MAGELLAN®
PROFESSIONAL

MobileMapper™ Office

User Manual

MAGELLAN NAVIGATION PROFESSIONAL PRODUCTS - LIMITED WARRANTY

(North, Central and South America)

Magellan Navigation warrants their GPS receivers and hardware accessories to be free of defects in material and workmanship and will conform to our published specifications for the product for a period of one year from the date of original purchase. THIS WARRANTY APPLIES ONLY TO THE ORIGINAL PURCHASER OF THIS PRODUCT.

In the event of a defect, Magellan Navigation will, at its option, repair or replace the hardware product with no charge to the purchaser for parts or labor. The repaired or replaced product will be warranted for 90 days from the date of return shipment, or for the balance of the original warranty, whichever is longer. Magellan Navigation warrants that software products or software included in hardware products will be free from defects in the media for a period of 30 days from the date of shipment and will substantially conform to the then-current user documentation provided with the software (including updates thereto). Magellan Navigation's sole obligation shall be the correction or replacement of the media or the software so that it will substantially conform to the then-current user documentation. Magellan Navigation does not warrant the software will meet purchaser's requirements or that its operation will be uninterrupted, error-free or virus-free. Purchaser assumes the entire risk of using the software.

PURCHASER'S EXCLUSIVE REMEDY UNDER THIS WRITTEN WARRANTY OR ANY IMPLIED WARRANTY SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT, AT MAGELLAN NAVIGATION'S OPTION, OF ANY DEFECTIVE PART OF THE RECEIVER OR ACCESSORIES WHICH ARE COVERED BY THIS WARRANTY. REPAIRS UNDER THIS WARRANTY SHALL ONLY BE MADE AT AN AUTHORIZED MAGELLAN NAVIGATION SERVICE CENTER. ANY REPAIRS BY A SERVICE CENTER NOT AUTHORIZED BY MAGELLAN NAVIGATION WILL VOID THIS WARRANTY.

To obtain warranty service the purchaser must obtain a Return Materials Authorization (RMA) number prior to shipping by calling 800-229-2400, option 1 (U.S.) or 408-615-3981 (International), or by submitting a repair request on-line at http://professional.magellangps.com/en/support/rma.asp. The purchaser must return the product postpaid with a copy of the original sales receipt to the address provided by Magellan Navigation with the RMA number. Purchaser's return address and the RMA number must be clearly printed on the outside of the package.

Magellan Navigation reserves the right to refuse to provide service free-of-charge if the sales receipt is not provided or if the information contained in it is incomplete or illegible or if the serial number is altered or removed. Magellan Navigation will not be responsible for any losses or damage to the product incurred while the product is in transit or is being shipped for repair. Insurance is recommended. Magellan Navigation suggests using a trackable shipping method such as UPS or FedEx when returning a product for service.

EXCEPT AS SET FORTH IN THIS LIMITED WARRANTY, ALL OTHER EXPRESSED OR IMPLIED WARRANTIES, INCLUDING THOSE OF FITNESS FOR ANY PARTICULAR PURPOSE, MERCHANTABILITY OR NON-INFRINGEMENT, ARE HEREBY DISCLAIMED AND IF APPLICABLE, IMPLIED WARRANTIES UNDER ARTICLE 35 OF THE UNITED NATIONS CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS. Some national, state, or local laws do not allow limitations on implied warranty or how long an implied warranty lasts, so the above limitation may not apply to you.

The following are excluded from the warranty coverage: (1) periodic maintenance and repair or replacement of parts due to normal wear and tear; (2) batteries and finishes; (3) installations or defects resulting from installation; (4) any damage caused by (i) shipping, misuse, abuse, negligence, tampering, or improper use; (ii) disasters such as fire, flood, wind, and lightning; (iii) unauthorized attachments or modification; (5) service performed or attempted by anyone other than an authorized Magellan Navigations Service Center; (6) any product, components or parts not manufactured by Magellan Navigation; (7) that the receiver will be free from any claim for infringement of any patent, trademark, copyright or other proprietary right, including trade secrets; and (8) any damage due to accident, resulting from inaccurate satellite transmissions. Inaccurate transmissions can occur due to changes in the position, health or geometry of a satellite or modifications to the receiver that may be required due to any change in the GPS. (Note: Magellan Navigation GPS receivers use GPS or GPS+GLONASS to obtain position, velocity and time information. GPS is operated by the U.S. Government and GLONASS is the Global Navigation Satellite System of the Russian Federation, which are solely responsible for the accuracy and maintenance of their systems. Certain conditions can cause inaccuracies which could require modifications to the receiver. Examples of such conditions include but are not limited to changes in the GPS or GLONASS transmission.) Opening, dismantling or repairing of this product by anyone other than an authorized Magellan Navigation Service Center will void this warranty.

MAGELLAN NAVIGATION SHALL NOT BE LIABLE TO PURCHASER OR ANY OTHER PERSON FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DAMAGES RESULTING FROM DELAY OR LOSS OF USE, LOSS OF OR DAMAGES ARISING OUT OF BREACH OF THIS WARRANTY OR ANY IMPLIED WARRANTY EVEN THOUGH CAUSED BY NEGLIGENCE OR OTHER FAULT OF MAGELLAN NAVIGATION OR NEGLIGENT USAGE OF THE PRODUCT. IN NO EVENT WILL MAGELLAN NAVIGATION BE RESPONSIBLE FOR SUCH DAMAGES, EVEN IF MAGELLAN NAVIGATION HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

This written warranty is the complete, final and exclusive agreement between Magellan Navigation and the purchaser with respect to the quality of performance of the goods and any and all warranties and representations. This warranty sets forth all of Magellan Navigation's responsibilities regarding this product. This limited warranty is governed by the laws of the State of California, without reference to its conflict of law provisions or the U.N. Convention on Contracts for the International Sale of Goods, and shall benefit Magellan Navigation, its successors and assigns.

This warranty gives the purchaser specific rights. The purchaser may have other rights which vary from locality to locality (including Directive 1999/44/EC in the EC Member States) and certain limitations contained in this warranty, including the exclusion or limitation of incidental or consequential damages may not apply.

For further information concerning this limited warranty, please call or write:

Magellan Navigation, Inc., 960 Overland Court, San Dimas, CA 91773, Phone: +1 909-394-5000, Fax: +1 909-394-7050 or

Magellan Navigation SA - ZAC La Fleuriaye - BP 433 - 44474 Carquefou Cedex - France Phone: +33 (0)2 28 09 38 00, Fax: +33 (0)2 28 09 39 39

MAGELLAN NAVIGATION
PROFESSIONAL PRODUCTS LIMITED WARRANTY

(Europe, Middle East, Africa)

All Magellan Navigation global positioning system (GPS) receivers are navigation aids, and are not intended to replace other methods of navigation. Purchaser is advised to perform careful position charting and use good judgment. READ THE USER GUIDE CAREFULLY BEFORE USING THE PRODUCT.

1. MAGELLAN NAVIGATION WARRANTY

Magellan Navigation warrants their GPS receivers and hardware accessories to be free of defects in material and workmanship and will conform to our published specifications for the product for a period of one year from the date of original purchase or such longer period as required by law. THIS WARRANTY APPLIES ONLY TO THE ORIGINAL PURCHASER OF THIS PRODUCT.

In the event of a defect, Magellan Navigation will, at its option, repair or replace the hardware product with no charge to the purchaser for parts or labor. The repaired or replaced product will be warranted for 90 days from the date of return shipment, or for the balance of the original warranty, whichever is longer. Magellan Navigation warrants that software products or software included in hardware products will be free from defects in the media for a period of 30 days from the date of shipment and will substantially conform to the then-current user documentation provided with the software (including updates thereto). Magellan Navigation's sole obligation shall be the correction or replacement of the media or the software so that it will substantially conform to the then-current user documentation. Magellan Navigation does not warrant the software will meet purchaser's requirements or that its operation will be uninterrupted, error-free or virus-free. Purchaser assumes the entire risk of using the software.

2. PURCHASER'S REMEDY

PURCHASER'S EXCLUSIVE REMEDY UNDER THIS WRITTEN WARRANTY OR ANY IMPLIED WARRANTY SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT, AT MAGELLAN NAVIGATION'S OPTION, OF ANY DEFECTIVE PART OF THE RECEIVER OR ACCESSORIES WHICH ARE COVERED BY THIS WARRANTY. REPAIRS UNDER THIS WARRANTY SHALL ONLY BE MADE AT AN AUTHORIZED MAGELLAN NAVIGATION SERVICE CENTER. ANY REPAIRS BY A SERVICE CENTER NOT AUTHORIZED BY MAGELLAN NAVIGATION WILL VOID THIS WARRANTY.

3. PURCHASER'S DUTIES

To obtain service, contact and return the product with a copy of the original sales receipt to the dealer from whom you purchased the product.

Magellan Navigation reserves the right to refuse to provide service free-of-charge if the sales receipt is not provided or if the information contained in it is incomplete or illegible or if the serial number is altered or removed. Magellan Navigation will not be responsible for any losses or damage to the product incurred while the product is in transit or is being shipped for repair. Insurance is recommended. Magellan Navigation suggests using a trackable shipping method such as UPS or FedEx when returning a product for service.

4. LIMITATION OF IMPLIED WARRANTIES

EXCEPT AS SET FORTH IN ITEM 1 ABOVE, ALL OTHER EXPRESSED OR IMPLIED WARRANTIES, INCLUDING THOSE OF FITNESS FOR ANY PARTICULAR PURPOSE OR MERCHANTABILITY, ARE HEREBY DISCLAIMED AND IF APPLICABLE, IMPLIED WARRANTIES UNDER ARTICLE 35 OF THE UNITED NATIONS CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS.

Some national, state, or local laws do not allow limitations on implied warranty or how long an implied warranty lasts, so the above limitation may not apply to you.

5. EXCLUSIONS

The following are excluded from the warranty coverage:

(1) periodic maintenance and repair or replacement of parts due to normal wear and tear;

(2) batteries;

(3) finishes;

(4) installations or defects resulting from installation;

(5) any damage caused by (i) shipping, misuse, abuse, negligence, tampering, or improper use; (ii) disasters such as fire, flood, wind, and lightning; (iii) unauthorized attachments or modification;

(6) service performed or attempted by anyone other than an authorized Magellan Navigations Service Center;

(7) any product, components or parts not manufactured by Magellan Navigation,

(8) that the receiver will be free from any claim for infringement of any patent, trademark, copyright or other proprietary right, including trade secrets

(9) any damage due to accident, resulting from inaccurate satellite transmissions. Inaccurate transmissions can occur due to changes in the position, health or geometry of a satellite or modifications to the receiver that may be required due to any change in the GPS. (Note: Magellan Navigation GPS receivers use GPS or GPS+GLONASS to obtain position, velocity and time information. GPS is operated by the U.S. Government and GLONASS is the Global Navigation Satellite System of the Russian Federation, which are solely responsible for the accuracy

Table of Contents

1. Introduction

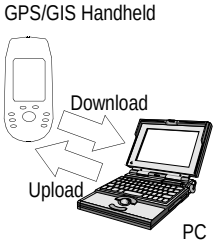
MobileMapper Office is an office software suite that interfaces Magellan GPS/GIS handheld receivers with your GIS system. MobileMapper Office allows you to prepare GIS jobs, feature libraries and waypoint files, build background maps from GIS data files and manage the information logged in the field (upload/download functions).

The MobileMapper Office software and its main functions are fully described in this manual, including all functions relative to data exchange between these receivers and MobileMapper Office.

MobileMapper Office's main functions are listed below:

- **Creating new job files by importing data from your GIS**. The imported GIS data can be in SHP, MIF or DXF format.
- **Uploading job files to the receiver** so field operators can revisit previously completed jobs. When you do that, not only do you upload GPS positions and descriptions of the previously visited features but also the complete feature library associated with this job, and any waypoint/route file currently open in MobileMapper Office.
- **Downloading completed job files from the receiver**. Again, when you do that, the complete feature library associated with this job is downloaded in addition to the GPS positions and descriptions of the visited features.

Conventions used for directions of data transfer



- **Exporting jobs in GIS format** (SHP, MIF, DXF or CSV).
- **Creating standalone feature libraries** using the Feature Library Editor. GIS layers can be imported from your GIS system when you create a feature library.
- **Creating lists of waypoints and routes** using the Waypoint/ Route Editor.
- **Creating background maps** using the Background Map and Map Editor utilities. You create a background map by importing data from SHP, DXF or MIF files (vector map) or from TIF, GTIF, BMP, JPG, JPEG, PNG or GIF files (raster map). Remember however that background maps are for viewing only.

  You cannot edit them or access information on the features shown on a background map. Background maps provide a backdrop, which gives visual orientation for your data and waypoint files. If you want to edit the positions or descriptions of a SHP, MIF or DXF file, you should import them into an MMJ job file.
- **Uploading standalone feature libraries and background maps to the receiver**. The relevant files can only be uploaded one by one.
- **Downloading standalone feature libraries and waypoints/ routes from the receiver**. The relevant files can only be downloaded one by one.
- **Handling a coordinate system database** from which you can specify the coordinate system MobileMapper Office should use to calculate the features and waypoints coordinates. ❒

2. Installing MobileMapper Office

If this is the first time you are installing MobileMapper Office, follow these steps:

- Close all applications running in Windows
- Insert the installation disk in the PC's CD-ROM drive
- Find and double-click the "Setup" file. After you specify where to install the MobileMapper Office programs, and you agree to the terms of the software license, your computer will complete the installation process.

If you are updating a previously installed version of MobileMapper Office, you should uninstall the older version before updating to the new version. To uninstall MobileMapper Office, follow these steps:

- On the Windows task bar, click on Start>Settings>Control Panel
- Double-click on Add/Remove Programs
- Highlight MobileMapper Office and click on the Remove button
- Now follow the instructions in the previous section to install the new version of MobileMapper Office. ❒

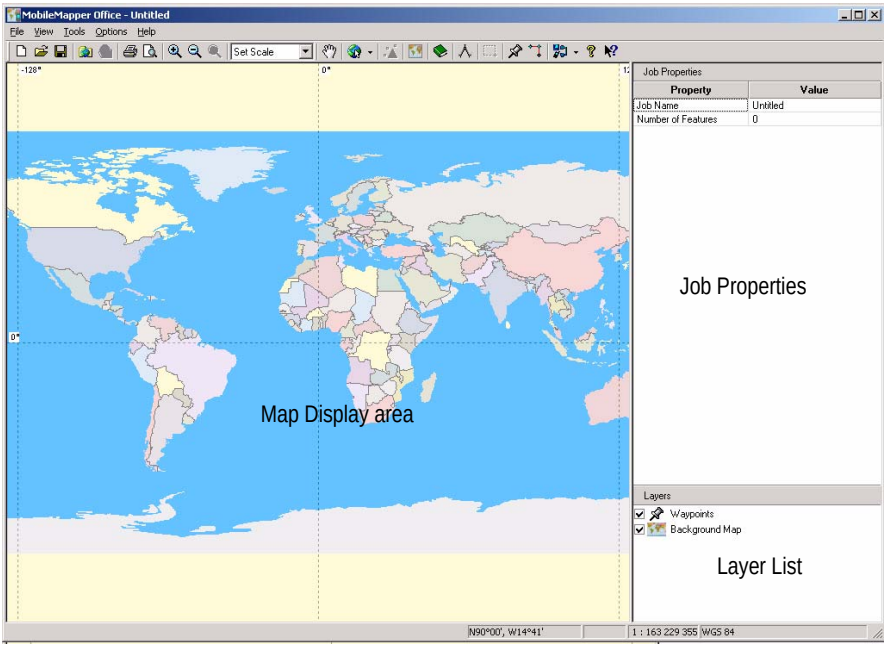
3. Launching MobileMapper Office

On the Window task bar, select successively Start, Programs and MobileMapper Office. This starts the program causing the main window to open on the PC screen, along with the Tip of the Day window. First read the content of this window if you are interested in learning a new tip, and then click the Close button to access MobileMapper Office's functions.

You may alternatively start just the Feature Library Editor, the MobileMapper Transfer utility, the Mission Planning program or this User Manual in order to open these modules on a standalone basis.

You may also launch MobileMapper Office from Windows Explorer or your desktop by double-clicking on any file with the .MMJ extension. ❒

4. MobileMapper Office Main Window



The main window of MobileMapper Office is organized as explained below (see also above figure):

- The Map Display area runs from the bottom of the Menu bar to the bottom border. It takes up about two-thirds of the screen, right to left.
- At the bottom of the window, in the status bar, a box is used for displaying the geographic location of the cursor in the selected coordinate system, the current scale value and the name of the currently used coordinate system.

- The right third of the window is used to display the Job Properties and Layer List windows. When opened, the window relevant to the Waypoints or Routes List is placed over the right pane. When you click on any feature on the map, the Feature Properties window replaces the Job Properties window.
- The Map Editor and the Feature Library Editor are each displayed in a secondary window that appears at the center of the screen. ❒

5. Map Display Area

Controlling the Content of the Map Display Area

The map display area shows data collected in the field, waypoints and GIS files imported into either job files or background maps.

MobileMapper Office also displays a very low-resolution map of the world showing coastlines, national boundaries and centroids of major cities. You use this coarse world map to help you select a spot on the globe and then zoom in to view data collected in that area and/or background maps created out of local files.

The data displayed in the Map Display area is controlled by the Layers List shown on the right-hand area, at the bottom of the main window.

When you want one of the listed layers displayed in the Map Display area, just fill in the check box located before this layer name. As a result, all the items pertaining to this layer will be shown in the Map Display area. Conversely, if you clear the check box, none of these items will be visible. If you double-click on a checked layer name, you will optimize the Map Display area settings (pan and scale) in order to obtain the best possible view of all the items pertaining to this layer.

By default, the following two layers are always displayed:

- Waypoints
- Background map

If a job is open, each feature type from the feature library used in the job also appears as a layer which can be displayed/ hidden on the Map Display area.

If you import a MIF or SHP file from your GIS system, then new layers will also be added to the Layer list.

In addition, you can change the look of these layers on the Map Display area by double-clicking on their names in the Job Properties window. Different icons are available for point features and different colors and styles are available for line, area and grid features.

The grid lines and labels will reflect the choice of the coordinate system used. However, all features will be PLACED on the map only based on their WGS 84 coordinates.

Changing the appearance of feature types will change their appearance in the receiver as well.

A number of viewing options are also available from the bottom of the Options menu to let you customize the Map Display area. You can for example show/hide the grid values, the scale interval, the feature and waypoint labels, etc.

Below is the list of icons from the Map toolbar that you can use to work on the content the Map Display area:

 : Allow you to respectively zoom in, zoom out and fit the scale to the map content (zoom to full extent). If your mouse includes a wheel button, you can also zoom in by rolling the wheel toward you or zoom out by rolling the wheel away from you.

: Allows you to adjust the scale to preset values (i.e. Previous Scale, Country, State, Region, City or Street) or zoom to a user-defined scale factor

 : Allows you to drag the map in any direction.

 : Allows you to select the map of a continent for display in the Map Display area as a backdrop to the job data (and also to the background map itself, if displayed).

 : Displays/hides the differential correction pane. It is made available only if the open job was recorded using the post-processing mode.

 : Gives access to the Background Maps dialog from which you can attach/detach a background map for the currently open job

 : (Gives access to the Feature Library Editor window; not a map-related button)

 : Allows you to measure distances on the map. See next chapter.

 : Allows you to define a region within a job file or background map

 : Switches the Waypoint window on and allows you to place new waypoints on the Map Display area

 : Allows you to draw routes connecting waypoints shown on the map

 : Allows you to upload jobs and background maps to the receiver and download jobs, waypoints and routes from the receiver.

Making Measurements on the Map Display Area

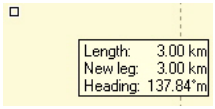
Step-by-Step Procedure

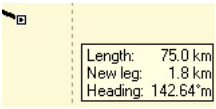
You can measure the distance and heading between any points displayed in the Map Display area:

- On the toolbar, click  , then click on the point on the map from which to start the measurement. The start point is then marked with a small square symbol.

  The distance is zero and the units are whatever you have selected.The default is meters. Until you start moving the cursor, the Heading value is the magnetic declination of the selected location.
- Then, as you move the mouse cursor away from the start point, MobileMapper Office will calculate the length and heading from the current location of the cursor to this point. The heading is displayed in reference to magnetic North, as signified by the letter “m.” The precision levels (one-tenth of a small unit and one hundredth of a large unit) are not editable.
- If you click on a second point, a straight line will appear on the map between the start point and the second point. Note that MobileMapper Office will snap to the closest feature position if you clicked close enough to this feature.

  MobileMapper Office will also start calculating the distance and heading from the current location of the cursor to the second point, plus the total length from the measurement’s start point.





When you click on the second point, the heading displayed is the magnetic declination of the second point location.

- If you move the cursor after clicking on the second point, the Measure Distance tool will add a new leg to the total distance being calculated. If you want to delete the first leg(s) and begin measuring a new point-to-point distance, right-click once.
- To stop measuring distances and headings on the map, press the Esc key or slowly press the right-click button twice or, in the toolbar, release the Measure Distance button.

Units Used by the Measurement Tool

The unit used in distance measurements can be user-set: From the **Options** menu, select **Units** and choose the desired units. Note that when checked, the **Large Units** option, located at the bottom of this menu, lets MobileMapper Office choose a more appropriate distance unit when you are measuring long distances. For example, when you measure distances beyond 1000 meters the units automatically switch to kilometers. If you switch to feet and mile using the above command, the units automatically switch to miles when the distance exceeds 1 mile.

What the Tool Actually Measures

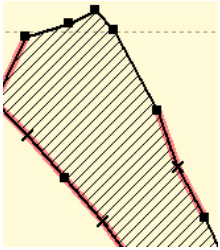
The Measure Distance Tool estimates the distance between points on a sphere of average Earth radius. The elevations of the points are not factored into the equation. Thus the receiver calculates the spherical distance rather than the horizontal or slope distance between the two positions.

GPS Position Display Filter

The GPS Position Display Filter is another function available on the Options menu that helps you control the content of the Map Display area. It allows you to highlight point features - and point locations making up line and area features - that do NOT meet a set of requirements that you choose on a pop-up window. The GPS Position Display Filter highlights those points that you might wish to filter out, i.e. delete, from your job.

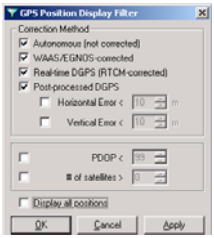
The features that will meet ALL your requirements will be represented as follows (see opposite):

- Points: will depend on chosen symbol
- GPS positions making up lines and areas: filled squares
- Lines and areas: lines joining up GPS positions.



The features that will not meet these requirements will be represented as follows (see opposite):

- Points: Chosen symbols are highlighted
- Positions making up line and area features: “x” symbols replacing squares
- Lines and areas: Red-highlighted lines connecting those individual point locations that exceed the filter criteria.



Note: The Correction Method, Horizontal/Vertical Errors, PDOP and # of satellites filters are greyed out when the Display all positions option is checked.

Below is the list of requirements that you can freely choose after selecting the **Options>GPS Position Display Filter** function:

- **Correction Method:** Choose the type of position solutions you would like to emphasize in the Map Display area. There are 4 possible options: Autonomous, WAAS/EGNOS corrected, real-time DGPS or post-processed DGPS. You may select more than one option. For more information about the post-processed DGPS feature, please see *Basics of Post-Processed Differential Correction on page 103*.
- **Horizontal/Vertical Errors:** If these buttons are both checked, all post-processed point features positions whose estimated accuracy exceeds the chosen values will be highlighted.
- **PDOP <:** All GPS positions calculated with a PDOP equal to or less than the specified one will meet this requirement.
- **# of satellites:** All GPS positions calculated from a number of satellites equal to or greater than the specified one will meet this requirement.

If you wish to remove the currently set filter, just check the **Show all positions** button and click **OK**.

Note that if you check this button, the dialog box will keep all your previous filter settings. This is to allow you to easily re-apply the same filter if you wish. You will do that by simply clearing the **Show all positions** button and clicking **OK**.

Also, note that the filter is disabled whenever you open another job or create a new one (the **Show all positions** button is checked). ❒

6. Working on Job Files

Creating a New Job

Before you ask field operators to create a new job with their receivers, you just need to create the appropriate feature library and upload it to their handhelds. Field operators will then just have to create a new job based on this feature library.

You can also prepare an "empty" job using the procedure below and later ask field operators to work from that job. By "empty job" we mean "with no features logged yet in the job" but remember waypoints and routes (i.e. a *.mmw file) can possibly be associated with an empty job if the mmw file is open in MobileMapper Office when you upload the job to the receiver.

You create job files using the New command from the File menu. Select Save from the File menu, type in a name for the job and click the Save button to create a new *.mmj file in the Docs folder (default folder).

To create a feature library, see explanations from page 76.

A job file cannot do without a feature library as field operators do need a feature library to complete their jobs. That is why you have to import a feature library –created earlier– into the job before uploading the job to the handheld. You can do that using the Import command from the File menu, specifying the Feature Library Files option in the Files of Type field, selecting the feature library to associate with the job and then clicking Open. As a result, all the feature types read from this library will appear as layers in the job.

To create waypoints and routes, see explanations from page 65.

You can also add waypoints and routes to be associated with the job. This is simply done by saving the job when waypoints/routes are shown in the Map Display area.

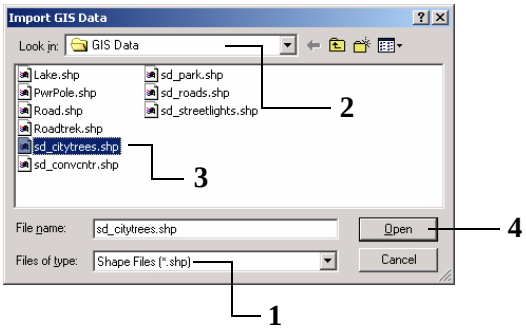
To choose a coordinate system, and for more information on coordinate systems, see explanations from page 93.

The coordinate system used to display the job in MobileMapper Office will be the one currently selected. All jobs subsequently opened will be displayed in this same coordinate system until you select a different one.

Importing GIS Data Into a Job File

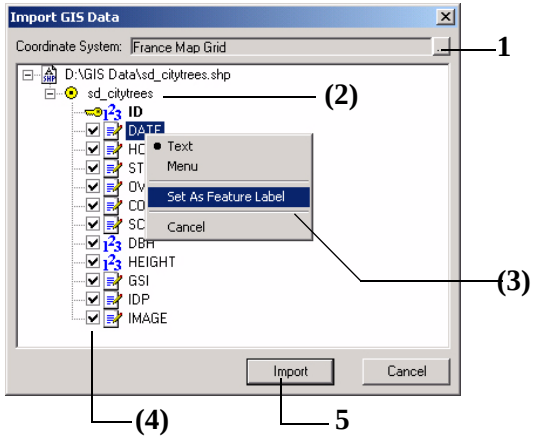
Step-by-Step Procedure

- Open a job in MobileMapper Office.
  Launching MobileMapper Office automatically opens an empty, "untitled" job. As with Microsoft Office applications, you may name this job using the **File>Save As** function or you may open an existing job using the **File>Open** function. You may also open a job clicking on **File** and selecting one of the jobs listed at the bottom on the window that you have recently opened.
- Select **File>Import**.
  This brings up a new window that allows you to select the file you want to import (see window example below):



1. Select the extension of the files you want to import: MMJ, MMF, waypoints/routes (MMW, XLS, TXT), SHP, MIF or DXF (**Files of type** field)

2. Select the directory in which to search for files to import
3. Select the files you want to import
4. Click on the Open button. This action brings up a new window (see window example below) displaying some information on the selected file and requiring some actions on your part.



1. First, there is a box at the top of the window in which MobileMapper Office tells you which coordinate system is used in the selected SHP file to describe the features it contains. This information is read from the PRJ file associated with the SHP file (i.e. the PRJ file having the same name.) MobileMapper Office suggests that you use this system.

MobileMapper Office DOES NOT search for a coordinate system in its database that would have exactly the same definition - with same or different name- as the the coordinate system prompted in the Import GIS Data window.

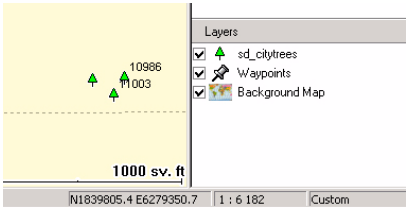
- If you do not have any particular idea on which coordinate system should be used, we recommend you to keep the one prompted by MobileMapper Office. When you import the file, this system will be added to MobileMapper Office's database and will also become the currently active coordinate system in MobileMapper Office.
- In contrast, if you know that this coordinate system already exists in MobileMapper Office's database, but under a different name, you may not wish to add the prompted system to the database (because you know it would be a duplicate of an already existing one). In that case, you should select the "equivalent" coordinate system from the database and so reject the prompted one.

The path to the SHP file is shown just underneath, including the file name. To the left of the layer name is the symbol that will be used to display the layer in MobileMapper Office. All the attributes contained in the file are then listed.

2. (Optional) Double-click on the layer name to change the symbol that will be used to display the layer on the Map Display area. You will be able to change it later on from the Job Properties window.
3. (Optional) Right-click on one of the attributes and click on Set as Feature Label if you want to select this particular attribute to display as a label on MobileMapper Office's Map Display area.

The attribute name will be displayed in bold face and there will be a key icon next to it.

4. (Optional) Clear the check boxes for all these attributes you do not want to import into the job.
5. Click on the **Import** button to allow MobileMapper Office to import the GIS data into the job. When import is complete, MobileMapper Office displays the imported layer on the Map Display area and the name of this new layer appears on the right, in the Layer list. See screen example below:



About Imported Formats

- When you select the SHP option, MobileMapper Office imports the information included in all the following files that comprise a shapefile: SHP, SHX, DBF (and PRJ files for the coordinate system if you accept it -see *Step-by-Step Procedure on page 15*).
- When you select the DXF import option, the program just imports the selected DXF file.
- When you select the MIF import option, both MIF and MID files for the specified GIS file are imported.

What if GIS Data Import Fails

About Coordinate Transformation

Incidentally, you can use MobileMapper Office to transform coordinates. First you import your GIS data files taking care to comply with their coordinate system requirement. Secondly, in MobileMapper Office, you select the coordinate system in which you would like your coordinates to be expressed. Then you just have to export back the GIS data, which this time will be expressed in this coordinate system once exported.

- If you click on the **Import** button and the selected file does not load into the open job file, the most likely problem is that *the coordinate system that you selected for the imported GIS file is incorrect*. You will see an error message telling you that the coordinate system you selected is incorrect. To fix this, select **File>Import**, select the file for import and select another coordinate system that your organization commonly uses.
- If you wish to import several files at a time, all must be in the same coordinate system.
- Conversely, you CAN import files in different coordinate systems provided you import them one after the other. The important thing in this case is that, for each imported file, the right coordinate system be selected in the GIS Data Import window (see point 1. above).
- If you are unsure of what coordinate system is being used to display the files that are already in the job, read its name in the status bar (bottom right). You can also select **Options>Select Coordinate System** on the MobileMapper Office tool bar to read this name.

Importing Files with Compatible Feature Libraries

When importing a job file into another, the two feature libraries must be compatible.

If the open job has a feature library with trees and rivers in it, you can import any file that has other feature types in it - such as roads.

But if the “trees” feature type in the open job has the attributes “height” and “species,” the attributes of the tree features in the imported file cannot have different attributes, such as “Type” or “Diameter.” This would create a feature library that would allow a field worker to describe trees in two different ways.

The idea of a feature library is to guide field workers to describe features in the same ways so all the feature descriptions are consistent and therefore analyzable in the GIS.

Connecting the Handheld to the PC

Using the USB Port (ProMark3 Only)

- Connect your receiver to one of the USB ports on your office PC using the USB cable provided with the receiver.
- Turn on the handheld by pressing the power (red) button.
- Once the ProMark3 workspace is displayed, double-tap the Mobile Mapping icon.
- If it is the first time you are connecting the handheld to the PC via USB, a PC message appears informing you that a new USB device has been detected and you have to install a new USB driver.
- Follow the instructions on the PC screen. When prompted to do so, browse the ProMark3 CD to select the “AT91_USBSer.inf” file. Then let the PC complete the installation of the USB driver. Once installed, USB appears as a new, virtual COM port. For example, if there are two COM ports on the PC (named COM1 and COM2), the USB port is likely to be named “COM3”

- Do the following on the PC:
  - On the menu bar, select Options and then GPS Settings...
  - In the dialog box that opens, click Autodetect. MobileMapper Office then starts a sequence to determine the port that the receiver is connected to, as well as the baud rate used on the receiver side. At the end of this sequence, the message “Found ProMark3” should appear as the status of one of the ports
  - Click OK to close the dialog box.

- If communication has already been established with the receiver during this working session and you want to make sure MobileMapper Office is still communicating with the handheld, do the following:
  - On the menu bar, select Options and then GPS Settings...
  - In the dialog box that opens, click Test. The receiver then tests the data link to the receiver, indicating which baud rate is used during this test. The message “Found ProMark3” should appear as the status of the port connected to the handheld.
  - Click OK to close the dialog box.

Using the Serial Port

- Connect your receiver to one of the serial ports on your office PCusing a serial cable.
- Turn on the handheld. (With ProMark3, double-tap the Mobile Mapping icon once the workspace screen is displayed.)
- If you are connecting the handheld to the PC for the first time, do the following on the PC:
  - On the menu bar, select Options and then GPS Settings...
  - In the dialog box that opens, click Autodetect. MobileMapper Office then starts a sequence to determine the port that the receiver is connected to, as well as the baud rate used on the receiver side. At the end of this sequence, the message "Found <Receiver model>" should appear as the status of one of the ports
  - Click OK to close the dialog box.

- If communication has already been established with the receiver during this working session and you want to make sure MobileMapper Office is still communicating with the handheld, do the following:
  - On the menu bar, select Options and then GPS Settings...
  - In the dialog box that opens, click Test. The receiver then tests the data link to the receiver, indicating which baud rate is used during this test. The message "Found <Receiver model>" should appear as the status of the port connected to the handheld.
  - Click OK to close the dialog box.

Uploading a Job to the Handheld

Before transferring data from MobileMapper Office to the receiver, make sure the receiver currently uses the expected storage medium (i.e. its internal memory or the inserted SD card). Otherwise change the medium on the receiver using the MENU key.

You may upload an entire job to the handheld or upload only a geographical portion of this job.

Uploading part of a job may be useful if for example you want the field operator to focus on a particular region covered by the job, or if you need to limit the size of the uploaded data because the entire job is too big to hold in the handheld.

Another way of limiting the size of the uploaded data is to delete the layers you do not need in the field (see *Deleting Feature Types on page 39*).

You need to use the Create Region function to select a geographical portion of a job.

Uploading an Entire Job

- First of all, you have to connect the handheld to the PC running MobileMapper Office and test the connection. See *Connecting the Handheld to the PC on page 20*.
- Open the job file in MobileMapper Office using the File>Open command. Job filenames are in the form "*.mmj".
- On the menu bar of the MobileMapper Office main window, select File, Upload to GPS and Job.... MobileMapper Office then routinely searches for the right baud rate to communicate with the handheld.

  When communication is established with the handheld, a message is displayed allowing you to rename the job file if necessary. Then click OK. This automatically starts the upload sequence. A dialog box keeps you informed on the file being transferred. A message is also displayed on the handheld informing you that file transfer is in progress. These two indications disappear from the PC and handheld screens when data transfer is complete.

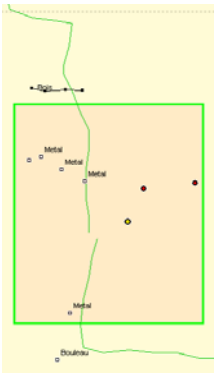
IMPORTANT!

1) When you upload a job file, not only do you upload all the logged features contained in this job, but also the feature library attached to the job. All MMJ job files include a feature library.

2) Job files are always in WGS 84/lat-lon, even if you select some other coordinate system/datum for displaying features, background maps and waypoints.

Uploading Part of a Job (Job Region)

You do exactly as if you were uploading the entire job (see *Uploading an Entire Job on page 23*, first two steps) except that you have to do the following before selecting the File>Upload to GPS>Job function:



Selecting part of a job by setting a region on the Map Display area

- Click  on the toolbar, drag a rectangle around the desired region in the Map Display area and release the mouse button. The limits of the region are then represented with a rectangle with hatching on the outside. You can still resize or reshape the rectangle by dragging its control points (corner and mid-side points). You can also move the whole rectangle by dragging the mouse cursor from inside the rectangle.
- When the definition of the region is okay, click outside of this region. The region definition is now complete and its limits are now represented with a thick green line. The selected region appears darker than the rest of the map.
- If necessary, click  again (this deletes the region you have just defined) to redraw the region entirely.
- Select File, Upload to GPS and Job and let MobileMapper Office complete the Upload phase.

NOTE 1: The Create Region function may also be used to define the limits of the background map you upload to the handheld. See *Setting a Map Region on page 88*.

NOTE 2: Some jobs require too much RAM space for the receiver to both display and edit - even if you could copy the unopened job file to the SD card. MobileMapper Office checks each job file you wish to copy to the receiver and returns a message “The size of current job is greater than available memory on your GPS unit!” when it determines that the job will require more RAM memory than is in the receiver.

The first thing you should consider if you see the above warning message is to upload a subset of the job - called a “job region” - into the receiver. You do this in MobileMapper Office by opening the job and clicking on Tools>Create Region. Then use your mouse to mark out a rectangle on the map display and highlight it by right clicking on the region. Then click on File>Upload to GPS and name the region.

With the job region highlighted, you can also click on File>Save Job Region to save the region as a new job file while leaving it as part of the original job file. You can alternatively click on File>Cut Job Region to cut the highlighted region out of the original job file and save it to a new job file. This allows you to cut a large job into several regions that individual field workers can update.

When they download their jobs at the end of the day, you can open the original job and import all the updated job regions. Because cutting a job region includes all the line and area features that are only partially located in the region and cuts them out of the original job, you do not have to worry about two regions containing portions of the same feature.

This makes it impossible for two workers to update the same line or area feature.

When importing GIS files into an MMJ job, it is best to take into the field the smallest amount of data that is required to get the job done. This can be achieved in the following ways:

- Remove any feature layers that you will not update in the field

  When you import any SHP or MIF file into an MMJ job, the feature and attribute schema is automatically converted into a feature library. But you still have the ability to control how much of the schema is converted by importing just those layers you need to update in the field.
- Remove any attributes you will not update for any included feature layer

  In the Import GIS Data dialog box, uncheck any feature attributes that you do not need to edit in the field.
- Put layers you will not edit into a background map

If you would like to use some feature layers in the field for navigation and orientation, but do not plan to update their attributes or locations, you can import them into a background map by clicking on **Tools > Background Maps**. MobileMapper Office's map screen will display the GIS layers you imported into the job superimposed over the layers you imported into the background map. Upload the job file (**File > Upload to GPS > Job**) and then the background map (**File > Upload to GPS > Background Map**).

Saving/Cutting a Job Region

You can save any job region as a new job using two commands on the **File** menu (see the previous section on how to create a job region):

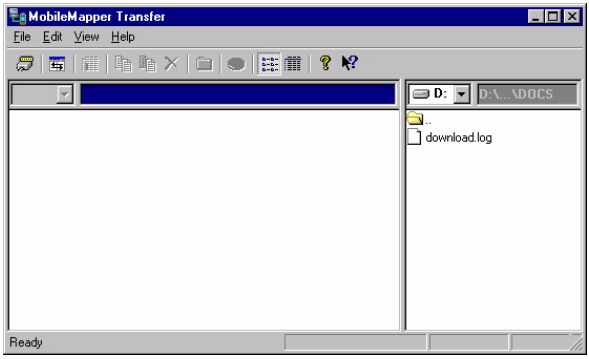
- **Save Job Region**: Allows you to save the job region as a new *.MMJ file without altering the contents of the original open job. Note that all the features inside the job region are copied from the original job to the new job. Also, all line and area features that intersect with the limits of the job region are copied in their entirety to the new job.
- **Cut Job Region**: Allows you to save the job region as a new *.MMJ file while cutting the contents from the original open job and pasting them to the new job. All line and area features that intersected the limits of the job region are moved in their entirety to the new job.

Downloading a Completed Job from the Handheld

MobileMapper Office uses the MobileMapper Transfer utility as an interface program to access the files stored on the GPS/GIS handheld.

First of all, you have to connect the handheld to the PC running MobileMapper Office and test the connection. See *Connecting the Handheld to the PC on page 20*.

- On the menu bar, select **File>Download from GPS**. This opens the MobileMapper Transfer window on your screen.

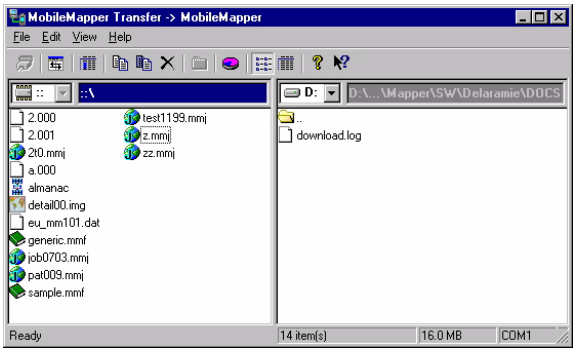


The right-hand pane lists all the files present in the default directory (...\Docs) on your PC (see example above). The left-hand pane will list the files stored on the handheld once the connection to this device is established.

- To connect to the handheld, on the menu bar at the top, select successively File>Connect>GPS Device via Cable. This will cause the transfer utility to routinely test which is the highest Baud rate supported by both the handheld and the PC. Once communication is established, the transfer utility starts reading the content of the handheld's memory.
- You may also transfer files from any computer drive and directory to another - as long as both are accessible by your PC - by selecting File>Connect>PC Drive. For example, if you insert your SD card into a card reader identified on your PC as the e: or f: drive, you can select this drive in MobileMapper Transfer and copy files from the SD card to another location on your PC or network.

  NOTE: MobileMapper Transfer processes some data files during download to your PC. Generic transfer utilities such as Windows Explorer or ActivSync cannot do this and so should not be used.

  After a few seconds, the window's left-hand pane should list the content of the handheld's memory.



Downloading a job file

Whenever you download a job from the receiver, MobileMapper Office will import it into any job already open in the Map Display area - unless the feature library of the downloaded job is incompatible from that of the open job (see page 19).

Because you typically want to re-import a job region that was previously excised from a larger job, it is a good idea to open the bigger job in MobileMapper Office prior to downloading the excised job region. This way you will automatically import the job region when it is downloaded and thus save time.

- Drag and drop this file from the left-hand pane to the right-hand pane (or select the file and press the F5 key, or use the Copy To command).
- Close the MobileMapper Transfer window. This will cause the downloaded job to be imported into the currently open job, provided both jobs use the same feature library. Otherwise a message will warn you that importing this job is impossible. If you use the CTRL-click feature to select two or more jobs, each with the same feature library, all of them will be displayed in the Map Display area after you exit the MobileMapper Transfer utility. You can then use the Save As function in MobileMapper Office to combine multiple files recorded in the file into a single job file on your PC.

  NOTE: If you experience any problems using MobileMapper Transfer to download data from the receiver, or from its SD card in a card reader, it sometimes helps to clear the receiver's internal memory and try the download again.

  You can clear memory by pressing the MENU button, selecting the Setup option and then the Clear Memory option. Highlight "All" and press enter. This does not delete any data from your SD card. However, you will have to re-initialize the unit before collecting more data.

The Import operation performed in the job downloading context is similar to using the **Import** command from the **File** menu. With this function, the downloaded data will automatically add up to the data of the currently open job. This means that you can merge multiple job files created for a single project before exporting the whole data to your GIS. In this particular case, it is indeed very likely that all these job files were created based on the same feature library.

When you import the excised portion of a job into the original file (by clicking on **File>Import**), all the excised features will be re-inserted - whether or not they have been updated. You can then export the original job with the updated region (or regions) back to your GIS.

Deleting a file from the handheld

- Select this file in the left-hand pane and press the Del key. MobileMapper Office then asks you to confirm that you want to delete the file. Click Yes if that is what you really want to do.

Viewing/Analyzing the Content of a Job

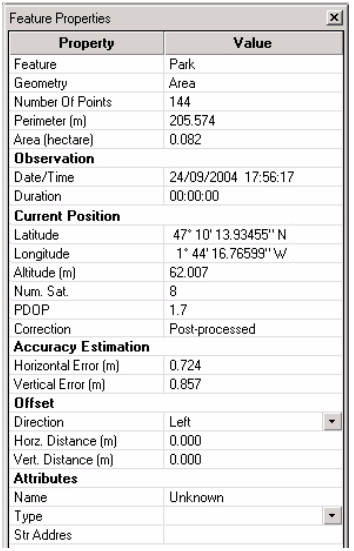
After downloading a completed job in MobileMapper Office as explained in the previous chapter, you can also open it in MobileMapper Office using the File>Open command. As a result, MobileMapper Office shows the content of this job in the main window.

First of all, you can see the list of layers present in this job in the right-hand part of the screen. Clear or check the buttons for the layers you want to see in the Map Display area. If enabled for display, the background maps shown are the one currently selected in the Background Map List (i.e. a vector and/or a raster map).

Now the main purpose of viewing a job in MobileMapper Office is to get a view of the features that were logged during field operations. If enabled for display, these features are represented on the Map Display area according to the viewing choices made for the corresponding layers. You can do more than just view these features. You can also view the conditions in which these features were logged. To do that, just click on these features, one after the other in the Map Display area. This opens a new window in which you can see the properties of these features.

If you access the Feature Library Editor after opening a downloaded job, this window will show the definition of the feature library that was used to create the job. Unlike a standalone feature library, you CANNOT edit a feature library attached to a job.

In the example below, MobileMapper Office shows the properties of the selected point being part of an area feature:



The Feature Properties window provides the following information:

- Feature name and geometry, number of points for lines and areas only, measurement(s), user-settable Updated field (see *Using the Point Feature's "Updated" Field on page 36*). Apart from the Updated field, these are non-editable properties.

MobileMapper Office performs all these measurements using three-dimensional, WGS-84 latitude/longitude coordinates of the features. The default units are meters and hectares, but other units can be selected. You can also display the positions of the features using other coordinate systems in MobileMapper Office. However, this will not change the length, perimeter and area values displayed in the Feature Properties window.

The length, perimeter and area measurements performed by the field receiver are based on the same algorithms as those used in MobileMapper Office.

The nature of the measurements performed is presented below:

Length: MobileMapper Office determines the length of a line feature in the same way used by the receiver: by estimating the distance between successive points on the line feature with the assumption that each point is on a sphere of average Earth radius. The elevations of the points are not factored into the equation. Thus the software calculates the spherical distance rather than the horizontal or slope distance between the successive positions. The length of the line feature is the sum of all these distances..

Perimeter: MobileMapper Office estimates the perimeter of an area feature in the same way it estimates the length of line features.

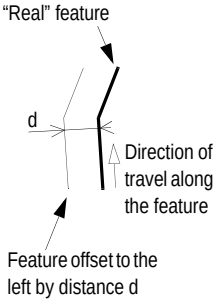
Area of area features: MobileMapper Office determines areas by estimating the area enclosed within point locations recorded in the field with the assumption that each point making up the feature is on a sphere of average Earth radius. Thus the area is that of a curved, not flat, feature.

- **Observation** data (non-editable): date/time, duration of point logging.
- **Current Position** for the selected point (non-editable): latitude, longitude, altitude, number of satellites used, PDOP and correction type.

  The correction type may be one of the following:
  - "WAAS"
  - "RTCM"

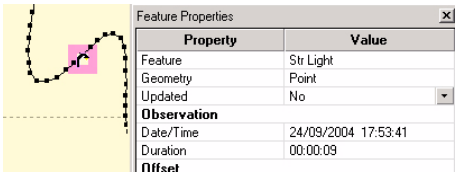
- "Post-processed"
- "Uncorrected" (for autonomous positions)

- **Accuracy Estimation** for the selected point: horizontal error, vertical error (non-editable).
- **Offset** data (editable): direction (for line or area) or bearing (for point), horizontal distance, vertical distance.
  This set of properties can be used to artificially move the receiver's GPS antenna by a certain distance from the real position it occupied in the field.
  For example, if the receiver was held at 5 feet (1.52 m) from the ground, you can enter "-1.52" m in the vertical distance cell to artificially bring the GPS antenna position down to ground level.
  Likewise, you can offset a line or area feature to the right or left by a certain distance that you enter in the horizontal distance cell. The Left and Right directions for the offset are defined with respect to the direction followed by the field operator along the feature while logging this feature (see example opposite).
- **Attributes** (editable): list of attributes and values currently assigned to these attributes. You can freely change these values or enter new ones if blank.



Using the Point Feature's "Updated" Field

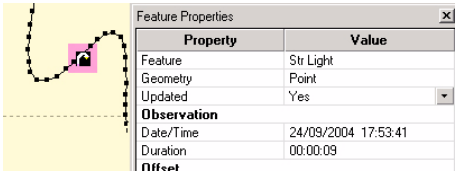
When you click on any point feature in the Map Display area, you will see that its Feature Properties window includes a row containing a field named "Updated". The content of this field can be user-set to "Yes" or "No".



You can freely use this field to qualify the feature points present in your job. For example after revisiting a point feature and downloading it back to the job file in MobileMapper Office, you may want to tag this feature point as a revisited one, i.e. an updated one. To do this:

- Select the point in the Map Display area
- In the Feature Properties window, click on the down arrow located on the right of this field and then select "Yes."

To make it easier for you to see at a glance which feature points you have previously set as "updated", MobileMapper Office shows these points in inverse video on the map:

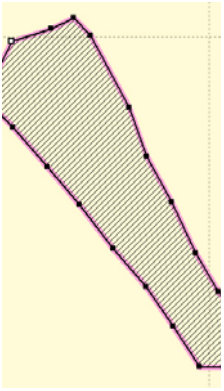


If you want to get rid of the “updated” information through a single operation, you just need to select Tools>Mark All Features as Not Updated and then click Yes to confirm this action. As a result all feature points in the job will be tagged as not updated (Updated=No).

Opening Several Jobs at a Time

You can open several jobs at a time on your computer. When you do that, you open as many instances of MobileMapper Office as the number of open jobs. Opening a job can simply be made by double-clicking on the corresponding MMJ file from Windows Explorer.

Individual Points in Line or Area Features



Line feature with all individual points shown - one of which is selected (hollow square in the upper left)

MobileMapper Office displays each of the individual points making up line and area features. These individual points are in fact the positions that were logged by the handheld receiver when line and area features were visited in the field.

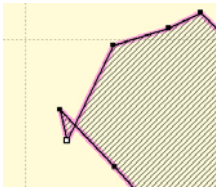
When the Map Display area shows line and area features, you can do the following:

- *Show/Hide their individual points*: Select Options from the menu bar and then check or clear the Show Feature Points option to respectively show or hide these points. When shown, these points appear as small black dots along the line and area features.
- *Select and view the properties of any of these individual points*: First have all individual points displayed by selecting Options and checking the Show Feature Points option, then make sure none of the buttons on the toolbar are active.

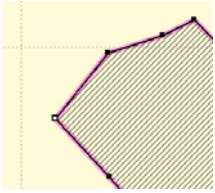
Then simply click on the desired individual point to select it. (The selected point appears as a hollow square.) All the properties of this point are now displayed in the Feature Properties window that opens on the right so you can read them. These properties are very similar to the ones you would read for a point feature.

To quickly display the properties of the next/previous individual point in the selected line or area feature, respectively press Shift+Right Arrow key or Shift+ Left Arrow key, or select View>Select Next or View>Select Previous. The Feature Properties window will be automatically refreshed to show the properties of the new point.

Before deleting a point:



After deleting the point:



- *Delete any of these individual points*: After selecting the desired point, select Tools>Delete Feature Point, or use the **Shift + Del** key combination from the keyboard. A message asks you to confirm the Delete request. After clicking on Yes, the line or area feature is updated to reflect the change made. Note that the feature keeps being selected and it is now the next feature point -in relation to the deleted feature point- that is now selected.

Deleting Features

You can delete features from the Map Display area, and so from the open job, using the following procedure:

- Make sure none of the buttons on the toolbar are active
- Click on the feature you want to delete. The feature then appears surrounded by a thick pink frame
- On the menu bar, select Tools>Delete Feature, or on the keyboard, press the Del key. A warning message asks you to confirm the delete operation
- Click the Yes button to let MobileMapper Office delete the feature, or the No button to cancel this operation.

Deleting Feature Types

Deleting feature types or layers amounts to changing the job's feature library

You can delete feature types from the open job using the following procedure:

- In the Job Properties pane, right click on the name of the feature type you want to delete and select **Delete Feature Type** from the pop-up menu

  Or
- Select the Feature Type layer in the Layers pane (bottom right) and then, from the menu bar, select **Tools>Delete Layer**. A warning message asks you to confirm the delete operation
- Click the **Yes** button to let MobileMapper Office delete the layer, or the **No** button to cancel this operation.

  If you click **Yes**, the layer disappears from the feature types and layers lists and all the features belonging to this layer disappear from the Map Display area.

Deleting some layers from a job may be useful when you want the field operator to focus on some features in this job, and so ignore all others, or if the handheld's memory space is too low to let MobileMapper Office upload the entire job.

Before deleting any layer from a job, remember it may be a good idea to save the job as a new file in order to keep the original job file unchanged, i.e with ALL its layers.

Exporting Jobs in GIS Formats

The most important processing of your field data is its export to a GIS. Exporting field data has two processes: conversion of the data files to a standard format a GIS can read and then the actual transfer of the file.

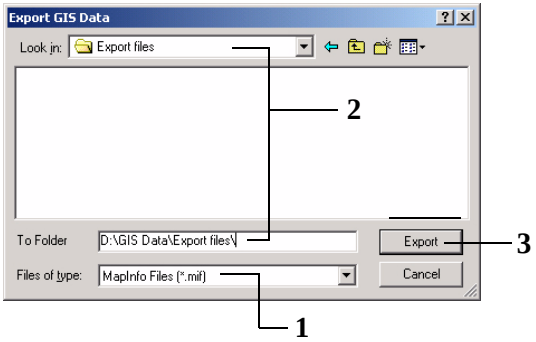
To convert your data into SHP, MIF, CSV or DXF, do the following:

- On the menu bar, select File>Open to list the job files in MobileMapper Office
- Select the job you want to export and click Open. The content of this job is now displayed on the screen.
- In the status bar, read the name of the currently used coordinate system (bottom right) and check that this system is the one used by your GIS. If that is not the case, select the right one using the Options>Coordinate System.... command. For more information on how to select a coordinate system, see *Selecting a Coordinate System for the Open Job on page 93*.

  If you imported a GIS file to MobileMapper Office, updated it in the field and exported it back to your GIS, you do not have to reset the coordinate system.

  Remember MobileMapper Office ALWAYS exports feature positions in the coordinate system currently selected for the job.
- On the menu bar, select File>Export.

  This brings up a new window that allows you to set the export function (see example below).



Note that you can also export just the job's feature library by selecting MMF as the "File of type."

1. Choose the export format (SHP, MIF, DXF, CSV - or MMF, see opposite) from the **Files of type** field.
2. Select the folder where to transfer the reformatted data files. You can select any folder that is accessible by your PC - including any GIS folders that may be on your network.

   Note that the exported files will be named automatically by MobileMapper Office. The reason is that the files must be named to reflect the names of the layers present in the job.
3. Click on the **Export** button. Your job will be automatically converted (re-formatted) and transferred to the selected folder.

   If a file already exists in the selected folder with the same name and same GIS format extension, then MobileMapper Office will ask you if you want to overwrite this file.

   The presence of such a file means that you have previously exported a job containing a layer with the same name. It is therefore your responsibility to decide whether the already existing file should be overwritten or not.

- When you select the SHP option, MobileMapper Office converts the information recorded in a job file (MMJ) into the following files that comprise a Shapefile: SHP, SHX and DBF files. MobileMapper Office exports each feature type to a separate shape file whose name reflects the feature type name.
- When you select the DXF export option, the program creates a single DXF file. Each feature type is exported to a separate DXF layer whose name reflects the feature type name. Each attribute is exported into a block reference along with the feature. Thus attributes can be seen in ACAD and imported into GIS software.
- When you select the MIF export option, both MIF and MID files are created for each feature type. Their names reflect those of the exported feature types.

GPS Metadata includes such parameters as Num. Sat., PDOP, Date/Time, Duration, Correction, Horizontal Error, Vertical Error (the last two are available only for those job files that were recorded in post-processing mode and then post-processed).

- If you want the GPS metadata to be exported as well, you should select the CSV export option. A comma-delimited ASCII file is then generated. You can read these CSV files with a large number of spreadsheet or database applications. Information on each position that is averaged into a point feature or connected into a line or area feature is displayed in rows. You can also parse them in any way you wish. The following files are created when using the CSV export option:
  - For each point feature type, MobileMapper Office creates a separate CSV file containing GPS metadata and feature attributes. The following metadata information, in addition to any attributes, is exported for point features:

Feature	Latitude	Longitude	Altitude	Num. Sat	PDOP	Date/Time	Duration	Correction

- For each line or area feature type, MobileMapper Office creates a set of files whose names are in the form <feature type name>.csv. These files include feature index and feature attributes fields. Then for each feature, MobileMapper Office creates a CSV file containing coordinates and GPS metadata for each individual point making up a line or area feature. These files are named as follows:

  <Feature type name>1.csv

  <Feature type name>2.csv

  Where 1, 2, etc. are the feature indices found in the file <feature type name>.csv. You can therefore access the GPS metadata for each individual point making up a line or area feature.

  The following information is exported for line features:

Feature	Length	Attribute #1	Attribute #2, etc.

  And for each point making up the line:

Point	Latitude	Longitude	Altitude	Num. Sat	PDOP	Date/Time	Duration	Horz error	Vert error

  The following information is exported for area features:

Feature	Perimeter	Area	Attribute #1	Attribute #2, etc.

  And for each point making up the area: ❒

Point	Latitude	Longitude	Altitude	Num. Sat	PDOP	Date/Time	Duration	Horz error	Vert error

7. Using the Feature Library Editor

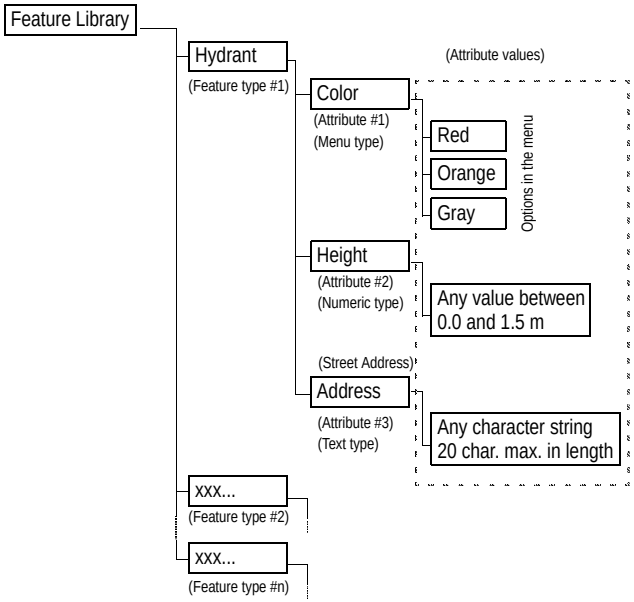
Introduction

There are no limits to the number of feature types or feature attributes in a feature library. However, there cannot be more than 20 characters in a feature type name, such as "road" or "tree." There cannot be more than 10 characters in any attribute name, such as "width" or "height." There cannot be more than 30 characters in any menu-style attribute value, such as "Needs immediate repair," and there cannot be more than 20 characters in any text-style attribute value, such as "near 123 Main St."

MobileMapper Office allows you to create new feature type libraries using the Feature Library Editor.

Feature libraries are standardized description templates that guide field operators when describing the features they are mapping or inspecting.

A feature library includes a number of feature types that either will be mapped or inspected. Each feature type is described according to a set of attributes. In fact, it will be the task of field operators to provide an attribute value for each attribute of a feature, depending on what they see or measure when they visit this feature. The diagram below shows the general architecture of a feature library through a simple example.

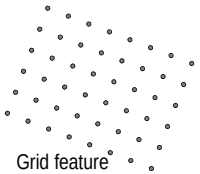


There are four different geometries for feature types:

- **Point**: Feature types such as trees or pipeline valves. Field operators should log point features in static mode, i.e. they should stay stationary at these points for at least one second.

- **Line**: Feature types such as roads or pipelines. Field operators should log line features in kinematic mode, i.e. they should start logging this type of feature at the beginning of the line, and then move along this line until the end where they should stop logging data.

- **Area**: Feature types like crop fields or lease boundaries.



- **Grid**: This feature type defines an array of evenly distributed waypoints where field operators record observations or make measurements using some instrument. In-depth information on grid features is given elsewhere (see *Grid Mapping Utility on page 59*).

There are three different types of attributes:

- **Menu** style: the attribute value is selected from a user-defined menu of preset values or phrases
- **Numeric** style: the attribute value can only be within a pre-defined range of numeric values
- **Text** style: the attribute value is in text form and should not exceed the permitted length (20 characters).

NOTE: Although the Feature Library does not support waypoints, you can create a "Waypoint" feature type. This allows you to record waypoints in the field and export them to GIS formats. Waypoints recorded using the receiver's Mark feature are not exportable by MobileMapper Office.

Creating a New, Standalone Feature Library File

There are two types of feature libraries:

- Standalone libraries that are editable and available for import into any job
- Libraries associated with a specific MMJ job file - in the same manner that an ESRI DBF file is associated with a particular Shapefile.

When you use the Feature Library Editor to create a new library, it is a standalone library that can be edited at any time and imported into any number of job files. But once you import this library into a job, the name of the library is changed to that of the job. Under this new name, it cannot be edited except for selecting new display symbology. This is done to ensure that the job can always be edited in the field and uploaded back into the GIS with the same feature library. This also allows two or more jobs with the same feature library to be merged.

- On the menu bar, select Tools, then Feature Library Editor. This opens the Feature Library Editor window at the center of the screen.

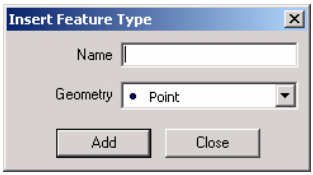
  Warning! If a job is open in MobileMapper Office's main window, the Feature Library Editor window defaults to the feature library used in the open job. This library CANNOT be changed except to select different map symbols and drawing styles.

If you want to create a new standalone feature library based on the open one, you have to do the following:

- On the menu bar, select **File**, then **Save As...** A new dialog box opens in which you can name and choose the folder where to store the new feature library. The default folder is .../DOCS. It is a good idea to group all feature library files in the "DOCS" default folder. These files can only be saved as "mmf" files as mentioned in the **Save as type**: field.
- Enter a name for the library in the **File name**: field. For example, type in "Libr-1" and click **Save**. The new name of the feature library now appears on the left-hand part of the Feature Library Editor window.

Inserting New Feature Types to the Feature Library

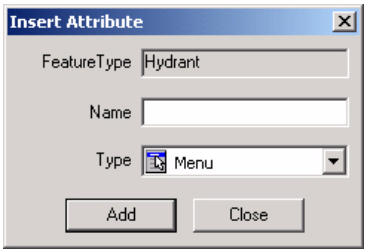
- In the Feature Library Editor window, right-click on the feature library name and select **Insert Feature**. A new dialog box opens in which you can define the first feature type for the library:



- Enter a name for this feature type in the **Name** field.
- Indicate the type of the feature. For example, if the feature is a hydrant, select **Point**; if it's a coast line, select **Line**; if it's a lake, select **Area**; if it's a network of point locations where measurements will be taken to create a contour map, select **Grid**. Grid features are presented in detail in a separate chapter (see *Grid Mapping Utility on page 59*.)
- Click the **Add** button. The Insert Feature Type dialog box is re-displayed to make it easier to add a series of feature types to the library.
- Indicate the type of the second feature as explained above and then click the **Add** button.
- Repeat the above steps until all the feature types have been defined.
- After defining the last feature type, click the **Close** button.

Defining Feature Attributes

- Under the feature library name, in the left-hand pane of the Feature Library Editor window, select the first feature name, right-click on it and select **Insert Attribute**. A new dialog box opens where you can define the first attribute for the feature type:

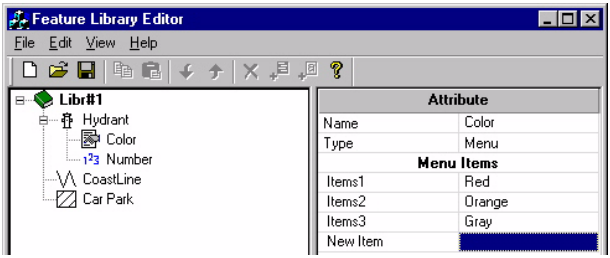


- Enter a name for this attribute in the **Name** field
- Indicate the type of the attribute value: Menu, Numeric or Text. If the attribute value will consist of a list of values or phrases that the field operator may choose from, select **Menu**; if the field operator will have to enter a number, select **Numeric**; and if the feature refers to a comment or any other alphanumeric string that the field operator will have to type in, select **Text**.
- Then click **Add** to add another attribute for the feature, or **Close** after the last attribute has been defined.
- Right-click on the next feature type on the left half of the window, select **Insert Attribute** and then define all of this feature type's attributes as explained above. Click the **Close** button when you are done.
- Repeat the above steps until all the attributes have been defined for all the feature types present in the library.

Defining Menu-Style Attribute Values

You define attribute values in the right-hand pane of the Feature Library Editor window.

- Click on the name of the first attribute of the first feature type. The right-hand pane of the Feature Library Editor window now shows a table containing the definition of this attribute. The highlighted cell is where you can enter the first attribute value for this attribute. Click on this cell.
- Type in the attribute value and press ENTER on your keyboard. A new row is added in the table where you can enter a second attribute value, etc.
- When you are done with the values of this attribute, click on the second attribute in the left-hand pane of the Feature Library Editor window. Resume the previous and present steps as many times as necessary.
- Example of attribute values (red, orange, gray) for one of the attributes (color) of a point feature (hydrant):



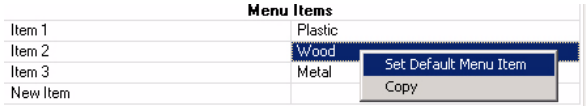
Defining Numeric-Style Attribute Values

For a Numeric-style attribute, you can define the precision, default value and range of possible values for the attribute (minimum and maximum values).

Defining Text-Style Attribute Values

For a Text-style attribute, you can define the maximum number of characters allowed (20 characters max.) and if you want any default value for the attribute.

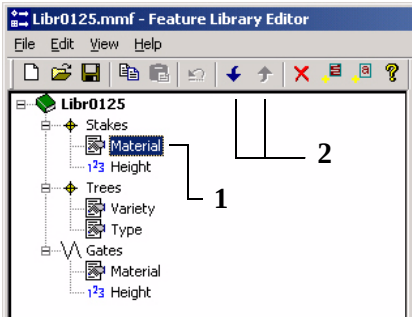
For a Menu style attribute, you should define a list of options the field operator will have to choose from. You may also define the option that will be automatically assigned by default to a feature logged in the field: Right-click on the cell containing the desired option and then select **Set Default Menu Item**. (see below).



Choosing the Attribute Used as a Label

You can choose which attribute of a given feature type should be used as a label on MobileMapper Office's Map Display area. This is simply done by having this attribute listed first for the feature type. To change the order of an attribute:

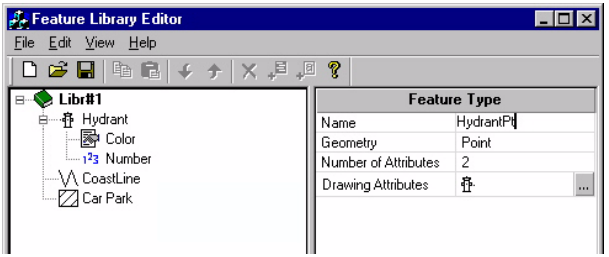
1. Select this attribute
2. Click on the Up or Down arrow button on the tool bar to define the new position of this attribute within the list.



Renaming a Feature Type or an Attribute

You can also use the Feature Library Editor to change the name of a feature type or attribute as explained below:

- In the left-hand pane of the Editor window, click on the feature type name you want to edit. This displays the Feature Type table on the right.
- Double-click on the cell containing the feature name (see example below) or attribute name and type in a new name.
- Press the Enter key to record the change.



From the same table, you can also change the display characteristics given to a feature type on the map (see next section).

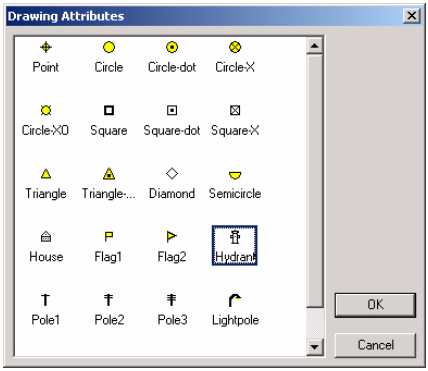
Defining the Representation of Feature Type

The representation of a point feature on the map is a symbol that you can define as explained below:

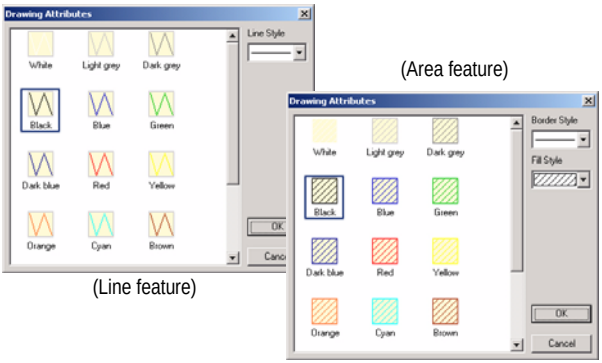
- To the right of the Drawing Attributes row of this table, click ..... A new dialog box opens in which you can select a new symbol for the feature type:

Twenty-two symbols are listed in this box. The symbol you choose here will also be shown on the receiver's Map screen during field operations dealing with features of this type.

MobileMapper Office does not support the importing of point feature symbols used in GIS applications because these are typically proprietary.



Using the same procedure, you can tell MobileMapper Office how you want line and area features to be displayed on the map (see drawing attributes in the two dialog boxes below).



Deleting Feature Types, Attributes or Attribute Values

The Feature Library Editor lets you delete, in a very simple manner, any feature type, attribute or attribute value option from the open feature library.

- To delete a feature type, you just select its name and you press the Del key on your keyboard. Deletion is immediate as MobileMapper Office does not require user confirmation. By deleting a feature type, you also delete all attributes and attribute values attached to this feature type.
- To delete an attribute from a feature type, expand that feature in the left-hand pane of the Feature Library Editor window, select the attribute you want to delete and press Del on your keyboard. Deletion is immediate as MobileMapper Office does not require user confirmation. By deleting an attribute, you also delete all attribute values attached to this attribute.
- To delete a Menu-style attribute value from the list of possible values, first select the concerned attribute in the left-hand pane of the Feature Library Editor window. Then in the right-hand pane of this window, highlight the cell containing the attribute value you want to delete and press Del on your keyboard. Deletion is immediate as MobileMapper Office does not require user confirmation.

Saving a Feature Library

When you are done with the definition of a feature library file, don't forget to save the file by selecting File>Save on the menu bar of the Feature Library Editor window.

Attaching a Feature Library to a Job

In order to preserve the consistency of your jobs over time, you are not allowed to edit the feature library attached to a job (unless the job is empty). You can however edit the symbols used to display the job in MobileMapper Office.

When you want to attach a feature library to a GIS job, you just have to import this feature library into the job open in the main window, using the File>Import command. The feature types contained in the feature library will then appear as "layers" in that job. When you save the job, the complete feature library will also be saved in this job.

Similarly, when you open a job after downloading it from your receiver, the feature types from the library file used for that job will automatically appear as layers pertaining to the job. If you run the Feature Library Editor while a job is open, it will display that job's feature library. If you edit this library, you must save it with a different file name. If you want to review any other feature library while a job is open, open the Feature Library Editor, click on File>Open and select the desired .mmf file.

Importing a Feature Library from a Job or GIS File

Using the File>Import command in the Feature Library Editor window, you can import the feature library used in an existing job or from a MIF or SHP file.

When importing a GIS file containing more than 20 characters (excluding dot and extension symbols) in the name, the Feature Library Editor truncates all characters beyond the 20th after displaying a warning message. If the first 20 characters in two different imported files are identical, the software displays a message saying the file already exists and generates an "Import Failed" error message. If this happens, you can rename the second file so that its first 20 characters are not identical to any previously imported file.

Uploading a Standalone Feature Library File to the Receiver

You usually have to upload a standalone feature library file to the handheld when this feature library has never been used to collect data into a job file.

- Unless already done, select Tools>Feature Library Editor to open the Feature Library Editor window
- Open the feature library file you want to upload using the File>Open... command. Feature library file names use the "*.mmf" extension. If you want to upload the feature library used in the open job, then you must save it as an MMF file from within the Feature Library Editor window before you are allowed to upload this file to the handheld.
- Ensure that the receiver is turned on and attached to the PC via a data cable
- On the menu bar of the Feature Library Editor window, select File and then Upload to GPS. MobileMapper Office then routinely searches for the right baud rate to communicate with the handheld (whether via USB or RS232). When communication is established with the handheld, the upload sequence is automatically started. A dialog box keeps you informed on the file being transferred. A message is also displayed on the handheld informing you that file transfer is in progress. These two message windows disappear from the PC and handheld screens when data transfer is complete. You may also insert the receiver's SD card into a card reader attached to your PC and use a file transfer tool such as Windows explorer to copy the feature library to the SD card. ❐

8. Grid Mapping Utility

Introduction

Working with the Grid Mapping Utility is an easy way to log GPS positions and GIS data at waypoints arranged in an evenly spaced grid. This allows you to gather measurements - made by field sensors such as depth sounders, chemical detectors and magnetometers - in an organized fashion with an easy-to-use navigation feature. You can then create contour maps with the necessary density of data while avoiding any gaps that might force you to return to the field.

Grid Features vs. Grid Points

The Grid Mapping Utility refers to two different grid concepts: grid features and grid points.

- Grid features are arrays of uniformly spaced points oriented in rows and columns.
- Grid points are navigation features similar to routes. They are created by MobileMapper Office and uploaded to the handheld. You navigate to each grid point using your receiver's navigation screens and record your observations or measurements using its data logging software.

Think of an apple orchard where the rows are about 15 feet (5 meters) apart and each tree is about 15 feet (5 meters) apart from the next tree in its row. The orchard is a grid feature. The location of each tree is a grid point. The number of apples on each tree is the attribute you wish to record.

Like a point, line or area feature, a grid feature is a feature geometry type. You can see the similarity in two ways:

- Just as a line or area feature is made of a string of point positions, a grid feature is a set of points.
- As with line and area features, a single feature type name corresponds to the entire grid feature. In a single job, you might record positions and descriptions of several line features classified as “roads” and two area features classified as “lakes.” And you might use one grid feature named “water depth” and one named “magnetic field.”

However, line and area features differ from grid features in two important ways:

- The positions making up line and area features mark the locations of real things like roads, lakes, etc. But the points making up a grid feature are imaginary target locations that you navigate to.
- The attributes you record for a road or a lake pertain equally to each of the point positions making up feature, but you typically record different descriptions at each grid point making up the grid feature.

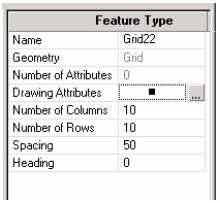
Setting up a Grid Feature in a Feature Library file

Use the Feature Library Editor window to set up a grid feature. To add a grid feature to the feature library:

- Right-click on the name of the feature library and select the Insert Feature option. Then select Grid as the feature type

- Click on the Add button, then on the Close button.
- Then define the attributes of the point feature that you will record at each of the grid points. Do this as you would for any point, line or area feature (see *Defining Feature Attributes on page 49* and *Defining Menu-Style Attribute Values on page 50*). Typically, these are text-type attributes for visual observations and numeric-type attributes for measurements made with instruments. But it is also possible to record observations using a menu-type of attributes.

Editing the Grid Properties

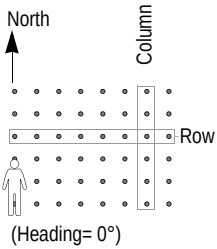


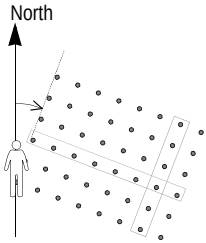
Grid properties table

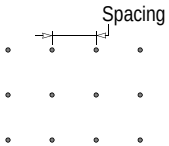
When you are done adding attributes to the grid feature, you will see the grid symbol and the name of the grid feature in the tree display of the feature library. If you click on the name of the grid feature, you will see a two-column table on the right labeled "Feature Type." This is where the default values of the grid feature are indicated. If you want to change any of these values, double-click on the value and type in a new one.

Name: Feature names like "pole," "road" or "lake" make it easy to identify the geometry of point line and area features. This is not so easy with grid features. You might find it helpful to insert the word "grid" into the name of grid features. However, there is a 15-character limit to the name length so you may prefer to name the grid types with distinctive names like "mag. field," "H_2O depth" or "CO_2 conc."

Geometry and **# of attributes**: Cannot be edited







Number of Columns /Number of Rows: The easiest way to determine how large the entire grid must be is to measure the area using a background map showing appropriate layers. You can draw a rectangle over the area to be mapped and measure the two sides of the rectangle in meters. Then divide each distance by the grid feature's spacing. Imagine yourself standing at one of the two corners of the rectangle where the grid feature is arrayed in front of you and to your right. The number of columns is the length of the side of the rectangle to your right divided by the grid spacing (in meters). The number of rows is the length of the side of the rectangle in front of you divided by the grid spacing.

Heading: The default heading is 0º (due North). If you leave the heading at this default value it means that the grid feature will be arrayed to the north and east of your position because these are the directions in front of you and to your right. If you want the grid feature oriented in any other direction, just type in the compass direction that you will face when standing with the grid in front of you and to the right.

Grid spacing: The default value for the distance between adjacent grid points is 50 meters. You can set this spacing to any number of meters you would like. This number will be automatically converted to any other distance unit is set in the receiver.

When changing from the default 50 meters, keep in mind that the selected value will determine the density of measurements. If this number is less than 5 meters or so, there is no point in using a Grid feature. Simply walk around and take samples by visually estimating the required density. If you increase the spacing, be sure the spacing supports the density of measurements you require.

Uploading the Grid Feature to the Receiver

You upload grid features to the receiver by uploading the feature library that contains this feature type. You can either upload the feature library as a standalone library that the user in the field can select to record a new job. Or you can use MobileMapper Office to import the feature library into a job created in the office. Either way, you just have to click on File>Upload to GPS and select the file you want to use in the field.

If you want to inform the field user where to begin logging the grid feature, just create a waypoint in MobileMapper Office by clicking on Tools>Place Waypoints. Make sure you change the name from the default "WPT001" to a name telling the user that this is the point of beginning for logging a grid. Then upload this waypoint as described in *Uploading a Job to the Handheld on page 23*. ❒

9. Using the Waypoint/Route Editor

Introduction

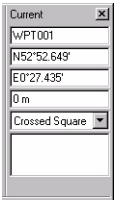
The Waypoint/Route Editor allows you to easily create a list of waypoints that might be useful for the field operator when she/he is performing a GIS job. For example one of these waypoints may help to localize a hardly visible feature.

The Waypoint/Route Editor also allows you to build new routes, based on the existing list of waypoints.

Placing Waypoints

- First of all, click the down arrow next to  on the tool bar and select the region where your jobs are going to take place. As a result, a map of your region appears on the Map Display area.
- On the toolbar, click  and then draw a rectangle around the part of the map you want to enlarge. When releasing the mouse, the map scale is adjusted so the Map Display area only shows this part of the map.
- On the toolbar, click  . This opens a new window in the right-hand part of the window where you can edit your definitions of waypoints.
- Click on the Map Display area where your first waypoint should be located. A waypoint icon now appears on the map with the name of the waypoint displayed next to it (see example opposite).

Creating a waypoint



Editing a waypoint

Defining the name and icon of the next waypoint

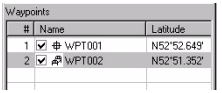
- In the right-upper part of the window (see example opposite), you can now make changes to the definition of this waypoint (name, coordinates, icon, optional comment).
- Next to this definition area, you can also define the name and icon for the next waypoint you will create
- When you are done with the definition of the first waypoint, create the second waypoint by clicking on the map where this second waypoint should be located. Again, you can adjust the definition of this waypoint in the right-upper part of the window, etc.

  Note that a waypoint table is updated in the right-lower part of the window as you create new waypoints. You can scroll this table horizontally and edit each of the cells if necessary. The second column (Name) contains a check button allowing you to show/hide each waypoint icon & name on the Map Display area.

Creating Waypoints from the Waypoint Table

Another very quick way of creating new waypoints is to use the aforementioned waypoint table.

- Right-click anywhere over this table and select **New Waypoint** in the pop-up menu. As a result a new waypoint is added in the waypoint table with default parameters and "zero" coordinates.
- You can then edit each cell to complete the definition of the new waypoint. The waypoint will then appear on the map (if located within the area covered by this map).



Waypoint table

Saving Waypoints

To save your waypoints, you just need to save the currently open job. When you do that and there are waypoints in the job, MobileMapper Office creates a separate MMW file containing this list of waypoints.

Finding a Waypoint on the Map

Use the View function when you have some difficulty finding a waypoint on the map because there are lots of them, or simply because you don't want to spend too much time searching for it.

MobileMapper Office helps you locate rapidly a waypoint.

- In the waypoint table, right-click on the row containing the definition of the waypoint and select View. The map is then moved accordingly within the Map Display area so as to put the waypoint in question exactly in the center of the Map Display area.

Editing/Deleting Waypoints

Waypoints can only be edited or deleted individually from the waypoint table. (You cannot select a waypoint by clicking on its icon in the Map Display area.)

To delete a waypoint:

- Select the row containing the waypoint you want to delete
- Press the Del key or right-click on the row and select Delete. Waypoints are deleted instantly, without user confirmation.

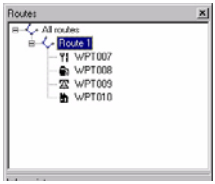
You can also delete all the existing waypoints and routes through a single operation by selecting the Clear All Waypoints option from the Tools menu.

Building a Route

After you have created a number of waypoints as explained in the previous chapter, you can now define routes graphically. Follow the instructions below to do this.

- On the toolbar, click  . This opens a new window in the right-upper part of the window where MobileMapper Office automatically creates a new route named “Route1” (if it’s the first one in the list). Note that MobileMapper Office continues to display the waypoint table below this window.
- Come back to the Map Display area and click on the waypoint that you want to define as the route’s start point
- Then click on the second point, then on the third, etc. Every time you click a new waypoint, “Finish” is displayed next to this waypoint which means you don’t have to do anything special to end the definition of the route. MobileMapper Office will “understand” that the route definition is complete when you proceed to another task in the software.

  Note that you can edit the name of the route by double-clicking on it. You can also remove a waypoint from the route by right-clicking on it and selecting **Delete**. The Map Display area is then updated to reflect that change in the definition of the route.



Creating a four-waypoint route

Saving Routes

To save your routes, you just need to save the currently open job. When saving a job with waypoints/routes displayed on the Map Display, MobileMapper Office creates a separate .MMW file containing this list of waypoints and routes. If no job is displayed, save the waypoints/routes as a new job file. Any time you want to import these waypoints/routes into any other job, click on File>Import.

Uploading Waypoints/Routes to the Receiver

This is done automatically when uploading the job containing these waypoints and routes. You do not need to check the waypoints layer (in the Layer's list) or open the Waypoints or Routes window. Waypoints and routes are uploaded to the receiver as a separate .MMW file.

Downloading Waypoints/Routes

MobileMapper Office and the receiver can create, edit and store waypoint files. But, because waypoints are used only for navigation, they can be transferred only between the PC and the receiver. And because they can be described only with a simple text message, they are not appropriate for export to a GIS. However, you can use the Feature Library Editor to create a point feature type called "Waypoint," add all the attributes you need and export these to your GIS.

The waypoints and routes you create in the field can be directly downloaded from the receiver to MobileMapper Office using the procedure below.

- Connect the receiver to your PC using the serial or USB cable (depending on the receiver model)
- Turn on the receiver
- On MobileMapper Office, select File>Download Waypoints/Routes. A message will then appear showing the download in progress. When the download is complete, you will see the new waypoints and routes listed in a window to the right of the MobileMapper Office map screen.

  Note that these waypoints and/or routes have been downloaded into the open job, which means this operation has brought changes to the job (see the "*" symbol after the job name in the title bar). You should then select File>Save if you want to save the downloaded waypoints and/or routes into this job.

  If waypoints and routes are already part of the open job, when you run the File>Download Waypoints/Routes function, MobileMapper Office will warn you that it will overwrite all these waypoints and routes before running the download operation. You then have to choose between overwriting the waypoints and routes or canceling the download operation. ❒

10.Background Maps

Introduction

Background maps are designed to provide useful details on working areas. Field operators might like to see these details on their handheld screens as they progress in their jobs so that they can more easily go to the places they have to visit.

Background maps are for viewing only. You cannot edit them or access information on their features. They provide a backdrop, which gives visual orientation for your data and waypoint files.

Background maps are shown in the Map Display area of the MobileMapper Office main window. They are independent of jobs. Whether there is an open job or not, you can have a background map displayed in this area. You may create this background map once and then it can be used as a background for many jobs at a certain location.

Background maps can result from two different categories of data:

- GIS Data allowing *vector* background maps to be created
- Raster data allowing *raster* background maps to be created.

You cannot merge these two categories of data in a single background map, but you can superimpose a vector map on a raster map in the Map Display area (see *Defining the Background Displayed in MobileMapper Office on page 86*).

Please, carefully read the explanations opposite to understand the difference between a background map "project" and the resulting "background map" on the Map Display area

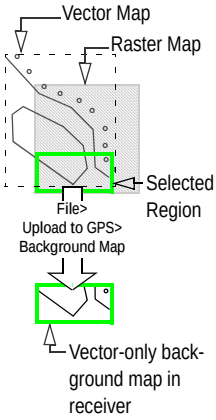
Background map projects are created using the Map Editor. The notion of "background map project" allows you to define the different *layers* (vector maps) or *images* (raster maps) comprising the background map, plus the map name and also the scale setting for vector maps, and if necessary, georeferencing information for raster maps. Use the Tools>Background Maps command to access the Map Editor. Background map projects are saved as separate files:

- With the "mmp" extension for vector maps
- With the "rmp" extension for raster maps.

Once you have defined and saved a background map project, whether a *vector* or *raster* map, you will then have to use the Operations>Create Map command to actually build the background map.

Usually it takes time to create a map, so it would be a benefit to do that once. After the background map is created, it will appear in the Background Maps list with the given name, and it can be selected at any time as a background for various job data.

A background map generally consists of a base map, plus additional details that you can for example import from your GIS system or from a map database. Thus, a background map is either a stack of several layers or/and a set of images, but as opposed to layers in a job file -which you can select on the Map Display area- the layers composing a vector map or the images composing a raster map, will result in a single backdrop on the Map Display area, with no possibility to select any individual items shown on this map.



When you create a vector map, you can import MIF, SHP and DXF files that are in any coordinate system, datum and zone. Those that are not included as preset systems by MobileMapper Office can be recreated using MobileMapper Office's user definable system support or imported from ESRI's PRJ files.

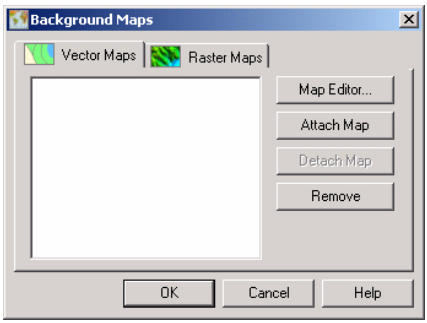
When you create a raster map, you can import image files in any of the following formats: TIF, GTIF, JPG, JPEG, PNG, BMP and GIF

To give you greater control over what you wish to store on the receiver, you must upload the job and/or the background map separately. To upload either of them, click on File>Upload to GPS and then select either the job or the background map option. If the background shown in the Map Display area consists of two background maps (i.e. a vector map and a raster map), *then only the vector map will actually be uploaded to the receiver* (see diagram opposite).

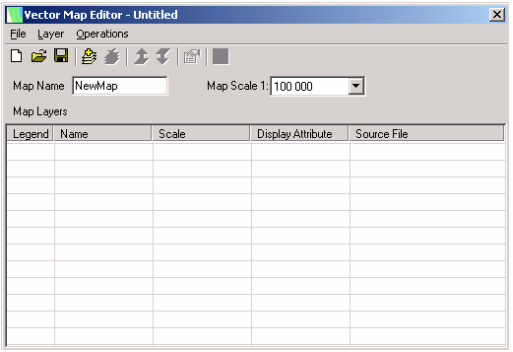
Creating a Vector Background Map

First Steps

- On the menu bar, select Tools and then Background Maps. This opens the Background Maps window.
- Click on the Vector Maps tab:



- Click on the **Map Editor...** button. This opens the Vector Map Editor window from which you can create a new vector map project:



- In the **Map Name** field, type in a name for the vector map project.
- In the **Map Scale** field, choose the scale "threshold" value controlling the display of the vector map in MobileMapper Office. If later on, the scale setting you use in the Map Display area is less than this threshold value, then the background map will NOT be displayed.

  For example, if you set the scale "threshold" value to 1:100,000, then the background map will be displayed only if the scale used in the Map Display area is greater than this value (for example 1:50 000 or 1:10 000).

The purpose of the scale "threshold" value is to hide the vector map attached to the Map Display area if you select a scale value in the Map Display area that is incompatible with the density of details in this vector map

Conversely, if the scale used by the Map Display area is equal to or less than 1:100 000 (e.g. 1:200 000), then the vector map will not be visible in the Map Display area. However, you will see the boundary of this vector map represented in the form of a rectangle. See also *Which Scale to Use to Display a Vector Background Map? on page 87*.

The scale "threshold" value can be set individually for each layer present in a vector map.

Adding Layers to a Vector Map Project

You can add as many layers as necessary to build a vector map. Layers may be SHP, DXF or MIF files.

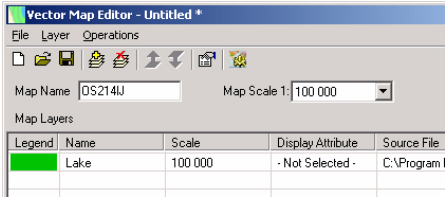
If you want to import layers from an MMJ job file, first export the job into SHP or MIF format and then import the desired layers back into the vector map.

When you import GIS files, you have to identify the coordinate system and datum used to display the GIS file. You can determine what system was used, by displaying the file in your GIS or by asking the GIS manager. You typically have to ask this question only once because most GIS files in a project are in the same coordinate system.

- Click  , or on the menu bar, select Layer>Add... A dialog box opens in which you should indicate the folder where to find the layer and then select the file corresponding to that layer.
- In the combo box located in the lower part of the dialog box, select the coordinate system on which the layer to be added is based (see warning opposite).

  If a PRJ file exists for the Shape file you are about to import, it is a good idea first to import the PRJ file from the Options>Browse Coordinate Systems command (see page 100). After this operation, the corresponding coordinate system will be available from the Select Coordinate System dialog box.

- Click on the Open button. The selected file now appears as a layer in the first row of the Vector Map Editor window:



- Resume the previous steps as many times as necessary to add all the layers you need for your vector map.
- Click  (or select Operations>Create Map) to build the map.
- Select File and then Save or Save As. In the dialog box that opens, choose a folder and enter a name for the vector map project you have just built. This project will have the "mmp" extension.
- Then click the Save button to save the project.
  By saving a map project, you make it possible to re-create a map without having to resume the steps described above. For example, if later on you want to change the appearance of a layer, you just need to re-open the map project, edit the layer and re-build the map.

Changing the Order of Layers

When you build the vector map, the first layer you placed in the table will be brought to the front, and the last one will be sent to the back. Intermediate layers will occupy intermediate positions in the layer stack, i.e., it will be obscured by the layers ahead of it on the layer list.

If one of your layers contains area features, it is important that this layer be placed at the bottom of the table otherwise all layers containing point or line features located within these area features would be hidden by these features.

To change the position of a layer in the table:

- Highlight the row containing this layer by clicking on any cell in this row
- Click  or  , or select Layer>Move Up or Move Down to move up or down the layer by one row. If necessary, repeat this step until the layer is at the right position in the table.

Removing Layers

- Highlight the layer you want to remove
- Click  , or select Layer>Remove from the menu bar, or press the Del key. This instantly removes the layer from the vector map project.

Changing the Visual Aspect of Layers

You can customize each layer by double-clicking on the corresponding row in the table or by using the **Layer>Edit...** command. This opens a dialog box in which you can choose the aspect you want for the layer when the vector map is built up later. As you will probably notice, the available options are much similar to those available when creating feature types with the Feature Library Editor.

- For a point feature layer, you can choose the type of icon that will be used to represent all the features pertaining to the layer
- For a line feature layer, you can choose the color and width of the line representing all the features pertaining to the layer
- For an area feature layer, you can choose whether all the features pertaining to this layer should be represented just by their *outlines* (in this case you choose a color for the outlines only, as you would for a line feature) or by opaque *areas* (in this case the color and filling style you choose apply to the entire area).

  If the area layer you are importing consists of contiguous areas, such as individual parcels making up a property map, you must use the outline option or the individual areas will not be distinguishable on the Map Display.

You can also do the following for each layer:

- Edit its name
- Select which attribute to display as a label together with the icon or line

The purpose of the scale "threshold" value is to hide the layer from the background map attached to the Map Display area if you select a scale value in the Map Display area that is incompatible with the density of details in this layer

- Change the scale "threshold" value controlling the display of the layer in MobileMapper Office if you want it to be different from the one you defined for the entire vector map. By default, each layer is allotted the same scale "threshold" value as the vector map's (see page 73). On the other hand, if you want to change the scale "threshold" value for a layer, then it can only be equal to or greater than that assigned to the vector map.
- If later on, the scale setting you use in the Map Display area is less than this "threshold" value, then the features pertaining to the layer will NOT be displayed (see also *Which Scale to Use to Display a Vector Background Map? on page 87* for more details).

Building the Vector Background Map

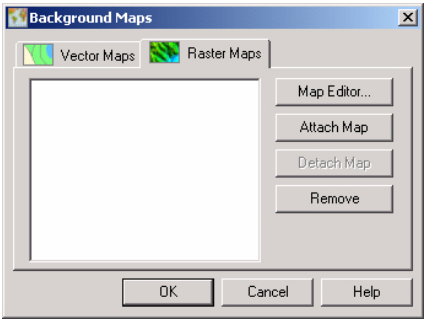
Once you are done with adding and re-arranging layers, you can build the vector map from these layers.

- First save the vector map project using the **File>Save** command if you are happy with the project name or the **File>Save as** command if you wish to rename the vector map project.
- Then click  , or on the menu bar, select **Operations>Create Map**. MobileMapper Office then builds the vector background map. A dialog box is displayed indicating that this operation is in progress. It disappears from the screen when the build operation is complete.
- Close the Vector Map Editor window. This takes you back to the Background Maps window where the newly created vector map is already attached.

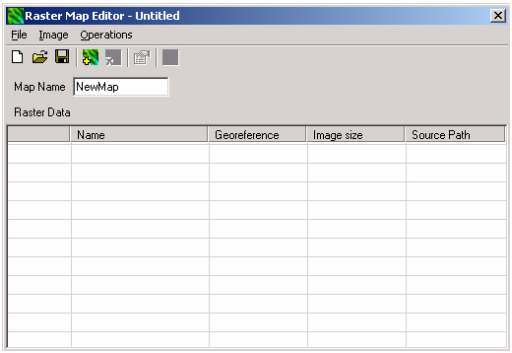
Creating a Raster Background Map

First Steps

- On the menu bar, select **Tools** and then **Background Maps**. This opens the Background Maps window.
- Click on the **Raster Maps** tab:



- Click on the **Map Editor...** button. This opens the Raster Map Editor window from which you can create a new raster map project:

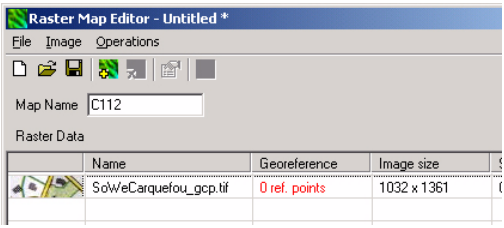


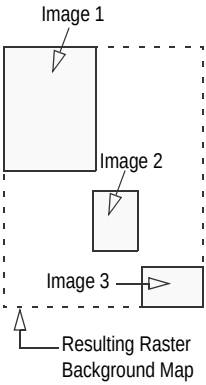
- In the **Map Name** field, type in a name for the raster map project.

Adding/Removing Raster Data To/From a Raster Map Project

You can add as many images (raster data) as necessary to build a raster map. Raster data may be TIF, GTIF, BMP, JPG, JPEG, PNG or GIF files.

- Click  , or on the menu bar, select **Image>Add...** A dialog box opens in which you should indicate the folder where to find the image, the format in which the image is saved and then select the file corresponding to that image.
- Click on the **Open** button. The selected file now appears in the first row of the Raster Map Editor window:





- Resume the previous steps as many times as necessary to add all the images you need for your raster map.
  Adding several images makes sense when you would like to gather several sections of maps spread out all over a given area into a single raster map (see example opposite).
  You can see through this example that adding images to a raster map project is not enough to thoroughly define the raster map: You need to position these sections of maps in space. This operation is usually referred to as “georeferencing”.

Some images, like GeoTIFF, are georeferenced by their distributor, so all you need to do is just add these images to your map project. For some other types of images, you will need to georeference them to further allow the software to create the raster map (see next point.) Even if you have only one image in the project, you should make sure it is properly georeferenced and if it's not, you will have to do it.

Removing Images from a Raster Map Project: If you would like to remove an image from the project, do the following:

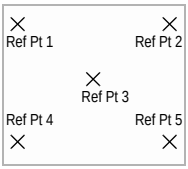
- Select the row containing the image you want to remove
- Click  , or select Image>Remove from the menu bar, or press the Del key. This instantly removes the image from the raster map project.

Georeferencing Images

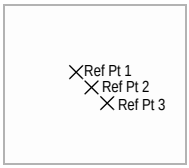
After adding an image to the raster map project, the software tells you whether the image needs georeferencing or not. You can read this information in the Georeference column (3rd column):

- If the column reads "georeferenced" after adding an image, you have nothing more to do (the image is properly georeferenced)
- On the contrary, if the same column reads "0 ref. points" (in red), georeferencing is required

Good Georeferencing:



Poor Georeferencing:



So what's georeferencing an image? It means defining at least 3 reference points giving the position of the image in space (i.e. on the horizontal plane used for mapping). Defining a reference point means entering its precise X-Y or Lat-Lon coordinates depending on the coordinate system used. The larger the number of reference points you define, the more evenly distributed these points over the entire image, the better the georeferencing of the image.

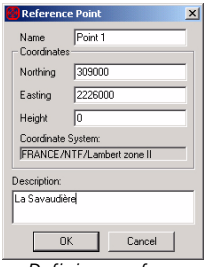
Obviously, as a prerequisite for georeferencing, you should collect all the known reference points -inside the area represented by the image- that you can use for this purpose.

To georeference an image, do the following after adding it to the raster map project:

- Edit the image by double-clicking anywhere inside the corresponding row in the Raster Map Editor window.

  (You could also select the row and then click  , or select **Image>Edit...** from the menu bar, to edit the image.) This opens a full-screen window showing the image.

- Top left of this window, click on  to select the coordinate system used by the known reference points. This opens the **Select Coordinate System** dialog box from which you can select this system. For more information on how to select a coordinate system, see *Selecting a Coordinate System for the Open Job on page 93*.
- After selecting the desired coordinate system, click **OK** to validate your choice and close the dialog box. You can now define your reference points. If necessary use the zoom in button to enlarge the image before defining these points.



Defining a reference point

- Top left of the window, click on 
- On the image, click exactly at the location where your reference point is. A new dialog box opens in which you can enter the name, coordinates and comments for the reference point (see opposite).
- Click OK when you have finished entering the reference point's properties. This closes the dialog box. On the image, you can now see the reference point icon.
- Repeat the above two steps until you have placed all your reference points on the map.

Reference Point icon

- Click on  again to stop adding new reference points. By releasing this button, you make it possible to use the other buttons of the window's toolbar.

Testing the reference points: After defining at least three reference points on the image, you can test the ability of the software to correctly georeference the image using these points:

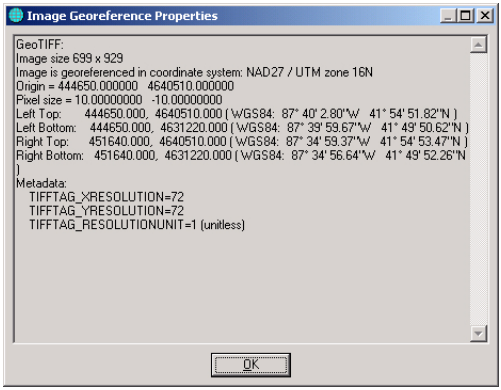
Note: Testing the reference points is not a prerequisite for building the raster map.

- Now that  is available for use, click on this button. If the georeferencing is successful, the following message will be displayed on the screen: "Image was successfully calibrated". If it's not, you will get a message of the type: "Cannot calibrate image. Please verify reference points. Minimum number of reference points is three."

Viewing the properties of an already georeferenced image: After adding a georeferenced file to the raster map project, do the following to display its georeference properties:

If you attempt to define reference points on an already georeferenced image, the following message will appear: "Image is already georeferenced. Do you really want to calibrate it?". *If you click Yes, you will lose all the georeference information initially attached to the image. You will then have to define the coordinate system used as well as the required number of reference points to let the software re-calibrate the image. So be sure that's what you really want to do before going any further into that procedure!*

- In the Raster Map Editor window's table, double-click in the row containing this image. This opens a new window viewing the image
- Top left of the window, click on  . This opens the Image Georeference Properties window (GeoTiff files only; see example below).



Managing your reference points: The window's toolbar includes two more buttons that you can use after selecting a reference point on the image. Make sure the leftmost button is released otherwise you won't be able to select any reference point. To select a reference point, click on the corresponding icon, which will then appear with green background. These two additional buttons are the following:

-  : Allows you to delete the selected reference point
-  : Allows you to display the properties of the selected reference point

When you have finished defining your reference points, close the full-display window by clicking on the cross button top right of the window.

Building the Raster Background Map

Do the following:

- Click  (or select Operations>Create Map) to build the map.
- Select File and then Save or Save As. In the dialog box that opens, choose a folder and enter a name for the raster map project you have just built. This project will have the "rmp" extension.
- Then click the Save button to save the project.

Defining the Background Displayed in MobileMapper Office

This function allows you to select the background map that you want to view in the Map Display area. You can select one raster map and one vector map at the same time. When you do that, MobileMapper Office will always bring the vector map in front and will send the raster map to back. The vector map is always transparent except in those areas containing items.

To define the background for the map display area, do the following:

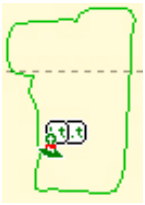
- Click  to open the Background Maps dialog box. This box contains two tabs: Vector Maps and Raster Maps. Each tab lists the names of the existing background maps.
- On each tab, select the name of the background map you want to view and click on the Attach button. A clip icon appears before this name indicating that the attachment is now effective. You can only attach one map on each of the tabs.
- Click on the Close button. This closes the dialog box and displays the attached background map(s) in the Map Display area. The way the *vector* background map is displayed is discussed in the next chapter.

The following functions are also available from the Background Map dialog box:

- Create New...: Provides access to the Map Editor window
- Detach: Detaches from the Map Display the background map that is highlighted with the paper clip icon
- Remove: Deletes the highlighted background map from your computer.

Which Scale to Use to Display a Vector Background Map?

The vector map's layers may or may not be visible in the Map Display area depending on the relationship between the scale you choose in the Map Display and the scale threshold(s) defined in the vector map.



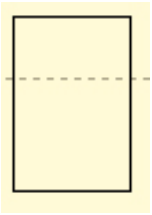
Vector map with all its layers displayed

- To display all the layers of the vector background map, choose a scale that is greater than the greatest scale threshold defined in the vector map.

  For example, a vector map contains three layers defined with the following scale threshold values: 1:10 000, 1:25 000 and 1:50 000. (The scale threshold assigned to the vector map is therefore 1:50 000.) The table below summarizes the map scale ranges for which the different layers of this vector map example will actually be displayed.

	1:50 000	1:25 000	1:10 000

1:50 000 or less (e.g. 1:100 000)	(None)		
< 1:25 000 and > 1:50 000 (e.g. 1:30 000)	✔		
< 1:10 000 and > 1:25 000 (e.g. 1:15 000)	✔	✔	
> 1:10 000 (e.g. 1:9 000)	✔	✔	✔



Vector map when represented only by its boundary

- If you choose a map scale that is less than any of these threshold values, then only the boundary of the vector background will be displayed (see opposite).

If one or more layers cannot be displayed owing to the chosen map scale, then the boundary of the vector background map will also be displayed together with those layers that are still enabled for display.

Setting a Map Region

This function allows you to define the exact limits of the background map –shown on the Map Display area– that you wish to upload to the handheld. Using this function also allows you to limit the file size of the uploaded portion of the background map for better display performance in the field.

- Click  on the toolbar, drag a rectangle around the desired region in the Map Display area and release the mouse button. The limits of the region are then represented with a rectangle. You can still resize or reshape the rectangle by dragging its control points (corner and mid-side points). You can also move the whole rectangle by dragging the mouse cursor from inside the rectangle.
- When the location and size of the region is okay, click outside of this region.The region is now defined and its limits are represented by a thick green line.

  To delete the region and start over, click  .

  Note: The Create Region function may also be used to define the geographical limits of the job you upload to the handheld. See *Uploading Part of a Job (Job Region) on page 24*.

Uploading Whole or Part of the Background

After attaching a *vector* and/or *raster* background map to the Map Display area and possibly setting a map region (see the previous two chapters), you can now proceed with the uploading of the background map to the handheld, to the PC's hard disk or to the SD card inserted in the local SD card reader.

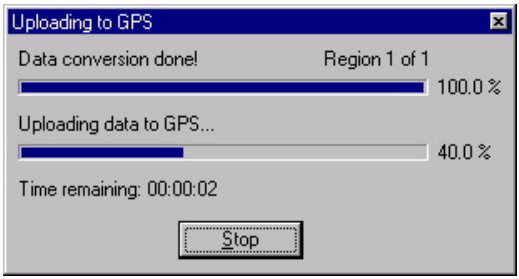
We'll explain here how you can upload a background map. You have to upload jobs and background maps separately. Background maps are not included in the job files. Only feature libraries are actually written into job files. *Only vector maps can be uploaded*. If the Map Display area's background consists of a raster map and a vector map, then only the vector map will be uploaded.

Because many background maps are very large and because most SD card readers use the USB communication standard (that is faster than the serial cable's RS232 protocol), you may find the SD card upload option to be the best way to put background maps into your handheld.

- On the menu bar, select File>Upload to GPS>Background Map. If no Map region has been defined previously in the Map Display area, a message will pop up warning you that the whole background map is going to be uploaded. If you click Yes, the procedure will continue. If you click No, the procedure will be aborted.

  In the next dialog box that opens, you have to select the destination of the background map. This can be the receiver (GPS Unit), the local SD Card reader or the PC hard disk (Hard Drive).

- Check Upload to GPS Unit and click the Next> button. If you have previously run the procedure described in *Connecting the Handheld to the PC on page 20* to test the communication with the handheld, then a new dialog box will be displayed reporting successful connection to the handheld. Otherwise, MobileMapper Office will suggest that you change the settings of the PC port connected to the handheld.
- After successful connection to the handheld, click the Next> button again. A new dialog box indicates the size of the file to be downloaded.
- You just have to click the Finish button to let MobileMapper Office complete the upload operation. The following message is displayed while the file is being uploaded: ❒



11.Coordinate System

Introduction to Coordinate Systems and Datums

For the purposes of collecting or updating map data, both MobileMapper Office and the receiver software will display the coordinates of features imported from your GIS maps in whatever datum you wish. This means that if you move the map cursor (in either MobileMapper Office or the receiver software) over a feature on a map screen, the coordinate numbers (lat/lon or northing/easting) will be displayed in the coordinate system/datum of your choice. This allows you to compare the coordinates of features on the receiver map with coordinates you might have in a database.

However, the receiver uses only the WGS 84 datum to project data onto the map screen, i.e. to position features spatially on a map. One way to visualize this is if you were to select NAD 83 or ED 50 as your datum in either MobileMapper Office or the receiver and moved the map cursor over a feature, you would display coordinate numbers (lat/lon or northing/easting) that were calculated using this datum. If you switched to the WGS 84 datum, the coordinates displayed on the receiver's Position Screen or in MobileMapper Office suite's coordinate display window would change - but the position of the feature on the map screen would NOT change.

Why is this? Calculating coordinates doesn't take much computing power but using powerful map projection algorithms does. Moving features around on the small map extents used by workers in the field does not warrant any decrease in receiver map display performance.

It would take an unnecessary increase in time to display a map that would hardly change in appearance. To re-project positions on a MobileMapper Office map screen using a variety of datums would not be a problem for the PC and its larger screen. However, this is a GIS function that is outside the scope of MobileMapper Office, which is designed as a GPS data communication, display and validating tool and not as a GIS in itself. Because Magellan does not know what algorithms your GIS uses for map projections, you should always transform your GPS positions using the same GIS you use to manage your existing maps. This is the best way to assure conformance of the positions to your GIS maps and databases.

Defining Coordinate Systems in MobileMapper Office

Coordinate systems are organized in three different types as summarized in the table below:

System	Coordinates	Definition
Projected	Easting, Northing, Height	Datum + Projection + System Definition (name, units, labels, vertical datum)
Geographic	Latitude, longitude, Height	Datum + System Definition (name, units, labels, vertical datum)
Geocentric	X ECEF, Y ECEF, Z ECEF	Datum + System Definition (name units, labels)

MobileMapper Office supports the following projections:

- Transverse Mercator
- Lambert Conformal Conic 1SP
- Lambert Conformal Conic 2SP

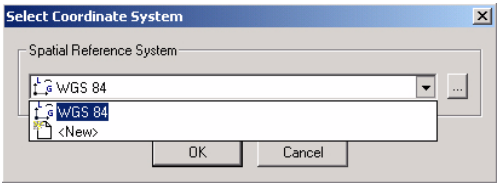
- Oblique Stereographic
- Oblique Mercator
- Lambert Conformal Conic 27
- Oblique Mercator 27
- Transverse Mercator 27
- Transverse Mercator Alaska 27
- Transverse Mercator OSTN02 (projection grid)
- Oblique Stereographic RD2000 (projection grid)
- Ground System.

A large number of geodetic and grid systems are available for use. However, if none of these systems is suitable for your jobs, you can create a new one, based on the information you have to define this system. This is described in the next chapters.

Selecting a Coordinate System for the Open Job

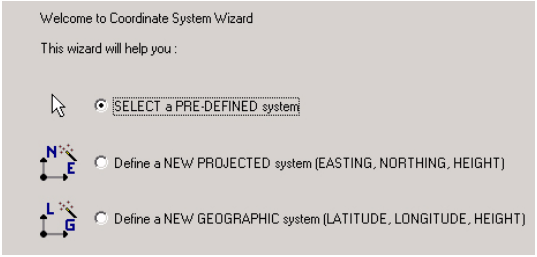
The coordinate system assigned to a job is defined by selecting **Options>Select Coordinate System**.

This brings up a new dialog box in which you can choose the desired coordinate system for the job. The list of systems attached to the **Spatial Reference System** field contains at least the following two options:

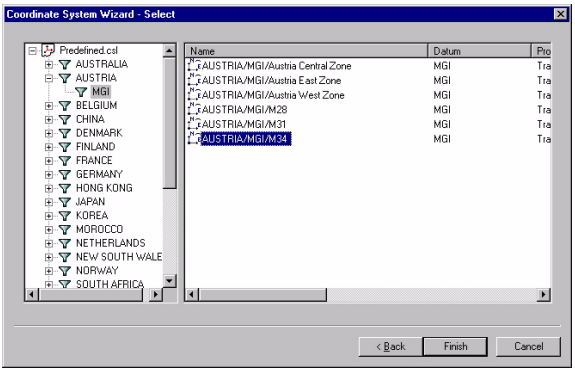


- Selecting <WGS 84> will directly select WGS 84 as the job's coordinate system.

  You can click on the ... button, next to the field, to edit the definition of the WGS 84. If you change and enable any of the parameters defining the WGS 84, MobileMapper Office will create a new system named WGS 84~1 by default.
- Selecting <New> will display the following dialog box:



- If you check SELECT a PRE-DEFINED system and you click the Next button, MobileMapper Office will display the list of pre-defined systems (more than 500 are available).
  In this case you just have to select a system in the right-hand list (see example below) and click the Finish button.



The selected system name will then appear in the **Spatial Reference System** field. From now on, this system will also be available from the list attached to this field.

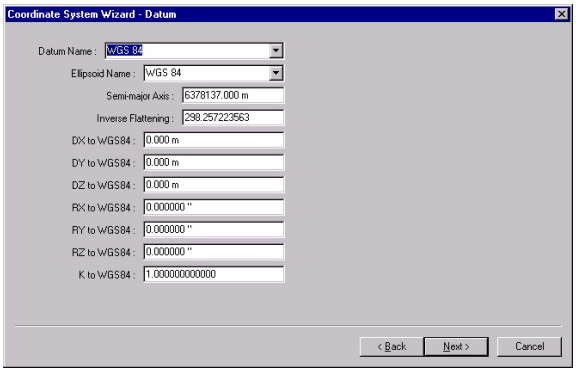
- If you check either **Define a NEW PROJECTED system** or **Define a NEW GEOGRAPHIC system**, then MobileMapper Office will allow you to define a new system (see hereafter).

Creating a Projected System

The process of creating a new projected system goes through three distinct phases corresponding to three different dialog boxes, as explained below. To access the first of these dialog boxes, do the following:

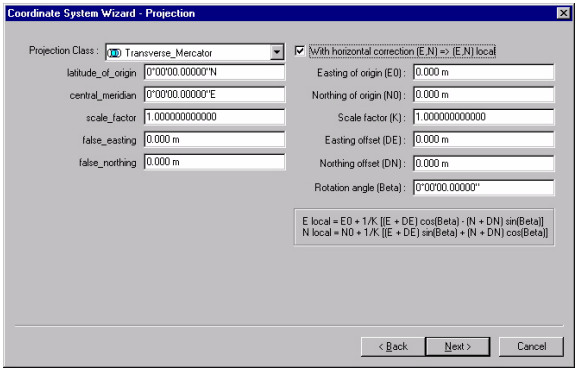
- Run the **Options>Browse Coordinate Systems** command
- Click  , check the **Define a NEW PROJECTED system** option and click the **Next** button. This opens the **Coordinate System Wizard-Datum** dialog box (continued below).

Defining the Datum

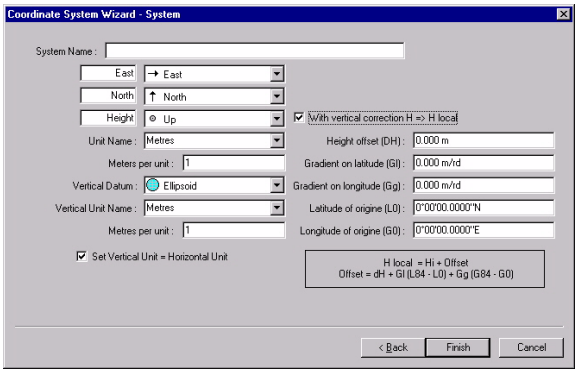


- There are two different scenarios to define a datum for a new system:
  - The new system relies on a known datum: just select a name from the list attached to the **Datum name** field. The rest of the dialog box (i.e. ellipsoid name and definition + position in space) is updated to match your selection.
  - The new system relies on an unknown datum: type the name of the new datum in the **Datum name** field, then type the name of the associated ellipsoid in the **Ellipsoid name** field. Enter the semi-major axis and inverse flattening ratio in the next two fields and then define the position in space of this ellipsoid with respect to the WGS 84 in the remaining 7 fields.

    Note that the datum and the ellipsoid that you create in this second scenario are also intrinsically tied to each other.
- When you have finished defining the datum, click the **Next** button to display the next dialog box (see below).



- Select the desired type of projection from the list attached to the Projection Class field, and then complete the fields underneath
- If the new system includes a horizontal correction, check the box top right. This action unveils a number of fields in the right-hand part of the dialog box that you must complete to define the horizontal correction.
- When you have finished defining the projection, click the Next button to display the next dialog box (see below).



- Enter the following parameters to complete the definition of the new projected system:
  - Projected system name
  - Labels associated with the three coordinates
  - Unit used for horizontal coordinates (Meters, Feet or Survey feet). For your information, the **Meters per unit** field indicates the value, in m, of the selected unit (e.g. 1 foot=0.3048 m)
  - Vertical datum: the “Ellipsoid” option refers to the ellipsoid you have selected earlier for the datum
  - Unit used for vertical coordinates (**Meters per unit** field: same as above). The check box located bottom left allows you to define the same units for ALL coordinates when checked.
  - Vertical correction: check the corresponding box if the local system includes a vertical correction, and then enter the parameters defining this correction.
- Click **OK** to create the new system and close the dialog box. The new system then becomes the one selected in the **Spatial Reference System** field.

Creating a Geographic System

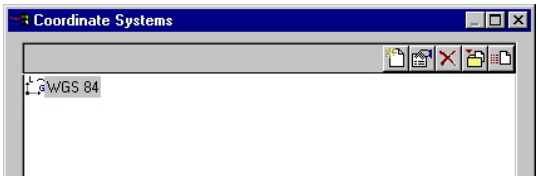
- Run the Options>Browse Coordinate Systems command
- Click  , check the Define a NEW GEOGRAPHIC system option and click the Next button. This opens the Coordinate System Wizard-Datum dialog box.
- Follow the same procedure as when you create a projected system. The only difference is that you do not have to define a projection.

Creating a Geocentric System

- Run the Options>Browse Coordinate Systems command
- Click  , check the Define a NEW GEOCENTRIC system option and click the Next button. This opens the Coordinate System Wizard-Datum dialog box.
- Follow the same procedure as when you create a projected or geographic system. Defining a geocentric system is much like defining a geographic system except that you do not have to define a vertical datum.

Managing Coordinate Systems

- On the MobileMapper Office menu bar, select Options>Browse Coordinate Systems. The dialog box that opens looks like the one below:



The content of this dialog box determines the list of coordinate systems attached to the Spatial Reference System field in the dialog box that opens when you select Options>Select Coordinate System.

The following functions can be performed from this box:

-  : After selecting a system, click on this button to edit the properties of this system
-  : Click on this button to add a new coordinate system to the list. After clicking on this button, choose the type of coordinate system you want to define and then define this system, or simply select it from the list of pre-defined systems.
-  : After selecting a system in the list, click on this button to delete this system. You can only delete a pre-defined system from this list, not from the list of pre-defined systems. Conversely, a system you have created yourself will be definitively deleted from the coordinate system library if you delete it.

CSL: Coordinate System List file
PRJ: ESRI PRoJection Definition file

-  : Click on this button if you want to import a coordinate system from a file in CSL or PRJ format. After clicking on this button, select the file to be imported from the folder you choose and then click Open. The imported system will appear in the list of coordinate systems. Files in CSL or PRJ format are ASCII files.
-  : Click on this button after selecting the coordinate system you want to export. Specify the target folder, the export format (csl or prj) and click Save. The system is exported in the specified format. ❒

12.Print Function

MobileMapper Office's Print function allows you to print the content of the Map Display area. What will be printed will therefore depend on which layers you will check in the Layers List. Like most Windows applications, the Print Preview and Print Setup functions are available from the File menu.

Use Print Preview to adjust the map scale. The map scale control looks like a linear pot. You set the map scale by dragging the cursor to the desired position. The resulting scale value is then displayed in the field nearby and the content of the Map Display area is updated to reflect the change of scale.

You can also type in the desired scale (minimum 1/300) directly in the field nearby. After typing in the scale value, press the Enter key to validate it. The preview will then be adjusted accordingly and the cursor of the linear control will be brought to mid-position to reflect the newly entered scale. You can then adjust the scale value around the typed value either by dragging the cursor in either direction or by selecting one of the preset values -surrounding the last entered value- from the list attached to the scale value field.

Use Print Setup to set the page format and orientation and choose your printer. ❒

13.Save Map function

Not only can you print the content of the Map Display area but you can also save it as an image file. The available formats are BMP, JPEG, TIFF and TGA.

To save the content of the Map Display area, use the **Save Map Image** from the **File** menu, choose a format and a folder where to save the file, name the file and click on the **Save** button. ❒

14.Post-Processing

Field Receiver (Handheld)

The Post-Processing mode allows you to enhance the accuracy of your feature locations from about 2-3 meters with WAAS/EGNOS/RTCM corrections to less than one meter under favorable conditions (tracking > 5 satellites under an open sky with a PDOP < 4). This mode makes use of differential techniques (DGPS) to achieve this higher level of accuracy.

However, unlike unaided GPS or WAAS/EGNOS/RTCM GPS, the Post-Processing mode does not deliver accurate positions instantly. You will need to *post-process* your field data in MobileMapper Office to obtain feature locations exhibiting DGPS (Differential GPS) accuracy.

Basics of Post-Processed Differential Correction

Differential correction software removes some of the error inherent in the standalone GPS position determined by roving GPS receiver. A reference station with known coordinates records GPS satellite data at the same time as the rover receiver. Because the true coordinates of the reference receiver are known, the differential correction software can use this information to “correct” the raw measurements of the distance to each satellite that were recorded by the rover receiver. The corrected GPS measurements at any time are common to all GPS receivers within a few hundred kilometers of the reference receiver.

If you combine the adjustments calculated for the reference receiver with the measurements recorded by the rover receivers, you can improve the accuracy of the rovers. Such techniques for improving GPS accuracy are called "differential correction."

You can calculate and apply differential corrections in two ways. You can broadcast the corrections as they are calculated by the reference receiver in "real-time" to any rover receiver that is equipped with a radio to pick up the corrections. The rover uses a radio to receive these corrections and internal software to apply them to the GPS measurements it receives. It then differentially corrects its positions in real-time. This is how real-time systems such as WAAS, EGNOS or Coast Guard systems work. Most GPS-for-GIS receivers are equipped with an internal WAAS/EGNOS receiver and firmware to apply the corrections. They can also use beacon-type receivers such as the MobileMapper Beacon to pick up Coast Guard or other national differential GPS broadcasts.

You can alternatively download the data recorded by both the reference and rover receivers and use differential correction software on your PC to apply the corrections. This is called "post-processing" because the accuracy is improved after everything is recorded. Real-time correction systems are essentially transparent to the user but are limited in the level of accuracy they can provide. Although post-processing requires more effort and does not produce the results in real time, it is more accurate because post-processing software runs on more powerful computers and can go forwards and backwards through the data to provide more accurate solutions.

Field Implementation

System Requirements

Post-processing requires that you have two GPS data files recorded at the same time. Therefore you need two receivers:

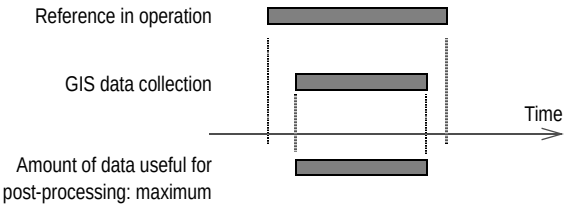
- One is left stationary over a known control point and is called *base* or *reference station*. If a receiver is used as the reference, after making sure the receiver has calculated its position, you will activate the Reference Station option and then let the receiver operate on its own. The receiver will continually log a GPS measurements file, sometimes referred to as "raw data" file.
- The other is the "rover" and collects data exactly as you would for real-time accuracy. So you will just have to concentrate on your job and leave the rest to the receiver! With the "Post-processing" mode enabled in a job, not only will the receiver log GIS data in the specified MMJ job, but also GPS measurements in a separate file (GPS measurements file). This data logging function will be performed as a background task that will stop when you close the job.

You can use the receiver as either a reference receiver or as a rover receiver. You can also use any Magellan receiver that records B-, D-, E- and W-files. But perhaps the most common way to obtain reference station files is to download them from the Internet from a public source of GPS reference receiver data.

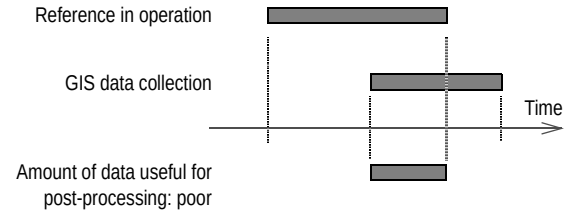
This data is usually published in the Receiver Independent Exchange Format or RINEX. MobileMapper Office's post-processing differential correction module can accept reference station data in any of these formats.

Timing Requirement

There is a very important timing requirement that you should observe: The following two events (“Reference in operation” and “GIS data collection”) should overlap in time. See diagram below:



If these two events do not overlap entirely, then only the “common part” will be usable later in the post-processing:



If more than one reference station file is required to differentially correct the rover job file, simply place all of them in the same directory. When you open up the rover file, all the appropriate reference station files will be displayed and MobileMapper Office will automatically use those portions of the files that overlap the rover file.

If the GIS operator is also the person in charge of setting up and operating the reference, then this timing requirement will naturally be met if the operator proceeds in the following order:

- Operator sets up the reference and puts it in operation
- Operator performs GIS data collection with the receiver
- After completing the GIS job(s), operator goes back to the reference, turns it off and brings the reference and rover files back to the office.

Where to Install the Reference

If you wish to install your own reference station, the only important thing is that it be sited in a location that gives a maximum view of the sky in all directions. Ideally, this location will be over a survey control point that is positioned with the greatest accuracy possible. Any error in the coordinates will be translated to the positions of all the rover job files.

Accuracy Vs. Distance Between Reference and Rover

Accuracy is a certain minimum distance, say 50 cm to which you must add 1 or 2 parts per million (1 to 2 millimeters per km of distance between the reference and the rover). At 100 km, you must add 10 cm to the best possible accuracy. Beyond 300 km, the rover will likely see a satellite that the reference cannot see. If this occurs, the satellite has to be thrown out of the solution and this could have a very negative impact on accuracy. So the important thing is that both receivers can continuously track a maximum number of satellites (and the same satellites).

Downloading GPS Measurements Files to MobileMapper Office

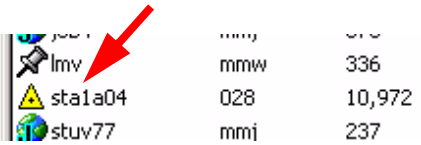
File naming conventions:

The first 4 characters are the "Site ID" that you typed into the Site ID screen when you set up the reference receiver. The next letter shows the number of the reference receiver file recorded that day. The "05" stands for the year (2005). The file extension contains the number of the day in the calendar year, e.g. "31" designates Jan 31 and "32" designates Feb 1.

Note: GPS measurements files are split into three or four different files by MobileMapper Transfer when they are downloaded to the PC: B-, D-, E- and W-files. The MobileMapper Office differential correction utility needs these types of files to be in the same directory as the rover job file. This occurs automatically.

To do this, you will use the same tool as the one used to download job files, namely the *MobileMapper Transfer* module. Downloading GPS measurements files to MobileMapper Office is different however depending on whether the connected receiver is a reference or a rover:

- After connection to a "reference" receiver, MobileMapper Transfer will show a new type of file marked with a yellow triangle icon: this is the GPS measurements file collected at the reference site.



To download this file, simply drag & drop it from the left-hand pane to the right-hand pane, in the folder where you will also download the job file and its associated GPS measurements file (see below).

- After connection to a "rover" receiver, MobileMapper Transfer will display only the job files (.mmj), feature libraries (.mmf) and waypoint files (.mmw) that are recorded on the SD card. But when you transfer a rover job file, the GPS measurements file is simultaneously transferred to the same directory you select for the .mmj file.

Even after transfer is complete, MobileMapper Transfer will not display the GPS measurements files, but you may be certain that they are there. If you ever suspect that any of the necessary files have been moved out of the directory, you may check this using Windows Explorer. However, you should use only MobileMapper Transfer to transfer files from the receiver's SD card to your PC.

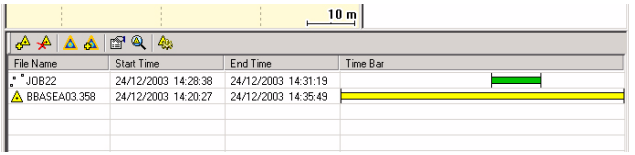
Notes: 1) Before you record any type of file, you should check the remaining memory on the receiver (for ProMark3, in internal memory or on SD card depending on which storage medium you are using). This is especially important before logging a reference station file, because the handheld warns you when memory is getting close to full. You can see this warning when recording a rover file, but not when recording a reference station file - because you won't be there.
2) When memory is full, the receiver will automatically close the file and no data will be lost.

There are actually four files with every job: B, D, E and W but only B, W and E files from the rover are used. There are also four files with every reference station file: B, D, E and W. The B file contains the GPS observables, the D file contains a file description - in this case the reference file's site ID and its averaged position - the E-file contains ephemeris data (info on the SVs' positions in their orbits) and the W file contains SBAS data

Post-Processing Phase

Remember the job file and the GPS measurements file collected at the reference (reference file) should have been downloaded to the same folder (the job folder) on your computer. As explained earlier, the GPS measurements file collected by the rover (rover file) always "follows" the job file.

If you now open the job file in MobileMapper Office, you will see all the DGPS-related information gathered in a new window located at the bottom of the MobileMapper Office window. This new window would not appear if the job file had been created with the "Real-time" option. The figure below is an example of what you can see in this window. A thorough description of this window is provided in *Description of the Differential Correction Window on page 115*.

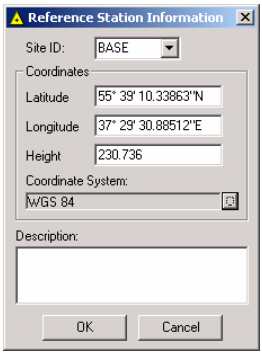


NOTE: when you record a job and close it, then re-open it and append more data to it, you will see two lines in the Differential correction window for this job. Each line will be labeled as "Job1" for example. You will also see the gap when the job was not being recorded.

- In the **Time Bar** column, check that the rover and reference files overlap in time. (There must be a common period of time during which GPS measurements files were logged simultaneously by the reference and the rover. Remember that multiple base files can be used to cover the full time extent of the rover files). If this requirement is met, then post-processing is possible.

  But before starting the post-processing, you have to enter the exact coordinates of the control point where the reference was installed (see below). You are supposed to know these coordinates.

- In the lower part of the screen, click on the row describing the reference station file.
- Then click on  . This opens the **Reference Station Information** dialog box. This dialog box looks like this:



It is very important that the reference station coordinates displayed in this dialog box be as accurate as possible. Any error in the coordinates will be passed to each position in the rover file.

The first time you download data from a reference station with the indicated site ID, MobileMapper Office will search the same folder for a file containing the surveyed coordinates of this site.

Most CORS reference files include very accurate reference station positions. However, if no file is found, MobileMapper Office will calculate an average position using the data recorded by the reference receiver over the duration of the file. Even if this file is 24 hours long, the error added to each of the rover positions will probably be greater than 1 meter. You should, therefore, always check that the displayed coordinates are correct before proceeding with the post-processing.

If you can find more accurate coordinates for the reference receiver and type them into the Reference Station Information dialog box, MobileMapper Office will remember them and display them every time you use any reference data from a receiver with the same Site ID.

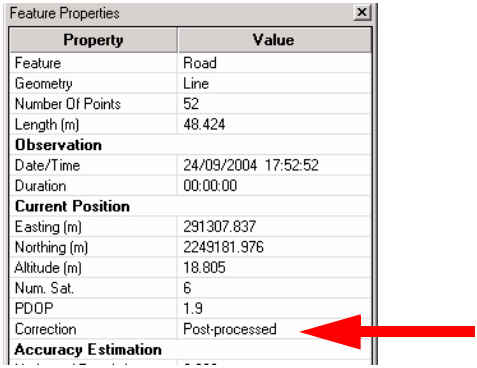
- First select the coordinate system in which the coordinates of the control point are accurately known. For more information on how to select a coordinate system from this dialog, refer to the procedure described in *Selecting a Coordinate System for the Open Job on page 93*.
- Then enter the coordinates of the control point. You may also enter a description of the reference receiver or its location.
- Click OK to close the dialog box. Once you click OK, the coordinates last displayed in the dialog box are written into memory. Any subsequent file recorded with this same Site ID will use the coordinates you just entered.

- Click on  to start post-processing the job. A message box appears denoting post-processing in progress.
  When the job is fully processed, the Map Display area is refreshed to show the changes made to the locations (and shapes) of your features after applying the differential corrections determined by MobileMapper Office.
  If you click on any of the features shown in the Map Display area, the Feature Properties window will appear showing the new properties of the feature (corrected, more accurate coordinates, etc.).
  The Feature Properties window displays the number of satellites used to calculate a position and the PDOP for that position. The more satellites used to calculate a position and the lower the PDOP, the greater the probability of good accuracy.

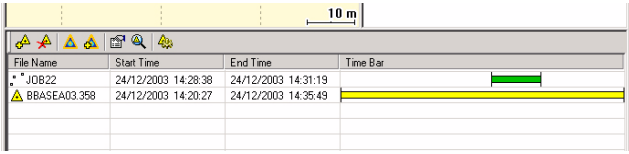
Many factors such as tree canopy, radio emissions, tall buildings and steep hills can negatively affect GPS accuracy. If the GPS data quality is good enough to permit the calculation of a position but bad enough to yield a very low probability of good accuracy, MobileMapper Office will display the number of satellites as being 0 and the PDOP as being 200.

If you notice that some of the point features you recorded are missing or some of the line or area features have straight sections in them, this indicates that the quality of the data during these epochs did not permit the calculation of any position.

The Correction row indicates that the feature position is a post-processed DGPS Solution:



Description of the Differential Correction Window



The Differential Correction window contains two different items: a table and a toolbar.

Each row in the table depicts a GPS measurements file present in the job folder. The table consists of the following columns:

File Name: Gives the name of the GPS measurements file. An icon before the name tells you whether the file was logged by a rover or a reference receiver:

: Rover

: Reference

Also, MobileMapper Office refers to the reference files as "Reference Receiver Files". See the tool tip and the dialog box you see when you click on the Add Reference Station button.

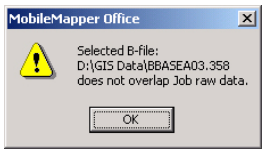
Start Time: Date & time when the rover or reference receiver started logging data to the file indicated.

End Time: Date & time when the rover or reference receiver stopped logging data to the file indicated.

Time bar: Allows you to see at a glance if all the GPS measurements files present in the job overlap. The longer the common periods of time, the better the post-processing will be. Reference files are shown in yellow, rover files in green. Sections of rover files that are shown in red means that there is no reference data available for these "red" periods of time.

The toolbar contains five buttons. The function of each of them is described below:

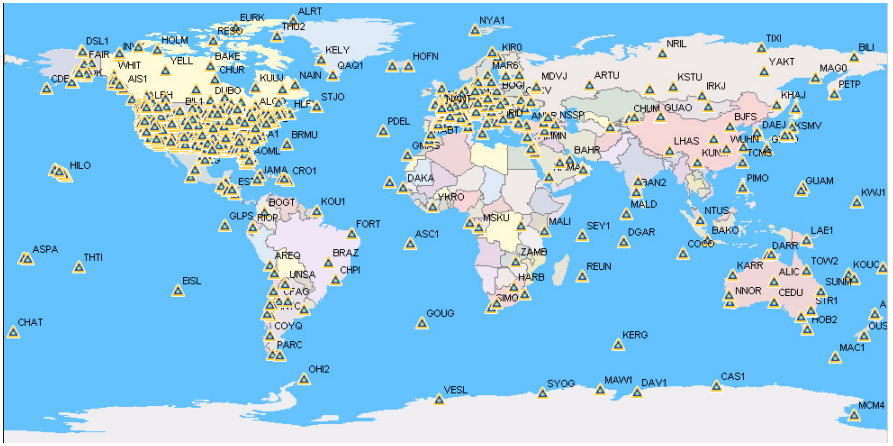
 : Allows you to add a new reference file to the post-processing. It makes sense to add new reference files to the post-processing only if these files offer additional observation data for the period of time covered by your rover file. If you attempt to add a reference file that does not overlap with the rover file, you will see the following message :



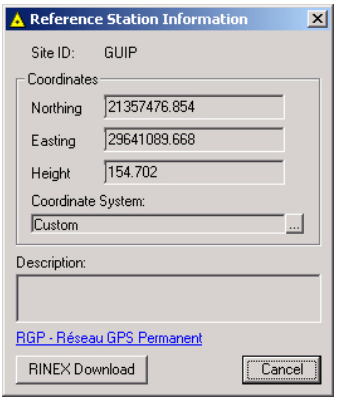
When you click on this button, a dialog box opens asking you to choose the reference file you wish to use. Reference files can be in two different formats: RINEX or B*.*.

 : Removes the selected reference station file from the differential correction window. This button does not delete the reference file but simply removes it from the list of files to include in post-processing. You can always add a reference station that you earlier removed by clicking on the Add Reference Station button.

: Displays the positions of the CORS (Continuously Operating Reference Stations) on the map. If you display the world map, you will notice that this button shows/ hides ALL of the CORS operated around the world!



You can read the properties of a CORS by double-clicking the corresponding “small triangle” icon on the map. A dialog box opens in which you can read its name and coordinates.



You can download RINEX data from the indicated CORS station by clicking on the RINEX Download button

 : Launches the RINEX Download utility allowing you to download GPS raw data in RINEX format, via the Internet, for the reference stations you would like to use in the post-processing of your jobs. This function is discussed in detail in *Downloading RINEX Data via the Internet on page 119*.

 : Edits the properties of the selected reference station. Note that this is the reference STATION properties, not the properties of the file. You use this function to give the reference its true coordinates. Before doing this, you have to choose the coordinate system in which these true coordinates are expressed. The greater the accuracy of the coordinates appearing in this dialog box, the greater the absolute accuracy of the corrected job file.
Note that MobileMapper Office keeps in memory a list of existing references derived from the reference files you download to your job folders. It is therefore essential that you use a specific site ID for each control point on which you install a reference. Otherwise you may unintentionally overwrite the reference station's coordinates.

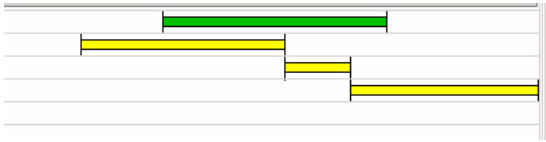
 : Adjusts the zoom on the Map Display area so that both your features and the references can be seen on the screen.

 : Starts post-processing the displayed job file using data from the indicated reference receiver. If several reference files are present in the table, select the one you want to work with before clicking on this button. See also below.

Working with Several Reference Files

If MobileMapper Office detects several reference files that overlap with the job's rover file, you will be asked to choose the file to be used in the post-processing.

But if several reference files are necessary to "cover" the rover file and these files do not overlap with each other (see example below), you do not need to select any reference file since all of them will automatically be involved in the processing.



GPS Position Display Filter

See *GPS Position Display Filter on page 12*.

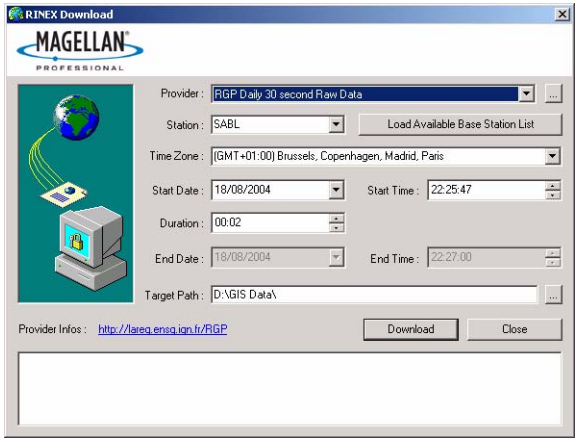
Downloading RINEX Data via the Internet

Introduction

The Rinex Download utility allows you to download RINEX raw data from a provider, via the web.

Rinex Download will automatically set the **Start date**, **Start time** and **Duration** fields to fit in with the rover files present in the open job.

This means RINEX Download will by default ask the data provider to send data for the same period of time as the rover file.



Rinex Download is organized, and should be used, as follows:

- Provider: This field contains the Provider's web address. Rinex Download provides a pre-defined list of about 10 providers. The default selection is NGS CORS. When you launch Rinex Download from within MobileMapper Office and a station is selected, the corresponding provider will be selected. When you select a provider, the corresponding web address is displayed in the lower part of the window (in underlined blue characters) after the "Provider Info:" text string. Clicking on this address would launch your Internet explorer to connect to this website.

- Station: This field is displayed only if you have selected a raw data provider in the Provider field. You then have to choose the station for which you want raw data.

  The Load Available Base Station List button opposite this field allows you to ask the provider to send an up-to-date list of all the stations for which raw data files are collected.collected. Click this button first and then select the station name in the Station field.
- Time Zone: Rinex Download automatically reads this information from your computer time settings so you should not normally have to set this field. If you do it however, make sure that the daylight saving setting corresponds to the settings in Windows Date/Time Properties. Click this button first and then select the station name in the Station field.
- Start Date, Start Time, Duration: Same as above. These fields determine the period of time for which you want data from your provider. The End date and End time fields are software set for your information.

  To change the Start date, click on the corresponding down-arrow. A calendar is then displayed:

  - Click on the displayed year and use the up/down arrows next to it to set the year
  - Click on the right/left arrow to set the month
  - Click on the day number to set the day. This closes the calendar.

- Target Path: This field allows you to define the folder where you want Rinex Download to store the downloaded files.

  To do this, click on ..., browse your disk until you can select the desired folder name and then click OK. The selected folder and its path will then appear in the Target Path field.

If Rinex Download returns the error message "Time does not overlap" when downloading data, you should check that your computer is set to the correct time (select Start>Settings>Control Panel>Date/Time *to check this point)*

- Download button: Click on this button when you agree with all the settings in the window and you want to start downloading data. Below is an example of the message lines that appear in the output pane –located in the lower part of the window– as raw data downloading takes place:

```
Connecting to Host "cddisa.gsfc.nasa.gov"... Ok
Searching for file "/pub/gps/gpsdata/04013/04d/brst0130.04d.Z" ... Ok
Searching for file "/pub/gps/gpsdata/brdc/2004/brdc0130.04n.Z" ... Ok
Downloading File "/pub/gps/gpsdata/04013/04d/brst0130.04d.Z"... Ok
Downloading File "/pub/gps/gpsdata/brdc/2004/brdc0130.04n.Z"... Ok
Disconnecting... Ok
Uncompressing Observation file(s)... Ok
Merging Observation data to "brst0131.04o"... Ok
Uncompressing Navigation file(s)... Ok
Merging Navigation data to "brst0131.04n"... Ok
```

  Note the different operations performed during this phase:

  - Rinex Download connects to the Provider's web address
  - Provider then searches for and then download the corresponding files to the specified folder
  - Disconnection from Provider's web address
  - Rinex Download locally uncompresses and merges the observation files
  - Rinex Download then locally uncompresses and merges the navigation files.

Below is another example of messages read in the output pane when downloading data from an NGS CORS:

```
Connecting to Host "www.ngs.noaa.gov"... Ok
Searching for file "/cors/rinex/2004/232/mhcb/mhcb2320.04d.Z" ... Ok
Searching for file "/cors/rinex/2004/232/brdc2320.04n.gz" ... Ok
Downloading File "/cors/rinex/2004/232/mhcb/mhcb2320.04d.Z"... Ok
Downloading File "/cors/rinex/2004/232/brdc2320.04n.gz"... Ok
Disconnecting... Ok
Uncompressing Observation file(s)... Ok
Merging Observation data to "mhcb2321.04o"... Ok
Uncompressing Navigation file(s)... Ok
Merging Navigation data to "mhcb2321.04n"... Ok
```

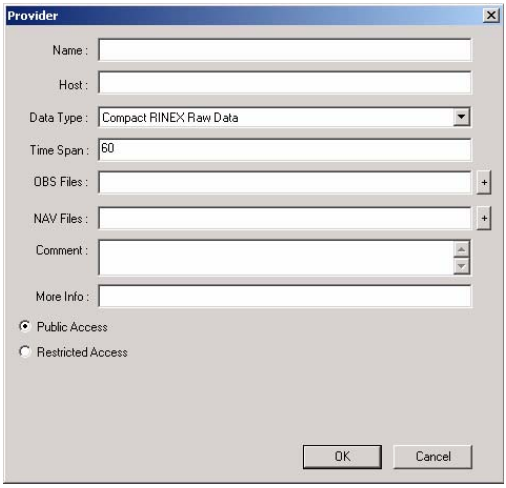
- **Close** button: Click on this button to quit Rinex Download.

Adding a New Provider

See also *Example of Adding a New Provider of Reference Station Data on page 132*.

You can add more Internet sources of RINEX data by following the instructions below. You can also edit the properties of a provider or delete one that you will never use.

- Click on  located after the **Provider** field. This opens a new dialog box showing all the existing providers.
- In the lower part of this dialog box, click on the **Add** button. This opens a new dialog box in which you can define a new provider. The dialog box is slightly different depending on whether the access to the website is public or restricted. See the **Data Type** field in the screen example below:



Some reference data sites have complex instructions for accessing data. If you are working with one of these sites, you may have to download data manually by visiting the site. When you do so, please remember to download both the observation files and navigation files for the desired time period and make sure that the two file names contain the same four-character site ID code.

This dialog box is organized and should be used as follows:

- Name: Enter the provider name or any other information relevant to this provider.
- Host: Enter the provider's web address
- Data Type: Choose the type of data delivered by the provider (compact RINEX raw data).
- Time Span: (Data Duration) Rinex Download needs to know the period of time covered by any of the files delivered by this provider. Enter this time in minutes (1440 min. for daily data, 60 min. for hourly data, etc.). Ask your provider or consult its website if you do not know this value.
- OBS Files: Rinex Download needs to know where the files are stored on the provider's website and how they are named.

You should then enter the path to files (example: /pub/gps/rawdata) followed by the syntax used in the filenames. The "+" button located on the right of this field allows you enter this syntax in a more friendly way. Ask your provider or consult its website if you do not know the path and the syntax of filenames.

- NAV files: Same as OBS files field above.
- Comment: Enter your personal notes regarding the provider (optional)
- More Info: For example, use this field to enter the address of a particular page on the provider's web site.
- Public/Restricted Access radio buttons: Choose the appropriate option. If you check Restricted Access, then you will have to enter a username and a password in the next two fields.
- Log in: If you have checked Restricted Access, enter the username normally supplied by the provider to access his specified website
- Password: If you have checked Restricted Access, enter the password normally supplied by the provider to access his specified website. ❒

15.Appendices

Importing Waypoints into MobileMapper Office

You can use MobileMapper Office to import MobileMapper waypoint files (.mmw), MapSend waypint files (.wpt) or specially formatted .txt or .xls files. There is no conversion module to automate the importing of files in other formats.

Importing a text file (*.txt)

In order to import a .txt waypoint file in .txt format, the file must contain the following information:

- A command line: "$PMGNWPL"
- A numeric field is the latitude in DDMM.MMMMM (Degrees.Minutes.Decimal Minutes to 5 places)
- An N (or S) for north (or south) latitude
- A second numeric field for the longitude in DDDMM.MMMMM format (Degrees/Minutes/Decimal Minutes to 5 places)
- An E (or W) for east (west) longitude
- A third numeric field (in the example below, a zero) for the altitude
- A field for a message (indicated in the example below by the letter "M")
- A field containing the waypoint's name (WPT001, WPT002)
- A final field containing a code for selecting an icon

After importing a file you can easily edit waypoint names, icons and messages in MobileMapper Office.

Example of a waypoint file in .txt format:
$PMGNWPL,3721.08731,N,12156.18597,W,0,M,WPT001,,a*2D
$PMGNWPL,3721.12816,N,12156.15346,W,0,M,WPT002,,a*28

Importing an Excel file (*.xls)

It is also possible to import waypoints in Microsoft Excel files if the format is correct. The following is an example of what information must be in each column.

Note: the first row with column headers is mandatory (keep headers in English).

#	Name	Icon	Message	Latitude	Longitude	Altitude (m)	Latitude (degrees)	Longitude (degrees)	Icon ID
1	WPT001	Crossed Square		N37°21.087'	W121°56.186'	0	37.35145517	-121.93643283	a
2	WPT002	Crossed Square		N37°21.128'	W121°56.153'	0	37.35213600	-121.93589100	a
3	WPT003	Crossed Square		N37°21.090'	W121°56.070'	0	37.3515.367	-121.93450083	a
4	WPT004	Crossed Square		N37°21.039'	W121°56.093'	0	37.35065350	-121.93488717	a

Naming Conventions for Rover and Reference Files (Post-Processing Option)

Suppose you have created a new job named “JOB1.MMJ.” You selected the post-processing job mode in MobileMapper so that it records GPS measurement files in addition to JOB1.MMJ. The table below illustrates how these files will appear at various stages of the differential correction process:

Rover file seen on receiver	JOB1.MMJ
Rover file seen on MobileMapper Transfer’s left window, before download	JOB1.MMJ
Rover file seen on MobileMapper Transfer’s right window, after download	JOB1.MMJ
Rover files seen with Windows Explorer, after download	JOB1.MMJ, JOB1.B00, JOB1.D00, JOB1.E00 and JOB1.W00
Rover file seen on MobileMapper Office’s Differential Correction window	JOB1

Suppose you have logged a reference station file on MobileMapper. The table below illustrates how the resulting files will appear at various stages of the differential correction process:

Reference file seen on receiver	Not Seen
Reference file seen on MobileMapper Transfer's left window, before download	0001a04.034 (for the first file recorded at reference station site ID 0001 on the 34th day of 2004
Reference file seen on MobileMapper Transfer's right window, after download	b0001a04.34, d0001a04.34, e0001a04.34 and w0001a04.34
Reference files seen with Windows Explorer, after download	b0001a04.34, d0001a04.34, e0001a04.34 and w0001a04.34
Reference file seen on MobileMapper Office's Differential Correction window	b0001a04.34

The rover files with a B, D, E or W in the extension represent files with different GPS measurements all related to the original rover file. MobileMapper Office handles the information in these files automatically. But if you archive your files, you should include them in the archived directories.

The reference files that start with B, D or E are similarly handled automatically by MobileMapper Office but should be archived together with the rover files.

Reference files recorded by non-MobileMapper receivers may have other naming conventions.

Defining a User Map Datum

The receiver software allows you to define the full set of 9 parameters defining a map datum. After pressing MENU and selecting Setup>Map Datum>Primary/Secondary and "USER" in the prompted list, you now have access to two different screens on which these 9 parameters are presented:
1st screen:
Delta A (meters)
Delta F (X 10,000)
Delta X (meters)
Delta Y (meters)
Delta Z (meters).

2nd screen (select Next> at the bottom of the 1st screen to access this screen):
Rotation X (sec)
Rotation Y (sec)
Rotation Z (sec)
Scale factor (ppm).

Whether you are in the office using MobileMapper Office, or in the field working with your receiver, the system lets you create the user map datum you need.

However you will not use the same methods in the receiver and in MobileMaper Office to define the semi-major axis and flattening for your user datum.

In MobileMapper Office, you will use the conventional way of defining a user datum, i.e. by entering the semi-major axis (*a*), the inverse flattening (*1/f*) and the other 7 parameters.

The method used in the receiver is different as it is based on the use of parameters Δa (Delta A)and Δf *(Delta F)* –known as the *Molodensky* parameters– instead of *a* and *1/f*. The other 7 seven parameters are exactly the same as those in MobileMapper Office.

Δa and Δf are defined as follows:

Δa *(m) = a(WGS 84) - a(Local Datum)*

Δf *= f(WGS 84) - f(Local Datum)*

Note that the flattening (*f*), instead of the inverse flattening (*1/f*), is used in the expression of Δf. So we have:

$$\Delta f = \left[\frac{1}{\frac{1}{f}(WGS84)}\right] - \left[\frac{1}{\frac{1}{f}(Local)}\right]$$

Because the resulting Δf is a very small quantity, it is multiplied by 10 000 to make it easier to handle. (The resulting value is closer to 1.) It is *this* value that you have to enter in the Delta F field on the handheld screen.

Calculation example:

	6 378 137	6 378 388
	298.257 223 563	297

		Complete the fields below on the receiver screen using the values of Δa and 10000xΔf, below, left):
Δ	- 251 m	Delta A (meters)
	$3.352\ 810\ 665 \times 10^{-3}$	
	$3.367\ 003\ 367 \times 10^{-3}$	
Δ	$-- 0.014\ 192\ 702 \times 10^{-3}$	
Δ	- 0.141 927 02	Delta F (X10,000)

Δa and Δf of Frequently Used Datums

Airy	6377563.396	299.3249646	573.604	0.11960023
Australian National	6378160.0	298.25	-23.0	-0.00081204
Bessel 1841	6377397.155	299.1528128	739.845	0.10037483
Bessel 1841 (Nambia)	6377483.865	299.1528128	653.135	0.10037483
Clarke 1866	6378206.4	294.9786982	-69.4	-0.37264639
Clarke 1880	6378249.145	293.465	-112.145	-0.54750714
Everest	6377276.345	300.8017	860.655	0.28361368
Fischer 1960 (Mercury)	6378166.0	298.3	-29.0	0.00480795
Fischer 1968	6378150.0	298.3	-13.0	0.00480795
GRS 1967	6378160.0	298.247167427	-23.0	-0.00113048
GRS 1980	6378137.0	298.257222101	0.0	-0.00000016
Helmert 1906	6378200.0	298.3	-63.0	0.00480795
Hough	6378270.0	297.0	-133.0	-0.14192702
International	6378388.0	297.0	-251.0	-0.14192702
Krassovsky	6378245.0	298.3	-108.0	0.00480795
Modified Airy	6377340.189	299.3249646	796.811	0.11960023
Modified Everest	6377304.063	300.8017	832.937	0.28361368
Modified Fischer 1960	6378155.0	298.3	-18.0	0.00480795
South American 1969	6378160.0	298.25	-23.0	-0.00081204
WGS 60	6378165.0	298.3	-28.0	0.00480795
WGS 66	6378145.0	298.25	-8.0	-0.00081204
WGS 72	6378135.0	298.26	2.0	0.0003121057
WGS 84	6378137.0	298.257223563	0.0	0.0

Shortcut Keys

Control-Z	In feature library editor, undoes last deletion.
Alt-F	Displays File menu items.
Alt-F-N	Opens a new file in MobileMapper Office or in the Feature Library Editor (same as Control N).
Alt-F-O	Opens an existing file in MobileMapper Office or in the Feature Library Editor (same as Control O).
Alt-F-S	Saves the file in MobileMapper Office or in the Feature Library Editor (same as Control S).
Alt-F-A	Saves the file open in MobileMapper Office or in the Feature Library Editor with a different name.
Alt-F-X	Exits MobileMapper Office or the Feature Library Editor.
Alt-T	Opens the Tools Menu.
Alt-T-F	Opens the Feature Library Editor.
Alt-T-B	Opens the Background Map window.
+/- key or mouse wheel	Zooms in or out in Map Display area.
Shift-Left arrow / Shift-Right arrow	Selects previous / next point in selected line or area feature.
Delete key	Deletes selected feature.
Shift-Delete	Deletes selected individual point in line or area feature.
Direction keys + Control key	Pans the map horizontally or vertically.
Mouse wheel + Control key	Pans the map horizontally.
Mouse wheel + Shift key	Pans the map vertically.
Pg Up, Pg Dwn, Home, End keys	Pans the map diagonally.

Example of Adding a New Provider of Reference Station Data

See also *Adding a New Provider on page 123*.

The CORS sites shown on the map display area are part of the following CORS networks:

- International GPS Service
- National Geodetic Survey (United States)
- Réseau GPS Permanent (France)

You can add other networks and their providers and also automatically download their data. There are two requirements:

- First, the reference station data must be available as individual files listed on an ftp site. MobileMapper Office cannot access data available from Worldwide Web pages, although it is possible to manually download such files for post-processing.
- Second, the data files must be named according to certain conventions.

For example, month codes must consist of either two digits or three characters (see list below).

[d]	1-digit day of week (0-6, Sunday is 0)
[dd]	2-digit day of month (00-31)
[ddd]	3-digit day of year (001-366)
[h]	1-char RINEX file hour (a-x, where a = 00 GMT and x = 23 GMT)
[hh]	2-digit hours (00-23)
[mm]	2-digit minutes (00-59)
[MM]	2-digit month (01-12)
[MO]	2-character month (e.g., JA-DE for sites using English)
[Mon]	3-character month (e.g., Jan-Dec for sites using English)
[S]	1-character site ID (upper case)
[ssss]	4-character site ID (lower case)
[SSSS]	4-character site ID (upper case)
[wwww]	4-digit GPS week number (e.g., 1047)
[y]	1-digit year (0-9)
[yy]	2-digit year (00-99)
[yyyy]	4-digit year (e.g., 2005)

Note that codes are provided between brackets. When inputting file name conventions into MobileMapper Office, you must type in both the brackets and the letters in between exactly in the same way as listed above.

Note that codes are case-sensitive when you type them into MobileMapper Office because the path names on most ftp sites are case-sensitive. The permissible ranges are indicated between parentheses.

CORS data providers may describe their file naming rules in a file posted on the ftp site, e.g. ftp://www.ngs.noaa.gov/cors/README.txt or on pages you can find on providers' web sites, e.g. http://igscb.jpl.nasa.gov/components/dcnav/cddis_data_daily_yym.html.

You can, in a more empirical way, find the data structure used by providers on their sites, for example by locating the required data and then parsing the syntax of the downloadable file name so you can deduce the parameters you have to specify in RINEX Download's Add Provider dialog box.

To illustrate the process of adding a CORS data provider to the list of supported providers, we will use the IGS Global Data Centre (IGS GDC) - IGNI (Institut Géographique National - France) as an example.

Manually locate the daily data you need, e.g.:

ftp://igs.ensg.ign.fr/pub/igs/data/2005/270/artu2700.05d.Z as the Observation file and:

ftp://igs.ensg.ign.fr/pub/igs/data/2005/270/artu2700.05n.Z as the Navigation file.

By analyzing the syntax of these links, it is easy to fill in the different parameters required in RINEX Download's Add Provider dialog box:

FTP Host: igs.ensg.ign.fr

OBS Files: /pub/igs/data/[yyyy]/[ddd]/[ssss][ddd]0.[yy]d.Z

NAV Files: /pub/igs/data/[yyyy]/[ddd]/[ssss][ddd]0.[yy]n.Z

Time Span: 1440 min. for daily data.

Here is another example using as provider the IGS Regional Data Centre (IGS RDC) - BKGI (Federal Office of Carthography and Geodesy - Germany)

Example of downloadable Observation file:

ftp://igs.ifag.de/IGS/obs/2005/270/ajac2700.05d.Z

Navigation file:

ftp://igs.ifag.de/IGS/obs/2005/270/ajac2700.05n.Z

Or a global Navigation file merged from all IGS sites:

ftp://igs.ifag.de/IGS/BRDC/2005/270/brdc2700.05n.Z

The resulting RINEX Download entries to be used in the Add Provider dialog box are:

FTP Host: igs.ifag.de

OBS Files: /IGS/obs/[yyyy]/[ddd]/[ssss][ddd]0.[yy]d.Z

NAV Files: /IGS/BRDC/[yyyy]/[ddd]/brdc[ddd]0.[yy]n.Z

Time Span: 1440 min. for daily data.

Mission Planning Utility

Mission planning is a separate utility provided along with MobileMapper Office that you can launch from the Windows task bar (select Start>Programs>MobileMapper Office>Mission Planning)

Mission Planning allows you to know which GPS satellites should be visible from a given observation point on the surface of the Earth, and for a given period of time (max. 24 hours).

Please refer to the on-line User's Guide that is accessed via the program's Help menu to know more about this utility. ❒

Glossary

Attribute: A description item of a feature.

Attribute value: One of the possible values that can be ascribed to a feature.

Base Station: See Reference Station.

B-File: A binary MobileMapper data file containing GPS measurement data.

Carrier phase data: Phase angle measurements for the 1575 MHz radio wave carrying the GPS coded messages. Using carrier phase data greatly improves GPS accuracy.

Datum: A mathematical definition of a surface from which coordinates of a given system are referenced.

D-File: A binary MobileMapper data file created by field collection software and stored in the receiver.

DGPS: Differential Global Positioning System. Commonly used to refer to real-time differential correction techniques.

Differential Correction: The process of:

(1) calculating how much to adjust GPS measurements to reduce the difference between a location's surveyed coordinates and the coordinates calculated by a GPS receiver that is kept stationary over that point; and

(2) the application of these adjustments to the GPS measurements recorded by any number of receivers within a few hundred kilometers of the "reference receiver."

Differential GPS: See DGPS.

E-File: A binary MobileMapper data file containing GPS ephemeris data.

Ephemeris Data: Information transmitted from a satellite which allows the GPS receiver to determine the satellite's position in space.

Export: Converting field data files to GIS Formats and writing them to any directory visible to the PC.

Feature: Any element located in the field that you wish to record for further uploading into a GIS database for example. A feature can represent a real object (streetlight, park, electrical transformer, etc.) or on the contrary, something invisible or impalpable (gas, noise level, dose of fertilizer, etc.).

Each new feature that you log in the field can only be an “emanation” or “offshoot” of one of the feature types described in the feature type library associated with the job in progress. The logging procedure will be different depending on the type of the feature you are logging.

To log a feature: Means to save the characteristics of a feature into the receiver's memory. The user is in charge of entering the description of this feature whereas the receiver is responsible for saving the GPS position(s) it has determined on this feature.

To describe a feature: Means to give each attribute of the feature one of the prompted values for this feature.

Feature Library: A file containing all the feature types required for a given job. (In fact we should say “Feature Type Library”.)

Feature Type: An item present in a feature library. Each feature type is defined by a geometry type, a name, a certain number of possible attributes and the list of possible values for each attribute. There are four different geometries in feature types: point, line, area and grid.

Field: Any area on MobileMapper's screen dedicated to displaying the value of a parameter. Some fields are user-editable, some others are not.

Geographic Information System: A system of digital maps, data analysis software and a database of features, attributes and geographic locations.

GIS: See Geographic Information System.

Global Positioning System: A system of satellites providing worldwide coverage for positioning information. Although installed and maintained by the United States, the broadcast signals are available to anyone anywhere in the world.

GPS: See Global Positioning System

GPS satellite geometry: The satellite distribution at a given location. measured by the PDOP index

GPS signal multipath: Occurs when the GPS signal arrives at the antenna by a path other than a straight line. Multipath signals make the receiver think that a GPS satellite is farther away than it is and the resultant position is inaccurate.

Job file: File containing a feature type library and a collection of features that grows as you log new features in the field with this job file open. All the features in the job file necessarily "originate" from the feature types present in the job file's feature type library.

Nesting: This word is used to describe a feature that you are logging whereas another feature is already being logged.

PDOP: Positional Dilution of Precision. An accuracy factor derived from the geometry of the constellation of GPS satellites used to calculate a position. In general, the more widely distributed the satellites are in the sky, the greater the accuracy. In general, PDOPs less than 10 are good.

Post-processing: Differential corrections applied to GPS positions in a PC - after both rover and reference data are logged and downloaded. Post-processing is slower but more accurate than real-time differential correction.

RTCM: Radio Technical Commission for Maritime Services. Commonly refers to a format of real-time DGPS format.

Reference Station: A stationary GPS receiver logging, or broadcasting, data from a known point. The data is used for differential correction. Reference Station is synonomous with Base Station.

RINEX: Receiver Independent Exchange Format. A "universal" GPS measurement data format designed to allow compatibility b tween different brands of GPS receivers.

Shapefile: A set of GIS files invented by ESRI but published as an open file standard readable by most GISs. A shapefile consists of a map file (SHP), a file containg feature descriptions (DBF), a file relating the map locations with the feature description (SHX) and sometimes a file containing coordinate system information (PRJ).

Waypoint: A pre-determined coordinate point to which a GPS receiver can navigate. GPS receivers can also log waypoints in the field for later navigation. GPS for GIS receiver have largely replaced waypoints with point features.

WGS-84 coordinate system: World Geodetic System, 1984. The coordinate system is used by GPS receivers for computing their positions. ❐

Index

R

S

T

U

W

MobileMapper™ Office

User Manual

Magellan
Mobile Mapping Solutions Contact Information:
In USA +1 408 615 3970 ▪ Fax +1 408 615 5200
Toll Free (Sales in USA/Canada) 1 800 922 2401
In South America +56 2 273 3214 ▪ Fax +56 2 273 3187
Email mobilemapping@magellangps.com

In Singapore +65 6235 3678 ▪ Fax +65 6235 4869
In China +86 10 6566 9866 ▪ Fax +86 10 6566 0246
Email mobilemappingapac@magellangps.com

In France +33 2 28 09 38 00 ▪ Fax +33 2 28 09 39 39
In Germany +49 81 6564 7930 ▪ Fax +49 81 6564 7950
In Russia +7 495 956 5400 ▪ Fax +7 495 956 5360
In the Netherlands +31 78 61 57 988 ▪ Fax +31 78 61 52 027
Email mobilemappingemea@magellangps.com
www.magellangps.com

MAGELLAN®
PROFESSIONAL

P/N 631514-01C