Conversion Between Geodetic and Grid Locator Systems

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Conversion Between Geodetic and Grid Locator Systems

This simple paper system lets you convert latitudes and longitudes to grid locators—and vice versa—*without* a computer or calculator. Give it a try on your next "gridpedition"!

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The grid locator system is widely used in Europe and North America for reporting station position during contacts at VHF and above.[1] One of the advantages of grid locators is that they describe positions in four or six characters—compared to the ten or fourteen characters necessary with the geodetic (latitude/longitude) system. A six-character grid locator describes a coarse position with its first two characters and, with successive characters, refines the position to an area 2.5′ of latitude × 5′ of longitude in size. This article describes a tabular method of converting between the grid locator and latitude/longitude systems.

Brief Anatomy of a Grid Locator

Of a full (six-character) grid locator, three characters (the first, third and fifth) specify longitude in steps of increasing precision; the remaining three characters (the second, fourth and sixth) specify latitude in steps of increasing precision. See Fig 1.

The first character (always a letter) of a grid locator specifies longitude in 20° increments, with the letter *A* corresponding to the interval 180° W to 160° W, the letter *B* corresponding to the interval 160° W to 140° W, and so on until the letter *R*, which covers 160° E to 180° E longitude.

The second character in a grid locator specifies latitude in 10° increments. For instance, the letter *A* covers the interval from 90° S to 80° S, *B* covers 80° S to 70° S, and so on until *R*, which specifies latitudes from

[1]In Europe, this system is usually referred to as the *Maidenhead locator system*.

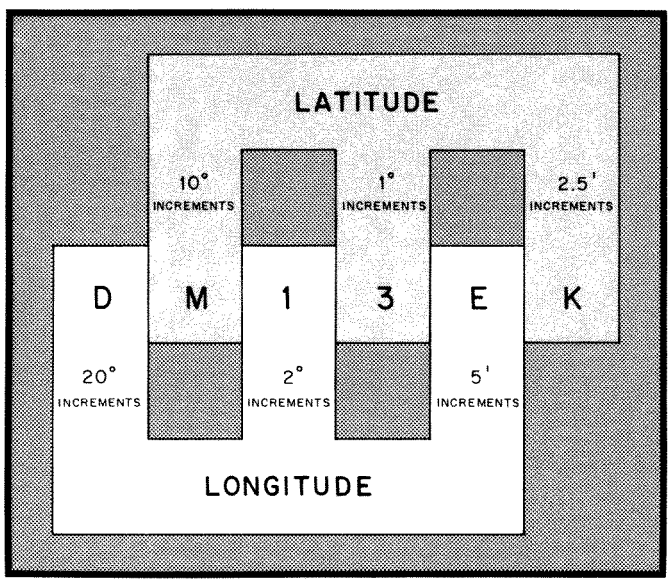

Fig 1—Anatomy of a grid locator. In its six-character form, the grid locator specifies positions on the earth to the nearest 5′ of longitude and 2.5′ of latitude. For many Amateur Radio purposes, however, only the first four grid characters (specifying positions—*grid squares*—to the nearest 2° of longitude and 1° of latitude) are used. See the text and Tables 1 through 6 for how to convert geodetic coordinates to grid locators and vice versa.

Table 1
1st Longitude Character

Degrees Longitude	Letter
−180	A
−160	B
−140	C
−120	D
−100	E
−80	F
−60	G
−40	H
−20	I
0	J
+20	K
+40	L
+60	M
+80	N
+100	O
+120	P
+140	Q
+160	R
+180	

Table 2
2nd Longitude Character

Degrees Longitude	Number	
−20	0	0
−18	1	+2
−16	2	+4
−14	3	+6
−12	4	+8
−10	5	+10
−8	6	+12
−6	7	+14
−4	8	+16
−2	9	+18
0		+20

Table 3
3rd Longitude Character

Minutes Longitude	Letter	
−120	A	0
−115	B	+5
−110	C	+10
−105	D	+15
−100	E	+20
−95	F	+25
−90	G	+30
−85	H	+35
−80	I	+40
−75	J	+45
−70	K	+50
−65	L	+55
−60	M	+60
−55	N	+65
−50	O	+70
−45	P	+75
−40	Q	+80
−35	R	+85
−30	S	+90
−25	T	+95
−20	U	+100
−15	V	+105
−10	W	+110
−5	X	+115
0		+120

Table 4
1st Latitude Character

Degrees Longitude	
−90	A
−80	B
−70	C
−60	D
−50	E
−40	F
−30	G
−20	H
−10	I
0	J
+10	K
+20	L
+30	M
+40	N
+50	O
+60	P
+70	Q
+80	R
+90	

↑ Letter

Table 5
2nd Latitude Character

Degrees Latitude		
−10	0	+0
−9	1	+1
−8	2	+2
−7	3	+3
−6	4	+4
−5	5	+5
−4	6	+6
−3	7	+7
−2	8	+8
−1	9	+9
0		+10

↑ Number

Table 6
3rd Latitude Character

Minutes Latitude		
−60.0	A	0.0
−57.5	B	+2.5
−55.0	C	+5.0
−52.5	D	+7.5
−50.0	E	+10.0
−47.5	F	+12.5
−45.0	G	+15.0
−42.5	H	+17.5
−40.0	I	+20.0
−37.5	J	+22.5
−35.0	K	+25.0
−32.5	L	+27.5
−30.0	M	+30.0
−27.5	N	+32.5
−25.0	O	+35.0
−22.5	P	+37.5
−20.0	Q	+40.0
−17.5	R	+42.5
−15.0	S	+45.0
−12.5	T	+47.5
−10.0	U	+50.0
−7.5	V	+52.5
−5.0	W	+55.0
−2.5	X	+57.5
0.0		+60.0

↑ Letter

Table 7
Sample Grid Locators

City	Longitude	Latitude	Locator
Munich	11° 36.5′ E	48° 8.8′ N	JN58TD
Montevideo	56° 12.7′ W	34° 54.6′ S	GF15VC
Washington, DC	77° 3.9′ W	38° 55.2′ N	FM18LW
Wellington	174° 44.7′ E	41° 17.0′ S	RE78IR

Remember: West longitudes and south latitudes are treated as *negative* values in the grid locator system; east longitudes and north latitudes are *positive*.

80° N to 90° N. West longitudes and south latitudes are treated as *negative* values in the grid locator system; east longitudes and north latitudes are *positive*.

The third and fourth characters are digits in the range 0 through 9. The third character divides longitude lunes into 2° increments; the fourth character divides latitude zones into 1° increments.

The last two characters (always letters) in a grid locator subdivide the 2° × 1° rectangles designated by the third and fourth characters into smaller rectangles that are 5 × 2.5 minutes of arc in size. The letters *A* through *X* are used to specify each coordinate of these 5′ × 2.5′ rectangles.

Conversion Tables

Tables 1 through 6, inclusive, can be used to convert latitude and longitude to grid locators, or grid locators to latitude and longitude.

Converting Latitude and Longitude to Grid Locators

Example: The location of an observatory at 105° 44.0′ W longitude and 32° 58.8′ N latitude can be readily converted to a grid locator. Find the longitude characters first. (Remember: West longitude is negative in the grid-locator system.) According to Table 1, the first grid character is *D* because the observatory's longitude is between −100° and −120°. Record the first character of the unknown locator, leaving space for the characters to come:

D_ _ _ _ _ _

(For values of longitude that are exact multiples of 20°, *work from zero* and choose the grid-locator letter *"above"* the correct exact longitude value. For examples: −120° longitude = C, not D; +20° longitude = K, not J. Apply this "use the higher letter or number" rule to Tables 1 through 6 whenever you must work with exact multiples of the longitude and latitude increments reflected in the tables.)

So far, we have accounted for exactly 100° of the observatory's longitude. Find the second longitude character by referring to Table 2 for the number corresponding to the longitude remainder, −5° 44.0′. Because −5° 44.0′ falls within the −4° to −6° range, that number is *7*. We now have *two* characters of the grid locator:

D_7_ _ _ _

Now, we have accounted for exactly 104° of the observatory's −105° 44.0′ longitude. Use Table 3 to find the letter that corresponds to the remaining −1° 44.0′ of longitude. Expressed in minutes, −1° 44.0′ = −60′ + −44.0′, or −104.0′. This number falls within the −100′ to −105′ range, so the third longitude letter is *D*. Now we have all three longitude characters of the unknown grid locator:

D_7_D_ _ _

The three latitude characters come next. The observatory's latitude is 32° 58.8′ N. This is a *positive* latitude in the grid-locator system. According to Table 4, the first latitude character is *M* because the observatory's latitude is between +30° and +40°. We now have four grid characters:

DM7_D_ _

The most significant latitude character, M, accounts for exactly 30° of the observatory's latitude. Find the second latitude character by referring to Table 5 for the number corresponding to the latitude remainder, +2° 58.8′. Because +2° 58.8′ falls in the +2° to +3° range, that number is *2*. We now have *five* grid-locator characters:

DM72D_ _

So far, we have accounted for exactly 32° of the observatory's +32° 58.8′ latitude. Use Table 6 to find the letter corresponding to the remaining +58.8′ of latitude. Because +58.8′ falls within the +57.5′ to +60.0′ range, that letter is *X*. We now have the observatory's complete grid locator: DM72DX.

Converting Grid Locators to Latitude and Longitude

The conversion of grid locators to geodetic coordinates can be illustrated with the grid locator DM13EK. The geodetic coordinates we find will correspond to the *exact center* of the region specified by DM13EK. As before, it's useful to separate the grid locator into elements of longitude and latitude. Also as before, we'll do the longitude first:

D = −100°
1 = −16°
E = −1° 35′
Round = −0° 2.5′

Sum = −117° 37.5′, or 117° 37.5′ W longitude

The rounding term is used to compute the longitude of the *center* of the specified region—a region 5′ × 2.5′ (longitude × latitude) in size because DM13EK is a six-character locator. We know that the longitudinal center of this region must lie somewhere along a line half—2.5′—of the region's longitudinal width (5′) from its

(continued on page 43)

Conversion Between Geodetic and Grid Locator Systems

(continued from page 30)

eastern and western edges, so the longitude rounding term is 2.5′. (The rounding term must carry the same sign as that of other coordinate digits [negative rounding terms for negative longitudes and latitudes, positive rounding terms for positive longitudes and latitudes.]) Next, we'll calculate the *latitude* specified by DM13EK:

```
  M =  +30°
  3 =   +3°
  K =   +0° 25′
Round = +0°  1.25′
-------------------
Sum =  +33° 26.25′, or 33° 26.25′ N
  latitude
```

For six-character locators, the latitude rounding term is 1.25′ because the region designated by a six-character locator is 2.5′ wide in latitude. Again, the rounding term must carry the same sign as that of the other coordinate digits.

For *four*-character (grid-square) locators, the rounding terms are 1° (longitude) and 30′ (latitude) because grid squares are 2° × 1° (longitude × latitude) in size. As before, the grid-square rounding terms must carry the same sign as that of the other digits in their respective coordinates.

For more examples of grid locators, see Table 7. Use the coordinates and grid locators shown there as a basis for practice in converting geodetic coordinates to grid locators, and vice versa.

The *Rand-McNally Road Atlas* can be used for estimating station locations by interpolating between the geodetic coordinates marked on the edges of the atlas' state maps. For the highest precision, use US Geological Survey quad sheets that cover your areas of interest.

Summary

Tables 1 through 6, inclusive, provide a field-transportable method of converting between the geodetic and grid-locator systems. For Field Day exercises and VHF/UHF contests, the tables provide a means of cross-checking station coordinates when the station computer has been left at home.

References

J. Lindholm, "VHF/UHF Century Club Awards," *QST*, Jan 1983, pp 49-51.

W. Overbeck, "A Universal Grid-Locator Program for Your Personal Computer," *QST*, Dec 1986, pp 30-31.

Edmund T. Tyson became interested in Amateur Radio in the early 1940s. Entering military service in 1944, he worked in various career fields involving electronics. Assigned to Wright Field in 1953, Ed worked on airborne TV systems for reconnaissance. In 1957, he was assigned as project engineer to establish and operate an observatory for tracking and photographing satellites. Retiring after 33 years of military and civilian service, Ed has been involved in designing and building electronic and computer equipment for astronomical applications. He is currently involved in relocating a 48-inch telescope from New Mexico to California. He was licensed as a Technician in 1986 and upgraded to Advanced Class in 1988.