Spatial Referencing in the TNT Products

The TNT family of products provide the most advanced software for creating, displaying, processing, and analyzing all types of geospatial data. The "*geo*" in *geospatial* means that the data objects in your TNT Project Files include spatial reference information that relates the features portrayed in these objects to positions in the real world. This spatial referencing is set up when you georeference image or map data or when you import geospatially-referenced data from an external source. Geospatial referencing enables TNT processes to accurately overlay different geodata layers for display and processing, to report real-world positions of features in View windows, and to reproject (warp) geodata objects when necessary (among other procedures).

Coordinate Reference System = **Coordinate System** + **Datum**

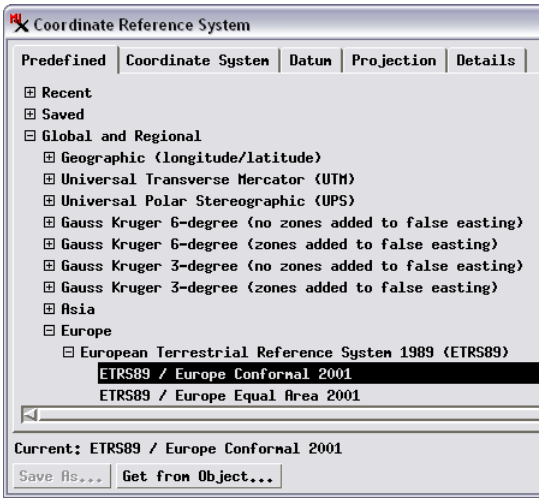
Any georeferenced spatial object must have an assigned *Coordinate Reference System*. A Coordinate Reference System combines a *Coordinate System* with a *Datum*, which gives the relationship of the Coordinate System to the surface and shape of the Earth. A *projected* Coordinate System (such as the 2D planar Coordinate System for a UTM zone) also specifies a *coordinate transformation* (traditionally called a *map projection*) between positions in geodetic (ellipsoidal) coordinates and positions in the Coordinate System. A Coordinate System may also be unprojected; examples include global latitude-longitude coordinates or a local Cartesian Coordinate System used for a construction site.

Efficient and robust handling of spatial referencing is at the heart of the TNT products. All TNT processes handle spatial referencing information via a Spatial Referencing framework that provides all coordinate system and datum definitions and transformations. This framework conforms to the International Organization for Standardization (ISO) standard 19111 entitled *Spatial Referencing by Coordinates*, which in turn encompasses the Open Geospatial Consortium's Abstract Specification also entitled *Spatial Referencing by Coordinates*. These standards describe the elements that are necessary to fully define various types of coordinate systems and coordinate reference systems applicable to geographic information. They also provide a standard framework for coordinate conversion and for transformations between different coordinate reference systems. By conforming to these international standards for spatial referencing, the TNT products provide you with a robust yet flexible foundation for all spatial operations with your data. Definitions of critical terms from the ISO standard are provided on the next page.

The Coordinate Reference System window is used throughout the TNT products to set the Coordinate Reference System (CRS) for a geospatial object or for a geospatial operation. You can choose from hundreds of predefined CRSs, thousands of combinations of coordinate systems and datums, or create and save specialized CRSs. An introduction to the use of the Coordinate Reference System window can be found in the Technical Guide entitled *Georeference: Coordinate Reference System Window*.

Highlights of TNT Spatial Referencing

- provides single unified interface for selection / setup of coordinate reference systems
- controls all projection, conversion, and transformation of spatial coordinates (object to object, screen to object, ...)
- choose from thousands of coordinate reference systems in global / regional and national / local groupings
- define and save custom coordinate reference systems to match your locally-supplied data
- includes all coordinate system, datum, and projection values from the European Petroleum Survey Group (EPSG) geodetic parameter database (which is updated every 6 months) plus many others
- provides direct datum transformations, eliminating inaccuracies due to intermediate transformation to WGS84
- use any supported length unit for Coordinate System; coordinates are stored in that unit, not converted to meters
- regular updates available as part of your TNT patches
- preserves custom and private coordinate reference systems when new TNT versions are installed



Use the Coordinate Reference System window to select a predefined Coordinate Reference System or to define a custom Coordinate Reference System.

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Spatial Referencing Terms and Definitions

The following terms and definitions for concepts and procedures in spatial referencing in the TNT products have been adopted by MicroImages from the ISO standard 19111 entitled *Spatial Referencing by Coordinates*, Section 4:

Coordinate Reference System
Coordinate System that is related to the real world by a datum. (For geodetic and vertical datums, it will be related to the Earth.)

Coordinate System
Set of mathematical rules for specifying how coordinates are to be assigned to points.

Cartesian Coordinate System
Coordinate System that gives the positions of points relative to *n* mutually perpendicular axes.

Datum
Parameter or set of parameters that serve as a reference or basis for the calculation of other parameters. (A datum defines the position of the origin, the scale, and the orientation of the coordinate system.)

Map Projection
Coordinate conversion from a geodetic coordinate system to a plane.

Projected Coordinate System
Two-dimensional coordinate system resulting from a map projection.

Geodetic Coordinate System or Ellipsoidal Coordinate System
Coordinate system in which position is specified by geodetic latitude, geodetic longitude, and (in the three-dimensional case) ellipsoidal height.

Engineering Datum or Local Datum
Datum describing the relationship of a coordinate system to a local reference. (Engineering datum excludes both geodetic and vertical datums.) Example: a system for identifying relative positions within a few kilometers of the reference point.

Coordinate Conversion
Change of coordinates, based on a one-to-one relationship, from one coordinate system to another based on the same datum. Example: between geodetic and Cartesian coordinate systems or between geodetic coordinates and projected coordinates, or change of units such as from radians to degrees or feet to meters. (A coordinate conversion uses parameters which have constant values.)

Coordinate Transformation
Change of coordinates from one coordinate reference system to another coordinate reference system based on a different datum through a one-to-one relationship. (A coordinate transformation uses parameters that are derived empirically by a set of points with known coordinates in both coordinate reference systems.)