Chapter 8

Making Multiple View Orthographic Drawings

In this chapter, you will learn how to use the following VBA functions to World Class standards:

- **Beginning a New Visual Basic Application**
- **Opening the Visual Basic Editor in AutoCAD**
- **Laying Out a User Input Form in Visual Basic**
- **Creating and Inserting an Image into a Form in Visual Basic**
- **Insert a Label into a Form**
- **Insert a Textbox into a Form**
- **Insert Command Buttons into a Form**
- **Adding a Copyright Statement to a Form**
- **Adding Comments in Visual Basic to Communicate the Copyright**
- **Declaring Variables in a Program with the Dimension Statement**
- **Setting Variables in a Program**
- **Assigning Values to the Variables**
- **Inputting the Code to Set a System Variable**
- **Load AutoCAD Linetypes**
- **Inputting the Code to Create and Set Layers**
- **Inputting the Code to Draw in Visual Basic**
- **Using Selection Sets and Mirroring in Visual Basic**
- **Drawing a Centerline and Arraying the Line**
- **Drawing Circles and Ending the Subroutine**
- **Resetting the Data with the cmdClear Command Button**
- **Exiting the Program with the cmdExit Command Button**
- **Executing a Subroutine with the cmdDraw Command Button**
- **Inserting a Module into a Visual Basic Application**
- **Running the Program**

Beginning a New Visual Basic Application

In this chapter, we will continue to learn how to use the Visual Basic Application (VBA) program to create a form and then to generate drawings automatically. We reiterate many elements of the earlier lessons, but now we add the capability to add multiple views, placing entities on specific layers, using selection sets, then mirroring and arraying entities in AutoCAD Model Space. Eventually in following chapters, we add text and dimensions.

At the beginning of every chapter, we will start a new Visual Basic Application project, use a sketch to determine the extent of what the program will do, create the form and then write the code. Once the code is finished, we will run the program and multiple orthographic views will appear on the graphical display.

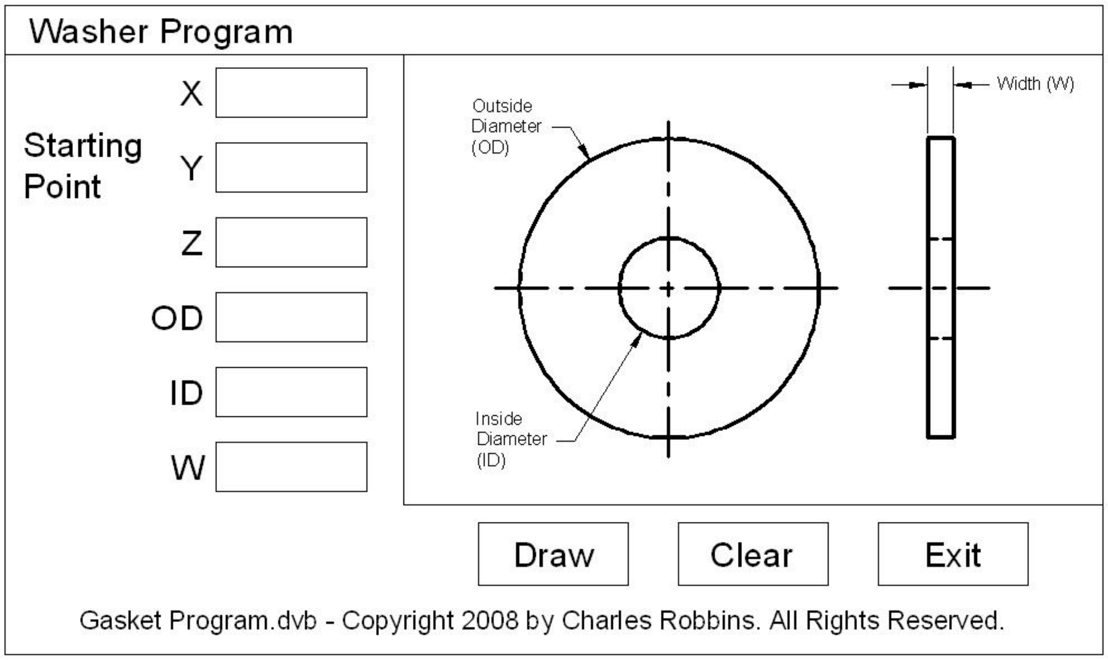


Figure 8.1 – Rough Sketch of the Washer Form

Remember, that all programming projects begin with one or more sketches, with one portraying the part, detail, or assembly and the other being the user input form. In this Visual Basic Project, the Washer program, we will be running a user input form inside the AutoCAD application, so we need to sketch the structure of this special dialogue box. We will name the Input form, **Washer Program**. We will place six textboxes on the left side of the form to key in the starting point of the Washer, the outside diameter dimension, the inside diameter measurement and washer width. On the right side of the form, we will place an image of the Washer. We will have three command buttons, **Draw**, **Clear** and **Exit**. On the bottom of the form, we will write the copyright statement using another label. On this presentation, we can help ourselves by being as accurate as possible, by displaying sizes, fonts, colors and any other specific details which will enable us to quickly create the form. From the beginning of inserting the form into the project, we need to refer to our sketch. The sketch of the form is shown in Figure 8.1.

Remember, we should train new programmers initially in the art of form building. When using the editor, we insert and size the form, and selecting the Controls Toolbox, we will place all the various input tools and properly label them. Whenever we place an input tool, the properties window will display a list of attributes associated with the tool, and we will take every effort to arrange the tool by performing such actions as naming, labeling and sizing the visual input device.

Opening the Visual Basic Editor in AutoCAD

Opening the Visual Basic Editor in AutoCAD is essential to creating the program to automate the drawing process. In this version of the World Class CAD – Visual Basic Applications for AutoCAD, we are using AutoCAD 2008, but we just finished using all the programs in this text with a group programming in AutoCAD 2000. Their drawings were automatically made just as efficiently as if they were using the most recent version of the Autodesk software.

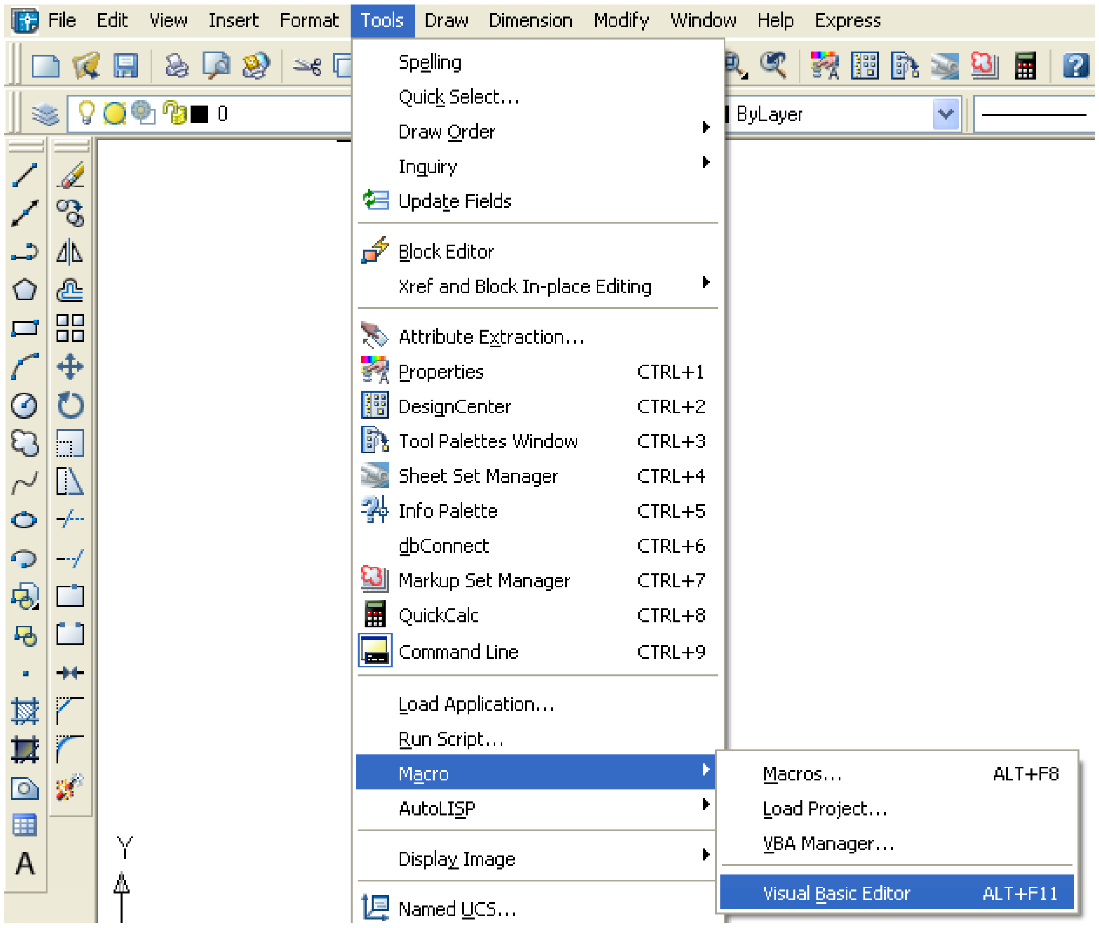


Figure 8.2 – Launching the Visual Basic Editor

Now, select Tools on the Menu bar; then pick Macro and choose the Visual Basic Editor. Look to the right of the phrase, Visual Basic Editor and the shortcut keys Alt – F11 is noted. For quick launching of the editor, press Alt – F11.

The Visual Basic Editor will appear on the computer desktop as a new program application. Looking down on the computer's Taskbar, we can see the AutoCAD and Microsoft Visual Basic Editor program tabs. Just single click either program tab to switch between the applications. However, if we close the AutoCAD drawing, unlike a stand alone version of Visual Basic, the Visual Basic Editor will also close.

For those individuals with previous Visual Basic experience, the Visual Basic Editor in AutoCAD has the same layout as in other VB programs. The Menu Bar contains tools for our use as well as the four toolbars shown in Figure 8.4, which are Standard, Debug, Edit and Userform. Presently, only the Standard toolbar is showing. On the left side of the workspace is the Project menu, which shows the files pertaining to this project. Below the Project menu is the Properties pane. Being familiar with the Properties tool in AutoCAD, makes using this device simple.

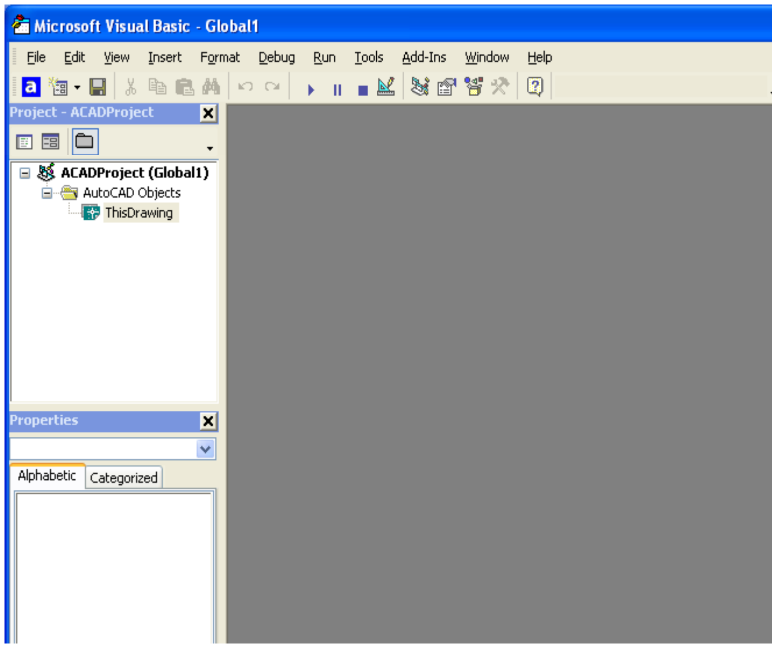


Figure 8.3 – The Visual Basic Editor

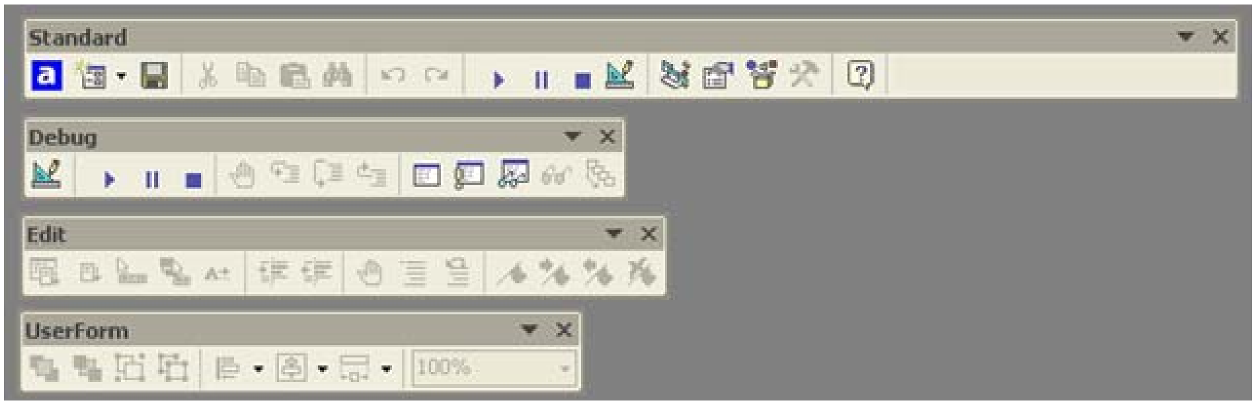


Figure 8.4 – Toolbars in the Visual Basic Editor

With the Visual Basic Editor open, select **File** on the Menu Bar and select **Save Project**. Remember, we have a folder on either the desktop or in the My Documents folder called "VBA Programs". Save the project with the filename "Washer". The file has an extension called *dvb* which means DCL and Visual Basic programs as shown in Figure 8.5.

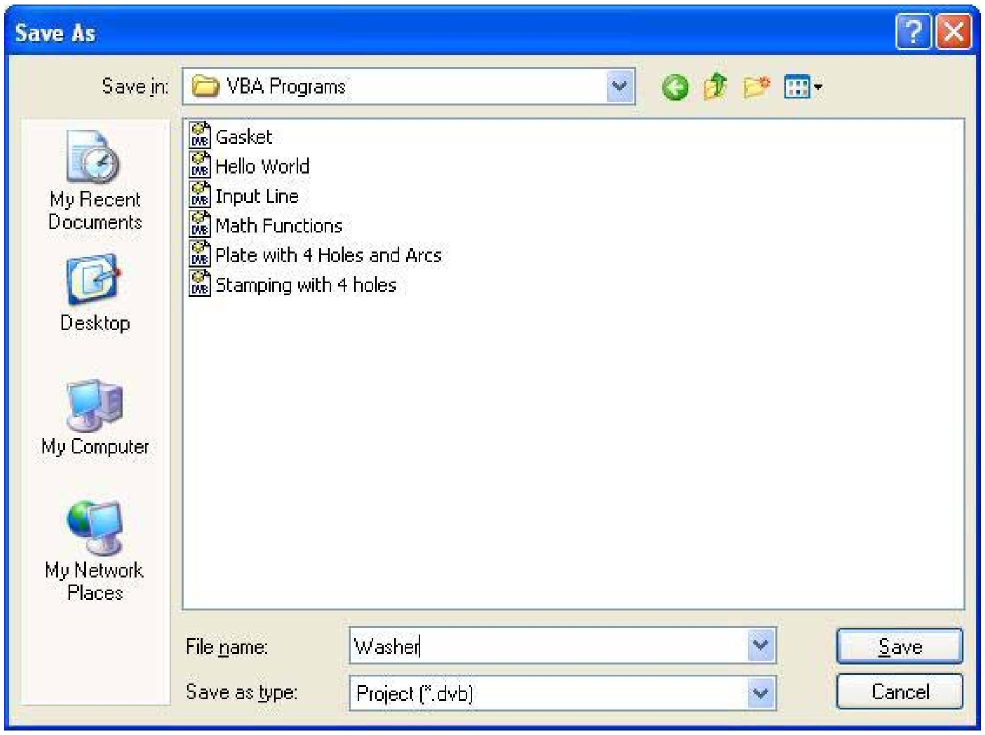


Figure 8.5 – Saving the Washer Program

Laying Out a User Input Form in Visual Basic

Now that we have an idea of what the dialogue box in our program will look like, select the **Insert UserForm** button on the Standard toolbar to insert a new form as shown in Figure 8.6. Instantaneously, the once grey work area is changed to contain our UserForm1. A Form folder with Userform1 is now in the Project menu and the Properties pane contains the attributes associated with UserForm1 as shown in figure 8.7.

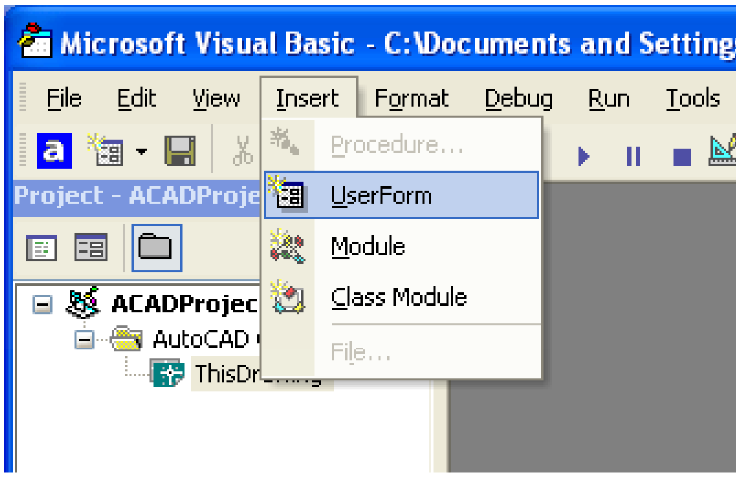
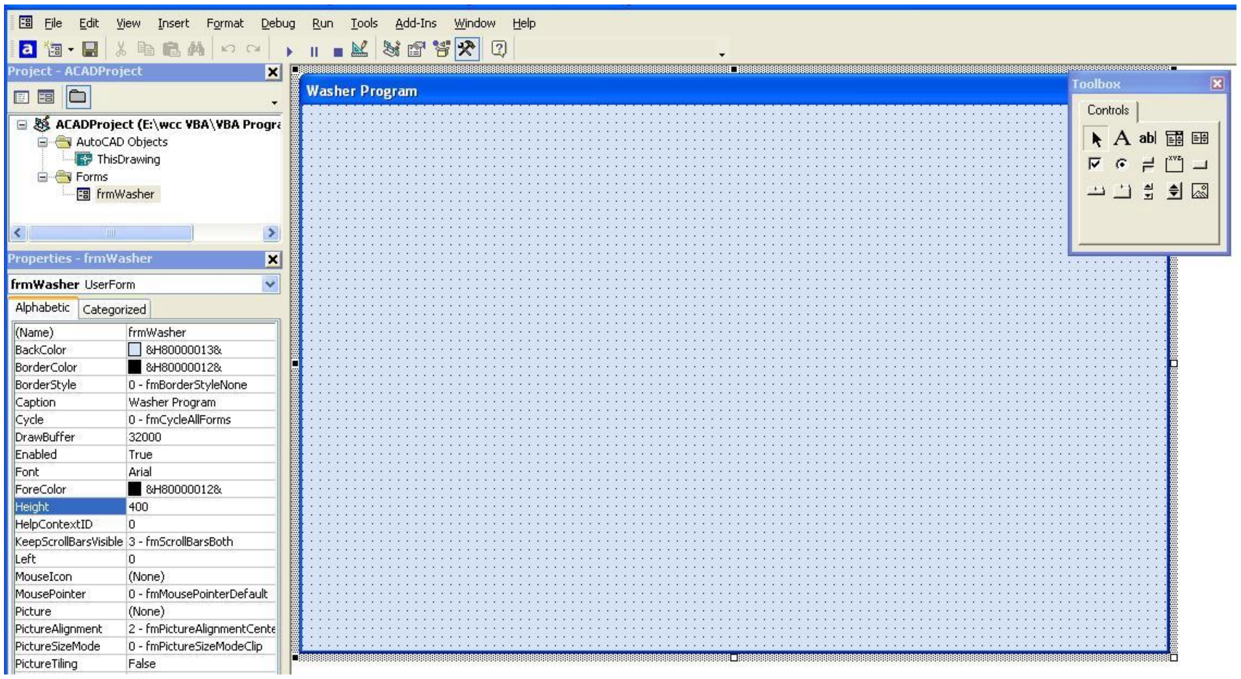


Figure 8.6 – Inserting a User Form

Change the name of the user form to frmWasher. We use the frm prefix in front of all of the form names in Visual Basic. Change the background of the form to light blue by setting the BackColor in the Properties Pane on the left side of the Visual Basic Application window to “&H80000013&”.


File Edit View Insert Format Debug Run Tools Add-Ins Window Help
Project - ACADProject
ACADProject (E:\wcc VBA\VBA Progra
AutoCAD Objects
ThisDrawing
Forms
frmWasher
Washer Program
Toolbox
Controls

Properties - frmWasher

frmWasher UserForm

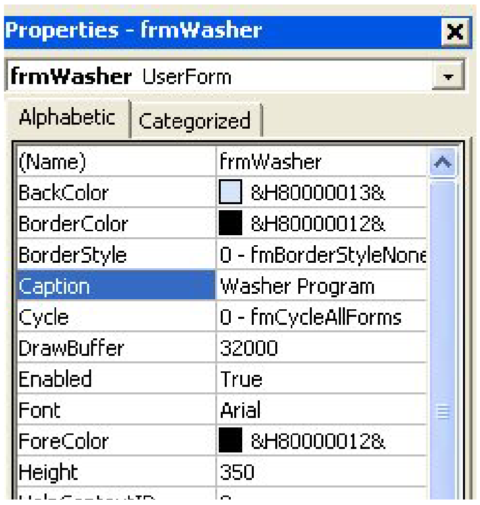
Alphabetic | Categorized

(Name)	frmWasher
BackColor	&H80000013&
BorderColor	&H80000012&
BorderStyle	0 - fmBorderStyleNone
Caption	Washer Program
Cycle	0 - fmCycleAllForms
DrawBuffer	32000
Enabled	True
Font	Arial
ForeColor	&H80000012&
Height	400
HelpContextID	0
KeepScrollBarsVisible	3 - fmScrollBarsBoth
Left	0
MouseIcon	(None)
MousePointer	0 - fmMousePointerDefault
Picture	(None)
PictureAlignment	2 - fmPictureAlignmentCente
PictureSizeMode	0 - fmPictureSizeModeClip
PictureTiling	False

Figure 8.7 – Designing the Washer Form in Visual Basic

Next, we will change the **Caption** in the Properties pane to **Washer** to agree with the sketch in Figure 8.1. Go ahead and change the form in two other aspects, Height and Width.

Alphabetic	
(Name)	frmWasher
BackColor	&H80000013&
Caption	Washer
Height	350
Width	535


Properties - frmWasher

frmWasher UserForm

Alphabetic | Categorized

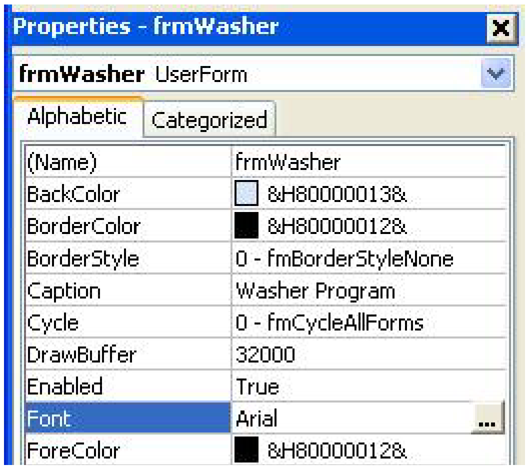
(Name)	frmWasher
BackColor	&H80000013&
BorderColor	&H80000012&
BorderStyle	0 - fmBorderStyleNone
Caption	Washer Program
Cycle	0 - fmCycleAllForms
DrawBuffer	32000
Enabled	True
Font	Arial
ForeColor	&H80000012&
Height	350

Figure 8.8 – Setting the Caption and other Properties

The form will change in size to the height and width measurement. The background color will change to a light blue. There are many more attributes in the Properties pane that we will use on future projects.

In previous chapters, we set the Font and Font size for the labels, textboxes and command buttons after creating those specific interfaces. If we set the Font to Arial, Bold and the Font size to 14 on the form, then all of the labels, textboxes and command buttons that we insert from the Control Toolbox will already be set to those attributes.

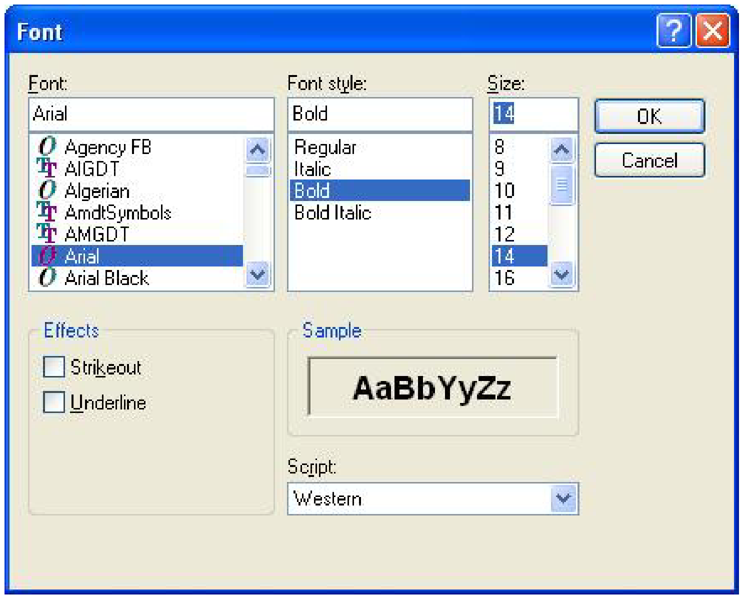
On the left side of the Visual Basic Editor, locate the property that controls the font and font size in the Properties window. When highlighting the row for Font, a small command button with three small dots appears to the right of the default font name of Tahoma. Click on the three dotted button to open the Visual Basic Font window.



(Name)	frmWasher
BackColor	&H8000000F&
BorderColor	&H80000012&
BorderStyle	0 - fmBorderStyleNone
Caption	Washer Program
Cycle	0 - fmCycleAllForms
DrawBuffer	32000
Enabled	True
Font	Arial ...
ForeColor	&H80000012&

Figure 8.9 – Changing the Font

We will select the Arial font, Bold font style and 14 size for this project to agree with the initial sketch if the user input form. When we adjust the attributes for the label, these changes do not alter globally for the other objects on the form. If we wish to underline the text or phrase in the label, add a check to the Underline checkbox in the Effects section of the Font window. When we finish making changes to the font property, select the OK command button to return to the work area.



Font: Arial
Font style: Bold
Size: 14
☐ Strikeout
☐ Underline
Script: Western

Figure 8.10 – The Font Window in Visual Basic

Creating and Inserting an Image into a Form in Visual Basic

As in previous chapters, this form will have a picture of the part that we will create automatically, so we need to make a drawing of part in AutoCAD. Dimension the drawing as we do in any other drawing, but we will use the Edit Text tool to remove the actual dimension and write in the variable name that matches the textbox label. In Figure 8.11, we show dimensions that associate with the outside diameter (OD), inside diameter (ID) and width (W) textboxes. When the drawing is finished, we need to save the drawing as an image file. Use the **Saveimg** command to save file on the VBA Programs folder. Create a folder named Images in the VBA Programs folder and save the file as the same name as the program for matching purposes, Washer. We saved the file as a Bitmap with a width of 312 pixels and a height of 210 pixels.

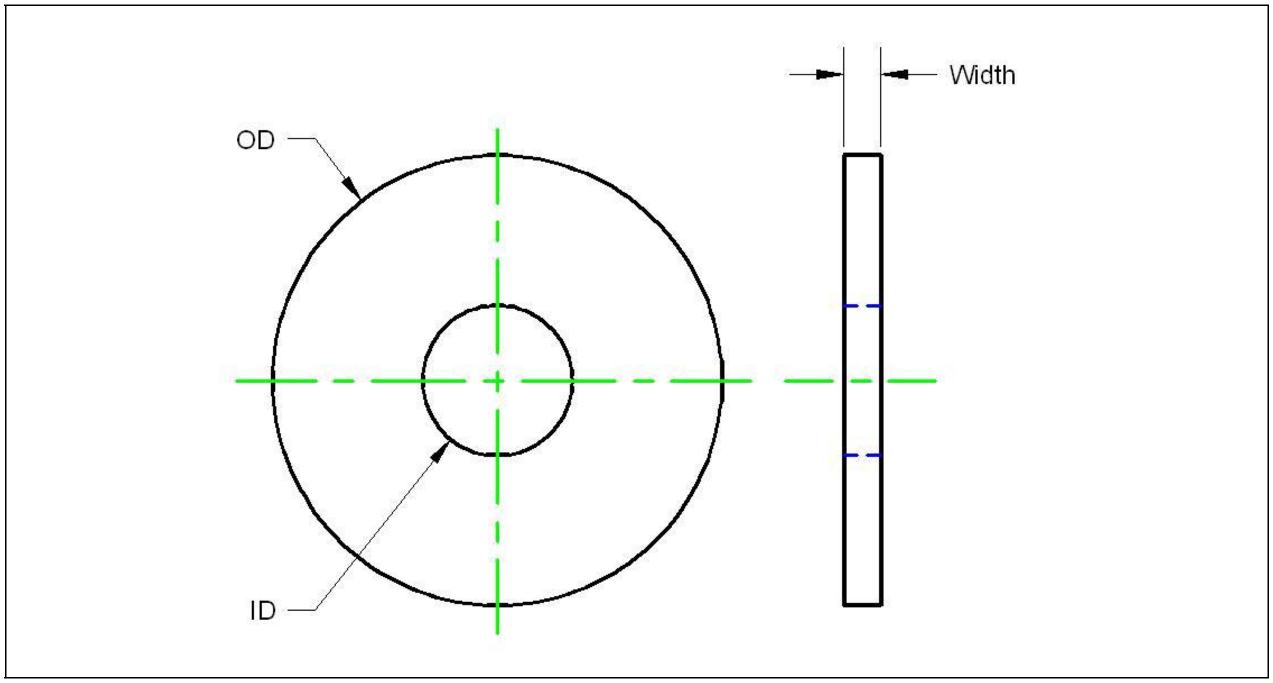


Figure 8.11 – Creating the Washer Form Image in AutoCAD

On the control toolbox, select the Image tool and then draw a rectangular box on the form in the upper right corner as shown in figure 8.13. After outlining the size of the image, we will direct the program to the folder and filename of the digital image. In the Properties – Image pane, select the attribute named Picture. With the mouse, select the three dot box in the empty cell to the right of Picture. The Load Picture window appears on the screen. Go to the VBA Programs folder and then the Images folder. Select the file, Washer and it will appear in the picture frame.

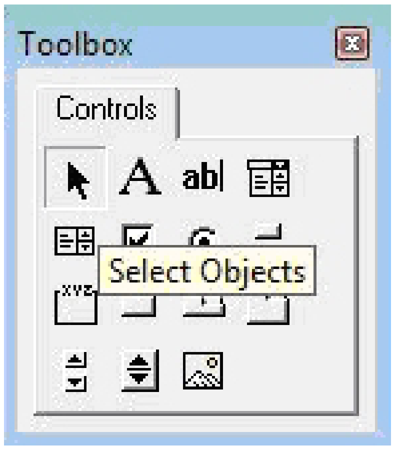
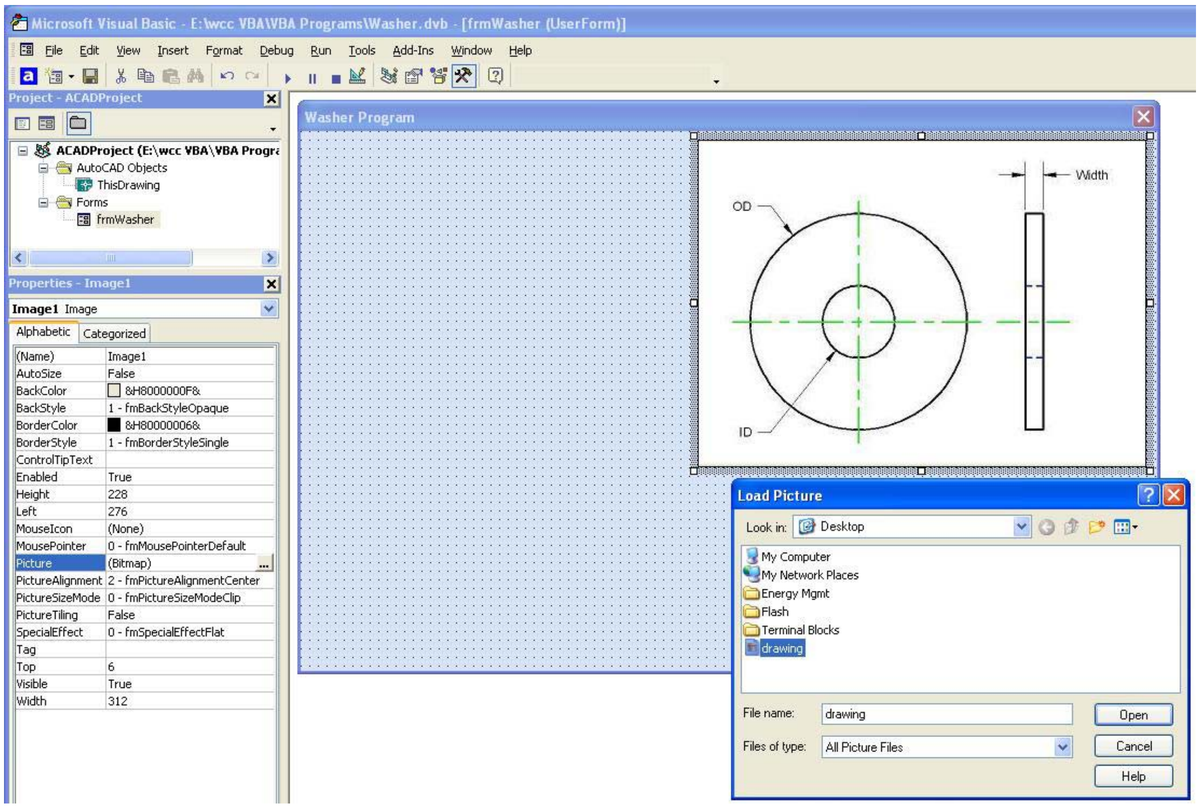


Figure 8.12 – The Control Toolbox

In the Properties pane set the image name to ImgWasher, the width to 312 and the height to 210. The image will finally appear as shown in Figure 8.14.


Microsoft Visual Basic - E:\wcc VBA\VBA Programs\Washer.dvb - [frmWasher (UserForm)]
File Edit View Insert Format Debug Run Tools Add-Ins Window Help
Project - ACADProject
ACADProject (E:\wcc VBA\VBA Progra
AutoCAD Objects
ThisDrawing
Forms
frmWasher
Washer Program
Width
OD
ID
Properties - Image1
Image1 Image
Alphabetic
Categorized
Load Picture
Open
Cancel
Help

(Name)	Image1
AutoSize	False
BackColor	&H8000000F&
BackStyle	1 - fmBackStyleOpaque
BorderColor	&H80000006&
BorderStyle	1 - fmBorderStyleSingle
ControlTipText	
Enabled	True
Height	228
Left	276
MouseIcon	(None)
MousePointer	0 - fmMousePointerDefault
Picture	(Bitmap)
PictureAlignment	2 - fmPictureAlignmentCenter
PictureSizeMode	0 - fmPictureSizeModeClip
PictureTiling	False
SpecialEffect	0 - fmSpecialEffectFlat
Tag	
Top	6
Visible	True
Width	312

Look in: Desktop

My Computer
My Network Places
Energy Mgmt
Flash
Terminal Blocks
drawing

File name: drawing

Files of type: All Picture Files

Figure 8.13 – Placing an Image on the Form

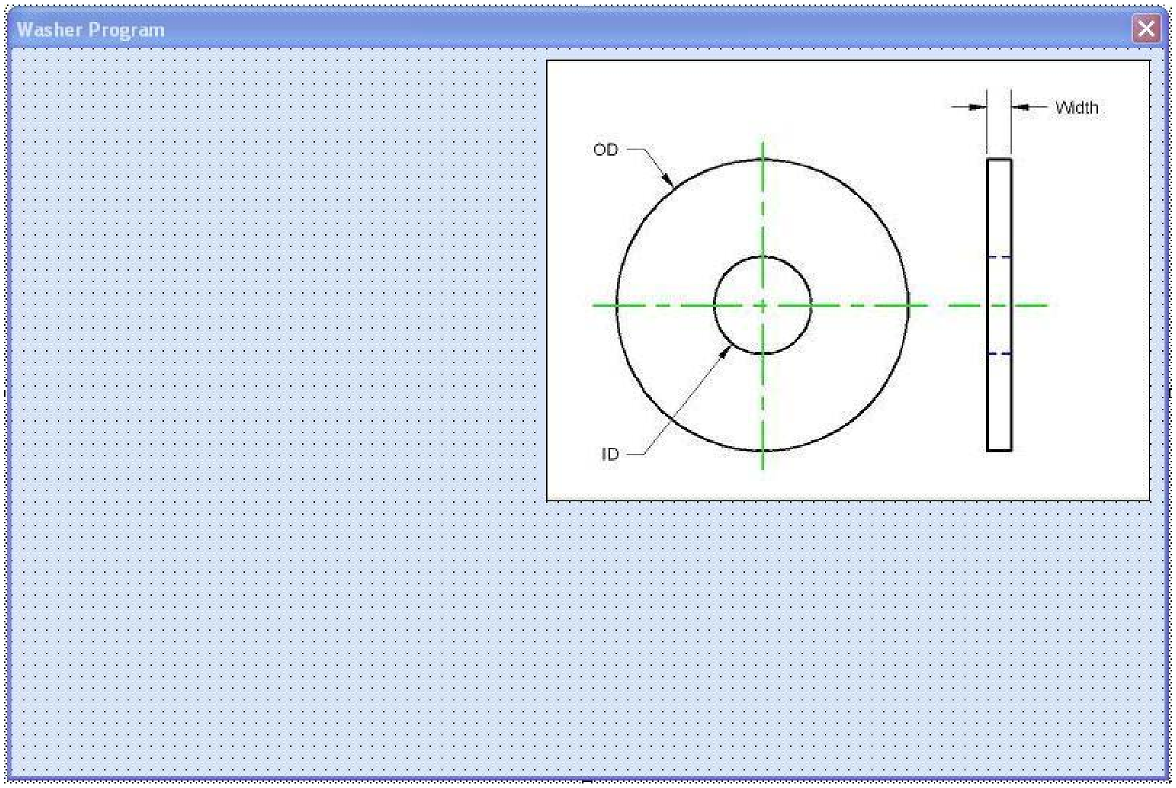


Figure 8.14 – Placing an Image on the Form

Inserting a Label into a Form

A good form is easy to figure out by the user, so when we are attempting to provide information on the window that will run in AutoCAD; we add labels to textboxes to explain our intent. Press the Label (A) button on the Control Toolbar to add a label. To size the label area, click on the upper left area of the form and hold down on the left mouse button, draw the dotted label box as shown in the sketch.

When the first label is done, the background color of the label matches the background color of the form. In many cases that effect is visually pleasing to the eye, versus introducing another color. Both color and shape will direct the user in completing the form along with the explanation we place on the window to guide the designer in using the automated programs. Use colors and shape strategically to communicate well.

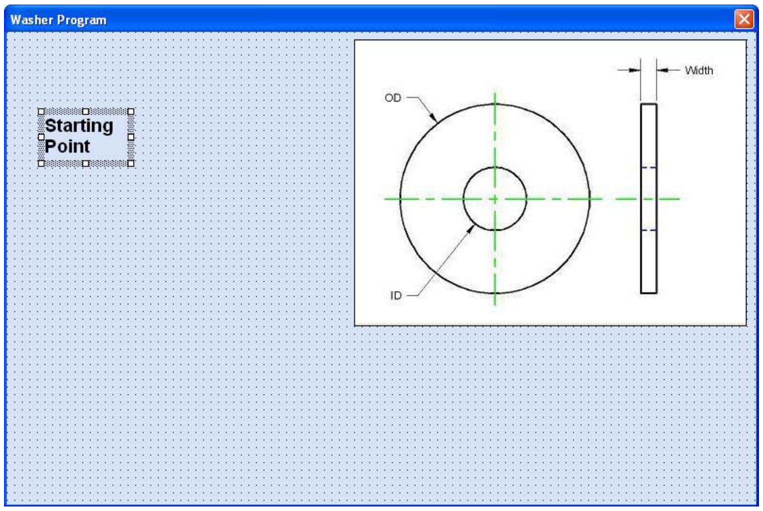


Figure 8.15 – The Finished Label on the Form

For the first label, set the name as **lblStartingpoint** and the caption as Startingpoint. The width of the textbox is 66 and the height is 36. For a label with more than one line of text, left justify the text.

Inserting a Textbox into a Form

A textbox is used so that a user of the computer program can input data in the form of words, numbers or a mixture of both. Press the TextBox (ab) button on the Control Toolbar to add a textbox to the form. To size the textbox, click on the upper left area of the form and hold down on the left mouse button, draw the dotted textbox as shown in Figure 8.16.

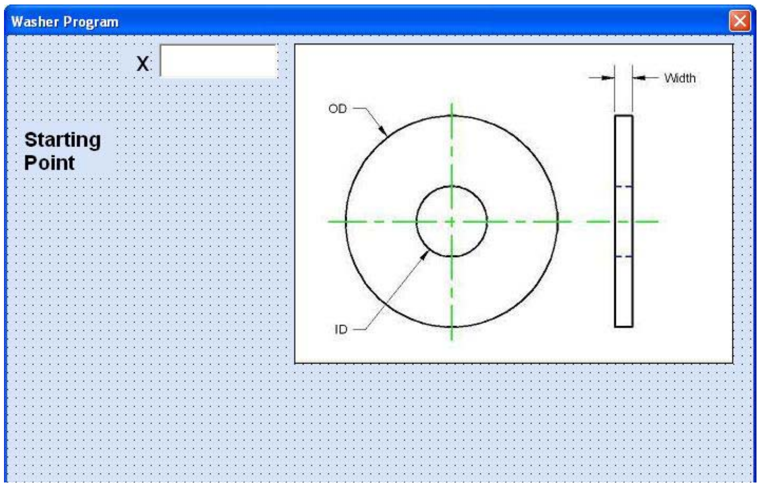
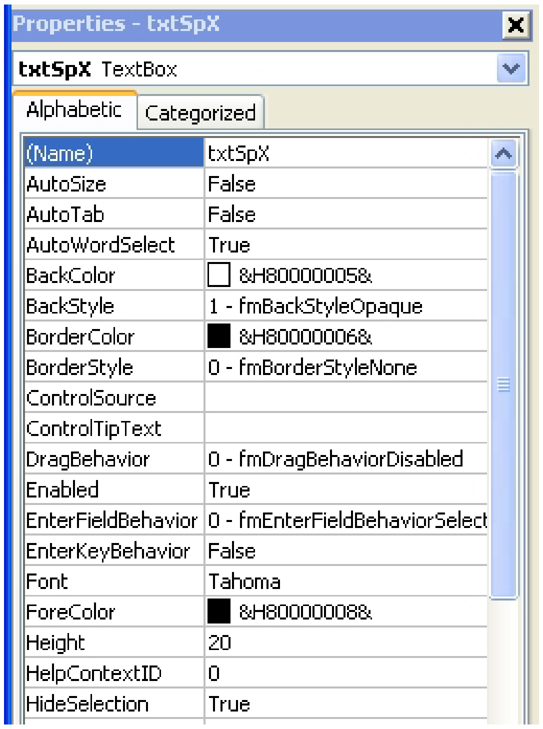


Figure 8.16 – Placing a TextBox on the Form

We will name the textbox using the three letter prefix txt followed by the name or phrase of the tool. For our first textbox, the name is **txtSpX.**

Alphabetic	
(Name)	txtSpX
Height	20
Width	78

We place a Label using a common Visual Basic naming convention **lblSpX** just to the left of the Textbox. The Caption for the Label will be **X.** On all of the labels that are just to the left of the Textboxes, we will align the text to the right by setting the **TextAlign** property to right align.


Properties - txtSpX

txtSpX TextBox

Alphabetic | Categorized

(Name)	txtSpX
AutoSize	False
AutoTab	False
AutoWordSelect	True
BackColor	☐ &H80000005&
BackStyle	1 - fmBackStyleOpaque
BorderColor	■ &H80000006&
BorderStyle	0 - fmBorderStyleNone
ControlSource	
ControlTipText	
DragBehavior	0 - fmDragBehaviorDisabled
Enabled	True
EnterFieldBehavior	0 - fmEnterFieldBehaviorSelect
EnterKeyBehavior	False
Font	Tahoma
ForeColor	■ &H80000008&
Height	20
HelpContextID	0
HideSelection	True

Figure 8.17 – Changing the (Name) to txtName

We will add another TextBox named **txtSpY** under the first one and the Label to the left of the textbox is called **lblSpY.** The Caption for the Label will be **Y.**

We will add yet another TextBox named **txtSpZ** under the first one and the Label to the left of the textbox is called **lblSpZ.** The Caption for the Label will be **Z.**

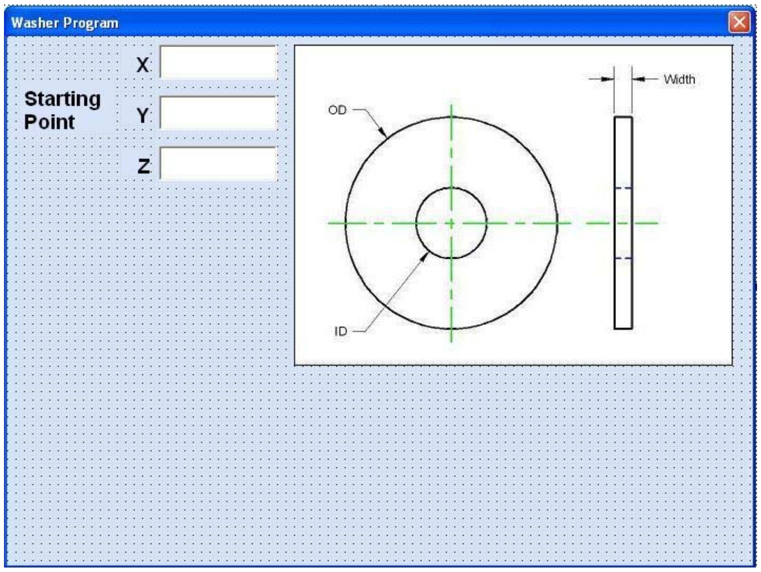


Figure 8.18 – Adding the Y and Z Textboxes

We will add three more textboxes to the form named **txtOD, txtID,** and **txtW**. The labels to the left of the textbox are called **lblOD, lblID,** and **lblW**. The Captions for the Labels are shown in figure 8.19.

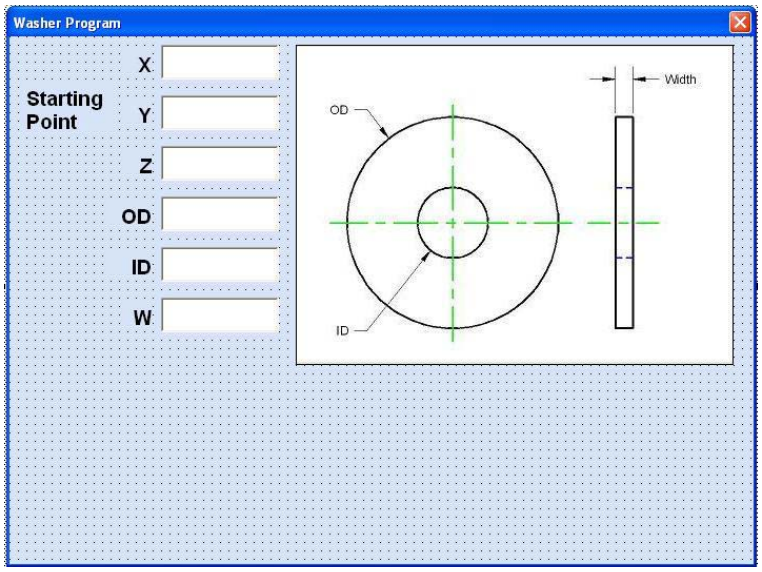


Figure 8.19 – Adding the Last Six Textboxes

Inserting a Command Buttons into a Form

A command button is used so that a user will execute the application. Press the Command button on the Control Toolbar to add a command button. To size the label area, click on the upper left area of the form and hold down on the left mouse button, draw the command button as shown in Figure 8.20.

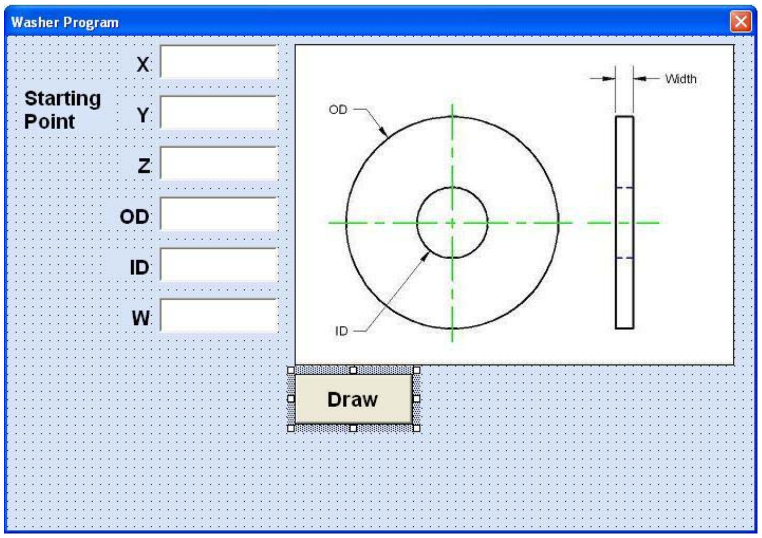
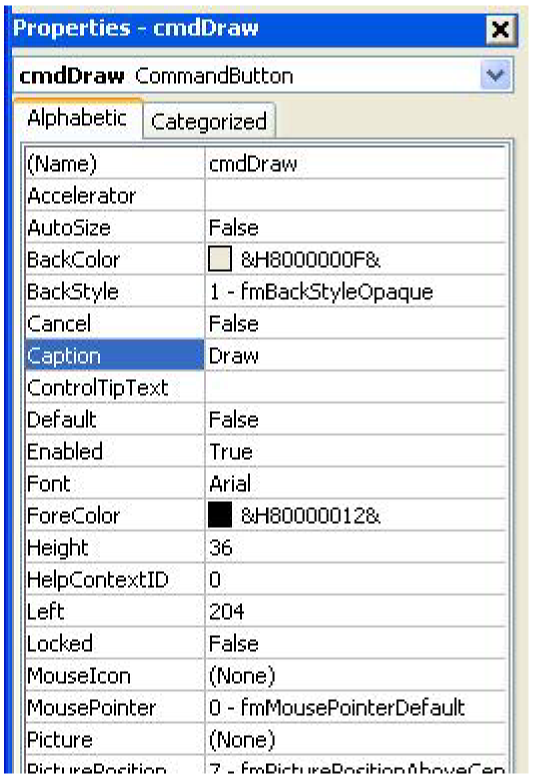


Figure 8.20 – Insert a Command Button onto a Form

We will name the command button using the name is **cmdDraw.**

Alphabetic	
(Name)	cmdDraw
Caption	Draw
Font	Arial
Height	36
Width	84

The font we want for the Command Button is 16 point, Arial Bold. When highlighting the row for Font, a small command button with three small dots appears to the right of the font name of Arial Narrow. Click on the three dotted button to open the Visual Basic Font window. Make the changes as we did before and press OK to save the property.



Properties - cmdDraw

cmdDraw CommandButton

Alphabetic | Categorized

(Name)	cmdDraw
Accelerator	
AutoSize	False
BackColor	□ &H8000000F&
BackStyle	1 - fmBackStyleOpaque
Cancel	False
Caption	Draw
ControlTipText	
Default	False
Enabled	True
Font	Arial
ForeColor	■ &H80000012&
Height	36
HelpContextID	0
Left	204
Locked	False
MouseIcon	(None)
MousePointer	0 - fmMousePointerDefault
Picture	(None)
PicturePosition	7 - fmPicturePositionAboveCen

Figure 8.21 – Changing the (Name) to cmdDraw

Add a second Command button; named cmdClear is for clearing the Starting point's X, Y, Z coordinates, OD, ID, and W textboxes. The third command button is to exit the program. When the user presses the Exit command button, the application closes and full control of the manual AutoCAD program returns to the user. Notice the equal spacing between the command buttons gives a visually friendly appearance.

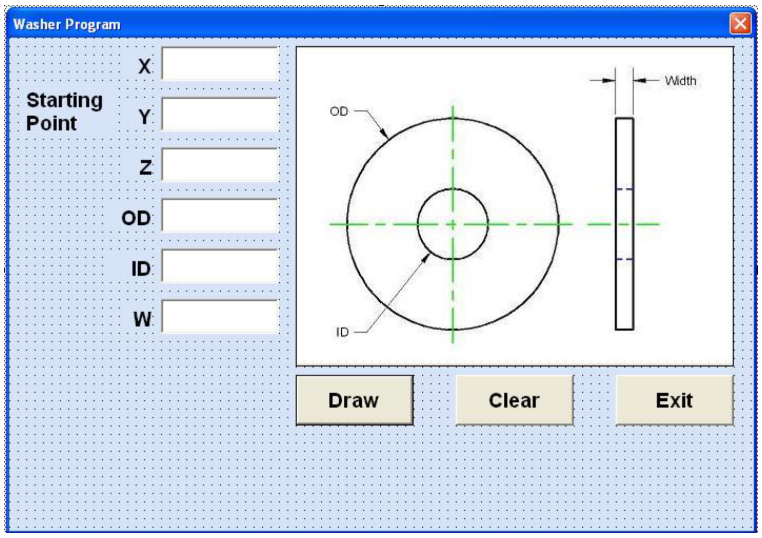


Figure 8.22 – Insert Two More Command Buttons

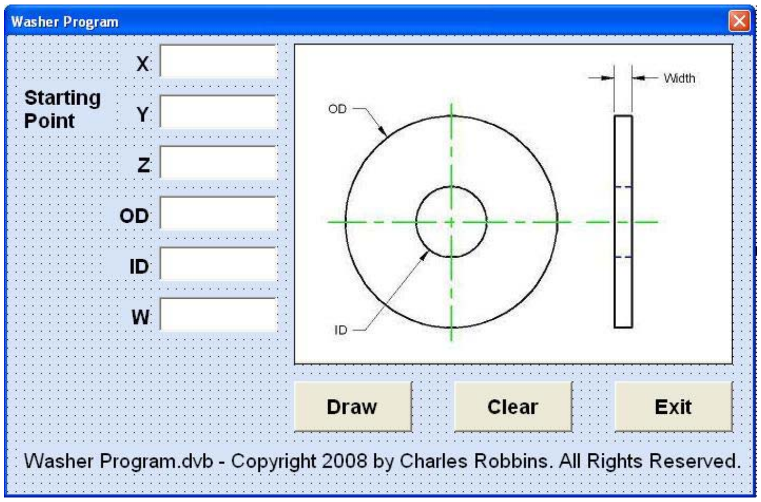
Adding a Copyright Statement to a Form

At the beginning of a new program, we will expect to see an explanation or any special instructions in the form of comments such as copyright, permissions or other legal notices to inform programmers what are the rules dealing with running the code. Comments at the opening of the code could help an individual determine whether the program is right for their application or is legal to use. The message box is a great tool when properly utilized to inform someone if they are breaking a copyright law when running the code.

Finish the form with the following copyright information.

'Washer Program.dvb - copyright (c) 2008 by Charles Robbins. All Rights Reserved.

If there are special rules or instructions that the user needs to know, place that information on the bottom of the form.



Washer Program.dvb - Copyright 2008 by Charles Robbins. All Rights Reserved.

Figure 8.23 – Adding a Copyright Statement

Now that the form is complete, we will begin to write the code that actually interfaces the content of the form using logic and computations to draw the stamping in the AutoCAD graphical display. We will begin the program with comments and place addition phrases throughout the program to assist ourselves or others in the future when modifying the code.

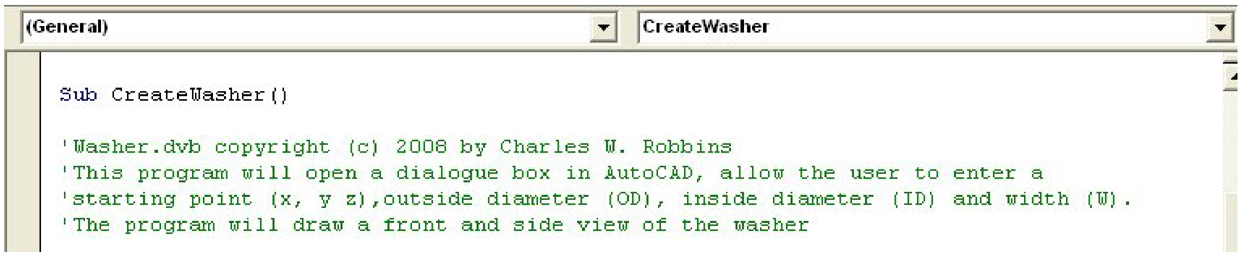
Adding Comments in Visual Basic to Communicate the Copyright

The comments we placed in the first three lines of the program will inform the individual opening and reading the code, but those user that may run the application without checking, the label on the bottom of the form with the copyright information is a great tool to alert the client to the rules of the program and what will the application do.

To begin the actual coding of the program, double click on the Draw command button to enter the programming list. At the top of the program and before the line of code with **Sub CreateWasher ()**, place the following comments with the single quote (‘) character. Remember, the single quote character (‘) will precede a comment and when the code is compiled, comments are ignored.

Type the following line of code:

```
Sub CreateWasher ()

'Washer.dvb copyright (c) 2008 by Charles W. Robbins
'This program will open a dialogue box in AutoCAD, allow the user to enter a
'starting point (x, y z),outside diameter (OD), inside diameter (ID) and width (W).
'The program will draw a front and side view of the washer
```



```
Sub CreateWasher()

'Washer.dvb copyright (c) 2008 by Charles W. Robbins
'This program will open a dialogue box in AutoCAD, allow the user to enter a
'starting point (x, y z),outside diameter (OD), inside diameter (ID) and width (W).
'The program will draw a front and side view of the washer
```

Figure 8.24 – Adding Comments into the Code

Declaring Variables in a Program with the Dimension Statement

When we are going to use a number, text string or object that may change throughout the life of the code, we create a variable to hold the value of that changing entity. In Visual Basic, the dimension or dim statement is one of the ways to declare a variable at the script of procedure level. The other two ways are the Private and Public statements, which we will use in later chapters.

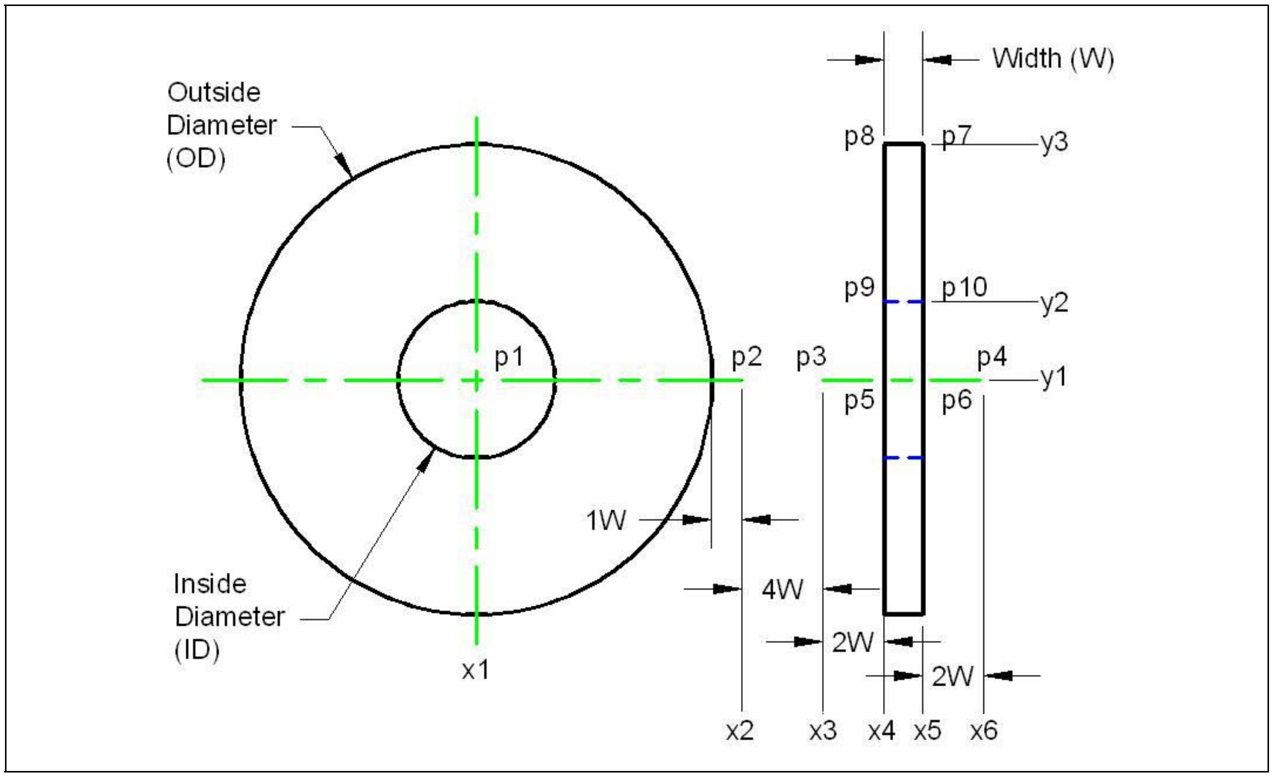


Figure 8.25 – Identifying the Variables for the Washer Program

In Figure 8.25, we have a drawing that shows an X and Y grid for each point we need to draw. In this program, we only need points 1 through 6. To create the points, we have made a grid with the values of x1 through x5 horizontally on the bottom and y1 through y4 vertically on the left. In the program, we will define point P1 as coordinate (x2, y1, z1), point P2 as (x4, y1, z1) and so forth. We have found that points are easily defined using this method and therefore explaining the algebra in the program is simpler.

In our program, we will declare a variable to enable us to draw lines and circles, a variable for each vertex and a variable for each textbox. As we can see below, the made up name **objCircle** is an AutoCAD Circle by definition and the contrived name **objLine** is a line. To mirror the four lines in the right orthographic view of the drawing, we have made three addition variables, **objSs1, objDrawingObject** and **objMirroredObject.** The first is for creating a selection set, the second is to hold drawing objects and the last is for mirroring the objects. We will cover the selecting and mirroring code later in the chapter.

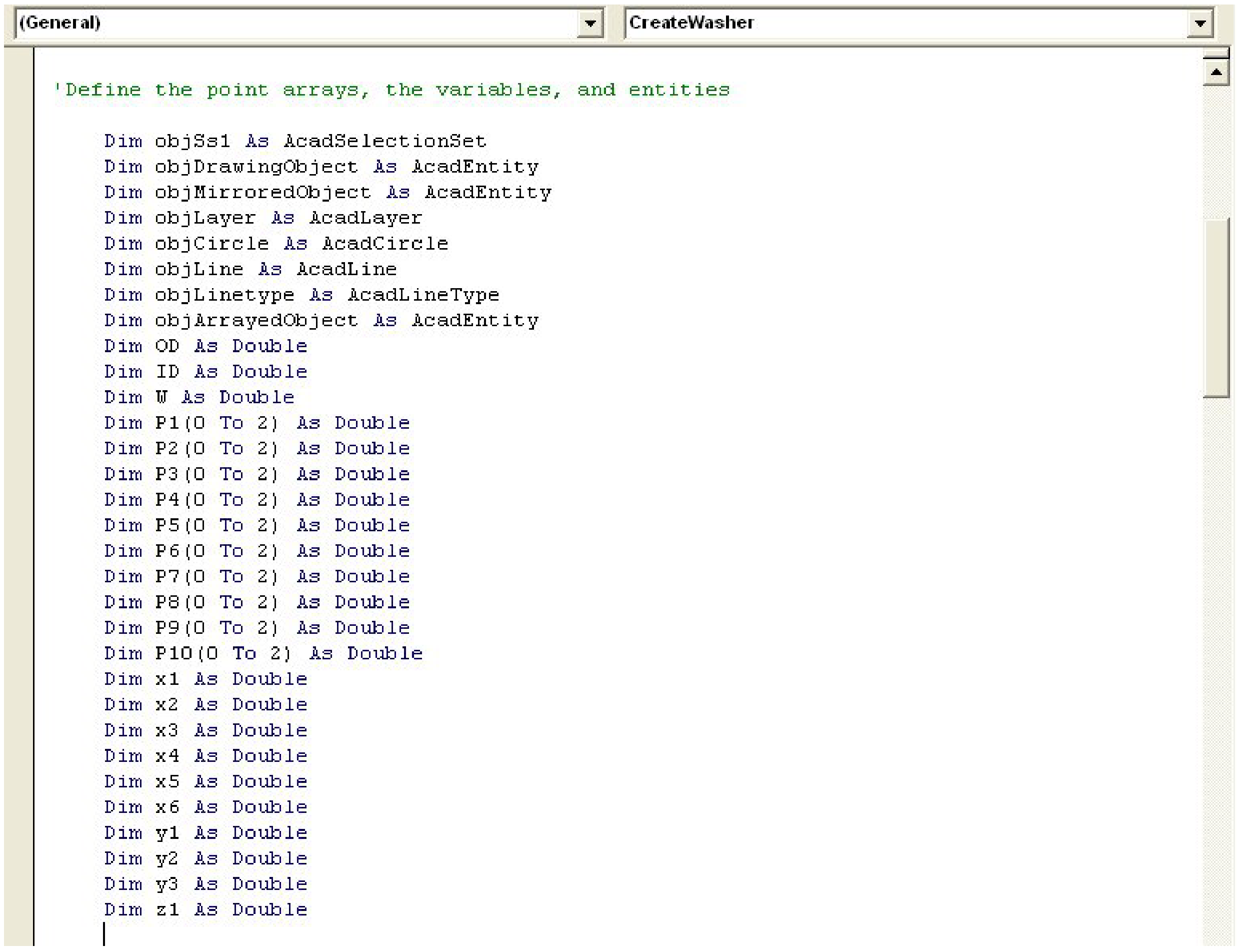
We will set variables for array (**objArrayedObject**), the linetypes (**objLinetype**) and layers (**objLayers**). Then, we declare variables of the textboxes OD, ID and W as double integers (As Double).

Type the following lines of code after the comment.

```
'Define the point arrays, the variables, and entities

  Dim objSs1 As AcadSelectionSet
  Dim objDrawingObject As AcadEntity
  Dim objMirroredObject As AcadEntity
  Dim objLayer As AcadLayer
  Dim objCircle As AcadCircle
  Dim objLine As AcadLine
  Dim objLinetype As AcadLineType
  Dim objArrayedObject As AcadEntity
  Dim OD As Double
  Dim ID As Double
  Dim W As Double
  Dim P1(0 To 2) As Double
  Dim P2(0 To 2) As Double
  Dim P3(0 To 2) As Double
  Dim P4(0 To 2) As Double
  Dim P5(0 To 2) As Double
  Dim P6(0 To 2) As Double
  Dim P7(0 To 2) As Double
  Dim P8(0 To 2) As Double
  Dim P9(0 To 2) As Double
  Dim P10(0 To 2) As Double
  Dim x1 As Double
  Dim x2 As Double
  Dim x3 As Double
  Dim x4 As Double
  Dim x5 As Double
  Dim x6 As Double
  Dim y1 As Double
  Dim y2 As Double
  Dim y3 As Double
  Dim z1 As Double
```

The vertices or points are declared as double integers (As Double) with an array of zero to two (0 to 2). The vertex P1(0) represents the X coordinate, the P1(1) represents the Y coordinate and P1(2) represents the Z coordinate. Some may think that it is a waste of time to involve the Z-axis in a two dimension drawing, but we will incorporate the Z coordinate for designers that work in all three dimensions. For everyone else, we will just enter zero (0) in the Z coordinate textbox. We will declare points P1 through P10 for the vertices in the drawing in Figure 8.25.

As discussed previously, we have given the Washer drawing problem a grid, so we declare x1 through x6, y1 through y3, and z1.



```
'Define the point arrays, the variables, and entities

    Dim objSs1 As AcadSelectionSet
    Dim objDrawingObject As AcadEntity
    Dim objMirroredObject As AcadEntity
    Dim objLayer As AcadLayer
    Dim objCircle As AcadCircle
    Dim objLine As AcadLine
    Dim objLinetype As AcadLineType
    Dim objArrayedObject As AcadEntity
    Dim OD As Double
    Dim ID As Double
    Dim W As Double
    Dim P1(0 To 2) As Double
    Dim P2(0 To 2) As Double
    Dim P3(0 To 2) As Double
    Dim P4(0 To 2) As Double
    Dim P5(0 To 2) As Double
    Dim P6(0 To 2) As Double
    Dim P7(0 To 2) As Double
    Dim P8(0 To 2) As Double
    Dim P9(0 To 2) As Double
    Dim P10(0 To 2) As Double
    Dim x1 As Double
    Dim x2 As Double
    Dim x3 As Double
    Dim x4 As Double
    Dim x5 As Double
    Dim x6 As Double
    Dim y1 As Double
    Dim y2 As Double
    Dim y3 As Double
    Dim z1 As Double
```

Figure 8.26 – Declaring Variables with Dim Statements

Remember, when selecting variable names, they should be a word or a phrase without spaces that represents the value that the variable contains. If we want to hold a value of one's date of birth, we can call the variable, DateofBirth. The keywords Date and Birth are in sentence case with the first letter capitalized. There are no spaces in the name. Some programmers use the underscore character (_) to separate words in phrases. This is acceptable, but a double underscore (__) can cause errors if we do not detect the repeated character.

Assigning Values to the Variables

After we declare the variables and before we start drawing, we will assign values to the variables from the input the user types in the textboxes on the launched user form and then assign values to each of the vertices in the set of construction points.

We show algebraic expressions between each point on the X number line. After setting x1 to the value entered in the X textbox, we calculate the value of x2 as x1 plus the outside diameter divided by 2 plus the width W.

x2 = x1 + OD / 2 + W

To calculate the position x3, add 4 times W to x2 as shown below.

x3 = x2 + 4 * W

With practice and a good sketch such as shown in figure 8.25, writing the mathematical section of the code can be done easily.

```
'assigning values to the variables

   OD = txtOD
   ID = txtID
   W = txtW
   x1 = txtSpX
   x2 = x1 + OD / 2 + W
   x3 = x2 + 4 * W
   x4 = x3 + 2 * W
   x5 = x4 + W
   x6 = x5 + 2 * W
   y1 = txtSpY
   y2 = y1 + ID / 2
   y3 = y1 + OD / 2
   z1 = txtSpZ
```

We use the same sketch to make the point assignments. Just review the data from Figure 8.25 and make the correct coordinate designation as shown. Remember that P1(0) is the x position, P1(1) is the y position and P1(2) is the z position.

```
'point assignments and math

   P1(0) = x1
   P1(1) = y1
   P1(2) = z1
   P2(0) = x2
   P2(1) = y1
   P2(2) = z1
```

```
    P3(0) = x3
    P3(1) = y1
    P3(2) = z1
    P4(0) = x6
    P4(1) = y1
    P4(2) = z1
    P5(0) = x4
    P5(1) = y1
    P5(2) = z1
    P6(0) = x5
    P6(1) = y1
    P6(2) = z1
    P7(0) = x5
    P7(1) = y3
    P7(2) = z1
    P8(0) = x4
    P8(1) = y3
    P8(2) = z1
    P9(0) = x4
    P9(1) = y2
    P9(2) = z1
    P10(0) = x5
    P10(1) = y2
    P10(2) = z1
```

Inputting the Code to Set a System Variable

To change a system variable such as the Object Snap Mode, so the Endpoint, Midpoint or other setting cannot interfere with the construction of the orthographic view of the Washer, we will turn off the Object Snaps. Type **ThisDrawing.SetVariable "osmode", 0** and the system setting for Object Snaps will be turned off.

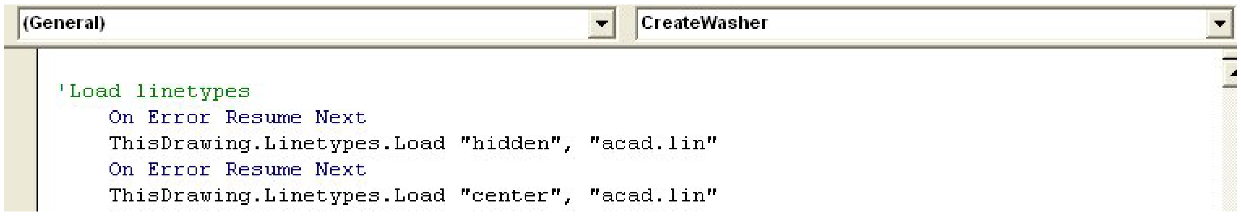
To change the linetype scale, use the same format, except the variable name is "ltscale" and the new setting is 0.5.

```
'Set variables

    ThisDrawing.SetVariable "osmode", 0
    ThisDrawing.SetVariable "ltscale", 0.5
```

Load AutoCAD Linetypes

Before setting a linetype in a layer, we need to load them into the current file. Use the **ThisDrawing.Linetypes.Load** function with the linetype name followed by a comma and the file holding the linetype definition. Use **On Error Resume Next** before the expression to avoid errors if the linetype is already loaded.

```
'Load linetypes
  On Error Resume Next
  ThisDrawing.Linetypes.Load "hidden", "acad.lin"
  On Error Resume Next
  ThisDrawing.Linetypes.Load "center", "acad.lin"
```



```
'Load linetypes
    On Error Resume Next
    ThisDrawing.Linetypes.Load "hidden", "acad.lin"
    On Error Resume Next
    ThisDrawing.Linetypes.Load "center", "acad.lin"
```

Figure 8.27 – Loading Linetypes

Inputting the Code to Create and Set a Layer

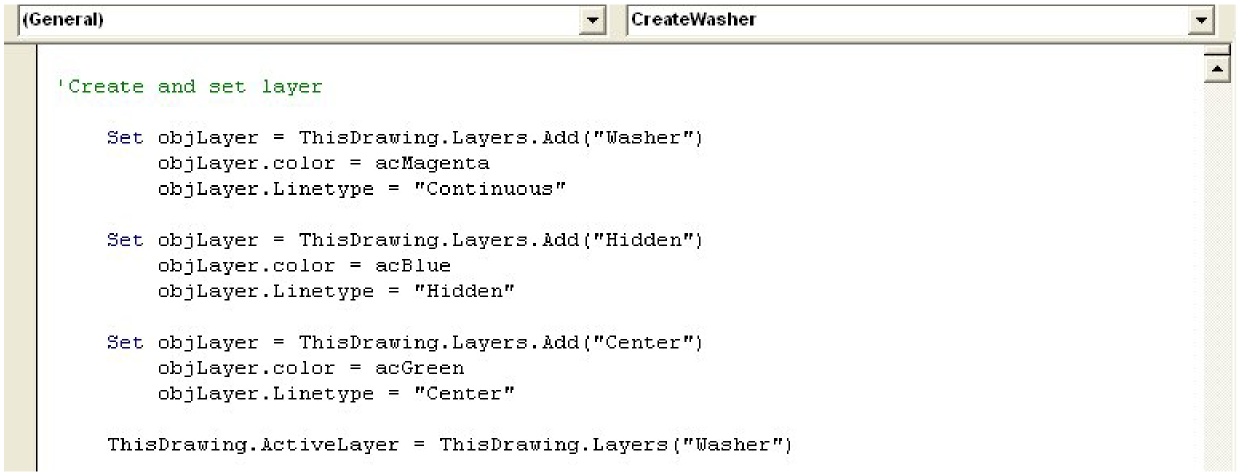
Many times, we will want to create a layer and then set the layer throughout a program. To create a layer, type **Set objLayer = ThisDrawing.Layers.Add** and in parenthesis place the new layer name in quotes, such as “Washer”. After making the new layer, set the layer color and linetype by typing **objLayer.Color = acBlue** and **objLayer.Linetype = “Continuous”**. We could make a layer the color blue and with hidden lines if we choose.

In this program, we need to make a washer layer for the object with a continuous linetype, a hidden line layer a hidden linetype and a center line layer with a center linetype. We can make as many layers following the format below.

```
'Create and set layer

  Set objLayer = ThisDrawing.Layers.Add("Washer")
    objLayer.color = acBlue
    objLayer.Linetype = "Continuous"

  Set objLayer = ThisDrawing.Layers.Add("Hidden")
    objLayer.color = acBlue
    objLayer.Linetype = "Hidden"

  Set objLayer = ThisDrawing.Layers.Add("Center")
    objLayer.color = acGreen
    objLayer.Linetype = "Center"
```

To set the layer current, before drawing an entity, we would type:

```
ThisDrawing.ActiveLayer = ThisDrawing.Layers("Washer")
```



```
'Create and set layer

    Set objLayer = ThisDrawing.Layers.Add("Washer")
        objLayer.color = acMagenta
        objLayer.Linetype = "Continuous"

    Set objLayer = ThisDrawing.Layers.Add("Hidden")
        objLayer.color = acBlue
        objLayer.Linetype = "Hidden"

    Set objLayer = ThisDrawing.Layers.Add("Center")
        objLayer.color = acGreen
        objLayer.Linetype = "Center"

    ThisDrawing.ActiveLayer = ThisDrawing.Layers("Washer")
```

Figure 8.28 –Creating and Setting an AutoCAD Layer

Inputting the Code to Draw in Visual Basic

Now we want to enter the code that will actually draw the four lines in AutoCAD Model Space. We use the Set function to draw a line by typing **Set ObjLine** and then we tell the computer that it will draw in Modelspace by adding a line from point P6 to point P7. Draw the next two lines from P7 to P8 and from P8 to P5.

Go ahead and type the following comments and drawing code:

```
'Draw three line

  Set objLine = ThisDrawing.ModelSpace.AddLine(P6, P7)
  Set objLine = ThisDrawing.ModelSpace.AddLine(P7, P8)
  Set objLine = ThisDrawing.ModelSpace.AddLine(P8, P5)

  ThisDrawing.ActiveLayer = ThisDrawing.Layers("Hidden")

  Set objLine = ThisDrawing.ModelSpace.AddLine(P9, P10)
```

The last line on the right orthographic view is the hidden line from P9 to P10. We change the layer by entering, **ThisDrawing.ActiveLayer = ThisDrawing.Layers("Hidden")** before the line code.

Using Selection Sets and Mirroring in Visual Basic

Before we mirror the four lines across the vertical centerline, we will select the four objects using the Select all function, First, we define a temporary selection set called objSs1 by typing

Set objSs1 = ThisDrawing.SelectionSets.Add("TempSS") and then we select the four entities using **objSs1.Select (acSelectionSetAll).**

To mirror the four objects in objSs1, we key the following code:

```
For Each objDrawingObject In objSs1
     Set objMirroredObject = objDrawingObject.Mirror(P3, P4)
     objMirroredObject.Update
Next
```

We will always input the mirror function as shown, only changing the name of the selection set containing the entities or changing the points on the mirror line. The last step in the process is to delete the selection set with **objSs1.Delete.**

Drawing a Centerline and Arraying the Line

Like mirroring, we array entities by selecting the object. This time we zoom all to have the centerline appear in the graphical display, and then use **acSelectionSetLast** to retrieve the last entity drawn. When we array the centerline, we type:

```
Set objArrayedObject = objDrawingObject.ArrayPolar(4, 2 * 3.14159265358979, P1)
```

Where the 4 is the number of objects in the array, the 2 * 3.14159265358979 represents 2 times pi or 360 degrees. P1 is the center point of the array. After the array, we delete the selection set objSs1.

```
'Draw center line
   ThisDrawing.ActiveLayer = ThisDrawing.Layers("center")
   Set objLine = ThisDrawing.ModelSpace.AddLine(P1, P2)

'Array the centerline around sp
   ThisDrawing.Application.ZoomAll
   Set objSs1 = ThisDrawing.SelectionSets.Add("TempSS")
       objSs1.Select (acSelectionSetLast)

   For Each objDrawingObject In objSs1
       Set objArrayedObject = objDrawingObject.ArrayPolar(4, 2 * 3.14159265358979, P1)
       objMirroredObject.Update
   Next
   objSs1.Delete

   Set objLine = ThisDrawing.ModelSpace.AddLine(P3, P4)
```

Type **Set objLine = ThisDrawing.ModelSpace.AddLine(P3, P4)** to place the last centerline which is in the right orthographic view from points P3 to P4.

Drawing the Circles and Ending the Subroutine in Visual Basic

We use the Set function to draw a circle by typing **Set ObjCircle** and then we tell the computer that it will draw in Modelspace by adding a circle from the center point P1 with a radius that contains the value from the Diameter textbox divided by 2. Then we draw one more circle with the radius at center point P1.

```
'Draw the circles

  ThisDrawing.ActiveLayer = ThisDrawing.Layers("Washer")
   Set objCircle = ThisDrawing.ModelSpace.AddCircle(P1, OD / 2)
   Set objCircle = ThisDrawing.ModelSpace.AddCircle(P1, ID / 2)
```

To end this Visual Basic subroutine, we will type a comment saying so. In the future, this will be more elaborate, but for now we will just get used to announcing the natural divisions of the script.

Type the following code:

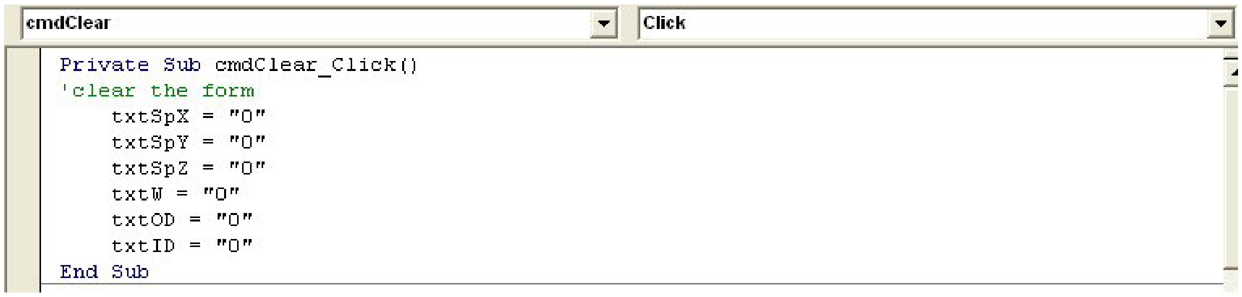
```
'End of program
End Sub
```

Resetting the Data with the cmdClear Command Button

To clear the textboxes containing the user input, we will first set the textbox for txtXcoord, txtXcoord.text property to a "0.00" entry by using the equal sign "=".This makes the property equal zero as a default. We do this also for the Y and Z coordinates. We will set the textboxes for txtWidth, txtWidth.text property to a black entry by using the equal sign "=" and the null string "", and this will make that property blank. Notice that after the control object name the dot (.) separates the suffix which is the name of the property for that object.

Key the following code as a new subroutine **Private Sub cmdClear_Click().**

```
Private Sub cmdClear_Click()
'clear the form
   txtSpX = "0"
   txtSpY = "0"
   txtSpZ = "0"
   txtW = "0"
   txtOD = "0"
   txtID = "0"
End Sub
```



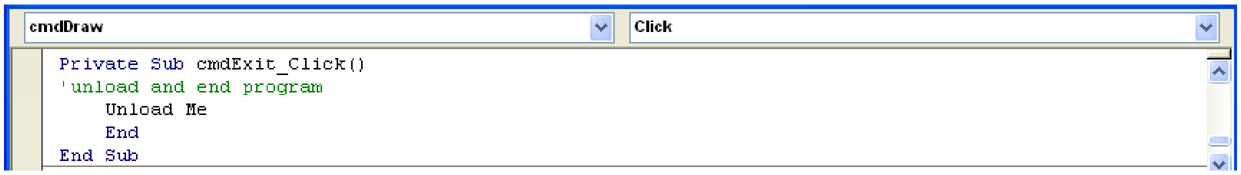
```
Private Sub cmdClear_Click()
'clear the form
    txtSpX = "0"
    txtSpY = "0"
    txtSpZ = "0"
    txtW = "0"
    txtOD = "0"
    txtID = "0"
End Sub
```

Figure 8.29 – Computing the Reset Button by Clearing Textboxes

Exiting the Program with the cmdExit Command Button

To exit this program, we will unload the application and end the program.
Type the following code:

```
Private Sub cmdExit_Click()
'unload and end program
   Unload Me
   End
End Sub
```



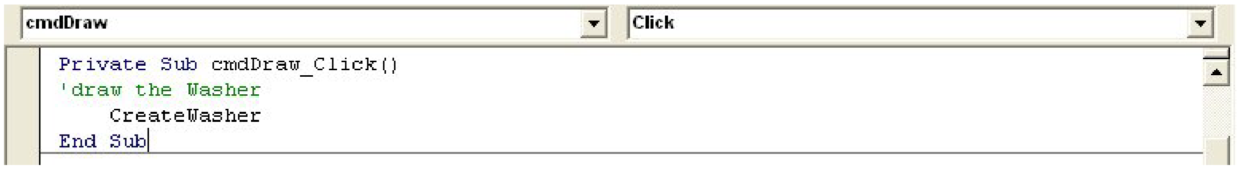
```
Private Sub cmdExit_Click()
'unload and end program
    Unload Me
    End
End Sub
```

Figure 8.30 – Coding the Exit Button

Executing a Subroutine with the cmdDraw Command Button

In this program, we use a subroutine which is executed by the Draw command button, so type the following code to execute the subroutine, **CreateWasher**

```
Private Sub cmdDraw_Click()
'draw the Washer
   CreateWasher
End Sub
```



```
Private Sub cmdDraw_Click()
'draw the Washer
    CreateWasher
End Sub
```

Figure 8.31 – Coding the Draw Button

Written below is the entire program for creating the Washer.

```
Sub CreateWasher ()

'Washer.dvb copyright (c) 2008 by Charles W. Robbins
'This program will open a dialogue box in AutoCAD, allow the user to enter a starting point (x, y z)
'outside diameter (OD), inside diameter (ID) and width (W). The program will draw a front and side
'view of the washer
'Define the point arrays, the variables, and entities

    Dim objSs1 As AcadSelectionSet
    Dim objDrawingObject As AcadEntity
    Dim objMirroredObject As AcadEntity
    Dim objLayer As AcadLayer
    Dim objCircle As AcadCircle
    Dim objLine As AcadLine
    Dim objLinetype As AcadLineType
    Dim objArrayedObject As AcadEntity
    Dim OD As Double
    Dim ID As Double
    Dim W As Double
    Dim P1(0 To 2) As Double
    Dim P2(0 To 2) As Double
    Dim P3(0 To 2) As Double
    Dim P4(0 To 2) As Double
    Dim P5(0 To 2) As Double
    Dim P6(0 To 2) As Double
    Dim P7(0 To 2) As Double
    Dim P8(0 To 2) As Double
    Dim P9(0 To 2) As Double
    Dim P10(0 To 2) As Double
    Dim x1 As Double
    Dim x2 As Double
    Dim x3 As Double
    Dim x4 As Double
    Dim x5 As Double
    Dim x6 As Double
    Dim y1 As Double
    Dim y2 As Double
    Dim y3 As Double
    Dim z1 As Double

'assigning values to the variables

    OD = txtOD
    ID = txtID
    W = txtW
    x1 = txtSpX
```

```
   x2 = x1 + OD / 2 + W
   x3 = x2 + 4 * W
   x4 = x3 + 2 * W
   x5 = x4 + W
   x6 = x5 + 2 * W
   y1 = txtSpY
   y2 = y1 + ID / 2
   y3 = y1 + OD / 2
   z1 = txtSpZ

'point assignments and math

   P1(0) = x2
   P1(1) = y1
   P1(2) = z1
   P2(0) = x4
   P2(1) = y1
   P2(2) = z1
   P3(0) = x1
   P3(1) = y2
   P3(2) = z1
   P4(0) = x3
   P4(1) = y3
   P4(2) = z1
   P5(0) = x4
   P5(1) = y4
   P5(2) = z1
   P6(0) = x5
   P6(1) = y1
   P6(2) = z1

'Set variables

   ThisDrawing.SetVariable "osmode", 0
   ThisDrawing.SetVariable "ltscale", 0.5

'Load linetypes
   On Error Resume Next
   ThisDrawing.Linetypes.Load "hidden", "acad.lin"
   On Error Resume Next
   ThisDrawing.Linetypes.Load "center", "acad.lin"

'Create and set layer

   Set objLayer = ThisDrawing.Layers.Add("Washer")
      objLayer.color = acMagenta
      objLayer.Linetype = "Continuous"
```

```
  Set objLayer = ThisDrawing.Layers.Add("Hidden")
    objLayer.color = acBlue
    objLayer.Linetype = "Hidden"

  Set objLayer = ThisDrawing.Layers.Add("Center")
    objLayer.color = acGreen
    objLayer.Linetype = "Center"

  ThisDrawing.ActiveLayer = ThisDrawing.Layers("Washer")

'Draw three line

   Set objLine = ThisDrawing.ModelSpace.AddLine(P6, P7)
  Set objLine = ThisDrawing.ModelSpace.AddLine(P7, P8)
  Set objLine = ThisDrawing.ModelSpace.AddLine(P8, P5)

  ThisDrawing.ActiveLayer = ThisDrawing.Layers("Hidden")

  Set objLine = ThisDrawing.ModelSpace.AddLine(P9, P10)

'Mirror the line and arcs across vertical centerline

  Set objSs1 = ThisDrawing.SelectionSets.Add("TempSS")
    objSs1.Select (acSelectionSetAll)

  For Each objDrawingObject In objSs1
    Set objMirroredObject = objDrawingObject.Mirror(P3, P4)
    objMirroredObject.Update
  Next
  objSs1.Delete

'Draw center line
  ThisDrawing.ActiveLayer = ThisDrawing.Layers("center")
  Set objLine = ThisDrawing.ModelSpace.AddLine(P1, P2)

'Array the centerline around sp
  ThisDrawing.Application.ZoomAll
  Set objSs1 = ThisDrawing.SelectionSets.Add("TempSS")
    objSs1.Select (acSelectionSetLast)

  For Each objDrawingObject In objSs1
    Set objArrayedObject = objDrawingObject.ArrayPolar(4, 2 * 3.14159265358979, P1)
    objMirroredObject.Update
  Next
  objSs1.Delete

  Set objLine = ThisDrawing.ModelSpace.AddLine(P3, P4)
```

```
'Draw the circles
    ThisDrawing.ActiveLayer = ThisDrawing.Layers("Washer")
    Set objCircle = ThisDrawing.ModelSpace.AddCircle(P1, OD / 2)
    Set objCircle = ThisDrawing.ModelSpace.AddCircle(P1, ID / 2)

End Sub
Private Sub cmdClear_Click()
'clear the form
    txtSpX = ""
    txtSpY = ""
    txtSpZ = ""
    txtW = ""
    txtOD = ""
    txtID = ""
End Sub

Private Sub cmdDraw_Click()
'draw the Washer
    CreateWasher
End Sub

Private Sub cmdExit_Click()
'unload and end program
    Unload Me
    End
End Sub
```

Inserting a Module into a Visual Basic Application

Insert a Module by selecting Insert on the Menu Bar and select Module as shown in Figure 8.32. In the Project Menu, double click on the Module and type the following code.

```
Sub DrawWasher ()
'draw the Washer
    frmWasher.Show
End Sub
```

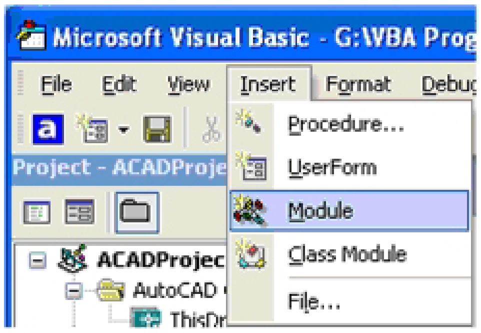
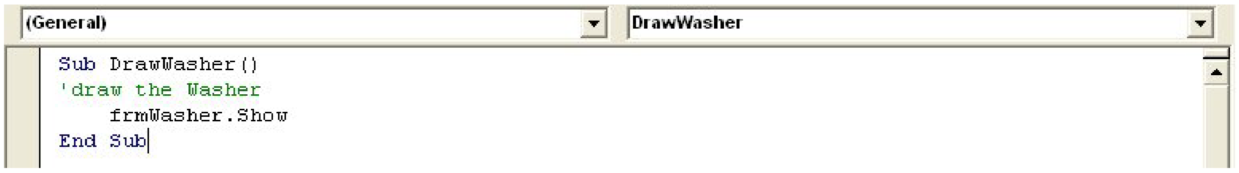


Figure 8.32 – Inserting a Module

The line of code, **frmWasher.Show** will display the form at the beginning of the program.

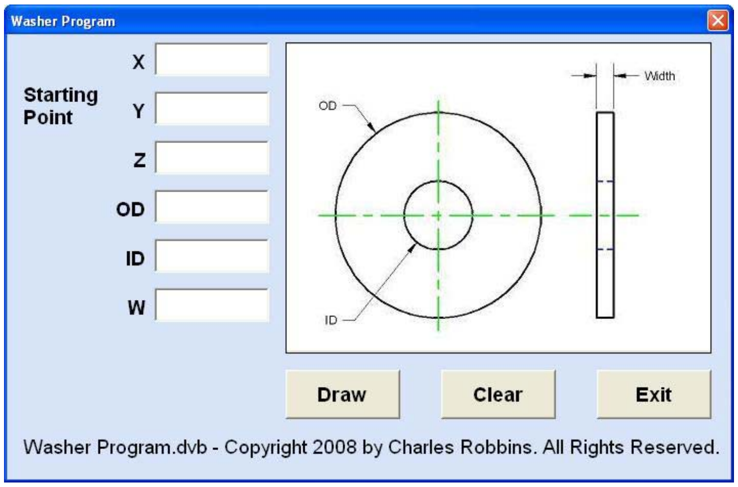


```
Sub DrawWasher()
'draw the Washer
    frmWasher.Show
End Sub
```

Figure 8.33 – Coding the Module

Running the Program

After noting that the program is saved, press the F5 to run the Washer application. The Washer window will appear on the graphical display in AutoCAD as shown in Figure 8.34.



Washer Program.dvb - Copyright 2008 by Charles Robbins. All Rights Reserved.

Figure 8.34 – Launching the Program

Type the following data or something similar into the textboxes and select the Draw Command Button to execute the program. To exit the program, press the Exit command button on the Washer Program window. In AutoCAD, the drawing of the finished Washer will appear as shown in Figure 8.36.

X	4
Y	4
Z	0
OD	4
ID	2.5
W	0.25

Figure 8.35 – Input Data

There are many variations of this Visual Basic Application we can practice and draw many single view orthographic drawings. While we are practicing with forms, we can learn how to use variables, make point assignments and draw just about anything we desire. These are skills that we want to commit to memory.

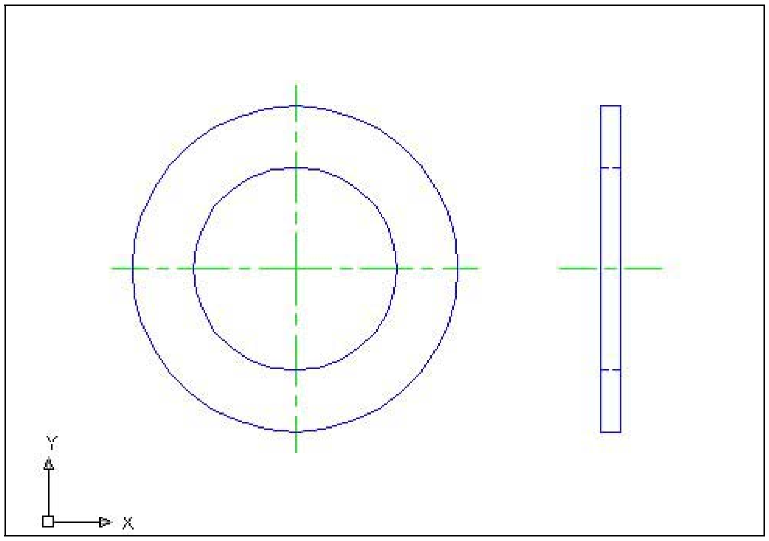


Figure 8.36 – The Finished Draw

*** World Class CAD Challenge 5-8 * - Write a Visual Basic Application that draws a Washer with a front and right view by inputting data in a form. Complete the program in less than 120 minutes to maintain your World Class ranking.**

Continue this drill four times making other shapes and simple orthographic views with lines and circles, each time completing the Visual Basic Application in less than 120 minutes to maintain your World Class ranking.