

# Setting up the GPS User Grid for Cheap Maps

## What this technique does

This is a paper to describe a technique to setup a GPS receiver to work with run of the mill generic maps with no coordinate systems on them.

## Perspective

I think that mapping GPS receivers are great. I think that good maps with UTM or latitude and longitude are great. However, using this technique, you can use a cheap receiver with a cheap generic road map, which is good, but does not otherwise have GPS usable information. The accuracy may not be good enough for navigation, but it should be good enough for orientation as a tourist.

There are easier ways to find waypoints. If you just need some waypoints, I would recommend my technique for using [www.mapblast.com](http://www.mapblast.com) in the Waypoint section of my book at [www.smallboatgps.com](http://www.smallboatgps.com) or search [www.gpsinformation.net](http://www.gpsinformation.net) for some links to waypoint sources.

## Map requirements

For this technique to work you need the following:

- A map fairly small scale map where projection differences between the different corners are small. A city street map is an example of a suitable type of map.
- The map must have square grids. You can always draw them in.
- You must know the GPS coordinates of one point on the map.
- The map must be laid out with a north south orientation

## The technique

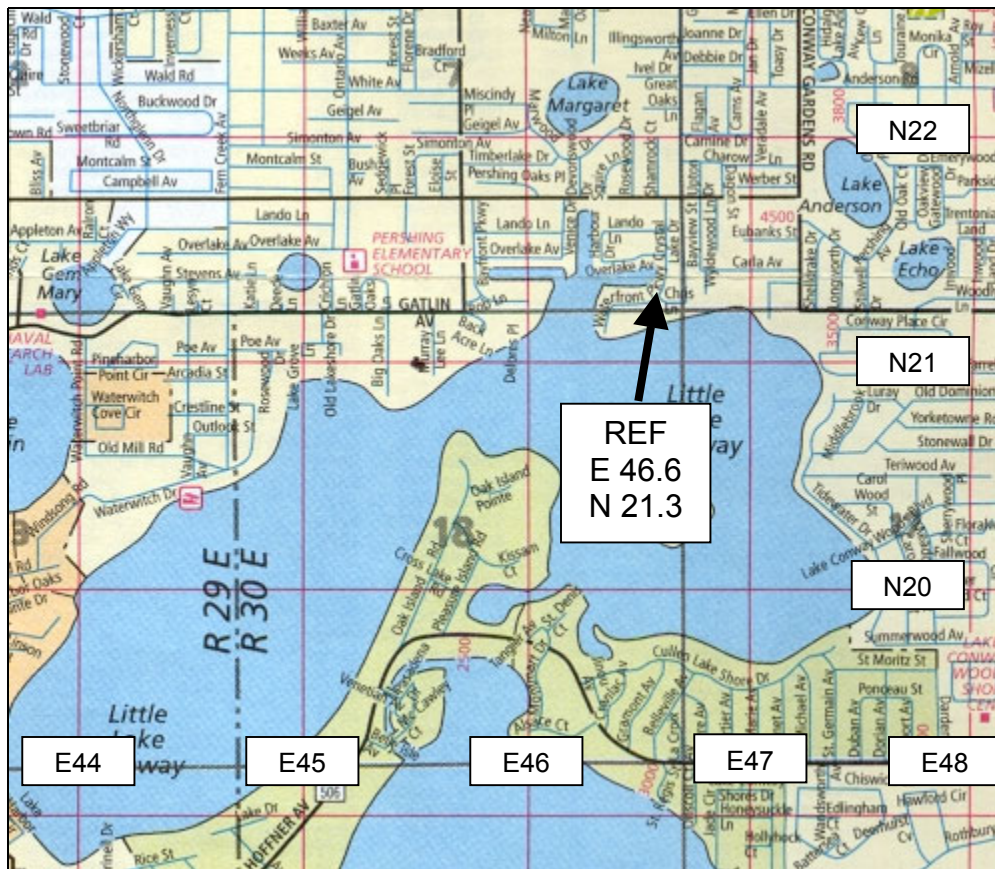


Figure 1

### Preview

Figure 1 is a small area of an ordinary street map which is 45 inches by 36 inches. The grids were pre-drawn and labeled from 14 to 59 horizontally an CH to Y vertically. I kept the horizontal numbering and renumbered vertically from 1 to 58 vertically. The numbering goes left to right and bottom to top – west to east and south to north.

As a preview, the whole point of this exercise it to make the GPS give readouts in terms of this grid rather than latitude and longitude which is not of much use on this map. From the map, REF is about E 46.6 and N 21.3. Jumping ahead to see how the GPS will eventually describe this point I have shown the GPS user grid coordinates in Figure 2 . The GPS gives the east coordinate first, easting, and then the north coordinate, northing. I have the grid set up to display two decimal places. The decimal place must be inserted mentally. The GPS shows 000460 002130.

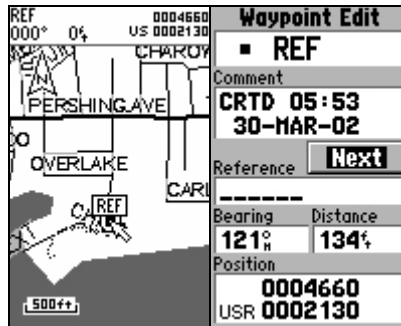


Figure 2

### Map setup

A reference point is found and compared with the map and the GPS. The map reference point is shown in Figure 1 and the GPS at that same point is Figure 3. The map reference point is about E46.6 and N21.3. This is just based on an eyeball estimate on the map.

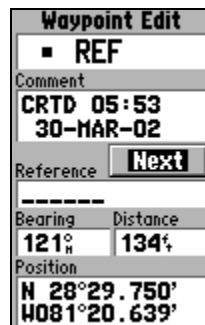


Figure 3

It is important to note that an actual GPS sampling of the latitude and longitude is not required. If you can find the latitude and longitude of a point using another method, this would also be acceptable. For example, you could set up a map before going on a trip. Find the coordinates of a point on the map such as a landmark and enter the point as a reference waypoint.

The next step is to find how many meters there are between gridlines. The more accurate you can get this the better. The error in this measurement will grow as you get further from the reference position whereas the error in reading the point on the grid or with measuring the latitude and longitude will be the same in all parts of the map.

I was lucky in that the legend published an approximate value of 1 inch = .67 miles and each grid is .75 inches. Depending on the map, you might just have to measure a grid and compare it with the scale in the legend. Here are some conversion factors to get meters:

Multiply miles by 1609 meters/mile  
 Multiply feet by .3048 meter/feet  
 Multiply yards by .9144 meters/yard

In my example, each grid is .75 inches/grid \* .67 miles/inch \* 1609 meters/mile = 809 meters/grid.

### GPS setup

User Grid Setup	Waypoint Edit	User Grid Setup	Waypoint Edit
Longitude Origin W081°20.639'	REF	Longitude Origin W081°20.639'	REF
Scale +0.1236090	Comment CRTD 05:53 30-MAR-02	Scale +0.1236090	Comment CRTD 05:53 30-MAR-02
False Easting +0.0%	Reference <b>Next</b>	False Easting +4660.0%	Reference <b>Next</b>
False Northing +0.0%	Bearing Distance ----- 121% 134%	False Northing -387658.0%	Bearing Distance ----- 121% 134%
<b>Save</b>	Position 0000000 USR 0389788	<b>Save</b>	Position 0004660 USR 0002130
Step 1	Step 2	Step 3	Check

Figure 4

#### step 1

The longitude of REF is entered as the Longitude Origin.

The scale is the inverse of the number of meters per grid. I multiplied the inverse of the number of meters per grid. I then multiplied this by 100 to get the user grid to give two decimal places. This is really one more decimal place than is justified, but I would rather the grid indicate too many than too few places.

From my scale calculation: Scale = 1/(809 meter/grid) \* 100 = .00123609 grids/meter.

At this point, I set the False Easting and False Northing to zero.

#### step 2

In this step I checked to see that the first number, the easting, is 0. This is a check that I had entered the reference longitude correctly. This means that REF is 0 distance from the reference. The bottom number is a measure of the number of grid lengths that REF is from the equator. This measure is in grid lengths since I have already input a Factor in Step 1. Ref is 3,897.88 grids north of the equator.

### step 3

If you remember, REF on the map is measured as E 46.6 and N21.3. Since we are adding the decimal place, this becomes E4660 and N2130. The False Easting is 4660. For the nothing, I want to remove the distance from the equator and add the distance from the bottom of the grid. The False Northing is  $2130 - 389788$  (from Step 2) =  $-387658$ .

### Check

I want to check my work. I go back and check that the user grid coordinates for REF are what I intended. Remember that the user coordinate is like Cartesian coordinates in that it is x then y. The user grid GPS position for REF is now E 4660 N 2130. When you add the decimal point this corresponds to the map grid of E 46.6 N 21.3.

The user grid checks. Now, write the parameters from the user grid setup on the map so you can use them again with this map so that you can use them again without having to go through all of this trouble.

### How well does it work?

I went to another section of the map to check the correlation between the map grid and the GPS user coordinates.

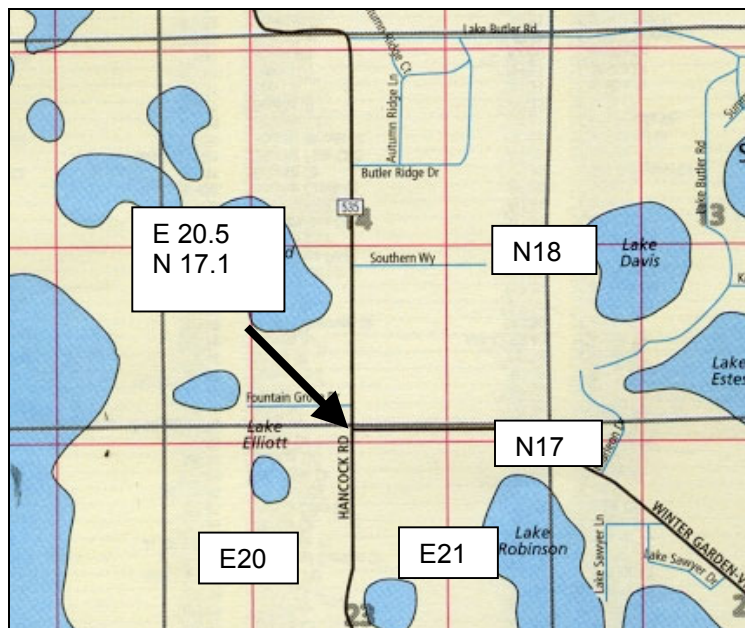


Figure 5



Figure 6

Figure 5 and Figure 6 compare the same point. The map shows the intersection to be about E 20.5 N 17.1, The GPS shows this point as 2027 1701. This is probably good enough accuracy for many applications.

I hope this works well for you. Check out my book on how to use GPS for boating at [www.smallboatgps.com](http://www.smallboatgps.com).

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