

TRANSVERSE MERCATOR

10xxxxxx.1

LEGAL RESTRICTIONS:

This Reusable Software Component (RSC) contains data with Unlimited Government Rights.

DESCRIPTION:

TRANSVERSE MERCATOR is a C language code component that provides conversions between Geodetic coordinates (latitude and longitude) and Transverse Mercator projection coordinates (easting and northing).

CERTIFICATION LEVEL:

This RSC has been certified at level 4. A level 4 component satisfies the criteria for reliability, testing, and documentation for the Army Reuse Center (ARC). The component comes with test materials and a Reuse Manual that aids in integrating the component into a software system.

LEVEL OF TESTING/ACCEPTANCE:

Unit and integration testing have been performed for the functions contained in this component.

PURPOSE/INTENDED USE:

The purpose of TRANSVERSE MERCATOR is to provide a reusable component which supports the following coordinate conversions:

- Geodetic coordinates (latitude and longitude in radians) to Transverse Mercator projection coordinates (easting and northing in meters),
- Transverse Mercator projection coordinates (easting and northing in meters) to Geodetic coordinates (latitude and longitude in radians).

A particular ellipsoid is specified in terms of the following parameters:

- Semi-Major Axis (a): Radius (in meters) at the equator, and
- Semi-Minor Axis (b): Radius (in meters) at a pole.

A particular variation of the Transverse Mercator projection is specified in terms of the following parameters:

- Central Meridian – Longitude (in radians) at the origin of the projection,
- Origin Latitude – Latitude (in radians) at the origin of the projection,
- False Easting – A coordinate value (in meters) assigned to the central meridian of the projection to avoid the inconvenience of using negative coordinates, and
- False Northing – A coordinate value (in meters) assigned to the origin latitude of the projection to avoid the inconvenience of using negative coordinates.
- Scale Factor – a multiplier for reducing a distance in projected coordinates to the actual distance along the central meridian.

HARDWARE/ENVIRONMENT CONSTRAINTS:

There are no hardware or environment constraints. There are no limitations.

FUNCTIONS:

`Set_Transverse_Mercator_Parameters` – This function sets the ellipsoid parameters and Transverse Mercator projection parameters for the particular variation of the Transverse Mercator projection that is to be used in subsequent coordinate conversion operations.

`Get_Transverse_Mercator_Parameters` – This function returns the current values of the ellipsoid parameters and Transverse Mercator projection parameters.

`Convert_Geodetic_To_Transverse_Mercator` – This function converts the specified geodetic coordinates (latitude and longitude in radians) to Transverse Mercator projection coordinates (easting and northing in meters) using the current ellipsoid parameters and Transverse Mercator projection parameters.

`Convert_Transverse_Mercator_To_Geodetic` – This function converts the specified Transverse Mercator projection coordinates (easting and northing in meters) to

geodetic coordinates (latitude and longitude in radians) using the current ellipsoid parameters and Transverse Mercator projection parameters.

EXAMPLE APPLICATIONS:

The following example illustrates how TRANSVERSE MERCATOR can be used to convert Geodetic coordinates to Transverse Mercator projection coordinates and back again:

Function Call:

```
status = Set_Transverse_Mercator_Parameters (a, b, Origin_Latitude, Central_Meridian,  
False_Easting, False_Northing, Scale_Factor)
```

Inputs:

a	6378137.0
b	6356752.3142
Origin_Latitude	0.0
Central_Meridian	0.0
False_Easting	0.0
False_Northing	0.0
Scale_Factor	1.0

Function Call:

```
status = Convert_Geodetic_To_Transverse_Mercator (Latitude, Longitude, Easting,  
Northing)
```

Inputs:

Latitude:	35.0
Longitude:	-2.0

Outputs:

Easting:	-182187
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Northing: 3876416

Function Call:

```
status = Convert_Transverse_Mercator_To_Geodetic (Easting, Northing, Latitude,  
Longitude)
```

Inputs:

Easting: -182187

Northing: 3876416

Outputs:

Latitude: 35.0

Longitude: -2.0