

MapInfo

# MapInfo Pro

MapBasic  
Version 12.5.1

User Guide



# Notices

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# Getting Started

Welcome to the MapBasic Development Environment, the powerful, yet easy-to-use programming language that lets you customize and automate MapInfo® Pro.

The following pages tell you what you need to know to install the MapBasic software. For information on the purpose and capabilities of MapBasic, see [A Quick Look at MapBasic](#).

**Note:** asdad

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## What's New

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New in this release of MapBasic:

- Added a new section that describe how to start using the new Ribbon Interface in MapInfo Pro 64-bit, see [Getting Started with the Ribbon Interface \(MapInfo Pro 64-bit\)](#) on page 125
- Added a new section explaining Integrated Mapping for MapInfo Pro 64-bit, see [Integrated Mapping \(MapInfo Pro 64-bit\)](#) on page 239
- Added a new section that describes how to set search paths for MapBasic Include and Module files, see [Setting Search Paths for MapBasic Include and Module Files](#) on page 43
- Added new and updated existing functions and statements, see *What's New* in the *MapBasic Reference* or *MapBasic Help*.
- Added descriptions for two new variable types, This and RefPtr, see *What's New* in the *MapBasic Reference* or *MapBasic Help*.

## System Requirements

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This product is tested on the following Microsoft Windows Desktop Operating Systems:

- Windows 7 Ultimate 64-bit SP1
- Windows 2008 Server R2 64-bit SP1
- Windows 2008 Server R2 64-bit SP1 with XenApp 6.0
- Windows 8 64-bit
- Windows 8.1 64-bit
- Windows 2012 Server 64-bit
- Windows 2012 Server 64-bit with XenApp 7.0

## System Notes

The following are the hardware peripherals and disk space requirements:

- Display – Any display adapter supported by Windows.
- Mouse – Any mouse or pointing device supported by Windows.
- Disk Space – The minimum suggested disk space is 10 MB.

MapInfo Pro can run applications created with current or earlier versions of MapBasic.

## OpenSource Attribution Notices

### QT Assistant 5.2.0

This product contains QT Assistant, version 5.2.0, which is licensed under GNU Lesser General Public License, Version 2.1, February 1999. The license can be downloaded from:

<http://www.gnu.org/licenses/lgpl-2.1.txt>. The source code for this software is available from <http://qt-project.org/downloads>.

# Installing the MapBasic Development Environment

## Before You Begin

The MapBasic installation procedure is described below. If you haven't already done so:

- Install MapInfo Pro before you install MapBasic. Please see the *MapInfo Pro Install Guide* for installation instructions.

## Installation

The MapBasic development environment is free. You can download a copy of MapBasic from the Pitney Bowes Inc. web site, at [www.mapinfo.com](http://www.mapinfo.com), by selecting **Support > Product Downloads** and then clicking the **MapBasic** link. There is also information there about building custom applications and integrating MapInfo Pro into your application using the MapBasic development environment, go to <http://www.mapinfo.com/mapbasic>.

## Starting MapBasic

To start the MapBasic Development Environment either:

- double-click the MapBasic icon on your desktop, or
- from the **Start** menu, select **MapBasic 12.0** from the Selected Program folder.

**Note:** You can check for product updates to your version anytime by selecting **Help > Check for Update**.

## MapBasic File Names and File Types

The MapBasic installation procedure places these files on your computer:

File Name	Description
QT directory	Contains the QT Assistant tool for presenting on-line documentation.
Samples directory	Contains sample programs.
errors.doc	Text file listing MapBasic error codes.
httplib.def	Include file containing web server related define codes.
httptypes.def	Include file containing internet connection define codes.
icons.def	Include file containing ButtonPad—and cursor—related define codes.
mapbasic.bas	Header file for Visual Basic programmers; contents similar to <code>mapbasic.def</code> , but using Visual Basic syntax.
mapbasic.def	Include file containing standard define codes.

File Name	Description
mapbasic.exe	executable file which runs the MapBasic development environment.
MAPBASIC.H	Header file for C/C++ programmers; contents similar to mapbasic.def, but using C/C++ syntax.
MapBasic.qch	MapBasic on-line help file.
MapBasic.qhc	MapBasic on-line help file.
MapBasicHelp.exe	executable file which runs the MapBasic Help from outside the application.
ExtensibilityReference.qch	Extensibility Reference help file.
ExtensibilityReference.qhc	Extensibility Reference help file.
ExtensibilityReferenceHelp.exe	executable file which runs the Extensibility Reference Help from outside the application.
IntegratedMappingReference.qch	Integrated Mapping Reference help file.
IntegratedMappingReference.qhc	Integrated Mapping Reference help file.
IntegratedMappingReferenceHelp.exe	executable file which runs the Integrated Mapping Reference Help from outside the application.
mblib.dll	Part of the software; contains shared libraries.
mbres.dll	Part of the software; contains resources such as strings and dialog boxes.
menu.def	Include file containing menu-related define codes.
mihelp.dll	Part of the QT Assistant tool; contains resources for the MapBasic on-line help.
miscutil.dll	Part of the software; contains shared executables.
papersize.def	Include file for use by MapBasic application developers. It contains defines for use with printer control MapBasic statements.
userinfo	Contains log of installation process.
xmllib.def	Include file containing MapInfo XML library define.
xmltypes.def	Include file containing XML-related define codes.

As you use the MapBasic development environment, you produce files with the following extensions:

File Name	Description
<i>filename</i> .mb	Program files (source code)
<i>filename</i> .mbx	Compiled (executable) files
<i>filename</i> .mbp	Project files (which list all modules to include in a project)

File Name	Description
<i>filename.mbo</i>	Object files (files created after compiling modules in a project)
<i>filename.err</i>	Error listings, generated if you compile a program that has compilation errors.

## MapBasic Documentation Set

MapBasic's documentation set includes:

Document	Description	How to access
MapBasic User Guide	Complete guide on how to use MapBasic.	PDF - MapBasicUserGuide.pdf <ul style="list-style-type: none"> <li>View online at <a href="http://www.mapinfo.com/mapbasic">http://www.mapinfo.com/mapbasic</a>.</li> <li>Installs with MapInfo Pro and are accessible from <code>MapInfo\Professional\Documentation</code> folder</li> </ul>
MapBasic Reference	Complete guide to all MapBasic commands.	PDF - MapBasicReference.pdf <ul style="list-style-type: none"> <li>View online at <a href="http://www.mapinfo.com/mapbasic">http://www.mapinfo.com/mapbasic</a>.</li> <li>Installs with MapInfo Pro and are accessible from <code>MapInfo\Professional\Documentation</code> folder</li> </ul>
MapBasic Help	Includes all of the information in <i>MapBasic Reference</i> plus dialog and menu descriptions.	QT documentation <ul style="list-style-type: none"> <li>Click <b>Help</b>, then click <b>Contents</b> in MapBasic.</li> <li>Installs with MapInfo Pro and are accessible by running the <code>MapInfo\MapBasic\MapBasicHelp.exe</code> executable</li> </ul>
Extensibility Reference Help	MapInfo Pro 64-bit .NET Object Model API	QT documentation <ul style="list-style-type: none"> <li>Installs with MapBasic and are accessible by running the <code>MapInfo\MapBasic\ExtensibilityReferenceHelp.exe</code> executable</li> </ul>
Integrated Mapping Reference Help	API documentation to add Integrated Mapping capabilities to your application	QT documentation <ul style="list-style-type: none"> <li>Installs with MapBasic and are accessible by running the <code>MapInfo\MapBasic\IntegratedMappingReferenceHelp.exe</code> executable</li> </ul>

## Conventions Used in This Manual

This manual uses the following terms and typographical conventions.

### Terms

This manual addresses the application developer as you, and refers to the person using an application as the user. For example:

You can use MapBasic's **Note** statement to give the user a message.

The terms program and application are used in the following manner:

- A *program* is a text file typed in by you, the programmer. Typically, MapBasic program files have the extension .MB.
- An *application* file is a binary file executable by MapInfo Pro. The application file must be present when the user runs the application. MapBasic creates the application file when you compile your program. MapBasic application files typically have the extension .MBX (MapBasic eXecutable).
- A *command* is an item that you choose from a menu. For example, to open a file, choose the **Open** command from the **File** menu.
- A *statement* is an instruction you can issue from a MapBasic program. For example, a MapBasic program can issue a **Select** statement to select one or more rows from a table.

### Typographical Conventions

The Courier font shows sample MapBasic program statements:

```
Note "hello, world!"
```

**Bold Capitalization** identifies MapBasic keywords:

The **Stop** statement is used for debugging purposes.

In the examples that appear in this manual, the first letter of each MapBasic language keyword is capitalized. However, you are not required to use the same capitalization when you type in your own programs. If you prefer, you can enter your programs using upper case, lower case, or mixed case.

References to menu commands in the MapBasic development environment use the greater-than sign (>), as in the following example:

- Choose the **File > New** command to open a new **Edit** window.

The expression "**File > New**" refers to the **New** command on the **File** menu.

## Getting Technical Support

---

Pitney Bowes Inc. offers a free support period on all new software purchases and upgrades, so you can be productive from the start. Once the free period ends, Pitney Bowes Inc. offers a broad selection of extended support services for individual, business, and corporate users.

Technical Support is here to help you, and your call is important. This section lists the information you need to provide when you call your local support center. It also explains some of the technical support procedures so that you will know what to expect about the handling and resolution of your particular issue.

Please remember to include your serial number, partner number or contract number when contacting Technical Support.

## Contacting Technical Support

Full technical support for MapBasic is provided for the currently shipping version plus the two previous versions.

### Technical Support Contact Information

Extended support options are available at each of our technical support centers in the Americas, Europe/Middle East/Africa, and Asia-Pacific regions. To contact the office nearest you, refer to the **Support > Contact Support** section on our website:

[www.mapinfo.com/support](http://www.mapinfo.com/support)

### Technical Support Online Case Management System

The Technical Support Online Case Management system is another way to log and manage cases with our Technical Support center. You must register yourself the first time you access this site if you do not already have a user ID.

<http://go.pbinsight.com/online-case-management>

### Before You Call

Please have the following information ready when contacting us for assistance:

1. Serial Number. You must have a registered serial number to receive Technical Support.
2. Your name and organization. The person calling must be the contact person listed on the support agreement.
3. Version of the product you are calling about.
4. The operating system name and version.
5. A brief explanation of the problem. Some details that can be helpful in this context are:
  - Error messages
  - Context in which the problem occurs
  - Consistency—is the problem reoccurring or occurring erratically?

### Expected Response Time

Most issues can be resolved during your initial call. If this is not possible, Technical Support will issue a response before the end of the business day. A representative will provide a status each business day until the issue is resolved.

Support requests submitted by e-mail or through the online tracking system are handled using the same guidelines as telephone support requests; however, there is an unavoidable delay of up to several hours for message transmission and recognition.

## Software Defects

If the issue is deemed to be a bug in the software, the representative will log the issue in Pitney Bowes Inc. bug database and provide you with an incident number that you can use to track the bug. Future upgrades and patches have fixes for many of the bugs logged against the current version.

## Other Resources

### MapInfo-L Archive Database

MapInfo-L (MapInfo List) is an independent discussion group, which Pitney Bowes Inc. monitors to respond to questions posted to this site. To subscribe to this discussion group, go to:

<http://groups.google.com/group/mapinfo-l?hl=en>

and click **Join this group**.

**Note:** Any messages sent to the list can be read by anyone on the list.

### Other Useful Sites for MapInfo Users

**MapInfo Tools** is a web site organized by Barbara Carroll as a repository and free file exchange for software tools.

<http://mapinfotools.com>

**GISnet** is a web site authored by MapInfo Partner Bill Thoen. There are many links to GIS information in general and specific links to MapInfo resources.

<http://www.gisnet.com/catalog/software/tools/index.php>



# A Quick Look at MapBasic

MapBasic is a software package that lets you customize and automate the MapInfo Pro desktop-mapping software.

## In this section:

- **Getting Started** .....26
- **What Are the Key Features of MapBasic?** .....27
- **How Do I Learn MapBasic?** .....28
- **The MapBasic Window in MapInfo Pro** .....29

# Getting Started

The MapBasic software provides you with a development environment. Using this development environment, you can write programs in the MapBasic programming language.

The MapBasic development environment includes:

- A text editor you can use to type your programs. If you already have a text editor you would rather use, you can use that editor instead of the MapBasic text editor. For details, see [Using the Development Environment](#).
- The MapBasic compiler. After you have written a program, compile it to produce an "executable" application (specifically, an application that can be run by MapInfo Pro).
- The MapBasic linker. If you are creating a large, complex application, you can divide your program into separate modules, then "link" those modules together into one application.
- *MapBasic Help*, providing reference information for each statement and function in the MapBasic language.
- From looking at the name, you might expect the MapBasic programming language to be reminiscent of traditional BASIC languages. In fact, MapBasic programs do not look much like traditional BASIC programs. MapBasic does, however, bear a resemblance to newer versions of BASIC which have been developed in recent years (for example, Microsoft's Visual Basic language).

A Traditional BASIC Code Sample	A MapBasic Code Sample
<pre> 20 GOSUB 3000     30 IF DONE = 1 THEN GOTO 90     40 FOR X = 1 TO 10     50 GOSUB 4000     60 NEXT X     80 GOTO 30 </pre>	<pre> Call Check_Status(quit_time) Do While Not quit_time For x = 1 To 10 Call Process_batch(x) Next Loop </pre>

Every MapBasic program works in conjunction with MapInfo Pro. First, you use the MapBasic development environment to create and compile your program; then you run MapInfo Pro when you want to run your program. Thus, a MapBasic program is not a stand-alone program; it can only run when MapInfo Pro is running. You could say that a MapBasic program runs on top of MapInfo Pro.

However, MapBasic is not merely a macro language, MapBasic is a full-featured programming language, with over 300 statements and functions. Furthermore, since MapBasic programs run on top of MapInfo Pro, MapBasic is able to take advantage of all of MapInfo Pro's geographic data-management capabilities.

**Note:** This version of MapBasic is compatible with both the 32-bit and 64-bit version of MapInfo Pro. For MapInfo Pro 32-bit, all user interface modification MapBasic commands work the same way as before. For MapInfo Pro 64-bit, as it uses the new Ribbon Interface instead of menus, related MapBasic commands and functions have been either enhanced or deprecated.

## How Do I Create and Run a MapBasic Application?

[Using the Development Environment](#) provides detailed instructions on creating a MapBasic application.

If you are in a hurry to get started, you can create your first program by following these steps:

1. Run the MapBasic development environment.
2. Choose **File > New** to open an **Edit** window.

3. Type a MapBasic program into the **Edit** window. If you do not have a program in mind, you can enter the following one-line MapBasic program:

```
Note "Welcome to MapBasic!"
```

4. Choose **File > Save** to save the program to a file. Enter a file name such as `welcome.mb`.  
**Note:** Do not close the **Edit** window.
5. Choose **Project > Compile Current File**. MapBasic compiles your program (`welcome.mb`) and creates a corresponding executable application file (`welcome.mbx`).
6. Run MapInfo Pro.
7. Choose **Tools > Run MapBasic Program**. MapInfo Pro prompts you to choose the program you want to run.
8. Select `welcome.mbx` to run your program display the message, "Welcome to MapBasic!" in a dialog box.

Those are the main steps involved in creating, compiling, and running a MapBasic application. In practice, of course, the process is more complex. For example, the procedure outlined above does not describe what happens if you encounter a compilation error. For more details on creating and compiling MapBasic programs, see [Using the Development Environment](#).

## What Are the Key Features of MapBasic?

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### MapBasic Lets You Customize MapInfo Pro

Through MapBasic, you can customize the MapInfo Pro user-interface. A MapBasic application can modify or replace the standard MapInfo Pro menus, add entirely new menus to the MapInfo Pro menu bar, and present the user with dialog boxes custom-tailored to the task at hand.

Thus, MapBasic lets you create turn-key systems, custom-tailored systems that help the user perform tasks quickly and easily, with minimal training.

### MapBasic Lets You Automate MapInfo Pro

MapBasic applications are often used to spare end-users the tedium of doing time-consuming manual work. For example, a MapInfo Pro user may need to develop a *graticule* (a grid of horizontal and vertical longitude and latitude lines) in the course of producing a map. Drawing a graticule by hand is tedious, because every line in the graticule must be drawn at a precise latitude or longitude. However, a MapBasic application can make it very easy to produce a graticule with little or no manual effort.

### MapBasic Provides Powerful Database-Access Tools

You can perform complex, sophisticated database queries with a single MapBasic statement. For example, by issuing a MapBasic **Select** statement (which is modeled after the Select statement in the SQL query language), you can query a database, apply a filter to screen out any unwanted records, sort and sub-total the query results. All of this can be accomplished with a single MapBasic statement.

Using powerful MapBasic statements such as **Select** and **Update**, you can accomplish in a few lines of code what might take dozens or even hundreds of lines of code using another programming language.

### MapBasic Lets You Connect MapInfo Pro to Other Applications

You are not limited to the statements and functions that are built into the MapBasic programming language. Because MapBasic provides open architecture, your programs can call routines in external libraries. If you need functionality that isn't built into the standard MapBasic command set, MapBasic's open architecture lets you get the job done.

MapBasic programs can use Dynamic Data Exchange (DDE) to communicate with other software packages, including Visual Basic applications. MapBasic programs also can call routines in Windows Dynamic Link Library (DLL) files. You can obtain DLL files from commercial sources, or you can write your own DLL files using programming languages such as C. MapBasic provides Integrated Mapping, that lets you integrate MapInfo Pro functionality into applications written using other development environments, such as Visual Basic. For details see [Integrated Mapping](#).

## How Do I Learn MapBasic?

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If you have not already done so, you should learn how to use MapInfo Pro before you begin working with MapBasic. This manual assumes that you are familiar with MapInfo Pro concepts and terminology, such as tables, **Map** windows, and workspaces.

Once you are comfortable using MapInfo Pro, you can use the following printed and online instructional materials to help you learn about MapBasic.

#### ***MapBasic User Guide***

This book explains the concepts behind MapBasic programming. Read the *User Guide* when you are learning how to program in MapBasic. Each chapter discusses a different area of programming. For example, every MapBasic programmer should read [MapBasic Fundamentals](#). [Creating the User Interface](#) explains how to create custom menus and dialog boxes, while [File Input/Output](#) tells you how to perform file input/output.

#### ***MapBasic Reference***

This A-to-Z reference contains detailed information about every statement and function in the MapBasic language. Use the *MapBasic Reference* when you need a complete description of a particular statement or function.

#### **Sample Programs**

Many programmers find that the best way to learn a programming language is to study sample programs. Accordingly, MapBasic comes with a library of sample programs. See the Samples directory installed on your MapBasic DVD or download for sample programs included with MapBasic.

**Note:** The *MapBasic User Guide* frequently refers to the TextBox sample program (`textbox.mb`). You may want to become familiar with this program before you learn MapBasic.

#### **MapInfo Workspace Files**

MapInfo Pro can save session information (for example, the list of what tables and windows are open) in a workspace file. If you use a text editor to examine a workspace file, you will see that the workspace contains MapBasic statements. You can copy MapBasic statements out of a workspace file, and paste the statements into your program. In a sense, any MapInfo workspace is a sample MapBasic program.

For example, suppose you want to write a MapBasic program that creates an elaborate page layout. You could create the page layout interactively, using MapInfo Pro, and save the layout in a MapInfo workspace file. The workspace file would contain a set of MapBasic statements relating to page layouts. You then could copy the layout-related statements from the workspace file, and paste the statements into your MapBasic program.

#### **MapBasic Help**

The MapBasic development environment provides extensive Help. Much of the *MapBasic Help* is reference information, providing descriptions of every statement and function in the language. The Help file also provides instructions on using the MapBasic development environment.

**Note:** As you are typing in your program, if you select a statement or function name and press **F1**, the **Help** window shows you help for that statement or function.

The *MapBasic Help* contains many brief sample programs which you can copy from the **Help** window and paste into your program. You can copy text out of the **Help** window by clicking and dragging within the **Help** window.

If you are viewing a **Help** screen and you click on a MapBasic menu or a MapBasic **Edit** window, the **Help** window disappears. This is standard behavior for Windows Help. The **Help** window has not been closed, it is simply in the background. Note that you can return to the **Help** window by pressing **Alt+Tab**. You can also prevent the **Help** window from disappearing by checking the **Help** window's **Help > Always on Top** menu item.

## The MapBasic Window in MapInfo Pro

---

The MapInfo Pro software provides the **MapBasic** window to help you learn the syntax of statements in the MapBasic language.

To open the MapBasic window:

1. Run MapInfo Pro.
2. Choose **Options > Show MapBasic Window**.

The **MapBasic** window appears on the screen. Thereafter, as you use MapInfo Pro's menus and dialog boxes, the **MapBasic** window displays corresponding MapBasic statements.

For example, if you perform a query by using MapInfo Pro's **Select** dialog box, the **MapBasic** window automatically shows you how you could perform the same operation through statements in the MapBasic language.

You can also enter statements directly into the **MapBasic** window, although not all MapBasic statements may be executed in this manner. To determine if a statement may be issued through the **MapBasic** window, consult the *MapBasic Reference* and *MapBasic Help*. Statements that are not supported through the **MapBasic** window are identified by a notice that appears under the **Restrictions** heading. As a general rule, you cannot enter flow-control statements (for example, **For...Next** loops) through the **MapBasic** window.

The **MapBasic** window is also a debugging tool. For details, see [Debugging and Trapping Runtime Errors](#).

## Training and On-Site Consulting

Pitney Bowes Inc. Corporation offers MapBasic training classes. If you want to become proficient in MapBasic as quickly as possible, you may want to attend MapBasic training. To ensure an ideal training environment, class size is limited to eight to ten people. For information on scheduled classes, call The Pitney Bowes Inc. Training department.

If you require extensive assistance in developing your MapBasic application, you may be interested in Pitney Bowes Inc. Consulting Services. You can arrange to have MapBasic systems engineers work on-site with you. For additional information, call MapInfo Pro Services.



# Using the Development Environment

The MapBasic software includes a text editor you can use to type your program. Conventional menu items (for example, **Undo**, **Copy**, **Paste**) make it easy to edit your program. Other menu items let you compile (and, optionally link) your program(s) into executable form. Online help for the MapBasic language is available as well.

The MapBasic text editor, MapBasic compiler, and *MapBasic Help* are collectively known as the Development Environment.

## In this section:

- **Introduction to MapBasic Development Environment . . .32**
- **Editing Your Program . . . . .32**
- **Compiling Your Program . . . . .34**
- **Linking Multiple Modules Into a Single Project . . . . .37**
- **Menu Summary in MapBasic Development Environment .40**
- **New MapBasic IDE features . . . . .43**

# Introduction to MapBasic Development Environment

The MapBasic Development Environment contains a built-in text editor that you can use to create and edit MapBasic programs. Pull-down menus—**File**, **Edit**, **Search**, **Project**, **Window**, and **Help**—provide you with everything you need to create and edit programs, compile them, and handle any syntax errors detected by the MapBasic compiler.

If you are familiar with other text editors, you will find MapBasic's text editor easy to use. Most of the MapBasic menus are predictable: the **File** menu contains **Open**, **Close**, **Print**, and **Save** commands, while the **Edit** menu contains **Undo**, **Cut**, **Copy**, and **Paste** commands. However, MapBasic also contains elements not found in conventional text editors (for example, a compiler and a linker).

## Editing Your Program

If you have not already done so, run MapBasic. Then, from the **File** menu, either choose **Open** (to display an existing program) or **New** (to open a blank **Edit** window).

Type your program into the **Edit** window. If you do not yet have a program to type in, you can use the following one-line sample MapBasic program:

```
Note "Welcome to MapBasic!"
```

Once you have typed in your program, you can save your program to disk by choosing **Save** from the **File** menu. Give your program a name such as `welcome.mb`.

MapBasic automatically appends the file extension `.mb` to program files. Thus, if you name your program `welcome`, the actual file name is `welcome.mb`.

Since MapBasic saves your program in a conventional text file, you can use other text editing software to edit your program if you wish.

## Keyboard Shortcuts

The following table lists the keyboard shortcuts you can use within the MapBasic **Edit** window.

Keyboard Action	Effect of Action
<b>Home</b> / <b>End</b>	Insertion point moves to beginning/end of line.
<b>Ctrl+Home</b> / <b>Ctrl+End</b>	Insertion point moves to beginning/end of document.
<b>Ctrl+Tab</b> / <b>Ctrl+Shift+Tab</b>	Insertion point moves backward/forward one word.
<b>Ctrl+T</b>	Displays the <b>Go To Line</b> dialog box.
<b>Ctrl+O</b>	Displays the <b>Open</b> dialog box.
<b>Ctrl+N</b>	Opens a new, empty <b>Edit</b> window.
<b>Ctrl+S</b>	Saves the active <b>Edit</b> window.
<b>Ctrl+P</b>	Prints the active <b>Edit</b> window.



Keyboard Action	Effect of Action
<b>Ctrl+A</b>	Selects all text in the <b>Edit</b> window.
<b>Ctrl+C</b>	Copies selected text to the clipboard.
<b>Ctrl+X</b>	Cuts selected text and copies it to the clipboard.
<b>Ctrl+V</b>	Pastes text from the clipboard into the <b>Edit</b> window.
<b>Ctrl+Del</b>	Deletes the word after the insertion point.
<b>Del</b>	Deletes selected text; does not copy to clipboard.
<b>Ctrl+F</b>	Displays the <b>Find And Replace</b> dialog box.
<b>Ctrl+G</b>	Repeats the most recent Find command.
<b>Ctrl+R</b>	Replaces the selected text (using the replacement text from the <b>Find And Replace</b> dialog box), and performs another Find.
<b>Ctrl+J</b>	Displays <b>Select Project File</b> dialog box.
<b>Ctrl+K</b>	Compiles the program in the active window.
<b>Ctrl+E</b>	Next Error command; scrolls the <b>Edit</b> window to show the line that caused a compilation error.
<b>Ctrl+L</b>	Links the active project.
<b>Ctrl+U</b>	Sends message to MapInfo Pro to run the active program.
<b>F1</b>	Displays Help.
<b>F8</b>	Displays <b>Text Style</b> dialog box, allowing you to change the font.
<b>Ctrl+F4</b>	Closes the active <b>Edit</b> window.
<b>Alt+F4</b>	Exits the MapBasic development environment.
<b>Shift+F4</b>	Tile windows.
<b>Shift+F5</b>	Cascade windows.

**Note:** If you select a function name before pressing **F1**, Help shows a topic describing that function.

#### Mouse Shortcuts

Mouse Action	Effect of Action
<b>Double-click</b>	Double-clicking on text within your program selects a word. Double-clicking in the list of error messages scrolls the window to show the line of your program that caused the error.
<b>Triple-click</b>	Highlights entire line of text (32-bit version only).
<b>Drag &amp; Drop</b>	Dragging text to another window copies the text. Dragging text within the same window moves the text (unless you hold down the <b>Ctrl</b> key during the drag, in which case the text is copied).

**Note:** The *MapBasic Help* contains code samples. You can drag & drop code samples from the **Help** window to your **Edit** window.

To drag and drop code samples from the **Help** window to your **Edit** window:

1. Display help.
2. Click and drag within the **Help** window to highlight the text you want to copy.
3. Click on the text you highlighted. Without releasing the mouse button, drag the text out of the **Help** window.
4. Move the mouse pointer over your **Edit** window, and release the mouse button. The text is dropped into your program.

## Limitations of the MapBasic Text Editor

Each MapBasic **Edit** window can hold a limited amount of text. If the MapBasic text editor beeps when you try to insert text, the beeping indicates that the **Edit** window is full.

There are three ways to work around this size limitation:

- If you have another text editor, you can use that editor to edit your program. To compile your program, switch to MapBasic and choose the **Compile From File** menu command.
- You can break your program file (.mb file) into two or more smaller files, and then use the MapBasic **Include** statement to incorporate the various files into a single application. For more information about the **Include** statement, see the *MapBasic Reference*.
- You can break your program file (.mb file) into two or more smaller files, and then create a MapBasic project file which links the various program files into a single application. In some ways, this is similar to using the **Include** statement to combine program modules. Project files, however, provide a more efficient solution. Each file included in a project can be compiled separately; this means that when you edit only one of your modules, you only need to recompile that module.

## Compiling Your Program

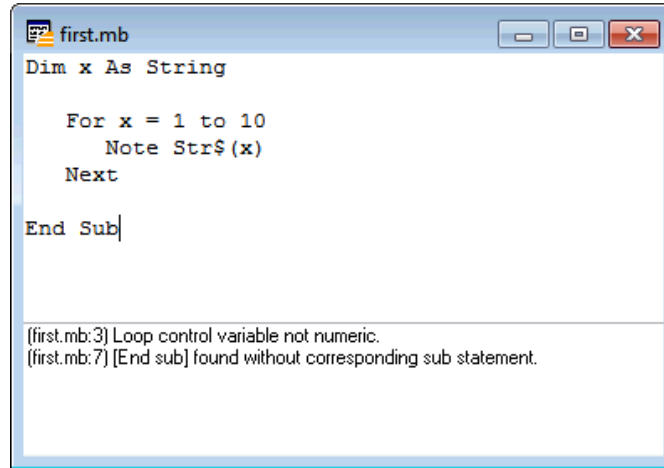
---

If you haven't already done so, display your program in a MapBasic **Edit** window. Then, to compile your program, choose **Compile Current File** from the **Project** menu.

**Note:** You can have multiple **Edit** windows open at one time. When you choose **Compile Current File**, MapBasic compiles the program that is in the front-most window. Thus, if you have multiple **Edit** windows open, you must make the appropriate window active before you compile.

The MapBasic compiler checks the syntax of your program. If your program contains any syntax errors, MapBasic displays a dialog box indicating that errors were found, and then displays descriptions of the errors in a list beneath the **Edit** window.

Each error message begins with a line number, indicating which line in the program caused the error. You must correct your program's errors before MapBasic can successfully compile your program.



**Figure 1: First.mb**

If you double-click an error message that appears beneath the **Edit** window, MapBasic scrolls the window to show you the line of the program that caused the error.

After you correct any errors in your program, choose **Compile Current File** again to try to recompile. Once your program compiles successfully, MapBasic displays a dialog box indicating that compilation was complete.

When compilation is successful, MapBasic creates an .mbx file (MapBasic eXecutable). This .mbx file must be present to run the finished application. Thus, if you want to provide your users with a finished MapBasic application, but you do not want to give them all of your source code, give the users your .mbx file but not your .mb file.

## A Note on Compilation Errors

There are some types of spelling errors which the MapBasic compiler cannot detect. For example, the MapBasic compiler will compile the following program, even though the program contains a typographical error on the second line (STATES is misspelled as TATES):

```

Open Table "states"
  Map From tates

```

The MapBasic compiler cannot identify the typographical error on the second line. This is not a defect of the compiler, rather, it is because some variable and table references are not evaluated until runtime (until the moment the user runs the program). When the user runs the preceding program, MapInfo Pro attempts to carry out the **Map From tates** statement. At that time, MapInfo Pro displays an error message (for example, "Table tates is not open") unless a table called tates is actually available.

## Running a Compiled Application

To run the compiled application, choose **File > Run MapBasic Program** from MapInfo Pro's main menu. The **Run MapBasic Program** dialog box prompts you to choose a MapBasic application file (.mbx file) to run.

The MapBasic development environment also provides a shortcut to running your program: After compiling your program, choose **Run** from MapBasic's **Project** menu (or press **Ctrl+U**). MapBasic sends a message to MapInfo Pro, telling MapInfo Pro to execute the application.

**Note:** MapInfo Pro must already be running.

## Using Another Editor to Write MapBasic Programs

If you already have a favorite text editor, you can use that editor for editing your MapBasic program. Just save your MapBasic program as a standard text file.

You can also use word processing software to edit your programs. However, if you use a word processor to edit your programs, you may need to take special steps to make sure that the word processor saves your work in a plain text file format. Saving a document as plain text often involves choosing **Save As** instead of **Save**. For more details on saving a document in a plain text format, see the documentation for your word processing software.

### Compiling Programs Written In Another Editor

Earlier, we discussed how MapBasic's **Compile Current File** menu item compiles whichever program is on the screen in the active **Edit** window. MapBasic also provides an alternate method for compiling your program: the **File > Compile From File** command on the MapBasic main menu.

If you use a text editor other than MapBasic to edit your program, you probably will want to use **Compile From File** to compile your program. **Compile From File** compiles a program without displaying the program in a MapBasic **Edit** window.

When you choose **Compile From File**, MapBasic prompts you to choose a file to compile. If the chosen file has any compilation errors, MapBasic writes the error messages to a text file with the .err extension. For example, if you choose **Compile From File** to compile the program `dispatch.mb`, MapBasic writes any error messages to the text file `dispatch.err`. To view the error file, choose **File > Open**.

### Compiling and Linking Programs From the Command Line

If you use a text editor other than MapBasic to edit your programs, you may find it awkward switching to MapBasic whenever you want to compile or link your application. However, there is a way to automate the process of compiling and linking: if you can configure your text editor so that it issues a command string, then you can compile programs without leaving your editor.

You can start the MapBasic development environment by executing the command:

```
mapbasic
```

If the command line also includes the parameter **-D** followed by one or more program names, MapBasic automatically compiles the program files. For example, the following command line launches MapBasic and compiles two program files (`main` and `sub1`):

```
mapbasic -D main.mb sub1.mb
```

If the command line includes the parameter **-L** followed by one or more project file names, MapBasic links the projects. (Linking and Project files are discussed in [Compiling and Linking a Project](#).) For example, the following command line links the `TextBox` application:

```
mapbasic -L tbproj.mbp
```

The command line can include both the **-D** and the **-L** parameters, as shown below:

```
mapbasic -D textbox.mb -L tbproj.mbp
```

If you launch MapBasic with a command line that includes the **-D** parameter or the **-L** parameter, MapBasic shuts down after compiling or linking the appropriate files.

To start MapBasic without displaying a splash screen use the **-Nosplash** parameter:

```
mapbasic -Nosplash
```

# Linking Multiple Modules Into a Single Project

## What is a MapBasic Project File?

A project file is a text file that allows MapBasic to link separate program files into one application. If you are developing a large, complex application, your program could eventually contain thousands of lines of code. You could type the entire program into a single program file. However, most programmers dislike managing program files that large; once a program file grows to over a thousand lines, it can be difficult to locate a particular part of the program. Therefore, many programmers break up large applications into two or more smaller files. The practice of breaking large programs down into smaller, more manageable pieces is known as modular programming.

If you do divide your program into two or more modules, you need to create a project file. The project file tells the MapBasic linker how to combine separate modules into a single, executable application.

Project files are an optional part of MapBasic programming. You can create, compile, and run applications without ever using a project file. However, if you plan to develop a large-scale MapBasic application, it is worth your while to take advantage of MapBasic's project-file capabilities.

## What Are The Benefits of Using Project Files?

- **Project files let you modularize** your programming. Once you set up a project file, you can divide your program into numerous, small files. Modular programs are generally easier to maintain in the long run. Also, having modular programs makes it unlikely that your program will grow too large to be edited in a MapBasic **Edit** window.
- **Project files make it easy to have two or more programmers working** on a project at the same time. Once you have set up a project file, each programmer can work on a separate module, and the modules can be joined (or, more specifically, "linked") by the project file.
- **Project files can reduce the time it takes to recompile** your application. If you change one module in a multiple-module project, you can recompile just that module, then relink the project. This is often much faster than recompiling all source code in the project—which is what you must do if you do not use project files.

## Examples of Project Files

The TextBox application uses a project file (`tbproj.mbp`) that looks like this:

```
[Link]
Application=textbox.mbx
Module=textbox.mbo
Module=auto_lib.mbo
```

Similarly, the ScaleBar application uses a project file (`sbproj.mbp`) that looks like this:

```
[Link]
Application=scalebar.mbx
Module=scalebar.mbo
Module=auto_lib.mbo
```

In both examples, the final line of the project file tells MapBasic to build the `auto_lib` module into the project. The `auto_lib` module is one of the sample programs included with the MapBasic software.

If a MapBasic program includes the `auto_lib` module, the program can provide a special **Auto-Load** button in its **About** dialog box. By choosing the **Auto-Load** button, the user can set up the application so that it loads automatically every time the user runs MapInfo Pro. If the user does not turn on the Auto-Load feature, the MapBasic application stops running as soon as the user exits MapInfo Pro.

To build the Auto-Load feature into your MapBasic program, see the instructions listed in the file `auto_lib.mb`.

### Creating a Project File

If you have already written a program file, and you want to create a project file for your program, follow these steps:

1. Choose **File > New** to open a new **Edit** window.
2. Enter the following line in the **Edit** window:

```
[Link]
```

3. Enter a line that contains the text `Application=appfilename` (where `appfilename` specifies the file name of the executable file you want to create). For example:

```
Application=C:\MB\CODE\CUSTOM.MBX
Application=Local:MapBasic:custom.mbx
Application=/MapBasic/mb_code/custom.mbx
```

4. Enter a line that contains the text `Module=modulename` (where `modulename` specifies the name of a MapBasic object file). For example:

```
Module=C:\MB\CODE\CUSTOM.MBO
Module=Local:MapBasic:custom.mbo
Module=/MapBasic/mb_code/custom.mbo
```

Note the extension on the filename; MapBasic object files have the file extension `.mbo`. MapBasic creates an object file when you compile a single module that is part of a multiple-module project.

Whenever you choose **Project > Compile Current File**, MapBasic tries to compile the current file into an executable application file (ending with `.mbx`). However, if the program file contains calls to functions or procedures that are not in the file, MapBasic cannot create an `.mbx` file. In this case, MapBasic assumes that the program is part of a larger project. MapBasic then builds an object file (`.mbo`) instead of an executable file (`.mbx`). MapBasic also creates an object file whenever the module that you are compiling does not have a Main procedure.

5. Repeat **step 2** for every file you wish to include in your application.
6. Choose **File > Save As** to save the project file.

In the **Save As** dialog box, choose the file type "Project File" (from the list of file types in the lower left corner of the dialog box), so that the file has the extension `.mbp` (MapBasic Project).

7. Close the **Edit** window (either choose **File > Close** or click on the window's close box).

If you add more modules to the project at a later date, remember to add appropriate `Module=` lines to the project file.

### Opening multiple files

Once you have created a project file, you can compile and link your project by following these steps:

1. Compile each module that is used in the project.

To compile a module, choose **File > Open**, then choose **Project > Compile Current File**.

To compile a module without first displaying it, choose **File > Compile From File**.

2. Choose **Project > Select Project File** to tell MapBasic which project file you want to link. The **Select Project File** dialog box displays.
3. Choose the project (`.mbp`) file you want, and click **OK**. The selected project file appears in an **Edit** window. This file remains selected until you exit MapBasic, close the project file's **Edit** window, or choose the **Project > Select Project File** command again. Only one project file can be selected at any time.

**Note:** You cannot change which project file is selected by making an **Edit** window the front-most window. You cannot change which project file is selected by choosing **File > Open**. To select the project file you want to link, choose **Project > Select Project File**.

4. Choose **Project > Link Current Project** to link your application. MapBasic reads the object (.mbo) files listed in the project file. If there are no link errors, MapBasic builds an executable (.mbx) file. If there are link errors, MapBasic displays an error message.

You also can link a project in a single step, without first displaying the project file in an **Edit** window, by choosing **File > Link From File**.

The object files created by the MapBasic compiler cannot be linked using any other linker, such as a C-language linker. Only the MapBasic linker can link MapBasic object modules.

## Opening Multiple Files

If you use project files, you may find that you sometimes need to open all of the program files in your project. To simplify this process, the **Open** dialog box lets you open multiple files at the same time.

To open multiple files at one time:

1. Select **File > Open**.
2. Click a file name in the **Open Program** dialog box.
3. Hold down the **Shift** key or the **Ctrl** key as you click on another file name.

Holding down the **Shift** key lets you select a list of adjacent files.

Holding down the **Ctrl** key lets you add files to the selected set, one file at a time.

## Calling Functions or Procedures From Other Modules

If an .MB file is part of a multiple-module project, it can call functions and sub procedures located in other modules. For example, `textbox.mb` calls the `HandleInstallation` procedure, which is located in the `auto_lib` library. Calling a function or sub procedure located in another module is known as an external reference.

If your MapBasic program calls an external procedure, your program file must contain a **Declare Sub** statement. Similarly, if your program calls an external function, your program file must contain a **Declare Function** statement. These **Declare** statements tell the MapBasic compiler what parameters are used by the procedure or function.

The sample program `textbox.mb` contains the statement `Include "auto_lib.def"`. The `auto_lib.def` definitions file contains a set of **Declare Sub** and **Declare Function** statements which correspond to the `auto_lib` module. If `textbox.mb` did not include the `auto_lib.def` definitions file, the MapBasic compiler would consider the call to the `HandleInstallation` procedure to be a syntax error ("Invalid sub procedure name").

## Sharing Variables With Other Modules

To declare a global variable that can be used by two or more modules in a project:

1. Place **Global** statements in a definitions file (for example, `globals.def`).
2. Use the **Include** statement to incorporate the definitions file into each module that needs to use the global variables.

For example, the `auto_lib.def` definitions file declares two global string variables, `gsAppFilename` and `gsAppDescription`. The `auto_lib.mb` program file and the `textbox.mb` program file both issue the statement:

```
Include "auto_lib.def"
```

Therefore, the two modules can share the global variables. When the `textbox.mb` program stores values in the global variables, the `auto_lib.mb` library is able to read the new values.

Global variables also allow you to share information with other applications that are running.

### Declaring Variables That Cannot Be Shared With Other Modules

A program file can contain **Dim** statements that are located outside of any function or sub procedure definition. Such **Dim** statements are known as module-level **Dim** statements. If a variable is declared by a module-level **Dim** statement, all functions and procedures in that module (i.e., in that `.mb` file) can use that variable. However, a MapBasic file cannot reference another file's module-level **Dim**s.

Use module-level **Dim** statements if you want to declare a variable that can be shared by all procedures in a file, but you want to be sure that you do not accidentally use a variable name that is already in use in another module.

# Menu Summary in MapBasic Development Environment

---

## The File Menu

The **File** menu provides commands that let you create, open, close, save, exit, and print MapBasic programs.

- **New** opens a new **Edit** window where you can type in your program.
- **Open** displays an existing file in an **Edit** window. The file can be a MapBasic program file (for example, `dispatch.mb`), a list of error messages (`dispatch.err`), or a MapInfo Pro workspace file. Each workspace is actually just a text file containing an assortment of MapBasic statements.

The **Open** dialog box lets you open two or more files at the same time. To select multiple files, hold down the **Shift** key or the **Ctrl** key as you click on the file names.

**Note:** Some text files are too big to be displayed in a MapBasic **Edit** window. For information on bypassing this limitation, see [Limitations of the MapBasic Text Editor](#).

- **Close** closes the active **Edit** window. If you have made changes in the current window, MapBasic prompts you to either save or discard the changes before closing the window. **Close** is available when at least one **Edit** window is open.
- **Close All** closes all open **Edit** windows. As with the **Close** command, MapBasic prompts you to either save or discard any unsaved changes. **Close All** is available when at least one **Edit** window is open.
- **Save** saves the contents of the active **Edit** window to disk. **Save** is available when you have changed the contents of an **Edit** window.
- **Save As** saves the contents of the active **Edit** window under a new file name. **Save As** is available when you have an open **Edit** window.
- **Revert** discards any changes made to the **Edit** window since it was last saved. **Revert** is available when you have changed the contents of an **Edit** window.
- **Compile From File** compiles an existing `.mb` file directly from the contents of the disk file, without first displaying the contents of the file in an **Edit** window. (As opposed to the **Compile Current File** command on the **Project** menu, which compiles whatever program is in the active **Edit** window.) Use **Compile From File** to compile a program written in another text editor.

If there are compilation errors, **Compile From File** writes error messages to a text file named `filename.err`. To view the errors file, choose **File > Open**.



- **Link From File** links an existing project without first displaying the contents of the project file in an **Edit** window. (As opposed to the **Link Current Project** command on the **Project** menu, which links the current project.)
- **Page Setup** defines printer options (for example, paper size and orientation).
- **Print** prints the active **Edit** window.

**Print** is available when there is at least one **Edit** window open.

- **Exit** exits the MapBasic environment. MapBasic prompts you to either save or discard any changes that have not been saved.

## The Edit Menu

The **Edit** menu provides commands that you can use when drafting and editing your MapBasic program.

- **Undo** cancels the most recent change you made in the active **Edit** window. When you select **Undo**, MapBasic discards the last change you performed, and then the menu item changes to read **Redo**. If you select **Redo**, MapBasic then re-applies the discarded change.

**Undo** is enabled when there is at least one open **Edit** window, and you have made changes to the text in that window.

- **Cut** copies the selected (highlighted) text to the Clipboard, then removes the selected text from the **Edit** window. The text remains on the Clipboard and you can later insert it elsewhere through the **Paste** command (see below). **Cut** is available when text is selected in the active **Edit** window.
- **Copy** copies the selected text to the Clipboard, but does not delete it. **Copy** is available when text is selected in the active **Edit** window.
- **Paste** copies the contents of the Clipboard to the active **Edit** window at the current cursor location. If you select text in the **Edit** window, and then perform **Paste**, the text from the clipboard replaces the selected text.

**Paste** is available when text is in the Clipboard and there is at least one open **Edit** window.

- **Clear** deletes selected text without copying it to the Clipboard. **Clear** is available when there is selected text in an open **Edit** window.
- **Select All** selects the entire contents of the active **Edit** window. **Select All** is available when there is at least one open **Edit** window.

## The Search Menu

The **Search** menu helps you to locate and replace text in the **Edit** window. Some of these commands simplify the process of locating statements that have syntax errors.

- **Find** searches the active **Edit** window for a particular text string. **Find** is available when there is at least one open **Edit** window. To find the next occurrence of a text string: Type the text string you want to find into the Find text box. If you want the search to be case-sensitive, check the **Match Case** check box.

When you click on the **Find** button, MapBasic searches forward from the current insertion point. If MapBasic finds an occurrence of the Find string, the window scrolls to show that occurrence. If the text is not found, MapBasic beeps.

- **Find Again** finds the next occurrence of the string specified in the previous **Find** dialog box.

**Find Again** is available when there is at least one open **Edit** window, and a Find operation has been performed.

- **Replace And Find Again** replaces the selected text with text specified in the **Find** dialog box, then finds and highlights the next occurrence of the search string.

**Next Error** is a feature of the compiler that helps you correct syntax errors. When a program does not compile correctly, MapBasic displays a list of the errors at the bottom of the **Edit** window. **Next Error** scrolls forward through the **Edit** window, to the line in your program which corresponds to the next error in the error list. **Next Error** is available when there are error messages in the active **Edit** window.

- **Previous Error** is similar to **Next Error**. **Previous Error** scrolls backward through the **Edit** window to the previous item in the error list. **Previous Error** is available when there are error messages relating to the active **Edit** window.
- **Go To Line** prompts you to type in a line number, then scrolls through the **Edit** window to that line in your program.

A program may compile successfully, yet it may encounter an error at runtime. When this happens, a dialog box appears, indicating that an error occurred at a certain line in your program. Typically, you then want to return to the MapBasic development environment and go to the appropriate line of your program. **Go To Line** is available when there is at least one **Edit** window open.

To replace all occurrences of a text string:

- Type the replacement string in the Replace With text box, and click the **Replace All** button.

MapBasic replaces all occurrences of the Find string with the Replace With string.

**Note:** This replacement happens instantly, with no confirmation prompt.

To confirm each string replacement:

1. Choose **Search > Find**. The **Find** dialog box appears.
2. Fill in the **Find** and **Replace With** text boxes.
3. Within the **Find** dialog box, click the **Find** button.

MapBasic finds and highlights the next occurrence of the text string.

To replace the currently-highlighted string, press **Ctrl+R** (the hot-key for the **Replace And Find Again** menu command).

If you do not want to replace the currently-highlighted occurrence of the Find string, press **Ctrl+G** (the hot-key for the **Find Again** menu command).

## The Project Menu

The **Project** menu lets you compile and run MapBasic programs, display program statistics, and show or hide the error window.

- **Select Project File** presents a dialog box which lets you open an existing project file. A project file is a text file that lists all the modules that comprise your application. Once you select a project file, that project file becomes the active project file, and you can compile the file by choosing **Link Current Project**.
- **Compile Current File** compiles the program in the active **Edit** window. **Compile Current File** is available if there is at least one open **Edit** window.

If the compiler detects syntax errors in the program, MapBasic displays a list of errors at the bottom of the **Edit** window. If there are no syntax errors, MapBasic builds an mbx file (if the module is a stand-alone program) or an object module (mbo) file.

- **Link Current Project** links the modules listed in the current project file, and produces an executable application file (unless there are errors, in which case an error message displays). **Link Current Project** is available whenever a project file is open.
- **Run** sends a message to the MapInfo Pro software, telling it to execute the application in the front-most **Edit** window.
- **Get Info** displays statistics about the program in the active **Edit** window. **Get Info** is available if there is at least one open **Edit** window.

- **Show/Hide Error List** activates or deactivates the error list associated with the active **Edit** window. If the error list is currently displayed, the menu item reads **Hide Error List**. If the error list is currently hidden, the menu item reads **Show Error List**. **Show/Hide Error List** is available when there is an open **Edit** window with associated error messages.

## The Window Menu

If you have more than one **Edit** window open, MapBasic's **Window** menu lets you arrange your windows or switch which window is active.

Commands on this menu are available when there is at least one **Edit** window open.

- **Tile Windows** arranges the **Edit** windows in a side-by-side pattern.
- **Cascade Windows** arranges the **Edit** windows in an overlapping pattern.
- **Arrange Icons** organizes the icons that correspond to your minimized **Edit** windows. You can click an **Edit** window's minimize button to temporarily shrink that window down to an icon.
- **Text Style** lets you choose the font in which the window is displayed. The font you choose is applied to the entire window.
- The bottom of the Window menu lists a menu item for each open **Edit** window. To make one of the **Edit** windows active (i.e., to bring that window to the front), select the appropriate item from the Window menu.

## The Help Menu

Use the **Help** menu to access *MapBasic Help*. The help file contains descriptions of all statements and functions in the MapBasic language. **Help** also includes a comprehensive set of cross-reference screens to help you find the name of the statement you need.

- **Contents** opens the **Help** window at the **Contents** screen. From there, you can navigate through help by clicking on hypertext jumps, or you can click on the **Search** button to display the **Search** dialog box.
- **Search For Help On** jumps directly to the **Search** dialog box.
- **How To Use Help** displays a **Help** screen that explains how to use *MapBasic Help*.
- **Check for Update** opens the Pitney Bowes Inc. web site focusing on a page that lists any available updates to the product.
- **About MapBasic** displays the **About** box, which shows you copyright and version number information.

**Note:** Many of the **Help** screens contain brief sample programs. You can copy those program fragments onto the clipboard, then paste them into your program. To copy text from a **Help** screen, choose **Edit > Copy** from the **Help** window's **Edit** menu or by dragging text directly out of the **Help** window, and drop it into your program.

# New MapBasic IDE features

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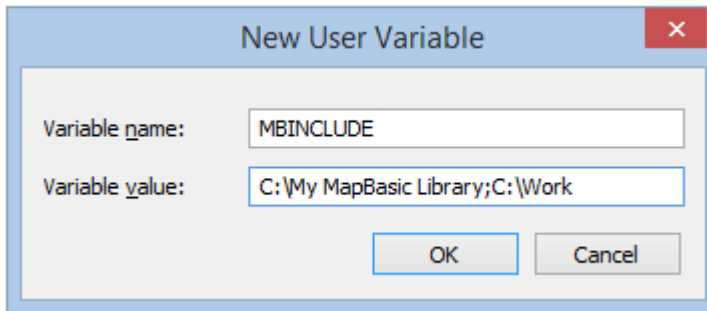
## Setting Search Paths for MapBasic Include and Module Files

To make it easier to develop MapBasic libraries of definitions and modules, you can set environment variables for search paths for Include (.def) files when compiling and Module (.mbo) files when linking. By default, MapBasic will search for these files first in the path specified in your MapBasic code and then under the folder where MapBasic is installed. By setting these environment variables you can specify additional folders to search after the path specified in your code but before the MapBasic folder. The

environment variables are called **MBINCLUDE** and **MBMODULE** for Include and Module files, respectively, and their values should be set to a semi-colon delimited list of folders to search. MapBasic will search the folders specified and all sub-folders beneath them.

You can set environment variables via the **Advanced System Settings** on your system. The variables must be set before you run MapBasic for them to be effective.

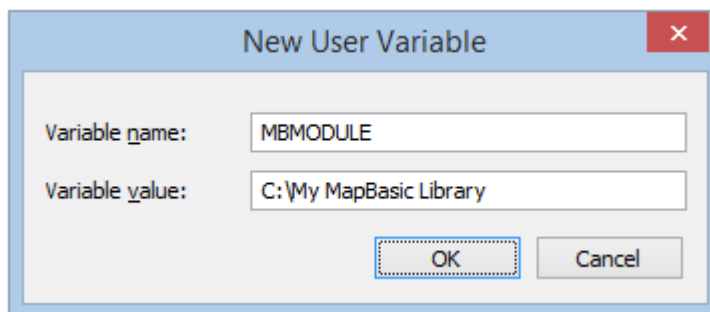
To set additional search folders for Include files, set the environment variable **MBINCLUDE**. For example, if you have libraries of .def files in or beneath the folders "C:\My MapBasic Library" and "C:\Work", set the **MBINCLUDE** environment variable as follows:



The screenshot shows a dialog box titled "New User Variable" with a close button (X) in the top right corner. It contains two text input fields: "Variable name:" with the text "MBINCLUDE" and "Variable value:" with the text "C:\My MapBasic Library;C:\Work". Below the fields are two buttons: "OK" and "Cancel". The "OK" button is highlighted with a blue border.

Do not use quotes around the folder names even if the path contains spaces.

To set additional search folders for Module files, similarly set the environment variable **MBMODULE**. For example, if you have libraries of .mbo files in or beneath the folder "C:\My MapBasic Library", set the **MBMODULE** environment variable as follows:



The screenshot shows a dialog box titled "New User Variable" with a close button (X) in the top right corner. It contains two text input fields: "Variable name:" with the text "MBMODULE" and "Variable value:" with the text "C:\My MapBasic Library". Below the fields are two buttons: "OK" and "Cancel". The "OK" button is highlighted with a blue border.

Here is an example of section of MapBasic code:

```
Include "mapbasic.def"  
Include "utilities.def"  
Include "myapplication.def"
```

Assuming you set your environment variables as above, when compiling MapBasic will search for these .def files first in the folder where the file you are compiling is located, then under "C:\My MapBasic Library" and its subfolders, next under "C:\Work" and its subfolders, and last under the folder where MapBasic was installed. If the file "utilities.def", for example, is used by multiple applications you've written you can put it somewhere under "C:\My MapBasic Library" or "C:\Work" and MapBasic can find it without you having to specify the path in the code.

Similarly your project (.mbp) file could look as follows:

```
[Link]Application=myapplication.mbx  
Module=myapplication.mbo  
Module=library.mbo
```

If the file "library.mbo", for example, is used by multiple applications you've written you can put it somewhere under "C:\My MapBasic Library" and MapBasic can find it without you having to specify the path in the project file.

# MapBasic Fundamentals

Every MapBasic programmer should read this chapter, which describes many fundamental aspects of the MapBasic programming syntax.

## In this section:

- **General Notes on MapBasic Syntax** .....46
- **Expressions** .....51
- **Looping, Branching, and Other Flow-Control** .....60
- **Procedures** .....64
- **Procedures That Act As System Event Handlers** .....67
- **Tips for Handler Procedures** .....69
- **Compiler Instructions** .....71
- **Program Organization** .....72

# General Notes on MapBasic Syntax

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Before getting into discussions of specific MapBasic statements, it is appropriate to make some observations about MapBasic program syntax in general.

## Comments

In MapBasic, as in some other BASIC languages, the apostrophe character (') signifies the beginning of a comment. When an apostrophe appears in a program, MapBasic treats the remainder of the line as a comment, unless the apostrophe appears within a quoted string constant.

## Case-Sensitivity

The MapBasic compiler is case-insensitive. You can enter programs with UPPER-CASE, lower-case, or Mixed-Case capitalization.

For clarity, this manual capitalizes the first letter of each MapBasic language keyword. Program variables appear in lower-case. For example, in the following program sample, the words **If** and **Then** have proper capitalization because they are keywords in MapBasic, whereas the word **counter** appears in lower-case, because it is the name of a variable.

```
If counter > 5 Then
    Note "Count is too high"
End If
```

## Continuing a Statement Across Multiple Lines

When you write a MapBasic program, you can continue longer statements across more than one line. For example, the following code sample continues the **If...Then** statement across several lines:

```
If counter = 55
    Or counter = 34 Then
    Note "Counter is invalid"
End If
```

## Codes Defined In mapbasic.def

Many MapBasic statements and function calls will not work properly unless the following statement appears at or near the top of your program:

```
Include "mapbasic.def"
```

The file `mapbasic.def` is a text file containing definitions for many standard MapBasic codes. As a rule, the codes defined in `mapbasic.def` are all in upper-case (for example, TRUE, FALSE, BLACK, WHITE, CMD\_INFO\_X, OBJ\_INFO\_TYPE, etc.). As you read the program examples that appear in the MapBasic documentation, you will see many such codes. For example:

```
If CommandInfo( CMD_INFO_DLG_OK ) Then
```

If your program references standard codes (such as `CMD_INFO_DLG_OK` in the example above), your program must issue an **Include** statement to include `mapbasic.def`. If you omit the **Include** statement, your program will generate a runtime error (for example, "Variable or Field `CMD_INFO_DLG_OK` not defined").

## Typing Statements Into the MapBasic Window

The MapInfo Pro software has a feature known as the **MapBasic** window. Typing statements directly into the **MapBasic** window helps you to learn MapBasic statement syntax. However, some restrictions apply to the **MapBasic** window:

- Some MapBasic statements may not be entered through the **MapBasic** window, although you may use those statements within compiled MapBasic programs. The general rule is flow-control statements (such as **If...Then**, **For...Next**, and **GoTo**) do not work in the **MapBasic** window.
- To determine whether you can type a particular statement into the **MapBasic** window, see the *MapBasic Reference* or *MapBasic Help*. If a statement does not work in the **MapBasic** window, that statement's entry in the *MapBasic Reference* indicates the restriction.
- When you type statements directly into MapInfo Pro's **MapBasic** window, you must take special steps if you want to continue the statement across multiple lines. At the end of the each partial line, type **Ctrl+Enter** instead of **Enter**. After you have typed the entire statement, highlight the lines that make up the statement, and press **Enter**.
- Codes that are defined in `mapbasic.def` (for example, BLACK, WHITE, etc.) may not be entered in the **MapBasic** window. However, each code has a specific value, which you can determine by reading `mapbasic.def`; for example, the code BLACK has a numerical value of zero (0). When you are entering commands into the **MapBasic** window, you must use the actual value of each code, instead of using the name of the code (for example, use zero instead of "BLACK").
- Each statement that you type into the **MapBasic** window is limited to 256 characters.

## Variables

MapBasic's syntax for declaring and assigning values to variables is much like the syntax of other modern BASIC languages. However, MapBasic supports some types of variables that are not available in other languages (such as the Object variable; for a complete list of MapBasic variable types, see the description of the **Dim** statement in the *MapBasic Reference*).

### What Is a Variable?

Think of a variable as a very small piece of your computer's memory. As you write programs, you will find that you need to temporarily store various types of information in memory. To do this, you declare one or more variables. Each variable has a unique name (for example, counter, x, y2, customer\_name). For each variable that you declare, MapBasic sets aside a small piece of memory. Thereafter, each variable can contain one small piece of information.

### Declaring Variables and Assigning Values to Variables

The **Dim** statement defines variables. You must declare every variable that you use, and the variable declaration must appear before the variable is used.

Use the equal operator (=) to assign a value to a variable.

The following example declares an Integer variable and assigns a value of 23 to that variable:

```
Dim counter As Integer
counter = 23
```

A single **Dim** statement can declare multiple variables, provided that the variable names are separated by commas. The following **Dim** statement declares three floating-point numeric variables:

```
Dim total_distance, longitude, latitude As Float
longitude = -73.55
latitude = 42.917
```

A single **Dim** statement can declare variables of different types. The following statement declares two Date variables and two String variables:

```
Dim start_date, end_date As Date,  
    first_name, last_name As String
```

### Variable Names

Variable names must conform to the following rules:

- Each variable name can be up to thirty-one characters long.
- Variable names may not contain spaces.
- Each variable name must begin with a letter, an underscore (`_`) or a tilde (`~`).
- Each variable name can consist of letters, numbers, pound signs (`#`), or underscore characters (`_`).
- A variable name may end in one of the following characters: `$`, `%`, `&`, `!`, or `@`. In some BASIC languages, these characters dictate variable types. In MapBasic, however, these characters have no special significance.
- You may not use a MapBasic keyword as a variable name. Thus, you may not declare variables with names such as **If**, **Then**, **Select**, **Open**, **Close**, or **Count**. For a list of reserved keywords, see the discussion of the **Dim** statement in the *MapBasic Reference*.

### Data Types

MapBasic supports the following types of variables:

Type	Description
SmallInt	Integer value between -32767 and 32767; stored in two bytes.
Integer	Integer value between -2 billion and 2 billion; stored in four bytes.
Float	Floating-point value; stored in eight-byte IEEE format.
String	Variable-length character string, up to 32,767 characters long.
String * <i>n</i>	Fixed-length character string, <i>n</i> characters long (up to 32,767 characters).
Logical	True or False.
Date	Date.
Object	Graphical object, such as a line or a circle; see <a href="#">Graphical Objects</a> for details.
Alias	Column reference of a table; see <a href="#">Working With Tables</a> for details.
Pen	Pen (line) style setting; see <a href="#">Graphical Objects</a> .
Brush	Brush (fill) style setting; see <a href="#">Graphical Objects</a> .

## Fixed-length and variable-length String variables

MapBasic supports both fixed-length and variable-length String variables. A variable-length String variable can store any string value, up to 32,767 characters long. A fixed-length String variable, however, has a specific length limit, which you specify in the **Dim** statement.

To declare a variable-length String variable, use `String` as the variable type. To declare a fixed-length String variable, follow the `String` keyword with an asterisk (`*`), followed by the length of the string in bytes.



In the following example, `full_name` is declared as a variable-length String variable, while `employee_id` is declared as a fixed-length String variable, nine characters long:

```
Dim full_name As String,
    employee_id As String * 9
```

**Note:** Like other BASIC languages, MapBasic automatically pads "every fixed-length String variable with blanks, so that the variable always fills the allotted space. Thus, if you declare a fixed-length String variable with a size of five characters, and then you assign the string "ABC" to the variable, the variable will actually contain the string "ABC " ("ABC" followed by two spaces). This feature is helpful if you need to write an application that produces formatted output.

## Array Variables

To declare an array variable, follow the variable name with the size of the array enclosed in parentheses. The array size must be a positive integer constant expression. The following **Dim** statement declares an array of ten Date variables:

```
Dim start_date(10) As Date
```

To refer to an individual element of an array, use the syntax:

```
array_name(element-number)
```

Thus, the following statement assigns a value to the first element of the `start_date` array:

```
start_date(1) = "6/11/93"
```

To resize an array, use the **ReDim** statement. Thus, in cases where you do not know in advance how much data your program will need to manage—perhaps because you do not know how much data the user will enter—your program can use the **ReDim** statement to enlarge the array as needed. Use the **UBound( )** function to determine the current size of an array.

The following example declares an array of String variables called `name_list`. The latter part of the program increases the size of the array by ten elements.

```
Dim counter As Integer, name_list(5) As String
...
counter = UBound(names)           ' Determine current array size
ReDim names(counter + 10)         ' Increase array size by 10
```

MapBasic arrays are subject to the following rules:

- MapBasic supports only one-dimensional arrays.
- In MapBasic, the first element in an array always has an index of one. In other words, in the example above, the first element of the `names` array is `names(1)`.

If you need to store more data than will fit in an array, you may want to store your data in a table. For more information on using tables, see [Working With Tables](#).

MapBasic initializes the contents of numeric arrays and variables to zero when they are defined. The contents of string arrays and variables are initially set to the null string.

## Custom Data Types (Data Structures)

Use the **Type...End Type** statement to define a custom data type. A custom data type is a grouping of one or more variables types. Once you define a custom data type, you can declare variables of that type by using the **Dim** statement.

The following program defines a custom data type, employee, then declares variables of the employee type.

```
Type employee
  name As String
  title As String
  id As Integer
End Type
Dim manager, staff(10) As employee
```

Each component of a custom data type is referred to as an element. Thus, the employee data type in the preceding example has three elements: name, title, and id. To refer to an individual element of an array, use the generic syntax:

```
variable_name.element_name
```

The following statement assigns values to each element of the manager variable:

```
manager.name = "Joe"
manager.title = "Director of Publications"
manager.id = 111223333
```

You can declare an array of variables of a custom type. The following statement assigns values to some of the elements of the first item in the employee array:

```
staff(1).name = "Ed"
staff(1).title = "Programmer"
```

**Type...End Type** statements must appear outside of any sub procedure definition. Sub procedures are discussed later in this chapter. Typically, **Type...End Type** statements appear at or near the very top of your program. A **Type** definition may include elements of any other type, including previously-defined custom data types. You can also declare global variables and arrays of custom data types.

## Global Variables

Variables declared with the **Dim** statement are local variables. A local variable may only be used within the procedure where it is defined. MapBasic also lets you declare global variables, which may be referenced within any procedure, anywhere in the program.

To declare a global variable, use the **Global** statement. The syntax for the **Global** statement is identical to the syntax for the **Dim** statement, except that the keyword **Global** appears instead of the keyword **Dim**. Thus, the following **Global** statement declares a pair of global Integer variables:

```
Global first_row, last_row As Integer
```

**Global** statements must appear outside of any sub procedure definition. Sub procedures are discussed later in this chapter. Typically, **Global** statements appear at or near the top of the program.

The following program declares several global variables, then references those global variables within a sub procedure.

```
Declare Sub Main
  Declare Sub initialize_globals
  Global gx, gy As Float ' Declare global Float variables
  Global start_date As Date ' Declare global Date variable
  Sub Main
    Dim x, y, z As Float ' Declare Main proc's local vars
    Call initialize_globals
    ...
  End Sub
  Sub initialize_globals
    gx = -1 ' Assign global var: GX
    gy = -1 ' Assign global var: GY
```

```

start_date = CurDate() ' Assign global var: START_DATE
End Sub

```

Whenever possible, you should try to use local variables instead of global variables, because each global variable occupies memory for the entire time that your program is running. A local variable, however, only occupies memory while MapBasic is executing the sub procedure where the local variable is defined.

MapBasic global variables can be used to exchange data with other software packages. When an application runs on Windows, other applications can use Dynamic Data Exchange to read and modify the values of MapBasic global variables.

## Scope of Variables

A sub procedure may declare a local variable which has the same name as a global variable. Thus, even if a program has a global variable called `counter`, a sub procedure in that program may also have a local variable called `counter`:

```

Declare Sub Main
  Declare Sub setup
  Global counter As Integer
  ...
  Sub setup
    Dim counter As Integer
    counter = 0
    ...
  End Sub

```

If a local variable has the same name as a global variable, then the sub procedure will not be able to read or modify the global variable. Within the sub procedure, any references to the variable will affect only the local variable. Thus, in the example above, the statement: `counter = 0` has no effect on the global `counter` variable.

Upon encountering a reference to a variable name, MapBasic attempts to interpret the reference as the name of a local variable. If there is no local variable by that name, MapBasic attempts to interpret the reference as the name of a global variable. If there is no global variable by that name, MapBasic tries to interpret the reference as a reference to an open table. Finally, if, at runtime, the reference cannot be interpreted as a table reference, MapBasic generates an error message.

## Expressions

In this section, we take a closer look at expressions. An expression is a grouping of one or more variables, constant values, function calls, table references, and operators.

### What is a Constant?

An expression can be very simple. For example, the statement: `counter = 23` assigns a simple integer expression namely, the value 23 to the variable, `counter`. We refer to the expression 23 as a numeric constant. You might think of a constant as a specific value you can assign to a variable.

The following program declares a String variable, then assigns a string constant (the name "Fred Mertz") to the variable:

```

Dim name As String
name = "Fred Mertz"

```

The syntax for numeric expressions is different than the syntax for string expressions: string constants must be enclosed in double-quotation marks (for example, "Fred Mertz") whereas numeric constants (for example, 23) are not. You cannot assign a String expression, such as "Fred Mertz," to a numeric variable. For more information on constant expressions, see [A Closer Look At Constants](#).

## What is an Operator?

An operator is a special character (for example, +, \*, >) or a word (for example, And, Or, Not) which acts upon one or more constants, variables, or other values. An expression can consist of two or more values that are combined through an operator. In the following example, the plus operator (+) is used within the expression `y + z`, to perform addition. The result of the addition (the sum) is then assigned to the variable, `x`:

```
Dim x, y, z As Float
  y = 1.5
  z = 2.7
  x = y + z
```

In this example, the plus sign (+) acts as an operator—specifically, a numeric operator. Other numeric operators include the minus operator (-), which performs subtraction; the asterisk (\*), which performs multiplication; and the caret (^), which performs exponentiation. A complete list of numeric operators appears later in this chapter.

The plus operator can also be used within a String expression to concatenate separate strings into one string. The following program builds a three-part string expression and stores the string in the variable, `full_name`:

```
Dim first_name, last_name, middle_init, full_name As String
  first_name = "Fred "
  middle_init = "R. "
  last_name = "Mertz"
  full_name = first_name + middle_init + last_name

  ' At this point, the variable full_name contains:
  ' Fred R. Mertz
```

## What is a Function Call?

The MapBasic language supports many different function calls. Each function has a different purpose. For example, the **Sqr()** function calculates square root values, while the **UCASE\$( )** function converts a text string to uppercase. When you enter a function name into your program, your program calls the named function, and the function returns a value.

A function call can comprise all or part of an expression. For example, the following statement assigns a value to the variable, `x`, based on the value returned by the **Minimum()** function:

```
x = Minimum( y, z )
```

The MapBasic function call syntax is similar to that of other modern BASIC languages. The function name (for example, "Minimum", in the example above) is followed by a pair of parentheses. If the function takes any parameters, the parameters appear inside the parentheses. If the function takes more than one parameter, the parameters are separated by commas (the **Minimum()** function takes two parameters).

A function call is different than a generic statement, in that the function call returns a value. A function call cannot act as a stand-alone statement; instead, the value returned by the function must be incorporated into some larger statement. Thus, the following program consists of two statements: a **Dim** statement declares a variable, `x`; and then an assignment statement assigns a value to the variable. The

assignment statement incorporates a function call (calling the **Sqr( )** function to calculate the square root of a number):

```
Dim x As Float
x = Sqr(2)
```

Similarly, the following program uses the **CurDate( )** function, which returns a Date value representing the current date:

```
Dim today, yesterday As Date
today = CurDate( )
yesterday = today - 1
```

The **CurDate( )** function takes no parameters. When you call a function in MapBasic, you must follow the function name with a pair of parentheses, as in the example above, even if the function takes no parameters.

MapBasic supports many standard BASIC functions, such as **Chr\$( )** and **Sqr( )**, as well as a variety of special geographic functions such as **Area( )** and **Perimeter( )**.

## A Closer Look At Constants

A constant is a specific value that does not change during program execution. Programmers sometimes refer to constants as "hard-coded" expressions, or as "literals."

### Numeric Constants

Different types of numeric variables require different types of constants. For instance, the constant value 36 is a generic numeric constant. You can assign the value 36 to any numeric variable, regardless of whether the variable is Integer, SmallInt, or Float. The value 86.4 is a floating-point numeric constant.

### Hexadecimal Numeric Constants

MapBasic 4.0 and later supports hexadecimal numeric constants using the Visual Basic syntax: `&Hnumber` (where `number` is a hexadecimal number). The following example assigns the hexadecimal value 1A (which equals decimal 26) to a variable:

```
Dim i_num As Integer
i_num = &H1A
```

Numeric constants may not include commas (thousand separators). Thus, the following statement will not compile correctly

```
counter = 1,250,000 ' This won't work!
```

If a numeric constant includes a decimal point (decimal separator), the separator character must be a period, even if the user's computer is set up to use some other character as the decimal separator.

### String Constants

A String constant is enclosed in double quotation marks. For example:

```
last_name = "Nichols"
```

Each string constant can be up to 256 characters long.

The double quotation marks are not actually part of the string constant, they merely indicate the starting and ending points of the string constant. If you need to incorporate a double-quotation mark character

within a string constant, insert two consecutive double-quotation marks into the string. The following program illustrates how to embed quotation marks within a string:

```
Note "The table ""World"" is already open."
```

### Logical Constants

Logical constants can be either one (1) for TRUE or zero (0) for FALSE. Many MapBasic programs refer to the values TRUE and FALSE; note that TRUE and FALSE are actually defined within the standard MapBasic definitions file, `mapbasic.def`. To refer to standard definitions like TRUE and FALSE, a program must issue an Include statement, to include `mapbasic.def`. For example:

```
Include "mapbasic.def"
Dim edits_pending As Logical
edits_pending = FALSE
```

### Date Constants

To specify a date constant, enter an eight-digit Integer with the format YYYYMMDD. This example specifies the date December 31, 1995:

```
Dim d_enddate As Date
d_enddate = 19951231
```

Alternately, you can specify a string expression that acts as a date constant:

```
d_enddate = "12/31/1995"
```

When you specify a string as a date constant, the year component can be four digits or two digits:

```
d_enddate = "12/31/95"
```

You can omit the year, in which case the current year is used:

```
d_enddate = "12/31"
```

**Caution:** Using a string as a date constant is sometimes unreliable, because the results you get depend on how the user's computer is configured. If the user's computer is configured to use Month/Day/Year formatting, then "06/11/95" represents June 11, but if the computer is set up to use Day/Month/Year formatting, then "06/11/95" represents the 6th of November.

If the user's computer is set up to use "-" as the separator, MapInfo Pro cannot convert string expressions such as "12/31" into dates.

To guarantee predictable results, use the **NumberToDate( )** function, which accepts the eight-digit numeric date syntax. (Numeric date constants, such as 19951231, are not affected by how the user's computer is configured.) If you need to use strings as date values—perhaps because you are reading date values from a text file—use the **Set Format** statement to control how the strings are interpreted. For **Set Format** statement details, see the *MapBasic Reference* or *MapBasic Help*.

To configure date formatting options under Microsoft Windows, use the Regional Settings control panel.

### Alias Constants

Alias variables are discussed in detail in [Working With Tables](#). You can assign a string expression to a variable of type Alias. For example:

```
Dim column_name As Alias
column_name = "City"
```

The following table contains examples of various types of constants.

Types	Sample assignments	Notes
Integer	<code>i = 1234567</code>	
SmallInt	<code>m = 90</code>	
Float	<code>f = 4</code> <code>size = 3.31</code> <code>debt = 3.4e9</code>	
String	<code>s_mesg = "Fred Mertz"</code>	Enclose string in double quotes. To embed quotes in a string, type two quotation marks. To include special characters use the <b>Chr\$( )</b> function.
Logical	<code>edits_pending = 1</code> <code>edits_pending = TRUE</code>	1= true, 0 = false The MapBasic definition file defines TRUE and FALSE.
Date	<code>d_starting = 19940105</code> <code>date_done = "3/23/88"</code> <code>paiddate = "12-24-1993"</code> <code>yesterday = CurDate( ) - 1</code>	
Alias	<code>col_name = "Pop_1990"</code> <code>col_name = "COL1"</code>	Aliases can be assigned like strings. See <a href="#">Working With Tables</a> for more information about Alias variables.
Pen	<code>hwypen = MakePen(1, 3, BLACK)</code>	There is no constant syntax for Pen expressions.
Brush	<code>zbrush = MakeBrush(5, BLUE, WHITE)</code>	There is no Brush constant syntax.
Font	<code>lbl_font = MakeFont("Helv", 1, 20,</code> <code>BLACK, WHITE)</code>	There is no Font constant syntax.
Symbol	<code>loc_sym = MakeSymbol(44, RED, 16)</code>	There is no Symbol constant syntax.
Object	<code>path = CreateLine(73.2, 40, 73.6,</code> <code>40.4)</code>	There is no Object constant syntax.

## Variable Type Conversion

MapBasic provides functions for converting data of one type to another type. For instance, given a number, you can produce a string representing the number calling the function **Str\$( )**:

```
Dim q1, q2, q3, q4, total As Float, s_message As String
...
total = q1 + q2 + q3 + q4
s_message = "Grand total: " + Str$(total)
```

## A Closer Look At Operators

Operators act on one or more values to produce a result. Operators can be classified by the data types they use and the types of results they produce.

### Numeric Operators

Each of the operators in the following table is a numeric operator. Two numeric values can be combined using a numeric operator to produce a numeric result.

Operator	Performs	Example
+	addition	$x = a + b$
-	subtraction	$x = a - b$
*	multiplication	$x = a * b$
/	division	$x = a / b$
\	integer division	$x = a \setminus b$
Mod	integer remainder	$x = a \text{ Mod } b$
^	exponentiation	$x = a ^ b$

The \ and Mod operators perform integer division. For example:

10 / 8	returns	1.25
10 \ 8	returns	1 (the integer portion of 1.25)
10 Mod 8	returns	2 (the remainder after dividing 10 by 8)

The minus sign (-) operator can be used to negate a numeric value

```
x = -23
```

### String Operators

The plus operator (+) lets you concatenate two or more string expressions into one long string expression.

```
Note "Employee name: " + first_name + " " + last_name
```

You can use the ampersand operator (&) instead of the plus operator when concatenating strings. The & operator forces both operands to be strings, and then concatenates the strings. This is different than the + operator, which can work with numbers or dates without forcing conversion to strings.

**Note:** The & character is also used to specify hexadecimal numbers (&H*number*). When you use & for string concatenation, make sure you put a space before and after the & so that the MapBasic compiler does not mistake the & for a hex number prefix.



The **Like** operator performs string comparisons involving wild-card matching. The following example tests whether the contents of a String variable begins with the string "North":

```
If s_state_name Like "North%" Then ...
```

The **Like** operator is similar to the **Like( )** function. For a description of the **Like( )** function, see the *MapBasic Reference* or *MapBasic Help*.

### Date Operators

The plus and minus operators may both be used in date expressions, as summarized below.

Expression	Returns
<code>date + integer</code>	a Date value, representing a later date
<code>date - integer</code>	a Date value, representing an earlier date
<code>date - date</code>	an Integer value, representing the number of elapsed days

The following example uses the **CurDate( )** function to determine the current date, and then calculates other date expressions representing tomorrow's date and the date one week ago:

```
Dim today, one_week_ago, tomorrow As Date,
    days_elapsed As Integer
today = CurDate( )
tomorrow = today + 1
one_week_ago = today - 7
' calculate days elapsed since January 1:
days_elapsed = today - StringToDate("1/1")
```

### Comparison Operators

A comparison operator compares two items of the same general type to produce a logical value of TRUE or FALSE. Comparison operators are often used in conditional expressions (for example, in an **If...Then** statement).

Operator	Returns TRUE if	Example
=	equal to	If a = b Then ...
<>	not equal to	If a <> b Then ...
<	less than	If a < b Then ...
>	greater than	If a > b Then ...
<=	less than or equal to	If a <= b Then ...
>=	greater than or equal to	If a >= b Then ...
Between...And...value	is within range	If x Between f_low And f_high Then...

Each of these comparison operators may be used to compare string expressions, numeric expressions, or date expressions. Note, however, that comparison operators may not be used to compare Object, Pen, Brush, Symbol, or Font expressions.

The Between...And... comparison operator lets you test whether a data value is within a range (for example, X >= 500 And X <= 600). The following **If...Then** statement uses a Between...And... comparison:

```
If x Between 0 And 100 Then
    Note "Data within range."
Else
    Note "Data out of range."
End If
```

The same program could be written another way:

```
If x >= 0 And x <= 100 Then
    Note "Data within range."
Else
    Note "Data out of range."
End If
```

When you use the = operator to compare two strings, MapBasic examines the entire length of both strings, and returns TRUE if the strings are identical. String comparisons are not case sensitive; so this **If...Then** statement considers the two names ("Albany" and "ALBANY") to be identical:

```
Dim city_name As String
city_name = "ALBANY"
If city_name = "Albany" Then
    Note "City names match."
End If
```

If you wish to perform case-sensitive string comparison, use the **StringCompare( )** function, which is described in the *MapBasic Reference*.

**Note:** Be careful when comparing fixed-length and variable-length strings. MapBasic automatically pads every fixed-length string with spaces, if necessary, to ensure that the string fills the allotted space. Variable-length strings, however, are not padded in this manner. Depending on your data and variables, this difference might mean that two seemingly-identical strings are not actually equal.

You can use the **RTrim\$( )** function to obtain a non-padded version of a fixed-length string. You then can compare the value returned by **RTrim\$( )** with a variable-length string, without worrying about interference from padded spaces.

### Logical Operators

Logical operators operate on logical values to produce a logical result of TRUE or FALSE:

Operator	Returns TRUE if	Example
And	both operands are TRUE	If a And b Then...
Or	either operand is TRUE	If a Or b Then...
Not	operand is FALSE.	If Not a Then...

For example, the following **If...Then** statement performs two tests, testing whether the variable x is less than zero, and testing whether x is greater than ten. The program then displays an error message if either test failed.

```
If x < 0 Or x > 10 Then
  Note "Number is out of range."
End If
```

### Geographic Operators

These operators act on Object expressions to produce a logical result of TRUE or FALSE.

Operator	Returns TRUE if	Example
Contains	first object contains centroid of second object	If a Contains b Then...
Contains Part	first object contains part of second object	If a Contains Part b Then...
Contains Entire	first object contains all of second object	If a Contains Entire b Then...
Within	first object's centroid is within second object	If a Within b Then...
Partly Within	part of first object is within second object	If a Partly Within b Then...
Entirely Within	all of first object is within second object	If a Entirely Within b Then...
Intersects	the two objects intersect at some point	If a Intersects b Then...

For a more complete discussion of graphic objects, see [Graphical Objects](#).

## MapBasic Operator Precedence

Some operators have higher precedence than others. This means that in a complex expression containing multiple operators, MapBasic follows certain rules when determining which operations to carry out first. To understand how MapBasic processes complex expressions, you must be familiar with the relative precedence of MapBasic's operators.

Consider the following mathematical assignment:

```
x = 2 + 3 * 4
```

This assignment involves two mathematical operations addition and multiplication. Note that the end result depends on which operation is performed first. If you perform the addition first (adding 2 + 3, to obtain 5), followed by the multiplication (multiplying 5 \* 4), the end result is 20. In practice, however, multiplication has a higher precedence than addition. This means that MapBasic performs the multiplication first (multiplying 3 \* 4, to obtain 12), followed by the addition (adding 2 + 12, to obtain 14).

You can use parentheses to override MapBasic's default order of precedence. The following assignment uses parentheses to ensure that addition is performed before multiplication:

```
x = (2 + 3) * 4
```

The following table identifies the precedence of each MapBasic operator.

Highest priority:	parentheses
	exponentiation
	negation
	multiplication, division, Mod, integer division
	addition, subtraction, string concatenation (&)
	geographic operators, comparison operators, Like
	Not
	And
Lowest Priority:	Or

Operators appearing on the same row have equal precedence. Operators of higher priority are processed first. Operators of the same precedence are evaluated left to right in the expression, except exponentiation, which evaluates from right to left.

## Looping, Branching, and Other Flow-Control

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Flow-control statements affect the order in which other statements are executed. MapBasic has three main types of flow-control statements:

- Branching statements cause MapBasic to skip over certain statements in your program (for example, **If...Then**, **GoTo**).
- Looping statements cause MapBasic to repeatedly execute one or more designated statements in your program (for example, **For...Next**, **Do...While**).
- Other statements provide special flow-control (for example, **End Program**).

## If...Then Statement

MapBasic's **If...Then** statement is very similar to comparable If...Then statements in other languages. The **If...Then** statement tests a condition; if the condition is TRUE, MapBasic executes the statements which follow the **Then** keyword. In the following example, MapBasic displays an error message and calls a sub-procedure if a counter variable is too low:

```
If counter < 0 Then
    Note "Error: The counter is too low."
    Call reset_counter
End If
```

An **If...Then** statement can have an optional **Else** clause. In the event that the original test condition was FALSE, MapBasic executes the statements following the **Else** keyword instead of executing the statements following the **Then** keyword.

The following example demonstrates the optional **Else** clause.

```
If counter < 0 Then
    Note "Error: The counter is too low."
    Call reset_counter
Else
    Note "The counter is OK."
End If
```

An **If...Then** statement can also have one or more optional **Elseif** clauses. The **Elseif** clause tests an additional condition. If the statement includes an **Elseif** clause, and if the original condition turned out to be FALSE, MapBasic will test the **Elseif** clause, as in the following example:

```
If counter < 0 Then
    Note "Error: The counter is too low."
    Call reset_counter
ElseIf counter > 100 Then
    counter = 100
    Note "Error: The counter is too high; resetting to 100."
Else
    Note "The counter is OK."
End If
```

**Note:** **Elseif** is a single keyword. A single **If...Then** statement can include a succession of two or more **Elseif** clauses, subsequently testing for condition after condition. However, if you want to test for more than two or three different conditions, you may want to use the **Do...Case** statement (described below) instead of constructing an **If...Then** statement with a large number of **Elseif** clauses.

## Do Case Statement

The **Do Case** statement performs a series of conditional tests, testing whether a certain expression is equal to one of the values in a list of potential values. Depending on which value the expression matches (if any), MapBasic carries out a different set of instructions.

The following example tests whether the current month is part of the first, second, third, or fourth quarter of the fiscal year. If the current month is part of the first quarter (January-February-March), the program assigns a text string an appropriate title ("First Quarter Results"). Alternately, if the current month is part of the second quarter, the program assigns a different title ("Second Quarter Results"), etc.

```
Dim current_month, quarter As SmallInt,
    report_title As String
current_month = Month( CurDate() )
' At this point, current_month is 1 if current date
' is in January, 2 if current date is in February, etc.
```

```
Do Case current_month
  Case 1, 2, 3
    ' If current month is 1 (Jan), 2 (Feb) or 3 (Mar),
    ' we're in the First fiscal quarter.
    ' Assign an appropriate title.
    report_title = "First Quarter Results"
    quarter = 1
  Case 4, 5, 6
    report_title = "Second Quarter Results"
    quarter = 2
  Case 7, 8, 9
    report_title = "Third Quarter Results"
    quarter = 3
  Case Else
    '
    ' If current month wasn't between 1 and 9, then
    ' current date must be in the Fourth Quarter.
    '
    report_title = "Fourth Quarter Results"
    quarter = 4
End Case
```

**Note:** **Case Else** is an optional clause of the **Do Case** statement. If a **Do Case** statement includes a **Case Else** clause, and if none of the previous Case clauses matched the expression being tested, MapBasic carries out the statements following the **Case Else** clause. The **Case Else** clause must be the final clause in the **Do Case** construction.

## GoTo Statement

The **GoTo** statement tells MapBasic to go to a different part of the program and resume program execution from that point. The **GoTo** statement specifies a label. For the **GoTo** statement to work, there must be a label elsewhere within the same procedure. A label is a name which begins a line. Each label must end with a colon (although the colon is not included in the **GoTo** statement). See the example below.

```
If counter < 0 Then
  GoTo get_out
End If
...
get_out:
End_Program
```

Many programming professionals discourage the use of **GoTo** statements. Careful use of other flow-control statements, such as **If...Then**, usually eliminates the need to use **GoTo** statements. Thus, if you like, you may avoid using **GoTo** statements.

## For...Next Statement

The **For...Next** statement sets up a loop that executes a specific number of times. With each iteration of the loop, MapBasic executes all statements that appear between the **For** and **Next** clauses. When creating a **For...Next** loop, you must specify the name of a numeric variable as a counter. You must also specify that counter variable's starting and ending values. With each iteration of the loop, MapBasic increments the counter variable by some step value. By default, this step value is one. To use a different increment, include the optional **Step** clause.

The following example uses a **For...Next** loop to add the values from an array of numbers:

```
Dim monthly_sales(12), grand_total As Float,
  next_one As SmallInt
...
For next_one = 1 To 12
  grand_total = grand_total + monthly_sales(next_one)
Next
```

At the start of the **For...Next** statement, MapBasic assigns the start value to the counter variable. In the example above, MapBasic assigns a value of one to the variable: `next_one`. MapBasic then executes the statements that appear up to the **Next** keyword. After each iteration of the loop, MapBasic increments the counter variable. If the counter variable is less than or equal to the end value (for example, if `next_one` is less than or equal to twelve), MapBasic performs another iteration of the loop.

A **For...Next** loop halts immediately if it encounters an **Exit For** statement. This allows you to conditionally halt the loop prematurely.

See the *MapBasic Reference* for more information on the **For...Next** loop.

## Do...Loop

The **Do...Loop** statement continually executes a group of statements for as long as a test condition remains TRUE or, optionally, for as long as the condition remains FALSE.

There are different forms of the **Do...Loop** statement, depending on whether you want to test the looping condition before or after the body of the statements that are executed. The following program tests the loop condition at the end of the loop:

```
Dim sales_total, new_accounts(10) As Float,
    next_one As SmallInt
next_one = 1
Do
    sales_total = sales_total + new_accounts(next_one)
    next_one = next_one + 1
Loop While next_one <= UBound(new_accounts)
```

Note that the preceding loop always executes for at least one iteration, because the looping condition is not tested until the end of the loop.

The following loop tests the loop condition at the start of the loop. Because the condition is tested at the start of the loop, the statements within the body of the loop may never be executed. If the test condition is FALSE from the beginning, the statements within the following **Do...Loop** will never be executed.

```
Dim sales_total, new_accounts(10) As Float,
    next_one As SmallInt
next_one = 1
Do While next_one <= UBound(new_accounts)
    sales_total = sales_total + new_accounts(next_one)
    next_one = next_one + 1
Loop
```

In the examples above, both **Do...Loop** statements included the keyword **While**; thus, both loops continue while the test condition remains TRUE. Alternately, a **Do...Loop** can use the **Until** keyword instead of the keyword **While**. If a **Do...Loop** statement specifies **Until**, the loop will continue only for as long as the test condition remains FALSE.

A **Do...Loop** statement halts immediately if it encounters an **Exit Do** statement. This statement allows you to conditionally terminate a loop prematurely.

## While...Wend Loop

MapBasic supports the conventional BASIC **While...Wend** loop syntax. A **While...Wend** statement is very similar to a **Do While...Loop** statement.

If you are an experienced BASIC programmer, and you therefore are in the habit of using **While...Wend** statements, you can continue to use **While...Wend** statements as you use MapBasic. Note, however, that the **Do...Loop** statement syntax is in some ways more powerful than the **While...Wend** syntax. You can exit a **Do...Loop** statement prematurely, through the **Exit Do** statement, but there is no corresponding statement for exiting a **While...Wend** loop.

See the *MapBasic Reference* for more information on the **While...Wend** loop.

## Ending Your Program

The **End Program** statement halts the MapBasic application, removes any custom menu items created by the application, and removes the application from memory. **End Program** also closes any files opened by the application (through the **Open File** statement), but it does not close any open tables.

The **End Program** statement is not required. In fact, there are situations where you should be careful not to issue an **End Program** statement. For example, if your application adds menu items to a MapInfo Pro menu, you probably want your application to remain running for the duration of the MapInfo Pro session, because you want your custom menu items to remain available for the entire session. In such cases, you should be careful not to issue the **End Program** statement, because it would halt your application and remove your application's custom menu items. For a complete discussion of custom menus, see [Creating the User Interface](#).

## Ending Your Program and MapInfo Pro

The **End MapInfo** statement halts the MapBasic application (much as the **End Program** statement does), and then exits the MapInfo Pro software as well.

# Procedures

---

Procedures (often referred to as sub-procedures) are an integral part of the MapBasic program architecture. A typical MapBasic program is comprised of numerous sub-procedures; each sub-procedure contains a group of statements that perform a specific task. By breaking your program into several sub-procedures, you modularize your program, making program development and maintenance easier in the long run.

## Main Procedure

Every MapBasic program has at least one procedure, known as the Main procedure. When you run a MapBasic application, MapBasic automatically calls that application's Main procedure.

The following program demonstrates the syntax for explicitly declaring the Main procedure. In this example, the Main procedure simply issues a **Note** statement:

```
Declare Sub Main
  Sub Main
    Note "Hello from MapBasic!"
  End Sub
```

The **Declare Sub** statement tells MapBasic that a sub-procedure definition will occur further down. You must have one **Declare Sub** statement for each sub-procedure in your program. The **Declare Sub** statement must appear before the actual sub-procedure definition. Typically, **Declare Sub** statements appear at or near the top of your program.

You may recall from [Using the Development Environment](#) that a MapBasic program can be as simple as a single line. For example, the following statement:

```
Note "Hello from MapBasic!"
```

is a complete MapBasic program which you can compile and run. Note that even a simple, one-line program has a Main procedure. However, in this case, we say that the Main procedure is implied rather than being explicit.



## Calling a Procedure

When you run a compiled application, MapInfo Pro automatically calls the Main procedure (regardless of whether the Main procedure is implied or explicitly defined). The Main procedure can then call other sub-procedures through the **Call** statement.

The following program contains two procedures: a Main procedure, and a procedure called `announce_date`.

```
Declare Sub Main
  Declare Sub announce_date

  Sub Main
    Call announce_date( )
  End Sub

  Sub announce_date
    Note "Today's date is " + Str$( CurDate() )
  End Sub
```

## Calling a Procedure That Has Parameters

Like other modern BASIC languages, MapBasic lets you create sub-procedures which take parameters. If a sub-procedure takes parameters, they are declared within parentheses which follow the procedure name in the **Sub...End Sub** statement.

The following example shows a sub-procedure called `check_date`, which takes one parameter (a Date value). The sub-procedure checks to see whether the value of the Date parameter is too old (more than 180 days old). If the Date parameter value is too old, the procedure sets the Date parameter to the current date.

```
Declare Sub Main
  Declare Sub check_date(last_date As Date)

  Sub Main
    Dim report_date As Date
    report_date = "01/01/94"
    Call check_date( report_date )
    ' At this point, the variable: report_date
    ' may contain the current date (depending on
    ' what happened in the check_date procedure).

  End Sub

  Sub check_date(last_date As Date)
    Dim elapsed_days As SmallInt
    elapsed_days = CurDate() - last_date
    If elapsed_days > 180 Then
      last_date = CurDate()
    End If
  End Sub
```

## Passing Parameters By Reference

By default, each MapBasic procedure parameter is passed by reference. When a parameter is passed by reference, the following rules apply:

- The **Call** statement must specify the name of a variable for each by-reference parameter.

- If the called sub-procedure assigns a new value to a by-reference parameter, the new value is automatically stored in the caller's variable. In other words, the sub-procedure can use a by-reference parameter to return a value to the caller.

Thus, in the example above, the **Call** statement specifies the name of a Date variable `report_date`:

```
Call check_date( report_date )
```

Then, within the `check_date` procedure, the parameter is known by the name `last_date`. When the `check_date` procedure performs the assignment `last_date = CurDate( )`, MapBasic automatically updates the Main procedure's `report_date` variable.

## Passing Parameters By Value

Sometimes, it is awkward to pass parameters by reference. For each by-reference parameter, you must specify the name of a variable in your **Call** statement. At times, you may find this awkward (for example, because you may not have a variable of the appropriate type).

Like other modern BASIC languages, MapBasic lets you specify that a procedure parameter will be passed by value rather than by reference. To specify that a parameter be passed by value, include the keyword **ByVal** before the parameter's name in the **Sub...End Sub** statement.

When a parameter is passed by value, the following rules apply:

- The **Call** statement does not need to specify the name of a variable as the parameter. The **Call** statement may specify a variable name, a constant value or some other expression.
- If the called sub-procedure assigns a new value to a by-value parameter, the calling procedure is not affected. In other words, the sub-procedure cannot use a by-value parameter to return a value to the caller.

The following example shows a procedure (`display_date_range`) which takes two by-value Date parameters.

```
Declare Sub Main
  Declare Sub display_date_range(ByVal start_date As Date,
    ByVal end_date As Date )

  Sub Main
    Call display_date_range( "1/1", CurDate() )
  End Sub

  Sub display_date_range(ByVal start_date As Date,
    ByVal end_date As Date )
    Note "The report date range will be: " + Str$(start_date)
      + " through " + Str$(end_date) + "."
  End Sub
```

In this example, both of the parameters to the `display_date_range` procedure are by-value date parameters. Thus, when the Main procedure calls `display_date_range`:

```
Call display_date_range( "1/1", CurDate() )
```

neither of the parameters needs to be a Date variable. The first parameter ("1/1") is a constant Date expression, and the second parameter is a date expression derived by calling the **CurDate( )** function.

## Calling Procedures Recursively

The MapBasic language supports recursive function and procedure calls. In other words, a MapBasic procedure can call itself.

Programs that issue recursive procedure or function calls may encounter memory limitations. Each time a program makes a recursive call, MapInfo Pro must store data on the stack; if too many nested recursive

calls are made, the program may generate an out-of-memory error. The amount of memory used up by a recursive call depends on the number of parameters and local variables associated with the procedure or function.

## Procedures That Act As System Event Handlers

Some procedure names have special meaning in MapBasic. For example, as we have seen, the sub-procedure named `Main` is special, since MapBasic automatically calls the `Main` procedure when you run an application.

In addition to `Main`, MapBasic has several other special procedure names: **EndHandler**, **ForegroundTaskSwitchHandler**, **RemoteMapGenHandler**, **RemoteMsgHandler**, **RemoteQueryHandler** ( ), **SelChangedHandler**, **ToolHandler**, **WinChangedHandler**, **WinClosedHandler**, and **WinFocusChangedHandler**. Each of these reserved procedure names plays a special role in MapBasic programming. To fully understand how they work, you need to understand MapBasic's approach to system events and event-handling.

### What Is a System Event?

In a Graphical User Interface environment, the user controls what happens by typing and by using the mouse. Technically, we say that mouse-clicks and other actions taken by the user generate system events. There are many different kinds of events; for example, when the user chooses a menu item, we say that the user has generated a menu-choose event, and when the user closes a window, we say the user has generated a window-close event.

### What Is an Event Handler?

An event-handler is part of a MapBasic program which responds to a system event. Once the user has generated an event, the application must respond accordingly. For instance, when the user generates a menu-choose event, the software may need to display a dialog box. Alternately, when the user generates a window-close event, the software may need to gray out a menu item or hide an entire menu.

In MapBasic, sub-procedures can act as event-handlers. In other words, you can construct your program in such a way that MapBasic automatically calls one of your sub-procedures when and if a certain system event occurs.

To build event-handlers that respond to menu or button-pad choices, see [Creating the User Interface](#). To build any other types of system event-handlers, you must define a sub-procedure with a special name. For example, if you want your program to respond automatically whenever the user closes a window, your application must contain a procedure named **WinClosedHandler**.

The following table lists all of MapBasic's special handler names. These special handlers are discussed in more detail in the *MapBasic Reference* and *MapBasic Help*.

Special Handler Name	Nature of Handler Procedure or Function
EndHandler	Called when the application terminates or when the user exits MapInfo Pro. <b>EndHandler</b> can be used to do clean-up work (for example, deleting temporary work files).
ForegroundTaskSwitchHandler	Called when MapInfo Pro gets the focus (becomes the active application) or loses the focus.
RemoteMapGenHandler	Called when an OLE Automation client calls the MapGenHandler method; used primarily in MapInfo ProServer applications.

Special Handler Name	Nature of Handler Procedure or Function
RemoteMsgHandler	Called when the application is acting as the server in an interprocess conversation, and the remote client sends an execute request.
RemoteQueryHandler( )	Called when the application is acting as the server in an interprocess conversation, and the remote client sends a peek request.
SelChangedHandler	Called whenever the Selection table changes. Since the Selection table changes frequently, the SelChangedHandler procedure should be as brief as possible to avoid slowing system performance.
ToolHandler	Called when the user clicks in a <b>Map</b> , <b>Browser</b> , or <b>Layout</b> window using the MapBasic tool.
WinChangedHandler	Called when the user pans, scrolls, or otherwise resets the area displayed in a Mapper. Since Mapper windows can change frequently, the WinChangedHandler procedure should be as brief as possible to avoid slowing system performance.
WinClosedHandler	Called when the user closes a Mapper, Browser, Grapher, or Layout.
WinFocusChangedHandler	Called when the window focus changes (i.e., when the user changes which window is the active window).

Typically, you do not use the **Call** statement to call the special procedures listed above. If your program contains one of these specially named procedures, MapBasic calls that procedure automatically, when and if a certain type of system event occurs. For example, if your program contains a procedure called **WinClosedHandler**, MapBasic automatically calls the **WinClosedHandler** procedure every time the user closes a window.

All of the special handler procedures are optional. Thus, you should only include a **WinClosedHandler** procedure in your application if you want your application to be notified every time a window is closed. You should only include a **SelChangedHandler** procedure in your application if you want your application to be notified each time Selection changes, etc.

The following program defines a special event-handler procedure named **ToolHandler**. Note that this program does not contain any **Call** statements. Once this program is running, MapBasic calls the **ToolHandler** procedure automatically, when and if the user selects the MapBasic tool and clicks on a **Map**, **Browser**, or **Layout** window.

```

Include "mapbasic.def"

Declare Sub Main
Declare Sub ToolHandler

Sub Main
  Note "The ToolHandler demonstration is now in place. "
  + "Select the MapBasic tool (+) and click on a Map "
  + "to see a printout of map coordinates."
End Sub
Sub ToolHandler
  If WindowInfo( FrontWindow(), WIN_INFO_TYPE ) = WIN_MAPPER Then
    Print "X: " + Str$( CommandInfo(CMD_INFO_X) )
    Print "Y: " + Str$( CommandInfo(CMD_INFO_Y) )
    Print " "
  End If
End Sub

```

Within a system event handler procedure, you can call the **CommandInfo( )** function to learn more about the event that made MapBasic call the handler. In the example above, the **ToolHandler** procedure calls **CommandInfo( )** to determine the map coordinates where the user clicked.

The following sample **SelChangedHandler** procedure appears in the sample program, TextBox (textbox.mb). This procedure automatically disables (grays out) a menu item whenever the user de-selects all rows, and automatically re-enables the menu item whenever the user selects more rows.

See `textbox.mb` for more details.

```
Sub SelChangedHandler
  If SelectionInfo(SEL_INFO_NROWS) < 1 Then
    Alter Menu Item create_sub Disable
  Else
    Alter Menu Item create_sub Enable
  End If
End Sub
```

## When Is a System Event Handler Called?

By default, a MapBasic application terminates after executing all statements in the **Main** procedure. However, if an application contains one or more of the special handler procedures listed above (for example, if an application contains a **ToolHandler** procedure), the application remains in memory after the **Main** procedure is finished. An application in this state is said to be sleeping. A sleeping application remains dormant in memory until an appropriate event occurs (for example, until the user clicks with the MapBasic tool). When the event occurs, MapBasic automatically calls the sleeping application's handler procedure.

**Note:** If any procedure in an application issues the **End Program** statement, the entire application is removed from memory, regardless of whether the application contains special handler procedures. You must avoid using the **End Program** statement for as long as you want your program to remain available.

Custom MapBasic menus work in a similar manner. If a MapBasic application adds its own items to the MapInfo Pro menu structure, the application goes to sleep and waits for the user to choose one of the custom menu items. For a complete discussion of how to customize MapInfo Pro's menus, see [Creating the User Interface](#).

## Tips for Handler Procedures

### Keep Handler Procedures Short

Bear in mind that some system event-handler procedures are called frequently. For example, if you create a **SelChangedHandler** procedure, MapInfo Pro calls the procedure every time the Selection table changes. In a typical MapInfo Pro session, the Selection table changes frequently, therefore, you should make event-handler procedures, such as **SelChangedHandler**, as short as possible.

### Selecting Without Calling SelChangedHandler

If you are using a **Select** statement, but you do not want the statement to trigger the **SelChangedHandler** procedure, include the **NoSelect** keyword. For example:

```
Select * From World Into EarthQuery NoSelect
```

## Preventing Infinite Loops

Performing actions within a system handler procedure can sometimes cause an infinite loop. For example, if you declare a **SelChangedHandler** procedure, MapInfo Pro calls that procedure whenever the selection changes. If you issue a **Select** statement inside of your **SelChangedHandler** procedure, the **Select** statement will cause MapInfo Pro to call the procedure again in a recursive call. The end result can be an infinite loop, which continues until your program runs out of memory.

The **Set Handler** statement can help prevent infinite loops. At the start of your handler procedure, issue a **Set Handler...Off** statement to prevent recursive calling of the handler. At the end of the procedure, issue a **Set Handler...On** statement to restore the handler.

```
Sub SelChangedHandler
  Set Handler SelChangedHandler Off

  ' Issuing a Select statement here
  ' will not cause an infinite loop.

  Set Handler SelChangedHandler On
End Sub
```

## Custom Functions

The MapBasic language supports many different functions. Some are standard BASIC functions (for example, **Asc( )**, **Format\$( )**, **Val( )**, etc.) and some are unique to MapInfo Pro and MapBasic (for example, **Distance( )** and **ObjectGeography( )**). MapBasic also lets you define custom functions. Once you have defined a custom function, you can call that function just as you can call any of MapBasic's standard functions.

The body of a custom function is defined within a **Function...End Function** construction, which is syntactically very similar to a **Sub...End Sub** construction. The general syntax of a **Function...End Function** construct is as follows:

```
Function function_name( parameters, if any ) As data_type
  statement list
End Function
```

The function itself has a data type. This dictates which type of value (for example, Integer, Date, String) the function returns when called.

Within the body of the **Function...End Function** construction, the function name acts like a by-reference parameter. A statement within the **Function...End Function** construction can assign a value to the function name; this is the value that MapBasic later returns to the function's caller.

The example below defines a custom function called `money_format( )`. The `money_format( )` function takes one numeric parameter (presumably representing a sum of money), and returns a string (obtained by calling the **Format\$( )** function) representing the dollar amount, formatted with commas.

```
Declare Sub Main
  Declare Function money_format(ByVal num As Float) As String
  Sub Main
    Dim dollar_amount As String
    dollar_amount = money_format( 1234567.89 )
    ' dollar_amount now contains the string: "$1,234,567.89"
  End Sub
```

```
Function money_format(ByVal num As Float) As String
  money_format = Format$(num, "$,#.##;($,#.##)")
End Function
```

## Scope of Functions

A program can define a custom function that has the same name as a standard MapBasic function. When the program calls the function, the custom function is executed instead of the standard function.

## Compiler Instructions

MapBasic provides two special statements which make it easier to manage large-scale application development:

- The **Define** statement lets you define a shorthand identifier which has a definition; the definition is substituted for the identifier at compile time.
- The **Include** statement lets you combine two or more separate program files into one compilable program.

### The Define Statement

Through the **Define** statement, you can define an identifier which acts as a shorthand equivalent for some specific value.

Use a **Define** statement whenever you find yourself frequently typing an expression that is difficult to remember or to type.

For example, if your program deals extensively with objects and object colors, you might find that you frequently need to type in the value 16711680, a numeric code representing the color red. Typing such a long number quickly becomes tedious. To spare yourself the tedium of typing in 16711680, you could place the following **Define** statement in your program:

```
Define MY_COLOR 16711680
```

This **Define** statement creates an easy-to-remember shorthand keyword (MY\_COLOR) representing the number 16711680. After you enter this **Define** statement, you can simply type MY\_COLOR in every place where you would have typed 16711680. When you compile your program, MapBasic will assign each occurrence of MY\_COLOR a value of 16711680.

There are long-term benefits to using defined keywords. Suppose that you develop a large application which includes many references to the identifier MY\_COLOR. Lets presume that you then decide that red is not a good color choice, and you want to use green (65280) instead. You could easily make the switch from red to green simply by changing your **Define** statement to read:

```
Define MY_COLOR 65280
```

The standard MapBasic definitions file, `mapbasic.def`, contains many **Define** statements, including statements for several commonly-used colors (BLACK, WHITE, RED, GREEN, BLUE, CYAN, MAGENTA, and YELLOW). Use the **Include** statement to incorporate `mapbasic.def` into your program.

### The Include Statement

Through the **Include** statement, you can incorporate two or more separate program files into one MapBasic application. The **Include** statement has the following syntax:

```
Include "filename"
```

where *filename* is the name of a text file containing MapBasic statements. When you compile a program that contains an **Include** statement, the compiler acts as if the included text is part of the program being compiled.

Many MapBasic applications use the **Include** statement to include the standard MapBasic definitions file, `mapbasic.def`:

```
Include "mapbasic.def"
```

`mapbasic.def` provides **Define** statements for many standard MapBasic identifiers (TRUE, FALSE, RED, GREEN, BLUE, TAB\_INFO\_NAME, etc.).

The filename that you specify can include a directory path. If the filename that you specify does not include a directory path, the MapBasic compiler looks for the file in the current working directory. If the file is not found in that directory, the compiler looks in the directory where the MapBasic software is installed.

As you develop more and more MapBasic programs, you may find that you use certain sections of code repeatedly. Perhaps you have written a library of one or more custom functions, and you wish to use those custom functions in every MapBasic program that you write. You could put your custom functions into a separate text file, perhaps calling the text file `functs.mb`. You could then incorporate the function library into another program by issuing the statement:

```
Include "functs.mb"
```

Using **Include** statements also lets you work around the memory limitations of the MapBasic text editor. As discussed in [Using the Development Environment](#), each MapBasic **Edit** window is subject to memory limits; once a program file grows too large, you can no longer add statements to the file using a MapBasic **Edit** window. If this happens, you may want to break your program into two or more separate program files, then combine the files using the **Include** statement. Alternately, you could combine the separate modules using a project file; see [Using the Development Environment](#) for details.

## Program Organization

---

A MapBasic application can include any or all of the different types of statements described in this chapter. However, the different pieces of a MapBasic program must be arranged in a particular manner. For example, **Global** statements may not be placed inside of a **Sub...End Sub** definition.

The following illustration shows a typical arrangement of the various program components.

Global level statements appear at the top of the program...

```
Include "mapbasic.def"  
  other Include statements  
  Type...End Type statements  
  Declare Sub statements  
  Declare Function statements  
  Define statements  
  Global statements
```

...followed by the Main procedure definition...

```
Sub Main  
  Dim statements  
  ...  
End Sub
```



...followed by additional sub-procedure definitions...

```
Sub ...  
  Dim statements  
  ...  
End Sub
```

...and custom Function definitions...

```
Function ...  
  Dim statements  
  ...  
End Function
```



# Debugging and Trapping Runtime Errors

Even if your program compiles successfully, it may still contain runtime errors (errors that occur when you run your program). For example, if your program creates large database files, the program may generate an error condition if you run it when there is no free disk space.

This chapter shows you how to deal with runtime errors. This is a two-step process: first, you debug your program to find out where the error occurs; then, you modify your program to prevent the error from happening again.

## In this section:

- **Runtime Error Behavior** .....76
- **Debugging a MapBasic Program** .....76
- **Error Trapping** .....78

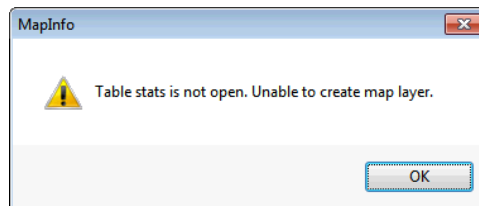
## Runtime Error Behavior

There are two main types of programming errors: compilation errors and runtime errors. Compilation errors, discussed in [Using the Development Environment](#), are syntax errors or other typographical mistakes that prevent a program from compiling successfully.

Runtime errors are errors that occur when the user actually runs an application. Runtime errors occur for various reasons; often, the reason has to do with precise conditions that exist at runtime. For example, the following statement compiles successfully:

```
Map From stats
```

However, if there is no table named "stats," this program generates a runtime error. When a runtime error occurs, MapInfo Pro halts the MapBasic application, and displays a dialog box describing the error.



The error message identifies the name of the program file and the line number at which the error occurred. In the example above, the name of the program is **map\_it**, and the line number containing the error is 16. This line number identifies which part of your program caused the runtime error. Once you know the line number, you can return to the MapBasic development environment and use the **Go To Line** command (on the **Search** menu) to locate the statement that caused the problem.

## Debugging a MapBasic Program

Some runtime errors are easy to correct. For example, some runtime errors can be caused by modest typing errors (for example, in the example above, the programmer probably meant to enter the table name as STATES instead of STATS). Other errors, however, can be harder to locate. To help you detect and correct bugs in your program, MapBasic provides debugging tools (the **Stop** and **Continue** statements) which work in conjunction with MapInfo Pro's **MapBasic** window.

### Summary of the Debugging Process

If part of your program is not working correctly, you can use the following procedure to identify where the problem occurs:

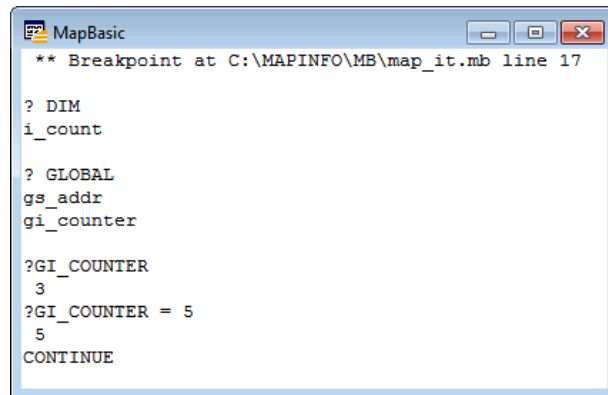
1. Within the MapBasic development environment, edit your program, and place a **Stop** statement just before the part of your program that seems to be failing.
2. Recompile and run your program.

When your program reaches the **Stop** statement, MapBasic temporarily suspends execution of your program and displays a debugging message in the **MapBasic** window (for example, "Breakpoint at `textbox.mb` line 23").

3. Within the **MapBasic** window:

- Type `? Dim` to see a list of all local variables that are in use.

- Type `? Global` to see a list of all global variables that are in use.
  - Type `? variable_name` to see the current contents of a variable.
  - Type `? variable_name = new_value` to change the contents of that variable.
4. When you are finished examining and modifying the contents of variables, type `Continue` in the **MapBasic** window to resume program execution. In MapInfo Pro, on the **HOME** tab, click **Tools**, and **Continue MapBasic Program**. Note that while a program is suspended, the **Tools** menu contains a **Continue MapBasic Program** command instead of a **Run MapBasic Program** command.



```

MapBasic
** Breakpoint at C:\MAPINFO\MB\map_it.mb line 17

? DIM
i_count

? GLOBAL
gs_addr
gi_counter

?GI_COUNTER
3
?GI_COUNTER = 5
5
CONTINUE

```

## Limitations of the Stop Statement

In the following cases, MapBasic does not allow you to suspend a program through the **Stop** statement:

- You may not use a **Stop** statement within a custom **Function...End Function** construct.
- You may not use a **Stop** statement within a dialog box control handler, because while the handler is active, the dialog box is still on the screen.
- You may not use a **Stop** statement within a `ProgressBar` handler.
- You may not debug one program while another program is running.
- Through the **Run Application** statement, one MapBasic application can "spawn" another application. However, you may not use the **Stop** statement to suspend execution of the spawned application.

Even without using the **Run Application** statement, it is possible to run separate MapBasic programs at one time. For example, if you run the `TextBox` application, `TextBox` creates its own custom menu, then remains sleeping until you choose an item from that menu. After loading `TextBox`, you can run other MapBasic applications. However, you may not use the **Stop** statement while you have multiple applications running simultaneously.

## Other Debugging Tools

MapBasic's **Note** and **Print** statements are also helpful when debugging a program. For example, if you wish to observe the contents of a variable as it changes, simply add a **Print** statement to your program:

```
Print "Current value of counter: " + counter
```

to print a message to MapBasic's **Message** window. The sample program `AppInfo.mbx` allows you to examine the values of global variables in any MapBasic applications that are running.

## Error Trapping

A well-designed program anticipates the possibility of runtime errors and includes precautions whenever possible. Intercepting and dealing with runtime errors is known as error trapping. In MapBasic, error trapping involves using the **OnError** statement.

Veteran BASIC programmers take note: in MapBasic, **OnError** is a single keyword.

At any point during execution, error trapping is either enabled or disabled. By default, all procedures and functions start with error trapping disabled. The **OnError** statement enables error trapping.

Typically, **OnError** specifies a label that must appear at another location in the same procedure or function. The statements following the label are known as the error-trapping routine. If an error occurs while an error-trapping routine has been enabled, MapBasic jumps to the specified label and executes the error-trapping routine instead of halting the application.

Within the error-trapping routine, you can call the **Err( )** function to obtain an Integer code indicating which error occurred. Similarly, **Error\$( )** returns a string describing the error message. For a complete listing of potential MapBasic error codes and their descriptions, see the text file `errors.doc` which is included with MapBasic. Each error-trapping routine ends with a **Resume** statement. The **Resume** statement tells MapBasic which line to go to once the error-trapping routine is finished.

For more about error trapping, see **OnError**, **Resume**, **Err( )** and **Error\$( )** in the *MapBasic Reference*.

**Note:** MapBasic can only handle one error at a time. If you enable error-trapping and then an error occurs, MapBasic jumps to your error-handling routine. If another error occurs within the error-handling routine (i.e., before the **Resume** statement), your MapBasic application halts.

### Example of Error Trapping

The program below opens a table called orders and displays it in **Map** and **Browse** windows. An error-trapping routine called `bad_open` handles any errors that relate to the **Open Table** statement. A second error-trapping routine called `not_mappable` handles errors relating to the **Map** statement.

```
Sub orders_setup
  ' At the start, error trapping is disabled
  OnError Goto bad_open
  ' At this point, error trapping is enabled, with
  ' bad_open as the error-handling routine.
  Open Table "orders.tab"
  OnError Goto not_mappable

  ' At this point, error trapping is enabled, with
  ' not_mappable as the new error-handling routine.
  Map From orders
  OnError Goto 0
  Browse * From orders

last_exit:
Exit Sub
  ' The Exit Sub prevents the program from
  ' unintentionally executing the error handlers.

bad_open:
  ' This routine called if Open statement had an error.
  Note "Couldn't open the table Orders... Halting."
  Resume last_exit

not_mappable:
  ' This routine called if the Map statement had an error
  Note "No map data; data will only appear in Browser."
```

```
Resume Next  
End Sub
```

The statement `OnError Goto bad_open` enables error trapping. If an error occurs because of the **Open Table** statement, MapBasic jumps to the error-trapping routine at the label `bad_open`. The error-trapping routine displays an error message, then issues a **Resume** statement to resume execution at the label `last_exit`.

If the **Open Table** statement is successful, the program then issues the statement `OnError Goto not_mappable`. This line resets the error trapping, so that if the `Map` statement generates an error, MapBasic jumps to `not_mappable`. The `not_mappable` error-trapping routine displays a message telling the user why no **Map** window was presented, and then executes a **Resume Next** statement. The **Resume Next** statement tells MapBasic to skip the line that generated the error, and resume with the following statement.

The `OnError Goto 0` statement disables error trapping. Thus, if an error occurs as a result of the **Browse** statement, that error is not trapped, and program execution halts.





# Creating the User Interface

The user interface is an important part of every application. MapBasic provides you with all the tools you need to customize MapInfo Pro's user interface.

## In this section:

- **Introduction to MapBasic User Interface Principles . . . .82**
- **Event-Driven Programming . . . . .82**
- **Menus . . . . .83**
- **Standard Dialog Boxes . . . . .93**
- **Custom Dialog Boxes . . . . .95**
- **Windows . . . . .103**
- **ButtonPads (Toolbars) . . . . .113**
- **Cursors . . . . .120**
- **Integrating Your Application Into MapInfo Pro . . . . .121**
- **Loading Applications Through the Startup Workspace .121**
- **Manipulating Workspaces through MapBasic . . . . .122**

# Introduction to MapBasic User Interface Principles

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By writing a MapBasic program, you can create a custom user interface for MapInfo Pro. A MapBasic program can control the following elements of the user interface:

- **Menus:** MapBasic programs can add custom menu items to existing menus, remove menus from the menu bar, and create entirely new menus.
- **Dialog boxes:** MapBasic programs can display custom dialog boxes, tailored to fit the users' needs.
- **Windows:** MapBasic programs can display standard types of MapInfo Pro windows (for example, **Map** and **Browse** windows) and customize the contents of those windows. MapBasic can also display messages in a special window (the **Message** window) and on the MapInfo Pro status bar.
- **ButtonPads** (also known as toolbars): MapBasic programs can add custom buttons to existing ButtonPads, or create entirely new ButtonPads. MapInfo Pro includes a special ButtonPad, Tools, to provide a place where MapBasic utilities can add custom buttons. For example, the ScaleBar application adds its custom button to the Tools pad.

The sample application, OverView, demonstrates many aspects of a custom interface created in MapBasic. When the user runs OverView, MapBasic adds custom items to the Tools menu. If the user chooses the custom Setup Overview menu item, MapBasic displays a custom dialog box. If the user chooses a table from this dialog box, MapBasic opens a new **Map** window to display the table.

## Event-Driven Programming

---

MapBasic follows a programming model known as event-driven programming. To understand how a MapBasic program can create a custom user interface, you must first understand the basic principles of event-driven programming.

### What Is an Event?

In a Graphical User Interface environment, the user controls what happens by typing and by using the mouse. Technically, we say that mouse-clicks and other actions taken by the user generate events. There are many different kinds of events; for example, when the user chooses a menu item, we say that the user has generated a menu-choose event, and when the user closes a window, we say the user has generated a window-close event.

### What Happens When The User Generates A Menu Event?

When the user generates an event, the software must respond accordingly. Thus, when the user chooses a menu item, the software may need to display a dialog box or, depending on which menu item the user chooses, the software may need to take some other action, such as opening or closing a table or a window. In general, when the user generates an event, we say that the software handles the event.

If a MapBasic application creates a custom menu, and the user chooses an item from that menu, the MapBasic application handles the menu-choose event. Typically, the MapBasic application handles the event by calling a procedure. In this situation, we say that the procedure acts as an event-handler, or handler for short.

Thus, creating custom menu items is typically a two-step process:

1. Customize the MapInfo Pro menu structure, using statements such as **Create Menu** or **Alter Menu**.
2. Specify a handler for each custom menu item. A handler can be a sub-procedure that appears elsewhere in your program. Set up each handler procedure to perform whatever tasks are appropriate

for the corresponding menu item(s). Alternately, instead of specifying a procedure as the menu item's handler, you can specify that the menu item call a standard MapInfo Pro command. Thus, you could create a custom menu item that invokes the **Create Thematic Map** command (from MapInfo Pro's **Map** menu).

As noted in [Using the Development Environment](#), the **Call** statement lets you call a sub-procedure. However, when a sub-procedure acts as an event-handler, you do not issue any **Call** statements. Instead of issuing **Call** statements, you include a **Calling** clause within the **Create Menu** statement.

For example, the `TextBox` application issues the following **Create Menu** statement:

```
Create Menu "TextBox" As
  "&Create Text Boxes..." Calling create_sub,
  "Close TextBox" Calling Bye,
  "About TextBox..." Calling About
```

This statement creates a custom menu with several menu items, each of which contains a **Calling** clause (for example, `Calling create_sub`). Each **Calling** clause identifies the name of a procedure that appears elsewhere in the `TextBox.mb` program. Thus, `create_sub`, `Bye`, and `About` are all sub-procedure names.

When and if the user chooses the **Create Text Boxes** item from the **TextBox** menu, MapBasic automatically calls the `create_sub` procedure. Thus, the `create_sub` procedure acts as the handler for that menu item.

## How Does a Program Handle ButtonPad Events?

Each button on a custom MapBasic ButtonPad has a handler procedure. Like the **Create Menu** statement, the **Create ButtonPad** statement contains a **Calling** clause which lets you designate a handler procedure. When the user works with a custom button, MapBasic calls the sub-procedure that you named in the **Create ButtonPad** statement.

MapBasic lets you create different types of custom buttons. With custom PushButtons, MapBasic calls the button's handler the moment the user chooses the button. With custom ToolButtons, MapBasic only calls the button's handler if the user chooses the tool and then clicks on a window. For more information, see [ButtonPads \(Toolbars\)](#).

## How Does a Program Handle Dialog Box Events?

Custom MapBasic dialog boxes can call handler procedures. Thus, if you create a custom dialog box that contains a check-box, MapBasic can call a handler procedure each time the user checks or clears the check-box. However, depending on your application, you may not need to create handlers for your dialog boxes. For a discussion of custom dialog boxes, see [Custom Dialog Boxes](#).

# Menus

Menus are an essential element of the graphical user interface. Accordingly, the MapBasic language lets you control every aspect of MapInfo Pro's menu structure. With a few lines of code, you can customize any or all of MapInfo Pro's menus or menu items.

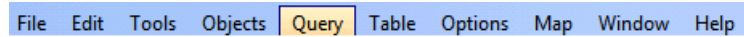
## Menu Fundamentals

MapInfo Pro's menu structure consists of the following elements:

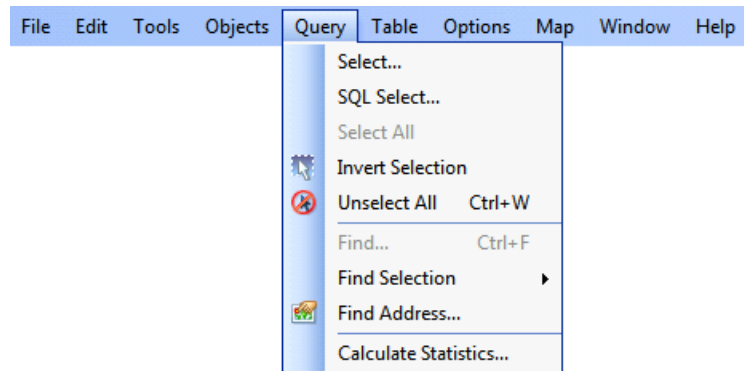
The menu bar is the horizontal bar across the top of the MapInfo Pro work area. The default MapInfo Pro menu bar contains words such as **File**, **Edit**, **Objects**, **Query**, etc.

A menu is a vertical list of commands that drops down if you click on the menu bar. For example, most applications include a **File** menu and an **Edit** menu.

A menu item is an individual command that appears on a menu. For example, the **File** menu typically contains menu items such as **Open**, **Close**, **Save**, and **Print**. Menu items are sometimes referred to as commands (for example, the **File > Save** command).



**Figure 2: A menu bar with the selected menu shown highlighted in blue.**



**Figure 3: Menu items.**

The concepts of menu, menu bar, and menu item are interrelated. Each menu is a set of menu items. For example, the **File** menu contains items such as **Open**, **Close**, **Save**, etc. The menu bar is a set of menus.

When the user chooses a menu item, some sort of action is initiated. Different menu items invoke different types of actions; some menu items cause dialog boxes to be displayed, while other menu items produce an immediate effect.

The action associated with a menu item is referred to as the menu item's handler. A menu item handler can either be a standard MapInfo Pro command code or a custom MapBasic sub-procedure name. In other words, when the user chooses a menu item, MapInfo Pro "handles" the menu-choose event, either by running a standard command code or by calling a sub-procedure from your application.

## Adding New Items to a Menu

To add one or more custom items to an existing menu, use the **Alter Menu** statement.

For example, the following statement adds two custom menu items to the **Query** menu (one item called Annual Report, and another item called Quarterly Report):

```
Alter Menu "Query" Add
  "Annual Report" Calling report_sub,
  "Quarterly Report" Calling report_sub_q
```

For each of the custom menu items, the **Alter Menu** statement specifies a **Calling** clause. This clause specifies what should happen when and if the user chooses the menu item. If the user chooses the Annual Report item, MapInfo Pro calls the sub-procedure report\_sub.

If the user chooses the Quarterly Report item, MapInfo Pro calls the sub-procedure report\_sub\_q. These sub-procedures (report\_sub and report\_sub\_q) must appear elsewhere within the same MapBasic application.

You also can create custom menu items that invoke standard MapInfo Pro commands, rather than calling MapBasic sub-procedures. The definitions file `menu.def` contains a list of definitions of menu codes (for example, `M_FILE_NEW` and `M_EDIT_UNDO`). Each definition in that file corresponds to one of the standard MapInfo Pro menu commands (for example, `M_EDIT_UNDO` corresponds to the Edit menu's Undo command). If a menu item's **Calling** clause specifies one of the menu codes from `menu.def`, and the user chooses that menu item, MapInfo Pro invokes the appropriate MapInfo Pro command.

For example, the following statement defines a "Color Coded Maps" menu item. If the user chooses Color Coded Maps, MapInfo Pro runs the command code `M_MAP_THEMATIC`. In other words, if the user chooses the menu item, MapInfo Pro displays the **Create Thematic Map** dialog box, just as if the user had chosen the **Map > Create Thematic Map** command.

```
Alter Menu "Query" Add
    "Color Coded Maps" Calling M_MAP_THEMATIC
```

## Removing Items From a Menu

An application can remove individual menu items. The following statement removes the Delete Table item from MapInfo Pro's **Table > Maintenance** menu. Note that the identifier `M_TABLE_DELETE` is a code defined in the menu definitions file, `menu.def`.

```
Alter Menu "Maintenance" Remove M_TABLE_DELETE
```

If you want to remove several items from a menu, there are two techniques you can use: you can issue an **Alter Menu...Remove** statement which lists all the items you wish to remove; or you can issue a **Create Menu...**statement which redefines the menu entirely, including only the items you want.

For example, the following statement creates a simplified version of the Map menu that includes only three items (Layer Control, Previous View, and Options):

```
Create Menu "Map" As
    "Layer Control" Calling M_MAP_LAYER_CONTROL,
    "Previous View" Calling M_MAP_PREVIOUS,
    "Options" Calling M_MAP_OPTIONS
```

## Creating A New Menu

To create an all-new menu, use the **Create Menu** statement. For example, the sample application, `TextBox`, issues the following **Create Menu** statement:

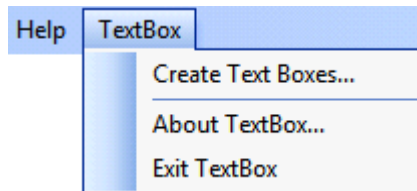
```
Create Menu "TextBox" As
    "&Create Text Boxes..." Calling create_sub,
    "(-",
    "&About TextBox..." Calling About,
    "E&xit TextBox" Calling Bye
```

The **Create Menu** statement creates a new "TextBox" menu. However, the act of creating a menu does not cause the menu to appear automatically. To make the new menu become visible, you must take an additional step.

You could make the `TextBox` menu visible by adding it to the menu bar, using the **Alter Menu Bar** statement:

```
Alter Menu Bar Add "TextBox"
```

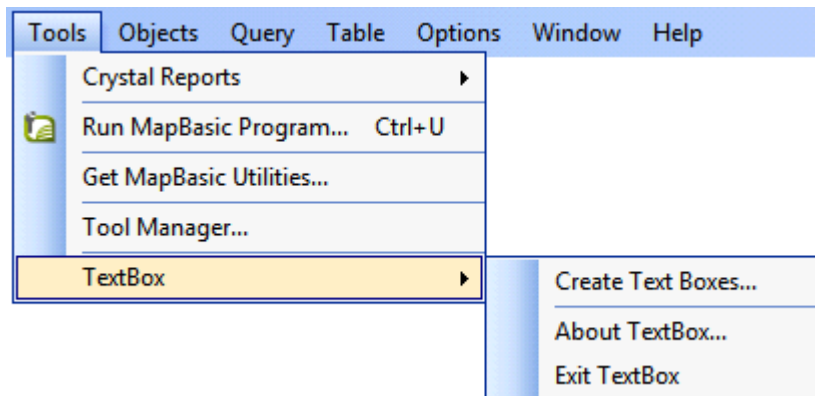
The **Alter Menu Bar Add** statement adds the menu to the right end of the menu bar. The menu produced would look like this:



In practice, adding menus onto the menu bar is sometimes problematic. The amount of space on the menu bar is limited, and every time you add a menu to the menu bar, you fill some of the remaining space. Therefore, for the sake of conserving space on the menu bar, the TextBox application uses a different technique for displaying its menu: instead of adding its menu directly onto the menu bar, the TextBox application uses an **Alter Menu** statement to add its menu as a hierarchical sub-menu, located on the Tools menu.

```
Alter Menu "Tools" Add
    " (-",
    "TextBox" As "TextBox"
```

As a result of this statement, the TextBox menu appears as a hierarchical menu located on the Tools menu. The resulting Tools menu looks like this:



Sample programs that are provided with MapInfo Pro, such as ScaleBar and OverView, follow the same convention (placing their menu items on hierarchical menus located off of the Tools menu). Thus, if you run the TextBox application, the ScaleBar application, and the OverView application, all three applications add their commands to the Tools menu.

If each of the sample programs (ScaleBar, etc.) added a menu directly onto the menu bar, the menu bar would quickly become over-crowded. Stacking hierarchical menus onto the Tools menu (or any other menu) is one way of conserving space on the menu bar. Note, however, that some users find hierarchical menus significantly harder to use.

How you design and organize your menus will depend on the nature of your application. Depending on your application, you may need to add one, two, or even several menus to the menu bar.

Regardless of whether you attach your menus to the menu bar or to other menus, MapInfo Pro is limited to 96 menu definitions. In other words, there can never be more than 96 menus defined at one time, including MapInfo Pro's standard menus. This limitation applies even when you are not displaying all of the menus.

### Altering A Menu Item

The MapBasic language lets you perform the following operations on individual menu items:

- You can disable (gray out) a menu item, so that the user cannot choose that menu item.
- You can enable a menu item that was formerly disabled.
- You can check a menu item (i.e., add a check-mark to the menu item); however, a menu item must be defined as "checkable" when it is created. To define a menu item as checkable, insert an exclamation point as the first character of the menu item name. For more information, see **Create Menu** in the *MapBasic Reference*.
- You can un-select a menu item (i.e., remove the check-mark)
- You can rename the menu item, so that the text that appears on the menu changes.

To alter a menu item, use the **Alter Menu Item** statement. The **Alter Menu Item** statement includes several optional clauses (Enable, Disable, Check, UnCheck, etc.); use whichever clauses apply to the change you want to make.

The sample program OverView demonstrates the process of creating, then altering, a custom menu. The OverView application creates the following custom menu:

```
Create Menu "OverView" As
  "&Setup OverView"  Calling OverView,
  "(Suspend Tracking" Calling MenuToggler,
  "(Pick Frame Style" Calling PickFrame,
  "(-",
  "Close Overview"  Calling Bye,
  "(-",
  "About Overview..." Calling About
```

The **Pick Frame Style** menu item is initially disabled. (Whenever the name of a menu item begins with the "(" character, that menu item is automatically disabled when the menu first appears.)

When and if the user sets up an overview window, the OverView application enables the **Pick Frame Style** menu item, using the following statement:

```
Alter Menu Item PickFrame Enable
```

If the user closes the overview window, the application once again disables the **Pick Frame** menu item, by issuing the following statement:

```
Alter Menu Item PickFrame Disable
```

PickFrame is the name of a sub-procedure in `overview.mb`. Note that PickFrame appears in both the **Create Menu** statement (in the **Calling** clause) and in the **Alter Menu Item** statements. When you issue an **Alter Menu Item** statement, you must specify which menu item you want to alter. If you specify the name of a procedure (for example, PickFrame), MapInfo Pro modifies whatever menu item calls that procedure.

Similarly, to enable the **Suspend Tracking** menu item, issue the following statement:

```
Alter Menu Item MenuToggler Enable
```

You also can use **Alter Menu Item** to change the name of a menu item. For example, the OverView application has a menu item that is initially called Suspend Tracking. If the user chooses Suspend Tracking, the application changes the menu item's name to Resume Tracking by issuing the following statement:

```
Alter Menu Item MenuToggler Text "Resume Tracking"
```

Note that MapInfo Pro enables and disables its own standard menu items automatically, depending on the circumstances. For example, the **Window > New Map Window** command is only enabled when and if a mappable table is open. Because MapInfo Pro automatically alters its own standard menu items, a MapBasic application should not attempt to enable or disable those menu items.

## Re-Defining The Menu Bar

To remove an entire menu from the menu bar, use the **Alter Menu Bar** statement. For example, the following statement causes the **Query** menu to disappear:

```
Alter Menu Bar Remove "Query"
```

You also can use **Alter Menu Bar** to add menus to the menu bar. For example, the following statement adds both the **Map** menu and the **Browse** menu to the menu bar. (By default, those two menus never appear on the menu bar at the same time. The **Map** menu ordinarily appears only when a Map is the active window, and the **Browse** menu ordinarily appears only when a **Browser** window is active.)

```
Alter Menu Bar Add "Map", "Browse"
```

The **Alter Menu Bar Add** statement always adds menus to the right end of the menu bar. One minor disadvantage of this behavior is the fact that menus can end up located to the right of the **Help** menu. Most software packages arrange the menu bar so that the last two menu names are **Window** and **Help**. Therefore, you may want to insert your custom menu to the left of the **Window** menu. The following statements show how to insert a menu to the left of the **Window** menu:

```
Alter Menu Bar Remove ID 6, ID 7  
Alter Menu Bar Add "Tools", ID 6, ID 7
```

The first statement removes the **Window** menu (ID 6) and **Help** menu (ID 7) from the menu bar. The second statement adds the **Tools** menu, the **Window** menu, and the **Help** menu to the menu bar. The end result is that the **Tools** menu is placed to the left of the **Window** menu.

For complete control over the menu order, use the **Create Menu Bar** statement. For example, this statement re-defines the menu bar to include the **File**, **Edit**, **Map**, **Query**, and **Help** menus (in that order):

```
Create Menu Bar As "File", "Edit", "Map", "Query", "Help"
```

For a list of MapInfo Pro's standard menu names ("File", "Query" etc.) see **Alter Menu** in the *MapBasic Reference* or *MapBasic Help*. To restore MapInfo Pro's standard menu definitions, issue a **Create Menu Bar As Default** statement.

## Specifying Language-Independent Menu References

Most of the preceding examples refer to menus by their names (for example, "File"). There is an alternate syntax for referring to MapInfo Pro's standard menus: you can identify standard menus by ID numbers. For example, in any menu-related statement where you might refer to the **File** menu as "File", you could instead refer to that menu as ID 1. Thus, the following statement removes the **Query** menu (which has ID number 3) from the menu bar:

```
Alter Menu Bar Remove ID 3
```

If your application will be used in more than one country, you may want to identify menus by their ID numbers, rather than by their names. When the MapInfo Pro software is localized for non-English speaking countries, the names of menus are changed. If your application tries to alter the "File" menu, and you run your application on a non-English version of MapInfo Pro, your application may generate an error (because in a non-English version of MapInfo Pro, "File" may not be the name of the menu). For a listing of the ID numbers that correspond to MapInfo Pro's standard menus, see **Alter Menu** in the *MapBasic Reference* or *MapBasic Help*.



## Customizing MapInfo Pro's Shortcut Menus

MapInfo Pro provides shortcut menus. These menus appear if the user clicks the right mouse button. To manipulate shortcut menus, use the same statements you would use to manipulate conventional menus: **Alter Menu**, **Alter Menu Item**, and **Create Menu**.

Each shortcut menu has a unique name and ID number. For example, the shortcut menu that appears when you right-click a **Map** window is called "MapperShortcut" and has an ID of 17. For a listing of the names and ID numbers of the shortcut menus, see **Alter Menu** in the *MapBasic Reference* or *MapBasic Help*.

To destroy a shortcut menu, use the **Create Menu** statement to re-define the menu, and specify the control code "-" as the new menu definition. For example:

```
Create Menu "MapperShortcut" ID 17 As "-"
```

## Assigning One Handler Procedure To Multiple Menu Items

The **Create Menu** and **Alter Menu** statements provide an optional **ID** clause, which lets you assign a unique ID number to each custom menu item you create. Menu item IDs are optional. However, if you intend to have two or more menu items calling the same handler procedure, you will probably want to assign a unique ID number to each of your custom menu items.

In situations where two or more menu items call the same handler procedure, the handler procedure generally calls **CommandInfo( )** to determine which item the user chose. For example, the following statement creates two custom menu items that call the same handler:

```
Alter Menu "Query" Add
  "Annual Report" ID 201 Calling report_sub,
  "Quarterly Report" ID 202 Calling report_sub
```

Both menu items call the procedure `report_sub`. Because each menu item has a unique ID, the handler procedure can call **CommandInfo( )** to detect which menu item the user chose, and act accordingly:

```
Sub report_sub
  If CommandInfo(CMD_INFO_MENUITEM) = 201 Then
    ' ... then the user chose Annual Report...
  ElseIf CommandInfo(CMD_INFO_MENUITEM) = 202 Then
    ' ... then the user chose Quarterly Report...
  End If
End Sub
```

Menu item IDs also give you more control when it comes to altering menu items. If an **Alter Menu Item** statement identifies a menu item by the name of its handler procedure, MapBasic modifies all menu items that call the same procedure. Thus, the following statement disables both of the custom menu items defined above (which may not be the desired effect):

```
Alter Menu Item report_sub Disable
```

Depending on the nature of your application, you may want to modify only one of the menu items. The following statement disables only the Annual Report menu item, but has no effect on any other menu items:

```
Alter Menu Item ID 201 Disable
```

Menu item ID numbers can be any positive Integer.

## Simulating Menu Selections

To activate a MapInfo Pro command as if the user had chosen that menu item, use the **Run Menu Command** statement. For example, the following statement displays MapInfo Pro's **Open Table** dialog box, as if the user had chosen **File > Open Table**:

```
Run Menu Command M_FILE_OPEN
```

The code M\_FILE\_OPEN is defined in menu.def.

## Defining Shortcut Keys And Hot Keys

Shortcut keys are keystroke combinations that let the user access menus and menu items directly from the keyboard, without using the mouse. Typically, a shortcut key appears as an underlined letter in the name of the menu or menu item when the Alt key is pressed. For example, in Windows, the shortcut keystroke to activate the MapInfo Pro **File** menu is **Alt+F**, as indicated by the underlined letter, F after the Alt key is pressed. To assign a shortcut key to a menu item, place an ampersand (&) directly before the character that you want to define as the shortcut key.

The following program fragment shows how a MapBasic for Windows program defines the C key (in Create Text Boxes) as a shortcut key.

```
Create Menu "TextBox" As
  "&Create Text Boxes..." Calling create_sub,
  ...
```

Hot keys are keystroke combinations that let the user execute menu commands without activating the menu. Unlike shortcut keys that let you traverse through the menu structure using the keyboard, hot keys let you avoid the menu completely. The following program fragment adds the hot key combination **Ctrl+Z** to a custom menu item:

```
Alter Menu "Query" Add
  "New Report" + Chr$(9) + "CTRL+Z/W^%122" Calling new_sub
```

The instruction `+ Chr$(9)` tells MapBasic to insert a tab character. The tab character is used for formatting, so that all of the menu's hotkey descriptions appear aligned.

The text **CTRL+Z** appears on the menu, so that the user can see the menu item has a hot key.

The instruction `/w^%122` defines the hot key as **Ctrl+Z**. The code `/w^%122` is a hot key code recognized by MapInfo Pro: `/w` specifies that the code is for MapInfo Pro for Windows; the caret (^) specifies that the user should hold down the **Ctrl** key; and `%122` specifies the letter "z" (122 is the ASCII character code for 'z').

```
Alter Menu "Query" Add
  "New Report /Mz" Calling new_sub
```

The instruction `/Mz` defines the hot key as Command+Z.

For a listing of codes that control menu hot keys, see **Create Menu** in the *MapBasic Reference* or *MapBasic Help*.

## Controlling Menus Through the MapInfo Pro Menu File

The default menu structure of MapInfo Pro is controlled by the MapInfo Pro menu file. If you want to customize MapInfo Pro's menu structure, you can do so by altering the menu file.

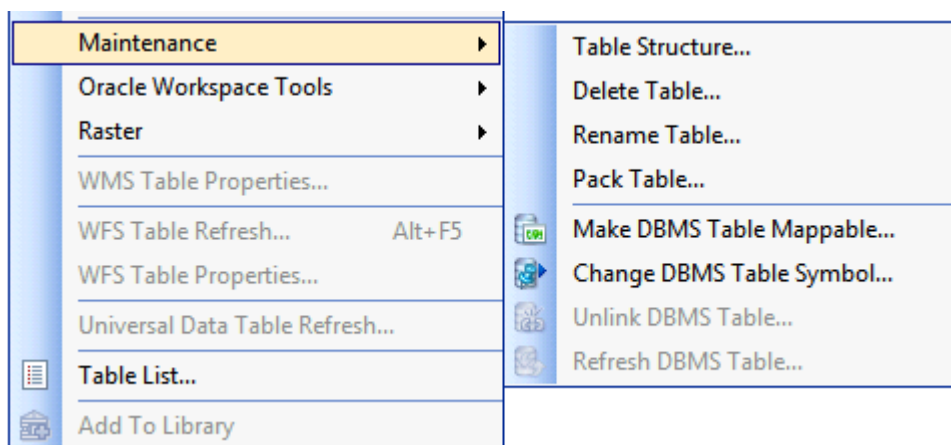
With MapInfo Pro, the menu file is called MAPINFOPRO.MNU.

Since the menu file is a text file, you can view it in any text editor. If you examine the menu file, you will see that it bears a strong resemblance to a MapBasic program. If you change the menu definitions in the menu file, the menus will look different the next time you run MapInfo Pro. In other words, altering the menu file gives you a way of customizing the menu structure without using a compiled MapBasic application.

**Caution:** Before you make any changes to the menu file, make a backup of the file. If the menu file is corrupted or destroyed, you will not be able to run MapInfo Pro (unless you can restore the menu file from a backup). If you corrupt the menu file, and you cannot restore the file from a backup, you will need to re-install MapInfo Pro.

The menu file contains several **Create Menu** statements. These statements define MapInfo Pro's standard menu definitions (File, Edit, etc.). If you wish to remove one or more menu items from a menu, you can do so by removing appropriate lines from the appropriate **Create Menu** statement.

For example, MapInfo Pro's **Table > Maintenance** menu usually contains a Delete Table command, as shown below.



If you examine the menu file, you will see that the Maintenance menu is defined through a **Create Menu** statement that looks like this:

```
Create Menu "&Maintenance" As
  "&Table Structure..."
  HelpMsg "Modify the table structure."
  calling 404,
  "&Delete Table..."
  HelpMsg "Delete a table and its component files. "
  calling 409,
  "&Rename Table..."
  HelpMsg "Rename a table and its component files."
  calling 410,
  "&Pack Table..."
  HelpMsg "Compress tables to conserve space
  and eliminate deleted records."
  calling 403,
  . . .
```

Because the Delete Table command is potentially dangerous, you might want to re-define the Maintenance menu to eliminate Delete Table. To eliminate the Delete Table command from the menu, remove the appropriate lines ("&Delete Table..." through to calling 409) from the menu file. After you make this change, the **Create Menu** statement will look like this:

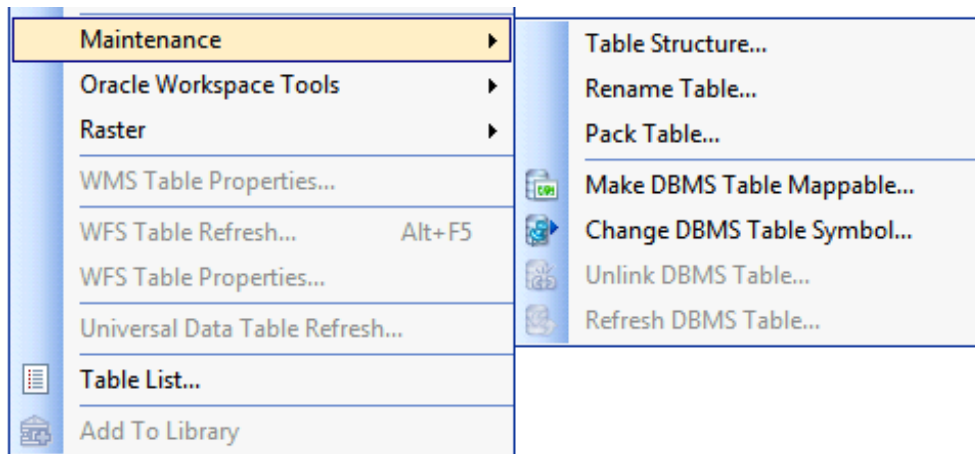
```
Create Menu "&Maintenance" As
  "&Table Structure..."
  HelpMsg "Modify the table structure."
  calling 404,
```

```

"&Rename Table..."
HelpMsg "Rename a table and its component files."
calling 410,
"&Pack Table..."
HelpMsg "Compress tables to conserve space
and eliminate deleted records."
calling 403,
. . .

```

The next time you run MapInfo Pro, the **Table > Maintenance** menu will appear without a **Delete Table** item.



Similarly, if you wish to remove entire menus from the MapInfo Pro menu bar, you can do so by editing the **Create Menu Bar** statement that appears in the menus file.

If MapInfo Pro is installed on a network, and you modify the menu file in the directory where MapInfo Pro is installed, the changes will apply to all MapInfo Pro users on the network. In some circumstances, you may want to create different menu structures for different network users. For example, you may want to eliminate the **Delete Table** command from the menu that appears for most of your users, but you may want that command to remain available to your network system administrator.

To assign an individual user a customized menu structure, place a customized version of the menus file in that user's "home" directory. For Windows users, the home directory is defined as the user's private Windows directory (i.e., the directory where `WIN.INI` resides).

To assign an individual user a customized menu structure, place a customized version of the menus file in that user's "home" directory/folder. The menu file can be placed directly in the System directory, or in the Preferences directory within the System directory.

When a user runs MapInfo Pro, it checks to see if a copy of the menus file exists in the user's home directory. If a copy of the menus file is present in the user's home directory, MapInfo Pro loads that set of menus. If there is no menu file in the user's home directory, MapInfo Pro loads the menu file from the directory where it is installed.

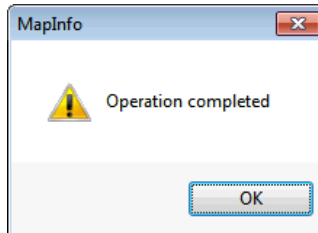
Thus, if you want different users to see two different versions of the menu structure, create two different versions of the menu file. Place the version that applies to most of your users in the directory where MapInfo Pro is installed. Place the version that applies only to individual users in the home directories of the individual users.

## Standard Dialog Boxes

Dialog boxes are an essential element of the user interface. MapBasic provides several different statements and functions that let you create dialog boxes for your application.

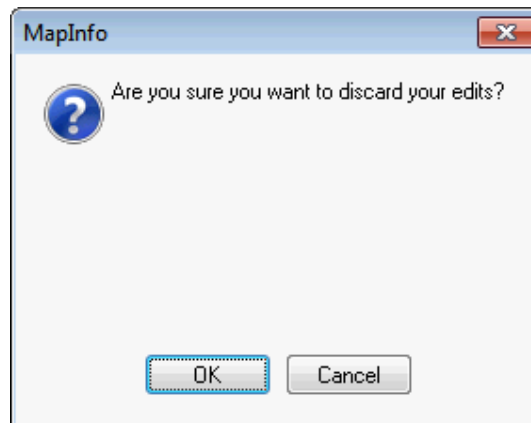
### Displaying a Message

Use the **Note** statement to display a simple dialog box with a message and an **OK** button.



### Asking a Yes-or-No Question

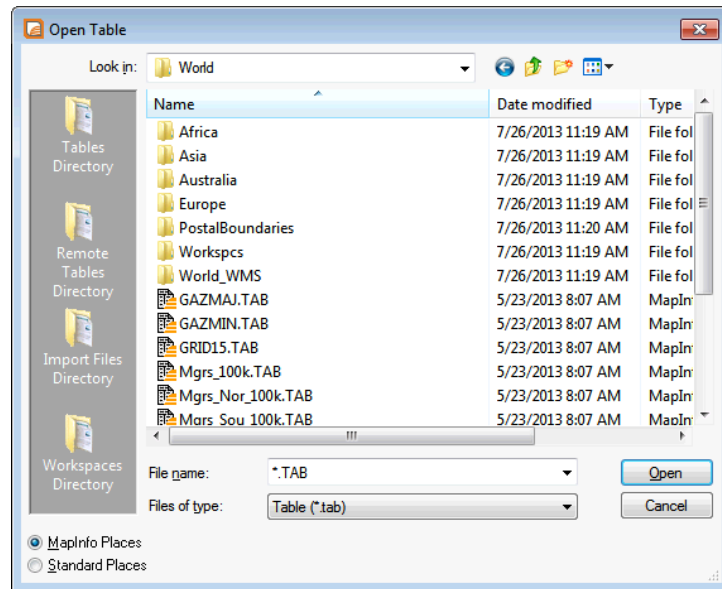
Use the **Ask( )** function to display a dialog box with a prompt and two buttons. The two buttons usually say **OK** and **Cancel**, but you can customize them to suit your application. If the user chooses the **OK** button, the function returns a TRUE value, otherwise, the function returns FALSE.



### Selecting a File

Call the **FileOpenDlg( )** function to display a standard **File Open** dialog box. If the user chooses a file, the function returns the name of the chosen file. If the user cancels out of the dialog box, the function returns an empty string.

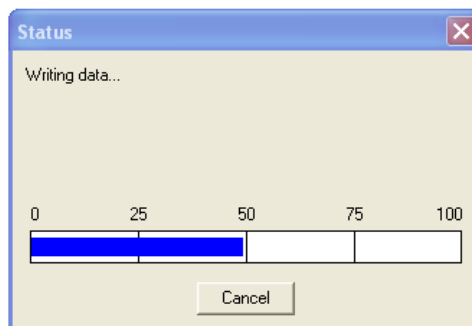
The **FileOpenDlg( )** function produces a dialog box that looks like this:



The **FileSaveAsDlg ( )** function displays a standard **File Save As** dialog box, and returns the file name entered by the user.

### Indicating the Percent Complete

Use the **ProgressBar** statement to display a standard percent-complete dialog box, containing a progress bar and a **Cancel** button.



### Displaying One Row From a Table

MapInfo Pro does not provide a standard dialog box that displays one row from a table. However, you can use MapInfo Pro's **Info** window to display a row. For instructions on managing the **Info** window, see [Customizing the Info window](#).

For more information about the statements and functions listed above, see the *MapBasic Reference*. If none of the preceding statements meets your needs, use the **Dialog** statement to create a custom dialog box, as described below.

## Custom Dialog Boxes

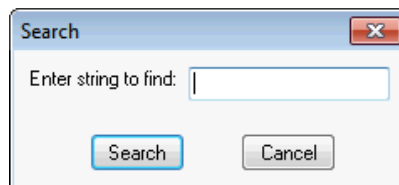
The **Dialog** statement lets you create custom dialog boxes. When you issue a **Dialog** statement, MapInfo Pro displays the dialog box and lets the user interact it. When the user dismisses the dialog box (for example, by clicking the **OK** or **Cancel** button), MapInfo Pro executes any statements that follow the **Dialog** statement. After the **Dialog** statement, you can call the **CommandInfo( )** function to tell whether the user chose **OK** or **Cancel**.

Everything that can appear on a dialog box is known as a *control*. For example, every **OK** button is a control, and every **Cancel** button is also a control. To add controls to a dialog box, include **Control** clauses within the **Dialog** statement. For example, the following statement creates a dialog box with four controls: a label (known as a **StaticText** control); a box where the user can type (known as an **EditText** control); an **OK** push-button (known as **OKButton** control) and a **Cancel** push-button (**CancelButton** control).

```
Dim s_searchfor As String

Dialog
  Title "Search"
  Control StaticText
    Title "Enter string to find:"
  Control EditText
    Into s_searchfor
  Control OKButton
  Control CancelButton
If CommandInfo(CMD_INFO_DLG_OK) Then
  '
  ' ... then the user clicked OK -- in which case,
  ' the String variable: s_searchfor will contain
  ' the value entered by the user.
  '
End If
```

This **Dialog** statement produces the following dialog box:



### Sizes and Positions of Controls

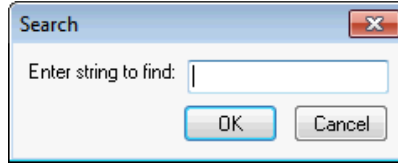
If you want to change the size of a dialog box control, you can include the optional **Width** and **Height** clauses within the **Control** clause. If you want to change the position of a dialog box control, you can include the optional **Position** clause.

For example, you might not like the default placement of the buttons in the dialog box shown above. To control the button placement, you could add **Position** clauses, as shown below:

```
Dim s_searchfor As String
Dialog
  Title "Search"
  Control StaticText
    Title "Enter string to find:"
  Control EditText
    Into s_searchfor
```

```
Control OKButton
Title "Search"
Position 30, 30
Control CancelButton
Position 90, 30
```

Because two of the **Control** clauses include **Position** clauses, the dialog box's appearance changes:



Positions and sizes are stated in terms of dialog box units, where each dialog box unit represents one quarter of a character's width or one eighth of a character's height. The upper-left corner of the dialog box has the position 0, 0. The following **Position** clause specifies a position in the dialog box five characters from the left edge of the dialog box, and two characters from the top edge of the dialog box:

```
Position 20, 16
```

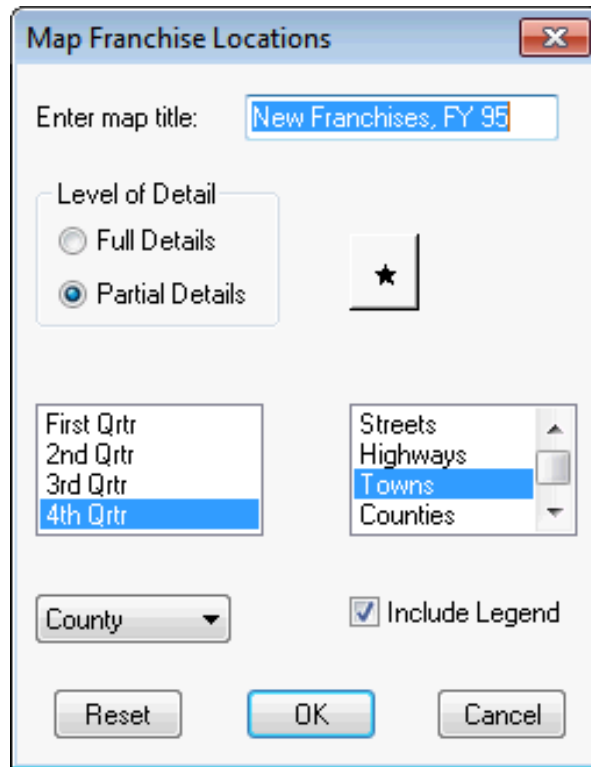
A horizontal position of 20 specifies a position five characters to the right, since each dialog box unit represents one fourth of the width of a character. A vertical position of 16 specifies a position two characters down, since each dialog box unit spans one eighth of the height of a character.

You can include a **Position** clause for every control in the dialog box. You also can specify **Width** and **Height** clauses to customize a control's size.

## Control Types

The previous examples contained four types of controls (StaticText, EditText, OKButton, and CancelButton). The following illustration shows all of MapBasic's dialog box control types.





Each control type shown in the previous dialog box is named in the following list:

- StaticText box – The **Enter Map Title** box.
- GroupBox – The **Level of Detail** panel.
- RadioGroup – The **Full Details** and the **Partial Details** radial buttons.
- ListBox – The **Show Results For** list box.
- PopupMenu – The **scope of Map** drop-down list.
- Button – The **Reset** button.
- OKButton – The **OK** button.
- EditText box – The **Enter Map Title** box, where the user can type their input.
- Picker (SymbolPicker) – The **Show Franchises As** button, which displays a symbol on it.
- MultiListBox – The **Include Map Layers** scrolling list box.
- Checkbox – The **Include Legend** checkbox.
- CancelButton – The **Cancel** button.

### StaticText

A StaticText control is a non-interactive control that lets you include labels in the dialog box. For example:

```
Control StaticText
  Title "Enter map title:"
  Position 5, 10
```

### EditText

An EditText control is a boxed area where the user can type. For example:

```
Control EditText
  Value "New Franchises, FY 95"
  Into s_title
  ID 1
  Position 65, 8 Width 90
```

### GroupBox

A GroupBox control is a rectangle with a label at the upper left corner. Use GroupBoxes for visual impact, to convey that other dialog box controls are related. For example:

```
Control GroupBox
  Title "Level of Detail"
  Position 5, 30 Width 70 Height 40
```

### RadioGroup

A RadioGroup control is a set of "radio buttons" (i.e., a list of choices where MapBasic only allows the user to select one of the buttons at a time). For example:

```
Control RadioGroup
  Title "&Full Details;&Partial Details"
  Value 2
  Into i_details
  ID 2
  Position 12, 42 Width 60
```

### Picker

There are four types of Picker controls: PenPicker, BrushPicker, FontPicker, and SymbolPicker. Each Picker control lets the user select a graphical style (line, fill, font, or symbol). The illustration shown above includes a SymbolPicker control, showing a star-shaped symbol. For example:

```
Control SymbolPicker
  Position 95, 45
  Into sym_variable ID 3
```

### ListBox

A ListBox control is a scrollable list from which the user can select one item. MapBasic automatically appends a vertical scroll bar to the right edge of the ListBox if there are too many list items to be displayed at one time. For example:

```
Control ListBox
  Title "First Qrtr;2nd Qrtr;3rd Qrtr;4th Qrtr"
  Value 4
  Into i_quarter
  ID 4
  Position 5, 90 Width 65 Height 35
```

### MultiListBox

A MultiListBox is similar to a ListBox, except that the user can **Shift+click** or **Ctrl+click** to select two or more items from the list. For example:

```
Control MultiListBox
  Title "Streets;Highways;Towns;Counties;States"
  Value 3
  ID 5
  Position 95, 90 Width 65 Height 35
```

### PopupMenu

A PopupMenu appears as a text item with a down arrow at the right edge. As the user clicks on the control, a menu pops up, allowing the user to make a selection. For example:

```
Control PopupMenu
  Title "Town;County;Territory;Entire state"
```

```
Value 2
Into i_scope
ID 6
Position 5, 140
```

### CheckBox

A **CheckBox** is a label with a box. The user can check or clear the box by clicking on the control. For example:

```
Control CheckBox
Title "Include &Legend"
Into l_showlegend
ID 7
Position 95, 140
```

### Buttons

Button controls are perhaps the most common type of control that you will use, since almost every dialog box has at least one button. MapBasic provides special control types **OKButton** and **CancelButton** for creating **OK** and **Cancel** buttons.

```
Control Button
Title "&Reset"
Calling reset_sub
Position 10, 165

Control OKButton
Position 65, 165
Calling ok_sub

Control CancelButton
Position 120, 165
```

Each dialog box should have no more than one **OKButton** or **CancelButton** control. Both controls are optional. However, as a general rule, every dialog box should have at least one **OK** and/or a **Cancel** button, so that the user has a way of dismissing the dialog box. If either control has a handler, MapBasic executes the handler procedure and then resumes executing the statements that follow the **Dialog** statement.

Every type of control is described in detail in the *MapBasic Reference* and *MapBasic Help*. For example, to read about **ListBox** controls, see **Control ListBox**.

## Specifying a Control's Initial Value

Most types of controls have an optional **Value** clause. This clause specifies how the control is set when the dialog box first appears. For example, if you want the fourth item in a **ListBox** control to be selected when the dialog box first appears, add a **Value** clause to the **ListBox** clause:

```
Value 4
```

If you omit the **Value** clause, MapInfo Pro uses a default value. For example, **CheckBox** controls are checked by default. For more information about setting a **Value** clause, see the appropriate Control description (for example, **Control CheckBox**) in the *MapBasic Reference*.

## Reading a Control's Final Value

Most types of controls allow an optional **Into** clause. This clause associates a program variable with the control, so that MapInfo Pro can store the dialog box data in the variable. If you create a control with an

**Into** clause, and if the user closes the dialog box by clicking the **OK** button, MapInfo Pro stores the control's final value in the variable.

The **Into** clause must name a local or global variable in your program. The variable that you specify must be appropriate for the type of control. For example, with a **CheckBox** control, the variable must be Logical (TRUE meaning checked, FALSE meaning clear). See the *MapBasic Reference* for more information about the type of variable appropriate for each control.

**Note:** MapInfo Pro only updates the **Into** variable(s) after the dialog box is closed, and only if the dialog box is closed because the user clicked **OK**. If you need to read the value of a control from within a dialog box handler procedure, call the **ReadControlValue( )** function.

## Responding to User Actions by Calling a Handler Procedure

Most types of controls can have handlers. A handler is a sub-procedure that MapBasic calls automatically when and if the user clicks that control. The optional Calling handler clause specifies a control's handler; handler must be the name of a sub-procedure that takes no parameters. When the user clicks on a control that has a handler procedure, MapBasic calls the procedure. When the procedure finishes, the user can continue interacting with a dialog box (except in the case of **OKButton** and **CancelButton** controls, which automatically close the dialog box).

Handler procedures allow your program to issue statements while the dialog box is on the screen. For example, you may want your dialog box to contain a **Reset** button. If the user clicks on the **Reset** button, your program resets all controls in the dialog box to their default values. To create such a dialog box, you would need to assign a handler procedure to the Reset Button control. Within the handler procedure, you would issue **Alter Control** statements to reset the dialog box's controls.

A **ListBox** or **MultiListBox** control handler can be set up to respond one way to single-click events while responding differently to double-click events. The handler procedure can call the **CommandInfo(CMD\_INFO\_DLG\_DBL)** function to determine whether the event was a single- or double-click. For an example of this feature, see the Named Views sample program (*nviews.mb*). The Named Views dialog box presents a list of names; if the user double-clicks on a name in the list, the handler procedure detects that there was a double-click event, and closes the dialog box. In other words, the user can double-click on the list, rather than single-clicking on the list and then clicking on the **OK** button.

If two or more controls specify the same procedure name in the **Calling** clause, the named procedure acts as the handler for both of the controls. Within the handler procedure, call the **TriggerControl( )** function to determine the ID of the control that was used.

Most dialog box controls can have handler procedures (only **GroupBox**, **StaticText**, and **EditText** controls cannot have handlers). You also can specify a special handler procedure that is called once when the dialog box first appears. If your **Dialog** statement includes a **Calling** clause that is not part of a **Control** clause, the **Calling** clause assigns a handler procedure to the dialog box itself.

The **Alter Control** statement may only be issued from within a handler procedure. Use **Alter Control** to disable, enable, show, hide, rename, or reset the current setting of a control. The **Alter Control** statement can also set which **EditText** control has the focus (i.e., which control is active). For more information, see **Alter Control** in the *MapBasic Reference* or *MapBasic Help*.

## Enabled / Disabled Controls

When a control first appears, it is either enabled (clickable) or disabled (grayed out). By default, every control is enabled. There are two ways to disable a dialog box control:

- Include the optional **Disable** keyword within the **Dialog** statement's **Control** clause. When the dialog box appears, the control is disabled.
- From within a handler procedure, issue an **Alter Control** statement to disable the control. If you want the control to be disabled as soon as the dialog box appears, assign a handler procedure to the dialog

box itself, by including a **Calling** clause that is not within a **Control** clause. This handler will be called once, when the dialog box first appears. Within the handler, you can issue **Alter Control** statements. This technique is more involved, but it is also more flexible. For example, if you want a control to be disabled, but only under certain conditions, you can place the **Alter Control** statement within an **If...Then** statement.

**Note:** If you are going to use an **Alter Control** statement to modify a dialog box control, you should assign an ID number to the control by including an **ID** clause in the **Dialog** statement. For an example, see **Alter Control** in the *MapBasic Reference* or *MapBasic Help*.

## Letting the User Choose From a List

The **ListBox** control presents a list of choices. There are two ways you can specify the list of items that should appear in a **ListBox** control:

- Build a String expression that contains all of the items in the list, separated by semicolons. For example:

```
Control ListBox
  Title "First Qrtr;2nd Qrtr;3rd Qrtr;4th Qrtr;Year in Review"
```

- Declare an array of String variables, and store each list item in one element of the array. In the **Control** clause, specify the keywords **From Variable**. For example, if you have created a String array called `s_list`, you could display the array in a **ListBox** control using this syntax:

```
Control ListBox
  Title From Variable s_list
```

You can use the **From Variable** syntax in all three of MapBasic's list controls (**ListBox**, **MultiListBox**, and **PopupMenu**).

## Managing MultiListBox Controls

If your dialog box contains a **MultiListBox** control, you must use a handler procedure to determine what list item(s) the user selected from the list. In most cases, a dialog box with a **MultiListBox** control contains an **OKButton** control with a handler procedure. The **OKButton**'s handler procedure calls the **ReadControlValue( )** function within a loop. The first **ReadControlValue( )** call returns the number of the first selected list item; the next call returns the number of the next selected list item, etc. When **ReadControlValue( )** returns zero, the list of selected items has been exhausted. If **ReadControlValue( )** returns zero the first time you call it, none of the list items are selected.

Within a handler procedure, you can de-select all items in a **MultiListBox** control by issuing an **Alter Control** statement, and assigning a value of zero to the control. To add a list item to the set of selected items, issue an **Alter Control** statement with a positive, non-zero value. For example, to select the first and second items in a **MultiListBox** control, you could issue the following statements:

```
Alter Control 1 Value 1
Alter Control 1 Value 2
```

Note that both the **ReadControlValue( )** function and the **Alter Control** statement require a control ID. To assign a control ID to a **MultiListBox** control, include the optional **ID** clause in the **Control MultiListBox** clause.

## Specifying Shortcut Keys for Controls

When a MapBasic application runs on MapInfo Pro, the application dialog boxes can assign shortcut keys to the various controls. A shortcut key is a convenience that lets the user activate a dialog box control using the keyboard instead of the mouse.

To specify a shortcut key for a control, include the ampersand character (&) in the control's title immediately before the character that is to be used as a shortcut key character. For example, the following **Control** clause creates a Button control with R as the shortcut key:

```
Control Button
  Title "&Reset"
  Calling reset_sub
```

Because an ampersand appears in the Button control's title, the user is able to activate the **Reset** button by pressing **Alt+R**. If you want to display an ampersand character in a control, use two successive ampersand characters (&&).

You cannot specify a shortcut key for an **EditText** control. However, if you place a **StaticText** label to the left of an **EditText** control, and you specify a shortcut key for the **StaticText** label, the user can set the focus on the **EditText** control by pressing the shortcut key of the **StaticText** label.

### Modal versus Modeless Dialog Boxes

The **Dialog** statement creates a modal dialog box. In other words, the user must close the dialog box (for example, by clicking **OK** or **Cancel**) before doing anything else with MapInfo Pro.

Some dialog boxes are modeless, meaning that the dialog box can remain on the screen while the user performs other actions. For example, MapInfo Pro's Image Registration dialog box is modeless. The **Dialog** statement cannot create modeless dialog boxes. If you want to create modeless dialog boxes, you may need to develop an application in another programming environment, such as Visual Basic, and call that application from within your MapBasic program (for example, using the **Run Program** statement).

## Closing a Dialog Box

After a MapBasic program issues a **Dialog** statement, it will continue to be displayed until one of four things happens:

- The user clicks the dialog box's **OKButton** control (if the dialog box has one).
- The user clicks the dialog box's **CancelButton** control (if the dialog box has one).
- The user otherwise cancels the dialog box (for example, by pressing the **Esc** key).
- The user clicks a control that has an associated handler procedure that issues a **Dialog Remove** statement.

Ordinarily, a dialog box terminates when the user clicks an **OKButton** or **CancelButton** control. There are times when the user should be allowed to continue using a dialog box after pressing **OK** or **Cancel**. For example, in some dialog boxes if the user presses **Cancel**, the application asks the user to verify the cancellation (Are you sure you want to lose your changes?). If the user's response is No, the application should resume using the original dialog box.

The **Dialog Preserve** statement lets you allow the user to continue using a dialog box after the **OK** or **Cancel** Button is clicked. You can only issue a **Dialog Preserve** statement from within the handler sub-procedure of either the **OKButton** or **CancelButton** control.

The **Dialog Remove** statement halts a dialog box prematurely. When a control's handler procedure issues a **Dialog Remove** statement, the dialog box halts immediately. **Dialog Remove** is only valid from within a dialog box control's handler procedure. **Dialog Remove** can be used, for instance, to terminate a dialog box when the user double-clicks a **ListBox** control. The Named Views sample program (NVIEWWS.MB) provides an example of allowing the user to double-click in a list.

# Windows

A MapBasic application can open and manipulate any of MapInfo Pro's standard window types (**Map** windows, **Browse** windows, etc.).

To open a new document window, issue one of these statements: **Map**, **Browse**, **Graph**, **Layout**, or **Create Redistrict**. Each document window displays data from a table, so you must have the proper table(s) open before you open the window.

To open one of MapInfo Pro's other windows (for example, the **Help** window or the **Statistics** window), use the **Open Window** statement.

Many window settings can be controlled through the **Set Window** statement. For example, you could use the **Set Window** statement to set a window's size or position. There are also other statements that let you configure attributes of specific window types. For example, to control the order of layers in a **Map** window, you would issue a **Set Map** statement. To control the display of a grid in a **Browse** window, you would issue a **Set Browse** statement.

Each document window (**Map**, **Browser**, **Layout**, **Graph**, **Layer Control**, **Browser**, or **Redistrict**) has an Integer identifier, or window ID. Various statements and functions require a window ID as a parameter. For example, if two or more **Map** windows are open, and you want to issue a **Set Map** statement to modify the window, you should specify a window ID so that MapInfo Pro knows which window to modify.

To obtain the window ID of the active window, call the **FrontWindow( )** function. Note that when you first open a window (for example, by issuing a **Map** statement), that new window is the active window. For example, the OverView sample program issues a **Map** statement to open a **Map** window, and then immediately calls the **FrontWindow( )** function to record the ID of the new **Map** window. Subsequent operations performed by the OverView application refer to the ID.

**Note:** A window ID is not a simple, ordinal number, such as 1, 2, etc. The number 1 (one) is not a valid window ID. To obtain a window ID, you must call a function such as **FrontWindow( )** or **WindowID( )**. For example, to obtain the window ID of the first window that is open, call `WindowID(1)`. To determine the number of open windows, call **NumWindows( )**.

The **WindowInfo( )** function returns information about an open window. For example, if you want to determine whether the active window is a **Map** window, you can call **FrontWindow( )** to determine the active window's ID, and then call **WindowInfo( )** to determine the active window's window type.

To close a window, issue a **Close Window** statement.

## Specifying a Window's Size and Position

There are two ways to control a window's size and position:

- Include the optional **Position**, **Width**, and **Height** clauses in the statement that opens the window. For example, the following **Map** statement not only opens a **Map** window, it also specifies the window's initial size and position:

```
Map From world
  Position (2,1) Units "in"
  Height 3 Units "in"
  Width 4 Units "in"
```

- Issue a **Set Window** statement to control a window's size or position after the window is open. Note that the **Set Window** statement requires an Integer window ID.

## Map Windows

A **Map** window displays mappable objects from one or more tables. When opening a **Map** window, you must specify the tables that you want to display; each table must already be open.

The following statement opens a **Map** window:

```
Map From world, worldcap, grid30
```

This example maps the objects from the World, Worldcap, and Grid30 tables.

To add layers to a **Map** window, issue an **Add Map Layer** statement. To remove map layers from a **Map** window, issue a **Remove Map Layer** statement. If you want to temporarily hide a map layer, you do not need to remove it from the map; instead, you can use the **Set Map** statement to set that layer's Display attribute to off.

The **Set Map** statement is a very powerful statement that can control many aspects of a **Map** window. By issuing **Set Map** statements, your program can control map attributes that the user would control through the **Map > Layer Control** and **Map > Options** commands. For more information, see **Set Map** in the *MapBasic Reference*.

Use the **Shade** statement to create a thematic map (a map that uses color coding or other graphical devices to display information about the data attached to the map). The **Shade** statement lets you create the following of MapInfo Pro's styles of thematic maps: ranges, bar charts, pie charts, graduated symbols, dot density, or individual values. When you create a thematic map, MapInfo Pro adds a thematic layer to the affected window. To modify a thematic map, use the **Set Shade** statement.

Use the **Create Grid** statement to create a thematic type that enables analysis unconstrained by pre-existing geographic boundaries. Surface themes provide a continuous color visualization for point data sets that you previously looked at as a point thematic or graduated symbol. An inverse distance weighted interpolator populates the surface values from your MapInfo Pro point table. This powerful thematic can be used in many industries like telco, retail analysis, insurance, traditional GIS areas, and many more. This new theme and grid format is supported by open APIs for additional grid formats and interpolators which allows customization by our developer community. Refer to the **Create Grid** statement in the *MapBasic Reference*. To modify a surface thematic, use the **Inflect** clause of the **Set Map** statement.

To change a **Map** window's projection, you can issue a **Set Map** statement with a **CoordSys** clause. Alternately, you can display a map in a specific projection by saving your table(s) in a specific projection (using the **Commit Table...As** statement).

To control whether scroll bars appear on a **Map** window, issue a **Set Window** statement.

## Using Animation Layers to Speed Up Map Redraws

If the **Add Map Layer** statement includes the **Animate** keyword, the layer becomes a special layer known as the animation layer. When an object in the animation layer is moved, the **Map** window redraws very quickly, even if the map is very complex.

The animation layer is useful in realtime applications, where map features are updated frequently. For example, you can develop a fleet-management application that represents each vehicle as a point object. You can receive current vehicle coordinates by using GPS (Global Positioning Satellite) technology, and then update the point objects to show the current vehicle locations on the map. In this type of application, where map objects are constantly changing, the map redraws much more quickly if the objects being updated are stored in the animation layer instead of a conventional layer.

The following example opens a table and makes the table an animation layer:

```
Open Table "vehicles" Interactive  
Add Map Layer vehicles Animate
```

Animation layers have the following restrictions:



- When you add an animation layer, it does not appear in the **Layer Control** window.
- The user cannot interact with the animation layer by clicking in the **Map** window. For example, the user cannot use the Info tool to click on a point in the animation layer.
- Each **Map** window can have only one animation layer. The animation layer automatically becomes the map's top layer. If you attempt to add an animation layer to a **Map** window that already has an animation layer, the new animation layer replaces the old one.
- Workspace files do not preserve information about animation layers.
- To terminate the animation layer processing, issue a **Remove Map Layer Animate** statement.

To see a demonstration of animation layers, run the sample program `ANIMATOR.MBX`.

### Performance Tips for Animation Layers

The purpose of the animation layer feature is to allow fast updates to small sections of the **Map** window. To get the best redraw speed possible:

- Avoid displaying the **Map** window in a **Layout** window. If the **Map** window that has the animation layer is displayed in a **Layout** window, screen updates may not be as fast.
- Make sure that the layer you are using as an animation layer is only displayed once in the **Map** window.

For example, suppose you are working with two tables: Roads (a table containing a street map), and Trucks (a table containing point objects, each of which represents a delivery truck). Suppose your **Map** window already contains both layers. If you want to turn the Trucks layer into an animation layer, you need to issue the following statement:

```
Add Map Layer Trucks Animate
```

However, you now have a problem: the Trucks layer now appears in the **Map** window twice—once as a conventional map layer, and once as an animation layer. Because the Trucks layer is still being displayed as a conventional layer, MapInfo Pro will not be able to perform fast screen updates. In other words, updates to the **Map** window will redraw as slowly as before, which defeats the purpose of the animation layer feature.

The following example demonstrates how to handle this situation. Before you add the Trucks layer as an animation layer, turn off the display of the "conventional" Trucks layer:

```
'temporarily prevent screen updates
  Set Event Processing Off

'set the original Trucks layer so it won't display
  Set Map Layer "Trucks" Display Off

'add the Trucks layer to the map, as an animation layer
  Add Map Layer Trucks Animate

'allow screen updates again
  Set Event Processing On

' At this point, there are two Trucks layers in the
' Map window. However, the "conventional" Trucks layer
' is not displayed, so it will not slow down the display
' of the "animated" Trucks layer.
```

## Browser Windows

A **Browser** window displays columns of table data. The following statement opens a simple **Browser** window that displays all the columns in the World table:

```
Browse * From world
```

The asterisk specifies that every column in the table should appear in the Browser. To open a **Browser** window that displays only some of the columns, replace the asterisk with a list of column expressions. For example, the following statement opens a **Browser** window that shows only two columns:

```
Browse country, capital From world
```

The **Browse** statement can specify column expressions that calculate derived values. For example, the following statement uses the **Format\$( )** function to create a formatted version of the World table's Population column. As a result, the second column in the Browser contains commas to make the population statistics more readable.

```
Browse country, Format$(Population, ",#") From world
```

If the **Browse** statement specifies a simple column name (for example, country), the **Browser** window allows the user to edit the column values (unless the table is read-only). However, if the **Browse** statement specifies an expression that is more complex than just a column name, the corresponding column in the **Browser** window is read-only. Thus, if you want to create read-only columns in a **Browser** window, you can do so by browsing an expression, rather than a simple column name.

The expressions that you specify in the **Browse** statement appear as column headers across the top of the **Browser** window. The following statement shows how you can override the default column expression with an alias column header:

```
Browse country, Format$(Population, ",#") "Pop" From world
```

Because the String expression "Pop" appears after the column expression, "Pop" will be the column header that appears on the **Browser** window.

You can also set the initial default position of the **Browser** window. The following example positions the initial display so that the second column of the fifth row is in the upper left position of the **Browser** window display:

```
Browse * From world Row 5 Column 2
```

## Graph Windows

A **Graph** window contains a graph containing labels and values computed from a table. This sample displays a graph using one column for labels and another for data:

```
Graph country, population From world
```

The first item after the keyword **Graph** is the name of the column that provides labels for the data. Each following item is an expression that provides the graph with data. The example above is a simple expression in which the data is one column of the table. You can use any valid numeric expression.

## Layout Windows

A **Layout** window represents a page layout. To open a **Layout** window, use the **Layout** statement.

Most Layout windows contain one or more frame objects. To create a frame object, issue a **Create Frame** statement. Layout windows also can contain any type of Map object. For example, to place a title on the page layout, create a text object by issuing a **Create Text** statement.

A **Layout** window can be treated as a table. For example, you can add objects to a Layout by issuing an **Insert** statement that refers to a table name such as "Layout1." However, strictly speaking, the objects that appear on a layout are not saved in table format (although they are saved in workspace files). For more information on accessing a **Layout** window as if it were a table, see [Working With Tables](#).

Objects stored on **Layout** windows must use a Layout coordinate system, which defines object coordinates in terms of "paper" units such as inches or millimeters. For more information on Layout coordinates, see [Graphical Objects](#).

### Key Differences between Layout Windows and Layout Designer Windows

MapInfo Pro provides a **Layout Designer** window that will eventually replace the classic **Layout** window. You can continue creating your layouts in the classic **Layout** window for printing and distributing maps, or take advantage of some of the enhanced features in the **Layout Designer** window.

Each classic **Layout** window is represented by a hidden system table, such as layout1, layout2, and so on. This allows MapBasic programs to manipulate classic layouts using table statements:

- To select items in a classic layout: `Select * from layout1 Where rowid = 1`
- To add new items to a classic layout: `Create Line ... Into layout1`
- To delete items from a classic layout: `Delete From layout1 Where rowid = 2`

The **Layout Designer** window does not have a layoutN table associated with it, so you must use different syntax when manipulating a **Layout Designer** window; you need to use its window ID. For examples, see [Layout Designer Windows](#).

When a classic **Layout** contains a map, browser, or legend frame, that frame is not a window; it is a picture of a separate window. When a **Layout Designer** contains a map, browser, or legend frame, that frame is an embedded object that can be manipulated in-place.

Classic **Layout** windows let you draw certain types of shapes (such as points, polylines, and polygons) that are not available in **Layout Designer** windows. **Layout Designer** windows let you display image files in frames, which are not supported by classic **Layout** windows.

Custom drawing tools (created using the **Create ButtonPad** or **Alter ButtonPad** statements, with the **ToolButton** subclause) are not supported by the **Layout Designer**. Custom drawing tools that work with Map windows are supported inside of map frames, but such tools only work on the map frame after the frame is activated.

MapBasic applications can manipulate both classic **Layout** windows and **Layout Designer** windows. However, for some operations the MapBasic syntax differs depending on the type of layout window.

Both classic layouts and **Layout Designer** layouts save to workspace files. To view the syntax that creates each type of layout, create a layout (either type), save to a workspace, and then open the workspace (.WOR File) in a text editor.

## Layout Designer Windows

A **Layout Designer** window represents a page layout. To open a **Layout Designer** window, use the **Layout Designer** statement.

For a discussion about the differences between a classic **Layout** window and a **Layout Designer** window, see [Key Differences between Layout Windows and Layout Designer Windows](#).

### Basic Layout Designer Operations

To create frames or other objects within the layout, execute a **Set CoordSys** statement to specify the paper unit to use (in inches or centimeters).

The following example creates a new **Layout Designer**, creates a line in the layout, and maximizes the window:

```
Dim layoutID As Integer
Layout Designer
layoutID = FrontWindow( )
Set CoordSys Layout Units "cm"
Create Line Into Window layoutID (1, 1) (7, 2) Pen(1, 2, 255)
Set Window layoutID Max
```

To zoom in, zoom out, or re-center a layout (classic or **Layout Designer** layout), use the **Set Layout** statement. The following example resets the layout zoom level to the default (100%) and scrolls the window to the top left:

```
Set Layout Zoom 100 Center (0, 0)
```

Some of the clauses in the **Set Layout** statement apply only to classic **Layout** windows, and have no effect on **Layout Designer** windows; see the *MapBasic Help* for details.

Once you have the window ID of a **Layout Designer** window, you can query its status using the **LayoutInfo( )** function. You can query the status of specific frames on a **Layout Designer** using the **LayoutItemInfo( )** function. For details on these functions, see the *MapBasic Help*.

### Working with Map Frames

To create a new map in a **Layout Designer** frame, use the **Map From** statement, and include the optional **Into Window** clause to specify the ID of your **Layout Designer** window.

```
Dim layoutID As Integer
Dim mapFrameID As Integer
Layout Designer
layoutID = FrontWindow( )
Map From Towns, Roads Into Window layoutID
mapFrameID = WindowId( 0 )
```

Each map frame has an ID number that identifies it, just as each **Map** window does. After you create a map frame, you can call **WindowID(0)** to obtain the ID number of the most recently-opened map.

Once you know a map frame's ID number, you can manipulate that map the same way you would manipulate a **Map** window. For example, to change the settings on a layer, or to pan or zoom the map, use the **Set Map** statement.

Some Map Window operations cannot be performed on map frames. For example, you can maximize a **Map** window using a **Set Window ... Max** statement, but you cannot maximize a map frame.

A map frame can be activated (in which case it has a blue border) or inactive. Map tools, such as the **Label** tool and the **Select** tool, only work on a map frame when the frame is active. Users can activate a map frame by double-clicking or pressing **ALT+click** on the frame. To activate a map frame via MapBasic, use the **Set Window... Front** statement:

```
Set Window mapFrameID Front
```

When the user switches to a different window, the map frame automatically de-activates. Users can also deactivate by pressing **ALT+click** again on the frame, or clicking elsewhere in the **Layout Designer** window.

If a **Map** window is already open, and you want to clone that map into a new map frame in your **Layout Designer**, use the **Create Frame** statement:

```
Set CoordSys Layout Units "in"
Create Frame Into Window layoutID (1, 1) (4, 4) From Window mapWindowID
```

### Determining Whether a Map is in a Frame or a Window

In some cases, a MapBasic program might need to determine whether the current map is a **Map** window or a map frame. For example, an MBX might use the **WinFocusChangedHandler** subroutine, which is called automatically whenever the user switches from one window to another. Many MBXs use the **WinFocusChangedHandler** to enable or disable menu items and toolbar buttons, depending on what type of window is in use.

The following sample **WinFocusChangedHandler** subroutine shows how you can use the **WindowInfo()** function to tell whether the active map is a map frame or a **Map** window:

```

Include "mapbasic.def"
Declare Sub Main
Declare Sub WinFocusChangedHandler

Sub Main
  Print "Ready to detect Layout Frame activation."
End Sub

Sub WinFocusChangedHandler
  Dim winID, layoutID As Integer
  winID = FrontWindow()
  If (winID = 0) Then
    Exit Sub
  End If
  If (WindowInfo(winID, WIN_INFO_TYPE) <> WIN_MAPPER) Then
    Print "Front window is not a map."
    ' Here you could disable menu items that require a map
  Else
    layoutID = WindowInfo(winID, WIN_INFO_PARENT_LAYOUT)
    If (layoutID = 0) Then
      Print "The active map is not inside a layout; must be a Map window"
      ' Here you could enable Map-window-specific menu items
    Else
      Print "The active map is inside a Layout Designer."
      ' Here you could enable Map-frame-specific menu items
    End If
  End If
End Sub

```

### Working with Browser Frames

To create a browser frame, use the **Browse** statement, and include the **Into Window** clause:

```
Browse * From Parcels Into Window layoutID
```

Browser frames are more restrictive than Browser windows. Browser frames do not allow the user to select rows or edit cells. Also, the browser toolbar (at the top of each **Browser** window) is not included in browser frames, because layouts are used primarily for output and printing, and images of toolbars do not add value to printouts.

You can sort or filter browser Frames, using the **Set Browse** statement, just as you would sort or filter Browser windows.

Browser frames can be activated like Map frames, using the **Set Window... Front** syntax, or by double-clicking or pressing **ALT+click** mouse gestures.

### Working with Legend Frames

To create a legend frame, use the **Create Designer Legend** statement. This statement behaves differently, depending on whether you are using a map frame or a **Map** window:

- If you execute a **Create Designer Legend** statement against a **Map** window, then the user will see a new **Legend Designer** window open containing one or more legend frames.
- If you execute a **Create Designer Legend** statement against a map frame in a **Layout Designer**, the user will not see a **Legend Designer** window. Instead, the user will see the legend frames appear inside the **Layout Designer** (the same **Layout Designer** that contains the map frame). In this scenario, the **Layout Designer** window becomes the new container for the legend frames. Even though a separate **Legend Designer** window does not display, a Legend Designer MapBasic window identifier does and it can be used as the window identifier argument for any of the **Legend Designer** MapBasic statements and functions.

When you use the **Create Designer Legend** statement, you do not specify an **Into Window** clause. Instead, the destination is automatic: When you create a legend for a map frame, the legend is automatically created as a frame inside the same layout as the map frame.

To obtain the window identifier for any of the legends in the **Layout Designer**, use **LayoutItemInfo()** and the attribute `LAYOUT_ITEM_INFO_LEGEND_DESIGNER_WINDOW`.

### Working with Image Frames

To place an image frame (such as a .JPG image) to your **Layout Designer**, use the **Add Image Frame** statement.

```
Add Image Frame
  Position (1, 1) Units "in"
  Width 3 Units "in" Height 6 Units "in"
  From File "C:\data\images\Logo.jpg"
```

Although workspaces preserve image frame settings, a .WOR file does not include a copy of the image; instead, the .WOR file saves the path to the image file. If you share your .WOR files with others, make sure you also provide copies of any image files that you display in image frames.

If the image file is in the same directory as the .WOR file (or in a subdirectory of that directory), the .WOR file stores a relative path in the **Add Image Frame** statement.

### Working with Text Frames

To add Text to a **Layout Designer**, use the **Create Text** statement, and include the **Into Window** clause to specify window ID for the **Layout Designer** window.

To specify the text style, include the optional **Font** clause. If this clause is omitted, the text frame will be created using MapInfo Pro's current font style.

Specify hard line breaks by including `\n` in the text. For example:

```
Layout Designer
Set CoordSys Layout Units "in"
Create Text Into Window FrontWindow( )
  "Title goes here\nSubtitle goes here"
  (0.3, 0.3) (8.2, 1.2)
  Font ("Times New Roman",1,16,255)
  Justify Center
```

Some aspects of the **Font** clause, such as halo color, expanded text, and shadow text are ignored by **Layout Designer**.

### Working with Shapes

You can create shapes into a **Layout Designer**, using the **Create Line**, **Create Ellipse**, **Create Rect**, and **Create RoundedRect** statements. Each of these statements supports an optional **Into Window** clause to designate the ID of the **Layout Designer** window that you want to use. For example:

```
Layout Designer
Set CoordSys Layout Units "in"
Create Rect
  Into Window FrontWindow()
  (0.25, 0.2) (8.25, 1.5)
  Pen(1,2,0) Brush(2,14737632,14737632)
```

The shape-creation statements let you include an optional **Pen** clause to specify the line style for lines and borders. Except for the **Create Line** statement, they also let you include a **Brush** clause to specify a fill style. If you omit these style clauses, then the objects are created using MapInfo Pro's current styles.

**Note:** The **Layout Designer** supports only simple, solid line and fill styles. If the **Pen** or **Brush** clause specifies non-solid patterns, then those patterns are ignored and the resulting shape will still use

a simple, solid style. (This restriction does not apply to the contents of map frames. You can use complex line and fill styles in your map layers, and those styles will work correctly in a map frame in **Layout Designer**).

### Controlling Front-to-Back Order (Z-Order)

Every statement that lets you create a **Layout Designer** frame provides an optional **Priority** clause, which controls whether the frame is created in front of other frames or behind them. We refer to this as the z-order of the frames.

The following example creates a rectangle, behind all other frames, by specifying `Priority 1`:

```
Create Rect Into Window FrontWindow()
  (1.15, 0.25) (4.5, 2.6)
  Priority 1
  Pen(1,2,0) Brush(2,14737632,14737632)
```

To create the object in front of or on top of other layout frames, specify a larger **Priority** value. Priority values are integers of 1 or larger. If you do not specify a **Priority** when creating a legend frame, then the frame is automatically placed on top of other frames.

Frames may be created with duplicate **Priority** values. The render order places the most recently created item over the others of equal priority. No adjustment to the existing object z-order attributes are made as a result of processing a **Priority n** clause.

**Note:** The **LayoutItemInfo** function does not support querying the frame's z-order property, so there is no mechanism for querying the z-order of a frame. There is no support for modifying the z-order of a frame via MapBasic.

## Redistrict Windows

Use the **Create Redistricter** statement to begin a redistricting session. The **Create Redistricter** statement lets your program control all redistricting options that the user might configure through the **Window > New District Window** dialog box.

Once a redistricting session has begun, you can control the Districts Browser by issuing **Set Redistricter** statements. To perform actions from the **Redistrict** menu, use the **Run Menu Command** statement.

For example, to assign objects to a district (as if the user had chosen **Redistrict > Assign Selected Objects**), issue the following statement:

```
Run Menu Command M_REDISTRICT_ASSIGN
```

To end a redistricting session, close the Districts Browser by issuing a **Close Window** statement. Note that values in the base table change as objects are re-assigned from district to district. After a redistricting session, you must save the base table if you want to retain the map objects' final district assignments. To save a table, issue a **Commit** statement.

For more information about redistricting, see the MapInfo Pro documentation.

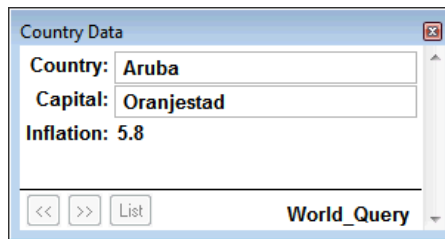
## Message Window

You can use MapBasic's **Print** statement to print text to the **Message** window. For example, the following statement prints a message to the **Message** window:

```
Print "Dispatcher is now on line."
```

### Customizing the Info Window

The **Info** window displays a row from a table. The user can edit a row by typing into the **Info** window. To control and customize the **Info** window, use the **Set Window** statement. The following picture shows a customized **Info** window:



The following program creates the customized **Info** window shown above.

```
Include "mapbasic.def"
Open Table "World" Interactive
Select
  Country, Capital, Inflat_Rate + 0 "Inflation"
  From World
  Into World_Query
Set Window Info
  Title "Country Data"
  Table World_Query Rec 1
  Font MakeFont("Arial", 1, 10, BLACK, WHITE)
  Width 3 Units "in" Height 1.2 Units "in"
  Position (2.5, 1.5) Units "in"
  Front
```

Note the following points about this example:

- Ordinarily, the **Info** window's title bar reads "Info Tool." This program uses the **Title** clause to make the title bar read "Country Data."
- To specify which row of data appears in the window, use the **Set Window** statement's **Table...Rec** clause. The example above displays record number 1 from the `World_Query` table. (`World_Query` is a temporary table produced by the **Select** statement.)
- The **Info** window displays a box for each field in the record; the scroll-bar at the right edge of the window allows the user to scroll down through the fields. To limit the number of fields displayed, the example above uses a **Select** statement to build a temporary query table, `World_Query`. The `World_Query` table has only three columns; as a result, the **Info** window displays only three fields.

To make some, but not all, of the fields in the **Info** window read-only:

1. Use a **Select** statement to produce a temporary query table.
2. Set up the **Select** statement so that it calculates expressions instead of simple column values. The **Select** statement shown above specifies the expression `"Inflat_Rate + 0"` for the third column value. (The `"Inflation"` string that follows the expression is an alias for the expression.)

```
Select
  Country, Capital, Inflat_Rate + 0 "Inflation"
```

1. In the **Set Window Info** statement, use the **Table... Rec** clause to specify which record is displayed. Specify a row from the query table, as in the example above. When a column in the query table is defined with an expression, the corresponding box in the **Info** window is read-only. (In the example above, the `Inflation` field is read-only.)
2. When the user types a new value into the **Info** window, MapInfo Pro automatically stores the new value in the temporary query table, and in the base table on which the query was based. You do not need to issue additional statements to apply the edit to the table. (However, you do need to issue a **Commit** statement if you want to save the user's edits.)



To make all fields in the **Info** window read-only, issue the following statement:

```
Set Window Info ReadOnly
```

**Note:** All of the fields in the **Info** window are read-only when you display a table that is a join (such as a **StreetInfo** table) or a query table that uses the **Group By** clause to calculate aggregate values.

## ButtonPads (Toolbars)

A **ButtonPad** is a resizable, floating window which contains one or more buttons. The user can initiate various types of actions by choosing buttons from a **ButtonPad**.

The terms "ButtonPad" and "toolbar" mean exactly the same thing. The MapInfo Pro user interface refers to toolbars. For example, MapInfo Pro's **Options** menu has a **Toolbars** command, which lets the MapInfo Pro user show or hide toolbars. Meanwhile, the MapBasic language syntax refers to toolbars as **ButtonPads**. For example, use the **Alter ButtonPad** statement to show or hide a toolbar.

MapInfo Pro provides several standard **ButtonPads**, such as the Main **ButtonPad**. A MapBasic program can add custom buttons to existing **ButtonPads**, or create entirely new **ButtonPads**.

### What Happens When the User Chooses a Button?

Like menu items, custom buttons have handler procedures. When a user works with a custom button, MapBasic automatically calls that button's handler procedure. Thus, if you want MapBasic to display a custom dialog box each time the user clicks on a button, create a sub procedure which displays the dialog box, and make that procedure the handler for the custom button.

A MapBasic program can create three different types of buttons: **ToolButtons**, **ToggleButton**s, and **PushButton**s. The button type dictates the conditions under which MapBasic calls that button's handler.

- **PushButton:** When the user clicks on a **PushButton**, the button springs back up, and MapBasic calls the **PushButton**'s handler procedure.

The **Layer Control** button is an example of a **PushButton**. Clicking on the **Layer Control** button has an immediate effect (a dialog box displays), but there is no lasting change to the status of the button.

- **ToggleButton:** When the user clicks on a **ToggleButton**, the button toggles between being checked (pushed in) and being unchecked (not pushed in). MapBasic calls the button's handler procedure each time the user clicks on the **ToggleButton**.

The **Show/Hide Legend Window** button is an example of a **ToggleButton**. Clicking on the button has an immediate effect: showing or hiding the **Legend Window**. Furthermore, there is a lasting change to the button's status: the button toggles in or out.

- **ToolButton:** When the user clicks on a **ToolButton**, that button becomes the active tool, and remains the active tool until the user chooses a different tool. MapBasic calls the button's handler procedure if the user clicks in a **Map**, **Browse**, or **Layout** window while the custom button is the selected tool.

The **Magnify** tool is an example of a **ToolButton**. Choosing the tool does not produce any immediate effects; however, choosing the tool and then clicking in a **Map** window does have an effect.

### MapBasic Statements Related To ButtonPads

The following statements and functions let you create and control custom buttons and **ButtonPads**:

### Create ButtonPad

This statement creates a new ButtonPad and provides a custom icon for a button. You have to define both small and large sized buttons with resource file ids of *n* and *n+1* respectively.

### Alter ButtonPad

After creating a custom ButtonPad, your program can alter various attributes of the ButtonPad. The **Alter ButtonPad** statement lets you reposition, show, or hide a ButtonPad, or add or remove buttons to or from a ButtonPad.

The **Alter ButtonPad** statement lets you modify any ButtonPad, even standard pads, such as Main. If your application needs only one or two custom buttons, you may want to add those buttons to the standard Main ButtonPad, instead of creating a new ButtonPad.

### Alter Button

This statement modifies the status of a single button. Use the **Alter Button** statement to disable (de-activate) or enable (activate) a button, or to change which button is currently selected.

### CommandInfo( )

Use the **CommandInfo( )** function within a button's handler procedure to query information about how the user has used the custom button. For example, if the user chooses a ToolButton and then clicks in a **Map** window, the **CommandInfo( )** function can read the x- and y-coordinates of the location where the user clicked.

If you create two or more buttons that call the same handler procedure, that procedure can call `CommandInfo(CMD_INFO_TOOLBTN)` to determine which button is in use.

Thus, within a button's handler procedure, you might call **CommandInfo( )** several times: Once to determine which button the user has chosen; once to determine the x-coordinate of the location where the user clicked; once to determine the y-coordinate; and once to determine whether or not the user held down the **Shift** key while clicking.

### ToolHandler

**ToolHandler**, a special procedure name, gives you an easy way to add one button to the Main ButtonPad. If your MapBasic program includes a procedure named **ToolHandler**, MapBasic automatically adds one ToolButton to the Main ButtonPad. Then, if the user chooses the ToolButton, MapBasic automatically calls the **ToolHandler** procedure each time the user clicks in a **Map**, **Browse**, or **Layout** window.

A MapBasic program cannot customize the button icon or draw mode associated with the **ToolHandler** procedure; the icon and cursor always use a simple + shape. If you need to specify a custom icon or cursor, use the **Create ButtonPad** or **Alter ButtonPad** statement instead of a **ToolHandler** procedure.

If the user runs multiple MapBasic applications at one time, and each application has its own **ToolHandler**, each application adds its own button to the Main ButtonPad.

## Creating A Custom PushButton

The following program creates a custom ButtonPad containing a PushButton. The `button_prompt` procedure is the button's handler; therefore, whenever the user clicks the custom PushButton, MapBasic automatically calls the `button_prompt` procedure.

```
Include "icons.def"
  Declare Sub Main
  Declare Sub button_prompt

Sub Main
  Create ButtonPad "Custom" As
    PushButton
```

```

Icon MI_ICON_ZOOM_QUESTION
Calling_button_prompt
HelpMsg "Displays the query dialog\nQuery"
Show
End Sub
Sub button_prompt
' This procedure called automatically when
' the user chooses the button.
' ...
End Sub

```

The **Main** procedure contains only one statement: `Create ButtonPad`. This statement creates a custom `ButtonPad`, called "Custom," and creates one custom button on the `ButtonPad`.

The **PushButton** keyword tells MapBasic to make the custom button a `PushButton`.

The **Icon** clause tells MapBasic which icon to display on the custom button. The identifier, `MI_ICON_ZOOM_QUESTION`, is defined in the file `icons.def`. To see a list of standard MapInfo Pro icon identifiers, examine `icons.def`.

The **Calling** clause tells MapBasic to call the `button_prompt` procedure whenever the user clicks on the custom button.

The **HelpMsg** clause defines both a status bar help message and a ToolTip help message for the button. Help messages are discussed in [Assigning Help Messages to Buttons](#).

See the **Create ButtonPad** statement in the *MapBasic Reference* for image size considerations.

## Adding A Button To The Main ButtonPad

The preceding example used the **Create ButtonPad** statement to create an all-new `ButtonPad`. MapBasic can also add custom buttons to MapInfo Pro's default `ButtonPads`, such as `Main`. To add a button to an existing `ButtonPad`, use the **Alter ButtonPad** statement, instead of the **Create ButtonPad** statement, as shown in the following example:

```

Alter ButtonPad "Main"
Add Separator
Add PushButton
Icon MI_ICON_ZOOM_QUESTION
Calling_button_prompt
HelpMsg "Displays the query dialog\nQuery"
Show

```

The **Add PushButton** clause adds a custom button to the `Main ButtonPad`, while the **Add Separator** clause places an empty space between the new button and the previous button. The **Add Separator** clause is optional; use it when you want to separate buttons into distinct groups.

MapInfo Pro includes a special `ButtonPad`, called `Tools`, so that MapBasic utility programs will have a place where they can add custom buttons. For example, the `ScaleBar` utility adds its button to the `Tools ButtonPad`.

## Creating A Custom ToolButton

The preceding examples created custom `PushButtons`. MapBasic also can create custom `ToolButtons`, which act like MapInfo Pro tools, such as the `Magnify` and `Line` tools. If a program creates a custom `ToolButton`, the user can choose that tool, and then use that tool to click, and sometimes drag, on a **Map**, **Browse**, or classic **Layout** window, or on an active map frame in a **Layout Designer** window.

The following example creates a custom `ToolButton`. After selecting the tool, the user can click and drag in a **Map** window. As the user drags the mouse, MapInfo Pro displays a dynamically-changing line connecting the current cursor position to the location where the user clicked.

```
Include "icons.def"
Include "mapbasic.def"
Declare Sub Main

Declare Sub draw_via_button
Sub Main
  Create ButtonPad "Custom" As
    ToolButton
    Icon MI_ICON_LINE
    DrawMode DM_CUSTOM_LINE
    Cursor MI_CURSOR_CROSSHAIR
    Calling draw_via_button
    HelpMsg "Draws a line on a Map window\nDraw Line"
  Show
End Sub
Sub draw_via_button
  Dim x1, y1, x2, y2 As Float
  If WindowInfo(FrontWindow(), WIN_INFO_TYPE) <> WIN_MAPPER Then
    Note "This tool may only be used on a Map window. Sorry!"
    Exit Sub
  End If

  ' Determine map location where user clicked:
  x1 = CommandInfo(CMD_INFO_X)
  y1 = CommandInfo(CMD_INFO_Y)
  x2 = CommandInfo(CMD_INFO_X2)
  y2 = CommandInfo(CMD_INFO_Y2)

  ' Here, you could create objects based on x1, y1, x2, and y2.
End Sub
```

In this example, the **Create ButtonPad** statement includes the **ToolButton** keyword instead of the **PushButton** keyword. This tells MapBasic to make the custom button act like a drawing tool.

The button definition includes a **DrawMode** clause, which tells MapBasic whether the user can drag after clicking with the tool. The example above uses the **DM\_CUSTOM\_LINE** drawing mode; therefore, the user is able to click and drag with the custom tool, just as you can click and drag when using MapInfo Pro's standard Line tool. When a tool uses the **DM\_CUSTOM\_POINT** mode, the user cannot drag after clicking. For a listing of all available drawing modes, see **Alter ButtonPad** in the *MapBasic Reference* or *MapBasic Help*.

The **DrawMode** clause also controls what the user sees while dragging. With the **DM\_CUSTOM\_LINE** mode, MapBasic draws a line between the cursor location and the point where the user first clicked. With the **DM\_CUSTOM\_RECT** mode, MapBasic draws a rectangular marquee while the user drags the mouse. Regardless of which **DrawMode** is used with a `ToolButton`, MapInfo Pro calls the button's handler procedure after the user clicks and releases the mouse button. The handler procedure can call **CommandInfo( )** to determine where the user clicked.

**Note:** If the user cancels the operation by pressing the Esc key, MapInfo Pro does not call the handler procedure.

## Choosing Icons for Custom Buttons

When you define a custom button, you control the icon that appears on the button. To specify which icon you want to use, use the **Icon** clause.

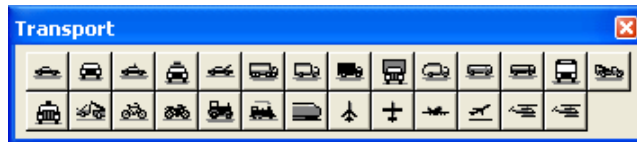
The keyword `Icon` is followed by a code from `ICONS.DEF`. For example, the following statement defines a custom button that uses the icon for MapInfo Pro's Info button. The code `MI_ICON_INFO` is defined in `ICONS.DEF`.

```
Alter ButtonPad "Main"
  Add Separator
  Add PushButton
    Icon MI_ICON_INFO
    Calling_procedure_name
```

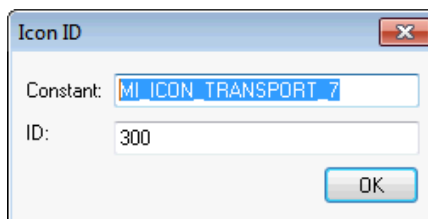
**Note:** MapInfo Pro provides many built-in icons, most of which are not used in MapInfo Pro's standard user interface. To see a demonstration of the built-in icons, run the sample program Icon Sampler (`ICONDEMO.MBX`) and then choose an item from the Icon Sampler menu. To see the code for a particular icon, position the mouse over that icon.

The button's ToolTip shows you the icon code. You also can copy an icon's code to the clipboard:

1. Run the Icon Sampler application (`ICONDEMO.MBX`).
2. Choose an item from the Icon Sampler menu. A custom ButtonPad appears.



3. Click on the button whose icon you want to use. A dialog box appears.



4. Press **Ctrl+C** (the Windows shortcut for the Copy command).
5. Click **OK** to dismiss the dialog box.
6. Switch to MapBasic. Press **Ctrl+V** (the shortcut for Paste) to paste the code into your program.

## Selecting Objects by Clicking With a ToolButton

If the user chooses a custom ToolButton and then clicks on a map object, the object is not selected; instead, MapInfo Pro calls the custom ToolButton's handler procedure. If you need to select the object on which the user clicked, issue a `Select` statement from within the handler procedure.

The following handler procedure selects the town boundary region where the user clicked. To determine the coordinates where the user clicked, call `CommandInfo()`. Then, to select objects at that location, issue a `Select` statement with a `Where` clause, and specify a geographic operator such as `Contains`. The following example selects all the town regions that contain the location where the user clicked.

```
Sub t_click_handle
  Dim fx, fy As Float

  fx = CommandInfo(CMD_INFO_X)
  fy = CommandInfo(CMD_INFO_Y)
  Select * From towns
```

```
Where obj Contains CreatePoint (fx, fy)

End Sub
```

**Note:** Instead of using a **Select** statement, you could call the **SearchPoint()** or **SearchRect()** function to perform a search, and then call **SearchInfo()** to process the search results. For an example of this technique, see **SearchInfo()** in the *MapBasic Reference* or *MapBasic Help*.

Another approach would be to define a procedure called **SelChangedHandler**. If the user is running an application that contains a **SelChangedHandler** procedure, MapInfo Pro automatically calls that procedure every time the selection changes. The user could select objects by pointing and clicking with MapInfo Pro's standard Select tool (the arrow-shaped icon at the upper left corner of MapInfo Pro's Main ButtonPad), and your application could respond by issuing statements within the **SelChangedHandler** procedure.

## Including Standard Buttons in Custom ButtonPads

You can include any of MapInfo Pro's standard buttons (such as the Select button) on custom ButtonPads. For example, the following statement creates a custom ButtonPad containing two buttons: The standard MapInfo Pro Select button, and a custom button.

```
Create ButtonPad "ToolBox" As
  ' Here is the standard Select button...
  ToolButton
    Icon MI_ICON_ARROW
    Calling M_TOOLS_SELECTOR
    HelpMsg "Select objects for editing\nSelect"
  ' Here is a custom ToolButton...
  ToolButton
    Icon MI_ICON_LINE
    DrawMode DM_CUSTOM_LINE
    Calling sub_procedure_name
    HelpMsg "Draw New Delivery Route\nNew Route"
```

The first button's **Calling** clause specifies `M_TOOLS_SELECTOR`, which is a numeric code defined in `MENU.DEF`. This code represents MapInfo Pro's Select button. Every standard MapInfo Pro button has a corresponding code in `MENU.DEF`. Because the second button is a custom button, its **Calling** clause specifies the name of a procedure, rather than a numeric code.

Note that the custom button includes a **DrawMode** clause, but the Select button does not. When you place a standard button on a custom pad, you should omit the **DrawMode** clause, because each of MapInfo Pro's standard buttons already has a pre-defined draw mode. You should only specify a **DrawMode** clause when creating a custom **ToolButton**.

**Caution:** **ToolButtons** and **ToggleButton**s are not interchangeable. You cannot convert one type of button to another type merely by replacing the **ToolButton** keyword with the **ToggleButton** keyword (or vice versa). **ToolButtons** return x/y coordinates in response to the user clicking on a window. **ToggleButtons**, however, do not return coordinates, and they respond as soon as the user clicks on the button.

If you include standard MapInfo Pro buttons in your custom ButtonPads, make sure that you do not accidentally change a **ToolButton** to a **ToggleButton**. To see how MapInfo Pro's standard buttons are defined, view the MapInfo Pro menu file, `MAPINFOW.MNU`. The menu file contains the **Create ButtonPad** statements that define MapInfo Pro's ButtonPads.

**Note:** You can copy button definitions out of `MAPINFOW.MNU` and paste them into your programs.

## Assigning Help Messages to Buttons

Your users may not understand the purpose of a toolbar button just by looking at its icon. Therefore, MapBasic lets you create two types of on-screen help messages to assist your users:

- **Status bar help.** Used to show a brief description of the button, this type of help message appears on the MapInfo Pro status bar (assuming that the status bar is currently visible).
- **ToolTip help.** Used to show the name of the button, this type of help message appears next to the mouse cursor.

In earlier versions of MapInfo Pro, status bar help only appeared when the user clicked on a button. In version 4.0 and later, both the status bar help and ToolTip help appear when the user leaves the mouse cursor positioned over a toolbar button.

Both types of help messages are defined through the **HelpMsg** clause, in the **Create ButtonPad** and **Alter ButtonPad** statements. Within the **HelpMsg** clause, you specify one string that contains the status bar help message, followed by the letters \n, followed by the ToolTip message.

For example:

```
Create ButtonPad "Custom" As
  PushButton
  Icon MI_ICON_ZOOM_QUESTION
  Calling generate_report
  HelpMsg "This button generates reports\nGenerate Report"
  Show
```

In this example, the custom button's status bar help message is "This button generates reports" and its ToolTip message is "Generate Report." To show or hide the status bar, use the **StatusBar** statement.

## Docking a ButtonPad to the Top of the Screen

Use the **Alter ButtonPad** statement to attach a toolbar to the top edge of the screen. (This is sometimes known as "docking" the toolbar.) For example, the following statement docks the Main toolbar:

```
Alter ButtonPad "Main" Fixed
```

The keyword **Fixed** specifies that the pad should be docked to the top of the screen. To change a toolbar from docked to floating, specify **Float** instead of **Fixed**. The **Fixed** and **Float** keywords can also be used within the **Create ButtonPad** statement, so that you can set the docked status at the moment you create the toolbar.

To determine whether a toolbar is currently docked, call the **ButtonPadInfo( )** function.

## Other Features of ButtonPads

MapBasic also offers the following ButtonPad-related features:

- **Enabled/Disabled Buttons.** A MapBasic program can disable or enable custom buttons as needed. For details, see the *MapBasic Reference*, **Alter ButtonPad**.
- **Custom Button Icons.** You can use a resource editor to create custom icons, and use those custom icons on MapBasic ButtonPads.
- **Custom Draw Cursors.** The cursor is the shape that moves as you move the mouse. By default, all custom MapBasic buttons use a simple cursor, shaped like a pointer. However, you can use a resource editor to create custom cursors.

The MapBasic development environment does not include a resource editor. However, MapBasic programs can incorporate bitmaps and cursors created using other resource editors. For more information about creating custom icons and cursors, see [Integrated Mapping](#).

## Cursors

MapInfo Pro users can change the crosshair cursor style by pressing the X key. Cursors in the MapInfo Pro application are independent of cursors in the MapBasic application, so changing the cursor style in MapInfo Pro does not change the cursor style in MapBasic and vice versa.

There is no MapBasic support for changing the crosshair cursor style for MapInfo Pro tools, and there is no MapBasic support for changing cursor style by pressing the **X** key within a MapBasic application. However, you can access the crosshair cursor styles for use within your MapBasic applications. The `icons.def` file defines the following crosshair cursors.

MI_CURSOR_CROSSHAIR	138	displays a small blue crosshair cursor
MI_CURSOR_LRG_CROSSHAIR	164	displays a large blue crosshair cursor
MI_CURSOR_TINY_CROSSHAIR	165	displays a tiny XOR crosshair cursor



The following is an example that sets the cursor style:

```
Create ButtonPad "TestCursor" as ToolButton
    calling my_handler cursor MI_CURSOR_TINY_CROSSHAIR
```

### Cursor modifications to ICONS.DEF

MapBasic provides you options to switch between 1-bit and 32-bit per pixel cursors. Use them interchangeably to eliminate delays in the rendering of cursors in environments like Citrix.

The `icons.def` contains information about 1-bit per pixel cursors for all the cursors except for the windows default cursors. The cursors `MI_CURSOR_ARROW`, `MI_CURSOR_IBEAM`, `MI_CURSOR_CROSS`, `MI_CURSOR_PLUS`, and `MI_CURSOR_WAIT` do not have a value of 1-bit per pixel. The rest of the cursors have both 1-bit and 32-bit per pixel values.

For example, the cursor `MI_CURSOR_FINGER_LEFT` will have a corresponding 1-bit per pixel cursor in addition to the already existing 32-bit per pixel cursor. The new 1-bit per pixel cursor is named `MI_CURSOR_FINGER_LEFT_1BPP`.

The code

```
Calling btnsub1 Cursor MI_CURSOR_FINGER_LEFT
```

will call the 32-bit per pixel cursor `MI_CURSOR_FINGER_LEFT`. This will switch if you switch the cursors using the **Enable True Color Cursors** check box in the **System Settings Preferences** dialog box in MapInfo Pro or via a MapBasic command such as the one described above.

However, if you want to use the corresponding 1-bit per pixel cursor explicitly, you need to execute

```
Calling btnsub1 Cursor MI_CURSOR_FINGER_LEFT_1BPP
```



## Integrating Your Application Into MapInfo Pro

The preceding sections have discussed how a MapBasic application can customize the user interface by creating custom menus, dialog boxes, windows, and ButtonPads. Once you have completed your application, however, one issue will remain: what steps does the user have to take to run your application, so that your customized user-interface will take effect?

Any MapInfo Pro user can run a MapBasic application by choosing **Tools > Run MapBasic Program**. However, you may want to set up your application so that it runs automatically, instead of forcing your users to choose **File > Run MapBasic Program** every time they run MapInfo Pro. If you are creating what is known as a turn-key system, you probably want your application to run automatically, as soon as the user launches MapInfo Pro.

Using Windows, you can change the command line of a shortcut icon in a similar manner. Right-click the shortcut icon, choose **Properties**, and click on the Shortcut tab.

Ordinarily, MapInfo Pro displays the **Quick Start** dialog box as soon as the user runs it (unless the user has cleared the **Display Quick Start** dialog box check box in the **Startup Preferences** dialog box). However, if you add the name of a MapBasic application to the command that launches MapInfo Pro, then the **Quick Start** dialog box will not appear. Depending on the nature of your application, this behavior may or may not be desirable. If you want your application to run automatically, without disabling the **Quick Start** dialog box, you may need to use a different method for loading your application. Instead of modifying the MapInfo Pro command line, you may want to create a special workspace, called the Startup workspace.

## Loading Applications Through the Startup Workspace

"Startup" is a special name for a workspace. If a startup workspace exists on the user's system, MapInfo Pro loads the workspace automatically. If the startup workspace contains a **Run Application** statement, MapInfo Pro runs the specified application.

For example, if you want to run the ScaleBar application, you could create a startup workspace that looks like this:

```
!Workspace
!Version 600
!Charset Neutral
Run Application "scalebar.mbx"
```

The first three lines are required for MapInfo Pro to recognize the file as a workspace. The fourth line, in this example, launches a MapBasic application by executing a **Run Application** statement.

The presence of a startup workspace has no effect on the display of the **Quick Start** dialog box. MapInfo Pro loads the startup workspace (if there is one), and then displays the Quick Start dialog box (unless the user has configured the system so that the **Quick Start** dialog box never displays).

On Windows, the startup workspace has the name `STARTUP.WOR` and can be located in the directory in which MapInfo Pro is installed or in the user's private Windows directory (the directory where `WIN.INI` is stored). If a `STARTUP.WOR` exists in both directories, both workspaces will be executed when the user starts MapInfo Pro.

In a networked environment, if you want the startup workspace to apply to all MapInfo Pro users on the network, you should place the startup workspace file in the directory where MapInfo Pro is installed. If you do not want all the network users to run the same startup workspace file, you should use the alternate

location for the startup workspace (for example, on Windows, place the workspace in the users' private Windows directories).

# Manipulating Workspaces through MapBasic

---

Since workspaces are simply text files, you can create and edit a startup workspace using any text editor. Furthermore, since a MapBasic program can perform file input/output, your MapBasic program can automate the maintenance of the startup workspace.

To see how a MapBasic program can manipulate a workspace file, try this:

1. Choose MapInfo Pro's **Tools > Run MapBasic Program** command to run the **TextBox** application.
2. Choose **Tools > TextBox > About TextBox** to display the **About TextBox** dialog box.
3. Click on the **Auto-Load** button on the **About TextBox** dialog box. MapInfo Pro displays a dialog box that lets you activate automatic the loading of the **TextBox** application.
4. Choose **OK** on the **Enable Automatic Loading** dialog box. MapInfo Pro displays a message indicating that the **TextBox** application is now configured to run automatically. Choose **OK** on the **About TextBox** dialog box.
5. Exit MapInfo Pro, then restart it. Note that in this new MapInfo Pro session, the **TextBox** application runs automatically; you do not need to choose **Tools > Run MapBasic Program** application.

When you choose **OK** in step 4, the **TextBox** application adds a **Run Application** statement to the startup workspace file. If the startup workspace file does not exist, the **TextBox** application creates it.

The maintenance of the startup workspace is handled by functions and procedures in the program module `auto_lib.mb`. Many of the sample programs that are bundled with MapInfo Pro contain the same functionality; for example, a MapInfo Pro user can set up the **ScaleBar** application to run automatically by choosing the **Auto-Load** button on the **About ScaleBar** dialog box.

The `auto_lib.mb` program module is one of the sample programs included with MapBasic. If you want your application to include the **Auto-Load** feature, follow the instructions that appear in the comments at the top of `auto_lib.mb`.

## Performance Tips for the User Interface

If you are making frequent updates to objects in a **Map** window, using an Animation Layer can make the window redraw more quickly. Animation Layers are described in [Using Animation Layers to Speed Up Map Redraws](#).

## Avoiding Unnecessary Window Redraws

Whenever your application alters a **Map** window (or alters an object in the window), MapInfo Pro redraws the window. If your application makes several alterations, the **Map** window will redraw several times, which can annoy your users.

There are two ways to suppress unnecessary window redraws:

- To suppress unnecessary redrawing of one **Map** window, use the **Set Map...Redraw Off** statement. Then issue all statements that affect the **Map** window. When you are finished updating the map, issue a **Set Map...Redraw On** statement to allow the window to redraw. The window will redraw once, showing all changes you made.
- To suppress unnecessary redrawing of all MapInfo Pro windows, use the **Set Event Processing Off** statement. When you are finished updating various windows, issue a **Set Event Processing On** statement, and the screen will redraw once.

## Purging the Message Window

The **Print** statement prints text to the **Message** window.

**Note:** Printing large amounts of text to the **Message** window can dramatically slow down subsequent **Print** statements.

If your program prints large amounts of text to the **Message** window, you should periodically clear the **Message** window by issuing a `Print Chr$(12)` statement.

## Suppressing Progress Bar Dialog Boxes

If your application minimizes MapInfo Pro, you should suppress progress bars by using the **Set ProgressBars Off** statement.

When a progress bar displays while MapInfo Pro is minimized, the progress bar is frozen for as long as it is minimized. If you suppress the display of progress bars, the operation can proceed, even if MapInfo Pro is minimized.



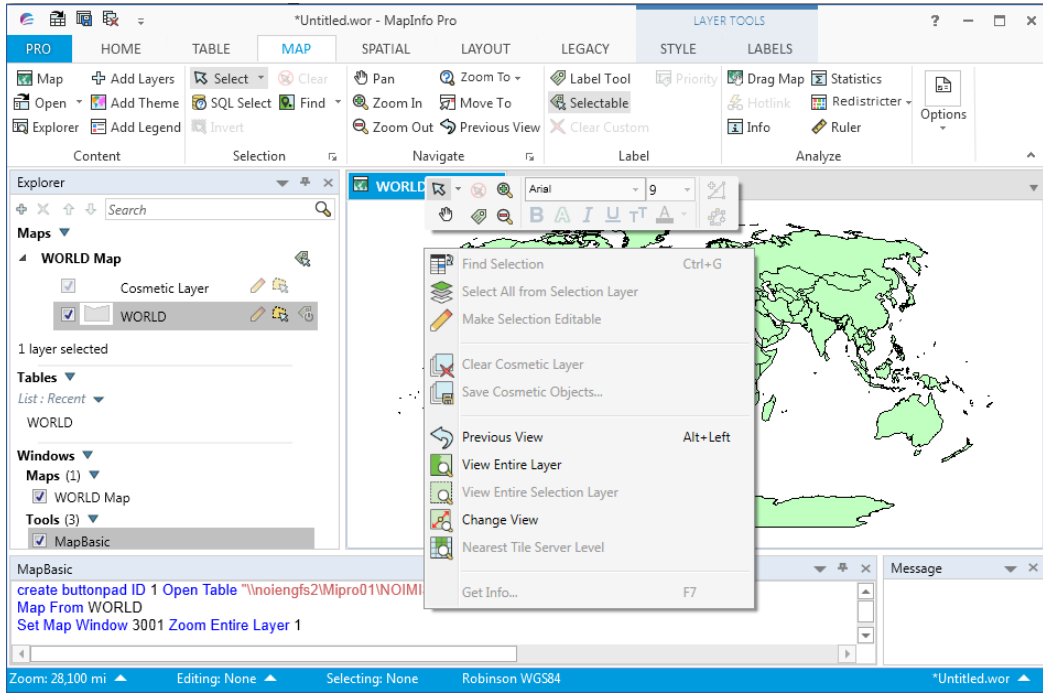
# Getting Started with the Ribbon Interface (MapInfo Pro 64-bit)

Ribbon user interface (UI) is a rich command presentation system in Windows-based applications, which replaces the old style of layered menus, toolbars, and task panes in the 32-bit version.

It consists of a command bar or Ribbon, contextual tabs, mini-toolbars, status bar and BackStage. It offers the developers a robust and consistent model for managing dynamic content in a variety of collection-based controls. Using the Ribbon Extensibility developers can manipulate the Ribbon UI components to enhance user's efficiency and ease of use.

MapInfo Pro allows you to customize the Ribbon Interface contents. You can add groups and panels and modify keyboard shortcuts. By writing a MapBasic program, you can create a custom user interface for MapInfo Pro by modifying the BackStage or the MapInfo Pro status bar. A MapBasic program can control the following elements of the Ribbon interface.

1. Ribbon
2. Status Bar
3. Mini-Toolbar
4. User Controls
5. Context Menu
6. Back stage



**In this section:**

- **Ribbon** .....127
- **Status Bar** .....127
- **Mini Toolbar** .....128
- **User Control** .....128
- **Context Menu** .....129
- **BackStage** .....129

## Ribbon

A Ribbon in MapInfo Pro is a command bar located at the top of the screen that replaces the traditional menus and toolbars. The Ribbon provides quick access to commonly used tasks through a series of tabs, which lays out commands in logical groups. The Ribbon also contains drop-down galleries, split lists, contextual tabs and mini toolbars.

The basic Ribbon components are:

1. **Tabs** sit across the top of the Ribbon. Each tab represents core tasks you perform in a given program.
2. **Groups** are sets of related commands, displayed under a tab on the Ribbon. They pull together all the commands you are likely to need for a type of task, and they remain on display and readily available, giving you rich visual aid.
3. **Commands** are arranged in groups on the Ribbon. A command can be a button, a split list, or a box where you enter information.
4. **Icons** - User can add icons in the Ribbon. Users can use same icons for different functions while adding the components.

The MapInfo Ribbon includes Home, Table, Map, Spatial and Layout tabs that each displays a different set of commands when selected.

The following sample code demonstrates how to customize a Ribbon in MapInfo Pro. This code snippet adds a new Ribbon tab, a new Ribbon group under this tab and a new button control in the group.

```
IRibbonTabCollection tabCollection = application.Ribbon.Tabs; //Gets a
collection of tabs in the Ribbon
//"application" is the MapInfo Pro application handle obtained using
SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) in MapBasic code
//SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) returns an instance of MapInfo
Pro x64 application represented as a This variable type in MapBasic,
referring to an instance of IMAPINFOPRO.
//IMAPINFOPRO interface is the base interface providing access to MapInfo
Pro UI components in your addins
//Refer to the main subroutine in
Samples\RIBBONINTERFACE\DotNet\RibbonCustomization\RibbonCustomization.mb
for more details
IRibbonTab customTab = tabCollection.Add("NewTab", "New Tab"); //Adds a
new tab with caption on the Ribbon
IRibbonControlGroup bar = customTab.Groups.Add("CustomGrp", "New Group");
//Adds a group which will contain buttons for the required commands
bar.Controls.Add("NewBtn", "New Item", ControlType.Button); //Adds a button
in the group
```

For a detailed sample refer to the **RibbonCustomization** sample under [Samples\RIBBONINTERFACE\DotNet Directory](#) on page 271 and **Ribbon Customization** sample under [Samples\RIBBONINTERFACE\MapBasic Directory](#) on page 275

## Status Bar

A MapInfo Pro status bar is a graphical control element which poses an information area typically found at the window's bottom. It can be divided into sections to group information. Its job is primarily to display information about the current state of its window.

The following sample code demonstrates how to customize a status bar in MapInfo Pro. This code snippet adds a new text block to the status bar.

```
IStatusBar statusBar = application.StatusBar; // Get Status Bar
// "application" is the MapInfo Pro application handle obtained using
SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) in MapBasic code
// SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) returns an instance of MapInfo
Pro x64 application represented as a This variable type in MapBasic,
referring to an instance of IMAPINFOPRO.
// IMAPINFOPRO interface is the base interface providing access to MapInfo
Pro UI components in your addins
IMapInfoControlCollection controls = statusBar.Controls; // Get controls
in status bar
// After getting the control in a UI element you can add, hide and modify
controls
// Only supported controls can be added to a UI element in MapInfo Pro
IMapInfoControl ctrl = controls.Add("NewItm", "New Item",
ControlType.TextBlock); // Adds a text block to the status bar
```

For a detailed sample refer to the **StatusBar** sample under [Samples\RIBBONINTERFACE\DotNet Directory](#) on page 271

## Mini Toolbar

---

The Mini Toolbar in MapInfo Pro is a smaller version of the full toolbar found near the top of the application window. The Mini Toolbar appears when you right-click inside any map window.

The following sample code demonstrates how to customize a Mini Toolbar in MapInfo Pro. This code snippet adds a new button to the Mini Toolbar.

```
IContextMenu cnTxtMenu = application.ContextMenus; // Get ContextMenus
interface
// "application" is the MapInfo Pro application handle obtained using
SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) in MapBasic code
// SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) returns an instance of MapInfo
Pro x64 application represented as a This variable type in MapBasic,
referring to an instance of IMAPINFOPRO.
// IMAPINFOPRO interface is the base interface providing access to MapInfo
Pro UI components in your addins
IMapMiniToolBar miniToolBar = cnTxtMenu.MapMiniToolBar; // Get the Mini
ToolBar
IMapInfoControlCollection controls = miniToolBar.Controls; // Get controls
in Mini ToolBar
// After getting the control in a UI element you can add, hide or modify
them
// Only supported controls can be added to a UI element in MapInfo Pro
IMapInfoControl ctrl = controls.Add("NewItm", "New Item",
ControlType.Button); // Add new button to the Mini Toolbar
```

For a detailed sample refer to the **MiniToolBar** sample under [Samples\RIBBONINTERFACE\DotNet Directory](#) on page 271

## User Control

---

In MapInfo Pro, you can create your own custom, reusable controls using .Net and MapBasic code. These are called user controls.

For a detailed sample refer to the **Docking Support** sample under [Samples\RIBBONINTERFACE\DotNet Directory](#) on page 271



## Context Menu

The context menu (also called contextual, shortcut, and popup or pop-up menu) is a menu in MapInfo Pro that appears upon a right-click mouse operation. The context menu offers a limited set of choices that are available in the current state, or context, of MapInfo Pro.

The following sample code demonstrates how to customize a context menu in MapInfo Pro. This code snippet adds a new context menu item to an existing context menu.

```

IContextMenu cnTxtMenus = application.ContextMenus; // Get ContextMenus
interface
//"application" is the MapInfo Pro application handle obtained using
SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) in MapBasic code
//SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) returns an instance of MapInfo
Pro x64 application represented as a This variable type in MapBasic,
referring to an instance of IMAPINFOPRO.
//IMAPINFOPRO interface is the base interface providing access to MapInfo
Pro UI components in your addins
IContextMenu menu = cnTxtMenus.GetContextMenu(ContextMenuId.MapperShortcut);
// Get the specified context menu
IMapInfoControlCollection controls = menu.Controls; // Get controls in the
context menu
// After getting the controls in a UI element you can add, hide and modify
these
// Only supported controls can be added to a UI element in MapInfo Pro
IMapInfoControl ctrl = controls.Add("NewItm", "New Item",
ControlType.ContextMenuItem); //Add the new context menu item

```

For a detailed sample refer to the **MiniToolbar** sample under **Samples\RIBBONINTERFACE\DotNet Directory** on page 271

## BackStage

The BackStage view is accessible by clicking on the "PRO" tab at the top left corner of the application window.

In MapInfo Pro it gives you the options to set the preferences for the map window, browser window, explorer window, Legend window and devices. You can also set the behavior of the MapInfo Pro, access the licensing options and the Exit command.

The BackStage view is fully extensible by using XML to define the structure, components, and callback procedures to add or edit the functionality.

The following sample code demonstrates how to customize BackStage in MapInfo Pro. This code snippet adds a new tab item to the BackStage.

```

IRibbonBackStage backStage = application.BackStage; // get the BackStage
interface
//"application" is the MapInfo Pro application handle obtained using
SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) in MapBasic code
//SYSTEMINFO(SYS_INFO_IMAPINFOAPPLICATION) returns an instance of MapInfo
Pro x64 application represented as a This variable type in MapBasic,
referring to an instance of IMAPINFOPRO.
//IMAPINFOPRO interface is the base interface providing access to MapInfo
Pro UI components in your addins
IMapInfoControlCollection controls = backStage.Controls; // Get controls
in the BackStage
// After getting the controls in a UI element you can add, hide and modify
these
// Only supported controls can be added to a UI element in MapInfo Pro

```

```
IMapInfoControl ctrl = controls.Add("NewItm", "New Item",  
ControlType.BackStageTabItem); //Add new BackStage tab item
```

For a detailed sample refer to the **BackStageAddIn** sample under [Samples\RIBBONINTERFACE\DotNet Directory](#) on page 271

# Working With Tables

MapBasic provides you with a full complement of statements and functions for working with tables. For instance, you can modify the structure of a table using the **Alter Table** statement, or locate a row in a table using **Fetch**. The **Import** statement lets you create a MapInfo table from a text file and the **Export** statement lets you export a table to a different format.

This chapter introduces you to the MapBasic statements and functions that let you manage your MapInfo tables. Refer to the MapBasic *Reference* for more information about each statement and function.

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## Opening Tables Through MapBasic

---

A table must be open before a MapBasic application can access the table. Use the **Open Table** statement to open a table. For example, the following statement opens the World table:

```
Open Table "C:\mapinfo\data\world"
```

Notice that the **Browse** statement identifies the table by its alias (Earth). The table's alias name remains in effect for the as long as the table is open. The table has not been permanently renamed. To permanently rename a table, use the **Rename Table** statement.

If you include the optional **Interactive** clause in the **Open Table** statement, and if the table you specify cannot be located in the directory that you specify, MapInfo Pro displays a dialog prompting the user to locate the table. If you omit the **Interactive** keyword and the table cannot be located, the **Open Table** statement generates an error.

### Determining Table Names at Runtime

When referring to a table in MapBasic, you can either use a string expression or hard-code the table name into your program. For example, if the tables States, Pipeline, and Parcels are open when your program is run, you can specify their names explicitly in your program:

```
Select * From States  
Browse * From Pipeline  
i = NumCols(Parcels)
```

You may or may not want to limit your program to work with specific table names. For example, you might want to prompt the user to choose a table from a list of open tables. Since you wouldn't know the name of the selected table ahead of time, you couldn't hard-code it into the program.

You can use a string variable to store the name of a table. Assuming that a table called Zoning is open, you can do the following:

```
Dim work_table As String  
work_table = "Zoning"  
Browse * From work_table
```

### Opening Two Tables With The Same Name

MapInfo Pro assigns a non-default table alias if you attempt to open two tables that have the same alias. For example, if you open the table "C:\data1994\sites", MapInfo Pro assigns the table its default alias ("sites"); but if you then attempt to open a different table that has an identical default alias (for example, "C:\backup\sites"), MapInfo Pro must assign a non-default alias to the second table, so that the two tables can be differentiated. In this example, MapInfo Pro might assign the second table an alias such as "sites\_2."

If you include the optional **Interactive** keyword in the **Open Table** statement, MapInfo Pro will display a dialog box to let the user specify the table's non-default alias. If you omit the **Interactive** keyword, MapInfo Pro assigns the alias table name automatically.

As a result of this behavior, you may not be able to make assumptions about the alias name with which a table was opened.

However, you can use the **TableInfo( )** function to determine the alias under which a table was opened, as shown in the following example:

```
Include "mapbasic.def"
Dim s_filename As String
Open Table "states" Interactive
s_filename = TableInfo(0, TAB_INFO_NAME)
Browse * from s_filename
```

The function call `TableInfo(0, TAB_INFO_NAME)` returns the alias name of the most recently opened table.

## Opening Non-Native Files As Tables

You can access "non-native" files (dBASE, Lotus, Excel, or text files) as tables, even though they are not stored in the MapInfo table format. However, before you access a non-native file through MapBasic, you must register the file. When you register a file, MapInfo Pro builds a table (.tab) file to accompany the non-native file. You only need to register each file once. After you have registered a file, you can treat the file as a table.

The following statement registers a dBASE file:

```
Register Table "income.dbf" Type DBF
```

After you have registered a file, the file is considered a table, and you can open it the same way you would open any MapInfo table, by issuing an **Open Table** statement.

```
Open Table "income" Interactive
```

MapInfo Pro's ability to query a table is not affected by the table's source. For example, you can issue a SQL Select statement to extract data from a table, regardless of whether the table was based on a spreadsheet or a database file.

However, MapInfo Pro's ability to modify a table does depend in part on the table's source. If a table is based on a .dbf file, MapInfo Pro can modify the table; when you update such a table in MapInfo Pro, you are actually modifying the original .dbf file. However, MapInfo Pro cannot modify tables that are based on spreadsheets or ASCII (text) files. If you need to modify a table, but MapInfo Pro cannot modify the table because it is based on a spreadsheet or ASCII file, make a copy of the table (using the **Commit Table...As** statement) and modify the copy.

### Creating A Report File From An Open MapInfo Table

High quality reports of tabular data, processed within MapInfo Pro, can be produced using the industry standard report writer, from Seagate Crystal Reports. Crystal provides a highly intuitive environment for developing professional reports. See the **Create Report From Table** and **Open Report** statements in the *MapBasic Reference*.

## Reading Row-And-Column Values From a Table

MapBasic programs can access specific column values from specific rows in a table, through the following procedure:

1. Use a **Fetch** statement to specify which row in the table you want to query. This action sets which row is current.
2. Use a table-reference expression (for example, *tablename . columnname*) to access a specific column in the current row.

For example, the following program reads the contents of the Country column from the first row of the World table:

```
Dim s_name As String
  Open Table "world" Interactive
  Fetch First From world
  s_name = world.Country
```

Every open table has a current-row setting; this setting is known as the row cursor (not to be confused with the mouse cursor, which is the shape that moves across the screen as you move the mouse). When you issue a **Fetch** statement, you position the row cursor on a specific row in the table. Subsequent table references (for example, world.country) extract data from whichever row is specified by the cursor.

The **Fetch** statement provides several different ways of positioning the cursor. You can move the cursor forward or backward one row at a time, position the cursor on a specific row number, or set the cursor on the first or last row in the table. To determine whether a **Fetch** statement has attempted to read past the end of a table, call the **EOT()** function. For more information on the **Fetch** statement or the **EOT()** function, see the *MapBasic Reference*.

The MapBasic language recognizes three different types of expressions that reference specific column values:

The preceding example used the *tablename.columnname* syntax (for example, world.country).

Another type of column reference is *tablename.col#*. In this type of expression, a column is specified by number, not by name (where col1 represents the first column in the table). Since Country is the first column in the World table, the assignment statement above could be rewritten as follows:

```
s_name = world.col1
```

A third type of column reference takes the form *tablename.col(numeric expression)*. In this type of reference, the column number is specified as a numeric expression within parentheses. The preceding assignment statement could be rewritten as follows:

```
Dim i As Integer
  i = 1
  s_name = world.col(i)
```

Column Reference Syntax	Example
<i>tablename.columnname</i>	world.country
<i>tablename.COLn</i>	world.COL1
<i>tablename.COL(n)</i>	world.COL(i)

Using this syntax, you can write a MapBasic program that determines, at runtime, which column to reference.

The *tablename* in a table reference is optional in statements in which the table name is already part of the statement. For instance, in the **Browse** statement you are required to specify column names and then the table name. Since the table name is explicitly specified in the statement (in the **From** clause), the column references at the beginning of the line do not need to include the *tablename*.

```
Select Country, Population/1000000 From World
  Browse Country, Col2 From Selection
```

The **Select** statement also has a **From** clause, where you name the table(s) to be queried. Column names that appear within a **Select** statement do not need the *tablename*. prefix if the **Select** statement queries a single table. However, if a **Select** statement's **From** clause lists two or more tables, column references must include the *tablename*. prefix. For a general introduction to using the SQL Select statement, see the *MapInfo Pro User Guide*, or see **Select** in the *MapBasic Reference*.

There are instances in which you must use the **COL $n$**  or the **COL( $n$ )** column referencing method. In the example above, the **Select** statement identifies two columns; the latter of these columns is known as a derived column, since its values are derived from an equation ( $\text{Population}/1000000$ ). The subsequent **Browse** statement can refer to the derived column only as `col2` or as `col(2)`, because the derived expression  $\text{Population}/1000000$  is not a valid column name.

## Alias Data Types as Column References

The preceding examples have used explicit, "hard-coded" column names. For example, the following statement identifies the Country column and the Population column explicitly:

```
Select Country, Population/1000000 From World
```

In some cases, column references cannot be specified explicitly, because your application will not know the name of the column to query until runtime. For example, if your application lets the user choose a column from a list of column names, your application will not know until runtime what column the user chose.

MapBasic provides a variable type, **Alias**, that you can use to store column expressions that will be evaluated at runtime. As with String variables, you can assign a text string to an **Alias** variable. MapBasic interprets the contents of the **Alias** variable as a column name whenever an **Alias** variable appears in a column-related statement.

For example:

```
Dim val_col As Alias
  val_col = "Inflat_Rate"
  Select * From world Where val_col > 4
```

MapBasic substitutes the contents of `val_col` (the alias, `Inflat_Rate`) into the **Select** statement in order to select all the countries having an inflation rate greater than 4 percent.

**Note:** The maximum length of the alias is 32 characters.

In the example below, the sub-procedure `MapIt` opens a table, maps it, and selects all records from a specified column that have a value greater than or equal to a certain value. `MapIt` uses an **Alias** variable to construct column references that will be evaluated at runtime.

```
Include "mapbasic.def"
  Declare Sub Main
  Declare Sub MapIt( ByVal filepath As String,
    ByVal col_name As String,
    ByVal min_value As Float )

  Sub Main
    Call MapIt("C:\MAPINFOW\MAPS\WORLD.TAB", "population", 1500000)
  End Sub

  Sub MapIt( ByVal filepath As String,
    ByVal col_name As String,
    ByVal min_value As Float )

    Dim a_name As Alias
    a_name = col_name
    Open Table filepath
    Map From TableInfo(0, TAB_INFO_NAME)
    Select * From TableInfo(0, TAB_INFO_NAME)
    Where a_name >= min_value
  End Sub
```

In the `MapIt` procedure, a **Select** statement specifies an **Alias** variable (`a_name`) instead of an explicit column name. Note that the `col_name` parameter is not an **Alias** parameter; this is because MapBasic does not allow by-value **Alias** parameters. To work around this limitation, the column name is passed

as a by-value String parameter, and the contents of the String parameter are copied to a local **Alias** variable (`a_name`).

The example above demonstrates how an **Alias** variable can contain a string representing a column name ("population"). An **Alias** variable also can contain a full column reference in the form `tablename.columnname`. The following example demonstrates the appropriate syntax:

```
Dim tab_expr As Alias
  Open Table "world"
  Fetch First From world
  tab_expr = "world.COL1"
  Note tab_expr
```

The preceding **Note** statement has the same effect as the following statement:

```
Note world.COL1
```

## Scope

The syntax `tablename.columnname` (for example, `world.population`) is similar to the syntax used to reference an element of a custom Type. MapBasic tries to interpret any `name.name` expression as a reference to an element of a Type variable. If the expression cannot be interpreted as a type element, MapBasic tries to interpret the expression as a reference to a column in an open table. If this fails, MapBasic generates a runtime error.

## Using the "RowID" Column Name To Refer To Row Numbers

RowID is a special column name that represents the row numbers of rows in the table. You can treat RowID as a column, although it isn't actually stored in the table. Think of RowID as a virtual column, available for use, but not visible. The first row of a table has a RowID value of one, the second row has a RowID value of two, and so on.

The following example selects the first row from the World table:

```
Select * from world Where RowID = 1
```

The following example uses RowID to Select all of the states with a 1990 population greater than the median.

```
Dim median_row As Integer
  Select * From states Order By pop_1990 Into bypop
  median_row = Int(TableInfo(bypop, TAB_INFO_NROWS)/2)
  Select * From bypop Where RowID > median_row
```

Since the **TableInfo()** function returns the total number of rows in the virtual table `bypop`, the variable `median_row` contains the record number of the state with the median population. The last **Select** statement selects all the states that come after the median in the ordered table `bypop`.

If you delete a row from a table, the row is not physically deleted until you perform a pack operation. (Rows that have been deleted appear grayed in a **Browse** window.) Any deleted row still has a RowID value. Thus, deleting a row from a table does not affect the RowID values in the table; however, if you delete a row, save your changes, and then pack the table, the table's RowID values do change. To pack a table, choose MapInfo Pro's **Table > Maintenance > Pack Table** command, or issue the MapBasic statement **Pack Table**.



## Using the "Obj" Column Name To Refer To Graphic Objects

The Obj column is a special column name that refers to a table's graphical objects. Any table that has graphical objects has an Obj column (although the Obj column does not appear in any **Browser** window). If a row does not have an associated graphic object, that row has an empty Obj value.

The following example selects all rows that do not have a graphic object:

```
Select * From sites Where Not Obj
```

This is useful, for instance, in situations where you have geocoded a table and not all of the records matched, and you want to select all of the records that did not match.

The following example copies a graphical object from a table into an Object variable:

```
Dim o_var As Object
Fetch First From sites
o_var = sites.obj
```

For more information about graphical objects, see [Graphical Objects](#).

## Finding Map Addresses In Tables

MapInfo Pro users can find addresses in maps by choosing **Query > Find**. MapBasic programs can perform similar queries by issuing **Find** statements and **Find Using** statements. The **Find Using** statement specifies the table to be queried; the **Find** statement tries to determine the geographic coordinates of a location name (for example, "23 Main St"). The **Find** statement also can locate the intersection of two streets, given a string that includes a double-ampersand (for example, "Pawling Ave && Spring Ave").

After issuing a **Find** statement, call **CommandInfo( )** to determine whether the address was located, and call **CommandInfo( )** again to determine the location's geographic coordinates. Unlike MapInfo Pro's **Query > Find** command, the MapBasic **Find** statement does not automatically re-center a **Map** window. If you want to re-center the **Map** window to show the location, issue a **Set Map** statement with a **Center** clause. Also, the **Find** statement does not automatically add a symbol to the map to mark where the address was found. If you want to add a symbol, use the **CreatePoint( )** function or the **Create Point** statement. For a code example, see **Find** in the *MapBasic Reference* or *MapBasic Help*.

## Geocoding

To perform automatic geocoding:

1. Use the **Fetch** statement to retrieve an address from a table.
2. Use the **Find Using** statement and the **Find** statement to find the address.
3. Call **CommandInfo( )** to determine how successful the **Find** statement was; call **CommandInfo( )** again to determine x- and y-coordinates of the found location.
4. Create a point object by calling the **CreatePoint( )** function or the **Create Point** statement.
5. Use the **Update** statement to attach the point object to the table.

To perform interactive geocoding, issue the following statement:

```
Run Menu Command M_TABLE_GEOCODE
```

If you need to perform high-volume geocoding, you may want to purchase MapMarker, a dedicated geocoding product that is sold separately. MapMarker geocodes faster than MapInfo Pro and allows single-pass geocoding across the entire United States. MapBasic applications can control MapMarker through its programming interface. For more information on MapMarker, contact Pitney Bowes Inc. sales. The phone numbers appear at the beginning of this and other MapInfo product manuals.

### Performing SQL Select Queries

MapInfo Pro users can perform sophisticated queries by using MapInfo Pro's **Query > SQL Select** dialog box. All of the power of the SQL Select dialog box is available to MapBasic programmers through MapBasic's **Select** statement. You can use the **Select** statement to filter, sort, sub-total, or perform relational joins on your tables. For information, see **Select** in the *MapBasic Reference*.

### Error Checking for Table and Column References

MapBasic cannot resolve references to tables and columns at compile time. For instance, if your program references a column called `states.pop`, the MapBasic compiler cannot verify whether the `states` table actually has a column called `pop`. This means that typographical errors in column references will not generate errors at compile time. However, if a column reference (such as `states.pop`) contains a typographical error, an error will occur when you run the program.

Try the following to minimize the possibility of generating runtime errors. Use the **Interactive** clause with the **Open Table** statement, when appropriate. If the table cannot be located, a dialog box will prompt the user to locate the table. Do not assume that the table was opened under its default alias. After you issue an **Open Table** statement, call `TableInfo(0, TAB_INFO_NAME)` to determine the alias assigned to the table. For more information on opening tables, see **Open Table** in the *MapBasic Reference*.

## Writing Row-And-Column Values to a Table

---

To add new rows to a table, use the **Insert** statement. To change the values stored in the columns of existing rows, use the **Update** statement. Both statements are described in the *MapBasic Reference* and *MapBasic Help*.

If you add new rows to a table or modify the existing rows in a table, you must save your changes by issuing a **Commit** statement. Alternately, to discard any unsaved edits, issue a **RollBack** statement.

## Creating New Tables

---

Use the **Create Table** statement to create a new, empty table. Use the **Create Index** statement to add indexes to the table, and use **Create Map** to make the table mappable.

The following example creates a mappable table with a name, address, city, amount, order date, and customer ID columns. The name field and the customer ID field are indexed.

```
Create Table CUST
  (Name Char(20),
   Address Char(30),
   City Char(30),
   Amount Decimal(5,2),
   OrderDate Date,
   CustID Integer)
  File "C:\customer\Cust.tab"
Create Map For CUST CoordSys Earth

Create Index On CUST (CustID)

Create Index On CUST(Name)
```

You can also create a table by saving an existing table (for example, a selection) as a new table using the **Commit** statement, or by importing a table using the **Import** statement.

## Modifying a Table's Structure

Every table has a structure. The structure refers to issues such as how many columns are in the table, and which of the columns are indexed. A MapInfo Pro user can alter a table's structure by choosing MapInfo Pro's **Tools > Maintenance > Table Structure** command. A MapBasic program can alter a table's structure by issuing statements such as **Alter Table** and **Create Index**.

As a rule, a table's structure cannot be modified while the table has unsaved edits. If you have added rows to a table, but you have not saved the table, the table has unsaved edits. If a table has unsaved edits, you must save the edits (by issuing a **Commit** statement) or discard the edits (by issuing a **Rollback** statement) before modifying the table's structure.

The **Alter Table** statement modifies a table's structure. The following example renames the Address column to ShipAddress, lengthens the Name column to 25 characters, removes the Amount column, adds new ZIP Code and Discount columns, and re-orders the columns.

```
Alter Table CUST (Rename Address ShipAddress,
  Modify Name Char(25),
  Drop Amount
  Add Zipcode Char(10),
  Discount Decimal(4,2)
  Order Name, Address, City, Zipcode,
  OrderDate, CustID, Discount)
```

You cannot change the structure of tables that are based on spreadsheets or delimited ASCII files, and you cannot change the structure of the Selection table.

Use the **Add Column** statement to add a temporary column to a table. The **Add Column** statement lets you create a dynamic column that is computed from values in another table. Add Column can also perform advanced polygon-overlay operations that perform proportional data aggregation, based on the way one table's objects overlap another table's objects. For example, suppose you have one table of town boundaries and another table that represents a region at risk of flooding. Some towns fall partly or entirely within the flood-risk area, while other towns are outside the risk area. The **Add Column** statement can extract demographic information from the town-boundaries table, then use that information to calculate statistics within the flood-risk area. For information about the **Add Column** statement, see the *MapBasic Reference Guide*.

## Creating Indexes and Making Tables Mappable

Table indexes help MapInfo Pro to optimize queries. Some operations, like MapInfo Pro's **Find** and **Geocode** menu items, require an index to the field to be matched against. For instance, before you can use the Find command to locate a customer in your database by name, you must index the name column. **Select** statements execute faster for many queries when you use columns with indexes. SQL joins create a temporary index if the fields specified in the **Where** clause are not indexed. There is no limit to the number of columns that can be indexed. The Obj column is always indexed.

To create an index in MapBasic, use the **Create Index** statement. To remove an index, use the **Drop Index** statement. MapBasic cannot use indexes created in other packages and MapBasic cannot index on an expression. An index does not change the order of rows in a **Browser** window. To control the order of rows in a Browser, issue a **Select** statement with an **Order By** clause, and browse the selection.

## Reading A Table's Structural Information

The functions **TableInfo( )**, **ColumnInfo( )** and **NumTables( )** let you determine information about the tables that are currently open.

- **TableInfo( )** returns the number of rows in the table, the number of columns, and whether or not the table is mappable.

- **ColumnInfo( )** returns information about a column in a table, such as the column's name, the column's data type, and whether the column is indexed.
- **NumTables( )** returns the number of currently open tables (including temporary tables such as Query1).

The following program determines which tables are open and copies the table names into an array.

```
Include "mapbasic.def"
Dim i, table_count As Integer
Dim tablenames() As String

' determine the number of open tables
table_count = NumTables()

' Resize the array so that it can hold
' all of the table names.
ReDim tablenames(table_count)

' Loop through the tables
For i = 1 To table_count

' read the name of table # i
tablenames(i) = TableInfo(i, TAB_INFO_NAME)

'display the table name in the message window
Print tablenames(i)

Next
```

## Working With The Selection Table

Selection is a special table name that represents the set of rows that are currently selected. A MapBasic program (or an end-user) can treat the Selection table like any other table.

For example, you can browse the set of currently-selected rows by issuing the following statement:

```
Browse * From Selection
```

When you access the Selection table in this way, MapInfo Pro takes a snapshot of the table and names the snapshot QueryN, where N is a integer value of one (1) or greater. Like Selection, QueryN is a temporary table. The **SelectionInfo( )** function lets you determine the table alias MapInfo Pro will assign to the current Selection table (i.e., to learn whether the current Selection table will be known as Query1 or as Query2). **SelectionInfo( )** also lets you determine other information about the Selection, such as the number of selected rows.

### Cleaning Up "QueryN" Tables

As you use MapInfo Pro, you may find that you have opened a number of QueryN tables (Query1, Query2, etc.). For example, if you click on a map object and then browse the selection, the window's title may read "Query1 Browser." Each QueryN is a snapshot of a former selection.

MapBasic programs can cause QueryN tables to be opened as well. For example, making a reference to a column expression such as Selection.Obj causes MapInfo Pro to open a QueryN table. If you want your MapBasic program to close any QueryN tables that it opens, do the following:

- When you use **Select** statements, include the optional **Into** clause. Then, instead of accessing the table name "Selection" access the table name that you specified in the **Into** clause. If you use the **Into** clause, MapInfo Pro will not open QueryN tables when you access the query results. When you are done working with the query results table, close it by using a **Close Table** statement.

- If the user makes a selection (for example, by clicking on a map object), and then your program works with the selection, MapInfo Pro will open a QueryN table. The following example shows how to close the QueryN table.

```
' Note how many tables are currently open.
  i_open = NumTables()

  ' Access the Selection table as necessary. For example:
  Fetch First From Selection
  obj_copy = Selection.obj

  'If we just generated a QueryN table, close it now.
  If NumTables() > i_open Then
    Close Table TableInfo(0, TAB_INFO_NAME)
  End If
```

## Changing the Selection

Use the **Select** statement to change which rows are selected. The **Select** statement is a very powerful, versatile statement. You can use the **Select** statement to filter, sort, or sub-total your data, or to establish a relational join between two or more tables. All of the power of MapInfo Pro's **Query > SQL Select** command is available to MapBasic programmers through the **Select** statement.

If you issue a **Select** statement, and if you do not want the results table to have a name such as Query1, you can assign another name to the results table. The **Select** statement has an optional **Into** clause that lets you specify the name of the results table. For example, the following statement makes a selection and names the results table "Active."

```
Select * From sites
  Where growth > 15
  Into Active
```

For an introduction to the capabilities of SQL Select queries, see the *MapInfo Pro User Guide*. For detailed information about the **Select** statement, see the *MapBasic Reference Guide*.

## Updating the Currently-Selected Rows

You can use the **Update** statement to modify the Selection table. If you modify the Selection table, the changes that you make are applied to the base table on which the selection is based.

For example, the following **Select** statement selects some of the rows from the employees table. After the **Select** statement, an **Update** statement modifies the data values of the selected rows.

```
Select * from employees
  Where department = "marketing" and salary < 20000

  Update Selection
  Set salary = salary * 1.15
```

The **Update** statement will alter the values of rows in the employees table, because the selection is based on the employees table.

## Using the Selection for User Input

The Selection process is part of the user interface. Some applications are arranged so that the user selects one or more rows, then chooses an appropriate menu item. When the user makes a selection, the user is specifying an object (a noun). When the user chooses a menu item, the user is specifying an action (a verb) to apply to that object.

The sample program, `TextBox`, is based on this noun/verb model. The user selects one or more text objects, then chooses the **Table > TextBox > Create Text Boxes** command. The `TextBox` application then queries the Selection table, and draws boxes around the text objects that the user selected.

To query the current selection, use the `SelectionInfo( )` function. By calling `SelectionInfo( )`, you can determine how many rows are selected (if any) at the present time. If rows are currently selected, you can call `SelectionInfo( )` to determine the name of the table from which rows were selected. You then can call `TableInfo( )` to query additional information about the table.

If your application includes a sub-procedure called `SelChangedHandler`, MapInfo Pro calls that procedure every time the selection changes. For example, you may want some of your application's custom menu items to only be enabled when rows are selected. To perform that type of selection-specific menu maintenance, create a `SelChangedHandler` procedure. Within the procedure, call `SelectionInfo(SEL_INFO_NROWS)` to determine if any rows are selected. Based on whether any rows are selected, issue an `Alter Menu Item` statement that enables or disables appropriate menu items. For more information on menu maintenance, see [Creating the User Interface](#).

## Accessing the Cosmetic Layer

---

Each **Map** window has one Cosmetic layer, a special-purpose layer which is the top layer in the map. If the user performs a Find operation, MapInfo Pro places a symbol at the "found" location. Such symbols are stored in the Cosmetic layer. See [Graphical Objects](#) for more information on labeling.

To control the Cosmetic layer through MapBasic, issue table-manipulation statements (such as **Select**, **Insert**, **Update**, or **Delete**) and specify a table name such as `CosmeticN` (where *N* is an Integer, one or larger). For example, the table name `Cosmetic1` corresponds to the Cosmetic layer of the first **Map** window on the screen. The following statement selects all objects in that **Map** window's Cosmetic layer:

```
Select * From Cosmetic1
```

To determine a Cosmetic layer's exact table name, call `WindowInfo( )` with the code `WIN_INFO_TABLE`. For example, the following statement deletes all objects from the Cosmetic layer of the active **Map** window (assuming that the active window is a **Map** window):

```
Delete From WindowInfo(FrontWindow(), WIN_INFO_TABLE)
```

## Accessing Classic Layout Windows

---

This section applies to the classic **Layout** window. For a description of the differences between this window and a **Layout Designer** window, see [Layout Windows](#). For a description of how to work with the **Layout Designer** window, see [Layout Designer Windows](#).

MapBasic's object-manipulation statements can be applied to the objects on a classic **Layout** window. To manipulate a classic **Layout** window, issue statements that use the table name `LayoutN` (where *N* is an integer, one or larger).

For example, the table name `Layout1` corresponds to the first **Layout** window that you open. The following statement selects all objects from that **Layout** window:

```
Select * From Layout1
```

You can determine a **Layout** window's exact table name by calling the `WindowInfo( )` function with the `WIN_INFO_TABLE` code.

**Note:** Objects stored on a **Layout** window use a special coordinate system, which uses "paper" units (units measured from the upper-left corner of the page layout). Any MapBasic program that creates or queries object coordinates from Layout objects must first issue a **Set CoordSys** statement that specifies the Layout coordinate system.

For example, the TextBox sample program draws boxes (rectangle objects) around any currently-selected text objects, regardless of whether the selected text objects are on a **Map** window or a **Layout** window. If the selected objects are Layout objects, TextBox issues a **Set CoordSys Layout** statement.

When you are using MapInfo Pro interactively, MapInfo Pro's **Statistics** window gives you an easy way of determining the table name that corresponds to a **Layout** window or to a **Map** window's Cosmetic layer. If you select an object in a Map's Cosmetic layer, and then show the **Statistics** window (for example, by choosing **Options > Show Statistics window**), the **Statistics** window displays a message such as, "Table Cosmetic1 has 1 record selected." Similarly, if you select an object from a **Layout** window, the **Statistics** window displays, "Table Layout1 has 1 record selected."

## Multi-User Editing

If your MapBasic program works with tables in a multiple-user environment, you may encounter file-sharing conflicts. Sharing conflicts occur because MapInfo Pro only allows one user to modify a table at a time.

This section spells out the rules that govern MapInfo Pro's multi-user editing behavior. Read this section if you want to write a MapBasic program that allows multiple users to modify the same table at the same time.

### The Rules of Multi-User Editing

MapInfo Pro's multi-user table editing has three restrictions:

#### Rule 1

A table may only be edited by one user at a time.

Imagine two hypothetical users: User A and User B. Both users are attempting to use the same table, which is stored on a network.

User A begins editing the table. (For example, User A adds new rows to the table.) Moments later, User B attempts to edit the same table. MapInfo Pro prevents User B from editing the table, and displays the message, "Cannot perform edit. Someone else is currently editing this table." If User B is trying to edit the table through a MapBasic application, a runtime error occurs in the application.

As long as User A continues to edit the table, MapInfo Pro prevents User B from editing the same table. This condition remains until User A performs Save, Revert (discarding the edits), or Close Table.

**Note:** User B is allowed to read from the table that User A is editing. For example, User B can display the table in a **Map** window. However, User B will not "see" the edits made by User A until User A performs a Save.

#### Rule 2

Users cannot read from a table while it is being saved.

After editing the table, User A chooses the **File > Save Table** command. Then, while the Save operation is still underway, User B attempts to read data from the table. As long as the Save is underway, MapInfo Pro prevents User B from accessing the table at all. MapInfo Pro displays a dialog box (on User B's computer) with the message, "Cannot access file <tablename>.DAT for read." The dialog box contains **Retry** and **Cancel** buttons, with the following meaning:

### **Retry**

If User B clicks **Retry**, MapInfo Pro repeats the attempt to read from the file. The Retry attempt will fail if the Save is still underway. The user can click the **Retry** button repeatedly. After the Save operation finishes, clicking the **Retry** button succeeds.

### **Cancel**

If User B clicks **Cancel**, MapInfo Pro cancels the operation, and the **Retry/Cancel** dialog box disappears.

**Note:** If User B was loading a workspace when the sharing error occurred, clicking **Cancel** may halt the loading of the rest of the workspace. For example, a workspace contains **Open Table** statements. If the **Open Table** statement was the statement that caused the sharing conflict, and if the user cancels the **Retry/Cancel** dialog box, MapInfo Pro will not open the table. Subsequent statements in the workspace may fail because the table was not opened.

### **Rule 3**

A Save cannot be started while the table is being read by other users.

If other users are reading the table at the exact moment that User A chooses **File > Save Table**, the Save Table command cannot proceed. MapInfo Pro displays the message, "Cannot open file <tablename>.DAT for writing." The dialog box contains **Retry** and **Cancel** buttons, with the following meaning:

### **Retry**

If User A clicks **Retry**, MapInfo Pro repeats the attempt to save the table. The user can click the **Retry** button repeatedly. Clicking the **Retry** button will only succeed if the other users have finished reading from the table.

### **Cancel**

If User A clicks **Cancel**, MapInfo Pro cancels the Save operation, and the **Retry/Cancel** dialog box disappears. At this point, the table has not been saved, and the edits will not be saved unless User A chooses **File > Save Table** again.

### **How to Prevent Conflicts When Reading Shared Data**

As discussed in the previous section, some sharing conflicts display a **Retry/Cancel** dialog box. Ordinarily, the **Retry/Cancel** dialog box appears at the moment a sharing conflict occurs. However, a MapBasic program can suppress the dialog box by using the **Set File Timeout** statement.

In the parts of your program where you open or read from a shared table, use the **Set File Timeout** statement with a value larger than zero. For example, if you have a procedure that opens several tables, you may want to issue this statement at the start of the procedure:

```
Set File Timeout 100
```

The **Set File Timeout** statement sets a time limit; in this example, the time limit is 100 seconds. In other words, MapInfo Pro will automatically retry any table operations that produce a sharing conflict, and MapInfo Pro will continue to retry the operation for up to 100 seconds. Note that MapInfo Pro retries the table operations instead of displaying a **Retry/Cancel** dialog box. If the sharing conflict still occurs after 100 seconds of retries, the automatic retry stops, and MapInfo Pro displays the **Retry/Cancel** dialog box.

## **Preventing Conflicts When Writing Shared Data**

Several MapBasic statements alter the contents of a table. For example, the **Insert** statement adds new rows to a table. If your program attempts to alter the contents of a table, and a sharing conflict occurs, a MapBasic runtime error occurs. To trap this error, use the **OnError** statement. For example, if you have a procedure that inserts new rows into a table (as in the example below), you should create an



error-handling routine, and place an **OnError** statement at the top of the procedure to enable error trapping. (Error-handling is discussed in more detail in [Debugging and Trapping Runtime Errors](#).)

**Caution:** Use the **Set File Timeout** statement and the **OnError** statement exclusively. In places where an error handler is enabled, the file-timeout value should be zero. In places where the file-timeout value is non-zero, error handling should be disabled. The following example demonstrates this logic.

```
Function MakeNewRow(ByVal new_name As String) As Logical

    'turn off automatic retries
    Set File Timeout 0

    'turn off window redraws
    Set Event Processing Off

    'enable error-trapping
    OnError Goto trap_the_error

    'Add a new row, and save the new row immediately.
    Insert Into Sitelist ("Name") Values ( new_name )
    Commit Table Sitelist

    'Set return value to indicate success.
    MakeNewRow = TRUE

exit_ramp:

    Set Event Processing On
    Exit Function
trap_the_error:
    ' The program jumps here if the Insert or Commit
    ' statements cause runtime errors (which will happen
    ' if another user is already editing the table).

    If Ask("Edit failed; try again?", "Yes", "No") Then
        ' ... then the user wants to try again.
        Resume 0
    Else
        ' the user does not want to retry the operation.
        ' If the Insert succeeded, and we're getting an error
        ' during Commit, we should discard our edits.
        Rollback Table Sitelist

        ' set function's return value to indicate failure:
        MakeNewRow = FALSE
        Resume exit_ramp
    End If
End Function
```

Note the following points:

- When you modify a shared table, try to minimize the amount of time that the table has unsaved edits. In the example above, the **Commit** statement follows immediately after the **Insert** statement, so that there is very little time during which the table has unsaved edits.
- The example uses **Set Event Processing Off** to suspend event processing; as a result, MapInfo Pro will not redraw any windows during the edit. If we did not suspend event processing, the **Insert** statement might cause MapInfo Pro to redraw one or more windows, and the window redraw could conceivably trigger a sharing conflict (for example, because other tables in the same **Map** window may have a sharing conflict).
- This function sets file-timeout to zero. The procedure that calls this function may need to reset file-timeout to its previous value.

### Opening a Table for Writing

When you open a table in a multiple-user environment, there is a chance that MapInfo Pro will open the table with read-only access, even if the files that comprise the table are not read-only. If a MapBasic program issues an **Open Table** statement at the exact moment that the table is being accessed by another user, MapInfo Pro may open the table with a read-only status. The read-only status prevents successive statements from modifying the table.

The following example shows how to prevent MapInfo Pro from opening shared tables with a read-only status. Instead of simply issuing an **Open Table** statement, issue the statement within a loop that iterates until the file is opened read/write.

```
Retry_point:
  Open Table "G:\MapInfo\World"
  If TableInfo("World", TAB_INFO_READONLY) Then
    Close Table World
    Goto Retry_point
  End If
```

## Files that Make Up a Table

---

A table consists of several files: one file contains information about the table structure (column names, etc.); another file contains the table's row-and-column values; another file contains the table's graphic objects (if any); and the remaining files contain indexes. The file containing the row-and-column data can be in any format supported by MapInfo Pro: .dbf, Lotus .wks or .wk1 format, delimited ASCII file format, or Excel (.XLS or .XLSX) file format.

- `filename.tab`: Describes the structure of your table.
- `filename.dat` or `filename.dbf` or `filename.wks`: Contains tabular (row-and-column) data.
- `filename.map`: Contains the table's graphic objects.
- `filename.id`: Contains a geographic index.
- `filename.ind`: Contains indexes for columns in the table.

Because each table consists of several component files, you must be very careful when renaming a table. To rename a table, choose MapInfo Pro's **Table > Maintenance > Rename Table** command, or issue the MapBasic **Rename Table** statement.

## Raster Image Tables

---

Raster image tables (tables that display only raster image data, not vector data) do not have all of the component files listed above, because raster image tables do not contain tabular data. Every raster image table consists of at least two files: a .tab file (which stores the image's control points) and the file or files that store the raster image. For example, if a raster image table is based on the file photo.tif, the table might consist of two files: photo.tif and photo.tab.

In many ways, a raster image table is just like any other table. To open a raster image table, use an **Open Table** statement. To display a raster image table in a **Map** window, issue a **Map** statement. To add a raster image table to an existing map, issue an **Add Map Layer** statement. However, you cannot perform a Select operation on a raster image table. To determine if a table is a raster table, call **TableInfo()** with the **TAB\_INFO\_TYPE** code. If the table is a raster table, **TableInfo()** returns the code

**TAB\_TYPE\_IMAGE.** As a rule, MapInfo Pro does not alter the original image file on which a raster table is based. Therefore:

- If you use the **Drop Table** statement to delete a raster table, MapInfo Pro deletes the table file, but does not delete the image file on which the table is based.
- If you use the **Rename Table** statement on a raster table, MapInfo Pro renames the table file, but does not rename the image file on which the table is based.
- If you use the **Commit** statement to copy a raster table, MapInfo Pro copies the table file but does not copy the image file on which the table is based.

A raster image table's .tab file is created when a user completes MapInfo Pro's **Image Registration** dialog box. If you need to create a .tab file for a raster image through a MapBasic program, create the file using standard file input/output statements: create the file using the **Open File** statement, and write text to the file using the **Print #** statement; see example below.

The following program creates a table file to accompany a raster image file. This program assigns "dummy" coordinates, not true geographic coordinates. Therefore, the final table will not be suitable for overlaying vector map layers. However, if the raster image is a non-map image (as a company logo), the use of non-geographic coordinates is not a problem.

```

Include "mapbasic.def"
Declare Sub Main
Declare Function register_nonmap_image(ByVal filename As String,
    ByVal tablename As String) As Logical

Sub Main
Dim fname, tname As String
fname = "c:\data\raster\photo.gif" 'name of an existing image
tname = PathToDirectory$(fname)
    + PathToTableName$(fname) + ".tab" 'name of table to create
If FileExists(tname) Then
    Note "The image file is already registered; stopping."
Else
    If register_nonmap_image(fname, tname) Then
        Note "Table file created for the image file: "
        + fname + "."
    Else
        Note "Could not create table file."
    End If
End If
End Sub

Function register_nonmap_image( ByVal filename As String,
    ByVal tablename As String) As Logical
register_nonmap_image = FALSE
OnError GoTo handler
Open File tablename For Output As #1 FileType "MIta"
Print #1, "!Table"
Print #1, "!Version 300"
Print #1, "!charset Neutral"
Print #1
Print #1, "Definition Table"
Print #1, " File "" + filename + """"
Print #1, " Type ""RASTER"" "
Print #1, " (1,1) (1,1) Label ""Pt 1"", "
Print #1, " (5,1) (5,1) Label ""Pt 2"", "
Print #1, " (5,5) (5,5) Label ""Pt 3"" "
Print #1, " CoordSys NonEarth Units ""mm"" "
Print #1, " Units ""mm"" "
Print #1, " RasterStyle 1 45" ' Brightness; default is 50
Print #1, " RasterStyle 2 60" ' Contrast; default is 50
Close File #1
register_nonmap_image = TRUE ' set function return value
last_exit:
Exit Function
handler:
Close File #1
Resume last_exit
End Function

```

# Working With Metadata

## What is Metadata?

Metadata is data that is stored in a table's .TAB file, instead of being stored as rows and columns. For example, if you want to record summary information about who edited a table or when they performed the edits, you could store that information as metadata.

Metadata is not displayed in the standard MapInfo Pro user interface. Users cannot see a table's metadata (unless they display the .TAB file in a text editor or run the TableMgr sample MBX). However, MapBasic applications can read and write metadata values.

Each table can have zero or more metadata keys. Each key represents an information category, such as an author's name, a copyright notice, etc. For example, a key named "\Copyright" might have the value "Copyright 2005 Acme Corp."

## What Do Metadata Keys Look Like?

Each metadata key has a name, which always starts with the "\" (backslash) character. The key name never ends with a backslash character. Key names are not case-sensitive.

The key's value is always a string, up to 239 characters long.

The following table provides samples of metadata keys and key values.

Sample Key Name	Sample Key Value
"\Copyright Notice"	Copyright 2008 Pitney Bowes Mapinfo Corp."
"Info"	"Tax Parcels Map"
"Info Author"	"Meghan Marie"
"Info\Date\Start"	"12/14/01"
"Info\Date\End"	"12/31/01"
"IsReadOnly"	"FALSE"

Note the following points:

- Spaces are allowed within key names and within key values.
- You can define a hierarchy of keys by using key names that have two or more backslash characters. In the table above, several of the keys belong to a hierarchy that starts with the "\Info" key. Arranging keys in hierarchies allows you to work with an entire hierarchy at a time (for example, you can delete an entire hierarchy with a single statement).
- "\IsReadOnly" is a special key, reserved for internal use by MapInfo Pro. When you add metadata to a table, MapInfo Pro automatically creates the \IsReadOnly key. Do not attempt to modify the \IsReadOnly key.
- The table above shows each string within quotation marks to emphasize that they are string values. However, when you retrieve keys from a table, the strings retrieved by MapBasic do not actually include quotation marks.

## Examples of Working With Metadata

The **GetMetadata\$( )** function allows you to query a table's metadata, but only if you already know the exact name of the metadata key. If you know that a table has a key called "\Copyright" then the following function call returns the value of that key:

```
s_variable = GetMetadata$(table_name, "\Copyright")
```

The Metadata statement allows you to create, modify, or query a table's metadata, even if you do not know the names of the keys. The following examples demonstrate the various actions that you can perform using the Metadata statement.

**Note:** In the following examples, table\_name represents a string variable that contains the name of an open table.

The following example stores a key value in a table. If the key already exists, this action changes the key's value; if the key does not already exist, this action adds the key to the table's metadata.

```
Metadata Table table_name
  SetKey "\Info\Author" To "Laura Smith"
```

The following statement deletes the "\Info\Author" key from the table.

```
Metadata Table table_name
  Dropkey "\Info\Author"
```

The following statement deletes an entire hierarchy of keys at one time. All keys whose names start with "\Info" will be deleted.

```
Metadata Table table_name
  Dropkey "\Info" Hierarchical
```

When you use the Metadata statement to write or delete metadata, the changes take effect immediately. You do not need to perform a Save operation.

You also can use the Metadata statement to read the metadata from a table, even if you do not know the names of the keys. To read a table's metadata:

1. Issue a **Metadata Table...SetTraverse** statement to initialize a traversal.
2. Issue a **Metadata Traverse...Next** statement to retrieve a key. This statement retrieves the key's name into one string variable, and retrieves the key's value into another string variable.
3. Continue to issue **Metadata Traverse...Next** statements to retrieve additional keys. Typically, this statement is issued from within a loop. Once you have exhausted the keys, **Metadata Traverse...Next** returns an empty string as the key name.
4. Terminate the traversal by issuing a **Metadata Traverse...Destroy** statement. This action releases the memory used by the traversal.

The following example shows how to traverse a table's metadata.

```
Sub Print_Metadata(ByVal table_name As String)

  Dim i_traversal As Integer
  Dim s_keyname, s_keyvalue As String

  ' Initialize the traversal. Specify "\" as the
  ' starting key, so that the traversal will start
  ' with the very first key.
  Metadata Table table_name
    SetTraverse "\" Hierarchical Into ID i_traversal
  ' Attempt to fetch the first key:
  Metadata Traverse i_traversal
    Next Into Key s_keyname Into Value s_keyvalue
```

```
' Now loop for as long as there are key values;
' with each iteration of the loop, retrieve
' one key, and print it to the Message window.
Do While s_keyname <> ""
  Print " "
  Print "Key name: " & s_keyname
  Print "Key value: " & s_keyvalue

Metadata Traverse i_traversal
  Next Into Key s_keyname Into Value s_keyvalue
Loop

' Release this traversal to free memory:
Metadata Traverse i_traversal Destroy

End Sub
```

For a complete listing of the syntax of the **Metadata** statement, see the *MapBasic Reference* or *MapBasic Help*.

## Working With Seamless Tables

---

### What is a Seamless Table?

Seamless tables allow you to group multiple tables together and treat them as a single table. Once you have grouped your tables into a seamless table, you can add the entire group of tables to a very easily, simply by adding the seamless table (in the **Layer Control** window). For an introduction to working with seamless tables, see the *MapInfo Pro User Guide*.

### How Do Seamless Tables Work?

MapInfo Pro includes a MapBasic program, Seamless Manager (*seammgr.mbx*), that allows you to create and manipulate seamless tables. To see how a seamless table is composed, you need to turn the table's "seamless behavior" off, as follows:

1. Open a seamless table, such as USRaster.
2. Run the Seamless Manager application.
3. Choose **Tools > Seamless Manager > Turn Seamless Off** to turn off the seamless attribute for the DCMetroA table.
4. Choose **Window > New Browser Window** to display the table in a Browser window.

Like ordinary tables, a seamless table has rows and columns. Each row corresponds to a base table that is included in the seamless table.

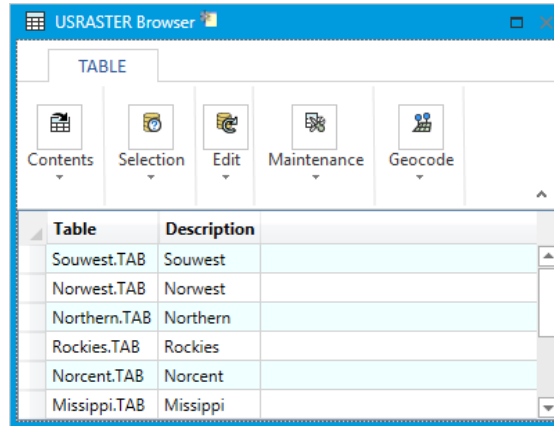


Figure 4: Descriptions from the second column...

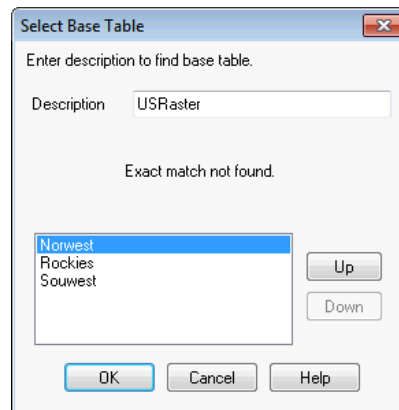


Figure 5: ...appear in the list if the user browses the seamless table.

The first column in a seamless table contains table names. The second column contains descriptions, which appear in the user interface. The table names in the first column may contain directory paths. You can omit the directory paths if the base tables are in the same directory as the seamless table, or if the base tables can be located by the Search Directories path (which is specified as a Preference, in the **Directory Preferences** dialog box).

Every row in a seamless table has a map object attached to it, just as objects are attached to rows in conventional tables. However, the objects in a seamless table are not intended for display. Each row in a seamless table has a rectangle object, which defines the minimum bounding rectangle (MBR) for the table named in the first column. When a user displays a seamless table in a **Map** window, MapInfo Pro compares the **Map** window's current extents against the MBRs stored in the table. MapInfo Pro only opens the base tables when necessary (i.e., when the area currently visible in the **Map** window intersects the table's MBR).

## MapBasic Syntax for Seamless Tables

Use the **Set Table** statement to turn a seamless table into a conventional table. For example, if you want to edit the descriptions in a seamless table, you could issue the following statement:

```
Set Table USRaster Seamless Off
```

and then edit the table's descriptions in a **Browser** window.

Call `TableInfo( , TAB_INFO_SEAMLESS )` to determine whether a table is a seamless table.

Call `GetSeamlessSheet( )` to display a dialog box that prompts the user to choose one base table from a seamless table.

## Limitations of Seamless Tables

All of the base tables in a seamless table must have the same structure (i.e., the same number of columns, the same column names, etc.).

Note that some MapInfo Pro operations cannot be used on seamless tables. For example:

- You cannot simultaneously select objects from more than one base table in a seamless table.
- The MapBasic **Find** statement cannot search an entire seamless table; the **Find** statement can only work with one base table at a time.
- You cannot make a seamless table editable in a **Map** window.
- You cannot create a thematic map for a seamless table.

## Accessing DBMS Data

---

The preceding discussions showed you how to work with local MapInfo tables, tables on your hard disk, or perhaps on a network file-server. This section describes how MapBasic can access DBMS tables, such as Oracle or SQL Server databases.

MapBasic's remote-data statements and functions all begin with the keyword **Server**, with the exception of the **Unlink** statement. For details on the syntax, see the *MapBasic Reference* or *MapBasic Help*.

### How Remote Data Commands Communicate with a Database

MapInfo Pro allows a MapBasic application to connect to multiple databases at one time and issue multiple intermixed SQL statements. This is done through connection handles and statement handles.

Connection handles (or numbers) identify information about a particular connection. MapBasic defines connection handles as variables of type integer (i.e., a connection number). An application receives a connection handle upon connecting to a data source. The connection handle is used to associate subsequent statements with a particular connection.

Statement handles (or numbers) identify information about an SQL statement. MapBasic defines statement handles as variables of type integer (i.e., a statement number). An application must receive a statement handle upon calling the **Server\_Execute( )** function to submit an SQL request. The statement handle is used to associate subsequent SQL requests, like the **Fetch** and **Close** operations, to a particular **Select** statement.

### Connecting and Disconnecting

Before a MapBasic application can begin executing SQL statements to remote databases, it must request a connection using the **Server\_Connect** function. Once a successful connection is established, the function returns a connection handle (hdbc) for use with subsequent SQL DataLink calls.

```
Dim hdbc As Integer
hdbc = Server_Connect("ODBC", "DLG=1")
```

When the driver performs a commit or rollback, it resets all statement requests associated with that connection. The Driver Manager handles the work associated with switching connections while transactions are in progress on the current connection.

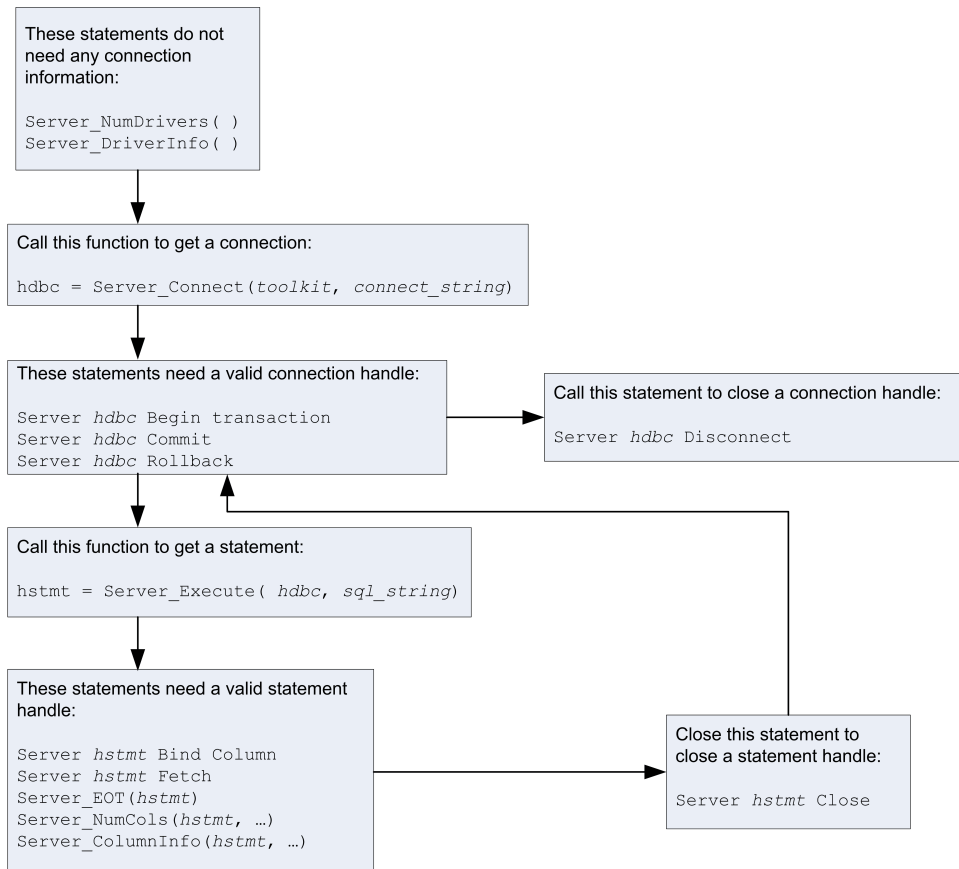
Use the following statement to disconnect:

```
Server hdbc Disconnect
```



This statement closes the connection and frees all resources associated with it.

The following chart describes the sequence in which SQL MapBasic **Server** statements can be issued. There are some statements that require no connection information (for example, **Server\_NumDrivers()**), some that require only a connection handle (for example, **Server Commit**), and some that require a statement handle (for example, **Server Fetch**).



You can download an entire table, some rows and columns, or a result set from an ODBC data source using the **Into** feature of the MapBasic statement **Server Fetch**. However, any updates applied to the downloaded table are not applied back to the server database table. Updating remote databases is accomplished by the **Save File** statement.

## PostGIS Geometry Conversion Behavior

If you try to save a map with unsupported spatial geometry types in PostGIS, these are the results:

- **Spatial Geometry Types with All Unsupported Objects:** If you have created a map that might contain all of the unsupported objects and you are trying to save to PostGIS, this message displays:

```
Table has unsupported objects (rounded rectangles, ellipses or
arcs). Convert to regions and/or polylines?
```

Click **Yes** to convert the unsupported objects to regions or polylines; you would select **No** to decline to convert the unsupported objects. If you decline, you cannot save the map you have created to the PostGIS database.

- **Spatial Geometry types with Region Objects Only:** If you have created a map that contains region objects only and you are trying to save to PostGIS, this message displays:

```
Table has unsupported objects (rounded rectangles or ellipses).  
Convert to regions?
```

Click **Yes** to convert the unsupported objects to regions; you would select **No** to decline to convert the unsupported objects. If you decline, you cannot save the map you have created to the PostGIS database.

- **For Spatial Geometry types with Line Objects Only:** If you have created a map that contains line objects only and you are trying to save to PostGIS, this message displays:

```
Arc is an unsupported object. Convert to polylines?
```

Click **Yes** to convert the unsupported objects to polylines; you would select **No** to decline to convert the unsupported objects. If you decline, you cannot save the map you have created to the SQL Server Spatial database.

- **For Spatial Geometry of type Rectangle:** If you have created a map that contains rectangle objects and you are trying to save to PostGIS, this message displays:

```
Cannot upload Object - Rectangle object type is not supported in this  
table. Operation canceled.
```

Click **OK**. You cannot save the map you have created to the PostGIS database.

## Accessing/Updating Remote Databases with Linked Tables

---

A linked table is a special kind of MapInfo table that retains links to a remote database. Edits can be made over multiple MapInfo Pro sessions. Because the linked table updates are occurring outside of an RDBMS transaction, other RDBMS users can update the same rows in the same tables. An optimistic concurrency control mechanism is used to prevent data corruption. Concurrency control is accomplished with the **Automatic/Interactive** clause of the **Commit Table** statement. When the data is saved, a connection with the remote database is re-established, editing conflicts are resolved, and the changed data is written to the RDBMS. A linked table is created with the MapBasic statement **Server Link Table**.

Linked tables contain information to re-establish connections and identify the remote data to be updated. This information is stored as metadata in the tab file.

An unedited linked table can be refreshed with current data from the remote database without respecifying the connection data, query, and table. A linked table is refreshed with the MapBasic statement **Server Refresh**.

A linked table can be unlinked with the MapBasic statement **Unlink**. Unlinking a table removes the link to the remote database. The end product is a normal MapInfo base table.

Using MapInfo Pro's spatial indexing, users will be able to store and retrieve points in any database; or spatial objects in supported spatial objects. See [Making a Remote Table Mappable](#).

### Live Access to Remote Databases

You can access data live from remote databases with the **Register Table** statement. When you specify the **Type** as ODBC, the **Register Table** statement tells MapInfo Pro to examine the ODBC table and build a corresponding table file (`filename.TAB`).

---

## Performance Tips for Table Manipulation

---

### Set the Default View for Remote Tables

Set the default view for a remote database table, so that only the data you are interested in opens in a map or browser. This improves data access speed for large tables.

The default view is stored in the MAPINFO\_MAPCATALOG in four columns that hold the bounds: VIEW\_X\_LL, VIEW\_Y\_LL, VIEW\_X\_UR AND VIEW\_Y\_UR. The MapCatalog is a registry table that contains metadata about remote tables. If there is no entry in the MapCatalog for the table, MapBasic retrieves the entire bounds.

To set the new default view, open the remote table (the entire bounds will display), adjust the view as desired and run the MapBasic tool **Window Manager** to call **Set Default View**. The new bounds will be updated in the MapCatalog and used the next time the table is opened.

When using the Save Copy As command to upload a table to a remote database data source, the default view for the original table is also used by the newly created table.

If the remote table has no default view entry in the MAPINFO\_MAPCATALOG, the remote database user (as identified in the database connection) must have ALTER permission to the MapCatalog in order to change the default view from the original setting. Without this permission, a warning message displays and the default view change fails.

### Minimize Transaction-File Processing

Ordinarily, when a user edits a MapInfo table, MapInfo Pro stores the edits in a temporary file known as a transaction file. As the user performs more and more edits, the transaction file grows larger. A large transaction file can slow down some operations, therefore, if your MapBasic program performs table editing, you may want to take one of the following steps to prevent the transaction file from growing too large:

- Save your edits (i.e., perform a **Commit** statement) regularly. For example, you might set up your program so that it performs a commit after every 100 edits. Saving your edits empties out the transaction file.
- Use a **Set Table...FastEdit** statement to turn on FastEdit mode. In FastEdit mode, edits are saved immediately to a table, instead of being stored in a transaction file. For details, see the *MapBasic Reference* or *MapBasic Help*. See also **Set Table...Undo Off**.

### Use Indices Where Appropriate

Some queries are faster if you index one or more columns in your table. For example, **Select** statements can be faster if you index the columns used in **Where**, **Order By**, or **Group By** clauses. However, you may not want to index every single column in your table. Indexing every column can slow down some operations because MapInfo Pro must spend more time maintaining indices.

If your application performs intensive table manipulation that does not involve queries, you may be able to improve speed by doing the following:

1. Delete the indices from your table (using the **Drop Index** statement).
2. Perform table edits as necessary.
3. Save your edits.
4. Use the **Create Index** statement to re-create the indices.

This strategy can speed up heavy-duty table manipulation, because MapInfo Pro no longer needs to maintain indices during the editing operations.

### Using Sub-Selects

The **Select** statement can include a **Where** clause that performs a sub-select, as described in the *MapBasic Reference*. However, you may find it faster to perform two non-nested **Select** statements, instead of one nested **Select...Where (Select ...)** statement.

If you perform a sub-select of this type:

```
... Where x = Any( Select ... ) ...
```

then MapInfo Pro does optimize the query performance, but only if column x is indexed.

### Optimized Select Statements

Some types of Select queries are optimized for fast performance. See **Select** in the *MapBasic Reference* or *MapBasic Help*.

### Using Update Statements

MapBasic allows you to update map objects one at a time, by performing an **Alter Object** statement and then an **Update** statement on individual rows, often within a loop. However, this type of table manipulation can be very slow, because you are issuing several statements for every row that you modify.

In some cases, you can obtain much faster performance by issuing a single **Update** statement that affects an entire table, rather than updating one row at a time. For an example, see the topic "Updating Symbols Quickly" in the *MapBasic Help*.

# File Input/Output

In MapBasic, there is an important distinction between managing files and managing MapInfo tables. The preceding chapter describes how MapBasic lets you manage tables. This chapter describes how you manage files that are not tables.

## In this section:

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- **Sequential File I/O** .....159
- **Platform-Specific & International Character Sets** .....161

## Overview of File Input/Output

---

File input/output (usually abbreviated file i/o) is a process of reading information from files (input) and/or writing information to files (output). The MapBasic language provides a set of standard BASIC input/output statements and functions to let you read and/or write text or binary files. Furthermore, because MapInfo Pro and MapBasic are designed to accommodate different hardware platforms, MapBasic's file i/o statements provide mechanisms that let you ensure seamless sharing of data.

There are three different types of file access: sequential, random, and binary. Which mode you should use depends on the nature of the data in the file(s) you need to access. The three modes are summarized below:

- Use **sequential** file i/o to read text from variable-length text files. For example, if one line of a text file is fifty characters long, and subsequent lines in the text file are longer or shorter than fifty characters, then the file is variable-length. Use sequential file i/o for accessing such files.
- Use **random** file i/o to read from text files that are fixed-length. If every line in a file is exactly 80 characters long, the file is fixed-length, and you can access the file using random file i/o.
- Use **binary** file i/o to access binary (non-text) file data. If you use binary file i/o to store data in a file, MapInfo Pro stores numeric data in an efficient storage format. Binary files containing numerical data cannot be viewed or edited in a text editor, however, they provide a more efficient format for storing numerical data than text files.

Regardless of which type of file i/o you will perform, the first step to performing file i/o is to open the file you want to use. In MapBasic, you open a file using the **Open File** statement. This statement has several optional clauses; which clauses you need to use depends on your specific situation. The following statement opens a text file for sequential input:

```
Open File "settings.txt" For Input As #1
```

When you open a file, you specify a file number; in the example above, the number is one (1). Later statements in your program refer to the same number that you specified in the **Open File** statement. For example, to read text from the file into a String variable, you could issue a **Line Input** statement, and the **Line Input** statement would refer to the same file number (#1) as the **Open File** statement:

```
Line Input #1, s_nextline
```

If you need to have two or more files open at the same time, make sure that each file is opened under a different number.

In some situations, you may need to create a new file in which to store your data. To create a new file, issue an **Open File** statement that includes the **For Output** clause:

```
Open File "workfile.txt" For Output As #2
```

Alternately, you can specify **For Append** in the **Open File** statement. With Append mode, MapBasic creates the file if it does not already exist, or MapBasic lets you append data to the file if it already does exist. When you are finished reading from or writing to a file, issue a **Close File** statement. For example:

```
Close File #1
```

The number parameter is the same identification number assigned to the file in the **Open File** statement. The pound sign (#) is optional. You do not need to execute a "save" command to save a file that was created or modified through file input/output. You are done modifying the file as soon as you issue the **Close File** statement. (MapBasic does provide a **Save File** statement, but its purpose is to let you copy a file, not save changes to a file.)

There are many ways in which programs can generate runtime errors during file i/o. If the **Open File** statement specifies the wrong file name, or if you attempt to open a file for output, but the file is flagged

as read-only, a runtime error will occur. If your program writes data to a file, the program could generate a runtime error if the program runs out of disk space. If you try to open a file for output, but that file is currently being modified by another network user, your program will generate a runtime error. If you are developing an application that performs file input/output, you should build error-handling routines into your program to detect and correct error conditions, and you should test your application under conditions likely to cause problems (for example, out of disk space). For information on how to create an error handler, see [Debugging and Trapping Runtime Errors](#).

In some circumstances, you can prevent errors from happening by calling appropriate functions. For example, before you issue an **Open File** statement, you can call the **FileExists( )** function to determine whether the file exists. Also, if your program needs to create a temporary, working file, but you do not know what name or directory path to assign to the file (because you do not know the names of your users' directories), call the **TempFileName\$( )** function. Other statements that are related to file i/o:

- The **Kill** statement deletes a file.
- The **Save File** statement saves a copy of a file.
- The **Rename File** statement changes the name of a file.
- Functions such as **ProgramDirectory\$( )**, **HomeDirectory\$( )** and **ApplicationDirectory\$( )** let you determine different directory paths at runtime. For example, to build a string representing the name of a file that exists in the MapInfo Pro directory (for example, the Startup workspace), when you do not know the name of the directory, call **ProgramDirectory\$( )**, to determine where MapInfo Pro is installed.

## Sequential File I/O

If you intend to perform sequential file i/o (reading/writing of variable-length text files), there are three different options you can specify in the **Open File** statement's **For** clause: **Input**, **Output**, or **Append**.

Use the **For Input** clause if you intend to read from an existing file. For example, the Named Views sample program (`nviews.mb`) issues the following statement to open an existing text file for input:

```
Open File view_file For Input As #1
```

The string variable `view_file` contains the name of a text file.

After you open a file for Input, you can read from the file using either the **Input #** statement or the **Line Input #** statement. The **Line Input #** statement reads an entire line from the file into a String variable. With the **Input #** statement, you can treat each line of text as a comma-separated list of values, and read each value into a separate variable.

For example, the Named Views application reads data that is formatted in the following manner:

```
"New York", -75.75, 42.83, 557.5
"Texas", -100.2, 31.29, 1200
```

Each line of the text file contains four values: a name, an x-coordinate, a y-coordinate, and a zoom distance. The Named Views application uses the following **Input #** statement to read each line into four separate variables:

```
Input #1, vlist(tot).descript,
        vlist(tot).x,
        vlist(tot).y,
        vlist(tot).zoom
```

The `vlist` variable is an array of custom type variables.

When you read data sequentially, you need to test to see whether each read was successful. After your program has read the entire contents of the file, if you attempt to read further the read operation will fail. To test whether a read operation was successful, call the **EOF( )** function (end-of-file) after each input

operation. If the **EOF()** function returns a value of FALSE, then you have not yet exhausted the contents of the file (which means that your read was successful). When the **EOF()** function returns TRUE, you are at the end of the file.

**Note:** Reading the last line of the file does not cause the end-of-file condition. The **EOF()** function will only return TRUE after you have attempted to read past the end of the file.

To create a file that contains a comma-separated list of expressions, issue an **Open File** statement with the **For Output** clause or the **For Append** clause. After opening the file, use the **Write #** statement to write data to the file. In the **Write #** statement, you can specify a comma-separated list of expressions to be written to each line in the file. For example, the Named Views application issues the following **Write #** statement (within a loop) to create a file with the four values (name, x, y, and zoom) shown above:

```
Write #1, vlist(i).descript, vlist(i).x, vlist(i).y, vlist(i).zoom
```

The **Write #** statement encloses each string expression in double-quotation marks within the file, as shown in the example above ("New York"...). In some situations, using the **Write #** statement may be inappropriate, because you may not want text to be enclosed in quotation marks. To write text to a file without quotation marks, use **Print #** instead of **Write #**.

If you want to read an entire line into one String variable, use the **Line Input #** statement. Use the **Print #** statement to create a file that can later be read using the **Line Input #** statement. For an example of using **Print #** and **Line Input #** to read or write an entire line at once, see the sample program `auto_lib.mb`. The `auto_lib` program reads and writes MapInfo workspace files (specifically, the startup workspace file).

You cannot write to a sequential file that was initially opened for input and you cannot read from a sequential file that was initially opened for output.

## Random File I/O

To perform random-access file i/o, specify the **For Random** clause in the **Open File** statement:

```
Open File "datafile.dat" For Random As #1 Len = 80
```

When you open a file in Random mode, you include a **Len** clause that indicates the number of bytes in each line in the file. Note that any text file contains end-of-line terminators; invisible characters that are embedded in the file to mark the end of each line. The line length specified in the **Len** clause (80 in the example above) specifies the exact number of characters in each record, including any end-of-line terminators (for example, carriage-return/line-feed characters).

After you have opened a file for random access, you can read from or write to the file using the **Get** and **Put** statements. See the *MapBasic Reference* for more information about these statements.

## Binary File I/O

Binary files are files that contain numeric values stored in binary format. The following statement demonstrates how to open a file for binary access:

```
Open File "settings.dat" For Binary As #1
```

After you have opened a file for binary access, you can read from or write to the file using the **Get** and **Put** statements; see the *MapBasic Reference*.

Numerical data stored in binary format is stored very efficiently. For example, each Integer value is stored using exactly four bytes of the file, regardless of how large the Integer value is. By contrast, if an Integer value is nine digits long (for example, 111,222,333), and you store the value in a text file, the value will occupy nine bytes of the file. Binary storage provides a more efficient format for the storage of non-text



data. However, if you need to be able to view your files in a text editor, you should store your data in text files rather than binary files.

The records in a binary file can include character strings, but they must be of fixed length.

---

## Platform-Specific & International Character Sets

---

If you encounter problems reading text files that originated on another hardware platform or in another country, you may need to use the **Open File** statement's optional **CharSet** clause. Every character on a computer keyboard corresponds to a numeric code. For example, the letter "A" corresponds to the character code 65. A character set is a set of characters that appear on a computer, and a set of numeric codes that correspond to those characters.

Different character sets are used in different countries. For example, in the version of Windows for North America and Western Europe, character code 176 corresponds to a degree symbol; however, if Windows is configured to use another country's character set, character code 176 may represent a different character. The fact that different countries use different character sets may cause problems if you need to read a file that originated in a different country.

To correct character set-related misinterpretations, include a **CharSet** clause in your **Open File** statement. The **CharSet** clause lets you explicitly state the character set with which the file was originally created. If you include a **CharSet** clause which correctly identifies the file's origin, MapInfo Pro will correctly interpret data while reading from (or writing to) the file. For a listing of character set names that can be used in a **CharSet** clause, see **CharSet** in the *MapBasic Reference*.

### File Information Functions

The following functions return information about an open file:

- **FileAttr( )** returns the mode in which the file was opened (INPUT, OUTPUT, APPEND, RANDOM, or BINARY).
- **EOF( )** returns a logical TRUE if there has been an attempt to read past the end-of-file, or if the file pointer has been placed past the end-of-file.
- **Seek( )** returns the location in the file in offset bytes. On a RANDOM file, this is the number of the last record used times the record length, not the record number alone.
- **LOF( )** returns the length of the entire file in bytes.

Each of these functions uses the file number assigned in the **Open File** statement as an argument. For more information, see the *MapBasic Reference* or *MapBasic Help*.



# Graphical Objects

Much of MapBasic's power lies in its ability to query and manipulate map objects—arcs, ellipses, frames, lines, points, polylines, rectangles, regions, rounded rectangles, and text objects. This chapter discusses how a MapBasic program can query, create, and modify the objects that make up a map. Note, however, that you need to understand the principles of MapInfo tables before you can understand how MapBasic can store objects in tables. If you have not already done so, you may want to read [Working With Tables](#) before reading this chapter.

## In this section:

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- [Using the "Obj" Column](#) .....164
- [Querying An Object's Attributes](#) .....166
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- [Creating Objects Based On Existing Objects](#) .....174
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## Using Object Variables

MapBasic's **Object** variable type allows you to work with both simple objects, like lines, and complex objects, like regions. (Visual Basic programmers take note: MapBasic's **Object** type represents graphical shapes, not OLE objects.)

MapBasic **Object** variables can be treated much like other variables. You can assign values to object variables, pass object variables as arguments to functions and procedures, and store the values of object variables in a MapInfo table.

Use the **Dim** statement to define an object variable:

```
Dim Myobj, Office As Object
```

You do not have to specify the specific type of object that you want the variable to contain. An object variable can contain any type of map or layout object.

Use the equal sign (=) to assign a value to an object variable, as shown in the next example:

```
Office = CreatePoint(73.45, 42.1)
Myobj = Office
```

You can assign objects from other object variables, functions that return objects, or table expressions of the form `tablename.Obj`. However, there is no syntax for specifying a literal ("hard-coded") object expression.

An object variable holds all of the information that describes a map object. If you store a line object in an object variable, the variable contains both geographic information about the line (for example, the line's starting and ending coordinates) and display information (the line's color, thickness, and style). MapBasic also provides four style variable types (Pen, Brush, Symbol, and Font) that can store styles without storing object coordinates.

## Using the "Obj" Column

The column named Obj is a special column that refers to a table's graphical objects. Any table that has graphical objects has an Obj column, although the Obj column typically does not appear in any **Browser** window.

To access the contents of the Object column, use an expression of the form `tablename.obj` (or of the form `tablename.object`). The following example declares an object variable (`current_state`), then copies an object from the states table into the variable.

```
Dim current_state As Object
Open Table "states"
Fetch First From states
current_state = states.obj
```

You can perform the same kinds of operations with object columns that you can with regular columns. You can use SQL queries that reference the object column, update the values (objects) in the column, and read its contents into variables.

The following statement creates a query table with state abbreviations and the area of each state; the Obj column is used as one of the parameters to the **Area( )** function:

```
Select state, Area(obj, "sq mi")
From states
```

The next example creates a one-row table with the total miles of highway in California:

```
Select Sum(ObjectLen(obj, "mi"))
  From highways
  Where obj Within (Select obj From states Where state = "CA")
```

Some rows do not contain map objects. For example, if you open a database file as a MapInfo table and geocode the table, the geocoding process attaches point objects to the rows in the table. However, if some of the rows were not geocoded, those rows will not have map objects. To select all the rows that do not have objects, use the condition **Not obj** in the **Select** statement's **Where** clause. The next statement selects all rows that do not have map objects:

```
Select *
  From sites
  Where Not obj
```

## Creating an Object Column

Not all tables are "mappable." For example, if you base a table on a spreadsheet or database file, the file initially cannot be displayed in a map. To make the table mappable, you must use the **Create Map** statement, which adds an object column to the table.

To remove the Object column from a table, use the **Drop Map** statement. Note that **Drop Map** removes the object column completely. In some cases, you may want to delete individual objects from a table, without deleting the entire Object column; this is sometimes referred to as "un-geocoding" a table. To delete individual object values without removing the Object column, use the **Delete Object** statement.

To determine whether a table has an Object column, call the **TableInfo( )** function with the **TAB\_INFO\_MAPPABLE** code.

## Limitations of the Object Column

Object columns have some restrictions that do not apply to other column types. For example, you can only have one object column per table. When you perform a selection that joins two tables, and both tables have object columns, the results table contains only one of the table's objects (the objects from the first table listed in the **Select** statement's **From** clause).

The next example performs a query involving two mappable tables: the states table, and an outlets table, which contains point objects representing retail outlets. The **Select** statement's **From** clause lists both tables. Because the states table is listed first, the results table will contain objects from the states table.

```
Select *
  From states, outlets
  Where states.state = outlets.state
  Map From selection
```

If you list the outlets table first in the **From** clause, as shown below, the **Select** statement's results table will contain point objects (outlets), rather than state regions:

```
Select *
  From outlets, states
  Where outlets.state = states.state
  Map From selection
```

Each row in a table can contain only one object. Note, however, that an individual object can contain multiple parts. A region object can contain many polygons; thus, a group of islands can be represented as a single region object. Similarly, a polyline object can contain many sections. To determine the number of polygons in a region object or the number of sections in a polyline object, select the object, and choose MapInfo Pro's **Edit > Get Info** command. To determine the number of sections or polygons from within a program, call the **ObjectInfo( )** function with the **OBJ\_INFO\_NPOLYGONS** code.

## Querying An Object's Attributes

A MapInfo table can contain a mixture of different types of objects. For example, a street map might contain a mixture of lines and polylines. You can call the **ObjectInfo()** function with the **OBJ\_INFO\_TYPE** code to determine the object's type. For details, see **ObjectInfo()** in the *MapBasic Reference* or *MapBasic Help*.

If you are using the **MapBasic** window interactively, there are various other ways you can display an object's type. For example, you could issue the following statements from the **MapBasic** window to display a message describing the object's type:

```
Fetch First From world
Note world.obj
```

The following statement selects all Text objects from a classic **Layout** window.

```
Select *
From Layout1
Where Str$(obj) = "Text"
```

To determine information about an object's geographic coordinates, call the **ObjectGeography()** function. For example, call **ObjectGeography()** if you want to determine the x- and y-coordinates of the end points of a line object. Determining coordinates of nodes in a polyline or region is more complex, because polylines and regions have variable numbers of nodes. To determine coordinates of nodes in a polyline or region, call **ObjectNodeX()** and **ObjectNodeY()**.

To determine an object's centroid, use the **Centroid()** function or the **CentroidX()** and **CentroidY()** functions. To determine an object's minimum bounding rectangle (the smallest rectangle that encompasses all of an object), call the **MBR()** function.

To determine other types of object attributes, call the **ObjectInfo()** function. For example, after you copy an object expression from a table into an Object variable, you can call **ObjectInfo()** to determine the type of object (line, region, etc.), or call **ObjectInfo()** to make a copy of the object's Pen, Brush, Symbol, or Font style. If the object is a text object, you can use **ObjectInfo()** to read the string that comprises the text object.

Many of the standard MapBasic functions take objects as arguments, and return one piece of information about the object as a return value. For example, the **Area()**, **Perimeter()**, and **ObjectLen()** functions take object parameters. The example below calculates the area of a flood zone:

```
Dim floodarea As Float
Open Table "floodmap"
Fetch First From floodmap
floodarea = Area(floodmap.obj, "sq km")
```

Note that labels are not the same as text objects. To query a text object, you call functions such as **ObjectInfo()**. To query a label, you call functions such as **LabelInfo()**. Labels are discussed in [Working With Map Labels](#).

### Object Styles (Pen, Brush, Symbol, Font)

Every object has one or more style settings. For example, every line object has a Pen style, which defines the line's color, thickness, and pattern (for example, solid vs. dot-dash), and every Point object has a Symbol style, which defines the point's shape, color, and size. Enclosed objects such as regions have both a Pen style and a Brush (fill) style.

The following table summarizes the four object styles.

Object	Object Style
Pen	Width, pattern, and color of a line
Brush	Pattern, foreground color, and background color of a filled area
Font	Font name, style, size, text color, background color; applies only to text objects
Symbol	For MapInfo Pro symbols: Shape, color, and size attributes. For symbols from TrueType Fonts: Shape, color, size, font name, font style (for example, bold, italic, etc.), and rotation attributes. For custom symbols based on bitmap files: File name, color, size, and style attributes.

For detailed information on the four styles, see **Brush** clause, **Font** clause, **Pen** clause, and **Symbol** clause in the *MapBasic Reference* and *MapBasic Help*.

The MapBasic language provides various statements and functions that allow you to create objects (for example, the **Create Text** statement, the **CreateLine( )** function, etc.). Each of the object creation statements has optional clauses to let you specify the style(s) for that object. For example, the **Create Line** statement includes an optional **Pen** clause that lets you specify the line's style. If you issue an object creation statement that does not specify any style settings, MapInfo Pro assigns the current styles to the object.

**Note:** You cannot use the = operator to compare two style values. For example, the following program, which attempts to compare two Brush variables, will generate a runtime error.

```
Dim b1, b2 As Brush

b1 = MakeBrush(2, 255, 0)
b2 = CurrentBrush()

If b1 = b2 Then
  Note "The two brush styles are equal."
End If
```

If you need to compare two styles, use the **Str\$( )** function to convert each style into a string expression. For example, the following statement compares two Brush values:

```
If Str$(b1) = Str$(b2) Then ...
```

If you need to compare specific elements of a style (for example, to see whether two Symbol styles have the same point size), use the **StyleAttr( )** function to extract individual style elements (color, etc.), and then compare the individual elements.

## Understanding Font Styles

Every text object has a Font style. A Font style defines the type face (for example, Times Roman vs. Helvetica), text style (for example, bold, italic, etc.), and text color. A Font style also identifies how large the text is, in terms of point size. However, the point size is sometimes ignored. The following list summarizes how a Font's point size affects different types of text.

- When you create a text object in a classic **Layout** window or a text frame in a **Layout Designer** window, the Font's point size controls the text height. If the Font style specifies 10-point text, the text object is defined with 10-point text.

On a classic **Layout** window, the text might not display at 10 points, depending on whether you zoom in or out on the layout; but when you print the layout, the text height will be 10 points.

- When you use the **Create Text** statement to create a text object in a mappable table, the current font's point size is ignored. In this situation, the text height is controlled by map coordinates, which you specify in the **Create Text** statement. When you issue a **Create Text** statement, you specify two pairs of x- and y-coordinates that define a rectangular area on the map; the text object fills the rectangular area. Because of this design, text objects stored in a mappable table will grow larger as you zoom in, and grow smaller as you zoom out.
- When you use the **CreateText( )** function to create a text object in a mappable table, the current font's point size controls the initial size of the text. However, zooming in on the map will cause the text to grow larger.
- When you create a label in a **Map** window, the Font's point size controls the text height. The text displays and prints at the height specified by the Font style. Note that labels behave differently than text objects stored in a table. Labels are discussed in [Working With Map Labels](#).

A Font style includes a font name, such as "Courier" or "Helvetica." Font names may be different on each hardware platform; for example, Helv and TmsRmn (or Times New Roman) in the Microsoft Windows environment are called Helvetica and Times on the Sun platforms. Helvetica, Times and Courier are recognized in a MapBasic **Font** clause regardless of the platform that is in use at runtime.

## Stacked Styles

You can stack styles for a layer, so that they become a list of styles drawn on top of each other, to create a more complex or interesting looking map feature. You can stack styles for points, polylines, and polygon features. This is especially useful for polyline styles.

Figure A shows a sample line using one of MapInfo's interleaved line styles. Figure B shows the same sample using a stacked line style.

Figure A: interleaved line style

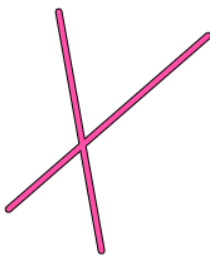
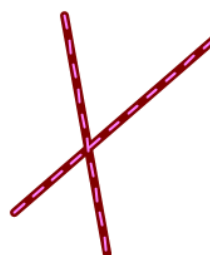


Figure B: stacked line style



Stacked styles create more meaningful display styles for your application without having to add your data as multiple layers in a map. You can define as many styles in a stacked style as you want. However, the more styles you define the more you will impact the map's rendering performance. Typically, most cartographic maps would use two or three styles in a stacked style to draw features.

### Stacked Styles are part of Layer Style Overrides

To set up a stacked style, you must first check the layer's Style Override checkbox, which you access through Layer Control's **Layer Properties** dialog box (or, similarly, through the **Zoom Ranged Display Override** dialog box). Stacked styles become part of your layer's display settings and apply to every object in the layer. Stacked styles are not stored as part of a TAB file; instead, they are saved in a workspace, because they are part of a layer's display settings. This means that you can apply stacked styles even if the TAB files you are working with are read-only.



### MapBasic for Stacked Styles

Stacked styles are fully supported in MapBasic. They are defined as a list of like style clauses separated by commas. For instance, to define the stacked line style previously you would use:

```
Line (7,2,8388608), Line (2,9,16744703)
```

To use this as a global style override for your map layer, you would add it to the **Global** clause in a Set Map statement:

```
Set Map Layer 1 Display Global Global Line (7,2,8388608), Line  
(2,9,16744703)
```

The first **Line** clause encountered in MapBasic is drawn first, followed by the next **Line** clause if there is a comma, and so on.

To create stacked styles for Layer Display Overrides using MapBasic, see the *MapBasic Reference* for the Set Map statement. To query stacked style attributes, refer to new functions in the *What's New* section of the *MapBasic Reference*.

### More Stacked Style Examples

A stacked point style can make the symbol stand out more. Here are examples of what that can look like and the MapBasic statement to make this part of a layer's global style.

#### Example with a Point Object (Symbols)

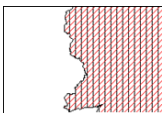
A stacked style point can make the point symbol stand out more.



```
Set Map Layer 1 display Global Global  
Symbol (32,16777136,24),  
Symbol (36,255,14)
```

#### Example with a Polygon (Region)

A stacked region style could be used to create a fill that uses two colors and two different line patterns.



```
Set Map Layer 1 Display Global Global  
Brush (4,0,16777215),  
Brush (5,16711680)
```

## Style Variables

MapBasic provides style variable types—Pen, Brush, Symbol, and Font—that correspond to object style attributes. There are several ways you can assign a style to a style variable:

- Build a style expression by calling **MakePen()**, **MakeBrush()**, **MakeFont()**, **MakeSymbol()**, **MakeCustomSymbol()**, or **MakeFontSymbol()**, and assign the value to the style variable. These functions allow you to explicitly specify the desired styles. For example, the ScaleBar sample program calls **MakeBrush()** to build black and white brush expressions, so that the scale bar can have alternating blocks of black and white.
- Call **CurrentPen()**, **CurrentBrush()**, **CurrentFont()**, or **CurrentSymbol()**, and assign the return value to the style variable. These functions read the current styles (i.e., the styles that appear if you choose MapInfo Pro's **Options > Line Style, Region Style, Symbol Style, or Text Style** command when there are no objects selected).
- Call **ObjectInfo()** to determine the style of an existing object, and assign the return value to a style variable.

- Let the user choose a style through a dialog box. If a dialog box contains a PenPicker, BrushPicker, SymbolPicker, or FontPicker control, the user can choose a style by clicking on the control. For more information on dialog boxes, see [Creating the User Interface](#).

The following example demonstrates how to call the **MakePen( )** function to construct a Pen style. The Pen style value is assigned to a Pen variable.

```
Dim p_var as Pen
p_var = MakePen(1, 10, RGB(128, 128, 128))
```

The **MakePen( )** function's arguments define the pen style: 1 signifies that the style is one pixel wide, 10 signifies a pattern (dotted), and the **RGB( )** function call specifies a color. For more information about the three parameters that make up a pen style (including a chart of all available line patterns), see **Pen** clause in the *MapBasic Reference* or *MapBasic Help*. Similarly, for more information about Brush, Font, or Symbol options, see **Brush** clause, **Font** clause, or **Symbol** clause.

The following example demonstrates how to read an existing object's Pen style into a Pen variable:

```
p_var = ObjectInfo(obj_var, OBJ_INFO_PEN)
```

Once you have stored a Pen expression in a Pen variable, you can use the Pen variable within an object creation statement:

```
Create Line Into Variable obj_var
(-73, 42) (-74, 43)
Pen p_var
```

The function **StyleAttr( )** returns one component of a particular style. For example, the TextBox sample program displays a dialog box that lets the user choose a pen style; the selected style is stored in the Pen variable, pstyle. TextBox then issues the following statement to read the Pen style's color component into an Integer variable (line\_color):

```
line_color = StyleAttr(pstyle, PEN_COLOR)
```

Colors are stored internally as integer numbers. For instance, black is 0 and blue is 255. The **RGB( )** function calculates the color value from quantities of red, green, and blue that you specify. For instance, the function call **RGB(0, 255, 0)** returns the color value for green.

Use the **RGB( )** function where a color is called for. For example:

```
highway_style = MakePen(2, 2, RGB(0, 0, 255))
```

Alternately, instead of calling **RGB( )** you can use one of the standard color definition codes (BLACK, WHITE, RED, GREEN, BLUE, YELLOW, CYAN, and MAGENTA) defined in `mapbasic.def`.

## Selecting Objects of a Particular Style

The **ObjectInfo( )** function lets you extract a Pen, Brush, Symbol, or Font value from an object. Once you have a Pen, Brush, Symbol or Font, you can call the **StyleAttr( )** function to examine individual elements (for example, to determine the color of a Symbol style).

You can use the **Select** statement to select objects based on styles. As the following example shows, the **Select** statement's **Where** clause can call the **ObjectInfo( )** and **StyleAttr( )** functions, so that MapInfo Pro selects only those objects that have certain attributes (for example, objects of a certain color).

The following example adds a custom button to the Tools toolbar. If you select a point object and then click the custom button, this program selects all point objects in the same table that have the same color.

```
Include "mapbasic.def"
Declare Sub Main
Declare Sub SelectPointsByColor()
```

```

Sub Main
  ' Add a custom button to the Tools toolbar.
  Alter ButtonPad "Tools" Add
  PushButton
  Calling SelectPointsByColor
  HelpMsg "Select points of same color\nSelect By Color"
End Sub
Sub SelectPointsByColor
  Dim i_color, i_open As Integer
  Dim symbol_style As Symbol
  Dim object_name, table_name As String

  ' Note how many tables are currently open.
  i_open = NumTables()

  ' Determine the name of the table in use.
  table_name = SelectionInfo(SEL_INFO_TABLENAME)
  If table_name = "" Then
    ' ... then nothing is selected; just exit.
    Exit Sub
  End If
  ' Exit if the selection is in a non-mappable table.
  If Not TableInfo(table_name, TAB_INFO_MAPPABLE) Then
    Exit Sub
  End If
  ' See whether the selected object is a Point.
  ' If it is a Point, determine its Symbol and Color.
  Fetch First From Selection
  object_name = Str$(Selection.obj)
  If object_name = "Point" Then
    symbol_style = ObjectInfo(Selection.obj, OBJ_INFO_SYMBOL)
    i_color = StyleAttr(symbol_style, SYMBOL_COLOR)
  End If

  ' Accessing "Selection.obj" may have caused MapInfo Pro to
  ' open a temporary table called Query1 (or Query2...).
  ' Let's close that table, just to be tidy.
  If NumTables() > i_open Then
    Close Table TableInfo(0, TAB_INFO_NAME)
  End If

  If object_name <> "Point" Then
    '...the selected object isn't a point; just exit.
    Exit Sub
  End If
  ' Select all the rows that contain point objects.
  Select * From table_name
  Where Str$(Obj) = "Point"
  Into Color_Query_Prep NoSelect

  ' Select those point objects that have the same
  ' color as the original object selected.
  Select * From Color_Query_Prep
  Where
    StyleAttr(ObjectInfo(obj, OBJ_INFO_SYMBOL), SYMBOL_COLOR)
    = i_color
  Into Color_Query

  Close Table Color_Query_Prep

End Sub

```

This example works with point objects, but the same techniques could be used with other object types. For example, to work with region objects instead, you would test for the object name "Region" instead of "Point", and call **ObjectInfo( )** with **OBJ\_INFO\_BRUSH** instead of **OBJ\_INFO\_SYMBOL**, etc.

# Creating New Objects

---

MapBasic contains a set of statements and functions through which you can create graphical objects. This section provides an introduction to object-creation statements and functions; for more, see the *MapBasic Reference Guide*.

## Object-Creation Statements

The following statements can be used to create new objects. All of the statements may be used to create objects on **Layout** windows. All of the statements except for **Create Frame** may be used to create objects on **Map** windows.

- **Create Arc** statement: Creates an arc.
- **Create Ellipse** statement: Creates an ellipse or a circle. (A circle is simply a special case of an arc—an arc with equal width and height.)
- **Create Frame** statement: Creates a frame. Frames are special objects that exist only on **Layout** windows; each frame can display the contents of an open window. Thus, if you want to place two maps on your page layout, create two frames.
- **Create Line** statement: Creates a line.
- **Create Point** statement: Creates a point.
- **Create Pline** statement: Creates a polyline.
- **Create Rect** statement: Creates a rectangle.
- **Create Region** statement: Creates a region.
- **Create RoundRect** statement: Creates a rounded rectangle.
- **Create Text** statement: Creates a text object.
- **AutoLabel** statement: This statement "labels" a **Map** window by drawing text objects to the Cosmetic layer. This statement does not create labels, it creates text objects. To create labels, use the **Set Map** statement.

## Object-Creation Functions

The following MapBasic functions return object values:

- **CreateCircle( )** function: returns a circle object.
- **CreateLine( )** function: returns a line object.
- **CreatePoint( )** function: returns a point object.
- **CreateText( )** function: returns a text object.

In some ways, object-creation functions are more powerful than the corresponding object-creation statements, because a function call can be embedded within a larger statement. For example, the following **Update** statement uses the **CreateCircle( )** function to create a circle object for every row in the table:

```
Update sites
  Set obj = CreateCircle(lon, lat, 0.1)
```

This example assumes that the sites table has a lon column containing longitude values (x coordinates) and a lat column containing latitude values (y coordinates).

## Creating Objects With Variable Numbers of Nodes

Polyline objects and region objects are more complex than other objects in that polylines and regions can have variable numbers of nodes (up to 32,763 nodes per object).

You can create a region object using the **Create Region** statement. In the **Create Region** statement, you can explicitly state the number of nodes that the object will contain. However, there are situations where you may not know in advance how many nodes the object should contain. For example, a program might read object coordinates from a text file, then build a region object that contains one node for each pair of coordinates read from the file. In that situation, the program cannot know in advance how many nodes the object will contain, because the number of nodes depends on the amount of information provided in the file.

If your program will create region or polyline objects, you may want to create those objects in two steps:

1. Issue a **Create Region** statement or a **Create Pline** statement to create an empty object (an object that has no nodes).
2. Issue **Alter Object** statements to add nodes to the empty object. The **Alter Object** statement is usually placed within a loop, so that each iteration of the loop adds one node to the object.

The following example demonstrates this process:

```

Include "mapbasic.def"

Type Point
  x As Float
  y As Float
End Type

Dim objcoord(5) As Point
Dim numnodes, i As Integer, myobj As Object
numnodes = 3
set CoordSys Earth
objcoord(1).x = -89.213 objcoord(1).y = 32.017
objcoord(2).x = -89.204 objcoord(2).y = 32.112
objcoord(3).x = -89.187 objcoord(3).y = 32.096

Create Pline Into Variable myobj 0

For i = 1 to numnodes
  Alter Object myobj Node Add (objcoord(i).x,objcoord(i).y)
Next

Insert Into cables (obj) Values (myobj)

```

## Storing Objects In a Table

After you create an object and store it in an Object variable, you usually will want to store the new object in a table. The user will not be able to see the object unless you store the object in a table.

To store an object value in a table, use the **Insert** statement or the **Update** statement. Which statement you should use depends on whether you want to attach the object to an existing row or create a new row to store the object.

Use the **Update** statement to attach an object to an existing row in a table. If that row already has an object, the new object replaces the old object. The **Update** statement can update any column in a table; to update a row's graphical object, refer to the special column name Obj.

For example, the following statement stores a point object in the Obj column of the first row in the Sites table:

```
Update sites
  Set Obj = CreatePoint(x, y)
  Where RowID = 1
```

Use the **Insert** statement to add a new row to a table. **Insert** lets you add one row to a table at a time or insert groups of rows from another table. The following statement inserts one new row into the Sites table, and stores a line object in the new row's Obj column:

```
Insert Into sites (Obj)
  Values (CreateLine(x1, y1, x2, y2))
```

The TextBox sample program demonstrates both the **Insert** statement and the **Update** statement. The TextBox application draws a box (a rectangle object) around each selected text object; each box is stored using an **Insert** statement. In addition, if the user checks the **Change Text Color to Match Box Color** check box, the program also changes the color of the selected text object, and then uses an **Update** statement to store the modified text object back in the table.

The **Insert** and **Update** statements are both powerful, flexible table-manipulation statements. In the preceding examples, the statements operated only on one column (the graphical object column, Obj); however, you can manipulate any column of your table using **Insert** and **Update**.

## Creating Objects Based On Existing Objects

---

A MapBasic program can create new objects based on existing objects. This section provides an introduction to various MapBasic statements and functions; for more information about a particular statement or function, see the *MapBasic Reference* or *MapBasic Help*.

### Creating a Buffer

A buffer region is a region representing the area within a certain distance of another object or objects. Buffers are useful for locating objects within a certain distance of other objects. For instance, you can create a buffer around a fiber optic cable to find all the dig sites within three hundred meters of the cable. You can use the **Create Object** statement to create buffer regions.

The following example creates a 300-meter buffer region around the selected segment of cable, then searches for dig locations within the buffer:

```
Dim danger_zone As Object

Create Object As Buffer
  From selection
  Into Variable danger_zone
  Width 300 Units "m"

Select * From dig_sites Where dig_site.obj Within danger_zone
```

MapBasic also provides a **Buffer( )** function, which returns an object value representing a buffer region.

### Using Union, Intersection, and Merge

The **Create Object** statement also can calculate unions and intersections of regions. If you specify **Create Object As Merge**, MapInfo Pro removes common segments from two or more neighboring regions, producing a single, combined region. When two regions with a common border are merged (for

example, Nevada and California), the resulting region covers the total area of both regions. The border between the neighboring regions is removed.

The following example demonstrates how to combine two regions from the states table:

```
Select *
  From states
  Where state ="CA" Or state = "NV"

Create Object As Merge
  From selection
  Into Table territory
```

The Merge operation is an exclusive-or (XOR) process. If you merge two region objects, and one of the objects is completely contained within the other object, the merge operation removes the smaller object's area from the larger object, leaving a hole.

Merge creates a new object. The two merged regions still exist in the source table. You may want to remove the two original regions, as shown below:

```
Select * From Territory Where TerrName = "Western Territory" or TerrName
=
  "NV"
Delete From selection
```

**Create Object As Union** and **Create Object As Intersection** let you create a region that represents logical combinations of two or more regions. These statements are different from Merge because they work with all of the segments of the source regions, not just the common segments. A Union is the total area of all polygons. An Intersection is the overlapping area. The object created by a union or an intersection may contain new nodes that do not appear in the original regions. MapBasic also provides a **Combine( )** function, which returns the object produced by combining two other objects.

## Creating Isograms

An Isogram is a map that displays a set of points that satisfy a distance or time condition. Isograms are either IsoChrones or IsoDistances. An IsoChrones is a polygon or set of points representing an area that can be traversed from a starting point in a given amount of time along a given road network. An IsoDistance is a polygon or set of points representing an area that can be traversed from a starting point travelling a given distance along a given road network.

Using the **Create Object As Isogram** statement you can create one or more of these regions, each with a different brush and pen style to differentiate them on your map. In order to create an Isogram, you need the use of an external service such as Envinsa.

To create an Isogram:

1. Open a connection to Envinsa using the **Open Connection** statement.  
The statement returns a handle to the connection in a variable that is passed on.
2. Configure the Isogram connection with the **Set Connection Isogram** statement.
3. Create the desired region with the **Create Object As Isogram** statement.

## Creating Offset Copies

A group of Offset functions and statements can be use to produce new objects that are offset from the initial objects by specified units.

The following statements can be used to create offset copies of existing objects.

- **Offset( )** function: returns a copy of initial object offset by specified distance and angle.

- **OffsetXY( )** function: returns a copy of initial object offset by a specified distance along the X and Y axes.
- **SphericalOffset( )** function: returns a copy of initial object by a specified distance and angle. The Distance Type used must be Spherical.
- **SphericalOffsetXY( )** function: returns a copy of initial object by a specified distance and angle. The Distance Type used must be Spherical.
- **CartesianOffset( )** function: returns a copy of initial object by a specified distance and angle. The Distance Type used must be Cartesian.
- **CartesianOffsetXY( )** function: returns a copy of initial object by a specified distance and angle. The Distance Type used must be Cartesian.

# Modifying Objects

---

## General Procedure for Modifying an Object

MapBasic provides many statements that you can use to modify an existing map object. Regardless of which statement you use to modify an object, the process of modifying an object is as follows:

1. Make a copy of the original object. (Often, this involves declaring an object variable, issuing a **Fetch** statement to position the row cursor, and issuing an assignment statement of the form `variable_name = tablename.obj`).
2. Issue statements or functions to modify the object. (This often involves issuing one or more **Alter Object** statements.)
3. Issue an **Update** statement to store the modified object back in the table.

The TextBox program demonstrates this process. If the user checks the **Change Text Color to Match Box Color** check box, the TextBox program uses an **Alter Object** statement to change the color of the selected object, and then uses an **Update** statement to store the altered text object back in the table.

## Repositioning An Object

Use the **Objects Move** statement to move objects a specified distance along the positive X axis. You can also specify the Distance Units and Distance Type. Use the **Objects Offset** statement to make a new copy of objects offset a specified distance along the positive X axis. You can also specify the Distance Units and Distance Type and specify whether the copied objects are placed in the same table as the source objects or into a different table.

## Moving Objects and Object Nodes

To modify an object's coordinates, issue an **Alter Object** statement that includes a **Geography** clause. You may need to issue more than one **Alter Object** statement (one statement to reset the object's x-coordinate, and another statement to reset the y-coordinate).

## Modifying An Object's Pen, Brush, Font, or Symbol Style

The **Alter Object** statement lets you modify an object's style. The example below uses the **Alter Object** command to change a selected object in a table:

```
Include "mapbasic.def"
Dim myobj As Object, mysymbol As Symbol
mysymbol = CurrentSymbol()
```



```

Fetch First From selection
myobj = selection.obj
If ObjectInfo(myobj, OBJ_INFO_TYPE) = OBJ_POINT Then
  Alter Object myobj
  Info OBJ_INFO_SYMBOL, mysymbol
  Update selection Set obj = myobj Where RowID = 1
Else
  Note "The selected object is not a point."
End If

```

- To modify the height of a text object that appears on a classic **Layout** window or a **Layout Designer** window, change the object's Font style (by issuing an **Alter Object** statement with an **Info** clause). The frame in the **Layout Designer** window must be in an active state.
- To modify the height of a text object that appears on a **Map** window or in a map frame in a **Layout Designer** window, change the object's x- and y-coordinates (by issuing an **Alter Object** statement with a **Geography** clause). The map in the **Layout Designer** window must be in an active state.
- To modify the height of a map label in a **Map** window or in a map frame in a **Layout Designer** window, issue a **Set Map** statement. The map in the **Layout Designer** window must be in an active state.

## Converting An Object To A Region or Polyline

To convert an object to a region object, call the **ConvertToRegion( )** function. To convert an object to a polyline object, call the **ConvertToPline( )** function. For more information on these functions, see the *MapBasic Reference* or *MapBasic Help*.

## Erasing Part Of An Object

The following statements and functions allow you to erase part of an object:

- The **Overlap( )** function takes two object parameters, and returns an object value. The resulting object represents the area where the two objects overlap (the intersection of the two objects).
- The **Erase( )** function takes two object parameters, and returns an object value. MapInfo Pro erases the second object's area from the first object, and returns the result.
- The **Objects Intersect** statement erases the parts of the current target objects that are not covered by the currently-selected object.
- The **Objects Erase** statement erases part of the currently-designated target object(s), using the currently-selected object as the eraser.

The **Objects Erase** statement corresponds to MapInfo Pro's **Objects > Erase** command, and the **Objects Intersect** statement corresponds to MapInfo Pro's **Objects > Erase Outside** command. Both operations operate on the objects that have been designated as the "editing target." The editing target may have been set by the user choosing **Objects > Set Target**, or it may have been set by the MapBasic **Set Target** statement. For an introduction to the principles of specifying an editing target, see the MapInfo Pro *User Guide*.

## Points Of Intersection

As mentioned earlier, you can add nodes to a region or polyline object by issuing an **Alter Object** statement. However, the **Alter Object** statement requires that you explicitly specify any nodes to be added. If you want to add nodes at the locations where two objects intersect, use the **Objects Overlay** statement or the **OverlayNodes( )** function.

Call the **IntersectNodes( )** function to determine the coordinates of the point(s) at which two objects intersect. **IntersectNodes( )** returns a polyline object containing a node at each point of intersection. Call **ObjectInfo( )** to determine the number of nodes in the polyline. To determine the coordinates of the points of intersection, call **ObjectNodeX( )** and **ObjectNodeY( )**.

## Working With Map Labels

A map label is treated as a display attribute of a map object. However, MapInfo Pro still supports the **AutoLabel** statement to provide backwards compatibility with older versions of the product in which map labels were text objects in the Cosmetic layer.

### Turning Labels On

A MapInfo Pro user can configure labeling options through the **Layer Control** window. A MapBasic program can accomplish the same results through the **Set Map...Label** statement. For example, the following statement displays labels for layer 1:

```
Set Map Layer 1 Label Auto On Visibility On
```

### Turning Labels Off

In the **Layer Control** window, clearing the **Automatic Labels Off/On** button (in the list of layers) turns off the default labels for that layer. This MapBasic statement has the same effect:

```
Set Map Layer 1 Label Auto Off
```

**Note:** The **Set Map...Auto Off** statement turns off default (automatic) labels, but it does not affect custom labels (labels that were added or modified by the user). The following statement temporarily hides all labels for a layer—both default labels and custom labels:

```
Set Map Layer 1 Label Visibility Off
```

A MapInfo Pro user can reset a layer's labels to their default state by choosing **Map > Clear Custom Labels**. This MapBasic statement has the same effect:

```
Set Map Layer 1 Label Default
```

### Editing Individual Labels

MapInfo Pro users can edit labels interactively. For example, to hide a label, click on the label to select it, and press **Delete**. To move a label, click the label and drag.

To modify individual labels through MapBasic, use a **Set Map...Label** statement that includes one or more **Object** clauses. For example, the following statement hides two of the labels in a **Map** window:

```
Set Map Layer 1 Label  
Object 1 Visibility Off  
Object 3 Visibility Off
```

For each label you want to customize, include an **Object** clause. In this example, Object 1 refers to the label for the table's first row, and Object 3 refers to the label for the table's third row. To save custom labels, save a workspace file; see the MapBasic **Save Workspace** statement.

**Caution:** Packing a table can invalidate custom (edited) labels previously stored in workspaces. When you store edited labels by saving a workspace, the labels are represented as **Set Map...Object...** statements. Each **Object** clause refers to a row number in the table. If the table contains rows that have been marked deleted (i.e., rows that appear grayed out in a

**Browser** window), packing the table eliminates the deleted rows, which can change the row numbers of the remaining rows.

In other words, if you pack a table and then load a previously-saved workspace, any edited labels contained in the workspace may be incorrect. Therefore, if you intend to pack a table, you should do so *before* creating custom labels.

If the only deleted rows in the table appear at the very end of the table (i.e., at the bottom of a **Browser** window), then packing the table will not invalidate labels in workspaces.

## Querying Labels

Querying a **Map** window's labels is a two-step process:

1. Initialize MapBasic's internal label pointer by calling **LabelFindFirst( )**, **LabelFindByID( )**, or **LabelFindNext( )**.
2. Call **LabelInfo( )** to query the "current" label. For an example, see **LabelInfo( )** in the *MapBasic Help*, or see the sample program, `LABELER.MB`.

## Other Examples of the Set Map Statement

To see the MapBasic syntax that corresponds to the **Layer Control** window, do the following:

1. Open the **MapBasic** window.
2. Make a **Map** window the active window.
3. Choose **Map > Layer Control** to display the **Layer Control** window.
4. Select the desired options.

MapInfo Pro applies your changes, and displays a **Set Map** statement in the **MapBasic** window. You can copy the text out of the **MapBasic** window and paste it into your program.

To see the MapBasic syntax that corresponds to editing an individual label, do the following:

1. Modify the labels in your **Map** window. (Move a label, delete a label, change a label's font, etc.)
2. Save a workspace file.
3. View the workspace file in a text editor, such as the MapBasic editor. Edits to individual labels are represented as **Set Map... Layer... Label... Object** statements in the workspace.

## Differences Between Labels and Text Objects

The following table summarizes the differences between text objects and labels.

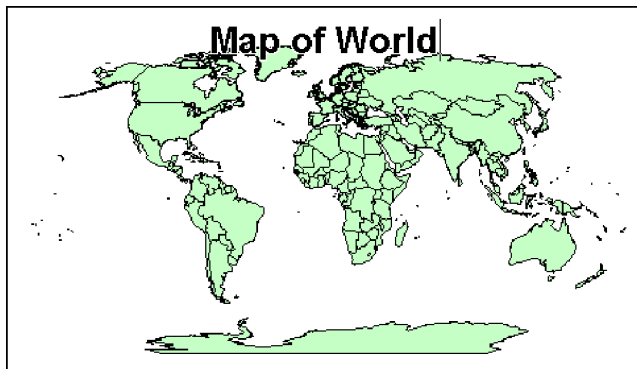
	Text objects	Labels
MapBasic statements used to create the text:	<b>AutoLabel</b> , <b>Create Text</b> , <b>CreateText( )</b>	<b>Set Map</b>
MapBasic statements used to modify the text:	<b>Alter Object</b>	<b>Set Map</b>
MapBasic functions used to query the text (for example, to determine its color):	<b>ObjectInfo( )</b> , <b>ObjectGeography( )</b>	<b>LabelFindByID( )</b> , <b>LabelFindFirst( )</b> , <b>LabelFindNext( )</b> , <b>LabelInfo( )</b>
MapBasic statement used to select the text:	<b>Select</b>	MapBasic programs cannot select labels.

	Text objects	Labels
Saving text in a Map:	Text objects can be stored in mappable tables.	Labels are only stored in workspaces.
Saving text in a Layout:	Text objects created in a Layout can be saved in a workspace.	Not applicable. Labels cannot appear in layouts (except when a map is in a layout).
Controlling the text height:	Text height is affected by the current map scale. Text grows larger as you zoom in, and smaller as you zoom out.	A label's text height is controlled by its font. Zooming in or out does not affect a label's text height.
Converting between text and labels:	Not applicable. Given a text object, there is no MapBasic function that returns a Label.	Given a label, the <b>Labelinfo( )</b> function can return a text object that approximates the label. See LABELER.MBX for an example.

When you create a label, you specify the label's anchor point (in x- and y-coordinates). For example, if you are viewing a map of the World table, this statement creates a label that acts as a title:

```
Set Map Layer 1 Label Object 1
  Visibility On      'show this record's label
  Anchor (0, 85)    'anchor the label at this (x,y)
  Text "Map of World" 'set label's text
  Position Center   'set position relative to anchor
  Font("Arial",289,20,0) 'set font style (20-point, etc.)
```

The resulting label can act as a map title.



If you need to place text on your map, you may find it easier to create labels, rather than text objects. You could create a table whose sole purpose is to be labeled, using this procedure:

1. Create a table (using the **Create Table** statement) that contains a character column. Make the character column wide enough to store the text that you want to appear on the map. Make the table mappable (using the **Create Map** statement).
2. Add the table to your **Map** window (using the **Add Map** statement). Use the **Set Map** statement to set the table's labeling options (font, Auto On, etc.).
3. When you want to add text to the map, insert a point or line object into the table, using an invisible symbol style (shape 31) or invisible pen style (pattern 1). The object will not be visible, but its label will appear. (Use line objects if you want the text to be rotated.)

**Note:** The sample program COGOLine.mb demonstrates how to create a line object at a specific angle.

**Note:** With this strategy, you do not need to use **Set Map...Object** statements to customize each label's position. You can display labels at their default positions. Then, if you want to move a label, move the object that corresponds to the label.

## Coordinates and Units of Measure

A MapBasic application can work in only one coordinate system at a time. MapBasic uses Earth coordinates, non-Earth coordinates, or Layout coordinates. The fact that MapBasic has a current coordinate system gives rise to the following programming guidelines:

- **Earth map:** Before you create, modify, or query objects from an Earth map, make sure that MapBasic is working in an Earth coordinate system. This is the default. With many MapBasic applications you do not need to worry about coordinate systems.
- **Non-Earth map:** Before creating, modifying, or querying objects from a non-Earth map, make sure that MapBasic is working in a non-Earth coordinate system. To do this, issue a **Set CoordSys Nonearth** statement.
- **Classic Layout window:** Before creating, modifying, or querying objects from a classic **Layout** window, make sure that MapBasic is working in a layout coordinate system. To do this, issue a **Set CoordSys Layout** statement.
- **Layout Designer window:** Before creating shapes, text, and image frames in a **Layout Designer** window, make sure that MapBasic is working in a layout coordinate system. To do this, issue a **Set CoordSys Layout** statement. Creating map or browser frames and querying objects does not require this.

Each MapBasic application has a CoordSys system setting that represents the coordinate system currently in use by that application. The default coordinate system setting is the Earth (longitude, latitude) system. By default, every MapBasic application can work with objects from Earth maps, and most MapInfo tables fall into this category. If a MapBasic application needs to work with objects on a **Layout** window, you must first issue a **Set CoordSys Layout** statement, as follows:

```
Set CoordSys Layout Units "in"
```

The **Set CoordSys Layout** statement lets you specify a paper unit name, such as "in" (inches). This dictates how MapBasic interprets **Layout** window coordinate information. To work in centimeters or millimeters, specify the unit name as cm or mm respectively. The following program opens a **Layout** window, then places a title on the layout by creating a text object. Since the object is created on a **Layout** window, the **Create Text** statement is preceded by a **Set CoordSys Layout** statement.

```
Include "mapbasic.def"

Dim win_num As Integer
Layout
win_num = FrontWindow()
Set CoordSys Layout Units "in"

Create Text
Into Window win_num
"Title Goes Here"
(3.0, 0.5) (5.4, 1.0)
Font MakeFont("Helvetica", 1, 24, BLUE, WHITE)
```

In the example above, the Layout coordinate system uses inches as the unit of measure. All of the coordinates specified in the **Create Text** statement represent inches. After you change the coordinate system through the **Set CoordSys** statement, the new coordinate system remains in effect until you explicitly change it back. Every MapBasic application has its own coordinate system setting. This allows one application to issue a **Set CoordSys** statement without interfering with any other applications that are running.

The MapBasic coordinate system is independent of the coordinate system used by any MapInfo Pro **Map** window. The default coordinate system is latitude/longitude (NAD 1927) (represented by decimal degrees, not degrees, minutes, and seconds.)

All coordinates specified in MapBasic statements or functions should be in latitude and longitude unless you change the MapBasic coordinate system with the **Set CoordSys** statement. For example, the function **CentroidX( )** returns the longitude of an object's centroid in decimal degrees, by default, even if the object is stored in a table or a window that has been assigned a different coordinate system. For example, the selection resulting from the statement below has the values: WY -107.554 43, the longitude and latitude of the centroid of Wyoming:

```
Select state, CentroidX(obj), CentroidY(obj)
  From states
  Where state = "WY"
```

After the following statements are executed, the selection contains: WY -934612.97 2279518.38; the coordinates reflect an Albers projection.

```
Set CoordSys Earth Projection 9, 62, "m", -96, 23, 29.5, 45.5, 0, 0
Select state, CentroidX(obj), CentroidY(obj)
  From states
  Where state = "WY"
```

To reset the MapBasic coordinate system to its default, issue the following statement:

```
Set CoordSys Earth
```

## Units of Measure

MapBasic programs deal with the following units of measure:

- Area units, such as square miles and acres, represent measurements of geographic areas. For a complete list of the area units supported by MapBasic, see **Set Area Units** in the *MapBasic Reference*. Because different area units are supported, functions, such as **Area( )**, can return results in whatever units are appropriate to your application.
- Distance units, such as kilometers and miles, represent measurements of geographic distance. For a list of distance units supported by MapBasic, see **Set Distance Units** in the *MapBasic Reference*.
- Paper units, such as inches or centimeters, represent non-geographic distances. For example, if you issue a **Set Window** statement to reset the width or height of a , you specify the window's new size in paper units, such as inches (on the screen).

At any point during a MapInfo Pro session, there is a current distance unit, a current area unit, and a current paper unit. The default units are miles, square miles, and inches, respectively. The effect of default units is best illustrated by example. The following statement creates a circle object:

```
obj_var = CreateCircle(x, y, 5)
```

Because MapBasic's default distance unit is miles, the circle object will have a radius of five miles. However, if you reset the distance unit by issuing a **Set Distance Units** statement, the meaning of the radius parameter (5) changes. Thus, the following example creates a circle object with a radius of 5 kilometers:

```
Set Distance Units "km"
obj_var = CreateCircle(x, y, 5)
```

To reset the current area unit or the current paper unit, use the **Set Area Units** statement or the **Set Paper Units** statement, respectively.

## Advanced Geographic Queries

MapBasic programs can perform complex data queries that take both tabular and graphical data into account. For example, your program can use the **Add Column** statement to calculate totals and averages of data values within a region, based on how the region object overlaps and intersects objects in other map layers.

To understand how MapBasic and MapInfo Pro can perform data-driven geographic analysis, you must understand how MapBasic programs can manage and query tables. If you have not already done so, you may want to read [Working With Tables](#) before reading this section.

### Using Geographic Comparison Operators

MapBasic does not allow you to use the equal operator (=) to perform logical comparisons of objects (If object\_a = object\_b). However, MapBasic does provide several geographic operators that let you compare objects to see how they relate spatially. The MapBasic comparison operators **Contains**, **Within**, and **Intersects** and the optional modifiers **Part** and **Entire** allow you to compare objects in much the same way as the relational operator can be used with numbers.

Below is an example of a geographic comparison in an **If...Then** statement:

```
If Parcel_Object Within Residential_Zone_Obj Then
    Note "Your Property is zoned residential."
End If
```

The example below illustrates a geographic comparison in a **Select** statement:

```
Select * From wetlands
Where obj Contains Part myproject
```

At least one of the objects used in a **Within** and **Contains** condition should be an object that represents an enclosed area: regions, ellipses, rectangles, or rounded rectangles.

Whether you use **Within** or **Contains** depends on the order of the objects in the expression. The rule is as follows:

- Use **Within** to test whether the first object is inside the second object.
- Use **Contains** to test whether the first object has the second object inside of it.

For example, when comparing points with regions:

- Points are **Within** regions.
- Regions **Contain** points.

The following statement selects the state(s) containing a distribution center object:

```
Select * From states
Where obj Contains distribution_ctr
```

The next statement selects all of the landfills within a county:

```
Select * From landfill
Where obj Within county_obj
```

The **Within** operator and the **Contains** operator test whether the centroid of an object is inside the other object. Use **Entire(ly)** to test whether the whole object is inside another object. Use **Part(ly)** to test whether any part of an object is within the other object.

The next statement selects all sections of a highway with any part going through a county:

```
Select * From highway
Where obj Partly Within countyobj
```

The **Partly Within** operator tests whether any portion of the first object is within the other object or touching it at any point. You also can use the **Entirely Within** operator to test if all of an object is within the area of another object. Since checking all of the segments of an object involves more calculations than checking only the centroid, conditions that involve the **Partly** modifier or the **Entirely** modifier evaluate more slowly.

The Intersects operator can be used with all types of objects. If any part of an object crosses, touches, or is within the other object, the objects intersect. Regions that touch at one corner intersect. A point on a node of a polyline intersects the polyline, lines that cross intersect, and a point inside a region intersects that region.

The table below summarizes MapBasic's geographic operators:

Operator	Usage	Evaluates TRUE if:
<b>Contains</b>	objectA Contains objectB	first object contains the centroid of the second object
<b>Contains Part</b>	objectA Contains Part objectB	first object contains part of the second object
<b>Contains Entire</b>	objectA Contains Entire objectB	first object contains all of the second object
<b>Within</b>	objectA Within objectB	first object's centroid is within the second object
<b>Partly Within</b>	objectA Partly Within objectB	part of first object is within the second object
<b>Entirely Within</b>	objectA Entirely Within objectB	the first object is entirely inside of the second object
<b>Intersects</b>	objectA Intersects objectB	the two objects intersect at some point

## Querying Objects in Tables

You can use MapBasic functions or geographic comparison operators to build queries using the object column of your table. Building these queries is much like building queries for regular columns, except that there are no object literals. Instead, queries using objects typically use functions or comparison operators (for example, **Entirely Within**) to analyze objects.

The statement below uses the **ObjectLen( )** function to find all the sections of cable greater than 300 meters in length:

```
Select *
From cable
Where ObjectLen(obj, "m") > 300
```

The next example calculates the total area of wetlands in Indiana:

```
Select Sum(Area(obj, "sq mi"))
From wetlands
Where obj Within (Select obj From states Where state = "IN")
```



The next statement selects all the storage tanks within one kilometer of a well at longitude lon, and latitude lat:

```
Set Distance Units "km"
Select * From tanks Where obj Within
CreateCircle(lon,lat, 1)
```

The statement below creates a selection with employees and the distance they live from an office (in order of farthest to nearest):

```
Select
  Name, Distance(Centroidx(obj), Centroidy(obj),
    office_lon, office_lat, "km")
From employee
Order By 2 Desc
```

## Using Geographic SQL Queries With Subselects

MapBasic allows you to query objects from one table in relation to objects in another table. For instance, you might want to query a table of doctors to see which ones are in Marion County, Indiana. Doctors are in one table, counties in another.

One approach is to select a county from the county table, copy the object into a variable, and query the table of doctors against the object variable. This is how it looks:

```
Dim mycounty As Object
Select *
  From counties
  Where name="Marion" and state="IN"
Fetch First From selection
mycounty = selection.obj
Select *
  From doctors
  Where obj Within mycounty
```

If you use a subselect in the **Where** clause instead of the variable mycounty, you can produce the same results with fewer statements:

```
Select *
  From doctors
  Where obj Within
    (Select obj From counties Where name="Marion" And state="IN")
```

Notice that the subselect (the latter select, which appears in parentheses) returns a table with only one column and one row—the object representing Marion County, Indiana. MapInfo Pro examines each row in the doctors table to determine whether that row is inside Marion County. The subselect performs the same function as the variable in the previous example (mycounty), because it returns the appropriate object to the expression.

To ensure that the subselect returns only the object column, the **Select** clause of the subselect lists only one column, obj. The statement will not evaluate properly if there are many columns in the subselect or if the column isn't an object column.

Use the **Any()** operator when the subselect returns multiple rows. The next example shows a subselect that uses **Any()** to process a group of rows. It finds all the doctors in counties that have a per-capita income of less than \$15,000. Compare the locations with each county in the subselect.

```
Select *
  From doctors
  Where obj Within
    Any (Select obj From counties Where inc_pcap < 15000)
```

Switch the order in the **Select** statement to select counties instead of doctors. The statement below finds all the counties that have a doctor specializing in neurology:

```
Select *
  From counties
  Where obj Contains
        (Select obj From doctors Where specialty = "Neurology")
```

The following example finds all the states bordering Nebraska:

```
Select *
  From states
  Where obj Intersects (Select obj From states Where state = "NE")
```

## Using Geographic Joins

Joins link two tables together by matching, row-for-row, entries in specified columns from two tables. The result is one table with a combination of columns for both tables with as many rows as there are matches. MapBasic extends the relational concept of a join with geographic join criteria. For instance, if you join demographic data with the states map, the resulting table can have all of the information from the states map as well as the demographic data for each state.

MapInfo Pro supports geographic conditions in the join. For instance, instead of matching two tables by a numeric ID, you can join tables by matching objects from one table that contain an object in the second table. This is particularly useful when there is no matching field. You can join all of the housing projects in a table with their congressional districts without having the congressional district information in the projects table to begin with. Determining the district may be the reason to perform the join in the first place—to see which projects are in which congressional districts. The SQL Select statement for that operation is:

```
Select *
  From projects, congdist
  Where projects.obj Within congdist.obj
```

After you have joined the tables geographically, you can use the **Update** statement to enter the congressional district names (from the name column) into the projects table (the column cd) as follows:

```
Update Selection Set cd = name
```

The resulting projects table now contains the name of the congressional district for every project. The following example calculates the total dollars spent on projects in each congressional district:

```
Select congdist.name, sum(project.amt)
  From congdist, project
  Where congdist.obj Contains project.obj
  Group By 1
```

Since the table order in the **Where** clause has changed, use the condition **Contains** instead of **Within**.

## Proportional Data Aggregation

The **Add Column** statement can perform advanced polygon-overlay operations that perform proportional data aggregation, based on the way one table's objects overlap another table's objects. For example, suppose you have one table of town boundaries and another table that represents a region at risk of flooding. Some towns fall partly or entirely within the flood-risk area, while other towns are outside the risk area. The **Add Column** statement can extract demographic information from the town-boundaries table, then use that information to calculate statistics within the flood-risk area. For information about the **Add Column** statement, see the *MapBasic Reference*.

# Advanced Features of Microsoft Windows

This chapter discusses how a MapBasic application can take advantage of Windows-specific technology.

## In this section:

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- **Creating Custom Button Icons and Draw Cursors . . . .192**
- **Inter-Application Communication Using DDE . . . . .194**
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## Declaring and Calling Dynamic Link Libraries (DLLs)

Dynamic Link Libraries, or DLLs, are files that contain executable routines and other resources (such as custom icons for toolbar buttons). You can use DLLs as libraries of external routines, and call those routines from your MapBasic program. You can issue a **Call** statement to a DLL routine, just as you would use a **Call** statement to call a MapBasic procedure. There are many DLLs available from commercial sources. The documentation for a particular DLL should describe the routines that it contains, its specific name, and any required parameters.

**Note:** If your MapBasic program calls DLLs, the DLLs must be present at run time. In other words, if you provide your users with your compiled application (MBX file), you must also provide your users with any DLLs called by your MBX.

The Windows DLLs are documented in the Windows Software Developer's Kit (SDK). Third-party books that describe the standard Windows files are also available.

### Specifying the Library

Before your MapBasic program can call a DLL routine, you must declare the DLL through a **Declare** statement (just as you use the **Declare** statement to declare the sub-procedures in your MapBasic source code). In the **Declare** statement, you specify the name of the DLL file and the name of a routine in the library.

```
Declare Sub my_routine Lib "C:\lib\mylib.dll"  
    (ByVal x As Integer, ByVal y As Integer)
```

If you specify an explicit path in your **Declare** statement (for example, `C:\lib\mylib.dll`), MapInfo Pro tries to load the DLL from that location. If the DLL file is not in that location, MapInfo Pro does not load the DLL (possibly causing runtime errors). If your **Declare** statement specifies a DLL name without a path (for example, `mylib.dll`), MapInfo Pro tries to locate the DLL from various likely locations, in the following order:

1. If the DLL is in the same directory as the .MBX file, MapInfo Pro loads the DLL; otherwise, go to step 2.
2. If the DLL is in the directory where MapInfo Pro is installed, MapInfo Pro loads the DLL; otherwise, go to step 3.
3. If the DLL is in the Windows\System directory, MapInfo Pro loads the DLL; otherwise, go to step 4.
4. If the DLL is in the Windows directory, MapInfo Pro loads the DLL; otherwise, go to step 5.
5. MapInfo Pro searches for the DLL along the user's system search path.

MapInfo Pro follows the same search algorithm when loading bitmap icon and cursor resources from DLLs.

### Passing Parameters

Many DLLs take parameters; for example, the example above shows a **Declare** statement for a DLL routine that takes two parameters.

MapBasic can pass parameters two ways: By value (in which case MapInfo Pro copies the arguments onto the stack), or by reference (in which case MapInfo Pro puts the address of your MapBasic variable on the stack; the DLL then can modify your MapBasic variables). For an introduction to the conceptual differences between passing parameters by reference vs. by value, see [MapBasic Fundamentals](#).

To pass a parameter by value, include the **ByVal** keyword in the **Declare** statement (as shown in the example above). If you omit the **ByVal** keyword, the argument is passed by reference.

The following MapBasic data types may not be passed by value: Arrays, custom data types (i.e., structures), and aliases. Fixed-length string variables may be passed by value, but only if the DLL treats the parameter as a structure. See [String Arguments](#), below.

## Calling Standard Libraries

The next example shows how a MapBasic program can reference the MessageBeep routine in the standard Windows library known as user.

```
Declare Sub MessageBeep Lib "user"
  (ByVal x As SmallInt)
```

Note that this **Declare** statement refers to the library name "user" not "user.dll". User is the name of a standard library that is included as part of Windows; other standard Windows library names include GDI and Kernel.

After you declare a DLL routine using a **Declare** substatement, you can use the **Call** statement to call the routine the way you would call any sub-procedure:

```
Call MessageBeep(1)
```

## Calling a DLL Routine by an Alias

Some DLL routines have names that cannot be used as legal MapBasic identifiers. For example, a DLL routine's name might conflict with the name of a standard MapBasic keyword. In this situation, you can use the Alias keyword to refer to the DLL routine by another name.

The following example shows how you could assign the alias Beeper to the MessageBeep routine in the User library:

```
Declare Sub Beeper Lib "user" Alias "MessageBeep"
  (ByVal x As SmallInt)

Call Beeper(1)
```

**Note:** The name by which you will call the routine—"Beeper" in this example—appears after the Sub keyword; the routine's original name appears after the Alias keyword.

## String Arguments

When calling a DLL routine, a MapBasic program can pass variable-length string variables by reference. If you are writing your own DLL routine in C, and you want MapBasic to pass a string by reference, define the argument as `char *` from your C program.

**Caution:** When MapBasic passes a by-reference string argument, the DLL routine can modify the contents of the string variable. However, DLL routines should not increase the size of a MapBasic string, even if the string is declared as variable-length in MapBasic.

A MapBasic program can pass fixed-length string variables by reference or by value. However, if you pass the argument by value, the DLL routine must interpret the argument as a C structure. For example, if your MapBasic program passes a 20-character string by value, the DLL could receive the argument as a structure consisting of five four-byte Integer values.

When a MapBasic program passes a string argument to a DLL, MapInfo Pro automatically includes a null character (ANSI zero) to terminate the string. MapInfo Pro appends the null character regardless of whether the MapBasic string variable is fixed-length or variable-length.

If your DLL routine will modify the string argument, make sure that the string is long enough. In other words, take steps within your MapBasic program, so that the string variable that you pass contains a sufficiently long string.

For example, if you need a string that is 100 characters long, your MapBasic program could assign a 100-character string to the variable before you call the DLL routine. The MapBasic function `String$( )` makes it easy to create a string of a specified length. Or you could declare the MapBasic string variable to be a fixed-length string (for example, `Dim stringvar As String * 100` will define a string 100 bytes long). MapBasic automatically pads fixed-length string variables with spaces, if necessary, so that the string length is constant.

## Array Arguments

MapBasic allows you to pass entire arrays to DLL routines in the same way that you can pass them to MapBasic sub-procedures. Assuming that a DLL accepts an array as an argument, you can pass a MapBasic array by specifying the array name with empty parentheses.

## User-Defined Types

Some DLLs accept custom data types as parameters. (Use the `Type` statement to create custom variable types.) MapBasic passes the address of the first element, and the rest of the elements of the user-defined type are packed in memory following the first element.

**Caution:** For a DLL to work with custom variable types, the DLL must be compiled with "structure packing" set to tightest packing (one-byte boundaries). For example, using the Microsoft C compiler, you can use the `/Zp1` option to specify tightest packing.

## Logical Arguments

You cannot pass a MapBasic Logical value to a DLL.

## Handles

A handle is a unique integer value defined by the operating environment and used to reference objects such as forms and controls. Operating-environment DLLs use handles to Windows (HWND), Device Contexts (hDC), and so on. Handles are simply ID numbers and you should never perform mathematical functions with them.

If a DLL routine takes a handle as an argument, your MapBasic program should declare the argument as `ByVal Integer`.

If a DLL function returns a handle as its return value, your MapBasic program must declare the function's return value type as `Integer`.

## Example: Calling a Routine in KERNEL

The following example illustrates calling a DLL. The DLL in this example, "kernel", is a standard Windows library. This program uses a routine in the kernel library to read a setting from the Windows configuration file, `WIN.INI`.

```
Declare Sub Main
' Use a Declare Function statement to reference the Windows
' "kernel" library.
Declare Function GetProfileString Lib "kernel" (
    lpszSection As String,
```

```

lpszEntry As String,
lpszDefault As String,
lpszReturnBuffer As String,
ByVal cbReturnBuffer As Smallint)
As Smallint

Sub Main
Dim sSection, sEntry, sDefault, sReturn As String
Dim iReturn As Smallint

' read the "sCountry" setting
' from the "[intl]" section of WIN.INI.

sReturn = String$(256, " ")
sSection = "intl"
sEntry = "sCountry"
sDefault = "Not Found"
iReturn = GetProfileString(sSection, sEntry,
sDefault, sReturn, 256)

' at this point, sReturn contains a country setting
' (for example, "United States")
Note "[" + sSection + "]" + chr$(10) + sEntry + "=" + sReturn
End Sub

```

The **Declare Function** statement establishes a reference to the kernel library. Note that the library is referred to as "kernel" although the actual name of the file is `krnl386.exe`. Windows uses the correct library if your program refers to "kernel". The kernel library receives special handling because it is a standard part of the Windows API. If you create your own library, your **Declare Function** statements should reference the actual name of your DLL file.

If you use DLLs to store custom `ButtonPad` icons and/or custom draw cursors, you can use the same basic technique-calling `SystemInfo(SYS_INFO_MIPLATFORM)` to determine which DLL to use. However, the `MapBasic` syntax is somewhat different: Instead of using a **Declare** statement, you reference DLL resources (bitmap icons and cursors) by including a **File** clause in the **Create ButtonPad** statement, as shown in the following example.

```

Declare Sub Main
Declare Function getDLLname() As String
Declare Sub DoIt

Sub Main
Dim s_dllname As String

s_dllname = getDLLname()

Create ButtonPad "Custom" As
ToolButton Calling doit
Icon 134 File s_dllname
Cursor 136 File s_dllname
End Sub

Function getDLLname() As String
If SystemInfo(SYS_INFO_MIPLATFORM) = MIPLATFORM_WIN32 Then
getDLLname = "..\icons\Test32.DLL"
Else
getDLLname = "..\icons\Test16.DLL"
End If
End Function

Sub DoIt
'this procedure called if the user
'uses the custom button...
End Sub

```

See [Creating Custom Button Icons and Draw Cursors](#) for a discussion of creating custom `ButtonPad` icons.

## Troubleshooting Tips for DLLs

The following tips may help if you are having trouble creating your own DLLs.

- If you are using C++ to create your own DLLs, note that C++ compilers sometimes append extra characters to the end of your function names. You may want to instruct your C++ compiler to compile your functions as "straight C" to prevent your function names from being changed.
- The Microsoft 32-bit C compiler provides three calling conventions: Standard (keyword "\_\_stdcall"), C (keyword "\_\_cdecl") and fast call (keyword "\_\_fastcall"). If you are creating DLLs to call from MapBasic, do not use the fast call convention.
- If you are having trouble passing custom MapBasic data types (structures) to your DLL, make sure that your C data structures are "packed" to one-byte boundaries, as discussed above.
- MapBasic can pass arguments by reference (the default) or by value. Note, however, that passing arguments by value is not standardized among compilers; for example, different compilers behave differently in the way that they process C-language doubles by value. Therefore, you may find it more predictable to pass arguments by reference. When you pass an argument by reference, you are passing an address; the major compilers on the market are consistent in their handling of addresses.
- It is good programming to make your DLLs "self-contained." In other words, each DLL routine should allocate whatever memory it uses, and it should free whatever memory it allocated.
- It is important to set up your MapBasic **Declare** statement correctly, so that it declares the arguments just as the DLL expects the arguments. If a DLL routine expects arguments to be passed by value, but your program attempts to pass the arguments by reference, the routine may fail or return bad data.

## Creating Custom Button Icons and Draw Cursors

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The MapBasic language lets you control and customize MapInfo Pro's ButtonPads, which are an important part of MapInfo Pro's user interface. For an introduction to how MapBasic can control ButtonPads, see [Creating the User Interface](#).

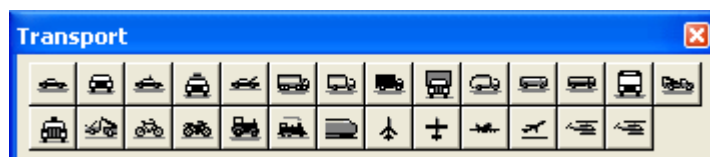
A small picture (an icon) appears on each button. You may want to create your own custom icons to go with the custom buttons that you create. The process of creating custom icons varies from platform to platform. On Windows, custom ButtonPad icons are stored as BMP resources in DLL files.

A MapBasic program also can use custom cursors (the shapes that moves with the mouse as you click and drag in a Map or Layout window). This section discusses the process for creating custom cursors for Windows.

### Reusing Standard Icons

Before you go about creating your own custom button icons, take a moment to familiarize yourself with the icons that are built into MapInfo Pro. Starting with version 4.0, MapInfo Pro includes a wide assortment of custom icons. These icons are provided to make it easier for MapBasic developers to create custom buttons.

To see a demonstration of the built-in icons, run the sample program Icon Sampler (`ICONDEMO.MBX`). The following picture shows one of the ButtonPads created by the Icon Sampler.





Each of the icons built into MapInfo Pro has a numeric code. For a listing of the codes, see `ICONS.DEF`. To see an individual button's code, run `ICONDEMO.MBX`, and place the mouse cursor over a button; the button's ToolTip shows you the button's code.

If none of MapInfo Pro's built-in icons are appropriate for your application, you will want to create custom icons, as described in the following pages.

## Custom Icons

To create custom icons for MapInfo Pro, you need a resource editor. The MapBasic development environment does not include its own resource editor; however, MapBasic programs can use the resources that you create using third-party resource editors. For example, you could create custom icons using AppStudio (the resource editor that is provided with Microsoft Visual C).

On Windows, custom icons are stored in a DLL file. Before you begin creating custom icons, you should develop or acquire a DLL file where you intend to store the icons. This DLL file can be a "stub" file (such as a file that does not yet contain any useful routines).

You must create two bitmap resources for each custom icon. The first bitmap resource must be 18 pixels wide by 16 pixels high; this is the icon that will appear if the user does not check the **Large Buttons** check box in MapInfo Pro's **Toolbar Options** dialog box. The second bitmap resource must be 26 pixels wide by 24 pixels tall; this is the icon that will appear if the user does check the **Large Buttons** check box. You must create both resources.

The process of creating custom bitmaps involves the following steps:

- Acquire or develop the DLL file where you will store your custom icons.
- Edit the DLL using a resource editor, such as AppStudio.
- For each icon you wish to create, add two bitmap (BMP) resources: one bitmap that is 18 wide by 16 high, and another bitmap that is 26 wide by 24 high (in pixels). (You must create bitmap resources, not icon resources.)
- Assign sequential ID numbers to the two bitmap resources. For example, if you assign an ID of 100 to the 18 x 16 bitmap, assign an ID of 101 to the 26 x 24 bitmap.

Once you have created the pair of bitmap resources, you can incorporate your custom bitmaps into your MapBasic application using either a **Create ButtonPad** or an **Alter ButtonPad** statement. In your program, refer to the ID of the smaller (18 x 16) bitmap resource. For example, if you assigned the IDs 100 and 101 to your bitmap resources, your program should refer to ID 100, as shown in the following statement:

```
Alter ButtonPad "Tools"
  Add PushButton
    Icon 100 File "MBICONS1.DLL"
    HelpMsg "Add new record"
    Calling new_route
  Show
```

The DLL file where you store your custom icons (in this example, `MBICONS1.DLL`) must be installed on your user's system, along with the `.MBX` file. The DLL file can be installed in any of the following locations:

- The directory where the `.MBX` file is located;
- the directory where the MapInfo Pro software is installed;
- the user's Windows directory;
- the system directory within the Windows directory;
- or anywhere along the user's search path.

If you place the DLL in any other location, your MapBasic program must specify the directory path explicitly (for example, `Icon 100 File "C:\GIS\MBICONS1.DLL"`). Note that the `ProgramDirectory$( )` and `ApplicationDirectory$( )` functions can help you build directory paths relative to the MapInfo Pro directory or relative to the directory path where your `MBX` is installed.

## Custom Draw Cursors for Windows

The process of creating custom draw cursors is similar to the process of creating custom icons. However, draw cursors have some attributes that do not apply to icons (for example, each draw cursor has a "hot spot").

To create custom draw cursors, use a resource editor to store CURSOR resources in a DLL. You can store CURSOR resources and BMP resources in the same DLL file.

## Inter-Application Communication Using DDE

---

Inter-Process Communication, or IPC, is the generic term for the exchange of information between separate software packages. Windows supports IPC through the Dynamic Data Exchange protocol, commonly known as DDE.

If two Windows applications both support DDE, the applications can exchange instructions and data. For instance, a DDE-capable Windows package, such as Microsoft Excel, can instruct MapInfo Pro to carry out tasks (for example, Map From World).

### Overview of DDE Conversations

A DDE conversation is a process that can take place between two Windows applications. Both applications must be running, and both must support DDE conversations. A single DDE conversation can involve no more than two applications; however, MapInfo Pro can be involved in multiple conversations simultaneously.

In a conversation, one application is active; it begins the conversation. This application is called the client. The other, passive application is called the server. The client application takes all initiative; for instance, it sends instructions and queries to the server application. The server reacts to the instructions of the client.

### How MapBasic Acts as a DDE Client

The MapBasic language supports the following statements and functions that allow a MapBasic application to act as the client in a DDE conversation.

MapBasic Statement or Function	Action
<b>DDEInitiate( )</b>	Opens a conversation.
<b>DDERequest\$( )</b>	Requests information from the server application.
<b>DDEPoke</b>	Sends information to the server application.
<b>DDEExecute</b>	Instructs the server application to perform an action.
<b>DDETerminate</b>	Closes a DDE conversation.
<b>DDETerminateAll</b>	Closes all DDE conversations which were opened by the same MapBasic program.

Refer to the *MapBasic Reference* or *MapBasic Help* for detailed information on these statements and functions.

To initiate a DDE conversation, call the **DDEInitiate( )** function. **DDEInitiate( )** takes two parameters: an application name, and a topic name.

Typically, the application parameter is the name of a potential server application (for example, Excel is the DDE application name of Microsoft Excel). The list of valid topic parameters varies depending of the application. Often, the topic parameter can be the name of a file or document currently in use by the server application.

For instance, if Excel is currently editing a worksheet file called `TRIAL.XLS`, then a MapBasic application can initiate a conversation through the following statements:

```
Dim channelnum As Integer
channelnum = DDEInitiate("Excel", "TRIAL.XLS")
```

In this example, Excel is the application name, and `TRIAL.XLS` is the topic name.

Many DDE applications, including MapInfo Pro, support the special topic name `System`. You can use the topic name `System` to initiate a conversation, then use that conversation to obtain a list of the available topics.

Each DDE conversation is said to take place on a unique channel. The **DDEInitiate( )** function returns an integer channel number. This channel number is used in subsequent DDE-related statements.

Once a conversation has been initiated, the MapBasic application can send commands to the server application by issuing the **DDEExecute** statement. For instance, a MapBasic application could instruct the server application to open or close a file.

A MapBasic application can request information from the server application by calling the **DDERequest\$( )** function. When calling **DDERequest\$( )**, you must specify an item name. A DDE item name tells the server application exactly what piece of information to return. If the server application is a spreadsheet, the item name might be a cell name.

Use the **DDEPoke** statement to send information to the server. Generally, when a MapBasic application pokes a value to the server application, the value is stored in the appropriate document, as if it had been entered by the user. The following example shows how a MapBasic program can store the text "NorthEast Territory" in a cell in the DDE server's worksheet.

```
DDEPoke channelnum, "R1C2", "NorthEast Territory"
```

Once a DDE conversation has completed its task, the MapBasic (client) application should terminate the conversation by issuing a **DDETerminate** or **DDETerminateAll** statement. **DDETerminate** closes one specific DDE conversation; **DDETerminateAll** closes all open DDE conversations that were opened by that same application. Multiple MapBasic applications can be in use at one time, with each application conducting its own set of DDE conversations.

When a MapBasic application acts as a DDE client, the application may generate runtime errors if the server application "times-out" (does not respond to the client's actions within a certain amount of time).

MapInfo Pro stores the time-out setting in the Windows registry. For more details about how MapInfo Pro stores settings in the registry, search for "registry" in the *MapBasic Help* index.

## How MapInfo Pro Acts as a DDE Server

MapInfo Pro acts as the server when another Windows application initiates the DDE conversation. This allows the client application to read from MapBasic global variables and even poke values into MapBasic global variables. The DDE client can also perform execute operations to run MapBasic statements; for example, the client could use DDE execute functionality to issue a MapBasic **Map** statement. (However, the client cannot issue MapBasic flow-control statements.)

Other software packages do not necessarily provide the same set of DDE statements that MapBasic provides. While MapBasic provides a **DDEPoke** statement, other packages may provide the same functionality under a different name. To learn what DDE statements are provided by a particular Windows application, refer to the documentation for that application.

Any application that acts as a DDE client must address the three basic DDE parameters: application, topic, and item.

**Application name:** Specify MapInfo Pro as the application name to initiate a DDE conversation with MapInfo Pro as the server.

**Topic name:** Specify System or specify the name of a MapBasic application that is currently running (for example, SCALEBAR.MBX).

**Item name:** The item name that you specify depends on the topic you use. If you use MapInfo Pro as the application name and System as the topic name, you can use any item name from the table below.

The following table shows the actions and items supported by a DDE conversation with Application as MapInfo and Topic as System.

DDE action	DDE item name	Effect
Peek request	"SysItems"	MapInfo Pro returns a TAB-separated list of item names accepted under the System topic. Topics SysItems Formats Version
Peek request	"Topics"	MapInfo Pro returns a TAB-separated list of currently available topics (System, and the names of all running MapBasic applications).
Peek request	"Formats"	MapInfo Pro returns a list of all Clipboard formats supported by MapInfo Pro (TEXT).
Peek request	"Version"	MapInfo Pro returns a text string representing the MapInfo Pro version number, multiplied by 100. For example, MapInfo Pro 12.0 returns "1200". See example below.
Peek request	A MapBasic expression	MapInfo Pro interprets the string as a MapBasic expression and returns the value as a string. If expression is invalid, MapInfo Pro returns an error. This functionality applies to MapInfo Pro 4.0 and higher.
Execute	A text message	MapInfo Pro tries to execute the message as a MapBasic statement, as if the user had typed the statement into the <b>MapBasic</b> window. The statement cannot contain calls to user-defined functions, although it can contain calls to standard functions. The statement cannot reference variables that are defined in compiled applications (.MBX files). However, the statement can reference variables that were defined by executing Dim statements into the <b>MapBasic</b> window.

For example, the following MapBasic program—which you can type directly into the **MapBasic** window—conducts a simple DDE conversation using "MapInfo" as the application and "System" as the topic.

```
Dim i_channel As Integer
i_channel = DDEInitiate("MapInfo", "System")
Print DDERequest$(i_channel, "Version")
DDETerminate i_channel
```

The **DDEInitiate( )** function call initiates the DDE conversation. Then the **DDERequest\$( )** function performs a peek request, using "Version" as the item name.

If you use the name of a running MapBasic application (for example, C:\MB\SCALEBAR.MBX, or SCALEBAR.MBX, or SCALEBAR) as the DDE topic name, you can use any item name from the table below.

The following table shows the actions and items supported by a DDE conversation with Application as MapInfo and Topic as the name of a running MapBasic application.

DDE action	DDE item name	Effect
Peek request	"{items}"	MapInfo Pro returns a TAB-separated list of the global variables defined by the running application. See example below.
Peek request	The name of a global variable	MapInfo Pro returns a string representing the value of the variable.
Peek request	A string that is not the name of a global variable	If the MapBasic application has a function called <code>RemoteQueryHandler( )</code> , MapInfo Pro calls the function. The function can determine the item name by calling <code>CommandInfo(CMD_INFO_MSG)</code> .
Poke	The name of a global variable	MapInfo Pro stores the new value in the variable.
Execute	A text message	If the MapBasic application has a procedure called <code>RemoteMsgHandler</code> , MapInfo Pro calls the procedure. The procedure can determine the text message by calling <code>CommandInfo(CMD_INFO_MSG)</code> .

For example, the following MapBasic program—which you can type directly into the **MapBasic** window—conducts a simple DDE conversation using `SCALEBAR.MBX` as the topic. This conversation prints a list of the global variables used by `SCALEBAR.MBX`.

**Note:** This conversation will only work if the application `SCALEBAR.MBX` is already running.

```
Dim i_channel As Integer
i_channel = DDEInitiate("MapInfo", "SCALEBAR.MBX")
Print DDERequest$(i_channel, "{items}")
DDETerminate i_channel
```

## How MapInfo Pro Handles DDE Execute Messages

There are two ways that the client application can send MapInfo Pro an execute message:

- When a conversation uses "System" as the topic, and the client application sends an execute message, MapInfo Pro tries to execute the specified message as a MapBasic statement.
- When a conversation uses the name of a MapBasic application as the topic, and the client sends an execute message, MapInfo Pro calls the application's `RemoteMsgHandler` procedure, which can then call `CommandInfo( )` to determine the text of the execute message.

A MapBasic application can act as the client in one DDE conversation, while acting as the server in another conversation. A MapBasic application can initiate a conversation with another MapBasic application, or with MapInfo Pro itself.

## Communicating With Visual Basic Using DDE

Many MapBasic programmers use Microsoft's Visual Basic language to enhance their MapBasic applications. You might use Visual Basic to create elaborate dialog boxes that would be difficult to create using the MapBasic **Dialog** statement. For example, a Visual Basic program can create custom controls that are not available through MapBasic's **Dialog** statement.

MapBasic applications can communicate with Visual Basic applications using DDE (or using OLE Automation). For more information about communicating with Visual Basic applications, see [Integrated Mapping](#).

### Examples of DDE Conversations

For an example of using DDE to read and write values of cells in a Microsoft Excel worksheet, see `DDEInitiate( )` in the *MapBasic Reference* or *MapBasic Help*.

The sample program, `AppInfo (APPINFO.MBX)`, provides a more complex DDE example. The `AppInfo` program is a debugging tool. If you run your MapBasic application, and then you run `AppInfo`, you can use `AppInfo` to monitor the global variables in your MapBasic program. The `WhatApps( )` procedure queries the DDE item name "Topics" to retrieve the list of running MBX files. The `WhatGlobals( )` procedure conducts another DDE conversation, using the "{Items}" item name to retrieve the list of global variable names.

### DDE Advise Links

When `MapInfo Pro` acts as a server in a DDE conversation, the conversation can support both warm and hot advise links. In other words, when a Windows application initiates a DDE conversation that monitors the values of MapBasic global variables, Windows is able to notify the DDE client when and if the values of the MapBasic global variables change.

When a MapBasic application acts as a client in a DDE conversation, there is no mechanism for creating an advise link.

## Incorporating Windows Help Into Your Application

---

If you are developing a complex application, you may want to develop help file that explains the application. To create a help file, you need a help compiler. The MapBasic development environment does not include a help compiler. However, if you already own a Windows help compiler, and you use it to create a Windows help file, you can control the help file through a MapBasic application.

**Note:** Pitney Bowes Inc. Technical Support staff cannot assist you with the creation of on-line help files.

Within your program, you can control the **Help** window by using the **Open Window**, **Close Window**, and **Set Window** statements. The following statement opens the **Help** window, showing the **Contents** screen of the *MapInfo Pro Help* file:

```
Set Window Help Contents
```

The **Set Window** statement has many uses; see the *MapBasic Reference* for details. Most forms of the **Set Window** statement require an Integer window identifier, but if you specify the Help keyword, you should omit the Integer identifier—there is only one **Help** window.

If you create a custom help file, and call the file `Dispatch.hlp`, the following statement displays your help file in the **Help** window:

```
Set Window Help File "C:\MAPINFO\DISPATCH.HLP"
```

The following statement sets the **Help** window so that it displays the help that has 500 as its context ID number:

```
Set Window Help ID 500
```

Context ID numbers (such as 500 in the preceding example) are defined in the [MAP] section of a help file's Project file (for example, `filename.hlp`). For more information about the architecture of a Windows help file, see the documentation for the Windows Software Developers Kit (SDK).

If you want to provide a help screen for a specific dialog box in your application, place a button control in the dialog box, and assign the button a title called "Help."

```
Control Button
  Title "Help"
  Calling show_help_sub
```

Assign the Help Button control a handler procedure, and have the handler procedure issue a **Set Window** statement. The user will be able to obtain help for the dialog box by clicking the **Help** button. For more information about assigning handler procedures to dialog box controls, see [Creating the User Interface](#).





# Integrated Mapping

You can control MapInfo Pro using programming languages other than MapBasic. For example, if you know how to program in WPF, you can integrate a MapInfo Pro **Map** window into your WPF application, while doing most—maybe even all—of your programming in WPF. This type of application development is known as Integrated Mapping, because you are integrating elements of MapInfo Pro into another application.

If you already know how to program in other programming languages, such as C# or WPF, you will find that Integrated Mapping provides the easiest way to integrate **Integrated Mapping** on page 201 MapInfo Pro windows into non-MapBasic applications.

**Note:** If you are interested in using .Net to create integrated mapping applications, see **Integrated Mapping in .Net**.

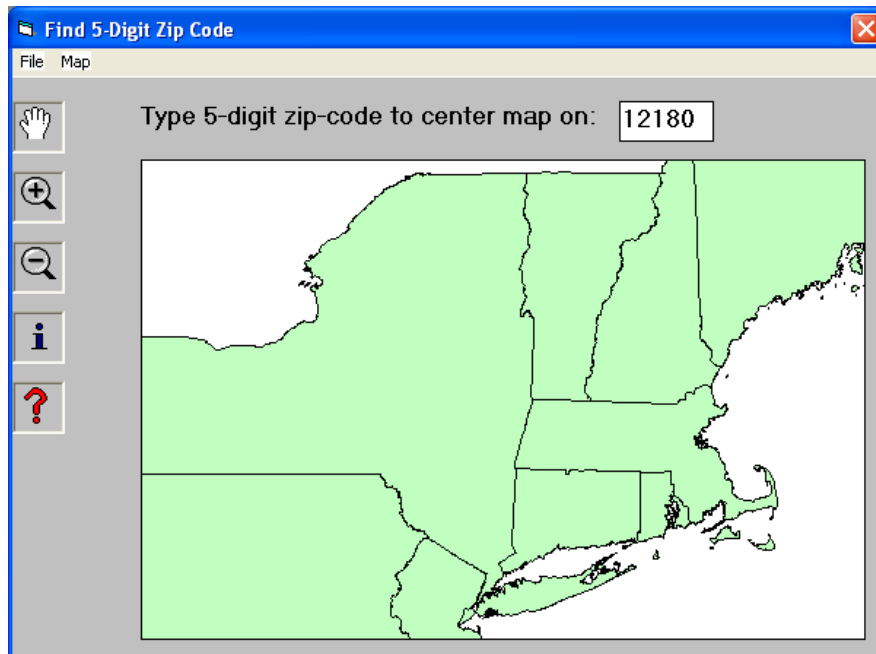
## In this section:

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## What Does Integrated Mapping Look Like?

---

You control the appearance of the Integrated Mapping application. If you want, you can create a user interface that is radically different from the MapInfo Pro user interface. For example, the following picture shows the FindZip application (a sample Visual Basic application that integrates a MapInfo Pro **Map** window into a Visual Basic form).



When you integrate a map into your program, the user sees a genuine MapInfo Pro **Map** window—not a bitmap, metafile, or any other type of snapshot. You can allow the user to interact with the map (for example, using the Zoom tools to magnify the map). An integrated **Map** window has all of the capabilities of a **Map** window within MapInfo Pro.

**Note:** When the user runs an Integrated Mapping application, the MapInfo Pro "splash screen" (the image that ordinarily displays while MapInfo Pro is loading) does not appear.

## Conceptual Overview of Integrated Mapping

---

To create an Integrated Mapping application, you write a program—but not a MapBasic program. Integrated Mapping applications can be written in several languages. The most often-used languages are C and Visual Basic. The code examples in this chapter use Visual Basic.

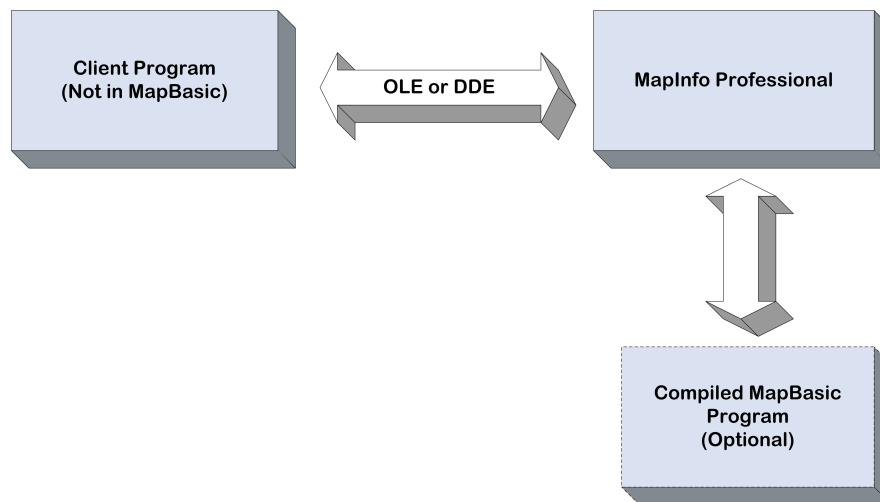
Within your program, you issue a statement to launch MapInfo Pro in the background. For example, if you are using Visual Basic, you could launch MapInfo Pro by calling Visual Basic's `CreateObject( )` function. MapInfo Pro launches silently in the background, without displaying a splash .

Your program manipulates MapInfo Pro by constructing strings that represent MapBasic statements, using OLE Automation (or DDE, if you prefer) to send the strings to MapInfo Pro. MapInfo Pro executes the statements as if you had typed the statements into the **MapBasic** window.

If you want to open a **Map** window, use MapBasic's **Map From** statement, just as you would in a conventional MapBasic program. But in an Integrated Mapping application, you also issue additional statements (for example, **Set Next Document Parent**) to make the **Map** window become a child window of your application. This process is known as "reparenting" the window. You can reparent Map, Browse, Graph, Layout, and Legend windows.

**Note:** Reparenting MapInfo Pro's windows into another application does not give MapInfo Pro access to the other application's data. Before you can display data in a MapInfo Pro window, you must store the data in a MapInfo table.

This illustration shows the major elements of an Integrated Mapping application:



Note that the compiled MapBasic program (.MBX) element is optional. For some applications, you might not need to create a compiled MapBasic program. However, if you have already written MapBasic programs, you can continue to use your existing MapBasic code as part of an Integrated Mapping solution.

## Technical Overview of Integrated Mapping

### System Requirements

- Integrated Mapping requires MapInfo Pro 4.0 or later. You may use a full copy of MapInfo Pro or MapInfo runtime (a special "stripped-down" version of MapInfo Pro, sold only as the base for custom applications).
- Your user's computer must have enough free memory and system resources to run both your client program and MapInfo Pro simultaneously.
- Your client program (for example, your Visual Basic program) must be able to act as an OLE Automation controller or as a DDE client. OLE Automation is strongly recommended, because it is faster and more reliable than DDE. Automation also provides better error reporting than DDE. MapInfo Pro uses OLE properties to report runtime error codes; if you use DDE instead of OLE, you cannot retrieve runtime error codes.
- Your client program must be able to create a user-interface element (for example, a window, form, or control) as a place-holder for where the map will go. Your client program must also be able to determine the Windows HWND value of the user-interface element.

## A Short Sample Program: "Hello, (Map of) World"

---

For example, in Visual Basic you can place a PictureBox control on a form. When you send a command to MapInfo Pro, telling the application to create a map inside the PictureBox, you must specify the PictureBox's HWND.

### Other Technical Notes

- To develop an Integrated Mapping application, you must write a program in a language other than MapBasic. (We refer to this program as the client program.) You can write the client program using various popular development products, such as C/C++, Visual Basic, PowerBuilder, or Delphi.
- Integrated Mapping uses OLE Automation, but does not use OLE Embedding. When you want to place a MapInfo Pro **Map** window into your application, you do not embed it; instead, you "reparent" the window by sending MapInfo Pro a series of command strings. The end result is that MapInfo Pro windows appear to the user as child windows of your application.
- Integrated Mapping does not involve VBX controls or OCX controls. The MapInfo Pro software does include some DLLs, but you do not call those DLLs directly; those DLLs are used internally by MapInfo Pro.

## A Short Sample Program: "Hello, (Map of) World"

---

The following Visual Basic example will give you a sense of how easy it is to integrate MapInfo Pro windows into another application.

Create a new Visual Basic project. In the project's General Declarations procedure, declare an Object variable. (In this example, we will name the variable mi, but you can use any variable name you like.)

```
Dim mi As Object
```

Next, add statements to the Form\_Load procedure, so that the procedure looks like this:

```
Sub Form_Load()  
    Set mi = CreateObject("MapInfo.application")  
    mi.do "Set Application Window " & Form1.hWnd  
    mi.do "Set Next Document Parent " & Form1.hWnd & " Style 1"  
    mi.do "Open Table ""World"" Interactive Map From World"  
    mi.RunMenuCommand 1702  
    mi.do "Create Menu ""MapperShortcut"" ID 17 As ""(-"" "  
End Sub
```

When you run this Visual Basic program, it launches MapInfo Pro in the background, and creates a **Map** window. The **Map** window behaves as a child window of the Visual Basic program. The following sections provide detailed explanations of each step in the Integrated Mapping process.

## A Closer Look at Integrated Mapping

---

The following section explains how to integrate elements of MapInfo Pro into a Visual Basic application. This discussion is written with two assumptions:

- You should already understand the basic terms and concepts of Windows programming. For example, you should know what a "child window" is. For background information on the concepts of Windows programming, see the documentation for your programming language.
- You should already know how to program in Visual Basic, because the code examples in this discussion use Visual Basic syntax. However, even if you are not a Visual Basic developer, you should read this

section anyway. The basic concepts and procedures discussed in this section also apply to other programming languages.

### Starting MapInfo Pro

To start a unique instance of MapInfo Pro, call Visual Basic's `CreateObject()` function, and assign the return value to a Visual Basic Object variable.

**Note:** You may want to make the Object variable global, otherwise, the MapInfo object is released when you exit the local procedure.)

For example, if you named your Object variable "mapinfo" then the following statement launches MapInfo Pro:

```
Set mapinfo = CreateObject("MapInfo.Application")
```

To attach to a previously-running instance of MapInfo Pro which was not launched by a Visual Basic `CreateObject()` call, use Visual Basic's `GetObject()` function.

```
Set mapinfo = GetObject( , "MapInfo.Application")
```

**Note:** If you are working with a MapInfo runtime instead of a full copy of MapInfo Pro, specify "MapInfo.Runtime" instead of "MapInfo.Application". Note that a MapInfo runtime and a full copy of MapInfo Pro can run simultaneously.

The Visual Basic `CreateObject()` and `GetObject()` functions use OLE Automation to connect to MapInfo Pro. If you need to use DDE rather than OLE, use Visual Basic's `Shell()` function to start MapInfo Pro, and then use the `LinkMode` property to establish the DDE connection.

Under Window, multiple instances of MapInfo Pro can be running simultaneously. If you launch MapInfo Pro, and then launch an Integrated Mapping application that calls Visual Basic's `CreateObject()` function, two separate instances of MapInfo Pro will be running.

## Sending Commands to MapInfo Pro

After launching MapInfo Pro, construct text strings that represent MapBasic statements. For example, if you want MapInfo Pro to execute a MapBasic **Open Table** statement, you might construct the following string (within Visual Basic):

```
msg = "Open Table ""STATES.TAB"" Interactive "
```

If you connected to MapInfo Pro using OLE Automation, send the command string to MapInfo Pro by using the `Do` method. For example:

```
mapinfo.Do msg
```

When you use the `Do` method, MapInfo Pro executes the command string as if you had typed the command into the **MapBasic** window.

If you connected to MapInfo Pro using DDE, send the command string to MapInfo Pro by using the `DDE LinkExecute` method.

## Querying Data from MapInfo Pro

To query the value of a MapBasic expression, construct a string that represents the expression. For example, if you want to determine the value returned by the MapBasic function call **WindowID(0)**, construct the following string (within Visual Basic):

```
msg = "WindowID(0) "
```

If you connected to MapInfo Pro using OLE Automation, send the expression string to MapInfo Pro by using the Eval OLE method. For example:

```
Dim result As String
result = mapinfo.Eval "WindowID(0)"
```

When you use the Eval method, MapInfo Pro interprets the string as a MapBasic expression, determines the value of the expression, and returns the value, as a string.

**Note:** If the expression has a Logical value, MapInfo Pro returns a one-character string, "T" or "F".

If you connected to MapInfo Pro using DDE, query the value by using the DDE LinkRequest method. Ensure that you close all tables before the Integrated Mapping application exits.

### Reparenting MapInfo Pro Windows

After you launch MapInfo Pro, use the MapBasic statement **Set Application Window** so that MapInfo Pro dialog boxes and error messages are owned by your client program. (In the following statement, "FormName" is the name of a form in Visual Basic.)

```
msg = "Set Application Window " & FormName.hWnd
mapinfo.Do msg
```

Then, whenever you want to integrate a MapInfo Pro window into the Visual Basic application, send MapInfo Pro a **Set Next Document** statement, followed by the MapBasic statement that creates the window.

For example, the following commands create a MapInfo Pro **Map** window as a child window of the Visual Basic program. ("MapFrame" is the name of a PictureBox control in Visual Basic.)

```
msg = "Set Next Document Parent " & MapFrame.hWnd & " Style 1"
mapinfo.Do msg

msg = "Map From States"
mapinfo.Do msg
```

The **Set Next Document** statement lets you "reparent" document windows. Within the **Set Next Document** statement, you specify the HWND (handle) of a control in your Visual Basic program. The next time you create a **MapInfo Pro** window (using the **Map**, **Graph**, **Browse**, **Layout**, or **Create Legend** statements), the newly-created window is reparented, so that it has your client program as its parent.

The **Set Next Document** statement includes a **Style** clause which controls the type of window you will create. The example above specifies Style 1 which produces a child window with no border. You could specify Style 2 to produce a popup window with a half-height title bar (like MapInfo Pro's **Legend** window), or Style 3 to produce a popup window with a full-height title bar.

For each window that you reparent, issue a pair of statements æ a **Set Next Document Parent** statement, followed by the statement that creates the window. After you create the window, you may want to query the value "WindowID(0)" to obtain MapInfo Pro's Integer Window ID for the new window. (Many MapBasic statements require that you know the window's ID.)

```
mapid = Val(mapinfo.eval("WindowID(0)"))
```

Note that even after you have reparented a **Map** window, MapInfo Pro maintains that window. If part of the window needs to be repainted, MapInfo Pro automatically repaints it. Therefore, your client program can simply ignore any erase or repaint messages pertaining to the reparented window.

If you are working in C, you might not be able to ignore erase messages. In this case you should set your parent window's style to include the WS\_CLIPCHILDREN window style.

### Reparenting Legends, Raster Dialog Boxes, and Other Special Windows

MapInfo Pro has several modeless windows, including the **Info** window, **Ruler** window, **Message** window, the Raster related dialog boxes, and Statistics window. To reparent one of these special "floating" windows, use MapBasic's **Set Window...Parent** statement. For example, the FindZip sample program uses the following statement to reparent the **Info** window:

```
mapinfo.do "Set Window Info Parent " & FindZipForm.hWnd
```

Note that the process for reparenting the **Info** window is different than the process for reparenting **Map** windows. When reparenting the **Info** window, you do not use the **Set Next Document** statement. The process is different because there is only one **Info** window, whereas you can have numerous **Map** windows.

Legend windows are a special case. Ordinarily, the MapInfo Pro user interface has only one **Legend** window, just as it has only one **Info** window. However, the MapBasic language includes a **Create Legend** statement, so that you can create additional Legend windows.

To reparent MapInfo Pro's standard "one and only" **Legend** window, use MapBasic's **Set Window Legend Parent** statement.

To create a custom **Legend** window and reparent it, use MapBasic's **Set Next Document** statement, and then use MapBasic's **Create Legend** statement. Note that in this case, you are creating a Legend that is tied to one specific **Map** or **Graph** window. Unlike MapInfo Pro's default **Legend** window, such custom Legend windows do not change when the active window changes.

You can make a legend float inside a **Map** window. In the **Set Next Document** statement, specify the **Map** window's HWND as the parent. The legend becomes a frame "trapped" within the **Map** window. For an example of this technique, see the sample program FindZip.

### Opening the Table List, Layer Control, or Move Map To windows

In integrated mapping applications, opening the Table List or Layer Control windows shows their respective dialog version. Since there is no dialog version of the **Move Map To** window, nothing happens when opening this window in an integrated mapping application.

### Allowing the User to Resize a Map window

Whether the user is able to resize the **Map** window depends on how you set up your application. The sample program, FindZip, places a **Map** window in a Visual Basic PictureBox control, so that it cannot be resized. However, you could reparent a **Map** window using an MDI interface, which allows the user to resize the window.

**Note:** When the user resizes the **Map** window, MapInfo Pro does not automatically reset the map's contents to fill the new window size. Therefore, if your application allows the user to resize the **Map** window, you must call the Windows API function MoveWindow to make the **Map** window conform to the new size.

For example, you can use the following Visual Basic Declare statement to access the MoveWindow API function:

```
Declare Function MoveWindow Lib "user32" _
    (ByVal hWnd As Long, _
    ByVal x As Long, ByVal y As Long, _
    ByVal nWidth As Long, ByVal nHeight As Long, _
    ByVal bRepaint As Long) As Long
```

When the user resizes the **Map** window, call `MoveWindow`. In Visual Basic, a resize event triggers the `Form_Resize()` procedure; you could call `MoveWindow` from within that procedure, as shown in the following example.

```
Dim mHwnd As Long
mHwnd = Val(mapinfo.Eval("WindowInfo(FrontWindow(),12)"))
MoveWindow mHwnd, 0, 0, ScaleWidth, ScaleHeight, 0
```

The number 12 corresponds to the MapBasic identifier `WIN_INFO_WND`.

`ScaleWidth` and `ScaleHeight` are properties of a Visual Basic form, representing the form's current width and height.

**Note:** The `ScaleMode` property must be set to `Pixels`, so that `ScaleWidth` and `ScaleHeight` represent pixel measurements.

### Integrating MapInfo Pro Toolbar Buttons

You cannot re-parent MapInfo Pro's `ButtonPads` (toolbars). If you want your client program to have toolbar buttons, you must create the buttons in the language you are using. For example, if you are using Visual Basic, you must create your toolbar buttons using Visual Basic.

If you want a Visual Basic toolbar button to emulate a standard MapInfo Pro button, use MapInfo Pro's **RunMenuCommand** method. (This method has the same effect as the MapBasic **Run Menu Command** statement.) For example, the `FindZip` sample program has an `InfoTool_Click` procedure, which issues the following statement:

```
mapinfo.RunMenuCommand 1707
```

When the user clicks the Visual Basic control, the `FindZip` program calls MapInfo Pro's **RunMenuCommand** method, which activates tool number 1707 (MapInfo Pro's Info tool). As a result of the method call, MapInfo Pro's Info tool becomes the active tool.

The "magic number" 1707 refers to MapInfo Pro's Info tool. Instead of using magic numbers, you can use identifiers that are more self-explanatory. MapBasic defines a standard identifier, `M_TOOLS_PNT_QUERY`, which has a value of 1707. Thus, the following **RunMenuCommand** example has the same effect as the preceding example:

```
mapinfo.RunMenuCommand M_TOOLS_PNT_QUERY
```

Using identifiers (such as `M_TOOLS_PNT_QUERY`) can make your program easier to read. However, if you plan to use identifiers in your code, you must set up your program so that it includes an appropriate MapBasic header file. If you are using Visual Basic, use the header file `MAPBASIC.BAS`. If you are using C, use the header file `MAPBASIC.H`.

The following table lists the ID numbers for each of MapInfo Pro's standard tool buttons. The codes in the third column appear in `MAPBASIC.BAS` (for Visual Basic), `MAPBASIC.H` (for C), and `MENUS.DEF` (for MapBasic).

Main Toolbar Buttons	Number	Identifier Code
Select	1701	<code>M_TOOLS_SELECTOR</code>
Marquee Select	1722	<code>M_TOOLS_SEARCH_RECT</code>
Radius Select	1703	<code>M_TOOLS_SEARCH_RADIUS</code>
Boundary Select	1704	<code>M_TOOLS_SEARCH_BOUNDARY</code>
Zoom In	1705	<code>M_TOOLS_EXPAND</code>
Zoom Out	1706	<code>M_TOOLS_SHRINK</code>



Main Toolbar Buttons	Number	Identifier Code
Grabber	1702	M_TOOLS_RECENTER
Info	1707	M_TOOLS_PNT_QUERY
HotLink	1736	M_TOOLS_HOTLINK
Label	1708	M_TOOLS_LABELER
Ruler	1710	M_TOOLS_RULER
Drag Window	1734	M_TOOLS_DRAGWINDOW
Symbol	1711	M_TOOLS_POINT
Line	1712	M_TOOLS_LINE
Polyline	1713	M_TOOLS_POLYLINE
Arc	1716	M_TOOLS_ARC
Polygon	1714	M_TOOLS_POLYGON
Ellipse	1715	M_TOOLS_ELLIPSE
Rectangle	1717	M_TOOLS_RECTANGLE
RoundedRect	1718	M_TOOLS_ROUNDEDRECT
Text	1709	M_TOOLS_TEXT
Frame	1719	M_TOOLS_FRAME
AddNode	1723	M_TOOLS_ADD_NODE

You also can create custom drawing tool buttons, which call your program after being used. For a general introduction to the capabilities of custom toolbuttons, see [Creating the User Interface](#). For details on using custom toolbuttons within an Integrated Mapping application, see [Using Callbacks to Retrieve Info from MapInfo Pro](#).

## Customizing MapInfo Pro's Shortcut Menus

MapInfo Pro displays a shortcut menu if the user right-clicks on a **MapInfo Pro** window. These shortcut menus appear even in Integrated Mapping applications. Depending on the nature of your application, you may want to modify or even eliminate MapInfo Pro's shortcut menus. For example, you probably will want to remove the **Clone View** menu command from the **Map** window shortcut menu, because cloning a **Map** window may not work in an Integrated Mapping application.

To remove one or more items from a MapInfo Pro shortcut menu, use MapBasic's **Alter Menu...Remove** statement, or redefine the menu entirely by using a **Create Menu** statement. For details, see the *MapBasic Reference* or *MapBasic Help*.

To add custom items to a MapInfo Pro shortcut menu, use MapBasic's **Alter Menu...Add** statement, and specify the Calling OLE or Calling DDE syntax; see [Using Callbacks to Retrieve Info from MapInfo Pro](#).

To eliminate a shortcut menu entirely, use the MapBasic statement **Create Menu** to redefine the menu, and use the control code "-" as the new menu definition. For example, the following statement destroys MapInfo Pro's shortcut menu for **Map** windows:

```
mapinfo.do "Create Menu ""MapperShortcut"" ID 17 As ""(-"" "
```

### Printing an Integrated MapInfo Pro Window

You can use MapBasic's **PrintWin** statement to print a **MapInfo Pro** window, even a reparented window. For an example, see the FindZip sample program. The FindZip program's File menu contains a **Print Map** command. If the user chooses **Print Map**, the program executes the following procedure:

```
Private Sub Menu_PrintMap_Click()  
    mapinfo.do "PrintWin"  
End Sub
```

MapBasic's **PrintWin** statement prints the map on a single page, with nothing else on the page.

You also can use MapBasic's **Save Window** statement to output a Windows metafile (WMF file) representation of the **Map** window. For an example, see the FindZip sample program: If the user chooses **Print Form**, the program creates a metafile of the map, attaches the metafile to the form, and then uses Visual Basic's PrintForm method. The end result is a printout of the form which includes the metafile of the map.

### Detecting Runtime Errors

When your client program sends MapInfo Pro a command string, the command might fail. For example, the command "Map From World" fails if the World table is not open. MapInfo Pro generates an error code if the command fails.

To trap a MapInfo Pro error, set up error trapping just as you would for any other OLE Automation process. In Visual Basic, for example, use the **On Error** statement to enable error-trapping.

To determine which error occurred in MapInfo Pro, read MapInfo Pro's OLE Automation properties LastErrorCode and LastErrorMessage. For details on these properties, see [OLE Automation Object Models](#). For a listing of MapBasic's error codes, see the text file ERRORS.DOC.

**Note:** The LastErrorCode property returns values that are 1000 greater than the error numbers listed in ERRORS.DOC. In other words, if an error condition would cause a compiled MapBasic application to produce a runtime error 311, the same error condition would cause an Integrated Mapping application to set the LastErrorCode property to 1311.

When you run a MapBasic application (MBX file) via Automation, the MBX will not trap its own runtime errors. You can run an MBX by using the Do method to issue a MapBasic **Run Application** statement. However, if a MapBasic runtime error occurs within the MBX, the MBX will halt, even if the MBX uses the MapBasic **OnError** statement. If you are building an MBX which you will call via Automation, try to keep the MBX simple. Within the MBX, avoid using MapBasic's **OnError** statement; instead, do as much error checking and prevention as possible in the controlling application before running the MBX.

### Terminating MapInfo Pro

If you create a new instance of MapInfo Pro by calling Visual Basic's CreateObject( ) function, that instance of MapInfo Pro terminates automatically when you release its Object variable. If the Object variable is local, it is released automatically when you exit the local procedure. To release a global Object variable, assign it a value of Nothing:

```
Set mapinfo = Nothing
```

If you use DDE to communicate with MapInfo Pro, you can shut MapInfo Pro down by using the LinkExecute method to send an **End MapInfo** command string.

## Terminating Your Visual Basic Program

If you are creating a 16-bit Visual Basic program that uses DDE to communicate with MapInfo Pro, make sure you terminate your DDE links before you exit your Visual Basic program. If you exit your Visual Basic program while DDE links are still active, you may experience undesirable behavior, including runtime error messages. This problem occurs when you run 16-bit Visual Basic programs under a 32-bit version of Windows (Windows XP). To avoid this problem, set up your Visual Basic program so that it terminates its DDE links before it exits.

## A Note About MapBasic Command Strings

As shown in the preceding pages, you can create strings that represent MapBasic statements, and then send the strings to MapInfo Pro by using the Do OLE Method. Note that you can combine two or more statements into a single command string, as the following Visual Basic example illustrates. (In Visual Basic, the & character performs string concatenation.)

```
Dim msg As String

msg="Open Table ""States"" Interactive "
msg=msg & "Set Next Document Parent " & Frm.hWnd & " Style 1 "
msg=msg & "Map From States "

mapinfo.do msg
```

When parsing the command string at run time, MapInfo Pro automatically detects that the string contains three distinct MapBasic statements: An **Open Table** statement, a **Set Next Document** statement, and a **Map From** statement. MapInfo Pro is able to detect the distinct statements because **Open**, **Set**, and **Map** are reserved keywords in the MapBasic language.

Note the space after the keyword **Interactive**. That space is necessary; without the space, the command string would include the substring "InteractiveSet" which is not valid MapBasic syntax. Because each command string ends with a space, MapInfo Pro can detect that **Interactive** and **Set** are separate keywords.

If you combine multiple MapBasic statements into a single command string, make sure you include a space after each statement, so that MapInfo Pro can detect that the string contains separate statements.

## A Note About Dialog Boxes

In an Integrated Mapping application, the control **OKButton** will be ineffective in dismissing the dialog box. Use a regular push-button control and set a variable to determine if the user has clicked that button.

## A Note About Accelerator Keys

In an Integrated Mapping application, MapInfo Pro's accelerator keys (for example, **Ctrl+C** to copy) are ignored. If you want your application to provide accelerator keys, you must define those accelerators within your client program (for example, your Visual Basic application).

However, Integrated Mapping applications do support pressing the S key to toggle Snap To Node on or off.

## Using Callbacks to Retrieve Info from MapInfo Pro

---

You can set up your Integrated Mapping application so that MapInfo Pro automatically sends information to your client program. For example, you can set up your program so that whenever a **Map** window changes, MapInfo Pro calls your client program to communicate the Integer window ID of the window that changed. This type of notification, where an event causes MapInfo Pro to call your client program, is known as a callback.

- Callbacks allow MapInfo Pro to send information to your client program under the following circumstances:
- The user interacts with a **MapInfo Pro** window while using a custom tool. For example, if the user clicks and drags on a **Map** window to draw a line, MapInfo Pro can call your client program to communicate the x- and y-coordinates chosen by the user.
- The user chooses a menu command. For example, suppose your application customizes MapInfo Pro's shortcut menus (the menus that appear if the user right-clicks). When the user chooses a custom command from a shortcut menu, MapInfo Pro can call your client program to notify your program of the menu event.
- A **Map** window changes. If the user changes the contents of a **Map** window (for example, by adding or removing map layers, or by panning the map), MapInfo Pro can send your client program the Integer window ID of the window that changed. (This is analogous to MapBasic's special handler procedure, **WinChangedHandler**.)
- The status bar text changes in MapInfo Pro. MapInfo Pro's status bar does not appear automatically in Integrated Mapping applications. If you want your client program to emulate MapInfo Pro's status bar, you must set up your application so that MapInfo Pro notifies your client program whenever the status bar text changes.

### Technical Requirements for Callbacks

If you plan to use callbacks, your client program must be able to act as a DDE server or as an OLE Automation server. Visual Basic and C++ can create applications that are Automation servers.

### General Procedure for Using OLE Callbacks

The following steps provide an overview of the process of using callbacks through OLE:

1. Using Visual Basic, C++, or any other language that can act as an OLE server, create a class definition that defines one or more OLE methods. For details on how to create a class definition, see the documentation for your programming language.
2. If you want to emulate MapInfo Pro's status bar, create a method called `SetStatusText`. Define this method so that it takes one argument: a string.
3. If you want MapInfo Pro to notify your program each time a **Map** window changes, create a method called `WindowContentsChanged`. Define this method so that it takes one argument: a four-byte integer.
4. If you want MapInfo Pro to notify your client program whenever custom menu commands or custom buttons are used, create one or more additional method(s), using whatever method names you choose. Each of these methods should take one argument: a string.
5. Create an object using your custom class. For example, if you called the class "CMyClass", the following Visual Basic statement creates an object of that class:

```
Public myObject As New CMyClass
```

- After your program launches MapInfo Pro, call MapInfo Pro's **RegisterCallback** method, and specify the name of the object:

```
mapinfo.RegisterCallback myObject
```

If you want MapInfo Pro to notify your client program when the user uses a custom toolbar button, define a custom button (for example, send MapInfo Pro an **Alter ButtonPad...Add** statement). Define the custom button so that it uses the syntax *Calling OLE `methodname`* (using the method name you created in [step 4](#)).

MapInfo Pro's toolbars are hidden, like the rest of MapInfo Pro's user interface. The user will not see the new custom button. Therefore, you may want to add an icon, button, or other visible control to your client program's user interface. When the user clicks on your Visual Basic icon or button, send MapInfo Pro a **Run Menu Command ID** statement so that your custom toolbar button becomes the "active" MapInfo Pro tool.

- If you want MapInfo Pro to notify your client program whenever the user uses a custom menu command, define a custom menu command (for example, using the **Alter Menu...Add** statement to add an item to one of MapInfo Pro's shortcut menus). Define the custom menu command so that it uses the syntax *Calling OLE `methodname`* (using the method name you specified in [step 4](#)).
- Within the method(s) that you defined, issue whatever statements are needed to process the arguments sent by MapInfo Pro.
- If you created a `SetStatusText` method, MapInfo Pro sends a simple text string to the method, representing the text that MapInfo Pro would display on the status bar. If you want to emulate MapInfo Pro's status bar, add code to this method to display the text somewhere in your user interface.
- If you created a `WindowContentsChanged` method, MapInfo Pro sends a four-byte integer (representing a MapInfo Pro window ID number) to indicate which **Map** window has changed. Add code to this method to do whatever processing is necessary in response to the window's changing. For example, if you are keeping track of the **Map** window's current zoom level, you may want to call MapInfo Pro's **MapperInfo( )** function to determine the **Map** window's latest zoom level.
- If you are using methods to handle custom buttons or menu commands, MapInfo Pro sends a comma-delimited string to your custom method. Within your method, parse the string. The exact format of the string varies, depending on whether the user used a menu command, a point-mode drawing tool, a line-mode drawing tool, etc. [Processing the Data Sent to a Callback](#) explains the syntax of the comma-separated string.

## Processing the Data Sent to a Callback

Your Integrated Mapping application can create custom MapInfo Pro menu commands and custom MapInfo Pro toolbar buttons. When the user uses the custom commands or buttons, MapInfo Pro sends your OLE method a string containing eight elements, separated by commas. For example, the string sent by MapInfo Pro might look like this:

```
MI:-73.5548,42.122,F,F,-72.867702,43.025,202,
```

The contents of the comma-separated string are easier to understand if you are already familiar with MapBasic's **CommandInfo( )** function. When you write MBX applications (i.e., programs written in the MapBasic language and compiled with the MapBasic compiler), you can have your custom menu commands and custom buttons call MapBasic handler procedures instead of calling OLE methods. Within a handler procedure, you can call **CommandInfo( )** to determine various information about recent events. For example, if a MapBasic procedure acts as the handler for a custom drawing tool button, the following function call determines whether the user held down the **Shift** key while using the drawing tool:

```
log_variable = CommandInfo(CMD_INFO_SHIFT)
```

The code `CMD_INFO_SHIFT` is defined in the MapBasic header file, `MAPBASIC.DEF`. The following table lists `CommandInfo`-related defines, sorted in order of their numeric values.

Value	Codes That Have Meaning After a Menu Event	Codes That Have Meaning After a Button Event
1		CMD_INFO_X
2		CMD_INFO_Y
3		CMD_INFO_SHIFT
4		CMD_INFO_CTRL
5		CMD_INFO_X2
6		CMD_INFO_Y2
7		CMD_INFO_TOOLBTN
8	CMD_INFO_MENUITEM	

For an explanation of each code, see **CommandInfo( )** in the *MapBasic Reference* or *MapBasic Help*.

When you create a custom menu command or button that uses the

```
Calling OLE
```

*methodname* syntax, MapInfo Pro constructs a string with all eight **CommandInfo( )** return values, separated by commas. The string begins with the prefix MI: so that your OLE server can determine that the method call was made by MapInfo Pro.

The string that MapInfo Pro sends to your method is constructed in the following manner:

```
"MI:" +
  CommandInfo(1) + "," + CommandInfo(2) + "," +
  CommandInfo(3) + "," + CommandInfo(4) + "," +
  CommandInfo(5) + "," + CommandInfo(6) + "," +
  CommandInfo(7) + "," + CommandInfo(8)
```

If you assign a unique ID number to each of your custom buttons, you can have all of your buttons call the same method. Your method can determine which button called it by examining the seventh argument in the comma-separated string.

Once MapInfo Pro sends the comma-separated string to your method, it is up to you to add code to your method to parse the string.

Suppose your Integrated Mapping application adds a custom menu command to the MapInfo Pro shortcut menu. Every time the user chooses that custom menu command, MapInfo Pro sends your OLE method a comma-separated string. If the custom menu command has an ID number of 101, the string might look like this:

```
"MI:,,,,,,101"
```

In this case, most of the elements of the comma-separated string are empty, because the **CommandInfo( )** function can only return one piece of information about menu events (as is indicated in the table above). Of the eight "slots" in the string, only slot number eight pertains to menu events.

Now suppose you create a custom MapInfo Pro toolbar button that allows the user to click and drag to draw lines on a map. Every time the user uses that custom drawing tool, MapInfo Pro sends your OLE method a comma-separated string, which might look like this:

```
"MI:-73.5548,42.122,F,F,-72.867702,43.025,202,"
```

In this case, the comma-separated string contains several values, because **CommandInfo( )** is able to return several pieces of relevant information about toolbutton events. The first two elements indicate the

x- and y-coordinates of the location where the user clicked; the next two elements indicate whether the user held the **Shift** and **Ctrl** keys while clicking; the next two elements indicate the coordinates of the location where the user released the mouse button; and the last element indicates the button's ID number. The final "slot" in the string is empty, because slot number eight pertains to menu events, not button events.

## C/C++ Syntax for Standard Notification Callbacks

The preceding section discussed callbacks in the context of Visual Basic. This section identifies the specific C-language syntax for MapInfo Pro's standard callbacks, **SetStatusText** and **WindowContentsChanged**.

If you use MapInfo Pro's **SetCallback** method, MapInfo Pro can automatically generate notification callbacks to your IDispatch object. MapInfo Pro's standard callbacks have the following C syntax:

```
SCODE SetStatusText(LPCTSTR lpszMessage)
```

MapInfo Pro calls the **SetStatusText** method whenever the status bar text changes in MapInfo Pro. The single argument is the string value of the new status bar text.

```
SCODE WindowContentsChanged(Unsigned Long windowID)
```

MapInfo Pro calls the **WindowContentsChanged** method whenever the contents of a reparented **Map** window change. The single argument represents MapInfo Pro's Integer window ID that identifies which window changed. This callback is analogous to MapBasic's **WinChangedHandler** procedure.

## Alternatives to Using OLE Callbacks

As discussed earlier, MapInfo Pro callbacks can use OLE to send information to your client program. In some cases, however, you may need to set up callbacks that do not use OLE. For example, if you are developing programs in Visual Basic 3.0, you cannot use OLE for your callbacks, because Visual Basic 3.0 does not allow you to create your own OLE Automation servers.

MapInfo Pro supports two types of callbacks that are not OLE-dependent: Callbacks using DDE, and callbacks using compiled MapBasic applications (MBX files).

### DDE Callbacks

When you create custom toolbar buttons or menu commands, you specify a **Calling** clause. To handle the callback through DDE, use the syntax `Calling DDE server, topic`. Whenever the user uses the custom button or menu command, MapInfo Pro opens a DDE connection to the DDE server that you designate, and then sends a string to the DDE topic that you designate. The string uses the format discussed in [Processing the Data Sent to a Callback](#) (for example, "MI:.....101").

For an example of a DDE callback, see the sample program FindZip. The Form Load procedure sends MapInfo Pro an **Alter ButtonPad...Add** statement to create a custom toolbar button.

The new toolbutton definition includes the following calling clause:

```
Calling DDE "FindZip", "MainForm"
```

Whenever the user clicks on the map using the custom tool, MapInfo Pro opens a DDE connection to the FindZip application, and then sends a string to the "MainForm" topic. ("MainForm" is the value of the form's LinkTopic property.) For an introduction to DDE, see [Using the Development Environment](#).

## MBX Callbacks

If you create a compiled MapBasic application (MBX file), then you can set up your custom buttons and menu commands so that they call MapBasic procedures in the MBX. In the **Calling** clause, use the syntax `Calling procedure` (where `procedure` is the name of a procedure in the MapBasic program). After your Visual Basic application launches MapInfo Pro, run your MBX by sending MapInfo Pro a **Run Application** statement. For example:

```
mapinfo.do "Run Application ""C:\MB\MYAPP.MBX"" "
```

For an introduction to creating custom buttons and menu commands, see [Creating the User Interface](#).

### Online Help

An Integrated Mapping application can invoke MapInfo Pro dialog boxes by using MapInfo Pro's **RunMenuCommand** OLE method. If your application invokes a MapInfo Pro dialog box, you can control whether online help is available for the dialog box.

## Displaying Standard MapInfo Pro Help

You can allow your users to see the standard *MapInfo Pro Help* on the dialog box. This is the default behavior. If the user presses **F1** while a MapInfo Pro dialog box is displayed, Windows help displays an appropriate topic from the `MAPINFOW.CHM` (the standard *MapInfo Pro Help* file).

**Note:** Once the *MapInfo Pro Help* opens, the user can click various jumps or navigation buttons to browse the rest of the help file. Users may find this arrangement confusing, because the *MapInfo Pro Help* describes the MapInfo Pro user interface, not the user interface of your Integrated Mapping application.

## Disabling Online Help

You can disable *MapInfo Pro Help* for MapInfo Pro dialog boxes by issuing the following MapBasic statement:

```
Set Window Help Off
```

After you issue a **Set Window Help Off** statement, pressing **F1** while on a MapInfo Pro dialog box has no effect.

## Displaying a Custom Help File

You can set MapInfo Pro to use a custom help file. For example, the following MapBasic statement instructs MapInfo Pro to use the help file `CUSTOM.CHM` instead of `MAPINFOW.CHM`:

```
Set Window Help File "CUSTOM.CHM" Permanent
```

After you issue a **Set Window Help File...Permanent** statement, pressing the **F1** key causes MapInfo Pro to display the *MapInfo Pro Help*; however, MapInfo Pro displays the help file that you specify instead of `MAPINFOW.CHM`. Use this arrangement if you want to provide online Help for one or more MapInfo Pro dialog boxes, but you do not want the user to have access to all of the standard *MapInfo Pro Help* file.

If you want to provide custom help for MapInfo Pro dialog boxes, you must set up your custom help file so that its Context ID numbers match MapInfo Pro's dialog box IDs.

To determine the ID number of a MapInfo Pro dialog box:



1. Run MapInfo Pro with the `-helpdiag` command-line argument.
2. Display the MapInfo Pro dialog box for which you want to create help.
3. Press **F1**. Because you used the `-helpdiag` option, MapInfo Pro displays the dialog box's ID number instead of displaying help. Make note of the dialog box's ID number.
4. Using your Windows help-authoring software, edit your custom help file, so that your custom help topic is assigned the same ID number as the MapInfo Pro dialog box.

For example, MapInfo Pro's **Find** dialog box has the ID number 2202. If you want to provide your own online help for the **Find** dialog box, set up your help file so that your custom help topic has the Context ID number 2202.

Note the following points:

- MapBasic does not include a HTML help compiler. Microsoft provides this for free at:  
<http://www.microsoft.com/downloads/details.aspx?FamilyID=00535334-C8A6-452F-9AA0-D597D16580CC&displaylang=en>
- MapInfo Pro's dialog box ID numbers are likely to change in future versions.

## Related MapBasic Statements and Functions

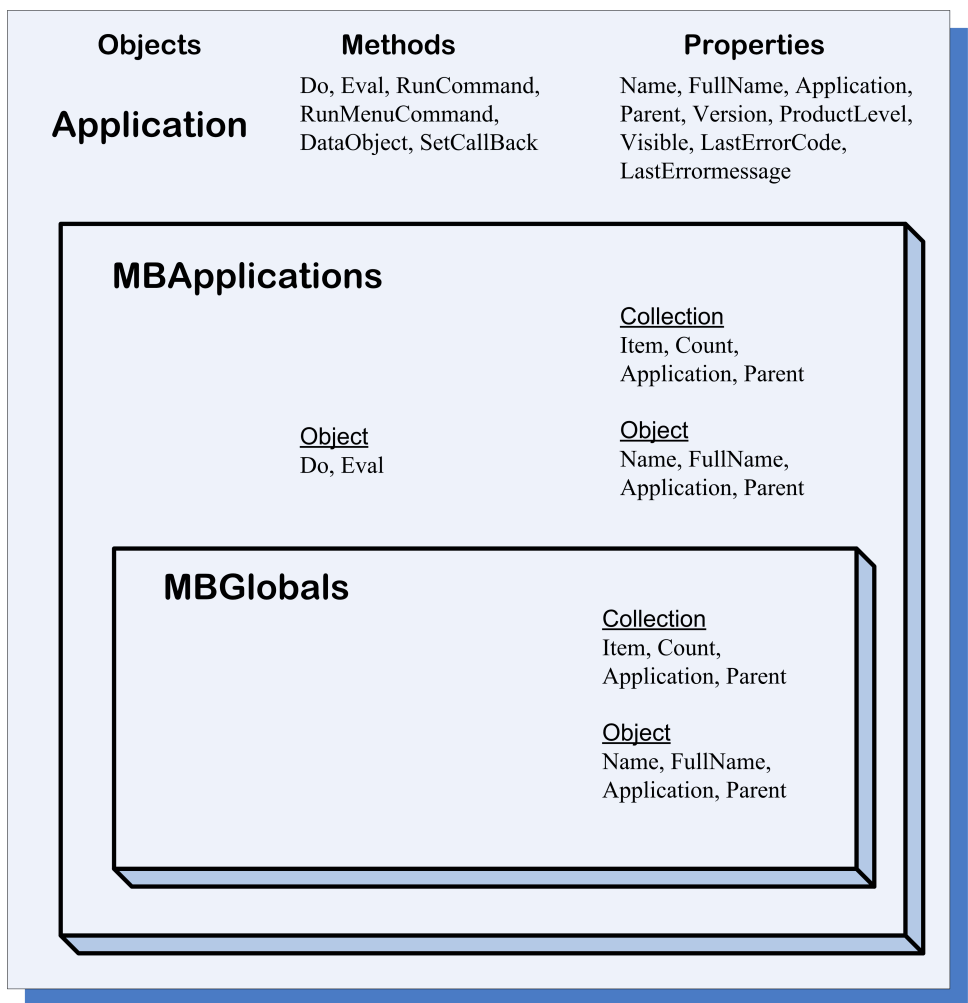
This section lists some of the MapBasic statements and functions that are particularly useful in Integrated Mapping applications. For details on these statements and functions, see the *MapBasic Reference* or *MapBasic Help*.

Statement/Function Name	Description
<b>Create Legend</b>	Creates a new <b>Legend</b> window.
<b>Map</b>	Creates a new <b>Map</b> window.
<b>MenuItemInfoByID( )</b> <b>MenuItemInfoByHandler( )</b>	Determines the status of a MapInfo Pro menu command (for example, checked or not checked).
<b>Open Table</b>	Opens MapInfo Pro tables.
<b>RemoteQueryHandler( )</b>	Allows MapBasic programs to handle peek requests from DDE clients.
<b>Run Menu Command</b>	Simulates user selecting a MapInfo Pro menu command or ButtonPad button.
<b>SearchPoint( )</b> , <b>SearchRect( )</b>	Searches the selectable layers of a <b>Map</b> window for objects at a specific x,y location or objects within a rectangular area. Allows you to emulate MapInfo Pro's Info tool or Label tool.
<b>SearchInfo( )</b>	Returns information about the results obtained by <b>SearchPoint( )</b> and <b>SearchRect( )</b> .
<b>Set Application Window</b>	Reparents dialog box windows. Issue this statement once in your client program after you have connected to or launched MapInfo Pro.
<b>Set Map</b>	Controls many aspects of <b>Map</b> windows.
<b>Set Next Document</b>	Reparents a document window, such as a <b>Map</b> window, to be a child window of your client program.

Statement/Function Name	Description
<b>Set Window</b>	Controls various aspects of MapInfo Pro windows.
<b>Shade, Set Shade</b>	Creates or modifies thematic map layers.
<b>SystemInfo( )</b>	Some values returned by <b>SystemInfo( )</b> are specific to Integrated Mapping.  Example: Specify SYS_INFO_APPLICATIONWND to retrieve the application's HWND.
<b>WindowID( ), WindowInfo( )</b>	Return info about MapInfo Pro windows, even reparented windows.

## OLE Automation Object Models

The following chart provides an overview of MapInfo Pro's OLE Automation Type Library. Methods and Properties are described in detail on the following pages.

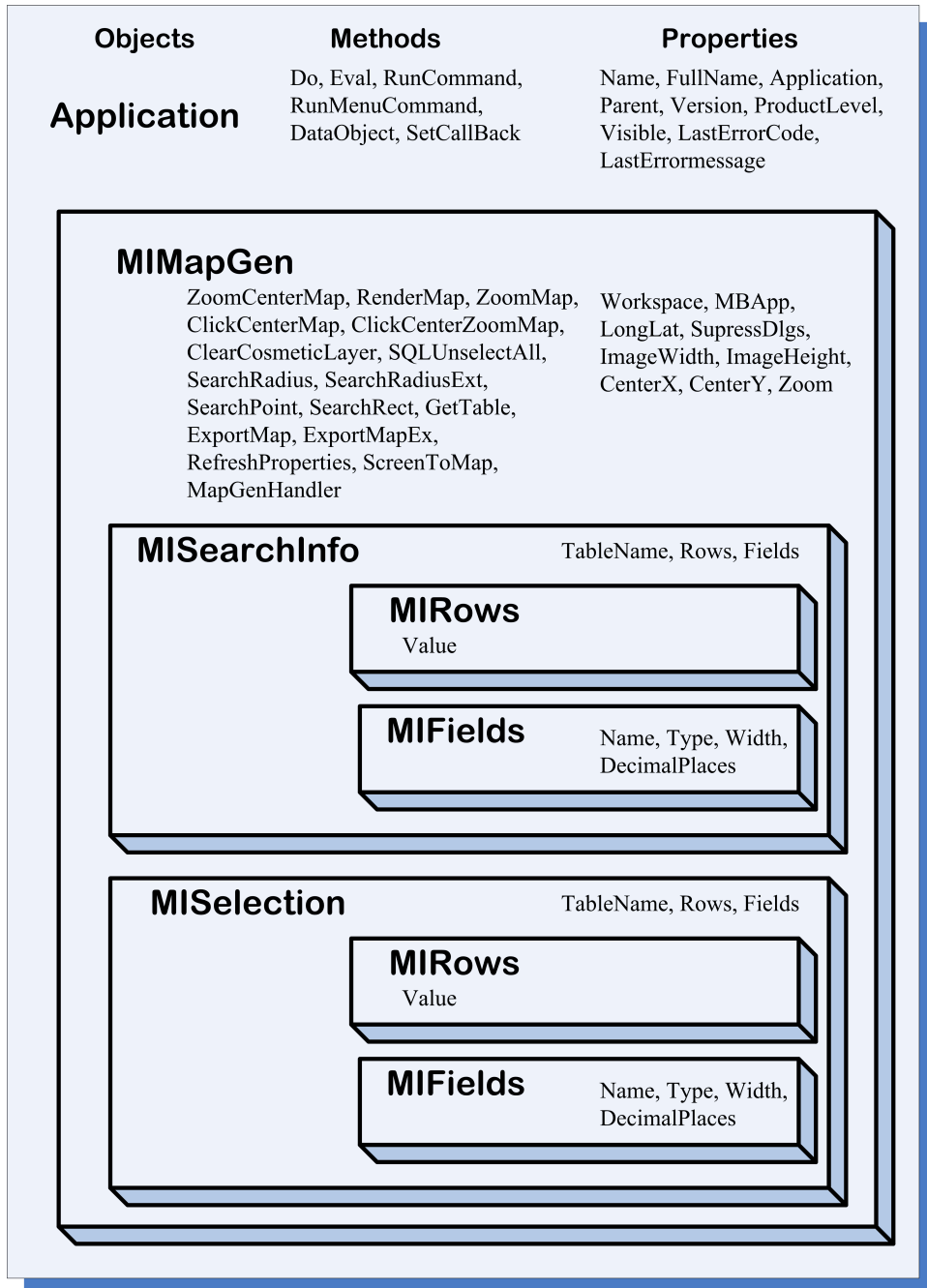


The Application object represents the instance of MapInfo Pro.

Each object in the MBBApplications collection represents a MapBasic application that is currently running.

Each object in the MBGlobals collection represents a global variable defined by one of the running MapBasic applications.

The following chart provides additional objects available in MapInfo Pro's OLE Automation Type Library. Methods and Properties are described in detail on the following pages.



### Using the OLE Object Model from within the MapInfo Pro Process

The OLE Automation object model was originally designed to be used from a client application running in a separate process (such as, an Integrated Mapping application). However, you can also use the

object model to execute commands from a DLL that is called from a running MapBasic program. If you take this approach, there are two things to keep in mind:

- You need to execute your commands against the MapInfo Pro process into which your DLL is loaded. This means you do NOT obtain the OLE object by executing a "CreateObject" function call, because this would create a second instance of MapInfo Pro. Instead, you need to use the OLE object that represents the current MapInfo Pro process. You obtain this value by calling the MapBasic function SystemInfo with the SYS\_INFO\_APPIDISPATCH attribute. The function returns an integer value that represents the IDispatch pointer for the primary OLE object. You pass this value from your MapBasic code to your DLL code and convert it into an OLE variable that you can use to call methods like Do and Eval (the exact mechanism for converting the pointer to an OLE object depends on the programming language you use to implement your DLL).
- If you want to use the callback notifications, be sure to register your callback object using the new RegisterCallback method, and not the older SetCallback. If you use SetCallback you take the risk that some other application running inside of MapInfo Pro will "steal" the callback slot associated with that method. Using RegisterCallback will eliminate this risk.

## Properties of the Application Object

The following table lists all of the properties that apply to the Application object. All properties in this table are read-only, except for Visible and LastErrorCode.

**Table 1: Properties of the Application Object**

Property Name	Functionality
Name	Returns application name ("MapInfo Pro"). OLE standard property. This is the default property for the Application object.
FullName	Returns full path to application executable. OLE standard property.
Application	Returns the Application object. OLE standard property.
Parent	Returns the Application object of its parent object; for an Application object, returns itself. OLE standard property.
Version	Returns text of current version number, multiplied by 100 (for example, MapInfo Pro 12.0 returns "1200").
ProductLevel	Returns integer, indicating which MapInfo product is running. For MapInfo Pro, returns 200.
Visible	Returns a boolean value, indicating whether application window is visible. This a read/write property. Read the property to determine the window's visibility or write the property to set the window's visibility.
LastErrorCode	Returns a small integer value giving the code number of the last MapBasic error that occurred during a Do, Eval, or RunCommand method call.  <b>Note:</b> The code numbers returned here are 1000 higher than the corresponding MapBasic error code numbers.  Error codes are never automatically cleared to zero; once an error occurs, the error remains until another error occurs (or until you write a new value to the property). This a read/write property.
LastErrorMessage	Returns a string of the error message that corresponds to LastErrorCode.

Table 2: Methods of the Application Object

Method Name	Functionality
Do( <i>string</i> )	Interprets a string as a MapBasic statement, and executes the statement.
Eval( <i>string</i> )	Interprets a string as a MapBasic expression, and returns the value of the expression; returns a string. If the expression has a Logical value, MapInfo Pro returns a one-character string, "T" or "F".
RunCommand( <i>string</i> )	Interprets a string as a MapBasic statement; this is a synonym for "Do."
RunMenuCommand( <i>menuid</i> )	<p>Executes the menu command indicated by the Integer menuid argument. See example below.</p> <p>This method activates a standard menu command or button; to activate a custom menu command or button, use the Do method to issue a Run Menu Command ID statement.</p>
DataObject( <i>windowID</i> )	<p>Returns an IUnknown interface representing window with a particular integer windowID. To get a metafile representation of the window, use QueryInterface for an IDataObject interface.</p> <p>IDataObject and IUnknown are the only two interfaces defined for this object.</p> <p><b>Note:</b> This is an advanced feature, intended for C programmers.</p>
SetCallback( <i>IDispatch</i> )	<p>Registers the OLE Automation object as a "sink" for MapInfo Pro-generated notifications. Only one callback function can be registered at a time.</p> <p>This method has been deprecated. It is a better practice to use the new methods RegisterCallback and UnregisterCallback.</p>
RegisterCallback( <i>IDispatch</i> )	Registers the OLE Automation object as a "sink" for MapInfo Pro-generated notifications. Use this method when you register a callback from within the MapInfo Pro process (for example, from a DLL that is called via MapBasic). Using this method ensures that your callback object will work side-by-side with other applications that may be running within the MapInfo Pro process.
UnregisterCallback( <i>IDispatch</i> )	Unregisters an OLE Automation object that was registered via the RegisterCallback method. You must pass the same argument that was used in the call to RegisterCallback.
SetCallbackEvents( <i>IDispatch, eventFlags</i> )	By default, MapInfo Pro will call all valid notification methods. Using this method you can control which callback notifications are sent to the callback object. For example, if your callback object implements WinContentsChanged and the SetStatusText methods, but in certain situations you only want to receive the SetStatusText notifications, you can call SetCallbackEvents ( <dispatch id>, CallbackEvents.WindowChanged ) to tell MapInfo Pro to only send window change notifications. See CallbackEvents below for details.
IDispatch* RegisterDockWindow(HWND hwnd, long domainId)	Registers the given window with MapInfo Pro and returns an object that represents the docked window. During this call the dock window is created and docked to the default position. Calls to Dock and Float methods can be used to set a custom dock state for the window.

Method Name	Functionality
	The domainId argument only useful if you are using the COM API directly from your .Net code. In this case you should pass in the id of the current AppDomain.
void UnregisterDockWindow(Dispatch* dockWindow)	Unregisters the dock window specified by the dockWindow argument. Attempts to interact with the DockWindow object after it is unregistered will result in an error.

For example, the following statement uses the Do method to send MapInfo Pro a **Map** statement:

```
mapinfo.Do "Map From World"
```

The following statement uses the RunMenuCommand method to execute MapInfo Pro's menu command code 1702, which selects MapInfo Pro's Grabber tool. (To determine a specific numeric value for a menu code, look in MENU.DEF, or see [Integrating MapInfo Pro Toolbar Buttons](#).)

```
mapinfo.RunMenuCommand 1702
```

The CallbackEvents enumeration is defined with these members:

- None,
- MenuItem,
- WindowChanged,
- SetStatusText

You can use one or more of these flags to SetCallbackEvents. To use more than one of the enumeration values, you must do a "bitwise or" operation. For example, the C++ call to turn the WindowContentsChanges and SetStatusText notification on is SetCallbackEvents( <dispatch id>, (int) (WindowChanged | SetStatusText) ).

## Properties of the DockWindow Object

DockWindow is a COM interface representing a dock window. The following table lists all of the properties that apply to the Application object.

**Table 3: Properties of the DockWindow Object**

Property	Description
BOOL Active	Gets a value that indicates whether the dock window is currently visible.
long id	Gets a numeric identifier for the dock window.
BOOL Closed	Gets a value that indicates whether a dock window is closed.
DockPosition DockPosition	Gets a value that indicates the state of the dock window. This value can indicate a floating state, or the side of the application to which the window is docked. If the window is not in a docked state, then the value for the last docked position is returned.  For description of DockPosition, see <a href="#">DockPosition Enumeration</a> .
int DockSizeCX	Gets the width of a window docked to the left or right side of the application. If the window is not in a docked state, then the value for the last docked width is returned.

Property	Description
int DockSizeCY	Gets the height of a window docked to the top or bottom side of the application. If the window is not in a docked state, then the value for the last docked position is returned.
BOOL Floating	Gets a value that indicates whether the window is in a floating state.
BOOL Pinned	Gets a value that indicates whether a dock window is unpinned. When a dock window is pinned a small tab with the window title appears in the dock area on the side of the application window where the window was docked. When you move your mouse over the tab the dock window scrolls into view. When you are done with the window it scrolls back out of view.
BSTR Title	Gets or sets a value that is used in the dock window caption bar.
LastErrorCode	Returns a small integer value giving the code number of the last MapBasic error that occurred during a Do, Eval, or RunCommand method call.  <b>Note:</b> The code numbers returned here are 1000 higher than the corresponding MapBasic error code numbers.  Error codes are never automatically cleared to zero; once an error occurs, the error remains until another error occurs (or until you write a new value to the property). This is a read/write property.
LastErrorMessage	Returns a string of the error message that corresponds to LastErrorCode.

Table 4: Methods of the DockWindow Object

Method	Description
void Activate()	Ensure that a window is visible and has focus.
void Close()	Closes a window. You can redisplay the window by calling Activate(). To destroy a window call IMapInfo.UnregisterDockWindow.
void Dock(DockPosition, cx, cy)	Docks a window to the side of an application window. For description of DockPosition, see <a href="#">DockPosition Enumeration</a> .
void Float (left, top, right, bottom)	Puts a window into floating state using the parameter values to determine the size and location of the window.
void FloatSize (*left, *top, *right, *bottom)	Gets the floating size and location of the window. If the window is not currently in a float state, then the value for the last float state are returned.
void Pin()	Pins a dock window to a side of the application window.

### DockPosition Enumeration

The DockPosition enumeration is defined with these members:

- PositionFloat,
- PositionLeft,
- PositionTop,
- PositionRight,
- PositionBottom

You can use these enumeration values in properties and methods of the DockWindow object.

## Properties of the MBAApplications Collection

MBAApplications is a collection of all the MapBasic applications that MapInfo Pro is currently running. The properties in the following table are all read-only.

**Table 5: Properties of the MBAApplications Collection**

Property Name	Functionality
Item	Returns IDispatch of a particular programobject object. Argument is a VARIANT type which can evaluate to an integer index (1...Count) or a string value (name of the program). This is the default property for the MBAApplications collection.
Count	Returns the long integer number of objects in the collection (i.e., the number of running applications).
Application	Returns IDispatch of the MapInfo Pro application object. OLE standard property.
Parent	Returns IDispatch of its parent object; for this collection, that's the MapInfo Pro application object. OLE standard property.

## Properties of an Object in MBAApplications

Each object in the MBAApplications collection is a running MapBasic application. The properties in the following table are all read-only.

**Table 6: Properties of an Object in MBAApplications**

Property Name	Functionality
Name	Returns name of application (for example, "FOO.MBX"). OLE standard property. This is the default property for an MBAApplication object.
FullName	Returns full path to MapBasic application .MBX file. OLE standard property.
Application	Returns IDispatch of the application. OLE standard property.
Property Name	Functionality
Parent	Returns IDispatch of its parent object; for a programobject, that's the MapInfo Pro application object. OLE standard property.

For example, the following statements determine the name of a running MapBasic application:

```
Dim appsList As Object
  Dim firstname As String

Set appsList = mapinfo.MBAApplications
If appsList.Count > 0 Then
  firstname = appsList(1).Name
End If
```



Table 7: Methods of an Object in MBApplications

Method Name	Functionality
Do( <i>string</i> )	The specified string is sent to the MapBasic application's <b>RemoteMsgHandler</b> procedure.
Eval( <i>string</i> )	The specified string is sent to the MapBasic application's <b>RemoteQueryHandler( )</b> function; the value returned by <b>RemoteQueryHandler</b> is returned.  <b>RemoteQueryHandler( )</b> must be defined as a function that returns a string. If the expression has a Logical value, MapInfo Pro returns a one-character string, "T" or "F".

## Properties of the MBGlobals Collection

MBGlobals is a collection of all the MapBasic global variables declared by a specific MapBasic application that is running. The properties in the following table are all read-only.

Table 8: Properties of the MBGlobals Collection

Property Name	Functionality
Item	Returns IDispatch of a particular mbglobal object. Argument is a VARIANT type which can evaluate to an integer index (1...Count) or a string value (name of the global variable). This is the default property for the MBGlobals collection.
Count	Returns a long integer value of the number of objects in the collection (the number of global variables).
Application	Returns IDispatch of MapInfo Pro application object. OLE standard property.
Parent	Returns IDispatch of its parent object; for this collection, that's the programobject object. OLE standard property.

## Properties of an Object in MBGlobals

Each object in the MBGlobals collection is a MapBasic global variable. The properties in the following table are all read-only, except for the Value property.

Table 9: Properties of an Object in MBGlobals

Property Name	Functionality
Value	Read/write. Read the property to retrieve a string representing the value of the MapBasic global variable; write the property to change the value of the variable. This is the default property for an MBGlobal object.
Name	Returns name of the variable. OLE standard property.
Type	Returns a text string giving the type of the variable as one of MapInfo Pro's standard types ("Integer", "Date", etc.).

Property Name	Functionality
Application	Returns IDispatch of the application. OLE standard property.
Parent	Returns IDispatch of its parent object; for an MBglobal object, that's the programobject which declared the global variable. OLE standard property.

The following Visual Basic example examines and then alters the value of a global variable (g\_status) in a MapBasic application.

```
Dim globinfo As Object
  Dim old_value As Integer

  ' Look at the globals used by the first
  ' running MapBasic app:
  Set globinfo = mapinfo.MBApplications(1).MBGlobals

  ' Look at a global's current value by reading
  ' its "Value" property:
  old_value = globinfo("g_status").Value

  ' Assign a new value to the global:
  globinfo("g_status") = old_value + 1
```

The expression `globinfo("g_status")` is equivalent to `globinfo("g_status").Value` because `Value` is the default property.

## Properties of the MIMapGen Object

The following table lists the properties that apply to the MIMapGen object. The MIMapGen object is used primarily by MapInfo ProServer applications; however, MapInfo Pro applications can use the MIMapGen object as well. For examples of using the MIMapGen object model, see the MapInfo ProServer documentation.

**Table 10: Properties of the MIMapGen Object**

Property Name	Functionality
Workspace	Path to a MapInfo workspace file. When you set the property, MapInfo Pro loads the workspace.
MBApp	Path that points to a MapBasic application (MBX file). When you set the property, MapInfo Pro runs the MBX.
LongLat	Boolean: Defines interface coordinate system. When TRUE, all values that you get and put (using CenterX and CenterY) represent longitude and latitude. When FALSE, the <b>Map</b> window's coordinate system will be used.
SuppressDlg	Boolean: If TRUE, an action that invokes a dialog box will generate an error. This includes dialog boxes invoked as a result of a <b>Run Menu Command</b> statement.
ImageWidth	Width of the image area, in pixels.
ImageHeight	Height of the image area, in pixels.
CenterX	X-coordinate (for example, Longitude) of the map center.
CenterY	Y-coordinate (for example, Latitude) of the map center.

Property Name	Functionality
Zoom	The width of the map (for example, number of miles across). This number reflects the units used by the <b>Map</b> window (for example, miles, kilometers).

Setting the Workspace property is the first step to using the MIMapGen object. MIMapGen is designed to work in situations where there is a single **Map** window (for example, when a web page shows a single map). To begin using MIMapGen, set the Workspace property, so that MapInfo Pro loads a workspace—typically, a workspace that contains a single **Map** window. Then you will be able to use the other methods and properties to manipulate the **Map** window.

## Methods of the MIMapGen Object

The following methods apply to the MIMapGen object.

**Table 11: Methods of the MIMapGen Object**

Method	Functionality
ZoomCenterMap( )	Renders the map based on the current CenterX, CenterY, and Zoom properties. The map is only regenerated if the center or the zoom have changed since the map was last rendered.
RenderMap( )	Same effect as ZoomCenterMap, except that the map is always regenerated.
ZoomMap (double <i>ZoomFactor</i> )	Zooms the map in or out, to the extent indicated by the zoom factor. Positive numbers zoom in; negative numbers zoom out.
ClickCenterMap (long <i>MouseX</i> , long <i>MouseY</i> )	Recenters the map based on the mouse click position. The x/y arguments represent locations on the map, in pixels.
ClickCenterZoomMap (long <i>MouseX</i> , long <i>MouseY</i> , double <i>ZoomFactor</i> )	Recenters the map based on the mouse click position, and zooms the map based on the zoom factor; negative number zooms out.
ClearCosmeticLayer( )	Same effect as the Map menu command: Deletes all objects from the Cosmetic layer.
SQLUnselectAll( )	Same effect as the Query menu command: De-selects all rows.
SearchRadius (double <i>CenterPointX</i> , double <i>CenterPointY</i> , double <i>Radius</i> )	Performs a radius search.
SearchRadiusExt (double <i>CenterPointX</i> , double <i>CenterPointY</i> , double <i>OuterPointX</i> ,	Performs a radius search, To define the search circle, specify the center point and a point that is somewhere along the circle's radius.

Method	Functionality
double <i>OuterPointY</i> )	
SearchPoint (double <i>CenterPointX</i> , double <i>CenterPointY</i> )	Searches a small area around the specified location.
SearchRect (double <i>x1</i> , double <i>y1</i> , double <i>x2</i> , double <i>y2</i> )	Searches within a rectangular area.
GetTable (string <i>Tablename</i> )	Returns an MISelection object (IDispatch); to access the contents of the table, use the MISelection object.
ExportMap (string <i>ImageType</i> , string <i>FileSpec</i> )	Generates an image file (for example, a JPEG, TIFF, PNG, PSD, BMP, WMF, or GIF file) of the <b>Map</b> window. See the MapBasic <b>Save Window</b> statement.
ExportMapEx (string <i>ImageType</i> , string <i>FileSpec</i> , string <i>CopyrightInfo</i> )	Generates an image file (for example, a JPEG, TIFF, PNG, PSD, BMP, WMF, or GIF file) of the <b>Map</b> window. See the MapBasic <b>Save Window</b> statement.
RefreshProperties( )	Updates CenterX, CenterY, Zoom, ImageHeight, and ImageWidth.
ScreenToMap (long <i>ScreenX</i> , long <i>ScreenY</i> , double <i>MapX</i> , double <i>MapY</i> )	Converts screen coordinates (pixels) into map coordinates (for example, longitude/latitude).
MapGenHandler (string <i>Message</i> )	Calls the MapBasic sub procedure RemoteMapGenHandler in the MBX application that was executed through the MApp property. Use this method to run MapBasic statements in an MBX file.

**Note:** The searching methods search only the topmost selectable layer. To access the search results, see the MISearchInfo object.

## Properties of the MISearchInfo Object

The following properties apply to the MISearchInfo object.

**Table 12: Properties of the MISearchInfo Object**

Property	Functionality
Rows	This property returns an MIRows collection (a collection of MIRow objects). The collection represents the search results.

Property	Functionality
Fields	This property returns an MIFields collection (a collection of MIField objects). The collection represents a set of field definitions (field names, etc.) describing the search results.
TableName	String: The name of the table that contains the search results.

To obtain an MISearchInfo object, use one of the MIMapGen object's search methods: SearchRadius, SearchRadiusExt, SearchPoint, or SearchRect.

## Method of the MIRow Object

The following method applies to the MIRow object. Each MIRow object represents one record returned by a search method, or one row in the table specified in the GetTable method call.

**Table 13: Method of the MIRow Object**

Method	Functionality
Value	Returns a pointer to the data value for the given column specified by using a variant arg. The allowed variant types are VT_12, VT_14, and VT_BSTR (where the VT_BSTR is the column name).

**Note:** To obtain a collection of MIRow objects, reference the Rows property of the MISearchInfo object or the MISelection object.

## Properties of the MIField Object

The following properties apply to the MIField object. Each MIField object describes one of the data columns in the latest search results, or one of the data columns in the table specified in the GetTable method call.

**Table 14: Properties of the MIField Object**

Property	Functionality
Name	String: The name of the column.
Type	Short: The data type of the field. The following values are valid: <ul style="list-style-type: none"> <li>• (1) DT_CHAR</li> <li>• (2) DT_DECIMAL</li> <li>• (3) DT_INTEGER,</li> <li>• (4) DT_SMALLINT</li> <li>• (5) DT_TIME</li> <li>• (6) DT_LOGICAL</li> <li>• (8) DT_FLOAT.</li> </ul>
Width	Short: The width of the field; applies to DT_CHAR and DT_DECIMAL fields only.
DecimalPlaces	Short: The number of decimal places in a DT_DECIMAL field.

**Note:** To obtain a collection of MIField objects, reference the Fields property of the MISearchInfo object or the MISElection object.

## Properties of the MISElection Object

The following properties apply to the MISElection object.

**Table 15: Properties of the MISElection Object**

Property	Functionality
Rows	This property returns an MIRows collection (a collection of MIRow objects). The collection represents all of the rows in a table.
Fields	This property returns an MIFields collection (a collection of MIField objects). The collection represents the field definitions (field names, etc.) for the table that was specified in the GetTable method.
TableName	String: The name of the table that was specified in the GetTable method.

To access the MISElection object, use the GetTable method from the MIMapGen object.

## MapInfo Pro Command-Line Arguments

If you use DDE to communicate with MapInfo Pro, you will need to launch MapInfo Pro manually (for example, by calling Visual Basic's Shell( ) function) before you establish the DDE connection. When you launch MapInfo Pro, you can use any of the command-line arguments listed below. If you want the user to remain unaware that MapInfo Pro is running, you will want to specify one of the following arguments.

Command-Line Argument	Effect
-nosplash	MapInfo Pro runs without showing its splash screen, although the main <b>MapInfo Pro</b> window still shows.
-server	MapInfo Pro runs without showing a splash screen or main window. Use this argument when you want MapInfo Pro to act as a behind-the-scenes server to another application (using DDE).
-automation or -embedding	MapInfo Pro runs without displaying a splash screen or main window. Additionally, MapInfo Pro registers its OLE Class Factory with the OLE subsystem, which allows MapInfo Pro to act as a behind-the-scenes OLE server to another application.
-regserver	MapInfo Pro registers its OLE capabilities in the registration database, then exits. Run MapInfo Pro with this argument once, when you install MapInfo Pro. Note that MapInfo Pro automatically registers itself when it is run normally. Note very well that this registers everything about the MapInfo product: OLE Automation, OLE Embedding, etc.
-unregserver	MapInfo Pro removes all references to itself from the registration database and exits. Use this option at uninstall time to remove MapInfo Pro from the system registry. Using this argument unregisters everything that the -regserver option registered.

Command-Line Argument	Effect
-helpdiag	This argument sets a flag in MapInfo Pro, so that MapInfo Pro displays a diagnostic dialog box every time you press <b>F1</b> for <i>MapInfo Pro Help</i> . For more information on Help issues, see <a href="#">Displaying Standard MapInfo Pro Help</a> .

**Note:** The forward slash ("/") can be used instead of the minus sign.

## Getting Started with Integrated Mapping and Visual C++ with MFC

The remainder of this chapter will walk you through the creation of an Integrated Mapping application using Microsoft Visual C++ with MFC. These instructions are written primarily for users of the 32-bit Visual C++ (version 2.0 or higher), but they have also been tested with the 16-bit version of Visual C++ (version 1.52). Differences are noted where appropriate.

### Create a New Project

1. Run Visual C++ 2.x (32-bit) or 1.5x (16-bit).
2. Choose **File > New** to create a new project.
3. Make the project an MFC AppWizard application, and choose the options that you want. For your first demonstration, it is easiest to make the application a single document application (SDI), rather than supporting multiple documents (MDI). Note well that you are not required to enable any of the standard OLE support. If you want to use callbacks to your application from MapInfo Pro, you should enable support for OLE Automation in Step 3 of 6 of the MFC AppWizard.
4. Build the application and run it to verify that everything starts out okay.

### Add OLE Automation Client Support

If you did not choose any OLE support during the AppWizard phase, you must add OLE Automation client support now.

1. Open `STDAFX.H` and add these lines:

```
#include <afxole.h>
#include <afxdisp.h>
```

2. Open your main program source file (i.e., `projectname.CPP`) and add the following lines to the beginning of `CprojectnameApp::InitInstance`:

```
if (!AfxOleInit()) {
    AfxMessageBox(IDP_OLE_INIT_FAILED);
    return FALSE;}

```

3. Add the message string by opening your resource file (i.e., `projectname.RC`), open the "String Table" resource, and pick **Resource > New String**. In the **Properties** dialog box that appears, set ID: to **IDP\_OLE\_INIT\_FAILED**, and Caption: to "OLE initialization failed. Make sure that the OLE libraries are the correct version." Close the **Properties** dialog box by clicking in the close box. Then close the resource windows and save the changes when prompted.

### Create the MapInfo Pro Support Class, and create an instance of it

In **Project > ClassWizard**, choose the OLE Automation tab, and click the **Read Type Library** button. Navigate to your MapInfo Pro program directory and select the `MAPINFOV.TLB` file. Click **OK** to confirm the classes to be created. This creates the classes that allow you to access MapInfo Pro through the OLE Automation interface.

Open your main program source file (i.e., `projectname.CPP`) and add the following lines of code.

- After all of the other `#includes` add:

```
#include "MapInfow.h"
```

- Just below the declaration `"CprojectnameApp theApp"`, add the following variable declaration:

```
DMapInfo mapinfo;
```

- Near the end of `CprojectnameApp::InitInstance`, but before the `OnFileNew( )` call, add:

```
mapinfo.CreateDispatch("MapInfo.Application");
```

Open the file `MAPINFOW.H` and add the following lines at the bottom of the file:

```
extern DMapInfo mapinfo;
```

```
#include "path-to-mapbasic-directory\mapbasic.h"
```

### Test Your Work

Add one more line of code at the end of the `CprojectnameApp::InitInstance` function, immediately following the `CreateDispatch` call added above:

```
::MessageBox(0, mapinfo.GetFullName(), mapinfo.GetName(), MB_OK);
```

Rebuild your program. When you run, you will get a message box on startup with the title "MapInfo Pro" and the full path to the MapInfo Pro executable in the message area. This demonstrates that you are successfully launching MapInfo Pro and accessing through OLE Automation. You probably want to comment out or remove the `::MessageBox` call as you work through the rest of this exercise.

### Redefine the Shortcut Menus

When we incorporate a Map into our application, we will get all of the functionality that MapInfo Pro provides for that Map automatically. Sometimes, this functionality is not appropriate. The place where this occurs most often is in the default shortcut menu (accessed by right-clicking on the Map), which includes at least one inappropriate command: **Clone Map**. To eliminate the inappropriate command, redefine the shortcut menu.

Near the end of `CprojectnameApp::InitInstance`, just after the `CreateDispatch` call we added, we will do our additional initialization:

```
// disable the help subsystem: not used in this application
mapinfo.Do("Set Window Help Off");
// Reprogram the mapper shortcut menu
mapinfo.Do("Create Menu \"MapperShortcut\" ID 17 as \"(-)\");
```

This is also a good time to do other initialization, such as opening tables that you know you'll need.

### Reparenting MapInfo Pro's Dialog Boxes

It is important to reparent MapInfo Pro's dialog boxes to your application window in case MapInfo Pro needs to interact with the user. By doing this, you ensure that the dialog box appears over your application and that your application window is disabled while the user interacts with the MapInfo Pro dialog box. This one statement reparents both dialog boxes that you ask MapInfo Pro to show (for example, by using `RunMenuCommand` with predefined item numbers) and error and warning messages that MapInfo Pro shows in response to unusual events.

In `MainFrm.CPP`, function `CMainFrame::OnCreate`, we need to do the following:



- After all of the other #includes add:

```
#include "MapInfow.h"
```

- At the end of CMainFrame::OnCreate, add:

```
char str[256];
    sprintf(str, "Set Application Window %lu", (long) (UINT)m_hWnd);
    mapinfo.Do(str);
```

Demonstrate that this works by adding the following statement to the *CprojectnameApp::InitInstance* function, just after the *OnFileNew()* call. This will cause MapInfo Pro to display one of its standard dialog boxes within the context of your application:

```
mapinfo.Do("Note \\"Hello from MapInfo\\");
```

Please test your application at this point to ensure that it is working properly.

### Adding a Map to your View

Now that you have a functioning MFC application that attaches to MapInfo Pro through OLE Automation, you can start taking advantage of MapInfo Pro's capabilities. In particular, we will now add a Map to this application.

Go to the **Project > ClassWizard** dialog box. Select the view class (*CprojectnameView*), and the "Message Maps" tab. Select the "*CprojectnameView*" object in the leftmost listbox.

In the Messages listbox, select "WM\_CREATE", then click **Add Function**; select "WM\_DESTROY", then click **Add Function**; and select "WM\_SIZE", then click **Add Function**.

In the view header file (*projectnameVW.H*), add the following member variables to the view class:

```
unsigned long m_windowid;
    HWND m_windowhwnd;
```

In the view source file (*projectnameVW.CPP*), add the following:

- After all of the other #includes add:

```
#include "MapInfow.h"
```

- In the constructor (*CprojectnameView::CprojectnameView*), initialize the variables:

```
m_windowid = 0;
    m_windowhwnd = 0;
```

- In the *OnCreate* method, add the following code after the call to *CView::OnCreate*:

```
//must have ClipChildren style for integratable maps to work
    SetWindowLong(m_hWnd, GWL_STYLE,
        GetWindowLong(m_hWnd, GWL_STYLE)
        |WS_CLIPCHILDREN);
    char str[256];
    mapinfo.Do("Open Table \\"States\\" Interactive");
    sprintf(str,
        "Set Next Document Parent %lu Style 1 Map From States",
        (long) (UINT)m_hWnd);
    mapinfo.Do(str);
    m_windowid = atol(mapinfo.Eval("WindowID(0)"));
    sprintf(str, "WindowInfo(0, %u)", WIN_INFO_WND);
    m_windowhwnd = (HWND)atol(mapinfo.Eval(str));
```

In the `OnDestroy` method, add the following code before the call to `CView::OnDestroy`:

```
if (m_windowhwnd) {
    ::DestroyWindow(m_windowhwnd);
    m_windowhwnd = NULL;
    m_windowid = 0L;
}
```

- In the `OnSize` method, add the following code after the call to `CView::OnSize`:

```
if (m_windowhwnd && cx > 0 && cy > 0) {
    ::MoveWindow(m_windowhwnd, 0, 0, cx, cy, TRUE);
}
```

### Adding a Map Menu Command

All menu items can be added using the example procedure described below. The example shows how to add a **Map > Layer Control** menu item.

1. Open your resource file (i.e., *projectname.RC*), open the "Menu" resource, and select `IDR_MAINFRAME`.
2. Add a new main menu item titled "Map". Under "Map" add a "Layer Control" item and save the changes to the RC file.
3. In **Project > ClassWizard**, chose the Message Map tab, and select *CprojectnameView* from the Class Name list. In the Object ID's list select the ID that maps to the menu item you just created—this will be `ID_MAP_LAYERCONTROL` by default. Once you select this, the `COMMAND` and `UPDATE_COMMAND_UI` messages will appear in the Messages window. Add function prototypes for each message by selecting each and pressing **Add Function**, accepting the default names generated.
4. In your *CprojectnameView* class you'll see both functions added. Add the following lines of code to the function bodies.

```
void CprojectnameView::OnMapLayercontrol()
{
    mapinfo.RunMenuCommand(M_MAP_LAYER_CONTROL);
}
```

```
void CprojectnameView::OnUpdateMapLayercontrol(CCmdUI* pCmdUI)
{
    CmdUI->Enable(m_windowid);
}
```

## Adding Toolbar Buttons and Handlers

---

All toolbar buttons can be added using the example procedure described below. The example will show how to add the MapInfo Pro Selector, Grabber, Zoom-In, and Zoom-Out tools to the toolbar. For convenience, we will also add them to a new menu named Tools; this makes adding them to the toolbar a little easier using the ClassWizard.

1. First, follow the instructions listed above (**Adding a Map Menu Command**) and create a new menu named Tools, with four new items (Selector, Grabber, Zoom-In, Zoom-Out). Define the `UPDATE_COMMAND_UI` and `COMMAND` functions as before, using the appropriate codes from the `MAPBASIC.H` file for each tool (`M_TOOLS_SELECTOR`, `M_TOOLS_RECENTER`, `M_TOOLS_EXPAND`, and `M_TOOLS_SHRINK`, respectively). Compile and test your application when you are done.
2. Open the project RC file, select the bitmap resource `IDR_MAINFRAME`, and make the bitmap 64 pixels wider (room for 4 more 16-pixel buttons). Move the images of the last several buttons to the

right, making room just after the "paste" button. Draw appropriate images for the four new tools, for example, an arrow (selector), a hand (grabber), a magnifying glass (zoom-in), and a magnifying glass with a minus sign (zoom-out).

3. Open the String resource, add new strings for each of the new tools. Use the same IDs as you used when creating the menu items earlier; the strings should be a descriptive string followed by \n and the tooltip text. For example, ID\_TOOLS\_SELECTOR as `Select map objects\nSelector`; ID\_TOOLS\_GRABBER as `Recenter the map\nGrabber`; ID\_TOOLS\_ZOOMIN as `Zoom-In to show less area, more detail\nZoom-In`; and ID\_TOOLS\_ZOOMOUT as `Zoom-Out to show more area, less detail\nZoom-Out`.
4. In `MAINFRM.CPP` locate the static `UINT BASED_CODE buttons[ ]` array and insert the ID constants into the array in the same position that they appear in the bitmap resource.
5. In order to get the user interface right, we need to keep track of which tool is currently selected. In the `CprojectnameView` header file, add an integer variable to keep track of this:

```
int m_eMouseMove;
```

6. Initialize this variable in the class constructor, to represent the initial state of the map. Note that we will use the `MapInfo Pro` constants for the various tools to keep track of which one is selected.

```
m_eMouseMove = M_TOOLS_SELECTOR;
```

7. If you created the menu items first, you already have `COMMAND` and `UPDATE_COMMAND_UI` entries in the message map; if not, you should add them now.
8. Update the user interface by calling `CCmdUI::SetRadio` in each `OnUpdate` routine, and set the `m_eMouseMove` variable accordingly in each `OnToolsToolname` handler. That is, your routines should now read as follows:

```
void CprojectnameView::OnToolsSelector()
{
    m_eMouseMove = M_TOOLS_SELECTOR;
    mapinfo.RunMenuCommand(M_TOOLS_SELECTOR);
}
void CprojectnameView::OnToolsGrabber()
{
    m_eMouseMove = M_TOOLS_RECENTER;
    mapinfo.RunMenuCommand(M_TOOLS_RECENTER);
}
void CprojectnameView::OnToolsZoomin()
{
    m_eMouseMove = M_TOOLS_EXPAND;
    mapinfo.RunMenuCommand(M_TOOLS_EXPAND);
}
void CprojectnameView::OnToolsZoomout()
{
    m_eMouseMove = M_TOOLS_SHRINK;
    mapinfo.RunMenuCommand(M_TOOLS_SHRINK);
}
void CprojectnameView::OnUpdateToolsSelector(CCmdUI* pCmdUI)
{
    pCmdUI->SetRadio(m_eMouseMove == M_TOOLS_SELECTOR);
    pCmdUI->Enable(m_windowid);
}
void CprojectnameView::OnUpdateToolsGrabber(CCmdUI* pCmdUI)
{
    pCmdUI->SetRadio(m_eMouseMove == M_TOOLS_RECENTER);
    pCmdUI->Enable(m_windowid);
}
void CprojectnameView::OnUpdateToolsZoomin(CCmdUI* pCmdUI)
{
    pCmdUI->SetRadio(m_eMouseMove == M_TOOLS_EXPAND);
    pCmdUI->Enable(m_windowid);
}
void CprojectnameView::OnUpdateToolsZoomout(CCmdUI* pCmdUI)
{

```

```
pCmdUI->SetRadio(m_eMouseMove == M_TOOLS_SHRINK);
pCmdUI->Enable(m_windowid);
}
```

## Using Exception Handling to Catch MapInfo Pro Errors

MapInfo Pro communicates error conditions to the Integrated Mapping application using the MFC `COleDispatchException` class. MapInfo Pro returns the error code in the `COleDispatchException` member variable `m_wCode`, and a description string in the `COleDispatchException` member variable `m_strDescription`. Other general OLE exceptions are passed via the `COleException` class. You must handle these exceptions somewhere in your application; if not, the top-level MFC exception handler will be invoked and will get the message "Command failed". You can add handlers for each type of exception in each of the `DMapInfo` methods. The following illustrates this in the `DMapInfo::Do` method.

The original `DMapInfo::Do` method, as generated by the ClassWizard, looks like this:

```
void DMapInfo::Do(LPCTSTR command)
{
    static BYTE BASED_CODE parms[] = VTS_BSTR;
    InvokeHelper(0x6001000b, DISPATCH_METHOD, VT_EMPTY,
        NULL, parms, command);
}
```

The improved `DMapInfo::Do` method, with exception handling built-in, looks like this:

```
void DMapInfo::Do(LPCTSTR command)
{
    static BYTE BASED_CODE parms[] = VTS_BSTR;
    try {
        InvokeHelper(0x6001000b, DISPATCH_METHOD, VT_EMPTY,
            NULL, parms, command);
    }
    catch(COleDispatchException *e) {
        // Handle the exception in a manner appropriate to your
        // application. The error code is in e->m_wCode.
        AfxMessageBox(e->m_strDescription);
        e->Delete();
    }
    catch(COleException *e) {
        AfxMessageBox("Fatal OLE Exception!");
        e->Delete();
    }
}
```

## Add OLE Automation Server Support

In your `CprojectnameDoc.cpp` file, add the Dispatch map after the Message map.

```
BEGIN_DISPATCH_MAP(CprojectnameDoc, CDocument)
//{{AFX_DISPATCH_MAP(CprojectnameDoc)
//NOTE:The ClassWizard will add and remove mapping macros here
//DO NOT EDIT what you see in these blocks of generated code!
//}}AFX_DISPATCH_MAP
END_DISPATCH_MAP()
```

In your `CprojectnameDoc.cpp` file, add to the `CprojectnameDoc` constructor:

```
EnableAutomation();
AfxOleLockApp();
```

In your *CprojectnameDoc.cpp* file, add to the *CprojectnameDoc* destructor:

```
AfxOleUnlockApp();
```

In your *CprojectnameDoc.h* header file, add the Dispatch section after the message map:

```
// Generated OLE dispatch map functions
//{{AFX_DISPATCH(CprojectnameDoc)
//NOTE:The ClassWizard will add and remove member functions here.
//DO NOT EDIT what you see in these blocks of generated code !
//}}AFX_DISPATCH
DECLARE_DISPATCH_MAP()
```

**Note:** The above code fragments illustrate adding automation support to your CDocument derived class. When using MFC, you can add automation support just as easily to any class derived from CCmdTarget. Thus, for an MDI application, you will want to attach the automation interface to either your CWinApp derived class or your CMDIFrameWnd derived class, both of which are derived from CCmdTarget because you only want to set the IDispatch pointer for MapInfo Pro callbacks once. In an MDI application, documents and their views are destroyed when closed. If you set the IDispatch pointer to a document, it will no longer be valid when the document is closed.

## Adding the WindowContentsChanged Callback

If you are writing an SDI application and you added the automation DISPATCH message map to your *CprojectnameDoc* class, then you can set the callback pointer in your *CprojectnameDoc* constructor, or any where else where it will only be called once.

```
mapinfo.SetCallback(this->GetIDispatch(FALSE));
```

In **Project > Class Wizard**, choose the OLE Automation tab, and select from the Class Name list the class that has OLE Automation enabled (for this example it is your *CprojectnameDoc* class). Choose **Add Method** and fill in the method name as "WindowContentsChanged", return type as "SCODE", and argument list as "long IWindowID". When you click **OK** and exit the dialog box, the Class Wizard automatically updates your *CprojectnameDoc.cpp* and header file. In the *.cpp* file, fill in the function body of WindowContentsChanged to do any post processing necessary. For example, this is a good place to do legend maintenance.

## Learning More

To learn more about Integrated Mapping, look at the sample programs provided with the MapBasic development environment. The following samples are provided:

- *Samples\VB\FindZip*: Visual Basic program, used as an example throughout this chapter.
- *Samples\VB\VMMapTool*: Visual Basic program that demonstrates advanced tasks, such as callbacks; requires Visual Basic 4.0 Professional Edition or later.
- *Samples\MFC\FindZip*: A sample MFC application.
- *Samples\PwrBldr\Capitals*: A sample 16-bit PowerBuilder application. You must have the PowerBuilder runtime environment on your system to run it.
- *Samples\Delphi\TabEdMap*: A sample Delphi application.

Check the *Samples* directory (within the *MapBasic* directory) for additional samples.



# Integrated Mapping (MapInfo Pro 64-bit)

You can control MapInfo Pro using programming languages other than MapBasic. For example, if you know how to program in WPF, you can integrate a MapInfo Pro **Map** window into your WPF application, while doing most—maybe even all—of your programming in WPF. This type of application development is known as Integrated Mapping, because you are integrating elements of MapInfo Pro into another application.

If you already know how to program in other programming languages, such as C# or WPF, you will find that Integrated Mapping provides the easiest way to integrate **Integrated Mapping** on page 201 MapInfo Pro windows into non-MapBasic applications.

**Note:** If you are interested in using .Net to create integrated mapping applications, see **Integrated Mapping in .Net**.

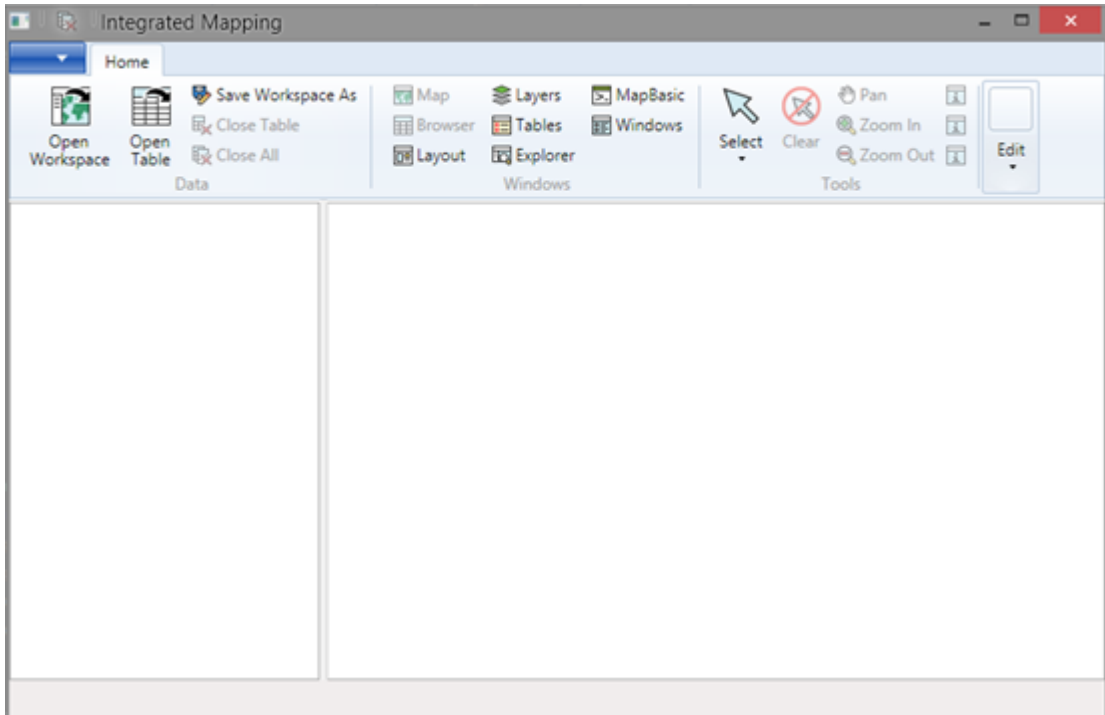
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## What Does Integrated Mapping Look Like?

---

You control the appearance of the Integrated Mapping application. If you want, you can create a user interface that is radically different from the MapInfo Pro user interface. For example, the following picture shows the WPF Integrated Mapping sample application (a sample WPF application that integrates a MapInfo Pro **Map** window into a WPF Window).



When you integrate a map into your program, the user sees a genuine MapInfo Pro **Map** window—not a bitmap, metafile, or any other type of snapshot. You can allow the user to interact with the map (for example, using the Zoom tools to magnify the map). An integrated **Map** window has all of the capabilities of a **Map** window within MapInfo Pro.

**Note:** When the user runs an Integrated Mapping application, the MapInfo Pro "splash screen" (the image that ordinarily displays while MapInfo Pro is loading) does not appear.

## Conceptual Overview of Integrated Mapping

---

To create an Integrated Mapping application, you write a program—but not a MapBasic program. Integrated Mapping applications can be written in several languages. The most often-used languages are C# and VB.Net. The code examples in this chapter use C#.

To get started with custom integrated mapping application client, you need two interfaces `IIntegratedMappingApplication` and `IMapInfoApplication`. Create a class implementing `IIntegratedMappingApplication` interface, this could be your WPF application `MainWindow` class. In the main method of your application call `MapInfoCore.Startup()` method to initialize the core components of MapInfo. Then to get access to events and other internal functionalities of MapInfo call `MapInfoCore.Initialize(instance of application window, Instance of IIntegratedMappingApplicatio)`. This



will return you instance of IMapInfoApplication interface which would allow you to get access to events and other stuff.

Your program manipulates MapInfo Pro by calling functions on IIntegratedMappingApplication interface.

If you want to open a Map window, use MapBasic's Map From statement, just as you would in a conventional MapBasic program. But in an Integrated Mapping application, you need to handle the IIntegratedMappingApplication.WindowCreated() function.

```
public void WindowCreated(IWindowInfo window,
    IEnumerable<System.Collections.Generic.KeyValuePair<string, string>>
    properties)
{
    var wi = window as WindowInfo;
    if (wi == null)
    {
        return;
    }
    // create new tab item
    var tab = new TabItem
    {
        Content = wi.UserControl,
        Tag = wi.WindowId,
    };
}
```

## Technical Overview of Integrated Mapping

### System Requirements

- Integrated Mapping requires MapInfo Pro 12.5.1 or later. You may use a full copy of MapInfo Pro or MapInfo runtime (a special "stripped-down" version of MapInfo Pro, sold only as the base for custom applications).
- Your user's computer must have enough free memory and system resources to run both your client program and MapInfo Pro simultaneously.
- Your client program must be able to create a user-interface element (for example, a window, form, or control) as a place-holder for where the map will go. Your client program must also be able to determine the Windows HWND value of the user-interface element.

## A Short Sample Program: "Hello, (Map of) World"

The following WPF example will give you a sense of how to integrate MapInfo Pro windows into another application. And this sample uses WPF ribbon to access the commands.

Create a new C# WPF project. Refer following dll files:

1. MapInfo.Application
2. MapInfo.Controls
3. MapInfo.StyleResources
4. MapInfo.Types
5. Miadm

### 6. System.Windows.Controls.Ribbon

Add the following section to "app.config" under configuration section.

```
<runtime>
  <appDomainManagerType value="MapInfo.MiPro.Interop.ProAppDomainManager"
/>
  <appDomainManagerAssembly value="miadm, Version=[miadm version],
Culture=neutral, PublicKeyToken=1c8d81d2ee78b75d" />
</runtime>
```

Derive WPF window from IIntegratedMappingApplication interface.

```
public partial class MainWindow : IIntegratedMappingApplication
```

Declare members of IMapInfoApplication type.

```
internal IMapInfoApplication Application;
```

Next add statements to the loaded event of main window.

```
try
{
    //Call to set your main application window into the MapInfo Application
    and get access to the interface to control MapInfo and listen to events.
    Application = MapInfoCore.Intialize(this, this);
    if(Application == null)
    {
        return;
    }

    //Access the MapInfo CommandBindings
    CommandBindings.AddRange(Application.InitializeCommandBindings(null,
null));

    MyRibbon.CommandBindings.AddRange(Application.InitializeCommandBindings(null,
null));

}
```

Bind open table command to the ribbon button.

```
<RibbonButton x:Name="OpenTable"
    Margin="4,0,0,0"
    DataContext="{x:Static cmds:ApplicationCommands.OpenTable}"
    Command="cmds:ApplicationCommands.OpenTable"
    Label="{Binding Path=Text}"
    SmallImageSource="{Binding Path=SmallIcon}"
    LargeImageSource="{Binding Path=LargeIcon}"
    ToolTipDescription="{Binding Path=ToolTipText}"
    ToolTipTitle="{Binding Path=ToolTipDescription}"
    ToolTipService.ShowOnDisabled="True" >
  <RibbonButton.ControlSizeDefinition>
  <RibbonControlSizeDefinition ImageSize="Large" IsLabelVisible="True"
/>
</RibbonButton.ControlSizeDefinition>
</RibbonButton>
```

For further details, refer IntegratedMappingWPF sample application under samples\dotnet folder.

## A Closer Look at Integrated Mapping

The following section explains how to integrate elements of MapInfo Pro into a WPF application. This discussion is written with two assumptions:

- You should already understand the basic terms and concepts of WPF programming. For background information on the concepts of WPF programming, see the documentation for your programming language.
- You should already know how to program in WPF, because the code examples in this discussion use WPF syntax.

### Starting MapInfo Pro

To access MapInfo Pro, you need to implement `IIntegratedMappingApplication` to manage windows.

- For WPF based application, the main Window class could implement this interface.
- For WinForms based application, the main form class could implement this interface.

Please refer following set of dll's.

- MapInfo.Application
- MapInfo.Controls
- MapInfo.StyleResources
- MapInfo.Types
- Miadm

Add the following section to "app.config" under the configuration section.

```
<runtime>
  <appDomainManagerType value="MapInfo.MiPro.Interop.ProAppDomainManager"
  />
  <appDomainManagerAssembly value="miadm, Version=[miadm version],
  Culture=neutral, PublicKeyToken=1c8d81d2ee78b75d" />
</runtime>
```

This will allow MapInfo Pro core to be loaded into separate app domain.

To access the MapInfo instance you need to call following method in application load event.

```
internal IMapInfoApplication Application;

Application = MapInfoCore.Initialize(this, this);
```

The above call set your main application window into the MapInfo Application and get access to the interface to control MapInfo and listen to events.

### Subscribing to MapInfo Pro events

Events exposed by MapInfoPro are listed under `IApplicationEvents` and `IEventsCommon` interfaces. `IMapInfoApplication` interface provides access to these events.

Example, how to handle StatusBar events in your app.

```
Application.Events.ConfigureStatusField += <Your_EventHandler>;
Application.Events.StatusFieldTextChanged += <Your_EventHandler>;
```

### Managing Window events

MapInfo Pro exposes three events WindowCreated, WindowShowing, PreviewWindowClosed and WindowClosed to manage the lifetime of child windows in integrated mapping clients.

The following function allows clients apps to hook on the window created event.

```
void WindowCreated(IWindowInfo window, IEnumerable<KeyValuePair<string,
string>> properties);
```

The following code snippet shows how to handle new mapper window and display as child control in TabPage.

```
public void WindowCreated(IWindowInfo window,
IEnumerable<System.Collections.Generic.KeyValuePair<string, string>>
properties)
{
var wi = window as WindowInfo;
if (wi == null)
{
return;
}
// create new tab item
var tab = new TabItem
{
Content = wi.UserControl,
Tag = wi.WindowId,
};
}
```

The following function is called to show or hide the window.

```
void WindowShowing(IWindowInfo window, bool bShow);
```

The following code snippet shows how to manage the tab show and hide behavior.

```
public void WindowShowing(IWindowInfo window, bool bShow)
{
// find the tab to show/hide.
TabItem tab = window.IsDocumentWindow ? _documentTabItems.FirstOrDefault(x =>
(int)x.Tag == window.WindowId) : _toolTabItems.FirstOrDefault(x =>
(int)x.Tag == window.WindowId);
if (tab != null)
{
if (bShow == false)
{
// Hiding window.
if (tab.Visibility == Visibility.Visible)
{
// if hiding the current document window then choose next document
window
if (window.IsDocumentWindow && (LastDocumentWindow == window
|| LastDocumentWindow == null))
{
SetNextDocumentWindow(window);
}
}
// if hiding the current active window then choose next active window.
```

```

    if (_activeWindow == window)
    {
        SetNextActiveWindowInternal(window);
    }

    tab.Visibility = Visibility.Collapsed;
}
else
{
    // Show window and make it active.
    if (tab.Visibility == Visibility.Collapsed)
    {
        tab.Visibility = Visibility.Visible;
        SetActiveWindow(window);
    }
}
}
}

```

The following functions allow client apps to manage window close behavior and resource management.

```
PreviewWindowClosed and WindowClosed
```

### Accessing MapInfo Pro Commands (WPF)

MapInfo Pro exposes built in command infrastructure to client applications using following function.

```

CommandBindingCollection
InitializeCommandBindings (ExecutedRoutedEventHandler exec,
CanExecuteRoutedEventHandler canExec);

```

Example, how to bind with WPF client apps.

```

CommandBindings.AddRange (Application.InitializeCommandBindings (null, null));

MyRibbon.CommandBindings.AddRange (Application.InitializeCommandBindings (null,
null));

```

## Sending Commands to MapInfo Pro

After launching MapInfo Pro, construct text strings that represent MapBasic statements. For example, if you want MapInfo Pro to execute a MapBasic **Open Table** statement, you might construct the following string (within C#):

```
string msg = $"Open Table ""STATES.TAB"" Interactive "
```

Using the `IMapInfoApplication.EvalMapBasicCommand` method. . For example:

```
Application.EvalMapBasicCommand(msg)
```

When you use the `EvalMapBasicCommand` method, MapInfo Pro executes the command string as if you had typed the command into the **MapBasic** window.

### Querying Data from MapInfo Pro

To query the value of a MapBasic expression, construct a string that represents the expression. For example, if you want to determine the value returned by the MapBasic function call **WindowID(0)**, construct the following string (within WPF):

```
string msg = "WindowID(0)"
```

```
string result = Application.EvalMapBasicCommand(msg)
```

When you use the `EvalMapBasicCommand` method, MapInfo Pro interprets the string as a MapBasic expression, determines the value of the expression, and returns the value, as a string.

**Note:** If the expression has a Logical value, MapInfo Pro returns a one-character string, "T" or "F".

Ensure that you close all tables before the Integrated Mapping application exits.

# Working with .Net

MapBasic programs can call functions and subroutines written using Microsoft's .Net development platform. You can write code in languages such as C# (C-sharp) and VB.Net (Visual Basic for .Net), using Microsoft's Visual Studio development environment. Then you can call those .Net routines from your MapBasic programs.

Some tasks that are difficult—or, in some cases, not supported at all—in the MapBasic language are relatively easy to do in .Net. For example, MapBasic's **Dialog** statement cannot create dialog boxes with Tab controls or TreeView controls, but you can easily create such dialogs in .Net.

You may find it useful to write some parts of your application using .Net, and then call those routines from your MapBasic application.

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# Introduction and Requirements for .Net Programming

---

This chapter assumes that you are already somewhat familiar with how to write code in .Net. In particular, you should already understand how to define a class in .Net, how to give your class a constructor, and how to build a project using Microsoft's Visual Studio development environment for .Net.

You must use MapInfo Pro and MapBasic version 10 or higher to call .Net routines from MapBasic.

The .Net version 3.5 framework or higher must be installed on the computer where you will run the MapBasic application (.mbx) file; however, you can assume that the .Net framework is already present on any system where MapInfo Pro 10 or higher is running, since the MapInfo Pro installer will install the framework if it is not already present.

Code samples in this chapter are provided in VB.Net and C#. The examples in this chapter were written using Visual Studio 2005.

## Terminology

In this chapter, the term method refers to any sub or function routine written in .Net. For example, a Sub routine written in VB is one type of method, while a Function written in VB is another type of method. Both types of methods can be called from MapBasic.

Some methods can be called without first creating an instance of the class. C# programmers refer to these methods as static methods, while VB.Net syntax refers to them as shared functions. In this chapter, we will use the term static method to refer to a method that can be called without first creating an instance of the class.

## Getting Started

---

This section provides a simple example of how to create a class in .Net, and use the class from MapBasic.

Calling a .Net method from MapBasic involves six basic steps:

1. Create a class in .Net, containing one or more static methods
2. Build the .Net class into an assembly
3. Make the assembly available to the MapBasic application
4. Add a **Declare Method** statement to the .MB program
5. Call the method that you declared in the **Declare Method** statement
6. Compile and run your MapBasic application.

## Creating a Class in .Net

You can start by defining a class in .Net. The class can be very simple. The main requirement is that the class must contain at least one static method. MapBasic programs can only call .Net methods that are static.

The following example shows a simple class, with one static method that displays a greeting in a dialog box. This method takes one String argument, and returns an integer value (indicating the number of characters in the String).



If you write this class in C#, the code looks like this:

```
using System;
using System.Windows.Forms;

namespace MapBasicMethods
{
    public class Demo
    {
        public static int SayHello(String strName)
        {
            MessageBox.Show("Hello, " + strName);
            return strName.Length;
        }
    }
}
```

Much of the code in this example was generated by Visual Studio, so there is little code that you have to type in by hand. When you create a new project in Visual Studio, choose the project template that lets you define a new Class Library, and Visual Studio will generate much of the needed code.

This same class, written in VB, might look like this:

```
Namespace MapBasicMethods

    Public Class Demo

        Public Shared Function SayHello(ByVal s As String) As Integer
            System.Windows.Forms.MessageBox.Show("Hello, " + s)
            Return s.Length
        End Function

    End Class

End Namespace
```

**Note:** This VB example declares the namespace explicitly, in the source code. Your VB project might not have the Namespace declaration in the source code if you have a Root Namespace set in your VB project properties.

The SayHello method uses the .Net MessageBox class to display a dialog box such as this:



Since this sample uses the MessageBox class, the project depends on a standard assembly, System.Windows.Forms. If you type in this example yourself, you may need to add a Reference to the System.Windows.Forms assembly to your Visual Studio project.

## Building and Copying the Assembly File

Once you have written your class, you use Visual Studio to build the class into a .exe or .dll file.

You will need to make your assembly available to your MapBasic application. The simplest way to do this is to copy the assembly (.dll) file to the directory where the .MBX file resides in the directory from where you will run the .MBX. Alternatively, rather than copy the assembly to the .MBX directory, you

could instead register the assembly in the .Net Global Assembly Cache (GAC). To register your assembly, use the `gacutil` utility provided by Microsoft; for details, see the .Net documentation from Microsoft.

**Note:** MapInfo Pro allows you to run a .MBX application from a network location, such as a UNC path. However, the default .Net Framework security settings do not allow loading a .Net assembly from the network. If you call your own .Net assembly from your MapBasic application, consider installing your application files on client machines, rather than having the client machines access the files via a network. Otherwise you will have to modify the security settings through the .Net Framework Configuration utility found in **Control Panel > Administrative Tools**. The exact steps to change the security settings are beyond the scope of this documentation.

Now that you have a static method, in a class, in a .Net assembly, you can call that method from MapBasic.

## Declaring and Calling the Method from MapBasic

Before you call the .Net method from MapBasic, you must add a **Declare Method** statement to your .MB program. The **Declare Method** statement is very similar to the **Declare Function** statement, but it includes additional syntax to let you specify the assembly and class name of your .Net class.

For details about the Declare Method syntax, see the *MapBasic Help*. The following example shows how you might declare the `SayHello` method from the example above.

```
' MapBasic syntax for declaring a .Net method as a function
Declare Method SayHello
  Class "MapBasicMethods.Demo" Lib "MBMethods.dll"
  (ByVal strName As String) As Integer
```

In this example, we will call the method by its actual name, `SayHello`. (You could refer to the method with an alias, using the **Alias** clause; but for this simple example, it is not necessary to use an alias. You only need to use the **Alias** clause when you need to differentiate multiple functions that have the same name.)

The **Class** clause specifies the class name as `MapBasicMethods.Demo` because our source code specified that `MapBasicMethods` is the namespace, and `Demo` is the class name.

The **Lib** clause specifies the name of the assembly file as `MBMethods.dll` your assembly name will depend on your project settings in Visual Studio.

The argument list matches the argument list of the .Net method: one by-value String argument.

The return type matches the return type of the .Net method. The MapBasic "Integer" type is a 4-byte integer, which is equivalent to the C# "int" type (also known as `System.Int32`).

Once your **Declare Method** statement is in place, you can call your .Net method just as you would call any other MapBasic function. For example:

```
' MapBasic syntax for calling a .Net method
Dim i As Integer
i = SayHello("Fred")
```

If your .Net method does not have a return value (i.e. it is a Sub rather than a Function, or it is a C# void method), or if you simply want to ignore the return value, omit the final **As** clause from the **Declare Method** statement. For example:

```
' MapBasic syntax for declaring a .Net method as a sub
Declare Method SayHello
  Class "MapBasicMethods.Demo" Lib "MBMethods.dll"
  (ByVal strName As String)

Declare Sub Main

Sub Main
```

```

    Call SayHello("Fred")
End Sub

```

Compile and run the MapBasic program. When your .MBX calls the `SayHello` method, your .Net assembly is loaded and your static method is called.

Note that if your **Declare Method** statement contains errors (such as misspelling the Class name), your MapBasic program may still compile, but the method call will fail when you try to run your .MBX. Your assembly name, class name, method name and method argument list are not validated until you actually call the method at run-time.

## Calling a Method by an Alias

If the method name that you specify in a **Declare Method** statement is the same as one of the existing Function or Sub routine names in your MapBasic program, your program will not compile, because a MapBasic program cannot allow multiple routines to use the same name. To correct this error, add the **Alias** clause to the **Declare Method** statement. Within the **Alias** clause, you specify the .Net method's original name; then, you change the frame argument—the argument that follows the Method keyword—to be a unique name (i.e. a function name that is not already in use). In the following example, we call a .Net method that is defined with the name "ShowDialog", but within the .MB source code, we call the method by the name "ShowPointDialog":

```

Declare Method ShowPointDialog
  Class "MyProduct.MyWrapper"
  Lib "MyAssembly.DLL" Alias ShowDialog () As Integer

  Dim i As Integer
  i = ShowPointDialog()

```

## Passing Arguments to .Net

Some MapBasic variable types, such as Pen and Brush, cannot be passed to a .Net method. The following table summarizes how MapBasic variable types correspond to .Net data types.

MapBasic type	.Net type	VB.NET type	C# Type
SmallInt	System.Int16	Short	short
Integer	System.Int32	Integer	int
Float	System.Double	Double	double
String(both variable- and fixed-length)	System.String	String	String
Logical	System.Boolean	Boolean	bool
Types (aka structures)	Varies; see below		
All Other MapBasic Types	n/a	n/a	n/a

Arguments can be array types. For example, if your .Net method takes an argument that is an array of Integer values, the **Declare Method** statement might look like this:

```
Declare Method ProcessIntegerArray  
  Class "MyProduct.MyWrapper" Lib "MyAssemblyName"  
    (idNumbers() As Integer)
```

Arguments can be passed by-reference or by-value. The syntax for specifying by-ref vs. by-val varies from language to language. The following table demonstrates how you might pass String arguments by-val vs. by-ref in various cases.

**Note:** You cannot resize a MapBasic array variable within your .Net method.

Language	By-Reference Syntax	By-Value Syntax
MapBasic	str As String	ByVal str As String
VB.Net	ByRef str As String	ByVal str As String
C#	ref String str	String str

**Note:** MapBasic can only pass array arguments and structure arguments ByRef.

## Performance Notes

The speed of calling a .Net method depends on how much data you pass via the argument list. The more data you pass as arguments, the longer the call will take.

If you find that the execution speed of calling .Net methods is not satisfactory, try to minimize the amount of data that you pass via the argument list.

# Working with Structures in .Net

---

## Passing Custom Variable Types (Structures) to .Net

MapBasic programs can pass structures (custom variable types created using the **Type** statement) to .Net, but some restrictions apply, and you need to do some additional work in .Net—namely, creating an appropriate Class definition in .Net to represent the structure.

When you want to pass a MapBasic structure to a .Net method, you must do the following in your .MB code:

1. Use the MapBasic **Type** statement to define your MapBasic structure. (If you want to pass a structure to .Net then you have probably already done this.)
2. Use the **Declare Method** statement to describe a .Net method signature, and include your MapBasic Type in the method argument list.
3. Declare a variable of your structure type, and assign its field values.
4. Call the method, and pass the structure variable to the method call.

The following MapBasic code defines a structure type with 3 fields, then passes that structure type to a .Net method.

**Note:** The **Type** statement must come before the **Declare Method** statement, because the Type name (in this example, ParcelInfo) is used within the **Declare Method** statement.

```
Type ParcelInfo
    idnum      As Integer
    descript  As String
    area      As Float
End Type

Declare Method ShowParcelDialog
    Class "MapBasicMethods.Demo" Lib "MBMethods.dll"
    (p As ParcelInfo)

Declare Sub Main
Sub Main
    Dim p As ParcelInfo
    p.idnum = 23
    p.descript = "Sample parcel"
    p.area = 123.45

    Call ShowParcelDialog( p )
End Sub
```

In this example we are passing a ParcelInfo data structure to a .Net method. The next question is: how should the .Net method be written, so that it will be able to receive the data sent from MapBasic?

When a .Net method needs to receive structure information sent from MapBasic, you need to do the following:

1. Define a Class in .Net.
2. Give your Class a public constructor, and give this constructor an argument list that matches the fields in your MapBasic structure. For example, if your MapBasic structure contains an integer, a string, and a floating-point number, then your constructor's argument list must also take an integer, a string, and a floating-point number. (Your class can also have other constructors, but MapInfo Pro/MapBasic will ignore those other constructors.)
3. Somewhere in one of your .Net classes, write a public static method (the method that you will call from MapBasic). Add an argument to this method, and define the argument type as the Class you created in step 1.

The following C# code sample demonstrates how to create a Parcel class that corresponds to the ParcelInfo structure described above:

```
public class Parcel
{
    private int m_ID;
    private string m_Description;
    private double m_Area;

    public Parcel(int idnum, string description, double area)
    {
        m_ID = idnum;
        m_Description = description;
        m_Area = area;
    }
    // TODO: You will probably find it useful to create a Property
    // for the ID, and for the Description, and for the Area.
    // MapInfo/MapBasic do not require that Properties exist.
}
```

Having defined the Parcel class, you can now define a public static method that takes an argument of type Parcel.

```
public static int ShowParcelDialog(Parcel parc)
{
    // Here you would write code to display the
    // parcel information in a dialog box...
```

```

    MessageBox.Show("Hello, world");
    return 0;
}

```

Now your MapBasic program can pass a ParcelInfo structure to the ShowParcelDialog method. While your MapBasic program sends a structure to the method call, the ShowParcelDialog method receives an object of the appropriate type; MapInfo Pro converts the structure to the appropriate .Net type, so that the method call can be performed. (This is why you are required to put a public constructor on your .Net class—MapInfo Pro needs the public constructor so that it can convert the MapBasic data structure into an appropriate type of .Net object.)

When you pass a MapBasic structure to your .Net method, the call succeeds only if the argument's .Net class has a public constructor with arguments that match the fields in the MapBasic structure. If no such constructor exists, your MapBasic program will produce a run-time error when it attempts to call the method. Note that this is a run-time error condition; the MapBasic compiler cannot detect this type of problem at compile-time.

In some cases, you might not start out with an existing MapBasic Type structure as your "given"—instead, you might start out with a pre-existing .Net method signature. Suppose you want to call a .Net method that has already been written, and this existing method expects one argument: a System.Drawing.Point object.

```

public static void ShowPointDialog(System.Drawing.Point p)
{
    MessageBox.Show("p.x is: " + p.X + ", p.y is: " + p.Y);
}

```

This method's argument does not match any of the standard MapBasic variable types, such as Integer or String. Therefore, if you want to call this method from MapBasic, you will need to define a MapBasic structure that approximates the .Net argument type (System.Drawing.Point, in this case). The following MapBasic example shows the appropriate syntax:

```

Type Location
    ix as Integer
    iy as Integer
End Type

Declare Method ShowPointDialog
Class "MyProduct.MyWrapper"
    Lib "MyAssembly.DLL" (pnt As Location)
    . . .
    Dim loc As Location
    loc.ix = 23
    loc.iy = 42

Call ShowPointDialog(loc)

```

In this example, MapInfo Pro will try to convert the MapBasic structure into a .Net System.Drawing.Point object, by calling a public constructor on the Point class. This conversion process is similar to what happened in the previous example, with one important difference: In this case, you did not have to write the .Net Point class, because it already exists—it is a class provided by Microsoft.

Because the MapBasic Location structure contains two Integer fields, MapInfo Pro will try to find a public constructor on the Point class that takes two integers. The fields from the MapBasic structure are passed to the .Net constructor, thus creating a .Net Point object. The Point object is passed to the method to complete the call.

Some .Net classes do not have public constructors. For example, the System.Drawing.Color structure does not have public constructors; therefore, it is impossible to define a MapBasic structure that approximates a System.Drawing.Color object. If you need to pass color information to your .Net method,

give your method separate red, green, and blue arguments. Then, inside your .Net method you can combine those values to form a .Net Color.

```
Public Shared Sub ShowColorDialog(ByRef r As Integer, ByRef g As Integer,
    ByRef b As Integer)

    Dim c As Color
    Dim dlg As ColorDialog
    dlg = New ColorDialog
    dlg.Color = Color.FromArgb(r, g, b)
    If (dlg.ShowDialog = DialogResult.OK) Then
        c = dlg.Color
        r = c.R
        g = c.G
        b = c.B
    End If
End Sub
```

In this example we are instantiating objects, such as the `ColorDialog`, and calling non-static methods on those objects. As stated earlier, MapBasic programs (.MB source code) can only call static methods; however, the .Net code that you write inside your static method has no such restriction. Inside your static method, your .Net code can instantiate objects, and use those objects to call non-static methods (instance methods).

## Restrictions of Passing Structures

If you pass MapBasic structures to .Net, you may need to give your .Net methods unique names. Note that .Net allows a class to have multiple methods with the exact same name (as long as the argument lists are different); MapBasic, however, is more restrictive. If you pass MapBasic structures to .Net, and if your .Net class has multiple methods with the same name and the same number of arguments, then MapBasic might not be able to determine which of the methods you want to call. In this situation your MapBasic program will produce a run-time error when you attempt to call the .Net method. The simplest way to resolve this type of ambiguity is to use a unique method name for any .Net method to which you will be passing a structure.

If you pass a structure to a .Net method, and the .Net method modifies the object passed to it, the corresponding MapBasic structure is not modified. If you need to have your .Net method update your MapBasic argument variables, use `ByRef` scalar variable arguments (such as "ix As Integer") rather than structures.

## Exception Handling

An unhandled exception in a .Net method will cause a runtime error in your MapBasic application (MapBasic error code 1666). Any unhandled runtime error in a MapBasic application will halt the .MBX; therefore, you will want to handle all such errors. You can choose whether you prefer to trap your error conditions in your .Net code, or in your .MB code.

The .Net error handling mechanism (try-catch-finally blocks) is more robust than the error handling provided in MapBasic. Therefore, it is generally preferable to catch exceptions in your .Net code, rather than allowing exceptions to propagate to your .MB program. However, if you do not want to or for some reason cannot catch an exception in your .Net method, you can handle the resulting runtime error in your .MB program, using MapBasic's **OnError** statement.

The following code demonstrates the MapBasic error-trapping syntax:

```
Sub MakeExternalCall
```

```

OnError Goto caughtit
Call DoSomething()      ' Call a .Net method
g_status = 0           ' set result code; 0 = success
Exit Sub
caughtit:

' Code only comes here if method call caused an error.
if Err() = 1666 Then
' Code comes here if we called the .net method,
' but the .net method threw an unhandled exception.
' TODO: Look at Error$() to determine exact exception
g_status = -1
else
' Other Err codes might indicate that the method was
' not called, possibly due to a typo in Declare Method
Note "Check Declare Method statement. Error: " + Error$()
g_status = -2
end if

End Sub

```

## Working with the GAC

### Loading an Assembly from the Global Assembly Cache (GAC)

The **Declare Method** statement's **Lib** clause identifies a .Net assembly. If the assembly file is in the same directory as the .MBX file, the **Lib** clause can simply identify the assembly by its file name (such as `mbtools.dll` or simply `mbtools`).

If you are using an assembly that has been registered in the GAC, there is no need to copy the .DLL file to the same directory as the .MBX file. However, when you reference an assembly from the GAC, your **Lib** clause must provide more information, because the GAC might contain more than one version of an assembly. In this situation, the **Lib** clause needs to specify a fully-qualified assembly name.

The following example shows how to reference the `System.IO.File.Delete` method, which is in Microsoft's `mscorlib` assembly:

```

Declare Method Delete
Class "System.IO.File"
Lib "mscorlib, Version=2.0.0.0, Culture=neutral,
PublicKeyToken=b77a5c561934e089"
(ByVal path as string)

```

For more information on registering an assembly in the GAC, or on fully qualified assembly names, consult the .Net documentation from Microsoft.

The following example demonstrates how to declare methods in assemblies that are registered in the GAC. Note that when an assembly is loaded from the GAC, the **Lib** clause must specify a fully-qualified assembly name. Various utilities exist that can help you to identify an assembly's fully-qualified name, including the `gacutil` utility provided by Microsoft as part of Visual Studio.

```

' Declare a method from the System.Windows.Forms.dll assembly:
Declare Method Show
Class "System.Windows.Forms.MessageBox"
Lib "System.Windows.Forms, Version=2.0.0.0, Culture=neutral,
PublicKeyToken=b77a5c561934e089"
(ByVal str As String, ByVal caption As String)

' Declare a method from the mscorlib.dll assembly:
Declare Method Move

```



```

Class "System.IO.File"
  Lib "mscorlib, Version=2.0.0.0, Culture=neutral,
  PublicKeyToken=b77a5c561934e089"
  (ByVal sourceFileName As String, ByVal destFileName As String)

' Display a .Net MessageBox dialog box with both a message and a caption:
Call Show("Table update is complete.", "Tool name")

' Call the .Net Move method to move a file
Call Move("C:\work\pending\entries.txt", "C:\work\finished\entries.txt")

```

## Controlling MapInfo Pro from Within a .Net Method

The MapInfo Pro installation includes a .Net assembly, `miadm.dll`, which supports MapBasic / .Net interoperability. You may find some of these "interop" methods useful because they allow you to execute MapBasic statements from within a .Net method.

For example, imagine you have written a .Net **Map Properties** dialog box that contains various map options, plus **OK**, **Cancel**, and **Apply** buttons. Suppose the dialog box can be used as follows:

1. Your MapBasic program calls a .Net method to display your **.Net** dialog box.
2. The user selects various options within the dialog box, then clicks the **Apply** button to apply the changes.
3. The MapInfo Pro **Map** window is updated immediately; however, because the user clicked **Apply** (as opposed to **OK**), the dialog box remains on the .
4. Later, after the user finally dismisses the dialog box, the .Net method returns.

To update a **Map** window, you use a MapBasic statement such as **Set Map**. However, in this example, the **Set Map** statement needs to be executed from within .Net code, because in this example, we are updating the map before the .Net method has returned.

MapInfo Pro's COM interface provides a `Do` method, which allows you to execute MapBasic statements, and an `Eval` method, which allows you to retrieve information about the state of MapInfo Pro. If you have written any Integrated Mapping applications, you are already familiar with the `Do` and `Eval` methods; see [Integrated Mapping](#) for more details.

The `MapInfo.MiPro.Interop.InteropServices` class gives .Net programmers easy access to MapInfo Pro's `Do` and `Eval` methods. The `InteropServices` class has a `MapInfoApplication` property that gives you a reference to the `MapInfoApplication` object. The `MapInfoApplication` class, in turn, provides the `Do` and `Eval` methods.

For an example of using `Do` and `Eval`, see the `Named Views` sample application installed with MapBasic (see `Samples\DotNet\NamedViews`). The `Named Views` application calls the `Eval` method to determine the window ID of the active **Map** window:

```

private static int GetFrontWindow()
{
  string evalResult =
  InteropServices.MapInfoApplication.Eval("FrontWindow()");
  return Int32.Parse(evalResult);
}

```

Similarly, the `Named Views` application uses the `Do` method to issue a **Set Map** statement from within .Net code:

```

InteropServices.MapInfoApplication.Do(string.Format(
  "Set Map Window {0} Center ( {1}, {2} ) Zoom {3}",
  windowId, centerX, centerY, mapperZoom));

```

Before you can use the `MapInfo.MiPro.Interop.InteropServices` class, your .Net project must include a reference to the `miadm.dll` assembly. The assembly is located in the MapInfo Pro install directory.

**Note:** If you encounter any errors while building the Named Views sample project, you may need to re-create the reference in the Visual Studio project, so that it specifies the current location for the assembly.

The `MapInfoApplication` class is a wrapper class, which gives .Net programmers easy access to MapInfo Pro's COM interface. This class is provided as a convenience, so that you may access methods, properties and events through a standard .Net class, instead of dealing with the COM interface directly. In addition to providing the Do and Eval methods shown above, the `MapInfoApplication` class also provides the properties and events listed below.

### MapInfoApplication members

#### Methods

##### Do

Executes a MapBasic statement, as if you had typed the statement into the **MapBasic** window

##### Eval

Evaluates a MapBasic expression, and returns the result, as a string

#### Properties

##### FullName

Gets the full path to the application executable

##### LastErrorCode

Gets an integer representing the last MapBasic error that occurred during a Do or Eval method call

##### LastErrorMessage

Gets the error message associated with LastErrorCode

##### Name

Gets the application name

##### Version

Gets the version number string, representing the version number, multiplied by 100

#### Events

##### MenuItemClick

Occurs when the user selects a custom menu item defined with the syntax: Calling OLE "MenuItemHandler"

##### StatusBarTextChanged

Occurs when the MapInfo Pro status bar text changes

##### WindowContentsChanged

Occurs when the contents of the **Map** window change (such as when a map is zoomed in or out)

## Integrated Mapping in .Net

---

Integrated mapping is an application architecture where you write your own application (the "client" application), which your users could launch instead of launching MapInfo Pro. Your application would

then launch MapInfo Pro silently, in the background, so that you can display MapInfo maps within your application's user interface.

The following section describes how to write an integrated mapping application using .Net. For a general discussion of integrated mapping concepts and rules, see the Integrated Mapping chapter.

The MapBasic installation includes a sample .Net integrated mapping application; see `samples\DotNet\IntegratedMapping`. You might find it useful to refer to the sample application as you read this section.

## Accessing MapInfo Pro through COM

In an integrated mapping application, you will use MapInfo Pro's COM interface. Before you can do this, you need to add a Reference in your Visual Studio project:

1. Create a Visual Studio project.
2. In the **Solution Explorer** window, right-click the References folder and select **Add Reference**.
3. In the **Add Reference** dialog box, go to the **COM** tab.
4. Choose **MapInfo 12.0 OLE Automation Type Library** and click **OK**.

Visual Studio will generate `mapinfo.interop.dll` which provides .Net wrapper classes to access MapInfo Pro's COM interface. Now your application can reference the `MapInfoApplication` class. In the sample application, this class is initialized at the top of the `MapForm.InitializeComObject` method:

```
_mapInfoApp = new MapInfoApplication();
```

Once the `_mapInfoApp` object is initialized, you can use its **Do** method to execute MapBasic statements (which is analogous to typing statements into MapInfo Pro's **MapBasic** window), or use its **Eval** method to retrieve information from MapInfo Pro.

In particular, you will be using the **Do** method to execute the following MapBasic statements:

1. **Set Application Window** — this allows you to use MapInfo dialog boxes in your client application.
2. **Open Table** — this statement opens MapInfo tables.
3. **Set Next Document Parent** — this statement puts MapInfo Pro into a special state, so that the next **Map** window opened will be "re-parented" so that it appears within your client application.
4. **Map From** — this statement creates a **Map** window.

The sample application demonstrates the use of these statements; for examples, search the `MapForm` class for calls to the `Do` method.

## Callback Methods

In some cases, integrated mapping applications need to provide callback methods. If your application needs to execute code whenever certain events occur—for example, if you need to execute code whenever the user alters the map—then you will need to set up a callback method, so that MapInfo Pro can call your callback method every time that event occurs.

MapInfo Pro will call the following callback methods:

- The **WindowContentsChanged** method is called by MapInfo Pro whenever the contents of the **Map** window change (e.g. when a layer is added or removed).
- The **SetStatusText** method is called by MapInfo Pro whenever anything happens that would alter the text on the MapInfo Pro status bar.
- Any custom OLE menu item has a handler method; the name of the handler method is specified in the client application. The sample application defines one custom OLE menu item and specifies **MenuItemHandler** as the handler name. This method name also appears in the MapBasic statement that defines the custom menu item (the **Create Menu** statement or the **Alter Menu...Add** statement).

In the sample application, these callbacks are represented by the `IMapInfoCallback` interface. The C# version of the interface, from `MapInfoCallback.cs`, looks like this:

```
public interface IMapInfoCallback
{
    // Method called by MapInfo Pro when window changes
    int WindowContentsChanged(UInt32 windowID);

    // Method called by MapInfo Pro when the status bar text
    changes
    int SetStatusText(string message);

    // Method called by MapInfo Pro when user chooses custom OLE
    menuItem
    void MenuItemHandler(string commandInfo);
}
```

The Visual Basic version of the interface, from `MapInfoCallback.vb`, looks like this:

```
Public Interface IMapInfoCallback
    ' Method called by MapInfo Pro when window changes
    Function WindowContentsChanged(ByVal windowID As UInt32) As Integer

    ' Method called by MapInfo Pro when the status bar text
    changes
    Function SetStatusText(ByVal message As String) As Integer

    ' Method called by MapInfo Pro when user chooses custom OLE
    menuItem
    Sub MenuItemHandler(ByVal commandInfo As String)
End Interface
```

The same source code module contains the **MapInfoCallback** class, which demonstrates how to implement the `IMapInfoCallback` interface. Note that the `MapInfoCallback` class has attributes to mark the class as COM-visible, so that MapInfo Pro will be able to call the methods. The C# syntax for the class attributes:

```
[ClassInterface(ClassInterfaceType.None)]
[ComVisible(true)]
public class MapInfoCallBack : IMapInfoCallback
```

The VB version of the class attributes:

```
<ClassInterface(ClassInterfaceType.None)> _
<ComVisible(True)> _
Public Class MapInfoCallBack
    Implements IMapInfoCallback
```

In the same file where the `IMapInfoCallback` interface is defined, there is a second interface, **ICallbackNotify**. Implement this interface in your Windows Forms application. In the sample application, this interface is implemented in `MapForm.cs` or `MapForm.vb`.

Events can cause MapInfo Pro to call the callback (`IMapInfoCallback`) class, which in turn notifies the client (`ICallbackNotify`) class. For a better understanding of how and when the various interface methods are called, consider the following sequence of events:

1. The user runs the Integrated Mapping client application, which silently launches MapInfo Pro. In the sample application, this happens in the **MapForm.InitializeComObject** method. This method launches MapInfo Pro, instantiates the callback object, and registers the callback object with MapInfo Pro:

```
private void InitializeComObject()
{
    // Create the MapInfo Pro object
    _mapInfoApp = new MapInfoApplication();

    // Set parent window for MapInfo Pro dialogs
```

```

_mapInfoApp.Do("Set Application Window " + this.Handle);

// Create the callback object
_callbackObject = new MapInfoCallBack(this);

// Register the callback object with Professional
_mapInfoApp.RegisterCallback(_callbackObject);
}

```

2. The client application calls the `MapInfoApplication.Do` method to open tables and **Map** windows. In the sample application, this happens in the **MapForm.NewMap** method, which is called when the user has chosen **File > Open** to open one or more .tab files.
3. The user modifies the map in some way. In the sample application, the user can select Layer Control from the **Map** window's right-click menu, then use the dialog box to modify the map. MapInfo Pro manages the **Layer Control** window.
4. Because the map has been modified, MapInfo Pro notifies the client app by calling the `MapInfoCallback.WindowContentsChanged` method.
5. The `WindowContentsChanged` method calls the **MapForm.OnWindowContentsChanged** method. The code to be included in this method will depend on the purpose of the application. For example, if your application displays information about the map, on the status bar or elsewhere in your form, then you might want to update your form in the `OnWindowContentsChanged` method.
6. If the application includes a custom OLE menu item, MapInfo Pro calls the menu item's handler method whenever the user selects the menu item. In the sample application, the **Alter Menu** statement adds an item to the map's context menu, and specifies "MenuItemHandler" as the handler name. Therefore, if the user selects the custom menu item, MapInfo Pro calls the **MenuItemHandler** method, which then calls the **MapForm.OnMenuItemClick** method. The code to be included in the `OnMenuItemClick` method will depend on the purpose of the custom menu item.
7. Whenever the user does something that would cause MapInfo Pro to modify the text on the status bar—for example, clicking in the map to make a selection—MapInfo Pro calls the **MapInfoCallback.SetStatusText** method. This method calls the **MapForm.OnStatusBarTextChanged** method. If you want to make your client application's status bar look like the MapInfo Pro status bar, you could add code to the `OnStatusBarTextChanged` method to update your status bar.
8. On exit, we un-register the callback object. In the sample application, this happens in the `FormClosed` method.

```

private void Form1_FormClosed(object sender, FormClosedEventArgs e)
{
    // Unregister the callback object
    MapInfoApp.UnregisterCallback(_callbackObject);
}

```

The sample application defines one custom OLE menu item. If your application defines multiple OLE menu items, you can have each menu item call its own designated handler method. Or, you can have all of your OLE menu items call the same handler method—but, if you do, then you will need to give each custom menu item an ID number (by including the ID clause in the **Create Menu** or **Alter Menu...Add** statement) so that the handler method can determine which menu item the user selected.

Note that the `MapInfoCallback` class is re-usable. You could write several different integrated mapping applications, and use the same `MapInfoCallback` class with each of those applications.

## Thread Safety Issues

To understand the sample `MapInfoCallback` class, you must first understand how multi-threading can affect a Windows Forms user interface. When you want to execute code that will manipulate your Windows Forms user interface—for example, if you want to change the text displayed on the form's status bar—you must make sure that the code is executing on the same thread that was used to create the user interface.

It is likely that callback methods will execute on a different thread than the thread that created your user interface. Therefore, your callback methods must detect and correct any thread safety issues before executing any code that affects your user interface.

The Windows Forms Control class provides an `InvokeRequired` property. If `InvokeRequired` is true, it indicates that the current thread is not the correct thread for updating the Control, in which case, you must use the `Control.Invoke` method to apply any changes to the Control. The `Invoke` method ensures that the change is applied on the appropriate thread.

For example, the sample `MapInfoCallback.SetStatusText` method contains the following code, which ensures that any changes made to the status bar occur on the appropriate thread:

```
if (_callbackClient.InvokeRequired)
{
    _callbackClient.Invoke(this._onStatusBarTextChangedDelegate, new
Object[] { text });
}
else
{
    _callbackClient.OnStatusBarTextChanged(text);
}
```

Note that we are using the `_callbackClient` object (an object that implements `ICallbackNotify`) to access the `InvokeRequired` property and the `Invoke` method. In the sample application, the `Form` class serves as the `ICallbackNotify` object:

```
public partial class MapForm : Form, ICallbackNotify
```

In the sample application, the `_callbackClient` member is a reference to the `MapForm`. Since the `Form` class derives from `Control`, we are able to call `_callbackClient.Invoke`.

**Note:** Do not perform the callback un-register operation in a destructor method, as that method will probably be called from an incorrect thread.

# Sample Programs

The MapBasic software includes the following sample program files.

**Note:** Additional examples may have been added after the printing of this manual.

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## Samples\Delphi Directory

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**tabmap:** run MapInfo Pro as an OLE server using Delphi.

## Samples\DLLEXAMP Directory

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### Samples\DLLEXAMP\Loadlib Directory

**loadlib.mb:** The files in this directory are the source code to a C language DLL that can be compiled for either Win16 or Win32, and a test program written in MapBasic that exercises the function in the DLL.

### Samples\DLLEXAMP\ResDLL Directory

Contains sample programs to demonstrate techniques for Win16 & Win32 compatibility.

## Samples\DotNet Directory

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### Samples\DotNet\GoogleConnect Directory

A MapBasic utility to send map views or selections to Google Earth.

### Samples\DotNet\HelloWorld Directory

Simple of calling a .Net method from MapBasic (C# and VB.Net versions)

### Samples\DotNet\IntegratedMapping Directory

Integrated Mapping client application written in .Net (C# and VB.Net versions)

### Samples\DotNet\NamedViews Directory

Named Views MapBasic tool, which uses .Net for managing XML files and dialog boxes (C# and VB.Net versions). The Named Views application lets you define named views, which act as bookmarks that let you return to that map view at a later time.

## Samples\MapBasic Directory

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The `Samples\MapBasic\` directory contains subdirectories that include sample program files. The contents of each subdirectory is described in the following sections.

### Samples\MapBasic\ANIMATOR Directory

**Animator.mb:** demonstrates how Animation Layers can speed up the redrawing of **Map** windows.

### Samples\MapBasic\APPINFO Directory

**AppInfo.mb:** retrieves information about the MapBasic applications that are currently running.



**Samples\MapBasic\AUTOLBL Directory**

**AutoLbl.mb:** "labels" a map by placing text objects in the Cosmetic layer (emulating the way earlier versions of MapInfo Pro created labels).

**Samples\MapBasic\GOGOLINE Directory**

**COGOLine.mb:** draws a line at a specified length and angle.

**Samples\MapBasic\CoordinateExtractor Directory**

**Coordinateextractor.mb:** updates two columns with the x and y coordinates in the table's native projection or a user selected projection for each object in the table.

**Samples\MapBasic\CSB Directory**

**CoordSysBounds.mb:** enables you to check and set the coordinate system bounds of any mappable MapInfo base table.

**Samples\MapBasic\DATABASE Directory**

**Autoref.mb:** refreshes linked tables every (Interval) seconds

**BuildSQL.mb:** allows you to connect to DBMS databases; build, save, and load queries; run queries and preview or download the results.

**Connect.mb:** provides the **MapInfo DBMS Connection Connection Manager** dialog box and related functions. The connection manager allows you to select an existing connection to use, disconnect existing connections, and get new connections.

**DescTab.mb:** provides a dataLink utility function that given a table opens a dialog box that describes it.

**DLSUtil.mb:** returns the list value at the selection index for Dialog Box List control processing.

**GetMITab.mb:** MapInfo Pro table picker dialog box.

**MIOdbCat.mb:** This is the DBMS Catalog tool that is loaded from the MapInfo Pro Tool Manager. This allows the database administrator to create a MapInfo Pro User with the with a MAPINFO\_MAPCATALOG table. It also allows the DBA to delete a table from the catalog.

**MIRowCnt.mb:** This is the DBMS Count Rows in Table tool that is loaded from the MapInfo Pro Tool Manager. This tool lets you connect to DBMS databases and run a count(\*) against tables, updating the mapcatalog with the results.

**MISetMBR.mb:** This is the CoordSysBounds tool that is loaded from the MapInfo Pro Tool Manager. This tool allows the DBA to change the bounds of a table in the MapInfo\_MAPCATALOG table.

**MIUpIdDB.mb:** This tool provides the ability to generate the Database specific SQL statements allowing you to upload a MapInfo table.

**MIUpload.mb:** This is the Spatialize SQL Server Table tool that is loaded from the MapInfo Pro Tool Manager. This tool provides the ability to upload a MapInfo table to a remote database with spatial column information. The Spatial columns are used with DBMS linked tables, which allows a remote database table to be mappable in MapInfo Pro.

**PickCol.mb:** This tool provides a server table column picker dialog box.

**PickSel.mb:** This tool provides a selection picker dialog box as part of the `BuildSQL.mbx`.

**PickTab.mb:** This tool provides functions to get a list of server database tables, and table owners (schemas), and contains a generic function that provides a table selection dialog box.

**PrepSQL.mb:** This tool provides a SQL Query prepare function that processes query parameters. The parameters are bound here (resolved and replaced with a value).

**SQLPVW.mb:** This tool resolves each parameter to a value and return the resolved SQL query string given an SQL query string with embedded parameters of a specific format.

**SQLUtil.mb:** This tool provides many utility functions that enable Mapinfo to access to ODBC data.

**SQLView.mb:** This tool provides a SQL DataLink application for testing the SERVER\_COLUMNINFO function for all options (except VALUE).

### Samples\MapBasic\DeleteDuplicates

**DeleteDuplicates.mb:** This tool allows the user to delete duplicate records from a table while retaining map objects. The user may also select whether they want a 'Count' column added to the newly created table.

### Samples\MapBasic\DISPERSE Directory

**disperse.mb:** This tool provides a takes points at given coordinates and disperses them either randomly or systematically.

### Samples\MapBasic\DistanceCalc

**DistanceCalc.mb:** The Distance Calculator tool can be used to calculate the distance from a selected object (or group of objects) to the closest or farthest object(s). You can also specify criteria to limit the results.

### Samples\MapBasic\DMSCNVRT Directory

**DMSCnvt.mb:** This tool converts between columns of Degree/Minute/Second coordinates and columns of decimal-degree coordinates.

### Samples\MapBasic\FTPLib

**FilesManager.mb:** A MapBasic sample program to demonstrate the usage of MapInfo HTTP/FTP library API to receive/send/search files from/to FTP server.

**FTPtest.mb:** A MapBasic sample program to demonstrate the usage of MapInfo HTTP/FTP library API to receive/send/search files from/to FTP server.

### Samples\MapBasic\GEOSET Directory

**Geoset.mb:** This tool enables you to create a MapX or MapXtreme Geoset from the layers and settings of a MapInfo Pro **Map** window, or to read a MapX or MapXtreme Geoset files to load the corresponding tables and layer settings to a MapInfo Pro **Map** window.

### Samples\MapBasic\GRIDMAKR Directory

**GridMakr.mb:** This tool creates a grid (graticule) of longitude/latitude lines.

### Samples\MapBasic\HTMLImageMap Directory

**HTMLImageMap.mb:** This tool creates a clickable HTML image map from a MapInfo Pro **Map** window for use in a web browser.

### Samples\MapBasic\HTTPLIB

**HTTPUtil.mb:** A sample program to demonstrate how to wrap MapInfo HTTP/XML library internet APIs into MapBasic functions/subs.

**MapUtils.mb:** A sample program of MapBasic functions/subs to help with map-associated activities.

**TrafficInfo.mb:** A sample program to demonstrate how to use the MapInfo HTTP/XML library API to get traffic information from Yahoo.

**XMLUtil.mb:** A sample program to demonstrate how to wrap the MapInfo HTTP/XML library XML APIs into MapBasic functions/subs.

**YahooTrafficRSS.mb:** A sample program to demonstrate how to use the MapInfo HTTP/XML library API to get traffic information from Yahoo.

### Samples\MapBasic\CONDEMO Directory

**IconDemo.mb:** This tool demonstrates the built-in ButtonPad icons provided in MapInfo Pro.

### Samples\MapBasic\INC Directory

**inc.mb:** This directory contains include files that can be useful when programming in the MapBasic environment.

Among these files are:

- Definition (.DEF) files used by various of the MapBasic tools installed with MapInfo Pro. `AUTO_LIB.DEF` and `RESSTRNG.DEF` are needed by the Tool Manager registration system and the tools' string localization module, respectively (both of these are stored in the \LIB directory.)
- `MAPBASIC.DEF` contains, among other things, the definitions for general purpose macros, logical constants, angle conversion, colors, and string length. These are used as inputs for various MapBasic functions.
- `MENU.DEF` contains the definitions needed to access and/or modify MapInfo Pro's dialog boxes, toolbars, and menu items.
- `MAPBASIC.H` is the C++ version of `MAPBASIC.DEF` plus `MENU.DEF`.
- `MAPBASIC.BAS` is the Visual Basic 6.0 version of `MAPBASIC.DEF` plus `MENU.DEF`.

### Samples\MapBasic\LABELER Directory

**labeler.mb:** This tool allows you to transfer your layers labels into permanent text objects, label the current selection, and use a label tool and individually label objects into permanent text objects.

### Samples\MapBasic\LayoutTemplate

Layout templates that provide a convenient way to format print output.

**CMSGrid.mb:** This file contains helper routines used by `CMSPrint.mb`, for example a routine to print a **Browser** window in the template.

**CMSPrint.mb:** This file contains routines for rendering and printing objects, such as **Map**, **Browser**, **Label**, **Grid**, **Graph** windows, in a **Layout** window.

**CMSUtil.mb:** The `LayoutTmpl.t` file uses routines in this file for initializing the LayoutTemplate tool. For example, it contains the routines that load and parse the ini file, check if a specific table is open or not, and opens currently selected layers.

**LayoutTmpl.mb:** It is the primary file which loads and initializes the LayoutTemplate tool as per settings defined in `LayoutTemplate.ini` (which typically is located under the `C:\Users\<USER>\AppData\Roaming\MapInfo\MapInfo\Professional\<version#>\LayoutTemplate` folder.

**TmplHndlr.mb:** This file contains routines for manipulating templates for creating a new template; deleting, editing, or renaming an existing template.

**TmplUtil.mb:** This file contains some utility functions required by the LayoutTemplate tool.

### Samples\MapBasic\LEGENDS Directory

**Legends.mb:** This tool allows you to manage two or more Legend windows in MapInfo Pro. (The standard MapInfo Pro user interface has only one **Legend** window.)

### Samples\MapBasic\LIB Directory

**lib:** This directory contains a library of functions and subroutines that can be useful when programming in the MapBasic environment.

In particular, two of these files are used by many of the MapBasic tools installed with MapInfo Pro:

- `AUTO_LIB.MB` is used by most tools to help register themselves into the Tools directory.
- `RESSTRNG.MB` is used by the localized tools to look up the appropriate language strings in the tools' `.STR` files.

### Samples\MapBasic\LINESNAP Directory

**linesnap.mb:** This tool allows you to trim or extend a single-segment line to its intersection point with another chosen line.

### Samples\MapBasic\MAPWIZ Directory

**mapwiz.mb:** This tool provides a template which can be used to create a Tool Manager application.

### Samples\MapBasic\NorthArrow Directory

**northarrow.mb:** This MapBasic program creates North Arrows.

### Samples\MapBasic\PACKAGER Directory

**packager.mb:** This tool packages a copy of a workspace into a single directory for easier backups, compression, or transfer between computers.

### Samples\MapBasic\ProportionalOverlap

**ProportionalOverlap.mb:** This tool calculates proportional aggregates for objects in a target table that overlap with objects in a base table. Calculation results are added to a new or to an existing column in the target table, which you can then save.

### Samples\MapBasic\RegVector Directory

**regvector.mb:** This tool allows you to copy a table of vector objects (regions, polylines, points, etc.) from one location to another by specifying target locations for three points in the original table.

### Samples\MapBasic\RINGBUF Directory

**ringbuf.mb:** this tool allows you to create multiple "donut" ring buffers. It also will calculate sums and averages of underlying data within each ring.

### Samples\MapBasic\RMW Directory

**rotatemapwindow.mb:** This tool enables you to rotate the contents of the current **Map** window a specific number of degrees.

### Samples\MapBasic\RotateLabels Directory

**rotatelabels.mb:** This tool allows you to rotate labels.

### Samples\MapBasic\RotateSymbols Directory

**rotatesymbols.mb:** This tool allows you to rotate symbols in a table.

### Samples\MapBasic\SEAMMGR Directory

**seammgr.mb:** This tool creates and manages seamless map tables.

**Samples\MapBasic\Send2MXM Directory**

**send2mxm.mb**: This tool allows you to write custom MapX Geoset and associated .tab files to create a user-defined subset of a **Map** window's background data for display on a mobile device.

**Samples\MapBasic\SHIELDS Directory**

**Shields.mb**: This tool draws decorative frames around text objects. Note that this application only works with true text objects, not map labels.

**Samples\MapBasic\SNIPPETS Directory**

The Snippets directory contains sample programs and code snippets that you can incorporate into your custom MapInfo applications.

**Note:** In addition to containing sample code snippets, this directory also contains three tools that are installed with MapInfo Pro Tool Manager. These are the Named Views tool [NVIEW.S.MBX], the Overview tool [OVERVIEW.MBX] and the Scalebar drawing tool [SCALEBAR.MBX].

**acad.mb**: uses DDE to communicate with AutoCAD for Windows.

**addnodes.mb**: This snippet adds nodes to objects. This can be useful if you intend to project a map; the added nodes prevent slivers from appearing between regions in situations where a large region has a long, straight edge.

**geocode.mb**: This snippet demonstrates how to geocode through MapBasic.

**geoscan.mb**: This snippet scans a table to predict a geocoding hit-rate.

**get\_tab.mb**: This is a module, not a complete application. get\_tab contains routines to display a dialog box that presents the user with a list of open tables. For an example of using the get\_tab routines, see the OverView application.

**nviews.mb**: This snippet creates a "named views" application that lets you enter a name to describe your current "view" of a map (current center point and zoom distance). Once a view is defined, you can return to that view by double-clicking it from the Named Views dialog box. To link this application, use the project file `nvproj.mbp`.

**objinfo.mb**: This snippet displays descriptive information about an object.

**overview.mb**: This snippet opens a second **Map** window to show an overview of the area in an existing **Map** window. As you zoom in or out or otherwise change your view in the original map, the overview window adjusts automatically. To link this application, use the project file `obproj.mbp`.

**scalebar.mb**: This snippet draws a distance scale bar on a **Map** window. To link this application, use the project file `sbproj.mbp`.

**textbox.mb**: This is the sample program used as an example throughout this manual. To link this application, use the project file `tbproj.mbp`.

**watcher.mb**: uses DDE to communicate with Microsoft Excel; sets up an Excel worksheet to monitor global variables in a MapBasic application.

**Samples\MapBasic\SpiderGraph Directory**

**SpiderGraph.mb**: This application draws lines between objects in a single table, or the objects from two tables based on a join. It then creates a new table of lines that connect the objects from the origin table to the objects from the destination table based on matching column values.

**Samples\MapBasic\SRCHREPL Directory**

**srchrepl.mb**: performs search-and-replace operations within a table.

### Samples\MapBasic\SWSpatialize Directory

**sw\_spatialize.mb**: This program allows an existing SQL Server table that has not been set up for spatial data to be spatialized. When a SQL Server table is spatialized, it can have spatial data inserted into and extracted from it.

### Samples\MapBasic\SYMBOL Directory

**symbol.mb**: allows you to create/edit/delete MapInfo symbols. Editor that lets you customize the MapInfo symbol set.

### Samples\MapBasic\SyncWindows Directory

**syncwindows.mb**: This program synchronizes mapper windows, creates objects in all mapper windows, tiles windows, and clears cosmetic layer in all **Map** windows.

### Samples\MapBasic\TABLEMGR Directory

**tablemgr.mb**: This application lists all open tables in a list box and provides more information about a table as the user clicks on it. Also allows the user to set some table properties and view table metadata.

### Samples\MapBasic\TEMPLATE Directory

**toolapp.mb**: This is a template for a MapInfo Pro tool application. To link this application, use the project file `toolapp.mbp`.

### Samples\MapBasic\WINMGR Directory

**wmngm.mb**: This program allows you to set the title of a document window title and set the default view for a table.

### Samples\MapBasic\WorkspaceResolver

**WorkspaceResolver.mb**: This tool opens a workspace with references to tables that no longer exist. It performs a search and replace for the missing tables or resolves the workspace file by ignoring the missing tables. You can request to open or save a repaired version of the workspace. The default is to open and save the resolved workspace.

## Samples\MFC Directory

---

**FindZip**: This application demonstrates how Integrated Mapping allows you to integrate elements of MapInfo Pro into a C++ program written using Microsoft Foundation Class (MFC).

**mdimfc**: An Integrated Mapping application using C++.

## Samples\PwrBldr Directory

---

**Capitals**: An Integrated Mapping application using PowerBuilder.

**Note**: The PowerBuilder runtime libraries are not provided; you must already have PowerBuilder libraries installed to run this application.

## Samples\VB4 Directory

---

**Callback:** OLE automation callbacks.

**FindZip:** This application demonstrates how Integrated Mapping allows you to integrate elements of MapInfo Pro, such as a **Map** window, into a Visual Basic program. Requires Visual Basic 3.0 or later.

**VMapTool:** A demonstration of advanced Integrated Mapping tasks, such as callbacks. Requires Visual Basic.

## Samples\VB6 Directory

---

**Callback:** OLE automation callbacks.

**FindZip:** This application demonstrates how Integrated Mapping allows you to integrate elements of MapInfo Pro, such as a **Map** window, into a Visual Basic program.

**VMapTool:** A demonstration of advanced Integrated Mapping tasks, such as callbacks.

## Samples\RIBBONINTERFACE\DotNet Directory

---

### Samples\RIBBONINTERFACE\DotNet\BackStageAddIn Directory

This sample AddIn exposes the following behavior:

1. Changes caption of the Backstage Header.
2. Adds a BackStage tabItem.
3. Adds custom controls in BackStage tab AddIns.

#### How To Run:

1. Open BackStage.csproj
2. If MapInfo Pro x64 is installed at the default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed at the default location then update the assembly reference path for MapInfo.Types.dll, MapInfo.Events.dll, and miadm.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run BackStage.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\DotNet\Docking Support Directory

This sample AddIn demonstrates adding docking support to windows added by any user control. Also demonstrates modifying existing MapInfo Pro Windows docking properties.

#### How To Run:

1. Open DockingSupport.csproj.
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll and MapInfo.Events.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run DockingSupport.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\DotNet\FloatingWindowRibbon Directory

This sample AddIn exposes the following behavior:

1. Adding controls to Floating Window Ribbon based on the window type.

#### How To Run:

1. Open FloatingWindowRibbon.csproj
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll, MapInfo.Events.dll, and miadm.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run FloatingWindowRibbon.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\DotNet\HelloRibbon Directory

This sample AddIn enables to add a new tab in the application.

#### How To Run:

1. Open HelloRibbon.csproj.
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run HelloRibbon.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\DotNet\MapBasicBuildTask Directory

#### How To Run:

1. Open MapBasicBuildTasks.csproj
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll, MapInfo.Events.dll, and miadm.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run MapBasicBuildTasks.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\DotNet\MiniToolbar Directory

This sample AddIn demonstrates how to customize the Mapper Context Menu and Mini Tool bar.

#### How To Run:

1. Open MiniToolbar.csproj
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll and mibase.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run MiniToolbar.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.



**Samples\RIBBONINTERFACE\DotNet\ProSampleAddIn Directory**

This sample AddIn exposes the following behavior:

1. Ribbon
  - a. Customization of Ribbon tab.
  - b. Customization of gallery controls.
  - c. Exposes commands to control the behavior of existing commands in tab.
2. Hide/UnHide Backstage tabs.
3. Customizing the backstage tabs and allowing AddIns to add custom content.
4. OLE Handler.
5. Rearranging an existing MapInfo Pro Window.
6. Managing the tab grouping.
7. Hiding/UnHiding the QAT.
8. Custom windows and docking behavior.
9. Customizing floating window Ribbon.
10. Manage custom tasks.
11. Provide custom window to navigate the Object Model.

**How To Run:**

1. Open ProSampleAddIn.csproj
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll, MapInfo.Events.dll, & miadm.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run ProSampleAddIn.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

**Samples\RIBBONINTERFACE\DotNet\ProSpy Directory**

This sample AddIn monitors the events in MapInfo Pro by logging all or selected events to the message window.

**How To Run:**

1. Open ProSpy.csproj
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll and MapInfo.Events.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run ProSpy.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

**Samples\RIBBONINTERFACE\DotNet\ReBranding Directory**

This sample AddIn exposes the following behavior:

1. Change caption of Backstage Header.
2. Change application title.
3. Provide MapInfo Pro Color Scheme Editor in BackStage AddIn tab.
4. Provide option to apply a sample color scheme.
5. Hide QAT and status bar.
6. Hide About, Help and Product Tabs.
7. Rename the explorer window.

**How To Run:**

1. Open ReBranding.csproj
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll, MapInfo.Events.dll, & miadm.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run ReBranding.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\DotNet\RibbonCustomization Directory

This sample AddIn demonstrates addition of controls to ribbon. Includes examples on customizing existing ribbons and also adding new ones.

#### How To Run:

1. Open RibbonCustomization.csproj
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll and MapInfo.Events.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run RibbonCustomization.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\DotNet\RuntimeRebranding Directory

#### How To Run:

1. Open RuntimeRebranding.csproj
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll and MapInfo.Events.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run RuntimeRebranding.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\DotNet\StatusBar Directory

This sample AddIn demonstrates how to customize the MapInfo Pro status bar.

#### How To Run:

1. Open StatusBar.csproj
2. If MapInfo Pro x64 is installed in default location i.e. "C:\Program Files\MapInfo\Professional\" then you just have to build the project. In case MapInfo Pro x64 is not installed in default location then update the assembly reference path for MapInfo.Types.dll to your MapInfo Pro x64 bit installation directory and build the project.
3. Run StatusBar.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

## Samples\RIBBONINTERFACE\MapBasic Directory

---

### Samples\RIBBONINTERFACE\MapBasic\HelloRibbon Directory

This sample AddIn demonstrates adding a new tab, group and a button in MapBasic script. The button displays a message dialog.

#### How To Run:

1. Open HelloRibbon.csproj
2. Link the HelloRibbon.mbp MapBasic project.
3. Run HelloRibbon.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\MapBasic\ProSpyMB Directory

This sample AddIn enables to monitor the events in MapInfo Pro by logging all or selected events to the message window.

#### How To Run:

1. Open ProSpyMB.csproj
2. Link the ProSpyMB.mbp MapBasic project.
3. Run ProSpyMB.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.

### Samples\RIBBONINTERFACE\MapBasic\Ribbon Customization Directory

This sample AddIn demonstrates creating new ribbon and addition of controls to ribbon. Includes examples on customizing existing ribbons and also adding new ones.

#### How To Run:

1. Open Ribbon Customization.csproj
2. Link the Ribbon Customization.mbp MapBasic project.
3. Run Ribbon Customization.MBX from the project output path.

**Note:** Sample is only for MapInfo Pro 64-bit.



# Summary of Operators

Operators act on one or more values to produce a result. Operators can be classified by the data types they use and the type result they produce.

## In this section:

- **Numeric Operators** .....278
- **Comparison Operators** .....278
- **Logical Operators** .....279
- **Geographic Operators** .....279
- **Precedence** .....280
- **Automatic Type Conversions** .....281

## Numeric Operators

The following numeric operators act on two numeric values, producing a numeric result.

Operator	Performs	Example
+	addition	$a + b$
-	subtraction	$a - b$
*	multiplication	$a * b$
/	division	$a / b$
\	integer divide (drop remainder)	$a \setminus b$
Mod	remainder from integer division	$a \text{ Mod } b$
^	exponentiation	$a ^ b$

Two of these operators are also used in other contexts. The plus sign (+) acting on a pair of strings concatenates them into a new string value. The minus sign (-) acting on a single number is a negation operator, producing a numeric result. The ampersand also performs string concatenation.

Operator	Performs	Example
-	numeric negation	$- a$
+	string concatenation	$a + b$
&	string concatenation	$a \& b$

## Comparison Operators

The comparison operators compare two items of the same general type to produce a logical value of TRUE or FALSE. Although you cannot directly compare numeric data with non-numeric data (for example, String expressions), a comparison expression can compare Integer, SmallInt, and Float data types. Comparison operators are often used in conditional expressions, such as **If...Then**.

Operator	Returns TRUE if:	Example
=	a is equal to b	a = b
<>	a is not equal to b	a <> b
<	a is less than b	a < b
>	a is greater than b	a > b
<=	a is less than or equal to b	a <= b
>=	a is greater than or equal to b	a >= b

## Logical Operators

The logical operators operate on logical values to produce a logical result of TRUE or FALSE:

Operator	Returns TRUE if:	Example
And	both operands are TRUE	a And b
Or	either operand is TRUE	a Or b
Not	the operand is FALSE	Not a

## Geographic Operators

The geographic operators act on objects to produce a logical result of TRUE or FALSE:

Operator	Returns TRUE if:	Example
Contains	first object contains the centroid of the second	objectA Contains objectB
Contains Part	first object contains part of the second object	objectA Contains Part objectB
Contains Entire	first object contains all of the second object	objectA Contains Entire objectB
Within	first object's centroid is within the second object	objectA Within objectB
Partly Within	part of the first object is within the second object	objectA Partly Within objectB
Entirely Within	the first object is entirely inside the second	objectA Entirely Within objectB
Intersects	the two objects intersect at some point	objectA Intersects objectB

## Precedence

A special type of operators are parentheses, which enclose expressions within expressions. Proper use of parentheses can alter the order of processing in an expression, altering the default precedence. The table below identifies the precedence of MapBasic operators. Operators which appear on a single row have equal precedence. Operators of higher priority are processed first. Operators of the same precedence are evaluated left to right in the expression (with the exception of exponentiation, which is evaluated right to left).

Priority	MapBasic Operator
(Highest Priority)	parenthesis
	exponentiation
	negation
	multiplication, division, Mod, integer division
	addition, subtraction
	geographic operators
	comparison operators, Like operator
(Lowest Priority)	Not
	And
	Or



For example, the expression  $3 + 4 * 2$  produces a result of 11 (multiplication is performed before addition). The altered expression  $(3 + 4) * 2$  produces 14 (parentheses cause the addition to be performed first). When in doubt, use parentheses.

## Automatic Type Conversions

When you create an expression involving data of different types, MapInfo Pro performs automatic type conversion in order to produce meaningful results. For example, if your program subtracts a Date value from another Date value, MapBasic will calculate the result as an Integer value (representing the number of days between the two dates). The table below summarizes the rules that dictate MapBasic's automatic type conversions. Within this chart, the token Integer represents an integer value, which can be an Integer variable, a SmallInt variable, or an Integer constant. The token Number represents a numeric expression which is not necessarily an integer.

Operator	Combination of Operands	Result
+	Date + Number	Date
	Number + Date	Date
	Integer + Integer	Integer
	Number + Number	Float
	Other + Other	String
-	Date - Number	Date
	Date - Date	Integer
	Integer - Integer	Integer
	Number - Number	Float
*	Integer * Integer	Integer
	Number * Number	Float
/	Number / Number	Float
\	Number \ Number	Integer
MOD	Number MOD Number	Integer
^	Number ^ Number	Float



# Supported Table Types

This section lists supported data types.

## In this section:

- [Supported ODBC Table Types](#) .....284

## Supported ODBC Table Types

---

These are the ODBC data types that MapInfo Pro supports:

- SQL\_BIT
- SQL\_TINYINT
- SQL\_SMALLINT
- SQL\_INTEGER:
- SQL\_REAL
- SQL\_BIGINT
- SQL\_DECIMAL
- SQL\_DOUBLE
- SQL\_FLOAT
- SQL\_NUMERIC
- SQL\_BINARY
- SQL\_LONGVARBINARY
- SQL\_VARBINARY
- SQL\_LONGVARCHAR
- SQL\_DATE
- SQL\_TYPE\_DATE
- SQL\_TIMESTAMP
- SQL\_TYPE\_TIMESTAMP
- SQL\_TIME
- SQL\_TYPE\_TIME
- SQL\_CHAR
- SQL\_VARCHAR

# Making a Remote Table Mappable

## In this section:

- [Prerequisites for Storing/Retrieving Spatial Data . . . . .286](#)

## Prerequisites for Storing/Retrieving Spatial Data

---

There are four prerequisites for storing and retrieving points on an RDBMS table.

1. The coordinate values for the spatial data must be stored in columns of the table as numbers or a supported spatial data type.

Possible methods for accomplishing this include:

- Existing data.
- Use Easyloader to upload to the database. This application will work for all supported databases.

This is a data creation task and can be done at any time.

2. To increase performance on queries against the coordinates, a spatial index column can be included. This is done as part of the sample upload applications, if it is desired. This is a data creation task and can be done at any time.
3. MapInfo Pro stores information about which columns are the coordinates in a special table on the RDBMS system known as the MapInfo Map Catalog. There must be one Map Catalog per database. To create the Map Catalog use Easyloader or `MIODBCAT.MBX`. You can also follow the procedure for manually creating a Map Catalog, described in [Manually Creating a MapInfo\\_MapCatalog](#). This is a once only task and is required before ANY tables on that database can be mapped in MapInfo Pro.
4. MapInfo Pro gets catalog information about mappable tables using the MapBasic statement **Server Create Map**. This is a once per table task and is required before this specific table can be mapped in MapInfo Pro.

# Manually Creating a MapInfo\_MapCatalog

These instructions are for manually creating a MapInfo Map Catalog and making a remote table mappable, two procedures that are necessary for geocoding remote tables. This information is designed for users who do not have access to MapInfo Pro.

MapInfo Pro users would create a MapInfo Map Catalog automatically.

- **Making a Remote Table Mappable**

You or your database administrator must create one MapInfo Map Catalog for each database you wish to access in MapBasic.

## In this section:

- **Manually Creating a MapInfo\_MapCatalog . . . . .288**
- **Manually Making a Remote Table Mappable . . . . .289**

# Manually Creating a MapInfo\_MapCatalog

To create a MAPINFO\_MAPCATALOG manually:

1. If the RDBMS requires owners and users, then create the user MAPINFO with the PASSWORD MAPINFO in the specific database where the mappable tables are located.
2. Create the table MAPINFO\_MAPCATALOG in the database.

The Create Table statement must be equivalent to the following SQL Create Table statement:

```

Create Table MAPINFO_MAPCATALOG (
    SPATIALTYPE           Float,
    TABLENAME           Char(32),
    OWNERNAME            Char(32),
    SPATIALCOLUMN        Char(32),
    DB_X_LL              Float,
    DB_Y_LL              Float,
    DB_X_UR              Float,
    DB_Y_UR              Float,
    VIEW_X_LL            Float,
    VIEW_Y_LL            Float,
    VIEW_X_UR            Float,
    VIEW_Y_UR            Float,
    COORDINATESYSTEM    Char(254),
    SYMBOL               Char(254),
    XCOLUMNNAME          Char(32),
    YCOLUMNNAME          Char(32),
    RENDITIONTYPE        Integer,
    RENDITIONCOLUMN     VarChar(32),
    RENDITIONTABLE      VarChar(32),
    NUMBER_ROWS          Integer
)
    
```

It is important that the structure of the table is exactly like this statement. The only substitution that can be made is for databases that support varchar or text data types; these data types can be substituted for the Char data type.

3. Create a unique index on the TABLENAME and the OWNERNAME, so only one table for each owner can be made mappable.
4. Grant Select privileges to all users on the MAPINFO\_MAPCATALOG. This allows users to make tables mappable. The Update, Insert, and Delete privileges must be granted at the discretion of the database administrator.

### Spatial Index Types

The spatial index type applies to the column that has the spatial information in the DBMS table. The spatial index provides a fast way for MapInfo Pro to access the spatial data in the table. The index types to choose from are.

Spatial Index Type	Type Number
MapInfo MICODE schema (any database)	1
XY schema (any database)	4
Oracle Spatial Geometry	13



Spatial Index Type	Type Number
SpatialWare for SQL Server	14
Oracle Spatial Annotation Text	16
SQL Server Spatial (for geometry)	17
SQL Server Spatial (for geography)	18
PostGIS for PostgreSQL	19
SQL Server Spatial with M and Z values (for geometry)	20
SQL Server Spatial with M and Z values (for geography)	21

You use the XY Coordinates option when there is no index

## Manually Making a Remote Table Mappable

For each spatial table in the remote database that you want to access in MapBasic, you must add a row to the MAPINFO\_MAPCATALOG table. This is carried out in MapInfo Pro when on the **TABLE** tab, you click **Maintenance, Database, and Make DBMS Table Mappable**.

If you do not use MapInfo Pro to manage the Map Catalog, you must manually add rows to the MAPINFO\_MAPCATALOG table for each spatial table in the database that you want to geocode. Each entry must contain the following information about the table.

Column Name	Values to Assign	Example
SPATIALTYPE	<p>SPATIALTYPE values are constructed from the spatial index type from <a href="#">this table</a> and the value that represents the table contents as described here:</p> <ul style="list-style-type: none"> <li>• 0 - points only</li> <li>• 1 – lines</li> <li>• 2 - regions</li> <li>• 3 - all geometries</li> <li>• 4 – text</li> </ul>	4.2
TABLENAME	Name of the table.	Drainage
OWNERNAME	Owner name.	Georgetown
SPATIALCOLUMN	Name of the column, if any containing spatial features. The name is:	NO_COLUMN

Column Name	Values to Assign	Example
	<ul style="list-style-type: none"> <li>NO_COLUMN (for mappable tables using X,Y)</li> </ul>	
DB_X_LL	X coordinate of the lower left corner of the layer's bounding rectangle, in units indicated by the COORDINATESYSTEM as defined by MapInfo Pro.	-360
DB_Y_LL	Lower left bounding Y value.	-90
DB_X_UR	Upper right bounding X value.	360
DB_Y_UR	Upper right bounding Y value.	90
VIEW_X_LL	X coordinate of the lower left corner of the view's bounding rectangle, in units indicated by the COORDINATESYSTEM as defined by MapInfo Pro.	-360
VIEW_Y_LL	Lower left bounding Y value.	-90
VIEW_X_UR	Upper right bounding X value.	360
VIEW_Y_UR	Upper right bounding Y value.	90
COORDINATESYSTEM	<p>A string representing a MapInfo-supported coordinate system that specifies a map projection, coordinate units, etc.</p> <p>For Example:</p> <pre>Earth Projection 1,33 (for NAD 83) or</pre>	Earth Projection 1,0
SYMBOL	A <b>MapInfo Symbol</b> clause (for a layer containing points)	Symbol (35,0,12)
XCOLUMNNAME	Specify the name of the column containing X coordinates.	NO_COLUMN
YCOLUMNNAME	Specify the name of the column containing Y coordinates.	NO_COLUMN
RENDITIONTYPE	Specify 1 if on, 0 if off.	1
RENDITIONCOLUMN	Specify the name of the rendition column.	MI_SYMBOL
RENDITIONTABLE	Specify the name of the rendition table. This field is not used.	left empty
NUMBER_ROWS	Specify the number of rows in the table.	11

# Glossary

If you do not find the term you are looking for in this glossary, check the glossary in the *MapInfo Pro User Guide* on the MapInfo Pro DVD or in the *MapInfo Pro Help System*.

## In this section:

- **Definition of Terms** .....292
- **List of Embedded images in MapInfo Pro Style Resources (MapInfo Pro 64-bit)** .....301

## Definition of Terms

---

### aggregate functions

In MapBasic, functions such as **Sum( )** and **Count( )** that calculate summary information about groups of rows in a table. See *Select* in the *MapBasic Reference Guide* or *Help System*.

### alias

A name by which a MapInfo Pro user (or a MapBasic program) refers to an open table. For example, if a table name is `C:\MapInfo\Parcels.Tab`, then its alias would be `Parcels`. Table aliases may not contain spaces; any spaces in a table name become underscore characters in a table alias. Alias is also a MapBasic data type; an alias variable can store a string expression that represents a column name (for example, *World.Population*). The maximum length of an alias is 32 characters.

### animation layer

In MapInfo Pro, a special "floating" layer added to a map that allows for redraw of objects in that layer only. Modifying an object in the animation layer does not cause other layers to redraw.

### application data files

A set of configuration, template, and custom symbol files and directories that affect the basic settings and customizations of maps.

### argument

Also known as a parameter. In MapBasic, an argument is part of a statement or a function call. If a statement or function requires one or more arguments, you must specify an appropriate expression for each required argument. The argument that you specify is passed to the statement or function. In syntax diagrams in the *MapBasic Reference Guide* and *MapBasic Help*, arguments are formatted in *italics*.

### array

A grouping of variables of the same type used to keep similar elements together.

### bar chart

A type of thematic map that displays a bar chart of thematic variables for each record in a table from which the map is based.

### breakpoint

A debugging aid. To make your program halt at a specific line, place a breakpoint before that line.

### brush style

An object's fill pattern. The style is comprised of pattern, foreground color, and background color.

## ButtonPad

Another word for "toolbar".

## by reference, by value

In MapBasic, two different ways of passing parameters to a function or procedure. When you pass an argument by reference (the default), you must specify a variable name when you make the function call; the called function can modify the variable that you specify. When you pass an argument by value (using the **ByVal** keyword), you do not need to specify a variable name.

## client

An application that uses or receives information from another program. Often referred to in database connections or DDE connections.

## column

Part of a table or database. A table contains one or more columns, each of which represents an information category (for example, name, address, and phone number). Columns are sometimes referred to as "fields". Tables based on raster images do not have columns.

## comment

A programmer's note included in the program. The note has no use in the syntax necessary for compiling the program. In the MapBasic language, an apostrophe (single quotation mark - ` `) marks the beginning of a comment. When an apostrophe appears in a statement, MapBasic ignores the remainder of the line (unless the apostrophe appears inside of a literal string expression).

## compiler

A program that takes the text of a program, checks for syntax errors, and converts the code to an executable format.

## control

A component of a dialog box, such as a button or a check box.

## coordinate

An x,y location in a Cartesian coordinate system, or a Latitude, Longitude location in an earth coordinate system. Coordinates represent locations on a map relative to other locations. Earth coordinate systems may use the equator and the Greenwich prime meridian as fixed reference points. Plane coordinate systems describe a two-dimensional x,y location in terms of distance from a fixed reference and are usually in the first quadrant so that all coordinates are positive numbers.

## coordinate system

A set of parameters that specifies how to interpret the locational coordinates of objects. Coordinate systems may be earth (for example, coordinates in degrees longitude/latitude) or non-earth (for example, coordinates in feet) based; earth maps are referenced to locations on the Earth.

### Cosmetic layer

In MapInfo Pro, a temporary layer that exists on every map window. This layer always occupies the topmost position on the layer control. MapInfo Pro's `Find` command places symbols in the Cosmetic layer to mark where a location was found.

### cursor, mouse cursor, row cursor

The mouse cursor is a small image that moves as the user moves the mouse. The row cursor is a value that represents which row in the table is the current row.

### DDE

See, [Dynamic Data Exchange \(DDE\)](#) on page 294.

### degrees longitude, degrees latitude, decimal degrees

Degrees (longitude and latitude) are coordinates used to represent locations on the surface of the earth. Longitude, or X-coordinate, represents a location's east-west position, where any location west of the prime meridian has a negative X value. Latitude, or Y-coordinate, represents a location's north-south position, where any location south of the equator has a negative Y value.

### derived column

In MapBasic, a column in a query table, produced by applying an expression to values already existing in the base table. See the `Add Column` statement.

### disabled

A condition where part of the user interface (a menu command, dialog box control, or toolbar button) is not available to the user. The disabled item is generally shown as "grayed out" to indicate that it is not available. See also: [enabled](#) on page 294.

### Dynamic Link Library (DLL)

Microsoft Windows files containing shared executable routines and other resources. DLLs are generally called from one program to handle a task which often returns a value back to the original program.

### Dynamic Data Exchange (DDE)

Microsoft Windows-specific protocol that allows different applications to exchange instructions and data. Both applications must be DDE compliant for a successful exchange.

### enabled

The opposite of [disabled](#) on page 294; a condition where a menu command, dialog box control, or toolbar button is available for use.

## expression

In MapBasic, a grouping of one or more variables, constant values, function calls, table references, and operators.

## file input/output, file i/o

The process of reading information from a file or writing information to a file. Note that the MapBasic language has one set of statements for performing file i/o, and another set of statements for performing table manipulation.

## focus

In a dialog box, the active control (the control which the user is currently manipulating) is said to have the focus; pressing the Tab key moves the focus from one control to the next. Focus also refers to the active application that is running. Switching to a different application (for example, by pressing **Alt+Tab** on Windows) causes the other application to receive the focus.

## folder

An area for file storage; also called a directory.

## geographic join

A relational link between two mappable tables based on geographic criteria (for example, by determining which point objects from one table are inside of regions in the other table).

## global variable

A variable defined at the beginning of a program that can be used in any procedure or function.

## Global Positioning System (GPS)

A hardware/software system that receives satellite signals and uses the signals to determine the receiver's location on the globe.

## handler

A procedure in a program. When a specific event occurs (such as the user choosing a menu command), the handler performs whatever actions are needed to respond to the event.

## hexadecimal

A base-16 number system, often used in computer programming. Each character in a hexadecimal number can be 0-9 or A-F. In MapBasic, you must begin each hexadecimal number with the &H prefix (for example, &H1A is a hexadecimal number that equals decimal 26).

## integrated mapping

Technology that allows MapInfo Pro features, such as **Map** windows, to be integrated into other applications (such as Visual Basic programs).

### isochrone

A polygon or set of points representing the area that can be traversed in a road network from a starting point in a given amount of time.

### isodistance

A polygon or set of points representing the area that is at a certain travel distance from the starting point.

### Isogram

An Isogram is a map that displays a set of points that satisfy a distance or time condition. Isograms are either IsoChrones or IsoDistances.

### keyword

A word recognized as part of the programming language; for example, a statement or function name. In the MapBasic documentation, keywords appear in **bold**.

### latitude

The horizontal lines on a map that increase from 0 degrees at the Equator to 90 degrees at both the North (+90.0 degrees) and South (-90.0 degrees) poles. Used to describe the North-South position of a point as measured usually in degrees or decimal degrees above or below the equator.

### linked tables

A type of MapInfo table that is downloaded from a remote database. The data is taken from the remote database and transferred locally. The next time the table is linked back to the remote database, MapInfo Pro checks time stamps to see if there are any differences between the two tables. Where differences occur, the table is updated with the new information.

### linker

In MapBasic, a program that combines separate modules from a project file into a single MBX application file.

### literal value

An expression that defines a specific, explicit value. For example, 23.45 is a literal number, and "Hello, World" is a literal string. Also referred to as a hard-coded value.

### local variable

A variable that is defined and used within a specific function or procedure. Local variables take precedence over global variables of the same name.

### longitude

The vertical lines on a map, running from the North to South poles, used to describe the east-west position of a point. The position is reported as the number of degrees east (to -180.0 degrees) or west



(to +180.0 degrees) of the prime meridian (0 degrees). Lines of longitude are farthest apart at the Equator and intersect at both poles, and therefore, are not parallel.

## loop

A control structure in a program that executes a group of statements repeatedly. Incorrect coding of a loop can create an infinite loop (a situation where the loop never ends).

## MapBasic Window

A window in the MapInfo Pro user interface. From MapInfo Pro's **Options** menu, choose **Show MapBasic Window**. You can type MapBasic statements into the MapBasic window, without compiling a program.

## MapInfo Runtime

A special version of MapInfo Pro that contains all of the geographic and database capabilities of a full version but does not include the specific menu and toolbar options in a standard package. Used to create customized versions of MapInfo Pro.

## MBX file

A MapBasic executable file, which the user can run in MapInfo Pro on the **Home** tab by pointing to **Tools** and **Run MapBasic Program**. Any MapInfo Pro user can run an MBX file. To create an MBX file, you must use the MapBasic development environment.

## metadata

In MapInfo Pro, information about a table (such as date of creation, copyright notice, etc.) stored in the .TAB file instead of being stored in rows and columns.

## methods, OLE methods

In MapBasic, part of OLE Automation. Calling an application's methods is like calling a procedure that affects the application.

## module-level variable

A variable that can be accessed from any function or procedure in an program file, although it cannot be accessed from other program files in the same project. Created by defining the variable outside of any function or procedure.

## native

A standard file format. Choosing MapInfo Pro's **File > New** menu command creates a native MapInfo table, but a table based on a spreadsheet or text file is not in MapInfo's native file format.

## object

A graphical object is an entity that can appear in a **Map** or **Layout** window (for example, lines, points, or circles). A MapBasic object variable is a variable that can contain a graphical object. The Object column name refers to the set of objects stored in a table. An OLE object is a Windows-specific entity (produced, for example, through drag and drop).

## Object Linking and Embedding (OLE)

Technology that allows objects created in one application to be used in another application. An object can be any information such as a map, chart, spreadsheet, sound effect, or text. Embedding is the process of inserting an object from a server into a container application.

## automation, OLE automation

In MapInfo Professional, OLE Automation is technology through which one Windows application can control another Windows application. For example, a Visual Basic application can control MapInfo Pro through MapInfo Pro's Automation methods and properties.

## operator

A special character or word that acts upon one or more constants, variables, or other values. For example, the minus operator (-) subtracts one number from another.

## parameter

Another word for "argument".

## pen style

The line style set for an object. The style is comprised of width, pattern, and color.

## pie chart

A circle divided into sectors representing values as percentages in comparison to one another. MapInfo Pro can display pie charts in the **Graph** window or in thematic maps.

## platform

An operating environment for computer software (for example, Windows, Linux).

## procedure, sub procedure

In MapBasic, a group of statements enclosed within a **Sub...End Sub** construction. Sometimes referred to as a routine or a subroutine.

## progress bar

A standard dialog box that displays a horizontal bar, showing the percent complete.

## project, project file

In MapBasic, a project is a collection of modules. A project file (.MBP file) is a text file that defines the list of modules. Compiling all modules in the project and then linking the project produces an application (MBX) file.

**property, OLE property**

Part of OLE Automation. A property is a named attribute of an OLE object. To determine the object's status, read the property. If a property is not read-only, you can change the object's status by assigning a new value to the property.

**raster underlay table**

A table that consists of a raster image. This table does not contain rows or columns; therefore, some MapBasic statements that act on tables cannot be used with raster underlay tables.

**record**

A collection of related fields treated as a unit, such as a record for a customer containing fields for name, address, and telephone number.

**recursion**

A condition where a function or procedure calls itself. While recursion may be desirable in some instances, programmers should be aware that recursion may occur unintentionally, especially with special event handlers such as SelChangedHandler.

**remote data**

Data stored in a remote database, such as an Oracle or SYBASE server.

**routine**

In MapBasic, a group of statements that performs a specific task; for example, you can use the `OnError` statement to designate a group of statements that will act as the error-handling routine.

**row**

Another word for "record".

**run time**

The time at which a program is executing. A runtime error is an error that occurs when an application is running.

**scope of variables**

Refers to whether a variable can be accessed from anywhere within a program (global variables) or only from within a specific function or procedure (local variables). If a procedure has a local variable with the same name as a global variable, the local variable takes precedence; any references to the variable name within the procedure will use the local variable.

**seamless tables**

A type of table that groups other tables together, making it easier to open and map several tables at one time.

### server

An application that performs operations for or sends data to another application (the client). Often referred to in database connections or DDE connections.

### Shortcut menu

A menu that appears if the user clicks the right mouse button.

### source code

The uncompiled text of a program.

### standard

Standard menu commands and standard toolbar buttons appear as part of the default MapInfo Pro user interface. Standard dialog boxes are dialog boxes that have a predefined set of controls (for example, the **Note** statement produces a standard dialog box with one static text control and an **OK** button). If a MapBasic program creates its own user interface element (dialog box or toolbar button) that element is referred to as a custom dialog box or a custom button.

### statement

An instruction in a MapBasic program. In a compiled MapBasic program, a statement can be split across two or more lines.

### status bar

In MapInfo Pro, a bar at the bottom of the screen that displays messages that help in using MapInfo Pro. The StatusBar also displays messages that pertain to the active window. In a Map window, the StatusBar indicates what layer is editable, the zoom display of the map, and the status of Snap and Digitizing modes. In a Browser window, the StatusBar indicates the number of records currently displaying and the total number of records. In a Layout window, the StatusBar indicates the zoom display as a percentage of the actual size of the map.

### Status Bar Help

A help message that appears on the status bar when the user highlights a menu command or places the mouse cursor over a toolbar button.

### subroutine

A group of statements; in MapBasic syntax, subroutines are known as procedures or sub procedures.

### toolbar

A set of buttons. The user can "dock" a toolbar by dragging it to the top edge of the application's work area. The MapBasic documentation often refers to toolbars as "ButtonPads" because **ButtonPad** is the MapBasic-language keyword that you use to modify toolbars.

## ToolTip

A brief description of a toolbar button; appears next to the mouse cursor when the user holds the mouse cursor over a button.

## transparent fill

A fill pattern, such as a striped or cross-hatch pattern, that is not completely opaque, allowing the user to see whatever is "behind" the filled area.

## variable

A small area of memory allocated to store a value.

# List of Embedded images in MapInfo Pro Style Resources (MapInfo Pro 64-bit)

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Prefix the below images URI with "pack://application:,,/MapInfo.StyleResources;component/Images" to use them in addins.

- Images/Application/closeAll\_16x16.png
- Images/Application/closeAll\_32x32.png
- Images/Application/closeDbms\_16x16.png
- Images/Application/closeDbms\_32x32.png
- Images/Application/import\_16x16.png
- Images/Application/import\_32x32.png
- Images/Application/MPABOUT.BMP
- Images/Application/openDbms\_16x16.png
- Images/Application/openDbms\_32x32.png
- Images/Application/openUniversal\_16x16.png
- Images/Application/openUniversal\_32x32.png
- Images/Application/openWfs\_16x16.png
- Images/Application/openWfs\_32x32.png
- Images/Application/openWms\_16x16.png
- Images/Application/openWms\_32x32.png
- Images/Application/openWorkspace\_16x16.png
- Images/Application/openWorkspace\_32x32.png
- Images/Application/print\_16x16.png
- Images/Application/print\_32x32.png
- Images/Application/saveWorkspace\_16x16.png
- Images/Application/saveWorkspace\_32x32.png
- Images/Window/tasksWindow\_16x16.png
- Images/Window/tasksWindow\_32x32.png
- Images/Window/toolManager\_16x16.png
- Images/Window/toolManager\_32x32.png
- Images/Window/windowList\_16x16.png
- Images/Window/windowList\_32x32.png
- Images/Mapping/addBaseMap\_16x16.png

- Images/Mapping/addBaseMap\_32x32.png
- Images/Mapping/addLayer\_16x16.png
- Images/Mapping/addLayer\_32x32.png
- Images/Mapping/addTheme\_16x16.png
- Images/Mapping/addTheme\_32x32.png
- Images/Mapping/areaSelect\_16x16.png
- Images/Mapping/areaSelect\_32x32.png
- Images/Mapping/basemapAerial\_16x16.png
- Images/Mapping/basemapAerial\_32x32.png
- Images/Mapping/basemapHybrid\_16x16.png
- Images/Mapping/basemapHybrid\_32x32.png
- Images/Mapping/basemapRoads\_16x16.png
- Images/Mapping/basemapRoads\_32x32.png
- Images/Mapping/boundarySelect\_16x16.png
- Images/Mapping/boundarySelect\_32x32.png
- Images/Mapping/changeView\_16x16.png
- Images/Mapping/changeView\_32x32.png
- Images/Mapping/clearCustomLabels\_16x16.png
- Images/Mapping/clearCustomLabels\_32x32.png
- Images/Mapping/clear\_16x16.png
- Images/Mapping/clear\_32x32.png
- Images/Mapping/cloneMap\_16x16.png
- Images/Mapping/cloneMap\_32x32.png
- Images/Mapping/copy\_16x16.png
- Images/Mapping/copy\_32x32.png
- Images/Mapping/cut\_16x16.png
- Images/Mapping/cut\_32x32.png
- Images/Mapping/dragMap\_16x16.png
- Images/Mapping/dragMap\_32x32.png
- Images/Mapping/graphSelect\_16x16.png
- Images/Mapping/graphSelect\_32x32.png
- Images/Mapping/infoTool\_16x16.png
- Images/Mapping/infoTool\_32x32.png
- Images/Mapping/invert\_16x16.png
- Images/Mapping/invert\_32x32.png
- Images/Mapping/labelPriority\_16x16.png
- Images/Mapping/labelPriority\_32x32.png
- Images/Mapping/labelTool\_16x16.png
- Images/Mapping/labelTool\_32x32.png
- Images/Mapping/layerControl\_16x16.png
- Images/Mapping/layerControl\_32x32.png
- Images/Mapping/lockScale1\_16x16.png
- Images/Mapping/lockScale1\_32x32.png
- Images/Mapping/lockScale2\_16x16.png
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- Images/Mapping/lockScale\_16x16.png
- Images/Mapping/lockScale\_32x32.png
- Images/Mapping/mapOptions\_16x16.png
- Images/Mapping/mapOptions\_32x32.png
- Images/Mapping/marqueeSelect\_16x16.png
- Images/Mapping/marqueeSelect\_32x32.png

- Images/Mapping/measure\_16x16.png
- Images/Mapping/measure\_32x32.png
- Images/Mapping/moveTo\_16x16.png
- Images/Mapping/moveTo\_32x32.png
- Images/Mapping/newBrowser\_16x16.png
- Images/Mapping/newBrowser\_32x32.png
- Images/Mapping/newMap\_16x16.png
- Images/Mapping/newMap\_32x32.png
- Images/Mapping/openTable\_16x16.png
- Images/Mapping/openTable\_32x32.png
- Images/Mapping/pan\_16x16.png
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- Images/Mapping/paste\_16x16.png
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- Images/Mapping/redistrict\_16x16.png
- Images/Mapping/redistrict\_32x32.png
- Images/Mapping/scalebar\_16x16.png
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- Images/Mapping/selectableLabels\_16x16.png
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- Images/Mapping/select\_16x16.png
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- Images/Mapping/sqlSelect1\_16x16.png
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- Images/Mapping/sqlSelect\_16x16.png
- Images/Mapping/sqlSelect\_32x32.png
- Images/Mapping/statsWindow\_16x16.png
- Images/Mapping/statsWindow\_32x32.png
- Images/Mapping/undo\_16x16.png
- Images/Mapping/undo\_32x32.png
- Images/Mapping/zoomIn\_16x16.png
- Images/Mapping/zoomIn\_32x32.png
- Images/Mapping/zoomOut\_16x16.png
- Images/Mapping/zoomOut\_32x32.png
- Images/Mapping/zoomTo\_16x16.png
- Images/Mapping/zoomTo\_32x32.png
- Images/Table/addNewRow\_16x16.png
- Images/Table/addNewRow\_32x32.png
- Images/Table/addToLibrary\_16x16.png
- Images/Table/addToLibrary\_32x32.png
- Images/Table/addToMap\_16x16.png
- Images/Table/addToMap\_32x32.png
- Images/Table/appendRows\_16x16.png
- Images/Table/appendRows\_32x32.png
- Images/Table/browserFont\_16x16.png
- Images/Table/browserFont\_32x32.png
- Images/Table/clearFilter\_16x16.png
- Images/Table/clearFilter\_32x32.png
- Images/Table/clearSortFilter\_16x16.png
- Images/Table/clearSortFilter\_32x32.png
- Images/Table/closeTable\_16x16.png

- Images/Table/closeTable\_32x32.png
- Images/Table/createPoints\_16x16.png
- Images/Table/createPoints\_32x32.png
- Images/Table/filter\_16x16.png
- Images/Table/filter\_32x32.png
- Images/Table/findMapSelection\_16x16.png
- Images/Table/findMapSelection\_32x32.png
- Images/Table/geocodeServer\_16x16.png
- Images/Table/geocodeServer\_32x32.png
- Images/Table/geocode\_16x16.png
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- Images/Table/showGridlines\_16x16.png
- Images/Table/showGridlines\_32x32.png
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- Images/Table/sortAscending\_32x32.png
- Images/Table/sortClearSort\_16x16.png
- Images/Table/sortClearSort\_32x32.png
- Images/Table/sortDescending\_16x16.png
- Images/Table/sortDescending\_32x32.png
- Images/Table/sortMulticolumn\_16x16.png
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- Images/Table/sort\_32x32.png
- Images/Table/sort\_onOff\_16x16.png
- Images/Table/sort\_onOff\_32x32.png
- Images/Table/updateColumn\_32x32.png
- Images/Table/viewEditMetadata\_16x16.png
- Images/Table/viewEditMetadata\_32x32.png
- Images/Application/clearMapbasicWindow\_16x16.png
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- Images/Application/getTools\_16x16.png
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- Images/Application/saveMapbasicContents\_32x32.png
- Images/Layout/addHorizGuideline\_16x16.png
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- Images/Layout/pageLines\_16x16.png
- Images/Layout/pageLines\_32x32.png
- Images/Layout/regionStyle\_16x16.png
- Images/Layout/regionStyle\_32x32.png
- Images/Layout/reorderBackward\_16x16.png
- Images/Layout/reorderBackward\_32x32.png
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- Images/Layout/reorderBack\_32x32.png
- Images/Layout/reorderForward\_16x16.png
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- Images/Layout/textAllCaps\_16x16.png
- Images/Layout/textAllCaps\_32x32.png
- Images/Layout/textExpanded\_16x16.png
- Images/Layout/textExpanded\_32x32.png
- Images/Layout/textHalo\_16x16.png
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- Images/Mapping/insertLegend\_32x32.png
- Images/Mapping/new3DMap\_16x16.png
- Images/Mapping/new3DMap\_32x32.png
- Images/Mapping/newPrismMap\_16x16.png
- Images/Mapping/newPrismMap\_32x32.png
- Images/Window/connectionsWindow\_16x16.png
- Images/Window/exportImage\_16x16.png
- Images/Window/exportImage\_32x32.png
- Images/Window/recoverWindows\_16x16.png
- Images/Window/recoverWindows\_32x32.png
- Images/Window/redrawWindows\_16x16.png
- Images/Window/redrawWindows\_32x32.png
- Images/Window/ruler\_16x16.png
- Images/Window/ruler\_32x32.png
- Images/Window/statsWindow\_16x16.png
- Images/Window/statsWindow\_32x32.png
- Images/Window/tools\_16x16.png
- Images/Window/tools\_32x32.png
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