How to set the Spatial Reference for a feature dataset or stand-alone feature class in a Geodatabase

This document describes how to set the Spatial Reference when creating a new empty feature dataset or stand-alone feature class in ArcCatalog. It also provides an overview of the function and components of the Spatial Reference for datasets and stand-alone feature classes in a geodatabase.

Documentation accompanying ArcGIS 9 contains the topic 'Setting an appropriate geodatabase spatial domain'. It shows you how to determine the optimal values for the xy domain and precision of a feature dataset or stand-alone feature class. To find the topic, see the chapter 'Creating new items in a geodatabase', in the book *Building a geodatabase*. You can also find it in the ArcGIS Desktop Help. To access the topic, start ArcCatalog or ArcMap, and open the ArcGIS Desktop Help. In the Index tab type 'spatial domain' and press Enter.

Tips

It is easiest to import the Spatial Reference information from existing data, if you have a coverage, shapefile, or geodatabase dataset for the right area with this information already defined.

It is often a good idea to set a larger extent (X,Y Domain, as well as Z and M Domains) than your data initially requires, allowing for the addition of new data. If you are importing from an existing dataset, it is best to use a dataset that covers your entire area of interest, rather than one that covers a small part of your area of interest.

Once a dataset's Spatial Reference has been set, it can be changed using the extract data wizard. You can also extract the schema from an existing dataset, such as those provided as data model samples, and create a new dataset with its own spatial reference. (Please see the Tips and Tricks document on disconnected editing for more information).

If you plan to have a geometric network or a topology in the dataset, make sure that the Precision is large enough (and the cluster tolerance small enough) to prevent vertices of features from being snapped together.

You can click Save As on the Spatial Reference Properties Dialog to save the Coordinate System as a .prj file.

For more information please see **Understanding Map Projections, The Geodatabase Workbook, ArcSDE Administration Guide,** and **Building a Geodatabase** in the ArcGIS documentation.

What's the purpose of the Spatial Reference?

When you set the Spatial Reference for a dataset you assign Coordinate System, Precision, and XY Domain (extent) values that are suitable for the data that you want to store in the dataset. These specify where the data is in space, so ArcMap or other tools will be able to use the data and project it on the fly to match other data, and also how the data is stored in the geodatabase. All feature classes that you store in a dataset will share this Spatial Reference (including the extent), so you should be sure that all of the feature classes you plan to add fit within it. It is important to get this right the first time because the extent and Precision cannot be changed after the schema is created, or after data is loaded. There is a separate Tips and Tricks document on the datamodels website (called How to Create a Geodatabase from a Repository) that describes how to specify the Spatial Reference while running the Schema Wizard.

There are two ways to set the Spatial Reference for a new dataset. The easiest is to import the Spatial Reference from an existing dataset or feature class (this could be a shapefile or coverage with a PRJ file, or a geodatabase feature class or dataset). You can also choose from one of many predefined Coordinate Systems (or specify Your own) and then specify the extent and Precision values. In either case you can manually adjust the Precision and extent values to suit the data that you plan to load, and to accommodate any topological relationships you may plan to implement.

What are the steps for setting the Spatial Reference for a dataset?
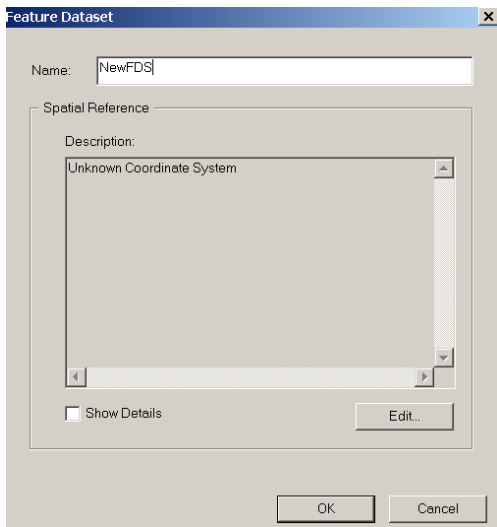
Create a Geodatabase

Right-click the folder in ArcCatalog where you want to create the Geodatabase, then point to New and then click Personal Geodatabase. For details on how to create Multi-User geodatabases, see **Managing ArcSDE Application Services, ArcSDE Configuration and Tuning Guide [for your database],** and **Understanding ArcSDE**.

Create a feature dataset

In ArcCatalog, right-click the database where you want to create a new feature dataset. Point to New, and then click Feature Dataset.
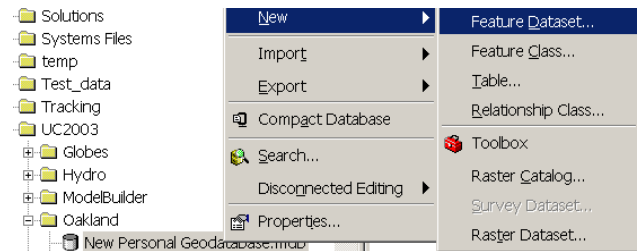

Type a name for the feature dataset.

Click Edit to define the Spatial Reference of the dataset.

Define the Spatial Reference

The following steps also apply when you are creating a stand-alone feature class in a geodatabase.

You can import some or all of the Spatial Reference information from existing data, such as the data that you intend to load into the dataset, or you can select a Coordinate System from a list of pre-defined Coordinate Systems. These are presented in more detail below as Option A and Option B of Step 1. In either case, you should always also proceed to Step 2, and examine and sometimes set the XY Domain, Precision, Z Domain, and M Domain of the dataset.
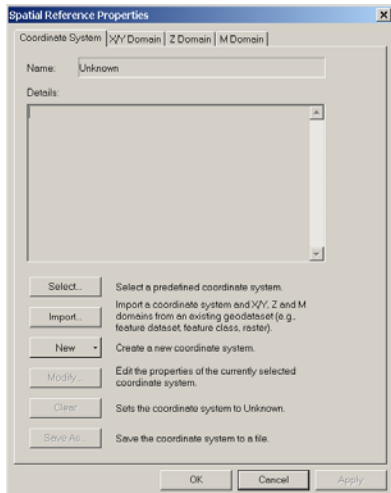
Step 1:
Option A: Import

To use the same Spatial Reference as another feature dataset, feature class, coverage, or shapefile, click Import and choose the feature dataset or feature class to import the information from.

TIP: This is the simplest way to set the spatial reference, if you have existing data with a defined projection. The Coordinate System (projection and datum) of the new dataset will be the same as the source data.

NOTE: The XY Domain and Precision for the dataset will be calculated using the coordinate values present in the data; this will usually result in a moderate buffer space around the existing data that will allow for new features to be added outside the extent of the source data. If you intend to add features more than two or three times beyond the width of the existing dataset, you should examine the XY Domain and set it manually.

TIP: It is best to import the Spatial Reference from data that covers the full extent of the area of interest for the new dataset. For example, if your area of interest in a state, it is best if you import the Spatial Reference from a coverage that contains the whole state. If you select a coverage of a single county within the state as the source of Your Spatial Reference You may find that the extent of the new dataset is too small to include some other counties.

TIP: Because XY Domain and Precision are inversely related; it is also best to choose a dataset that is not many times larger than the extent of data that you plan to store in the dataset. For example, if you want to store a feature class of engineering/survey grade measurements to a fraction of a centimeter, using a continent scale coverage as the source of Your Spatial Reference may result in a Precision that is too small. This can result in coordinates being rounded, losing information.

Option B: Select

To set a new spatial reference, click Select and choose the feature dataset's Coordinate System from the list of existing projected or geographic Coordinate Systems. The Coordinate System and Datum should match the data that you intend to load into the dataset.

NOTE: You will need to set the XY Domain and Precision for the dataset. The default values are unlikely to be useful.

Modify the Coordinate System

Once you have defined a Coordinate System you can modify its parameters. Click Modify to change any parameters of the Coordinate System you have chosen. Edit the Coordinate System's parameters and click OK. For more information on Coordinate Systems and datums, see ***Understanding Map Projections***.

Step 2:
Set the XY Domain and Precision

Whether you imported the Spatial Reference from an existing dataset or selected a Coordinate System from the list, it is good practice to check, and if necessary change, the XY Domain and Precision of the dataset.

Click the X/Y Domain tab. This tab has text boxes where you can view and set the minimum and maximum X and Y values for the coordinates of features that will be stored in the dataset.

Next, acquire appropriate minimum and maximum X and Y values for your dataset. You can obtain these values by adding the data to ArcMap, placing the pointer at the bottom and top corners of the data in ArcMap and copying the coordinate values into ArcCatalog. It is best to zoom out a little to include areas outside the extent of your existing data, to accommodate future expansion.

2
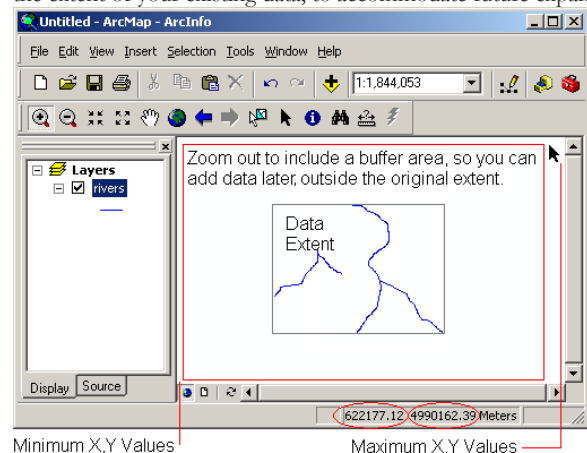
If you imported the Spatial Reference from a shapefile, coverage, or feature class then the XY Domain values from that data, plus a buffer, will be used as the default XY Domain.

Type the minimum and maximum X and Y coordinate values for the dataset.
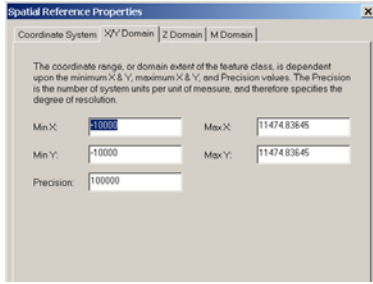
Check the Precision value. The dataset will store this many parts for each of the Coordinate System's units of measure. For a Coordinate System with feet as the units, a Precision of 100 will store data to 1% of a foot. Changing the Precision will change the maximum XY values; and changing the XY values will change the Precision.

Set the Z Domain and Precision

The Z domain specifies the minimum and maximum Z values for feature classes with Z values in the geometry. The Z Precision is analogous to the XY Precision.

What are the steps for setting the Spatial Reference for a stand-alone feature class?

Feature classes, sometimes called stand-alone feature classes, can be created in a geodatabase outside of a dataset. When you create a new empty stand-alone feature class you need to set its Spatial Reference. The Coordinate System, XY Domain, Precision, and (when you specify that the geometry will store Z or M values) Z and M Domains for stand-alone feature classes are all set in the same way that you set them for a dataset, and serve the same purposes. New feature classes that you create within a dataset will have the dataset's Spatial Reference.

Create a new feature class

In ArcCatalog, right-click on the geodatabase where you want to create the new stand-alone feature class, click New, and click Feature Class. Type a name and optionally an alias, choose the type of features that you want to store in the feature class, and click Next. Click Next again, unless you are using a configuration keyword.

Set the Spatial Reference of the feature class

Before you can set the Spatial Reference for a stand-alone feature class you must specify the geometry of the features that will be stored in the feature class.

Click Geometry, in the Data Type column.
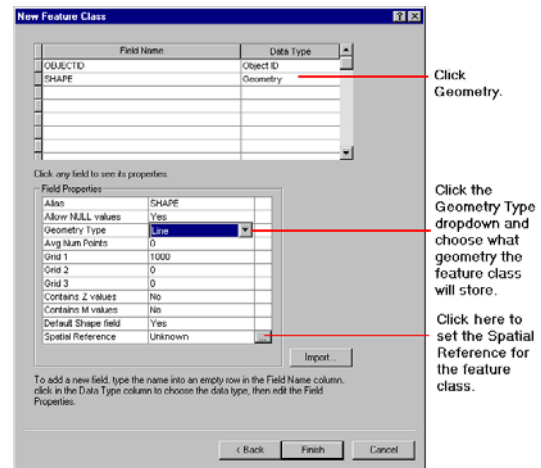
You can now specify the properties for the geometry field, including the geometry type, whether or not the features will store M or Z values with their geometry, the spatial index grid size, and the Spatial Reference. In this example we'll use the default spatial index grid and not store M or Z values.

Click the entry in the column beside Geometry Type, in the Field Properties table (the default geometry is Polygon), and click the geometry that you want to store in the feature class.

Click the button beside the entry "Unknown" for the Spatial Reference, in the Field Properties table.

Use the steps outlined in the "Define the Spatial Reference" section of this document to finish defining the spatial reference for your stand-alone feature class.

What are the components of a Spatial Reference?

A dataset's Spatial Reference has several parts: the Coordinate System, the XY Domain (or Extent), the Precision, and the Z and M Domains.

Coordinate System

The Coordinate System of a dataset identifies its projection and datum. You should set the Coordinate System and datum to be the same as any data you intend to load in to the dataset. This information allows ArcMap and other applications to represent your data in the correct place relative to other data. Unlike the rest of the Spatial Reference, the Coordinate System information can actually be changed after it has been established; this does not reproject the data.

XY Domain

The XY Domain, or Extent, of a dataset is the range of X and Y coordinate values that it will store. This permanently defines the area in the dataset that can contain features; in a sense it defines the edge of the world with respect to the dataset. No features can

have coordinate values that are greater or less than these values. Features that exceed these limits cannot be loaded or digitized into the dataset.

Precision

The Precision is the number of internal geodatabase storage units allocated to each Coordinate System unit. For example, if the Coordinate System units are meters and the Precision is 1000, the geodatabase allocates enough storage units to each meter to store coordinate values to the nearest millimeter. There is an inverse relationship between the extent of a dataset, that is, its range of values in the X and Y dimensions, and how precisely coordinate values can be stored in the dataset. A dataset with the extent of a city could store microscopic position measurements very precisely; in contrast, a dataset with the extent of the globe can store measurements of position less precisely, although still to within about a meter.

In addition to controlling how precisely the coordinates of features can be stored, Precision also comes into play when a topology or geometric network is going to be built in a dataset. In order for features to share geometry, their vertices are snapped together when they fall within a cluster tolerance of each other. The minimum cluster tolerance is roughly 2.5 times the minimum vertex spacing allowed by the Precision; vertices of features within this distance will be snapped together, and in some cases vertices within an area 10 times greater may be affected. If you are planning to create a topology within the dataset you should be sure that the Precision is high enough (and the cluster tolerance small enough) to avoid deforming or collapsing features.

Z and M Domains

The Z and M Domains for a dataset are conceptually the same as the Extent (XY Domain), in that they control the minimum and maximum values that can be stored in Z (elevation) or M (measure) aware feature classes. Z domains apply to all feature classes in the dataset; different M domains can be specified for feature classes within the dataset.