

# RDF Mapper V2.5 Documentation

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## Introduction

RDFMapper is a software package for visualising bearings from radio direction finding (RDF) hardware. This allows the bearings to be used to perform 'visual triangulation' of the location of a transmitter source. There are various possible ways to use the software:

### Stand-alone mobile RDF receiver

In this instance the software is used with RDF hardware to produce bearings on a map. As the mobile RDF system is moved, multiple bearings taken from different positions provide an indication of the source location.

### Stationary RDF receiver

In this instance the software can only display bearings from a fixed location and so triangulation is not possible. The software is capable of uploading the bearings to a 'bearing server'.

### Stationary/mobile RDF receiver with additional remote bearings

This may be the most powerful instance. The software can be run on multiple systems (stationary or mobile). The bearings from one or more of these systems can be uploaded to a bearing server. The bearings on the server can be plotted on one or more systems, and therefore multiple RDF receivers can be visualised simultaneously while they are in different locations. In fact the software can be run without any RDF hardware, being used just to download and visualise bearings from remote RDF receivers.

## Basic Usage

### Starting the software

RDFMapper is distributed as a single executable for Windows, MacOS X and Linux. In most cases, simply running this executable (double-clicking) will be enough to get up and running.

The software is distributed in this way for ease of use, but the single-executable model does mean that during start up various temporary files have to be created. As a result, start up times for RDFMapper can be quite long. Please be patient, once the software has started it should run quite quickly even on older hardware.

RDFMapper runs a small web server as it starts, this is where all the magic is performed. The software then launches your web browser and points it to the web server. We're then able to make use of modern web-mapping tools to visualise the RDF data. For this reason, you may receive a warning from Windows about the firewall – in order to use RDFMapper you must click 'allow'.

### General use

The user interface is handled entirely in the web browser as a single page. Closing or refreshing this page will close the software (see below). The map on the left side of the window is where bearings and remote RDF receivers are plotted, this map is entirely interactive (see Navigating the map). On the right side of the window are the controls relating to GPS, RDF, location, bearing plotting, web server uploading/downloading etc.

### Stopping the software


Closing the web browser (or the tab) in which RDFMapper is running will automatically cause the closure of the back-end. You should be warned before leaving the page or closing the browser, in an attempt to prevent accidental closure.

In the event that the browser crashes or closes without communicating to the back-end that it is closing, the back-end will automatically close after approximately 30 seconds. If you try to re-launch the software within this time, you may find it doesn't work.

## Navigating the map

Map navigation is very similar to any other web mapping system (e.g. Google Maps).

- Panning
  - Click and drag
  - Use the arrow keys
- Zoom
  - Double click (zoom in)
  - Scroll (using scroll wheel, track pad etc)
  - Click the + or – symbols in the top left of the map

The map style can be changed to various web sources, including satellite imagery. To select a style, click on the layers symbol  in the top right of the map window.

## Map Controls

Clicking on the ‘Map Controls’ label in the menu on the right, will open these controls.

Clicking ‘Snap to current location’ (keyboard ‘c’) will cause the map to centre on the current GPS location. If you don’t have any GPS input, you should not use this control as it will move to the software default location (Wellington, New Zealand).

Checking the box ‘Follow GPS location’ will cause the map to centre on the GPS location every time a new GPS fix is received.

Clicking ‘Clear bearings’ (keyboard ‘space’) will remove all current bearings from map.

## GPS

Clicking on the ‘GPS’ label in the menu on the right, will open these controls.

‘Fixes for speed/heading’ is the number of fixes that are averaged to ascertain the current speed and heading. If you have an RDF receiver mounted on a vehicle, the GPS coordinates are used to calculate your speed and heading, which allows the bearings from the RDF to be correctly aligned with the map. Increasing the value of this variable should provide a more stable heading/speed, but it will also introduce a lag in the adaptation of the heading after you turn a corner.

‘Minimum speed (km/h)’ is the minimum speed required to accept a bearing from the RDF receiver. If your current speed is lower than this value, bearings will not be plotted. This is used to ensure that at low speeds, when GPS heading information is likely to be unreliable, erroneous bearings are not plotted. Setting this variable to ‘0’ will plot all bearings.

'GPS Port' allows the selection of the serial port to which the GPS device is attached. The 'GPS baud rate' allows selection of the appropriate serial baud rate. Every time one of these values is changed, the system will connect to the port with the current settings. The status can be seen below the 'GPS baud rate' box. If 'Connected' appears in red, this indicates that the port has been opened, but that the expected data is not being received. This could mean that this is the wrong port, or that the baud rate is incorrect. Once 'Connected' goes green, this indicates that valid data has been received. If data is received but no location information is provided, the message will read 'Connected (no signal)' - this almost always indicates that the GPS device has no GPS lock.

## Manual pos/head

Clicking on the 'Manual pos/head' label in the menu on the right, will open these controls.

Checking the box 'Use manual input' will cause the software to ignore the GPS settings and received data, and rely instead on manual positioning and map alignment.

After enabling manual input, GPS settings are greyed out and manual settings are enabled.

The current location can be set by clicking on the map, which moves the red marker to the point that was clicked.

The heading can be set in two ways, either by entering it manually in the 'Heading' box, or by clicking on the map.

To set the heading on the map, press 'h' on the keyboard, and then click on a point along the heading. You can also click the 'set' button and then click on the map (this is equivalent to pressing 'h').

Setting the position and heading this way allows for quick and easy establishment of the RDF receiver's location and rotation within the real world. As an example consider an RDF antenna array is mounted on a vehicle with the front of the vehicle being 0 degrees. The user can drive the vehicle to a specific location and then click that location on the map. Next the user would press 'h' and click a point on the map which is directly ahead of the car in the real world (like the far end of a street). The RDF antenna array is now tied into the real world.

## RDF

Clicking on the 'RDF' label in the menu on the right, will open these controls.

Checking 'Single bearing mode' will only plot one bearing at a time. Disabling this will plot bearings whenever they're received from the RDF receiver, and they will remain on the screen until cleared. Single bearing mode is most useful with static stations and the continuous mode is most useful when using a mobile receiver and wishing to plot bearings along a baseline for triangulation.

'RDF Port' allows the selection of the serial port to which the RDF receiver is attached. The 'RDF baud rate' allows selection of the appropriate serial baud rate. Every time one of these values is

changed, the system will connect to the port with the current settings. The status can be seen below the 'RDF baud rate' box. If 'Connected' appears in red, this indicates that the port has been opened, but that the expected data is not being received. This could mean that this is the wrong port, or that the baud rate is incorrect. Once 'Connected' goes green, this indicates that valid data has been received. Note that this data will only result in a plotted bearing if in manual mode, or if the GPS conditions are met (see GPS section).

## Web upload/download

Clicking on the 'Web upload/download' label in the menu on the right, will open these controls.

This section allows the local system to upload bearings to the bearing server, and also allows it to download bearings from the bearing server.

The 'Bearing server' is the address to the bearing server you wish to use. For more information on setting up a bearing server, see the 'Bearing Server' section. When this address is changed, the software will attempt to use it. At the bottom of the 'Web uploading/downloading' section are status lines for upload and download. If the server address is wrong, it will be reflected here. Note that the default server is 'http://rdf.musther.net/', this is a public server.

'This station's ID' is the name given to the local station. This is used to register the station with the bearing server, and is the name necessary for another system to download bearings from the server. The default is '12345' but note that as this is the default for all users so using this will lead to strange results. You can use any alphanumeric characters for this name (e.g. JM544Home) – the station name is case-sensitive (JM554Home is not the same as JM554home).


Checking 'Enable bearing uploads' will begin uploading bearings as they are received and plotted locally.

Under 'Add & remove stations' is a drop-down box and a text box, with two buttons 'Add' and 'Remove'. Typing a station name into the text box and clicking 'Add' will add it to the list. This station will now be requested from the server. Stations currently in the list can be seen by expanding the drop-down box and can be removed by selecting them and clicking 'Remove'. If a station name cannot be found on the server, a message will be presented in bottom right of the window. This name will continue to be requested until the station is removed, so if you are waiting for someone at a remote station to begin uploading, it is safe to leave the name in the list.

The 'Update period (s)' is the number of seconds between downloading bearings from the server. The default is 5 seconds which should be adequate for most purposes. Decrease this if you need to, but please consider the number of requests made to the server.

## Stations on the map

Once a station is added to the list it will be plotted on the map. It will initially exist as coordinates (0,0) which is off the west coast of Africa. As soon as data is received from the bearing server, this

station will move to it's correct position. Clicking on the stations icon  will open a popup showing the station's name and the age of the bearing plotted from it. Note that the age of the bearings will not be correct if the computers being used do not have the time and timezone correctly set.

## Security

For ease of use there is very little security surrounding the bearing server. Anyone can upload station and bearing data, and anyone with the name of that station can download it. The only security is via the obscurity of the station names. The database itself is not available publicly, so the name of a station is required to access its data, however the database is stored in plain text on the server, so the server owner (and those with access) could see the data. An example of the database is shown here to demonstrate what data is stored:

Station ID	Timestamp	Station Latitude	Station Longitude	Bearing End Latitude	Bearing End Longitude
TSTA4	1529532418	-41.263954	174.655373	-26.621505	226.841775

## Bearing Server

There is a publicly available bearing server hosted at <http://rdf.musther.net>

It is quite easy however to set up your own bearing server. You'll need a publicly accessible web server which supports PHP. Unzip the contents of the bearing server zip file into a publicly accessible location on your web server. Then inside the 'data' folder, the 'data' file needs to be made writeable by the web server. On a Linux server this command will work:

```
chmod a+x data
```

The bearing server includes the files:

- index.html
- read.php
- save.php
- data (folder)
  - data
  - .htaccess

The 'read' and 'save' php files perform the actions for uploading and downloading data. The index.html file simply provides information if someone navigates to the base address. It also provides some obscurity as to what files are in that directory by preventing an index listing.

The 'data' folder contains the 'data' file, which contains the database. The '.htaccess' file in the 'data' folder prevents listing or access to the data file. As a result it cannot be accessed publicly but only via the webserver, meaning only via the php scripts.



## Troubleshooting

RDFMapper has been extensively tested, however if you find a bug, please report it with as much detail as possible to [jon@musther.net](mailto:jon@musther.net)

### Browser Issues

As RDFMapper uses your system browser for the user interface and map drawing, issues can arise from using old or unusual browsers. If you experience missing parts of the user interface, or the map does not load, it is quite likely that your browser is out-dated. The largest amount of testing of RDFMapper has been conducted using Google Chrome, so we recommend you download and install this. You will need to set the new browser as your system default so that it is opened when you start RDFMapper.

## Author and licensing

RDFMapper is written by Jonathan Musther with much help on all things RF from Wil (PA8W) – check out his website: <http://members.chello.nl/~w.hofman/pa8w/>

RDFMapper is Copyright 2018 Jonathan Musther, and released under a single-user license (unless otherwise specified).

Upon purchase, the user has the right to use RDFMapper on as many computers as desired, providing that the user is the primary beneficiary of this use. The sharing of bearings between users for RDFMapper is specifically exempted from this benefit.

You must not do, or allow others to do any of the following: modify, adapt, alter, translate, or create derivative works of RDFMapper.

If you are in any doubt about your rights or responsibilities, please contact: [jon@musther.net](mailto:jon@musther.net)