

THE UTM SYSTEM

UTM coordinates are based on a family of 120 Transverse Mercator map projections (two for each UTM zone, with one for each N/S hemisphere).

- The earth is divided into 60 zones, each 6° wide in longitude (with the exception of a few non-standard-width zones for Svalbard and southwest Norway). See Figure 1.

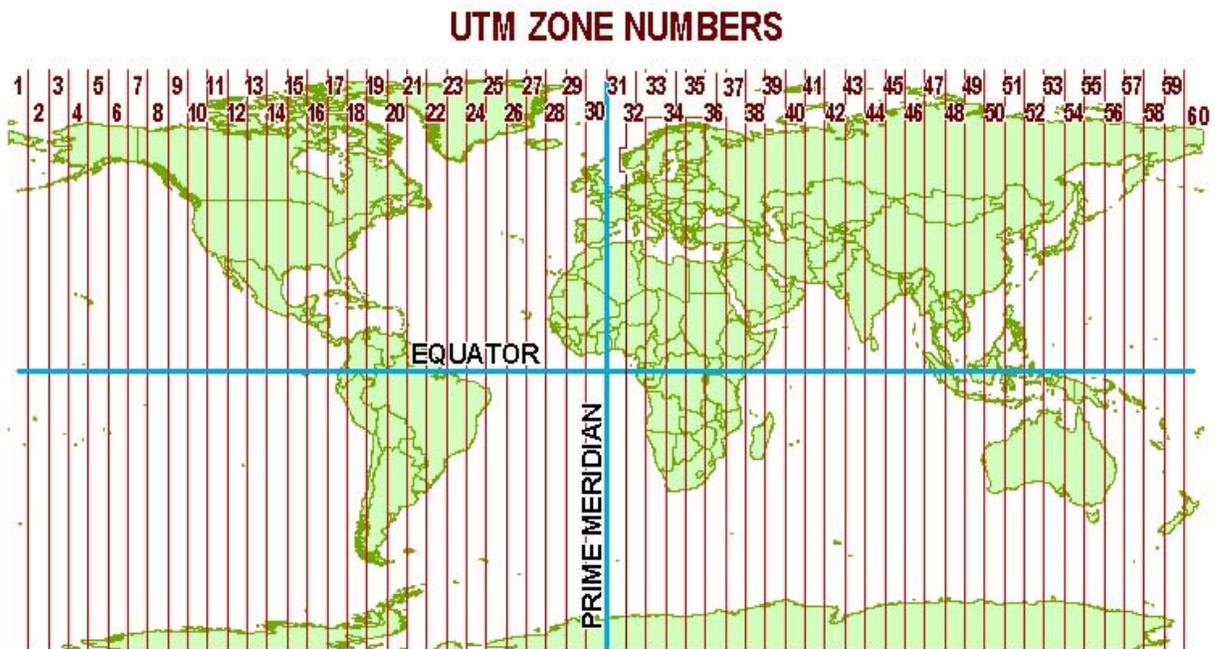


Figure 1.

- Numbering of zones begins at 180° and proceeds eastward.
 - Zone 1 is from 180°W to 174°W,
 - Zone 2 is from 174°W to 168°W, and so on.
- Each zone has a central meridian.
 - Zone 1 central meridian is 177°W,
 - Zone 2 central meridian is 171°W, and so on.

- The X value, called the Easting, has a value of 500,000m at the central meridian of each zone (Figure 2).
- The Y value, called the Northing, has a value of 0m at the equator for the northern hemisphere (Figure 3), 10,000,000m at the equator for the southern hemisphere.

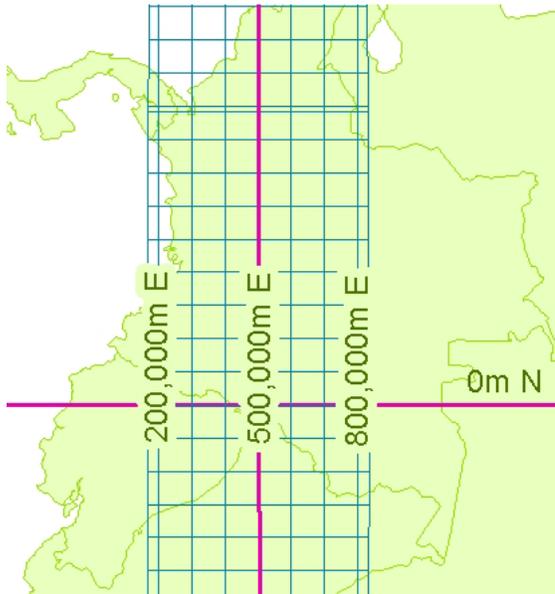


Figure 2. Easting values.

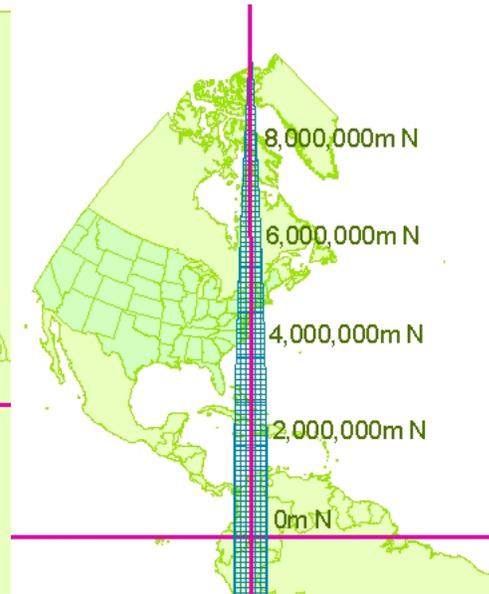


Figure 3. Northing values.

- UTM is limited to the area between 84°N and 80°S. Beyond that, Universal Polar Stereographic (UPS) coordinates are used. See section on UPS.

REFERENCING / EXPRESSING A POSITION IN UTM COORDINATES

- In the UTM system, positions are expressed as Easting / Northing, e.g. “580817mE, 4251205mN”. In some cases, the letters are left off, e.g. “580817 4251205”.
- If positions occur near UTM zone junctions, the UTM zone may also be specified, e.g. “580817mE, 4251205mN, Zone 15”.
- Since the above expresses two possible positions on the earth, the hemisphere may also be specified, e.g. “580817mE, 4251205mN, Zone 15, Northern Hemisphere” (Figure 4).

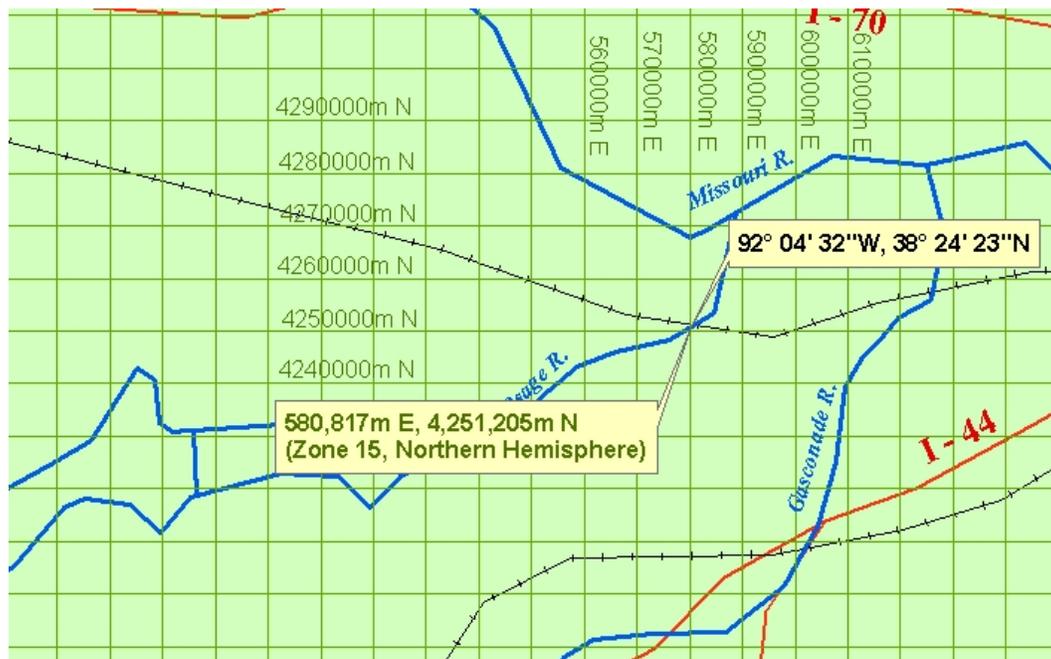


Figure 4. Example of position expressed in both Lat/Long and UTM coordinates.

- Many systems abbreviate the above, representing the hemisphere as a single letter, “N” for northern hemisphere, and “S” for southern hemisphere, e.g. “15N 580817 4251205”.

THE UNIVERSAL POLAR STEREOGRAPHIC (UPS) SYSTEM

UPS coordinates are based on a family of two Polar Stereographic map projections, one for each pole.

- The origin of the UPS coordinate system is the pole (north or south), where $X=2,000,000\text{m}$ and $Y=2,000,000\text{m}$.
- The X-axis lies along the meridians 90°E and 90°W .
 - Moving from the pole (north or south), X-values (Eastings) increase along the 90°E meridian.
- The Y-axis lies along the meridians 0° and 180° .
 - Moving from the north pole, Y-values (Northings) increase along the 180° meridian.
 - Moving from the south pole, Y-values (Northings) increase along the 0° meridian.
- **CAUTION:** IN MANY SYSTEMS, THE LETTER AFTER THE ZONE NUMBER DESIGNATES A LATITUDINAL BAND, **NOT** A HEMISPHERE. MORE ON THIS BELOW.

THE LETTER AFTER THE UTM ZONE NUMBER: IS THAT A HEMISPHERE OR A LATITUDINAL BAND?

Since the creation of UTM, developers have interpreted the rules for expressing an earth-wide unique UTM position in one of two ways:

1. By including an "N" or "S" after the zone number to specify a hemisphere.
2. By including the 8° latitudinal band designator (see the section on MGRS) after the zone number.

Example: The position at 92°W , 38°N , expressed in UTM coordinates, is:

587798m E, 4206287m N, Zone 15.

This reference is valid for two positions on the earth. In order to make it unique for only one position worldwide, i.e. 92°W , 38°N :

- Developer #1 includes an “N” to specify northern hemisphere:
15N 587798 4206287
- Developer #2 includes the 8° latitudinal band designator:
15S 587798 4206287

This situation is causing confusion among users and developers. The two 8° latitudinal bands, from 0° to 8°N and from 32°N to 40°N, are assigned the designations “N” and “S”, respectively. These designations are often mistaken for hemisphere designations.

Technical Manual 8358.1 contains the authoritative definition of UTM. NGA will soon publish an updated version of TM 8358.1, which will provide clarification on this issue.

**For additional guidance and assistance contact NGA’s
Office of GEOINT Sciences (SN), Coordinate Systems Analysis Branch
St. Louis, MO: 314-263-4171 (DSN 693-4171)
Bethesda, MD : 301-227-3340 (DSN 287-3340)**