The MapInfo Interchange File (MIF)

Format Specification

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MapInfo Interchange File (MIF) Format Specification

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Introduction

This specification provides information about the MapInfo Interchange File (MIF) format. MIF is an ASCII text file format that fully describes the contents of a MapInfo table. MIF consists of two related files: one for the graphical data, and one for the tabular data. The graphical data is in a file with a .mif extension, and the tabular data is in a file with a .mid extension. MIF files can be read and written by MapInfo Professional and translated into other formats with other programs. In this guide, you will find information on:

Chapter 1: MapInfo Data Interchange Format

- **MIF File Header**
- **MIF Data Section**
- **Pen Styles**
- **Brush Styles**
- **Symbol Styles**
- **Font Styles**
- **Colors**
- **MID File**

Chapter 2: Creating Your Own Coordinate System

- **Projections and Coordinate Systems**
- **Elements of a Coordinate System**
- **Editing the MAPINFOW.PRJ File**
- **Affine Transformations**
- **Frequently Asked Questions on Projections**
- **More Information on Projections**

Chapter 1: MapInfo Data Interchange Format

This chapter describes the data interchange format for MapInfo. In this chapter, you will find information on:

- **MIF File Header**
- **MIF Data Section**
- **Pen Styles**
- **Brush Styles**
- **Symbol Styles**
- **Font Styles**
- **Colors**
- **MID File**

This versatile format allows generic data to be attached to a variety of graphical items. Since it is ASCII, it is editable, relatively easy to generate, and works on all platforms supported by MapInfo. Perhaps the best way to understand the MapInfo Interchange Format (MIF) is to study the sample file at the end of this chapter in conjunction with the explanation of the file format. You can also create samples of your own by exporting files to MIF and then examining those files in a text editor.

MapInfo data is in two files - the graphics reside in a .MIF file and textual data is contained in a .MID file. The textual data is delimited data, with one row per record and either Carriage Return, Carriage Return plus Line Feed, or Line Feed between lines. The MIF file has two areas - the file header area and the data section. Information on how to create MapInfo tables is in the header; the graphical object definitions are in the data section.

MIF File Header

This is a description of MIF file header with optional information in square brackets.

```
VERSION n
Charset "characterSetName"
[ DELIMITER "<c>" ]
[ UNIQUE n,n.. ]
[ INDEX  n,n.. ]
[ COORDSYS...]
[ TRANSFORM...]
COLUMNS n
  <name> <type>
  <name> <type>
      .
      .
DATA
```

Version

The Version clause states whether you are using VERSION 1, VERSION 2, VERSION 300 or VERSION 450 of the format. Version 300, introduced with MapInfo 3.0, allows multiple–section polyline objects. VERSION 450 introduced the expanded node limit: the maximum number of nodes for regions and polylines is 1,048,572 nodes for a single polygon region or polyline. The limit drops by seven nodes for every two additional polygons.If an object with more than 32K nodes is saved and the table is read in a version of MapInfo prior to version 4.5, the object(s) will not be visible. Objects in the table that do not exceed the 32K limit will be visible. VERSION 450 also includes point sized pen width.

Charset

The Charset clause specifies which character set was used to create text in the table. For example: Specify “WindowsLatin1” to indicate that the file was created using the Windows US & Western Europe character set; specify “MacRoman” to specify the Macintosh US & Western Europe character set; or specify “Neutral” to avoid converting the text into another character set. If you are not using one of these character sets, you can determine the correct syntax for your character set by exporting a table and examining the .MIF file in a text editor.

Delimiter

Specify the delimiting character in quotation marks, for example:

```
DELIMITER ”;”
```

The default delimiter is Tab; if you are using the default, you do not need the DELIMITER line.

Unique

Specify a number. This number refers to a database column; 3 is the third column, 7 is the seventh column, and so forth. What happens to columns in the UNIQUE list is subtle. For example, imagine that you have a database with highways in it. Each highway has only one name, but it might be represented by several segments. You would put the NAME column in the UNIQUE list, while the column containing data for the individual segments would not be in that list. This has the effect of creating two related tables; one with names, and one with the other attributes of the objects. This is how MapInfo’s various street maps (StreetInfo) are prepared.

Index

To indicate that columns in the table are indexed, include a number (or a comma–separated list of numbers) in the Index clause. Each number refers to a database column; 3 is the third column, 7 is the seventh column, and so forth. Columns in the INDEX list will have indexes prepared for them.

CoordSys Clause

Specify the COORDSYS clause to note that the data is not stored in longitude/latitude form. When no COORDSYS clause is specified, data is assumed to be stored in longitude/latitude forms.

All coordinates are stored with respect to the northeast quadrant. The coordinates for points in the United States have a negative X while coordinates for points in Europe (east of Greenwich) have a positive X. Coordinates for points in the Northern hemisphere have a positive Y while coordinates for points in the Southern hemisphere have a negative Y.

Syntax1

CoordSys Earth
[**Projection** *type*,
datum,
unitname
[**,** *origin_longitude*]
[**,** *origin_latitude*]
[**,** *standard_parallel_1* [**,** *standard_parallel_2*]]
[**,** *azimuth*]
[**,** *scale_factor*]
[**,** *false_easting*]
[**,** *false_northing*]
[**,** *range*]]
[**Affine Units** *unitname, A, B C, D, E, F]*
[**Bounds (** *minx, miny*) **(** *maxx, maxy*)]

Syntax2

CoordSys Nonearth
[**Affine Units** *unitname, A, B C, D, E, F]*
Units *unitname*
Bounds (*minx, miny*) **(** *maxx, maxy*)

Syntax3

CoordSys Layout Units *paperunitname*

Syntax4

CoordSys Table *tablename*

Syntax5

CoordSys Window *window_id*

type is a positive integer value representing which coordinate system to use

datum is a positive integer value identifying which datum to reference

unitname is a string representing a distance unit of measure (e.g. "m" for meters); for a list of unit names, see Set Distance Units

origin_longitude is a float longitude value, in degrees

origin_latitude is a float latitude value, in degrees

standard_parallel_1 and *standard_parallel_2* are float latitude values, in degrees

azimuth is a float angle measurement, in degrees

scale_factor is a float scale factor

range is a float value from 1 to 180, dictating how much of the Earth will be seen

minx is a float specifying the minimum x value

miny is a float specifying the minimum y value

maxx is a float specifying the maximum x value

maxy is a float specifying the maximum y value

paperunitname is a string representing a paper unit of measure (e.g. "in" for inches); for a list of unit names, see Set Paper Units

tablename is the name of an open table

window_id is an Integer window identifier corresponding to a Map or Layout window

A performs scaling or stretching along the X axis.

B performs rotation or skewing along the X axis.

C performs shifting along the X axis.

D performs scaling or stretching along the Y axis.

E performs rotation or skewing along the Y axis.

F performs shifting along the Y axis.

Transform Clause

When you have MIF files with coordinates stored with respect to the northwest quadrant (quadrant 2), you can transform them to the northeast quadrant (quadrant 1) with a transform clause.

Quadrant 2: Northwest Quadrant	Quadrant 1: Northeast Quadrant
Quadrant 3: Southwest Quadrant	Quadrant 4: Southeast Quadrant

The transform clause has the following syntax:

```
TRANSFORM Xmultiplier, Ymultiplier, Xdisplacement,
Ydisplacement
```

To transform quadrant 2 data into quadrant 1 data, use the following transform clause:

```
TRANSFORM -1,0,0,0
```

The zeroes instruct MapInfo to ignore that parameter.

When you have an application which creates MIF files in quadrant 2, you can:

- Add the TRANSFORM clause to the MIF files
- Change the application so that it creates coordinates in quadrant 1
- Change the application so that it adds a TRANSFORM clause to the MIF files

Columns

Specify the number of columns. Then, for each column, create a row containing the column name, the column type, and, for character and decimal columns, a number to indicate the width of the field. Valid column types are:

- char (width)
- integer (which is 4 bytes)
- smallint (which is 2 bytes, so it can only store numbers between -32767 and +32767)
- decimal (width,decimals)
- float
- date
- logical

This is an example of the columns section of the header:

```
COLUMNS  3
STATE char (15)
POPULATION integer
AREA decimal (8,4)
```

For the database specified in this header, the MID file has three columns:

a 15 character field that represents the STATE column,

an integer field that represents the POPULATION column,

an AREA column that consists of a decimal field with up to 8 total characters (digits, decimals points, and optional sign) and 4 digits after the decimal.

MIF Data Section

The data section of the MIF file follows the header and must be introduced with DATA on a single line:

```
DATA
```

The data section of the MIF file can have any number of graphical primitives, one for each graphic object. MapInfo matches up entries in the MIF and MID files, associating the first object in the MIF file with the first row in the MID file, the second object in the MIF file with the second row in the MID file, and so on.

When there is no graphic object corresponding to a particular row in the MID file, a “blank” object (NONE) must be written as a place holder in the corresponding place in the MIF file.

```
NONE
```

The graphical objects that can be specified are:

- point
- line
- polyline
- region
- arc
- text
- rectangle
- rounded rectangle
- ellipse

A **point** object takes two parameters; an X coordinate and a Y coordinate. As an option, specify the symbol that represents the point. Symbols are designated by numbers. If you omit the SYMBOL clause, the current symbol is used.

```
POINT   x y
  [ SYMBOL (shape, color, size)]
```

MapInfo 4.0 also supports two variations on the SYMBOL clause; see Symbol discussion later in this chapter.

A **line** objects requires four parameters; an X and a Y coordinate for each end point. As an option, specify a pen type. When no pen type is specified, the current pen type is used.

```
LINE   x1 y1 x2 y2
  [ PEN (width, pattern, color)]
```

A **polyline** object consists of one or more sections. If the polyline has more than one section, include the MULTIPLE keyword, followed by the number of sections. For each section, specify a numpts argument (which indicates the number of nodes in that section), followed by an x/y coordinate pair for each node. Use the optional PEN clause (described later in this chapter) to specify the line style. If you include the optional SMOOTH keyword, the polyline is smoothed.

```
PLINE  [ MULTIPLE  numsections ]
  numpts1
 x1 y1
 x2 y2
     :
[  numpts2
 x1 y1
 x2 y2     ]
     :
  [ PEN (width, pattern, color)]
  [ SMOOTH ]
```

A **region** object consists of one or more polygons. Specify the number of polygons through the numpolygons argument (immediately after the REGION keyword). For each polygon, specify a numpts argument (which indicates the number of nodes in that polygon), followed by an x/y coordinate pair for each node. Use the optional PEN and BRUSH clauses (described later in this chapter) to specify the object's style. Use the optional CENTER clause to define the object's centroid explicitly. The centroid must be within the object.

```
REGION  numpolygons
  numpts1
    x1 y1
    x2 y2
      :
[  numpts2
    x1 y1
    x2 y2  ]
     :
  [ PEN (width, pattern, color)]
  [ BRUSH (pattern, forecolor, backcolor)]
  [ CENTER x y ]
```

An **arc** requires the diagonally opposite corners of its bounding rectangle and the beginning (a) and ending (b) angles of the arc in degrees, moving counter–clockwise with zero at three o'clock. As an option, specify the pen type. (An arc specifies a section of an ellipse, the corners of which are determined by the bounding rectangle.)

```
ARC  x1 y1 x2 y2
  a b
  [ PEN (width, pattern, color)]
```

A **text** object consists of a text string, up to 255 characters long. To make the text string wrap onto multiple lines, insert the characters **\n** within the textstring argument (e.g. "First line \nSecond line \nThird line"). The x1, y1, x2, and y2 arguments specify the location of the text on the map. Spacing can be 1.0 (single spacing), 1.5, or 2.0 (double spacing). Use the Font clause (described later in this chapter) to control the typeface, etc.

```
TEXT  "textstring"
  x1 y1 x2 y2
   [ FONT...]
[ Spacing {1.0 | 1.5 | 2.0}]
[ Justify {Left | Center | Right}]
[ Angle text_angle]
[ Label Line {simple | arrow} x y ]
```

A **rectangle** requires the coordinates of the diagonally opposite corners. As an option, specify pen and brush types.

```
RECT  x1 y1 x2 y2
  [ PEN (width, pattern, color)]
  [ BRUSH (pattern, forecolor, backcolor)]
```

A **rounded rectangle** requires the coordinates of the diagonally opposite corners and the degree of rounding (a). As an option, specify pen and brush types. Degree of rounding is expressed in coordinate units.

```
ROUNDRECT  x1 y1 x2 y2
  a
  [ PEN (width, pattern, color)]
  [ BRUSH (pattern, forecolor, backcolor)]
```

An **ellipse** object requires the coordinates of the diagonally opposite corners of its bounding rectangle. As an option, specify pen and brush types.

```
ELLIPSE x1 y1 x2 y2
  [ PEN (width, pattern, color)]
  [ BRUSH (pattern, forecolor, backcolor)]
```

Pen Styles

The Pen clause specifies the width, pattern, and color of a linear object, such as a line, polyline arc, or the border of a region. The Pen clause has the following syntax:

```
PEN (width, pattern, color)
```

Width is a number from 1 to 7. 1-7 is the width in screen pixels. 11-2047 are values that will be converted to points:

penwidth = (number of points * 10) + 10

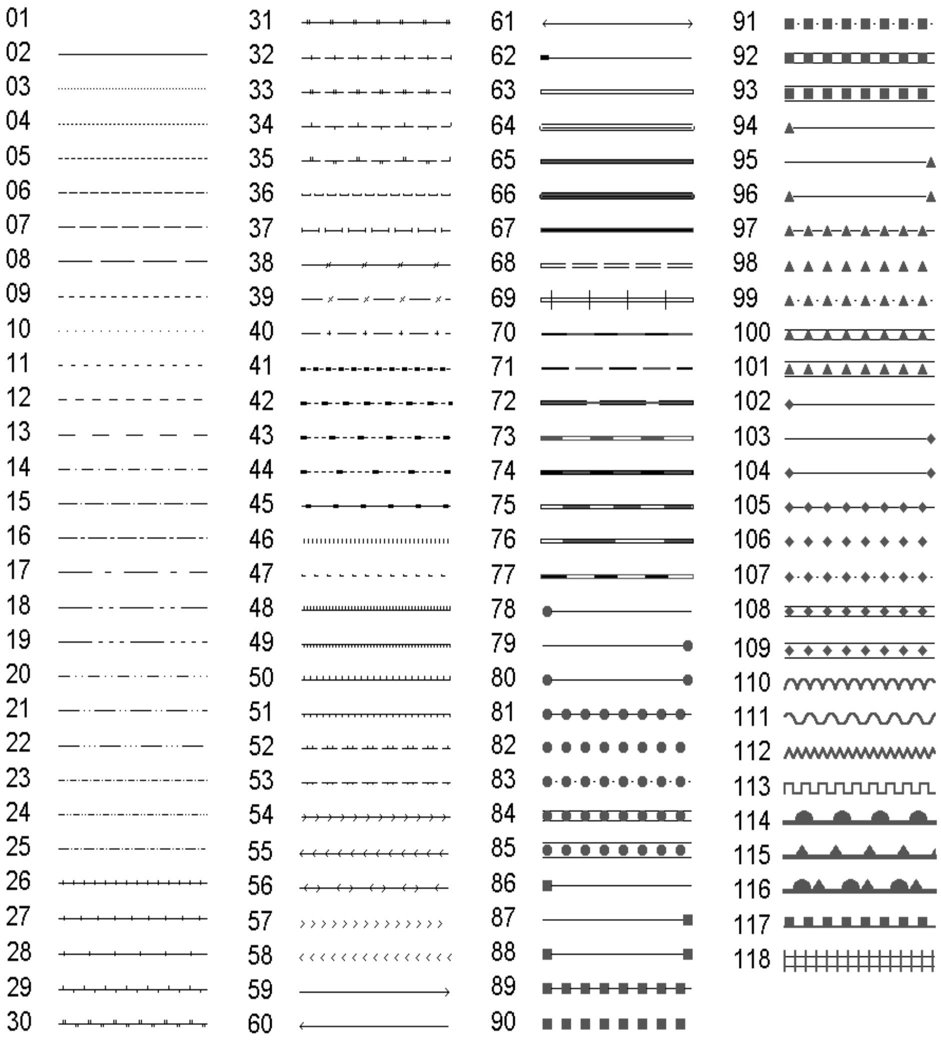
0 is only valid when the pen pattern is 1 for invisible lines.

Color is an integer, representing a 24–bit RGB color value.

Pattern is an integer from 1 to 118; pattern number 1 is invisible. The pattern number corresponds to a pen number in the pen file. The pen file can be modified using a pen editor.

Valid pen numbers are from 1 to maximum number of pens in the pen file, which should not exceed 127. If a pen style is interleaved, 128 will be added to the pen number. Interleaved styles are in the range 129-255. Because the pen file can be modified, and interleaved can be specified, the pen pattern can be a number between 1-255.

The following table lists the available line styles by default:

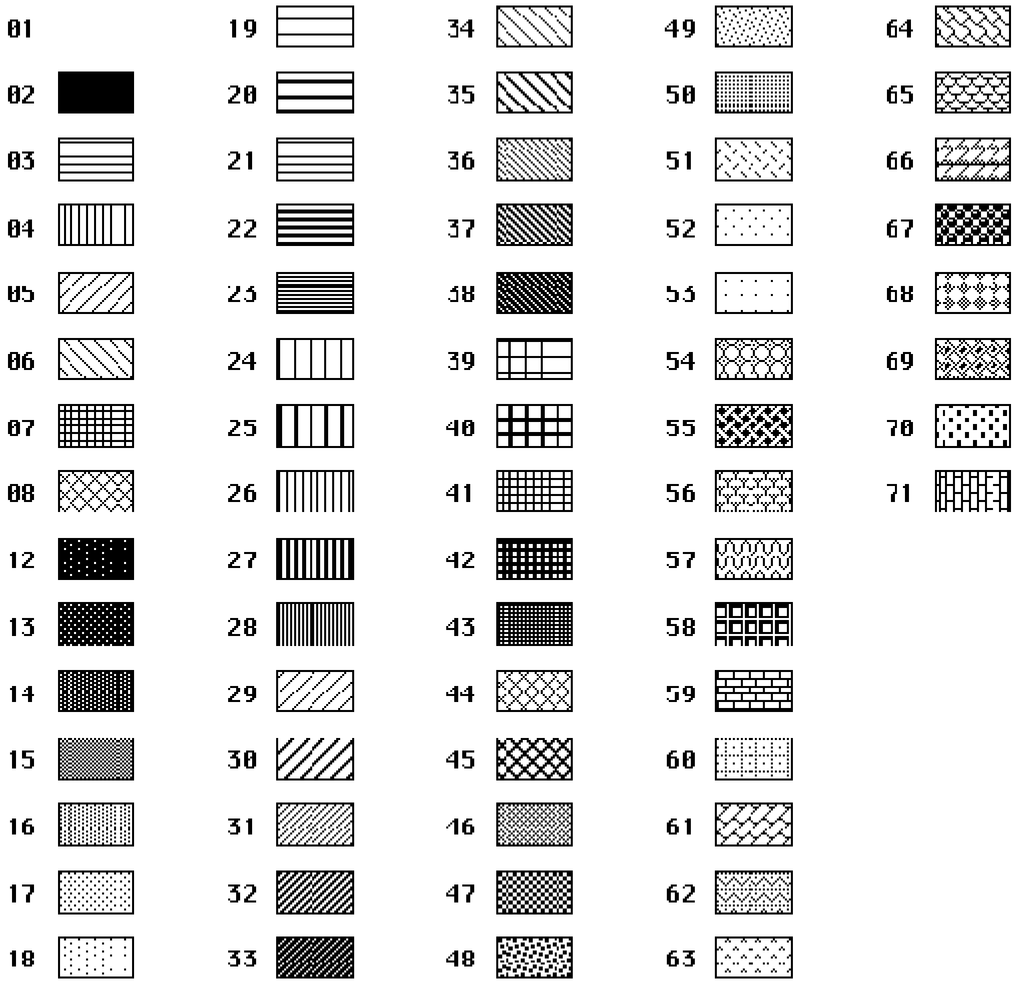


Brush Styles

Brush specifies the pattern, foreground color, and background color of a filled object, such as a circle or region. The Brush clause has the following syntax:

```
Brush (pattern, forecolor  [, backcolor ])
```

The forecolor and backcolor arguments are both integers, representing 24–bit RGB color values. Pattern is a number from 1 to 71. Note: Pattern number 1 is “no fill,” and pattern number 2 is a solid fill. Pattern numbers 9-11 are reserved. The following table illustrates the available styles:



Tip: To specify a transparent fill style, use pattern number three or larger, and omit the backcolor argument. For example: **Brush(5, 255)**

Symbol Styles

The Symbol clause specifies the appearance of a Point object. There are three different forms of the Symbol clause, described below.

Symbol Clause-MapInfo 3.0 Syntax

The Symbol clause specifies the appearance of a Point object. There are three different forms of the Symbol clause. To specify a symbol style using “Old MapInfo Symbols” (the symbols that were used in earlier versions of MapInfo), use the following syntax:

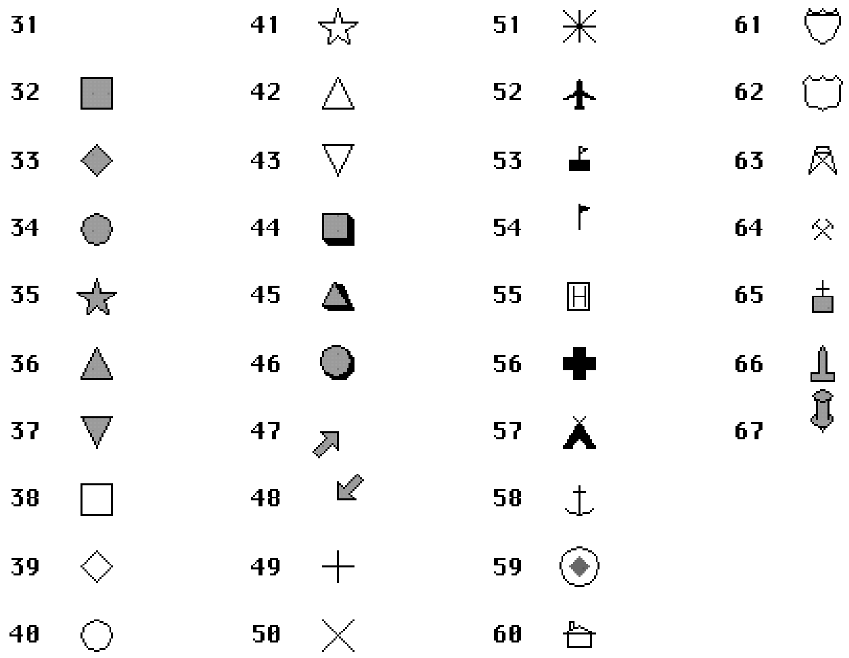
```
SYMBOL (shape, color, size)
```

The shape argument is an integer value, 31 or larger; 31 represents a blank symbol (i.e. the object will not be visible). The standard set of symbols includes symbols 32 through 67, inclusive, but the user can customize the symbol set by using the Symbol application.

The color argument is an integer representing a 24–bit RGB color value.

The size argument is an integer from 1 to 48, representing a point size.

The following table lists the default symbols provided with MapInfo:



Symbol Clause-TrueType Font Syntax

To specify a symbol style based on a character from a TrueType font, use the following syntax:

```
SYMBOL (shape, color, size, fontname, fontstyle, rotation)
```

The fontname argument is a text string that identifies the name of a font (e.g. “Wingdings”).

The fontstyle argument is an integer that controls settings such as Bold. The following table lists the values you can use as fontstyle.

fontstyle value	Effect on Symbol style
0	Plain text
1	Bold text
16	Black border around symbol
32	Drop shadow
256	White border around symbol

To specify two or more style attributes, add the values from the left column. For example, to specify Bold and Drop Shadow, use 33.

The rotation argument is a floating–point number, representing a rotation angle, in degrees.

Symbol clause - Custom Bitmap File Syntax

To specify a symbol style based on a character from a TrueType font, use the following syntax:

```
SYMBOL (filename, color, size, customstyle)
```

The filename argument is a text string that identifies a bitmap file (e.g. “Arrow.BMP”) in the CustSymb directory.

The customstyle argument is an integer that controls whether color and background attributes are used. The following table lists the values you can use as customstyle:

customstyle value	Effect on Symbol style
0	Both the Show Background setting and the Apply Color setting are off; symbol appears in default state. White pixels in the bitmap appear transparent, allowing whatever is behind the symbol to show through.
1	The Show Background settings is on; white pixels in the image are opaque.
2	The Apply Color setting is on; non–white colors in the image are replaced with the Symbol’s color value.
3	Both Show Background and Apply Color settings are on.

Font Styles

The Font clause specifies the appearance (typeface, color, etc.) of text objects. The Font clause has the following syntax:

```
FONT (”fontname”, style, size, forecolor [, backcolor] )
```

Fontname in double quotation marks is the typeface to be displayed. Style is the text attribute of the typeface as shown in the following table. Size must be 0 in a MIF file, because each text object on a Map is attached to the map itself (thus the text size changes as you zoom in or out). Forecolor is an integer representing a 24–bit RGB color. The background color is optional; if you include it, MapInfo fills the area behind the text with the color you specify.

style value	Effect on Font Appearance
0	Plain
1	Bold
2	Italic
4	Underline
16	Outline (only supported on the Macintosh)
32	Shadow
256	Halo
512	All Caps
1024	Expanded

To specify two or more style attributes, add the values from the left column. For example, to specify Bold and All Caps, use 513.

Colors

Colors are often defined in relative concentrations of red, green, and blue. Each color is a number from 0 to 255, inclusive; the RGB value of a color is calculated by the following formula:

(red * 65536) + (green * 256) + blue

These are some often used colors and their values:

Red: 16711680

Green: 65280

Blue: 255

Cyan: 65535

Magenta: 16711935

Yellow: 16776960
Black: 0

MID File

The MID file contains data, one record of data per row, delimited by the character specified in the delimiter statement. The default delimiter is Tab. Each row in the MID file is associated with a corresponding object in the MIF file; first row with first object, second row with second object.

If delimiter character is included as part of the data in a field, enclose the field in quotation marks.

The MID file is an optional file. When there is no MID file, all fields are blank.

Chapter 2: Creating Your Own Coordinate System

MapInfo provides over 300 predefined coordinate systems. However, you may want to use another coordinate system. You create another coordinate system by changing the parameters of one of the predefined systems or by defining new coordinate systems from scratch. This section tells you what those parameters are and how to make the changes. In this chapter, you will find information on:

- **Projections and Coordinate Systems**
- **Elements of a Coordinate System**
- **Editing the MAPINFOW.PRJ File**
- **Affine Transformations**
- **Frequently Asked Questions on Projections**
- **More Information on Projections**

Projections and Coordinate Systems

While the terms “projection” and “coordinate system” are often used interchangeably, they do not have the same meaning. A projection is an equation or set of equations containing a set of parameters—the exact number and nature of the parameters depends on the projection. When each of those parameters has been assigned a specific value, the result is a coordinate system. The items listed in the Choose Projection dialog are coordinate systems.

Projection is the method of reducing the distortion of curved earth features on a flat paper map or computer screen. A coordinate system is a collection of parameters that describe coordinates. One of the parameters is projection.

Elements of a Coordinate System

This section briefly defines the elements of a coordinate system. The first element in defining a coordinate system is the set of equations for the system’s projection. The elements after that are the parameters for the projection. None of the coordinate systems require all of these parameters.

Projections and Their Parameters

The following table indicates the parameters applicable to each projection. They are listed in the order they appear in the MAPINFOW.PRJ file.

	Datum	Units	Origin, Longitude	Origin, Latitude	Standard Parallel 1	Standard Parallel 2	Azimuth	Scale Factor	False Easting	False Northing	Range
Albers Equal–Area Conic	X	X	X	X	X	X			X	X	
Azimuthal Equidistant	X	X	X	X *							X
Cylindrical Equal Area	X	X	X		X						
Eckert IV	X	X	X								
Eckert VI	X	X	X								
Equidistant Conic	X	X	X	X	X	X			X	X	
Gall	X	X	X								
Hotine Oblique Mercator	X	X	X	X			X	X	X	X	
Lambert Azimuthal Equal–Area	X	X	X	X *							X
Lambert Conformal Conic	X	X	X	X	X	X			X	X	
Longitude–Latitude	X										
Mercator	X	X	X								
Miller	X	X	X								
Mollweide	X	X	X								
New Zealand Map Grid	X	X	X	X					X	X	
Regional Mercator	X	X	X		X						
Robinson	X	X	X								
Sinusoidal	X	X	X								
Stereographic	X	X	X	X				X	X	X	
Swiss Oblique Mercator	X	X	X	X					X	X	
Transverse Mercator	X	X	X	X				X	X	X	
Polyconic	X	X	X	X					X	X	

* MapInfo supports the Azimuthal Equidistant and Lambert Azimuth Equal–Area projections in the polar aspect only. The Origin Latitude for these projections must be either 90 or -90.

Projection

The projection is the equation or equations used by a coordinate system. The following list names the projections MapInfo uses and gives the number used to identify the projection in the MAPINFOW.PRJ file:

Number	Projection
9	Albers Equal–Area Conic
5	Azimuthal Equidistant (polar aspect only)
2	Cylindrical Equal–Area
14	Eckert IV
15	Eckert VI
6	Equidistant Conic, also known as Simple Conic
17	Gall
7	Hotine Oblique Mercator
4	Lambert Azimuthal Equal–Area (polar aspect only)
3	Lambert Conformal Conic
19	Lambert Conformal Conic (modified for Belgium 1972)
1	Longitude/Latitude
10	Mercator
11	Miller Cylindrical
18	New Zealand Map Grid
13	Mollweide
27	Polyconic
26	Regional Mercator
12	Robinson
16	Sinusoidal
20	Stereographic
25	Swiss Oblique Mercator
8	Transverse Mercator, also known as Gauss–Kruger

Number	Projection
21	Transverse Mercator, (modified for Danish System 34 Jylland–Fyn)
22	Transverse Mercator, (modified for Sjaelland)
23	Transverse Mercator,(modified for Danish System 45 Bornholm)
24	Transverse Mercator, (modified for Finnish KKJ)

Datum

The datum is established by tying a reference ellipsoid to a particular point on the earth. The following tables lists:

- The datums
- The maps where they are typically used
- Their reference ellipsoid
- The number used to identify the datum in the MAPINFOW.PRJ file.
- See Appendix G of the MapInfo Professional *User's Guide* for further information on special datum 9999.

Number	Datum	Area	Ellipsoid
1	Adindan	Ethiopia, Mali, Senegal, Sudan	Clarke 1880
2	Afgooye	Somalia	Krassovsky
3	Ain el Abd 1970	Bahrain Island	International
4	Anna 1 Astro 1965	Cocos Islands	Australian National
5	Arc 1950	Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, Zimbabwe	Clarke 1880
6	Arc 1960	Kenya, Tanzania	Clarke 1880
7	Ascension Island 1958	Ascension Island	International
8	Astro Beacon "E"	Iwo Jima Island	International
9	Astro B4 Sorol Atoll	Tern Island	International

Number	Datum	Area	Ellipsoid
10	Astro DOS 71/4	St. Helena Island	International
11	Astronomic Station 1952	Marcus Island	International
12	Australian Geodetic 1966 (AGD 66)	Australia and Tasmania Island	Australian National
13	Australian Geodetic 1984 (AGD 84)	Australia and Tasmania Island	Australian National
110	Belgium	Belgium	International
14	Bellevue (IGN)	Efate and Erromango Islands	International
15	Bermuda 1957	Bermuda Islands	Clarke 1866
16	Bogota Observatory	Colombia	International
17	Campo Inchauspe	Argentina	International
18	Canton Astro 1966	Phoenix Islands	International
19	Cape	South Africa	Clarke 1880
20	Cape Canaveral	Florida and Bahama Islands	Clarke 1866
21	Carthage	Tunisia	Clarke 1880
22	Chatham 1971	Chatham Island (New Zealand)	International
23	Chua Astro	Paraguay	International
24	Corrego Alegre	Brazil	International
9999	Custom (see Appendix G)		
1000	Deutsches Hauptdreicksnetz (DHDN)	Germany	Bessel
25	Djakarta (Batavia)	Sumatra Island (Indonesia)	Bessel 1841
26	DOS 1968	Gizo Island (New Georgia Islands)	International
27	Easter Island 1967	Easter Island	International

Number	Datum	Area	Ellipsoid
28	European 1950 (ED 50)	Austria, Belgium, Denmark, Finland, France, Germany, Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland	International
29	European 1979 (ED 79)	Austria, Finland, Netherlands, Norway, Spain, Sweden, Switzerland	International
108	European 1987 (ED 87)	Europe	International
30	Gandajika Base	Republic of Maldives	International
31	Geodetic Datum 1949	New Zealand	International
32	Geodetic Reference System 1967 (GRS 67)	Worldwide	GRS 67
33	Geodetic Reference System 1980 (GRS 80)	Worldwide	GRS 80
34	Guam 1963	Guam Island	Clarke 1866
35	GUX 1 Astro	Guadalcanal Island	International
36	Hito XVIII 1963	South Chile (near 53°S)	International
37	Hjorsey 1955	Iceland	International
38	Hong Kong 1963	Hong Kong	International
39	Hu–Tzu–Shan	Taiwan	International
40	Indian	Thailand and Vietnam	Everest
41	Indian	Bangladesh, India, Nepal	Everest
42	Ireland 1965	Ireland	Modified Airy
43	ISTS 073 Astro 1969	Diego Garcia	International
44	Johnston Island 1961	Johnston Island	International
45	Kandawala	Sri Lanka	Everest
46	Kerguelen Island	Kerguelen Island	International
47	Kertau 1948	West Malaysia and Singapore	Modified Everest
48	L.C. 5 Astro	Cayman Brac Island	Clarke 1866

Number	Datum	Area	Ellipsoid
49	Liberia 1964	Liberia	Clarke 1880
113	Lisboa (DLx)	Portugal	International
50	Luzon	Philippines (excluding Mindanao Island)	Clarke 1866
51	Luzon	Mindanao Island	Clarke 1866
52	Mahe 1971	Mahe Island	Clarke 1880
53	Marco Astro	Salvage Islands	International
54	Massawa	Eritrea (Ethiopia)	Bessel 1841
114	Melrica 1973 (D73)	Portugal	International
55	Merchich	Morocco	Clarke 1880
56	Midway Astro 1961	Midway Island	International
57	Minna	Nigeria	Clarke 1880
58	Nahrwan	Masirah Island (Oman)	Clarke 1880
59	Nahrwan	United Arab Emirates	Clarke 1880
60	Nahrwan	Saudi Arabia	Clarke 1880
61	Naparima, BWI	Trinidad and Tobago	International
109	Netherlands	Netherlands	Bessel
62	North American 1927 (NAD 27)	Continental US	Clarke 1866
63	North American 1927 (NAD 27)	Alaska	Clarke 1866
64	North American 1927 (NAD 27)	Bahamas (excluding San Salvador Island)	Clarke 1866
65	North American 1927 (NAD 27)	San Salvador Island	Clarke 1866
66	North American 1927 (NAD 27)	Canada (including Newfoundland Island)	Clarke 1866
67	North American 1927 (NAD 27)	Canal Zone	Clarke 1866

Number	Datum	Area	Ellipsoid
68	North American 1927 (NAD 27)	Caribbean (Turks and Caicos Islands)	Clarke 1866
69	North American 1927 (NAD 27)	Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua)	Clarke 1866
70	North American 1927 (NAD 27)	Cuba	Clarke 1866
71	North American 1927 (NAD 27)	Greenland (Hayes Peninsula)	Clarke 1866
72	North American 1927 (NAD 27)	Mexico	Clarke 1866
73	North American 1927 (NAD 27)	Michigan (used only for State Plane Coordinate System 1927)	Modified Clarke 1866
74	North American 1983 (NAD 83)	Alaska, Canada, Central America, Continental US, Mexico	GRS 80
107	Nouvelle Triangulation Francaise (NTF)	France	Modified Clarke 1880
1002	Nouvelle Triangulation Francaise (NTF) Greenwich Prime Meridian	France	Modified Clarke 1880
111	NWGL 10	Worldwide	WGS 72
75	Observatorio 1966	Corvo and Flores Islands (Azores)	International
76	Old Egyptian	Egypt	Helmert 1906
77	Old Hawaiian	Hawaii	Clarke 1866
78	Oman	Oman	Clarke 1880
79	Ordnance Survey of Great Britain 1936	England, Isle of Man, Scotland, Shetland Islands, Wales	Airy
80	Pico de las Nieves	Canary Islands	International
81	Pitcairn Astro 1967	Pitcairn Island	International
1000	Potsdam	Germany	Bessel

Number	Datum	Area	Ellipsoid
36	Provisional South Chilean 1963	South Chile (near 53°S)	International
82	Provisional South American 1956	Bolivia, Chile, Colombia, Ecuador, Guyana, Peru, Venezuela	International
83	Puerto Rico	Puerto Rico and Virgin Islands	Clarke 1866
1001	Pulkovo 1942	Germany	Krassovsky
84	Qatar National	Qatar	International
85	Qornoq	South Greenland	International
1000	Rauenberg	Germany	Bessel
86	Reunion	Mascarene Island	International
112	Rikets Triangulering 1990 (RT 90)	Sweden	Bessel
87	Rome 1940	Sardinia Island	International
88	Santo (DOS)	Espirito Santo Island	International
89	São Braz	São Miguel, Santa Maria Islands (Azores)	International
90	Sapper Hill 1943	East Falkland Island	International
91	Schwarzeck	Namibia	Modified Bessel 1841
92	South American 1969	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Venezuela, Trinidad, and Tobago	South American 1969
93	South Asia	Singapore	Modified Fischer 1960
94	Southeast Base	Porto Santo and Madeira Islands	International
95	Southwest Base	Faial, Graciosa, Pico, Sao Jorge, Terceira Islands (Azores)	International
1003	Switzerland (CH 1903)	Switzerland	Bessel

Number	Datum	Area	Ellipsoid
96	Timbalai 1948	Brunei and East Malaysia (Sarawak and Sabah)	Everest
97	Tokyo	Japan, Korea, Okinawa	Bessel 1841
98	Tristan Astro 1968	Tristan da Cunha	International
9999	User–defined (see Appendix G)		
99	Viti Levu 1916	Viti Levu Island (Fiji Islands)	Clarke 1880
100	Wake–Eniwetok 1960	Marshall Islands	Hough
101	World Geodetic System 1960 (WGS 60)	Worldwide	WGS 60
102	World Geodetic System 1966 (WGS 66)	Worldwide	WGS 66
103	World Geodetic System 1972 (WGS 72)	Worldwide	WGS 72
104	World Geodetic System 1984 (WGS 84)	Worldwide	WGS 84
105	Yacare	Uruguay	International
106	Zanderij	Surinam	International

Units

The following table lists the available coordinate units and the number used to identify the unit in the MAPINFOW.PRJ file:

Number	Units
6	Centimeters
31	Chains
3	Feet (also called International Feet)*
2	Inches
1	Kilometers

Number	Units
30	Links
7	Meters
0	Miles
5	Millimeters
9	Nautical Miles**
32	Rods
8	US Survey Feet (used for 1927 State Plane)***
4	Yards

* One International Foot equals exactly 30.48 cm.
** One Nautical Mile equals exactly 1852 meters.
*** One US Survey Foot equals exactly 12 / 39.37 meters, or approximately 30.48006 cm.

Coordinate System Origin

The origin is the point specified in longitude and latitude from which all coordinates are referenced. It is chosen to optimize the accuracy of a particular coordinate system. As we move north from the origin, Y increases. X increases as we move east. These coordinate values are generally called northings and eastings.

For the Transverse Mercator projection the origin’s longitude defines the central meridian. In constructing the Transverse Mercator projection a cylinder is positioned tangent to the earth. The central meridian is the line of tangency. The scale of the projected map is true along the central meridian.

In creating a Hotine Oblique Mercator projection it is necessary to specify a great circle that is not the equator nor a meridian. MapInfo does this by specifying one point on the ellipsoid and an azimuth from that point. That point is the origin of the coordinate system.

Standard Parallels (Conic Projections)

In conic projections a cone is passed through the earth intersecting it along two parallels of latitude. These are the standard parallels. One is to the north and one is to the south of the projection zone. To use a single standard parallel specify that latitude twice. Both are expressed in degrees of latitude.

Oblique Azimuth (Hotine Oblique Mercator)

When specifying a great circle (Hotine Oblique Mercator) using a point and an azimuth (arc), the azimuth is called the Oblique Azimuth and is expressed in degrees.

Scale Factor (Transverse Mercator)

A scale factor is applied to cylindrical coordinates to average scale error over the central area of the map while reducing the error along the east and west boundaries. The scale factor has the effect of recessing the cylinder into the earth so that it has two lines of intersection. Scale is true along these lines of intersection.

You may see the scale factor expressed as a ratio, such as 1:25000. In this case it is generally called the scale reduction. The relationship between scale factor and scale reduction is:

scale factor = 1–scale reduction

In this case the scale factor would be 1–(1/25000) or 0.99996.

False Northings and False Eastings

Calculating coordinates is easier if negative numbers aren’t involved. To eliminate this problem in calculating State Plane and Universal Transverse Mercator coordinates, it is common to add measurement offsets to the northings and eastings. These offsets are called False Northings and False Eastings. They are expressed in coordinate units, not degrees. (The coordinate units are specified by the Units parameter.)

Range (Azimuthal Projections)

The range specifies, in degrees, how much of the earth you are seeing. The range can be between 1 and 180. When you specify 90, you see a hemisphere. When you specify 180 you see the whole earth, though much of it is very distorted.

Polyconic Projection

The following description is copied from “Map Projections -- A Working Manual”, USGS Professional Paper 1395, by John P. Snyder.

The Polyconic projection, usually called the American Polyconic in Europe, achieved its name because the curvature of the circular arc for each parallel on the map is the same as it would be following the unrolling of a cone which had been wrapped around the globe tangent to the particular parallel of latitude, with the parallel traced onto the cone. Thus, there are many (”poly-”) cones involved, rather than the single cone of each regular conic projection.

The Polyconic projection is neither equal–area nor conformal. Along the central meridian, however, it is both distortion free and true to scale. Each parallel is true to scale, but the meridians are lengthened by various amounts to cross each parallel at the correct position along the parallel, so that no parallel is standard in the sense of having conformality (or correct angles), except at the central meridian. Near the central meridian, distortion is extremely small.

Editing the MAPINFOW.PRJ File

The MAPINFOW.PRJ file lists the parameters for each coordinate system on a separate line, as in the following examples:

```
“Mollweide (Equal Area)”, 13, 62, 7, 0
“Albers Equal-Area Conic (Alaska)”, 9, 63, 7, -154, 50, 55, 65, 0, 0
“Alabama,Western Zone (1983)”, 8, 74, 7,-87.5, 30.0, 0.9999333333, 600000, 0
“UTM Zone 9 (NAD 27 for Canada)”, 8, 66, 7, -129, 0, 0.9996, 500000, 0
```

The first element in each list is the name of the coordinate system in quotes. The second element in each list is the number that identifies the projection. The remaining elements in the list are the parameter values for that particular coordinate system. The elements follow the order as outlined in the table “Elements of a Coordinate System” at the beginning of this chapter. Each element is separated by commas.

To create your own coordinate system you will need to add a new entry to the MAPINFOW.PRJ file that lists the appropriate elements. The process is described below.

Creating a New Coordinate System

To create a new coordinate system for use in MapInfo:

1. Open MAPINFOW.PRJ in a text editor or word processor.
2. On a separate line, and following the convention of the other entries list the name for the new coordinate system in quotes, followed by a comma.
3. Add the appropriate numbers for each parameter that pertains to your coordinate system. The order of parameters is important. See the table “Elements of a Coordinate System” at the beginning of this chapter for the parameters for your coordinate system. Separate each parameter with a comma.
4. If necessary, move your new coordinate system to the appropriate place in the list of coordinate systems. For instance, if the new coordinate system applies to a hemisphere, put it in the “Projections of a Hemisphere” group.
5. Save your edited MAPINFOW.PRJ file.

Example of a New Coordinate System

To illustrate this process, consider the following parameters for a coordinate system that you want to add to the MAPINFOW.PRJ file:

Projection	Equidistant Conic
Datum	NAD 83
Units	meters
Origin	30°N, 90°30′W
Standard Parallels	10°20′N and 50°N
False Easting	10,000,000 m
False Northing	500,000 m

1. Open MAPINFOW.PRJ in a text editor or word processor.
2. On an empty line, put the name of your new coordinate system in quotes, followed by a comma.
3. Enter the following information to represent your coordinate system:
   `6, 74, 7, -90.5, 30, 10.33333, 50, 10000000, 500000`
4. Move the entry to its appropriate place among like coordinate systems, if necessary.
5. Save your edited MAPINFOW.PRJ file.

You can now use your custom coordinate system just as you would use any of the coordinate systems that come with MapInfo.

Things to keep in mind when editing the MAPINFOW.PRJ file:

- When specifying projection, datum and units, use the *number* that represents the parameter. These numbers are listed in the table for each parameter earlier in this chapter. In our example, 6 represents Equidistant Conic projection; 74 represents NAD 83 datum, and 7 represents meters.
- You must record the coordinates in decimal degrees. See Appendix G of the Mapinfo Professional *User’s Guide* for instructions on converting degrees, minutes, seconds, into decimal degrees.
- Remember to include a negative sign for west longitudes and south latitudes.
- You must list the origin longitude first in the MAPINFOW.PRJ file even though it is commonly seen elsewhere following the latitude.
- Carry out decimals to at least five (5) places for greater accuracy.
- Do not use commas to represent thousands or millions in large numbers. Only use commas to separate parameters from one another.

There are other ways you can edit this file. When you want a shorter list remove coordinate systems from the file. You can also change the names, change group headings and reorder the file to suit your needs.

Note: Group headings are distinguished by the hyphen at the beginning of the name. Names of coordinate systems cannot begin with a hyphen or a space.

Affine Transformations

MapInfo provides the ability to define rotated or skewed coordinate systems by allowing an optional affine transformation in any coordinate system definition. You can also define a coordinate system with bounds and an affine transformation. In that case, add 3000 to the projection number, enter the Affine parameters (A,B,C,D,E,F) and then list the bounds (x1,y1,x2,y2). The general form is:

Name, Projection Number + 3000, projection components (*from Appendix F of the MapInfo Professional User's Guide*), Affine units, A, B, C, D, E, F, x1, y1, x2, y2

An example of a Mapinfow.prj line with a rotated Affine transformation might look like this with the affine parameters in **Bold** and bounds in *Italics*:

”Equal Area for GA (NAD 27)”, 3009, 62, 7, -96, 23, 29.5, 45.5, 0, 0, **0 7, -0.00000000001, 1, -116.071, -1, -0.00000000001, -50.53120** , *0 -6972009.20702, -16901023.2253, 26829936.181, 16900922.1627*

Description

An affine transformation has the following form:

$$x' = Ax + By + C$$

$$y' = Dx + Ey + F$$

In these equations, the **base** coordinates (x, y) are transformed to produce the **derived** coordinates (x’, y’). The six constants A through F determine the effect of the transformation and we use the post multiply method for homogenous 2D coordinate systems. This can be considered a matrix operation as follows:

$$\begin{matrix} A & B & C \\ D & E & F \\ 0 & 0 & 1 \end{matrix} \quad * \quad \begin{matrix} X \\ Y \\ 1 \end{matrix} \quad = \quad \begin{matrix} X' \\ Y' \\ 1 \end{matrix}$$

Where (X,Y) and (X’,Y’) are as defined above.

To do various types of affine transformations the values of A, B, B, D, E, and F need to be determined. It is fairly easy to define the basic Transformations, Translations, Rotations, Scaling in X, Scaling in Y, Shearing in X and Shearing in Y which can be done using an Affine Transformation.

Transformation: C and F are the values you want (0, 0) to go to, A=E=1 and B=D=0. So to move the coordinate system so the origin is at (5, 2) the values would be: A=1, B=0, C=5, D=0, E=1, and F=2.

Rotation about the origin: A=E=cos(angle to rotate), -B=D=sin(angle to rotate), C=F=0. So to rotate 60 degree counterclockwise around the origin, A=.5,B=-.866, C=0, D= .866, E= .5, and F=0.

To Scale in the X direction: A is the scale you want to use. E =1 and the rest are 0. So to scale to 3 times the size in the X direction the values would be A=3, B=0, C=0, D=0, E= 1, F=0.

To Scale in the Y direction: E is the scale you want to use. A =1 and the rest are 0. So to scale to 5 times the size in the Y direction the values would be A=1, B=0, C=0, D=0, E= 5, F=0.

To Scale Overall just make sure that A and E are equal.

To Shear in the X direction: A = E = 1, B is the shear factor and the rest are 0. So to Shear by 5 units in the X direction then A=1, B=5, C=0, D= 0, E=1, F= 0.

To Shear in the Y direction: A = E = 1, D is the Shear factor and the rest are 0. So to Shear by 4 units in the Y direction then A=1, B=0, C=0, D= 4, E=1, F= 0.

Now to get a general affine transformation, do a pre-matrix multiplication of the basic pieces of the transformation. Make sure that you put the first operation on the right. So to Translate to (5,2) Rotate 60 degrees and then Shear 5 units in Y and then Translate to (3, 2). The values would be A=.5, B= -.866, C=6.232, D=3.366, E=-2.23, F=22.758.

Frequently Asked Questions on Projections

Question: ”What do the \p#### codes mean in the Mapinfow.prj file?”

e.g.: ”--- Australian Map Grid (AGD 66) ---”

”AMG Zone 47 (AGD 66)”, 8, 12, 7, 99, 0, 0.9996, 500000, 10000000

”AMG Zone 48 (AGD 66)\p20248”, 8, 12, 7, 105, 0, 0.9996, 500000, 10000000

Answer: MapInfo uses the \p#### or Projected Coordinate System (PCS) codes shown in the above example when registering GeoTIFF images with the GEOREG.MBX utility. GeoTIFF files often identify their coordinate system with a single code number instead of listing the coordinate system parameters, so GEOREG.MBX scans the MAPINFOW.PRJ file to find a matching supported code. MapInfo supports a subset of PCS codes, depending on the projection they use, in values between 20000 and 32760). Codes cannot be used more than once in the mapinfow.prj file. For more information about GeoTIFF files, see **http://www.remotesensing.org/geotiff/geotiff.html**.

Question: ”How do I convert a coordinate system with units in meters to use feet?”

Answer: You will need to edit the Mapinfow.prj file to modify the same projection in a different measurement system and adjust the False Eastings and Northings used for the difference.

For example below, the first line is the original projection expressed in meters. The second line is a copied modification of the first, where the units were changed from ”7” (meters) to ”8” (feet) indicating this coordinate system is now using feet, and the False Easting (2000000) and Northing (500000) components were ***divided*** by .3048 to convert them from meters to feet.

Example:

”California, Zone I (1983) \ p26941”, 3, 74, 7, -122, 39.3333333333, 40, 41.6666666667, 2000000, 500000

”California, Zone I FT (1983) \ p26941”, 3, 74, **8** , -122, 39.3333333333, 40, 41.6666666667, ***6561679.7, 164041.99***

Question: ”I chose Longitude / Latitude (NAD 83) as my projection, however, whenever I look at the Choose Projection dialog, it keeps saying Longitude / Latitude (GRS 80), why won’t my projection change?”

Answer: The GRS 80 datum is exactly identical to NAD 83 datum. MapInfo uses the numeric parameters, not the name, to decide which coordinate system to highlight in the Choose Projection dialog. Since GRS 80 has the same numeric parameters as NAD 83, and GRS 80 comes earlier in the list, MapInfo chooses GRS 80 instead of NAD 83.

More Information on Projections

The first three publications listed below are relatively short pamphlets. The last two are substantial books. We’ve also given addresses and phone numbers for the American Congress of Surveying and Mapping (the pamphlets) and the U.S. Geological Survey (the books).

American Cartographic Association. *Choosing a World Map—Attributes, Distortions, Classes, Aspects*. Falls Church, VA: American Congress on Surveying and Mapping. Special Publication No. 2. 1988.

American Cartographic Association. *Matching the Map Projection the Need*. Falls Church, VA: American Congress on Surveying and Mapping. Special Publication No. 3. 1991.

American Cartographic Association. *Which Map is Best? Projections for World Maps*. Falls Church, VA: American Congress on Surveying and Mapping. Special Publication No. 1. 1986.

John P. Snyder. *Map Projections—A Working Manual.* Washington: U.S. Geological Survey Professional Paper 1395. 1987

John P. Snyder and Philip M. Voxland. *An Album of Map Projections*. Washington: U.S. Geological Survey Professional Paper 1453. 1989.

Addresses and phone numbers:

American Congress on Surveying and Mapping
5410 Grosvenor Lane, Suite 100
Bethesda, MD 20814–2212
301–493–0200

Earth Science Information Center
U.S. Geological Survey
507 National Center
Reston, VA 22092
703–860–6045 or 1–800–USA–MAPS

Peter H. Dana of the Department of Geography, University of Texas at Austin has also put up an incredible website for explanations of Map projections, Geodetic Datums, and Coordinate systems. It is a valuable as many of these explanations were also presented using MapInfo Professional. The materials may be used for study, research, and education, but please credit the author:

Peter H. Dana, The Geographer's Craft Project, Department of Geography, The University of Texas at Austin.

For Geodetic Datum information and explanations, go to

http://www.utexas.edu/depts/grg/gcraft/notes/datum/datum.html

For Information on Coordinate systems and other principles, go to

http://www.utexas.edu/depts/grg/gcraft/notes/coordsys/coordsys.html

For Information on Map Projections go to

http://www.utexas.edu/depts/grg/gcraft/notes/mapproj/mapproj.html