CHAPTER 6 VBA PROGRAMMING FOR LSM

CONTENTS

6 VBA PROGRAMMING FOR LSM

6.1 VBA Programming

6.1.1 General Syntax

Object oriented programming

Class Modules

6.1.2 Working with Files

I/O operations, file operations are implemented in VBA

Use of the implemented functions

Example:

```
Type CALIBRATION_PARAM
    lambda As Long
    angle As Double
    Translation As Double
End Type

Function DataFromCalibFile(strGetFile As String, calibArray() As CALIBRATION_PARAM) As Integer
    Dim hFile As Long
    Dim strLine As String
    Dim varData(1 To 3) As Variant
    Dim paramCnt As Integer

    paramCnt = -1
    'get the next free file handle
    hFile = FreeFile
    'check if file exist
    If (Len(Dir(strGetFile)) > 0) Then
        Open strGetFile For Input Access Read Shared As hFile
            If (Not EOF(hFile)) Then
                Line Input #hFile, strLine

                paramCnt = 0
                Do Until EOF(hFile)
                    Input #hFile, varData(1), varData(2), varData(3)
                    calibArray(paramCnt).lambda = varData(1)
                    calibArray(paramCnt).angle = varData(2)
                    calibArray(paramCnt).Translation = varData(3)
                    paramCnt = paramCnt + 1
                Loop
            End If
        Close #hFile
    End If

    DataFromCalibFile = paramCnt
End Function Objektstruktur
```

Use of the API function for additional functionality

6.1.3 Access to Windows API Function and external DLLs

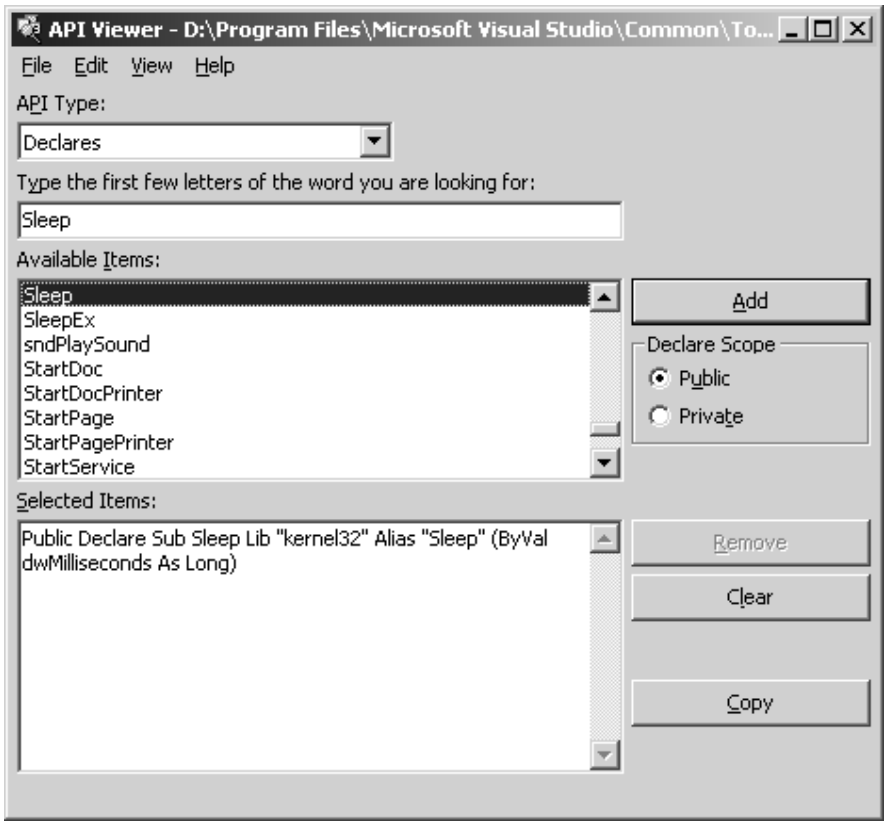
- with Type Libraries

  OLE

- with Declare Statements

  API Text Viewer

  searches WIN32API.TXT



Example:

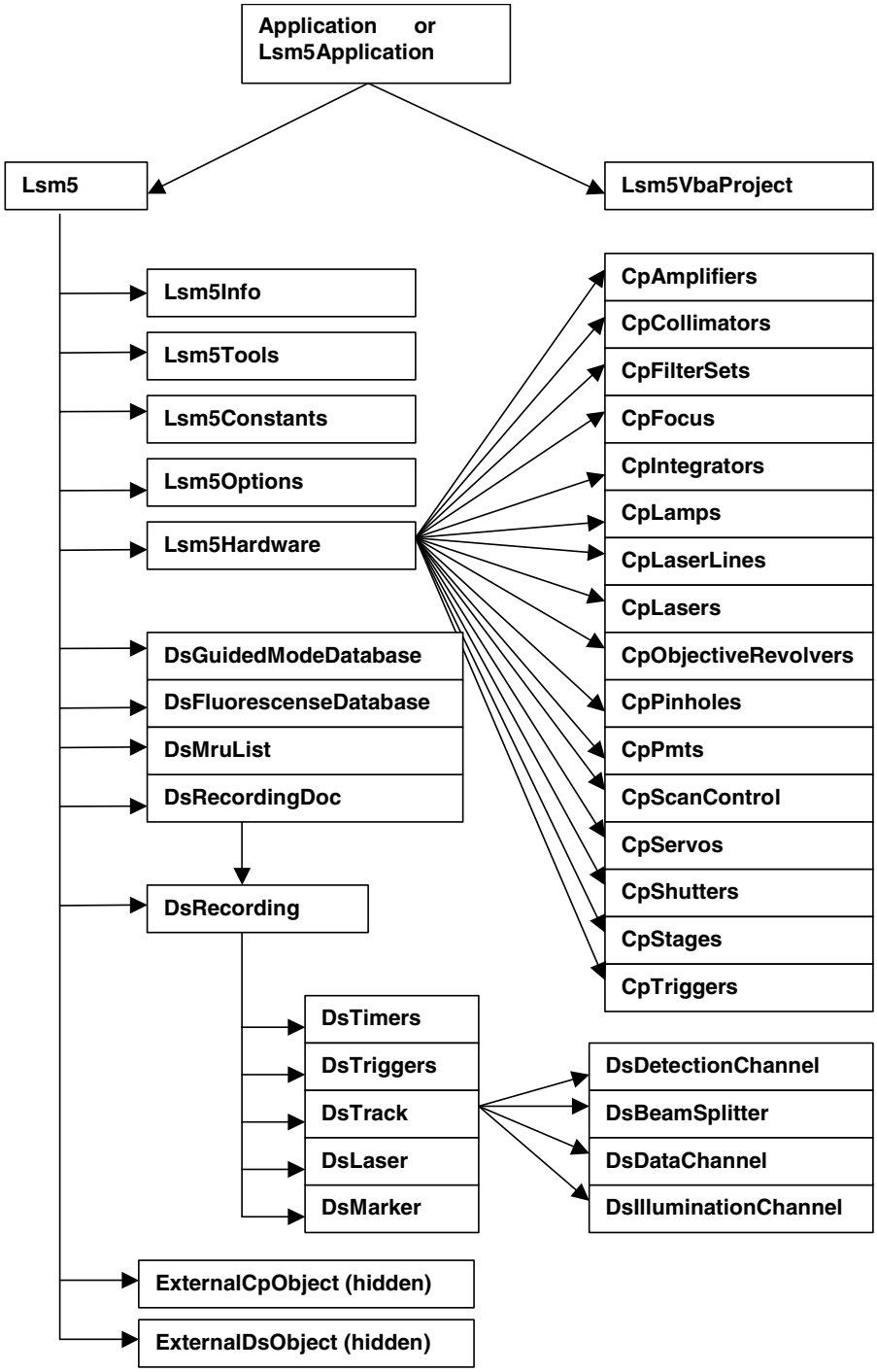
```
Declare Sub Sleep Lib "kernel32" (ByVal dwMilliseconds As Long)

Declare Function RegOpenKeyEx _
    Lib "advapi32.dll" Alias "RegOpenKeyExA" _
    (ByVal hKey As Long, ByVal lpSubKey As String, _
    ByVal ulOptions As Long, ByVal samDesired As Long, _
    phkResult As Long) As Long


Public Declare Function RegCloseKey _
    Lib "advapi32.dll" (ByVal hKey As Long) As Long


Public Declare Function RegQueryValueEx _
   Lib "advapi32.dll" Alias "RegQueryValueExA" _
   (ByVal hKey As Long, ByVal lpValueName As String, _
   ByVal lpReserved As Long, lpType As Long, _
   lpData As Any, lpcbData As Long) As Long        ' Note that if you declare the lpData  parameter
   as String, you must pass it By Value.

Public Const HKEY_CLASSES_ROOT = &H80000000

Public Const SYNCHRONIZE = &H100000
Public Const READ_CONTROL = &H20000
Public Const STANDARD_RIGHTS_READ = (READ_CONTROL)
Public Const KEY_QUERY_VALUE = &H1
Public Const KEY_ENUMERATE_SUB_KEYS = &H8
Public Const KEY_NOTIFY = &H10
Public Const KEY_READ = ((STANDARD_RIGHTS_READ Or KEY_QUERY_VALUE Or
KEY_ENUMERATE_SUB_KEYS Or KEY_NOTIFY) And (Not SYNCHRONIZE))

Public Const REG_SZ = 1                         ' Unicode null terminated string
Public Const ERROR_SUCCESS = 0&
```

```
Function FServerFromDescription(strName As String, strPath As String) As Boolean
    Dim lngResult As Long
    Dim strTmp As String
    Dim hKeyServer As Long
    Dim strBuffer As String
    Dim cb As Long
    Dim i As Integer

    FServerFromDescription = False

    strTmp = VBA.Space(255)
    strTmp = strName + "\CLSID"
    lngResult = RegOpenKeyEx(HKEY_CLASSES_ROOT, strTmp, 0&, KEY_READ, hKeyServer)

    If (Not lngResult = ERROR_SUCCESS) Then GoTo error_exit
    strBuffer = VBA.Space(255)
    cb = Len(strBuffer)

    lngResult = RegQueryValueEx(hKeyServer, "", 0&, REG_SZ, ByVal strBuffer, cb)
    If (Not lngResult = ERROR_SUCCESS) Then GoTo error_exit

    lngResult = RegCloseKey(hKeyServer)
    strTmp = VBA.Space(255)
    strTmp = "CLSID\" + Left(strBuffer, cb - 1) + "\LocalServer32"
    strBuffer = VBA.Space(255)
    cb = Len(strBuffer)
    lngResult = RegOpenKeyEx(HKEY_CLASSES_ROOT, strTmp, 0&, KEY_READ, hKeyServer)
    If (Not lngResult = ERROR_SUCCESS) Then GoTo error_exit

    lngResult = RegQueryValueEx(hKeyServer, "", 0&, REG_SZ, ByVal strBuffer, cb)
    If (Not lngResult = ERROR_SUCCESS) Then GoTo error_exit
    strPath = Left(strBuffer, cb - 1)
```

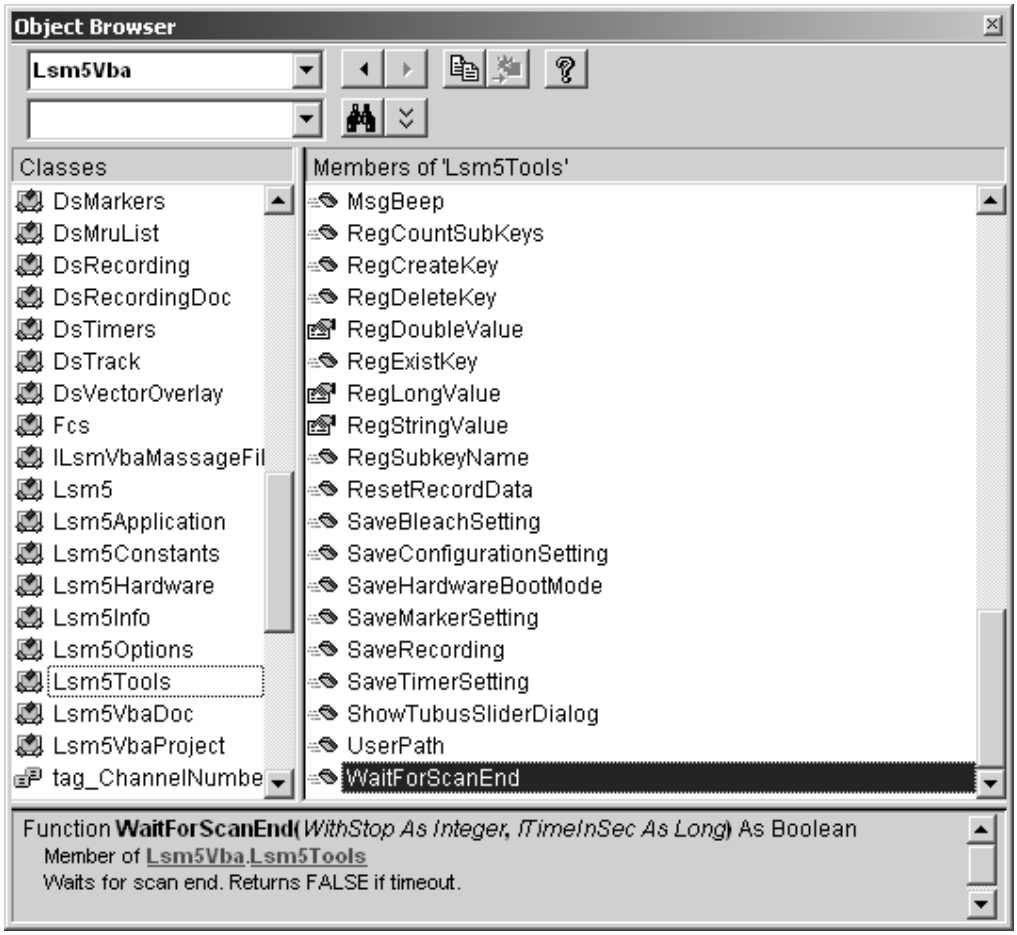
```
    lngResult = RegCloseKey(hKeyServer)
    hKeyServer = 0

    i = Len(strPath)

    Do Until (i = 0)
        If (VBA.Mid(strPath, i, 1) = "\") Then
            strPath = Left(strPath, i - 1)
            FServerFromDescription = True
            Exit Do
        End If
        i = i - 1
    Loop

error_exit:
    If (Not hKeyServer = 0) Then lngResult = RegCloseKey(hKeyServer)
    hKeyServer = 0

End Function
```

6.2 Programming for LSM

6.2.1 Object structure



To search the object structure use the object browser



6.2.2 Differences in access to LSM Hardware with Lsm5Hardware Object / DsRecording Object

Object Browser Project / Library LsmVba auswählen und Objekt Struktur untersuchen

- Access with DsRecording Object

  Status maintains at Scan Start

```
Public Sub CopyRecording(Destination As DsRecording, Source As DsRecording)
    Dim TS As DsTrack
    Dim TD As DsTrack
    Dim DataS As DsDataChannel
    Dim DataD As DsDataChannel
    Dim DetS As DsDetectionChannel
    Dim DetD As DsDetectionChannel
    Dim IlS As DsIlluminationChannel
    Dim IlD As DsIlluminationChannel
    Dim BS As DsBeamSplitter
    Dim BD As DsBeamSplitter
    Dim lT As Long
    Dim ll As Long
    Dim success As Integer

    Destination.Copy Source
    Destination.Objective = Source.Objective
    For lT = 0 To Destination.TrackCount - 1

        Set TS = Source.TrackObjectByIndex(lT, success)
        Set TD = Destination.TrackObjectByIndex(lT, success)

        TD.Collimator1Position = TS.Collimator1Position
        TD.Collimator2Position = TS.Collimator2Position

        For ll = 0 To TD.DataChannelCount - 1
            Set DataS = TS.DataChannelObjectByIndex(ll, success)
            Set DataD = TD.DataChannelObjectByIndex(ll, success)
            DataD.ColorRef = DataS.ColorRef
        Next ll
```

```
        For lI = 0 To TD.DetectionChannelCount - 1
            Set DetS = TS.DetectionChannelObjectByIndex(lI, success)
            Set DetD = TD.DetectionChannelObjectByIndex(lI, success)
            DetD.Filter1 = DetS.Filter1
            DetD.Filter2 = DetS.Filter2
            DetD.DetectorGain = DetS.DetectorGain
            DetD.AmplifierGain = DetS.AmplifierGain
            DetD.AmplifierOffset = DetS.AmplifierOffset
            DetD.PinholeDiameter = DetS.PinholeDiameter
        Next lI

        For lI = 0 To TD.IlluminationChannelCount - 1
            Set IlS = TS.IlluminationObjectByIndex(lI, success)
            Set IlD = TD.IlluminationObjectByIndex(lI, success)
            IlD.Acquire = IlS.Acquire
            lD.Power = IlS.Power
            IlD.DetectionChannelName = IlS.DetectionChannelName
        Next lI

        For lI = 0 To TD.BeamSplitterCount - 1
            Set BS = TS.BeamSplitterObjectByIndex(lI, success)
            Set BD = TD.BeamSplitterObjectByIndex(lI, success)
            BD.Filter = BS.Filter
        Next lI

    Next lT
End Sub
```

- Access with Lsm5Hardware Object

Status will be updated at Scan Start to current recording parameters

```
Private Sub FillPinholeList()
    Dim count As Long
    Dim i As Long
    Dim ObjPinholes As CpPinholes
    Dim Servos As Object
    Dim ServoX As Object
    Dim ServoY As Object
    Dim success As Boolean

    CmbPinhole.Clear

    Set Servos = Lsm5.ExternalCpObject.pHardwareObjects.pServos
    Set ObjPinholes = Lsm5.Hardware.CpPinholes
    count = ObjPinholes.count
    For i = 0 To count - 1
        success = ObjPinholes.Select(i)
        If (success) Then
            Set ServoX = Servos.pItem(ObjPinholes.Name + "X")
            Set ServoY = Servos.pItem(ObjPinholes.Name + "Y")
            If ((Not ServoX Is Nothing) And (Not ServoY Is Nothing)) Then
                CmbPinhole.AddItem ObjPinholes.Name
            End If
        End If
    Next i
    If (count) Then CmbPinhole.ListIndex = 0        ' select first pinhole

    Set ObjPinholes = Nothing
    Set Servos = Nothing
    Set ServoX = Nothing
    Set ServoY = Nothing
End Sub
```

- Access with external Lsm5Hardware Object

6.2.3 Access to hidden Interface

- When do I need to use the hidden Interface?
- How do I find the desired Object / Method?
  Open Tool / References
  Browse CP.dll search, open
  Choose Object Browser Project / Library DS or CP
  Examine Object Structure

Example:

```
Function GetLaserKind(WaveLength As String, kind As Integer)
    Dim count As Long
    Dim CpObject As Object
    Dim Lines As Object
    Dim i As Long
    Dim Success As Integer
    Dim WaveLenghtOfIndex As Long
    Dim Attenuation As Double
    Dim Enable As Integer
    Dim Name As String

    GetLaserValueMax = False

    Set CpObject = Lsm5.ExternalCpObject()
    Set Lines = CpObject.pHardwareObjects.pLaserLines

    count = Lines.lCount
    For i = 0 To (count - 1)
        Success = Lines.bLineInfo(i, WaveLenghtOfIndex, Attenuation, Enable, Name)
        If (Success And (WaveLenghtOfIndex = WaveLenght)) Then
            kind = Lines.AttenuatorType(WaveLenght)

            Set Lines = Nothing
            Set CpObject = Nothing
            Exit Function
        End If
    Next i

    Set Lines = Nothing
    Set CpObject = Nothing

End Function
```

6.2.4 Access to scanned pictures

Example:

```
Function ChannelIndexFromChannelName(ChannelName As String, ChannelIndex As Long)
    Dim num As Long, num1 As Long, num2 As Long
    Dim i As Long
    Dim Success As Integer
    Dim DetectionChannel As DsDetectionChannel
    Dim LsmInfo As Lsm5Info
    Dim Recording As DsRecording

    ChannelIndexFromChannelName = False

    Set Recording = Lsm5.DsRecording
    Set LsmInfo = Lsm5.Info
    If (LsmInfo.NumberOfPmtsInSystem(num, num1, num2) = True) Then
        For i = 0 To (num + num1 - 1)
            Set DetectionChannel = Recording.DetectionChannelOfActiveOrder(i, Success)
            If Success Then
                If (StrComp(DetectionChannel.Name, ChannelName) = 0) Then
                    ChannelIndex = i
                    ChannelIndexFromChannelName = True
                    GoTo exit_function
                End If
            End If
        Next i
    End If

exit_function:
    Set LsmInfo = Nothing
    Set Recording = Nothing
End Function
```

```
Function GetAveragePixel(ScanDoc As DsRecordingDoc, ChannelName As String, mean As Double)
    Dim line As Variant
    Dim x As Long, xmax As Long
    Dim y As Long, ymax As Long
    Dim spl As Long
    Dim bpp As Long
    Dim Sum As Double
    Dim Channel As Long

    GetAverageScanLineParams = False

    If (ChannelIndexFromChannelName(ChannelName, Channel) = False) Then
        Exit Function
    End If

    'check for valid doc
    If (ScanDoc Is Nothing) Then Exit Function
    Sum = 0
    xmax = ScanDoc.Recording.SamplesPerLine
    ymax = ScanDoc.Recording.LinesPerFrame
    For y = 0 To ymax - 1
        line = ScanDoc.ScanLine(Channel, 0, 0, 0, spl, bpp)

        For x = 0 To spl - 1
            Sum = Sum + line(x)
        Next x
    Next y
    mean = Sum / (xmax*ymax)

    GetAverageScanLineParams = True
End Function
```

6.2.5 Backup Recording

```
        .
        .
        .
Dim Recording As DsRecording
Dim BackupRecording As DsRecording
Dim ScanDoc As DsRecordingDoc

Set Recording = Lsm5.DsRecording
'create a backup recording
Set BackupRecording = Lsm5.CreateBackupRecording
Success = BackupRecording.Copy(Recording)

Recording.ScanMode = "Line"
Recording.FramesPerStack = 1
Recording.StacksPerRecord = 1
Recording.ScanDirection = eSingleForeward
Recording.SpecialScanMode = "NoSpecialScanMode"
Recording.TimeSeries = False
Recording.ZoomX = ZOOM_X
Recording.ROTATION = ROTATION
Recording.Sample0X = OFFSET_X
Recording.Sample0Y = OFFSET_Y
Recording.SamplesPerLine = IMAGE_SIZE
Recording.StartScanTime = 8

Success = SetChannelDetection(ChannelName, 1, AmpOffset, 100)
Set ScanDoc = Lsm5.StartContinuousScan

        .
        .
        .

Lsm5.StopScan
'restore the backup recording
Recording.Copy BackupRecording
Set Recording = Nothing
Set BackupRecording = Nothing
```

6.2.6 Events

- What are Events good for?

- Mouse Events
- Scan state events
- Hardware Events

```
Private Sub Lsm5VbaDoc_SystemEvent(ByVal EventNr As Long, ByVal Param As Variant)
    Dim x As Long
    Dim y As Long
    Dim z As Long
    Dim t As Long
    Dim c As Long
    Dim tmp As Long
    Dim pt As POINT
    Dim dsDoc As DsRecordingDoc

    'get the active Recording Document
    Set dsDoc = Lsm5.DsRecordingActiveDocObject
    If (dsDoc Is Nothing) Then Exit Sub
    If (Not dsDoc.IsValid) Then Exit Sub

    If (EventNr = eImageWindowLeftButtonDownEvent) Then
        If dsDoc.GetCurrentMousePosition(c, t, z, y, x) <> 0 Then
            'do something
                    .
                    .
                    .


        End If
    End If

End Sub
```