

Gmap4

USNG and MGRS Coordinates

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For more documentation see the [Gmap4 Help page](#)

Also see the "[What is new](#)" page

This link will start Gmap4 and display a USNG grid

https://mappingsupport.com/p/gmap4.php?usng=14S_QG_0044_8474&z=5&t=t1

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1. Why are USNG coordinates important?

The Federal Emergency Management Agency (FEMA) has formally adopted the U.S. National Grid (USNG) coordinate system as its "standard geographic reference system for land-based operations".

https://mappingsupport.com/p/recreation/FEMA_USNG_Directive_Final_10_15_2015.pdf

This was done in large part so that emergency responders can have a common 'language of location'. Using latitude longitude to express locations does not provide a common 'language of location' since there are a number of different ways to write and speak them. Here are just a few:

Decimal degrees	40.68921,-74.04466 N 40.68921 W 74.04466 40.68921 N 74.04466 W
Degrees and decimal minutes	40° 41.353' -74° 2.680' N 40° 41.353' W 74° 2.680' N 40D 41.353M W 74D 2.680M
Degrees, minutes, seconds	40° 41' 21" -74° 2' 41"

UTM coordinates are also not a good choice because even if you ignore the UTM zone designation, you still need to deal with about 12 digits in order to provide a location.

18T 580722,4504697

In some of the past large scale hurricanes, responders that came from all over used different types of coordinate systems and formats since that is what they trained with at home. In the after-action reports, that disorganized approach was widely recognized as causing locational chaos. There had to be a better way. A task force was appointed and in due course it recommended that the **U.S. National Grid (USNG)** be adopted as a coordinate system that was easy to learn, easy to use and easy to represent on maps. USNG is based on the Military Grid Reference System (MGRS) which U.S. ground forces have already used for decades. In fact, for all practical purposes, **USNG is the same as MGRS except USNG coordinates are written with some spaces for easier legibility.**

One big advantage of the USNG coordinate system is that it provides an easy way to shorten the coordinates that need to be spoken or written during an emergency. While here is an example of a full USNG coordinate, USNG 18T WL 8072 0469, the first two parts define a large area. If an emergency response is taking place within that large area then to describe a 100 meter square within that area only takes 6 digits: 807 046. Describing a 10 meter square within that large area only takes 8 digits: 8072 0469.

The MGRS version of this same coordinate simply eliminates the spaces: 18TWL80720469.

Do you have a GPS? Look at the list of coordinate systems it can display. A great many GPSs can display USNG and/or MGRS coordinates.

2. What can you do with USNG coordinates and Gmap4?

Gmap4 has a variety of features that deal with coordinates. Most of those features include support for both USNG and MGRS coordinates. Here is a brief description of how Gmap4 helps you use USNG. Anything you can do with USNG coordinates in Gmap4, you can also do with MGRS coordinates.

a. Display USNG grid lines and labels

The default coordinate format is decimal degrees. To change the coordinate format to USNG:

Click Menu ==> UTM - USNG - Lat Lng

Select USNG. If the map shows a world view, then zoom in a bit.

The grid lines are muted black and white so they are easy to see on basemap areas that are both very light and very dark. The grid line labels are color coded to help people learn to “read right - then up”. If you keep zooming in the eventually you will see a 100 meter grid.

b. Display USNG coordinates for map center and cursor location

After you select USNG (see above) the coordinates for the center of the map appear in one corner. On a desktop/laptop you will also see the cursor’s coordinates.

c. Display USNG coordinates for any spot on the screen

Desktop/laptop users: Rightclick the map anywhere.

The popup that appears shows the USNG coordinate plus other coordinate formats for the spot that you clicked.

Mobile users: Do a simulated rightclick.

Tap the angle at the left side of the screen and then drag the crosshair that appears. Tap that symbol and the rightclick popup appears. To remove this crosshair from the map, tap the angle at the left side of the screen.

d. Geolocation (mobile only)

Touch Menu ==> My location

The symbol that is displayed will follow you as you walk, just like on a GPS.

Touch the symbol to see your coordinates.

The coordinates are displayed using the current coordinate format you selected (see above).

If you display your coordinates and then touch the “Link to this spot” button, a Gmap4 link will be displayed. You can email or text that link to anyone. That person can touch/click the link and Gmap4 will open in their browser and the map will show a symbol at your position. If that symbol is touched/clicked then your coordinates will be displayed. If someone needs to know your position and they can receive a text or an email, this feature is a good way to share your location with that person.

Touch Menu ==> ‘My location’ again to turn this feature off.

e. **Get a link to replicate the map on your screen including USNG**

Click Menu ==> Link to this map

The link that is displayed will replicate the map on your screen. If USNG is displayed on your screen then USNG will also be displayed on the screen of anyone that clicks that link.

You can also rightclick the map anywhere. The popup that appears has a button at the top labeled "Link to this spot". If USNG is already turned on when you do this, then the link that appears will open Gmap4 centered at the spot you clicked and the USNG grid will be displayed.

f. **Get a link to open the map centered at your USNG location**

Mobile users:

1. Menu ==> UTM - USNG - LatLng. Select USNG.
2. Menu ==> My location. The map will center at your position.
3. Tap the location symbol at the center of the screen
4. Tap the button "Link to this spot"

The link that is displayed will open Gmap4 and show a **red paddle at your position**. A USNG grid will also be displayed. Someone traveling to meet you could open this link on their phone/tablet and turn on the geolocation feature (Menu ==> My location). Their phone/tablet will then show (1) a static symbol for your location and (2) a moving symbol showing their location as they travel to meet you.

g. **Get a link to open at any USNG coordinate**

The way the map looks when it opens on the screen is controlled by parameters that you can add to the Gmap4 link. For a full list of the parameters please see the pdf file "Link Parameters".

Here is an example of how to write the parameter to center the map at a USNG coordinate when the map opens: `&usng=10T_FS_0783_9134`

Here is a basic Gmap4 link using the above USNG coordinate:

https://mappingsupport.com/p/gmap4.php?usng=10T_FS_0783_9134

Note the underscores in the USNG coordinate. Although they are not required, it is generally a **bad practice to make links that include spaces**. Various email programs and other software will not correctly handle links that include spaces.

h. Search on USNG coordinates

Menu ==> Search

Enter a USNG coordinate and then click “**Search**” at the far right.

If you want to see a red paddle at the spot you search for, then click “**Search and Mark**”.

To remove the red paddle, do another search and click “Search”.

When you search on a USNG coordinate the map will usually be centered in the middle of that grid box as a result of your search.

You can also search on UTM coordinates, most reasonable ways to write latitude longitude, addresses and many place names.

i. Get turn-by-turn directions to a USNG coordinate

First make sure that the coordinate format is set to USNG and do either of the following options.

Option 1:

1. Rightclick the map where you want the trip to start. **Mobile users** can simulate a right click by tapping the angle symbol at the left edge of the screen, dragging the crosshair that appears and then tapping the crosshair.
2. Scroll to the bottom of the popup and click “Directions from here”.
3. Enter the USNG coordinates for your destination in the “Ending location” box.

Option 2 (mobile users):

1. Turn on the geolocation feature (Menu ==> My location)
2. Tap the symbol at the center of the screen showing your location.
3. Tap “Directions from here”.
4. Enter the USNG coordinates for your destination in the “Ending location” box.

j. Convert between USNG - Latitude Longitude (D, DM, DMS) - UTM

There are several different ways to convert coordinates. Chose the approach best suited for your needs:

- * Rightclick a spot on the map
- * Do geolocation (mobile only). Touch the symbol to get your location in the current format style, change the format style (via Menu) and then touch the location symbol again.
- * Search on USNG, UTM or latitude longitude. Then either:

1. Change the basemap to the Google aerial, zoom all the way in **using the slider in the upper left corner**, right click near the center of the map
- or
2. Change the coordinate format and then look at the corner of the screen where it shows the coordinate for the center of the screen.

k. Display a USNG grid on top of GIS data

You can display a GIS grid on top of anything that Gmap4 can display. Gmap4 can display most GIS data that is available via either the REST interface (ESRI) or WMS interface (open source).

Any user that reads the Gmap4 GIS documentation can (1) make a Gmap4 link to display the GIS data they want to see and (2) display a USNG grid on top of that GIS data. The Gmap4 GIS documentation page has plenty of example map links. You can open any map and then turn on a USNG grid. <https://mappingsupport.com/p/gmap4-arcgis-layers-on-google-maps.html>

There are two ways to specify GIS data that you want to see on the map.

- * Specify the GIS data by including parameters in the Gmap4 link.
 Good: You do not need to put a data file online in order to specify the GIS data
 Bad: The Gmap4 link can become quite long. In some cases link shortening services like bitly will choke. Also some people dislike shortened links due to internet security concerns.
- * Specify the GIS data in a text file. <== **Recommended for most cases**
 Good: **You can change the content of the text file by adding/deleting GIS data without changing the Gmap4 link since that link merely points to the text file.**
 Bad: You have to put the text file online. Fortunately Google Sites provides free hosting and the Gmap4 pdf documentation “Working With Files” has step-by-step instruction for using Google Sites.

3. Grid lines and the “Tilt” feature

The “Tilt” setting is under the Menu button. By default this setting is on and when you are zoomed in and looking at certain larger urban areas then the screen will tilt the map and you will be looking down at about a 45 degree angle. This only works for urban areas where Google has access to oblique aerial images.

When you display a map with a grid (USNG, MGRS or UTM) then Gmap4 turns the tilt setting off. This is done so the grid lines appear in the correct location on your screen. You can still do Menu ==> “Tilt” and the map will tilt if you are looking at an urban area where Google has provided this feature. However, when there is a grid on your screen you should usually not turn tilt on since most grid lines will be moved a bit from their correct location. If you change the coordinate system to latitude longitude then the tilt setting will have the default value of on

unless (1) you have used the Menu button to turn tilt off or (2) tilt has been turned off with a parameter in the Gmap4 link.

4. 911 dispatching and responding

Problem: The hypothetical county Rolling Rock dispatches first responders to USNG coordinates. However, few people that call 911 know their location in USNG coordinates. Instead, many callers provide coordinates they get from their cell phone or GPS. These coordinates are latitude longitude expressed as decimal degrees, or degrees and decimal minutes, or degrees minutes seconds. Other callers report their location in UTM coordinates. Other callers provide an address. Still other callers know the section, township and range where they are located.

The problem at the Rolling Rock 911 dispatch center is how to convert any of these different ways to express location into USNG coordinates so responders can be sent out.

Solution: The following Gmap4 link is one way to solve this problem:

https://mappingsupport.com/p/gmap4.php?coord=usng&rest=http://www.geocommunicat.or.gov/ARCGIS/REST/services/MapView/MapServer?name=Township_range&layers=23,27&transparent=true

To search on most reasonable ways to write coordinates, including USNG coordinates, do **Menu** ==> **Search** and enter the coordinates into the search window at the top of the screen. Gmap4 will figure out the type of coordinate you entered and center the map at that location. **The USNG coordinates for the center of the screen are always displayed in one corner of the map.** Rolling Rock county uses those USNG coordinates to dispatch responders.

There is no required way for entering coordinates. Gmap4 will understand most reasonable ways to write any of the common coordinate formats. However, in the interest of eliminating needless typing, here is a suggested format for entering coordinates:

dd.ddddd	47.290201 -91.2838722
dd mm.mmm	47 17.412 -91 17.032
dd mm ss	47 17 25 -91 17 2
utm	15T 629760 5238842
usng	15T XN 2975 3884
mgrs	15TXN29753884

Note that Gmap4 uses **latitude bands** as part of UTM coordinates. The USA is in latitude bands R, S, T and U. This method for expressing UTM coordinates is also used by Garmin on its GPS units. This method has also now been adopted by the USGS.

If an address is entered in the search window then Gmap4 will use Google's address search in the background and return the result.

If a 911 caller reports their location by providing a section township and range (like my brother did once in northern Michigan after being run off a backwoods road) then the dispatcher opens the Gmap4 **basemap menu**, goes to the Overlay section and turns on the "Township_range" layer by clicking it. The dispatcher then drags and zooms the map to find the correct township-range and then changes the basemap to "**t4 CalTopo Hi-res**" to find the correct section. When the map is **centered at the correct spot**, the USNG coordinates for that location are copied from the corner of the screen. Also, a rightclick at the desired location will display coordinates in all the common formats, including USNG, for the spot that was clicked.

Now here is an improvement to the above approach. Instead of specifying GIS data you want to see on the map right in the Gmap4 link (as shown above), a better approach will often be to (1) specify GIS data in a text file, (2) put that text file online and (3) make a Gmap4 link that will read that text file.

By making such a text file you can:

- Add/delete/modify GIS specifications in the text file without changing the Gmap4 link that uses the text file.
- Specify multiple KML/KMZ files. The limit is 5.
- Define waypoints with descriptions (including links) and "always on" labels.
- Defines lines.

Here is a demonstration text file I made for Lake County Minnesota:

https://sites.google.com/site/gmap4files/p/demo/demo_lake_county.txt

And here is a Gmap4 link that uses this text file:

https://mappingsupport.com/p/gmap4.php?usng=15T_XN_0531_6039&z=9&t=m&tilt=off&q=h
https://sites.google.com/site/gmap4files/p/demo/demo_lake_county.txt

Note that this text file is online at Google Sites which provides free file hosting. For step-by-step instructions please go to the Gmap4 Help page and download the pdf file "Working With Files".

https://mappingsupport.com/p/gmap4_help.html

If you download the above text file and open it then you will see that this file specifies one KMZ file showing some trails and a number of GIS layers from various servers. Gmap4 can display one or more of these layers and the layers can be stacked on the map in any order.

To turn any GIS layers on, click/touch the basemap button. This button always shows the name of the current basemap and is in the upper right corner of the map (desktop) or lower right corner (mobile). Go to the "Overlay" section and click layers to turn them on. Click again to turn the layer off. A layer that is on has a number. A higher numbered layer is on top of a lower numbered layer.

Note that you have to be zoomed in before some of this GIS data will display. This GIS data is sent to Gmap4 in the form of “tiles” each of which is a jpg image that is 256 pixels on a side. It takes a number of tiles to fill your screen. Sometimes a GIS server can be slow and it might take a few seconds (or longer) to send you all the tiles to fill your screen.

I have some **more ideas** for this topic of how Gmap4 might help with 911 dispatching and responding so expect some updates to this section after I do a bit more software development. Also since I always enjoy hearing ideas from users here is my contact page:
https://mappingsupport.com/p/gmap4_contact.html

5. Sources for more USNG information

Video introductions to USNG

<https://youtu.be/F-qduWx45pE>

Excellent introduction to USNG! Power point slides. **Tutorial starts at slide 34.**

http://www.gis.state.mn.us/committee/emprep/download/USNG/USNG_Presentation_24SEP09_sds.ppt

Video on USNG. You might have to ask for a new link to view the video.

<https://nsgic.webex.com/nsgic/lsr.php?AT=pb&SP=TC&rID=18195187&rKey=16080ab65d36e037&act=pb>

Another good introduction to USNG.

<https://napsfoundation.org/wp-content/uploads/2014/01/Implementation-Guide-to-The-USNG.pdf>

USNG center and more links.

<http://usngcenter.org/>

<http://usngcenter.org/portfolio-item/general-presentations/>

http://usngcenter.org/wp-content/uploads/2013/08/USNG_Zone_Junction_2009_0806.pdf

Florida was the first state to officially adopt USNG coordinates as a standard.

<http://www.floridadisaster.org/gis/usng/>

http://www.floridadisasterengineers.org/USNG_Files/FDE_posting1/USNG_GENERAL/Start_usng_US-National-Grid.pdf

Minnesota has adopted USNG coordinates as a standard. One place USNG coordinates are being used is on trail signage in two of the counties north of Lake Superior.

http://www.co.lake.mn.us/departments/emergency_management/arrowhead_trail_marker_project.php

<http://www.mngeo.state.mn.us/committee/emprep/download/USNG/>

http://www.co.lake.mn.us/index.asp?Type=B_BASIC&SEC={585161F7-63B8-4E61-8E87-896C6D4DB273}

Lament from a **Georgia** SAR responder.

http://www.mountainpathfinder.com/georgia_sar_us_national_grid.html

6. Twitter feed with USNG news

Here are the twitter feeds I follow to stay up-to-date.

@USNGFlorida

@USNG