Getting More from Your Handheld GPS Unit

Are you getting all that you can from your handheld unit? Are you able to directly observe State Plane coordinates with your handheld? Although inexpensive units may not have a selection for the State Plane coordinate grid that you use in your state, if your State Plane Coordinate Zone uses the Transverse Mercator projection, then it is possible to use the USER GRID position format to configure your unit to display State Plane coordinates directly.

The USER GRID position format is based on the Universal Transverse Mercator (UTM) System, which is a global grid system. The only difference between a UTM zone and the State Plane Coordinate Zones that use the Transverse Mercator projection is the values of the defining constants. Both systems are metric and both are referenced to the same ellipsoid, the Geodetic Reference System of 1980. Basically, the difference is a matter of translation and scale. The USER GRID position format is essentially a UTM zone in which you can customize the defining constants to correspond to the specific State Plane Coordinate Zone of interest to you.

The defining constants that vary depending upon the particular State Plane Coordinate Zone are as follows:

- Longitude of the Central Meridian
- Scale Factor at the Central Meridian
- False Easting of the Central Meridian
- Latitude of the Grid Origin
- False Northing of the Grid Origin

The defining constants for each zone of the 1983 State Plane Coordinate System can be found in NOAA Manual NOS NGS 5: State Plane Coordinate System of 1983 by James E. Stem.

Because of the similarities between the UTM zones and the Transverse Mercator State Plane Coordinate Zones, the Longitude, Scale Factor and False Easting of the Central Meridian of your particular State Plane Coordinate Zone can be entered directly into the

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False Northing Values Determined Using The Method Described

Alabama East (0101)	-3375407
Alabama West (0102)	-3319892
Alaska Zone 2 (5002)	-5985317
Alaska Zone 3 (5003)	-5985317
Alaska Zone 4 (5004)	-5985317
Alaska Zone 5 (5005)	-5985317
Alaska Zone 6 (5006)	-5985317
Alaska Zone 7 (5007)	-5985317
Alaska Zone 8 (5008)	-5985317
Alaska Zone 9 (5009)	-5985317
Arizona East (0201)	-3430631
Arizona Central (0202)	-3430631
Arizona West (0203)	-3430745
Delaware (0700)	-4207477
Florida East (0901)	-2692051
Florida West (0902)	-2692051
Georgia East (1001)	-3319781
Georgia West (1002)	-3319781
Hawaii Zone 1 (5101)	-2083150
Hawaii Zone 2 (5102)	-2249193
Hawaii Zone 3 (5103)	-2341506
Hawaii Zone 4 (5104)	-2415321
Hawaii Zone 5 (5105)	-2396891
Idaho East (1101)	-4614371
Idaho Central (1102)	-4614371
Idaho West (1103)	-4614306
Illinois East (1201)	-4059418
Illinois West (1202)	-4059281
Indiana East (1301)	-3901864
Indiana West (1302)	-3901864
Maine East (1801)	-4836302
Maine West (1802)	-4744047
Mississippi East (2301)	-3264526
Mississippi West (2302)	-3264526
Missouri East (2401)	-3966785
Missouri Central (2402)	-3966785
Missouri West (2403)	-4003801
Nevada East (2701)	+4153526
Nevada Central (2702)	+2153526
Nevada West (2703)	+153526
New Hampshire (2800)	-4707019
New Jersey (2900)	-4299572
New Mexico East (3001)	-3430662
New Mexico Central (3002)	-3430631
New Mexico West (3003)	-3430689
New York East (3101)	-4299572
New York Central (3102)	-4429252
New York West (3103)	-4429252
Rhode Island (3800)	-4549800
Vermont (4400)	-4707008
Wyoming East (4901)	-4484768
Wyoming East Central (4902)	-4384768
Wyoming West Central (4903)	-4484768
Wyoming West (4904)	-4384768

Author Note: *Scale Factors at the Central Meridian were rounded up to the 7th decimal place when applicable.*

Figure 1 Create a waypoint with the latitude and longitude of the State Plane Coordinate Grid Origin.

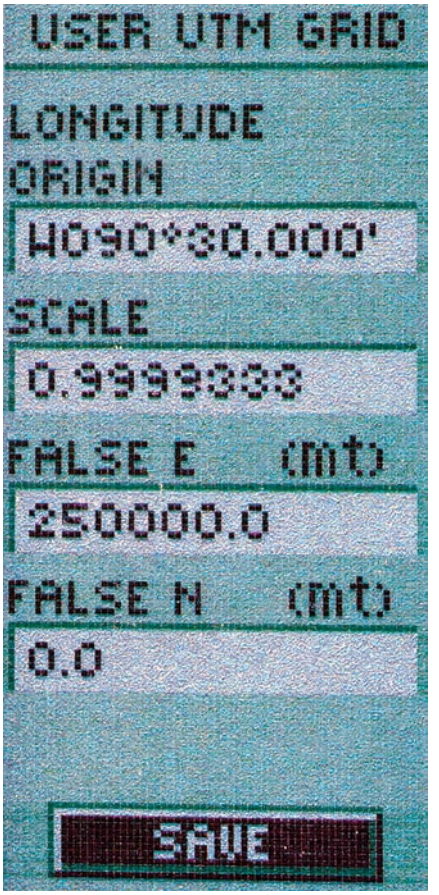

Figure 2 Enter Zone defining constants on the USER GRID setup page. Initially, set the False Northing equal to zero.

USER GRID setup page. The False Northing, however, requires a little more work. The UTM zones of the Northern Hemisphere have their Grid Origin at the equator with a False Northing of zero, but each State Plane Coordinate Zone has its origin at a specified latitude. Before you can obtain State Plane Coordinates directly on your handheld, you will need to determine the difference in Northing between the UTM and your particular State Plane Coordinate Zone.

The easiest way to determine this difference is to use the handheld unit itself. Begin by choosing the "hddd°mm'ss.s" position format (on the Garmin etrex it is: Menu > Setup > Units > Position Format) and NAD83 for the MAP DATUM. Then create a waypoint with the latitude and longitude of the State Plane Coordinate Grid Origin for your zone (**Figure 1**). One might think that the longitude wouldn't matter, because it's the Northing component that you are interested in and not the Easting, but you won't get the right value if you don't use the longitude of the origin. As an example, the latitude of the Grid Origin of the Missouri East Zone is 35°50' North and the longitude is 90°30' West. After creating the waypoint, return to the Position Format page and choose USER GRID.

On the USER GRID setup page enter the Longitude of the Central Meridian, the Scale Factor at the Central Meridian and the False Easting of the Central Meridian for the State Plane Coordinate Zone of interest to you. (In NOAA Manual NOS NGS 5 the Scale Factor of the Central Meridian is listed as a ratio. To obtain the Scale Factor merely subtract the ratio as a fraction from one. For instance, the ratio for the Missouri East Zone is 1:15,000. The Scale Factor as a number is, therefore, one minus 1/15,000 which is equal to 0.9999333.) For False Northing enter zero (**Figure 2**). Save your changes and then make sure that MAP DATUM is set to NAD83.

Now, go to your waypoints list and select the waypoint with the latitude and

longitude of your Zone's Grid Origin. You will note that the coordinates are displayed as X (easting) and Y (northing) with the X value on top and the Y value on the bottom. (For those of us that are accustomed to using Northing and Easting, it's a bit of an adjustment, but to enjoy the benefit you'll have to get used to it.) The X value displayed should be the value of the False Easting of the Central Meridian for your Zone. For the Missouri East Zone the X value is 250000. The Y value displayed is the difference between the UTM origin at the equator and the UTM northing at your Zone's Origin. For the Missouri East Zone the Y value is 3966785 (**Figure 3**). In order for your handheld to display the correct Northing for your State Plane Coordinate Zone, a negative of this Y value should be entered on the USER GRID setup page for the False Northing (**Figure 4**). If the Northing of your Zone's Grid Origin is not zero (such as in Indiana, Nevada and Wyoming), then add the Northing of the Zone's Grid Origin to this negative value to get the correct False Northing. For example, the value obtained for the Nevada East Zone, using the procedure described above, is -3846474. The Northing of the Zone's Grid Origin is 8,000,000. Add -3846474 to 8,000,000 to obtain a False Northing of +4153526.

On the USER GRID setup page for the Missouri East Zone, then, the values entered would be as follows:

Longitude Origin:	W090°30.000'
Scale:	0.9999333
False E (mt):	250000.0
False N (mt):	-3966785.0

If you return to your waypoints list and select the waypoint of your Zone's Grid Origin, the Y value displayed should be zero (**Figure 5**). Now that you have determined the False Northing, you are ready to directly observe State Plane Coordinates on your handheld unit.

There are other ways to determine the False Northing for your Zone, but I believe the method described above is the simplest. Whatever the method you choose, the basic procedure is to enter a waypoint in the latitude and longitude position format and then to switch to the USER GRID position format to determine the difference between the UTM origin and the Northing of your Zone's Grid Origin.

Now that you have determined your False Northing, you may want further verification that the handheld is actually providing the correct value. To do this you could visit a horizontal control station whose position in State Plane Coordinates you know. However, a field visit is not necessary for verification purposes, because the same thing can be accomplished by simply using the control station data sheet or a geographic position conversion utility, such as CORPSCON.

Figure 3 The waypoint at the Zone Origin displays the value of the False Northing when viewed in USER GRID format.

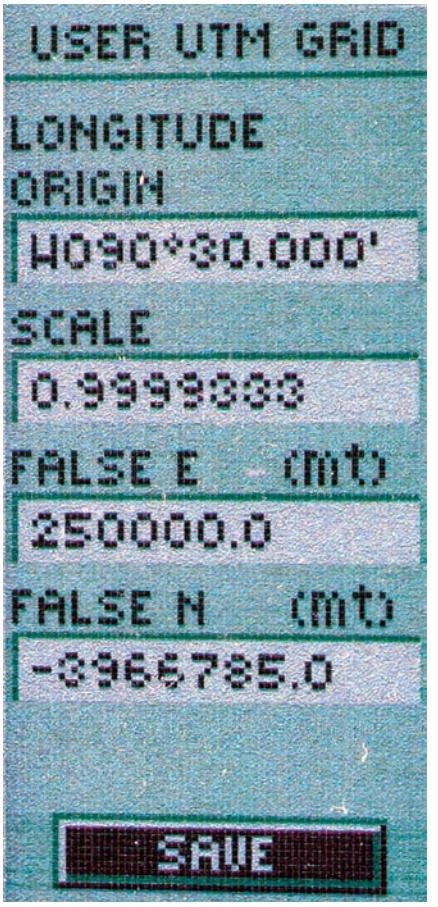

Figure 4 Enter the False Northing value on the USER GRID setup page.

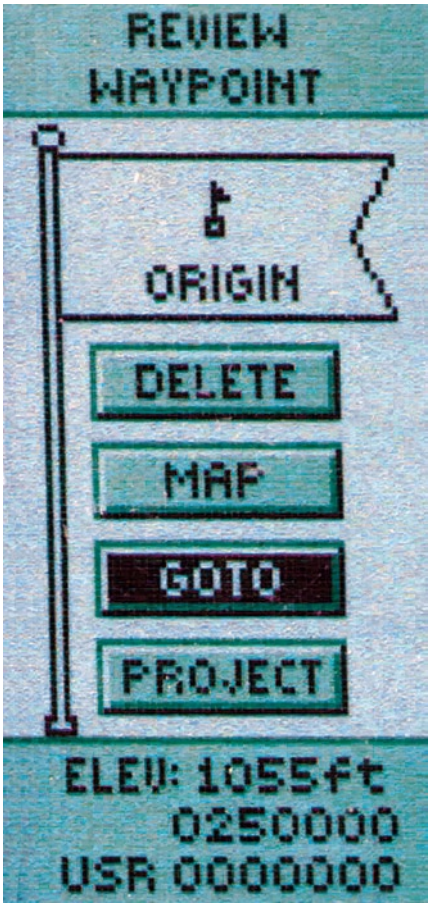

Figure 5 When the defining constants have been entered correctly, the Zone's Grid coordinates will display.

Once you have the data available, select the "hddd°mm'ss.s" position format on your handheld unit. Create a waypoint with the latitude and longitude of the known point. Next, select the USER GRID and enter the defining constants for the appropriate State Plane Coordinate Zone, including the False Northing that you have determined for that Zone. Now go to the waypoints list and select the waypoint that you just created. If you have entered everything correctly, the coordinate values displayed should match within a couple meters of the actual values on the data sheet. The difference can be attributed to rounding of the Scale Factor at the Central Meridian on the USER GRID setup page and rounding of the latitude and longitude when entering the waypoint.

So now you have set up your handheld to display State Plane coordinates directly and you've verified that it is displaying correctly. You are now entering a whole new dimension of utility with your handheld GPS unit. Don't be fooled, however, into believing that your handheld is now more accurate than ever before, because it is not any more accurate than it was. It is simply more useful, because now you can easily perform calculations with the position information that is directly displayed in State Plane coordinates.

In addition, you can also now use your handheld unit as a conversion utility. For instance, let's say you are in the field searching for corners of the U. S. Public Land Survey System and you have scaled a latitude and longitude from your handy 7.5 minute USGS topographic map. You can create a waypoint in your handheld unit using the "hddd°mm'ss.s" position format as you normally would. If you then switch to the USER GRID that you have set up for your State Plane Coordinate Zone, the waypoint you created will display in State Plane coordinates. Granted, the conversion may be a little rough, but when you are in the field, a rough number that you can work with may be all that you need for search purposes.

And that's not all. Not only can you obtain State Plane coordinates directly, but if you really wanted to, you could create your very own Transverse Mercator zone and you could configure your handheld unit to directly display its grid coordinates! Now that's getting more from your handheld GPS unit, isn't it?