

GPS basics

1 Introduction

TODO

2 Basic Terminology

- GPS – Global Positioning System
- Waypoint – a point in geographical space, a location
- Track – a record of where you've been
- Route – a plan of where you'd like to go
- Heading – the direction in which you're travelling
- Bearing – the direction to a waypoint
- GPX file – a data file containing any combination of waypoints, tracks and routes

2.1 Waypoint

A geographical location. The essential data items for a waypoint are the coordinates, usually in the form of latitude and longitude. A waypoint may contain other data items, see within the following sections.

2.2 Track

A record of where you've been, stored as a series of waypoints. This is the most common feature of a GPS device. Often referred to as a 'breadcrumb trail'. The waypoints typically contain the date, time and elevation in addition to the coordinates. According to the capability of the GPS device, there may be other data items such as temperature, heart rate etc. The frequency of recording depends on the device. For a 20 mile cycle ride there will typically be many hundreds of points.

2.3 Route

A plan of where you would like to go. It consists of a series of waypoints. If elevations are included in the waypoints then an elevation profile can be created and the character of the ride can be assessed. Typically a route needs far less waypoints than are found in a track. A GPS device can guide the user on a route by showing the distance and direction to the next waypoint on the route. This is especially useful for off road or marine activities. GPS applications can create a route from a track with a customisable maximum

number of points, e.g. 100. Routes can be created by GPS applications to follow the road network. This is dependent on the underlying map being able to support this requirement. Alternatively one might like to create a route by manually clicking to store each waypoint. When doing this it's a good idea to position points at significant locations such as road junctions.

2.4 Heading

The heading is the compass direction in which you are travelling. Often confused with bearing, an easy way to remember the difference is to think 'head', ie where your head is pointing is usually the direction you are going.

2.5 Bearing

This is the compass direction to a point somewhere other than where you're at. Typically the direction to a waypoint. When following a route, if the bearing direction is different to the heading direction, then you're going astray.

3 GPS

The Global Positioning System uses 32 satellites in geostationary orbit around the Earth. After turning on a GPS device it can take some time to identify the satellites within view. A good signal from at least 4 satellites is needed to obtain an accurate fix. Accuracy for latitude and longitude is good, typically within several metres. But elevation accuracy is not so good. When analysing a track that starts and ends at the same location, the calculations for ascent and descent can differ by a considerable amount.

4 GPX files

When a GPS device records a track the data can be exported as a file in GPX format. This is a standard XML format that conforms to a base standard but there are many possible extensions that have been added by Garmin (and maybe others) to include extra data such as heart rate, temperature etc. A GPX file is the common means of transferring data between GPS applications.

However, there are other file formats such as TCX (training center database) and it depends on the particular GPS application which file formats are supported.

5 Maps

Ordnance Survey

Google maps

Bing maps

Open Source maps

6 Creating a Route

TODO

7 GPS devices

TODO

8 Resources

TODO