WinX/32 Automation 3.X User Programming Description for Visual Basic®

ROPER SCIENTIFIC®
BEYOND IMAGING

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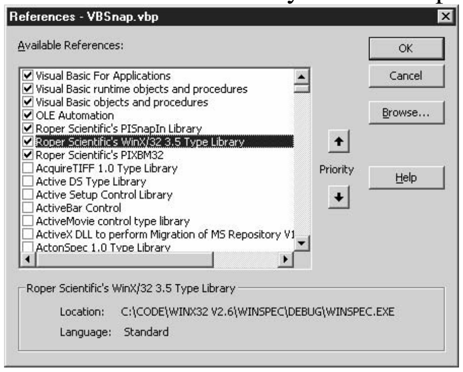
Overview

WinX/32 Automation provides a way to write programs to control the WinView/32 and WinSpec/32 family of Roper Scientific applications (hereafter referred to as WinX/32). This ability was provided to users of the previous generation of RS software via Macro Basic. Automation allows programs to be written in Visual Basic® or any other application language that supports the Microsoft® Windows® Automation standard, such as the macro languages in Microsoft® Excel and Microsoft® Word. (*Princeton Instruments technical support will only support Microsoft® Visual Basic, Microsoft® Excel, and Microsoft® Word.)*

Each application that supports Automation provides entry points through objects whose methods can be called by an outside program. Windows uses a file called a *type library* to provide information about what objects an application provides. The Windows registry stores the location of the type library. When WinX/32 is installed, the WinX/32 type library is registered. This means that "Roper Scientific's WinX/32 3.X Type Library" will show up in Windows' list of automation support providers. Visual Basic and other programs provide a way to look at the list and choose which applications the user's program will call. In Visual Basic the facility is called the *References* browser.



References - VBSnap.vbp

Available References:

- ✓ Visual Basic For Applications
- ✓ Visual Basic runtime objects and procedures
- ✓ Visual Basic objects and procedures
- ✓ OLE Automation
- ✓ Roper Scientific's PISnapIn Library
- ✓ Roper Scientific's WinX/32 3.5 Type Library
- ✓ Roper Scientific's PIXBM32
- ☐ AcquireTIFF 1.0 Type Library
- ☐ Active DS Type Library
- ☐ Active Setup Control Library
- ☐ ActiveBar Control
- ☐ ActiveMovie control type library
- ☐ ActiveX DLL to perform Migration of MS Repository V1
- ☐ ActonSpec 1.0 Type Library

Roper Scientific's WinX/32 3.5 Type Library

Location: C:\CODE\WINX32 V2.6\WINSPEC\DEBUG\WINSPEC.EXE

Language: Standard

Automation programs may be written either as stand-alone programs (executables) or as dynamic link libraries (DLLs.) One advantage of a DLL user program is that WinX/32 will automatically show a menu item and a toolbar button for it. DLL user programs that are integrated with WinX/32 this way are called "Snap-Ins". The easiest way to produce a program is to write a Visual Basic executable. Visual Basic Snap-Ins require additional effort to produce and have some limitations: they always run as modal, so there is no possibility of interacting with the WinX program while a VB Snap-In is running.

Microsoft supplies three versions of Visual Basic: the Learning Edition, the Professional Edition, and the Enterprise Edition. You must have the Professional or Enterprise edition in order to produce a DLL. The Learning Edition can produce a compiled executable program, but it may not run as fast as one compiled with the Professional or Enterprise editions. The examples in this document were produced using the Professional Edition.

Once your program is written, you can run it by clicking on the Run button in Visual Basic. This is a good way to debug your program. When you are fairly confident that the program is bug-free, you can compile it as an executable. The program can then be run in the normal way from an explorer window, or from the Execute Macro menu item in WinX/32. The Execute Macro menu item remembers the last 8 macros, so they can be selected quickly from a list.

A Visual Basic executable project can be converted to run as a Snap-In DLL. You must know how to add a resource file to the project; also, Visual Basic Snap-Ins have limitations that stand-alone programs do not have. Roper Scientific also supplies a **Visual Basic Snap-In Wizard,** which will set up a new Snap-In DLL project.

The macro languages of Microsoft programs such as Excel or Word also use the Visual Basic syntax and can be used to write programs that call WinX/32 functions. These macro programs run in interpreted mode, so things like For...Next loops will be slower than with a compiled program. However, if your macro mainly consists of calls to built-in functions of these applications, the overall speed of your macro may still be very good.

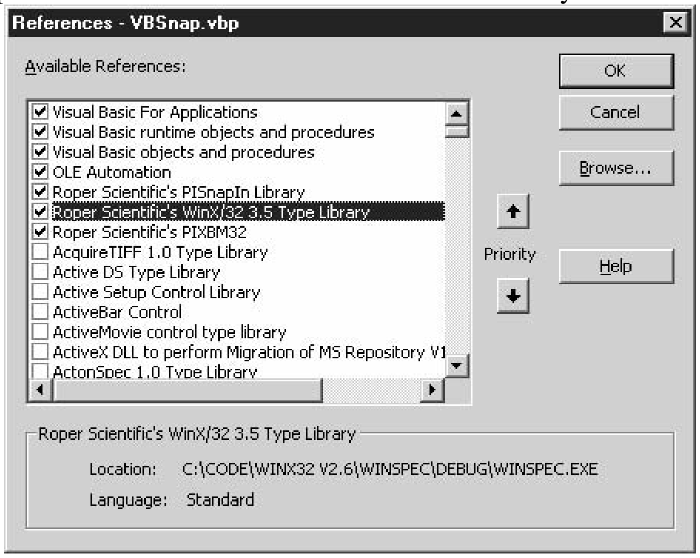
Beginning in Visual Basic®

Note: The examples in this section were produced using the Visual Basic Professional Edition.

Basic Example

This first example describes how to create a Visual Basic executable program that can automate WinX/32.

1. Start a new project of the type "Standard Executable". Visual Basic will create a project with a standard form or dialog. Your VB program will display this form when it first starts to run. Usually you will write your VB program by drawing controls on this form and by specifying what happens when a user interacts with these controls. If you want to make the program begin some action immediately when it starts, without waiting for user interaction, put the code in the `Load` function for the start-up form, or else set a function or subroutine as the start-up object instead of the form.



References - VBSnap.vbp

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- [✓] Visual Basic For Applications
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- [✓] OLE Automation
- [✓] Roper Scientific's PISnapIn Library
- [✓] Roper Scientific's WinX/32 3.5 Type Library
- [✓] Roper Scientific's PIXBM32
- [ ] AcquireTIFF 1.0 Type Library
- [ ] Active DS Type Library
- [ ] Active Setup Control Library
- [ ] ActiveBar Control
- [ ] ActiveMovie control type library
- [ ] ActiveX DLL to perform Migration of MS Repository V1
- [ ] ActonSpec 1.0 Type Library

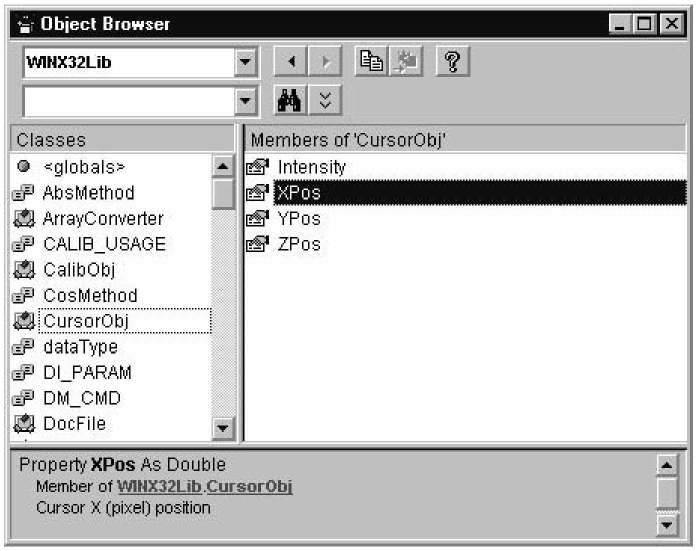
Roper Scientific's WinX/32 3.5 Type Library

Location: C:\CODE\WINX32 V2.6\WINSPEC\DEBUG\WINSPEC.EXE

Language: Standard

2. To gain access to the WinX/32 objects, go to the References browser (in the Project menu) and check the item “Roper Scientific's WinX/32 3.X Type Library”. If this item is not present, then WinX/32 was not installed properly.

3. Once the correct references have been selected, the Visual Basic Object Browser (under the View menu) will show all of the type information available in the selected type libraries. To see inside the WinX/32 type library, use the drop-down box at the top of the Object Browser to select “WINX32Lib”; it defaults to “All”. For each item, a short help string or "hint" is available and will be



Object Browser

WINX32Lib

Classes: <globals>, AbsMethod, ArrayConverter, CALIB_USAGE, CalibObj, CosMethod, CursorObj, dataType, DI_PARAM, DM_CMD, DocFile

Members of 'CursorObj': Intensity, XPos, YPos, ZPos

Property **XPos** As Double
Member of WINX32Lib.CursorObj
Cursor X (pixel) position

displayed at the bottom of the Object Browser window when you select it. Part of this hint will also appear when you are typing the method or property into your program. You can leave this window open while you are writing your program to show what type information is available to you.

4. A WinX/32 automation object can be created in Visual Basic using the following syntax:

   `Dim` *`object name`* **`As New Winx32Lib.`***`object type`*

   For example:

   ```
   Dim objWinX As New WinX32App
   ```

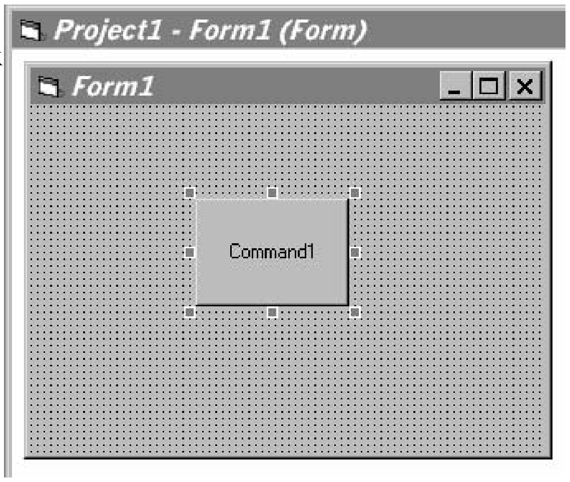
5. You can omit the "Winx32Lib" part of these statements if you are sure no other type library also supplies an object of that type. For instance, if some other program also had an object called "DocFile", and you selected both that program and WinX/32 in the References browser, then VB would have no way of knowing which DocFile object to create.

   Once the object is created, you can access its properties and methods.

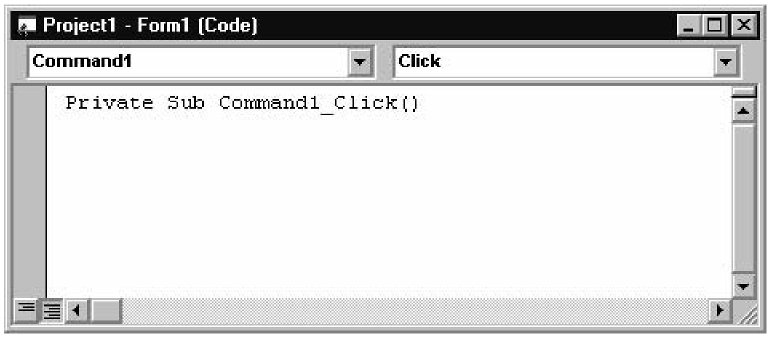
   ```
   objWinX.ShowDemoBox "Hello World!"
   ```

6. Create a button on your new form by clicking the button icon on the VB toolbox and then drawing a box on the form. When you are done you should see something like the form on the right.

   If you have trouble figuring out how to place a button on a form, or want more information, look in the Visual Basic Help Contents for "Designing a Form".



7. To get to the code that will execute when a user clicks on the new button, double-click on it with the mouse. You will be taken to a code window looking like the one below.



```
Private Sub Command1_Click()
```

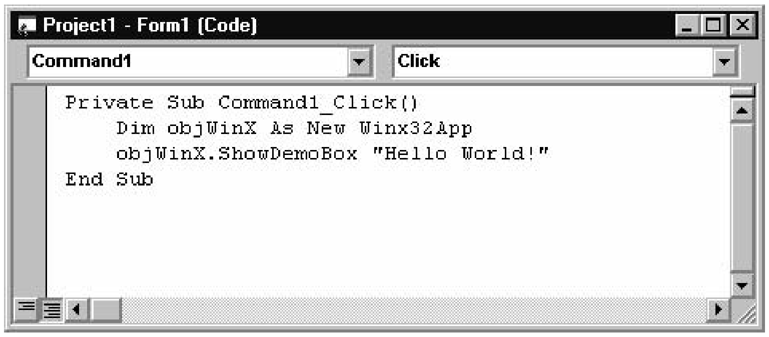
8. Into that window, after the line that says

   `Private Sub Command1_Click()`

   type the two lines already given, that is:

   ```
   Dim objWinX As New WinX32App
   objWinX.ShowDemoBox "Hello World!”
   ```

   The result should look like the figure below:

   ```
   Private Sub Command1_Click()
       Dim objWinX As New Winx32App
       objWinX.ShowDemoBox "Hello World!"
   End Sub
   ```

9. Now just click on the Start button in the VB menu bar, or else choose the Start item under Run. You should see your new form come up. Click on the button. If a WinX/32 program wasn't running yet, it will start up at that point, and display a message box with the contents "Hello World!"

Data Collection Example

Next try giving your program the ability to collect an image or spectrum. Stop the running VB program, and replace the code in **`Command1_Click`**() with the following:

```
Private Sub cmdTest_Click()   Dim objExp As New ExpSetup
   Dim objDoc As DocFile
   If objExp.Start(objDoc) Then    ' start the experiment
      Dim intStatus As Integer
      While objExp.GetParam(EXP_RUNNING, intStatus) And intStatus = 0
         DoEvents    ' wait for the experiment to finish
      Wend
      If intStatus Then   ' check for errors
         MsgBox "Error running experiment."
      End If
      Dim vntFrame As Variant ' get the first frame
      objDoc.GetFrame 1, vntFrame
      Dim intIndex As Integer
      Dim strData As String   ' display some points
      For intIndex = 0 To 4
         strData = strData & vntFrame(intIndex, 0) & ", "
      Next intIndex
      strData = Left(strData, Len(strData) - 2)
      MsgBox strData
   End If
End Sub
```

This little routine will start an acquisition, wait until it is done, retrieve the first frame of data, and display a few values from it.

Data Manipulation Example

Finally try doing something with the data and putting it back into WinX/32. Replace the code in Command1_Click with the following example that takes an image, subtracts an offset, then puts the image back into WinX/32

```
Private Sub cmdTest_Click()
   Dim objExp As New ExpSetup
   Dim objDoc As DocFile
   If Not objExp.Start(objDoc) Then     ' start the experiment
      MsgBox "Error running experiment."
      Exit Sub
   End If
   Dim intStatus As Integer
    While objExp.GetParam(EXP_RUNNING, intStatus) And intStatus = 0
      DoEvents    ' wait for the experiment to finish
    Wend
   If intStatus Then   ' check for errors
      MsgBox "Error running experiment."
      Exit Sub
   End If
   Dim vntFrame As Variant ' get the first frame
   objDoc.GetFrame 1, vntFrame
   Dim intXDim As Integer  ' determine the dimensions
   intXDim = objDoc.GetParam(DM_XDIM)
   Dim intYDim As Integer
   intYDim = objDoc.GetParam(DM_YDIM)
   Dim intX As Integer
   Dim intY As Integer
   For intY = 0 To intYDim - 1    ' subtract the offset
      For intX = 0 To intXDim - 1
         vntFrame(intX, intY) = vntFrame(intX, intY) - 10
      Next intX
   Next intY
   objDoc.PutFrame 1, vntFrame    ' put the data back
   objDoc.Update   ' update the display
End Sub
```

Things to Note about VB

Calling Syntax

Visual Basic differentiates between **Functions**, which return a value, and **Subroutines**, which do not. When calling either, you can put the arguments in parentheses or else just list them after the function name.

- For example, the **function** SetParam returns a value to indicate whether it succeeded in setting the designated parameter. If you don’t want to bother checking whether SetParam succeeds (although you really should!) you can call it without assigning the return value to anything:

```
Dim objExp As New ExpSetup
objExp.SetParam(EXP_EXPOSURE, 0.1) ' with parentheses (gives
                                     syntax error)
objExp.SetParam EXP_EXPOSURE, 0.1  ' without parentheses
```

The line with parentheses above will generate a syntax error if you enter it as shown. This is because SetParam is defined as a **function** which returns a Boolean value. VB won't allow you to write the call to a **function** in the parenthesized form unless you also assign the return value to something; for instance:

```
intStatus = objExp.SetParam(EXP_EXPOSURE, 0.1) ' with parentheses;
this will work
```

In this case, VB creates a variable of type Boolean and assigns the return value of SetParam to it.

- The **function** GetParam returns the value of the designated parameter as its return value, for example:

```
dblExposure = objExp.GetParam(EXP_EXPOSURE) '
```

so you must use the syntax with parentheses.

- **Subroutines** are also sensitive to the presence or absence of parentheses. In this case, if you use parentheses, you have to proceed the **subroutine** call with the **Call** keyword:

```
objWin.SetPosition top, left, right, bottom ' without parentheses
Call objWin.SetPosition(top, left, right, bottom) ' with
parentheses
```

- More difficulties arise with **functions** that take a variable number of arguments; for instance, the Print **function** of PrintWindow. The best way to call this **function** is to use the form with parentheses, and assign the return value:

```
intStatus = objPrint.Print(1, 1, 0, "This is ", 21, " characters")
' this will work
```

Getting Data

When you use the ExpSetup object's Start or StartFocus function to begin collecting data, WinX/32 launches a separate thread to run the acquisition task. This means that your VB program can continue to run while data is being collected. Therefore, you may need to cause the program to wait until data is actually available before proceeding. Visual Basic provides the DoEvents function to allow a program to wait, while allowing the user to interact with the program in such ways as moving the window, clicking on a Stop button, etc. The code fragment below illustrates this process:

```
Dim objDoc As DocFile ' a document for the data
Dim vntFrame As Variant ' a local array for the data
Dim objExp As New ExpSetup ' to start data collection
objExp.Start(objDoc) ' take one set of frames and stop
While objExp.GetParam(EXP_RUNNING) ' wait for data to be acquired
  DoEvents ' allow Windows to process messages
Wend
objDoc.GetFrame 1, vntFrame ' now get data
```

Conclusion

At this point, you know enough to automate many common tasks, using stand-alone Visual Basic programs to control WinView or WinSpec. To find out how to create a Snap-In DLL, see the section entitled “Creating a Snap-In DLL”.

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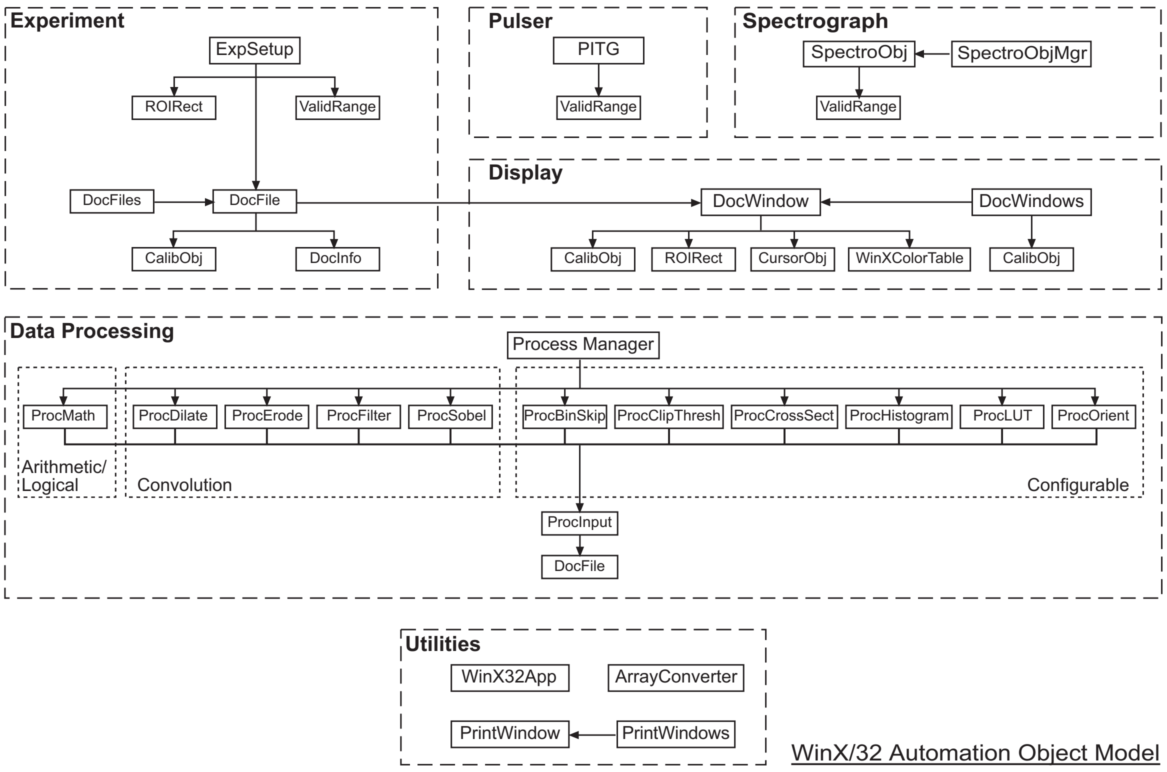
WinX/32 Automation Objects

Introduction

What follows is a list of the WinX/32 Automation objects. Each section corresponds to a different functionality of WinX/32 . Below is the object model that shows all of the objects and how they relate to each other within each section.

WinX/32 Automation Object Model :

Functionality	Description
Experiment	Objects that control an experiment and data acquisition
Pulser	Objects that program a timing generator
Spectrograph	Objects that program a spectrograph
Display	Objects that control how data is displayed
Data Processing	Objects used for post-processing data via arithmetic, logical, kernel or other operations
Utilities	Objects used to display information to the user or make data handling more efficient



WinX/32 Automation Object Model

Experiment

ExpSetup

This object represents a WinX/32 experiment. It controls experiment parameters as well as data acquisition.

`Function GetParam(Param As enum EXP_CMD, result As Integer) As Any`
`Function SetParam(Param As enum EXP_CMD, Value As Any) As Integer`

Get and set experiment parameters (see the **EXP_CMD** parameters list for details).

For more information see GetParam function in the DocFile section, and also the discussion of Calling Syntax under "Things to Note".

`Function GetDocument() As DocFile`

Returns a pointer to an object of type DocFile. If the returned value is not empty, it is the data file associated with the current or last data collection. An empty return value indicates that either no data collection has run since the program started, or that the data file from the data collection was closed. You can use the returned object to call the DocFile interface functions for the document.

`Function Start(File As DocFile) As Boolean`
`Function Start2(optional pRes) As DocFile`
`Function StartFocus(File As DocFile) As Boolean`
`Function StartFocus2(optional pRes) As DocFile`

Begin collecting data. **`Start`** causes all of the frames in the experiment to be acquired; then the acquisition stops. **`StartFocus`** acquires the first frame in the experiment repeatedly, until the **`Stop`** function is called (or until the WinX user stops the acquisition). If the DocFile object supplied is empty, WinX/32 will create a new document and give it the default name for new documents, and the new data will be put into this document. If the DocFile object supplied is not empty, then the new data will be put into it. If an empty DocFile object is supplied, then on return it will be set to the new data file. The Boolean value indicates whether data collection was successfully started. The second version of these functions are used when it is necessary to bind to a DocFile object with the **Set** statement (as in scripting).

Example:

```
Dim objExp As New ExpSetup
Dim objDoc As New DocFile ' leave doc empty, WinX will supply
objExp.Start objDoc ' will acquire one set and stop
```

`Function Stop() As Boolean`

Stop collecting data. The return value indicates whether data collection was in progress before the function was called.

Function IsAvail(Param As enum EXP_CMD, optional Range As ValidRange) As Boolean
Function IsAvail2(Param As enum EXP_CMD, optional pRes) As ValidRange

Determines whether a feature corresponding to one of the parameters is available. You can call this function to find if the value returned from a given GetParam parameter will be valid, or to find whether the parameter value is able to be set via SetParam and what the range of valid values are. The second version of this function is used when it is necessary to bind to a ValidRange object with the **Set** statement (as in scripting).

Example:

```
Dim objExp As New ExpSetup
Dim objValid As ValidRange
Dim intStatus As Integer
intStatus = objExp.IsAvail(EXP_ADC_TYPE, objValid) ' Can we set
   the ADC type?
If intStatus And vR.CurrentValue <> 2 And objValid.MinValue <=
   2 And objValid.MaxValue >= 2 Then
  intStatus = objExp.SetParam(EXP_ADC_TYPE, 2) ' Yes
End If
```

Function GetROI(index As Integer) As ROIRect
Function SetROI(Rect As ROIRect) As Boolean

Gets or sets a detector ROI. ROIs determine how pixels are read from the detector. The value of index must be 1 or greater. The rectangle information is passed as an ROIRect object, which is described below. You must call SetParam with the EXP_USEROI parameter to control whether the ROIs are used. You should call ClearROIs before setting up one or more ROIs with SetROI.

The GetROI function can return a “no” ROIRect object if the WinX/32 software has no ROIs set up. Be sure to check for this condition as in the following example:

Example:

```
Dim objExp As New ExpSetup
Dim objROI As ROIRect
Set objROI = objExp.GetROI(0)
If TypeName(objROI) = "Nothing" Then
    MsgBox "No ROIs are available"
End If
```

Sub ClearROIs()

Erases all of the detector ROIs. This forces the detector to use the entire array for the next data collection. You can call SetParam with the EXP_USEROI parameter to control whether the ROIs are used without erasing them. You should call ClearROIs before setting up one or more ROIs with SetROI.

Function Load As Boolean
Function Save As Boolean

These functions allow you to save and restore the entire experiment setup in a disk file. The name of the file is set by a previous call to the SetParam function with the EXP_SETUPNAME parameter. The return value is False if the operation did not succeed, otherwise it is True.

`Function WaitForExperiment As Boolean`

This function waits for any pending data collection to complete. It is provided for programmers who do not wish to write DoEvents loops in their own code. The Start and StartFocus methods of ExpSetup return control almost immediately to the calling program. Often, a simple VB program that collects data will want to wait for the data collection to finish before proceeding. To do so, simply call this function:

If you want your program to be able to do some processing while data collection is proceeding, you will have to write a loop using the VB DoEvents keyword (see the example on page 11.)

If the return value is False, then either there was no controller or the program was stopped before data collection completed.

`Function AcquireBackground() As Boolean`

This function acquires a background file as if the user clicked on the "Acquire Background" toolbar button. Returns True on success.

`Function AcquireFlatfield() As Boolean`

This function acquires a flatfield file as if the user clicked on the "Acquire Flatfield" toolbar button. Returns True on success.

ROIRect

The ROIRect object represents a region of interest. It is used by the GetROI and SetROI functions of the DocWindow and ExpSetup objects.

Properties:

Name	Native Type	Description
Top	Double	X coordinate of the top left corner of the rectangle
Left	Double	Y coordinate of the top left corner of the rectangle
Bottom	Double	Y coordinate of the bottom right corner of the rectangle
Right	Double	X coordinate of the bottom right corner of the rectangle
XUnits	XCALIBUNIT	Units of the X coordinates
YUnits	YCALIBUNIT	Units of the Y coordinates
XGroup	Long	“Group size” used in the X direction (only significant for ExpSetup ROIs)
YGroup	Long	“Group size” used in the Y direction (only significant for ExpSetup ROIs)

```
Sub Get(top As Double, left As Double, bottom As
        Double, right As Double, xg As Long, yg As
        Long)
Sub Set(top As Double, left As Double, bottom As
        Double, right As Double, xg As Long, yg As
        Long)
```

Use these functions to get or set the ROI at once, without having to set each property.

ValidRange

The ValidRange object represents valid values that a parameter can hold. It is returned from the IsAvail function of the ExpSetup, PITG, and SpectroObj objects.

Properties:

Name	Native Type	Description
AvailValues	Long Array (only when DataType is X_ENUM, Empty otherwise)	All discrete, legal enum values for this parameter (only valid when DataType is X_ENUM)
Count	Integer	Number of valid items for this parameter
DataType	Integer	Datatype used for this parameter (specified by the dataType enum)
MinValue	Double	Minimum legal value for this parameter
MaxValue	Double	Maximum legal value for this parameter
DefaultValue	Double	Default value for this parameter
CurrentValue	Double	Current value of this parameter
Increment	Double	Minimum increment value for this parameter
ReadOrWrite	ExpRdWrType	Able to call get/set params

DocFile

This object represents a WinX/32 data file. Besides creating one, this object can be retrieved through the following objects: ExpSetup, DocWindow, and all process objects.

Properties:

Name	Native Type	Description
Title	String	The title in its associated DocWindow (excluding the dimensions)

`Function Open(Name As String [, xLen As Integer, yLen As Integer, zLen As Integer, datatype As Long, newName As String]) As Boolean`

Gets a pointer to an open document. If a name is supplied as the first parameter, then a pointer to an open document is returned, or a document is opened from disk (the document must already exist). The other parameters are optional, if Name is not a null string. If Name is "", Open creates a new document using the values for xLen, yLen, zLen and datatype to determine the size of the document, and newName to determine the name. If newName is "", the new document gets the default name. If xLen, yLen, or zLen are 0, the current controller setup determines the size of the document.

The data type is specified by the dataType enum.

Example:

```
Dim objDoc As New DocFile
objDoc.Open "Circuit.spe"
```

`Function OpenNew(Name As String, pInfo As DocInfo) As Boolean`

This is an alternative way to open a data file with the DocFile object. The String is the filename of a pre-existing file. If the String is empty, a new document will be created. This method uses the DocInfo object to specify information about the new document. In addition to the parameters used in the Open function, such as Xlen, Ylen, and Datatype, the DocInfo object allows you to specify whether to open the file in Append mode and whether to display the file in a window.

When a data file is opened in Append mode, any old file with the same name is not erased. Instead, the number of frames specified in the pInfo structure is added onto the end of the old file. The parameter DM_LASTFRAMERDY specifies which is the last frame with valid data. When a new file is first opened, it is set to zero. If an old file is appended to, then DM_LASTFRAMERDY is set to the number of frames in the file before the append occurred. The PutFrame and PutStrip functions update the DM_LASTFRAMERDY parameter; However, if you put data into the file using PutPixel, you must update DM_LASTFRAMERDY yourself.

For more information, including how to use the bShowWindow member of DocInfo, see the description of DocInfo.

`Function GetWindow() As Object`

Returns a pointer to an object of type DocWindow, which you may use to call the DocWindow interface (display) functions for a window displaying this document.

```
Sub GetFrame(frame As Integer, buffer As Variant)
Sub PutFrame(frame As Integer, buffer As Variant)
Sub GetStrip(frame As Integer, strip As Integer, buffer
             As Variant)
Sub PutStrip(frame As Integer, strip As Integer, buffer
             As Variant)
Function GetPixel(frame As Integer, strip As Integer,
                  pixel As Integer) As Variant
Sub PutPixel(frame As Integer, strip As Integer, pixel
             As Integer, pixel As Variant)
```

GetFrame copies the data from a document into a Visual Basic array. If buffer is an empty Variant, GetFrame creates an array of the proper size and data type and sets buffer to point to it before copying the data.

PutFrame copies the data from a Visual Basic array into a document. The array should be one created with GetFrame to ensure that the size and data type match.

`GetStrip` and **`PutStrip`** are similar to **`GetFrame`** and **`PutFrame;`** they copy one strip to or from the document.

`GetPixel` returns a single pixel value from the document. **`PutPixel`** sets the value of a single pixel in the document. The pixel value is automatically converted from the type of the Visual Basic variable used to the correct data type for the document.

Example:

See **Data Collection Example** (page 11) in the "Beginning Visual Basic" section.

`Sub AllocFrame(buffer As Variant)`

`AllocFrame` takes an empty variant and constructs a Visual Basic array of the correct size and data type to hold one frame of data from the document. Normally it is not necessary to use this function since **`GetFrame`** and **`GetStrip`** will perform an **`AllocFrame`** if the buffer Variant supplied to them is not set up yet.

Example:

```
Dim objDoc As New DocFile
Dim vntFrame As Variant
objDoc.Open "circuit.spe"
objDoc.AllocFrame vntFrame
'
' later in the program...
'
objDoc.PutFrame 1, vntFrame
```

Function GetParam(Param As enum DM_CMD, result As Integer) As Any
Function SetParam(Param As enum DM_CMD, Value As Any) As Integer

Allows setting and getting document parameters (strips, frames, etc.). **SetParam** returns non-zero on error. Note that not all parameters may be set after a document is created. For instance, once created the **DM_XDIM** and **DM_YDIM** parameters can not be set, since this would require changing the size of the file on disk.

WinX/32 will try to convert the parameter to the correct type corresponding to the particular **DM_CMD**. If this cannot be done, Visual Basic reports a 'Type Mismatch' error. For more information see the discussion of Calling Syntax under "Things to Note".

Example:

```
Dim objDoc As New DocFile
ObjDoc.Open "circuit.spe"
Dim intXDim As Integer
intXDim = objDoc.GetParam(DM_XDIM) ' find the pixels per track
objDoc.SetParam DM_YLABEL, "Watts" ' set the y label to "Watts"
```

Function GetCalibration As CalibObj
Function SetCalibration(Calib As CalibObj) As Boolean

Allows setting and getting the X axis calibration information in the docfile. The information is passed as a CalibObj object, which is described below.

Example:

```
Dim objDoc As New Docfile
Dim objCal As CalibObj
objDoc.Open "Circuit.spe"
Set objCal = objDoc.GetCalibration
objCal.DisplayUnits = XW_WAVELENGTH ' Change display units only
bRes = objDoc.SetCalibration objCal
```

Sub Update()

Redraws all frames for this doc.

Function Save() As Boolean

Saves the data in the document with the current filename.

Function SaveAs(Name As String, nType As Long) As Boolean

Saves the data in the document with a new filename to a new file type. Use this function to convert a file to a new data type. The valid values for nType are located in docType enum.

Function Close() As Boolean

Closes all windows associated with this doc and closes the file. If the doc is unsaved, the user will be prompted to save it before closing. The return value is 1 if the document was open before the save, or zero otherwise.

DocFiles

The DocFiles object is a *collection* object used to refer to all of the open doc files. It can be used in a For…Each loop and DocFile objects can be accessed like array elements (i.e., objDocFiles(intIndex)).

`Function GetAt(index As Integer) As DocFile`

Returns the open DocFile, if any, corresponding to the zero-based index. The index value must be less than the number of open documents, or else the returned object will be empty.

`Function Count() As Integer`

Returns the number of open DocFile objects.

`Sub CloseAll()`

Closes all of the open DocFile objects.

CalibObj

The CalibObj object represents axis calibration. It is used by the SetCalib and GetCalib functions of the DocFile, DocWindow, and DocWindows objects. It has these properties:

Properties:

Name	Native Type	Description
DisplayUnit	XCALIBUNIT	Selected calibration unit for Display
Input Unit	XCALIBUNIT	Selected calibration unit for the CalibVal array
Order	BYTE (1-5)	Order of polynomial for calibration
PairCount	Integer	Number of valid pairs of PixelLoc and CalibVal
PixelLoc(10)	Double	Array of locations specified in pixels
CalibVal(10)	Double	Array of calibration values at PixelLoc positions.
PolyCoeffs(5)	Double	Array of polynomial coefficients for calibration
LaserPosition	Double	Laser wavenumber (valid for relative wavenumber units only)
Label	String	Calibration units label
UsageFlag	CALIB_USAGE	Flag to use calibration

Where XCALIBUNIT is one of:

`XW_SYSTEM`	Relative system units like channels, strips, and frames.
`XW_DATA`	Absolute units including offset and linear factor.
`XW_WAVELENGTH`	Polynomial calibration of wavelength

`XW_ABSWAVENUM`	Wavenumber units
`XW_RELWAVENUM`	Relative wavenumber units
`XW_EVOLTS`	Electron volts

The combination of DisplayUnits and InputUnits allows the programmer to supply calibration values (in the CalibVal array) in one unit, such as wavelength, while at the same time requiring the program to display the data (by default) in another unit, such as wavenumbers. The display units for a particular window may also be changed with the SetParam function of DocWindow.

`Function Lambda(Pixel As Integer) As Double` - returns the wavelength for a given pixel.
`Function Pixel(Lambda As Double) As Integer` - returns the pixel for a given wavelength.

DocInfo

The DocInfo object supplies information to the OpenNew method of DocFile.

Properties:

Name	Native Type	Description
X	integer	Number of pixels in each strip of the new document
Y	integer	Number of strips in each frame of the new document
Z	integer	Number of new frames in the new document
dataType	dataType	Data type for the new document
Name	String	The name for the new document
bShowWindow	Boolean	True if the document should be shown in a window
bAppend	Boolean	True if the document should be opened in append mode
FileType	docType	Type of file (SPE, TIF, etc.)

DocInfo defaults to bAppend = False, bShowWindow = True. If no name is supplied, the "Untitled" string is used.

Here is an example of using the DocInfo object with OpenNew to open a new data file:

```
Dim objDoc As New DocFile
Dim objInfo As New DocInfo ' supplies info about new document
objInfo.x = 200 ' 200 pixels per strip
objInfo.y = 2 ' 2 strips
objInfo.Z = 1 ' 1 frame
objInfo.dataType = X_FLOAT ' floating point data
objInfo.bShowWindow = True ' display the file in a window
objInfo.bAppend = False ' overwrite; don’t append to existing
                          file
objInfo.Name = "newdata" ' use this for the name
objInfo.FileType = dt_SPE
objDoc.OpenNew "", objInfo   ' create the file
```

Display

DocFile

Refer to the **Experiment** section for the **DocFile** description (page 20).

DocWindow

This object represents the window in which a doc file is displayed. This object should not be created --- it should be retrieved through the DocFile or DocWindows objects.

Properties:

Name	Native Type	Description
Title	String	The title in the window (including the dimensions)
Visible	Boolean	The state of the shown/hidden window
ColorTable	WinXColorTable	The table that maps intensity to color.
Floating	Boolean	The state of attachment of this window to the application window.
Index	Long	The index of this window in the DocWindows collection.

`Sub SetPosition(top As Integer, left As Integer, bottom As Integer, right As Integer)`
`Sub GetPosition(top As Integer, left As Integer, bottom As Integer, right As Integer)`

Sets or gets the position of this window. Returns 0 on error.

`Sub Update()`

Redraws this frame.

`Function GetParam(Param As enum DI_PARAM, result As Integer) As Any`
`Function SetParam(Param As enum DI_PARAM, Value As Any) As Integer`

Allows setting and getting DocWindow parameters (axes, cross sections, etc.). SetParam returns non-zero on error. It is recommended to call Update after calling SetParam. Not all parameters can be set after the window is created.

For more information, see GetParam function in the DocFile section, and also the discussion of Calling Syntax under "Things to Note".

Function GetDocument() As DocFile

Returns a pointer to an object of type DocFile, which you may use to call the DocFile interface functions for the document attached to this window.

Function NewWindow([winType As PICTURE_TYPE]) As DocWindow

Returns a pointer to a new DocWindow object representing a new window with the same document.

Example:

```
Dim objDoc As New DocFile
Dim objWin1 As New DocWindow
Dim objWin2 As New DocWindow
objDoc.Open("circuit.spe")
Set objWin1 = objDoc.GetWindow
Set objWin2 = objWin1.NewWindow(WINX_GRAPH)
```

Sub Next
Sub Prev
Sub NextSkip
Sub PrevSkip
Sub First
Sub Last

Selects the strip or frame displayed by the window. For images, these subroutines control the displayed frame; for single curve graphs, they control the strip number; and for 3-D graphs, they control the strip number if the parameter DI_BPLOTFRAME is set to 0 or FALSE; otherwise, they control the frame number.

Sub Update()

Redraws this window.

Sub Close()

Closes this window.

Sub ZoomIn
Sub ZoomOut
Sub UnZoom

ZoomIn zooms in on the current window. If the ROI rectangle is being displayed in the window, the zoom is done to the ROI. If the ROI rectangle is not visible, then the zoom is done to increase the zoom factor by 10%.

ZoomOut undoes the previous ZoomIn, if any. UnZoom undoes all the previous ZoomIns for this window.

Function GetROI(index As Integer) As ROIRect
Function SetROI(Rect As ROIRect) As Boolean

Gets or sets the ROI rectangle for this window. Once the ROI rectangle is set, it can be displayed or hidden using the DI_BROIBOXON parameter in the SetParam function. The rectangle information is passed as an ROIRect object, which is described in that section.

`Function GetCursor As CursorObj`

Gets the CursorObj for this window. You can use the CursorObj to read or set the position of the cross cursor in this window. CursorObj functions and properties are listed in the CursorObj section.

`Function GetCalibration As CalibObj`
`Function SetCalibration(Calib As CalibObj) As Boolean`

Allows setting and getting the X axis calibration information for the window. The information is passed as a CalibObj object, which is described below. These functions are the same as the GetCalibration and SetCalibration functions for DocFile, except that they operate on the calibration of a window instead (the window calibration can be different from the file calibration, and different windows of the same data file can have different calibrations.)

`Function Activate() As Boolean`

This function makes this window the active window. The function returns True if successful, otherwise it returns False.

`Sub MoveCursor(X As Double, Y As Double)`

This function sets to the cursor in the window to the coordinates (x,y).

`Sub SetROIPos(top As Double, left As Double, bottom As Double, right As Double)`

This function draws an ROI rectangle in the window whose top-left point is (left, top) and whose bottom-right point is (right, bottom).

`Function GetHWnd() As Long`

Returns the Win32 handle of this window. Can be used with SendMessage, ShowWindow, and other Windows API functions.

`Sub ScrollTo(X As Long, Y As Long)`

This function sets the horizontal scrollbar (if there is one) to the X position and the vertical scrollbar (if there is one) to the Y position.

DocWindows

The DocWindows object is a *collection* object that refers to all of the open DocWindows. It can be used in a For…Each loop and DocWindow objects can be accessed like array elements (i.e., objDocWindows(intIndex)). DocWindow properties referred to by SetParam or GetParam are the defaults for the WinX/32 program.

`Function GetAt(index As Integer) As DocWindow`

Returns the open DocWindow, if any, corresponding to the zero-based index. The index value must be less than the number of open DocWindows, or else the returned object will be empty.

`Function Count() As Integer`

Returns the number of open DocWindow objects.

`Sub CloseAll()`

Closes all of the open DocWindow objects.

```
Sub Tile(BOOL bHorizontal)
Sub Cascade();
```

Arranges all of the open DocWindow objects.

```
Function GetParam(Param As enum DI_PARAM, result As
                  Integer) As Any
Function SetParam(Param As enum DI_PARAM, Value As Any)
                  As Integer
```

Allows setting and getting DocWindow default parameters (axes, cross sections, etc.). SetParam returns non-zero on error. For more information see GetParam function in the DocFile section, and also the discussion of Calling Syntax under "Things to Note".

```
Function GetCalibration As CalibObj
Function SetCalibration(Calib As CalibObj) As Boolean
```

Allows setting and getting the default X axis calibration information for the program. The information is passed as a CalibObj object, which is described below. These functions are the same as the GetCalibration and SetCalibration functions for DocWindow, except that they operate on the default calibration of the program, rather than the calibration for a specific window

```
Function GetActive() As DocWindow
```

This function returns the active window if it's a data window, otherwise it returns Nothing.

CalibObj

Refer to the **Experiment** section for the **CalibObj** description (page 23).

ROIRect

Refer to the **Experiment** section for the **ROIRect** description (page 18).

CursorObj

The CursorObj object controls the cursor in a DocWindow. Call the GetCursor function of DocWindow to get the CursorObj for the window. The CursorObj properties are always current; that is, you don't have to do multiple GetCursor calls in order to get the most recent values, and when you set a property, the cursor in the window moves immediately. (This is not like the ROIRect object, for instance.)

Properties:

Name	Native Type	Description
XPos	Double	X coordinate (pixel or wavelength) of the cursor
YPos	Double	Y coordinate (strip) of the cursor
ZPos	Double	Z coordinate (frame) of the cursor
Intensity	Double	Intensity value of the pixel under the cursor

WinXColorTable

A WinXColorTable object contains an array of 256 colors (zero-based) that are used to create a bitmap for an image in a DocWindow. The way the data intensity is mapped to these colors depends on the current palette shape of the DocWindow (i.e., linear, logarithmic, inverted, etc.). This object should not be created -- it should be retrieved through the DocWindow object.

Properties:

Name	Native Type	Description
Val(*i*)	Long	The value of each color in the table at index *i* in &H*BBGGRR* format
Red(*i*)	Integer	The red component (*RR*) of each color in the table at index *i* ranging from &H00 to &HFF
Green(*i*)	Integer	The green component (*GG*) of each color in the table at index *i* ranging from &H00 to &HFF
Blue(*i*)	Integer	The blue component (*BB*) of each color in the table at index *i* ranging from &H00 to &HFF

`Sub Realize`

Realizes the palette in the DocWindow.

Example:

```
Dim objDoc As New DocFile
Dim objWin As DocWindow
Dim objCT As WinXColorTable
Dim intIndex As Integer
objDoc.Open "circuit.spe"
Set objWin = objDoc.GetWindow
Set objCT = objWin.ColorTable
For intIndex = 120 To 140
  objCT.Red(intIndex) = 255  ' highlight mid-range data intensities
Next
objCT.Realize  ‘ display the changes
```

Data Processing

Overview

Thus far, the documentation has been arranged on an object-by-object basis. Since the processing objects are related to each other in functionality, the documentation will now take a functional approach. Specific functionality will be introduced, followed by the properties and/or methods that define this functionality, followed by the objects that implement this functionality.

A multitude of objects allow processing of WinX/32 data files and they are all related to each other in very specific ways. Basically, these processes can be broken down into two types: Arithmetic/Logical and Non-Arithmetic/Logical. (Refer to the table below to see the type of each process.)

Arithmetic/Logical Processes are those processes that can be found under the WinX/32 Image/Spectra Math dialog. These processes use unary or binary operators (operators that take one or two inputs). If the operator is binary, the second input may represent a constant. Otherwise, all inputs represent data files. Since these operators are basic, the actual processes themselves need not be configured. An example of this type is adding two images together.

Non-Arithmetic/Logical Processes are the rest of the processes. These can be broken down into two subtypes, Convolution and Configurable. Convolution Processes apply a convolution kernel to a single input data file. Since the process itself implicitly defines the application of the kernel, the actual processes themselves need not be configured. An example of this type is dilating an image. Configurable Processes do not use an arithmetic/logical operator or a convolution kernel. They are processes whose operators are complex enough that they must be configured. These operators also are only applied on a single data file. An example of this type is creating a histogram for an image.

Arithmetic/Logical Objects	**Non-Arithmetic/Logical Objects**	
	Convolution	**Configurable**
ProcMath	ProcDilate	ProcBinSkip
	ProcErode	ProcClipThresh
	ProcFilter	ProcCrossSect
	ProcSobel	ProcHistogram
		ProcLUT
		ProcOrient

Configuring the Input

All data processing objects require at least one input to operate on. The objects that implement this functionality act as the input data. They can be defined as a data file or a constant.

Properties:

Name	Native Type	Description
Value	Variant	A numerical value (representing a constant) or a valid path to a data file.
dataType	DataType	The data type of the input file if the Value property contains a path.
Xstart	Long	The starting column of data to be used if the Value property contains a path.
Xend	Long	The ending column of data to be used if the Value property contains a path.
Ystart	Long	The starting strip of data to be used if the Value property contains a path.
Yend	Long	The ending strip of data to be used if the Value property contains a path.
Zstart	Long	The starting frame of data to be used if the Value property contains a path.
Zend	Long	The ending frame of data to be used if the Value property contains a path.
Xcount	Long	The number of pixels per strip to be used if the Value property contains a path.
Ycount	Long	The number of strips to be used if the Value property contains a path.
Zcount	Long	The number of frames to be used if the Value property contains a path.

Methods:

```
Sub GetFromDoc(pDocFile As DocFile)
```
Initializes this input using an existing DocFile object.

Implemented by:
ProcInput

Example:
See the example located in **Running an Arithmetic/Logical Process.**

Configuring the Output

All data processing objects produce one output as a result of the process. The objects that implement this functionality define how the output data is presented.

Methods:

```
Function GetProcParam(Param As PRC_PARAM, optional
                     pRes As PROCERR) As Any
Function SetProcParam(Param As PRC_PARAM, vSetVal As
                     Any) As PROCERR
```

Allows setting and getting general parameters for the output data file, such as displaying the output or enabling file increment. Calling these through the ProcessManager object reads/modifies the default for all processes. Otherwise, only the calling process is affected.

WinX/32 will try to convert the parameter to the correct type corresponding to the particular PRC_PARAM. If this cannot be done, Visual Basic reports a 'Type Mismatch' error.

Implemented by:

ProcessManager, ProcBinSkip, ProcClipThresh, ProcCrossSect, ProcDilate, ProcErode, ProcFilter, ProcHistogram, ProcLUT, ProcMath, ProcOrient, ProcSobel

Example:

See the example located in **Running an Arithmetic/Logical Process.**

Configuring the Convolution Kernel

Non-Arithmetic/Logical Processes that contain a convolution kernel must configure the kernel before applying the process. The kernel resides in the specific process object itself. It is a two dimensional array (zero-based) of values. Elements may be changed individually by accessing the property below. To change the kernel dimensions or to change all elements at once, use the function below. The specific object implicitly defines the application of the kernel, so that aspect need not be configured.

Properties:

Name	Native Type	Description
Kernel(*x*, *y*)	Double	The kernel element at indices (*x*, *y*).

Methods:

```
Sub SetKernel(pvKernel)
```

Replaces the kernel with pvKernel. The variable pvKernel is usually a two-dimensional array of type Double or Variant. It may also be single dimension array. If this is the case, the process object assumes the array size is a perfect square x^2 such that it will take on the dimensions *x* by *x*.

Implemented by:

ProcDilate, ProcErode, ProcFilter, ProcSobel

Example:

See the example located in **Running a Non-Arithmetic/Logical Process.**

Configuring the Process

Configurable Processes must be configured before applying the process. Convolution Processes may use this functionality to read back the current dimensions of the kernel.

Methods:

```
Function GetParam(Param As PIIP_SetGetParam,
                  optional pRes As PROCERR) As Any
Function SetParam(Param As PIIP_SetGetParam, vSetVal
                  As Any) As PROCERR
```

Allows setting and getting parameters that define a Configurable Process, such as setting a low clipping value for the ProcClipThresh object. If called through a Convolution Process the current kernel dimension can be returned.

WinX/32 will try to convert the parameter to the correct type corresponding to the particular PIIP_SetGetParam. If this cannot be done, Visual Basic reports a 'Type Mismatch' error.

Implemented by:

ProcBinSkip, ProcClipThresh, ProcCrossSect, ProcDilate, ProcErode, ProcFilter, ProcHistogram, ProcLUT, ProcOrient, ProcSobel

Example:

See the example located in **Running a Non-Arithmetic/Logical Process.**

Running an Arithmetic/Logical Process

The input (or inputs if the operator is binary) must be configured beforehand. If the output is not configured, the defaults for the process will be used.

Methods:

```
Function Run(pInputA As ProcInput, pInputB As
             ProcInput, eOp As
             PIDP_IMAGEMATHOPERATION, szOutput As
             String, eOutType As dataType, optional
             pResult As PROCERR) As DocFile
```

Runs an arithmetic/logical process. The inputs are set with pInputA and pInputB (if the operator is binary). Otherwise, just use pInputA. The parameter eOp determines the arithmetic or logical operation. The output filename and data type are determined by szOutput and eOutType, respectively. After the function call, if no error is set in pResult, the output data file will be returned.

Implemented by:

ProcMath

Example:

```
' configure the first input
Dim objDoc As New DocFile
objDoc.Open "circuit.spe"
Dim objInputA As New ProcInput
Call objInputA.GetFromDoc(objDoc)  ' set Input A to circuit.spe
```

```
' configure the second input
Dim objInputB As New ProcInput
ObjInputB.Value = 10           ' set Input B to the constant 10

' configure the output
Dim objArith As New ProcMath
objArith.SetProcParam PRC_DISPLAYOUTPUT, False' don't display output

' run the process
Dim objOutput As DocFile
Set objOutput = objArith.Run(objInputA, objInputB,
IMAGEMATH_ADDITION, "c.spe", X_FLOAT)
objOutput.Save
objOutput.Close
```

Running a Non-Arithmetic/Logical Process

The input must be configured beforehand. If it's a Convolution Process, the kernel must be configured process itself already defines it. If a Configurable Process is used, the process itself must be configured appropriately. If the output is not configured, the defaults for the process will be used.

Methods:

`Function Run(pInputA As ProcInput, szOutput As String, eOutType As dataType, optional pResult As PROCERR) As DocFile`

Runs a non-arithmetic/logical process. The input is set with pInputA. The output filename and data type are determined by szOutput and eOutType, respectively. After the function call, if no error is set in pResult, the output data file will be returned.

Implemented by:

ProcBinSkip, ProcClipThresh, ProcCrossSect, ProcDilate, ProcErode, ProcFilter, ProcHistogram, ProcLUT, ProcOrient, ProcSobel

Example:

```
' configure the first input
Dim objDoc As New DocFile
objDoc.Open "circuit.spe"
Dim objInput As New ProcInput
Call objInput.GetFromDoc(objDoc)     ' set input to circuit.spe

' configure the first output
Dim objMorph As New ProcDilate
objMorph.SetProcParam PRC_DISPLAYOUTPUT, true  ' display output

' run the first process
Dim objOutput As DocFile
Set objOutput = morph.Run(objInput, "dilated.spe", X_FLOAT)
objOutput.Save

' configure the second input
Call objInput.GetFromDoc(objOutput)  ' set input to dilated.spe

' configure the second output
Dim objHist As New ProcHistogram
objHist.SetParam PRC_DISPLAYOUTPUT, false' don't display output
```

```
' configure the second process
objHist.SetParam HISTOGRAM_OPERATIONS, HISTOGRAM_NORMAL
objHist.SetParam HISTOGRAM_LOWVAL, 1
objHist.SetParam HISTOGRAM_HIGHVAL, 4096
objHist.SetParam HISTOGRAM_GROUP, 1

' run the second process
Set objOutput = objHist.Run(objInput, "hist.spe", X_FLOAT)
objOutput.Save
objOutput.Close
```

Utilities

WinX32App

This object is used to control general functionality of the application such as sizing the window, displaying a message box, and hiding the applications.

Properties:

Name	Native Type	Description
Flavor	String	The WinX/32 program that is running. For instance, WinView/32 returns the string "WinView/32", and WinSpec/32 returns "WinSpec/32".
Version	String	The version of WinView or WinSpec that is running. For instance, version 2.5 of WinSpec returns a string like "2.5.0.0".
rectBottom	Long	Bottom coordinate of the main window.
rectLeft	Long	Left coordinate of the main window.
rectRight	Long	Right coordinate of the main window.
rectTop	Long	Top coordinate of the main window.
Visible	Boolean	The state of the shown/hidden main window.

`Sub ShowDemoBox(Text As String)`

Displays the text in Text via a simple message box.

Example:

```
Dim objWinX As New WinX32App
objWinX.ShowDemoBox "This is my text"
```

`Function GetAppWnd() As Long`

Returns the Win32 window handle of the WinX/32 application's main window. Can be used with SendMessage, ShowWindow, and other Windows API functions.

Example:

```
Public Declare Function ShowWindow Lib "user32" (ByVal hwnd As
   Long, ByVal nCmdShow As Long) As Long
Public Const SW_SHOWMAXIMIZED = 3
Dim objWinX As New WinX32App
Dim lngWnd As Long
lngWnd = objWinX.GetAppWnd
' Maximize the WinX/32 application window
Dim lngResult As Long
lngResult = ShowWindow(lngWnd,SW_SHOWMAXIMIZED)
```

`Function GetAppRect(top As Long, left As Long, bottom As Long, right As Long) As Boolean`

Retrieves the coordinates of the WinX/32 application's main window. Returns non-zero on error.

`Function CountOpenDocs() As Long`

Returns the number of documents open.

`Function CloseOpenDocs(cDocs As Short) As Boolean`

Closes all open document windows. If cDocs is not 0, it will have the number of windows closed on return. Returns 0 if no error.

`Function InfoBox(Boolean bOn) As Boolean`

Opens or closes the info box. Returns TRUE if the box was open before the call.

Example:

```
Dim objWinX As New WinX32App
Dim blnStatus As Boolean
blnStatus = objWinX.InfoBox (True)
```

`Function StatusBar(Boolean bOn) As Boolean`

Opens or closes the Status Bar. Returns non-zero if the bar was open before the call.

`Sub Hide(Boolean bhide)`

This function can hide or show the WinX/32 application and all child windows. If the user did not start WinView or WinSpec before running your program, the first time your program creates a COM object (such as a WinX32App or a DocFile) then WinView or WinSpec will start automatically. When the program detects that it is starting as a result of a COM object call, it will wait an additional 3 seconds before displaying its splash screen or main window. This is to give your program enough time to call the Hide function, which will prevent the window from ever being displayed. You can also call the Hide function after the WinX/32 application is visible. If the Boolean parameter is true, the application will not be visible; if False, if will be visible.

`Function StatusBarMsg(Index As Integer, Color As Integer, Text As String) As Boolean`

Use this function to display a message in the status bar at the bottom of the WinX/32 application. The status bar is divided into 8 panes. The leftmost pane corresponds to an Index of zero. Colors are defined as:

Black	1	Yellow	7
Red	2	Dark Gray	8
Green	3	Gray	9
Blue	4	Light Gray	10
Cyan	5	White	11
Pink	6		

Note that the WinX/32 application uses the status bar panes for its own purposes, and that the text you place onto the pane may be subsequently overwritten by the application.

`Sub ShowProgress(Percent As Integer)`

Use this function to control the progress indicator, which appears on the second pane of the status bar. Normally, this indicator is used to indicate the progress of some process the application is running. The value of Percent should be between zero and 100. A value of 0 makes the progress indicator disappear. Any other value will cause it to appear and display a bar to indicate the value of Percent. Since the application also uses the progress indicator, your setting may be overwritten if data collection or some other process is running.

`Function Quit() As Boolean`

Use this function to attempt to close WinX/32. This function acts as if the user clicked on the system close button ([x] in the top right corner of the window). In certain situations (such as the program in data acquisition mode), the user is prompted as to whether or not close the program. If the user declines to close, WinX/32 will remain open. The return value is True if WinX/32 was closed successfully, otherwise the return value is False.

`Function ShowFileOpen(InName As String) As String`
`Function ShowFileSaveAs(InName As String) As String`

Use these functions to show WinX/32's File Open/Save-As Dialog. The dialog is initialized with InName. If Open/Save was pressed, the function returns the name of the file selected (including the path). If Cancel was pressed, the function returns an empty String.

`Sub LoadFactoryDefaults(INIFile As String)`

If passed the path to a valid WinX/32 INI file, it will reload these hardware defaults. If passed an empty string, it will reload the hardware defaults stored in the controller's NVRAM.

`Sub SaveAll`

Saves all documents that are open and have been modified.

PrintWindow

This object represents a text window. The PrintWindow appears when the user program first calls the Print or Clear methods of the object. Besides being created, this object can be retrieved from the PrintWindows object.

Properties:

Name	Native Type	Description
Title	String	The title in the window

`Function OpenFile(Name As String) As Boolean`

Opens a print window file from disk. The file must already exist. The function returns False if not successful.

```
Function Print(xpos As Integer, line As Integer, color
              As Long, ParamArray Pstuff() As Variant)
              As Boolean
```

Print to the print window at a character position xpos on a given line using a given color. Any number of items of any type can be printed in one call. The color parameter takes a long hex number in the format &H*BBGGRR*, where *RR* (amount of red), *GG* (amount of green), and *BB* (amount of blue) can be in the range of &H00 to &HFF. Returns True on success.

Note: Due to the variable number of parameters in ParamArray, the return value must be assigned. Otherwise, Visual Basic will not recognize the function.

Example:

```
Dim objPrint As New PrintWindow
Dim blnStatus As Boolean
blnStatus = objPrint.Print(0, 1, 0, "This is", text")
blnStatus = objPrint.Print(5, 2, &HFF, "This is", " more", " text")
blnStatus = objPrint.Print(10, 3, &HFF00, "This is", " line", 3)
```

`Function SaveAs(Name As String) As Boolean`

Saves a print window to a file on disk. If the file already exists, it is overwritten without warning. The function returns False if not successful. The file name should include an extension of ".PRN" in order for the file to be recognized by WinX/32 and Windows as a WinX/32 print window file.

```
Function SetFont(FaceName As String, PointSize As Long)
                As Boolean
```

This function sets the font for subsequently printed text in the print window. FaceName should be the name of an existing font on the system; if the font does not exist, Windows will try to find as close a match as possible. PointSize gives the size of the font in points. The function returns False if not successful

```
Function SetPosition(top As Integer, left As Integer)
                    As Boolean
```

Set the position of the print window with respect to the screen (can exceed the boundaries of the app window). Returns False on error.

`Function SetSize(width As Integer, height As Integer) As Boolean`

Set the position of the print window with respect to the screen (can exceed the boundaries of the app window). Returns 0 on error.

`Sub SysCmd(Cmd As Long, Param As Long) As Long`

This is a function for more advanced programmers. It allows a VB program to send a WM_SYSCOMMAND message to the print window. The WM_SYSCOMMAND message takes a parameter which causes the window to perform one of the actions in the "system menu", the menu which appears when you click the box in the upper left corner of the window. The actions which a PrintWindow can perform in response to a WM_SYSCOMMAND message include, but are not limited to, those in the following table:

Cmd	Value	Action performed
`SC_SIZE`	&HF000	Starts the keyboard-driven sizing of a window
`SC_MOVE`	&HF010	Starts the keyboard-driven moving of a window
`SC_MINIMIZE`	&HF020	Minimizes the window
`SC_MAXIMIZE`	&HF030	Maximizes the window
`SC_NEXTWINDOW`	&HF040	Selects the next open window
`SC_PREVWINDOW`	&HF050	Selects the previous open window
`SC_CLOSE`	&HF060	Closes the window
`SC_VSCROLL`	&HF070	Causes the window to scroll vertically
`SC_HSCROLL`	&HF080	Causes the window to scroll horizontally
`SC_ARRANGE`	&HF110	Arranges the icons of minimized windows
`SC_RESTORE`	&HF120	Restores the window from the minimized or maximized states

The value for Param will depend on the value for Cmd; for all of the Cmds listed, it can be zero.

SysCmd returns a value which depends on the Cmd; for all of the Cmds listed, it will be zero if successful.

`Sub Clear()`

Clears the contents of the print window.

`Sub Close()`

Closes the print window.

`Sub Open()`

This function opens the print window.

`Function GetHWnd()As Long`

Returns the Win32 handle of this window. Can be used with SendMessage, ShowWindow, and other Windows API functions.

`Function GetRichEditWnd()As Long`

This function is for advanced programmers only. It returns the handle of the window's RichEditCtrl. The RichEditCtrl is a Windows object; PrintWindow objects use it to display text. By using the handle of the control, the programmer can send messages directly to the control in order to achieve text effects not supported directly by the PrintWindow.

PrintWindows

The PrintWindows object is a collection object, which refers to all of the open PrintWindow objects. It can be used in a For…Each loop and PrintWindow objects can be accessed like array elements (i.e., objPrintWindows(intIndex)).

`Function GetAt(index As Integer) As PrintWindow`

Returns the open PrintWindow, if any, corresponding to the zero-based index. The index value must be less than the number of open PrintWindow objects, or else the returned object will be empty.

`Function Count() As Integer`

Returns the number of open PrintWindow objects.

`Sub CloseAll()`

Closes all of the open PrintWindow objects.

ArrayConverter

An ArrayConverter object is a utility object used to manage array data types. It allows in-place data type conversions or copy conversions. The data types supported are: **Byte, Integer, Long, Single, Double** and **Variant**. All data types may be converted to larger data types. All data types except **Variant** can be truncated to smaller data types. To use these functions, the user program must create an ArrayConverter object and call the functions through it.

Properties:

Name	Native Type	Description
UnsignedInput	Boolean	Treat the input array as unsigned data type (e.g., a Integer data type would be treated as a 16-bit unsigned number).

`Sub Convert(Array As Any, Type As VbVarType)`

Performs an in-place conversion on Array to the data type Type. Array is a Variant containing an array of the supported data types. Type is an enum coming from the Visual Basic for Applications type library (included in standard Visual Basic projects).

Example:

```
' get an array of data
Dim objDoc As New DocFile
objDoc.Open "circuit.spe"
Dim vntFrame
objDoc.GetFrame 1, vntFrame

' display original data type
MsgBox TypeName(vntFrame)

' convert in-place
Dim objAC As New ArrayConverter
objAC.Convert vntFrame, vbDouble

' display new data type
MsgBox TypeName(vntFrame)
```

`Function CopyConvert(Array As Any, Type As VbVarType) As Any`

Converts Array to the data type Type and returns the result. Array retains its original data type. Array is a Variant containing an array of the supported data types. Type is an enum coming from the Visual Basic for Applications type library (included in standard Visual Basic projects).

Example:

```
' get an array of data
Dim objDoc As New DocFile
objDoc.Open "circuit.spe"
Dim vntFrame
objDoc.GetFrame 1, vntFrame

' display original data type
MsgBox TypeName(vntFrame)

' convert and store the result
Dim vntFrameCopy
Dim objAC As New ArrayConverter
vntFrameCopy = objAC.CopyConvert(vntFrame, vbDouble)

' display original and the new data types
MsgBox TypeName(vntFrame)
MsgBox TypeName(vntFrameCopy)
```

Spectrograph

SpectroObj

A SpectroObj object represents a spectrograph. This object should not be created -- you must retrieve this object from the SpectroObjMgr.

There are additional type libraries associated with the SpectroObj. These type libraries contain relevant enumerated types that may be used with the functions below. Use the type library associated with the manufacturer DLL of the spectrograph that ships with WinSpec/32.

`Function GetEnumParam(Param As SPT_CMD, index As Integer, optional pResult As Any) As Long`

Returns an enum parameter, which can then be passed to GetEnumString. Param is the same SPT_CMD that will be passed to GetEnumString. If more than one enum parameter is possible for a given SPT_CMD (determined by Count in the ValidRange object pertaining to that SPT_CMD), use the zero-based index to select a particular enum parameter. Success is determined by a non-zero value in pResult.

Example:

See the example located under the **GetEnumString** function.

`Function GetEnumString(Param As SPT_CMD, EnumVal As Integer, optional pResult As Any) As String`

Returns a string related in some way to the SPT_CMD Param (usually it is dialog text). EnumVal must be obtained from GetEnumParam using the same SPT_CMD. For SPT_CMD parameters that contain more than one string, multiple enum parameters must be used. See GetEnumParam for more details on how to do this. Success is determined by a non-zero value in pResult.

Example:

```
' use the current spectrograph
Dim objSpecs As New SpectroObjMgr
Dim objSpec As SpectroObj
Set objSpec = objSpecs.Current

' get information about the mirror location param
Dim objValid As ValidRange
Set objValid = objSpec.IsAvail(SPT_INST_MIRROR_LOCATION)

' get and display each mirror location string
Dim intIndex As Integer
Dim intParam As Integer
For intIndex = 0 To objValid.Count - 1
   intParam = objSpec.GetEnumParam(SPT_INST_MIRROR_LOCATION,
                                   intIndex)
   MsgBox objSpec.GetEnumString(SPT_INST_MIRROR_LOCATION,
                                intParam)
Next intIndex
```

`Function GetParam(Param As SPT_CMD, optional index As Integer, optional pResult As Any) As Any`

`Function SetParam(Param As SPT_CMD, pSetVal As Any, optional index As Integer) As Integer`

Allows setting and getting parameters for the spectrograph object. The optional index (zero-based) is only used for SPT_CMD parameters that require it. Non-zero (in pResult for GetParam and returned by SetParam) indicates success.

Note that these functions relate to the software object, not the actual hardware. The physical spectrograph is only programmed by the appropriate Process call.

WinX/32 will try to convert the parameter to the correct type corresponding to the particular SPT_CMD. If this cannot be done, Visual Basic reports a 'Type Mismatch' error.

Example:

See the example located under the **Move** function.

`Function IsAvail(Param As SPT_CMD) As ValidRange`

Returns a ValidRange object that corresponds to the particular SPT_CMD. Refer to the section on the ValidRange object for more details.

Example:

See the example located under the **GetEnumString** function.

`Sub Load(FileName As String)`

Configures the spectrograph object with all of the settings in an INI file pointed to by FileName.

`Function Move() As Integer`

Moves the physical spectrograph to the position currently set in the object.

Example:

```
' create a new spectrograph (note use of ActonSpec TypeLib)
Dim objSpecs As New SpectroObjMgr
Dim objSpec As SpectroObj
Set objSpec = objSpecs.Add(ACTON_TYPE,
ACTONSPECLib.ACTON_SP275)
                                   ' initialize the spectrograph

objSpec.SetParam SPT_PORT_TYPE, 6         ' set to use COM port
objSpec.SetParam SPT_PORT_ADDRESS, 1            ' set to port 1
objSpec.Process SPTP_CREATE_PORT          ' connect to the port
objSpec.Process SPTP_INITIALIZE                  ' general init
objSpec.Process SPTP_INST_LOADCONFIGURATION    ' load from inst

' determine and set new pos based on current pos
Dim dblPos As Double
dblPos = objSpec.GetParam(SPT_CUR_POSITION)
objSpec.SetParam SPT_NEW_POSITION, dblPos + 10
' move the instrument
objSpec.Move                           ' destroy the spectrograph
objSpecs.Remove objSpecs.Count ' use the index of the last one created
```

`Function Process(Param As SPT_PROCESS) As Integer`

Downloads applicable settings pertaining to the selected SPT_PROCESS to the physical spectrograph. A non-zero value is returned on success.

Example:

See the example located under the **Move** function.

`Sub Save(FileName As String)`

Saves all of the current settings in the spectrograph object to an INI file specified by FileName.

SpectroObjMgr

The SpectroObjMgr object is a *collection* object used to refer to all of the spectrographs. Use this object to create, remove or get access to the SpectroObj objects.

Properties:

Name	Native Type	Description
Count	Integer	The number of spectrographs available
Current	SpectroObj	The current spectrographs
Item(*i*)	SpectroObj	Access a spectrographs by collection index (one-based)

`Function Add(DLLType As SPECT_DLL_TYPES, SpecID As Integer) As SpectroObj`

Creates a new spectrograph object based on the manufacturer DLL and the spectrograph type. If successful, returns the created SpectroObj.

Note that the SpecID is an enumerated type from one of the spectrograph type libraries that ship with WinSpec/32.

Example:

See the example located under the **Move** function in **SpectroObj**

`Function GetAt(index As Integer) As SpectroObj`

Returns the SpectroObj at the given collection index (one-based).

`Sub Remove(iVal As Any)`

Removes the SpectroObj at the given collection index (one-based).

Example:

See the example located under the **Move** function in **SpectroObj**.

ValidRange

Refer to the **Experiment** section for the **ValidRange** description (page 19).

Pulser

PITG

A PITG object represents a pulser. It can be any one of the pulsers supported by WinX/32. If the user program does not create a specific pulser (using the **Create** function below) this object will represent WinX/32's currently selected pulser.

Properties:

Name	Native Type	Description
DLLVersion	Variant	A Long value representing the DLL version (v2.5.1.4 would be represented as 2050104)
DLLVersionString	String	A String representing the DLL version (v2.5.1.4 would be represented as "2.5.1.4")

```
Sub Create(TGtype As PITG_TYPES)
```

Creates the specified pulser type using the default port for that type. If **Create** is not called, the object represents WinX/32's current pulser (if there is one). Due to the intrinsic coupling between the PTG and the camera controller, it is highly recommended to avoid creating a PTG object and use WinX/32's current selected PTG instead.

Example:

See the example located under the **Start** function.

```
Function GetEnumParam(paramID As TG_CMD, index As
                      Integer, optional pResult As Any)
                      As Long
```

Returns an enum parameter, which can then be passed to GetEnumString. The argument paramID is the same TG_CMD that will be passed to GetEnumString. If more than one enum parameter is possible for a given TG_CMD (determined by Count in the ValidRange object pertaining to that TG_CMD), use the zero-based index to select a particular enum parameter. Success is determined by a non-zero value in pResult.

Example:

See the example located under the **GetEnumString** function.

```
Function GetEnumString(paramID As TG_CMD, EnumParam As
                       Long, optional pResult As Any)
                       As String
```

Returns a string related in some way to the TG_CMD paramID (usually it is dialog text). EnumParam must be obtained from GetEnumParam using the same TG_CMD. For TG_CMD parameters that contain more than one string, multiple enum parameters must be used. See GetEnumParam for more details on how to do this. Success is determined by a non-zero value in pResult.

Example:

```
' use the current pulser
Dim objPulser As New PITG

' get information about the delay width time units
Dim objValid As ValidRange
Set objValid = objPulser.IsAvail(TGC_PULSE_DELAY_UNITS)

' get and display each time unit
Dim intIndex As Integer
Dim intParam As Integer
For intIndex = 0 To objValid.Count - 1
   intParam = objPulser.GetEnumParam(TGC_PULSE_DELAY_UNITS,
                                     intIndex)
   MsgBox objPulser.GetEnumString(TGC_PULSE_DELAY_UNITS,
                                  intParam)
Next intIndex
```

Function GetParam(Param As TG_CMD, optional pResult As Any) As Any
Function SetParam(Param As TG_CMD, SetVal As Any) As Integer

Allows setting and getting parameters for the pulser object. Non-zero (in pResult for GetParam and returned by SetParam) indicates success.

Note that these functions relate to the software object, not the actual hardware. The physical pulser is only programmed by the appropriate Process call. The only two exceptions are TGC_TEMPERATURE and TGC_TRIGGER_COUNT, which read the values in the hardware each time they are gotten.

WinX/32 will try to convert the parameter to the correct type corresponding to the particular TG_CMD. If this cannot be done, Visual Basic reports a 'Type Mismatch' error.

Example:

See the example located under the **Start** function.

Function IsAvail(paramID As TG_CMD) As ValidRange

Returns a ValidRange object that corresponds to the particular TG_CMD. Refer to the section on the ValidRange object for more details.

Example:

See the example located under the **GetEnumString** function.

Function Process(ProcessID As TG_PROCESS) As Integer

Downloads applicable settings pertaining to the selected TG_PROCESS to the physical pulser. A non-zero value is returned on success.

Example:

See the example located under the **Start** function.

`Function Reset() As Integer`

Programs the pulser to a known default state. The PG200 will receive the Reset command. DG535 has outputs A, B, CD, and D set to 4V, 0V offset, high Z termination and single shot. The PTG is stopped, reloaded with the current timing pattern, and its trigger counter is reset. A non-zero return value designates success.

`Function SetGateLive(GateWidth As Double GateDelay As Double) As Integer`

Changes the pulser's gate width and gate delay on the fly. The time units used for the parameters are the ones previously set with TGC_SEQ_ARRAY_UNITS. A return value of non-zero designates success.

`Function Start() As Integer`

Starts the pulser. The PG200 will receive the Start sequence command. DG535 receives a single shot trigger if the timing mode is set to single shot. The PTG's main trigger is enabled. A non-zero return value designates success.

Example:

```
' create a PG200 object
Dim objPulser As New PITG
objPulser.Create PI_PG200

' prepare the pulser for a sequence
Const cintShots As Integer = 10
objPulser.SetParam TGC_SEQ_NUM_SHOTS, cintShots
objPulser.SetParam TGC_SEQ_ARRAY_UNITS, 1 ' microseconds

' designate a user-generated sequence
objPulser.SetParam TGC_SEQ_INC_TYPE, INC_CUSTOM

' generate a sequence
Dim dblDelays(1 To cintShots) As Double
Dim dblWidths(1 To cintShots) As Double
Dim intIndex As Integer
For intIndex = 1 To cintShots
   dblWidths(intIndex) = 50
   dblDelays(intIndex) = intIndex * 10
Next intIndex
objPulser.SetParam TGC_SEQ_WIDTH_ARRAY_HANDLE, dblWidths
objPulser.SetParam TGC_SEQ_DELAY_ARRAY_HANDLE, dlbDelays

' download the sequence to the pulser now
' NOTE: if this pulser represented WinX's pulser, this step
' would be unnecessary as the download is taken care of when
' the experiment runs
objPulser.Process TGP_PRELOAD_SEQUENCE

' set up the experiment
Dim objExp As New ExpSetup
objExp.SetParam EXP_SEQUENTS, cintShots

' run the experiment
' NOTE: if this pulser represented WinX's pulser, this step
' would be unnecessary as the pulser is started when the
' experiment runs
objPulser.Start    ' always start the pulser first
objExp.Start2
```

`Function Stop() As Integer`

Stops the pulser. The PG200 will receive the Stop sequence command. DG535 does nothing. The PTG’s main trigger is disabled. A non-zero return value designates success.

ValidRange

Refer to the **Experiment** section for the **ValidRange** description (page 19).

WinX32 Automation Enumerations

Experiment

EXP_CMD (ExpSetup Parameters)

U = Upgrade, S = Special

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	ST138	ST133	ST133 5 MHz	MicroMax	SpectroMax	MicroView	PentaMax	Mini-Cam	MSP-100	VICCD
`EXP_5X_GAIN_ENABLE`	☒	☒	☐	5X Gain Enable for 1MHz-only ADCs.			✓								
`EXP_ABSORBFILENAME`	☒	☒	☐	Name of the experiment absorbance source file.		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_ABSORBSTRIP`	☒	☒	☐	Absorbance strip number.		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_ACCESSNAME`	☒	☒	☐	Name of the experiment access pattern save file.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_ACCUMS`	☒	☒	☐	Number of accumulations to perform.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_ACQBACK_SHUTTER`	☒	☒	☐	Acquire Background Shutter Mode.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_ACQFLAT_SHUTTER`	☒	☒	☐	Acquire Flat Field Shutter Mode.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_ACTUAL_TEMP`	☐	☒	☐	Detector actual temperature.			✓	✓	✓	✓					

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	ST138	ST133	ST133 5 MHz	MicroMax	SpectroMax	MicroView	PentaMax	Mini-Cam	MSP-100	VICCD
EXP_ADC_OFFSET	☒	☒	☒	ADC Offset (0-255) for head. Not 1:1 equivalent to counts.				✓					✓	✓	
EXP_ADC_TYPE	☒	☒	☒	ADC speed: Fast (8) or Slow (9)		✓	✓	✓	✓	✓	✓	✓			
EXP_AMP_DIALOG	☒	☒	☒	Amplifier type: Low noise(0) or High capacity(1). Requires Smart detector head.			✓								
EXP_ANALOG_GAIN	☒	☒	☒	Sets the gain to low (1) medium (2), or high (3). Requires Smart detector head.			✓								
EXP_AUTOSAVE	☒	☒	☐	Automatically save named files	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_AVGAIN	☒	☒	☒	Avalanche Gain			✓								
EXP_AVGAIN_ENABLED	☒	☒	☒	Enable Avalanche Gain			✓								
EXP_AVGAIN_SETPOINT	☒	☒	☒	Online Avalanche Gain			✓								
EXP_BLEMISHFILENAME	☒	☒	☐	Name of the experiment blemish source file	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_CACCUMS	☒	☒	☐	Number of accumulations performed so far	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	ST138	ST133	ST133 5 MHz	MicroMax	SpectroMax	MicroView	PentaMax	Mini-Cam	MSP-100	VICCD
EXP_CONT_CLNS	☒	☒	☒	Enable (1) or disable (0) continuous cleans		✓	✓	✓	✓	✓	✓	✓			
EXP_CONTROLLER_ALIVE	☐	☐	☒	True if controller on and connected to computer	✓	✓	✓	✓	✓	✓	✓				
EXP_CONTROLLER_VERSION	☐	☐	☒	Valid ranges (?) of controller version			✓	✓	✓	✓	✓	✓			
EXP_COSMICFILENAME	☒	☒	☐	Name of the experiment cosmic source file	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_COSMICSENS	☒	☒	☐	Cosmic sensitivity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_CSEQUENTS	☒	☒	☐	Number of sequential frames collected so far	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_CUSTOM_SHUTTER	☒	☒	☒	Custom shutter compensation (0-30).									✓	✓	
EXP_DARKNAME	☒	☒	☐	Name of the experiment background source file	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_DATATYPE	☒	☒	☐	Experiment data type (include type AUTO)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_DATFILENAME	☒	☒	☐	Default base name for the data file	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_DELAY_TIME	☒	☒	☐	Delay between acquisitions.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	ST138	ST133	ST133 5 MHz	MicroMax	SpectroMax	MicroView	PentaMax	Mini-Cam	MSP-100	VICCD
`EXP_DISABLE_LASER`	☒	☐	☐	Sets optional ST133 register 0x06 to disable laser			✓ S								
`EXP_DOABSORB`	☒	☒	☐	Absorbance method (include disabled)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_DOBLEMISH`	☒	☒	☐	Blemish flag	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_DOCOSMIC`	☒	☒	☐	Cosmic flag (temporal, spatial, or disabled)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_EDGE_TRIGGER`	☒	☒	☒	Trigger polarity: Positive (1) or negative (0).			✓	✓	✓	✓	✓	✓			✓
`EXP_ETACTUAL`	☒	☒	☐	"Set" is same as EXP_EXPOSURE. "Get" gets actual programmed exposure time from controller.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_EVENT_HANDLE`	☐	☒	☐	Win32 event handle; event is signaled on every new frame. Requires PCI or ISA interface; timer mode not allowed.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_EXPOSURE`	☒	☒	☒	Exposure Time desired in seconds	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_FILEACCESS`	☒	☒	☐	Overwrite/Append on new data file											

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	ST138	ST133	ST133 5 MHz	MicroMax	SpectroMax	MicroView	PentaMax	Mini-Cam	MSP-100	VICCD
EXP_FILEINCCOUNT	☒	☒	☐	File increment count											
EXP_FILEINCENABLE	☒	☒	☐	File increment enable											
EXP_FLATFLDNAME	☒	☒	☐	Name of the experiment flat field source file											
EXP_FORCE_PP_INIT	☒	☐	☐	Force an initialization of the controller hardware. Requires PCI or ISA interface.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_HD_CHECK	☐	☒	☒	Returns if the detector head is smart (has NVRAM) and if so what type it is.			✓								
EXP_HTCLK	☒	☒	☒	Horizontal Clock register (1-16)		✓	✓	✓	✓	✓					
EXP_INTENSIFER_GAIN	☒	☒	☒	Intensifier gain (0-255) for PI-Max only.			✓								
EXP_KINETICS_WINDOWSIZE	☒	☒	☒	Window size (active area) for hardware kinetics systems.	✓										

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	**ST138**	**ST133**	**ST133 5 MHz**	**MicroMax**	**SpectroMax**	**MicroView**	**PentaMax**	**Mini-Cam**	**MSP-100**	**VICCD**
`EXP_LOGIC_OUTPUT`	☒	☒	☒	Output of BNC in the back of the controller: For ST133 V3, selects Not Scan (0) or Shutter (1). PentaMax V5 can also be Not Ready (2), Logic 0 (3), Cleaning (4), Not Frame Transfer Image Shift (5), and Logic 1 (7).			✓ **V3**					✓ **V5**			
`EXP_MAXTHRESHOLDVALUE`	☒	☒	☐	Maximum Threshold Value	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_MIN_BLOCK`	☒	☒	☒	Minimum block size to bin 'skips' close to the valid data		✓	✓	✓	✓	✓		✓			
`EXP_MINTHRESHOLDVALUE`	☒	☒	☐	Minimum Threshold Value	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_NEWWINDOW`	☒	☒	☐	Use new window for every run	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_NOP_ADC`	☒	☒	☐	NOP count to slow up transfer speed. Some computers need this to use an ISA interface card with 1MHz controllers.		✓	✓	✓	✓	✓	✓				
`EXP_NUM_MIN_BLOCK`	☒	☒	☒	Minimum number of skip blocks to use.		✓	✓	✓	✓	✓		✓			

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	ST138	ST133	ST133 5 MHz	MicroMax	SpectroMax	MicroView	PentaMax	Mini-Cam	MSP-100	VICCD
`EXP_NUM_OF_STRIPS_PER_CLN`	☐	☐	☒	Availability and value of number of strips per clean	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_NUMACCUMSEXP`	☐	☐	☐	Number of Times To Accumulate Experiment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_NUMBER_OF_CLEANS`	☐	☐	☒	Availability and number of hardware cleans.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_NUMREPEATSEXP`	☒	☒	☐	Number of times to repeat entire experiment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_OVERWRITECONFIRM`	☒	☒	☐	Overwrite confirmation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_READOUT_TIME`	☐	☒	☐	Readout time of frame.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_RET_SRCCMP`	☒	☒	☐	Select whether to return source comp with data. Source comp uses one entire column.	✓										
`EXP_ROICOUNT`	☒	☒	☐	Gets number of ROIs stored (read-only)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_RS170`	☐	☐	☒	RS170 availability flag.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_RUNNING`	☐	☒	☐	Get controller running status	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_RUNNING_APP`	☐	☒	☐	Get online process running status	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	ST138	ST133	ST133 5 MHz	MicroMax	SpectroMax	MicroView	PentaMax	Mini-Cam	MSP-100	VICCD
EXP_RUNNING_EXPERIMENT	☐	☒	☐	1 = Entire Experiment Running, 0 = Not Running	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_SAVEROPT	☒	☒	☐	Screen Saver/Blanker options	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_SEQUENTS	☒	☒	☐	Number of sequential frames	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_SETUPNAME	☒	☒	☐	Name of the experiment setup save file	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_SHT_GATE_MODE	☒	☒	☒	Shutter/gating mode for PI-Max systems: Gated (1), Shutter (2), and Safe Mode (0).			✓								
EXP_SHT_PREOPEN	☒	☒	☒	Mode for shutter: Pre-opened (1, usually in external sync mode), or opened and closed each shot (0).	✓	✓	✓	✓	✓	✓	✓	✓			
EXP_SHUTTER_COMP_TIME_MS	☒	☒	☐	This returns the shutter compensation time in ms.			✓	✓	✓	✓	✓	✓			

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	ST138	ST133	ST133 5 MHz	MicroMax	SpectroMax	MicroView	PentaMax	Mini-Cam	MSP-100	VICCD
EXP_SHUTTER_CONTROL	☒	☒	☒	Another mode for shutter: Normal (1), Disabled Closed (2), Disabled Open (3).	✓	✓	✓	✓	✓	✓		✓			
EXP_SKIPFRAMES	☒	☒	☒	This skips frames in the beginning of the experiment.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_STORE_STROBE	☒	☒	☒	Whether "store strobe" should be set. (1 = Yes)		✓	✓	✓	✓	✓					
EXP_TEMP_STATUS	☐	☒	☒	Temperature locked (1) or unlocked (0)			✓	✓	✓	✓					
EXP_TEMPERATURE	☒	☒	☒	Controller Set Temperature			✓	✓	✓	✓					
EXP_THRESHOLD_DEMAND_ UPDATE	☒	☒	☐	Threshold Demand Update	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_TIMING_MODE	☒	☒	☒	Timing mode: Freerun (1) or external sync (3)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_TTL_LINES	☒	☒	☒	Reads/Writes TTL lines (8 bits in and out) controller rear panel.		✓	✓	✓	✓	✓	✓				
EXP_USEMAXTHRESHOLDING	☒	☒	☐	Maximum Thresholding: Disabled (0) or Enabled (1)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EXP_USEMINTHRESHOLDING	☒	☒	☐	Minimum Thresholding: Disabled (0) or Enabled(1)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Parameter Name	Set	Get	Avail	Description	Hardware Support										
					ST130	ST138	ST133	ST133 5 MHz	MicroMax	SpectroMax	MicroView	PentaMax	Mini-Cam	MSP-100	VICCD
`EXP_USEROI`	☒	☒	☐	Use Full chip / ROI flag											
`EXP_VIDEO_TYPE`	☒	☒	☒	Video type: NTSC (1) or Pal (2). Also requires hardware jumpers to be installed.			✓	✓	✓	✓		✓			
`EXP_VTCLK`	☒	☒	☒	Vertical Clock register (1-16).		✓	✓	✓	✓	✓					
`EXP_XDIM`	☒	☒	☐	Get data X dimension; total size of all ROIs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_XDIMDET`	☐	☒	☐	Get detector X dimension	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_YDIM`	☒	☒	☐	Get data Y dimension; total size of all ROIs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_YDIMDET`	☐	☒	☐	Get detector Y dimension	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`EXP_YTNAME`	☒	☒	☐	Name of the experiment YT data file	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

DM_CMD (DocFile Parameters)

Note: These functions only affect values in the data file, not in the controller.

Parameter Name	Description/Native Type
`DM_ACCUMS`	Accumulations
`DM_ADCBITADJUST`	ADC bit adjust
`DM_ADCRATE`	ADC rate

Parameter Name	Description/Native Type
DM_ADCRESOLUTION	ADC resolution
DM_ADCTYPE	ADC type (FAST or SLOW)
DM_ASYNEN	Set asynchronous or synchronous (1 async, 0 sync)
DM_BACKGROUNDAPPLIED	Background subtraction flag
DM_BACKSUBNAME	Background subtraction file name
DM_BLEMISHAPPLIED	Blemish flag
DM_BLEMISHFILE	Blemish file name
DM_CLEANS	Cleans at start of acquisition
DM_CLKSPD	Clock speed, (kinetics/frame transfer)
DM_CLKSPD_us	Vertical clock speed in micro-seconds
DM_CONTROLLERNUM	Controller number if multiple controller system
DM_CONTROLLERTYPE	3 = ST130, 5 = ST138, 6 = PentaMAX, 7 = MicroMAX,
DM_COSMICAPPLIED	Cosmic ray removal flag
DM_COSMICTHRESHOLD	Cosmic ray removal threshold
DM_COSMICTYPE	Type of cosmic array if applied
DM_DATATYPE	Data type
DM_DETTYPE	Type of detector (i.e., Kodak 1400)
DM_DLABEL	Data label string
DM_DOCTYPE	Internal document type (SPE, TIFF, etc.)
DM_EXPOSEC	Exposure in seconds
DM_FILEDATE	Date file was created
DM_FILENAME	Name of file on disk
DM_FILETITLE	Name of file in window
DM_FILEVERSION	Software Version
DM_FLATFIELDAPPLIED	Flat field flag
DM_FLATFIELDNAME	Flat field file name
DM_FRAMECOUNT	Frames in this file
DM_FRAMEINPROS	Number of current frame in process/storage
DM_FRAMESIZE	Size of one frame in bytes
DM_GAIN	Gain
DM_GEOMETRIC	Geometric transformation: rotate = 1, reverse = 2, flip = 4
DM_GPIBADD	GPIB address

Parameter Name	Description/Native Type
DM_GPIBCONTROLADD	GPIB controller address
DM_HOURS	Hour of experiment
DM_HWACCUMS	Hardware Accumulation flag
DM_INTERFACETYPE	Interface card
DM_INTLEVEL	Interrupt level
DM_INUSE	Increment or decrement in use count
DM_IOADD1	IO base address
DM_KINTRIGMODE	Kinetics Trigger Mode
DM_LASTFRAMERDY	Number of last frame finished acquiring
DM_MIN	Minutes of experiment
DM_MINBLK	Minimum block grouping for skip before valid pixel
DM_NUMEXPREPEATS	Number of Times Experiment Repeated
DM_NUMEXPACCUMS	Number of Times Experiment Accumulated
DM_NUMFRAMES	Number of frames in file
DM_NUMMINBLK	Number of min blocks to do before doing geometric
DM_NUMROI	Number of ROIs in header. If 0, 1 is assumed
DM_NUMSKPPERCLN	Number of skips per clean
DM_PIXELSIZE	Size of each data point in bytes
DM_READOUTMODE	Readout FULL/KINETICS/FRAME XFER
DM_SCANCOUNT	Scans in this file
DM_SECS	Seconds of experiment
DM_SHUTTERCOMP	Shutter compensation
DM_SHUTTERTYPE	Shutter type
DM_STOREFLAG	Flag to store incoming data
DM_STORESYNC	Store synchronous flag
DM_SWMADE	Software package ID: WinView = 1, WinSpec = 2
DM_SWVERSION	File header version
DM_TEMPFLAG	Flag = TRUE if temporary file
DM_TIMINGMODE	Timing mode of experiment
DM_USERCOMMENT1	User comment field 1
DM_USERCOMMENT2	User comment field 2
DM_USERCOMMENT3	User comment field 3

Parameter Name	Description/Native Type
DM_USERCOMMENT4	User comment field 4
DM_USERCOMMENT5	User comment field 5
DM_USERINFO	User information area
DM_WINDOWSIZE	Window size (kinetics)
DM_xCAL_CALIB_COUNT	Number of pixel-value pairs in array
DM_xCAL_COEFFS	Polynomial coefficient array
DM_xCAL_CURR_UNIT	The currently selected scaling unit
DM_xCAL_FACTOR	Factor for ditto
DM_xCAL_FILE_LABEL	Label for calibration file
DM_xCAL_INPUT_UNIT	The units of the PXL_VAL
DM_xCAL_LASERLINE	Laser line (nm) for rel cm-1
DM_xCAL_OFFSET	Offset for absolute data scaling
DM_xCAL_POLYNOM_ORDER	Order of calibration polynomial
DM_xCAL_POLYNOM_UNIT	The units of the COEFFS
DM_xCAL_PXL_POS	Pixel array
DM_xCAL_PXL_VAL	Wavelength value array
DM_xCAL_STRING	The label for the X axis
DM_xCAL_VALID	Flag is cal is valid
DM_XDIM	X dimension of actual data stored in this file
DM_XDIMDET	X Dimension of detector physical
DM_XLABEL	X label string
DM_YDIM	Y dimension of actual data stored in this file
DM_YDIMDET	Y Dimension of detector physical
DM_YLABEL	Y label string

Display

DI_PARAM (DocWindow Parameters)

Parameter Name	Description
DI_BAUTOASPECT	Maintain fixed image aspect ratio
DI_BAUTOZOOM	Maintain fixed image zoom factor
DI_BCOLBARON	Show color bar pane

Parameter Name	Description
DI_BFULLRANGEX	Set X axis to full range
DI_BHIDLINE	Draw 3-D with hidden line or surface
DI_BHIDSURF	Draw 3-D with hidden surface
DI_BHXSECTON	X cross section on or off
DI_BINFOBARON	Info Bar on or off
DI_BINITAUTOAUTO	TRUE autoscale every live scan
DI_BINITAUTORANGE	TRUE ignore range settings in page, FALSE, use them
DI_BINITAUTOSCALE	TRUE do autoscale, FALSE use intensity settings in page.
DI_BMARK3D	Draw cursor curve in different color
DI_BMARKCURV	Draw 3-D marker curves in different color
DI_BNEWDATA	Flag that data may have changed
DI_BPLOTFRAME	Flag to plot 3-D in MultiStripSameFrame mode
DI_BPRINTCOLOR	Flag to print in color
DI_BROIBOXON	Flag to show ROI box
DI_BTOOLBARON	Tool Bar on or off
DI_BUPDATE	Flag to update window contents
DI_BVXSECTON	Y cross section on or off
DI_BXAXLBLON	X axis label on or off
DI_BXAXON	X axis on or off
DI_BYAXLBLON	Y axis label on or off
DI_BYAXON	Y axis on or off
DI_BZENDACTIV	Adjust Z axis position interactively
DI_DATAINTENHI	Max data intensity for display
DI_DATAINTENLO	Min data intensity for display
DI_DATASTEP	Pixel, strip, or frame skip value
DI_DATAVAIL	Bounds of available data (in data units)
DI_DATAVIS	Bounds of visible data (in data units)
DI_DBRITE	Window brightness setting 0 – 100
DI_DCONTR	Window contrast setting 0 – 100
DI_LABELDAT	Label string for data
DI_LABELXAX	Label string for x-axis

Parameter Name	Description
`DI_LABELYAX`	Label string for y-axis
`DI_NEEDAUTO`	0 = no autoscale, 1 = do normal autoscale, 2 = do 5%/95%
`DI_NMARKSTEP`	Number of curves between 3-D marker curves
`DI_PALETTE_SHAPE`	Linear, log, histogram, etc.
`DI_PALETTE_TYPE`	Gray scale or false color
`DI_PICTURE_TYPE`	Graph, 3-D or Image (Read-only)
`DI_ZAXISOFFSETX`	X component of Z axis offset
`DI_ZAXISOFFSETY`	Y component of Z axis offset
`DI_ZOOMXY`	Ratio of picture size to data size, x & y.

Data Processing

PIDP_IMAGEMATHOPERATION (Arithmetic/Logical Operators)

Operator Name	Description
`IMAGEMATH_ABSOLUTE`	Take the absolute value of the first input
`IMAGEMATH_ADDITION`	Add the two inputs
`IMAGEMATH_AND`	Apply the bitwise AND operator to the two inputs
`IMAGEMATH_COMPLEMENT`	Apply the bitwise COMPLIMENT operator to the two inputs
`IMAGEMATH_DIVISION`	Divide the two inputs
`IMAGEMATH_LOG10`	Take the log base 10 of the first input
`IMAGEMATH_MAX`	Take the maximum value between the two inputs
`IMAGEMATH_MIN`	Take the minimum value between the two inputs
`IMAGEMATH_MULTIPLICATION`	Multiply the two inputs
`IMAGEMATH_NATURALLOG`	Take the natural log of the first input
`IMAGEMATH_NOT`	Apply the logical NOT operator to the first input
`IMAGEMATH_OR`	Apply the bitwise OR operator to the two inputs
`IMAGEMATH_SQUARED`	Square the first input
`IMAGEMATH_SQUAREROOT`	Take the Square Root of the first input
`IMAGEMATH_SUBTRACTION`	Subtract the two inputs
`IMAGEMATH_XOR`	Apply the bitwise XOR operator to the two inputs

PIIP_SetGetParam (Configurable Process Parameters)

Parameter Name	Description	Applicable Process									
		ProcBinSkip	ProcClipThresh	ProcCrossSect	ProcDilate	ProcErode	ProcFilter	ProcHistogram	ProcLUT	ProcOrient	ProcSobel
BINSKIP_BINX	X-binning dimension	✓									
BINSKIP_BINY	Y-binning dimension	✓									
BINSKIP_SKIPX	X-skipping dimension	✓									
BINSKIP_SKIPY	Y-skipping dimension	✓									
BINSKIP_AVGFLAG	Use average binning	✓									
CLIP_BOTH	High and low clip flag		✓								
CLIP_HIGH	High clip flag		✓								
CLIP_LOW	Low clip flag		✓								
CLIPFLAGS	Clipping/threshold type		✓								
CROSS_MATHTYPE	Cross section math type			✓							
CROSS_SECTION_TYPE	Cross section direction			✓							
CS_AVERAGE	Cross section average flag			✓							
HIGHCLIPVAL	High clip value		✓								
HISTOGRAM_CUMULATIVE	Cumulative histogram flag							✓			
HISTOGRAM_GROUP	Histogram group value							✓			
HISTOGRAM_HIGHVAL	Histogram high value							✓			
HISTOGRAM_LOWVAL	Histogram low value							✓			
HISTOGRAM_NORMAL	Normal histogram flag							✓			
HISTOGRAM_OPERATIONS	Histogram type							✓			
KERNELX	X-dimension of kernel				✓	✓	✓				✓
KERNELY	Y-dimension of kernel				✓	✓	✓				✓
LOWCLIPVAL	Low clip value		✓								
LUT_INPUT_FILENAME	LUT input filename								✓		
ORIENT_FLIP	Flip image flag									✓	

Parameter Name	Description	Applicable Process									
		ProcBinSkip	ProcClipThresh	ProcCrossSect	ProcDilate	ProcErode	ProcFilter	ProcHistogram	ProcLUT	ProcOrient	ProcSobel
ORIENT_MODE	Orientation mode									✓	
ORIENT_REVERSE	Reverse image flag									✓	
ORIENT_ROTATE	Rotate image flag									✓	
SUMMATION	Cross section sum flag			✓							
THRESHOLD	Threshold flag		✓								
THRESHVAL	Threshold value		✓								
XCROSS	X-cross section			✓							
YCROSS	Y-cross section			✓							
ZCROSS	Z-cross section			✓							

PRC_PARAM (Process Output Control Parameters)

Parameter Name	Description
PRC_AUTOSAVE	Output file save options
PRC_DISPLAYOUTPUT	Display the results
PRC_FILEACCESS	Output file access type
PRC_FILEINCCOUNT	File increment counter value
PRC_FILEINCENABLE	Use auto-increment
PRC_NEWWINDOW	Open a new window
PRC_OUTFILENAME	Default output filename
PRC_OVERWRITECONFIRM	Confirm overwriting the output file
PRC_RUNNING	Process is running

PROCERR (Process Error Codes)

Parameter Name	Description
PROCERR_ABSIZEMISMATCH	Unequal ROI sizes for inputs A and B
PROCERR_BADINPUTA	Value of input A is invalid
PROCERR_BADINPUTB	Value of input B is invalid
PROCERR_BADOP	Arithmetic/logical operator is invalid
PROCERR_BADPARAM	Get/Set parameter is invalid
PROCERR_BADRANGEA	Invalid range set in input A
PROCERR_BADRANGEB	Invalid range set in input B
PROCERR_FILEOPENA	Cannot open input A
PROCERR_FILEOPENB	Cannot open input B
PROCERR_FILEOPENOUTPUT	Cannot open output file
PROCERR_NOERROR	No error
PROCERR_OUTFILECONFLICTA	Input A conflicts with output file
PROCERR_OUTFILECONFLICTB	Input B conflicts with output file

ProcFileAccessType (Process Output File Access Types)

Parameter Name	Description
PRCFA_APPEND	Append to output file if it exists
PRCFA_OVERWRITE	Overwrite output file if it exists

ProcSaveOpts (Process Output File Save Options)

Parameter Name	Description
PRCAS_AUTO	Automatically save file after each run
PRCAS_NOSAVE	Don’t autosave or prompt the user
PRCAS_PROMPT	Prompt user whether to save after each run

Spectrograph

NAMETYPE (Spectrograph Instrument Name Types)

Parameter Name	Description
`INST`	Instrument name only
`INSTCOMM`	Instrument name + COM port name
`INSTUSER`	Instrument name + user name

SPEC_ERROR_CODE (General Spectrograph Error Codes)

Parameter Name	Description
`CREATE_COMM_FAIL`	Failure to Create Comm Port
`CREATE_SPECT_FAIL`	Failure to Create Spectrograph Object
`INIT_COMM_FAIL`	Failure to Communicate (Init failed)
`NO_IO_ACCESS`	Failure to Initialize I/O Device
`NO_IO_DEVICE`	No I/O Device
`NO_SPEC_COMMUN`	Communication Error
`NO_SPEC_ERROR`	No Error
`PROCESS_FAILURE`	Failure to Perform Process
`SPEC_GEN_ERROR`	General Error
`WRONG_GRATING`	Invalid Grating
`WRONG_SLIT_WIDTH`	Invalid Slit Size
`WRONG_WAVELENGTH`	Invalid Wavelength

SPEC_STEP_ERRORCODE (Stepper Motor Error Codes)

Parameter Name	Description
`STEP_COMMANDERROR`	Wrong command/parameter detected
`STEP_CONNECTERROR`	Communication failure
`STEP_ERROR`	Error during status report
`STEP_NEEDRESET`	Flag to remember reset answer checking
`STEP_READY`	Selected motor is ready
`STEP_RESET`	Flag to remember reset answer checking
`STEP_WAITING`	Waiting, selected motor running

SPECT_DLL_TYPES (Spectrograph DLL Types)

Parameter Name	Description
`ACTON_TYPE`	Acton DLL
`GENERIC_SPECT_1_TYPE`	Generic1 DLL
`GENERIC_SPECT_2_TYPE`	Generic2 DLL
`SPEX_TYPE`	Spex DLL

SPT_CMD (General Spectrograph Parameters)

Parameter Name	Description
`SPT_ACCESS_ALL_GRAT_SPEEDS`	T = can access all grating speeds at same time, F = only current
`SPT_ACTIVE_GRAT_POS`	New position for active grating
`SPT_ACTIVE_GRATING_NUM`	Grating number to set (change)
`SPT_ACTIVE_MIRROR_LOC`	Location of active mirror
`SPT_ACTIVE_MIRROR_POS`	New position for active mirror
`SPT_ACTIVE_SLIT_LOC`	Location of active slit
`SPT_ACTIVE_SLIT_POS`	New position for active slit
`SPT_ACTIVE_TURRET_NUM`	Active turret number
`SPT_ADJUST_AVAIL`	Linear adjust available flag
`SPT_ARRAYSIZE`	Size of used array in pixel
`SPT_AUTOCALIBSUPPORTED`	Auto calibration supported flag
`SPT_BAUDRATE`	COMM port baud rate
`SPT_CALC_WL_INCENTERWL`	Input for WL calc: center wavelength
`SPT_CALC_WL_INDIST`	Input for WL calc: distance
`SPT_CALC_WL_OUTWL`	Output for WL calc
`SPT_CALIBUPDATE`	System calibration is updated flag
`SPT_COEFF`	Coefficient value
`SPT_COUNTERSUPPORTED`	Counter supported flag
`SPT_CTSFLOW`	COMM port CTS flow control
`SPT_CUR_GRATING`	Index of previous used grating (1-based)
`SPT_CUR_POSITION`	Current center of ROI position
`SPT_CURRGRATING`	Current grating number (1-based)

Parameter Name	Description
`SPT_CURRTURRET`	Current turret number (1-based)
`SPT_CUSTOM_NAME`	User defined name for generic types
`SPT_DATABITS`	COMM port # data bits
`SPT_DEF_DETECTORANGLE`	Default detector angle value
`SPT_DEF_FOCALLENGTH`	Default focal length value
`SPT_DEF_GRAT_BACKLASH_REQ`	Default grating backlash required
`SPT_DEF_GRAT_BACKLASHSTEPS`	Default grating backlash steps
`SPT_DEF_GRAT_MAX_SPEED`	Default maximum grating speed
`SPT_DEF_GRAT_MIN_SPEED`	Default minimum grating speed
`SPT_DEF_GRAT_SPEED`	Default grating speed
`SPT_DEF_GRAT_STEPSPERUNIT`	Default steps/unit for spectrograph
`SPT_DEF_GRAT_USERNAME`	Default user name
`SPT_DEF_GRATINGSPERTURRET`	Default gratings per turret
`SPT_DEF_GROOVES`	Default grooves as shown in combo box
`SPT_DEF_INCLUSIONANGLE`	Default inclusion angle value
`SPT_DEF_MAGNIFICATION`	Default magnification
`SPT_DEF_PIXELWIDTH`	Default detector pixel width
`SPT_DEF_PORTADDRESS`	Default port address
`SPT_DEF_PORTNAME`	Default port name
`SPT_DEF_PORTTYPE`	Default port type
`SPT_DEF_REFGRATING`	Default reference grating value
`SPT_DEF_SLIT_BACKLASH_REQ`	Default slit backlash required
`SPT_DEF_SLIT_BACKLASHSTEPS`	Default slit backlash steps
`SPT_DEF_SLIT_MAX_SPEED`	Default maximum slit speed
`SPT_DEF_SLIT_MIN_SPEED`	Default minimum slit speed
`SPT_DEF_SLIT_SPEED`	Default slit speed
`SPT_DEF_SLIT_STEPSPERUNIT`	Default slit steps per unit
`SPT_DFLT_BIN_FLAG`	For step & glue: 1 = default bin size always used
`SPT_DLL_FILE_VERSION`	File version
`SPT_DLL_PRODUCT_VERSION`	Product version
`SPT_ENDING_WAVELENGTH`	For step & glue: ending WL (in nm)
`SPT_ERROR_CODE`	General error code

Parameter Name	Description
SPT_EXCITATION	Laser wavelength or zero if ignored
SPT_FORCEMOVE	Force a move even if new == current
SPT_GENERIC_CHECKBOX	User defined checkbox
SPT_GENERIC_CHECKBOX_TXT	Title for user defined checkbox
SPT_GENERIC_COMBOBOX	User defined combo box
SPT_GENERIC_COMBOBOX_TXT	Title for user defined combo box
SPT_GENERIC_DLG_INDEX	Index of defining dialog controls
SPT_GENERIC_DLG_MAIN_TITLE	Title of generic dialog
SPT_GENERIC_EDITBOX	User defined edit box
SPT_GENERIC_EDITBOX_TXT	Title for user defined edit box
SPT_GENERIC_RADIOBUTTON	User defined radiobutton
SPT_GENERIC_RADIOBUTTON_GRP	Title for user defined radiobutton group
SPT_GENERIC_RADIOBUTTON_TXT	Title for user defined radiobutton
SPT_GENERIC_SPINBUTTON	User defined spin button
SPT_GLUE_BIN_SIZE	For step & glue: bin size (in nm)
SPT_GLUE_FILE_NAME	For step & glue: glue file name
SPT_GPIB_IO_SUPPORTED	GPIB I/O available
SPT_GRAT_ADJUST	Slope adjust value for HW-based calibration
SPT_GRAT_BACKLASH_REQ	T = grating backlash required
SPT_GRAT_CENTERADJ	Center adjust (0 offset) value
SPT_GRAT_DETECT_ANGLE	Detector angle
SPT_GRAT_FOCAL_LEN	Focal length value
SPT_GRAT_GROOVES	Grooves/nm of this grating
SPT_GRAT_HI_CAL_WAVE	High calibration wavelength
SPT_GRAT_HI_POS_WAVE	High position wavelength
SPT_GRAT_INCL_ANGLE	Inclusion angle (gamma)
SPT_GRAT_LINEAR_ADJ	Linear adjust value for SW-based calibration
SPT_GRAT_LO_CAL_WAVE	Low calibration wavelength
SPT_GRAT_LO_POS_WAVE	Low position wavelength
SPT_GRAT_MAG	Magnification
SPT_GRAT_MOVE_MODE	Grating movement mode (i.e. slew/scan)
SPT_GRAT_OFFSET	Linear adjust value for HW-based calibration

Parameter Name	Description
SPT_GRAT_REF_GRATING	Reference grating
SPT_GRAT_REF_WAVE	Reference wavelength
SPT_GRAT_SLOPE_ADJ	Slope adjust value for SW-based calibration
SPT_GRAT_STEPSPUNIT	Steps/unit for this grating
SPT_GRAT_STEPSUNIT_UNIT	Unit of grating steps/unit
SPT_GRAT_TYPE	Grating type (normal, mirror, not installed)
SPT_GRAT_USERNAME	User entered portion grating name as string
SPT_GRATING_SPEED	Current grating speed (offset)
SPT_GRATING_SPEED_INDEX	Index of grating to access at upper class level
SPT_GRATING_SPEED_MAX	Maximum grating speed (offset)
SPT_GRATING_SPEED_MIN	Minimum grating speed (offset)
SPT_GRATING_SPEED_NAME	Name for grating speed (i.e. 'ramp')
SPT_GRATING_SPEED_UNITS	Units text for grating speeds
SPT_GRATINGBACKLASHSTEPS	Grating backlash steps
SPT_GRATINGSPERTURRET	Gratings per turret
SPT_GRATINGWARNING	When changing grating flag
SPT_INST_CUR_GRAT_NUM	Get current grating number from instrument
SPT_INST_CUR_GRAT_POS	Get current grating position from instrument
SPT_INST_CURR_TURRET	Get current turret number from instrument
SPT_INST_GRAT_GROOVES	Grooves/nm of this grating from instrument
SPT_INST_GRAT_SPEED	Grating speed from instrument
SPT_INST_GRAT_USERNAME	User name taken from instrument info
SPT_INST_MIRROR_LOCATION	Location of mirror from instrument
SPT_INST_MIRROR_POSITION	Position of mirror from instrument
SPT_INST_MODELNAME	Model name as read from instrument
SPT_INST_NUM_MIRRORS	Number of supported mirrors from instrument
SPT_INST_NUM_SLITS	Number of supported slits from instrument
SPT_INST_NUMTURRETS	Number of turrets from instrument
SPT_INST_SERIALNUMBER	Serial number as read from instrument
SPT_INST_SLIT_LOCATION	Location of slit from instrument
SPT_INST_SLIT_POSITION	Position of slit from instrument
SPT_INST_SLIT_SPEED	Slit speed from instrument

Parameter Name	Description
SPT_INSTCOMMNAME	Inst name + Comm port name as string
SPT_INSTNAME	Actual spectrograph inst name as string
SPT_INSTUSERNAME	Inst name + user name as string
SPT_LASERWARNING	Warn when crossing laser line flag
SPT_LINEARADJUSTSUPPORTED	Adjustment of linear adjust supported
SPT_MANUFACTURE_NAME	Returns manufacturer of specific instrument
SPT_MARK_EXCITATION	Spectrographs marker position
SPT_MAX_GRATINGS_PER_TURRET	Max gratings per turret allowed
SPT_MAX_NUM_MIRRORS	Max mirrors allowed
SPT_MAX_NUM_SLITS	Max slits allowed
SPT_MAX_NUM_TURRETS	Max turrets allowed
SPT_MAX_SLIP_POS	Default max slit position
SPT_MIN_OVERLAP	For step & glue: minimum overlap (in nm)
SPT_MIN_SLIP_POS	Default min slit position
SPT_MIRROR_CURPOSITION	Current position of mirror (front, lateral, etc.)
SPT_MIRROR_ENABLED	T = mirror enabled
SPT_MIRROR_LOCATION	Location of mirror (entrance, exit, etc.)
SPT_MIRROR_NEWPOSITION	Requested position of mirror (front, lateral, etc.)
SPT_MODELNAME	Model name
SPT_MOTOR	Motor number
SPT_NEED_GRATING_SPEED_SET	T = grating speed needs to be set
SPT_NEED_SLIT_SPEED_SET	T = slit speed needs to be set
SPT_NEW_GRATING	Index of active grating (1 based)
SPT_NEW_MIRROR_INDEX	Index of newly added mirror
SPT_NEW_POSITION	Next position to move center of ROI to
SPT_NEW_SLIT_INDEX	Index of newly added slit
SPT_NMTOSTEPS_STEPS	Steps converted from wavelength (nm)
SPT_NMTOSTEPS_WL	Wavelength (nm) to convert to steps
SPT_NUM_SETABLE_GRAT_SPEEDS	Number of speeds for each grating
SPT_NUM_SETABLE_SLIT_SPEEDS	Number of speeds for each slit
SPT_NUM_SLITS	Number of supported slits
SPT_NUM_SPECT_AVAIL	Total number of spectrographs available

Parameter Name	Description
`SPT_NUM_STEPS`	For step & glue: number of steps
`SPT_NUMCOEFFS`	Number of coefficients
`SPT_NUMMIRRORS`	Number of supported mirrors
`SPT_NUMSTAGES`	Number of stages per instrument
`SPT_NUMTURRETS`	Number of turrets
`SPT_OFFSET_AVAIL`	0 offset value available flag
`SPT_OFFSETADJUSTSUPPORTED`	Adjustment of offset supported
`SPT_ORDER`	Optical observed order
`SPT_PARITY`	COMM port parity
`SPT_PIXEL_WIDTH`	Pixel width
`SPT_PORT_ADDRESS`	Port number (serial) or address (GPIB)
`SPT_PORT_NAME`	Port device name
`SPT_PORT_TYPE`	Port type – serial (6), GPIB (5)
`SPT_POSITIONMEMORY`	Position remembered by spectrograph flag
`SPT_POSITIONSUPPORTED`	Position supported flag
`SPT_PROCESS_MOVE_STATUS`	Status of move processes
`SPT_RESET`	Hardware reset available or not
`SPT_RESET_TIMOUT_MS`	Reset timeout in milliseconds
`SPT_ROI_CENTER`	Center of the scan pattern
`SPT_ROI_OFFSET`	ROI offset for the new position
`SPT_SERIAL_IO_SUPPORTED`	Serial I/O available
`SPT_SERIALNUMBER`	Serial number
`SPT_SLAVE_CNT`	Number of associated step spectrographs sharing the same port
`SPT_SLIT_BACKLASH`	Slit backlash steps
`SPT_SLIT_BACKLASH_REQ`	T = slit backlash required
`SPT_SLIT_CURPOSITION`	Current position of slit
`SPT_SLIT_ENABLED`	T = slit enabled
`SPT_SLIT_LOCATION`	Location of slit (Front entrance, side exit, etc.)
`SPT_SLIT_NEWPOSITION`	Requested position of slit
`SPT_SLIT_POS_UNITS`	Slit units (i.e., µm)
`SPT_SLIT_SPEED`	Current slit speed (offset)

Parameter Name	Description
SPT_SLIT_SPEED_INDEX	Index of slit to access at upper class level
SPT_SLIT_SPEED_MAX	Maximum slit speed (offset)
SPT_SLIT_SPEED_MIN	Minimum slit speed (offset)
SPT_SLIT_SPEED_NAME	Name for slit speed (i.e. 'start')
SPT_SLIT_SPEED_UNITS	Units of text for slit speeds
SPT_SLIT_STEPSPUNIT	Current slit steps/unit
SPT_SLIT_STEPSUNIT_UNIT	Unit of slit steps/unit
SPT_SPECTS_SUPPORTED	Spectrometers (used at high level)
SPT_SPEED_FOR_EACH_GRATING	T = each grating has own speed, F = 1 speed for all
SPT_SPEED_FOR_EACH_SLIT	T = each slit has own speed, F = 1 speed for all
SPT_STARTING_CENTER_WAVE	For step & glue: starting center wave (in nm)
SPT_STARTING_WAVELENGTH	For step & glue: starting WL (in nm)
SPT_STEP_ERROR_CODE	Error code for motors
SPT_STEP_SIZE	For step & glue: step size
SPT_STOPBITS	COMM port # stop bits
SPT_TRIMTOPRECISION	Value trimmed to precision
SPT_TYPE	Spectrograph type ID of this object (get only)
SPT_USERNAME	User entered portion of name as string
SPT_VALIDITYFLAG	T = valid object, F = not valid
SPT_WAVE_ORIENTED	Wavelength oriented instrument flag
SPT_WL_PRECISION	Precision of wavelength values

SPT_PROCESS (General Spectrograph Processes)

Parameter Name	Description
SPTP_ADD_MIRROR	Adds an empty mirror structure
SPTP_ADD_SLIT	Adds an empty slit structure
SPTP_CALC_WL	Calculate WL from input parameters
SPTP_CREATE_PORT	Creates a communications port
SPTP_EVAL_STEP_STATUS	Evaluates step status
SPTP_GET_SLOPEADJ_WL	Special slope adjust calc

Parameter Name	**Description**
`SPTP_INITIALIZE`	Reads from instrument
`SPTP_INST_GRATING_SPEED`	Get grating speed(s) from instrument
`SPTP_INST_LOADCONFIGURATION`	Reads inst config & cur positions, sets grating/mir/slit objs
`SPTP_INST_MODELNAME`	Read from instrument
`SPTP_INST_READCURPOSITIONS`	Reads current positions of ALL items
`SPTP_INST_RESETALLPOSITIONS`	Reads current positions and resets ALL items
`SPTP_INST_SERIALNUMBER`	Reads from instrument
`SPTP_INST_SLIT_SPEED`	Get slit speed(s) from instrument
`SPTP_NM_TO_STEPS`	Converts nm value to steps
`SPTP_PROCESS_MOVE_STATUS`	Get status of move processes
`SPTP_PROCESS_MOVES`	Process spectrograph moves as setup
`SPTP_REMOVE_ALL_MIRRORS`	Removes ALL mirrors
`SPTP_REMOVE_ALL_SLITS`	Removes ALL slits
`SPTP_RESET`	Resets instrument
`SPTP_SET_GRATING`	Changes grating
`SPTP_SET_GRATING_POS`	Move the active grating
`SPTP_SET_GRATING_SPEED`	Set grating speed(s) on instrument
`SPTP_SET_MIRROR_POS`	Move the active mirror
`SPTP_SET_SLIT_POS`	Move the active slit
`SPTP_SET_SLIT_SPEED`	Set slit speed(s) on instrument
`SPTP_SET_SLOPEADJ_WL`	Special slope adjust calc
`SPTP_SET_TURRET`	Changes turret
`SPTP_SETUP_OPTIONS`	Reads options installed on instrument
`SPTP_START`	Sets up all processes and starts them
`SPTP_STOP`	Stops all processes
`SPTP_TRIMTOPRECISION`	Trims value to required precision

Pulser

PITG_BRACKET_TYPE (PI-Max bracket type)

Parameter Name	Description
GEN3_BRACKET	PI-Max – Gen III bracket
ORIGINAL_BRACKET	PI-Max – Original bracket

PITG_COUPLING (External trigger coupling)

Parameter Name	Description
AC_COUPLED	AC coupled
DC_COUPLED	DC coupled

PITG_DELAY_FROM (Where delay is calculated from)

Parameter Name	Description
PTG_EXT_TRIG_IN	Calculate delay from Trigger-In
PITG_T0_OUT	Calculate delay from T0

PITG_ERROR_CODES (PITG error codes)

Parameter Name	Description
EC_DG535_DELAY_LINKAGE_ERROR	DG535 – Delay linkage error
EC_DG535_DELAY_RANGE_ERROR	DG535 – Delay range error
EC_DG535_RECALLED_DATA_WAS_CORRUPTED	DG535 – Recalled data was corrupted
EC_DG535_UNRECOGNIZED_COMMAND	DG535 – Unrecognized command
EC_DG535_VALUE_OUTSIZE_RANGE	DG535 – Value out of range
EC_DG535_WRONG_MODE_FOR_THE_COMMAND	DG535 – Invalid mode
EC_DG535_WRONG_NUMBER_OF_PARAMETERS	DG535 – Invalid number of parameters
EC_PG200_NEED_SETTLING_TIME	PG200 – Need settling time
EC_PITG_COMM_DLL	DLL load failure
EC_PITG_COMM_PORT	Communication port failure
EC_PITG_ILLEGAL_VALUE	TG_CMD value out of range

Parameter Name	Description
EC_PITG_NO_ERROR	No error
EC_PITG_PTG_CNTRRAM_LOAD	PTG – RAM load error
EC_PITG_PTG_CNTRRAM_READ	PTG – RAM read error
EC_PITG_PTG_CNTRRAM_WRITE	PTG – RAM write error
EC_PITG_PTG_REACHED_END_OF_RAM	PTG – Out of RAM
EC_PITG_PTG_TRIGGER_COUNT_OVERFLOW	PTG – Trigger count overflow
EC_PITG_READ_FR_TG_FAILED	Read from pulser failure
EC_PITG_SEND_TO_TG_FAILED	Write to pulser failure
EC_PITG_SHORT_PULSE_DEL_FOR_BRACKET	PI-Max – Pulse delay shorter than bracket delay
EC_PITG_UNINIT_VAR_AT_PROCESS	Not all necessary TG_CMD's are set before TG_PROCESS
EC_PITG_UNKNOWN_ERROR	Unknown error (bad code)
EC_PITG_UNSUPPORTED_PARM_ERROR	Invalid TG_CMD | TG_PROCESS

PITG_GATINGMODE (PG200:gating mode status)

Parameter Name	Description
GATING_DISABLED	PG200 – Disabled
GATING_ENABLED	PG200 – Enabled

PITG_INCREMENT_TYPES (Sequential increment types)

Parameter Name	Description
INC_CUSTOM	Increment is custom (does not touch arrays)
INC_EXPONENTIAL	Exponential increment
INC_FIXED	Fixed increment

PITG_PTG_TRIG_COUNT_TYPE (PTG triggers counted)

Parameter Name	Description
TRIGCNT_MAIN	PTG – Count main triggers only
TRIGCNT_MAIN_BURST	PTG – Count main and burst triggers

PITG_PULSING_MODE (Pulsing mode)

Parameter Name	Description
CONTINUOUS_PULSE	Continuous pulse
SEQUENTIAL_PULSE	Sequential pulse

PITG_SLOPE (External trigger slope)

Parameter Name	Description
NEGATIVE_SLOPE	Negative slope
POSITIVE_SLOPE	Positive slope

PITG_TERMINATION (External trigger termination)

Parameter Name	Description
FIFTY_OHMS	Fifty ohms
HIGH_Z	High impedance

PITG_TRIGMODES (Pulse triggering modes)

Parameter Name	Description
USE_EXTERNAL_TRIG	External trigger
USE_INTERNAL_TRIG	Internal trigger
USE_SINGLESHOT	PTG | DG535 – Single shot
USE_SINGLESHOT_INTERNAL	PTG – Single shot (internal trigger)

PITG_TRIGSYNCMODES (Where to synch PG200 to)

Parameter Name	Description
SYNC_TO_GATE	PG200 – Synchronize to gate
SYNC_TO_TRIGGER	PG200 – Synchronize to trigger

PITG_TYPES (Pulser types)

Parameter Name	Description
`PI_PG200`	PG200 pulser
`PI_PTG`	PTG pulser
`PITG_NONE`	No pulser
`SRS_DG535`	DG535 pulser

TG_CMD (Pulser settings)

Parameter Name	Description
`TGC_ANTICIPATE_ACTIVE`	PTG – Enable (non-zero)/disable(0) anticipator
`TGC_ANTICIPATE_TIME`	PTG – Anticipator time (microseconds)
`TGC_AUX_DELAY`	PTG – Aux delay
`TGC_AUX_DELAY_UNITS`	PTG – Aux delay units
`TGC_AUX_TRIGTOGATE`	PG200 – Trigger to gate aux delay
`TGC_AUX_TRIGTOGATE_UNITS`	PG200 – Trigger to gate aux delay units
`TGC_AUX_TRIGTOTRIG`	PG200 – Trigger to trigger aux delay
`TGC_AUX_TRIGTOTRIG_UNITS`	PG200 – Trigger to trigger aux delay units
`TGC_AUXTRIGSYNC_MODE`	PG200 – Aux trigger synch mode
`TGC_BURST_ACTIVE`	Enable(non-zero)/disable(0) burst triggers
`TGC_BURST_COUNTS`	Number of burst triggers per main trigger
`TGC_BURST_PERIOD`	Burst trigger period
`TGC_BURST_PERIOD_UNITS`	Burst trigger period units
`TGC_CLB_ACTIVE`	Enable (non-zero)/disable(0) calibration
`TGC_COUPLING`	External trigger coupling
`TGC_DEL_TRIGTOGATE`	PG200 – Trigger to gate delay
`TGC_DEL_TRIGTOGATE_UNITS`	PG200 – Trigger to gate delay units
`TGC_DEL_TRIGTOTRIG`	PG200 – Trigger to trigger delay
`TGC_DEL_TRIGTOTRIG_UNITS`	PG200 – Trigger to trigger delay units
`TGC_DELTRIGSYNC_MODE`	PG200 – Delay trigger synch mode

Parameter Name	Description
TGC_DISPLAY_COMMAND_SENT	DG535 – Non-zero to display sent commands
TGC_ERROR_CODE	Last error code set
TGC_EXT_SYNC_TO_CONT	DG535 – Output D delay after gating pulse done
TGC_EXT_SYNC_TO_CONT_UNITS	DG535 – Output D delay units
TGC_TRIG_THRESHOLD	External trigger threshold
TGC_FRONTPANEL_VIEWRATE	PG200 – Front panel view rate
TGC_GATINGMODE	PG200 – Synch mode
TGC_NUM_COMMAND_REPEATS	DG535 – Number of attempts to send a failed command
TGC_ON_CHIP_ACCUM	PTG – Number of triggers for on-chip accumulation
TGC_PULSE_DELAY	Gate pulse delay
TGC_PULSE_DELAY_FROM	PTG – Pulse delay measured from
TGC_PULSE_DELAY_UNITS	Gate pulse delay units
TGC_PULSE_WIDTH	Gate pulse width
TGC_PULSE_WIDTH_UNITS	Gate pulse width units
TGC_PULSING_MODE	Pulsing mode
TGC_SEQ_ARRAY_UNITS	Sequential array units
TGC_SEQ_AUX_ARRAY_HANDLE	Sequential aux delay array of doubles
TGC_SEQ_DELAY_ARRAY_HANDLE	Sequential delay array of doubles
TGC_SEQ_DELAY_END	Final sequential gate delay
TGC_SEQ_DELAY_END_UNITS	Final sequential gate delay units
TGC_SEQ_DELAY_START	Initial sequential gate delay
TGC_SEQ_DELAY_START_UNITS	Initial sequential gate delay units
TGC_SEQ_FAST_AMPLITUDE	Fast sequential amplitude
TGC_SEQ_FAST_TIMECONSTANT	Fast sequential time constant
TGC_SEQ_FAST_TIMECONSTANTUNITS	Fast sequential time constant units
TGC_SEQ_FX_DELAY_INC	Fixed sequential delay increment
TGC_SEQ_FX_DELAY_INC_UNITS	Fixed sequential delay increment units
TGC_SEQ_FX_WIDTH_INC	Fixed sequential width increment
TGC_SEQ_FX_WIDTH_INC_UNITS	Fixed sequential width increment units

Parameter Name	Description
TGC_SEQ_INC_TYPE	Sequencing increment type
TGC_SEQ_NUM_SHOTS	Number of timing patterns in a sequence
TGC_SEQ_ONCHIP_ACCUM_ARRAY_HANDLE	Sequential on-chip accum array of longs
TGC_SEQ_SLOW_AMPLITUDE	Slow sequential amplitude
TGC_SEQ_SLOW_TIMECONSTANT	Slow sequential time constant
TGC_SEQ_SLOW_TIMECONSTANTUNITS	Slow sequential time constant units
TGC_SEQ_WIDTH_ARRAY_HANDLE	Sequential width array of doubles
TGC_SEQ_WIDTH_END	Final sequential gate width
TGC_SEQ_WIDTH_END_UNITS	Final sequential gate width units
TGC_SEQ_WIDTH_START	Initial sequential gate width
TGC_SEQ_WIDTH_START_UNITS	Initial sequential gate width units
TGC_SLOPE	External trigger slope
TGC_SWEEP_NUM_OF_STEPS	Number of sweep steps
TGC_SWEEP_START_DEL_UNITS	Initial sweep delay units
TGC_SWEEP_START_DELAY	Initial sweep delay
TGC_SWEEP_STEP_SIZE	Sweep step size
TGC_SWEEP_STEP_SIZE_UNITS	Sweep step size units
TGC_TEMPERATURE	PTG – Get the temperature (read-only)
TGC_TERMINATION	External trigger termination
TGC_TRIG_FREQUENCY	Internal trigger frequency
TGC_TRIGGER_COUNT	PTG – Get the trigger count (read-only)
TGC_TRIGGER_COUNT_TYPE	PTG – Trigger count type to read
TGC_TRIGGER_MODE	Specify the trigger source
TGC_USE_FIXED_GATE	PI-Max – Use the fixed gate

TG_PROCESS (Pulser download processing)

Parameter Name	Description
`TGP_ANTICIPATE_TIME`	Load anticipator settings
`TGP_BURST_ACTIVE`	Load burst enable
`TGP_GEN_SEQUENCE_ARRAY`	Generate sequential arrays
`TGP_PRELOAD_SEQUENCE`	PG200/PTG – Load the sequence
`TGP_RESET_TRIGGER_COUNT`	Reset the trigger count
`TGP_SEQ_ADD`	Load sequential add
`TGP_SEQ_CLEAR`	Load sequential clear
`TGP_SEQ_SKIP`	Load sequential skip
`TGP_SEQ_START`	Load sequential start
`TGP_SEQ_STOP`	Load sequential stop
`TGP_SET_AUX_TRIGTOGATE`	Load trigger to gate aux delay
`TGP_SET_AUX_TRIGTOTRIG`	Load trigger to trigger aux delay
`TGP_SET_BURST`	Load burst settings
`TGP_SET_DEL_TRIGTOGATE`	Load trigger to gate delay
`TGP_SET_DEL_TRIGTOTRIG`	Load trigger to trigger delay
`TGP_SET_FRONTPANEL_VIEWRATE`	Load front panel view rate
`TGP_SET_MAIN_TRIGGER`	Load main trigger settings
`TGP_SET_SWEEP`	Load sweep
`TGP_SET_TIMING_PATTERN`	Load a timing pattern
`TGP_SET_TRIGGER_MODE`	Load main trigger type

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ActonSpec Type Library Enumerations

GRATINGSPEEDS (Speeds at which grating can be moved)

Parameter Name	Description
`FAST_SLEW_MODE`	Grating speed: slew mode (faster)
`NUM_GRATING_SPEEDS`	Number of grating speeds available
`SLOW_SCAN_MODE`	Grating speed: scan mode (slower)

MANUFACTURERS (Name of spectrograph manufacturer)

Parameter Name	Description
`MNFCTR_ID_ACTON`	Acton Research Corp.
`MNFCTR_ID_PI`	Princeton Instruments
`MNFCTR_ID_RS`	Roper Scientific
`NUM_MANUFACTURERS`	Number of manufacturer names available

MIRRORLOCATIONS (Port locations of mirrors)

Parameter Name	Description
`MIR_LOC_ENTRANCE`	Mirror located at entrance port
`MIR_LOC_EXIT`	Mirror located at exit port
`NUM_MIRROR_LOCATION`	Number of mirror locations available

MIRRORPOSITIONS (Deflection position of mirror)

Parameter Name	Description
`MIR_POS_FRONT`	Mirror deflection position: front
`MIR_POS_SIDE`	Mirror deflection position: side
`NUM_MIR_POS`	Number of mirror positions available

SLITLOCATIONS (Port location of slits)

Operator Name	Description
NUM_SLIT_LOCATION	Number of slit locations available
SLIT_LOC_FR_ENTR	Slit located at front entrance port
SLIT_LOC_FR_EXIT	Slit located at front exit port
SLIT_LOC_SD_ENTR	Slit located at side entrance port
SLIT_LOC_SD_EXIT	Slit located at side exit port

SPECTROMETERS (Acton spectrometers supported)

Parameter Name	Description
ACTON_AM505	Acton AM505 Spectrometer
ACTON_SP150	Acton SP150 Spectrometer
ACTON_SP275	Acton SP275 Spectrometer
ACTON_SP300i	Acton SP300i Spectrometer
ACTON_SP500	Acton SP500 Spectrometer
ACTON_SP500i	Acton SP500i Spectrometer
ACTON_SP700	Acton SP700 Spectrometer
ACTON_SP700i	Acton SP700i Spectrometer
NUM_SPECTROGRAPHS	Number of spectrometers available
PI_320PI	PI 320PI Spectrometer

SpexSpec Type Library Enumerations

MANUFACTURERS (Name of spectrograph manufacturer)

Parameter Name	Description
`MNFCTR_ID_ISA`	Instruments S. A.
`MNFCTR_ID_JY`	Jobin-Yvon
`MNFCTR_ID_SPEX`	Spex
`NUM_MANUFACTURERS`	Number of manufacturer names available

MIRRORLOCATIONS (Port locations of mirrors)

Parameter Name	Description
`MIR_LOC_ENTRANCE`	Mirror located at entrance port
`MIR_LOC_EXIT`	Mirror located at exit port
`NUM_MIRROR_LOCATION`	Number of mirror locations available

MIRRORPOSITIONS (Deflection position of mirror)

Parameter Name	Description
`MIR_POS_FRONT`	Mirror deflection position: front
`MIR_POS_SIDE`	Mirror deflection position: side
`NUM_MIR_POS`	Number of mirror positions available

SLITLOCATIONS (Port location of slits)

Operator Name	Description
`NUM_SLIT_LOCATION`	Number of slit locations available
`SLIT_LOC_FR_ENTR`	Slit located at front entrance port
`SLIT_LOC_FR_EXIT`	Slit located at front exit port
`SLIT_LOC_SD_ENTR`	Slit located at side entrance port
`SLIT_LOC_SD_EXIT`	Slit located at side exit port

SPECTROMETERS (Spex spectrometers supported)

Parameter Name	Description
`NUM_SPECTROGRAPHS`	Number of spectrometers available
`SPEX_270M`	Spex 270M
`SPEX232_RETRO`	Spex232 Interface Retro-Fit
`TRIAX_180`	Triax 180
`TRIAX_190`	Triax 190
`TRIAX_320`	Triax 320

WinX/32 Automation and VBScript

WinX/32 Automation cannot only be called in Visual Basic, but it can also be called in VBScript. In fact, any program that supports VBScript can call WinX/32 Automation objects! Since VBScript is basically a subset of Visual Basic, it is inherently limiting. These limitations (check the Visual Basic or VBScript documentation for specifics) my not allow some of the automation functions to be called. A full explanation of this is beyond the scope of this manual, but it involves supported data types of the scripting engine. In order to allow full access to the automation objects, scripting versions of the 'offending' functions were created. These functions perform the same actions as the 'offending' functions, but their parameter lists are slightly different. Below is a table of the 'offending' functions with their scripting counterparts.

Also note that VBScript only supports arrays of variants. This means that array data of different types cannot be accessed from VBScript (although the array can still be passed through automation functions). If it is necessary to access the data through VBScript, first use the ArrayConverter object and convert the data to the variant data type. If it is desired to pass this array back to WinX/32 automation, make sure to convert the data back to the original type.

Replacement Scripting Functions

Object	Original Function	Scripting Version	Scripting Version Parameter List
`DocFile`	`GetParam`	`SGetParam`	`(Param As DM_CMD, optional result As Any)`
`DocWindow`	`GetParam`	`SGetParam`	`(Param As DI_PARAM, optional result As Any)`
`DocWindows`	`GetParam`	`SGetParam`	`(Param As DI_PARAM, optional result As Any)`
`ExpSetup`	`GetParam`	`SGetParam`	`(Param As EXP_CMD, optional result As Any)`
`WinX32App`	`GetAppRect`	`SGetAppRect`	`(top As Any, left As Any, bottom As Any, right As Any)`
	`CloseOpenDocs`	`SCloseOpenDocs`	`(cDocs As Any)`
`All Process Objects`	`GetProcParam`	`SGetProcParam`	`(Param As PRC_PARAM, optional result As Any)`
`Configurable Process Objects`	`GetParam`	`SGetParam`	`(Param As PIIP_SetGetParam, optional result As Any)`
`Arithmetic/ Logical Process Objects`	`Run`	`SRun`	`(pInputA As ProcInput, pInputB As ProcInput, eOp As PIDP_IMAGEMATHOPERATION, szOutput As String, eOutType As dataType, optional pResult As Any)`

Object	Original Function	Scripting Version	Scripting Version Parameter List
Non-Arithmetic/ Logical Process Objects	Run	SRun	(pInputA As ProcInput, szOutput As String, eOutType As dataType, optional pResult As Any)

Creating a Snap-In DLL

Introduction

To create a Snap-In DLL, use the PI Snap-In Generator Wizard to generate a generic SnapIn; then use the Resource Editor Add-In to add bitmaps for the toolbar buttons and strings for the menu item. The PI Snap-In Generator Wizard should be available from the Add-In menu. If it is not, try going to the Add-In Manager and make sure that the check box next to the Snap-In Generator Wizard is checked.

Using the Wizard:

1. Begin by closing all open projects (use the Remove Project item of the File menu if necessary.)
2. Then select the Snap-In Generator Wizard from the Add-In menu.
3. Go to the screen that requests the project name.
4. Click on the **ellipsis** (…) to browse for a folder, and enter the name of your snap-in.
5. Click on **Next** until the **Finish** button is available.
6. Then click on **Finish**. The Wizard will create various source files, then compile them to produce a Snap-In DLL. When it is done, you will get a message box with an **OK** button.
7. After you click on **OK**, you will be able to edit the Snap-In code to produce your own actions.

Making Your Snap-In Appear on the WinX/32 Toolbar:

To make your snap-in appear on the toolbar you will have to add toolbar bitmaps and menu string resources to the project. Additionally, you will have to register the DLL.

1. To add the toolbar bitmap and menu string, you will need the resource editor Add-In. This editor is not shipped with Visual Basic, version 5.0. However, you can locate the file **ResEditI.exe** at either www.microsoft.com or our ftp site: ftp://ftp.princetoninstruments.com/software/official/winx32/support/ResEditI.exe and then run it to install the Add-In resource editor on your computer.

2. Next, then use the Add-In resource editor in Visual Basic to enable it. This action will add the Resource Editor item to the VB Tools menu.

3. Create the bitmap you will be adding to the project. You will have to use Windows Paint or a similar program to create the bitmap first. The bitmap should be 16 X 15 pixels and should be saved as a 256-color bitmap. Give the bitmap an ID of 101.

4. Using the Resource Editor, add two strings to the resource file. The first one will contain the menu item text for your snap-in and should have an ID of 101. The second will have the status line text for the snap-in and should have an ID of 102.

   Note: If you want a tooltip for your snap-in, you will have to be able to insert a carriage return/linefeed sequence into the string by pressing <CTRL><Tab> and <CTRL><Enter> in the string table (depending on the VB version, you may only need to press <CTRL><Enter>) - the tooltip text is separated from the status line text by these two characters.

5. Open the Immediate Window in Visual Basic (the menu item is under View).

6. Then type the single command Register (case-sensitive) and hit **Enter**.

Next time you start WinX/32, you should have a new menu item under Tools in WinX/32, and a new toolbar with at least one button. Selecting the menu item or the toolbar button runs the code in the PiSnapIn_OnCommand function of the clsSnapIn. You can put code in that function to bring up a form or do whatever you need.

Converting a Visual Basic "Exe" project to a "Snap-In":

1. In the Project Properties window, change the Project type to "ActiveX DLL".
2. Add a module called **`DllMain`**. To this module, add a Public subroutine called Main.
3. In the Project Properties window, change the startup object to **`Sub Main`**
4. In the Project References window, make sure "Roper Scientific's PIXBM32" and "Roper Scientific's Snap-In Library" are checked.
5. Add the RS-supplied class **`clsSnapIn`** to the project.

Putting up Your Main Form (omit if your program doesn't display a form):

1. In some module (**`DllMain`** will do) add a Public variable of type Form:

   ```
   Public theForm As Form
   ```

2. In the **`OnCommand`** subroutine in **`clsSnapIn`**, display the form as follows:

   a) Assign your form to the form variable

   b) Show the form in modal state.

   c) Assign "nothing" to the form variable.

   Example:

   ```
   Set theForm = frmMain
   theForm.Show vbModal
   Set theForm = Nothing
   ```

   This approximates the behavior of an executable, where the form is loaded when the program starts, and is destroyed when the program ends. Your Snap-In DLL will be "running" as long as WinX/32 is running, but the toolbar icon or menu command will bring up the main form of the snap-in; closing the form will destroy it.

Running Your DLL:

1. You'll need to add a menu string and (optionally) a toolbar bitmap. To add these things to a Visual Basic project, you'll need the Resource Editor add-in. Install the add-in (you can get it from Princeton Instruments or from the Microsoft Web site) and enable it using the add-in manager. Then use it to add a resource file to your project and add the bitmap and string resources. Finally, in **`clsSnapIn`**'s **`GetMenuTextID`** and **`GetBitMapID`** functions, return the value of the ID of the string and bitmap, respectively.
2. Compile your project. After it is compiled (successfully) open the Immediate Window and type the single command Register and hit **Enter**.

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