

Manual iGCT PRO V6.1

TABLE OF CONTENTS:

Introduction	2
Waypoint calculations	2
Latitude and Longitude	2
DMS Calculator	2
Convert WGS-UTM-Grid	3
What3words	3
Average	4
Projection	5
Project new waypoint	5
Distance and Bearing	6
Intersections	6
Two waypoints and bearings	6
Four waypoints	7
Line and circle	7
Two circles	7
Triangles	8
Circumscribed circle	8
Waypoint List	8
Text Calculator	9
Numbers	9
Decryption	9
Geocaching hint	9
Caesar cipher (ROT-N)	10
Vigenère cipher	10
Morse code	10

Introduction

The iGCT PRO app is a toolkit that focuses on typical tasks performed during geocaching. Tasks like making a projection from a waypoint, determining a new waypoint using two other waypoints, determining the distance to these waypoints, calculating the value of a Roman numeral, and averaging waypoints are examples of what the toolkit can accomplish.

This manual describes the features and gives hints and tips for using each feature.



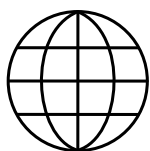
Waypoint calculations

The first item on the menu shows all the features relating to determining, calculating, and converting waypoint latitude and longitude values.

Latitude and Longitude

The first three menu items all share the same values. If you enter values in the DMS Calculator screen, you can switch to the What3words screen to see the three words associated with these coordinates or switch to the Convert screen to see the coordinates in other notations.

The Average screen uses its own list of coordinates but you can copy/paste these coordinates between screens if you want to.



DMS Calculator

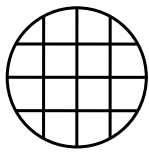
Waypoint coords are often written in the WGS84 notation e.g.: N 37° 19.484' W 122° 01.285'

But other formats are “fractional degrees” and “degrees, minutes and seconds” e.g.:

+37.3247359° -122.0214181° and N 37° 19' 484” W 122° 1' 17”

This screen performs the conversion between these formats. You can either edit the values for the latitude and longitude

components manually or paste a waypoint using the action-menu appearing after selecting one of the two green marker icons.



Convert WGS-UTM-Grid

The most common notation for latitude and longitude is the WGS84 notation with degrees as an integer value and minutes as a floating-point value with three digits of precision.

UTM (Universal Transverse Mercator) notation is a map projection system where the earth is divided in squares and the x (Easting) and y (Northing) coordinate within such a square is used to determine a location.

See [https://en.wikipedia.org/wiki/Universal Transverse Mercator coordinate system](https://en.wikipedia.org/wiki/Universal_Transverse_Mercator_coordinate_system) for more details.

A Grid is a similar system where the earth is flattened on a rectangular map for a specific country and the x and y offset in this map is specified. The app supports the Dutch (RD) and Swiss grids.

This converter screen performs the conversion between these three notations. You can either edit the edit fields manually or paste a waypoint using the action-menu appearing after selecting the marker icon.



What3words

“What3words has given every 3m square in the world a unique 3-word address. The words are randomly assigned to each square and will always stay the same.

Now it's easy to find and share any location with just three words.”
For more details see <https://what3words.com/>

First, select a language. Each language has a different set of words in that language.

Then enter either a three words location or specify the location in WGS84 format and see which three words correspondent with these coordinates.

You can also paste a waypoint using the action-menu appearing after selecting the waypoint icon.



Average

To determine the latitude and longitude of a certain point on the earth a GPS is used. But a single reading of coordinates from a GPS can deviate significantly from the 'real' coordinates. A common practice is to make several readings, preferably with different approaches of the target waypoint and on different times of the day or even days. The deviations inherent in the GPS acquisition system result in a 'cloud' of measurements. Taking the average latitude and longitude from all points in this cloud gives a much better approximation for the coordinates.

This screen aids in this process.

Since you may want to determine the coordinates of multiple waypoints, there are 25 averaging calculators which you can give a name. Use the buttons left and right to switch between these calculators.

Above the map showing all measurements there are controls to add measurements:

- From WP List, which let you add a waypoint previously added to the list
- From the GPS, wait for a stable reading and press accept

The map will show markers for each measurement (green), the last measurement in the series (light green, can quickly be removed with the undo button) and a marker for the average itself (purple).

Looking at the cloud of measurements on the map it is easy to spot errors in these measurements, For example, a marker that is

far away from the average, just click that marker and click the trash icon in the callout to remove it from the series.

The standard deviation (SD) of the averaged measurements is calculated where a two dimensional Gaussian distribution is assumed. Field-tests with an iPhone show that 3 m is a typical standard deviation. The blue circles have a radius 3, 6, and 9 meter and can be used to make a judgement of the measurement distribution and the scale of the map. The grey filled circles have a radius of 1, 2, and 3 times the standard deviation.

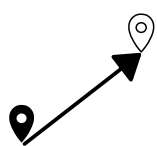
The three status indicators (red/green) shown to the right of the standard deviation indicate the results from a basic statistical analysis with the intent to give some guidance for making good estimates:

- Number of measurement must at least be 10. Larger is better.
- One or more markers have a distance to the center which is larger than three times the standard deviation.
- A standard deviation which is too small or too large based on the reference value 3 m. Limits are 1.9 m and 4.8 m.

Note that you can perform all kind of actions on the averaged coordinates by clicking the purple waypoint icon which will show the action menu. Examples are copy to clipboard or save in the waypoint list. Even if you have warnings this is possible, but you will be warned first explaining the nature of the warning.

All measurements are saved in each calculator. To re-use a calculator, you don't have to remove each marker by hand, just select the "Delete all" button and confirm the warning dialog.

Projection



Project new waypoint

Use this screen to determine new waypoint coordinates by entering the distance and bearing from existing waypoint coordinates to the destination.

The distance can be in meter or feet. Just click the unit to switch between the two.

The bearing is in degrees. Fractional degrees are possible. The bearing is the angle on the compass, 0° being North, going clockwise.

So if in a multi geocache the description tells you to go 500 m in the direction east you would enter 500 meter and 90 degrees.



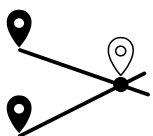
Distance and Bearing

This is the exact opposite of the Projection calculator. Now two waypoint coordinates are given and this screen calculates the distance between these two waypoints (in either meter or feet) and the bearing from the first waypoint to the second waypoint and the reverse bearing (the bearing from the second waypoint to the first).

Note that due to the curved surface of the earth two points differing only in the longitude will not give values 90° and 270° because all calculations are done using the great circle formula's. The distance between the two points is measured along a circle connecting these waypoints in the shortest way possible. Give it a try with a longitude in Europe and Canada with the same latitude (e.g. $N52^\circ E5^\circ$ and $N52^\circ E120^\circ$). This looks like the trajectory of a trans-Atlantic flight! Airplanes take the shortest route which is a curved line on the map.

Intersections

There are all kind of ways to make puzzles where two or more waypoints are given and lines (a bearing from a waypoint) and/or circles (a distance from a waypoint) are given and an intersection determines the new waypoint.



Two waypoints and bearings

A waypoint and a bearing determine a line on the globe. Two of these lines can intersect each other (or not). This calculator accurately calculates the intersection

coordinates.

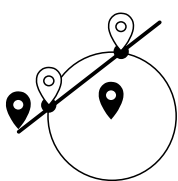
Note the coloring of the markers. These markers correspond to the input fields. The location icons can be used to call up the action-menu for that specific coordinate.



Four waypoints

When drawing a line between two waypoints and a line between two other waypoints these lines can intersect each other (or not).

This calculator accurately calculates the intersection coordinates. Note the coloring of the markers. These markers correspond to the input fields. The location icons can be used to call up the action-menu for that specific coordinate.

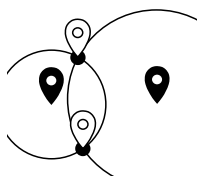


Line and circle

A waypoint and a bearing determine a line on the globe. A waypoint and a distance to that waypoint determine a circle on the globe.

The line and the circle can intersect each other. This will give two intersection points.

Note the coloring of the markers. These markers correspond to the input fields and the results. The location icons can be used to call up the action-menu for that specific coordinate.



Two circles

A waypoint and a distance to that waypoint determine a circle on the globe. When you want to find the coordinates of a point with a specified distance to one waypoint and a specified distance to another waypoint

the intersection of the two circles on the map give you two candidates.

Note the coloring of the markers. These markers correspond to the input fields and the results. The location icons can be used to call up the action-menu for that specific coordinate.

Triangles

Three waypoints determine a triangle on the map.

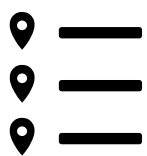


Circumscribed circle

The circle through the three waypoints form a triangle but also define a circle circumscribing this triangle.

This calculator calculates the coordinates of the center of this circle and the radius, that is the (equal) distance from this center to all the three waypoints.

Note the coloring of the markers. These markers correspond to the input fields and the results. The location icons can be used to call up the action-menu for that specific coordinate.



Waypoint List

This is the list of named waypoints with their coordinates. Up to 1000 waypoints can be stored in this list.

The ability to search the list is provided. The search uses the waypoint name field to conduct the search. Text case does not matter. You do not have to type in a complete word. Clever use of waypoint names will allow you to group similar items in the search results.

You can view all (or the filtered) waypoints on a map.

Adding waypoints can be done manually or using the action-menu in one of the other screens in the app.

Click a waypoint to edit its name and/or coordinates. Note that in this edit screen a compass is visible showing you the bearing to that waypoint and the distance. This can be used for navigating to that specific waypoint.

A=1 B=2 **Text Calculator**

In multi-caches the question at a waypoint is often to find some text and calculate a number from it.

This calculator converts a text to a number using the scheme a=1, b=2, ... z=26.

Other schemes are also provided.

Note that numbers keep their numerical value so to add all digits of a number like 1981 just enter it and the sum of all digits will be calculated as well as the 'reduced to one digit' sum (keep adding digits in the result until you get a one digit number). In this example 19,10 and 1.

XV 15 **Numbers**

A number can be written down in various formats. We are used to the base 10 notation: 1981

In multi-caches you may find this value on a building using Roman notation: MCMLXXXI

Computers store numbers in a binary format: 11110111101

A shorthand notation for these binary numbers is the hexadecimal (base 16) notation: 7BD

When you select a number field to edit, an appropriate keyboard will appear. Conversion to the other formats is immediate.

?! **Decryption**

Encryption is the process of translating plain text data (*plaintext*) into something that appears to be random and meaningless (*ciphertext*). Decryption is the process of converting ciphertext back to plaintext.

Geocaching hint

Hints given in a geocaching description use the Caesar ROT13 encryption/decryption method.

Enter the hint text to get the readable hint.

Caesar cipher (ROT-N)

This cipher method uses a simple substitution encryption. This means that every character is substituted by another character according to a rotating shift in the alphabet. The mostly used ROT13 method shifts the alphabet with 13 positions, this results in: A=>N, B=>O, ..., Y=>L and Z=>M. In the ROT13 method the same key can be used for encryption and decryption. It is identical to the Geocaching hint method.

Every other shift is also possible, use the + and - buttons to change the shift.

Vigenère cipher

The Vigenère cipher is a classic cryptography method. Characters are replaced using different alphabetic series, known as polyalphabetic substitution. A key word is used for the encryption.

You can enter plain text in the second edit field and a key string to perform encoding. Or enter an encoded string with the proper key to decode.

Morse code

Morse is a communication code consisting of short and long signals, which are broadcasted with short intervals. The short signals are represented by a . (a *dit*) and the long signals by a - (a *dah*). A group of signals represent a character or symbol.

You can enter plain text in the second edit field to generate the morse code. Or enter morse code to see the plain text.