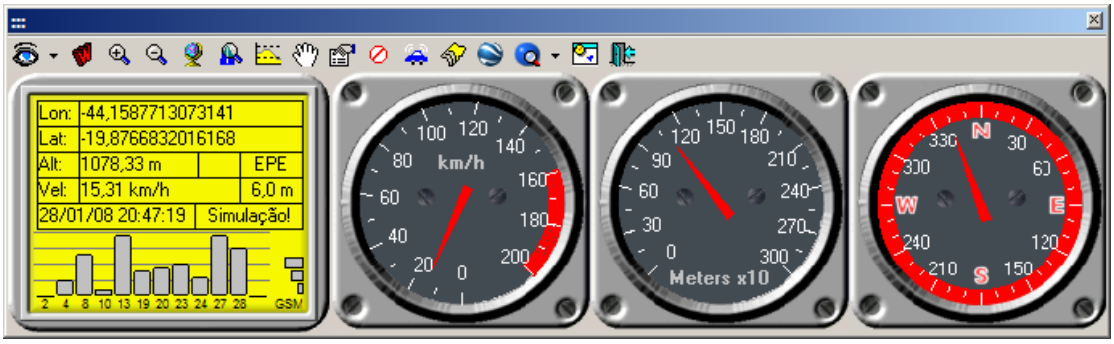
Buttons available in Navigation Console

 – Mark Waypoint
 – Zoom in
 – Zoom out
 – General View
 – Zoom in on the ship
 – Shows the Altitude Profile in real time
 – Automatic or manual drag of the screen
 – Configures Real-Time Navigation
 – Shows/Hides the instruments
 – Aborts communication
 – Shows the Remote Tracker Console (Vehicular Tracking)
 – Select background map
 – Open Maps in Google Earth®
 – Open Maps on the Internet
 – Arrange Windows
 – Exits Real-Time Navigation

Important!
For accurate use of real time navigation it is necessary that the GPS is outdoors, capturing satellites or in simulation mode. If you want to use real time navigation indoors, it is necessary to enable the *Simulation* mode in the GPS. For that, see the instruction of the GPS manual.

If the datum setting of **GPS TrackMaker®** is different from the GPS datum setting, there will be small differences in the indication of geodesic coordinates in RTN mode. This happens because when receiving the data from the GPS, the program makes the data conversion to the current datum.

13.2 Manipulating the Screen in RTN Mode



Press the right mouse button to drag the map. Click once with the left mouse button on the map to return the vehicle to the center of screen.

Button

Unpressed: Automatic mode that changes the screen every time that the ship starts to leave the screen limits. This is the default mode that must be enabled when the User wants to have a constant view of their position on the screen of the computer. In this mode, dragging the image or to zoom using the mouse is not allowed.

Pressed: In this mode, the User can drag the image with the right mouse button, or Zoom with left mouse button. However, the ship may not be displayed if it is outside of the screen limits. This mode is very useful when the User wants to verify some detail in the map that is out of the limits of the current position.

The shortcut key **CTRL F5** alternates AUTO view mode to MOVE mode and vice-versa. It is also possible to alternate the view mode through the *Nav Tools* menu.

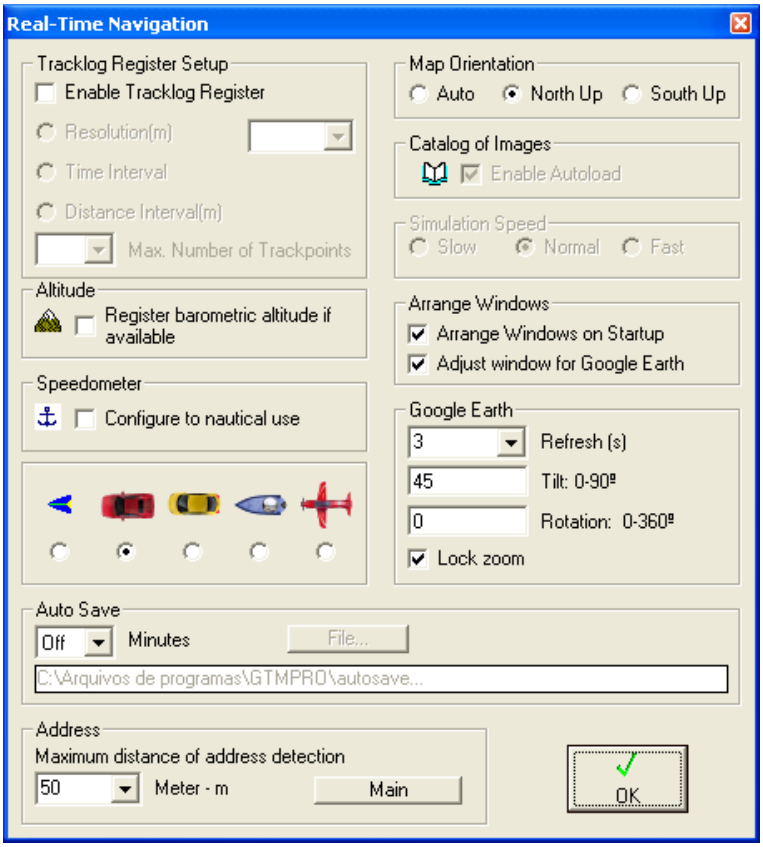
The following tools of screen manipulation are also available:

Zoom In (F2 Key).
Zoom Out (F3 Key).
General View (F4 Key).
Nav Zoom tool that zoom in the ship, placing it in the center of the screen. This function is very useful in case if *Move* mode is enabled and the ship is out of the screen limits. (Shortcut **CTRL F2**).
– Mark Waypoint (W Key)
– Shows Altitude Profile in real time
– Configures Real-Time Navigation
– Show/Hide instruments
– Abort communication
– Shows the Remote Tracker Console (Vehicular Tracking)
– Select background map
– Open Maps in Google Earth®
– Open Maps on the Internet
– Arrange Windows
– Exits Real-time Navigation mode

CTRL W: Alternates the visualization of Waypoints
CTRL T: Alternates the visualization of Tracklogs
CTRL R: Alternates the visualization of Routes
CTRL G: Alternates the visualization of grid lines
These functions can also be accessed through the *View* menu.

13.3 Configuring Real Time Navigation

Pressing the button, or selecting the *Configure* option in the *NavTools* menu, opens the configuration window in RTN mode, with the following options:



Tracklog Register

Enable Tracklog Register: Enabling this option, the program starts the Tracklog collection where the ship passes through.
Resolution: Method of Tracklog collection based on the geometry of the traveled track. The program verifies if Trackpoints are aligned in the same horizontal plane of the width defined by User, not taking into account the several straight line segments that present minor deflection. Thus, if Trackpoints are aligned, the program will register only the first and the last point.
Time Interval: Trackpoints are collected at each time interval defined by User.
Distance Interval: Trackpoints are collected at each distance interval defined by the User.

If the *Full* option was chosen in the selection box, the program will register all Trackpoints sent by the GPS, independent of the chosen collection method.

Also, choose the Maximum Number of Points (trackpoints) that a Tracklog can have when registered in real-time navigation. When this number is extrapolated, a new Tracklog is created.

Register of Barometric Altitudes

Some Garmin® models send barometric altitudes through NMEA protocol. Enable this option to register barometric altitudes instead of altitudes given by GPS system.

Map Orientation

For the navigation screen, there are three orientation options:
Auto: The program will change screen orientation so that the direction of the ship is always ascending, from bottom to the top of the screen.
North Up: The true north or grid north will always be indicated in the upper border of the screen.
South Up: The true south or grid south will always be indicated in the upper border of the screen.

Catalog of Images

If a Catalog of Images is loaded in memory and the *Enable Autoload* is marked, the program automatically loads the map that corresponds to that area in which the ship is in that moment. For more information about Images Catalogs, see Creating an Image Catalog.

Speed of Simulation

The speed of simulation mode is configured as follows:

Slow: Slow motion of the ship
Normal: Normal speed of the ship
Fast: Fast motion of the ship

Arrange Windows on Startup

This option activates the  button every time the Real-Time Navigation window is opened. The Console of Instruments, the Altitude Profile and the Navigation Window are automatically arranged, facilitating the data visualization on the screen.

Configure Speedometer to Nautical Use

Mark this option to reduce the speedometer scale for nautical use.

Auto-Save

The Auto-save option allows you to save the data at predetermined time intervals. For that, the User must configure the time interval in minutes and the file name in which the data will be saved. To disable Auto-Save, choose *Off* in the list box.

13.4 Registering Waypoints in Real Time

To select a Waypoint in RTN mode, press  button, or press ***W*** key or F9. Immediately a window indicating the data of the created Waypoint will appear.

Pressing ***<OK>*** button the Waypoint will be registered, appearing on screen if *View Waypoints* option is enabled.

13.5 Simulating Real Time Navigation

To activate the simulation mode of real time navigation, choose *Interface* > *Simulation* menu.

Entering in simulation mode, the program will open real time navigation screen simulating data reception from GPS. The blue ship will be looping on screen, facilitating to test all functions in RTN mode without being really navigating with GPS.

If a Tracklog or a Route is selected before entering in the simulation mode, the ship will make the same Route indicated in the Tracklog or in the Route, indicating in Tracklog the relative real values of the speed and date of storage of the Track. To know more about how to select data, see Selecting Data

13.6 Vehicular Tracking Interface

The tracking modules manufactured by Geo Studio introduce a new way to locate and track vehicles, allowing to track your vehicle directly from your computer. No monthly fee is required. Just insert a SIM card from any GSM operator and track your vehicle.

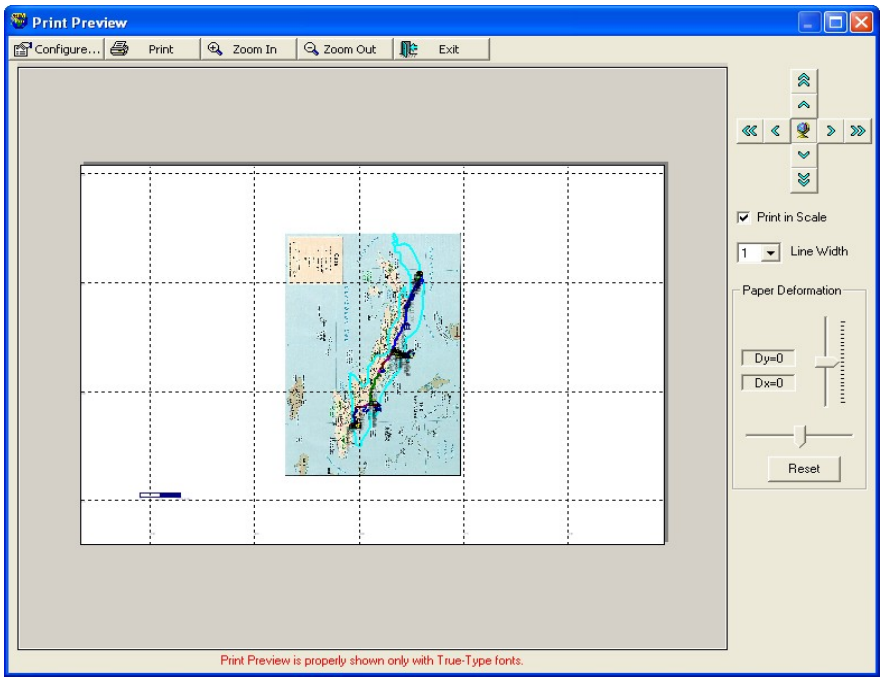
For further information, visit http://www.gpstm.com

14 Printing Data

14.1 Print Preview

This option is available only in GPS TrackMaker Professional®.

Print Preview function allows to view the map on screen before sending it to printer. To access it, choose *File* > *Print Preview* or press the button



Important: print preview is properly shown only with *true-type* fonts.

Print and View Options

Modify printer configurations.

Prints accordingly indicated on screen.

Zoom in . **<Page Down> , <+> ou <F2>**

Zoom out. **<Page Up>, <-> or <F3>**

Buttons of small displacement of image. **<Arrow Keys>**

Buttons of big displacement of image.

General view on the whole image. **< F4 >**

Option of Print in Scale: Activates the Print in Scale

Option of Line Width: Modifies the Line Width on Printer

Adjustment of Horizontal and Vertical Deformation: Adjusts Deformation of Paper

14.2 Printing Data

To print, just click on the  button on the tool bar.

The **GPS TrackMaker®** program allows you to send screen data to the printer. Only the data displayed on the screen will be sent to printer. Waypoints, Tracklogs and Routes will be printed.

The background color is not sent to the printer. By default, the background will be white with black Waypoint icons. Avoid choosing white as a text or grid color, because it will not be printed.

Map images inserted as background will also be printed.

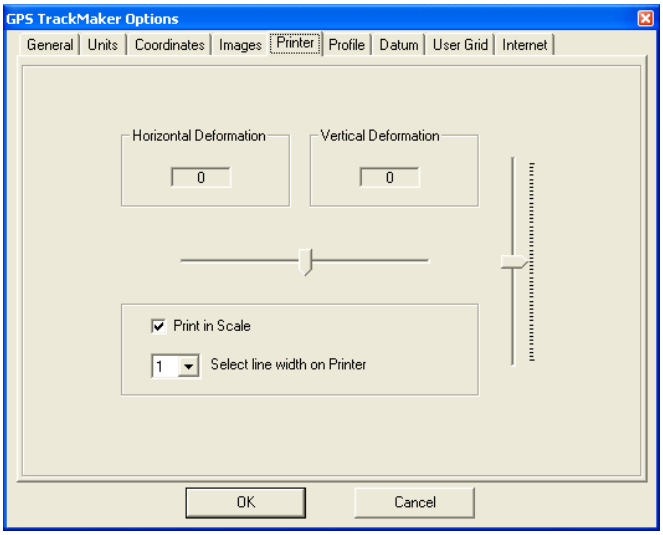
To print, click on the Print  button on the Tool bar or select the *Print* option in the *File* menu. You can also press **<CTRL P>.**

To modify the thickness of Tracklogs and Routes to be printed, you can modify the *Line width on Printer* field under *Options* in the *Tools* menu, choosing the thickness from 1 up to 10 times the normal value.

 Before printing, use the *Print Preview* function in GTM PRO® to see exactly how the data will be printed on the paper. For details, see Print Preview.

14.3 Printing in Scale

To print in scale, enable the *Print in Scale* option, in *Tools > Options > Printe*r.



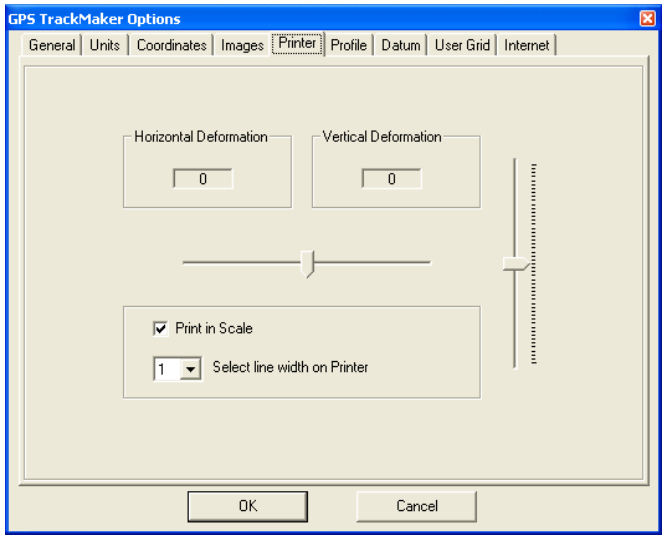
Every time a map is printed, the program automatically configures the printer to the scale indicated on the screen.

The different types and brands of printers available in the market can create small variations while printing in scale. These variations or deformations can occur in either the horizontal or vertical direction. To minimize this effect, configure the program for the characteristics of their printer. See Configuring Printer.

For more information about scale, see Showing Scale on Screen.

14.4 Configuring Printing

To configure the printer, choose *Tools > Options > Printer.*



Printing with no Scale

This kind of printing is for Users that only want to have the contents of the screen on paper, not depending on scale. The drawing size will depend on the paper size and not the map's scale.

To print the entire screen on the paper, disable the *Print in Scale* option. When using this option the scale indicated must not be considered.

Printing in Scale

To print in scale, just enable the *Print in Scale* option.

The different models and types of printers available in the market can bring small variations in printing to scale. These variations or deformations can occur horizontally or vertically. To minimize this effect, the User should adjust the *Horizontal Deformation* and *Vertical Deformation* controls, right after doing the necessary print tests, to verify if scale is really correct.

To facilitate the printer adjustment, is recommended that you modify the coordinate system to UTM and enable grid visualization. With these settings you can measure the distance between horizontal and vertical grid lines with a ruler (indicated in meters), comparing the print to scale.

For more information about print in scale, see Showing Scale on Screen and Printing in Scale.

Line width on Printer

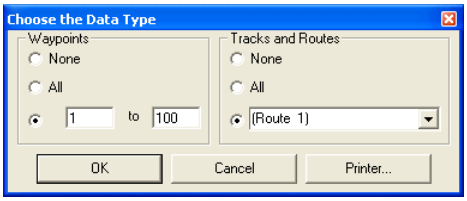
High-resolution printers can present problems in Tracklog thickness when printing. This option allows to define the Tracklog thickness up 10 times the normal thickness, allowing better print quality.

Any modification in *Line width on Printer* field will result only in modifications to the printout, it will have no effect on the screen configurations in the program.

14.5 Printing List of Data

To print tables with Waypoints, Tracklogs and Routes attributes, just choose *File > Print > Print List of Data*.

Type of data



The program will open the window to the side. Choose which type of data to be printed.

15 Catalog of Images

15.1 Creating a Catalog of Images

Introduction

The manipulation of big map images that occupy a large amount of memory is not always so simple. Especially in computers with insufficient memory or low capacity graphic cards, you can spend too much time loading and viewing map images (or photos).

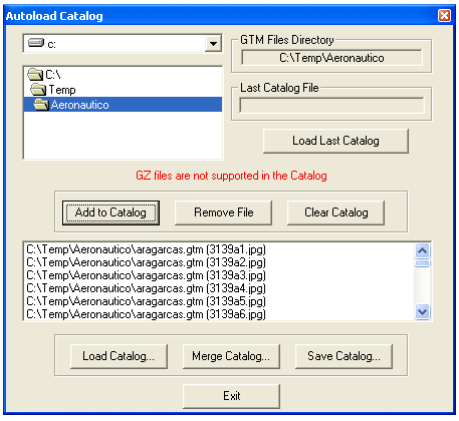
To avoid problems with big images, **GPS TrackMaker®** offers the *Images Catalog* resource, that is a registration of all inserted images in the User's GTM files. This way, the User can create several small maps of relatively reduced size, which will be shown on the screen as needed, eliminating the use of a large amount of memory or video resources.

Basically, with the Images Catalog, the User can have only the contour of all inserted maps on the screen of the computer, without the need to load them. The Images Catalog is also useful in real time navigation. Through the *Autoload* option, enabled in the configuration window of *RTN* mode, it is possible to automatically load just one map, when the ship is passing through the area of that map.

Important: after the catalog has been created, GTM files that are in it can't be modified, without damaging the Catalog data. It would then be necessary to create a new Catalog. It is good procedure to store GTM files from the Catalog in an exclusive directory, creating a Backup of the original files.

Creating a Catalog

First, it is necessary to have GTM files with inserted images. Image Catalogs will not be created if the GTM file contains only Waypoints, Tracklogs or Routes.



To create an Image Catalog, choose the *Autoload Catalog* in the *Tools* menu. The Catalog Window will immediately open.

Select the drive and the directory where the GTM files with the inserted images are stored. Then, press the ***<Add to Catalog>*** button and the program will seek all GTM files containing images in the directory.
The User can see the list of all GTM files with its respective maps. This information is stored in the memory of the program and can be saved to disk, in *CTG* format.

To save the new Catalog in disk, see Saving Catalog in Disk.

Removing Files From Catalog

After creating or loading an Image Catalog, all map images (or photos) from the Catalog with the name of the GTM files in which they are inserted are shown on the screen.

To remove an image from the Catalog, click on the image name and then press the ***<Remove File>*** button. To remove several images at the same time, just use the <SHIFT> or <CTRL> key to select several images at the same time.

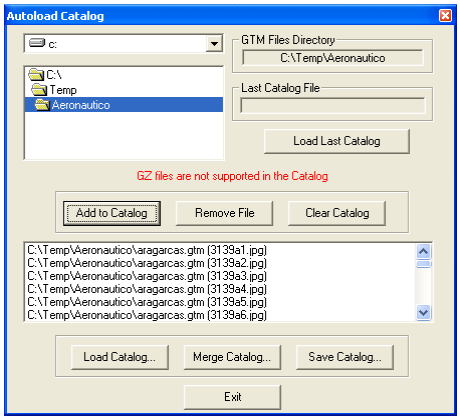
Removing the whole Catalog From Memory

To remove the Catalog from the memory of **GPS TrackMaker®**, press the ***<Clear Catalog>*** button. This procedure will delete only data from the memory of the program. The Catalog file stored on disk won't be affected.

15.2 Opening a Catalog from Disk

Catalog files are saved in *CTG* format. These are text files exclusive from the Catalog.

To open a file from the Images Catalog, choose the *Autoload Catalog* option in the *Tools* menu to open the Catalog Window.

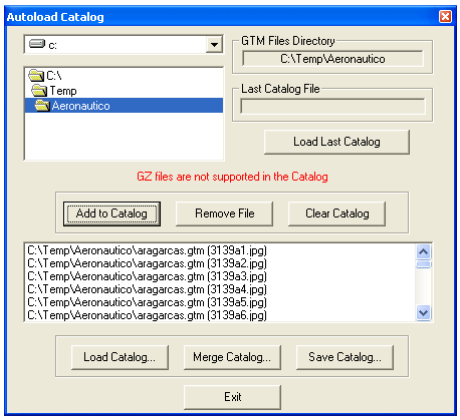


Then, press the ***<Load Catalog>*** button and choose a file from the Catalog.

Also press the ***<Load Last Catalog>*** button to load the last created or opened Catalog. This function is the *default* of the Catalog window. Just press <ENTER> when opening the Catalog window, to open the last catalog file.

15.3 Uniting Several Catalogs

To combine files from the Image Catalog, choose the *Autoload Catalog* option in the *Tools* menu to open the Catalog Window .

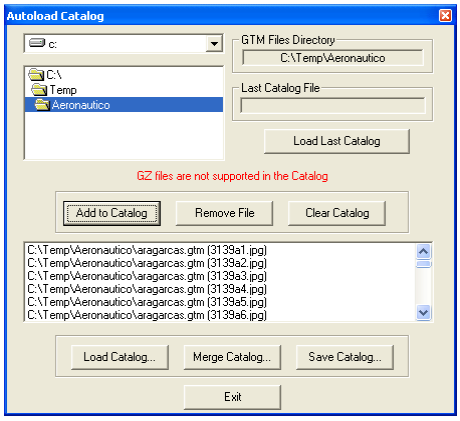


Then, press the ***<Merge Catalog>*** button and choose the Catalog file. The file will be automatically added to the Catalog stored in **GPS TrackMaker®**'s memory.

15.4 Saving the Catalog in Disk

Catalog files are saved to disk in *CTG* format, which is nothing more than text files exclusive of the Catalog .

To save an Image Catalog file in disk, choose the *Autoload Catalog* option in the *Tools* menu to open the Catalog Window.



Then, press the ***<Save Catalog>*** button.

15.5 Loading Images from Catalog

With the Images Catalog loaded in the memory of **GPS TrackMaker®**, your can have the contour of all maps (or photos) from the Catalog on the screen of the computer, without the need to load them. Specific images can also be loaded, guaranteeing an efficient handling of the memory in the computer and of data on the screen.

To use a specific image from the Catalog, it needs to be loaded into memory. To create a new Catalog, see Creating an Image Catalog. To know if the Catalog is in memory, verify if the image  appears on the Status Bar at the bottom of the screen.

Loading an image is accomplished through Tools -> Autoload catalog -> Extract images from catalog. All maps inserted within the screen limits will be loaded. Be careful for not to load a lot of images, because it can bring reduce the overall performance of the program.

15.6 Showing on screen Images from Catalog

With the Images Catalog loaded in the memory of **GPS TrackMaker®**, you can have the contour of all maps (or photos) from the Catalog on the screen of the computer, without the need to load them.

To view the available images of the catalog, click in Tools -> Autoload catalog -> View catalog of images on screen.

16 Maps on the Word Wide Web

16.1 Accessing Maps on the World Wide Web

Important: this tool requires the installation of Internet Explorer®, Netscape Navigator® or other compatible browser.

Many websites offer free maps that can be accessed through geographical coordinates (latitude and longitude). GPS TrackMaker® can be configured to open the Internet browser, allowing to show the position of a Waypoint, Tracklog or Route segment on the map.

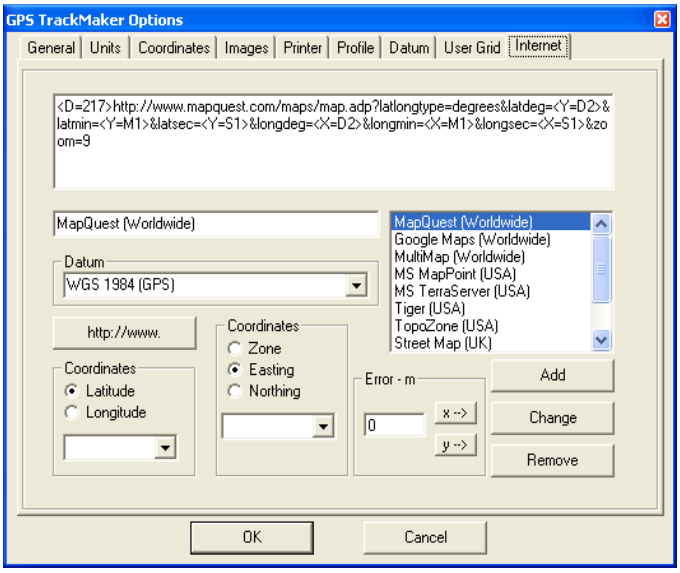
The first step to access maps is to configure the program GPS Trackmaker® with the list of websites that offer maps. Please, see Configuring Web Pages of Maps for details.

After creating the list of maps, click on the arrow beside the  and select a website from the list. Press **<OK>** to close the window.

Select a Waypoint or a segment of Tracklog or Route and press  to open the Internet browser with the position on the map.

Note: select only one Waypoint or one Tracklog/Route segment. See Selecting Data for details.

16.2 Configuring Web Pages of Maps



GPS TrackMaker® can be configured to open the Internet Explorer®, Netscape Navigator® or other similar program, allowing to show the position of a Waypoint, Tracklog or Route segment on a map.

To add a website to the list, choose Tools -> Options -> Internet

Type the webpage URL in the text box on the top of the window. Use the buttons and the list boxes to insert tags delimited by < > that will inform to the program how the URL will be opened in the browser.

Follow the steps below to create a URL to a map webpage:

1) Create a name for the webpage

2) Determine the datum of the data. Most of web pages use the WGS84 datum as default. For WGS84, a label ***<D=217>*** will be created in the beginning of the text, indicating that the coordinates will be converted to the WGS84 datum when the URL is opened in the browser.

3) Click on the **http://www** button to insert the header of the URL.

4) Type the URL of the web page that offers the maps.

5) Choose where the coordinates will be inserted and the coordinate notation. Insert the latitude and the longitude.

6) The error tags allow to move horizontally and vertically the point on the map. They are usually inserted after opening the URL and verified position errors. The use of these tags is not frequent.

7) Press ***<Add>*** to include the URL to the web page list.

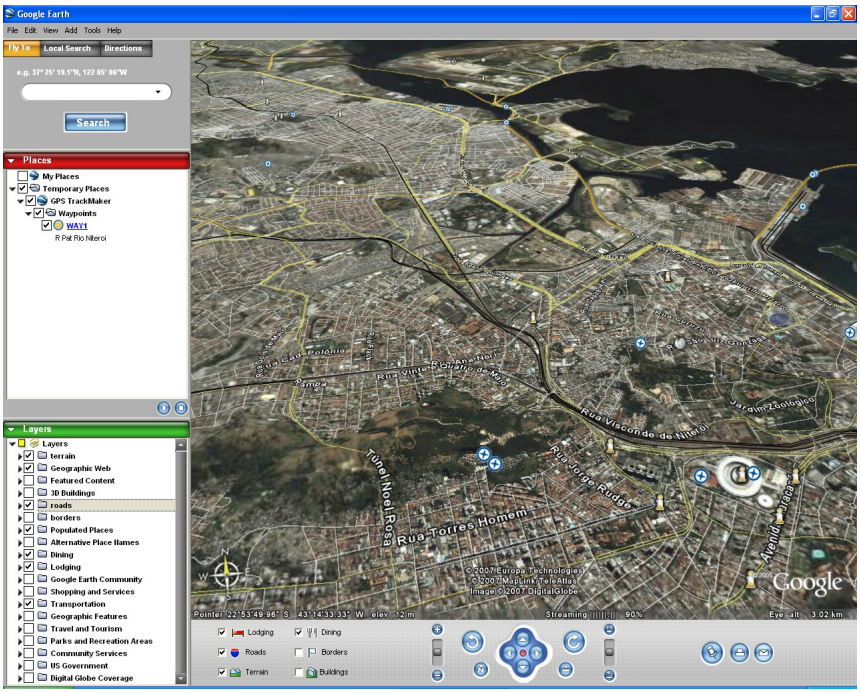
To edit the URL text, make the modifications in the text box on the top of the window and press ***<Modify>***.

To delete a URL from the list, first select it on the list and press ***<Remove>***.

16.3 Opening Maps in Google Earth®

Google Earth® is a fantastic program to visualize 3D maps through Internet, offering free satellite images of all World.

To install Google Earth®, it is necessary to have a fast Internet connection and a good video card. You can download the program at http://earth.google.com



GPS TrackMaker® has total support for Google Earth®:

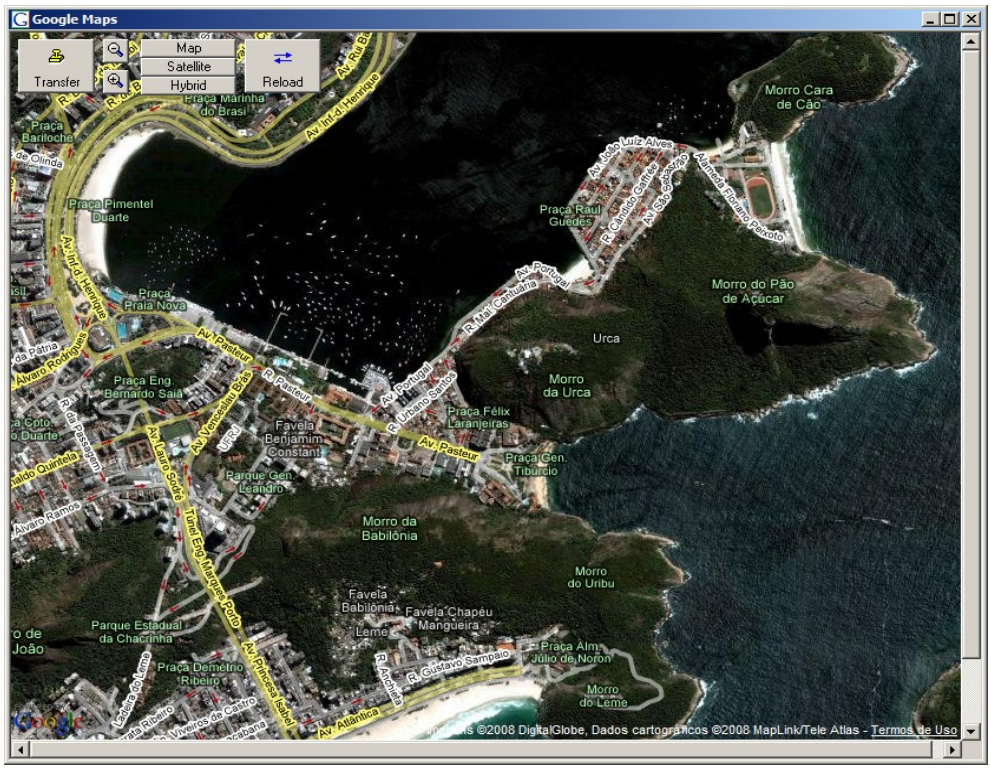
- Allows to import and export KML files with support for images, Tracklogs, Routes and Waypoints.
- sends selected Tracklogs, Routes and Waypoints to Google Earth®.
- In Real-Time Navigation, press to see the current position in Google Earth®.
- Click on map images and choose the option *View 3D in Google Earth*

Important: for map images, Google Earth® doesn't support *True Grid Mode*. Before sending an image to Google Earth®, first change the datum to WGS84 and the coordinate system to *Geographic Coordinates.* If the image doesn't present relevant variation of position, it can be sent to Google Earth®.

16.4 Opening Images from Google Maps®

Google Maps® is a fantastic service that distributes in Internet free maps and high resolution satellite images. To access Google Maps® press . It is necessary that your computer is connected to Internet.

The Google Maps® will be opened with a zoom level similar to the current scale of GPS TrackMaker®.



- Click with the left mouse button to drag the screen.
- Click on button to refresh the images.
- Click in the map type box to choose satellite images, maps or both.
- The buttons and and the mouse wheel define the map zoom level.

Tip: if you select Waypoints before opening the Google Maps window, they will be shown on the map.

Press to transfer the georeferenced image from Google Maps® to the main screen of GPS TrackMaker Professional®.

17 Internal Tables

17.1 Datum Table

The **GPS TrackMaker®** program features the conversion of geodesic coordinates between different parameters of datum. For that, the program uses internal tables that contain the characteristics of several ellipsoids and datum systems.

The default datum in GPS TrackMaker® is WGS 84, code #217.

The characteristics of each reference ellipsoid as well as each datum can be seen in the tables below:

Ellipsoids

1) Airy 1830
2) Modified Airy
3) Australian National
4) Bessel 1841 (Namibia)
5) Bessel 1841
6) Clarke 1866
7) Clarke 1880
8) Everest (India 1830)
9) Everest(Sabah Sarawak)
10) Everest (India 1956)
11) Everest (Malaysia 1969)
12) Everest (Malay. & Sing)
13) Everest (Pakistan)
14) Modified Fischer 1960
15) Helmert 1906
16) Hough 1960
17) Indonesian 1974
18) International 1924
19) Krassovsky 1940
20) GRS 80
21) South American 1969
22) WGS 72
23) WGS 84
24) French NTF
25) Israeli
26) Danish 1934

	Datum	Region
1)	Adindan	Burkina Faso
2)	Adindan	Cameroon
3)	Adindan	Ethiopia
4)	Adindan	Mali
5)	Adindan	Mean for Ethiopia ; Sudan
6)	Adindan	Senegal
7)	Adindan	Sudan
8)	Afgooye	Somalia
9)	Ain el Abd '70	Bahrain
10)	Ain el Abd '70	Saudi Arabia
11)	Am. Samoa '62	American Samoa Islands
12)	Anna 1 A'65	Cocos Islands
13)	Antigua Isd '43	Antigua (Leeward Islands)
14)	Arc 1950	Botswana
15)	Arc 1950	Burundi
16)	Arc 1950	Lesotho
17)	Arc 1950	Malawi
18)	Arc 1950 Mean	Mean for Arc 1950
19)	Arc 1950	Swaziland
20)	Arc 1950	Zaire
21)	Arc 1950	Zambia
22)	Arc 1950	Zimbabwe
23)	Arc 1960	Mean for Kenya ; Tanzania
24)	Arc 1960	Kenya
25)	Arc 1960	Taanzania
26)	Ascension Isd '58	Ascension Island
27)	Astro Beacon E'45	Iwo Jima
28)	Astro DOS 71/4	St. Helena Island
29)	Astro Tern Isd'61	Tern Island
30)	Astron. Station '52	Marcus Island
31)	Australian G. '66	Australia ; Tasmania
32)	Australian G. '84	Australia ; Tasmania
33)	Ayabelle Light.	Djibouti
34)	Bellevue (IGN)	Efate & Erromango Islands
35)	Bermuda 1957	Bermuda
36)	Bissau	Guinea-Bissau
37)	Bogota Obsty	Colombia
38)	Bukit Rimpah	Indonesia (Bangka and Belitung Ids)
39)	Camp Area Astro	Antarctica (McMurdo Camp Area)
40)	Campo Inchauspe	Argentina
41)	Canton Astro 1966	Phoenix Islands
42)	Cape	South Africa
43)	Cape Canaveral	Bahamas ; Florida
44)	Carthage	Tunisia
45)	Chatham Isd A. '71	New Zealand (Chatham Island)
46)	Chua Astro	Paraguay
47)	Corrego Alegre	Brazil
48)	Dabola	Guinea
49)	Deception Island	Deception Island ; Antarctia
50)	Djakarta (Batavia)	Indonesia (Sumatra)
51)	DOS 1968	New Georgia Islands (Gizo Island)
52)	Easter Island 1967	Easter Island
53)	Estonia System '37	Estonia
54)	European 1950	Cyprus
55)	European 1950	Egypt
56)	European 1950	England Channel Islands ; Scotland ; Shetland Islands
57)	European 1950	England ; Ireland ; Scotland ; Shetland Islands
58)	European 1950	Finland ; Norway
59)	European 1950	Greece
60)	European 1950	Iran
61)	European 1950	Italy (Sardinia)
62)	European 1950	Italy (Sicily)
63)	European 1950	Malta
64)	European 1950	Mean for Austria ; Belgium ; Denmark ; Finland ; France ; W. Germany Gibraltar ; Greece ; Italy ; Luxembourg ; Netherlands ; Norway Portugal ; Spain ; Sweden ; Switzerland

65)	European 1950	Mean for Austria ; Denmark ; France ; W. Germany ; Netherlands ; Switzerland
66)	European 1950	Mean for Iraq ; Israel ; Jordan ; Lebanon ; Kuwait ; Saudi Arabia ; Syria
67)	European 1950	Portugal ; Spain
68)	European 1950	Tunisia
69)	European 1979	Mean for Austria ; Finland ; Netherlands ; Norway ; Spain ; Sweden; Switzerland
70)	Fort Thomas 1955	Nevis ; St. Kitts (Leeward Islands)
71)	Gan 1970	Republic of Maldives
72)	Geod. Dat. '49	New Zealand
73)	Graciosa SW '48	Azores (Faial ; Graciosa ; Pico ; São Jorge ; Terceira)
74)	Guam 1963	Guam
75)	Gunung Segara	Indonesia (Kalimantan)
76)	GUX 1 Astro	Guadalcanal Island
77)	Herat North	Afghanistan
78)	Hermannskogel	Croatia-Serbia ; Bosnia-Herzegovina
79)	Hjorsey 1955	Iceland
80)	Hong Kong 1963	Hong Kong
81)	Hu-Tzu-Shan	Taiwan
82)	Indian	Bangladesh
83)	Indian	India ; Nepal
84)	Indian	Pakistan
85)	Indian 1954	Thailand
86)	Indian 1960	Vietnam (Com Son Island)
87)	Indian 1960	Vietnam (Near 16øN)
88)	Indian 1975	Thailand
89)	Indonesian 1974	Indonesia
90)	Ireland 1965	Ireland
91)	ISTS 061 '68	SouthGeorgia Islands
92)	ISTS 073 '69	Diego Garcia
93)	Johnston Isld '61	Johnston Island
94)	Kandawala	Sri Lanka
95)	Kerguelen Isld '49	Kerguelen Island
96)	Kertau 1948	West Malaysia and Singapore
97)	Kusaie Astro1951	Caroline Islands
98)	Korean System	South Korea
99)	L. C. 5 Astro 1961	Cayman Brac Island
100)	Leigon	Ghana
101)	Liberia 1964	Liberia
102)	Luzon	Philippines (Excluding Mindanao)
103)	Luzon	Philippines (Mindanao)
104)	M'Poraloko	Gabon
105)	Mahe 1971	Mahe Island
106)	Massawa	Ethiopia (Eritrea)
107)	Merchich	Morocco
108)	Midway Astro '61	Midway Islands
109)	Minna	Cameroon
110)	Minna	Nigeria
111)	Montserrat '58	Montserrat (Leeward Islands)
112)	Nahrwan	Oman (Masirah Island)
113)	Nahrwan	Saudi Arabia
114)	Nahrwan	United Arab Emirates
115)	Naparima BWI	Trinidad & Tobago
116)	NAD 1927	Alaska (Excluding Aleutian Ids)
117)	NAD 1927	Alaska (Aleutian Ids East of 180øW)
118)	NAD 1927	Alaska (Aleutian Ids West of 180øW)
119)	NAD 1927	Bahamas (Except San Salvador Id)
120)	NAD 1927	Bahamas (San Salvador Island)
121)	NAD 1927	Canada (Alberta ; British Columbia)
122)	NAD 1927	Canada (Manitoba ; Ontario)
123)	NAD 1927	Canada (New Brunswick ; Newfoundland ; Nova Scotia ; Quebec)
124)	NAD 1927	Canada (Northwest Territories ; Saskatchewan)
125)	NAD 1927	Canada (Yukon)
126)	NAD 1927	Canal Zone
127)	NAD 1927	Cuba
128)	NAD 1927	Greenland (Hayes Peninsula)
129)	NAD 1927	Mean for Antigua ; Barbados ; Barbuda ; Caicos Islands ; Cuba ; Dominican Republic ; Grand Cayman ; Jamaica ; Turks Islands
130)	NAD 1927	Mean for Belize ; Costa Rica; El Salvador ; Guatemala ; Honduras;

		Nicaragua
131)	NAD 1927	Mean for Canada
132)	NAD 1927	Mean for CONUS
133)	NAD 1927	Mean for CONUS (East of Mississippi ; River Including Louisiana; Missouri ; Minnesota)
134)	NAD 1927	Mean for CONUS (West of Mississippi ; River Excluding Louisiana, Minnesota ; Missouri)
135)	NAD'27	Mexico
136)	NAD'83	Alaska (Excluding Aleutian Ids)
137)	NAD'83	Aleutian Ids
138)	NAD'83	Canada
139)	NAD'83	CONUS
140)	NAD'83	Hawaii
141)	NAD'83	Mexico ; Central America
142)	North Sahara 1959	Algeria
143)	Obs. Met. 1939	Azores (Corvo & Flores Islands)
144)	Old Egyptian 1907	Egypt
145)	Old Hawaiian	Hawaii
146)	Old Hawaiian	Kauai
147)	Old Hawaiian	Maui
148)	Old Hawaiian	Mean for Hawaii ; Kauai ; Maui ; Oahu
149)	Old Hawaiian	Oahu
150)	Oman	Oman
151)	OS G. Britain '36	England
152)	OS G. Britain '36	England ; Isle of Man ; Wales
153)	OS G. Britain '36	Mean for England ; Isle of Man ; Scotland ; Shetland Islands ; Wales
154)	OS G. Britain '36	Scotland ; Shetland Islands
155)	OS G. Britain '36	Wales
156)	Pico de las Nieves	Canary Islands
157)	Pitcairn Astro '67	Pitcairn Island
158)	Point 58	Mean for Burkina Faso & Niger
159)	Pointe Noire 1948	Congo
160)	Porto Santo 1936	Porto Santo ; Madeira Islands
161)	PSA1956	Bolivia
162)	PSA1956	Chile (Northern ; Near 19øS)
163)	PSA1956	Chile (Southern ; Near 43øS)
164)	PSA1956	Colombia
165)	PSA1956	Ecuador
166)	PSA1956	Guyana
167)	PSA1956	Mean for Bolivia ; Chile ; Colombia ; Ecuador ; Guyana ; Peru; Venezuela
168)	PSA1956	Peru
169)	PSA1956	Venezuela
170)	PS Chilean 1963	Chile (Near 53øS) (Hito XVIII)
171)	Puerto Rico	Puerto Rico ; Virgin Islands
172)	Pulkovo 1942	Russia
173)	Qatar National	Qatar
174)	Qornoq	Greenland (South)
175)	Reunion	Mascarene Islands
176)	Rome 1940	Italy (Sardinia)
177)	S42 (Pulkovo '42)	Hungary
178)	S42 (Pulkovo '42)	Poland
179)	S42 (Pulkovo '42)	Czechoslavakia
180)	S42 (Pulkovo '42)	Latvia
181)	S42 (Pulkovo '42)	Kazakhstan
182)	S42 (Pulkovo '42)	Albania
183)	S42 (Pulkovo '42)	Romania
184)	S-JTSK	Czechoslavakia (Prior 1 Jan 1993)
185)	Santo (DOS) 1965	Espirito Santo Island
186)	Sao Braz	Azores (São Miguel ; Santa Maria Ids)
187)	Sapper Hill 1943	East Falkland Island
188)	Schwarzeck	Namibia
189)	Selvagem G '38	Salvage Islands
190)	Sierra Leone 1960	Sierra Leone
191)	SAD 1969	Argentina
192)	SAD 1969	Bolivia
193)	SAD 1969	Brazil
194)	SAD 1969	Chile
195)	SAD 1969	Colombia

196)	SAD 1969	Ecuador
197)	SAD 1969	Ecuador (Baltra ; Galapagos)
198)	SAD 1969	Guyana
199)	SAD 1969 Mean	Mean for Argentina ; Bolivia ; Brazil ; Chile ; Colombia ; Ecuador ; Guyana ; Paraguay ; Peru ; Trinidad & Tobago ; Venezuela
200)	SAD 1969	Paraguay
201)	SAD 1969	Peru
202)	SAD 1969	Trinidad & Tobago
203)	SAD 1969	Venezuela
204)	South Asia	Singapore
205)	Tananarive 1925	Madagascar
206)	Timbalai 1948	Brunei ; E. Malaysia (Sabah Sarawak)
207)	Tokyo	Japan
208)	Tokyo	Mean for Japan ; South Korea ; Okinawa
209)	Tokyo	Okinawa
210)	Tokyo	South Korea
211)	Tristan Astro '68	Tristão da Cunha
212)	Viti Levu 1916	Fiji (Viti Levu Island)
213)	Voirol 1960	Algeria
214)	Wake Isld '52	Wake Atoll
215)	W Eniwetok '60	Marshall Islands
216)	WGS 1972	Global Definition
217)	WGS 1984	Global Definition
218)	Yacare	Uruguay
219)	Zanderij	Suriname
220)	Amersfoort	Netherlands
221)	French NTF	France ; Nouvelle Triangulation Francaise
222)	Potsdam	Germany
223)	RT 90	Swedish
224)	CH-1903	Swiss
225)	Austria	Austria
226)	European 1950	Belgium
227)	Israeli	Israeli
228)	Rome 1940	Luxembourg
229)	Finland Hayford	Finland
230)	Dionisos	Greece
231)	SAD 69 (IBGE)	Brazil
232)	Potsdam II	Gemany
233)	Datum 73	Portugal
234)	WGS 1972 (GPS)	Global Definition
235)	Adindan (GPS)	Burkina Faso
236)	Ain el Abd 1970 (GPS)	Bahrain
237)	Arc 1960 (GPS)	Kenya and Taanzania
238)	Ascension Island 1958 (GPS)	Ascension Island
239)	Belgium 1950 (GPS)	Belgium
240)	Danish 1934 (GPS)	Denmark
241)	Hu-Tzu-Shan (GPS)	Taiwan
242)	Indian Bangladesh (GPS)	Bangladesh
243)	Indian Maen (GPS)	Mean for India
244)	Indian Thailand (GPS)	Mean for Thailand
245)	Indonesian 1974 (GPS	Mean for Indonesia
246)	Johnston Isld 61 (GPS)	Johnston Island
247)	Luzon Mean (GPS)	Mean for Philippines
248)	NAD27 Caribbean (GPS)	Mean for Caribe
249)	Nahrwan Saudi Arabia (GPS)	Mean for Saudi Arabia
250)	Naparima BWI (GPS)	Trinidad and Tobago
251)	Netherland Tri21 (GPS)	Mean for Netherland
252)	Nou Triag France (GPS)	France
253)	Nou Triag Luxemb (GPS)	Luxemburg
254)	Old Hawaiian Kauai (GPS)	Kauai/Hawaii
255)	Old Hawaiian Maui (GPS)	Maui/Hawaii
256)	Old Hawaiian Oahu (GPS)	Oahu/Hawaii
257)	Portugal 73 (GPS)	Portugal
258)	RT 90 (GPS)	Swedish
259)	Sapper Hill 1943 (GPS)	East Falkland Island
260)	Timbalai 1948 (GPS)	Mean for Brunei; E. Malaysia (Sabah Sarawak)
261)	Tokyo Mean (GPS)	Mean for Japan; South Korea; Okinawa
262)	Wake-Eniwetok 1960 (GPS)	Marshall Islands
263)	Fahud_	Oman

264)	Kalianpur	Bangladesh; Índia; Pakistan
265)	Manoca	Cameroon
266)	Mhast	Angola - Cabinda
267)	Monte Mario	Italy
268)	GDA94	Australia
269)	Segora	Indonesia - Southeast Kalimantan
270)	Voirol 1875	Algeria - north of 32 deg N
271)	MGI Ferro	Austria; Yugoslavia
272)	Samboja	Indonesia - east Kalimantan - Mahakam delta area
273)	LKS94	Lithuania
274)	ETRS89	Europe
275)	Aratu Campos	Brazil
276)	Aratu Espirito Santo	Brazil
277)	Aratu Cumuruxatiba-Alagoas	Brazil
278)	Aratu Mean	Brazil
279)	Aratu Potiguar	Brazil
280)	Aratu Santos	Brazil
281)	Beijing 1954 Datum	China
282)	Camacupa 94	Angola
283)	European 1987 Mean	Europe - West
284)	La Canoa	Venezuela
285)	Malongo 1987	Angola
286)	NAD27 for Michigan	USA - Michigan (elevated ellipsoid)
287)	Pulkovo II	Russia
288)	SIRGAS 2000	Geocentric Reference System for the Americas
289)	NZGD 2000	New Zealand Geodetic Datum 2000
290)	EGSA 87	Greek Geodetic Reference System 1987

17.2 Internal Icon Table of GPS TrackMaker®

The list below shows the icon index numbers, used by the **GPS TrackMaker®** program in TXT and GTM files, and their descriptions. Note that there are several icons that don't have equivalents in the GPS. When these icons are sent to the GPS, they will be changed to the Waypoint default icon.

1 - Airport 
2 - Ball Park 
3 - Bank 
4 - Bar 
5 - Boat Ramp 
6 - Campground 
7 - Car 
8 - City Large 
9 - City Medium 
10 - City small
11 - Dam 
12 - Danger Area 
13 - Drinking Water 
14 - Fishing Area 
15 - Gas Station 
16 - Glider Area 
17 - Golf Course 
18 - Heliport 
19 - Hotel 
20 - Animals 
21 - Information 
22 - Man Overboard 
23 - Marina 
24 - Mine 
25 - Medical Facility 
26 - Parachute Area 
27 - Park 
28 - Parking Area 
29 - Picnic Area 
30 - Private Field 
31 - Residence 
32 - Restaurant 
33 - Restroom 
34 - Scenic Area 
35 - School 
36 - Seaplane Base 
37 - Shipwreck 
38 - Shopping Center 
39 - Short Tower 
40 - Policy 
41 - Skiing Area 
42 - Soft Field 

43 - Swimming Area 
44 - Tall Tower 
45 - Telephone 
46 - Tracback Point 
47 - Ultralight Area 
48 - Waypoint 
49 - Boat 
50 - Exit 
51 - Flag 
52 - Duck 
53 - Buoy 
54 - Back Track 
55 - Beach 
56 - Bridge 
57 - Building 
58 - Car Repair 
59 - Cemetery 
60 - Church 
61 - Civil 
62 - Convenience 
63 - Crossing 
64 - Fast Food 
65 - Forest 
66 - Ghost Town 
67 - Levee 
68 - Military 
69 - Oil Field 
70 - Post Office 
71 - Rv Park 
72 - Scales 
73 - Summit 
74 - Toll Booth 
75 - Trail Head 
76 - Truck Stop 
77 - Tunnel 
78 - Highway 
79 - Gate 
80 - Fall 
81 - Fence 
82 - Mata-Burro 
83 - Fitness Center 
84 - Movie Theater 
85 - Live Theater 
86 - Zoo 
87 - Horn 
88 - Bowling 
89 - Car Rental 

90 - City Capitol 
91 - Controlled Area 
92 - Stadium 
93 - Museum 
94 - Amusement Park 
95 - Skull 
96 - Department Store 
97 - Pharmacy 
98 - Pizza 
99 - Diver Down 
100 - Light 
101 - Pin 
102 - (Blank)
103 - Pigsty 
104 - Tree 
105 - Bamboo 
106 - Banana Plant 
107 - Arrow-Down 
108 - Bifurcation 
109 - Cavern 
110 - River 
111 - Rock 
112 - Arrow-up 
113 - Trunk 
114 - Soccer Field 
115 - Sporting Court 
116 - Flag-Green 
117 - Trench 
118 - Ship-Yellow 
119 - Green Sign 
120 - Swamp 
121 - Lake 
122 - Stop! 
123 - Fishing Area 
124 - Speed Reducer 
125 - Stairway 
126 - Cactus 
127 - Ship-Red 
128 - Letter-S 
129 - Letter-D 
130 - Letter-N 
131 - Crossing 
132 - Cross 
133 - Flag-Red 
134 - Curve1 
135 - Curve2 
136 - Curve3 

137 - Curve4 
138 - Letter-W 
139 - Letter-L 
140 - Letter-R 
141 - Radio Beacon 
142 - Road Sign 
143 - Geocache 
144 - Geocache Found 
145 - Traffic Light 
146 - Bus Station 
147 - Train Station 
148 - School 
149 - Mile Marker 
150 - Conservation Area 
151 - Magellan® Waypoint 
152 - Box 
153 - Aerial 
154 - Auto Repair 
155 - Boat (1) 
156 - Exit Ramp 
157 - Fixed Nav Aid 
158 - Floating Buoy 
159 - Garden 
160 - Fish Farm 
161 - Lighthouse 
162 - Truck Service 
163 - Resort 
164 - Scuba 
165 - Shooting 
166 - Sight Seeing 
167 - Sounding 
168 - Winery 
169 - Navaid (Amber) 
170 - Navaid (Black) 
171 - Navaid (Blue) 
172 - Navaid (Green) 
173 - Navaid (Green;Red) 
174 - Navaid (Green;White) 
175 - Navaid (Orange) 
176 - Navaid (Red) 
177 - Navaid (Red;Green) 
178 - Navaid (Red;White) 
179 - Navaid (Violet) 
180 - Navaid (White) 
181 - Navaid (White;Green) 
182 - Navaid (White;Red) 
183 - Buoy (White) 

184 - Dot (White)
185 - Red Square 
186 - Red Diamond 
187 - Green Square 
188 - Green Diamond 
189 - Restricted Area 
190 - Navaid (unlit) 
191 - Dot (Small)
192 - Libraries 
193 - Lowrance WPT) 
194 - Lowrance WPT1 
195 - Lowrance WPT2 
196 - Mark (1) 
197 - Mark (2) 
198 - Mark (3) 
199 - Cross(Red) 
200 - Store 
201 - Exclamation 
202 - Flag (EUA) 
203 - Flag (CAN) 
204 - Flag (BRA) 
205 - Man 
206 - Animals (1) 
207 - Deer Tracks 
208 - Tree Stand 
209 - Bridge(1) 
210 - Fence(1) 
211 - Intersection
212 - Non-Direct Beacon 
213 - VHF Omni-Range 
214 - Vor/Tacan 
215 - Vor-Dme 
216 - 1st Approach Fix 
217 - Localizer Outer 
218 - Missed Appr. Pt 
219 - Tacan 
220 - Checked 
221 - Flag (Blue)
222 - Flag (Green) 
223 - Flag (Red) 
224 - Pin (Blue) 
225 - Pin (Green) 
226 - Pin (Red) 
227 - Box (Blue) 
228 - Box (Green) 
229 - Box (Pink) 
230 - Skiing Area(1) 

231 - Bicycle 
232 - Police(1) 
233 - Tractor 
234 - Ice Skating 
235 - Man Overboard(1) 
236 - Restricted Area(1) 
237 - Contact, Afro 
238- Contact, Alien 
239 - Contact, Ball Cap 
240 - Contact, Big Ears 
241 - Contact, Biker 
242 - Contact, Bug 
243 - Contact, Cat 
244 - Contact, Dog 
245 - Cont., Dreadlocks 
246 - Contact, Female1 
247 - Contact, Female2 
248 - Contact, Female3 
249 - Contact, Goatee 
250 - Contact, Kung-Fu 
251 - Contact, Pirate 
252 - Contact, Ranger 
253 - Contact, Smiley 
254 - Contact, Spike 
255 - Contact, Sumo 
256 - Water Hydrant 
257 - Anchor Prohibited 
258 - Circle with X 
259 - Diamond, Blue 
260 - Beacon 
261 - Coast Guard 
262 - Reef 
263 - Weed Bed 
264 - Dropoff 
265 - Dock 
266 - Buzzer 1 
267 - Buzzer 2 
268 - Buzzer 3 
269 - Buzzer 4 
270 - Buzzer 5 
271 - Buzzer 6 
272 - Buzzer 7 
273 - Buzzer 8