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PROFICY® SOFTWARE & SERVICES

PROFICY iFIX HMI/SCADA

Writing Scripts

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Writing Scripts

The Writing Scripts manual is intended for system integrators, OEMs, and process control engineers responsible for customizing their iFIX® software automation solution using Visual Basic for Applications. The manual assumes that you are familiar with Microsoft Windows and the Visual Basic programming language.

The first few sections of the book provide some background on Microsoft Visual Basic for Applications (VBA), but the intent of this manual is to describe the implementation of VBA within iFIX, not to explain how to program in Visual Basic.

If you are new to the Visual Basic language, you may want to consult one of several sources of information on the basics of VB programming, which are beyond the scope of this book. If you are a novice VB programmer, check out the Getting Started with iFIX and VBA chapter to learn where to find information on general VB programming topics.

Introduction

This introduction contains the following sections:

- Common Scripting Solutions
- Sample Code
- Development Tips

The Getting Started with iFIX and VBA chapter describes basic information on using the VBA programming language, and describes several key components of the VBA environment.

Starting with the section Optimizing Your VBA Project Development, this manual teaches you how to write VBA code for iFIX objects. The intention of these sections is to teach you how to code by example, and many times the best explanation of the sample code lies within the commented lines (lines that begin with an apostrophe — these lines are for explanatory remarks and are ignored by the VBA compiler), so look carefully. Because each section is dedicated to a different object, you can find the information you need quickly and easily.

Common Scripting Solutions

Several of this manual's VBA scripting examples were added based on feedback that we received from iFIX users like yourself. Check the section names in the Table of Contents for the task that best describes what you want to do through scripting.

If you find one that matches what you're looking for, click it to jump to the related section in this manual. If you don't find a match, browse the section that most closely fits your needs, as there are several examples or related topics within each section.

Sample Code

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One of the best ways to learn any programming language is to examine code that already exists and try to decipher how the code works. This manual contains a great deal of sample code that you can cut and paste directly into the Visual Basic Editor. The following is a list of the sample scripts included in this manual. You can click on an example title to view the sample code.

Working with iFIX Objects

- Example: Building an Animation Connection through a Script
- Example: Script Using ParseConnectionSource Method
- Example: Script Using GetConnectionInformation Method with IsConnected Method
- Example: Script Using the GetPropertyAttributes Method
- Example: Script Using CanConstruct Method
- Example: Script Using Construct Method
- Example: Script Using ValidateSource Method
- Example: Using Range Comparison
- Example: Using Exact Match Lookup
- Example: Animating the Rotation of an Object
- Example: Rotating a Group Using a Script

Manipulating Pictures

- Example: Creating a Toolbar
- Example: Using an Alias to Open and Close Displays
- Example: Using the ReplacePicture Subroutine

Accessing Real-time Data

- Example: Group Write
- Example: Group Read
- Example: Writes to Alternate Sources
- Example: Using the Database Tag's Value Property

Accessing Data from a Relational Database: Using ADO

- Example: Creating an ADO Record set
- Example: Populating a Flexgrid with Data from an ADO Record set
- Example: Adding a Record to a Database Using an ADO Recordset
- Example: Updating a Database Using an ADO Record set
- Example: Deleting a Record from a Database Using an ADO Record set

Working in the Run-time Environment

- Example: Changing the Data Source of an Animation Connected to an Object
- Example: Form Code
- Example: Module Code
- Example: iFIX Object Code

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Working with the Scheduler

- Example: Checking Disk Space and Triggering an Alarm if Too Low
- Example: Recording DownTime Monitoring

Manipulating Charts

- Example: Scroll Back and Scroll Forward Buttons
- Example: Creating Buttons that Scroll Back and Scroll Forward through Historical Data and Set Current Time
- Example: Using GetPenDataArray to Extract Data from Pen
- Example: SetPenDataArray Method with Hardcoded Values

Working with iFIX Security

- Example: Excerpt from Script which opens the Login Application
- Example: Using the System Object's FixGetUserInfo Method

Creating Tag Groups

- Example: Modifying Tag Group Data
- Example: Manipulating Tag Group Data

Using Samples in the VBA Help File and Source Code

Also, the iFIX Automation Interfaces help file has an example for each method in the system, and the VBA Help file contains an entire section devoted to nothing but sample code.

You can also look at the Visual Basic source code for all iFIX toolbars, Experts, and Wizards.

To view the Visual Basic source code:

1. In the iFIX WorkSpace, open a new picture.
2. In Ribbon vView, on the Home tab, in the WorkSpace group, click Settings, and then click Toolbars.

   - Or -

   In Classic view, on the WorkSpace menu, click Toolbars.
3. Select each toolbar in the Toolbars list box. Click the Close button.
4. In Ribbon view, on the Home tab, in the WorkSpace group, click Visual Basic Editor.

   - Or -

   In Classic view, on the WorkSpace menu, click Visual Basic Editor.
5. In the VBE, select the Project Explorer command from the View menu.
6. In the Project Explorer, click the plus sign (+) next to any of the available projects to show the contents of the project.
7. Double-click a form or module within the project to display it in the VBE. For example, if you expand the Project_Experts project, expand its Forms folder, and double-click the frmFill form to view the Fill Expert form.

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WARNING: Although you can look at the source code for the above mentioned objects within iFIX, do not modify any of the code or your environment may not work as expected.

Development Tips

The open architecture of iFIX provides an extremely flexible automation interface. In fact, you may learn that, in some cases, you can write two or more very different VBA scripts that achieve the same end result. In the code samples throughout this manual, you will find tips, suggestions, and tricks in an effort to help you discover the most efficient ways to automate iFIX with VBA.

Getting Started with iFIX and VBA

Visual Basic for Applications, or VBA, is the standard scripting language built into iFIX®. VBA was once only available in Microsoft Office applications. However, Microsoft has made VBA available through licensing, so companies like GE can integrate the language directly into their products.

Refer to the following sections for more information on how to get started with iFIX and VBA:

- What You Can Do With iFIX and VBA
- Components of a VBA Project
- Components of the VBA Editor
- Using VBA Forms
- VBA File Types
- Testing Your Code
- Saving Your Work
- Configuring VBA Options
- Configuring VBA Project Options
- Datatype Checking and the VBA Compiler

What You Can Do With iFIX and VBA

VBA can be used to customize and extend the functionality of iFIX. For example, you can create a custom wizard that automatically builds an iFIX picture at the click of a button. This functionality allows a user to develop automatic picture creation templates that can greatly reduce development time and effort when developing applications with large numbers of pictures. In addition, VBA enables you to manipulate, retrieve, and modify data from iFIX applications. For example, you can write a script that reads data from a database block and stores that information into a Microsoft SQL Server database. You can manipulate the objects in an iFIX picture based on the information in a Microsoft Word document. When you use VBA with iFIX, you build the most powerful industrial automation solution available.

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Once you begin working with the iFIX object model, you will start to understand how powerful VBA really is. Through VBA, you can:

- Extend or customize the functionality of iFIX applications.
- Manipulate an iFIX application or its data.
- Create your own custom dialog boxes to exchange data with operators.
- Integrate data from several iFIX applications.
- Create wizards that can perform several tasks at the click of a button.

VBA Features Not Supported in iFIX

- Ability to choose ActiveX Designers as project items.
- Developer add-ins (COM add-ins).
- Digital signatures for VBA projects.
- Multi-threaded projects.
- Strengthened project passwords.

Components of a VBA Project

First, let's take a look at the components of a VBA project:

- Host Application
- Visual Basic Editor
- Modules
- Forms

Host Application

All VBA projects must be associated with an application; you cannot create a stand-alone VBA project. The application that the VBA project is tied to is called the *host application*. In the case of iFIX, the host application is the iFIX WorkSpace, and each VBA project is embedded in an iFIX picture file (*.GRF), toolbar file (*.TBX), toolbar category file (*.TBC), schedule file (*.EVS), Dynamo set file (*.FDS), or User file (USER.FXG).

Visual Basic Editor

The Visual Basic Editor, or VBE, is the development environment that allows you to write and debug code, develop user forms, and view the properties of your VBA project.

Modules

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If you are developing large VBA projects, it may make sense to separate the code into several modules. Modules are self-contained blocks of code that perform a particular function. For example, if you wanted to write a wizard that creates a real-time chart for a specific data point, you may want to break the project up into three modules: one module to retrieve the value after prompting the operator to specify a data source, one module to plot the data after prompting the operator to specify a chart type, and one module to create the chart based on the operator's specifications.

NOTE: Do not include modules in Dynamo objects, since they are not moved with the Dynamo object.

Forms

Forms are custom dialog boxes that you create in VBA in order to exchange information with the operator. Examples of forms are message boxes, input dialogs, and configuration screens. Forms are essential in helping the application and the operator interact.

Components of the VBA Editor

There are several ways to launch VBA from iFIX. You can:

- In the iFIX WorkSpace, in Ribbon view, on the Tools tab, click Visual Basic Editor.
- In Classic view, select the Visual Basic Editor command from the WorkSpace menu.
- In Classic view, click the Visual Basic Editor toolbar button on the Standard Toolbar.
- Right-click the object that you want to write a script for and select Edit Script from the pop-up menu.
- Click the Edit Script button when adding a button to a custom toolbar through the Customize Toolbar dialog box. See the Understanding Toolbars section of the Understanding iFIX manual for more information on how to customize toolbars.
- Click the VB Editor button on the Add Timer Entry and Add Event Entry dialog boxes when creating an iFIX schedule or when using the Event or Timer Experts.

After you launch VBA, the Visual Basic Editor appears. The VBE consists of several different tools and windows to help you design, create, and manage your VBA projects. The tools you will use most often are shown in the following figure.

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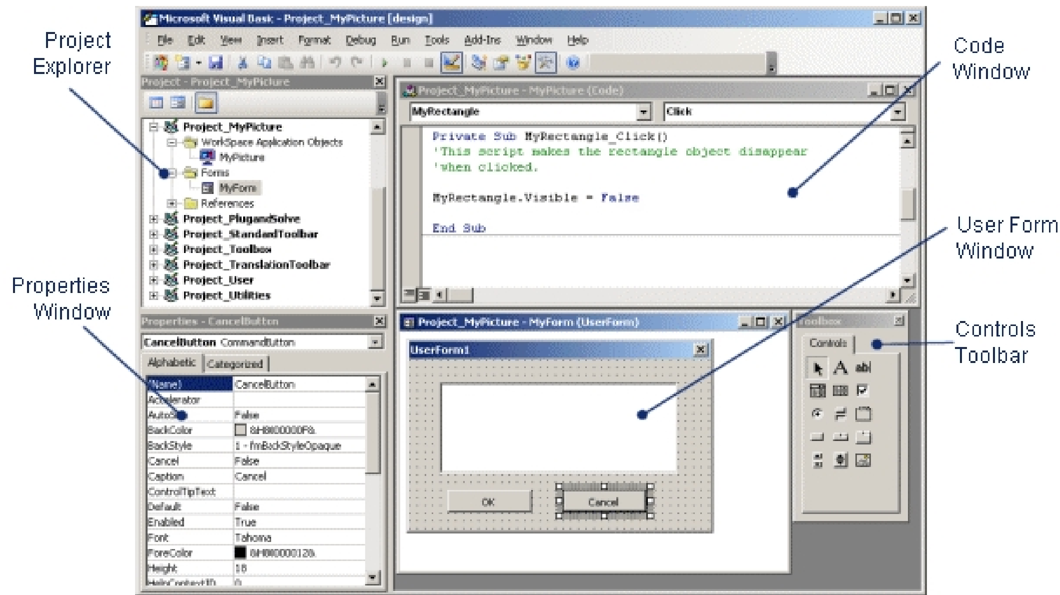

Microsoft Visual Basic Editor

Project Explorer

The Project Explorer is a special window in the VBE that shows each of the elements of your VBA project. The elements are presented in a tree format, with each branch displaying related information, such as forms, code modules, and elements from iFIX, such as pictures, toolbars, and global pages.

The Project Explorer makes it easy to select the project elements that you want to work with. For example, if you want to add a button to a particular form you've been working on, you can select the form from the Project Explorer. After you select a project element to edit, the VBA editor opens the appropriate tool. For example, if you select a form, the form displays on screen with the Form Toolbox available.

There are two ways to select and edit a project element that displays in the Project Explorer:

- Double-click the object.
- Choose the object, right-click, and then choose either View Object or View Code. Only the appropriate choice will be available. For example, View Object would not be available if you chose a code module.

To view the Project Explorer, select the Project Explorer command from the View menu or press Ctrl+R.

To learn more about the Project Explorer, refer to the Help topics within the sections Visual Basic User Interface Help and Visual Basic How-To Topics of the Visual Basic for Applications Help file, or search for the Index keywords "Project Explorer".

Properties Window

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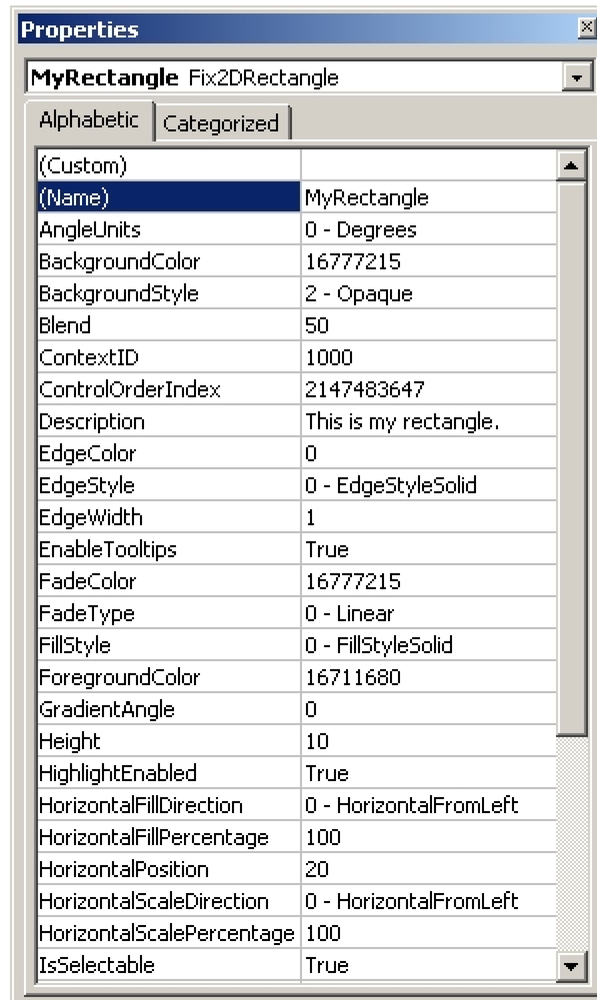
The Properties window is used to review and set properties for project objects. For example, you can set the background color for an iFIX picture in the Properties window, or you can change the name of a rectangle within that picture.



Properties Window

To view the Properties window:

In Ribbon view, on the View tab, in the Window group, click Property Window.

- Or -

In Classic view, on the View Menu, select the Property Window command.

- Or -

Press <F4>.

The Properties window displays the properties for the current object. When you select different objects in your VBA project, the Properties window changes to show just the properties of the object you selected. You can select the current object to work with in the Properties window by:

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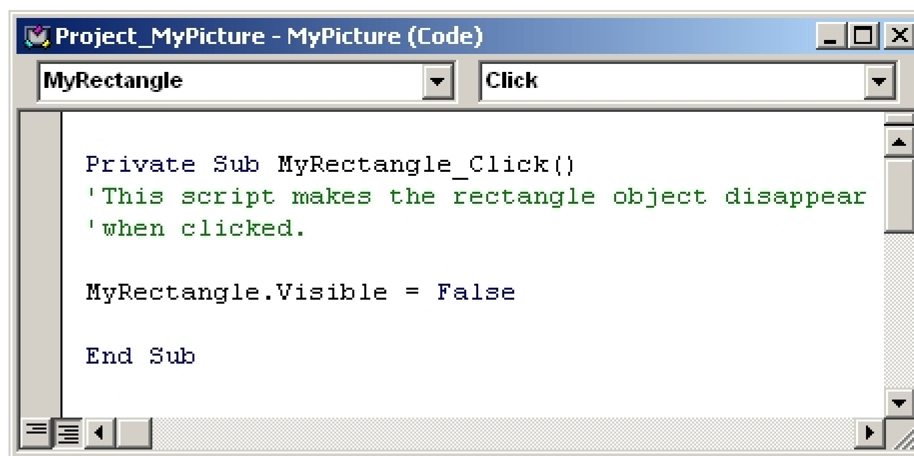
- Selecting the object from the drop-down list at the top of the Properties window.
- Selecting the object from the Project Explorer and then returning to the Properties window.
- Selecting the object (or control) within a form and then returning to the Properties window.

The Properties window consists of two panes: the names of the current object's properties appear in the left pane; the values for these properties appear in the right pane. To change a property, select the property in the left pane and click and edit the value in the right pane. Some properties have a predefined list of valid values, which allows you to choose from a drop-down list. Other properties require a value of Yes or No. In this case, you can simply double-click the Value column to toggle the value between Yes and No.

To learn more about the Property Window, refer to the Help topics within the sections Visual Basic User Interface Help and Visual Basic How-To Topics of the Visual Basic for Applications Help file, or search for the Index keyword "windows".

Code Window

The Code window is where you write any code associated with your VBA project. You could write code which is executed when the user clicks a button in an iFIX picture, or it could be a part of a procedure library you've written to serve your entire project.



Code Window

Two drop-down lists are located just below the title bar. One drop-down list shows all of the objects referenced in the code module, while the other drop-down list shows the procedures associated with each object.

To display the code window, do any of the following:

- Right-click an object in the iFIX WorkSpace and select Edit Script from the pop-up menu.
- Double-click any code element in your application in the Project Explorer, such as modules and class modules.
- Double-click anywhere on any form in your VBA project or any control on a form.
- Choose View Code from the VBE window. If you want to view the code for a specific project element, such as a worksheet, be sure you select that element first in the Project Explorer.

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- Choose the Module command from the Insert menu, or right-click the Project Explorer and then choose Insert Module.

Once the Code window is displayed, you can enter your code directly into the window.

To learn more about the Code window, refer to the Help topics within the sections Visual Basic User Interface Help and Visual Basic How-To Topics of the Visual Basic for Applications Help file, or search for the Index keyword "code window".

TIP: Remember, a great way to learn how to use VBA with iFIX is to view the scripts behind all of the Application Toolbar buttons. To view the code behind these buttons, run the Visual Basic Editor and expand the Toolbar (ApplicationToolbar) project in the Project Window.

WARNING: Do not update these files. Doing so may cause the toolbar buttons to stop working properly.

Using VBA Forms

It is likely that your VBA project will need a custom form. For example, you might provide the operator with a choice of options before your program executes some task, like importing data. Or you might want to provide the operator with a custom data entry dialog box.

In VBA, you build these forms yourself. These forms are just like the dialog boxes you've seen or used in Microsoft Windows, such as the logon dialog box shown when you start up. The only difference is that you get to choose how these dialogs appear, when they appear, and what they do.

To learn more about Visual Basic forms, refer to the Help topics within the sections Microsoft Forms Design Reference, Microsoft Forms Developer's Tips, and Microsoft Forms Object Model Reference of the Visual Basic for Applications Help file, or search for the Index keyword "forms".

Using VBA Forms within iFIX

One concept that you should keep in mind when launching forms from iFIX is the idea of *modal* and *modeless* forms. A form is *modal* if it does not allow you to work with its host application while it is being displayed. Conversely, if a form is *modeless* it allows you to work with its host application even while it is displayed.

If you launch a modal form from a VBA script within iFIX, users must respond to the form before they can continue working with the iFIX environment (which includes selecting menus, toolbars, objects in a picture, and so forth). No subsequent code is executed until the form is hidden or unloaded. When a form is modeless, all subsequent code is executed as it is encountered.

WARNING: Never try to unload a form from within the same form, or from any control within the form. Instead, call the Hide method from within the form, and unload it from the main routine once it is hidden.

Modeless forms do not appear in the task bar and are not in the window tab order. To call a modeless form, use the following code:

```
userForm1.Show vbModeless
```

NOTE: You may lose data associated with a modeless UserForm if you make a change to the UserForm project that causes it to recompile, for example, removing a code module.

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When using a modeless form, if you do not want to allow the user to get to the WorkSpace, use the DeActivateWorkspaceUI which essentially disables the WorkSpace UI. For more information, see the DeActivateWorkspaceUI method topic in the iFIX Automation Interfaces Electronic Book.

Inserting an Alarm Summary object into a VBA form may cause unpredictable results when opening the picture or switching environments from run-time to configuration or vice versa.

VBA File Types

The VBA Editor allows you to import and export components of your VBA projects. This makes it easy to share your work with other applications and Visual Basic projects.

If there is a component of another VBA project you would like included in the project you are working on, that component must first be exported from the source project and imported into your project. Components of a VBA application are always stored separately, so you can load a component from a VB project easily. The following table shows the typical extensions used for VBA components, so you will know what type of file to look for when you import to VBA:

Extension	Component
FRM	Form
CLS	Class Module
BAS	Code Module

To learn more about importing and exporting Visual Basic files, refer to the Help topics within the section Visual Basic User Interface Help of the Visual Basic for Applications Help file, or search for the Index keywords "import" and "export".

VBA Naming Conventions

You must adhere to the following standard VBA naming conventions when naming iFIX pictures, schedules, objects, variables, modules, and procedures. You can find this information in the Help topics within the section Visual Basic Naming Rules of the Visual Basic for Applications Help file:

- You must use a letter as the first character.
- Names cannot exceed 255 characters in length.

  NOTE: Visual Basic for Applications isn't case-sensitive, but it preserves the capitalization in the statement where the name is declared.
- You should not use any names that are identical to the functions, statements, and methods in Visual Basic because you may shadow the same keywords in the language.
  - To use an intrinsic language function, statement, or method that conflicts with an assigned name, you must explicitly identify it.

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- Precede the intrinsic function, statement, or method name with the name of the associated type library. For example, if you have a variable called Right, you can only invoke the Right function using VBA.Right.

- You cannot repeat names within the same level of scope. For example, you cannot declare two variables named *level* within the same procedure. However, you can declare a private variable named *level* and a procedure-level variable named *level* within the same module.
- You cannot use a space, hyphen (-), period (.), exclamation mark (!), or the characters @, &, $, # in the name.

  NOTE: If you have database tags that contain invalid VBA characters, such as hyphens, and you want to manipulate these tags through scripts, you can use two iFIX subroutines (ReadValue and WriteValue) to do so. You can learn more about the ReadValue and WriteValue subroutines in the section Optimizing Your VBA Project Development, or in the iFIX Automation Interfaces Electronic Book.
- You should not use an underscore (_) in the name. It may cause problems with scripting, because VBA uses underscores in the naming of scripts associated with objects.
- Pictures, schedules, Dynamo sets, toolbars, and toolbar categories require unique names so that the iFIX WorkSpace can load them simultaneously. This is true even though the file name extensions differ for different document types. The following scenarios illustrate this point:
  - If you attempt to open a picture whose name conflicts with a document that is already open, you will not be able to open the picture. Instead, the following text appears:

    ```
    Another Schedule, Picture, Toolbar, or Dynamo Set with same name is already open.
    ```
  - If you attempt to enable a toolbar whose name conflicts with a picture that is already open, the iFIX WorkSpace will not enable the toolbar.
  - If you open a picture that has the same name as a toolbar category, and then either click the Buttons tab on the Customize Toolbars dialog box or run the Task Wizard, the iFIX WorkSpace will not display the toolbar category.

To correct naming conflicts for a picture:

1. Close the picture.
2. Rename the picture to a name that does not conflict with the other document.
3. Close the conflicting Dynamo set, schedule, picture, or toolbar.
4. Restart the WorkSpace.
5. Open the renamed picture and save it.

Avoid naming an object, a picture, and a global subroutine with the same name, particularly if you refer to the object in a Visual Basic script. This ensures that VBA can distinguish between your objects and your subroutines. Otherwise, you may receive the following error when running a script:

```
Expected procedure, not variable.
```

Renaming VBA Objects Through Scripting

Avoid renaming VBA objects in a VBA script. Doing so will cause the code associated with those objects not to function. For example, if a rectangle named Rect1 has an associated event called Sub Rect1_Click(), changing the name of the rectangle to Rect2 will cause Sub Rect1_Click() not to function since there is no longer an object called Rect1.

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The script below prompts the user to enter a new name for a rectangle object when that object (Rect1) is clicked. When you enter a new name and click OK, the object Rect1 no longer exists and the code becomes orphaned and useless.

```
Private Sub Rect1_Click()
     Dim strNewName as String
     strNewName = InputBox("Enter new name")
     Rect1.Name = strNewName
End Sub
```

Testing Your Code

You will need to run your project a number of times before it is finished. To run a procedure, position the cursor anywhere in the procedure and choose Run Sub/User Form from the Run menu, or press F5.

You can also display the form you are working on, execute any code that you have attached to event procedures within the form, and test the controls that you have placed on the form. To run the form, position the cursor anywhere on the form, and then choose Run Sub/User Form from the Run menu, or press F5.

To learn more about running your VBA code, refer to the Help topics within the section Visual Basic How-To Topics of the Visual Basic for Applications Help file, or search for the Index keywords "running code" or "executing code".

Saving Your Work

Code, forms, and modules you create with VBA are associated with an iFIX picture, toolbar, toolbar category, schedule, Dynamo set, or User Global file within the WorkSpace application. Therefore, saving the work you completed in a VBA project only occurs when you save these iFIX documents.

To save a picture from VBA, choose the Save command from the File menu. This will save any changes that you have made to the picture, as well as to the VBA project.

NOTE: Toolbar and toolbar category files are saved automatically when you exit the WorkSpace. If you made changes to the User Global file, iFIX displays a message box that asks you if you want to save your changes.

Configuring VBA Options

You can configure the VBA Editor with a number of different options. These options are set in the Options dialog box. The Options dialog box displays when you select Options from the Tool menu. There are options on four different tabbed pages: Editor, Editor Format, General, and Docking. To choose a set of options to work with, click the appropriate tab. When you have made all of the required changes, click OK.

Tips for Configuring VBA Options

This section describes two specific items or settings that we recommend you take advantage of when configuring your VBA options.

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Require Variable Declaration

Although it is not required, you should use the Option Explicit statement in the Declarations section of a module to require variable declaration. The Option Explicit statement forces you to use variables that have already been declared as a certain type. Using the Option Explicit statement will help you avoid a common programming error and will shorten your debugging time.

To configure VBA to automatically add the Option Explicit statement to a new project:

1. On the Tools menu, click Options.
2. Select the Editor tab.
3. Select the Require Variable Declaration check box.
4. Click OK to activate this new option for all modules.

From this point on, when you create a new module, the Option Explicit statement will be added automatically. To learn more about setting VBA Editor options, click the Help button in the Options dialog box.

Clear the Compile On Demand Check Box

The Compile On Demand option, located on the General tab of the Options dialog box, determines whether a project is fully compiled before it starts, or whether code is compiled as needed, allowing the application to start sooner. We recommend that you clear this check box so you can more easily debug errors in your code.

WARNING: Do not enable the Notify Before State Loss option, located on the General tab of the Options dialog box. Doing so may cause an error or interruption in the iFIX WorkSpace.

Configuring VBA Project Options

In the previous section, you looked at the options available for configuring VBA. In this section, you will look at options specific to your project. These options are set in the VBA Project—Project Properties dialog box. You can display this dialog by selecting VBA Project Properties from the Tools menu, or when you right-click the project in the Project Explorer and select Project Properties. The options appear on two different pages. To choose a set of options, click the appropriate tab. When you have made all of the appropriate changes, click OK.

One option that you can enable for your project is to specify a Help file that you may have built for your project and the context ID that enables it to run with your project. For more information on how to create a picture-specific Help file, see the Creating Picture-Specific Help Files section of the Mastering iFIX manual.

For more information on the other project properties that are available, refer to the sections Visual Basic User Interface Help and Visual Basic How-To Topics in the Visual Basic for Applications Help file, or search for the Index keyword "properties" and select "project".

Datatype Checking and the VBA Compiler

The VBA 6.0 compiler uses stricter type checking than the VBA 5.0 compiler. You must use the exact datatypes that are defined in the function or subroutine declaration. The way variables are converted when being passed has changed. If executing code that meets the following conditions:

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1. One subroutine or function has a variable which is declared as type Variant. If you do not explicitly assign a type, it is Variant.
2. This variable is passed to a second subroutine or function.
3. The second subroutine or function is set up to accept a value from the first subroutine or function, but of a type other than Variant (Integer, long, or object, for example).

You may get this error:

```
Compile Error; ByRef argument type mismatch
```

Error Example

The following example shows two subroutines: the first subroutine gets a rectangle's downstream animation object, which is connected to the rectangle's VerticalFill Percentage. The second subroutine gets the animation object's class type. Since the second subroutine is defined as an object, and the first is passed in as a Variant/ObjectArrayItem, the VBA 6.0 compiler displays the ByRef argument mismatch error.

```
Private Sub CommandButton1_Click()
    Dim sSource As String
    Dim sFullQualSource As String
    Dim vSourceObjs As Variant
    Dim vTolerance As Variant
    Dim vDeadBand As Variant
    Dim vUpdateRate As Variant

    Rect1.GetConnectionInformation 1, "VerticalFillPercentage", _
    sSource, sFullQualSource, vSourceObjs, vTolerance, vDeadBand, _
    vUpdateRate

    CheckSourceObject vSourceObjs(0)

End Sub

'display the classname of the source object
Public Sub CheckSourceObject(objSrcObj As Object)
    MsgBox objSrcObj.ClassName
End Sub
```

This scenario is acceptable in a VBA 5.0 environment, but a ByRef Argument mismatch error is generated when running or compiling in VBA 6.0.

Workarounds

Either the calling routine or called routine has to change. The following scripts are workarounds that will satisfy the compiler and provide the exact same functionality.

Workaround 1 – This script changes the called routine and is the easier correction. Referring to the previous example, if you change the CheckSourceObject routine to specify that the argument is passed in by value, this will pass the compiler check. Since the parameter passed is not being modified, it is safe to pass by value.

```
'display the classname of the source object
Public Sub CheckSourceObject(ByVal objSrcObj As Object)
    MsgBox objSrcObj.ClassName
End Sub
```

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Workaround 2 – This script changes the calling routine so that the coercion is performed before the call.

```
Private Sub CommandButton1_Click()
    Dim sSource As String
    Dim sFullQualSource As String
    Dim vSourceObjs As Variant
    Dim vTolerance As Variant
    Dim vDeadBand As Variant
    Dim vUpdateRate As Variant
    Dim objSourceObject As Object
    Rect1.GetConnectionInformation 1, "VerticalFillPercentage", _
    sSource, sFullQualSource, vSourceObjs, vTolerance, vDeadBand, _
    vUpdateRate

    Set objSourceObject = vSourceObjs(0)
    CheckSourceObject objSourceObject
    Set objSourceObject = Nothing
End Sub
```

In this corrected call, there is an additional declaration for objSourceObject. The following line is also added:

```
    Set objSourceObject = vSourceObjs(0)
    Set objSourceObject = Nothing
```

This line assigns a declared Object to the first element of the variant array. Next, we pass in the objSourceObject, which is an Object instead of the Variant/ObjectArrayItem. This passes the compiler check.

Optimizing Your VBA Project Development

VBA is a powerful scripting tool integral to iFIX. Many features of iFIX allow you to use VBA more effectively. This chapter presents many options that help you build your projects more easily:

- Using iFIX Subroutines and Experts
- Keyboard Accelerators
- General iFIX Scripting Tips
- VBA Coding Help Features

Using iFIX Subroutines and Experts

iFIX includes several subroutines that can help simplify scripts that are intended to perform common tasks, such as acknowledging alarms or replacing pictures. Since these subroutines are stored in the FactoryGlobals project, they can be accessed directly through the Visual Basic Editor. For more information on FactoryGlobals, see the Creating Global Scripts chapter of this manual.

In addition to providing the code necessary to perform the task at hand, subroutines offer several extras that you would normally have to code yourself, including:

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- Generic error handling.
- Posting of operator messages to the alarm system.
- Conformance to VBA naming conventions.

If you are using tag names that contain special characters, this is a perfect case for using the **ReadValue** and **WriteValue** global subroutines to access your tags in VBA.

For example, suppose you have the following tag:

```
Fix32.SCADA.SORTER|SIZER|BLOCK10|PT.F_CV
```

In VBA, you can read this tag with the following syntax:

```
Private Sub Text1_Click()
     Dim x As Variant
     x = ReadValue("Fix32.SCADA.SORTER|SIZER|BLOCK10|PT.F_CV")
     Text1.Caption = x
End Sub
```

Once the value is stored as a variant (*x*), you can use it in expressions.

Sending Operator Messages to Alarm Areas

In some cases, you may need to handle the sending of operator messages to alarm areas in your own scripts. For example, a subroutine may not exist for the exact task that you want to perform. The following is an example of a specific case involving the WriteValue subroutine.

As stated in the previous section, subroutines handle the posting of operator messages to alarm areas for you. Therefore, the following script:

```
Writevalue "1", "sample"
```

will send out this message:

```
Fix32.ThisNode.sample.f_cv was set to 1.
```

However, this script will not generate an operator message:

```
Fix32.ThisNode.sample.f_cv=1
```

A separate subroutine, **SendOperatorMessage**, is provided for that purpose. Simply add a call to the SendOperatorMessage to generate the desired message.

WriteValue, **ReadValue**, **SendOperatorMessage**, and all other iFIX subroutines are described in more detail in the Subroutine Summary section of the iFIX Automation Interfaces Electronic Book.

The code within the global subroutines offers a wealth of information to the developer who is learning how to automate iFIX with VBA.

The global subroutines can be found in the FactoryGlobals VBA project. The FactoryGlobals file is write-protected to maintain the integrity of these scripts. For your convenience, you can view the content of the global subroutines module by clicking the following link: globalsubroutines.txt. This file contains all of the code exported from within these subroutines in a text file.

iFIX also provides several Experts to help you perform the most common functionality. Just as subroutines offer help to the seasoned VBA programmer, Experts can help developers who want to achieve

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similar results without having to write any VBA code at all. These Experts, which look like standard dialog boxes, actually generate VBA code for you, based on how you configured the options within the Expert. You can learn more about Experts in the Creating Pictures manual.

Using the Multiple Command Script Wizard

The Multiple Command Script Wizard is a graphical interface that uses command Experts to assemble one or more VBA script commands into a sequence. The wizard can be used to generate a scripted command sequence that is triggered by a mouse click on an object, a Scheduler entry, or a key macro.

You can use the wizard to rearrange or delete discrete command script segments in the sequence. You can also use the Visual Basic Editor to manually edit a script sequence created with the wizard, although you cannot use the wizard to manipulate manually edited sections of VBA script.

The following is an example of a VBA script generated by the Multiple Command Script Wizard:

```
Private Sub Rect2_Click()

    '***** Scripts Authoring Tool *****
    'The Comments below have been added automatically.
    'Any changes could cause adverse effects to the functionality
    'of the Script Authoring Experts.
    'WizardLast=Wizard2
    'WizardEditing=Wizard0
    'WizardName=MultipleCommands

    'Wizard1=AcknowledgeAlarm
    'Property1=Fix32.THISNODE.AI0.F_CV
    'Property2=False
    'PropertyDescription=AcknowledgeAnAlarm: Property1=Database Tag, Property2=Select Tag in Run mode
    AcknowledgeAnAlarm "Fix32.THISNODE.AI0.F_CV"
    'WizardEnd

    'Wizard2=AlarmHorn
    'Property1=optExpertTypeSilence
    'PropertyDescription=AlarmHornSilence: Property1=Type
    AlarmHornSilence
    'WizardEnd

End Sub
```

NOTES:

- Although the Multiple Command Script Wizard's purpose is to fully automate the VBA command scripting process, you can manually edit scripts generated by the wizard with the VB Editor. You may add or edit VBA scripts anywhere before the Scripts Authoring Tool header line (***** Scripts Authoring Tool *****), or directly between a "WizardEnd" and a “Wizard[x]=” statement. Do not edit any of the commented areas in the wizard-generated script. If the Multiple Command Script Wizard detects an improperly customized VBA script, you may encounter an error.
- The Multiple Command Script Wizard does not check the command sequence to make sure commands occur in a logical order.

For more information about the Multiple Command Script Wizard, see the Creating Pictures ebook.

Keyboard Accelerators

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You can use keyboard accelerators, key sequences that allow you to perform a function, to fire scripts using the KeyUp or KeyDown events. However, the built-in WorkSpace keyboard accelerators take precedence over any KeyUp or KeyDown events in the picture or user area. Therefore, you should avoid using keyboard accelerators that conflict with those that are reserved for internal use. The following table lists all of the reserved accelerators in the run-time and configuration environments.

Keyboard Accelerator	Purpose	Works in Run-time Mode	Works in Configure Mode
F1	Invokes Help.	No	Yes
F10, Ctrl + F10, Alt (alone)	Activates the WorkSpace menu bar.	Yes	Yes
Ctrl + F4	Closes document.	Yes	Yes
Ctrl + W	Toggles between configuration or run-time environment.	Yes	Yes
Ctrl + O	Activates Open File dialog.	Yes	Yes
Ctrl + P	Activates Print File dialog.	Yes	Yes
Ctrl + Esc	Activates Windows Start menu (unless disabled through security).	Yes	Yes
Ctrl + Break, Ctrl + Alt +Break	Breaks script execution.	Yes	No
Ctrl + Alt + Esc, Ctrl + Alt + Shift + Esc	WorkSpace window becomes inactive (unless disable through security).	Yes	Yes
Ctrl + Alt + Del	Brings up Windows Login (or Security) dialog box, unless disabled through security.	Yes	Yes
All Alt key combinations	Activates the WorkSpace menu.	Yes	Yes
Shift + letter combinations	Alphanumeric data entry (could trigger when entering an uppercase letter).	Yes	Yes
Ctrl + A	Selects all	No	Yes
Ctrl + C	Copies	No	Yes
Ctrl + D	Duplicates	No	Yes
Ctrl + F	Finds and replaces	No	Yes
Ctrl + O	Opens document	Yes	Yes
Ctrl + P	Prints document	Yes	Yes
Ctrl + S	Saves document	No	Yes
Ctrl + V	Pastes from the clipboard	No	Yes
Ctrl + Z	Undoes the last action	No	Yes

General iFIX Scripting Tips

This section lists some tips to keep in mind when writing VBA scripts within iFIX when:

- Creating an iFIX Shape with a VBA Script
- Using iFIX Collections

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- Connecting Animation Objects to Data Sources
- Reusing Scripts
- Cutting and Pasting Code
- VBA References
- Tracking Errors in Subroutines
- Filtering out Global Pages

Creating an iFIX Shape with a VBA Script

Use the following script to create a shape through a VBA script:

```
Dim Pic As Object
Dim Shape As Object

Set Pic = Application.ActiveDocument.Page
Shape.HorizontalPosition = 10
Shape.VerticalPosition = 10
Shape.Width = 30
Shape.Height = 30
Shape.ForegroundColor = RGB( 255, 0, 0 )
```

The BuildObject method creates the object. Once the object is created, you can perform one of these options:

- Set the object's properties through VBA code.
- Call the CreateWithMouse method (as in the above example) to change your mouse cursor into the draw cursor and then configure the properties of the object using the traditional iFIX user interface.

Using iFIX Collections

Use a BaseCount of 1 when using iFIX collections such as SelectedShapes, Procedures, ContainedSelections, ContainedObjects, and Documents. See the VBA Help file for more information on collections.

Connecting Animation Objects to Data Sources

To connect an animation object and a data source, use the SetSource method to set the Animation object's source property:

```
AnimationObj.SetSource "FIX32.NODE.TAG.FIELD", False, _
ExpressionEditor1.RefreshRate, ExpressionEditor1.DeadBand, _
ExpressionEditor1.Tolerance
```

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The SetSource method allows you to set the data source's refresh rate, deadband, and tolerance. The second parameter lets you set an undefined object as the data source. (True indicates a UseAnyway condition.)

Reusing Scripts

You can develop scripts directly in the main VBA project; however, this approach makes reusing the scripts more difficult. Instead, you should store subroutines in a separate module and then call these subroutines from the main project when you want to reuse the scripts. This allows you to export and then import the scripts into a new project with minimal modification, and also provides a more modular, component-based design.

Cutting and Pasting Code

You can cut (or copy) and paste an object from one project to another by dragging and dropping that object. Although this operation directly copies the VB code within the object to the new project, it does not automatically copy the event entries (a Click event, for example). Make sure you copy the content of the event entry into a subroutine (by selecting Edit Script from the object's pop-up menu) before pasting the code into the new project.

VBA References

VBA allows you to add an object library or type library reference to your project, which makes another application's objects available in your code. These additions to your VBA project are called *references*. You can view, add, and delete references by selecting the References command from the Tools menu in the Visual Basic Editor (VBE).

Whenever you add a control into a picture, the control's type library is referenced by the picture within VBA. When you delete a control from a picture, the reference to the control is automatically removed to increase performance. However, you should never manually remove the references to "Project_FactoryGlobals" or "Project_User".

Whenever you reference objects, controls, or mechanisms in VBA, follow the guidelines in the following sections. To learn more about references in VBA, refer to the VBA Help file.

Deleting Objects Referenced by Name in a Script

Any object that is referenced by name in a script cannot be deleted. For example, in the following sample script the code in Rect2_Click will execute, but the pen will not be deleted:

```
Rect1_Click()
     Pen1.Source = "Fix32.ThisNode.AI_30.F_CV"
End Sub

Rect2_Click()
     Chart1.DeletePen 1
End Sub
```

If you wanted to access the object in this example without referencing it by name, you could use the following code in Rect1_Click ():

```
Rect1_Click()
```

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```
        Dim o as object
        set o = Chart1.Pens.Item(1)
        o.Source = "Fix32.ThisNode.AI_30.F_CV"
    End Sub
```

Using Deleted Object Types in Scripts

When an object (2Dshape, FixDynamics object, ActiveX control) is deleted from a picture and no object of that type are left in the picture, the reference to that object's type library in the VBA project is removed. To continue to use this object's type in scripts, you must manually add a reference to the type library in the VBE by selecting References from the Tools menu and selecting the type library.

Dragging and Dropping Dynamo Objects or Toolbar Buttons

You should be aware of the following behavior when dragging and dropping a Dynamo object into a picture, cutting and pasting a Dynamo object, or dragging and dropping a toolbar button from a category into a toolbar:

- VBA copies all forms, scripts, events, and sub-forms associated with the toolbar button or Dynamo object.
- VBA does not copy any VBA modules or class modules associated with the toolbar button or Dynamo object. Code that you put in these modules will not run if you drag the Dynamo object or the toolbar button to another picture or toolbar.
- VBA does not copy references to other objects such as controls or DLLs that you create for toolbar buttons or Dynamo objects. For example, if you include a third-party OCX as a control on a form for a toolbar button, VBA does not copy the reference when you drag the toolbar button to a toolbar. The script will not run until you open the Visual Basic Editor and create a reference to the OCX for the toolbar project.

Tracking Errors in Subroutines

Every global subroutine includes an optional parameter called intErrorMode. The intErrorMode parameter allows users to trap errors and to send them to Alarm Services. There are three options for the intErrorMode.

Enter this option...	To...
0	Use the default error handling. Allows subroutines to provide the error messages. If no entry is made for the intErrorMode parameter, the default is used.
1	Allow the user to handle the error messages. Errors in the subroutines are passed back to the calling routine for handling.
2	Write errors to all Alarm Services. No error messages display. Instead, the errors are written to all iFIX Alarm Services, including the Alarm History window.

For example, if you use the intErrorMode parameter with the OpenDigitalPoint subroutine, the command would look like:

```
OpenDigitalPoint [DigitalPoint], [intErrorMode]
```


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Examples

For the OpenPicture subroutine, you get the standard error message if you enter 0 for the intErrorMode, as shown in the following example:

```
OpenPicture "BadPic", , , , 0
```

When you use 0 for the intErrorMode, if you try to open a picture that does not exist, a message box appears whose title is the name of the picture that made the erroneous call and whose contents are the error number and error description.

If you enter a 1 for intErrorMode, the error is raised for you to handle:

```
OpenPicture "BadPic", , , , 1
```

Your error handling code would have to look something like this:

```
On Error Goto Errorhandler
OpenPicture "BadPic", , , , 1
End Sub
Errorhandler:
     Msgbox "my error message" + Chr(13) + Cstr(Err.Number) + Chr(13) + Err.Description, , Err.Source
```

If you enter a 2 for intErrorMode, the error is sent to all Alarm Services, including the Alarm History window using the SendOperatorMessage method:

```
OpenPicture "BadPic", , , , 2
```

When you use 2 for the intErrorMode, you provide for silent error tracking.

Filtering out Global Pages

Plug and Solve® and expert globals can affect existing scripts that loop through the documents collection. If you have scripts that loop through the documents collection, and you want to filter out all global pages to look at your documents only, look at the Document.Type property using the following sample code:

```
If docobj.Type = "FixGlobalsServer.FixGlobalsServer.1" then
'this is a global page
```

VBA Coding Help Features

The VBA editor includes a number of extremely useful features to help you write code accurately and quickly. These features try to anticipate what you are writing in the code, and they prompt you with possible data types, built-in procedure templates, member functions, and more, as you type.

Visual Basic makes writing code easy, with features that can automatically fill in statements, properties, and arguments for you. As you enter code, the editor displays lists of appropriate choices, statement or function prototypes, or values. Options for enabling or disabling these and other code settings are available on the Editor tab of the Options dialog, which you can access by selecting Options from the Tools menu.

Refer to the following sections for more information on these VBA coding help features:

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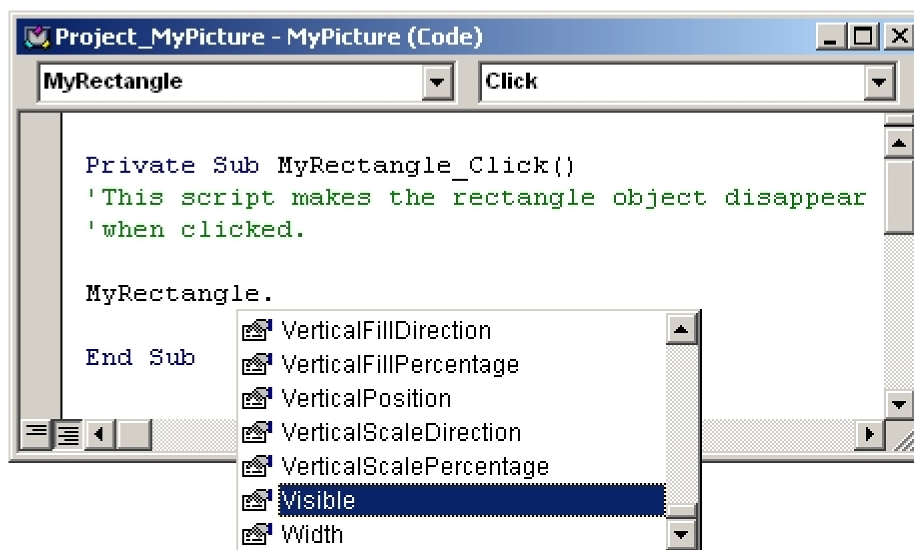
- Auto List Members
- Auto Quick Info
- Context Sensitive Help

Auto List Members

When you enter the name of a control in your code, the Auto List Members feature presents a drop-down list of properties available for that control. Type in the first few letters of the property name and the name will be selected from the list; the <TAB> key will complete the typing for you. This option is also helpful when you aren't sure which properties are available for a given control.



Auto List Members Feature

Auto Quick Info

The Auto Quick Info feature displays the syntax for statements and functions. When you enter the name of a valid Visual Basic statement or function the syntax is shown immediately below the current line, with the first argument in bold. After you enter the first argument value, the second argument appears in bold.

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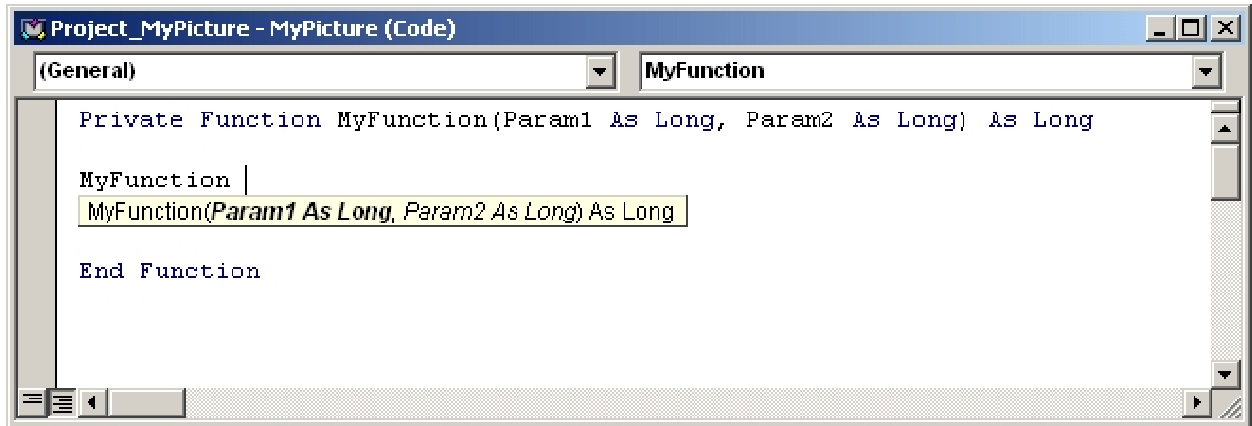

Auto Quick Info Feature

Context Sensitive Help

Many parts of Visual Basic are *context sensitive*, which means that you can get Help on these parts directly without having to go through the Help menu. For example, to get Help on any iFIX object, method, property, or event, or any VBA keyword, click that word and press F1.

Working with iFIX Objects

The integration of VBA into iFIX provides you with additional control and flexibility to develop, manipulate, and animate objects and graphics in the iFIX WorkSpace. This is important since objects make up a large part of your application.

This chapter gives you some specific examples on how you can use VBA scripting to enhance the performance of iFIX objects in your application. It also gives you helpful tips for working with objects and their characteristics.

Refer to the following sections for more information on working with iFIX objects:

- VBA Object Count Limit
- Object Availability in the VB Editor
- Understanding the iFIX Object Hierarchy
- Connecting Objects to Data Sources to Create Animations
- Making Connections
- Animation Properties and Methods
- Connection Example: Animating the Rotation of a Rectangle
- Rotating a Group

VBA Object Count Limit

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Microsoft currently limits the amount of VBA controls to 1207 per project. An iFIX picture is considered a VBA project. The current version of iFIX provides a VBA Object Count warning that notifies you when you are approaching the maximum level.

After creating your 1147th control, iFIX provides a dialog box notifying you that you are approaching the maximum allowed and should begin to remove unnecessary controls. If you continue to create scripts without removing them, you will continue to receive the warning. If you try to create your 1208th control, iFIX notifies you that the script cannot be created. To continue adding scripts, you must remove some VBA controls.

Object Availability in the VB Editor

The following steps describe how to make a single object available in the VB Editor.

▸ To make a single object available in the VB Editor:

1. Select the object in the picture.
2. Select Edit Script from the right-click menu.

▸ To make a group of objects available in the VB Editor:

1. Select the group of objects in the picture.
2. Select Enable Scripts from the right-click menu.

NOTE: When you select Enable Scripts, iFIX adds the objects to the VBA project, but does not start the VB Editor. Objects that are visible, such as rectangles and ovals, are not automatically available in the Editor.

For optimization purposes, if you choose not to tie a script to the object, it does not remain available after you close the picture. You will have to select it again in the picture and add the objects to the VBE if you want to use them in a script.

You can, however, forward-reference objects that are not available in the VBE. For example, you can write a script tied to Rect1 that references Oval1, as shown in the following example:

```
Oval1.Visible = False
```

The above code is acceptable even when Oval1 is not available to the VBE. The only difference in the VBE between objects that are available and objects that are not available is that the list of properties and methods available to the object appear when you type the period (.) after available objects. When forward-referencing objects, the objects will be added to the project when the picture is closed or saved.

The following objects are always available in the VBE:

- Timer objects
- Event objects
- Buttons
- Dynamos
- ActiveX controls
- Variables
- Any objects that have been added to the Global page

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Understanding the iFIX Object Hierarchy

There is a general hierarchy of objects in iFIX. The individual objects, as well as all of their related properties, methods, and events, are described in much greater detail in the Object Summary Help Topic in the iFIX Automation Interfaces Electronic Book.

The top layers in the object hierarchy are the Application and the System objects. The Application object represents the iFIX WorkSpace application. The System object is on the same level as the Application object and includes system information, date, time, and paths.

The next level below the Application object is the documents object which is a collection of active documents within the WorkSpace such as pictures and schedules.

The third level in the object hierarchy is the Page Object, which may be a picture, dynamo set, or scheduler object. If the page object is a picture, it can contain lines, rectangles, ovals, or other graphic objects. If the page object is a Scheduler object, it might contain timer or event objects.

Animation objects are unique to iFIX pictures and do not apply to other document objects.

VBA Object Browser

In addition to the iFIX Automation Interfaces Electronic Book, another great tool for visualizing the iFIX object hierarchy is the VBA Object Browser. The Object Browser displays the classes, properties, methods, events, and constants available from object libraries and the procedures in your project. You can use it to find and use objects you create, as well as all objects within iFIX. To launch the Object Browser in the VBE, press F2 or select the Object Browser command from the View menu.

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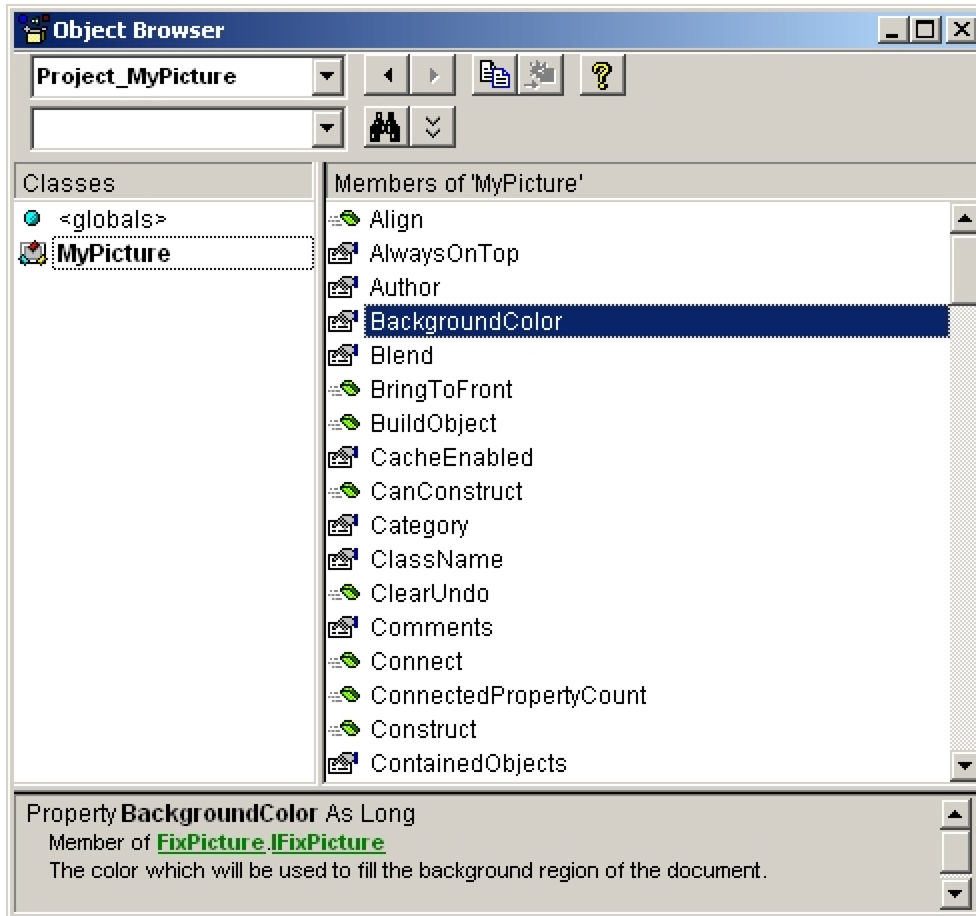

Object Browser

Press F1 to display the associated Help topic in the iFIX Automation Interfaces Electronic Book while positioned on any iFIX object, property, method, or event.

Connecting Objects to Data Sources to Create Animations

In order to animate the property of an object, you must connect that property to the data source that is providing the data. For example, if you want a tank to fill based on the output of a PLC connected to the tank, you would connect the vertical fill property of the tank's cylinder with the database point that contains the real-time value of the correct PLC address.

The transformation of data between objects occurs through *animationobjects*. There are three types of animation objects:

Linear – Converts data from one range of values to another, thereby performing signal conditioning. For example, if a data source has EGU limits from 0 to 65535, and a tank's fill percentage has a range of 0 to 100, the Linear object transforms the data source range to the tank's fill percentage range. Refer to the Understanding Signal Conditioning section of the Building a SCADA System manual for more detail on how the Linear object works.

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Lookup – Uses a table structure to map either a range of values or exact values from a data source to a single value of the connected object's property. For example, if a data source has multiple alarm values, the Lookup object maps each alarm value to a rectangle's color. You can also set up a Lookup object to divide a range of values into levels or rows, and map those levels to a rectangle's color. The Lookup object also has a Toggle property that can be used for blinking colors.

Format – Converts the source data into a string. When you set up a data source for a data link, for example, you actually create a Format object that transforms the data source into a string.

You will see examples of these objects in the scripting examples throughout this section. For more information on animation objects, including object-to-object connections, refer to the Creating Pictures manual. For a detailed explanation of all the animation properties and methods for each of the animation object types, refer to the Animation Properties and Methods section.

Visual Basic has many methods you can use to make connections to data sources. These various methods are detailed in the following sections.

Making Connections

A very important element of connecting objects to data sources is the way in which they are connected. You can connect to the data source:

- From an object's property directly to the data source.
- From an object's property to an animation object and then from the animation object to the data source.

Refer to the following sections for more information about making connections:

- Directly Connecting to a Data Source
- Making Connections through Animations
- Connecting or Disconnecting an Object's Property to a Data Source
- Retrieving Connection Information from a Property's Data Source
- Determining if an Object's Property is Being Used as a Data Source
- Retrieving General Connection Information

Directly Connecting to a Data Source

There are times when you may want to establish a direct connection to a data source, such as when you want to connect iFIX objects to some third-party controls. For more information, see the Creating Pictures manual.

The following figure illustrates the concept of a direct connection.

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As the Analog Input value increases, so does the rectangle's height.

As the rectangle's vertical fill percentage increases, so does its height.

Direct Connection Example

You can form a direct connection either by using the Animations dialog box or by writing a script. Both methods are described below.

NOTE: You cannot perform a Find and Replace on an object when that object has a direct connection to another object. To perform a find on an object in an object to object connection, use the One Tag search type in the Cross Reference Tool. For more information, refer to the Searching for One Tag section of the Mastering iFIX manual.

▶ To make a direct connection using the Animations dialog box:

1. Open the object's Animation dialog box.
2. Click the Size tab, and then click the height check box.
3. Enter a data source to animate the object's property.
4. In the Data Conversion area, select Object.

Making a Direct Connection by Writing a Script

To make a direct connection using a script, you need to call the Connect method. The following procedure shows you how to make a direct animation from an object to a data source on the Click event of a toolbar button in the configuration environment.

NOTE: For OPC data sources you need to remove any character, such as single quotes, that is not part of the valid server address syntax. For example: "ServerName.'Device:MyAddress'" should change to "ServerName.Device:MyAddress" after you remove the single quotes.

▶ To make a direction connection using a script:

1. Insert a rectangle into a picture and name it *MyRect*. Right-click the rectangle and select Edit Script to make MyRect available to the Visual Basic Editor.
2. Create a new toolbar and add a button named DirectConnect. See the Understanding Toolbars section of the Understanding iFIX manual for more information on creating toolbars and adding toolbar buttons.
3. Add the following code to the toolbar button's Click event:

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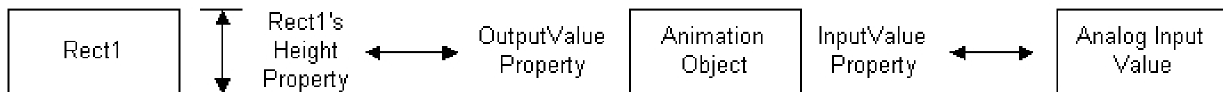
```
Private Sub DirectConnect_Click( )
     Dim lStatus as Long
     MyRect.Connect("Horizontal Position", _
     "FIX32.NODE.AI1.F_CV", lStatus)
End Sub
```

4. Close the Visual Basic Editor.
5. Click the DirectConnect button and switch to the run-time environment. The horizontal position of MyRect is now driven by the tag FIX32.NODE.AI1.F_CV.

Making Connections through Animations

Usually, you will make connections using Animation objects. Animation objects perform the data conversion between data source and connected object. The figure below illustrates the concept of Animation connections.

The Analog Input value is transformed by either percent, range, or formatting to drive the height of Rect1.



Animation Connections Example

▶ To make a linear animation connection using the Animations dialog box:

1. Double-click a rectangle. The Animations dialog box appears.
2. Select the Size tab and click the Height button. The Animations dialog box expands.
3. Enter a data source to animate the rectangle's height.
4. From the Data Conversion list box, select Range. This will allow the rectangle's height to change within a specific range based on the value of the data source.
5. Click OK. Note that the rectangle now has a linear animation object associated with it that transforms the data source value to scale the rectangle's height.

Making an Animation Connection through a Script

The following script uses the Linear Animation object to form the connection from a rectangle's Vertical Position property to a data source. This script is entered in the Click event of a toolbar named btnDirectConn. In this example, Animations is the picture name. For more information on the methods and properties used in the script, namely **SetSource**, **Connect**, **DoesPropertyHaveTargets**, and **GetPropertyTargets**, see the iFIX Automation Interfaces Electronic Book.

Example: Building an Animation Connection through a Script

```
Private Sub btnDirectConn_Click()
     Dim iRect As Object
     Dim iOval As Object
     Dim LinearObject As Object
     Dim strFullname As String
     Dim blnHasTargets As Boolean
     Dim lngStatus As Long
     Dim lngNumTargets As Long
```

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```
Dim lngIndex As Long
Dim strPropertyName As String
Dim strSource As String
Dim vtTargets()

'Create a rectangle and an oval
Set iRect = Animations.BuildObject("rect")
Set iOval = Animations.BuildObject("oval")

'Set some positioning and size attributes on
'the rectangle
iRect.HorizontalPosition = 80
iRect.VerticalPosition = 45
iRect.Height = 5
iRect.Width = 10
iOval.HorizontalPosition = 60
iOval.VerticalPosition = 35
iOval.Height = 5
iOval.Width = 10
iRect.Commit
iOval.Commit

'Create a Linear animation object for the rectangle
Set LinearObject = iRect.BuildObject("linear")

'Set the source of the Linear animation object
LinearObject.SetSource "AI1.F_CV", True

'Specify the Linear animation object's minimum and
'maximum Input and Output values
LinearObject.LoInValue = 0
LinearObject.LoOutValue = 0
LinearObject.HiInValue = 100
LinearObject.HiOutValue = 50

'Set UseDelta to True to ensure that the base position
'of the object will be added to the output value when
'the Linear object evaluates. If UseDelta is set to
'False, the output value would be absolute when the
'Linear object evaluates
LinearObject.UseDelta = True

'Connect the rectangle's VerticalPosition property to
'the output value of the Linear animation object
strFullname = LinearObject.FullyQualifiedName & _
".OutputValue"
iRect.Connect "VerticalPosition", strFullname, lngStatus

'Create a string containing the fully qualified data
'source for the rectangle's VerticalPosition property
strSource = "Animations." + iRect.Name + _
".VerticalPosition"

'Connect the oval's HorizontalFillPercentage property
'to the rectangle's VerticalPosition property by using
'the string created above as a data source
iOval.Connect "HorizontalFillPercentage", strSource, _
lngStatus

'Once connected, you can verify that the Rectangle's
'Vertical Position is being used as a data source for the
'Oval's Horizontal Fill Percentage using the Target methods.

'Now that there is a direct connection to the rectangle's
'VerticalPosition property, retrieve information about
```


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```
    'the objects that are using the VerticalPosition property
    'as a data source. This call will return if the property
    'is being used as a data source, how many objects are
    'using it as a data source, the status of the objects,
    'and the index of the object be passed to the
    'GetPropertyTargets method.

    'NOTE: If you only want to determine the number of
    'objects using the property as a data source, you can use
    'the NumberOfTargets property instead.

    iRect.DoesPropertyHaveTargets "VerticalPosition", _
    blnHasTargets, lngNumTargets, lngStatus, lngIndex

    'Use the lngIndex value from the DoesPropertyHaveTargets
    'call to determine which property of the rectangle has
    'targets and to obtain a list of object names that have
    'built connections to this property.

    iRect.GetPropertyTargets lngIndex, strPropertyName, _
    vtTargets

End Sub
```

Connecting or Disconnecting an Object's Property to a Data Source

The methods in this section connect or disconnect an object's property to a data source.

NOTE: Entries within brackets ([ ]) are optional.

The **Connect** method shown below connects an object's property to a data source:

```
Object.Connect(PropertyName As String, Source As String, _
(Returned) Status As Long, [Tolerance], [Flags], _
[DeadBand], [UpdateRate])
```

This call connects the property (defined in the PropertyName parameter), to a source (defined in the source parameter.) For example, if you want to connect a rectangle's height property directly to tag AI, you would enter the following:

```
Dim 1status as Long
Rect1.Connect("Height", "FIX32.NODE.AI.F_CV", 1status)
```

The **Disconnect** method disconnects the object's property from a data source:

```
Sub Disconnect(PropertyName As String)
```

The **SetSource** method sets the connection properties for an animation object. Use the **SetSource** method instead of directly setting the animation object's source property if additional properties have to be specified for the connection. You do not need to specify the data source.

```
Object.SetSource bstrExpression, [bUseAnyway], _
[vaUpdateRate], [vaDeadband], [vaTolerance], _
[vaConnectionFlags]
```

NOTE: If you are performing run-time source substitutions, and you want to preserve the tolerance, deadband, and the update rate for the tag, use the SetSource command instead of the Source property. If you use the Source property, the tolerance, deadband, and update rate settings are reinitialized to 0. The SetSource command provides the appropriate parameters to effectively set these attributes. You can only use the SetSource method for animation objects.

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Retrieving Connection Information from a Property's Data Source

The methods described in this section let you retrieve and manipulate a data source that is connected to a specified object's property. For more information on these methods, refer to the Visual Basic for Applications Help file.

Is the Object Connected to a Data Source?

The **IsConnected** method determines whether an object's property is connected to a data source:

```
Object.IsConnected(PropertyName As String, (Returned) _
HasConnection As Boolean (Returned) Index As Long, _
(Returned) Status As Long)
```

This method is typically used in conjunction with the **GetConnectionInformation** method, which is described later in this section. For more information on the parameters for the IsConnected method, see the IsConnected method topic of the iFIX Automation Interfaces Electronic Book.

Is the Connection Valid?

The **ParseConnectionSource** method parses the Data Source name to determine if a connection to an object's property exists. If a connection does exist, it returns the object that is connected to the property, as well as its fully qualified name. It accepts complex expressions and returns individual data sources for a complex expression:

```
Object.ParseConnectionSource(PropertyName As String, _
Source As String, (Returned) Status As Long, _
Returned Array) ValidObjects, (Returned Array) _
UndefinedObjects, (Returned) FullyQualifiedSource As String)
```

Example: Script Using ParseConnectionSource Method

The following example parses the AI1.F_CV source to the VerticalFillPercentage property of Oval Oval1 to determine the validity of the data source.

```
Dim iStatus As Long
Dim validObjs As Variant
Dim UndObjs As Variant
Dim FQSource As String

Oval1.ParseConnectionSource "VerticalFillPercentage", "AI1.F_CV", iStatus, validObjs, UndObjs, FQSource
```

How Many Properties Are Connected to the Data Source?

The **ConnectedPropertyCount** method returns the number of the object's properties that are connected to a data source.

```
Object.ConnectedPropertyCount (1connectedPropertyCount _
As Long)
```

The following example lets you find out how many properties in the object Rect1 are connected to data sources, and then converts that number into an integer.

```
Dim 1ConnectedCount as Long
Dim iNumProperties as Integer

Rect1.ConnectedPropertyCount 1ConnectedCount
iNumProperties = Cint (1ConnectedCount)
```

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In the above example, the number 4 might be returned, which indicates that four of Rect1's properties are connected to data sources. You could use this number to retrieve the connections with the **GetConnectionInformation** method described in the Retrieving Other Connection Information section.

What Other Connection Information Is Available?

The **GetConnectionInformation** method retrieves information from an object, such as the property that object is connected to, the full name of the data source, and all the source objects:

```
Object.GetConnectionInformation(Index As Long, (Returned) _
PropertyName as Sting (Returned) Source As String, _
(Returned) FullyQualifiedSource As String, (Returned) _
SourceObjects, [Tolerance], [Deadband], [UpdateRate])
```

This method is typically used in conjunction with the **IsConnected** method described earlier. In this example, notice the addition of the index parameter. You can get the index number with the IsConnected method or the **ConnectedPropertyCount** method. See the iFIX Automation Interfaces Electronic Book for more information on these methods.

Example: Script Using GetConnectionInformation Method with IsConnected Method

```
Dim blnHasConnection As Boolean
Dim lngStatus As Long
Dim lngIndex As Long
Dim strExpression As String
Dim strFullyQualifiedExpression As String
Dim vtSourceObjects
Dim Tolerance
Dim DeadBand
Dim UpdateRate

HorizontalObj.IsConnected "InputValue", blnHasConnection, lngIndex, lngStatus

If blnHasConnection Then
HorizontalObj.GetConnectionInformation lngIndex, "InputValue", strExpression, strFullyQualifiedExpression, vtSour
End If
```

Determining if an Object's Property is Being Used as a Data Source

The **NumberOfTargets** method returns the number of the object's properties that contain targets, that is, objects that use that object's property as their data source:

```
Object.NumberOfTargets(NumberOfTargets As Long)
```

The **DoesPropertyHaveTargets** method determines if the object's property (as defined by the PropertyName parameter) is being used as a data source and what object is using it:

```
Object.DoesPropertyHaveTargets(PropertyName As String, _
(Returned) HasTrargets As Boolean, (Returned) _
NumberOfTargets As Long, (Returned) Status As Long, _
Index As Long)
```

The **GetPropertyTargets** method retrieves the target object(s) and the property that the target(s) is connected to for the object's specified index number:

```
Object.GetPropertyTargets(Index As Long, (Returned) _
PropertyName As String, (Returned) Targets)
```

Retrieving General Connection Information

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This section describes additional connection methods for retrieving connection information and making connections. These methods include **CanConstruct, Construct, GetPropertyAttributes, and ValidateSource**.

GetPropertyAttributes Method

The **GetPropertyAttributes** method retrieves a list of property attributes for the specified Data Item object. For a tag reference, these are properties such as new alarm status and property range information (EGU limits, list of strings alarm strings (HIHI, LOLO, etc.)). Each property queried may have a different set of attributes. For more information on this method, refer to the iFIX Automation Interfaces Electronic Book.

```
Object.GetPropertyAttributes(FullyQualifiedName As String, _
Attribute As Long, (Returned) Results, (Returned) _
AttributeNames, (Returned) Status As Long)
```

Example: Script Using the GetPropertyAttributes Method

The following example fetches the attribute information for the HighEGU attribute of the AI1 block on node NODE1.

```
Dim vtResults
Dim vtAttributes
Dim lStatus As Long
Dim strLoEGU as String
Dim LoEGUval

Oval1.GetPropertyAttributes "FIX32.NODE1.AI1.F_CV", 3, vtResults, vtAttributes, lStatus
strLoEGU = vtAttributes(0)
LoEGUval = vtResults(0)
```

In the above example, the variable strLoEGU will now hold the string "FIX32.NODE1.AI1.A_ELO" and the variable LoEGUval will hold tag AI1's low EGU value.

CanConstruct Method

The **CanConstruct** method checks a data source reference for valid syntax. The CanConstruct method must have the default data system defined as part of the object name. For example, the object name *AI* would not work correctly.

```
Object.CanConstruct(ObjectName As String, (Returned)_
CanConstruct As Boolean)
```

Example: Script Using CanConstruct Method

The following example determines whether the datasource AI1 for NODE1 has valid syntax for the Picture TestPicture.

```
Dim bCanConstruct As Boolean

TestPicture.CanConstruct "FIX32.NODE1.AI1", bCanConstruct
```

Construct Method

The **Construct** method launches the Quick Add user interface and prompts you for information needed to create the tag. If Status returns 0, then the tag has been created:

```
Object.Construct(ObjectName As String, (Returned) Status _
As Long)
```

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Example: Script Using Construct Method

The following example displays the QuickAdd user interface that prompts the user for the information needed to create the tag NewAI1 for the Oval object Oval1 on node NODE1.

```
Dim lStatus As Long

Oval1.Construct "FIX32.NODE1.NEWAI", lStatus
```

ValidateSource Method

The **ValidateSource** method determines if a data source exists:

```
Object.ValidateSource(Object As String, (Returned) Status _
As Long, (Returned) Object As Object, (Returned) _
PropertyName As String)
```

Example: Script Using ValidateSource Method

The following example validates the AI1 source for the Oval Oval1.

```
Dim iStatus As Long
Dim iObj As Object
Dim sPropName As String

Oval2.ValidateSource "AI1", iStatus, iObj, sPropName
```

Animation Properties and Methods

The following sections detail the animation properties and methods you can use to connect an object's properties to data sources and create animations:

- General Animation Object Properties and Methods
- Linear Animation Object Properties
- Lookup Animation Object Properties and Methods
- Connection Examples: Using the Lookup Object
- Format Animation Object Properties

General Animation Object Properties and Methods

The following table provides the syntax and description for general animation object properties and methods.

General Animation Object Properties and Methods

Syntax	Description
Object.ConnectionFailed	Determines if the connection attempt was successful.
Object.Failed Source	Returns the source of the connection attempt, if the **SetSource** method failed.
Object.InputValue	Contains raw data from the data source which will be transformed

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	by the animation object.
Object.OutputValue	Contains the data which resulted from the transformation of the InputValue data.
Object.Source	Contains the source string for an animation (the input data source.) This property internally builds a connection between the input value property of the animation and the data source specified by this property. If you have used the correct syntax for the source, setting the Source property will work correctly. Using the **SetSource** method is the more effective way to set an animation object's source.
Object.SourceValidated	Specifies whether the animation object's source property has a valid data source connection.
Object.SetSource (bstrExpression As String, [bUseAnyway As _ Boolean], [vaUpdateRate], _ [vaDeadband], _ [vaTolerance], _ [vaConnectionFlags]	Sets the connection properties for an animation object. This method is used instead of directly setting the animation object's source property if additional properties have to be specified for the connection. You do not need to specify the data source. **NOTE:** The **SetSource** method can only be used for animation objects.

Linear Animation Object Properties

The following table provides the syntax and description of linear animation object properties.

Linear Animation Object Properties

Syntax	Description
Object.HiInValue	Specifies the upper limit on the input value range.
Object.HiOutValue	Specifies the upper limit on the output value range.
Object.LoInValue	Specifies the lower limit on the input value range.
Object.LoOutValue	Specifies the lower limit on the output value range.
Object.UseDelta	Specifies whether to use the absolute or relative value to set the output value range. The object will always start at the low output value.

Lookup Animation Object Properties and Methods

The following table provides the syntax and description of lookup animation object properties and methods.

Lookup Animation Object Properties and Methods

Syntax	Description
Object.ColorTable	Specifies whether the Lookup object's output values are colors.
Object.DefaultOutputValue	Specifies the value written to the object's property if the input value is not found within the Lookup object table.
Object.ExactMatch	Specifies if the Lookup object is a range or an exact match table. For example, if you are using a linear animation to animate the position of an object on your screen:

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	• If you set use delta to True, the object's position will be set to its base position on the screen and the transformed output value. • If you set use delta to False, the object's position will always fail within the set output range.
Object.ToggleSource	Contains the toggle source string name. This applies to all levels of a lookup object table. When the toggle source's value is true, the Lookup object levels toggle between the output value and the global toggle value. You set the global toggle value with the Global Toggle property (for example, setting the toggle source as blink on new alarm).
Object.GlobalOutputToggle	Specifies if the table has a global toggle source.
Object.GlobalToggle	Specifies the value that will be toggled to if the value of the global toggle source is true.
Object.SharedTableName	Specifies the name of a shared lookup table in a picture or shared threshold table in user globals. If this value is set, the object will use the table that can be shared by other objects, rather than its own unique table.
Object.ToggleRate	Specifies the rate at which the output of the Lookup object toggles between output1 and output2. For example, in a color table, this property is the blinking rate.
Object.Tolerance	Specifies the tolerance for exact match lookup tables.
Object.AddLevel (pInput1, pOutput1, [pInput2, pOutput2])	Adds a new level to the Lookup object table.
Object.GetLevel (iIndex, pInput1, pOutput1, [pInput2, pOutput2])	Gets the level properties for the specified level index of the Lookup object. Indexing begins at 1.
Object.RemoveAllLevels	Removes all levels from the Lookup table.
Object.Removelevel	Removes a level of a lookup table. Indexing begins at 1.

Connection Examples: Using the Lookup Object

This example shows you how to check to see if an object is connected to a data source, then lets you build a Lookup object that overwrites an existing color table.

Example: Using Range Comparison

In this example, the picture contains a rectangle named Rect1.

```
Private Sub BtnLookup_Click()
     Dim blnIsConnected As Boolean
     Dim lngIndex As Long
     Dim lngStatus As Long
     Dim strPropName As String
     Dim strSource As String
     Dim strFQSource As String
     Dim vtSourceObjects
     Dim LookupObject As Object
     Dim strFullname As String
     Dim blnIsEmpty As Boolean
```

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```
        'Check to see if the rectangle's ForegroundColor
        'property is already connected to a data source
        Rect1.IsConnected "ForegroundColor", blnIsConnected, _
        lngIndex, lngStatus

        'If it is, use the Disconnect method to remove the
        'existing property connection
        If blnIsConnected Then
             Rect1.Disconnect "ForegroundColor"
        End If

        'If a ForegroundColor animation does not exist, build an
        'empty lookup animation object off of the rectangle
        If (TypeName(LookupObject) = "Nothing") Then
             Set LookupObject = Rect1.BuildObject("lookup")
        End If

        'Add levels to your lookup animation object with a range
        'comparison using the AddLevel method. The following
        'table will have inputs between 10 and 20 displaying the
        'color with the RGB value of 255 (red), 21 through 40
        'would display RGB 65535 and so on
        LookupObject.AddLevel 10, 255, 20
        LookupObject.AddLevel 20, 65535, 40
        LookupObject.AddLevel 40, 65280, 60
        LookupObject.AddLevel 60, 16711680, 80
        LookupObject.AddLevel 80, 8388736, 100

        'Use the SetSource method to connect the lookup animation
        'object to the data source object. This connection
        'overwrites any existing color table set up
        LookupObject.SetSource "AI1.F_CV", True

        'We have connected the InputValue property of the lookup
        'animation object to the data source. Now, we will
        'connect the animation object's OutputValue property to
        'the shape. Its output is connected to the object it is
        'animating.
        strFullname = LookupObject.FullyQualifiedName & _
        ".OutputValue"
        Rect1.Connect "ForegroundColor", strFullname, lngStatus

   End Sub
```

Similarly, you can create an Exact Match color table using the LookupExact method and the ExactMatch property of an object. The following example shows you how.

Notice that, again, the example first checks that the object is connected in the first place, then proceeds to manipulate the object's property based on that connection.

Example: Using Exact Match Lookup

In this example, the picture contains a rectangle named Rect2.

```
   Private Sub BtnLookupExact_Click()
        Dim blnIsConnected As Boolean
        Dim lngIndex As Long
        Dim lngStatus As Long
        Dim strPropName As String
        Dim strSource As String
        Dim strFQSource As String
        Dim vtSourceObjects
        Dim LookupObject As Object
        Dim strFullname As String
        Dim blnIsEmpty As Boolean
```


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```
    'Check to see if the rectangle's ForegroundColor property
    'is already connected to a data source
    Rect2.IsConnected "ForegroundColor", blnIsConnected, _
    lngIndex, lngStatus

    'If it is, use the Disconnect method to remove the
    'property connection
    If blnIsConnected Then
         Rect2.Disconnect "ForegroundColor"
    End If

    'If a ForegroundColor animation does not exist, build an
    'empty lookup animation object off of the rectangle
    If (TypeName(LookupObject) = "Nothing") Then
         Set LookupObject = Rect2.BuildObject("lookup")
    End If

    'To create an exact match color table, the user can do
    'two things: (1) Call AddLevel with the same parameters
    'as a range comparison and set the ExactMatch property to
    'true OR (2) Call AddLevel without the second input
    'parameter. The following table will have inputs 10
    'displaying the color with an RGB value of 255
    '(red), 21 would display RGB 65535 and so on.

    LookupObject.AddLevel 10, 255, 20
    LookupObject.AddLevel 21, 65535, 40
    LookupObject.AddLevel 41, 65280, 60
    LookupObject.AddLevel 61, 16711680, 80
    LookupObject.AddLevel 81, 8388736, 100
    LookupObject.ExactMatch = True

    'Use the SetSource method to connect the lookup animation
    'object to the data source object. This connection
    'overwrites any existing ColorTable set up.
    LookupObject.SetSource "AI1.F_CV", True
    'We have connected the InputValue property of the lookup
    'animation object to the data source. Now, we will
    'connect the animation object's OutputValue property to
    'the shape. Its output is connected to the object it is
    'animating.
    strFullname = LookupObject.FullyQualifiedName & _
     ".OutputValue"
    Rect2.Connect "ForegroundColor", strFullname, lngStatus

End Sub
```

For more information on data sources, refer to the Creating Pictures manual. For information on changing data sources at run-time, refer to the Changing Data Sources section.

Format Animation Object Properties

This table provides the syntax and description of Format Animation Object properties.

Format Animation Object Properties

Syntax	Description
Object.Format	Specified the C Sprintf Format string into which the input is formatted for the Format object.

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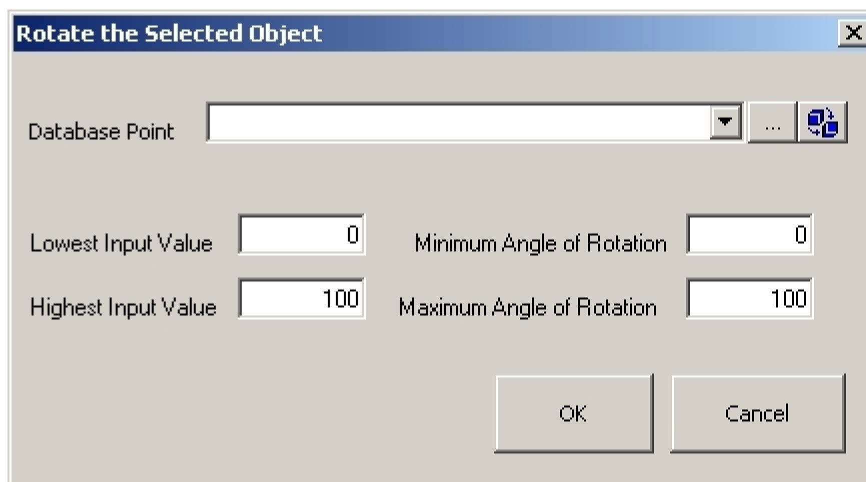
Object.SetNumericFormat ([WholeDigits], [DecimalDigits], _ [Justify])	Sets the format of a numeric value.
Object.SetStringFormat ([Format])	Sets the raw formatting for a string value.

Connection Example: Animating the Rotation of a Rectangle

The example in this section shows you how to animate an object through a VBA script; specifically, animating the rotation of a rectangle named Rect1. The code is taken directly from the iFIX Rotate Expert.

For this example, you need to provide operators with an interface in the configuration environment which allows them to animate the rotation of the selected object. You also need to allow them to select a data source with the Expression Editor control. For this example, assume that the operators will select a database block as their data source. You also want to allow them to select the minimum and maximum input and output values. After applying this form to a selected object, the operator can switch to run and see the object rotating as specified.

First, develop the basic form as shown in the following figure:



Rotate the Selected Object Dialog Box

The following script is intended for the OK button's Click event. The script creates an animation object, connects the animation object to the data point, and then connects the animation object to the selected shape. See the Creating Pictures manual for more information on Animation objects.

Example: Animating the Rotation of an Object

```
Private Sub cmdOK_Click()
Dim CurrentObject as Object
Dim RotateObject As Object
Dim i As Integer
Dim blnHasConnection As Boolean
Dim lngIndex As Long
Dim lngStatus As Long
Dim strFullName As String
Dim Result As Boolean
Dim FailedSourceString As String
Dim strPropertyName As String
```

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```
Dim strFullQualifiedSource As String
Dim strExpression As String
Dim strFullyQualifiedExpression As String
Dim vtSourceObjects
Dim dblTolerance As Double
Dim dblDeadband As Double
Dim dblUpdateRate As Double

On Error GoTo ErrorHandler

'Set CurrentObject equal to the first selected object in
'the picture.
Set CurrentObject = _
Application.ActiveDocument.Page.SelectedShapes.Item(1)

'Check if the selected object's RotationAngle property is
'already connected to a datasoure using the IsConnected
'method.
CurrentObject.IsConnected "RotationAngle", blnHasConnection, lngIndex, _
lngStatus

'If it is, use the GetConnectionInformation method to get
'the fully qualified name of the data source as well as the
'data source object.
If blnHasConnection Then
     CurrentObject.GetConnectionInformation lngIndex, _ 0
     strPropertyName, strExpression, _
     strFullyQualifiedExpression, vtSourceObjects
     'vtSourceObjects is a variant array of the data source
     'objects connected to the RotationAngle property of the
     'selected object. Get the first object in the array.
     'Assume that the first object connected to the
     'RotationAngle is the one you want.
     Set RotateObject = vtSourceObjects(0)
End If

'If a rotation connection does not exist, build an empty
'linear animation object off of the current object.
If (TypeName(RotateObject) = "Nothing") Then
     Set RotateObject = CurrentObject.BuildObject("Linear")
End If

'Use the SetSource method to connect the Animation object to
'the data source object that the user entered in the Expression
'Editor. This connection overwrites any existing Rotation set
'up.
RotateObject.SetSource ExpressionEditor1.EditText, True, _
ExpressionEditor1.RefreshRate, ExpressionEditor1.DeadBand, _
ExpressionEditor1.Tolerance

'Check the Animation object's ConnectionFailed property. If the
'connection failed, send a message to the user.
If RotateObject.ConnectionFailed = True Then
     FailedSourceString = "Data Source: " & _
     RotateObject.FailedSource & " doesn't exist."
     Result = MsgBox(FailedSourceString, vbOKOnly)
     Exit Sub
End If

'Now, we can set the LoInValue, HiInValue, LoOutValue, and
'HiOutValue of the Animation object with the values the user
'entered in the form.
RotateObject.LoInValue = Val(txtLoIn.Value)
RotateObject.HiInValue = Val(txtHiIn.Value)
RotateObject.LoOutValue = Val(txtMinAngle.Value)
```

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```
RotateObject.HiOutValue = Val(txtMaxAngle.Value)

'We connected the InputValue property of the Animation object
'to the data source. Animation objects receive their input
'from sources. Now, we will connect the Animation object's
'OutputValue property to the shape. It's output is connected
'to the object it is animating.
strFullName = RotateObject.FullyQualifiedName & ".OutputValue"
CurrentObject.Connect "RotationAngle", strFullName, lngStatus
```

Rotating a Group

To rotate a group using scripting, please use the following preferred method listed in the steps below.

To rotate a group using scripting:

1. Create a variable object that is used to store the rotation angle of the group.
2. Animate the group's rotation angle using that variable's current value as the source of the animation.
3. Set the current value of the variable using the script instead of changing the rotation angle of the group directly.

Example: Rotating a Group Using a Script

```
Dim bUp As Boolean

Private Sub CFixPicture_Initialize()
bUp = True
CommandButton1.Caption = "Rotate Up"
End Sub

Private Sub CommandButton1_Click()
Dim o As Object
Dim dVal As Double

' get the variable object, using FindObject
' to keep group out of VBA
Set o = Me.FindObject("RotationAngle")

' get the current value of the variable
dVal = o.CurrentValue

If bUp Then
 ' increment the value
    dVal = dVal + 5

    ' if we hit 45 then rotate down next time
    If dVal = 45 Then
        bUp = False
        CommandButton1.Caption = "Rotate Down"
    End If
Else
    ' decrement the value
    dVal = dVal - 5

 ' if we hit 0 then rotate up next time
    If dVal = 0 Then
        bUp = True
        CommandButton1.Caption = "Rotate Up"
    End If
```


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```
End If

' set the current value of the variable object
' which will result in rotating the group
o.CurrentValue = dVal

End Sub
```

Manipulating Pictures

This chapter provides source code examples that show how to manipulate iFIX pictures using VBA. This section also describes some important characteristics of using VBA scripting in your pictures. It includes the following sections:

- Understanding Picture Events
- Automatically Starting a Picture
- Managing Multiple Displays
- Changing Displays Using Global Subroutines
- Closing Pictures with Active Scripts
- Using the Workspace Application Object

After reading this section, you will be able to do the following tasks entirely through VBA scripts:

- Manage multiple displays
- Change displays using global subroutines

Understanding Picture Events

Each picture you create executes events when you open or close it. By writing a script for each event's handler, you can automatically complete specific task (such as initialization of variables) when a picture opens or closes.

The events that a picture executes vary depending on the WorkSpace environment. The following tables summarize the picture events the occur.

When you open a picture in the...	The following events occur...
Configuration environment	InitializeConfigure
Run-time environment	1. Initialize 2. Activated

When you close a picture in the...	The following events occur...
Configuration environment	N/A
Run-time	Close

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If you open a picture with an OpenPicture subroutine, the open events (Initialize and Activated) execute immediately. However, if the OpenPicture call is inside looping or branching structure (such as a FOR loop or an IF statement) then the open events do not fire until the OpenPicture script completes.

Conversely, if you close a picture with a ClosePicture subroutine, the Close event of the picture being closed never fires because the picture is removed from memory before its script has a chance to run.

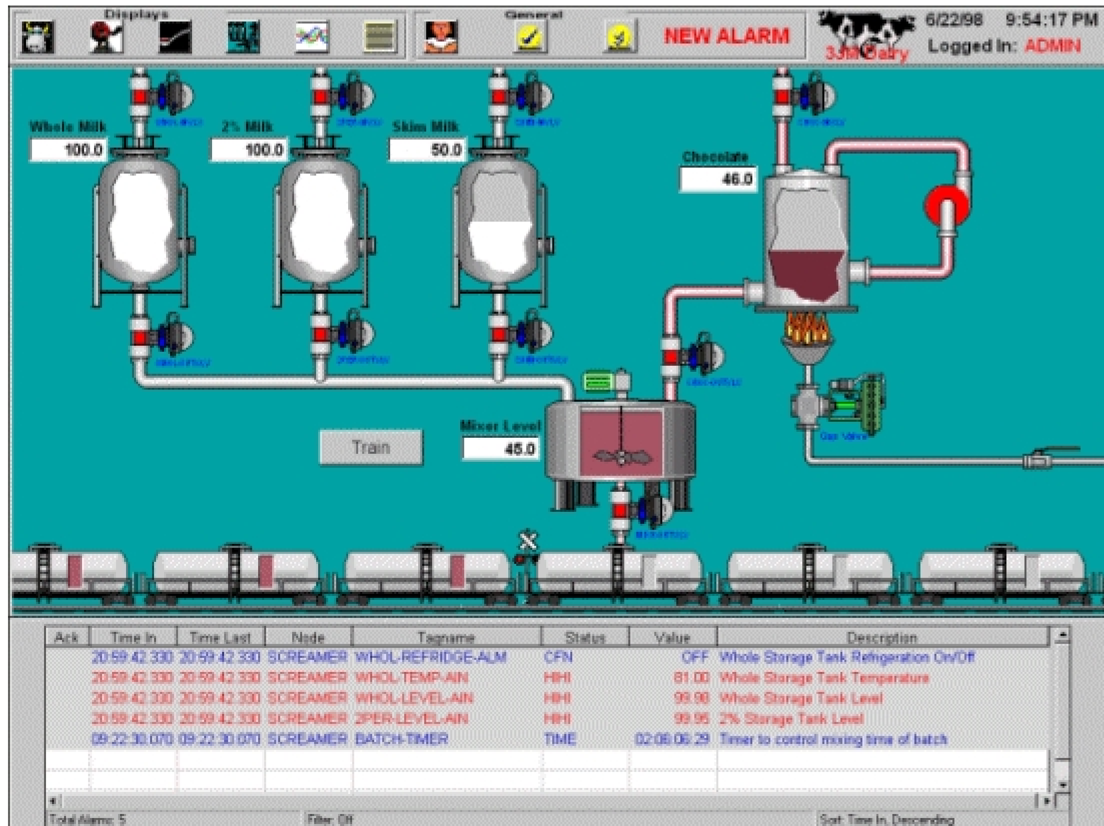
Pictures also execute Activated and Deactivated events as you switch from one picture to another. The Activated event occurs whenever of picture gains focus. The Deactivated event executes when a picture loses focus. For example, suppose you have two pictures open and the first picture, Picture1, has focus. When you select the second picture, Picture2, Picture1 executes the Deactivated event and Picture2 executes the Activated event. When you switch back, Picture2 executes the Deactivated event and Picture1 executes the Activated event.

Automatically Starting a Picture

This section describes how to create a run-time environment that contains a virtual toolbar and several pictures of the same size.

NOTE: This section only applies to pictures created with Enhanced Coordinates. This section does not support the legacy Logical Coordinates System.

The figure below shows a sample picture design, consisting of three untitled pictures: a main picture, a navigational banner, and an alarm banner.



Typical Picture Design

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Since the main picture has to be a certain size and position in the run-time environment, you may want to create a toolbar button to create pictures of the same size to fill the main process picture area. To do so, you must first create a picture area, navigation (or toolbar) area, and other run-time areas that are reserved as "special pictures." After creating these pictures, write down the following coordinates of the pictures so it will be easier to enter them into the script:

- Window top
- Window left
- Document height
- Document width

These coordinates can be found in the Properties window for the picture. See the Creating Pictures manual for more information on picture coordinates.

When opening iFIX pictures through scripts, you may want to remove any unwanted scroll bars by executing the **FitWindowToDocument** method, which is also illustrated in this code sample.

Let's take a look at the toolbar script. Wherever possible, comments are provided to help you understand that particular part of the script. These bold-faced comments will appear by default as green text when pasted into the VBA code window. Comment colors are configured in the VBA Option dialog.

Example: Creating a Toolbar

```
Dim iNewDoc As Object
Dim iPage As Object

'Create a new picture.
Set iNewDoc = Application.Documents.Add("FIX.PICTURE")
Set iPage = iNewDoc.Page
With iPage

     'Set the height of the document.
     .DocumentHeight = 51.3

     'Set the width of the document.
     .DocumentWidth = 100.44

     'Call the FitWindowToDocument method to expand the
     'window size so it matches the size of the document.
     'This action removes all scrollbars.
     .FitWindowToDocument
     .windowtoppercentage = 7.03
     .windowleftpercentage = 0#
     .titlebar = False

End With
Set iNewDoc = Nothing
Set iPage = Nothing
```

Managing Multiple Displays

Notice that there is a virtual toolbar at the top of the display in the illustration in the Automatically Starting a Picture section. The buttons on this toolbar are actually bitmaps that have their ButtonStyle property set to Pushbutton.

For more information on managing displays, refer to the following sections:

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- Setting a Pushbutton Property
- Setting the Active Document
- Creating a Global Variable

Setting a Pushbutton Property

The steps below describe how to set a Pushbutton property in your picture.

To set the Pushbutton property of a bitmap:

1. From the iFIX WorkSpace, in Ribbon view, on the Insert tab, in the Objects/Links group, click Objects/Links and then click Bitmap.

   \- Or -

   In Classic view, on the Insert menu, click Bitmap to insert a bitmap into your iFIX picture.
2. Right-click the bitmap and select Button Styles, PushButton from the pop-up menu. A 3D effect will appear around the bitmap to give it the appearance of a button.
3. Optionally, you can configure a second bitmap to be displayed when the button is depressed. To do this, right-click the bitmap and select Load Image, Secondary. You can also configure a ToolTip by entering the desired text for the ToolTip into the Description property of the bitmap and setting the EnableTooltips property to TRUE.

The top toolbar is actually a separate picture with no titlebar. Clicking a button in this area changes focus and changes what is known in VBA as the *ActiveDocument*. To be sure that the correct picture is operated on when you click the toolbar button, you should first set the active document.

Setting the Active Document

To set the active document, you need to create a variable object to hold the main picture name, or picture alias. In the code that follows, a variable object is used because the script requires multiple *main* pictures to be opened.

If you use an alias instead of a variable, an error would occur if the alias was set to the same name ("MainPicture"), when more than one main picture is opened at the same time. See the Creating Pictures manual for more information on aliases.

Creating a Global Variable

To work with the script in this section, you must first create a global variable object to hold the string that represents the current active picture.

To create a global variable object to hold the string for the current active picture:

1. In the iFIX WorkSpace system tree's Globals folder, right-click the User icon, and select Create Variable from the pop-up menu.

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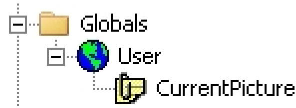
2. Set the Name property to CurrentPicture and the VariableType property to 8 - vtString. The system tree should look like the following:



System Tree Example

Once you have created the variable, add the following code to the Activate method of the main picture to set a Global variable:

```
Private Sub CFixPicture_Activated()

'Set the user global variable when you activate to find
'out the name of current active picture.
user.CurrentPicture.CurrentValue = Me.FullyQualifiedName

'Me is a VB intrinsic variable that tells you the name
'of the current project (picture object).
End Sub
```

The Global variable lets you know which main picture has focus so the toolbar can act on it. Now you can add the following script to the bitmap object by right-clicking it and selecting the Edit Script command from the pop-up menu:

```
Dim PicObj As Object

'Loop through the documents that are open.
For Each PicObj In Application.Documents
'If the document that is open has the same name as the
'current active main picture, set the active property,
'which will in turn set the active document.
If PicObj.Name = user.CurrentPicture.CurrentValue Then
     PicObj.active = True
     'Acknowledge alarms of the selected items in the
     'active picture.
     AcknowledgeAnAlarm
     Exit Sub
End If
Next PicObj
```

Changing Displays Using Global Subroutines

The FactoryGlobals global subroutines provide you with commands that allow you to manage your operator displays. Picture management subroutines include:

- OpenPicture
- ClosePicture
- ReplacePicture
- PictureAlias

Refer to the subroutines topic of the iFIX Automation Interfaces Electronic Book for more information on calling these subroutines.

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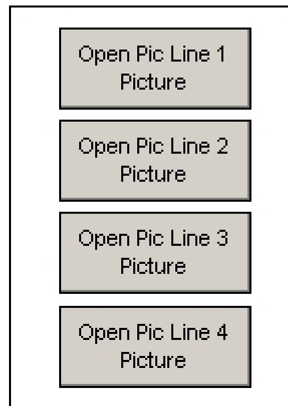
In the next example, an overview display contains four push buttons that allow operators to monitor plant lines. The first button opens the first line picture, the second button opens the second line picture, and so forth.



Push Button Example

The VBA scripts that make the command buttons operational are provided in this section. The use of aliases (in the following script, *Line* is the name of an alias) gives the script control over the opening and closing of displays, regardless of the exact picture names. Each time the operator selects the appropriate button, the script closes any picture with an alias of *Line*, and reassigns the alias to the opened picture.

Example: Using an Alias to Open and Close Displays

```
Private Sub OpenLine1Command_Click()
     ClosePicture "Line"
     OpenPicture "Line1", "Line"
End Sub

Private Sub OpenLine2Command_Click()
     ClosePicture "Line"
     OpenPicture "Line2", "Line"
End Sub

Private Sub OpenLine3Command_Click()
     ClosePicture "Line"
     OpenPicture "Line3", "Line"
End Sub

Private Sub OpenLine4Command_Click()
     ClosePicture "Line"
     OpenPicture "Line4", "Line"
End Sub
```

The following script performs the same function using the **ReplacePicture** subroutine, without using aliases. With **ReplacePicture**, all pictures display in the same window:

Example: Using the ReplacePicture Subroutine

```
Private Sub OpenLine1Command_Click()
     ReplacePicture ("Line1")
End Sub

Private Sub OpenLine2Command_Click()
     ReplacePicture ("Line2")
End Sub
```

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```
Private Sub OpenLine3Command_Click()
     ReplacePicture ("Line3")
End Sub

Private Sub OpenLine4Command_Click()
     ReplacePicture ("Line4")
End Sub
```

Closing Pictures with Active Scripts

A script cannot be fully executed if the picture containing it is closed or replaced. Therefore, if you use the **Close** method on the picture which contains the active script, the **Close** method should appear as the last method in the script. Otherwise, the picture closes before the rest of the script can run.

Remember that some command subroutines, such as **ReplacePicture** and **ClosePicture**, contain the **Close** method, so they are also affected.

Using the Workspace Application Object

When using the WorkSpace Application object from another task, you must tell the operating system you are done with it by setting it to Nothing (set Application = Nothing) before the WorkSpace is shut-down.

Creating Global Scripts

iFIX includes two global pages that allow you to store public objects, methods, forms, and variable objects so they can be accessed from anywhere within your system.

The **FactoryGlobals** page contains the iFIX subroutines and all of their supporting variables, forms, and functions. The FactoryGlobals file is write-protected to maintain the integrity of these scripts. See the Global Subroutines section for more information on the iFIX subroutines that are stored in the Fact-oryGlobals page.

The **User** page is the location where you can put your own objects, methods, forms, and variables that you want to use globally.

Since you can access the items that you define as **public** in the User page from anywhere in the sys-tem, make sure that what you enter is really what you want to expose. If you create a global public vari-able, remember that it can be changed from any script at any time.

This section provides examples of the items that you might want to include in your User page, including:

- Variable objects
- Threshold tables
- Procedures (VBA subroutines and functions)
- Forms

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Creating a Global Variable Object

Variable objects can be stored in the iFIX User page so that they can be accessible throughout your application, regardless of which pictures are open. You can read more about variable objects in the Creating Pictures manual.

To make a variable object global by adding it to the User page:

1. In the WorkSpace system tree, double-click the Globals folder.
2. Right-click the User icon and select Create Variable. An icon representing the Variable object appears under the User icon.
3. Right-click the Variable object icon and select Animations. The Animations dialog box appears.
4. Set values for the Variable object and click OK.

To create a global variable using the Variable Expert:

1. Select the Variable Expert from the Toolbox.
2. Assign a name and type for the variable.
3. Select the Global Variable option and click OK.

How FIX32 Predefined Variables Map to iFIX Object Properties

In FIX32, a predefined variable is a read-only variable whose name is reserved for use by the Command Language. Predefined variables have the following scope:

- **Global variables** – available to any running script. In FIX32, global scope variables begin with the prefix #GS_ (for global scope string variables) or #GN_ (for global scope numeric variables).
- **Picture variables** – available to scripts running in a given picture. In FIX32, picture scope variables begin with the prefix #PS_ (for picture scope string variables) or #PN_ (for picture scope numeric variables).

In iFIX, both global and picture variables can be accessed as an object property through an object link or a VBA command script. These object properties include link, picture, screen, security, system, and time properties.

Refer to the following table for a list of the FIX32 predefined variables and the corresponding iFIX object properties, with the proper syntax.

FIX32 Variable Syntax	iFIX Object Syntax	iFIX VBA Syntax	Description
#PS_CUR_LINK	Untitled1. SelectedDatasource	Me.SelectedDatasource or Untitled1. SelectedDatasource	Contains the data source of the currently selected object.
#PS_CUR_SHDW	Untitled1. HighlightedDatasource	Me. HighlightedDatasource or Untitled1. HighlightedDatasource	Contains the data source of the currently highlighted object.

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#PS_CUR_NODE	Untitled1. SelectedNodeName	Me.SelectedNodename or Untitled1. SelectedNodeName	Contains the SCADA node from the currently selected object.
#PS_CUR_TAG	Untitled1. SelectedTagName	Me.SelectedTagname or Untitled1. SelectedTagname	Contains the tag name or OPC element (item) of the currently selected object.
#PS_CUR_FIELD	Untitled1. SelectedFieldName	Untitled1. SelectedFieldName	Contains the field name of the currently selected object.
#PS_PICTURE	Untitled1.PictureName	Me.PictureName or Untitled1.PictureName	Contains the picture name or alias.
#PN_PICTURE_WIDTH and #PS_PICTURE_ WIDTH	Untitled1.PictureWidth	Me.PictureWidth or Untitled1.PictureWidth	Contains the picture width, in pixels.
#PN_PICTURE_ HEIGHT and #PS_ PICTURE_HEIGHT	Untitled1.PictureHeight	Me.PictureHeight or Untitled1.PictureHeight	Contains the picture height, in pixels.
#GN_SCREEN_WIDTH and #GS_SCREEN _ WIDTH	System.ScreenWidth	System.ScreenWidth	Contains the display screen width, in pixels.
#GN_SCREEN_ HEIGHT and #GS_SCREEN _ HEIGHT	System.ScreenHeight	System.ScreenHeight	Contains the display screen height, in pixels.
#GS_LOGIN_NAME	System. LoginUserName	System.LoginUser-Name	Contains the user ID of the currently logged in user. If security is dis-abled, this string is empty.
#GS_FULL_NAME	System. LoginUserFullName	System. LoginUserFullName	Contains the full name of the currently logged in user. If security is dis-abled, this string is empty.
#GS_GROUP	System.LoginGroup	System.LoginGroup	Contains the first group name that the currently logged in user belongs to. If security is disabled, this string is empty.
#GS_NODE	System. MyNodeName	System.MyNodeName	Contains the iFIX phys-ical node name.
#GS_CURRENT_ PICTURE	System. CurrentPicture	System.CurrentPicture	Contains the currently act-ive picture displayed in the iFIX WorkSpace.

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#GS_DATE	System.CurrentDate	System.CurrentDate	Contains the current system date. The date string is formatted according to the "short date" format in the Regional and Language Options in the Control Panel.
#GS_TIME	System.CurrentTime	System.CurrentTime	Contains the current system time. The time string is formatted according to the "time" format in the Regional and Language Options in the Control Panel.
#GS_HOUR and #GN_HOUR	System. CurrentTimeHour	System. CurrentTimeHour	Contains the hour component of the current system time.
#GS_MIN and #GN_MIN	System. CurrentTimeMinute	System. CurrentTimeMinute	Contains the minute component of the current system time.
#GS_SEC and #GN_SEC	System. CurrentTimeSecond	System. CurrentTimeSecond	Contains the second component of the current system time.
#GS_DAY and #GN_DAY	System. CurrentDateDay	System. CurrentDateDay	Contains the day component of the current system date.
#GS_MONTH and #GN_MONTH	System. CurrentDateMonth	System. CurrentDateMonth	Contains the month component of the current system date.
#GS_YEAR and #GN_YEAR	System. CurrentDateYear	System. CurrentDateYear	Contains the 4-digit year component of the current system date.

Creating a Global Threshold Table

You can also configure a system-wide threshold table. Global threshold tables provide you with more centralized control over your system's data conversions. If you created a global threshold table that defined colors for value ranges, and you need to change a color or a value because you are moving to a different system, you only need to change it in one place.

To create a global threshold table that is used for all current alarms in the system:

1. In the iFIX WorkSpace system tree, double-click the Globals folder.
2. Right-click the User icon and select Create Threshold Table from the pop-up menu. The Custom Lookup Table dialog box appears as shown in the following figure.

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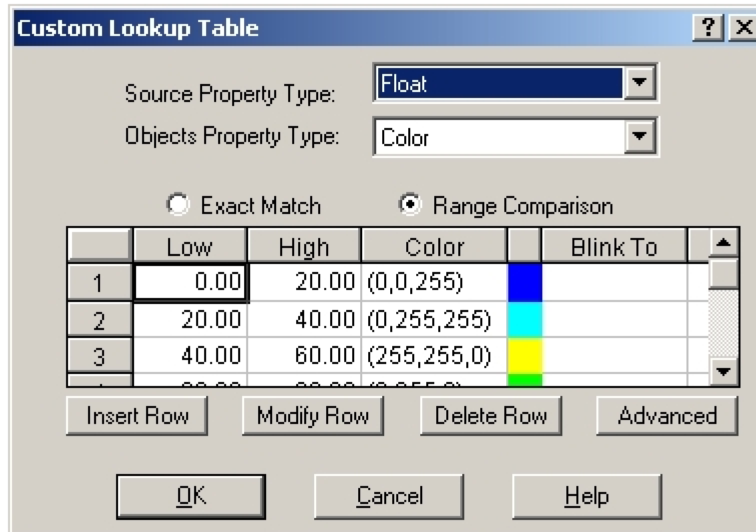

Custom Lookup Table Dialog Box

3. Keep the default values of the dialog box and click OK. A threshold table icon appears under the User icon.

To name the table:

1. In the iFIX WorkSpace system tree, right-click the new threshold table's icon, and select Property Window from the pop-up menu.
2. Enter a value for the Name property. If you are creating a global threshold table that is used for all current alarms in the system, enter CurrentAlarmThresholds.

Once you have named your threshold table, you can make connections from iFIX objects to this table. The following procedure provides an example of how to connect an object, in this case an oval, to a global threshold table named CurrentAlarmThresholds.

To connect an oval to a global threshold table:

1. Create an oval.
2. Click the Foreground Color Expert button.
3. In the Data Source field, enter a database tag.
4. Select the Current Alarm option.
5. Select the Use Shared Threshold Table check box.
6. Enter CurrentAlarmThresholds, the name of the global table that you created, in the Shared Table field.

The oval will now use the CurrentAlarmThresholds table instead of a custom table. Likewise, you can configure all objects that are assigned a Color By Current Alarm animation to use the CurrentAlarmThresholds table. If you ever need to change a color, value, or type, you only have to change it in one place.

Creating A Global Procedure

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You may want global access to subroutines and functions if you use them frequently. iFIX provides global subroutines and functions, such as **OpenPicture**, **ToggleDigitalPoint**, and **OnScan**, that you can use in your pictures and schedules. You can also include your own global subroutines and functions in the User page.

To add a global subroutine to the User page:

1. Open the Visual Basic Editor.
2. If the Project Explorer is not already displayed in the VBE, select Project Explorer from the View menu.
3. In the Project Explorer, select the Project_User project.
4. On the Insert menu, click Module. You need to store your code in a module and not in the Project_User page itself.
5. Enter the following code in the Code window:

```
Public Sub DisplayMyMessage()
     MsgBox "This is my message box."
End Sub
```

6. Close the Code window and create a rectangle in your picture.
7. Right-click the rectangle and select Edit Script from the pop-up menu. VBE opens the Code window for the rectangle's Click event. Enter the following in the Code window:

```
DisplayMyMessage
```

8. When you click the rectangle in the run-time environment, the message box that was stored in the Project_User page appears.

Accessing Real-time Data

iFIX gives you the flexibility to access all kinds of data to perform your scripting applications. This chapter details how to access real-time data through various methods. The examples show you how to use the Data System OCX to perform group reads and writes and how to write to a database tag.

Refer to the following sections for more details:

- Using the Data System OCX for Group Reads and Writes
- Reading from and Writing to a Database Tag

Using the Data System OCX for Group Reads and Writes

The Data System OCX (FixDataSystems.ocx) is a logical control that gives you flexible read and write capability, allowing you to perform group reads and writes to a database. Typically, performing a read and write through scripting involves the following steps:

1. Create the data item (DI).
2. Validate and add the DI to the OPC server.

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3. Write the value to the DI.

This process can take time, as each data item must be processed in the OPC server. If the OPC server is running at slower speeds, the process can take even longer. The Data System OCX simplifies this process by not requiring that you write to a single data item, changing the read and write process to the following steps:

1. Create the data item (DI).
2. Validate and add the DI to the OPC server.
3. Hold the DI in memory, create and validate other DIs, and read and write the DIs in a group.

Because it allows group reads and writes, the Data System OCX optimizes reading from and writing to large numbers of data points. You can create groups from VB scripts which can be returned from memory and written to at any time.

NOTE: To use the Datasystem OCX, you must ensure the reference to the Intellution iFIX Data System Access Control v1.0 Type Library is included in the project. To add this reference in VBA, on the Tools menu, click References. The References dialog box appears. Select Intellution iFIX Data System Access Control v1.0 Type Library check box, and click OK.

The following example illustrates how to use the Data System OCX to create a group of database tags and perform a group read and group write on them.

The following example writes a value of 50 to a group of database tags:

Example: Group Write

```
Public Sub WriteValueToGroup()

'Create the Data Server Object.
Dim FDS As Object
Dim DIItem As Object

'Create an instance of the Data System control.
Set FDS = CreateObject("FixDataSystems.Intellution FD Data _
     System Control")

'You do not need to call CreateObject if you include a
'reference to the FIX Data System. This control can handle
'multiple groups. For this example, we only need one group.
'We will add all the data sources with new alarms to the
'group and do a group read and then a group write.
FDS.Groups.Add "TankGroup"

'Add all the Tank tags to the Data System OCX's Data Item
'collection. You can add or delete groups without affecting
'the order of the group should the position of an item
'change. This is achieved by specifying a group name
'("TankGroup")rather than listing item numbers.
FDS.Groups("TankGroup").DataItems.Add "FIX32.MYNODE.TANK1.F_CV"
FDS.Groups("TankGroup").DataItems.Add "FIX32.MYNODE.TANK2.F_CV"
FDS.Groups("TankGroup").DataItems.Add "FIX32.MYNODE.TANK3.F_CV"
FDS.Groups("TankGroup").DataItems.Add "FIX32.MYNODE.TANK4.F_CV"
FDS.Groups("TankGroup").DataItems.Add "FIX32.MYNODE.TANK5.F_CV"
FDS.Groups("TankGroup").DataItems.Add "FIX32.MYNODE.TANK6.F_CV"
FDS.Groups("TankGroup").DataItems.Add "FIX32.MYNODE.TANK7.F_CV"
FDS.Groups("TankGroup").DataItems.Add "FIX32.MYNODE.TANK8.F_CV"
FDS.Groups("TankGroup").DataItems.Add "FIX32.MYNODE.TANK9.F_CV"
FDS.Groups("TankGroup").DataItems.Add _
     "FIX32.MYNODE.TANK10.F_CV"
```

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```
'Read all of the data items that you added to the Data System
'control.
FDS.Groups("TankGroup").Read

'If the value of each tag is not 50, then set it to 50.
For Each DIItem in FDS.Groups("TankGroup").DataItems
     If DIItem.Value <> 50 Then
          DIItem.Value = 50
     End If
Next

'Now write 50 to each tag in the database.
FDS.Groups("TankGroup").Write
End Sub
```

The next example does the following:

1. Creates a Data System OCX FDS.
2. Adds the data group DataGroup1 to the Groups collection.
3. Adds a Data Item to the DataItems collection.
4. Reads the group DataGroup1.
5. Reads the DataItem.

Example: Group Read

```
Public Sub ReadValueFromGroup()
'Create the Data System OCX
Dim FDS As Object
Set FDS = CreateObject("FixDataSystems.Intellution FD Data _
System Control")

'Add a group to the Groups collection
FDS.Groups.Add ("DataGroup1")
FDS.Groups.Item("DataGroup1").DataItems.Add("Fix32._
THISNODE.AI1.F_CV")

'Read DataGroup1
FDS.Groups.Item("DataGroup1").Read

'Read the DataItem
FDS.Groups.Item("DataGroup1").DataItems.Item(1).Read
End Sub
```

The final example in this section shows you how to perform writes to alternate data sources:

1. Creates a Data System OCX FDS.
2. Adds the data group DataGroup1 to the Groups collection.
3. Adds a Data Item to the DataItems collection.
4. Writes the value of the Group DataGroup1.
5. Writes a value to the DataItem.

Example: Writes to Alternate Sources

```
Public Sub WriteToAlternateSources()
'Create the Data System OCX
Dim FDS As New FixDataSystem
Dim g1 As FixDataSystems.Group

'Create the first group to read from
FDS.Groups.Add("DataGroup1")
Set g1=FDS.Groups.Item("DataGroup1")
```


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```
'Add an item to the group to be read
g1.DataItems.Add("Fix32.MYNODE.AI1.F_CV")

'Read the group
g1.Read
'Get the value of the item
Dim x As Long
x=g1.DataItems.Item(1).Value

'Create the second group to write
Dim g2 As FixDataSystems.Group
FDS.Groups.Add("Group2")
Set g2=FDS.Groups.Item("Group2")

'Add the item, set it's value and write the group
g2.DataItems.Add("Fix32.MYNODE.AI2.F_CV")
g2.DataItems.Item(1).Value = x+1
g2.Write
End Sub
```

For more information on using the Data System OCX, including its related properties and methods, refer to the DataSystem OCX object topic of the iFIX Automation Interfaces Electronic Book.

Reading from and Writing to a Database Tag

There are several ways to write a value to a database tag. The examples in this section show you how to:

- Write a value directly to a defined database tag.
- Write a value to a database tag using the WriteValue global subroutine.
- Write a value to a database tag using its Value property.

NOTES:

- An unsigned write occurs when a database tag is configured for electronic signature, but you write a value directly to that tag without capturing a signature. If you are working in a secure environment with the Electronic Signature option enabled, you must be aware of the impact of unsigned writes to the process database.
- Unsigned writes can originate from scripts. Refer to the Implications of Database Writes With Electronic Signature section of the Using Electronic Signatures manual for detailed information.

Writing a Value to a Defined Database Tag

The easiest way to write a value to a defined database tag is to perform a direct write:

```
FIX32.NODE.AI1.F_CV = 50#
```

In this example, a value of 50 is written to the database tag FIX32.NODE.AI1.F_CV. Because of the restrictions enforced by VBA naming conventions, this is not the recommended method for writing values through VBA scripting (see the VBA Naming Conventions section). The easiest methods for reading and writing values through VBA scripting are by using the WriteValue and ReadValue subroutines. These subroutines are described in more detail in the next section.

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Writing a Value Using the WriteValue Subroutine

In order to overcome the limitations of VBA's naming conventions, iFIX provides the global subroutines **WriteValue** and **ReadValue** for writing values to and reading values from database tags. The following two examples show how to use the WriteValue subroutine to write a value to a tag.

This script writes a value of 50 to the FIX32.MYNODE.AI-1.F_CV tag:

```
Private Sub CommandButton1_Click()
     WriteValue "50", "AI-1"
Exit Sub
```

If you omit the second parameter, the WriteValue subroutine writes a value of 60 to the first connection of the selected object in the run-time environment. For example, let's say that you have a rectangle selected in your picture, and that rectangle has a VerticalFillPercentage animation tied to the tag FIX32.MYNODE.AO3.F_CV. When you click a push button containing the following script:

```
Private Sub CommandButton1_Click()
     WriteValue "60"
Exit Sub
```

iFIX writes a value of 60 to the FIX32.MYNODE.AO3.F_CV tag.

Write a Value Using the Database Tag's Value Property

This example assumes that there is a color animation on a shape named *Rect1*. It receives the database tag connected to Rect1's ForegroundColor property and writes a value of 70.

Example: Using the Database Tag's Value Property

```
Private Sub CommandButton1_Click()
Dim objDataTag as Object
Dim blnHasConnection as Boolean
Dim lStatus as Long
Dim lIndex as Long
Dim strPropertyName as String
Dim strExpression as String
Dim strFQE as String
Dim vtAnimationObjects
Dim objDataTag as Object
Dim strDataSourceName as String

Rect1.IsConnected "ForegroundColor", blnHasConnection, _
lIndex, lStatus
Rect.GetConnectionInformation lIndex, strPropertyName, _
strExpression, strFQE, vtAnimationObjects

'Assume that the first Animation object is the color
'animation object you are looking for. Set the string
'name for the data source equal to the data source of
'the animation object.
strDataSourceName= vtAnimationObjects(0).Source

'Use the FindObject method to get the database tag
'object with the string name FIX32.MYNODE.AI1.F_CV.
Set objDataTag = _
System.FindObject("FIX32.MYNODE.AI1.F_CV")

'Set the Value property of the Database Tag object
'equal to 70.
```


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```
ObjDataTag.Value = 70

End Sub
```

Accessing Data from a Relational Database

iFIX not only gives you the ability to access real-time data, but also has the flexibility to access data from a relational database. This chapter shows you how to access data from a relational database using ActiveX Data Objects (ADO).

The chapter also discusses how to effectively query an SQL database. You can also perform this task using VisiconX, which is now included as an integral part of iFIX.

For more information on VisiconX, see the Using VisiconX manual.

Database Access in VBA: MDAC

While iFIX supports the Data Access Object (DAO), the Remote Data Object (RDO), and the ActiveX Data Object (ADO), it is recommended in most cases that you use ADO for all iFIX VBA scripts that deal with database access. ADO is part of Microsoft Data Access Components (MDAC).

For a summary of Microsoft's database technologies, refer to article ID 190463 on the Microsoft web site. This article describes database technologies such as MDAC, DA SDK, ODBC, OLE DB, ADO, RDS, and ADO/MD, and the differences between them. For information on MDAC and iFIX, refer to the Third-Party Software Installed During the iFIX Install section in the Getting Started with iFIX electronic book.

Using ActiveX Data Objects

This example shows how to manipulate data in a relational database using ActiveX Data Objects (ADO). ADO is a free download from Microsoft's web site. Currently, Microsoft is encouraging VBA developers to use ADO over the other types of data access. The key elements covered in this section include:

- Creating ADO objects.
- Populating an MSFlexGrid from a Select statement.
- Adding a record to the database.
- Updating a record in the database.
- Deleting a record from the database.

Creating ADO Objects

In order to use ActiveX Data Objects to manipulate data, you need to reference the ActiveX Data Objects Library in your picture's project. Select the References command from the VBE Tools menu and

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then select the ADO type library. The object variables are declared at the Module level, which means that they are available in all of the other routines in this example. If you don't need to manipulate the records after reading them, then they can be declared at the Procedure level.

Example: Creating an ADO Record set

```
'General Declarations
Dim conODBC As ADODB.Connection
'This stores the link to the database.
Dim adoRS As ADODB.Recordset
'This stores the results of the query.

Private Sub InitADO()
     Dim strQuery As String
     On Error GoTo ErrorHandler

     'SQL query that ADO will run.
     strQuery = "SELECT Recipe_ID, Recipe_Name, Batch_Size, " _
     & "Milk_Quan , Choc_Quan, Mix_Time, Milk_Type _
     FROM ACCEPT_TEST & "ORDER _BY _Recipe_Name ASC"

     Set conODBC = New ADODB.Connection
     'Create ADO Connection Object.

     'Connect to the database. Connect string can be DSN-less.
     'This varies by database type.
     conODBC.Open "driver= _
     & " SQL server};server=thunder;uid=sa;pwd=;database=master"
     Set adoRS = New ADODB.Recordset
     'Create ADO Recordset Object.

     'Run the query, and set options to allow read/write access.
     adoRS.Open strQuery, conODBC, adOpenDynamic, _
     adLockPessimistic, adCmdText
     Exit Sub
     ErrorHandler:
          HandleError
End Sub
```

Populating an MSFlexGrid or Similar Spreadsheet OCX with ADO

To get the data out of the record set for display, a spreadsheet or grid is handy. The following code shows how to copy the data into the grid.

NOTE: The example provided here uses the MSFlexGrid. You can use this or any similar spreadsheet, such as the VideoSoft VSFlexGrid, in your applications. GE does not provide the MSFlexGrid; it is referenced in the documentation for illustration purposes only.

Example: Populating a Flexgrid with Data from an ADO Record set

This example builds upon the previous example for the population of ADORS. It assumes a flexgrid already exists in a picture.

```
Private Sub LoadRecipes()
     Dim iRow As Integer
     Dim iCol As Integer
     On Error GoTo ErrorHandler

     'Set MSFlexGrid column sizes and titles.
     InitGrid
     iRow = 0
```


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```
     'Read though the entire record to populate the grid.
     While adoRS.EOF <> True
          iRow = iRow + 1
          MSFlexGrid1.Row = iRow
          For iCol = 0 To 5
               MSFlexGrid1.Col = iCol
               MSFlexGrid1.Text = adoRS(iCol)

          'After setting the row and column of the grid, insert
          'data into the cell.
          Next iCol

          'Move to the next record returned from the query.
          adoRS.MoveNext

     Wend

     'The row number will show the number of records returned.
     RecipeCount.Value = Str(iRow)
     Exit Sub
     ErrorHandler:
          HandleError
End Sub
```

Adding a Record to the Database through ADO

If the recordset is not opened as read-only, you can add records to the database through ADO.

Example: Adding a Record to a Database Using an ADO Recordset

```
Private Sub AddRecipe()
     Dim lIndex As Long
     On Error GoTo ErrorHandler
     If RecipeName.Value = "" Then
          MsgBox "Please Enter Recipe Parameters First",_
          vbExclamation, "Recipe Control"
          Exit Sub
     End If
     adoRS.AddNew 'Adds a new record to the recordset.

     'Populate the record with data.
     adoRS!Batch_Size = CLng(BatchSize.Value)
     Milk_Quan = CLng(MilkQuan.Value)
     adoRS!Choc_Quan = CLng(ChocQuan.Value)
     adoRS!Mix_Time = CLng(MixTime.Value)
     adoRS!Milk_Type = CLng("1")
     adoRS!Recipe_Name = RecipeName.Value
     adoRS.Update  'Commits the new record to the database.
     adoRS.Requery 'Refreshes the recordset.
     LoadRecipes 'Populates the grid.
     Exit Sub

     ErrorHandler:
     'Handle the error returned if any columns need to be unique
     '(such as recipe name) but weren't.
     If Err.Number = -2147217887 Then
          MsgBox "Recipe Names Must be Unique", vbExclamation, _
          "Recipe" & "Control"
          Exit Sub
     End If
     HandleError
```

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```
End Sub
```

Updating a Record in the Database through ADO

If the recordset is not read-only, you can change values in a record and write them to the database with ADO.

Example: Updating a Database Using an ADO Record set

```
Private Sub UpdateRecipe()
     On Error GoTo ErrorHandler

     'Check for primary key setting before update.
     If RecipeID.Value = "" Then
          MsgBox "Please Select a Recipe First", vbExclamation, _
           "Recipe" & "Control"
          Exit Sub
     End If
     adoRS.Requery 'Refresh the recordset.
     While adoRS!Recipe_ID <> CLng(RecipeID.Value)
          adoRS.MoveNext
          'Move to the selected record to be updated.
     Wend

     'Set any changed values.
     adoRS!Batch_Size = CLng(BatchSize.Value)
     adoRS!Milk_Quan = CLng(MilkQuan.Value)
     adoRS!Choc_Quan = CLng(ChocQuan.Value)
     adoRS!Mix_Time = CLng(MixTime.Value)
     adoRS.Update  'Commits the updated record to the database.
     adoRS.Requery 'Refreshes the recordset.
     LoadRecipes 'Populates the grid.
     Exit Sub
     ErrorHandler:
          HandleError

End Sub
```

Deleting a Record from the Database through ADO

If the recordset is not read-only, you can delete records from the database with ADO.

Example: Deleting a Record from a Database Using an ADO Record set

```
Private Sub DeleteRecipe()
     On Error GoTo ErrorHandler

     'Check for primary key setting before delete.
     If RecipeID.Value = "" Then
          MsgBox "Please Select a Recipe First", vbExclamation, _
          "Recipe Control"
          Exit Sub
     End If
     adoRS.Requery 'Refresh the recordset.
     While adoRS!Recipe_ID <> CLng(RecipeID.Value)
          adoRS.MoveNext
          'Move to the selected record to be updated.
     Wend
```


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```
     adoRS.Delete  'Deletes the current record in the recordset.
     adoRS.Update  'Commits the deleted record to the database.
     adoRS.Requery 'Refreshes the recordset.
     LoadRecipes 'Populates the grid.
     Exit Sub
     ErrorHandler:
          HandleError

End Sub
```

For more information on ADO, refer to the Advanced Topic: Using SQL section.

Advanced Topic: Using SQL

Structured Query Language (SQL) is a standard language that is used by relational databases to retrieve, update, and manage data. Although it provides the common syntax for applications to use, it does not provide a common application program interface (API). Open Database Connectivity (ODBC) is Microsoft's standard API for accessing, viewing, and modifying data from a variety of relational databases.

Previously, accessing data meant writing a Microsoft Visual Basic script, which can be tedious and requires knowledge of Visual Basic. However, VisiconX, a component of the current version of iFIX, harnesses Microsoft ADO technology. By using ADO, VisiconX lets you access data easily and quickly without writing scripts. For more information, refer to the Using VisiconX manual.

Working in the Run-time Environment

iFIX VBA allows you to dynamically control your objects and pictures while you are working in the run-time environment. This chapter focuses on how you can script your applications to perform a variety of functions at run time, such as:

- Changing data sources.
- Changing properties in objects, or in pens of a chart.
- Entering data in global forms.

Changing Data Sources

This section illustrates how you can write scripts that dynamically change the data source of objects "on the fly" at run-time. As we discussed in the Working with iFIX Objects chapter, animating objects begins by making a connection to a data source. The first example shows you how to create a direct connection while in the run-time environment. It includes the following topics:

- Creating a Direct Connection to an Object
- Changing a Text Object's Caption
- Changing a Variable Object's Current Value
- Changing the Data Source of a Data Link

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- Change a FIX Event's Data Source
- Replacing String Properties

NOTE: When you change a data source at run time, the change does not remain intact when you switch back to the configuration environment. The behavior of the picture depends on the status of the picture cache. In addition, if you add or delete scripts in run mode, the picture will not be loaded into cache when it is closed. Refer to the Using Picture Caching section of the Creating Pictures manual.

Creating a Direct Connection to an Object

The following example connects an AI tag to the Horizontal Fill Percentage of a rectangle when you click it in the run-time environment.

▶ To connect an AI tag to the Horizontal Fill Percentage of a rectangle when you click it:

1. Draw a rectangle on your screen.
2. Create an AI database Tag with RA as the I/O address (using the SIM driver).
3. Right-click the rectangle and select Edit Script from the pop-up menu.
4. Enter the following code in the rectangle's Click event:

```
Dim lstatus as Long
Rect1.Connect "HorizontalFillPercentage", _    "Fix32.Thisnode.AI.F_CV", lstatus
```

5. Switch to Run and Click the rectangle.

Before you click the rectangle, it is solid. After you click it, the rectangle starts to fill based on the AI tag's value. You have dynamically connected the rectangle's fill level to the database tag.

Example: Changing the Data Source of an Animation Connected to an Object

As we discussed in the Working with iFIX Objects chapter, there are three different types of animation objects — Lookup, Linear, and Format. The example below shows you how to set an object, and change the source of the animation object that is connected to it while you are in the run-time environment.

▶ To set an object and change the source of the animation object that is connected to it:

1. Create an AI block (AI1) with RA as the I/O address, and another AI block (AI2) with RG as the I/O address.
2. Create two Data links. Connect one Data link to AI1, and connect the other to AI2.
3. Add a rectangle, and animate its Foreground Color (a Lookup object) using AI1 as the data source.
4. Now animate the fill of the rectangle (a Linear object), and use AI1as the data source.
5. Edit the rectangle's Click event.
6. Enter the following code:

```
Dim AllObj As Object
Dim SingleObj As Object
Dim Count As Integer
Dim ObjCount as Integer

'Set AllObj equal to the collection of contained objects
'in the picture.
Set AllObj = _
```

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```
Application.ActiveDocument.Page.ContainedObjects

'Check how many objects are in the picture.
For Each SingleObj In AllObj
     Count = AllObj.Count
     'Look through all of the objects in the picture.
     While Count > 0
          'If the current object (shape) has contained objects,
          'check the number of objects (animations) it contains.
          If SingleObj.ContainedObjects.Count > 0 Then
               ObjCount = SingleObj.ContainedObjects.Count
               'For each object contained in the current object,
               'check its class name.
               While ObjCount > 0
                    Select Case _
                    SingleObj.ContainedObjects._
                    Item(ObjCount).ClassName
                    'If the contained object is a Lookup
                    '(table), change the data source to
                    'FIX32.THISNODE.AI2.F_CV

                    Case "Lookup"
                    SingleObj.ContainedObjects._
                    Item(ObjCount).Source = _
                    "Fix32.Thisnode.AI2.F_CV"
                    'If the contained object is a Linear object,
                    'change the data source to
                    'FIX32.THISNODE.AI2.F_CV

                    Case "Linear"
                    SingleObj.ContainedObjects._
                    Item(ObjCount).Source = _
                    "Fix32.Thisnode.AI2.F_CV"
                    End Select

                     ObjCount = ObjCount - 1
                Wend
          End If
     Count = Count - 1
     Wend
Next SingleObj
```

7. Switch to the run-time environment and click the rectangle.

   Both the Fill and Color animations change from the current value of AI1 to the current value of AI2.

Changing a Text Object's Caption

The following example changes the caption of text you have entered when you click on the text at run-time.

To change a text object's caption:

1. Create a Text object and enter "Hello".
2. Edit the Text object's Click event.
3. Enter the following code:

```
Text1.Caption = "New Caption"
```

4. Switch to Run and click on the Text object.

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The caption of the Text object will change from Hello to New Caption.

Changing a Variable Object's Current Value

This example shows you how to write a script that changes a Variable object's current value when clicking text at run time.

To change a Variable object's caption:

1. Create a Variable object.
2. Change the object's type to Long.
3. Create a Text object.
4. Using the Animations dialog box, animate the Text object's Caption using the Variable object's CurrentValue property as its data source.
5. Right-click the Text object and select Edit Script from the pop-up menu.
6. Enter the following code in the Text object's Click event:

   ```
   Variable1.CurrentValue = Variable1.CurrentValue + 10
   ```

7. Switch to the run-time environment and click the Text object.

   The caption of the Text object increments by 10 (as will the Variable's current value).

Changing the Data Source of a Data Link

This example details how to change the data source of a Data link in the run-time environment using the Format object.

To change the data source of a Data link using the Format object:

1. Create an AI block with RA as the I/O address, and a DO block in the database.
2. Create a Data link and connect it to the AI block.
3. Right-click the Data link and select Edit Script from the pop-up menu.
4. Enter the following code in the Data link's Click event:

   ```
   DataLink1.ContainedObjects.Item(1).Source = _
   "Fix32.Thisnode.DO.F_CV"
   ```

5. Initialize the DO block, switch to the run-time environment, and click the Data link.

   The caption of the Data link changes to the current value of the DO block.

Change a FIX Event's Data Source

The steps that follow describe how to change the data source of a FIX event in the run-time environment.

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To change the data source of a FIX event in the run-time environment:

1. In Database Manager, create an AI block and a DO block.
2. Create a new Picture.
3. Insert a FIX event.
4. Name the FIX event, and choose the AI block as a data source.
5. Add a rectangle to your picture. Right-click the rectangle and select Edit Script from the pop-up menu.
6. Enter the following code in the rectangle's Click event:

```
Dim obj As Object
Dim Count As Integer

'Set obj equal to the collection of objects contained in 'the active picture
Set obj = Application.ActiveDocument.Page.ContainedObjects
Count = obj.Count

'Loop through all of the objects in the picture to find 'any that are Event objects.
While Count > 0
     'If the object is an Event object, change its source
     If obj.Item(Count).ClassName = "FixEvent" Then
          obj.Item(Count).Source = "Fix32.ThisNode.DO.F_CV"
          'Display a message box that describes the change.
          MsgBox "The Fix Event " & obj.Item(Count).Name & _
          " is now connected to the data source " & _
          obj.Item(Count).Source
     End If
     Count = Count - 1
Wend
```

7. Switch to the run-time environment and click the rectangle. The message box appears stating that the source has changed.

Replacing String Properties

You can use the FindReplace object to replace string properties of an object at run time. The following example uses the FindReplaceInObject method to accomplish this.

The code in this example searches through a group of objects within a picture and changes their data sources by replacing AO with AI.

To search for AO data sources in a picture and replace with them AI data sources:

1. Insert a Data link and assign Fix32.Thisnode.AO.F_CV as the data source.
2. Insert a rectangle and animate its HorizontalFillPercentage using AO as the data source.
3. Now duplicate the rectangle three times.
4. Select all the rectangles and group them.
5. Name the group "MyGroup".
6. Create a Push button. Right-click the Push button and select Edit Script from the pop-up menu.
7. Enter the following code in the Push button's Click event:

```
Dim Success As Boolean
FindReplace.FindReplaceInObject MyGroup, 4, "AO", "AI",_
```

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```
     Success
'The 4 indicates to search through data sources only.
```

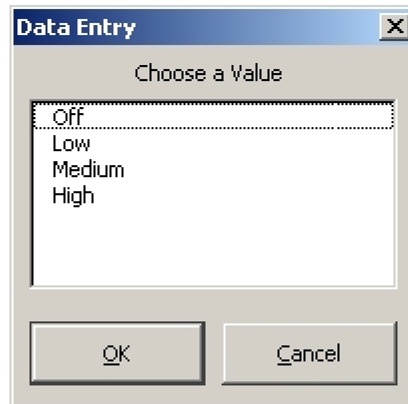
8. Switch to the run-time environment and click the Push button.

   The FindReplace object searches MyGroup and changes all instances of AO to AI. Because the Data link's data source falls outside of MyGroup, it remains unchanged.

Creating Global Forms for Data Entry

This example shows how to create a UserForm in the UserGlobals page and reference it from a picture for the purpose of data entry. Inserting run-time accessible forms in the User Globals page allows only one copy of the form on the system. This makes version control easier and minimizes the size of iFIX picture files.

This example uses a form that you create in User Globals. The following figure shows how it should appear in the run-time environment.



Data Entry Dialog Box

This example contains a UserForm **frmListEntry** and a module **UGSubs**, both of which are located in Project_User. The name of the picture is LISTENTRY1.GRF.

Example: Form Code

```
Option Explicit
Dim strDataSource As String
'Custom subroutine to pass DataSource and List items to form
Public Sub SetupTheData(DataSource As String, _
Optional Item1 As String, Optional Item2 As String, _
Optional Item3 As String, Optional Item4 As String, _
Optional Item5 As String, Optional Item6 As String)
'Get the data source and any passed-in items for the list.
'This example uses six items, but there is no limit.

strDataSource = DataSource
     If Item1 <> "" Then EntryBox.AddItem Item1
     If Item2 <> "" Then EntryBox.AddItem Item2
     If Item3 <> "" Then EntryBox.AddItem Item3
     If Item4 <> "" Then EntryBox.AddItem Item4
     If Item5 <> "" Then EntryBox.AddItem Item5
     If Item6 <> "" Then EntryBox.AddItem Item6
```

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```
End Sub

Private Sub CancelButton_Click()
     Unload Me

End Sub

Private Sub OKButton_Click()
     Dim DataObj As Object

     On Error GoTo ErrorHandler
     'Write the chosen value from the list to the tag.
     Set DataObj = System.FindObject(strDataSource)
     DataObj.Value = EntryBox.Value
     Unload Me
     Exit Sub
     ErrorHandler:
          MsgBox "Error " + Str(Err.Number) + " has occurred" _
          + Chr(10) + Chr(13) + Err.Description

End Sub
```

Example: Module Code

```
Option Explicit
'Declare the Form object.
'This must be in a Module to use the user-defined data type.
'The user-defined data type allows Quick Info and Auto
'Complete to work.
Public ListForm As frmListEntry
Public Sub GetListForm()
     'Creates a new instance of the form.
     Set ListForm = New frmListEntry

End Sub
```

Example: iFIX Object Code

```
Private Sub CommandButton1_Click()

     On Error GoTo ErrorHandler
     'Create an instance of the form.
     UGSubs.GetListForm
     'Pass in the tag to control and load the form list with
     'choices. Use text or numbers as appropriate for the
     'tag-field data type.
     UGSubs.ListForm.SetupTheData _
     "Fix32.BATCH1.BATCH-RECIPENAME.A_CV", _
     "Off", "Low", "Medium", "High"
     'Show the form.
     UGSubs.ListForm.Show
     Exit Sub
     ErrorHandler:
          HandleError

End Sub
```

Working with the Scheduler

This section briefly discusses the Scheduler application and the VBA DoEvents function. It includes the following topics:

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- Scheduler
- DoEvents Function
- Using Timers in place of DoEvents
- Using Scripts with Time-based Entries
- Using Scripts with Event-based Entries

For more information on the Scheduler application, refer to the Mastering iFIX manual. For more information on the DoEvents function, refer to the iFIX Automation Reference. The examples that appear later in this section illustrate how to work with the two Scheduler objects: **Timer** and **Event**.

Scheduler

There are certain tasks that you may want to perform at a specified time or interval, or when a change occurs in a database value or in any OPC data server value. For example, you may want to run a script that generates a report at the end of every shift or replaces the currently-displayed picture when a database point exceeds a certain value.

The Scheduler allows you to create, edit, monitor, and run both types of actions as scheduled entries. In the Scheduler, you define the time or event that triggers a scheduled entry, and the action, referred to as an *operation*, that you want to occur.

The Scheduler is useful because it allows iFIX to schedule time- or event-based scripts to run as background tasks. This makes it ideal for reducing overhead, since you do not have to use VBA for monitoring purposes. Because schedules can be run as background tasks, they have their own VBA thread. This allows you to have two scripts running at the same time; one in the background and one in the active application.

If you will be writing scripts from a background task that will be manipulating objects or pictures in the iFIX WorkSpace, you must first get a pointer to the WorkSpace application. The script below shows how you can use the GetObject method to do this:

```
Dim App As Object
Set App = GetObject("", "WorkSpace.Application")
```

Once you have the pointer to the WorkSpace application, you can use the App object in your code to represent the Application object in the iFIX WorkSpace.

See the Mastering iFIX manual for more information on the FixBackgroundServer task and the Scheduler application.

DoEvents Function

Within iFIX, VBA functions as a single-threaded application. The system can initiate more than one script; however, only one script can be running at any one time. When an event triggers a script, it is placed in a queue. Each script in the queue is executed in the order in which it is received once the previous script has run to completion. For this reason, scripts that loop and scripts that take a long time to run can delay execution of the scripts behind them in the queue. The DoEvents Function allows the operating system to process events and messages waiting in the queue and enables an event to yield exe-

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cution so that the operating system can process other UI events. Use the VBA DoEvents function in scripts that take a long time to run.

WARNING: Any time you temporarily yield the processor within an event procedure, make sure the procedure is not executed again from a different part of your code before the first call returns; this could cause unpredictable results. It is strongly advised that you do not use DoEvents functions in your iFIX scripting.

See the Visual Basic for Applications Help file for more information, including an example of the DoEvents function.

For more information on DoEvents, go to the Microsoft Support web site and search for Article ID: 118468.

Using Timers in place of DoEvents

The DoEvents call allows a program to process events while in VBA script. However, the DoEvents call cannot control what is executed and does not control what is currently executing.

The following script is an example of a DoEvents call:

```
Dim I as Integer
For I = 0 to 10000
If I Mod 100 = 0 Then
     DoEvents
     'Execute events every hundredth iteration through the loop
End If
     'Do Something
Next I
```

If your code is tied to an event, your code may be executed again before DoEvents returns. If the code is operating on global data or data that exists outside the scope of the script, you could corrupt your own data by reentering the routine.

You can solve this problem by using timers in place of DoEvents to execute portions of the code.

The following script outlines the solution:

```
'Here is a global variable to track the iterations through the
'loop.
'Note that it is initialized to zero by VBA
Dim IndexCount As Integer

Sub StartRoutine() 'Execute this routine to start

IndexCount = () 'We are starting a new loop
FixTimer.StartTimer 'Get the timer going

End Sub

Private Sub StopRoutine()
'The timer routine will execute this when completed
FixTimer.StopTimer

End Sub

Private Sub CfixPicture_Initialize()

'Make sure that the timer is stopped on picture load
StopRoutine

End Sub
```

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```
Private Sub CommandButton1_Click().

'This will launch the routine from a button
StartRoutine

End Sub

Private Sub FixTimer_OnTimeOut(ByVal1TimerId As Long)
'This is the timer routine

'This variable ensures that another timer event doesn't execute 'the routine
Static iAlreadyHere As Integer
If (iAlreadyHere = 1) Then
     Exit Sub

End If

'Lock out other callers
iAlreadyHere = 1
Dim I As Integer

For i = IndexCount to 10000
'Note: We will exit this loop before we hit 10,000

'Do Something
     If i Mod 100 = 0 Then
       IndexCount = i + 1
       iAlreadyHere = 0 'Timers can now execute this routine
       Exit Sub 'Give up process and allow other things to run

     End If

Next i

StopRouting 'We are done
iAlreadyHere = 0

End Sub
```

Using timers to execute portions of code allows VBA, the picture, and global variables to be in a predictable state while executing your VBA script.

Using Scripts with Time-based Entries

There are certain tasks that you will want to perform at a specified time or interval or when a change occurs in the process. To schedule these tasks you will need to define the time that triggers the action that you want to occur. You can use the Scheduler application within iFIX or you can write your own VBA script. For more information on the Scheduler, refer to the Scheduler section of the Mastering iFIX manual.

The following example periodically checks the amount of available hard disk space. If the amount of disk space gets too low, it triggers an alarm in the iFIX database. The OnTimeOut event occurs at an interval defined in the properties of the CheckDiskSpace event.

Example: Checking Disk Space and Triggering an Alarm if Too Low

```
'First, declare the Windows API function call
'GetDiskFreeSpace so you can use it to get the amount of
```


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```
'free space available on the disk.

Private Declare Function GetDiskFreeSpace Lib "kernel32" _
Alias "GetDiskFreeSpaceA" (ByVal lpRootPathName As String, _
lpSectorsPerCluster As Long, lpBytesPerSector As Long, _
lpNumberOfFreeClusters As Long, lpTotalNumberOfClusters _
As Long) As Long

'Check the disk space on the Timer Event's OnTimeOut
'event. If it is less than 150MB, set an alarm.
'CheckDiskSpace is the name of the Timer object
'created in the Scheduler.

Private Sub CheckDiskSpace_OnTimeOut(ByVal lTimerId As Long)
     Dim lAnswer As Long
     Dim lpRootPathName As String
     Dim lpSectorsPerCluster As Long
     Dim lpBytesPerSector As Long
     Dim lpNumberOfFreeClusters As Long
     Dim lpTotalNumberOfClusters As Long
     Dim lBytesPerCluster As Long
     Dim lNumFreeBytes As Double
     Dim lDiskSpace As Double

'Warning: The parameter below hard codes C: as the drive to
'check. If you do not nave a C: drive, this code will return 0
'as the free space. You need to change this parameter to match
'the drive you want checked.

     lpRootPathName = "c:\"
     lAnswer = GetDiskFreeSpace(lpRootPathName, _
     lpSectorsPerCluster, lpBytesPerSector, _
     lpNumberOfFreeClusters, lpTotalNumberOfClusters)
     lBytesPerCluster = lpSectorsPerCluster * lpBytesPerSector
     lNumFreeBytes = lBytesPerCluster * lpNumberOfFreeClusters
     lDiskSpace = Format(((lNumFreeBytes / 1024) / 1024), _
     "0.00")

     If lDiskSpace < 150# Then
          Fix32.NODE1.lowdiskspacealarm.f_cv = 1

     Else
          Fix32.NODE1.lowdiskspacealarm.f_cv = 0

     End If
End Sub
```

Using Scripts with Event-based Entries

The following is an example of downtime monitoring. The Scheduler application waits for the value of FIX32.NODE1.DOWNTIMESTART.F_CV to be true. When it is true, the script launches a form that allows the user to enter the reason for the downtime occurrence. When the user clicks OK, the script opens the appropriate database and writes the time, date, data source, and downtime description to the database. Use the parameters in the following table to create the event object and the form. Be careful to place the Option Buttons inside the Frame.

DownTime Start Event Properties

OBJECT	PROPERTY	SETTING
Event	Name	Line1Packer1DownTime
	Event Type	On True

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	Data Source	Fix32.NodeName.DownTimeStart.F_CV
Form	Name	frmDownTime
	Caption	Downtime Monitoring Logging to Relational Database
Command Button	Name	cmdOK
	Caption	OK
Frame	Name	fraLine1Packer1
	Caption	Packaging Line 1 Packer 1
Option Button	Name	optDownTimeReasonOne
	Caption	Bad packaging material
Option Button	Name	optDownTimeReasonTwo
	Caption	Fallen bottle or bottle jam on line to packer
Option Button	Name	optDownTimeReasonThree
	Caption	Low oil pressure in packer drive
Option Button	Name	optDownTimeReasonFour
	Caption	<Leave this caption blank>
Textbox	Name	**TxtDownTimeReasonFour**
	Enabled	**False**

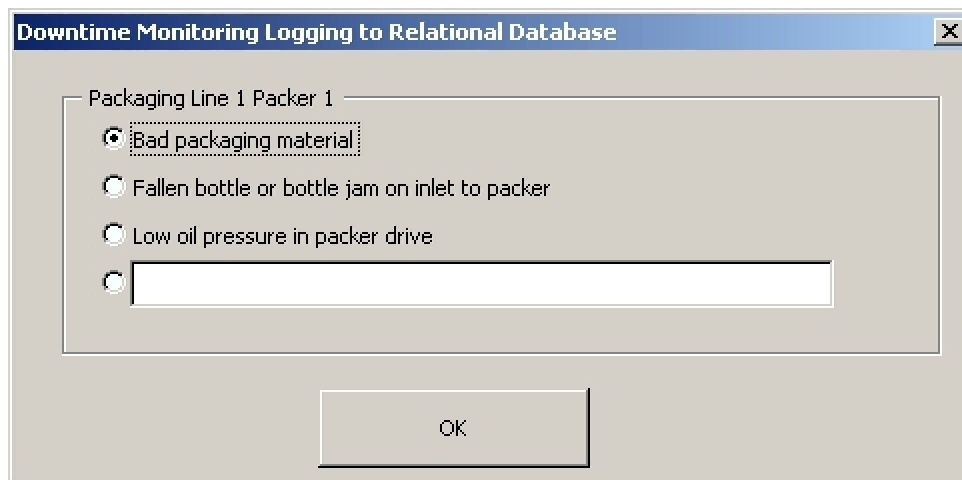
Example: Recording DownTime Monitoring

```
'Place the following code into the subroutine created after
'clicking the VB Editor button in the Modify Event Entry dialog.

'On the Event object's OnTrue event, initialize the form
'with the Event's data source and then show the form.
'Line1Packer1DownTime is the name of the event created
'in Scheduler.

Private Sub Line1Packer1DownTime_OnTrue()
     frmDownTime.InitializeDataSource _
     (Line1Packer1DownTime.Source)
     frmDownTime.Show

End Sub
```



Downtime Monitoring Logging to the Relational Database

```
'Place the following code directly in the form you create and 'set a reference to Microsoft DAO 3.X Object Librar

Public sDataSource As String
```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```
'This is the initialize routine that is called from the Event
'object's OnTrue event. It creates a public instance of the
'string name of the data source for the form to use.
Public Sub InitializeDataSource(DataSource As String)
     sDataSource = DataSource

End Sub

'When the option button beside the text box is selected,
'enable and set focus to the text box.
Private Sub optDownTimeReasonFour_Click()

     txtDownTimeReasonFour.Enabled = True
     txtDownTimeReasonFour.SetFocus

End Sub

'When the form gets activated, set the first option to true
Private Sub UserForm_Activate()
     optDownTimeReasonOne.Value = True

End Sub

'When the user selects OK, store which reason they chose.
Private Sub cmdOK_Click()
     Dim DownTimeReason As String
     If optDownTimeReasonOne.Value = True Then
          DownTimeReason = optDownTimeReasonOne.Caption
     ElseIf optDownTimeReasonTwo.Value = True Then
          DownTimeReason = optDownTimeReasonTwo.Caption
     ElseIf optDownTimeReasonThree.Value = True Then
          DownTimeReason = optDownTimeReasonThree.Caption
     ElseIf optDownTimeReasonFour.Value = True Then
          If txtDownTimeReasonFour.Text <> "" Then
               DownTimeReason = txtDownTimeReasonFour.Text
          Else
               MsgBox "Please enter a reason for the _
               downtime event"
               txtDownTimeReasonFour.SetFocus
          End If
     End If

'Call the AddDownTimeEventData subroutine to add the
'downtime information to the database.
Call AddDownTImeEventData(DownTimeReason)
     Unload Me

End Sub

'This subroutine writes the data to the database and
'updates it.
'This database has not been provided and will need to be created
'for this subroutine to execute without error.

Public Sub AddDownTImeEventData(DownTimeReason As String)

     'Create an instance of the Workspace.
     Dim wrkSpace As Workspace
     Set wrkSpace = CreateWorkspace("", "admin", "", dbUseJet)

     'Open the downtime database.
     Dim db As Database
     Set db = wrkSpace.OpenDatabase(System.PicturePath & _
     "\downtime.mdb")
```

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```
    'Create a recordset.
    Dim rs As Recordset
    Set rs = db.OpenRecordset("Packaging", dbOpenDynaset)

    'Set up the time of downtime occurrence.
    Dim TimeDate As Date
    TimeDate = Now
    rs.AddNew
    rs.Fields(1) = TimeDate
    rs.Fields(2) = TimeDate
    rs.Fields(3) = sDataSource
    rs.Fields(4) = DownTimeReason
    rs.Fields(5) = Fix32.NODE1.downtimeperiod.f_cv
    rs.Update

End Sub
```


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Manipulating Charts

This chapter shows how to use VBA scripts to manipulate charts so they display real-time and historical data for a given process value at the click of a button. The examples in this chapter show how to perform the following chart tasks through scripting:

- Switch from real-time data to historical data at run time.
- Scroll historical data in a chart.
- Automatically update historical data in a chart.
- Set chart and pen properties at run time.
- Add a pen.
- Delete a pen.
- Change the pen data sources.
- Passing in external data to a pen.
- Change a chart's duration.
- Change a chart's start and end times.
- Zoom a pen.
- Pause a real-time chart.

For this example to work properly, you must have a previously-configured Extended Trend tag and you must have already successfully trended this tag's data in a chart. Also, you will need to add three command buttons to your iFIX picture. The figure below shows how the picture might look.

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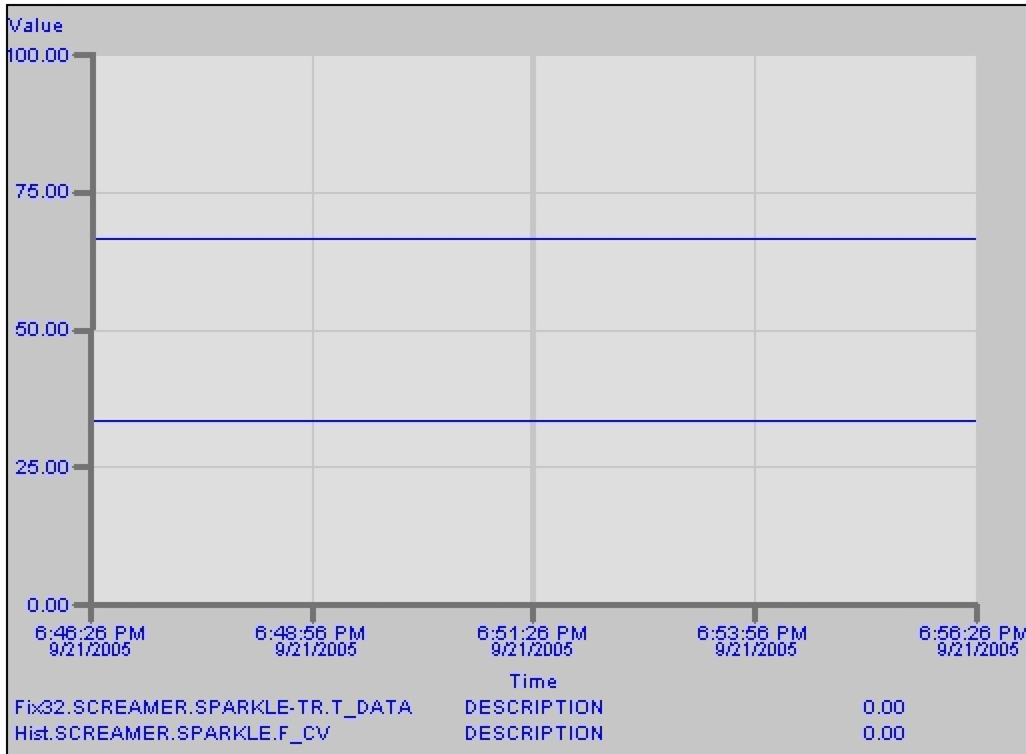

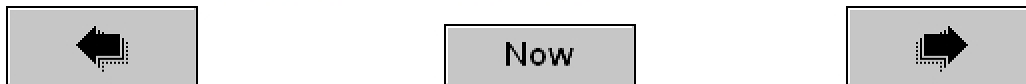

Historical Trending Example

Switching from Real-time to Historical Data

This method uses two chart pens for the same value - one real-time pen and one historical pen - and uses the Visibility property to switch between the two. Although you can do nearly the same thing by simply changing the Source property on a single pen, this script is more advantageous because the historical data is fetched while the historical pen is invisible. Therefore, operators do not have to wait as long for the historical data to display. The pens are switched when the Back button is clicked, and the Forward button switches back to real-time once the scroll returns to the present time.

The code for these buttons is shown below:

Example: Scroll Back and Scroll Forward Buttons

```
Private Sub CommandButton2_Click() 'Scroll back button.
     'If the real-time pen is scrolled back in time, switch
     'to historical data.
     If Chart1.Pens.Item(1).ShowLine = 1 Then
          'Make the real-time pen invisible and historical
          'pen visible.
          Chart1.Pens.Item(1).ShowLine = False
          Chart1.Pens.Item(2).ShowLine = True
```

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```
        'Set the historical pen to active.
        Chart1.CurrentPen = 2

        'Make real-time pen legend invisible and historic pen
        'legend visible.
        Chart1.Pens.Item(1).Legend.Visible = False
        Chart1.Pens.Item(2).Legend.Visible = True

        'Change the data type indicator.
        Text26.Caption = "Historical Data"
    End If

    'If it's a historical pen, scroll the chart backward.
    Chart1.ScrollBack
End Sub

Private Sub CommandButton1_Click() 'scroll forward button
    'If it's a real-time pen, scrolling forward is
    'not available.
    If Chart1.Pens.Item(1).ShowLine = 1 Then
        MsgBox "Can't move into the future!", _
        vbExclamation, "This isn't a Time Machine."
        Exit Sub
    End If

    'If historical pen, scroll the chart forward.
    Chart1.ScrollForward

    'If historical pen is scrolled beyond current
    'time, switch back to real-time.
    If Chart1.EndTime >= Now Then
        'Make the historical pen invisible and
        'real-time pen visible.
        Chart1.Pens.Item(2).ShowLine = False
        Chart1.Pens.Item(1).ShowLine = True

        'Set the real-time pen to active.
        Chart1.CurrentPen = 1

        'Make historical pen legend invisible
        'and real-time pen legend visible.
        Chart1.Pens.Item(1).Legend.Visible = True
        Chart1.Pens.Item(2).Legend.Visible = False

        'Change the data type indicator.
        Text26.Caption = "Real-Time Data"
    End If
End Sub
```

Scrolling Historical Data

This example shows how to create buttons to scroll through historical data and set the current time in a chart.

Example: Creating Buttons that Scroll Back and Scroll Forward through Historical Data and Set Current Time

```
Private Sub CommandButton1_Click() 'Scroll back button.
    Chart1.ScrollBack
End Sub
```

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```
Private Sub CommandButton2_Click() 'Scroll forward button.
     Chart1.ScrollForward
End Sub

Private Sub CommandButton3_Click()
'This button manually sets the chart to the current time and
'refreshes the data.
     Chart1.EndTime = Now
     Chart1.RefreshChartData
End Sub
```

Automatically Updating a Chart

In a picture with a chart that contains historical data, you can create an event object that fires a script while a digital tag is closed at a predefined interval. You can use this script to update your chart automatically.

```
'This script sets the chart to the current time and refreshes
'the data at the interval specified in the event. For
'example, if you want a one minute refresh, the interval will
'be 60,000 ms.
Private Sub HistRefresh_WhileTrue()
     Chart1.EndTime = Now
     Chart1.RefreshChartData
End Sub
```

For more information on how charts scroll, refer to the Trending Historical Data manual.

Environment-specific Chart Properties and Methods

Most chart properties and methods function in both the configuration and the run-time environments. However, some properties and methods are limited to a specific environment. These properties and methods are listed in the following sections:

- Chart Properties Limited to the Configuration Environment
- Chart Properties Limited to the Run-time Environment
- Chart Methods Limited to the Run-time Environment

Chart Properties Limited to the Configuration Environment

The following Chart properties only function in the Configuration environment:

- DaysBeforeNow
- FixedDate
- FixedTime
- StartDateMode

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- StartTimeMode
- TimeBeforeNow

NOTE: Run-time changes that you make to the configuration properties of a chart revert back to the original settings once the display is closed.

Chart Properties Limited to the Run-time Environment

The following Chart properties only function in the run-time environment:

- EndTime
- StartTime

Chart Methods Limited to the Run-time Environment

The following Chart properties only function in the run-time environment:

- AutoScaleDisplayLimits
- GetTimeCursorInfo
- Refresh
- RefreshChartData
- ResetChartData
- ResetZoom
- ScrollBack
- ScrollForward
- SetTimeCursorTime
- XYHitTest
- Zoom

Environment-specific Pen Properties and Methods

Most Pen properties and methods function in both the Configuration and the run-time environments. However, some properties and methods are limited to a specific environment. These properties and methods are listed in the following sections:

- Pen Properties Limited to the Configuration Environment
- Pen Properties Limited to the Run-time Environment
- Pen Methods Limited to the Run-time Environment

Pen Properties Limited to the Configuration Environment

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The following Pen properties only function in the Configuration environment:

- FixedDate
- FixedTime
- DaysBeforeNow
- TimeBeforeNow
- StartTimeType
- StartDateType

NOTE: Run-time changes that you make to the configuration properties of a Pen revert back to the original settings once the display is closed.

Pen Properties Limited to the Run-time Environment

The following Pen properties only function in the run-time environment:

- AverageDataValue
- CurrentValue
- HighestDataValue
- LowestDataValue
- Starttime
- EndTime

Pen Methods Limited to the Run-time Environment

The following Pen properties only function in the run-time environment:

- AutoScaleDisplayLimits
- GetCurrentValue
- GetPenDataArray
- ResetChartData
- Refresh
- ScrollTimeForward
- ScrollTimeBack
- SetCurrentValue
- SetPenDataArray
- ValueTimeFromXY
- XYFromValueTime

Setting the Properties of Multiple Pens with One Call

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Some Pen properties are also exposed at the Chart level, which allows you to set the properties of all Pens within a Chart with one call. In some cases, the Chart property will reflect the value of the CurrentPen. Keep in mind that if you have customized the properties of one of the Pens, setting one of these properties through the Chart will overwrite any previous changes.

The following Pen properties can be set through the Chart:

- AutoScaleDisplayLimits
- DaysBeforeNow
- Duration
- EndTime
- FixedDate
- FixedTime
- GetDuration
- GetInterval
- GetTimeBeforeNow
- HorizontalGridColor
- HorizontalGridStyle
- Interval
- NumberofHorizontalGridLines
- NumberofVerticalGridLines
- ScrollBack
- ScrollForward
- SetDuration
- SetInterval
- SetTimeBeforwNow
- ShowDate
- ShowHorizontalGrid
- ShowVerticalGrid
- ShowLegend
- ShowTimeAxis
- ShowValueAxis
- StartTimeMode
- ShowTimeAxisTitle
- ShowValueAxisTitle
- StartDateMode
- StartTime
- TimeAxisNumLabels
- ValueAxisNumLabels
- TimeAxisNumTicks
- ValueAxisNumTicks
- TimeAxisTitle
- ValueAxisTitle
- VerticalGridColor
- VerticalGridStyle

Adding a Pen

To add a new pen to a chart, use the following syntax:

```
Chart.AddPen("Fix32.NODE.TAG.F_CV")
```

In the configuration environment, adding a pen will expand the chart by the height of the legend line. At run-time, the chart does not expand. Instead, the plot area shrinks.

Deleting a Pen

Deleting a pen is easy. For example, if you have a chart with three pens and you want to delete the second, use the following syntax:

```
Chart1.DeletePen(2)
```

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The deletion will not work if there is a script referencing the name of the pen you are trying to delete.

For example:

```
Pen2.PenLineColor = 255
Chart1.DeletePen(2)
```

This deletion will fail because there is a script explicitly using Pen2. Instead, use the following script sequence:

```
Private Sub Rect2_Click()
     Dim pPen As Object
     Set pPen = Chart1.Pens.Item(2)
     pPen.PenLineColor = 255
     Chart1.DeletePen (2)
End Sub
```

If you delete all your pens, you will create a blank chart. To add the pen back into the chart, open the Chart Configuration dialog box, or use the AddPen method in VBA.

NOTE: If you are deleting a single pen, and you want to add another, change the pen source via Pen.Source = "Fix32.Node.Tag.f_cv". This will give your chart better performance.

Changing Data Sources in a Pen

The following example shows you how to change data sources in a pen.

Suppose you have a process variable, PumpTemp1 (AI) which is also the input tag for PumpTemp1-History (ETR storing an hour of data), and you are collecting historical data from PumpTemp1. To view the different data associated with PumpTemp1, create three buttons to view the different data, using the script sequence that follows:

```
Private Sub Rect2_Click()
     Pen1.Source = "Fix32.Area1.PumpTemp1.F_CV"
End Sub

Private Sub Rect3_Click()
     Pen1.Source = "Fix32.Area1.PumpTemp1-History.T_DATA2"
End Sub

Private Sub Rect4_Click()
     Pen1.Source = "Hist.Area1.PumpTemp1.F_CV"
     'Now set the start time and fetch
     Pen1.StartTime = #10/31/98 11:30:00 AM#
     Chart1.RefreshChartData
End Sub
```

The previous example allows you to easily switch between different types of data. This next example changes the data source of a pen by editing an object's Click event.

▸ To change the data source of a pen by editing an object's Click event:

1. Create an AI block and a DO block in the database.
2. Create a chart and add a pen with DO as the data source.
3. Add a rectangle. Right-click the rectangle and select Edit Script from the pop-up menu.
4. Enter the following code in the rectangle's Click event:

   ```
   Dim Obj As Object
   ```

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```
Dim ChartObj As Object
Dim Count As Integer
Dim ChartCount As Integer

Set Obj = Application.ActiveDocument.Page.ContainedObjects
Count = Obj.Count
While Count > 0
     If Obj.Item(Count).ClassName = "Chart" Then
          ChartCount = Obj.Item(Count).ContainedObjects.Count
               While ChartCount > 0
                    Set ChartObj = _
                    Obj.Item(Count).ContainedObjects._
                    Item(ChartCount)
                    If ChartObj.ClassName = "Pen" Then
                         ChartObj.Source = "Fix32.Thisnode.AI.F_CV"
                    End If
                    ChartCount = ChartCount - 1
               Wend
     End If
     Count = Count - 1
Wend
```

5. Switch to the run-time environment and click the rectangle.

   In the Chart, the Pen's Source will change from DO to AI.

Passing in External Data to a Pen

If you have a real-time pen defined, and attempt to pass external (SQL) data to the pen using the SetPenDataArray method, the time and legend values keep updating with the real-time value.

To avoid this problem, disconnect from the real-time data source before calling the SetPenDataArray method, as show in the following sample code:

```
Pen1.SetSource "ChartData", True
res=Pen1.SetPenDataArray (count, vtVal, vtDate, vtQual)
```

where *ChartData* can be any string.

The SetPenDataArray Method takes arrays of parameters. One of these parameters is quality. This parameter holds the OPC Quality of the data as a numeric constant. When creating your own data in a relational database, you need to specify a value of 192 for this field in order for your data to plot on the chart object.

Keep in mind that the data you pass to a pen does not have to be from a SQL query - it can consist of any external data. To bring this data into a pen, use the call Pen.SetPenDataArray. You can also use GetPenDataArray to extract the data from the pen. Refer to the following example:

Example: Using GetPenDataArray to Extract Data from Pen

```
Dim lNumPts As Long
Dim vVal As Variant
Dim vPsa As Variant
Dim vQual As Variant
Pen1.GetPenDataArray lNumPts, vVal, vPsa, vQual
```

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Example: SetPenDataArray Method with Hardcoded Values

The following is sample code for the SetPenDataArray method with hardcoded values. You can use this code to test or show the functionality of this method. For this example to complete, the Quality(x) must be equal to 192.

```
Private Sub Rect2_Click()

Dim iWrkSpace As Workspace
Dim db_var_name As Database
Dim record_var As Recordset
Dim iCount As Integer
Dim dVal As Variant
Dim dtDate As Variant
Dim lQual As Variant
Dim iResult As Integer
Dim iRow As Integer
Dim iCol As Integer
Dim i As Integer

'Please note that this example can handle a maximum of 500 points.
'If you need more points, increase the size of the
'following declarations.

Dim Value(500) As Double
Dim Times(500) As Date
Dim Quality(500) As Long

'Create an object on the iFIX WorkSpace and the
'Specified SQL database

Set iWrkSpace = CreateWorkspace("", "admin", "", dbUseJet)
Set db_var_name = iWrkSpace.OpenDatabase("Chart.mdb")
Set record_var = db_var_name.OpenRecordSet("Data Query", dbOpenDynaset)

record_var.MoveLast
iCount = record_var.RecordCount
record_var.MoveFirst


'Load the array with the Recordset values

For i = 0 To iCount - 1
           Value(i) = record_var.Fields("Value").Value
           Times(i) = record_var.Fields("Time").Value
     'If the Quality(x) is not equal to 192 the Point
     'will be ignored by the chart
           Quality(i) = record_var.Fields("Quality").Value
           record_var.MoveNext
Next i

'Close the connection with the SQL database
db_var_name.Close


'Set up the correct array types

dVal = Value
dtDate = Times
lQual = Quality
iResult = Pen1.SetPenDataArray(iCount, dVal, dtDate, lQual)

End Sub
```


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Changing the Chart Duration

The following script specifies a ten-minute chart:

```
Chart1.Duration = 600
```

You can also use the following:

```
Chart1.SetDuration 0, 0, 10, 0
```

The end time will be calculated as the start time plus the duration. If you are using historical pens, you can fetch the data again by using:

```
Chart1.RefreshChartData
```

Changing the Start and End Times

To set the start time in your chart to Oct.31 at 12:30, enter the following script:

```
Chart1.StartTime = #10/31/98 12:30:00 PM#
```

The end time is calculated as the start time plus the duration.

Or use:

```
Chart1.EndTime = #10/31/98 12:30:00 PM#
```

The start time is calculated as the end time minus the duration.

If you are using historical pens, you can fetch the data again by using:

```
Chart1.RefreshChartData
```

Zooming

If the chart is selectable, you may use the mouse to enclose an area in the chart to zoom to in a rectangle selector. Alternately, you can use scripts to set the pen Hi and Lo limits to zoom:

```
'Original limits are 0 to 100, but data is fluctuating
'between 60 and 80.
Pen1.HiLimit = 85
Pen1.LoLimit = 55

'To zoom back out:
Pen1.HiLimit = 100
Pen1.LoLimit = 0

'The following method has the same effect:
Chart.ResetToOriginal

'Or you can also call this method, which would set the
'HI limit to 80 and the LO Limit to 60:
```

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```
Chart1.AutoScaleDisplayLimits
```

Pausing a Real-time Chart

If you are using real-time pens, you may want to pause the display to examine data. To do this, use the following script:

```
Chart1.Pause
'Now, to Resume:
Chart1.Resume

'There is a timeout associated with the Pause/Resume such
'that if the chart is paused for longer than the timeout,
'the chart will automatically resume. For example, to
'restart the chart after a minute:
Chart1.Timeout = 60
Chart1.Pause
```

Keyboard Accelerators

The following keyboard accelerators are available to a selectable chart:

Keyboard Accelerator	Default Purpose
Ctrl + Left Arrow	Moves the time cursor one pixel to the left.
Ctrl + Right Arrow	Moves the time cursor one pixel to the right.
Shift + Ctrl + Left Arrow	Moves the time cursor ten pixels to the left.
Shift + Ctrl + Right Arrow	Moves the time cursor ten pixels to the right.
Ctrl + Up Arrow	Selects the next pen to be the current pen.
Ctrl + Down Arrow	Selects the previous pen to be the current pen.

Using the Pens Collection

The pens contained in a chart are exposed in a collection called *Pens*. If you are constantly adding and deleting pens, writing specific scripts which operate on those pens may become cumbersome. Another way to write your scripts is to access Chart.Pens.Item(3) rather than access Pen3, for example. The order of the pens in this collection is the order that they appear in the Pen list in the Chart Configuration dialog box and in the legend.

Using the collection will also allow you to avoid any problems deleting pens that have scripts explicitly referencing them. Because of these advantages, we recommend you use the collection when you work with pens often.

Using RefreshChartData

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When using historical pens, if any of the time parameters change (StartTime, EndTime, Duration), you must call the method Chart.RefreshChartData in order to fetch the new data. If you are using ScrollForward and ScrollBack, calling RefreshChartData is not necessary.

Scrolling an Enhanced Chart VBA Example

The following code examples enable scrolling in an Enhanced Chart via scripting. This scrolling works similar to the scrolling provided with the current Historical Dynamo. The following code examples require a reference to the general data set “iFIX GeneralDataSet Object v 1.0 Type Library” in order to work properly.

Scrolling Forward (50%)

```
Dim dtTime As Variant
Dim dtDate As Variant
Dim dInterval As Long

' set scroll percentage
dInterval = LineChart1.Duration
dInterval = dInterval / 2 ' 50%

'scroll time
dtTime = GeneralDataset1.FixedTime
dtTime = DateAdd("s", dInterval, dtTime)
GeneralDataset1.FixedTime = dtTime

' scroll date
dtDate = GeneralDataset1.FixedDate
dtDate = DateAdd("s", dInterval, dtDate)
GeneralDataset1.FixedDate = dtDate

'refresh chart
LineChart1.RefreshChartData
```

Scrolling Backward (25%)

```
Dim dtTime As Variant
Dim dtDate As Variant
Dim dInterval As Long

' set scroll percentage
dInterval = LineChart1.Duration
dInterval = 0 - (dInterval / 4) ' 25%

'scroll time
dtTime = GeneralDataset1.FixedTime
dtTime = DateAdd("s", dInterval, dtTime)
GeneralDataset1.FixedTime = dtTime

' scroll date
dtDate = GeneralDataset1.FixedDate
dtDate = DateAdd("s", dInterval, dtDate)
GeneralDataset1.FixedDate = dtDate

'refresh chart
LineChart1.RefreshChartData
```

NOTE: Launching the Configuration dialog box is accomplished via the ShowCustomPages function call.

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These quick examples are limited in that they only operate on one data set within the Enhanced Chart and they access this data set by name. You can easily expand upon these examples to cover all data sets or just certain data sets within an Enhanced Chart by doing the following:

1. Retrieve the total number of data sets using the following method: GetNumberOfDataSets().
2. Iterate from 0 to the Number of Data Sets – 1.
3. Retrieve each data set via a call to the GetDataSetByPosition() method.

   NOTE: There is no longer a need to check whether a data source is historical or not before setting any time related properties. The GeneralDataSet will apply the time related properties accordingly.
4. Execute the code function calls provided in the above code examples.

Creating Custom Dynamos

This chapter provides an example for creating your own custom Dynamo object and Dynamo set. Once you become more comfortable building Dynamo objects, you can learn quite a bit about writing VBA scripts that work with iFIX by examining the scripts behind the Dynamo objects.

The following section, Creating a New Custom Dynamo, displays the actual example.

NOTE: In iFIX Dynamo sets, Dynamo objects are assigned their own properties with Get and Set functions and subroutines. This is the methodology we suggest for building complex Dynamo objects.

Creating a New Custom Dynamo

The following procedures demonstrate examples of how to create and use custom Dynamo objects in iFIX.

To build a Dynamo object:

1. Open a new picture.
2. Insert an Oval.
3. In the Properties window, change the Name property of the Oval to *dynOval*.
4. For the *dynOval* object, animate the **VerticalFillPercentage** property to any tag in the process database.
5. Insert a second Oval.
6. In the Properties window, change the Name property of the Oval to *dynOval2*.
7. Select both ovals.
8. Right-click the selected ovals, and select Dynamo. The Build Dynamo Wizard appears.

   NOTE: You can also click the Build Dynamo button, the first button on the Dynamo toolbar to open this dialog box.
9. In the Dynamo Name field, enter a name, if you do not want to use the default name.
10. Optionally, in the Object Description field, enter a description for the object.

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11. In the User Prompt field, enter a prompt such as *FillColor*.

    NOTES:

    - Ensure you enter a value here. If you do not enter a value, the user will not be shown the value in a user prompt, and as a result not have the option of changing it later. However, you can access this value manually from the Property window.
    - If you added multiple animations in this Dynamo object and you wanted them to all use the same value, enter the same name in all User Prompt fields. This results in one user prompt that changes all animations.

12. Click OK.

To build a Dynamo form:

1. Right-click the *Dynamo* object and select Edit Script from the pop-up menu.
2. In the Microsoft Visual Basic Editor, on the Insert menu, select UserForm.
3. If the Properties window is not already displayed, on the View menu, select Property Window.
4. In the Properties window, change the Name property of the form to *frmDyn1*.
5. On the Tools menu, click Additional Controls.
6. Select the iFIX Expression Editor Control and click OK.
7. Select the Expression Editor control on the toolbox and add it to the form.
8. Add a Command button on the form.
9. Right-click the Command button and select View Code from the pop-up menu.
10. Enter the following script:

    ```
    frmDyn1.hide
    ```

11. Select "General" from the Object Drop Down List (in the upper left of the Code Window).
12. Enter the following script:

    ```
    'FormVersion: 1.0
    ```

13. Select the script window for dynOval.
14. Choose Edit from the Procedure drop-down list.
15. Enter the following script:

```
Private Sub DynamoObjectName_Edit()
     Dim FillObj As Object
     frmDyn1.Show

     'FindLocalObject (below) is a subroutine in
     'FactoryGlobals Global Subroutines. In this case, it
     'finds the animation object that you created off of the
     'oval in step 4 of Building the Dynamo Object.

     Set FillObj = FindLocalObject(DynamoObjectName, _
     "AnimatedVerticalFillPercentage")
     FillObj.Source = frmDyn1.ExpressionEditor1.EditText
End Sub
```

16. Save your project and close the Microsoft Visual Basic Editor.

To create a Master Dynamo and place it in a Dynamo set:

1. In the iFIX WorkSpace, in Ribbon view, on the Home tab, in the New group, click Dynamo Set.

   - Or -

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In Classic view, on the File Menu, select New Dynamo Set.

An empty Dynamo set appears.

2. Drag the Dynamo that you created earlier in this section into the new Dynamo set. The Add Objects to Dynamo Set dialog box appears.
3. In the Add Objects to Dynamo Set dialog box, select Create a new Master Dynamo and then click OK. The object becomes a new Master Dynamo in the Dynamo set.
4. Select Save from the File menu and name your Dynamo set.

For more information on Dynamos, refer to the Creating Pictures manual.

Working with iFIX Security

The examples in this chapter illustrate how to use VBA scripts that work in conjunction with iFIX Security. Refer to the following sections:

- Using the Login Subroutine
- Getting User Information

You can read more about iFIX Security in the Configuring Security Features manual.

Using the Login Subroutine

The following script is an excerpt from the code for the Application Tabular's Login button. This script opens the **Login** application using the VBA **Shell** function.

Example: Excerpt from Script which opens the Login Application

```
Public Sub SecurityLogin()
     Dim strPath As String
     On Error GoTo ErrorHandler

     'Get the default iFIX directory.
     strPath = System.ProjectPath
     Shell strPath & "\Login.exe -m", 1
     Exit Sub

     ErrorHandler:
     HandleError
End Sub
```

Getting User Information

This script uses the System object's **FixGetUserInfo** method to get security information about the user.

Example: Using the System Object's FixGetUserInfo Method

```
Public Sub SecurityGetUser()
     Dim Result As Integer
     Dim UserID As String
```


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```
    Dim UserName As String
    Dim GroupName As String
    Dim UserInfo As String
    System.FixGetUserInfo UserID, UserName, GroupName
    MsgBox "Login Name: " & UserID & vbCr & "Full Name: " _
    & UserName & vbCr & "Clearance Level: " & GroupName
End Sub
```

Creating Tag Groups

The examples in this chapter illustrate how to use VBA scripts to create and use tags. It includes the following sections:

- Creating the Tag Group File Object
- Retrieving Tag Group Data
- Modifying Tag Group Data
- Manipulating Tag Groups

For more information on tag groups, refer to the Creating Pictures manual.

Creating the Tag Group File Object

You can create or modify a tag group file using the TagGroupDefinitionInterface. You can access the interface by creating a tag group file object. The following script creates a tag group file object.

```
Dim TGD as Object
set TGD = _
CreateObject("TagGroupDefinitionInterfaceDll.TagGroupDefinitionInterface")
```

Retrieving Tag Group Data

Once you create the tag group file object, you must retrieve the data in the file before you can modify it. To retrieve the data, use the following script.

```
'TokenList is an array of tag group symbols
Dim sTokenList() as String, TokenList as Variant

'ReplacementList is an array of tag group substitutions
Dim sReplacementList() as String, ReplacementList as Variant

'DescriptionList is an array of tag group descriptions
Dim sDescriptionList() as String, DescriptionList as Variant

'Create the tag group file object
Dim TGD As Object

Set TGD = _
CreateObject("TagGroupDefinitionInterfaceDll._
TagGroupDefinitionInterface")

'In order for the following method to execute without error,
'you need to have a Tag Group file named test or you replace
```

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```
'the "test" parameter with the name of your tag group file.

TGD.RetrieveDefinition "Test", 2, TokenList, ReplacementList, _
DescriptionList
```

Modifying Tag Group Data

After the tag group data is retrieved, your script can modify the data. For example, you can change an element in the sReplacementList array and then save to the tag group file with the UpdateDefinition method.

The following script shows how to change the substitution for elements 2 and 3 and save them to the tag group file.

Example: Modifying Tag Group Data

```
Dim sTokenList(4) as String, TokenList as Variant
Dim sReplacementList(4) as String, ReplacementList as Variant
Dim sDescriptionList(4) as String, DescriptionList as Variant
Dim TGD As Object

'Retrieve Tag Group data from tag group file
Set TGD = CreateObject("TagGroupDefinitionInterfaceDll._
TagGroupDefinitionInterface")
'In order for the following method to execute without error,
'you need to have a tag group file named "test1" or you will
'replace the "Test1" parameter with the name of your tag group 'file.

TGD.RetrieveDefinition "Test1", 4, TokenList, ReplacementList, _
DescriptionList

'Modify tag group data
TokenList(2) = "Tag3"
TokenList(3) = "Tag4"
ReplacementList (2) = "FIX32.NODE2.AI1.F_CV"
ReplacementList (3) = "FIX32.NODE2.AI2.F_CV"
DescriptionList (2) = "Temperature for Node 2"
DescriptionList (3) = "Pressure for Node 2"

'Create the tag group file object and save modified tag group file
Set TGD = _
CreateObject("TagGroupDefinitionInterfaceDll._
TagGroupDefinitionInterface")
TGD.UpdateDefinition "Test", 4, TokenList, ReplacementList, _
DescriptionList
Set TGD = Nothing
```

Manipulating Tag Groups

As a final example, we provide the following Command button script. This script iterates through all the tag group variables in a picture and creates a substitution string based on the name of the tag group variable.

This script assumes that the picture containing the Command button has retrieved the tag groups from the Tag Group object with the RetrieveDefinition method first.

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Example: Manipulating Tag Group Data

```
Private Sub CommandButton1_Click()
     Dim vaSymbols As Variant
     Dim vaSubstitutions As Variant
     Dim vaDescriptions As Variant
     Dim sSubstitutions() As String
     Dim sDescriptions() As String
     Dim PicPath as string

     'This will contain the number of symbols in a picture
     Dim Size As Integer
     Dim Counter As Integer
     Dim FileName As String

     'Set the filename
     FileName = "Test"

     'Delete tag group file if it exists. Kill permanently
     'deletes the specified file form the hard drive. Use with
     'caution.
     PicPath = System.PicturePath

     If DIR(PicPath + FileName + ".TGD" <> "" Then
          Kill PicPath + FileName + ".TGD"
     End If

     'Get the symbols from the picture
     Me.RetrieveTagGroupVariables Size, vaSymbols
     If Size = 0 Then
     Exit Sub
     End If
     ReDim sSubstitutions(Size - 1) As String
     ReDim sDescriptions(Size - 1) As String

     'Fill in the symbols and the descriptions
     For Counter = 0 To Size - 1
     Temp$ = "Fix32.thisnode." + vaSymbols(count2) + ".f_cv"
     sSubstitutions(Counter) = Temp$
     sDescriptions(Counter) = "Generated tag"
     Next Counter

     'Create the tag group file object
     Dim TGF As Object
     vaSubstitutions = sSubstitutions
     vaDescriptions = sDescriptions
     Set TGF = _
     CreateObject("TagGroupDefinitionInterfaceDll_
     .TagGroupDefinitionInterface")
     TGF.UpdateDefinition FileName, Size, vaSymbols, _
     vaSubstitutions, vaDescriptions
```

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