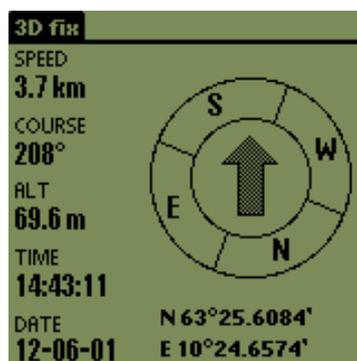


Cetus GPS Userguide

Cetus GPS 1.0
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<http://www.cetus.dk/gps>

Cetus GPS Userguide

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Introduction

This Userguide contains extensive information about using Cetus GPS for GPS navigation, tracking and field data collection. The information includes detailed descriptions of how Cetus GPS works and precision specifications for the displayed and logged data.

This is the primary source of information regarding Cetus GPS. Summaries of the content and frequently updated lists referenced from within this text as well as suggestions on how to use Cetus GPS for different applications are available at the Cetus GPS homepage.

The average user of Cetus GPS will have a reasonable amount of GPS experience and technical knowledge. Therefore in each section the presentation of basic information is accompanied by technical notes and descriptions.

There are huge advantages of compiling all available information into a single document, but this might seem a bit overwhelming to the novice user. Please bear in mind that you will probably be able to use Cetus GPS without reading a single line of this guide. The information here is provided to help you get the most out of Cetus GPS.

If you discover a bug in the current version of Cetus GPS, please look at [Appendix B](#) for information on how to submit an error report.

Cetus GPS and this Userguide are published in English for obvious reasons. English is not my native language, however, and I do have a lot to learn regarding the writing of English texts. I do, of course, want this text to be as correct as possible so please send me an email if you discover spelling or linguistic errors.

Quick start

In order to use Cetus GPS you need a Palm and a GPS receiver. If your GPS receiver is not the kind you attach directly to your Palm, you also need a GPS receiver cable for Palm to connect the GPS receiver to your Palm.

Downloading the latest version

Before you install Cetus GPS please visit the Cetus GPS homepage and click on the Download menu to check if you have the latest version.

The zip archive CetusGPS.zip contains the files listed below:

Readme.txt	<i>A short note about the zip archive</i>
CetusGPS.prc	<i>Cetus GPS for Palm</i>
MathLib.prc	<i>A free shared mathematical library</i>
CetusGPS.pdf	<i>The latest version of this Userguide</i>
Copyright.txt	<i>The Cetus GPS project copyright information</i>
Disclaimer.txt	<i>The Cetus GPS project disclaimer</i>
MathLib.txt	<i>Information about the MathLib library</i>

The MathLib library is not a part of the Cetus GPS project, a copy is simply included in the Cetus GPS archive for your convenience. Please see appendix D for detailed information about the MathLib library.

The download page also lists some archives containing TrackLog export utilities for various platforms. You will need a TrackLog export utility if you want to use the track logger function.

Installation

To install Cetus GPS onto your Palm you only need to install the files:

```
CetusGPS.prc  
MathLib.prc
```

Upgrade from a previous version

Delete the previous version of Cetus GPS using the Launcher delete function. Then perform the installation as a normal first time installation.

First time installation for Windows users

1. Go to the *Start* menu
2. Select Programs -> Palm Desktop -> Install Tool
3. Click on the *Add* button and select the file `CetusGPS.prc`
4. Click on the *Done* button
5. Click on the *Add* button and select the file `MathLib.prc`
6. Click on the *Done* button
7. Perform a Hotsync to install Cetus GPS

First time installation for Linux users

Provided that you have already configured Linux for Palm communication, you may install Cetus GPS by executing the commands:

```
pilot-xfer -i CetusGPS.prc  
pilot-xfer -i MathLib.prc
```

First time installation for Macintosh users

1. Start Hotsync Manager
2. Select *Install Handheld Files*
3. Click on *Add To List* and select the file `CetusGPS.prc`
4. Click on *Add To List* and select the file `MathLib.prc`
5. Close the Install Handheld Files window
6. Perform a Hotsync to install Cetus GPS

Configuring the GPS receiver

Before connecting the GPS receiver to the Palm, you must configure the GPS receiver to transmit data using the protocol:

NMEA-0183

There are various versions of the NMEA-0183 protocol. Cetus GPS accepts version 2.0 or newer. Earlier NMEA protocols like NMEA-0180 and NMEA-0182 are not supported.

On some GPS receivers you may specify the transmission speed. If this is the case, you must configure the transmission speed to 4800 bps.

If you are having problems configuring your GPS receiver, please consult the GPS receiver user guide.

Connecting the GPS receiver to your Palm

If your GPS receiver is not the kind that you attach directly to your Palm, you also need a GPS receiver cable for Palm to connect the GPS receiver to your Palm.

Optionally if you have a GPS receiver cable for a PC serial port, you can use this cable with a Palm modem cable or the Palm cradle and a null-modem adapter to connect the GPS receiver to your Palm. A null-modem adapter should be in stock in most computershops.

If you have not got a cable for your GPS receiver, your local GPS dealer should be able to order this for you. There are however some inexpensive unoriginal versions available for purchase on the Internet. Please look at the document [GPS receiver cable For Palm](#) on the Cetus GPS homepage for further information.

Taking Cetus GPS for a first run

Simply tap the *Cetus GPS* icon in the Launcher to start Cetus GPS. The first page you will see is the Navigate page. If the GPS receiver is connected and configured correctly, the **Cetus GPS** status text in the title bar will change to **No fix**, **2D fix**, **3D fix** or **DGPS fix** within a few seconds.

If Cetus GPS status shows **No GPS** you have a problem with either the cable connection or the GPS receiver configuration.

If you do not have a GPS, you may want to select the *Demo* menu to test how Cetus GPS works. All standard features are functional in the demo mode.

To quit Cetus GPS press the *Home* button. Other buttons have been remapped or disabled to prevent accidental termination of Cetus GPS, which may cause tracking interruptions when using the track log function.

The Philosophy behind Cetus GPS

In order to get the most out of Cetus GPS, you might want to know a little about the thoughts and ideas behind it. This section is devoted to that purpose.

About Cetus GPS

Cetus GPS for Palm is a versatile tool for advanced users featuring navigation, tracking and field data collection. Cetus GPS has three main features:

Navigation assistant

The navigation assistant provides instant access to your current position, course, speed, altitude, time and statistical information. The navigation assistant is a valuable supplement to the map and compass when driving, cycling or hiking in the outback.

Position logger

The position logger captures the current position, altitude, time and data accuracy information. The captured position data along with a description is saved to a Memo or copied to the clipboard for later insertion into a Palm spreadsheet, database or text document.

Using the Palm standard hotsync feature you may easily transfer the position data to your computer for further data processing. The position logger is suitable for both navigational use and GIS field data collection.

Track logger

The track logger stores position, altitude, speed, course, time and data accuracy information at a specified time interval. It provides a unique opportunity of calculating statistical data or reviewing interesting events of for instance a flight, a sail or a drive.

If your favorite data analysis software does not support the Cetus GPS track format, you may convert the track data to a standard text format using one of the TrackLog export utilities available for most computer platforms. Source code for the track export along with a description of the trackfile format is available at the homepage in order to let you implement this into your application.

Cetus GPS users

It is impossible to embrace all groups of potential Cetus GPS users: Scientists, engineers, GIS users, students, travellers, explorers, hikers, cyclists, drivers, yachtsmen, pilots, hunters, fishermen, geocachers - anyone who need a Palm GPS tool with detailed and accurate log functions for positions and tracks.

Cetus GPS qualities

Like Cetus GPS most GPS receivers are able to display navigational data, store positions and tracks. Cetus GPS, however, handles these features quite differently with a focus on the qualities described here:

Accuracy and precision

A measurement is not worth much if you do not know how accurate it is. This may not be an issue for the average GPS user who just needs to relocate the parking lot where he left his car, but if you plan to use navigational data from a GPS receiver for GIS applications or other forms of data analysis, you need to have at least some knowledge of how accurate the data is and to which precision it is stored.

The measurement accuracy is determined by the GPS receiver and accuracy information should be available from the GPS receiver vendor. The Cetus GPS Userguide states to which precision each data type is retrieved and stored. By combining these informations you are able to perform a complete accuracy evaluation.

Data formats

Most GPS receivers store data in a non-public format which is only supported by a few programs and often only on the Windows platform. Cetus GPS allows easy export of data to standard data formats available on most computer platforms including Extensive Markup Language (XML) and user defined comma-separated formats.

Track export utilities are available at the Cetus GPS homepage for Windows, Linux, DOS, Mac OS and Mac OS X. For the users of platforms that are not currently supported, a source code library containing data export routines and an in-depth description of the data formats is available.

User interface

The user interface on a GPS receiver is often limited by a small display and only a few buttons available to navigate the menus.

Cetus GPS takes advantage of the excellent features available on a Palm, and the user interface is therefore more detailed because of the bigger display and is simpler to navigate using standard Palm user interface elements.

Most people do not have the time or free hands for tapping on the Palm screen with their stylus when they are working or on the move, therefore Cetus GPS does not require a lot of interaction. The navigation assistant provides a great overview of the navigation information and the occasional interaction needed by the position and track logger is easily controlled by a few pushes on the hard buttons.

Using Cetus GPS

The main features of Cetus GPS are controlled via a set of pages like most GPS receiver user interfaces. Each page is described in the next section, here you will find a description of the elements that apply to all pages.

Titlebar status

The titlebar shows the current GPS receiver status. On pages where this information is irrelevant, the title bar is used for Palm specific status texts. You will need to know these status texts in order to determine the current GPS fix state and navigation data accuracy.

Cetus GPS

The Cetus GPS program name is displayed in the title bar until three seconds after program startup.

A screenshot of a title bar with a dark background and light text. The text 'Cetus GPS' is displayed in a monospaced font. To the right of the text is a solid light-colored rectangular bar.

No GPS

If Cetus GPS does not receive data from a connected GPS receiver, the status text **No GPS** is displayed in the title bar.

A screenshot of a title bar with a dark background and light text. The text 'No GPS' is displayed in a monospaced font. To the right of the text is a solid light-colored rectangular bar.

No fix

If Cetus GPS receives data from a GPS receiver and the GPS receiver reports that no satellite fix is available, the status text **No fix** is displayed.

A screenshot of a title bar with a dark background and light text. The text 'No fix' is displayed in a monospaced font. To the right of the text is a solid light-colored rectangular bar.

2D fix

If the GPS receiver reports that a two dimensional satellite fix is available, the status text **2D fix** is displayed.

A screenshot of a title bar with a dark background and light text. The text '2D fix' is displayed in a monospaced font. To the right of the text is a solid light-colored rectangular bar.

3D fix

If the GPS receiver reports that a three dimensional satellite fix is available, the status text **3D fix** is displayed.

A screenshot of a title bar with a dark background and light text. The text '3D fix' is displayed in a monospaced font. To the right of the text is a solid light-colored rectangular bar.

DGPS fix

If the GPS receiver reports that a differential GPS satellite fix is available, the status text **DGPS fix** is displayed.

A screenshot of a title bar with a dark background and light text. The text 'DGPS fix' is displayed in a monospaced font. To the right of the text is a solid light-colored rectangular bar.

2D fix, 3D fix or DGPS fix with HDOP information

If the GPS receiver reports that either a 2D, 3D or DGPS fix is available and you have selected *Show HDOP* in the user preferences, the current HDOP value is displayed in parentheses if available.

3D fix (1,4)

2D fix, 3D fix or DGPS fix with satellite and HDOP information

If the GPS receiver reports that either a 2D, 3D or DGPS fix is available and you have selected *Show sat* and *Show HDOP* in the user preferences, the current number of satellites being tracked is displayed if available and the current HDOP value is displayed in parenthesis after the satellite fix information if available.

3D 7 Sat (1,4)

Demo

If demo mode is enabled the title bar shows the status text **Demo**. Please read the section Demo mode for further information.

Demo

Hard buttons

Using Cetus GPS for tracking or field data collection you will probably not have much time left for tapping around the Palm menus or writing graffiti input. You may also want to pack the Palm in a shock- or waterproof case which normally prevent the use of a stylus.

In order to avoid this problem all the major functions of Cetus GPS therefore have been assigned to the Palm hard buttons.

To make the use of hard buttons consistent each button has a main function assigned. Below is a table describing the functions assigned to the different buttons. At each page description you will find a similar table listing how the different hard buttons work when the specific page is active

Datebook	<i>Go to the next Page in the Page menu</i>
Address book	<i>Go to the next view in the View menu. Only the navigate page has a View menu</i>
Arrows	<i>Nothing</i>
Todo list	<i>Toggle start/stop, only the track page uses this</i>
Memo pad	<i>Go to the Position page to save a position. If you are in the Position page, pressing the button again saves the position and returns to the previous page</i>

Page menus

Each page has it's own menu bar, and the menus differ from page to page in order to present only relevant menu items for the current page. At each page description you will find a table listing how the menu bar items work when the specific page is active

Demo mode

If you want to test Cetus GPS without having a GPS receiver connected to your Palm, you may select the **Demo** menu to activate the demo mode.

When entering demo mode, all GPS communication are suspended and Cetus GPS instead replays data from a special demo track log. The demo track was recorded at Kristiansten Fortress in Trondheim, Norway.

The title bar will show **Demo** instead of **3D fix** to remind you that the GPS data is not valid. All Cetus GPS features are fully functional when in the demo mode. You may save positions and record tracks just as in normal operation.

To exit the demo mode simply select the *Demo* menu again, Cetus GPS then resets all navigation and statistical data and return to normal operation.

If you are currently recording a track you are not able to enter the demo mode. Please go to the *Track* page and stop the track logger before entering demo mode.

Palm OS

In order to make the use of Cetus GPS as problem free as possible some of the regular Palm OS features have been disabled as described below.

Palm OS dialogs

When Palm OS displays generic dialogs like for instance the keyboard dialog or the grafitti help dialog the serial communication is stalled. In order to prevent this Cetus GPS discharges the request when Palm OS tries to open the dialog. You are therefore unable to use these dialogs while Cetus GPS is active.

Palm OS buttons

The silk buttons that are not related to Cetus GPS and unused hard buttons are disabled in order to prevent accidental termination of Cetus GPS.

Cetus GPS pages

Navigate page

The Navigate page shows updated navigation information. The current speed, course, altitude and position are always displayed, as is the compass card. The two values at the lower left of the display, are controlled by the *View* menu, which enables you to view different statistical information.



Page content

Compass card

The compass card rotates according to the current course referred to true north, the card has a resolution of 16 steps for a full rotation. When the speed drops to zero, the compass card freezes at the previous retrieved course value.

The arrow in the center always points upwards at the current version of Cetus GPS. If you point the arrow in the direction of your movement for instance if you walk holding the Palm in front of you with the top of the display pointing forwards, the four points of the compass are correctly positioned.

Position

Shows the current position formatted as decimal degrees, decimal minutes or decimal seconds according to the unit preferences. The position is referred to the WGS84 datum.

Because decimal degrees is the common GIS application format, the latitude and longitude are listed using 6 decimals. This does not represent the exact precision, however, please look at the *Navigation Data* section for more information.

SPEED

Shows current speed in kilometers per hour [km], nautical knots [knot] or statute miles per hour [mph] according to the unit preferences. Above a value of 100 no decimal is displayed.

[km] is displayed as unit rather than the more correct [km/h] unit in order to enhance readability.

COURSE

Shows the current course in degrees referred to True North. When the speed drops to zero, the course freezes at the previous retrieved value.

ALT

Shows the current altitude above mean sea level in meters [m] or feet [ft] according to the unit preferences. Above a value of 100 no decimal is displayed.

TIME

Shows the current time retrieved from the GPS receiver adjusted to UTC plus local time offset according to the general preferences.

DATE

Shows the current date retrieved from the GPS receiver adjusted to UTC plus local time offset and formatted according to the general preferences.

AVG SPEED

Shows the average speed since program start or the *Reset values* menu has been selected. The average speed unit is equal to the speed unit.

The average speed is calculated as the statistical mean of all speed measurements, hence it does not compensate for longer periods without movement. Unless the preference *Satellite fix* is enabled, the average speed value should correspond to the value calculated by most GPS receivers.

MAX SPEED

Shows the maximum speed obtained since program start or the *Reset values* menu has been selected. The maximum speed unit is equal to the speed unit.

MIN ALT

Shows the minimum altitude obtained since program start or the *Reset values* menu has been selected. The minimum altitude unit is equal to the altitude unit.

MAX ALT

Shows the maximum altitude obtained since program start or the *Reset values* menu has been selected. The maximum altitude unit is equal to the altitude unit.

Navigating using the navigate page

The navigate page is intended to be a valuable supplement to your map and compass when you are on the move.

Please keep in mind that the course is referred to True North unlike your compass that refers to Magnetic North. If the magnetic variation is high in your area, you need to take this into consideration when navigating. The magnetic variation is shown on the GPS page, please see the navigation data section for more information.

The current version of Cetus GPS does not support navigating to a selected position showing the distance and bearing. This is a planned extension, however, for more information on planned extensions and improvements please visit the Todo list document on the Cetus GPS homepage.

Menus

Page	Navigate	<i>Does nothing</i>
	Position	<i>Go to the Position page</i>
	Track	<i>Go to the Track page</i>
	GPS	<i>Go to the GPS page</i>
View	Time	<i>Show the current time and date</i>
	Speed	<i>Show the average speed and maximum speed</i>
	Altitude	<i>Show the minimum altitude and maximum altitude</i>
Navi	Reset values	<i>Reset average speed, maximum speed, minimum altitude and maximum altitude</i>
Options	Units	<i>View the Unit preferences dialog</i>
	Preferences	<i>View the General preferences dialog</i>
	Demo	<i>Enter or exit demo mode</i>
	About	<i>View the About dialog</i>

Hard buttons

Datebook	<i>Go to the Position page</i>
Address book	<i>Go to the next view in the View menu</i>
Arrows	<i>Nothing</i>
Todo list	<i>Nothing</i>
Memo pad	<i>Go to the Position page</i>

Position Page

The Position page enables you to save your current position to a Memo or to the Palm clipboard.



Saving a position

When you want to save a position you can either go to the *Position* page by selecting the page in the *Page* menu, pressing the *Datebook* button until the position page appears or press the *Memo* button.

Cetus GPS displays the status text **Waiting...** and starts retrieving new position data as soon as you enter the Position page.



It will accept the current GPS data only if these two conditions are met:

- The GPS receiver reports a 3D fix.
- The current GPS data is less than 2500 ms old.

When data is accepted Cetus GPS displays the status text **Retrieving...** briefly while copying the GPS data to the position.



When the copying has finished Cetus GPS displays the status text **Ready** which means that the position data is ready to be saved.



If you tap the *Save* button or press the *Memo* pad button the position data is saved according to the position preferences. Please see the *Position Preferences* page description for more information.

Tapping the *Refresh* button causes Cetus GPS to discard the current position data and then retrieve new position data.

Position averaging

The position page does not yet support position averaging. Using the track function, however, you are able to record a set of positions which you may afterwards subject to statistical calculations using a spreadsheet or some other data analysis software.

Page content

The position page lists the data described below. Which data is saved and in which format is determined by the Position Preferences.

Name

Shows a default serial number which is used as position name. You may change the serial number to another position name of your preference. Maximum length is 10 characters.

Text

You may enter a position description of your preference. Maximum length is 25 characters.

Latitude and longitude

Shows the position when the position was retrieved. The position is formatted as decimal degrees, decimal minutes or decimal seconds according to the unit preferences and is referred to the WGS84 datum.

Altitude

Shows the altitude above mean sea level when the position was retrieved. The altitude is shown in meters [m] or feet [ft] according to the unit preferences. Above a value of 100 no decimal is displayed.

Time

Shows the time and date when the position was retrieved. The time and date are adjusted to UTC plus local time offset and formatted according to the general preferences.

Satellites

Shows the number of satellites being tracked when the position was retrieved.

HDOP

Shows the Horizontal Dilution Of Precision (HDOP) when the position was retrieved. Look at the Navigation Data section for more information.

Menus

Page	Navigate	<i>Go to the Navigate page</i>
	Position	<i>Does nothing</i>
	Track	<i>Go to the Track page</i>
	GPS	<i>Go to the GPS page</i>
Edit	Undo	<i>Undo last action</i>
	Cut	<i>Cut the selected text to the clipboard</i>
	Copy	<i>Copy the selected text to the clipboard</i>
	Paste	<i>Paste text from the clipboard</i>
	Select All	<i>Select all text</i>
Pos	Preferences	<i>View the Position Preferences dialog</i>
Options	Units	<i>View the Unit preferences dialog</i>
	Preferences	<i>View the General preferences dialog</i>
	Demo	<i>Enter or exit demo mode</i>
	About	<i>View the About dialog</i>

Buttons

Save	<i>Save the position data to a memo or the Palm clipboard according the to the Position Preferences. The button is disabled when no position data is available</i>
Refresh	<i>Refresh the current position data. The button is disabled when no position data is available.</i>
Cancel	<i>Go to the previous active page if the position page was entered by pressing the Memo button. The button is disabled if the position page was entered via the page menu.</i>

Hard buttons

Datebook	<i>Go to the Track page</i>
Address book	<i>nothing</i>
Arrows	<i>nothing</i>
Todo list	<i>nothing</i>
Memo pad	<i>The same as the Save button</i>

Track Page

The Track page enables you to record and save a track log. A track is defined by a set of position data and status information saved at a specified time interval. For more information on the track data please see the Navigation Data section.



Saving a track

When you want to save a track you can either go to the *Track* page by selecting the page in the *Page* menu or by pressing the *Datebook* button until the *Track* page appears.

You then need to select the track record interval. You may choose between 1, 2, 5, 10, 30 and 60 seconds.

Please notice that some of the consumer GPS receivers only update every two seconds. If the time written to your track log jumps by two seconds when the GPS receiver has obtained a 3D fix this is the case and there is no need to set the track interval to less than every two seconds.

You may change the default track name to another track name of max. 10 characters. Please use only numbers and letters for future compatibility.

Before the track records are saved a special header containing information about GPS receiver, magnetic variation and other relevant data is saved.

To start the track logger tap the *Start* button or press the *Todo* button. Cetus GPS will then wait for a 2d satellite fix before it starts saving a track record at the specified interval. When you want to stop the track simply tap the *Stop* button or press the *Todo* button again

Transfer track files to a computer

How this is done depends on your computer platform. If you use the normal Palm Desktop software for Windows or Mac OS, your files on the Palm will back up only if the file archive bit is set. Therefore you need to select the *Archive* menu prior to Hotsyncing in order to backup your files.

If you use a standard Palm file transfer program like pilot-xfer under for instance Linux or Windows you do not need to select the *Archive* menu. Just retrieve the track files like you would retrieve any other Palm program or database.

Deleting track files

Selecting the menu *Delete all* in the *Track* menu will delete all track files on your Palm. There is no way to undo this so please make sure that you have transferred the files to your computer before doing this.

If you delete the Cetus GPS application using the Palm OS launcher delete feature all Cetus GPS related files including all track files will be deleted.

Track size

Each track file has a small header and the track record size is 22 bytes. A track file recorded at one second interval for an hour therefore occupies about 79 kb of Palm memory. If you record every two seconds it occupies half that size and so on.

Only the amount of free memory on your Palm determines how many records you are able to save to a single track.

When the Palm free memory is reduced to a minimum limit the track feature closes the track file and displays a warning dialog saying "Palm memory is low, track has stopped". If you have enabled *Alarm sound* in the general preferences an alarm will sound also.

The minimum free memory limit is not precise as the calculation of free memory is not completely accurate, the track logger stops somewhere between 28 Kb and 32 Kb free memory.

After reaching the minimum free memory limit you are not able to save any tracks until you have released some memory by deleting programs or documents on your Palm.

Cetus GPS is only able to save a track file to the Palm main memory. External memory cards are not supported yet.

Track integrity

When saving a track one of the most important issues beside the data precision is the track data integrity. In short you need to know when Cetus GPS saves track data and when it does not.

It is safe to assume that the track logger saves track data at the specified time interval as long as Cetus GPS is the active Palm program i.e. you can see Cetus GPS on your display. This holds no matter which Cetus GPS page or dialog you are viewing. There are however some special cases you need to take into consideration.

Time interval accuracy

Cetus GPS start tracking as soon as it detects at least a 2d satellite fix after you tap the start button. It does not synchronize to the GPS receiver NMEA sentences as this would be almost impossible to implement because of the many different GPS receivers.

The first record is saved when Cetus GPS starts tracking. Then after the specified interval the second record is saved and so on.

Palm OS is not a multitasking system that supports realtime task lists. Therefore syncing to a fraction of a second is not possible and this may cause minor variations at the order of milliseconds from the specified time interval. This is no major problem, however, as the calculated time until next record save is based on a multiple of seconds since track start and not on the time since last saved record.

Saving record data

When the track logger saves a record it accepts the GPS data as valid if these two conditions are met:

- The GPS receiver reports a 2D fix or better.
- The current GPS data is less than 2500 ms old.

If this is not the case the track record status is set to **No fix** or **No GPS** depending on the GPS receiver status and all other values are set to 'Data not available'.

Position timing accuracy

The second condition implies that if you for instance set the track interval to every two seconds you may theoretically end up saving track data that is up to 4500 ms old plus the time the GPS receiver needed to acquire data and transmit as NMEA sentences.

Normally a GPS receiver transmits the GPS data each second or every two seconds. A delay of 2500 ms therefore only occur when the GPS receiver has just lost it's satellite fix or the communication to the GPS receiver has been interrupted.

Under normal circumstances it is therefore safe to assume that the saved track record is, as a maximum, as old as the GPS receiver transmit interval plus the time the GPS receiver needed to acquire data and transmit as NMEA sentences.

However the NMEA sentence containing the position is UTC time-stamped and this is the time that is written to the track record. If you use this time in your calculations rather than expecting exactly the specified interval between each track record you should have no problem obtaining accurate results.

Launcher button

This button is disabled when tracking, that is you have to stop tracking before being able to quit Cetus GPS.

If you try tapping the launcher button a Cetus GPS dialog saying "This function is disabled while tracking" is displayed.

Power off

The power off button is disabled when tracking - that is you have to stop tracking before being able to turn your Palm off. The backlight feature works normally.

If you try pressing the power button a Cetus GPS dialog saying "This function is disabled while tracking" is displayed.

When tracking the auto-off feature is disabled regardless of the setting in the general preferences.

Low battery

When Palm OS initiates a low battery alert Cetus GPS intercepts the dialog and determines what to do about it.

If the battery voltage is below the warning level but above the critical level a warning dialog is displayed saying "Press power-button and replace batteries".

You are then supposed to press the power button once, replace the batteries and press the power button again. By doing so you ensure that the track logging continues and the power button will be disabled after powering on again.

If the battery voltage is below the critical level Cetus GPS accepts that Palm OS shuts the Palm off without any warning.

The Palm timers stops when the Palm is turned off. You therefore get a timing gap in your track data. You will see this as a leap in the saved time. The quicker you replace the batteries and press the power button again the smaller leap.

Please notice that if you have not set the Palm battery type to the type you are actually using, you might find that due to the heavier current load caused by the serial communication Palm OS does not issue a battery warning before the critical level is reached. This implies that you get no warning before the Palm shuts off. The problem occurs often if you use rechargables which normally have a much steeper discharge curve than alkalines.

In general you need to make sure that your batteries lasts while you are performing the track logging or at least be aware when the battery voltage approaches the warning level.

Date book alerts

All external alerts initiated by the datebook are simply discarded if they occur when Cetus GPS is tracking. While this may not be a nice way to handle datebook alerts it is the only way to ensure track logging integrity.

Menus

Page	Navigate	<i>Go to the Navigate page</i>
	Position	<i>Go to the Position page</i>
	Track	<i>Does nothing</i>
	GPS	<i>Go to the GPS page</i>
Edit	Undo	<i>Undo last action</i>
	Cut	<i>Cut the selected text to the clipboard</i>
	Copy	<i>Copy the selected text to the clipboard</i>
	Paste	<i>Paste text from the clipboard</i>
	Select All	<i>Select all text</i>
Track	Archive	<i>Sets the archive bit for all track files</i>
	Delete all	<i>Deletes all track files</i>
Options	Units	<i>View the Unit preferences dialog</i>
	Preferences	<i>View the General preferences dialog</i>
	Demo	<i>Enter or exit demo mode</i>
	About	<i>View the About dialog</i>

Buttons

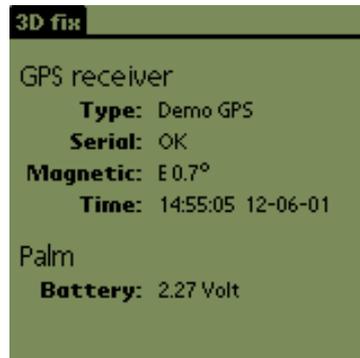
Start	<i>Start the track logger.</i>
Stop	<i>Stop the track logger.</i>

Hard buttons

Datebook	<i>Go to the GPS page</i>
Address book	<i>Nothing</i>
Arrows	<i>Nothing</i>
Todo list	<i>Toggles track logger start/stop</i>
Memo pad	<i>Go to the Position page</i>

GPS Page

This page lists information about the GPS receiver and the Palm.



Page content

Type

Displays the determined GPS receiver type. When Cetus GPS detects no GPS the GPS receiver type is reset. When running in demo mode the GPS type is set to 'Demo GPS'.

When Cetus GPS detects a DeLorme Tripmate GPS receiver, it sends an initialize string to the GPS in order to make it send navigational data using the NMEA protocol.

If Cetus GPS does not recognize the GPS receiver type, it set the GPS receiver type to *Unknown*. This is no problem, however, as the GPS receiver type information is not used except at the GPS page.

Serial

Displays 'Error' if more than 10 erroneous NMEA sentences have been received since you launched Cetus GPS and 'OK' otherwise.

If you see the 'Error' text it probably means that you have problems with the serial cable between your Palm and GPS receiver.

Magnetic

Displays the current magnetic variation which is the angle between the Geographical North Pole and the Magnetic North Pole.

E means Easterly variation that is you take away the variation from the True North bearing to get Magnetic North bearing. W means Westerly variation that is you add the variation to the True North bearing to get the Magnetic North bearing.

Time

Shows the current time and date retrieved from the GPS receiver adjusted to UTC plus local time offset according to the general preferences.

Battery

Shows the current Palm battery power voltage.

Menus

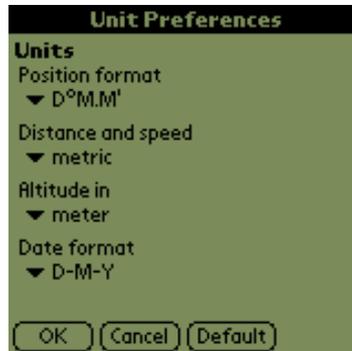
Page	Navigate	<i>Go to the Navigate page</i>
	Position	<i>Go to the Position page</i>
	Track	<i>Go to the Track page</i>
	GPS	<i>Does nothing</i>
GPS	Debug	<i>Save a Memo containing debug information. Please Read appendix B for further information</i>
Options	Units	<i>View the Unit Preferences dialog</i>
	Preferences	<i>View the Preferences dialog</i>
	Demo	<i>Enter or exit demo mode</i>
	About	<i>View the About dialog</i>

Hard buttons

Datebook	<i>Go to the Navigate page</i>
Address book	<i>Nothing</i>
Arrows	<i>Nothing</i>
Todo list	<i>Nothing</i>
Memo pad	<i>Go to the Position page</i>

Unit Preferences

The unit preferences dialog let you change the units used when presenting data. These preferences apply to most pages and features except positions saved as XML format and saved tracks, which are saved in a raw data format in order to preserve full data precision and ease the use of track data in data analysis programs.



Preferences

Position format

Select decimal degrees, decimal minutes or decimal seconds.

Distance and speed

Select metric, nautical or statute.

Altitude in

Select meter or feet

Date format

Select the desired date format.

Buttons

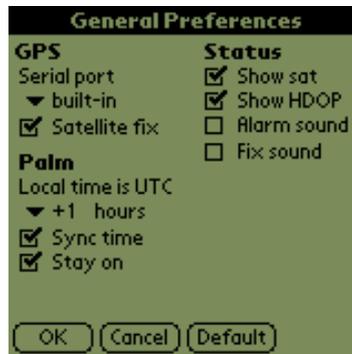
Ok	<i>Accept new settings and go to the previous active page</i>
Cancel	<i>Go to the previous active page</i>
Default	<i>Revert to default settings</i>

Hard buttons

Datebook	<i>Nothing</i>
Address book	<i>Nothing</i>
Arrows	<i>Nothing</i>
Todo list	<i>Nothing</i>
Memo pad	<i>Nothing</i>

General Preferences

The general preferences dialog let you change the preferences that apply to all pages and features available.



Preferences

Serial port

Select the serial port where your GPS receiver is connected. If your GPS receiver is connected to the Palm serial or USB port you should leave this setting at *built-in*.

If your Palm has one or two expansion card slots and you have a GPS receiver card inserted into one of them, you should select this expansion card slot.

Most Palms have only one expansion card slot, but for instance the HandEra 330 has two, here *Card 1* refers to the SD card slot and *Card 2* refers to the CompactFlash card slot.

If no serial port is found at the selected expansion card slot, Cetus GPS defaults to the built-in serial port.

Satellite fix

Some GPS receivers use mathematical extrapolation to estimate the probable position, course, speed and altitude if it loses the GPS fix. The extrapolation is continued for an amount of time depending on the GPS receiver. In practice this means from a few seconds and up to about 30 seconds, which may be close to the actual data if you are driving through a straight tunnel, but may result in huge deviations in other situations eg. if you are hiking in the woods.

Cetus GPS therefore stores the number of satellites being tracked in the track database. This number is normally not embraced by the extrapolation and thus contains valid data. Users who extract track data for analysis, may use the number of satellites being tracked to determine, if the individual record represents valid or estimated data

GPS data viewed on Cetus GPS pages are the "GPS data" which means that if the number of satellites being tracked drops, the data may be extrapolated. If the GPS receiver is equipped with a display, then Cetus GPS will show nearly the same information as the GPS receiver.

Statistical data calculations like average speed, maximum speed, minimum altitude and maximum altitude are correspondingly calculated using the "GPS data". The calculations should therefore return nearly the same values as the GPS receiver display.

When Satellite fix is selected, however, Cetus GPS discharges the extrapolated data by determining the current fix status by the number of satellites being tracked. This may cause a deviation in both the data being viewed and the statistical data calculations compared to data displayed on the GPS receiver.

Local time

Set the current timezone offset to Coordinated Universal Time (UTC). If set to 0, Cetus GPS shows time in UTC format.

Sync time

Cetus GPS update the Palm time according to the UTC plus the selected local timezone offset.

The update is performed the first time the following conditions are met:

- Cetus GPS has been launched
- A valid satellite fix is available
- Track log is not running
- Demo mode is disabled
- The year is less than 2021 (because of an error in some Rand McNally GPS receivers)

Please notice that setting the time may cause your Palm to freeze for a second or two.

Stay on

Cetus GPS prevents the Palm auto off function if it is receiving data from a GPS receiver.

Show sat

Information about the current number of satellites being tracked is added to the status text

Show HDOP

Information about the current HDOP value in parenthesis is added to the status text.

Alarm sound

When a low battery, a low memory or a memory error occurs an alarm sound is played. You may set the alarm sound volume in the Palm prefs.

Fix sound

When a change in the current satellite fix status occurs a system sound is played. You may set the system sound volume in the Palm prefs.

Buttons

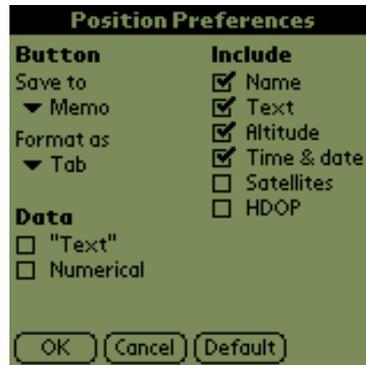
Ok	<i>Accept new settings and go to the previous active page</i>
Cancel	<i>Go to the previous active page</i>
Default	<i>Revert to default settings</i>

Hard buttons

Datebook	<i>Nothing</i>
Address book	<i>Nothing</i>
Arrows	<i>Nothing</i>
Todo list	<i>Nothing</i>
Memo pad	<i>Nothing</i>

Position Preferences

The position preferences dialog let you change the current preferences. These preferences applies only to the Position page.



Preferences

Save to

Select either to save the position as a new Memo in the Memo Pad or copy the position to the Palm clipboard.

If you select *Clipboard* please notice that you can have only one position on the clipboard at a time, you therefore need to exit Cetus GPS and paste the position to another application before saving the next position.

If you select *Memo* the Memo is saved in the *Unfiled* category. The Memo name is "CetusGPS" followed by the position name.

Format as

Select which format to use when saving the position data. Cetus GPS supports a strict XML document type which contains all position data and disregards all other data format preferences.

Cetus GPS also supports a user defined format where you are able to configure which data to include, each position data format and the delimiter to use between the position values (linefeed, comma, tabulator or semicolon). Most spreadsheets and other data analysis software prefer tab or semicolon.

"Text"

If selected, those position values not expressed as numerical values are encapsulated by "". If *Numerical* is not selected then all values except *satellites* and *HDOP* are encapsulated.

Numerical

If selected, the position is saved as a numerical value formatted as +/-D.D°. A positive value represents Northing and Easting, a negative value represents Souting and Westing. The altitude is also saved as a numerical value formatted as specified in the unit preferences. *Satellites* and *HDOP* remain numerical and *Time* and *Text* remain textual. Use this option if you want to perform calculations on either the position or the altitude.

Name

If selected, the position name will be saved.

Text

If selected, the position text will be saved.

Altitude

If selected, the position altitude will be saved.

Time & date

If selected, the time and date, the position was retrieved, will be saved.

Satellites

If selected, the number of satellites being tracked will be saved.

HDOP

If selected, the Horizontal Dilution Of Precision (HDOP) at the time the position was retrieved, will be saved.

Buttons

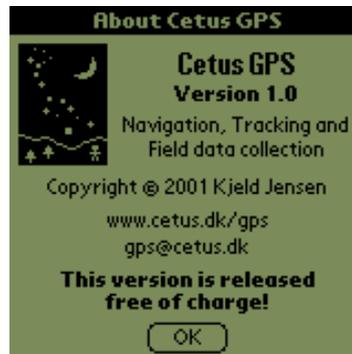
Ok	<i>Accept new settings and go to the Position page</i>
Cancel	<i>Go to the Position page</i>
Default	<i>Revert to default settings</i>

Hard buttons

Datebook	<i>Nothing</i>
Address book	<i>Nothing</i>
Arrows	<i>Nothing</i>
Todo list	<i>Nothing</i>
Memo pad	<i>Nothing</i>

About Dialog

The About Dialog shows the current Cetus GPS version number, a copyright notice and the Cetus GPS homepage address and contact email address.



The little image shows a man who looks at the stellar constellation Cetus. Tau Ceti, a star in this constellation, was chosen for the first search for extraterrestrial life in 1960 (project OZMA at the National Radio Astronomy Observatory in Green Bank, West Virginia, USA) and therefore represents the boundaries of human scientific knowledge.

From antiquity the constellation was considered to be the monster about to devour Andromeda before Perseus could come to the rescue. In biblical history Cetus was believed to be the whale who swallowed Jonah the prophet.

Buttons

Ok	<i>go to the previous active page</i>
-----------	---------------------------------------

Hard buttons

Datebook	<i>Nothing</i>
Address book	<i>Nothing</i>
Arrows	<i>Nothing</i>
Todo list	<i>Nothing</i>
Memo pad	<i>Nothing</i>

Navigation data

The previous part of this userguide describes how to install, configure and use the different features of Cetus GPS. This part describes which data Cetus GPS retrieves from the GPS receiver, how the data is handled and to which precision it is stored.

GPS receiver accuracy

The GPS receiver hardware and software quality determines how accurate the navigation data is. As Cetus GPS retrieves the navigation data from the GPS receiver without influencing the GPS receiver function, Cetus GPS will not affect the GPS receiver accuracy in any way.

The GPS receiver handles the navigation data at a certain precision which may or may not correspond to the navigation data accuracy. There is no way that Cetus GPS can detect how accurate the GPS receiver is and hence Cetus GPS uses a high precision in order not to compromise the accuracy.

Cetus GPS retrieves and stores all navigation data using integer operations and hence position data and track log precision are preserved.

Navigation data overview

Latitude

The latitude is retrieved from the GPS receiver as decimal minutes to a precision of 0.00001 decimal minutes which corresponds to a precision of about 0.019 meter. It is stored as decimal degrees using 7 decimals.

When using the latitude for mathematical calculations Northing is represented by a positive value and Southing by a negative value.

Longitude

The longitude is retrieved from the GPS receiver as decimal minutes to a precision of 0.00001 decimal minutes which corresponds to a precision of about 0.019 meter at the Equator and a higher precision towards the Poles as the meridians get closer. It is stored as decimal degrees using 7 decimals.

When using the longitude for mathematical calculations Easting is represented by a positive value and Westing by a negative value.

Altitude

The altitude describes the height above mean sea level. It is retrieved and stored as decimal meters to a precision of 0.01 meter.

Please notice that many consumer GPS receivers have a poor altitude accuracy, hence you may observe that Cetus GPS detects some strange altitude values.

Course

The course is retrieved from the GPS receiver, it is not calculated by Cetus GPS as a function of current and previous positions. It is retrieved and stored as degrees to a precision of 0.1 degree using True North reference. If the GPS receiver supports 0.01 degree precision, rounding is performed.

Speed

The speed is retrieved from the GPS receiver, it is not calculated by Cetus GPS as a function of current and previous positions. It is retrieved as nautical knots to a precision of 0.1 knot. If the GPS receiver supports 0.01 knot precision, rounding is performed. The speed is stored as m/s to a precision of 0.1 m/s.

HDOP

Horizontal Dilution Of Precision is a measure of how the satellite geometry influences the latitude and longitude data accuracy. A good satellite geometry and hence a good accuracy is obtained if the satellites being tracked are located as far away from each other as possible, while the geometry is poor if the satellites are located close to each other.

If the HDOP value is higher than about 4 the latitude and longitude data is normally disregarded. As the altitude data is probably also inaccurate, this is normally disregarded also.

Satellites being tracked

This value is set to the number of satellites being tracked by the GPS receiver. Your GPS receiver position fix is determined by the number of satellites being tracked as described in the table below:

<i>Satellites</i>	<i>Fix status</i>
0-2	No position fix
3	Two dimensional (2d) position fix
4-	Three dimensional (3d) position fix

The more satellites being tracked the higher accuracy the GPS usually provides. It is, however, not possible to calculate the precise accuracy increase at a certain number of satellites as this depends on several other factors also.

Time and Date

While the GPS system is based on GPS Time (GPST) which currently is 13 seconds ahead of Universal Time Coordinated (UTC) the NMEA-0183 protocol describes that time references are transmitted in UTC format.

Hence Cetus GPS receives the time and date in UTC format to a precision of 0.01 second. Some GPS receivers, however, only sends the time to a precision of 1 second.

Please notice that Cetus GPS has no way of detecting the delay added to the time and date, hence you should consider the time and date accuracy to be at the order of maximum plus one second.

The difference between GPST and UTC is defined by the periodically introduced UTC positive leap seconds. As of now 13 leap seconds has been introduced. According to the latest *Bulletin C* from the *International Earth Rotation Service* (IERS) no positive leap second will be introduced at the end of December 2001.

Conversion to local timezones are performed by adding the selected offset from the UTC reference.

Copyright

Cetus GPS is copyrighted © 2001 by

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Revised July 1, 2001

Appendix A – Staying updated

New releases

New features are added to the Cetus GPS program and the download library of utilities and examples is updated frequently. Please visit the Cetus GPS homepage for updated information

<http://www.cetus.dk/gps>

If you want to be informed of new releases of Cetus GPS, please subscribe to the Cetus GPS news list by sending an empty email to the email address:

gps-news-subscribe@cetus.dk

Comments and questions

If you want to discuss the use of Cetus GPS or ask questions related to Cetus GPS, please subscribe to the [Cetus GPS talk list](#) by sending an empty email to the email address:

gps-talk-subscribe@cetus.dk

You will then receive a confirmation email. To confirm your subscription, simply hit the reply button and press send.

Please check this Userguide and the [Frequently Asked Questions](#) page at the Cetus GPS homepage before submitting questions.

Email spam policy

Unfortunately the subscribing to news- or discussion lists often leads to a lot of spam emails. Please do not avoid subscribing to the Cetus GPS mailing lists for this reason. Your email address will not in any way be subject to spamming emails sent from the author of Cetus GPS, nor will the mailing list email addresses be sold or given away.

Appendix B – Error reporting

Fatal errors or unknown dialogs

If Cetus GPS causes a fatal error, it is probably caused by an internal program error. In this case it will be very helpful to have a detailed description of how the problem occurred. Here are some questions that may help you write a detailed error report:

- Which Palm and Palm OS version do you use?
- Which GPS receiver model do you use?
- How long time did Cetus GPS run before the error occurred?
- Which page were you viewing?
- Were the GPS receiver connected?
- What status did the title bar show?
- Are you able to re-create the error (please describe how)?

Navigation data problems

If the *Serial* status at the *GPS* page reports *Error* or if you discover anomalies in the way Cetus GPS displays or handles the navigation information like latitude and longitude coordinates, altitude, course, speed and so on, this may be caused by your GPS receiver sending NMEA-0183 V2.0+ data in a format that Cetus GPS does not recognize or decode correctly.

Cetus GPS has of course not been tested with all available GPS receiver models, and the NMEA-0183 V2.0+ standard is not very detailed when it comes to how the data are transmitted and which formats to use. Therefore this problem may occur with some GPS receivers.

Cetus GPS debug feature

In order to solve the problem some information about your GPS receiver is needed. A debug feature has been to Cetus GPS, it records the necessary data and saves the information to a Memo.

Please follow the directions below to record and mail the debug information.

1. Place your GPS receiver where it has a good view of the sky and wait until it tracks at least 4 satellites.
2. Launch Cetus GPS and let it stay on for about 2 minutes (constantly with a fix of more than 4 satellites).
3. Select the *Debug* menu at the *GPS* page and wait two seconds for the debug to complete.
4. Quit Cetus GPS by tapping the *Home* button
5. Perform a HotSync
6. Start the program that you normally use for reading and updating the Palm Memo's on your desktop computer.
7. Copy all the contents of the Memo named `CetusGPS debug` to your email client and mail it to gps@cetus.dk

Please include a detailed description of how the problem occurred. Here are some questions that may help you write a detailed error report:

- Which Palm model do you use?
- Which GPS receiver model do you use?

Cetus GPS debug memo information

The debug memo information is intended for debugging purposes. For your information the debug memo contains the following information:

```
Cetus GPS debug (memo name)
Cetus GPS version number
Palm OS version number
Seconds Cetus GPS has been running
Received RMC sentences/valid RMC sentences
Received GGA sentences/valid GGA sentences
Serial line error count
NMEA buffer limit count
```

These informations are followed by a 2 second sample of all input for the serial port. If you see nothing below the lines, the GPS receiver probably was not transmitting or was not connected properly. Please make sure that you did configure the GPS receiver to transmit NMEA-0183 V2.0+ data at 4800 bps speed.

Here are a few notes about the debug information which may prove valuable to you, if you are having troubles with the serial communication.

- If the number of valid sentences is lower than the number of received sentences but not zero, periodic communication problems occur somehow. The cause is probably a hardware problem (interference or noise).
- If the number of valid sentences is zero and the number of received sentences is not zero, the cause may be a software problem (protocol incompatibility).
- If the number of RMC or GGA sentences are approximately the same as the number of seconds, your GPS receiver updates this sentence each second. If it is about half the number of seconds, your GPS updates every 2 seconds and so on. Some GPS receivers do not send RMC or GGA sentences if no satellite fix is available. Therefore it is advisable to make sure that you have a satellite fix all the time from launch of Cetus GPS to selecting Debug.
- It is normal that the serial line error count or the NMEA buffer limit count is greater than zero. If the *Serial* information at the GPS page shows *OK*, you need not to be worried about this.

Appendix C – Homepage documents

Below is a list of Cetus GPS Userguide documents that are updated frequently and therefore are available at the Cetus GPS homepage. Click on the homepage Information menu to view them.

[Frequently asked questions](#)

Lots of questions and answers, please look here before submitting a question.

[Known issues](#)

Lists known issues for the current version of Cetus GPS.

[Registration](#)

Information about how to register Cetus GPS.

[Release history](#)

Lists updates, changes and bug fixes for each released version of Cetus GPS.

[Todo list](#)

Lists planned updates and extensions for Cetus GPS.

[Palm info](#)

A list of Palm OS compatible PDAs that have been tested with Cetus GPS

[GPS receiver info](#)

A list of GPS receivers that have been tested with Cetus GPS

[GPS receiver cable for Palm](#)

Tips on where to buy or how to create a GPS receiver cable for your Palm

[Credits](#)

A list of people who have contributed to the development of Cetus GPS

Appendix D – The MathLib Library

MathLib is a free shared library that can be used by any OS 2.0+ Palm program that needs IEEE 754 double precision math functions. It is distributed under the terms of the GNU Library General Public License, and is freely available with full source code and documentation at the MathLib Information webpage:

<http://www.radiks.net/~rhuebner/mathlib.html>

It's not a part of the Cetus GPS project, and you're not paying anything for its use; a copy is simply included in the Cetus GPS zip archive for your convenience.

Many Palm programs uses the MathLib library, so it might be installed on you Palm already. In any case no harm is done installing it again, it will just overwrite the existing copy.

Thanks to Rick Huebner who created MathLib, it has been a great help being able to use the maths functions available in the library.