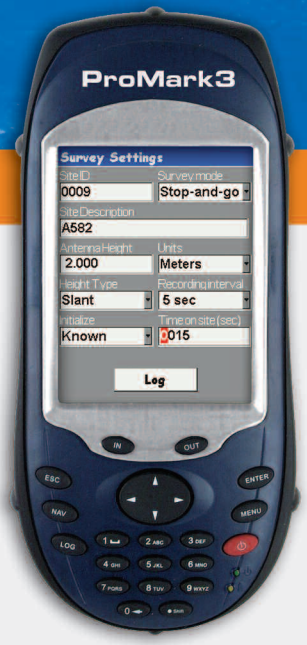
MAGELLAN®
PROFESSIONAL

ProMark™3

Reference Manual



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FCC Notice
This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by Magellan Navigation could void the user's authority to operate this equipment.
CAUTION: To comply with FCC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.

CE In the presence of RF field, the receiver's satellite signal strength may degrade. When removed from the RF field, the signal strength should return to normal.

RSS-210
This device has been found compliant with the Canadian RSS-210 specification, issue 5, November 2001 which stipulates that operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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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.

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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.

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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 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 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.

6. EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES

MAGELLAN NAVIGATION SHALL NOT BE LIABLE TO PURCHASER OR ANY OTHER PERSON FOR ANY INDIRECT, 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 OFMAGELLAN 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.

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7. COMPLETE AGREEMENT

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 WARRANTY GIVES YOU SPECIFIC RIGHTS. YOU 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 MAY NOT APPLY TO YOU.

8. CHOICE OF LAW.

This limited warranty is governed by the laws of France, 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.

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

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

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1. Introduction

What is the ProMark3 System?

ProMark3 is a complete GPS system providing precision surveying, GIS feature collection and navigation. A typical ProMark3 system includes two ProMark3 GPS receivers, GPS antennas, and all ancillary components required to get you up and running and producing quality data in a minimum amount of time.

x 2

Surveying

The ProMark3 system utilizes standard tripods or fixed-height GPS tripods to position system components above a given survey point. The ProMark3 receiver collects signals broadcast from GPS satellites, and stores this information in its internal solid-state memory or an SD Card. The collected data is extracted from the ProMark3 receiver via a cable to an office computer for post-processing.

The ProMark3 System operates in conjunction with GNSS Solutions, Magellan Navigation's highly-automated GPS post-processing engine.

GNSS Solutions is a complete, easy-to-use software package which manages and processes raw GPS data, deriving precise positioning data and presenting the results in easily understood report formats.

Mobile Mapping

The ProMark3 receiver enables you to map and describe GIS features and then format the data so that later it can be uploaded to a GIS. It offers an easy-to-use and easy-to-deploy solution for general mapping and for asset management.

ProMark3 combines all the navigation capabilities with feature attributing software to support GIS data collection in the field.

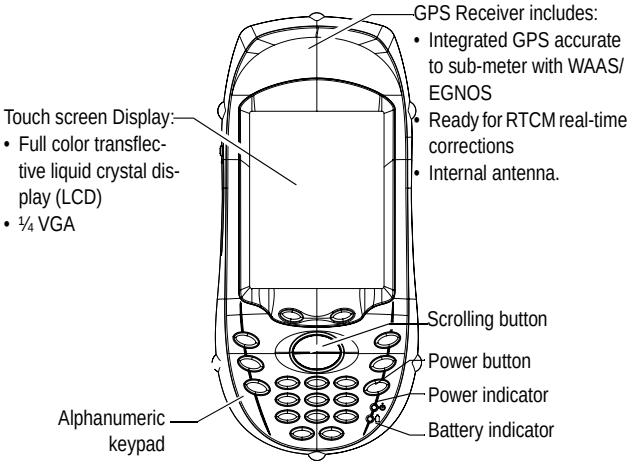
The ProMark3 receiver operates in conjunction with MobileMapper Office. This office software operates as the interface between ProMark3 and your GIS. MobileMapper Office is also used to refine feature positions for all those field jobs run in post-processing mode.

Items Supplied with ProMark3

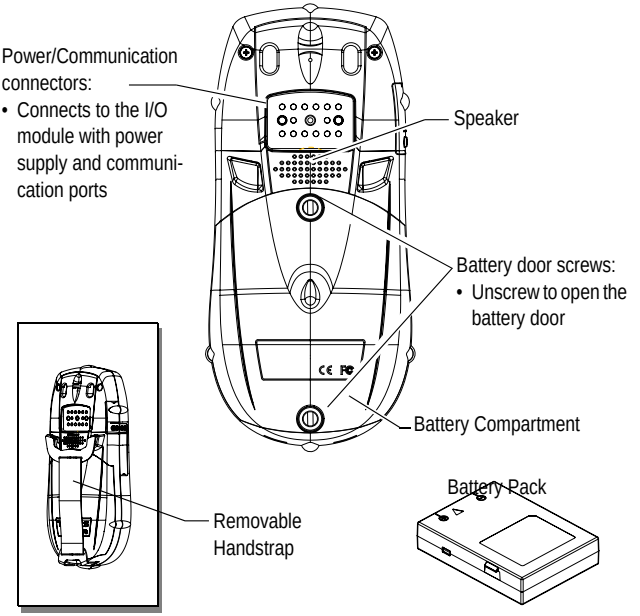
The items supplied with ProMark3 are described in the following paragraphs.

ProMark3 Receiver

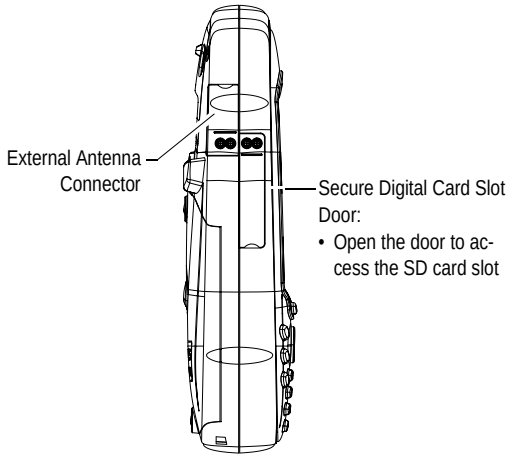
Front Panel



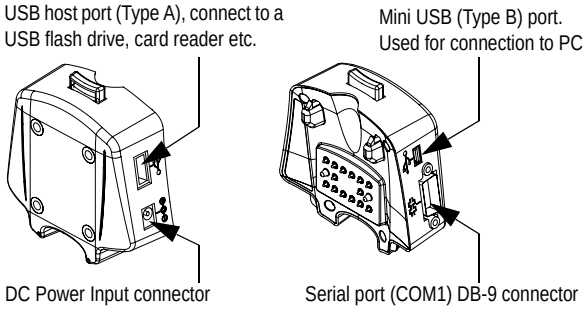
Back Panel:



Side Panel



I/O Module



USB Cable

The USB cable is used to connect the ProMark3 to an office computer via the ProMark3's I/O module. Use the mini USB port for this connection and not the USB host port.

The mini USB port is located next to the RS232 Sub-D port on the I/O module. Refer to diagrams on *page 4*.

AC Adapter/Charger

This device is used to power supply the ProMark3 from the AC power line.

If an internal battery has been inserted into the ProMark3 unit, this device will also provide a charging current for the battery. (Battery charging will be monitored by the ProMark3 unit).

External GNSS Antenna

The external GNSS antenna is required for surveying functions. While the built-in antenna is sufficient for navigation, a more sophisticated external antenna is required to obtain quality data for precision surveying. The external GNSS antenna is the physical data collection point for the raw GNSS satellite data. For this reason, it must be accurately positioned over the point to be surveyed, using a standard tripod or fixed-height GPS tripod.

External Antenna Cable

The external antenna cable connects the ProMark3 receiver to the external antenna. The small end of the cable fitted with a right-angle plug connects to the ProMark3. The large end of the cable screws onto the external antenna.

Vertical Antenna Extension

The vertical antenna extension provides clearance for the antenna cable when the antenna is mounted on a tripod. The length is 3 inches (0.0762 m).

Field Receiver Bracket

The field receiver bracket provides the means for mounting the ProMark3 receiver to the tripod.

HI (Height of Instrument) Measurement Tape

The HI measurement tape is used to measure height of the GPS antenna over the survey point. The end of the tape hooks onto the antenna. The tape is extended until the spike on the tape case is on the point. Then the height of the antenna is noted on the tape.

Field Bag

The field bag is used to transport the components of each ProMark3 receiver system between the office and the field.

User Documentation & MobileMapper Office Software CD

This CD includes the MobileMapper Office software required to interface ProMark3 with your GIS and post-process your field data.

This CD also includes the ProMark3 Getting Started Guide and the ProMark3 Reference Manual.

Initializer Bar and Antenna Adaptor

(Provided with two-receiver systems only.)

The initializer bar can be used to initialize your surveys from a base. This 0.20-m bar should be mounted on the base tribrach before use. The antenna adaptor will be inserted at the free end of the initializer bar and will temporarily receive the rover antenna during the initialization phase.

GNSS Solutions CD

(Provided with two-receiver systems only.)

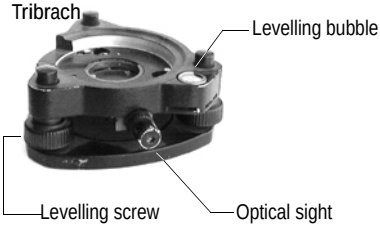
The GNSS Solutions software provides the tools required to download and process the GPS satellite data from each ProMark3 receiver to produce relative positions of all points surveyed. GNSS Solutions is provided on a CD which also contains a reference manual and tutorial supplement.

Additional Items Required but not Supplied

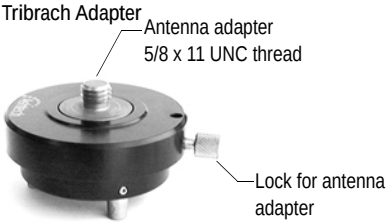
For Static Surveys or Base Stations

These items allow you to firmly position the GPS antenna over the survey point or station site (see opposite) at a measurable height from the ground.

These items (tripod, tribrach and tribrach adapter) are illustrated below.



Tribrach Adapter mounted to Tribrach:



An option to the tripod, tribrach and tribrach adapter combination is the fixed-height GPS tripod (see below).

For Kinematic Surveys

An option for mounting the ProMark3 rover when operating in kinematic mode is a range pole (see below).

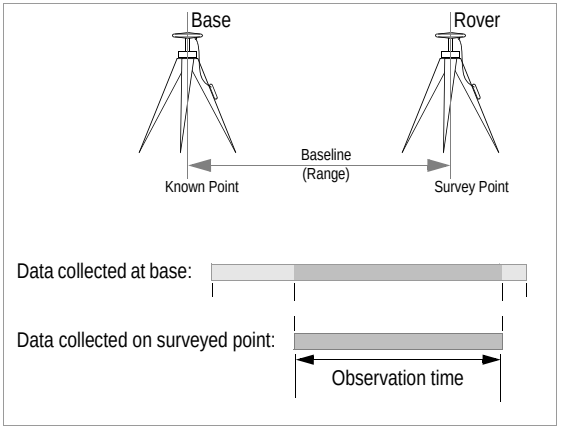
Specifications

Parameter	Specification
GPS survey mode supported	Static, Stop-and-go, Kinematic
Survey accuracy (RMS) - Static	Horizontal: 0.005m + 1 ppm Vertical: 0.010m + 2 ppm
Survey accuracy (RMS) – Stop-and-go	Horizontal: 0.012m + 2.5 ppm Vertical: 0.015m + 2.5 ppm
Real-Time Performance	SBAS (WAAS/EGNOS) RMS: Horizontal < 1 meter (3 feet) DGPS (Beacon or RTCM) RMS: Horizontal < 1 meter (3 feet)
Survey point spacing - Static (vector length)	Up to 20 kilometers
Survey point spacing – Stop-and-go (vector length)	Up to 10 kilometers
Observation time - Static	4 to 40 minutes typical, depending upon vector length
Observation time – Stop-and-go	15 seconds typical
Initialization time – Stop-and-go	15 seconds on known points 5 minutes on initializer bar
GPS satellite channels	12
SBAS satellite channels	2
GPS satellite elevation mask	10 degrees
Recording interval	1 – 30 seconds
Operating temperature range	-10 to +60 degrees C
Battery type	3.7 V Li-Ion, 3900 mAh
Battery life	8 hours (typical operation)
Data storage memory capacity	128 MB SDRAM, 128 NAND Flash Memory Removable SD Card: up to 1 GB

Surveying with ProMark3

The ProMark3 system is designed to perform GPS surveys using static, stop-and-go, and kinematic modes of GPS data collection. The three modes run independently.

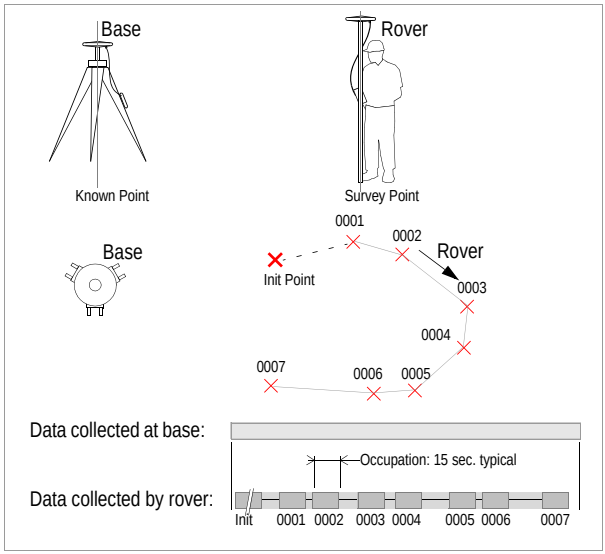
In the *Static* data collection mode, the GPS receiver systems simultaneously collect raw data from all available satellites while remaining stationary on their respective points. Data collection continues at these locations for a duration dependent upon the distance between the receivers, the satellite geometry, and the obstruction conditions at the data collection locations (i.e., trees or buildings blocking some of the sky).



When data collection is complete at these specific points, you move the GPS receiver systems to a new set of points to begin another data collection session. In most cases, one GPS receiver system will remain on its current point (pivot point) in order to link the previous set of points to the new set of points, in leap-frog fashion. After data collection is complete, data is downloaded form the GPS receivers to an office computer for post-processing using the GNSS Solutions software.

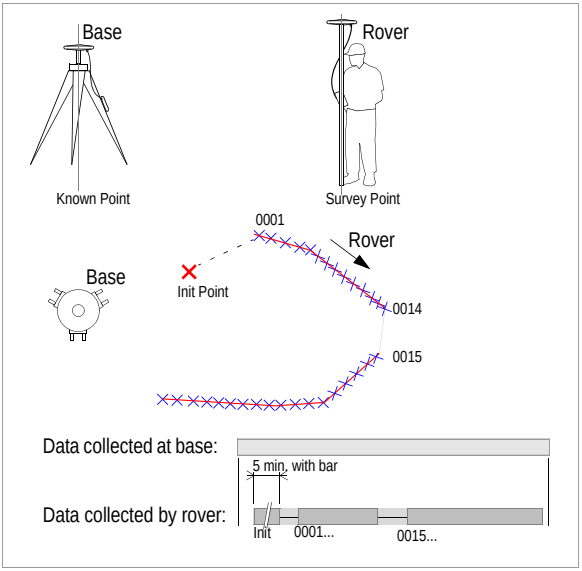
The post-processing activity computes vectors (position differences) to determine the position of all observed points relative to one or more fixed point positions. The static data collection method produces the most accurate and reliable results of any mode of GPS data collection. This is due primarily to the extended observation periods required for static data collection.

In the *Stop-and-Go* data collection mode, the GPS receiver systems simultaneously collect raw data from all available satellites while stationary on their respective points and while moving between points. In most cases, one GPS receiver is located on a known point serving as a base station collecting data at that location for the duration of the survey. Additional GPS receivers are used to locate objects and move between points. The occupation period for the stop-and-go method is much shorter than the static method.



After data collection is complete, data is downloaded from the GPS receivers to an office computer for post-processing using the GNSS Solutions software. The post-processing activity computes vectors (position differences) to determine the position of all observed points relative to one or more fixed point positions. The Stop-and-Go data collection method is faster than the static method, but not as accurate since the occupation period is much shorter.

In the *Kinematic* data collection mode, the GPS receiver systems simultaneously collect raw data from all available satellites while a receiver is moving.



In most cases, one GPS receiver is located on a known point serving as a base station collecting data at that location for the duration of the survey.

Additional GPS receivers are used to locate linear objects such as roads or collect data in a linear fashion for developing topographic elevation data.

The recording interval should be set to collect the amount of data needed relative to the speed of travel.

A recording interval too long will result in insufficient data.

After data collection is complete, data is downloaded from the GPS receivers to an office computer for post-processing using the GNSS Solutions software. The post-processing activity computes positions of all observed points relative to one or more fixed point positions. The Kinematic data collection method is best used for delineating linear type features such as roads, fences, lakes, etc.

Mobile Mapping with ProMark3

The ProMark3 system is also designed to log GIS features in a job file.

GIS features can be of the following types: points, lines, areas and grids. Grid features are Magellan's specific features detailed in *Logging GIS Data on a Preset Grid Feature on page 102*.

ProMark3 provides in real-time the length of the line you are logging or the surface area of the area you are logging.

You don't need an external antenna or any other accessories to collect GIS jobs. You just need to hold the unit at 45° from horizontal, not too close to you, and make sure you constantly have an open view of the sky.

When you start a new GIS job, ProMark3 asks you to:

1. Choose a feature library for the job.

   A feature library lists all the possible feature types you will see in the field. It also provides all the possible attributes for each feature type and all the possible values for each attribute.

   After you have chosen a feature library, you will only be able to log features that comply with those prompted in this library. You will not be able to add an extra feature type or an extra attribute to an existing feature. So choosing a library implies that you know the type of job you want to do.

2. Choose between Real-Time and Post-Processing.

   GIS features can be logged in Real-Time or Post-Processing mode.

   In Real-Time mode, any logged feature is georeferenced using the real-time position determined by the ProMark3.

   In Post-Processing mode, it is also the real-time position that is associated with each logged feature but you have the possibility to improve the accuracy of this real-time solution through post-processing. This can be achieved using MobileMapper Office.

After making these two choices you can start logging your GIS features in the open job. The navigation screens may be helpful to guide you to the features you have to go to.

When you are next to the feature type you want to log, a point feature type for example, describing the feature is very quick and easy as you just have to scroll through the different attributes prompted by the library and set them according to the information you get from the field (examples: the “color” of the feature is “black” or the “condition” of the feature is “needs maintenance”, etc.).

In the background, ProMark3 will add georeferencing information (i.e. one position for a point feature, several positions for a line or area feature) to the description of the feature.

After data collection is complete, data is downloaded from the ProMark3 to an office computer using the MobileMapper Transfer utility of the MobileMapper Office software.

From this software you can export the job to your GIS in a standard GIS format (SHP, MIF, CSV or DXF).

If the job was logged in Post-Processing mode, MobileMapper Office will allow you to post-process the job. Real-time positions of features will be differentially corrected using raw GPS data from a nearby reference station.

You can also use MobileMapper Office to upload a previous job to ProMark3. In this case, the ProMark3 will be used to update the content of this job. The different features contained in the job will be revisited in the field to update their attribute values or positions.

Navigating with ProMark3

The ProMark3 includes a wide range of navigational capabilities that you will find useful in your day-to-day surveying and mobile mapping operations. Two useful navigation features are:

- The map screen can be utilized to help you find a project site.
- The ProMark3 serves as an excellent reconnaissance tool. You can enter the known coordinates of the feature you wish to recon as a waypoint, and use ProMark3 to navigate to within 3 meters (10 feet) of the feature in the field. Be sure to select the correct map datum and coordinate system (use the USER option from the Map Datum list to define a custom map datum).

More information on SBAS is available at http://www.faa.gov/asd/international/sbas.htm More information on WAAS is available at the FAA web site http://gps.faa.gov/Programs/WAAS/waas.htm. More information on EGNOS is available at http://www.esa.int/EGNOS/.

ProMark3 includes the capability to utilize SBAS (Space-Based Augmentation System).

SBAS includes the Wide Area Augmentation System (WAAS) for the North American continent and the European Geostationary Navigation Overlay System (EGNOS) to provide improved positioning accuracy.

These systems calculate errors in the GPS signal, then transmit correction messages to capable GPS receivers. Typical accuracy with SBAS is three meters, although this accuracy can be degraded by multipath reflections and poor satellite geometry.

ProMark3 can also deliver real-time DGPS position fixes for your navigation using the MobileMapper Beacon from Magellan or any other external corrections receiver.

Time Spent in The Field

In general, the amount of time required to occupy a point depends on several factors:

1. **Distance between survey points**. In general, the greater this distance, the longer the observation time.
2. **Environmental conditions**, or the amount of obstruction or canopy preventing a completely open sky view. Some obstructions may block the reception of the satellite signal, requiring longer observation times to collect additional data for accurate processing.

   Too much obstruction prevents ProMark3 (or any GPS receiver) from receiving enough data to establish quality survey positions.
3. **Satellite Geometry** (PDOP): This refers to the position of the satellites that are orbiting the earth. If the satellites are positioned poorly (i.e. all on one side of the sky), it is more difficult to get an accurate position. The Mission Planning Tool in GNSS Solutions assists in planning survey times with optimal geometry.

Static

You will find that Static observation times will vary between 4 and 40 minutes depending upon factors 1, 2, and 3 above. The Observation Range feature of ProMark3 is designed to assist in determining observation times.

The Observation Range takes into consideration the number of satellites and satellite geometry, and determines when enough data has been collected for a given distance between points.

For more information on the observation range, please refer to pages *44* and *50*.

Stop-and-Go

Since the Stop-and-Go method requires an initialization, the occupation times are much shorter than the static method.

Initialization on a known point can be accomplished in as little as 15 seconds with a 1 second recording interval.

Initialization with the initializer bar is typically 5 minutes.

Stop-and-Go point occupations can be accomplished in as little as 15 seconds with a 1 second recording interval.

These occupation times may vary depending upon the three factors 1, 2 and 3 described above.

Kinematic

The Kinematic method also requires an initialization as detailed in the Stop-and-Go method.

Kinematic data collection does not use an occupation timer since kinematic data is collected while moving. The recording interval must be set to a value that properly matches the speed you are moving.

A recording interval set too slow may result in data that does not represent the feature being surveyed. A recording interval set too fast may result in data too dense for a particular application (This is also true in Static and Stop-and-Go).

The base and kinematic units must be set to the same recording interval for successful kinematic survey.

Mobile Mapping

The ProMark3 needs 2 or 3 seconds to open a feature, record at least one epoch and close the file successfully. So when you open a point feature, please record for 2 or 3 seconds before closing the feature. To improve accuracy of point features, we recommend recording for 30 seconds - or even longer for optimal accuracy.

For jobs performed in post-processing mode, the time requirements are those defined above for Stop-and-Go and Kinematic surveys keeping in mind that all GIS/Mapping jobs implicitly use an OTF initialization.

Where to Find Information

This manual is designed to guide you through the ProMark3 Surveying and Mobile Mapping procedures as well as provide general reference. You can find additional information in the following documents:

ProMark3 Getting Started Guide: This manual describes the basic procedures to start using ProMark3 in surveying and mobile mapping. It also briefly explains how to download your field data to the office software and how to process this data.

GNSS Solutions Reference Manual: This manual provides detailed instructions for post-processing and presenting the data collected by ProMark3.

MobileMapper Office User Manual: This manual provides detailed instructions for interfacing the ProMark3 with your GIS.

Magellan Navigation FTP site: Many useful documents relating to the ProMark3 are available at the following FTP site: ftp://ftp.magellangps.com/Reference Manuals/ProMark3

2. Preparing For First-Time Use

Charging the ProMark3 Battery Pack

Battery Life
ProMark3 will run for 8 hours with its internal battery in typical conditions of use.

The ProMark3 includes a rechargeable, replaceable battery pack. Before using the receiver, you must first charge the battery pack:

1. Locate the removable battery provided.
2. Open the battery door, located in the back of the receiver using a screwdriver or a coin.
3. Insert the battery –label side upward, contacts towards the top of the unit– into the battery compartment:

4. Close the battery door and tighten the screws.
5. Attach the Clip-on I/O module to the receiver as shown below (Insert bottom first, hold down release button, press I/O module against unit and release button):

6. Connect the AC adapter (see below) and then let it charge the battery for approximately six hours.

Connect cable from AC adapter to this input

7. To detach the clip-on I/O module, press the release button on the module.

Control Buttons

Under the screen you will see eight buttons located around a large oval “scrolling” button with 4 directional arrows on it.

IN/OUT: Use these buttons to zoom in and out when viewing a screen with a map displayed.

ESC: Takes you back to the previous screen without effecting any changes or scrolls navigation screens in reverse order.

NAV: Takes you to the various navigation screens where you can locate yourself and navigate to waypoints and features.

LOG: With no job started yet, gives access to the Survey screen or lets you create or open a GIS job. With an already started job and with a navigation screen displayed, takes you back to the Survey or GIS screen last displayed.

ENTER: Use this button to accept highlighted input and to initiate various functions.

MENU: Valid only after you have entered the Survey or GIS function. Provides access to a variety of functions such as setting up the receiver or selecting targets to navigate to various locations.

⏻ red power button: Turns on and off the unit.

Scrolling button: This four-arrow button has several functions:

- It is used to move the cursor in the chosen direction, from a data field to another, from an option in a menu to the previous or next option.
- In a highlighted field, the left/right arrow moves the cursor backward/forward; The up/down arrow increments/decrements the highlighted figure or string.
- On the Map screen, a navigation screen, this button allows you to switch to cursor mode and then to move the cursor in the chosen direction.

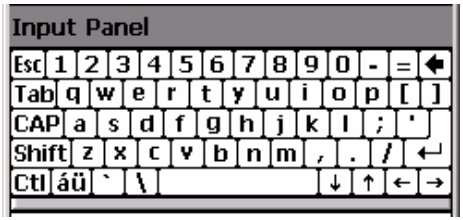
Alphanumeric keypad: ProMark3 uses a telephone-style alphanumeric keypad.

Buttons 2-9 contain alphanumeric characters. By pressing the key repeatedly, all characters on that key will be scrolled.

For example, the letters a, b, and c are associated with the "2" key. Tapping the key once enters an "a," twice enters a "b," three times enters a "c" and four times enters a "2."

Note that the "0" key includes the backspace. So if you have to enter "00", wait about 1 second before entering the second "0" or else you might delete the first "0".To adjust the repeat delay and rate, see *Keyboard on page 179*.

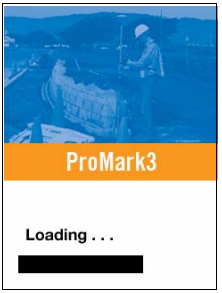
On-screen "virtual" keypad: This keypad is displayed at the bottom of the screen whenever data entry is requested. This means you can use this keypad rather than the unit keypad if you wish.



The on-screen keyboard is fitted with special keys such as the Shift and CAP keys to switch between upper and lowercase, the backspace key to delete the last entered character, a space key, etc.

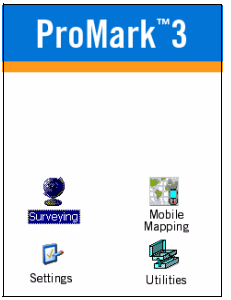
Using this keypad to enter alphabetical characters is more straigtforward as you just need to tap the corresponding key on the touch screen.

Turning On/Off the Receiver



ProMark3 start-up screen

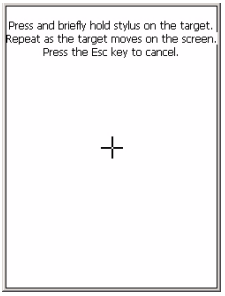
Once you have charged the battery, hold down the red key (the power button) on the front of the receiver until the power indicator turns solid green. You will first see the receiver's start-up screen (see opposite left). Wait for the progress bar to complete its sequence. The screen then displays the ProMark3 workspace with its 4 main icons: Surveying, Mobile Mapping, Settings and Utilities (see opposite right).



ProMark3 Workspace

When you need to turn off ProMark3, simply press the ⏻ red key until the screen displays the Shut Down window and then tap OK.

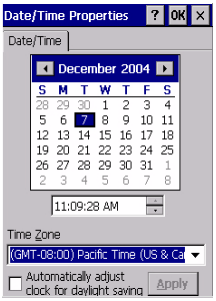
Calibrating the Screen



For the first-time use, you need to align your display screen so the cursor on the touch screen align with the tip of your stylus. Use the stylus pen to tap the center of each target that appears on the Calibration screen with the tip of the stylus. Tap anywhere on the display when finished.

To re-calibrate your screen at anytime, double-tap the Settings icon then double-tap Stylus from the list, tap the Calibration tab and then follow the instructions.

Automatic System Time Update

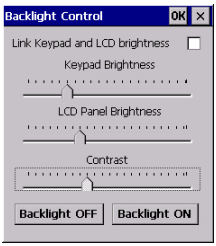


ProMark3 will automatically update the system date & time using the GPS time determined by the integrated GPS receiver and the time zone that you specify. To set the time zone:

- In the ProMark3 workspace, double-tap the **Settings** icon.
- Double-tap the Date/Time function. This opens the Date/Time Properties screen.
- Set the time zone field (see opposite) and then select **OK** on top of the screen.

  Please note that you should wait for a few seconds, after turning on ProMark3, before system time can effectively be updated.

Adjusting the Backlight



To switch the backlight on/off for both the keypad and display, or to adjust the brightness and screen contrast, double-tap the **Settings** icon on the ProMark3 workspace and then double-tap the **Backlight Control** function.

To conserve battery power, we recommend you to switch the backlight off whenever possible.

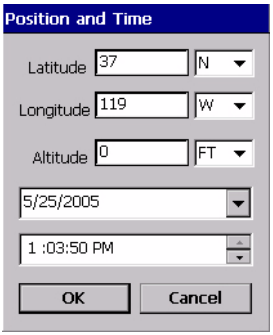
For other settings, please refer to *Setup Menu on page 149*.

Initializing GPS

Please Go Outside to Perform Initialization!
Initialization is required when 1) the receiver is brand new, 2) you have moved more than 500 miles from the last place you were using it, 3) memory has been completely erased or 4) the receiver has not been used for more than a few months.

Take the receiver to a location where there is a clear view of the sky, then:

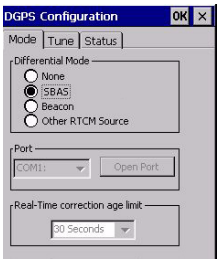
- From the ProMark3 workspace, double-tap successively the Utilities icon and then the GPS Init icon.
- Scroll down the list of continents and double-tap the continent where you are located (see figure below, left.) Similarly double-tap the country where you are located. Finally indicate the current time and date (see figure below, right.) and click OK.



The very first initialization of a GPS receiver may take a few minutes.

Initialization can be faster if you know the approximate coordinates of your current location. Rather than select your continent on the figure above left, just tap the Enter Coordinates button on this screen, then enter the approximate coordinates of your location plus the date and time and then tap OK. This will speed up the initialization phase.

DGPS Real-Time Configuration



The ProMark3 GPS receiver integrates SBAS signal reception. You can also use corrections from an external correction source, such as MobileMapper Beacon, a belt-mounted, Bluetooth-enabled beacon receiver connected to serial port COM1 or via a Bluetooth port, or from any other RTCM source.

For more information on using ProMark3 with an external corrections receiver, refer to *Using MobileMapper Beacon on page 184* or *Using Another RTCM Source on page 190*.

To open the DGPS Configuration window (see opposite), double-tap the Utilities icon on the ProMark3 workspace and then double-tap the DGPS Configuration icon.

If you want a differentially-corrected real-time position, make the appropriate setting.

Selecting the Surveying or Mobile Mapping function

From the ProMark3 workspace, do the following:

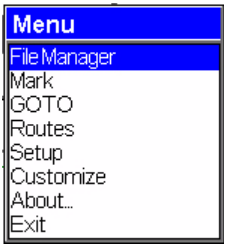
- Double-tap the Surveying icon if you want to perform a Static, Kinematic or Stop & Go survey
- Or double-tap the Mobile Mapping icon if you want to perform a GIS/Mapping job.

Whatever your choice, ProMark3 will then display a navigation screen.

Just press the NAV or ESC button to scroll through the different available navigation screens.

For more information on Navigation screens, please refer to *Navigation on page 126.*

Preliminary Settings



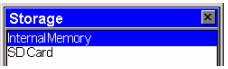
Now that ProMark3 displays a navigation screen, press MENU and double-tap Setup.

There are many options to select among, and all are explained in full in *Setup Menu on page 149*. For the purposes of getting started, however, we will concentrate on just a few of these options.

As a general rule, tap an option to open the corresponding setting window. Then tap the desired value. This will enable the value and take you back to the Setup menu. You can also return to the Setup menu by pressing the ESC button.

Notice: These settings can be performed from within either the Surveying or MobileMapping function.

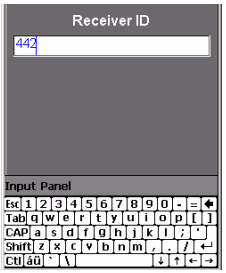
Storage



ProMark3 can store your jobs either in its internal memory or on the SD card you have inserted in the unit. Tap the desired option.

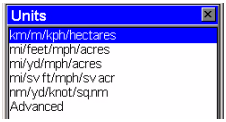
Receiver ID

(From within Surveying function only)



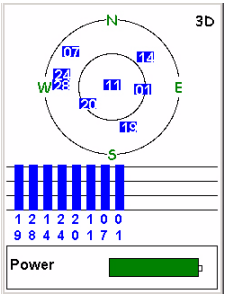
The Receiver ID screen provides you with the ability to enter the 4-character receiver ID which is used in naming the raw data files. Each raw data file from this receiver will include this 4-character receiver ID. It is important that each of your receivers use a unique Receiver ID.

Units



You select this option to set the units of measurement you want to use. Units are presented in this order: long distances, short distances, speed and area. You can set these units to "kilometers, meters, kph and hectares" or "miles, feet, mph, acres" if you like, or to three other standard sets of units. You can also create a custom mix of units by selecting the **Advanced** option that contains a wide variety of units for distance, speed, elevation, bearing and area

Checking that ProMark3 is Ready For Field Operations



Satellite Status screen

Press NAV repeatedly until the Satellite Status screen is displayed. This screen shows which satellites the receiver is tracking and where they are located in the sky. If you are not tracking 3 or more satellites you may have to move to a more open area.

When used with its internal antenna, the receiver will have the best view of the sky when you hold it at an angle of 45 degrees and not too close to you.

This allows the internal antenna to function optimally for the best accuracy.

In Survey jobs for which the external antenna is used, only the vertical orientation of this antenna is important.

3. Surveying

This chapter presents step-by-step procedures for performing a GPS survey with the ProMark3 system. Review this chapter thoroughly before attempting to perform your first survey. As an exercise, take your system outside of your office and perform a sample survey following the procedures outlined below. Then download and process the collected data with GNSS Solutions. After this exercise, you will be ready to perform your first real survey with the ProMark3 system.

Introduction to Static Surveying

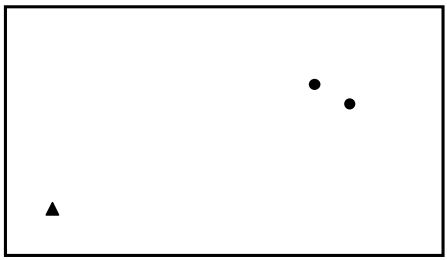
Prior to venturing out into the field, you must first plan how you will execute your static survey. Proper planning will greatly increase the chances of success. There are two primary areas of static survey planning, the *network design* and *observation plan*. Each is discussed below.

Network Design

You have identified a survey for which you wish to use the ProMark3 system to establish control. Regardless if the number of control points to be established is 2 or 20, you must design a network defining the number and location of observations (vectors in our case) that will be required to effectively position the new points.

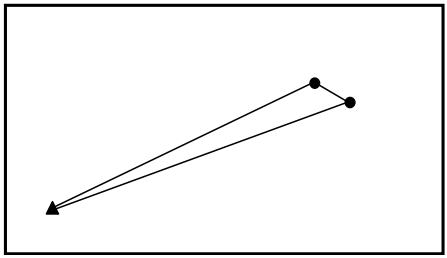
As an illustration, consider an example where two new intervisible points are to be established on a project site for use as control for a boundary survey. The two new points need to be tied to an existing control point 3 kilometers (1.9 miles) away.

Three-Point Control Survey Example



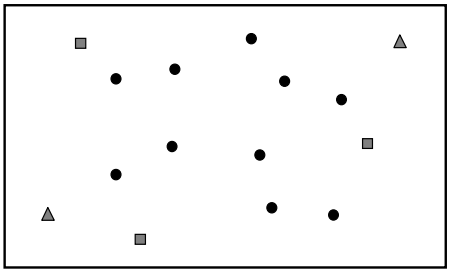
If you were to perform this survey with a conventional total station, you would probably plan on running a closed-loop traverse from the existing control point through the two new points (see figure below). The same philosophy can be used for GPS surveys. The figure below is your network design for this survey

Closed-Loop Traverse Design



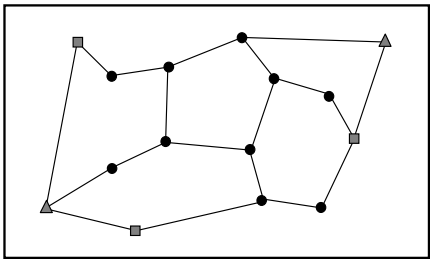
The previous example resulted in a very simple network design. The figure below represents a more complex control survey where 10 new points are to be established based on 2 existing horizontal and 3 existing vertical control points.

15-Point Control Survey Example



Again, if you were to perform this survey with a conventional total station, you would design a traverse plan which produced a strong looking network of closed-loop traverses through the points of the survey. The figure below shows one possible network design.

Network Design for 15-Point Control Survey



Although this network design was produced with conventional traversing in mind, this same design can also be used if performing the survey with GPS equipment.

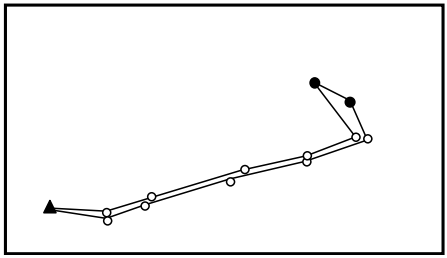
When designing your network, keep the following principles in mind:

- Design loops through the network points which resemble a square or circle. Avoid loops that are long and skinny. Circular or square shaped loops are stronger geometrically.
- Keep the number of points in each loop fewer than 10.
- Always include a direct link between intervisible points, i.e. points which may be used as a pair for orientation of a conventional traverse. Since, in most instances, intervisible points are relatively close to each other, it is important to get a direct observation between them.

Observation Plan

With the network design completed, the next step is to determine how and when data collection will be performed to produce the desired network. First let's discuss the how.

If you were to use a conventional total station to perform our three-point survey example, your resulting traverse could probably look something like this:

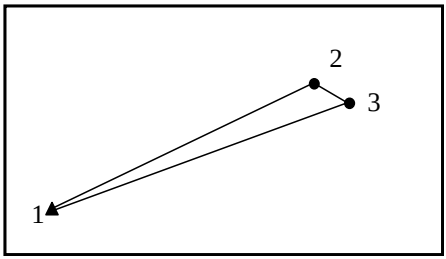


Closed-Loop Traverse of 3-Point Control Survey

The number of traverse legs required to traverse between each point in the network will depend upon the conditions on the ground between the points.

If you are in luck, the area is relatively flat and there is a straight road running from the existing control point to the two new points to be established, thus minimizing the number of legs required to complete the loop.

Surveying with GPS has the advantage of not requiring line-of-sight between the points surveyed. This allows for direct observations between the points. To illustrate this, let's take our 3-point control survey network design, shown again below.

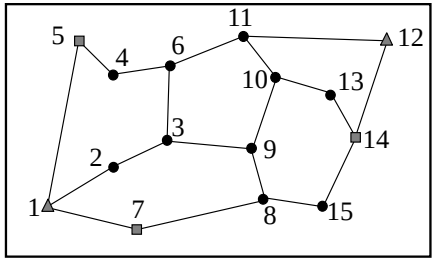


Network Design for 3-Point Control Survey

Assume that a 2-receiver ProMark3 system will be used to perform the above survey. To produce the link between the existing control point 1 and the new point 2, simply place one ProMark3 receiver system on point 1, place the other receiver on point 2 and simultaneously collect data between the two points. When the observation is complete, move the ProMark3 receiver from point 2 to point 3. Perform another observation, simultaneously collecting data on points 1 and 3. When completed, move the ProMark3 receiver from point 1 to point 2. Perform the final observation between points 3 and 2. When this data is downloaded and processed, the result will be three vectors (delta positions) forming the network design seen in the above figure.

Now consider the situation where a 3-receiver ProMark3 system is used. By placing one receiver on each of the 3 points in our network, the data for all three vectors can be collected in one observation, rather than the 3 separate observations required with using a 2-receiver system.

Now consider the observation plan for the more complex 15-point survey, shown again below.



Network Design for 15-Point Control Survey

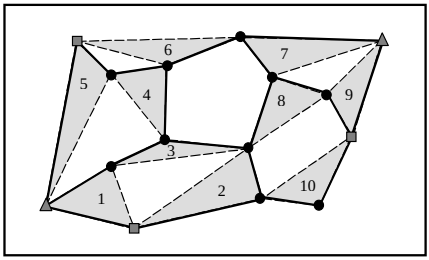
To execute this network design, you must perform a direct GPS observation between all points directly linked. Each link can be viewed as a required GPS vector. Counting the links in this network design, you will find that 19 GPS vectors are required to execute this design.

If the survey was to be performed using a 2-receiver ProMark3 system, 19 separate data collection sessions (observations) would be required. For example, you can start with a receiver on point 1 and another on point 2. After this observation, you would move the receiver from point 1 to point 3 to perform an observation between points 2 and 3, and so on until all vectors were observed.

Now consider the situation where the 15-point control survey above is to be performed using a 3-receiver ProMark3 system. With 3 receivers, each observation session will produce 2 vectors from the network design. For example, you may start by placing one receiver on point 1, the second on point 2, and the third on point 7. These three receivers would simultaneously collect data on these three points, resulting in the vectors between points 1 and 2, and points 1 and 7. In addition to these two vectors, a third vector is produced between points 2 and 7. At the end of this first observation, you could move the receiver from point 2 to point 9 and the receiver from point 1 to point 8.

The receiver at point 7 would remain as the pivot point, connecting the first observation to the second. This would continue until all vectors were observed.

The figure below shows what the observation plan might look like with a 3-receiver ProMark3 system.



Receiver Observation Plan for 15-Point Control Survey

The observation plan shows that it will take 10 separate observation sessions to complete the survey based on the network design shown on page 36.

Notice that all observation sessions, except for session 6, produce 2 vectors required from the network design. Observation 6 produces only one since there were an odd number of required vectors (19).

This completes the discussion on how to execute the observation plan.

The next question to answer is “When do we perform the observations?”

The best time to perform GPS surveys is determined by an examination of the GPS satellite constellation at your location for a given time of day. The number of visible GPS satellites and the distribution of the satellites in the sky are important factors impacting the observation time required to produce quality GPS vectors.

Times when the number of visible GPS satellites is low or the satellite distribution is poor will require extended data collection periods to ensure quality results. In rare instances, availability and distribution may be so poor that you are better off not performing your survey during these periods.

Included in the GNSS Solutions processing software package is a module called Mission Planning. The Mission Planning software provides you with the tools to examine the GPS satellite constellation. Using satellite almanac information, which predicts the location of the GPS satellites into the future, you can examine satellite availability and distribution for the day(s) when you wish to perform your survey to isolate any time periods were observation times may need to be extended or periods where it is best not to collect data.

You provide the software with your current location and the date when you wish to perform your survey. The software then provides you with multiple ways of examining the satellite constellation at your location for the given time. Pay particular attention to satellite availability (number of satellites in view) and the satellite distribution.

To assist in analyzing the quality of satellite distribution, Dilution of Precision (DOP) values are presented. DOP is a quality analysis value for satellite distribution. The most popular DOP value is PDOP, which stands for Positional Dilution of Precision. The PDOP value estimates the impact on the precision of your GPS observations due to satellite geometry. The smaller the PDOP value the better the satellite distribution (geometry) and therefore the better the precision of your observations.

With the current constellation of 26+ GPS satellites, it is uncommon to find periods in the day when satellite availability and distribution are so poor that data collection should be avoided. Time of poor availability and distribution are usually short in duration.

When using the static mode of GPS data collection, where observation times are usually 20+ minutes, short periods of poor availability and distribution can be tolerated.

When performing an observation during which a period of poor availability and distribution appears, observation times will normally need to be extended to compensate for this event.

The ProMark3 receiver includes a feature which estimates the observation time required to produce a quality solution. This feature is called the “Observation Range” and is discussed in more detail later on in this chapter. The Observation Range (or Observation Timer) takes into account satellite availability and distribution when determining the required observation time. If you are collecting data during a period of poor availability and distribution, you will find the Observation Timer will take longer to inform you when your survey is completed. It is automatically extending the observation period to compensate for the poor availability and distribution of satellites.

Analysis of the satellite constellation with Mission Planning prior to data collection will give you an idea of the time periods when extended observations will be required

NOTE: The ProMark3 receiver is designed to store GPS data for only those satellites that are at least 10° above the horizon. The receiver may lock onto a satellite between 0° and 10° but will not record this data. When using the Mission Planning software to analyze the satellite constellation, be sure to set the satellite cut-off angle to 10°. This will ensure that the satellite availability and distribution presented by Mission Planning matches what is being used by the ProMark3 receiver for data storage.

NOTE: The ProMark3 will track up to 12 satellites simultaneously. If more than 12 are available, ProMark3 will track the 12 satellites with the highest elevation.

Running a Static Survey

The procedures for performing a static survey with the ProMark3 system can be broken down into five primary categories: equipment check, site selection, system setup, static survey setup and data collection. Following the steps presented below should result in successful execution of your GPS survey.

Note: Remember that data must be simultaneously collected between 2 or more ProMark3 receiver systems in order to produce vectors between the receivers. Therefore, the following procedures must be followed for each ProMark3 receiver system used in the survey. There is no problem in setting up one ProMark3 receiver system and then moving to another site to set up another. Just be aware that the observation time is determined by the last receiver set up. For example, if you were alone and wanted to perform a survey with a 2-receiver ProMark3 system, you could set up the first receiver and start data collection. You could then move to the next site and set up the second receiver. Only when the second receiver is collecting data does simultaneous data collection begin. All the data collected by the first receiver up to this time is of no use and will be ignored during data processing.

Equipment Check

Prior to leaving the office to perform your survey, be sure to perform a thorough check of your GPS equipment:

1. Check through the ProMark3 system to ensure all components are present to successfully perform the survey.
2. Check to ensure that you have sufficient battery power to complete the survey. Bring along a spare set of batteries for insurance.
3. Bring along a copy of your network design and printout of the satellite availability and distribution analysis. These will be needed throughout the course of your survey.

With the equipment check completed, it's time to move to the field to perform your survey.

Site Selection

Proper site selection of performing GPS data collection is critical to the success of your survey. Not all sites are appropriate for GPS data collection.

GPS depends on reception of radio signals transmitted by satellites approximately 21,000 km from Earth. Being of relatively high frequency and low power, these signals are not very effective at penetrating through objects that may obstruct the line-of-sight between the satellites and the GPS receiver.

Virtually any object that lies in the path between the GPS receiver and the satellites will be detrimental to the operation of the system. Some objects, such as buildings, will completely block out the satellite signals. Therefore, GPS can not be used indoors.

For the same reason, GPS cannot be used in tunnels or under water. Other objects such as trees will partially obstruct or reflect/refract the signal; reception of GPS signals is thus very difficult in a heavily forested area.

In some cases, enough signal can be observed to compute a rough position. But in virtually every case, the signal is not clean enough to produce centimeter-level positions. Therefore, GPS is not effective in the forest.

This is not to say that your ProMark3 surveying system can only be used in areas with wide-open view of the sky. GPS can be used effectively and accurately in partially obstructed areas. The trick is to be able to observe, at any given time, enough satellites to accurately and reliably compute a position.

At any given time and location, 7-10 GPS satellites may be visible and available for use. The GPS system does not require this many satellites to function. Accurate and reliable positions can be determined with 5 satellites properly distributed throughout the sky. Therefore, an obstructed location can be surveyed if at least 5 satellites can be observed. This makes GPS use possible along a tree line or against the face of a building but only if that location leaves enough of the sky open to allow the system to observe at least 5 satellites.

For the above reasons, make every effort to locate new points to be established in areas where obstructions are at a minimum. Unfortunately, the site location is not always flexible.

You may need to determine the position of an existing point where, obviously, the location is not debatable. In situations were an existing point is in a heavily obstructed area, you may be forced to establish a new point offset from the existing point, or preferably a pair of intervisible points, and conventionally traverse to the required point to establish its position.

Be aware that obstructions at a GPS data collection site will affect the observation time required to accurately determine its location. Obstructed areas will require longer observation times.

The *Observation Range* function of the ProMark3 will automatically extend observation times at obstruction sites but in some cases, it may not extend the observation period long enough. You will have to use your own judgement of observation times when surveying obstructed site. Your judgement will improve through experience.

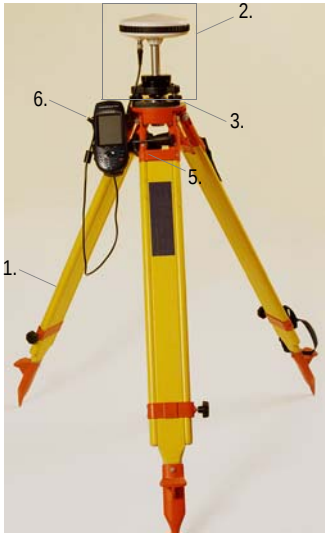
For large surveys utilizing 3 or more ProMark3 receiver systems, you may want to reckon all the site locations as part of your survey planning. This will eliminate any delays during the actual execution of the survey if problems are encountered finding an appropriate site.

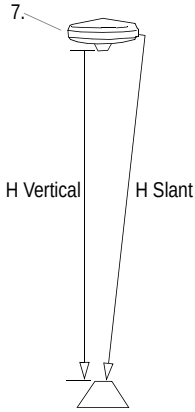
The more receiver systems utilized during the survey, the harder the task of coordinating the data collection becomes.

Remember, data must be collected simultaneously between points where a vector is desired. If one receiver operator is late in starting data collection due to problems with site location, this could cause problems.

System Setup (Base and Rover)

Now that the survey site is identified, it is time to set up the ProMark3 receiver system over the point to be surveyed. The setup procedure is illustrated below.





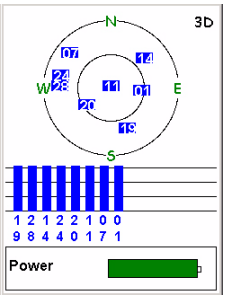
Typical setup with tripod is described here. You can also use a fixed-height tripod.

1. Set up the tripod / tribrach combination over the survey point.
   This is done in precisely the same manner as for a conventional total station. If using a fixed-height GPS tripod rather than a conventional tripod, a tribrach is not required.

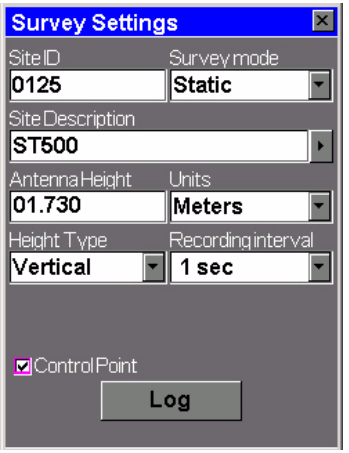
2. Attach the vertical extension bar and a tribrach adapter to the GPS antenna.
   With the GPS antenna in hand, attach the included vertical extension bar to the 5/8-11 thread on the bottom of the antenna. Attach a tribrach adapter to the other end of the vertical extension bar. If using a fixed-height GPS tripod rather than a conventional tripod, a tribrach adapter is not required
3. Place the GPS antenna assembly on the tripod.
   Be careful not to disturb the tripod when mounting the antenna assembly.
4. Place the ProMark3 receiver into the field bracket.
   With the field bracket in hand, insert the two flexible hooks located at the top of the bracket into the slots on either side of the loudspeaker grid at the back of the receiver and then tilt the receiver into place.
5. Attach the field bracket / ProMark3 combination onto the tripod.
6. Connect the GPS antenna cable to the unit
7. Measure and record instrument height (HI) of GPS antenna.

Static Survey Setup (Base and Rover)

1. Turn on the receiver by pressing the ⏻ red key. Wait for the ProMark3 workspace to appear on the screen.
2. Double-tap the **Surveying** icon to run the Surveying function. The screen displays the navigation screen that was last displayed.
3. Make the settings required when first using the Surveying function:
   - Press the MENU key
   - Tap **Setup**. In the Setup menu, tap successively the options you need to set. Remember you need to define the **Storage** medium (internal memory or SD card) and the **Receiver ID**. Skip step 3 when next using the Surveying function.
4. Press the NAV key until you see the Satellite Status screen (see opposite). Wait until at least 4 satellites are received.
5. When there is enough satellites received, press the LOG key. The **Survey Settings** screen opens.



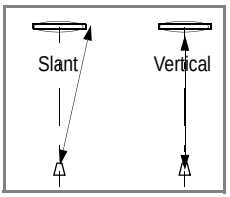
Satellite Status screen



You must assign a unique site ID to each point surveyed.

6. Enter the following parameters:
   - Site ID: Tap inside the field and enter a 4-character string using the virtual (on-screen) or real keyboard. Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the site ID.
   - Survey Mode: For a static survey, tap the currently selected mode and then tap Static.
   - Site Description: (Optional) Tap inside the field and enter a narrative description of the point (20 characters max.). Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the content of this field.

     When several Site Descriptions have previously been defined, you can quickly retrieve these by tapping the left arrow to the right of the field. The list of existing descriptions then appears in which you can tap the desired one. This automatically sets the Site Description field on the Survey Settings screen.
   - Antenna Height: Tap inside this field and enter the vertical distance between the antenna and the surveyed point. Be careful when entering the antenna height as this field uses a fixed format (xx.xxx). Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the content of this field.
   - Units: Tap inside this field and then tap the unit used to express the antenna height (meters, US feet or Int feet)

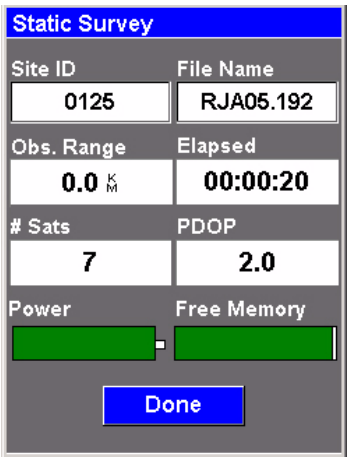


- Height Type: Tap inside this field and then tap the method used to measure the antenna height: Slant if you measured the antenna height to the outside edge of the GPS antenna, or Vertical if you measured the antenna height to the bottom of the GPS antenna mounting thread (see opposite).
- Recording Interval: Tap inside this field and then tap the recording interval (time in seconds between any two consecutive acquisitions of GPS data) you wish to use in your static survey. *Make sure the same recording interval is used at the base and in the rover.*
- Control Point check box: If you tap on this box to check it, you will be able, later on, to use the point associated with this Site ID as a control point.

Data Collection

7. Tap the Log button at the bottom of the screen.

The Static Survey screen opens providing information on the status of your survey during the data collection period.



With an antenna that has the best possible view of the sky, you should have #Sats *continuously greater than 4 and* PDOP *continuously less than 4.*

Obs. Range *is equivalent to* Obs. Timer *in ProMark2.*

Information provided here will help you determine when enough data has been collected.

- Obs. Range (Observation Range): Indicates the maximum length of the baseline that could be accurately determined through post-processing considering the amount of data currently collected. The more you collect data, the larger the value displayed in this field.
- Elapsed: Displays the amount of time since data storage began for the current observation session. The update rate of this field is tied to the recording interval you have chosen.

- # Sats: Displays the current number of healthy satellites – seen above the elevation mask – being logged into memory.
- PDOP: Displays the PDOP value at any given time, computed from all observed healthy satellites above the elevation mask.

- Site ID: Reminds you of the name you have given to the point you are surveying.
- File Name: Indicates the name of the file in which data is being collected. The file is automatically named by the receiver according to conventions provided in *Appendices* on *page 192*.
- Current Power and Memory statuses in graphical form.

8. When according to the Obs. Range parameter on the rover, enough data has been collected in this observation session (this implies that you must have a rough idea of the distance between the base and the rover), tap the Done button at the bottom of the screen or press the ENTER key.
9. Follow the steps presented above for each observation session required to complete your survey. After data collection is complete, take all ProMark3 receivers used in the survey to the office and download the data to an office computer as described in *Office Work with GNSS Solutions Software on page 79*. The data is now ready for post-processing using GNSS Solutions.

Introduction to Kinematic Surveying

The kinematic data collection process requires at least two receivers collecting data simultaneously.

One receiver is called the base and must remain stationary throughout the data collection. Typically, the base receiver will occupy a survey point for which the precise position is already known.

Once operational, the base system simply collects and stores raw data from all satellites with line of sight to the GPS antenna (cf. Static survey).

The kinematic base is essentially the same as a static occupation.

The other simultaneously operating GPS receiver(s) during a kinematic survey is (are) designated as the rover(s). The rover unit(s) can move during the survey and are used to position new points relative to the base.

There are two types of kinematic survey supported by the ProMark3 system:

- Stop-and-go (designated as “stop-and-go” in the receiver menus)
- Continuous kinematic (designated as “kinematic” in the receiver menus).

Stop-and-Go

Stop-and-go surveying is best suited for collection of points. During Stop-and-go, the system is centered over a point and collects data for a period of time. The occupation time for stop-and-go will typically range from 15-60 seconds.

It is highly recommended that a pole with bipod legs be used for Stop-and-go data collection to insure that the antenna is stable during this data collection period.

Once the point occupation is finished the system can be carried to the next survey point and the procedure is repeated.

Kinematic

Continuous kinematic data collection is suited for collecting bulk points with minimal attributing (terrain modelling) or linear features such as a road centerline.

During continuous kinematic data collection the user never has to stop moving. A point is collected every time the receiver records a data record.

The recording interval for this application would typically be 1-5 seconds, and the accuracy is typically 0.03 to 0.05 meters.

The rover system is designed to be carried easily and is mounted entirely to a range pole.

Kinematic data collection has the advantage of high productivity. However there are some trade-offs to be considered. Accuracy is not as good as with GPS static data collection methods (see data sheet for specifications). In addition, field procedures require more planning and care.

Before beginning the kinematic survey, the rover unit must go though an initialization stage. Initialization lasts from 15 seconds to 5 minutes depending on conditions. Procedures for initialization will be described in detail later in this manual.

During the kinematic data collection, the receiver must maintain lock on at least 5 satellites which are common at both the base and rover stations.

If the receiver detects that less than 5 satellites are tracked, it will send out an alarm indicating that the system must be re-initialized.

In cases of loss of lock due to obstructions, it is possible that the accuracy of processed results will be degraded if re-initialization is not performed in the field. Therefore, re-initialization in the field after a loss of lock is critical to maintaining survey accuracy.

Finally, kinematic surveys are most successful when the kinematic base receiver is close to the kinematic rover. Accuracies of GPS-derived positions are distance-dependent. The greater the distance between the GPS receivers, the larger the uncertainty.

In an ideal case, the kinematic base should be on the same project site as the kinematic rover. Kinematic surveys with a separation of more than 10 kilometers (6 miles) between the kinematic base and rover should be avoided. Such a separation makes kinematic initialization more difficult, increasing the chances of poor results.

When performing a kinematic survey, ProMark3 provides you with the tools to perform the following tasks:

- Manage data files in the GPS receiver
- Enter pertinent survey point attribute information required for data processing
- Monitor the progress of the kinematic survey.

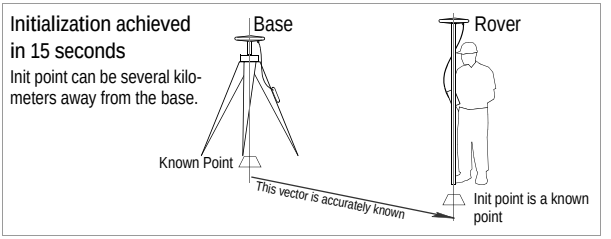
Initialization Methods

The initialization phase is required to ensure that your kinematic surveys, whether continuous or Stop & Go, will reach centimeter-level accuracies through post-processing.

With the "Known" method, you can make a survey at a fairly long distance from the base.

Three possible methods, from fastest to slowest:

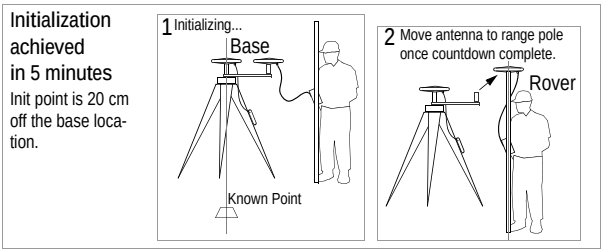
- Known: Initialization on Known point.



1. You have to enter the Site ID of the known point
2. GPS antenna held stationary over known point for about 15 seconds
3. Countdown indicates when initialization is achieved.

- Bar: On Initializer Bar Installed at the Base

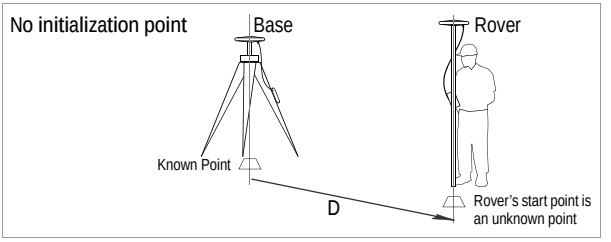
Conversely, with the "Bar" method (the method we recommend), your survey will necessarily start from the base and obviously the points to be surveyed should not be too far away from the base.



1. You freely enter a Site ID for the rover's start point
2. GPS antenna held stationary on the initializer bar for about 5 minutes.
3. Countdown indicates when initialization is achieved.
4. Move the antenna from the bar to the range pole taking care not to mask the antenna while doing this. Then start your job

- <None>: On The Fly (OTF) Initialization

With the "<None>" method, the survey start point can be any point but you should have a rough idea of the distance from your working area to the base so you can estimate the overall time you should spend collecting data (15 to 30 minutes typical).



1. You freely enter a Site ID for the rover's start point
2. There is no countdown indicating when initialization is achieved.

Allowing for kinematic initialization using Initializer bar at the base

"Known" point means a point that is stored in the receiver's memory as a control point.

With the "Known" initialization method, the total duration of the survey required for a successful survey increases with the distance from the rover to the base.

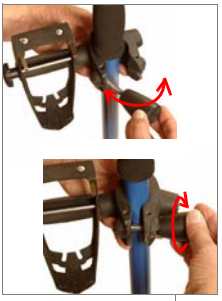
Running a "Stop & Go" Survey

Base Setup and Operation

The base is setup and operated in the same way as it is in static surveys (see *page 45*). The only difference is the possible use of the initializer bar at the base station.

The base antenna should be centered and levelled above the known point. To be able to use the initializer bar for initialization, be sure to incorporate the bar as part of the base setup as shown opposite. This bar gives an accurate baseline of 0.2 m (0.656 ft) for initialization.

Rover Setup



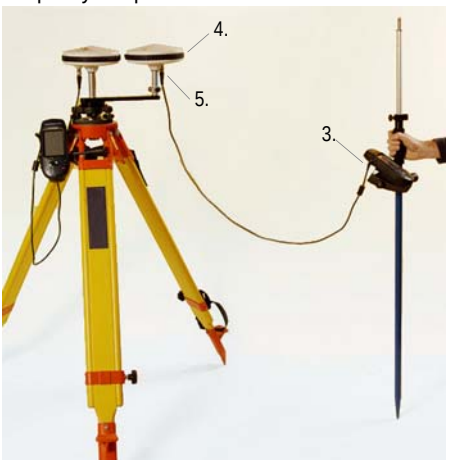
1.

Install the unit on its range pole:

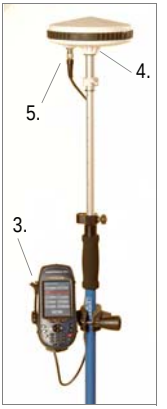
1. Attach the field bracket onto the pole.
2. Place the ProMark3 receiver into the field bracket.
3. Connect the GPS antenna cable to the unit.
4. Mount the GPS antenna on top of the pole or, in the case of a bar initialization, at the end of the base's initializer bar.
5. Connect the other end of the antenna cable to the rover antenna.

2.

Temporary Setup for Bar Initialization:



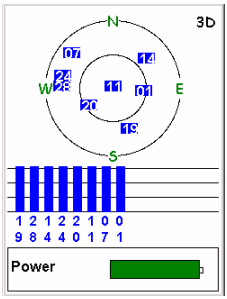
Setup for Known or <None> Initialization
(and Final Rover Setup after initialization step)



Stop & Go Survey Rover Setup

1. Turn on the receiver by pressing the ⏻ red key. Wait for the ProMark3 workspace to appear on the screen.

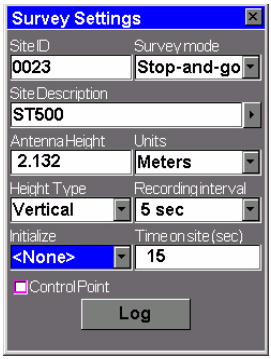
2. Double-tap the **Surveying** icon to run the Surveying function. The screen displays the navigation screen that was last displayed.
3. Make the settings required when first using the Surveying function:
   - Press the MENU key
   - Tap **Setup**. In the Setup menu, tap successively the options you need to set. Remember you need to define the **Storage** medium (internal memory or SD card) and the **Receiver ID**. Skip step 3 when next using the Surveying function.
4. Press the NAV key until you see the Satellite Status screen (see opposite). Wait until at least 4 satellites are received.
5. When there is enough satellites received, press the LOG key. The **Survey Settings** screen opens.
6. Tap inside the **Survey Mode** field and then tap **Stop-and-go**. The content of the screen will be different depending on the choice you make in the **Initialize** field (see below). This is explained in detail below.



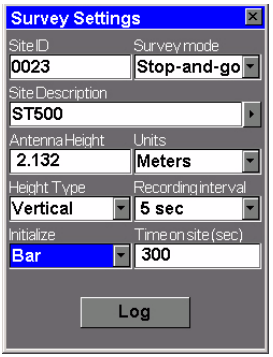
Satellite Status screen

Initialization method:

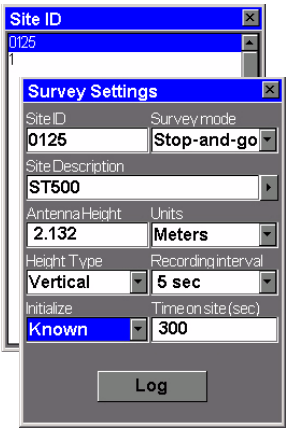
1) None



2) With initializer bar

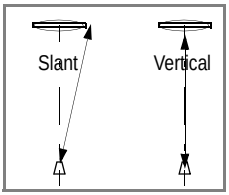


3) On known position



Enter the following parameters:

- Site ID and Site Description: Set these two parameters after choosing the Initialization method (see below after the Initialize parameter).
- Antenna Height: Tap inside this field and enter the vertical distance between the antenna and the surveyed point. Be careful when entering the antenna height as this field uses a fixed format (xx.xxx). Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the content of this field.
- Units: Tap inside this field and then tap the unit used to express the antenna height (meters, US feet or Int feet)



- Height Type: Tap inside this field and then tap the method used to measure the antenna height: Slant if you measured the antenna height to the outside edge of the GPS antenna, or Vertical if you measured the antenna height to the bottom of the GPS antenna mounting thread (see opposite).
- Recording Interval: Tap inside this field and then tap the recording interval (time in seconds between any two consecutive acquisitions of GPS data) you wish to use in your stop & go survey. *Make sure the same recording interval is used at the base and in the rover.*
- Initialize: Choose the method to initialize the stop & go survey (Known, bar or <None>; see *page 55*).

Carefully choose the Site ID!

Remember ProMark3 will automatically increment the Site ID as you progress in your Stop-and-go survey. So make sure the Site ID you choose will not generate Site IDs that already exist. If that was the case, ProMark3 would overwrite these Site IDs without warning you.

- Site ID: Set this parameter according to the initialization method you choose:
  - If <None> or Bar is selected, you can freely enter a Site ID from the keyboard. Tap inside the field and enter a 4-character string using the virtual (on-screen) or real keyboard. Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the site ID.
  - When you select Known, the receiver prompts you to choose a Site ID from the list of existing control points. Tap the desired Site ID.
- Site Description: (Optional) Tap inside the field and enter a narrative description of the point (20 characters max.). Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the content of this field.

  When several Site Descriptions have previously been defined, you can quickly retrieve these by tapping the left arrow to the right of the field. The list of existing descriptions then appears in which you can tap the desired one. This automatically sets the Site Description field on the Survey Settings screen.
- Time on site (sec): If Bar or Known is selected as the Initialization method, enter the occupation time on site, in seconds, required for initialization. If <None> is selected as the Initialization method, enter the occupation time required on the first point you want to survey.

- Control Point check box: Displayed only if <None> is selected in the Initialize field. If you check this box, you will be able, later on, to use the start point -i.e. the point where initialization took place- as a control point.

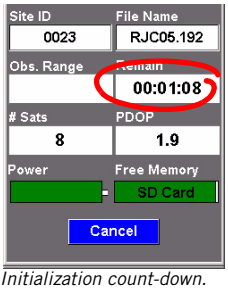
Initialization Phase

7. Tap the Log button at the bottom of the screen. This starts data collection which will stop only at the end of the Stop & Go survey. So be sure from now on, and until the end of the survey, that you will not mask the antenna.

   What happens after starting data collection depends on the chosen initialization method:

   - With Bar or Known selected, the receiver first goes through an intermediate screen showing the counting-down of the initialization phase (see screen opposite). The Remain field will count down beginning from the value of the Time on site field set in the Survey Settings screen. At the end of the countdown sequence, the Remain field reads “00:00:00”.

     If you are performing initialization **on known point**, you are now ready to start the stop & Go survey. Continued in next chapter *Data Collection*.



Initialization count-down.

If you are performing initialization **on bar**, you now have to move the rover antenna from the initializer bar to the top of the rover pole (see illustration opposite). While doing this, take care not to mask the rover antenna or else you would have to resume the initialization.

- With <None> selected, because there is no initialization phase, ProMark3 directly switches to data collection. Continued in next chapter *Data Collection*.

Data Collection

8. Walk to the 1st point you want to survey, making sure you will not mask the antenna.
9. If you have initialized on bar or known point, you may need to change some of the survey settings (typically you need to change the antenna height after moving the rover antenna from the initializer bar to the pole).

In this case, **press the LOG key**, which here is different from tapping the on-screen Log button, and then review and correct if necessary the following parameters:

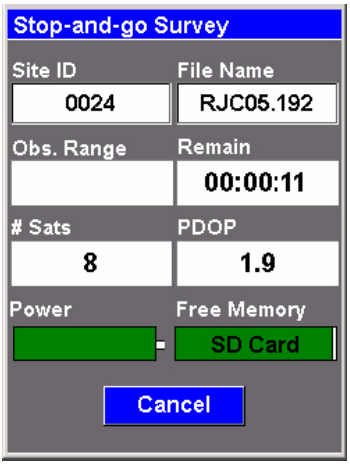
- Site ID: Enter a name for the 1st point to be surveyed
- Site Description: (Optional) Tap inside the field and enter a narrative description of the point (20 characters max.). Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the content of this field.

  When several Site Descriptions have previously been defined, you can quickly retrieve these by tapping the left arrow to the right of the field. The list of existing descriptions then appears in which you can tap the desired one. This automatically sets the Site Description field on the Survey Settings screen.
- Antenna Height: After bar initialization, you need to enter the new height of the rover antenna as it is now located on top of the pole. After initialization on known point, you should not have to change this parameter.
- Initialize: Check that <None> is now selected.
- Time on Site: Enter the occupation time needed on each point that you will survey (typically 15 seconds).

If you have selected <None> as the initialization method, skip step 9.

10. While holding the antenna pole stationary above this point, tap Log on the screen. The receiver then displays the screen below.

Make sure the rover antenna has the best possible view of the sky at all times during the survey. This should result in #Sats *continuously greater than 4 and* PDOP *continuously less than 4.*



The Obs. Range *field is irrelevant to the Stop & Go mode and for this reason is left blank.*

You may shorten the static occupation time (i.e. end the static occupation time before Remain *=00:00:00) by tapping the* Cancel *button. ProMark3 will then take you directly to the next screen on which the Site ID will have normally been incremented.*

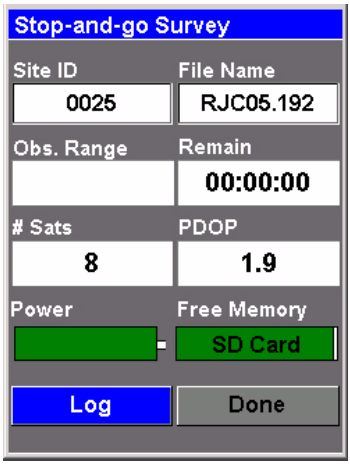
Information provided here will help you determine when enough data has been collected.

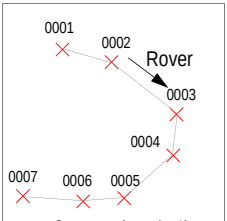
- Obs. Range (Observation Range): Field left blank as it is irrelevant to Stop & Go survey.
- Remain: Displays the remaining amount of time during which you should keep the antenna stationary over the surveyed point. At the end of the countdown, you can walk to the next point.
- # Sats: Displays the current number of healthy satellites – seen above the elevation mask – being logged into memory.

- PDOP: Displays the PDOP value at any given time, computed from all observed healthy satellites above the elevation mask.
- Site ID: Reminds you of the name given to the point you are surveying.
- File Name: Indicates the name of the file in which data is being collected. The file is automatically named by the receiver according to conventions provided in *Appendices* on *page 192*.

- Current **Power** and **Memory** statuses in graphical form.

11. Wait until Remain = 00:00:00. The receiver then displays the screen below:





Cross points indicate where static occupations take place. The line indicates continuous data collection, from the first to the last point.

Note that the content of the Site ID field is incremented by 1 after ending static occupation on a point (increment: 0 to 9, then A to Z, then 0.. again, etc.). You can however change the Site ID between any two occupation times by pressing the LOG key (not the on-screen LOG button) and editing the Site ID field.

12. Move to the next point and resume the above two steps until all the points have been visited.
13. Tap Done after surveying the last point. This completes the data collection phase.

Running a Kinematic Survey

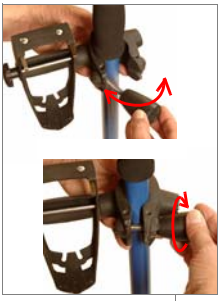
Base Setup and Operation

Allowing for kinematic initialization using Initializer bar at the base

The base is setup and operated in the same way as it is in static surveys (see *page 45*). The only difference is the possible use of the initializer bar at the base station.

The base antenna should be centered and levelled above the known point. To be able to use the initializer bar for initialization, be sure to incorporate the bar as part of the base setup as shown opposite. This bar gives an accurate baseline of 0.2 m (0.656 ft) for initialization.

Rover Setup



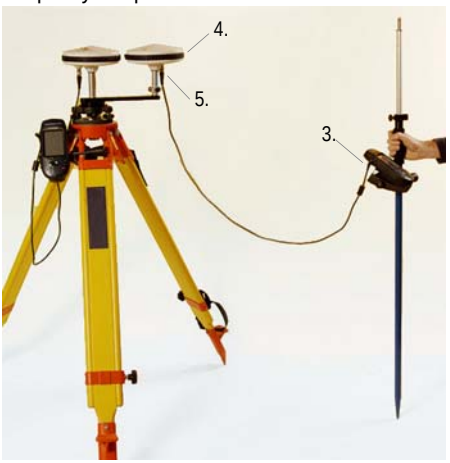
1.

Install the unit on its range pole:

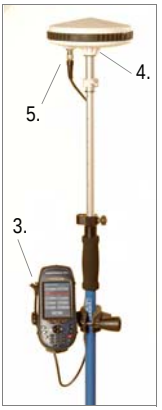
1. Attach the field bracket onto the pole.
2. Place the ProMark3 receiver into the field bracket.
3. Connect the GPS antenna cable to the unit.
4. Mount the GPS antenna on top of the pole or, in the case of a bar initialization, at the end of the base's initializer bar.
5. Connect the other end of the antenna cable to the rover antenna.
6. Measure the antenna height.

2.

Temporary Setup for Bar Initialization:

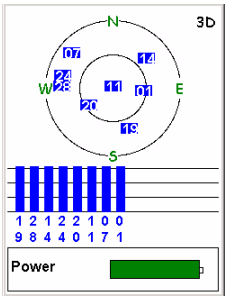


Setup for Known or <None> Initialization
(and Final Rover Setup after initialization step)



Kinematic Survey Rover Setup

1. Turn on the receiver by pressing the ⏻ red key. Wait for the ProMark3 workspace to appear on the screen.

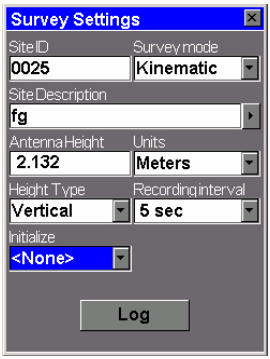


Satellite Status screen

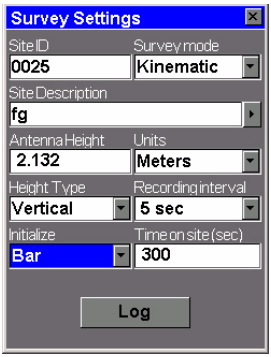
2. Double-tap the **Surveying** icon to run the Surveying function. The screen displays the navigation screen that was last displayed.
3. Make the settings required when first using the Surveying function:
   - Press the MENU key
   - Tap **Setup**. In the Setup menu, tap successively the options you need to set. Remember you need to define the **Storage** medium (internal memory or SD card) and the **Receiver ID**. Skip step 3 when next using the Surveying function.
4. Press the NAV key until you see the Satellite Status screen (see opposite). Wait until at least 4 satellites are received.
5. When there is enough satellites received, press the LOG key. The **Survey Settings** screen opens.
6. Tap inside the **Survey Mode** field and then tap **Kinematic**. The content of the screen will be different depending on the choice you make in the **Initialize** field (see below). This is explained in detail below.

Initialization method:

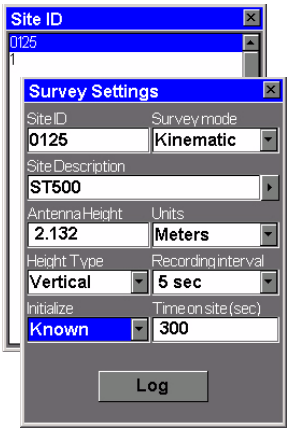
1) None



2) With initializer bar

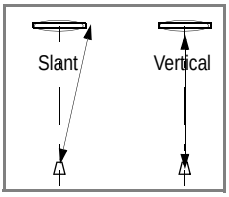


3) On known position



Enter the following parameters:

- Site ID and Site Description: Set these two parameters after choosing the Initialization method (see below after the Initialize parameter).
- Antenna Height: Tap inside this field and enter the vertical distance between the antenna and the surveyed point. Be careful when entering the antenna height as this field uses a fixed format (xx.xxx). Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the content of this field.
- Units: Tap inside this field and then tap the unit used to express the antenna height (meters, US feet or Int feet)



- Height Type: Tap inside this field and then tap the method used to measure the antenna height: Slant if you measured the antenna height to the outside edge of the GPS antenna, or Vertical if you measured the antenna height to the bottom of the GPS antenna mounting thread (see opposite).
- Recording Interval: Tap inside this field and then tap the recording interval (time in seconds between any two consecutive acquisitions of GPS data) you wish to use in your kinematic survey. *Make sure the same recording interval is used at the base and in the rover.*
- Initialize: Choose the method to initialize the kinematic survey (Known, bar or <None>; see *page 55*).

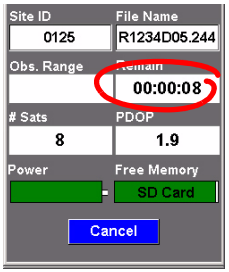
Carefully choose the Site ID!

Remember ProMark3 will automatically increment the Site ID as you progress in your Kinematic survey. So make sure the Site ID you choose will not generate Site IDs that already exist. If that was the case, ProMark3 would overwrite these Site IDs without warning you.

- Site ID: Set this parameter according to the initialization method you choose:
  -If <None> or Bar is selected, you can freely enter a Site ID from the keyboard. Tap inside the field and enter a 4-character string using the virtual (on-screen) or real keyboard. Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the site ID.
  -When you select Known, the receiver prompts you to choose a Site ID from the list of existing control points. Tap the desired Site ID.
- Site Description: (Optional) Tap inside the field and enter a narrative description of the point (20 characters max.). Then press the ENTER key, or tap ↵ on the on-screen keyboard, to validate the content of this field.
  When several Site Descriptions have previously been defined, you can quickly retrieve these by tapping the left arrow to the right of the field. The list of existing descriptions then appears in which you can tap the desired one. This automatically sets the Site Description field on the Survey Settings screen.
- Time on site (sec): If Bar or Known is selected as the Initialization method, enter the occupation time on site, in seconds, required for initialization. If you select <None>, this field is removed from the screen.

Initialization Phase

7. Tap the Log button at the bottom of the screen. This starts data collection which will stop only at the end of the Kinematic survey. So be sure from now on, and until the end of the survey, that you will not mask the antenna.



Initialization count-down.

What happens after starting data collection depends on the chosen initialization method:

- With Bar or Known selected, the receiver first goes through an intermediate screen showing the counting-down of the initialization phase (see screen opposite). The Remain field will count down beginning from the value of the Time on site field set in the Survey Settings screen. At the end of the countdown sequence, the Remain field reads "00:00:00".

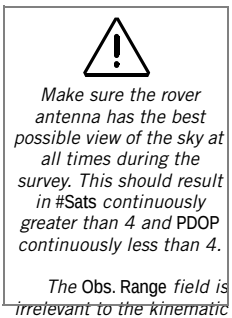
  If you are performing initialization on **known point**, you are now ready to start the stop & Go survey. Continued in next chapter *Data Collection*.

  If you are performing initialization **on bar**, you now have to move the rover antenna from the initializer bar to the top of the rover pole (see illustration opposite). While doing this, take care not to mask the rover antenna or else you would have to resume the initialization.

- With <None> selected, because there is no initialization phase, ProMark3 directly switches to data collection. Continued in next chapter *Data Collection*.

8. Walk to the start point of the trajectory you want to survey, making sure you will not mask the antenna.
9. If you have initialized on bar or known point, you may need to change some of the survey settings (typically you need to change the antenna height after moving the rover antenna from the initializer bar to the pole).
   In this case, **press the LOG key**, which here is different from tapping the on-screen Log button, and then review and correct if necessary the following parameters:
   - Antenna Height: After bar initialization, you need to enter the new height of the rover antenna as it is now located on top of the pole. After initialization on known point, you should not have to change this parameter.
   - Initialize: Check that <None> is now selected.

   If you have selected <None> as the initialization method, skip step 9.
10. Tap the on-screen Log button and then walk along the trajectory. The screen then looks like this:



Make sure the rover antenna has the best possible view of the sky at all times during the survey. This should result in #Sats *continuously greater than 4 and* PDOP *continuously less than 4.*

The Obs. Range *field is irrelevant to the kinematic mode and for this reason is left blank.*

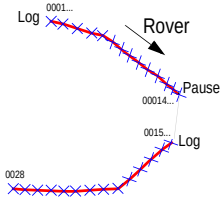
Information provided here will help you monitor the survey of the trajectory.

- Obs. Range (Observation Range): Field left blank as it is irrelevant to Kinemativ survey.
- Elapsed: Displays the time elapsed, in hours, minutes, seconds, since you tapped the Log button (at the begginning of the trajectrory).
- # Sats: Displays the current number of healthy satellites – seen above the elevation mask – being logged into memory.
- PDOP: Displays the PDOP value at any given time, computed from all observed healthy satellites above the elevation mask.

- Site ID: Indicates the name of the last logged position along the trajectory.
- File Name: Indicates the name of the file in which data is being collected. The file is automatically named by the receiver according to conventions provided in *Appendices* on *page 192*.

- Current **Power** and **Memory** statuses in graphical form.

As you are progressing along the trajectory, the content of the Site ID field will be incremented by 1 at the recording interval rate (increment: 0 to 9, then A to Z, then 0.. again, etc.).



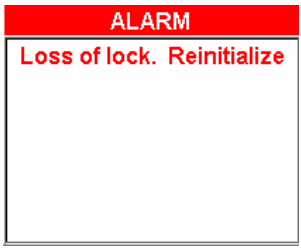
Bold lines indicate the trajectories surveyed. Data collection is NOT suspended between the trajectories.

11. Use the buttons at the bottom of the screen to do the following:
    - **Pause**: Tap this button when you arrive at the end of the trajectory. Remember tapping this button does not mean that you stop data collection: actually data collection continues! When you tap **Pause**, the button is then renamed "Log". Tap the **Log** button when you are at the start point of a new trajectory you want to survey..
    - **Done**: Will end the kinematic survey by closing the data file and taking you back to the last displayed navigation screen. This ends data collection. (After selecting **Done**, the receiver is idle but still in the Surveying function.)

Re-Initialization

When is Re-Initialization Required?

Re-initialization is required when the following message appears on the screen, due to poor GPS reception, while you are running a Stop & Go or Kinematic survey that you initialized through the “Bar” or “Known” initialization method:



When this occurs, you will unfortunately have to resume all or part of your survey. The reason for this is that due to a break in the flow of collected data, the post-processing software will not be able to deliver the expected level of accuracy for all those points that you might have surveyed AFTER the data break.

Following the occurrence of this message, tap anywhere outside of the message window to acknowledge the Reinitialize alarm. Then resume the survey from the last control point you surveyed (see next section).

The next section describes a preventive procedure that you can use to better respond to possible re-initialization requirements.

Preventive Steps to Facilitate Re-initialization

If you take care to create "intermediate" control points as you are progressing in your stop-and-go surveys, you will make re-initialization easier in the sense that you will not have to resume the survey from the beginning. Instead, you will just have to walk back to the last "intermediate" control point you will have surveyed and run a new initialization on this point using the "Known" option. Kinematic surveys conducted in the vicinity can also benefit from this intermediate control point should they undergo the same re-initialization problem.

1. Creating an intermediate control point

A couple of times during your stop & go surveys:

- Spot a location where reception is particularly good and where it is easy to come back (the location should clearly be marked one way or another).
- Keep still on that point.
- Press LOG (which here is different from tapping the on-screen **Log** button).
- Change the Site ID. Keep in mind the Site ID that is displayed (e.g. "1034") and the one you enter (e.g. "CP10").
- Check the **Control Point** option and tap **Log**.
- Keep still until the **Remain** field is zeroed.
- Then press LOG again, re-enter the former Site ID ("1034"), clear the **Control Point** option and continue with your survey.

2. Re-initializing on an intermediate control point

If the "Loss of Lock. Reinitialize" message arises when you are performing a Stop & Go survey:

- Acknowledge the alarm by tapping anywhere outside of the message window.
- Walk to the control point you last surveyed.
- Check that you have enough satellites and a good PDOP on that point
- Press the LOG key.
- Select "Known" in the Initialize field, then tap the Site ID corresponding to this point (remember in our example you named that point"CP10").
- Tap Log and wait for the Remain field to countdown to zero.
- Walk to the point where the alarm message occurred keeping the pole range always vertical and making sure the antenna has continuously an open view of the sky.
- When you have arrived at the point, press the LOG button, rename the Site ID and continue with your survey.

If the "Loss of Lock. Reinitialize" message arises when you are performing a Kinematic survey:

- Acknowledge the alarm by tapping anywhere outside of the message window.
- Tap Done to close the observation file.
- Walk to the control point you last surveyed.
- Check that you have enough satellites and a good PDOP on that point
- Press the LOG key.

- Select “Kinematic” as the Survey mode
- Select “Known” in the Initialize field, then tap the Site ID corresponding to the “intermediate” control point (remember in our example you named that point “CP10”).
- Tap Log and wait for the Remain field to countdown to zero.
- Walk to the beginning of the trajectory you were surveying when the alarm message occurred.
- Press the LOG key, rename the Site ID.
- Tap Log to resume the survey of the trajectory you have not been able to complete the first time.

Quitting the Surveying Function

Press the MENU key and tap Exit. This takes you back to the ProMark3 workspace screen.

Office Work with GNSS Solutions Software

Downloading Field Data from ProMark3

Do not forget to double-tap the Surveying icon or else no communication will be possible between ProMark3 and the PC.

Back in your office, do the following to download your field data. It is assumed that GNSS Solutions has already been installed on your PC.

1. On ProMark3:
   - Turn on the receiver.
   - Double-tap the Surveying icon.
   - Make sure the ProMark3 Storage option setting will allow the Download utility to access the desired files. For example, if the files to be downloaded are on the SD Card, make sure SD Card is selected as the Storage option. To set this information, press the MENU key then select Setup then Storage.
2. Clip the I/O module as shown opposite.

3. Connect the USB cable between the ProMark3 unit and your PC (see opposite).
   You can also use a serial cable (RS232) with female DB9 connectors that you connect between your PC and COM1 on ProMark3's I/O module (see *page 4*) but the downloading times will be longer than with USB..

   ⚠ The first time you connect ProMark3 to the office PC via USB, you may be asked to install a USB driver on the PC (although this driver should normally have been installed when installing GNSS Solutions). This driver is located on the GNSS Solutions CD in the ".../USB Driver/PROMARK/" folder. Once you have inserted the CD in your CD drive, ask the PC to search for this driver on the installation CD and then follow the on-screen instructions to complete the driver installation.

It is very important that you connect the ProMark3 to the PC BEFORE running Download.

4. On the PC:
   - From the Windows task bar, select Start>Programs>GNSS Solutions>Tools>Download.

     (Double-click  in the right side of the window if you want to change to the parent directory and open your project folder on the PC.)
   - In the Download window, select File>Connect>Receiver>Connect via Cable. This opens the Connect Via Cable dialog.
   - In this dialog, choose the port created on the PC following the installation of the USB driver and then click OK. (If you use an RS232 cable, just select the corresponding port number and click OK). The following appears successively in the status bar, at the bottom of the window:

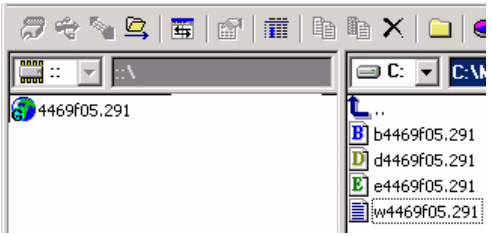
     Looking for remote on COMx at xxxx Baud...
     Connected to Data Source
     Setting Baud rate...
     Preparing for listing...
     Directory has been listed

     The left side of the Download window then lists the files present in the ProMark3.
   - Select the files you want to download. If necessary, hold down the Ctrl key to make a multiple selection.
   - Press the **F5** key or drag and drop the selected files from the left to the right side of the window. A Copying file dialog appears during data transfer.

If you have some difficulty identifying which port number should be selected as the USB port, first run Download WITHOUT the USB connection to ProMark3 in order to list the available ports. Then quit Download and resume the operation after connecting ProMark3. An additional port will then appear in the list. This additional port is precisely the port you need to select to allow communication with ProMark3 via USB.

Files resulting from the downloading of an observation file are named as follows:
X<Downloadedfilename>
where prefix X = "E" for Ephemeris Data, "B" for Position Data, "D" for GPS Raw Data and "W" for SBAS Data.

After the transfer is complete, notice in the right side of the Download window that each downloaded file has been split into different files named with different prefixes (see opposite).



- Close the Download window.

5. On ProMark3, quit the Surveying function, turn off the receiver and remove the cable between the PC and ProMark3.
6. Repeat the previous 5 steps for each of the ProMark3 units involved in the project to download their respective files to the same project folder on your office computer.
   Note that you can also download your field data from the SD card that you have previously removed from the ProMark3 and inserted into the local SD Card reader. The procedure is the same as above except that there is no connection to a remote device needed.

Downloading Field Data from the Local SD Card Reader

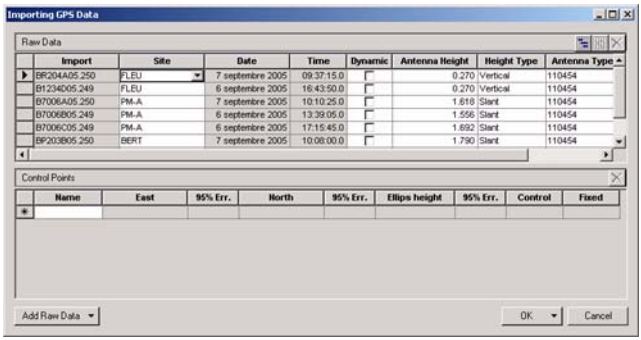
If your field data were logged on the SD Card, you can also download the field data from your local SD card reader if there is one.

- Extract the SD card from the ProMark3 and insert it into your local SC card reader.
- From the Windows task bar, select Start>Programs>GNSS Solutions>Tools>Download.
- (Double-click  in the right side of the window if you want to change to the parent directory and open your project folder on the PC.)
- In the Download window, select File>Connect>PC drive. As a result, the left side of the window shows the file structure of your PC.
- On top of the left side of the window, click on the down arrow and select the letter corresponding to your local SD card reader (for example "**G:**"). You can now see the field data files stored on the SD card.
- In the left side of the window, select the files you want to download. If necessary, hold down the Ctrl key to make a multiple selection.
- Press the **F5** key or drag and drop the selected files from the left to the right side of the window. A Copying file dialog appears during data transfer.

  As explained on *page 81*, each downloaded file is split into different files with different prefixes. These files can be seen in the right side of the window once the downloading is complete.
- Close the Download window.

Post-Processing Field Data

1. On your office computer, launch GNSS Solutions
2. Click **Create a New Project**, enter a project name and then click **OK**.
3. Click **Import Raw Data from Files**.
4. Browse your computer to change to the folder containing the data files you have just downloaded.
5. Select the files you want to import and click **Open**. The **Importing GPS Data** dialog lists the files you want to import (top). Each row describes one of these files (filename, associated Site ID, etc.)



6. At the bottom of the window, define which of the sites is the control point (base) and enter or check its known coordinates. You can also fix the control point if necessary by selecting one of the options available in the **Fixed** column. If you select **<Blank>**, the point won't be fixed.

   Press  in the top-right corner of the window if you have some doubt on which Site ID is the base. Pressing this button will show all the observation files vs. time.

The longest observation is likely to be the one recorded at the base. Refer to the *GNSS Solutions Reference Manual* for more information.

7. Click OK>To Import to import the data into the project. Depending on the type of survey, you can go even faster by running, in one operation, the Import, Process and Adjust functions.

Uploading a Vector Background Map to ProMark3

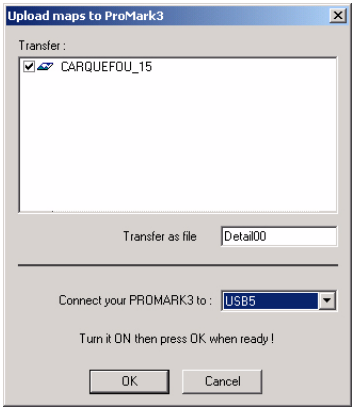
Vector background maps are generated from DXF, SHP or MIF files imported in a GNSS Solutions project.

Note that raster background maps CANNOT be uploaded to ProMark3 in its current version.

Assuming the ProMark3 unit is connected to the PC via the USB cable, it has been turned on and you have double-tapped the Surveying icon, do the following on PC side:

- Launch GNSS Solutions and then open the project containing the vector map you want to upload to ProMark3.
- In the Command pane on the left, click the Map topic bar and then the Upload Maps to External Device icon. GNSS Solutions then automatically detects the presence of the ProMark3 on the USB port and also lists the project maps that can be uploaded.

Here is a screen example that you could see at this stage:



- Name the file and then click OK. The following messages appear in succession during the map upload process:

```
Preparing data..
Creating data
Creating output image file...
Connecting... USBx
Uploading to GPS
```

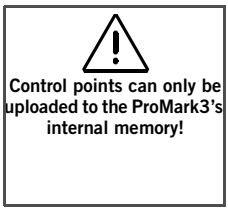
  While the last message above is displayed, a message on the ProMark3 screen informs you that the <map name>.imi file is being uploaded.
- When the file transfer is complete, press MENU, tap Setup and then Select Map.
- Tap in the Detail Map field and then select the name of the file you have just uploaded
- Tap Save. ProMark3 starts loading the new map. After a while, the Map screen is displayed.
- Use the IN, OUT and scrolling buttons to get a full view of the new map on the Map screen.

Uploading Control Points to ProMark3

You can uploads *control points* from an open GNSS Solutions project to your ProMark3. *Reference* and *target points* CANNOT be uploaded.

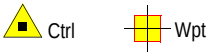
To know the definition of each of these point types, please read the "Point Properties" section in the *GNSS Solutions Reference Manual* (in Chapter 5).

During this operation, GNSS Solutions will transform fixed control points into control points (for stop & go or kinematic initialization) and non-fixed control points into *waypoints*.



Fixed control points can only be uploaded to the ProMark3's internal memory, not on the SD card. So make sure the internal memory is used as storage medium on the ProMark3 when uploading your control points (press MENU, tap Setup, Storage, Internal Memory and then OK).

NOTE: You can also keep "SD Card" as the storage medium and temporarily remove the SD card from the unit before running the upload function. In this configuration, i.e. in the absence of the SD card, the upload function will in fact load the control points into the internal memory. After you re-insert the SD card into the unit and you start a survey, data will be saved to the SD card, as requested by the Storage setting.



Fixed control points will also be available as waypoints in the ProMark3. On the map screen, these will appear as small yellow triangles whereas "normal" waypoints will continue to appear using the usual representation (a yellow cross square). See opposite.

Uploading control points, whether fixed or not, will always overwrite the complete list of control points currently available in the ProMark3. This means for example that there won't be any control points left in the ProMark3 if the selection of points you wish to upload does not include a single fixed control point.

As a general rule, you should therefore upload all the control points and waypoints you need *through a single upload operation*.

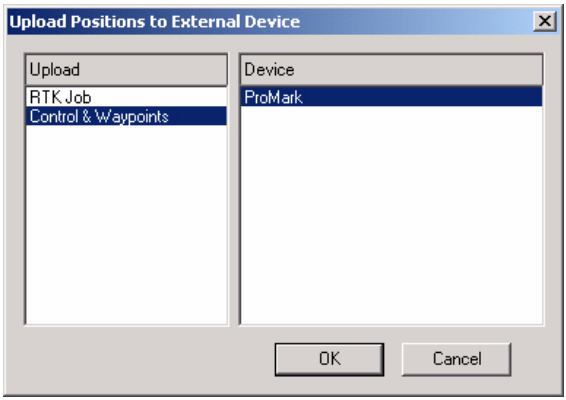
The names of the uploaded points will be truncated to 4 characters for control points and 8 characters for waypoints. Consequently, make sure the points you select will keep different names after truncation or rename those points that would otherwise have similar names after truncation.

Finally, you can choose whether the points you upload as waypoints will add up to the list of existing waypoints or will replace this list (at one step during the uploading, you will have to check or clear the Erase existing waypoints option).

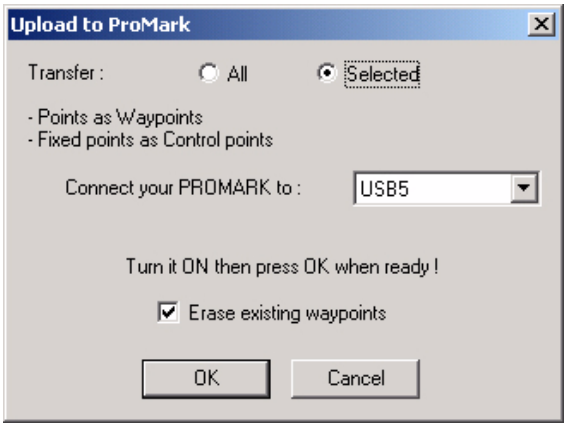
Assuming the ProMark3 unit is connected to the PC via USB (or RS232), it has been turned on and you have double-tapped the Surveying icon, do the following on PC side:

- Launch GNSS Solutions and then open the project containing the control points you want to upload to ProMark3.
- Select the control points you want to upload (select them on the Survey View or on the Points tab in the workbook).

- In the Command pane on the left, click the **Export** topic bar and then the **Upload Positions to External Device** icon. In the new dialog that opens, select **Control & Waypoints**:



- Click **OK**. GNSS Solutions then automatically detects the presence of the ProMark3 on the USB port.
  In the dialog that opens, make the appropriate selections and choose the right port to communicate with ProMark3:



- Click OK. The following messages appear in succession during the point upload process:

  ```
  Connecting... USBx
  Uploading control points and
  waypoints...
  ```

- The points you have uploaded can now be seen on the ProMark3 using the following procedure:
  - Press MENU and tap Exit
  - Double-tap Surveying
  - Press LOG
  - Select Stop-and-go or Kinematic as the Survey Mode
  - In the Initialize field, select Known. The list of available control points now appears in which you can recognize the points you have uploaded.
  - Press ESC
  - Press MENU and tap GOTO
  - Tap User Waypoint, then Position. The list of available user waypoints now appears in which you can recognize the points you have uploaded.

4. Mobile Mapping

Feature Libraries

A feature library is a hierarchical structure that guides you through the description process so you know you will describe thoroughly and quickly each feature you visit. You will not have to remember what attributes of each feature you should record: the feature library will tell you!

Feature libraries contain lists of features that you should be visiting during your field sessions.

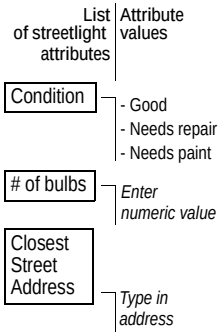
Features are four types:

- Point feature: The geometrical representation of this feature is a point. Logging this type of feature requires static occupation at the point.
- Line feature: The geometrical representation of this feature is a line. Logging this type of feature requires that you move along this line.
- Area feature: The geometrical representation of this feature is an area. Logging this type of feature requires that you move along its contour.
- Grid feature: The geometrical representation of this feature is an array of evenly-distributed waypoints. ProMark3 will guide you to each of these waypoints where you should enter a measurement performed at this point.

Each feature also has a number of attributes. There are three categories of attributes:

- Menu style where the attribute values are words or phrases that you pick off a list (e.g. a list of values for the attribute Condition might include Good, Needs Repair, etc.; see opposite)
- Numeric style where you select a number within a specified range (e.g. the # of bulbs might be in the range 0 to 3)
- Text style where you type in a note that can contain both numbers and letters (e.g. the closest street address)

Example of a "streetlight" point feature, as may be described in a feature library

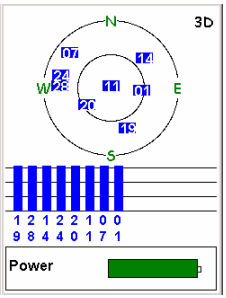


Feature libraries are created using the Feature Library Editor module in MobileMapper Office.

You can upload as many feature libraries as you want into ProMark3. Just remember that you can use only one feature library for logging data to an individual job.

Logging New GPS/GIS Data

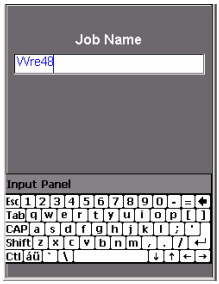
(Remember you can use the real-time DGPS capability if you need it. See *Implementing Real-Time DGPS on page 182*.)



Satellite Status screen

1. Turn on the receiver by pressing the ⏻ red button.
2. Double-tap the **Mobile Mapping** icon.
3. Press the NAV key until you see the Satellite Status screen (see opposite) Wait until at least 4 satellites are received. For the best accuracy it is important to hold the receiver at an angle of 45° from horizontal and not too close to you.

4. Follow the instructions below to log GIS features.



Entering a job name

Note that each ProMark3 includes a "Generic" library containing default features. This library contains a point feature, a line feature, an area feature and a grid feature. Each of these features has a single text-style attribute. Use this library only as a "backup" library.

1. Creating a Job and Selecting a Feature Library

- Press the LOG button
- Tap Create New Job. The screen displays the Job Name field in which you should enter the name of the new job. A keyboard is displayed underneath to let you enter this name.

  To enter a name, tap on the corresponding letters on the keyboard.
- When you have finished entering the name, tap ↵ on the on-screen keyboard or press the ENTER key. A new screen is then displayed listing the feature libraries stored in ProMark3.
- Tap the name of the feature library you want to use. A new screen is then displayed asking you to choose the job mode:
  - Real-time: If you select this job mode, the receiver will record only feature positions and descriptions and GPS metadata. Jobs recorded in real-time mode cannot be differentially corrected later on.
  - Post-processing: Select this job mode to allow ProMark3 to record the job so that later on, it can be post-processed in MobileMapper Office. In this job mode, ProMark3 will record GPS measurements files in addition to the MMJ job file that is recorded in real time. For more information, see *MobileMapper Office User Manual*.
- Tap one of these modes. The screen now lists all the features available from the selected feature library.

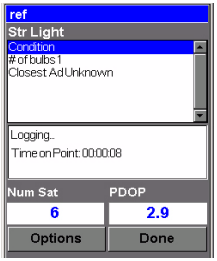
2. Logging and Describing a Point Feature

ProMark3 uses a fixed, time-based logging interval (1 second) when you log a point feature. The logging interval parameter cannot be accessed when you log a point feature.

- Choose the type of feature you want to log from this list. You can tell by the name of this feature whether it is a point feature, a line feature or an area feature.
- Tap a point feature (you are supposed to be near one of these features) and tap the on-screen Log button. This starts feature logging. A sound is heard every time ProMark3 logs data.

  The Logging screen is now displayed where you can see the list of attributes pertaining to this feature. You will now enter the "Description" phase of the feature.
- Tap the first attribute and enter the right attribute value describing the feature near you. This takes you back to the Logging screen.
- Highlight the next attribute in the list and repeat the previous step. Repeat this step until all the attributes have been properly described.

  "Describing" the feature only takes a few seconds. By the time you are done with the feature description, the feature's GPS position will have been saved in the job. You can also stay more time on the feature to let the receiver determine several positions. This will give an even more accurate position for the feature as ProMark3 will average all the GPS positions it has computed on the feature.
- To stop logging the feature, tap Done. This takes you back to the Feature List screen
- Move to the next feature and resume the above instructions to log this feature.



Logging screen

The Logging screen also displays the time elapsed since you started logging at this point feature, the number of satellites currently received and the current value of PDOP (see also page 107).

If you start logging a new feature and you realize this is a mistake, then you can delete the new feature being logged by tapping the Options *button and selecting Delete <feature name>. Deleting features only applies to new features being logged, not to features already logged.*

3. Logging and Describing a Line Feature

Basically, you use the same procedure as when you log a point feature (see 2. above). There are however two differences when you log a line feature:

- You need to define a logging interval when you start logging the feature
- And then you are supposed to move from the beginning to the end of the line feature before stopping the logging.

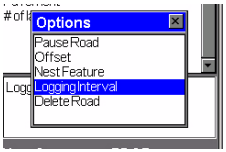
These differences are explained below.

After tapping a line feature from the Feature List screen (for example a road) and tapping the Log button, ProMark3 starts logging GPS positions from the position where you are. The default logging interval is 5 seconds.

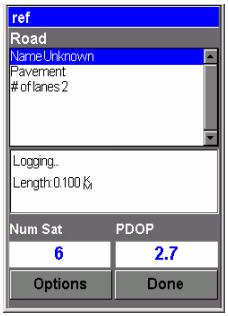
By decreasing the logging interval you can increase the level of detail in your maps. By increasing the logging interval, you can save memory. In general, you should set the logging interval to the smallest setting possible without running out of memory. Remember you can take multiple SD cards with you to the field. The only requirement is that you close the job file before replacing the SD card.

To change this interval:

- Tap Options on the screen and then Logging Interval.



Selecting the logging interval option



Logging screen

The Logging screen also displays the distance traveled since you started logging the line feature, the number of satellites currently received and the current value of PDOP (see also page 125).

Two options are then prompted:

By Time: Select this option when you want to log a new GPS position at regular intervals of time regardless of the distance traveled since the last position logged. After tapping this option, tap the desired time interval. This takes you back to the Logging screen where you can see the list of attributes pertaining to the feature.

By Distance: Select this option when you want to log a new GPS position only after you have moved by a certain distance since the last position logged. After tapping this option, tap the desired distance interval. This takes you back to the Logging screen where you can see the list of attributes pertaining to the feature.

- As you would for a point feature, describe the feature by describing the different attributes pertaining to the feature
- When the description is finished, you can start walking along the line feature
- When you arrive at the end of the line feature, with ProMark3 still displaying the Logging screen, tap **Done** to stop logging the feature.

The receiver determines the length of a line feature 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 receiver calculates the spherical distance rather than the horizontal or slope distance between the successive positions.

If you wish to change the logging interval while you are logging a line feature, you first need to pause the logging of the feature:

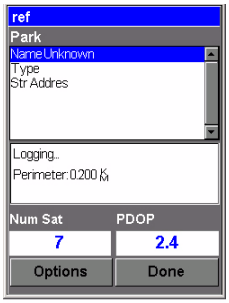
- Tap Options and then Pause <line feature name>
- Tap Options again and then Logging Interval. Set the new logging interval as explained above.
- After changing the logging interval, tap Options and then Resume <line feature name>. The receiver will continue to log the feature, but this time according to the new logging interval.

4. Logging and Describing an Area Feature

Basically, you use the same procedure as when you log a line feature, especially regarding the need for defining a logging interval (see 3. above). The only difference between a line and area feature is that for an area feature, the first and last position calculated by the receiver are connected when you close the feature.

Record the attributes of an area feature as you do for a line feature (see page 94):

- Tap the name of the area feature from the list of features and tap the Log button. ProMark3 starts logging the area feature.
- Choose a logging interval (see explanations given for a line area on page 95). This takes you back to the Logging screen where the list of attributes for the feature is displayed
- Describe each attribute by selecting or entering the appropriate attribute value for each of them.



Logging screen

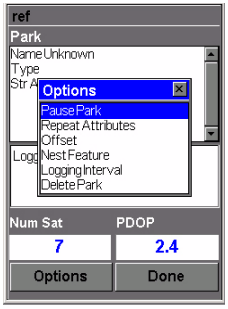
This screen displays the current values of perimeter and area measured since you started logging the feature (+ number of satellites and PDOP)

The receiver determines the perimeter of an area feature 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 receiver calculates the spherical distance rather than the horizontal or slope distance between the successive positions. The perimeter of the area feature is the sum of all these distances. For the same reason, the measured area is that of a curved, not flat, feature.

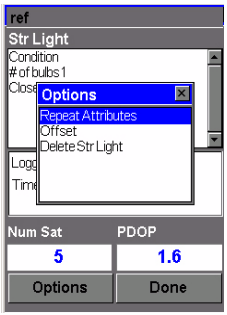
5. Pausing a Feature

When you are recording lines or areas, it is sometimes impossible to walk or drive the entire length of the feature because of obstacles in your way such as fences, buildings, bodies of water, etc. When you must interrupt the recording of any feature (excluding point features), follow these steps:

- Tap Options and then Pause <feature name>. This pauses the logging of the feature.
- Move around the obstacle to the next accessible portion of the feature
- To resume logging, tap Options and then Resume <feature name>. This resumes the logging.
- When you finish logging the feature, just tap Done.



Selecting the Pause Park option



Selecting the Repeat Attributes option

6. Logging New Features with Same Attributes as Those Set in the Previously Logged Feature

If you close a point, line or area feature and want to log the location of another feature of the same type and with an identical description, use the Repeat Attributes function.

After closing a feature, ProMark3 takes you back to the Feature List screen on which the same feature type is still selected. Just do the following:

- Move to the next similar feature you want to log.
- Tap Log to start logging the new feature.
- Tap Options and then Repeat Attributes. As a result, all the attributes of the previously logged feature are immediately assigned to the feature been logged.
- After logging the GPS position(s) of this feature, tap Done to close the feature.

7. Nesting a Feature

When you are logging GPS positions to a feature, you may find another feature that you also want to log. Rather than log the entire feature and come back to record this other feature, you can simply pause the feature being logged, log the other feature, close it and resume logging the first feature.

Logging one feature while you have paused another feature is called “nesting.” You can nest any feature, point line or area, into any line or area feature. It is not possible to nest a point feature inside another point feature.

Nesting is particularly useful when you are mapping things such as a road with streetlights along the route or a shoreline with stretches of erosion along it and the locations of certain habitats.

Assuming you are logging a line feature and the Logging screen is displayed, do the following, for example to nest a point feature:

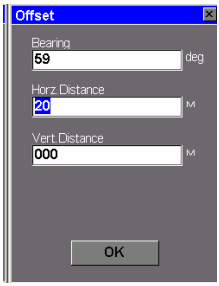
- Tap Options and then Pause <feature name>. This pauses the logging of the line feature.
- Tap Options again and then Nest Feature
- Move to the location of the feature you want to nest
- In the Feature List screen now displayed, tap the feature type you want to nest.
- Tap Log to start logging this feature.
- Describe the attributes of the feature as explained above
- Tap Done when you have finished logging the nested feature.
- Tap Options and then Resume <feature name>. This takes you back to the Logging screen from which you can normally finish the logging of the line feature.

8. Offsetting a Point Feature

Sometimes the feature you want to put on the map is in area of poor GPS reception or is not accessible. This is when you can map the feature using the offset utility. By combining the receiver's position with the bearing and distance to the feature, ProMark3 will automatically calculate and record the position of the feature.

To input an offset for a point feature, assuming the Feature List screen is now displayed, do the following:

- Tap one of the listed point features available from the selected feature library.
- Tap Log to start logging the feature
- Tap Options and then Offset.



Point Offset screen

If you do not have a compass, you can use ProMark3's Compass screen (see also page 128) to determine the bearing to the offset feature. If you have been moving for 5 to 10 seconds along a straight line, the Compass screen will tell you your bearing. You can use this to determine the bearing to the offset feature. CAUTION! The receiver cannot determine direction while stationary and the compass direction remains the same even if you rotate the receiver.

Visual estimation for horz. & vert. distances is usually good enough in terms of accuracy.

This displays the Point Offset screen on which you should enter the following parameters:

Bearing: Compass direction to the feature from your current position. You need a compass to measure this angle (see also opposite). To input a value for **Bearing**, press ENTER and type in the new value from the keyboard or the on-screen keyboard. Then press ENTER again.

Press the down arrow to move the cursor to the next field.

Horz. Distance: Horizontal distance to the feature from your current position. To input a value for **Horz. Distance**, press ENTER and type in the new value from the keyboard or the on-screen keyboard. Then press ENTER again.

Press the down arrow to move the cursor to the next field.

Vert. Distance: Vertical distance to the feature from your current position ("0" if the feature and yourself are at the same elevation -on a flat area). To input a value for **Vert. Distance**, press ENTER and type in the new value from the keyboard or the on-screen keyboard. Then press ENTER again.

Press the down arrow to move the cursor to the next field.

- Then tap **OK** to return to the Logging screen. This writes the offset into memory, but you can edit it later if you like by going through the same process. If you close the feature and return to the Map screen, you will see that the feature is offset from your position in the middle of the screen.

9. Offsetting a Line or Area Feature

For the same reasons as a point feature (see previous page), you may need to use the offset utility to map a line or area feature. By combining the receiver's position with the direction and the distance to the feature, ProMark3 will automatically calculate and record the location of the feature.

To input an offset for a line or area feature, assuming the Feature List screen is now displayed, do the following:

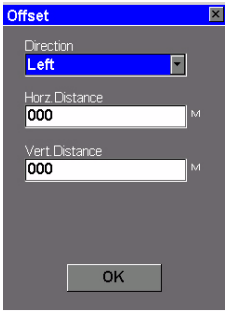
- Tap one of the line or area features available from the open feature library.
- Tap the **Log** button to start logging the feature.
- Tap **Options** and then **Offset**. This displays the Line or Area Offset screen on which you should enter the following parameters:

  Direction: Location of the feature with respect to your actual path. To input a value for **Direction**, tap the down arrow and then tap the desired option (Right or Left). Press the down arrow to move the cursor to the next field.

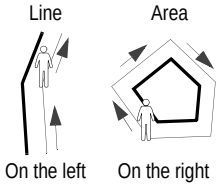
  Horz. Distance: Horizontal distance to the feature from your current position. To input a value for **Horz. Distance**, press ENTER and type in the new value from the keyboard or the on-screen keyboard. Then press ENTER again.

  Press the down arrow to move the cursor to the next field.

  Vert. Distance: Vertical distance to the feature from your current position ("0" if the feature and yourself are at the same elevation -on a flat area). To input a value for **Vert. Distance**, press ENTER and type in the new value from the keyboard or the on-screen keyboard. Then press ENTER again.



Line or Area Offset screen



Visual estimation for horz. & vert. distances is usually good enough in terms of accuracy.

Press the down arrow to move the cursor to the next field.

- Tap OK to return to the Logging screen. This writes the offset into memory, but you can edit it later if you like by going through the same process.
  Note: Offsets to area features are applied in MobileMapper Office and not in the receiver.

10.Logging GIS Data on a Preset Grid Feature

To operate the grid mapping utility, you will need a measurement device - anything from a depth sounder to a ruler, your own sense of smell or your ability to make visual observations. You will also need a compass.

The ProMark3's Grid Mapping Utility is an easy way to automatically set up a series of GPS waypoints to facilitate the logging of data in an orthogonal grid.This utility assures that you gather measurements made using field sensors such as chemical detectors, depth sounders and magnetometers at an evenly distributed set of locations. This in turn assures the creation in your GIS of contour maps with a prescribed density of data and without any gaps that might force you to return to the field.

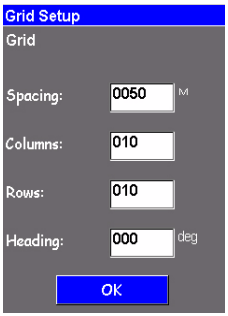
The Grid Mapping Utility deals with two different grid concepts: grid features and grid points.

- Grid features are arrays of uniformly spaced waypoints oriented in rows and columns
- Grid points are navigation features similar to waypoints.

Important Notice: Once you have logged a grid feature in a job (assuming the selected feature library allows you to do so), you cannot log any other feature type in the job, not even another grid feature. Conversely, once you have logged a point, line or area feature, you cannot log a grid feature even though the feature library selected for the job does initially include a grid feature type.

For this reason, you should collect your grid data in specific jobs.

GOTO will not be shown in the menu list if you press MENU while the unit displays the Map screen in cursor mode. In that case, just press NAV and then MENU again.



Grid Setup screen

To log GIS data on a preset grid, do the following:

- If you have created a waypoint to help you locate the first grid point, you can use any of ProMark3's navigation screens to get there. Press MENU and tap GOTO. Using the Left or Right arrow, make sure Alphabetical is selected at the bottom of the screen. Then tap User Waypoint. In the list of waypoints now displayed, tap the name of the waypoint you want to go to. Again, you may use any of the ProMark3's navigation screens to arrive at this waypoint
- Once you arrive at the point of beginning, you should open up the job file that includes the feature library describing the grid. If you opened an existing job, press LOG to take you to the New Feature screen. Then tap the grid feature type listed on the screen. Usually the term “grid” is included somewhere in the feature name so that you can easily recognize this type of feature. Tap the on-screen Log button. The Grid Setup screen appears on which you can read the definition of the grid (see opposite)..

  When you navigate to the location of the grid, you may decide to readjust the size and orientation of the grid based on field observations that you did not foresee back in the office. For example, you may find that navigating to waypoints with an east-west orientation is not feasible if the area of interest is situated on a narrow strip of land between two north-south running streams.

When you change the definition of a grid, ProMark3 always assumes that you are standing in the corner of the grid from which you can see the grid extend in front of you and to the right.

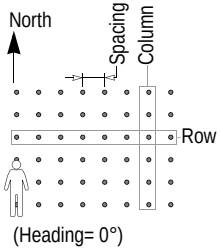
The definition of a grid is based on the following four parameters:

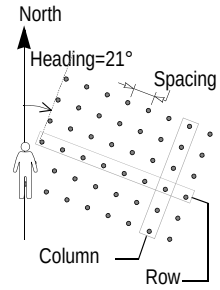
Spacing: Distance between any two consecutive waypoints in any row or column (default: 50 meters or 100 feet, depending on the units used)

Columns: Number of waypoints along the axis facing you (default: 10; Max.: 100)

Rows: Number of waypoints along the axis perpendicular to the direction you are facing (default: 10; Max.: 100)

Heading: Direction you face when the grid's columns extend in front of you and the rows extend to your right.





In the two examples above:
Columns=8
Rows=6

- To change the above parameters, use the up/down arrows to move the cursor to each of these fields, press ENTER and edit the field using either keyboard. When you are done with the definition of a field, press ENTER. Then press the down/up arrow to access the next field, etc.
- **Record an observation or measurement**: Tap OK at the bottom of the screen. This takes you to the Logging screen that indicates that you have begun logging data to the feature and that the receiver is ready to log the feature's attributes. Remember that you remain stationary for all point features. Describe the feature as you would any other point feature.

It is also possible to navigate to any grid point (or any location for that matter) on the Map screen by tapping over another grid point. After you record data at this location, you will still be prompted to go to the next grid point .

- **Navigate to the next grid point**: When you have finished recording the first point feature, tap Done. A message prompts you to go to the next grid point. Tap Yes to navigate to the next grid waypoint and record the next point feature within the grid. This takes you to the Map screen where you can see your current position marked by the arrow and the next grid waypoint highlighted with a "crossed box" target symbol. Small hollow squares indicate the locations of all the unvisited grid waypoints. Small filled squares ("black" squares) indicate the locations of where you recorded point feature.

  As you begin moving toward the target symbol, you will see your heading indicated by the direction of the arrow marking your position. Adjust your movement as necessary until you are positioned over the target symbol. You may also use any of the other navigation screens available with your ProMark3. The Arrival alarm is disabled when navigating to grid points. It is best to note your distance to the next point and stop when this value goes to zero. When you arrive at the next grid point, press the LOG button and you will see the same Logging screen you used for the earlier measurement or observation.

  Each grid point is a geographic coordinate you should make every effort to occupy so that the data you record is evenly spaced and complete. However, each grid point is merely an aid for navigating to the ideal location for an observation or measurement. All the data you record is ascribed to the position of the ProMark3 receiver and NOT to the grid point.

If you cannot physically occupy this point, but can make the necessary visual observation, you should do so and record an offset estimating the distance and bearing to the grid point. If you are recording measurements made by an instrument, you should NOT record an offset but rather try to make a recording as close as possible to the position.

- When you have occupied as many of the grid points as you can and recorded the necessary observations and measurements at each, tap Done at the bottom of the Logging screen.
- Tap No when ProMark3 asks you to go to the next grid point.
- Press the LOG button and tap Yes to close the job.

11.Closing the Job

To close a job, from the screen showing the list of attributes, tap Done then confirm by tapping Yes.

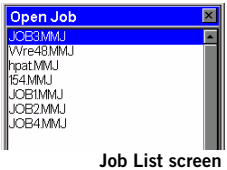
Revisiting and Updating Existing GPS/GIS Jobs

You can use ProMark3 not only to position and describe new GIS features but also to update information gathered previously. This is particularly useful when collecting data on things that change over time: streetlight bulbs burn out, new roads are added to housing developments, new crops are planted, etc.

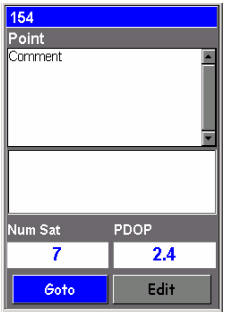
1. General Procedure

Return to the area where the original job was recorded, turn ProMark3 on and double-tap the Mobile Mapping icon. When it has calculated a GPS position, follow the procedure below to update the job or to append more data to it.

- Press the LOG button and tap Open Existing Job.
- Tap the name of the job you want to revisit.
- Unless this screen is already displayed, press NAV repeatedly until the Map screen is displayed. The Map screen provides a geographical view of the different featutes present in the job. From this screen, you will now indicate the first feature you want to revisit. If necessary, press the IN or OUT button to adjust the scale so you can see this feature.
- On the Map screen, tap on the feature you want to revisit first. (The feature name appears in the lower part of the screen when the cursor is positioned over the feature.)
- When the map cursor is positioned over the feature to be updated, press ENTER. A new screen is displayed showing the attribute values currently ascribed to the feature. Note that the Goto field is highlighted at the bottom of the screen.

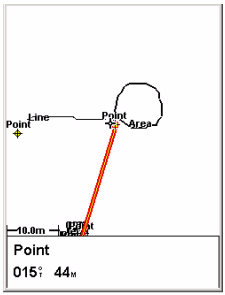


Job List screen



Screen prompting you to go to the selected feature

When you know which attributes must be changed for a point feature, which means you don't really need to visit the point, then tap Edit *rather than* Goto *and change the attributes directly.*



Map screen showing straight line to target

- Tap Goto to ask ProMark3 to guide you to this feature. By doing this, you will make the selected feature your destination and all the navigation screens will be set to help you reach that feature. The Map screen will also be automatically displayed showing a straight line connecting your current destination to the selected feature.
- Walk to the feature according to the navigation instructions provided on the Map screen. You can use other navigation screens if you prefer (see also Navigation Screens on Navigation Screens on page 126). You will know when you are close to the feature when the distance to the feature goes to zero or close to zero, or simply because you can identify it visually. Another nice way of being informed that you have arrived at the feature is to set the Alarms option.
- After arriving at the feature, press the LOG key. This takes you to the Feature Attributes screen.
- Now that you are near the feature and you can see which of its attributes need to be changed, tap successively each of these attributes and change them.
- After reviewing the attributes, tap the Done field at the bottom of the screen. This ends the review of this feature and displays the Map screen again.
- Follow the same steps described above to revisit and update the other features present in the job.

2. Repositioning a Point Feature

If a point feature appears to be mislocated on the Map screen, do the following after you have arrived at the feature:

- Press the LOG key and tap the on-screen Log button. Let the ProMark3 recompute the point position and then tap the Done button to close the feature.

  Note that only point features can be repositioned. If you wish to reposition a line or area feature, you should record a new feature and then delete the old one in MobileMapper Office.

3. Adding More Features and Attributes to the Job

If you want to add more features and descriptions to the existing job, you just have to record them exactly as you record features into a new job.

4. Closing the Job

To close a job, from the screen showing the list of attributes, tap Done then confirm by tapping Yes.

Using ProMark3 as a Reference Station

- Mount ProMark3 on a tripod placed over a control point, turn it on and then double-tap the Mobile Mapping icon.
- Press the MENU key, tap successively Setup and Storage to choose the media (SD Card or Internal Memory; SD Card recommended) where to store the reference station data ProMark3 is going to collect.
- Press the LOG key and then tap Reference Station. The Site ID screen is now displayed.
- Enter a Site ID (there is a four-character limit) as you would enter a job name, and then press ENTER.

  From now on, ProMark3 will operate as a reference station until you quit the Mobile Mapping function. It is therefore important that you not move the receiver or any optional external antenna until you quit the function.

  Before leaving the reference station, press the NAV key until you can see the Satellite Status screen. Check that the letter “R” now appears in the upper-right. This means the receiver is recording reference station data and you can now proceed with your job.
- After your job is complete, come back to the ProMark3 reference station, press the MENU key and tap Exit. The ProMark3 exits from the Mobile Mapping function.
- Turn off the unit.

Quitting the Mobile Mapping Function

Press the MENU key and tap Exit. This takes you back to the ProMark3 workspace screen.

Office Work with MobileMapper Office

Downloading Field Data from ProMark3

Do not forget to double-tap the MobileMapping icon or else no communication will be possible between ProMark3 and the PC.

Back in your office, do the following to download your field data. It is assumed that MobileMapper Office has already been installed on your PC.

1. On ProMark3:
   - Turn on the receiver.
   - Double-tap the MobileMapping icon.
   - Make sure the ProMark3 Storage option setting will allow the MobileMapper Transfer utility to access the desired files. For example, if the files to be downloaded are on the SD Card, make sure SD Card is selected as the Storage option. To set this information, press the MENU key then select Setup then Storage.
2. Clip the I/O module as shown opposite.

3. Connect the USB cable between the ProMark3 unit and your PC (see opposite)..
   You can also use a serial cable (RS232) with female DB9 connectors that you connect between your PC and COM1 on ProMark3's I/O module (see *page 4*) but the downloading times will be longer than with USB.

   ⚠ The first time you connect ProMark3 to the office PC, you may be asked to install a USB driver on the PC. This driver is located on the ProMark3 CD. Once you have inserted the CD in your CD drive, browse the MobileMapper Office installation folder to select the "AT91_USBSer.inf" file. Then follow the on-screen instructions to complete the driver installation.

It is very important that you connect the ProMark3 to the PC BEFORE running MobileMapper transfer.

4. On the PC:
   - From the Windows task bar, select Start>Programs>MobileMapper Office>MobileMapper Transfer.

     (Double-click  in the right side of the window if you want to change to the parent directory and open another folder on your PC.)
   - In the MobileMapper Transfer window, select File>Connect>GPS Device via Cable. The following appears successively in the status bar, at the bottom of the window:

     Looking for GPS device on COMx at xxxx Baud...
     Connected to Data Source
     Setting Baud rate...
     Preparing for listing...
     Directory has been listed

     The left side of the MobileMapper Transfer window then lists the files present in the ProMark3.
   - Select the files you want to download. If necessary, hold down the Ctrl key to make a multiple selection.
   - Press the **F5** key. A Copying file dialog appears during data transfer.
   - After the transfer is complete, close the MobileMapper Transfer window.
5. On ProMark3, quit the Mobile Mapping function, turn off the receiver and remove the cable between the PC and ProMark3.
6. Repeat the previous 5 steps for each of the ProMark3 units involved in the project to download their respective files to the same project folder on your office computer.

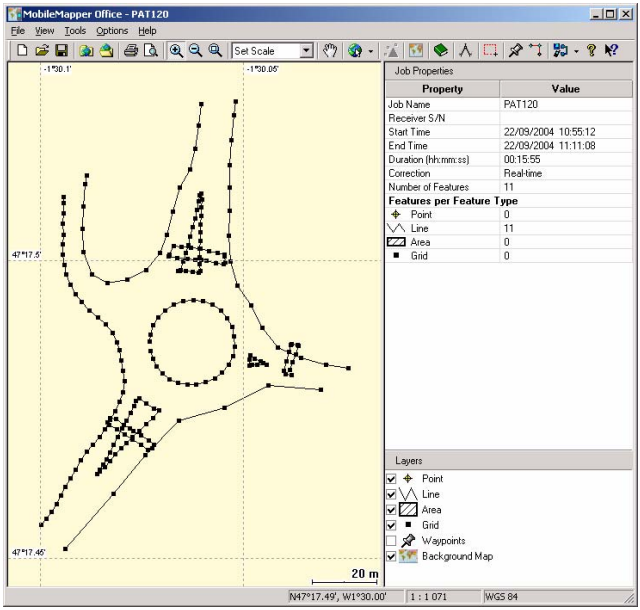
Downloading Field Data from the Local SD Card Reader

If your GIS jobs were logged on the SD Card, you can also download the field data from your local SD card reader if you've got one.

- Extract the SD card from the ProMark3 and insert it into your local SC card reader.
- From the Windows task bar, select **Start>Programs>MobileMapper Office>MobileMapper Transfer**.
- (Double-click  in the right side of the window if you want to change to the parent directory and open your job folder on the PC.)
- In the MobileMapper Transfer window, select **File>Connect>PC drive**. As a result, the left side of the window shows the file structure of your PC.
- On top of the left side of the window, click on the down arrow and select the letter corresponding to your local SD card reader (for example "**G:**"). You can now see the field data files stored on the SD card.
- In the left side of the window, select the MMJ files you want to download. If necessary, hold down the Ctrl key to make a multiple selection.
- Press the **F5** key or drag and drop the selected files from the left to the right side of the window. A **Copying file** dialog appears during data transfer.
- Close the Download window once the downloading is complete.

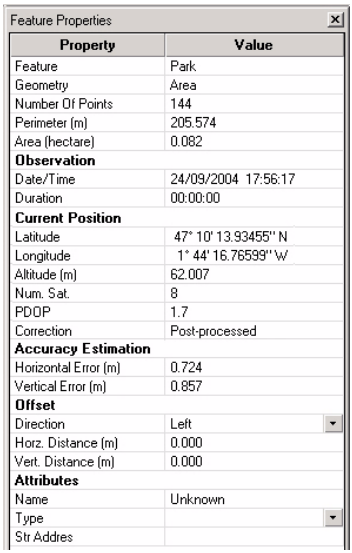
Viewing/Analyzing the Content of a Job

Run MobileMapper Office and then use the **File>Open** command to open one of the MMJ files you have previously downloaded. As a result, MobileMapper Office shows the content of this job in the main window. Here is an example of a job open in MobileMapper Office:



First of all, you can see the list of layers present in this job in the lower-right corner of the screen. Clear or check the buttons for the layers you want to see in the Map Display area (the pane occupying the left part of the window).

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. 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. Apart from the Updated field, these are non-editable properties.

  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:

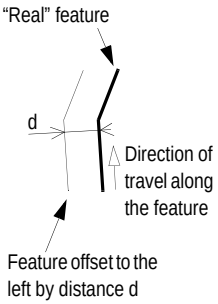
- "WAAS"
- "RTCM"
- "Post-processed"
- "Uncorrected" (for autonomous positions)

- **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.



There are many other functions that you can use in MobileMapper Office such as creating feature libraries or background maps, importing/exporting GIS data, downloading reference station data, post-processing jobs, etc. Please refer to the *MobileMapper Office User Manual* for more information.

Uploading a Vector Background Map

Vector background maps are generated from DXF, SHP or MIF files imported in MobileMapper Office's Map Editor.

Note that raster background maps CANNOT be uploaded to ProMark3 in its current version.

It is all or part of the background map attached to MobileMapper Office's Map Display area that can be uploaded.

The background map is output as an IMI file. The IMI file can be directly uploaded to the ProMark3, or copied to the SD card inserted in the local SD card reader, or stored on the PC hard disk. In all cases, a connection to the ProMark3 is a prerequisite to the upload sequence.

Assuming the ProMark3 unit has been connected to the PC via the USB or RS232 cable, it has been turned on, you have double-tapped the **Mobile Mapping** icon and you have selected the storage medium on which to upload the map, do the following on PC side:

- Launch MobileMapper Office.

To attach the desired vector map to the Map Display area:

- Click 
- On the **Vector Maps** tab, select this map from the left-hand list and then click the **Attach Map** button.
- Click **OK** to close the window.

If you want to upload only a region of the background map:

- Click 
- Drag a rectangle around the desired region and then release the mouse button.

The limits of the region are now 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.

  NOTE: To delete the region and start over, resume the above three steps.

Start the upload procedure as such by selecting File>Upload to GPS>Background Map. MobileMapper Office tests the connection to the ProMark3 (the software needs to know which type of receiver the map is intended for). Once the data link is established, you can make one of the following three choices:

- Upload to GPS Unit if you want to upload the map directly to the ProMark3.
- Upload to SD Card Reader if you simply want to copy the background map to the SD card inserted in the local SD Card Reader (you will use that SD card later in a ProMark3).
- Or Store on Hard Drive if you just want to create now the IMI file on your hard disk so that later you can copy it to an SD card using the local SD card reader.

1. If you select Upload to GPS Unit, then:
   - Click Next >
   - After the GPS unit has been detected on the USB or RS232 port, click Next > again.
   - MobileMapper Office indicates the size of the map file and the remaining memory space on ProMark3. Click Finish.

- If the map filename uses more than 8 characters, MobileMapper Office will warn you that this name will be truncated. Keep the truncated name or type a different name and then click OK.
- Wait until the uploading messages on the PC and ProMark3 disappear.
- When the upload procedure is complete, press MENU on the ProMark3, tap Setup and then Select Map.
- Tap in the Detail Map field and then select the name of the file you have just uploaded
- Tap Save. ProMark3 starts loading the new map. After a while, the Map screen is displayed.
- Use the IN, OUT and scrolling buttons to get a full view of the new map on the Map screen.

2. If you select Upload to SD Card Reader, then:
   - Click Next >.
   - Select the drive letter corresponding to the local SD card reader (e.g. "G:")
   - Click Next > again. MobileMapper Office indicates the size of the map vs. the remaining memory space on the SD card and the name of the background map file.
   - Click Finish if you agree. The background map file is transferred to the SD card.

3. If you select Store on Hard Drive:
   - Click Next >. MobileMapper Office indicates the size of the map vs. the remaining memory space on the hard disk, the folder where the file will be saved and the name of the background map file.
   - Click Finish if you agree. The background map file is saved on the hard disk.

Uploading Jobs and Waypoints to ProMark3

To create a waypoint in a job:

Click on  *in the MobileMapper Office toolbar and then click where to create the waypoint on the Map Display area. If necessary, adjust its coordinates, icon and name in the edit box on the right. For more detail, please refer to the* Using the Waypoint/Route Editor *Chapter in the* MobileMapper Office *User Manual.*

Jobs and waypoints associated with jobs are uploaded through the same procedure.

The way waypoints are uploaded and made available on the ProMark3 depends on whether the uploaded job is "empty" (i.e. there is no GIS data in it, just waypoints) or not:

- If the job is "empty", the uploaded waypoints will replace the list of existing waypoints stored in the ProMark3. Prior to uploading, a message will warn you that the waypoints currently stored in ProMark3 will be deleted.
- If the job is not "empty" (i.e. it contains GIS data), waypoints are uploaded as a separate MMW file associated with the MMJ job file. On ProMark3, these waypoints will be visible only when you open the corresponding job. These waypoints will add up to the list of existing waypoints.

Assuming the ProMark3 unit is connected to the PC via the USB or RS232 cable, it has been turned on and you have double-tapped the Mobile Mapping icon, do the following on PC side:

- Launch MobileMapper Office.
- Open the MMJ job file you want to upload
- Click  to read the list of waypoints associated with the job. If you change the list, save the job before continuing.
- Select File>Upload to GPS>Job.
  - If the job is "empty", a message will warn you that all waypoints currently stored in the ProMark3 will be lost if you continue. Click Yes if you agree and then wait until the upload procedure is complete.
  - If the job is not "empty", MobileMapper Office will successively upload the MMJ file and then the MMW file.

Uploading Jobs and Waypoints to the Local SD Card Reader

If you are using the SD card in the field rather than the ProMark3's internal memory, you can also copy your MMJ and MMW files to the SD card using the MobileMapper Transfer utility and your local SD card reader.

- Extract the SD card from the ProMark3 and insert it into your local SC card reader.
- From the Windows task bar, select Start>Programs>MobileMapper Office>MobileMapper Transfer.
- (Double-click  in the right side of the window to access the folder containing the MMJ and MMW files you want to upload.)
- In the MobileMapper Transfer window, select File>Connect>PC drive. As a result, the left side of the window shows the file structure of your PC.
- On top of the left side of the window, click on the down arrow and select the letter corresponding to your local SD card reader (for example "**G:**"). You can now see the field data files stored on the SD card.
- In the right side of the window, select the MMJ and MMW files you want to upload. If necessary, hold down the Ctrl key to make a multiple selection.
- Press the **F5** key or drag and drop the selected files from the right to the left side of the window. A Copying file dialog appears during data transfer.
- Close the MobileMapper Transfer window once the uploading is complete.

Exporting to GIS

- Open the job containing the data you want to export to your GIS.
- Run the File>Export function, select the format in which to export the data, name the export file and click Export.

For more information please refer to the MobileMapper Office User Manual (also provided on the ProMark3 CD).

5. Accuracy

Autonomous GPS, SBAS & DGPS Modes

ProMark3 provides autonomous 3-meter accuracy all around the globe assuming the receiver is tracking five GPS satellites and the PDOP < 4 (which is almost all the time).

ProMark3 is also capable of providing 50- to 70-cm horizontal accuracy using real-time differential corrections from its built-in SBAS receiver. You must be in North America to make use of the free WAAS signals broadcast by the US Federal Aviation Administration. You must be in Europe to make use of the free EGNOS signal broadcast by the European Union. If you are using the Mobile Mapping function and SBAS signals are received, a “W” will appear on all logging screens (after the number of received satellites; see *page 125*).

To achieve the best accuracy, it is important to hold the receiver at an angle of 45 degrees from horizontal. This allows the internal antenna to pick up signals from the GPS, WAAS and EGNOS satellites. This is especially true when recording data for post-processing.

In addition to SBAS, ProMark3 can apply real-time differential corrections (DGPS) from land-based systems such as Coast Guards beacons or your own privately broadcast RTCM Type 1 or Type 9 corrections. Just use the serial cable to connect your ProMark3 to a differential correction receiver. A "DGPS.." will appear on the ProMark3's Position screen when the receiver detects RTCM input.

The accuracy with land-based systems is approximately the same as with SBAS. However, it is possible to improve accuracy by one or two decimeters if you broadcast your own RTCM corrections while keeping the distance between the broadcasting reference receiver and the rover receiver less than 10 km (3 miles).

If you average positions for a point feature for a few minutes, even better accuracy is possible.

ProMark3 may warn you if the PDOP, and therefore the accuracy, of your positions has dropped below the level you selected during Setup (see *page 157*, the PDOP alarm option). If you see this warning you may press the ESC button and continue logging.

However, if you are running a kinematic survey or recording line or area features, you might want to return to the field when the GPS satellites are in a better configuration overhead (the constellation changes slowly but constantly).

And if you are running a static survey or recording a point feature, you should strongly consider moving to another location with better satellite reception and recording an offset (distance and bearing) to the feature.

Quality Indicators

GPS quality indicators

Tracking 3 satellites will in principle allow you to calculate a 2D position (lat/lon) using the last altitude recorded by the receiver. You need to track at least 4 satellites to get a 3D position (lat/lon/altitude). To achieve the specified accuracies for ProMark3, you will need to track 5 or more satellites.

On the Survey Status screen in Surveying or at the bottom of each logging screen in Mobile Mapping, you can see two numbers that give you a good indication of how accurate the ProMark3 unit should be.

The first is the number of satellites that the receiver is tracking. In Mobile Mapping, a “W” will appear after the number of satellites if SBAS is used. The presence of this letter is indicative of an even better accuracy level.

The second number is the Positional Dilution of Precision (PDOP), which is an estimate of accuracy that the receiver constantly calculates using the geometry of satellites in the sky. The more satellites that are being tracked and the more evenly they are distributed around the sky, the better the accuracy. PDOP values less than 4 or 5 are good. If the PDOP value is over 5, you should consider moving to an area with a clearer view of the sky and recording features with offsets.

6. Navigation

ProMark3 offers very helpful navigation functions that you can use while performing your field operations, whether Surveying or Mobile Mapping.

The present chapter tells you how to use the navigation screens, how to create waypoints and how to work with the GOTO and Routes functions.

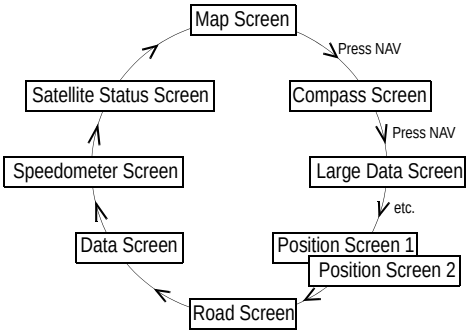
Navigation Screens

You will be able to view the different navigation screens only after launching the Surveying or MobileMapping application.

The Map screen has two modes: Position and Cursor. Using the stylus, tap anywhere on the map, or press any arrow key, to select Cursor mode. Press ESC to return to Position mode.

When a Position screen is displayed, press the Left or Right arrow key to display the other. Press this key again to return to the previous screen.

Except for the Satellite Status screen, all navigation screens can be customized.



ProMark3 offers 7 different navigation screens to help you locate yourself or navigate to waypoints or GIS features in an existing job. From any displayed screen, simply press the NAV button to access the last-used navigation screen. To display the next navigation screen, press NAV again. The sequence of navigation screens is as shown above. It can be scrolled in the reverse direction by pressing ESC once any of these navigation screens is displayed.

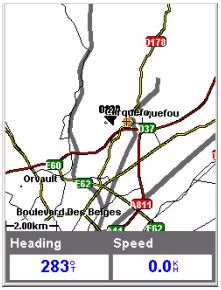
You may find that you do not regularly use all of these screens. To make it faster to move among those screens that you do use, you may turn off individual navigation screens (except the Map and Satellite Status screens) by pressing the MENU button, selecting the Setup option and then the Nav Screens option.

Select either On or Off for each screen until you see the Setup menu once more. Note that you must cycle through all the screens in order to put your selections into effect.

The following is a description of each of the navigation screens.

Map Screen

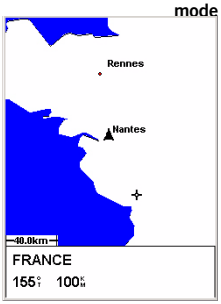
The Map screen shows a map of the area surrounding your current location. Use the IN and OUT buttons to adjust the scale.



Map screen in Position mode

The Map screen is always in the Position mode when you access this screen. In this mode, your present position is indicated by the large arrow icon in the center of the display. If you are moving, the arrow will point in the direction that you are heading. At the bottom of the screen is the scale for the map displayed and two data fields that can be customized, or turned off, depending upon your needs.

The present position icon will change to an hourglass when the ProMark3 is unable to compute a position fix due to poor signal reception.



Map screen in Cursor mode

Tap anywhere on the Map screen or press any of the arrow keys to switch to the Cursor mode. In this mode, you are provided with a cross hair cursor that can be moved using the stylus (you tap directly where you would like the cursor to be) or, for a step-by-step move, by using the arrow keys.

At the bottom of the display is the information for the position of the cursor relative to your present position (heading and distance). Also any points of interest or GIS features that the cursor is over will be shown.

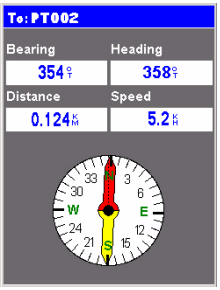
To return to the Position mode, press ESC. The cursor will disappear and the present position icon will appear centered on the map.

Compass Screen

The two data fields on top are customizable. The lower portion of the Compass screen displays your heading in a graphical manner.

The Compass screen contains the following information, from top to bottom:

- In the title bar: destination name if you are using the Goto function
- Data Fields: customizable data fields (see **Customize** option on page 162). Some of the data displayed requires you to be moving to be computed. Invalid data is indicated by dashes.
- Icon representing destination: Displayed outside the compass when you are using the Goto function. This provides you with the direction you need to head to arrive at the destination. When you are on course and heading straight for the destination, the destination icon will be lined up with the heading marker
- Compass/Heading marker: Using the compass and the heading marker, you can view your heading information in a familiar manner. Note that you need to be moving for this data to be valid.



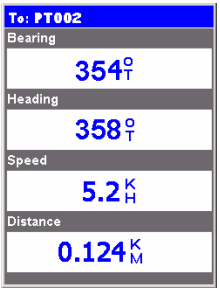
Compass screen

Large Data Screen

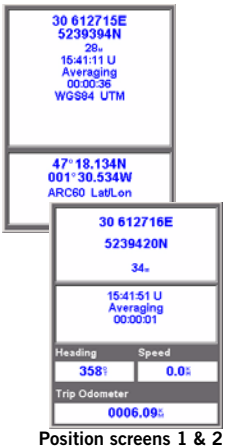
The Large Data screen is similar to the Compass screen but here the compass has been removed to allow for large display of the navigation data. This screen is ideal for when you have your unit mounted on the dashboard of a vehicle. Even from a distance the customizable information can be read with ease.

The Large Data screen contains the following information, from top to bottom:

- In the title bar: destination name if you are using the Goto function
- Data Fields: customizable data fields (see **Customize** option on page 162). Some of the data displayed requires you to be moving to be computed. Invalid data is indicated by dashes.



Large Data screen



Position screens 1 & 2

To switch from a screen to the other, just press the Left or Right arrow key.

The same data as on Position screen 1 is displayed on Position screen 2 except that the lower part of the screen, containing the two data fields and the trip odometer field, is replaced with the current position's coordinates expressed in the chosen secondary coordinate system and map datum.

Position Screens

Position screens #1 and #2 display your present position using the coordinate systems that you have selected (see how to select these systems in the two sections *Coord System on page 154* and *Map Datum on page 156*.

This screen shows all of the basic position, time and satellite information. Additionally, on Position screen #1, current navigation information is shown in the bottom half of the screen.

For the sake of comparison, Position screen #2 provides the coordinates of your present position both in the selected primary coordinate system and map datum, and in the selected secondary coordinate system and map datum.

Position screen #1 contains the following information, from top to bottom:

- Coordinates and elevation of your current position: Displays your current position in the chosen coordinate system. Also displays the elevation of the current position. If ProMark3 is not computing position fixes, the last computed position is displayed.

GPS Satellite Status: Provides information on the current status of the GPS receiver section of the ProMark3 (see table below).

Message	Description
Searching - 1st sat	Searching for 1st satellite
Searching - 2nd sat	1st satellite found; searching for 2nd satellite
Searching - 3rd sat	2 satellites are being tracked; searching for a 3rd
Searching - 4th sat	3 satellites are being tracked; searching for a 4th
Collecting Data	All satellites needed for position fix are being tracked and position is being computed
Averaging	ProMark3 is computing fixes; speed is near 0.0 and so position is being averaged
WAAS Averag	ProMark3 is computing fixes using SBAS; speed is near 0.0 and so position is being averaged
EPE xxx.	Estimated Position Error. ProMark3 is computing fixes while moving
DGPS DGPS Averag	Computed fixes are being differentially corrected using RTCM corrections ("DGPS Averaging" when speed near 0.0.)

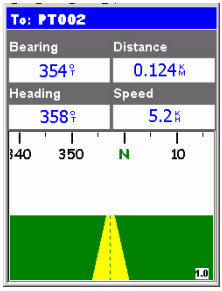
- Data Fields: customizable data fields (see **Customize** option on page 162). Some of the data displayed requires you to be moving to be computed. Invalid data is indicated by dashes.
- Trip Odometer: The odometer performs like the odometer in your car. It can be reset through the MENU button.

To customize the Position screens, use the functions described below. The first of these context-sensitive functions is prompted when you press the MENU button while a Position screen is displayed. Some of these functions also exist in the Setup menu.

Road Screen

The Road screen presents your route as if you were travelling on a road. When you need to make a turn, the road will graphically display the turn and the direction. Waypoint and destination icons will be displayed relative to your position as they come into view. Above the road is a compass that displays your heading and above that are four customizable data fields.

The Road screen contains the following information, from top to bottom:



Road screen

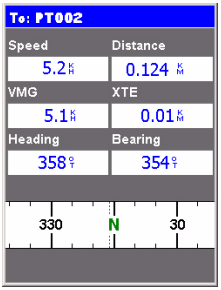
- In the title bar: destination name if you are using the Goto function
- Data Fields: customizable data fields (see **Customize** option on page 162). Some of the data displayed requires you to be moving to be computed. Invalid data is indicated by dashes.
- Compass: Displays your heading in a familiar compass format.
- Road: This graphically displays the route (Goto) that is active. As you move left or right of your intended track, the road will move on the display indicating which way you need to steer to get back on track. Ideally, the road would be centered on the display. Also, you will see upcoming turns in advance allowing you to make necessary preparations.
- Scale indicator: Use Zoom In/Out to change the scale.

Data Screen

When you need to see a lot of information in one place then you will appreciate the Data screen. The Data screen provides you with six data fields and an active compass that is the same as the one used on the road screen. You have the option of customizing this screen by selecting what data is displayed in the upper six fields. The lower portion of the screen is occupied by a compass providing your heading.

The Data screen contains the following information, from top to bottom:

- In the title bar: destination name if you are using the Goto function
- Data Fields: customizable data fields (see **Customize** option on page 162). Some of the data displayed requires you to be moving to be computed. Invalid data is indicated by dashes.
- Compass: Displays your heading in a familiar compass format.



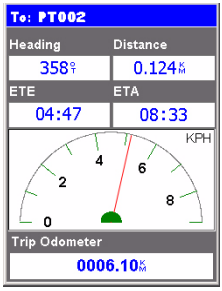
Data screen

Speedometer Screen

The Speedometer screen displays your speed in a familiar graphical format. There are four additional data fields at the top of the display that can be customized to display the data that you need. The bottom of the screen contains a trip odometer that will record the distance travelled since the last time the odometer was reset.

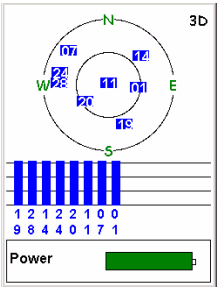
The Speedometer screen contains the following information, from top to bottom:

- In the title bar: destination name if you are using the Goto function
- Data Fields: customizable data fields (see **Customize** option on page 162). Some of the data displayed requires you to be moving to be computed. Invalid data is indicated by dashes.
- Speedometer: Displays your speed using a familiar speedometer display. The scale of the speedometer is not adjustable but will change dynamically to best display your speed.
- Trip Odometer: The odometer performs like the odometer in your car. It can be reset through the MENU button.



Speedometer screen

Satellite Status Screen



Satellite Status screen

Although the Satellite Status screen is part of the navigation screen sequence, it is not actually a navigation screen.

When ProMark3 is computing your position, an additional information appears in the right-upper corner with two possible values: 3D or 2D. 3D means the computed position is 3-dimensional (elevation computed). In 2D (2-dimensional), elevation is not computed. ProMark3 assumes that the last computed or entered elevation is the elevation for all computed positions.

See also page 30.

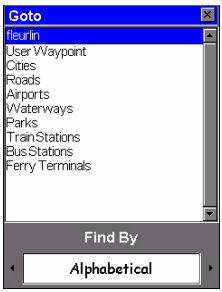
GOTO Function

Purpose

You use the GOTO function to ask ProMark3 to guide you from your current position to a destination point. You will be able to use this function only after launching the Surveying or MobileMapping application.

After you will have specified which destination point to go to, you will select your favorite navigation screen. You will then be able to read the information computed by ProMark3 to help you reach the destination.

Destination Point Types



List of POI categories

ProMark3 can guide you to:

- Any point of interest (POI) pre-loaded in ProMark3.
- Any waypoint created using the Mark function. This type of point is listed as a "User Waypoint" category in the POI (Point Of Interest) database.
- The active background map (as set in the DetailMap field on the MENU>Setup>Select Map screen), which appears on top of the POI list (see oposite).
- Any feature logged in the open GIS job which you will select graphically on the Map screen.

Selecting a POI as the Destination Point

GOTO will not be shown in the menu list if you press MENU while the unit displays the Map screen in cursor mode. In that case, just press NAV and then MENU again.

Press MENU and tap GOTO. The possible categories of POIs are now listed on the screen. Use the Up/Down arrow keys to highlight the category the destination point belongs to.

Before pressing ENTER to list all the points stored in this category, choose how you want these points to be listed by setting the Find By field. Press the left/right arrow to set this field. Two values are possible in this field:

- Alphabetical: Points will be listed in alphabetical order. ProMark3 will then help you find the desired point through one of the following two methods: *Keyboard Search* and *Alphabetic Scroll*.

  Keyboard Search: Before displaying the list of points in alphabetical order, ProMark3 displays a keyboard that you can use to enter the first few characters of the point you are looking for. When you press ENTER, you are taken to the alphabetical list with the point you began typing at the top of the display. Anytime you are viewing the list of points, you can re-access the keyboard by pressing ESC.

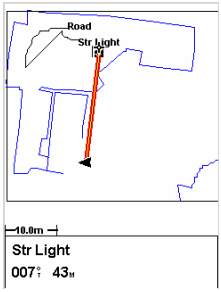
  Alphabetic Scroll: When the alphabetical list is displayed, you can use the IN and OUT buttons to step up or down the alphabet. If you were viewing points beginning with the letter “A”, pressing OUT would take you to the first waypoint beginning with “B”, and then “C” and so forth. Pressing IN does the same function but only in reverse.
- Nearest To: Only the 20 points from this category the closest to either your position or another POI will be listed.

When these 20 points are listed, ProMark3 indicates the bearing and distance to your current position from the first point in the list. You can change the point from which the nearest points are found. With the Nearest To field now highlighted, press ENTER and scroll to the category where this new point can be found. Select a new point and press ENTER. If you have already pressed the arrow keys and one of the nearest points in the list is highlighted, use the ESC button to scroll back to the Nearest To field.

Selecting a GIS Feature as the Destination Point

Assuming a GIS job is open and contains already logged features:

- Press NAV until the Map screen is displayed.
- Using the IN and OUT buttons, adjust the scale in such a way that you can see the feature you want to go to.
- Using the stylus, tap this feature. You know that the cursor is positioned over the feature when the “Cursor” indication at the bottom of the screen is replaced with the name of that feature. You may use the arrow keys to refine the position of the cursor over the feature.
- Press ENTER. A new screen appears giving the current description of the feature. At the bottom of the screen, simply tap Goto to enable the Goto function with this feature as your destination. Then select your favorite navigation screen, using the NAV button, and navigate to this feature.



Selecting a GIS feature as the destination

Saving Your Current Position as a Waypoint

Mark screen

Saving your current position as a waypoint is very easy and can be done from within the Survey or GIS function.

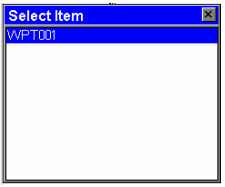
From any screen, just press the MENU button, and select the Mark option. The Mark screen appears. This screen provides the description of the waypoint you are about to save.

You can accept all the defaults by simply pressing ENTER (Save field already highlighted).

You can also edit the Icon, Name and Message fields using the arrow keys to access these fields. Obviously you should keep the Location and Elevation fields unchanged as they contain the coordinates of your current location.

Waypoints recorded using the receiver's Mark feature are not exportable by MobileMapper Office. If you wish to record waypoints in the field and export them to GIS formats, you should use MobileMapper Office's Feature Library Editor to create a "Waypoint" feature type. You can then log a "waypoint" as a point feature while recording a job file.

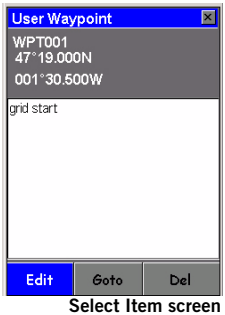
Editing/Deleting a User Waypoint



Select Item screen

You can edit/delete a waypoint from the Map screen:

- Press NAV until the Map screen is displayed
- Use the IN or OUT button, or move the cursor so that the waypoint you want to edit or delete is visible on the screen
- Position the cursor over that waypoint. The name of the waypoint then appears at the bottom of the screen.
- Press ENTER. This opens the Select Item screen on which ProMark3 lists the names of the items present in the vicinity.



Select Item screen

- Tap the waypoint you want to edit/delete. This opens the User Waypoint screen on which you can see the definition of the waypoint (coordinates+comments). At the bottom of the screen are three command fields that you can use for the following tasks:

  Edit (default choice): Select this field if you want to edit the definition of the waypoint. The following parameters can be changed: icon, name, coordinates, elevation and comment.

  Goto: Select this field if you want ProMark3 to guide you to this waypoint

  Del: Select this field if you want to delete the waypoint. ProMark3 will then ask you to confirm that you really want to delete the selected waypoint.

Clearing the GOTO function

To ask ProMark3 to stop guiding you to a destination while the Map screen is displayed in position mode:

- Press MENU
- Tap GOTO. A message appears asking you to confirm that you would like ProMark3 to stop guiding you to this point.
- Tap Yes
- Press ESC to return to the Map screen.

Routes

You will be able to use this function only after launching the Surveying or MobileMapping application.

As explained below, ProMark3 can handle two types of routes: GOTO route and multi-leg route.

GOTO Route

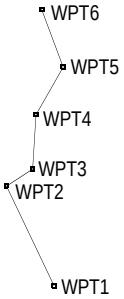
This in fact a route that you define when:

- You select a waypoint on the Map screen, you press ENTER twice to display the properties of this waypoint, and you tap GOTO to enable the Goto function to this waypoint . The same can be done to choose a POI or a GIS feature as the destination point.
- You use the GOTO option after pressing MENU and you choose a POI or waypoint as the destination point.

A GOTO route is a one-leg route whose two ends are your current position and the chosen destination point.

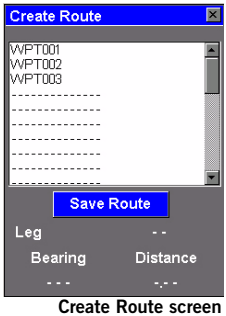
GOTO routes are not saved in memory. When you turn your ProMark3 off and then back on, the GOTO route is gone. You need to create a new GOTO route if you intend on completing the route.

Multi-leg Route



A multi-leg route consists of several waypoints or POIs that you should reach one after the other. The segment between any two consecutive waypoints or POIs is called a “leg.” Unlike GOTO routes, multi-leg routes can be stored in memory.

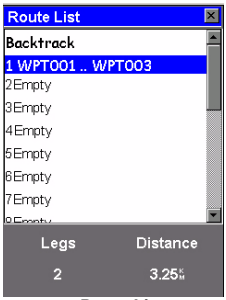
The *backtrack* route also belongs to the category of multi-leg routes (see *page 143*).



Create Route screen

1. Creating a Multi-leg Route

- Press MENU and tap **Routes**. The Route List screen is now displayed.
- Tap the first **Empty** route in the list.
- Press MENU and tap **Create New Rte**. The Create Route screen is now displayed and the first line on this screen is highlighted.
- Press MENU and tap **Insert WPT**. The Insert WPT screen is now displayed.
- Press the Left or Right arrow to select **Alphabetical** at the bottom of the screen.
- Tap **User Waypoint**
- Browse the list of available waypoints and tap the name of the waypoint you want to define as the first waypoint in the route. You are then prompted to define the second waypoint in the route.
- Resume the previous 4 steps to define the next waypoints in the route.
- When the last point of the route is defined, tap the **Save Route** button on the Create Route screen.



Route List screen

2. Activating/deactivating a Multi-Leg Route

- Press MENU and tap **Routes**.
- In the Route List screen now displayed, tap the route you want to activate.
- Press MENU and tap **Activate Route**. ProMark3 comes back to the Route List screen where the activated route now appears in bold characters. Press NAV to navigate along this route.

To deactivate this route:

- Press MENU and tap **Routes**,
- Tap the activated route in the list
- Press MENU and tap **Deactivate Route**. The route is now deactivated.

3. Asking ProMark3 to Retrace your Steps

If the Track Mode is active (see *page 151*), the ProMark3 automatically creates and stores hidden points into memory as you move. This series of points is called the "track" or "track history". To retrace your steps, do the following:

- Press MENU and tap Routes.
- Select Backtrack.
- Press MENU again and tap Activate Backtrk. A message appears warning you that the Track History Logging is now disabled.
- Tap OK and press NAV to return to the Map screen. Now let ProMark3 guide you along the existing track, using the track's hidden points as navigation waypoints, to go back to the track's start point.

4. Creating a Route from the Track History

- Press MENU and tap Routes.
- Select Backtrack.
- Press MENU again and tap Save Trk to Rte. ProMark3 converts the track's hidden points into User Waypoints. The new route then appears on the Route List screen. It consists of waypoints that are numbered "TxxPyy" (where xx is the route number in the list and yy is the order number of the waypoint in the route).

  For example the created route could be named "T01P01 .. T01P07".

  Note that the the route is a copy of the track and not the backtrack.

5. Other Functions Tied to Routes

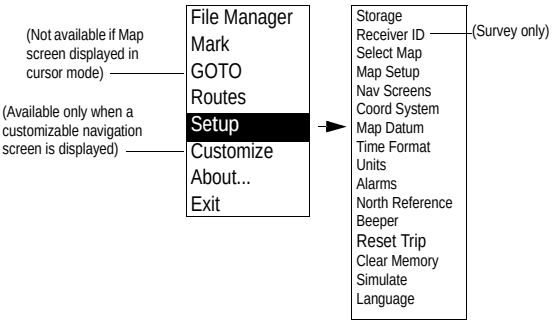
You can also do the following on the highlighted route using the functions available from the MENU button (see also diagram on page 148):

- Viewing the route on the Map screen by pressing MENU and tapping Map View Route. The Map screen then appears showing the route. Press ESC to come back to the Route List screen.
- Editing the route by pressing MENU and tapping View/Edit Route. From the View/Edit screen you can then press the MENU button to access options allowing you to insert, delete, replace the highlighted waypoint and then to save the changes made to the route.
- Reversing the route, i.e. reversing the direction of travel along the route, by pressiong MENU and tapping Reverse Route. This instantly reverses the route. Note that the first and last waypoints in the route name have been swapped.
- Deleting the route by pressing MENU and tapping Delete Route. A message will appear asking you to confirm this operation.
- If a route has been activated, selecting the leg you want to follow by pressing MENU and tapping Select Leg. The screen then shows the list of points making up the route. Tap the waypoint you want to navigate to. A warning message will appear asking you to confirm the leg change. After choosing Yes or No, press ESC twice to return to the navigation screen.

7. MENU key

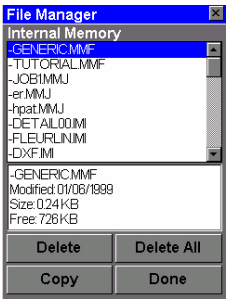
The MENU key is inactive until you double-tap the Survey or Mobile Mapping icon.

The diagram below shows the available functions when pressing MENU. When you select the Setup option in the menu list, another menu is displayed containing a number of options, as shown in the diagram below.



All the options available from the Menu screen are described below.

File Manager



This option allows you to list the files stored in the internal memory or SD card, depending on the choice you have made through Setup and Storage.

A sign is placed before each filename. The meaning of this sign is as follows:

+ Indicates that the file has not yet been downloaded from the handheld

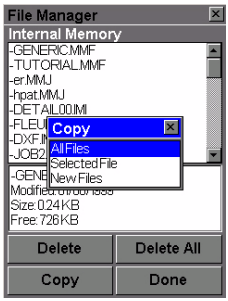
- Indicates that the file has been downloaded from the handheld.

The name, last modification date and size of the selected file is shown at the bottom of the screen. Only the following file types are listed:

- R*.*
- *.MMJ
- *.MMF
- *.IMI

You can delete the selected file or all the files by tapping respectively **Delete** or **Delete All** and then **Yes** to confirm.

(**Delete All** does not delete waypoints, track, routes and user settings but only the listed files, as opposed to **Clear All** in **Clear Memory** which deletes all waypoints, track and routes but does not impact user files; see *page 160*.)



When the internal memory is selected for storage, you can copy files to the SD Card you have previously inserted in the unit. Tap the **Copy** button and then one of the following options:

- **All Files**: All listed files are copied to the SD Card
- **Selected File**: Only the highlighted file is copied to the SD Card
- **New Files**: Only the files with filenames preceded by "+" are copied to the SD Card.

Mark

This option allows you to quickly create a new waypoint whose default coordinates will be those of your current location.

A typical use of this option is when you are located at a new point of interest and you wish to log its position.

When you select Mark in the menu list, ProMark3 displays the Mark screen with the following default values:

- Default icon in the Icon field
- "WPTxxx" as waypoint name in the Name field. "xxx" is a number that ProMark3 automatically increments as you create new waypoints
- Coordinates of your current location in the Location and Elevation fields

If you agree with all these parameters, and as the Save field is already selected at the bottom of the screen, you just have to press ENTER to create the new waypoint. This is the fastest procedure to create a new waypoint.

On the other hand, if you have to change any of these parameters or add a comment in the Message field, then you have first to edit the corresponding fields before selecting the Save field and pressing ENTER

The Route button gives direct access to the Route List screen where you can insert the newly created waypoint into a new or existing route.

If you would like to add more description or if you would like to export a waypoint to your GIS, use a feature library that includes a point feature called "Waypoint" and whatever level of attribution that you need. Then, when you want to record a waypoint, you can select the Waypoint feature type from the feature library and record a fully describable and exportable point feature.

GOTO

This option is discussed in detail on page 136.

Routes

This option is discussed in detail on page 141. The MENU button gives access to a list of specific options when the Routes option is enabled. This is summarized in the diagram below.

Insert WPT
Delete WPT
Replace WPT
Save Route

From View/Edit Route screen

Deactivate
Advance Leg
Save Trk to Rte

From Route list screen, backtrack route highlighted, activated

Activate Backtrk
Save Trk to Rte

From Route list screen, backtrack route highlighted, not activated

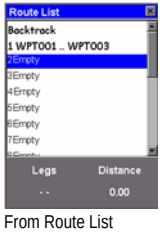
Activate Route
View/Edit Route
Reverse Route
Delete Route
Save Trk to Rte
Map View Route

From Route list screen, route highlighted, not activated

Deactivate Route
Select Leg
View/Edit Route
Reverse Route
Delete Route
Save Trk to Rte
Map View Route

From Route List screen, route highlighted and activated

Create New Rte
Save Trk to Rte



From Route List screen, empty route highlighted

Setup Menu

Storage

This option allows you to choose the media to which ProMark3 will save the data collected in the field. There are two possible choices:

- Internal Memory
- SD Card

In surveying, your choice of storage media is reminded at the bottom of the logging screen:

- "SD Card" is displayed inside the lower-right rectangle if you chose the SD Card
- Nothing is mentioned in that rectangle if you chose the internal memory.

Receiver ID

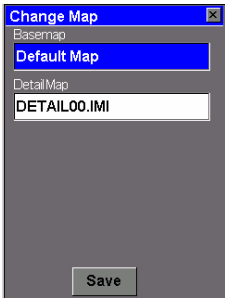
(Surveying only)

This option provides you with the ability to enter the 4-character receiver ID which is used in naming the raw data files. Each raw data file from this receiver will include this 4-character receiver ID.

The receiver ID must be unique among all receivers used together in a survey. Otherwise, raw data files will be given the same name, causing problems when the data is downloaded to the same location on the office computer for processing.

Valid characters are 0-9 and A-Z.

Select Map



This option is mainly used to choose the background map (Detail Map) that ProMark3 will display on the Map screen. The following parameters can be set on the Change Map screen:

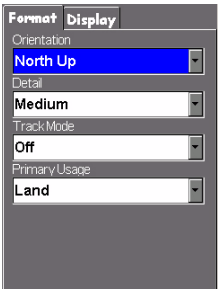
- Basemap: Only the Default Map option can be selected in this field. The default map – a worldwide map – is always present in ProMark3.
- Detail Map: Select the desired background map from the list attached to this field. If you did not upload a background map to ProMark3, then only the Empty option can be selected in this field. The extent of a detail map is usually limited to the extent of the area you are working in.

  Background maps are IMI files downloaded into the unit using GNSS Solutions (see *Uploading a Vector Background Map to ProMark3 on page 84*) or MobileMapper Office (see *Uploading a Vector Background Map on page 118*). Only one background map can be displayed at a time. This map naturally combines with the basemap. The list of detail maps shows the IMI files stored in the internal memory and those stored on the SD card whatever the storage setting.

After choosing the desired options for these parameters, tap Save.

Map Setup

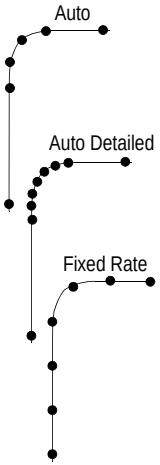
This option allows you to set the viewing options for the Map screen.



Map Setup screen, Format tab

On the **Format** tab, you can set the following parameters:

- **Orientation**: You can change how the map is orientated on the screen to either North Up, Course Up or Track Up. Default is North Up.
- **Detail**: Use this field to set the detail *for both the basemap and the detail map*. This field can be set to highest, high, medium, low or lowest. This changes the zoom level that different map objects (cities, highways, labels, etc.) are displayed. If you have set a zoom level and the display is too cluttered, set the map detail to a lower level; conversely set it to a higher level to view more detail.
- **Track Mode**: Allows you to set how often the ProMark3 stores track points:
  - **Off**: Stops the ProMark3 from saving any new track points.
  - **Auto**: The ProMark3 uses a method for track point storage that maximizes memory. Using **Auto**, you will see more points on and near turns and less points on straight stretches of the map.
  - **Auto Detailed**: Same as **Auto** but with more track points on and near turns.
  - **2.0 km, 1.0 km,..., 0.05 km, 0.01 km**: Fixed time intervals for track point storage.



Please note that the Track Mode will be automatically set to **Off** when you start logging a new feature in the open GIS job (using the Mobile Mapping application). This is to avoid confusion on the Map screen between features and track points. The Track Mode will be automatically restored with its initial settings when you close the GIS job.

- **Primary Usage**: ProMark3 can be set to either **Land** or **Marine** usage. When in Land (default), the map displays land areas in white and water areas in blue. For marine applications it may be desirable to reverse the display, showing water as white and land as blue. This will make reading some of the data information on the water easier.

Map Setup screen, Display tab

From the **Display** tab, you can customize the Map screen by specifying the items that ProMark3 should display on the map:

- **Show Map Info**: Use this option to show or hide the two data fields displayed at the bottom of the Map screen. To customize these fields, see *Customize on page 162*.
- **Waypoints** (default: checked)
- **Track Lines** (lines connecting track points if **Track Mode** different from **Off**; see page 151)
- **Pos-Dest Line** (line connecting current position to destination)
- **Depart-Dest Line** (line connecting initial position to destination)

Check the items you want to show and clear those you want to hide. You can also check or clear all these items in a single operation by respectively selecting Mark All or Clear All just above these items.

Press ESC or NAV to quit the Map Setup screen.

Nav Screens

This option allows you to remove the navigation screens that you do not need from the navigation screen sequence that you scroll by pressing NAV repeatedly (see page 126). When selecting this option, you are asked to turn off or on each of the available navigation screens. Tap “Off” for all these screens that you are not currently using. Note that the Map screen cannot be turned off. You must cycle through all the screens in order to save any changes to the On/Off status of any screen.

Coord System

This option allows you to define a primary coordinate system, and also a secondary coordinate system if you need one.

By defining a coordinate system, you tell ProMark3 how the calculated coordinates should be expressed. For example, if you choose **Lat/Lon**, all coordinates will be expressed as angles (latitudes and longitudes) and if you choose **UTM** or any other system, coordinates will all be distances (Northings and Eastings) from the chosen origin.

When you select the **Coord System** option from the Setup menu, ProMark3 asks you to specify which system you want to define (primary or secondary). Tap one. In the list that appears, tap the coordinate system you want to use. Depending on your choice, ProMark3 may then ask you additional information:

- If you select Lat/Lon, you are then asked to select the display format (DEG/MIN.MMM, DEG/MIN/SEC.SS, etc.)
- If you select any system other than Lat/Lon or UTM, you are asked to choose a scaling factor for displaying position coordinates: 1 meter, 10 meters or 100 meters. If you choose 1 meter, a northing coordinate will be displayed as, for example, 249143N. If you chose the 10-meter factor, the same coordinate will be displayed as 24914N. And if you select the 100-meter factor, the coordinate will be displayed as 2491N.

- For some systems, you are asked to supply information on grid zones or types
- For the User Grid, you are asked to supply a projection type (Transverse Mercator, Lambert Conic, Stereographic, Oblique Mercator or Polyconic), coordinates of origin, scale factor, unit to meters conversion and false Easting and Northing at origin

Notes on Coordinate Systems:

- The ProMark3 always uses the WGS 84 coordinates to locate the features and waypoints on the Map screen, even if you select some other coordinate system/datum.
- The coordinate systems and datums used to display anything on the Map screen are only for display. When you select some other coordinate system/datum, only the numbers of the coordinates of a feature/waypoint are changed. The map screen is not changed in appearance.

Map Datum

This option allows you to define a primary map datum, and also a secondary map datum if you need one.

A map datum is a geographic reference that ProMark3 will refer to to calculate the coordinates of your position. ProMark3 holds more than 70 different map datums in its memory.

After selecting the Map Datum option from the Setup menu, tap the map datum that applies to your country and working area.

To enter a user map datum, select the term "USER" in the list of datums arranged in alphabetical order. Then, for more information on how to enter a user map datum, refer to the appendix at the end of this manual (page 194).

Time Format

This option allows you to select the time format you want to use in ProMark3. You can choose from three different time formats: Local 24Hrs, Local AM/PM or UTC.

After selecting the Time Format option from the Setup menu, just tap the time format you want to use.

Units

This option allows you to select the units of measurement that will be used when displaying navigational data or features being logged.

All sets of units are formatted as follows: **long distance unit/short distance unit/speed unit/area unit**. You can select from 5 different sets of units.

You can also create your own set of units by selecting **Advanced** at the end of the list. You are then prompted to specify the unit you wish to use for each type of possible measure, i.e. Distance, Speed, Elevation, Bearing and Area.

After selecting the **Units** option from the Setup menu, tap the set of units you wish to use. If you have selected **Advanced**, a new list appears prompting you to choose a unit for each type of measure. Tap the first measure in the list and then tap the desired unit. This takes you back to the former screen where you can select the second measure, etc. When all units are defined, press ESC to come back to the Setup menu.

Alarms

All of the Alarm options are set in the same way. The instructions below apply to all of the Alarm settings. When the beeper is turned on for alarms (see **Beeper** option) an audible beep will be sounded for the alarm. A visual alert is displayed for the alarm whether the beeper is turned on or off.

Setting the Arrival Alarm: The arrival alarm alerts you that you have arrived at the destination of your GOTO route or to the destination of any leg in a route you are navigating on.

This option allows you to set how close you must come to the destination before the alarm begins to sound.

After the alarm sounds, you can reset the arrival alarm to a shorter distance, but this shorter distance will apply to the next target and not to the current one. If you want the alarm to sound again when you come within a shorter distance to the current target, first select another target destination and then reselect the original target.

Setting the PDOP Alarm: This turns on or off the alarm that can sound whenever ProMark3 has lost its ability to compute accurate position fixes due to poor geometry of the GPS constellation. Generally, PDOP values less than or equal to "5" are indicative of good operating conditions. So it is a good idea to set this alarm to "5." To turn off the PDOP alarm, enter "00."

Note: Apart from the Arrival and PDOP alarms, ProMark3 will generate a warning message on the screen in each of the following two cases:

- "Low Memory." This message will appear when the receiver is running out of memory. If raw data is being collected with the Surveying function or a GIS job is being logged, then the occurrence of this message will automatically stop data logging. You will however be allowed to enter the attribute values of the current GIS feature before the job is closed.
- "Out of Memory." This message will appear when the memory is full. The occurrence of this message will immediately end raw data collection or close the currently open GIS job and you will not be able to log anything until you free some space in memory.

North Reference

This option allows you to define the type of North reference you want ProMark3 to use. This can be True North, Magnetic North, Military True North or Military Magnetic North.

After selecting the **North Reference** option from the Setup menu, tap the desired North Reference from the displayed list.

Beeper

This option allows you to enable (On) or disable (Off) the beeper.

After selecting the **Beeper** option from the Setup menu, tap the desired option.

Reset Trip

If you tap this option, a warning message is displayed asking you to confirm your choice. To reset the trip odometer, tap the **Yes** button.

Clear Memory

This option allows you to clear one of the following data sets from ProMark3's memory:

- Track history: Will clear the track shown on the Map screen.
- Wpts/Routes: Will clear all waypoints and routes from memory.
- Routes: Will clear all routes from memory.
- Reset default: Will reset the receiver by restoring all factory defaults.
- All: Will clear all memory.

  (Clear All does not delete files but only waypoints, routes, track and user settings (language), as opposed to Delete All in File Manager which deletes all listed files but does not impact waypoints, track and routes; see *page 145*.)

After selecting the Clear Memory option from the Setup menu, tap the desired choice. ProMark3 will ask you to confirm your choice. If you have selected All, ProMark3 will then exit from the current application to return to the ProMark3 workspace screen. It will then automatically re-launch the same application for which re-initialization will be required (user language).

Simulate

This option allows you to set the simulator. It shows you how ProMark3 uses its various functions based on a simulated journey. The simulator is useful for learning or demonstrating ProMark3's GPS functions when indoors and there is no GPS reception. When the simulator is on, ProMark3 quits normal operation to operate in the simulator mode. You can choose one of the following three options when you access the **Simulate** option:

- **Off**: Will turn the simulator off. ProMark3 will return to normal operation
- **Auto**: Will turn the simulator on. A predefined heading and speed rate will be used.
- **User**: Will turn the simulator on. A user-defined heading and speed rate will be used.

After selecting the **Simulate** option from the Setup menu, just tap the desired choice.

If you have selected **User**, ProMark3 will then ask you to enter heading and speed data.

Language

This option allows you to select the language that ProMark3 will use to display text.

TIP: If you accidentally set the language to one you cannot read and want to get back to the Language Select screen, follow these instructions. Press MENU. Tap the fifth item in the list and then tap the last item in the new list. You are back at the Language Select screen.

Customize

The Map screen must be in Position mode if you wish to customize data fields. If the Map screen is in cursor mode (cursor is a crosshair), press ESC to return to the Position mode.

Except for the Satellite Status screen, all navigation screens can be customized through the following procedure:

- Press NAV repeatedly until the desired navigation screen is displayed
- Press MENU
- Tap Customize. Additionally for the Map screen, tap Customize Fields.
- On the Navigation screen now shown in edit mode, highlight the data field to be changed using the left/right arrow and press ENTER
- Choose the data in the list that you wish now to display in this field. Press ENTER. Data change in the field is immediate.
- Resume this procedure for all the fields that need to be changed on this screen and on the other navigation screens.

Available data:
BEARING
DISTANCE
SPEED
HEADING
VMG (Velocity made good)
CTS (Course to steer)
ETA (Estimated time of arrival)
ETE (Estimated time enroute
XTE (Crosstrack error)
Turn
Elevation
Time
Date
EPE (Estimated Positional Error)
Avg. Speed (Average speed)
Max Speed

If you select Customize when the Map screen is displayed, another option an additional menu is displayed showing two option:

- Customize Fields: This option is described above
- Street info: If you select this option, the bottom of the Map screen will display the name of the street you are currently walking or driving along. To re-activate the first option, press MENU, tap Customize and then Two Data Fields.

About...

The About... screen displays the current status of your ProMark3.

Using the About... screen you can see the serial number of the receiver, the version of software, the version and memory size of the basemap and the memory space percentage occupied by data & maps, routes and waypoints.

Exit

This option allows you to quit the Surveying or Mobile Mapping application that is currently running and return to the ProMark3 workspace screen.

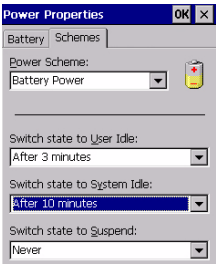
8. Power Management

ProMark3 comes with a removable/rechargeable battery, which provides enough energy for a full working day –provided you start your day with a fully charged battery. In order to ensure a longer battery life, use the external power whenever possible. When used, the external power source also automatically recharges the internal battery.

Power Saving Modes

The built-in advanced power saving features also help to optimize power consumption while the system is idle. The ProMark3 system has two power saving modes when the internal battery is used:

1. **User Idle** state: A state in which you are using the ProMark3 but not actively interacting with it. For example, you may be only looking at the display and not interacting with the system.
2. **System Idle** state: A state in which you are not directly using the ProMark3 but processes in the unit are still active.



You can configure the ProMark3 to automatically enter each state when it has been idle for a specified time.

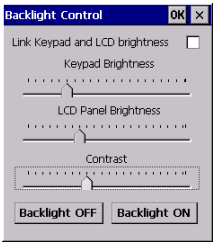
To change the idle times, from the ProMark3 workspace screen, double-tap the Settings icon and then the Power icon. Then make the necessary changes on the Schemes tab (see opposite.)

We recommend that you keep the default setting ("Never") for the last field.

Backlight Control

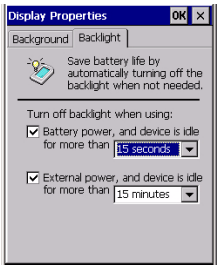
To adjust or turn on and off the backlights manually, first exit from the Surveying or Mobile Mapping function if you are working with one of these functions. Then from the ProMark3 workspace screen, double-tap the **Settings** icon. A list of functions is now displayed on the screen. Double-tap **Backlight Control**.

In the window that opens (see figure opposite), you can do the following:



- Adjust separately the brightness for the keypad and the brightness for the screen by dragging horizontally the corresponding cursors on the screen
- Adjust the screen contrast by moving the corresponding cursor.
- Tap the **Backlight OFF** button to turn off the backlight
- Tap the **Backlight ON** button to turn on the backlight

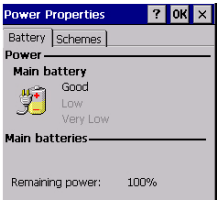
The backlight can also be turned off automatically after a user-set time delay. This delay will add up to the delay required before ProMark3 enters the **User Idle** state (see *page 164*). For example, if the ProMark3 switches to the User Idle state after 2 minutes of inactivity and the Backlight Off time delay is 15 seconds, then the backlights will turn off after 2 minutes and 15 seconds of inactivity.



To enable and set the Backlight-Off time delay, first exit from the Surveying or Mobile Mapping function if you are working with one of these functions. Then from the ProMark3 workspace screen, double-tap the **Settings** icon and then the **Display** icon. On the **Backlight** tab (see opposite):

- Check each of the two boxes on the left and then choose a Backlight-Off time delay for each case of power source (battery or external)
- Tap **OK** to close the dialog box.

After the backlights have been automatically turned off through this process, it is very easy to turn them back on: you just need to press a key or touch the screen.

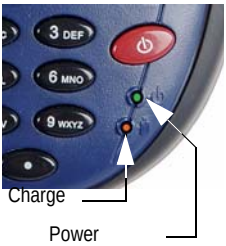


Checking Battery Status

From the ProMark3 workspace screen, double-tap the **Settings** icon and then the **Power** icon. Tap the **Battery** tab. This tab provides a visual indication of the the battery level (see opposite).

Note that it takes a few minutes after you have turned on the unit before this tab indicates the accurate status of the battery.

LED Indicators



Power LED (Green)	Indicates:
Off	Device Switched Off
Solid Green	Power On

Charge LED (Amber)	Indicates:
Off	Not charging
Solid Amber	Battery is fully charged
Blinking Amber	Battery is charging

The charge LED will give charging information only if the receiver is on.

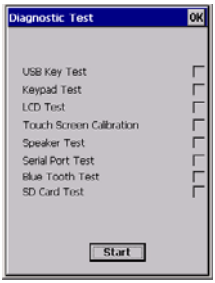
Turning Off ProMark3

Press the red key until the Shutdown window appears. Tap OK to confirm that you want to turn off the unit. As a result, the unit instantly shuts down.

9. Diagnostics & Upgrade Tools

This chapter focuses on the different ProMark3-embedded tools that allow you to test the operation of your ProMark3.

Testing ProMark3's Internal Peripherals



Use the **Tests** utility.

This utility can be found in the Utilities folder. To run this utility from the ProMark3 workspace screen, double-tap the Utilities icon and then the Tests icon.

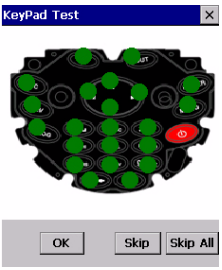
The Tests utility allows you to test various elements in the unit, namely USB, keypad, LCD, touch screen, speaker, serial port, Bluetooth and SD card.

After launching Tests, tap Start. All the tests are then run in succession. You can skip the test in progress by tapping Skip, or all the remaining tests by tapping Skip All.

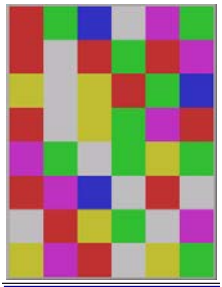
USB test: Plug a Mass Storage USB device, wait about 10 seconds and then tap OK.

If the test is successful, the unit will switch to the next test.

If the test fails, a Failed button will appear at the bottom of the screen, next to the OK button. You can either retry the test by tapping OK, or acknowledge that the test failed by tapping the Failed button. The unit will then continue with the tests.

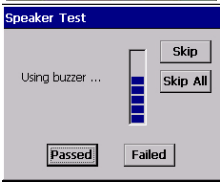


Keypad test: Successively press the key corresponding to the white spot shown on the screen. If the key is pressed successfully, the spot turns green and a new white spot appears on another location on the screen prompting you to press the corresponding key, etc. Tap OK at the end of the test.

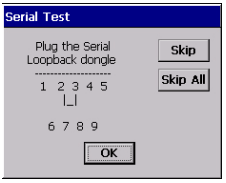


LCD test: Consists of displaying different colors and shapes with different levels of brightness and contrast. There is no user action required. This test can be skipped by pressing the ESC key.

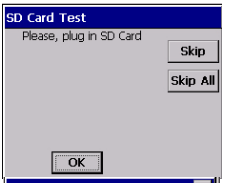
Stylus test: Follows automatically. Takes place as described in *Calibrating the Screen on page 25*. You can skip that test by pressing the ESC key.



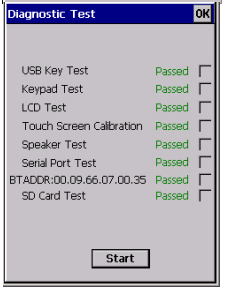
Speaker test: Tap **Passed** after the speaker has correctly emitted three different sounds with increasing volume. The test will be repeated indiefinitely until you tap **Passed** (or **Failed** if the test failed).



Serial Port test: You first need to connect a female plug on the ProMark3 I/O module's RS232 port on which pins 2 and 3 have been shorted. Then tap **OK** to start the test.



SD card test: You first need to insert an SD card in the unit and then tap **OK**.



At the end of the tests, the initial dialog box reappears on which you can see the tests that passed and those that failed. Note that Bluetooth is tested through an internal routine (see BT ADDR:... line).

Tap **OK** to close the Tests dialog box.

Testing GPS Section

Use **GPS Status**.

This utility can be found in the Utilities folder. To run this utility from the ProMark3 workspace screen, double-tap the Utilities icon and then the GPS Status icon.

GPS Status allows you to quickly check the current status of the GPS constellation after initializing the GPS section of the ProMark3 using the GPS Init utility (see *GPS Init on page 176*).

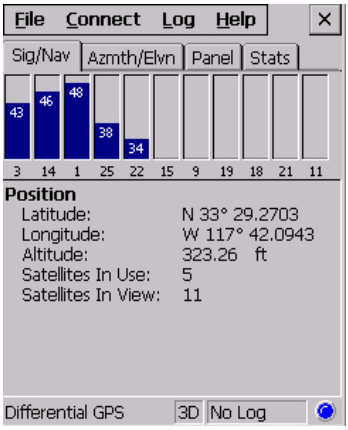
GPS Status gives a more detailed report of the GPS reception conditions than the Satellite Status screen does. (This screen can be displayed from within the Surveying or Mobile Mapping applications by pressing the NAV key.)

GPS Satus can also be used to log and playback NMEA data.

Signal Quality/Navigation Window (Sig/Nav)

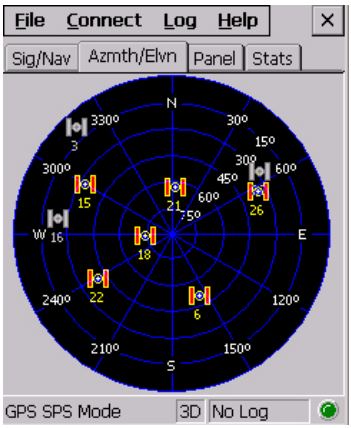
This window allows you to monitor Signal/Noise ratios for received satellites. This information is shown in graphical form. The signal quality window will grow or shrink to accommodate the number of satellites in view. The Position pane provides the coordinates of the current GPS position, including elevation. The “GPS Mode” bar displays the type of position being calculated by the GPS receiver.

There are three groups of GPS modes that can be displayed: NOFIX, 2D/3D, and differential modes.



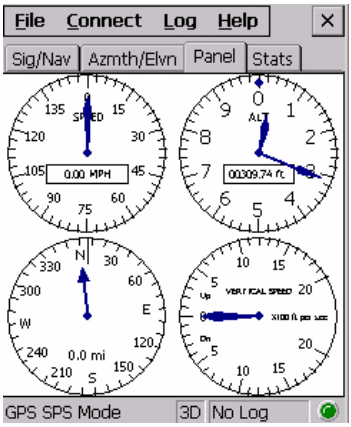
Azimuth and Elevation Graph (Azmth/Elvn)

This graph shows all the satellites currently in view. Each satellite is identified by its pseudo-random number (PRN), its azimuth and elevation angles.



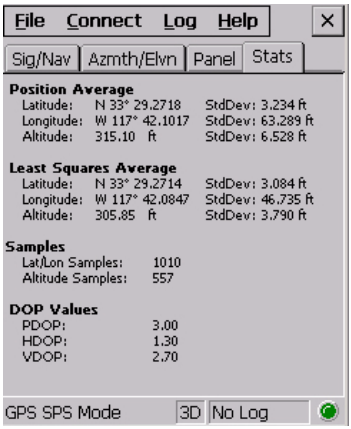
Panel Window (Panel)

This window displays the following parameters relevant to the unit: speed, altitude, heading and vertical speed.



Statistics Window (Stats)

This window provides the averaged coordinates of the computed position and shows the accuracy figures corresponding to the GPS receiver used in static mode. The Dilution of Precision (DOP) values are also displayed.



Logging NMEA Data

- In the menu bar, tap **Log** and then **Start**.
- Select the folder where you want the data file to be stored. *This can only be on the SD card!*
- Name the file using the on-screen keyboard. To be able to see the **Name** field, tap and hold the keyboard from its title bar and drag it upward.
- Tap **OK** located on top of the dialog box. Data logging starts immediately. The "Log:<current file size>" message appears in the status area at the bottom of the screen.
- To stop data logging, tap **Log** and then **Stop**. Data logging stops immediately.

  Example of logged data:

  ```
  Log Start: 2005/10/12 -- 01:56:56
  $GPGSV,4,1,14,08,27,062,44,15,11,312,36,09,22,252,41,10,32,181,45*71
  $GPGSV,4,2,14,18,21,316,44,27,01,068,28,29,84,045,48,07,06,126,37*7E
  $GPGSV,4,3,14,26,76,323,48,19,01,015,36,28,50,075,48,21,12,280,43*74
  $GPGSV,4,4,14,37,32,151,40,35,16,241,38*75
  $GPGGA,085656.00,4717.93754,N,00130.54139,W,2,09,1.0,036.93,M,49.6,M,,*48
  ```

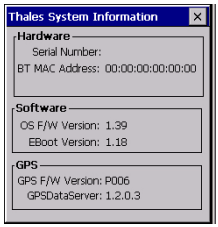
- Insert the SD card in your local SD Card reader to transfer the log file for further use.

ProMark3 Serial Number & Versions

Use **Thales System Info**.

This module can be found in the Settings folder. To run this module from the ProMark3 workspace screen, double-tap the Settings icon and then the Thales System Info icon.

This module provides the following information on the hardware, software and GPS section currently installed in your ProMark3:



- Hardware:
  - Serial Number
  - BT MAC Address
- Software:
  - OS F/W Version
  - EBoot Version
- GPS:
  - GPS F/W Version
  - GPSData Server.

Upgrading ProMark3 Software & Firmware

Use **AutoLoader.**

This utility can be found in the Utilities folder.

When Magellan releases new ProMark3 software or firmware (in the form of a single txt file), you will have to:

- Copy the txt file to an SD card
- Insert that SD card into your ProMark3
- Launch the AutoLoader utility: from the ProMark3 workspace screen, double-tap the Utilities icon and then the AutoLoader icon
- Select the TXT file you need to load and then let the AutoLoader utility complete the upgrade for you.

ProMark3 Reset Procedures

Hardware Reset

Clears the user settings and shuts down the unit.

Use the following key combination to hardware-reset the ProMark3 unit:

ESC+ENTER+Red Power key.

Software Reset

Re-boots the unit (start-up screen).

Use the following key combination to software-reset the ProMark3 unit:

ESC+ENTER+IN

10.Utilities & Settings

This chapter lists all the utilities and setting modules embedded in the ProMark3 unit. It gives details for all those utilities and setting modules that are not addressed elsewhere in the present manual. For all others, cross-references are provided.

Utilities

To run a utility from the ProMark3 workspace screen double-tap the Utilities icon and then double-tap the icon of the utility you want to run. You can only run one utility at a time.

GPS Init

This utility is in fact used when first using your ProMark3. Refer to *Initializing GPS on page 27* in this manual or to the *ProMark3 Getting Started Guide*.

GPS Reset

This utility allows you to re-apply the default settings to the GPS section of the ProMark3. When you tap Cold Reset, ProMark3 clears such data as almanac and iono data, etc. used by the GPS section.

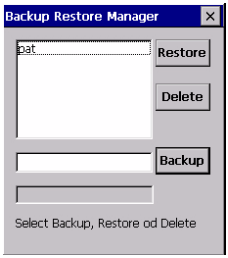
You usually need tu run a cold reset after installing new firmware or software in your ProMark3.

GPS Status

Refer to *Testing GPS Section on page 170*.

GPS Config

For future developments.



Backup

This utility allows you to save the unit's current configuration data to an SD Card. Note that user data files are NOT included in configuration data.

To create a backup file, first insert an SD card into the unit, then name the backup file. Tap **Backup** when you are ready to create the backup file. When the backup is complete, the name of the backup file appears in the list box.

Using Backup, you can also restore or delete any backup file saved on the inserted SD Card.

SNR Test & Burning Test

Test utilities used in manufacturing only. Not user test tools.

AutoLoader

Refer to *Upgrading ProMark3 Software & Firmware on page 174*.

Tests

Refer to *Testing ProMark3's Internal Peripherals on page 168*.

Chinese

A utility intended for future developments in Chinese language.

SNProg

Test utility used in manufacturing only. Not a user test tool.

DGPS Config

Refer to *DGPS Real-Time Configuration on page 28* and *Implementing Real-Time DGPS on page 182*.

Settings

To run a setting module from the ProMark3 workspace screen, double-tap the Settings icon and then double-tap the icon you want to run. You can only run one setting module at a time.

Backlight control

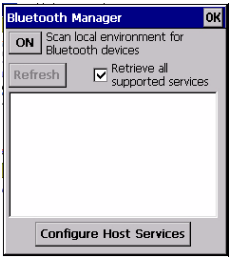
See *Backlight Control on page 165*.

Bluetooth Manager

The ProMark3 is equipped with built-in Bluetooth technology that allows short-range connections to other Bluetooth-enabled devices such as the MobileMapper Beacon.

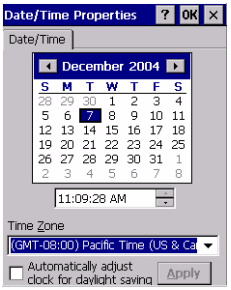
Use theBluetooth Manager to find, configure and establish connections to other Bluetooth devices. To start the Bluetooth Manager:

- Double-tap the Settings icon
- Double-tap the Bluetooth Manager icon
- Tap the ON button on Bluetooth Manager. The ProMark3 starts to search for other available Bluetooth devices that are within range. The detected devices are then listed.
- To preserve battery power, we recommend that you enable (turn on) Bluetooth only when using it: Tap the OFF button on Bluetooth Manager to disable Bluetooth.



For more information on Bluetooth when used to connect ProMark3 to a MobileMapper beacon, refer to *Using MobileMapper Beacon on page 184*.

Date/Time

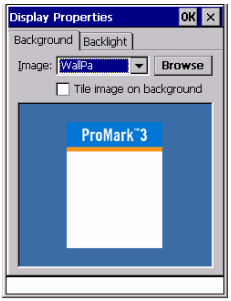


This module allows you to set the date, time and time zone. The time zone you choose in this module impacts the local time displayed in the Surveying and Mobile Mapping applications. This module also allows you to ask for automatic clock adjustment for daylight saving.

Changing the time in this window also updates the time running in the GPS Init utility (see *page 176*). So it's a good idea to set this window before running the GPS Init utility.

When the GPS section of the receiver has been initialized, the time displayed in this window comes under GPS control which means the time field provides the GPS time. This usually happens about 40 seconds after initialization is effective. From this time, you should not change the time in this window.

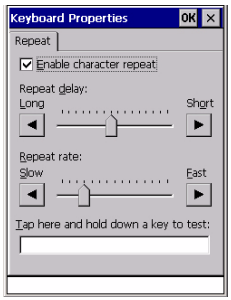
Display



This module is used to:

- Choose the screen background
- Enable and set two Backlight-Off time delays that will be activated after the ProMark3 switches to the User Idle state (refer to *Backlight Control on page 165*).

Keyboard



This module allows you to refine the keyboard settings (repeat delay and repeat rate) for optimum use.

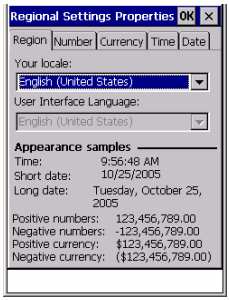
Owner

This module is used to identify the unit using the following information about the user: name, company, address, work phone and home phone. To be able to see all the fields in this dialog box, you will have to tap and hold the keyboard from its title bar and drag it upward or downward.

Power

Refer to *Power Management on page 164*.

Regional Settings



This module is used to perform various local settings such as number, currency, time & date formats. Default settings can be obtained in one operation by selecting your language/country on the **Region** tab.

Stylus

As explained on the screen, the first tab allows you to set and test your double-tap actions.

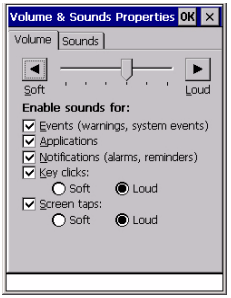
The second tab allows you to recalibrate the screen as explained in *Calibrating the Screen on page 25*.

System

This three-tab window gives information on the internal components of the ProMark3 system.

Thales System Info

Refer to *ProMark3 Serial Number & Versions on page 174*.



Volume & Sounds

This module allows you to make volume and sound settings.

11.Implementing Real-Time DGPS

The real-time DGPS functionality is needed in your ProMark3 when your applications require that the unit deliver submeter positions while you are working in the field.

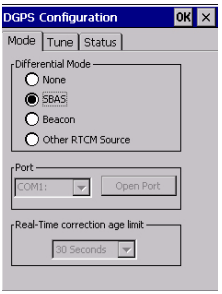
There are three different ways of providing ProMark3 with the differential correction data needed for real-time DGPS:

- Using SBAS (Satellite-Based Augmentation System). SBAS encompasses WAAS in the North American continent and EGNOS in Europe.
- Using Magellan' MobileMapper beacon (a IALA/US Coast Guard-compatible MF receiver)
- Using another RTCM source.

Using SBAS

This is the easiest way of implementing real-time DGPS in ProMark3.

As the correction data broadcast by SBAS uses the same transmission channel as GPS, you don't need any additional equiment or cable. Receiving correction data will only require one GPS reception channel in ProMark3. The allocation of this reception channel will be managed internally so you won't have anything special to do except for the following:



- On the ProMark3 workspace screen, double-tap **Utilities** and then **DGPS Config**.
- On the **Mode** tab, check **SBAS** by tapping on the button next to **SBAS**.
- Tap **OK**. A message is displayed confirming that SBAS is used as real-time DGPS source.
- Tap **OK** again. Close the **Utilities** folder and then run the Surveying or Mobile Mapping application.
- Press the NAV key until the Position screen #1 is displayed. On this screen (see *page 130*), if you are not moving, you will notice that the "WAAS Average" indication is displayed in the middle of the screen, meaning that the ProMark3 now delivers DGPS position fixes.

Using MobileMapper Beacon

Magellan's MobileMapper Beacon can be used to provide ProMark3 with real-time DGPS correction data from any beacon networks operated worldwide.

The connection between these two units can be achieved in two different ways:

- Via Bluetooth
- Or via a serial cable using the RS232 protocol.

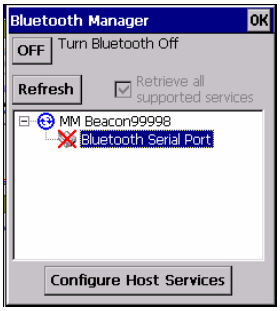
Via Bluetooth

Using ProMark3's DGPS Configuration and Bluetooth Manager utilities, tuning the beacon receiver and monitoring its performance through wireless communication is a simple process.

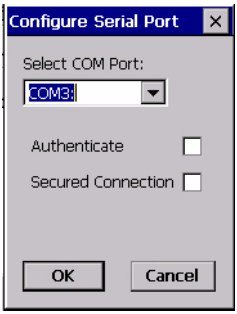
1. Establishing Communication Between the Two Units

- Power on MobileMapper Beacon and make sure your ProMark3 device is within range. (The distance between both units should be less than 10 meters.)
- On the ProMark3 workspace screen, double-tap Settings and then Bluetooth Manager. Tap ON and wait for it to detect the MobileMapper Beacon device.

- Tap the plus sign box next to the beacon device name:

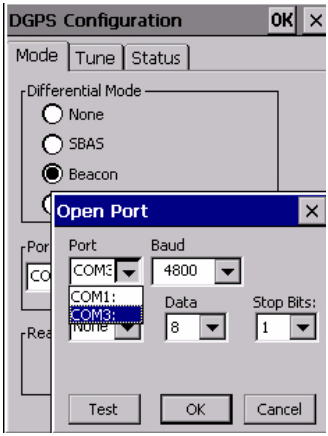


- Double-tap “Bluetooth Serial Port” to configure this port.
- Freely choose one of the listed ports (“COM3” for example):



- Tap OK.
- Tap OK in the Bluetooth Manager window.
- Close the Settings window (tap ×)

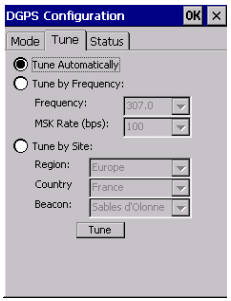
- Double-tap the **Utilities** icon and then the **DGPS Config** icon
- Tap **Beacon** and then tap the **Open Port** button
- In the list attached to the **Port** field, select the same port as the one you chose earlier in the Bluetooth Manager window. Keep the default settings for the other fields.



- If you tap the **Test** button, a message will appear informing you that the port is now available for read/write operations. Tap **OK** to close this message.
- Tap **OK** in the **Open Port** window to open the port and to return to the DGPS configuration window. Note that the **Open Port** button has been renamed "**Close Port**".

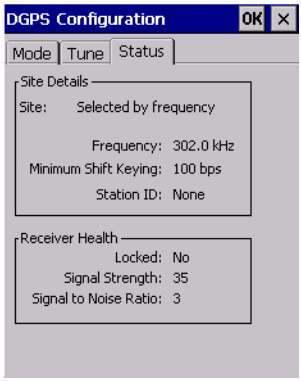
2. Tuning the MobileMapper Beacon Receiver

- Still in the DGPS Configuration window, select the Tune pane
- Choose one of the following options to tune the MobileMapper Beacon receiver:
  - Tune Automatically: Automatic method (default choice).
  - Tune by Frequency: Manual method. You are supposed to know the reception frequency (range: 283.5 to 325.0 kHz in 0.5-kHz steps) and the MSK rate (100 or 200 bits per second) used by the reference station you wish to use.
  - Tune By Site: Manual method. You have to specify the region and country where the reference station is located. Then select the site name of this reference station in the Beacon field.



- Tap the Tune button. If you tapped Tune Automatically, the MobileMapper Beacon will automatically search for the best signal, from a nearby reference station. Whatever your tuning choice, after a while a "Beacon Tuned Successfully" message is returned. Tap OK to close the message window.
- After the Beacon has been tuned, you can check the current tuning settings, Locked status (Yes/No), Signal Strength in dBµV and Signal to Noise Ratio in dB.

To read this information, you just need to select the Status pane in the DGPS Configuration window:

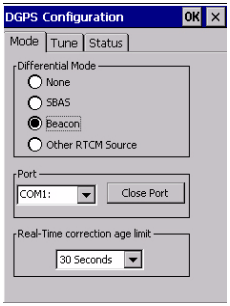


- Finally, tap OK on top of the DGPS Configuration window for all the settings to take effect. A new message appears confirming the acquisition of RTCM data via the selected port.
- Tap OK to close this message window.
- Tap OK to close the DGPS configuration window. Your ProMark3 will now operate in real-time DGPS mode. After launching the Surveying or Mobile Mapping function, press the NAV key until the Position screen #1 is displayed. On this screen (see *page 130*), you will notice that the “DGPS” indication is displayed in the middle of the screen, meaning that the ProMark3 now delivers DGPS position fixes.

Via a Serial Link

1. Establishing Communication Between the Two Units

- Clip the I/O module to the ProMark3
- Use the data cable provided with the MobileMapper Beacon to connect this unit to the ProMark3 RS232 Port (COM1). Port COM1 is located on the I/O module.
- Turn on the two units (ProMark3 and Beacon). When you turn on the ProMark3, a message is displayed indicating that an RTCM source is used on COM1: (but in fact the port is not open yet for use). Tap OK to close the message window and then follow the instructions below.

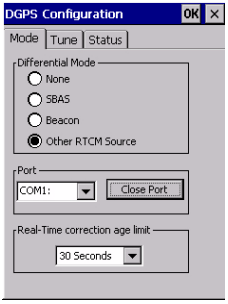


- On the ProMark3 workspace screen, double-tap the Utilities icon and then the DGPS Config icon
- On the Mode tab, tap Beacon
- Unless already done, select "COM1:" in the Port field and then tap the Open Port button
- Unless already done, set the COM1 port as follows:
  - Baud: 4800
  - Parity: None
  - Data: 8
  - Stop Bits: 1
- Tap OK to close this window and return to the DGPS Configuration window.

2. Tuning the MobileMapper Beacon Receiver

Same as via Bluetooth. See *page 187*.

Using Another RTCM Source



You can use another equipment used as the RTCM source. In this case, see the manufacturer's instructions to know how to connect this equipment to the ProMark3. On ProMark3 side, you just need to:

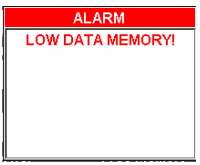
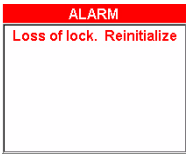
- Run the **DGPS Config** utility
- On the **Mode** tab, tap **Other RTCM Source**
- Then tap **Open Port**, select the port used, make the necessary settings and tap **OK**.
- Tap **OK** to close the DGPS Configuration window. A message will tell you that the RTCM source is now used in ProMark3.

12.Appendices

Main Alarm Screens

Alarm Acknowledge: *Tap anywhere on the screen outside of the alarm window to acknowledge (erase) the alarm message.*

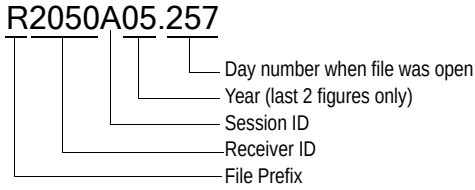
The "Not enough satellites..." and "No external antenna..." messages will also automatically disappear when the condition that triggered the message also disappears.

Alarm message	Description & Action Required
	(Surveying only) You are trying to start data collection with no external antenna connected to the unit. Please connect the external antenna using the appropriate cable and resume data collection.
	The internal battery is low and the unit will very shortly be unable to function properly. Please acknowledge the alarm, quit the current application, turn off the unit and replace the battery before doing anything else.
	The internal memory or SD card you are using for data collection is almost full. Do one of the following: 1) If possible, free some memory space using the File Manager command, 2) Switch to the other possible medium using the Setup>Storage command or 3) Replace the SD card if you work exclusively with SD cards.
	You were using the AC adapter as the power source for the unit and you have just unplugged it. The unit is now powered from its internal battery. Just acknowledge the alarm.
	If you are not collecting data, the unit warns you that it would be unable to collect data at your current location due to poor GPS reception conditions: Move to a better location. If a survey is in progress (Stop & Go or Kinematic without initialization or –less likely– Static), the unit warns you that it has stopped collecting data until the reception conditions improve.
	You are performing a stop-and-go or kinematic survey that you initialized with the initializer bar or at a known point. Poor reception conditions have triggered this message. Whether these conditions are intermittent or persistent, you *must* now acknowledge this message and resume all or part of the survey (see *Re-Initialization on page 75*).

File Naming Conventions

Survey Data Collection

Any file created while collecting survey datais named according to the following conventions:



The session ID increments A-Z, which provides up to 26 unique session IDs for any given day number. If more than 26 files are collected in one day, the first digit of the year is used as part of the session ID. The following file list illustrates the session ID incrementing scheme:

R2050**A**05.257 ... R2050**Z**05.257
R2050**AA**5.257 ... R2050**ZA**5.257
R2050**AB**5.257 ... R2050**ZB**5.257, etc.

GIS Post-Processing

Suppose you have created a new job named "JOB1.MMJ." You selected the post-processing job mode in ProMark3 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 and JOB1.E00
Rover file seen on MobileMapper Office's Differential Correction window	JOB1

Suppose you have logged a reference station file on ProMark3. The table below illustrates how the resulting files will appear at various stages of the differential correction process:

Reference file seen on receiver	R0001a06.014 (for 1st file logged at point 0001 on the 14th day of 2006)
Reference file seen on MobileMapper Transfer's left window, before download	0001a06.014 (for the first file recorded at reference station site ID 0001 on the 14th day of 2006
Reference file seen on MobileMapper Transfer's right window, after download	b0001a06.14, d0001a06.14, e0001a06.14 and w0001a06.14
Reference files seen with Windows Explorer, after download	b0001a06.14, d0001a06.14, e0001a06.14 and w0001a06.14
Reference file seen on MobileMapper Office's Differential Correction window	b0001a06.14

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.

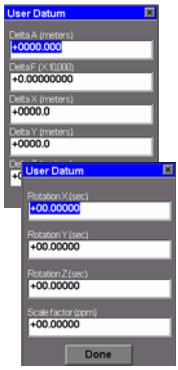
The reference files that start with B, D, E or W are similarly handled automatically by MobileMapper Office but should be archived together with the rover files.

Reference files recorded by non-ProMark3 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:

	WGS 84	Local Datum
a	6 378 137	6 378 388
1/f	298.257 223 563	297

▼

		Complete the fields below on the receiver screen using the values of Δa and 10000xΔf, below, left):
Δa	- 251 m	Delta A (meters)
$f_{WGS\ 84}$	3.352 810 665 x 10^{-3}	
f_{Local}	3.367 003 367 x 10^{-3}	
Δf	-- 0.014 192 702 x 10^{-3}	
10 000 x Δf	- 0.141 927 02	Delta F (X10,000)

Δa and Δf of Frequently Used Datums

Name	a	1/f	Da	Df x 10 000
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

Upload/Download Procedures (Summary)

Surveying

Download	From	To	Using (2)	See
Survey Data Files	ProMark3 (from SD card or internal memory) (1)	Project folder using Download utility	USB or RS232 link	Page 79
Survey Data Files	SD Card (in local SD card reader) (4)	Project folder using Download utility	Local SD card reader	Page 82

Upload	To	From	Using (2)	See
Vector Background map	ProMark3 (to SD card or internal memory) (1)	GNSS Solutions	USB or RS232 link	Page 84
Control Points	ProMark3 (to internal memory only)	GNSS Solutions	USB or RS232 link	Page 86

Mobile Mapping

Download	From	To	Using (2)	See
GIS data files	ProMark3 (from SD card or internal memory) (1)	Job folder using MobileMapper Transfer utility	USB or RS232 link	Page 111
GIS data files	SD Card (in local SD card reader) (4)	Job folder using MobileMapper Transfer utility	Local SD card reader	Page 113

Upload	To	From	Using (2)	See
GIS job and waypoint files	ProMark3 (to SD card or internal memory) (1)	MobileMapper Office	USB or RS232 link	Page 121
GIS job and waypoint files	SD card (in local SD card reader) (5)	MobileMapper Transfer	Local SD card reader	Page 122
Vector Background map	ProMark3 (to SD card or internal memory) (1)	MobileMapper Office	USB or RS232 link	Page 118
Vector Background map (3)	SD Card (in local SD card reader) (5)	MobileMapper Office	Local SD card reader	Page 118
Vector Background map (3)	PC hard disk	MobileMapper Office	N/A	Page 118

(1) Use MENU>Setup>Storage on ProMark3 to select the storage medium used.
(2) From fastest to slowest data transfer method: 1) via Local SD card reader, 2) via USB, 3) via RS232.
(3) ProMark3 must be connected via USB or RS232 to allow MobileMapper Office to generate the map specifically for use in ProMark3.
(4) SD card extracted from ProMark3 to be inserted in the local SD card reader.
(5) SD card later inserted in the ProMark3 for use in the field.

Ordering Information

NOTE: Magellan reserves the right to make changes to this list without prior notice.

Item	Designation	Part Number
	I/O Module	980808
	USB Cable	730396
	AC Adapter/Charger	980783
	External GNSS Antenna	110454
	External Antenna Cable	702058
	Vertical Antenna Extension	103717
	Field Receiver Bracket	702065
	HI Measurement Tape	111146
	Field Bag	111132

Item	Designation	Part Number
	ProMark3 User Documentation & MobileMapper Office Software	500900
	Initializer Bar and Antenna Adaptor	800954
	GNSS Solutions CD	702081-01

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 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 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 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 MobileMapper 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 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 the receiver 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 lat-

er navigation. GPS for GIS receiver have largely replaced waypoints with point features.

W-File: A binary data file containing SBAS data.

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

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ProMark™3

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