# Georeferencing a scanned map with OkMap

A scanned map, like a photograph, is a rectangular array of pixels.

In this example it measures 2550 pixels wide by 3510 pixels high.

Computers give individual pixels a pair of coordinates measured **across and down** from the **top left** hand corner.

Here the centre of the bridge across the Avonmore at Annamoe has pixel coordinates (1935, 2215)

However the Irish Grid coordinates of this point are measured **across and up** and are

(E 317289, N 199232)

These are in metres measured from an origin in the Atlantic off the South-West coast.





In order for the computer to display the coordinates of any point in the Irish Grid form a conversion formula is needed.

The process of calculating and saving this formula is called **georeferencing**. It can be done using **OkMap Desktop**. You must have the full version to do what follows.

You will need to have created a file of a scanned image of a paper map to work with.

#### File extensions

Scanned maps will be stored in files with extension of either **.jpg** or **.png**. Files with these extensions are **raster** files which means they consists of an array of pixels. OkMap can deal with either type but in the examples that follow **.jpg** is used

Georeferencing conversion formulae for use with OkMap are stored in files with the extension **.okm**. These are text files.

It is a good idea to set up File Explorer so as to show the full file names, including their extensions, and all the details about the file rather than just an icon.



# Georeferencing

Run OkMap and, in the **Home** tab, first load your **.jpg** raster file by going to

File > New > Raster Map

File H	ome View	Management Navigation Utilities	
<b>F</b> 3		( ••	
File	_	Мар	
New		Concernant Rester map	
		Calibrate a new raster map	
Coad		File	
		File waypoints, routes, tracks	

and then, using the resultant **New map** window, find and open your image file, **Mymap.jpg** say

It will appear shortly

Map calibration Select your projection (and datum) with the button below. If you don't know your projection map leave default values. Map setup World Geodetic System 1984 ensemble Equidistant Cylindrical (Spherical) Point Adjust point Adjust point	Map calibration         Select your projection (and datum) with the button below. If you don't know         your projection map leave default values.         Map setup       Grid setup         World Geodetic System 1984 ensemble         Equidistant Cylindrical (Spherical)         Point       Add         Y       Dx0         Adjust point       Emove         Justice       Y         Cancel       Accept	📲 Mymap.jpg 🗙	· · · · · · · · · · · · · · · · · · ·
USNG MGRS BNG IG Metric • • Zone X Y State of the state o		Mymapjig *	Map calibration         Select your projection (and datum) with the button below. If you don't know your projection map leave default values.         Map setup       Grid setup         World Geodetic System 1984 ensemble         Equidistant Cylindrical (Spherical)         Point       1         Add         Y       0 x 0         Remove         Adjust point         Qone       Y         Cancel       Accept

To the right of the map image is the **Map Calibration** window. You will probably need to widen this window to see everything.

Map setup	Grid setup			Photos List indexed	l files	
System 1984 ensel ndrical (Spherical)	Select map info			-		×
1 ~	Name					
	Description					^
IS BNG IG						~
ne X	Cancel		Next >		ОК	

Click on Map Setup and type in a name [you can just leave this blank] before clicking on Next.

After a considerable pause (be patient !) this will bring up the **Select projection and datum** screen.

If you click on	Proj/datum	<customized projection=""></customized>	vou will be	
, presented with	presented with a huge number of options.			

To reduce this to a manageable number you can filter the options by **Area** and type in the word **Ireland** (more patience required !) you will now get six options of which **TM65 / Irish Grid** should be selected.

A better way to bring up this option by itself is to filter by EPSG code.

🍕 Select project	ion and datum —	$\times$
Filter	EPSG ~ 29902	
Proj/datum	<customized projection=""></customized>	~
EPSG code	<customized projection=""> TM65 / Irish Grid</customized>	
Area		3
Datum		
Projection		
Unit		
	Cancel < Previous Next >	

Type in the code 29902 (patience, again) to get the single option TM65 / Irish Grid to select.

🧐 Select project	tion and datum	-		$\times$
Filter	EPSG ~ 29902			
Proj/datum	TM65 / Irish Grid			$\sim$
EPSG code	29902			
Area	3767 - Ireland - onshore			
Datum	6299 - TM65			
Projection	9807 - Transverse Mercator			
Unit	9001 - m			
	Cancel < Previous		ОК	,

On the resultant screen click on OK.

[Other projections will be needed for UK and European maps - see Note 2 below]

Click on **Grid setup** and make the East/North grid intervals 1.000m i.e. what we would write as 1,000m which is 1km.



Have your paper map to hand. To calibrate the scanned map you will now need to select three points at grid-line intersections and forming as large a triangle as you can for best accuracy.

For these three points make a note from your paper map of their coordinates. These can either be **6-digit** or **letter + 5-digit** coordinates. Paper maps should have the full 6-digits for the grid lines at each corner but may omit the first digit for other grid lines.

An explanation of the relationship between the OSI **letter + 5-digit** and its **6-digit** equivalent can be found in **Note 1** below.

**NB** The notation used in the Rambler is **letter + 3-digit** which gives an accuracy to within 100m.

# Calibrating

Mark the first of the three points chosen as a grid reference as follows:

Zoom in close to the first point and, in the **Home** tab, select the bright blue cross-hair icon to mark a

#### New georeference point



The cursor will change from an arrow to a cross. Move it across to your point and click.

The point will be marked with a blue cross in a black square and a number





Now in the **Map Calibration** window click on **Add**, click again on the bright blue dotted cross-hair and place the next point.

Repeat for the third point

Don't worry about getting the points on exact grid-line intersections – they can be nudged into positions later.

Now, in the **Map Calibration** window, go to the **Point** box and click on **3**, say.

Zoom in onto this point so that it takes up a large part of the screen.

If the cross-hair is not exactly in the centre of the grid-line intersection then nudge it into place using the blue **arrows** in the **Adjust point** area [clicking on one of the blue **circles** will move the point to one of the corners or the centre - not what you want].

#### Map calibration

Select your projection (and datum) with the button below. If you don't know your projection map leave default values.

	Map setup	Grid setup
TM65		
Transverse	Mercator	
Point	1 ~	Add
X-Y	244 x 3481	Remove



Now enter the coordinates of the point, making sure that you have first selected the Irish Grid reference system [**IG**] or the 6-figure reference form [**Metric**]

X 16000	040	Y 00
	16000	x 16000 040

Repeat this for points **1** and **2**.

Then, and only then click the Accept button at the bottom of the Map Calibration window.

USNG	MGRS BNG IG	Metric	• •
East.	316000	m	
North.	204000	m	
S i			

S i			
	Cancel	Accept	

A North pointing arrow will appear on the map and the georeferenced grid lines will appear in red. The colour and width of the lies can be changed in the **Grid** tab in **Preferences** [ 🏠 ]

If they don't appear go to the View tab and check the Metric grid box



These red grid lines should coincide reasonably well with the grid lines of the map.

It's very unlikely that this will be the case everywhere - it will depend on the state of the map when it was scanned and the quality of the scan.



If this clearly isn't the case then the coordinates of one or more of the three points are incorrect.

The data for the three calibration points can be modified by going to the **Management** tab and clicking on **Map parameters** 



You can then check/change the values for each point before clicking the **Accept** button.

**Note**: It may seem that OkMap has changed your original values but this is only a rounding error.

e.g. here 03995 rounds to 04000

Zone	X	Y	Zone	X	Y
0	16000	04000	0	16000	03995

You can also check by clicking on **Cursor** at the bottom left-hand corner of the screen [between **General** and **Map**] and checking that the georeferencing is correct by moving the cursor arrow onto a known grid-line intersection. The coordinates will be shown at the bottom of the screen in Irish grid form.

General Cursor Map Close					
2550 x 3509 593 2729 Ireland 1965 (Ireland	nd)	rd) T 13882 97918			East: 313,882m North: 197,918m
Finally go to	File	Home	View	Management	Navigation Utilities
				7	
Filo > Savo > Savo man	File			Projects	
rile > Save > Save map		New >		Reference Save pr	roject
and accept the default file name (the				Maps	
same as the <b>.jpg</b> file used but with the		Load	•	🔒 Save m	
extension <b>.okm</b> ).				Save m	ap image Save map
	Ď	Merge	•	👸 Save m	ap screenshot
				Waypoints, re	utes, tracks
		Split	×	Save wa	aypoints, routes, tracks
		Save		🍢 🛛 Save al	l waypoints, routes, tracks files
	Jave	0010		Toponyms	
				Save to	nonvms

At a later time this georeferenced map can be reloaded by going to **File > Load > Map** and clicking on the required **.okm** file. This will load the associated **.jpg** file and set up the georeferencing ready for your use.

Note: both Mymap.jpg and Mymap.okm files must be in the same folder for everything to work.

To send a georeferenced map to someone both files must be included. Since the files are likely to be large you may find that you cannot send them as email attachments. In this case consider using the free version of **WeTransfer** [<u>https://wetransfer.com</u>]

# Note 1: 6-figure coordinates and OSI lettered references

On an OSI map the 6-figure grid references are given for the points at the corners of the map. These will help you to decide what the 6-figure reference for any other point will be. Otherwise it can be calculated as follows.

In the national grid, Ireland is described as a square 500 km by 500 km. This is further divided into 25 squares, each of which is of side 100km and each of which is given a letter.

# Converting from an OSI lettered reference to a six-figure reference

Taking a scale of 100km = 1 unit the bottom left-hand corner of each square has coordinates such as:

V(0,0) W(1,0) R(1,1) H(2,3)

The OSI squares in the Wicklow area are



# Irish National Grid 100 km Squares

**N** (2,2) **O** (3,2) **S** (2,1) **T** (3,1).

The Rambler **letter + 3-digit** grid reference is converted to the OSI **letter + 5-digit** form by adding two zeroes after each of the two numbers.

Then the numerals given above for the letter are placed in front of the numbers.

So, for example, a reference:

O: 120 140 would translate [using O (3,2)] as follows:

Rambler form	OSI letter + 5-digit form 6-figure form	
O: 120 140	O: 120 <mark>00</mark> 140 <mark>00</mark>	<b>3</b> 120 <b>00</b> E <b>2</b> 140 <b>00</b> N

# Note 2: Georeferencing UK and European maps

Maps of Northern Ireland use the same Irish Grid Projection with Ireland 1965 Datum as OSi maps but elsewhere you will use different choices for Projection/Datum

Projection / datum	EPSG code
ED59 / UTM Zone 28N	23028
ED59 / UTM Zone 29N	23029
ED59 / UTM Zone 30N	23030
ED59 / UTM Zone 31N	23031
TM65 / Irish Grid	29902
OSGB36 / British National Grid	27700
WGS84 / UTM 28N	32628
WGS84 / UTM 32N	32632
WGS84 / UTM 33N	32633

The most commonly required projections and datums are given below.

#### UK maps

For UK maps you should choose the **OSGB36 / British National Grid** projection / datum.

It is a similar system to the OSI and grid references can be entered as either a **6-digit** number or **two letters + 5-digits** 

#### European maps

Most European maps use the UTM [Universal Transverse Mercator] format.



You will need to check the paper map to find the **Projection** and the **Datum** 

Maßstab – Scale – Scala 1: 25.000 00,51 km						
	1 cm auf der	Karte entspricht 25	0 m in der Nat	ur		
GPS Info:	Projektion Datum • D Ellipsoid	n • Projection • P Datum • Datum: • Ellipsoid • Ellip	roiezione : soide:	UTM (33T) WGS84 WGS84		

In this case, a map of part of Austria, the projection is **UTM 33T** and the datum is the most common one **WGS84** [World Geodetic System 1984]

In OkMap the system is simplified and only the UTM number is used together with the letters **N** or **S** [N/S of the equator] e.g. zones **33S**, **33T** and **33U** would all be simply **UTM zone 33N** 

So for this map you would need to choose the projection / datum WGS84 / UTM zone 33N in OkMap.

You will find that the UTM coordinates of points are usually 6-digits East but 7-digits North

Note: In Spain/Portugal maps may have a **Datum** of **ED-50** [short for European Datum 1950] in which case choose **ED50 / UTM zone 29N** or **ED50 / UTM zone 30N** or **ED50 / UTM zone 31N** 

Usually maps will have 1km grids but you may come across coordinates given in degrees and minutes with 1' grids. In this case, when you are in **Grid setup** you should change the **Lon. / Lat. grid intervals** to **1'** before clicking on **Copy from map** 

🇐 Set grid intervals			_		×
Lon. grid interval Lat. grid interval	1' ~ 1' ~	East grid interval North grid interval	1,000	∨ m ∨ m	
	Cancel			ОК	

# Checking the georeferencing

To check your georeferencing first create a .gpx track on your map in OkMap and save it.

Go to <u>All things GPS/GPX</u> on the website and use **GPX Local view** to check that it appears correctly there.

# Note 3: Changing the name of a .okm file

It is probably best to keep the names of any **.okm** file and its associated **.jpg** file the same except for the file extensions.

If you had two such files called, for example, **Camaderry.okm** and **Camaderry.jpg** and changed the names to **Brockaghs.okm** and **Brockaghs.jpg** using File Explorer you would get an error message when you tried to load **Brockaghs.okm** in **OkMap**.

This is because the **.okm** file contains the name of the **.jpg** file that it uses and that has now been changed.

To fix this problem the appropriate line in the **.okm** file must be edited to give the new file name.

To do this open Windows Notepad (or any other text editor) and load Camaderry.okm

```
<?xml version="1.0" encoding="utf-8"?>
<map xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" version="1.1"
creator="OkMap 10.11.3"
xmlns="http://www.okmap.it/xsd/map/1/1">
  <metadata>
    <name />
    <desc />
    <bounds minlat="52.8880747386594" minlon="-
6.62325646442613" maxlat="53.0731808238685" maxlon="-
6.23631902057385" />
  </metadata>
  <filename>Camaderry.jpg</filename>
  <size>
    <width>10065</width>
    <height>7898</height>
  </size>
  <projectionPredef>Irish Grid</projectionPredef>
  <datum>Ireland 1965 (Ireland)</datum>
  <proj>
    <name>Transverse Mercator</name>
  . . . . . . . . . .
  . . . . . . . . . .
```

You will see that this is just an ordinary **.txt** file. About 8 lines down you should find the line:

# <filename>Camaderry.jpg</filename>

change this line to

# <filename>Brockaghs.jpg</filename>

and save the file as a .txt file called Brockaghs.okm