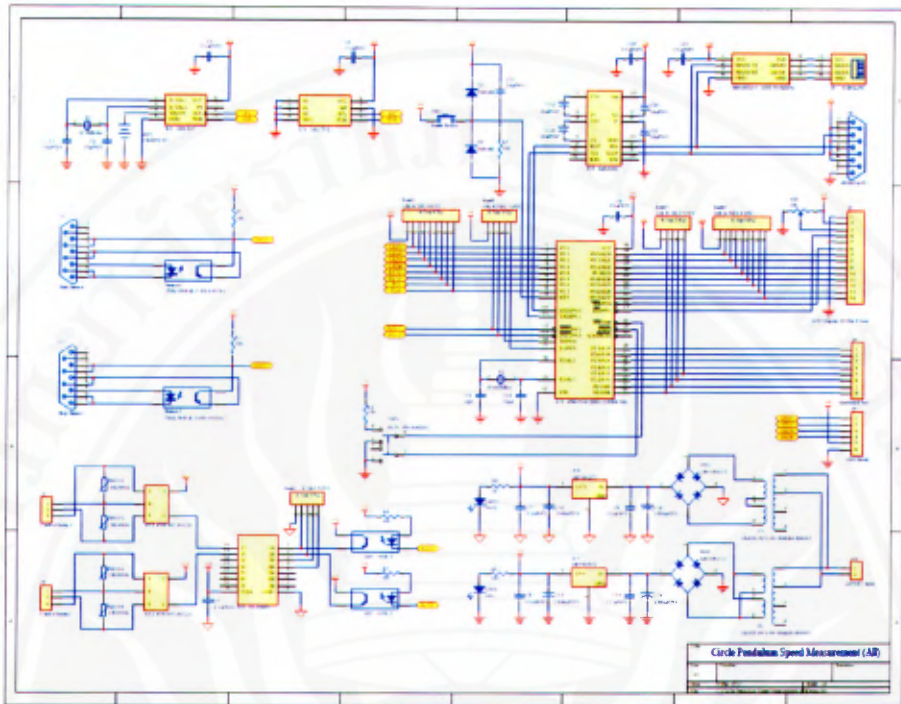


ภาคผนวก

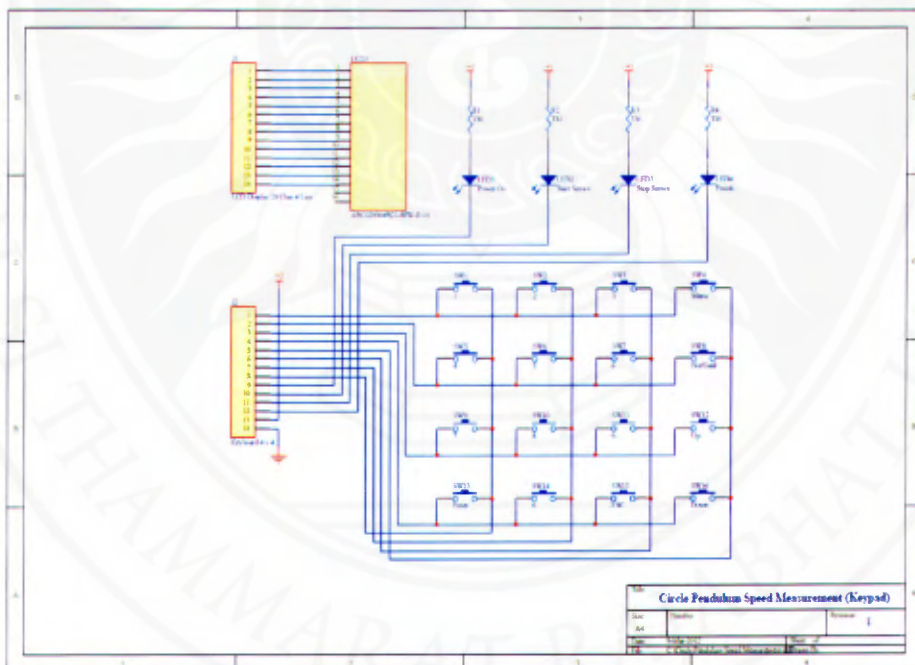




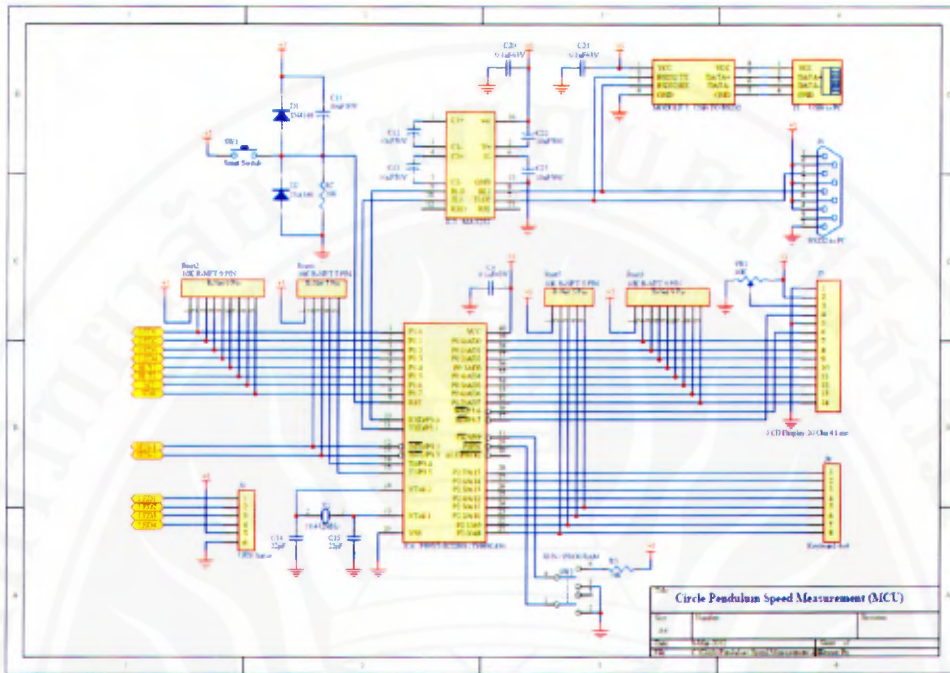
ภาคผนวก ก วงจรอิเล็กทรอนิกส์



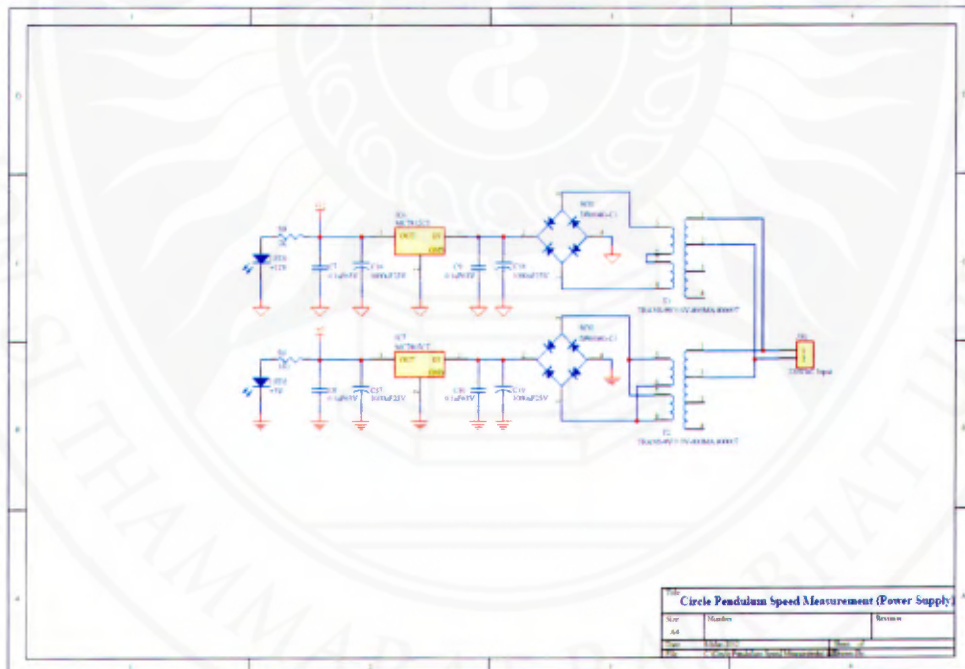
ภาพที่ ก-1 วงจรรวม



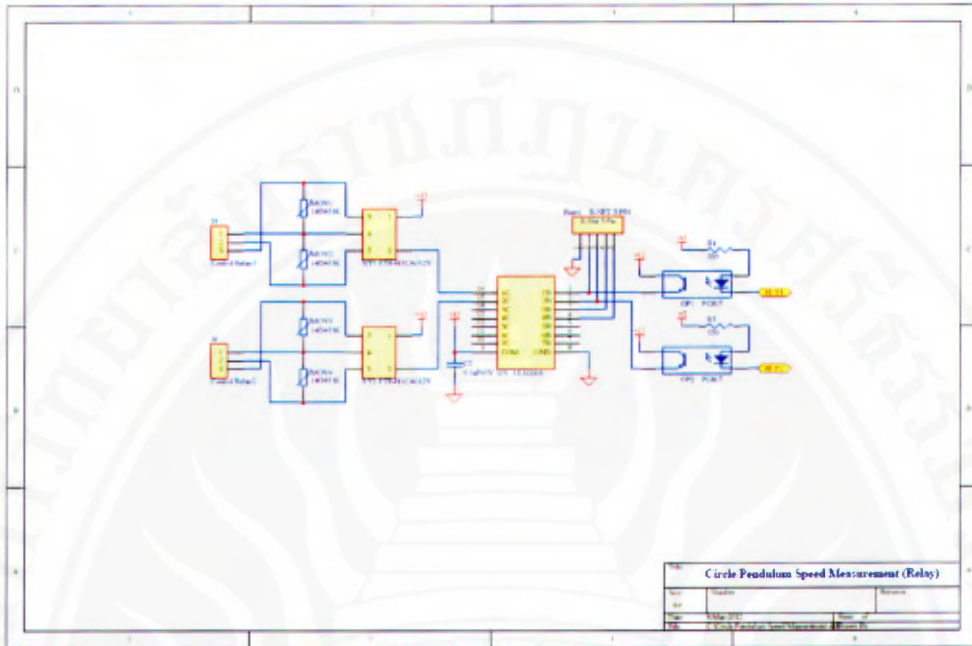
ภาพที่ ก-2 วงจรปุ่มหน้าจอก



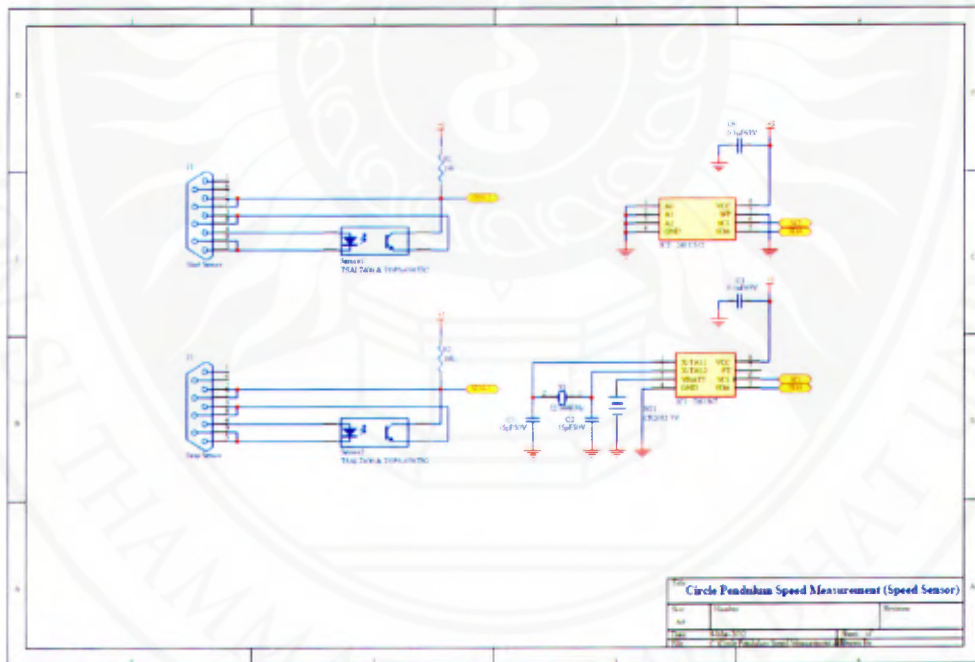
ภาพที่ ก-3 วงจรหลัก



ภาพที่ ก-4 วงจร power supply



ภาพที่ ก-5 วงจร รีเลย์



ภาพที่ ก-6 วงจรตรวจจับวัตถุ



ภาคผนวก ข คำสั่ง โปรแกรม

คำสั่ง โปรแกรม Visaul Basic Version 6.0

Circle Pendulum Speed Measurement.vbp

Type=Exe

Reference=*G{00020430-0000-0000-C000-00000000046}#2.0#0#C:\WINDOWS\system32\STDOLE2.TLB#OLE Automation

Object={F9043C88-F6F2-101A-A3C9-08002B2F49FB}#1.2#0; comdlg32.ocx

Object={648A5603-2C6E-101B-82B6-000000000014}#1.1#0; MSCOMM32.OCX

Object={5E9E78A0-531B-11CF-91F6-C2863C385E30}#1.0#0; MSFLXGRD.OCX

Object={38911DA0-E448-11D0-84A3-00DD01104159}#1.1#0; COMCT332.OCX

Object={BDC217C8-ED16-11CD-956C-0000C04E4C0A}#1.1#0; TABCTL32.OCX

Object={831FDD16-0C5C-11D2-A9FC-0000F8754DA1}#2.0#0; MSCOMCTL.OCX

Form=FormCommPort.frm

Reference=*G{6B263850-900B-11D0-9484-00A0C91110ED}#1.0#0#C:\WINDOWS\system32\MSSTDFMT.DLL#Microsoft Data Formatting Object Library 6.0 (SP4)

Form=FormMain.frm

IconForm="FormMain"

Startup="FormMain"

HelpFile=""

Title="Circle Pendulum Speed Measurement"

ExeName32="Circle Pendulum Speed Measurement.exe"

Command32=""

Name="CirclePendulumSpeedMeasurement"

HelpContextID="0"

Description="Circle Pendulum Speed Measurement"

CompatibleMode="0"

MajorVer=1

MinorVer=0

RevisionVer=0
AutoIncrementVer=0
ServerSupportFiles=0
VersionCompanyName="."
CompilationType=0
OptimizationType=0
FavorPentiumPro(tm)=0
CodeViewDebugInfo=0
NoAliasing=0
BoundsCheck=0
OverflowCheck=0
FPointCheck=0
FDIVCheck=0
UnroundedFP=0
StartMode=0
Unattended=0
Retained=0
ThreadPerObject=0
MaxNumberOfThreads=1
DebugStartupOption=0

[MS Transaction Server]

AutoRefresh=1

Form CommPort.frm

VERSION 5.00

Object = "{831FDD16-0C5C-11D2-A9FC-0000F8754DA1}#2.0#0"; "MSCOMCTL.OCX"

Begin VB.Form FormCommPort

AutoRedraw = -1 'True
BorderStyle = 3 'Fixed Dialog
Caption = "CommPort Setting"
ClientHeight = 4230
ClientLeft = 4440
ClientTop = 3600
ClientWidth = 5985
Icon = "FormCommPort.frx":0000
LinkTopic = "Form3"
LockControls = -1 'True
MaxButton = 0 'False
MinButton = 0 'False
ScaleHeight = 4230
ScaleWidth = 5985
ShowInTaskbar = 0 'False
StartupPosition = 2 'CenterScreen

Begin VB.Frame fraSettings

BorderStyle = 0 'None
Height = 3495
Left = 255
TabIndex = 2
Top = 570
Width = 5445

Begin VB.CommandButton cmdCancel

Caption = "Cancel"
Height = 300

```
Left          = 4335
TabIndex     = 22
Top          = 1065
Width        = 1080
End
Begin VB.Frame Frame1
Caption       = "Maximum Speed"
Height       = 870
Left         = 180
TabIndex     = 20
Top          = 630
Width        = 2340
Begin VB.ComboBox cboSpeed
Height       = 315
Left         = 375
Style        = 2 'Dropdown List
TabIndex     = 21
Top          = 330
Width        = 1695
End
End
Begin VB.Frame fraConnection
Caption       = "Connection Preferences"
Height       = 1770
Left         = 180
TabIndex     = 12
Top          = 1635
Width        = 2325
Begin VB.ComboBox cboStopBits
```

```
Height      = 315
Left        = 1050
Style       = 2 'Dropdown List
TabIndex    = 16
Top         = 1260
Width       = 1140
```

End

```
Begin VB.ComboBox cboParity
```

```
Height      = 315
Left        = 1050
Style       = 2 'Dropdown List
TabIndex    = 15
Top         = 810
Width       = 1140
```

End

```
Begin VB.ComboBox cboDataBits
```

```
Height      = 315
Left        = 1050
Style       = 2 'Dropdown List
TabIndex    = 14
Top         = 330
Width       = 1140
```

End

```
Begin VB.Label Label5
```

```
Caption     = "Stop Bits:"
Height      = 285
Left        = 180
TabIndex    = 19
Top         = 1320
```

```
        Width      = 885
    End
Begin VB.Label Label4
    Caption      = "Parity:"
    Height      = 285
    Left        = 180
    TabIndex    = 18
    Top         = 855
    Width       = 615
End
Begin VB.Label Label3
    Caption      = "Data Bits:"
    Height      = 285
    Left        = 180
    TabIndex    = 17
    Top         = 375
    Width       = 825
End
End
Begin VB.ComboBox cboPort
    Height      = 315
    Left        = 900
    Style       = 2 'Dropdown List
    TabIndex    = 11
    Top         = 150
    Width       = 1425
End
Begin VB.CommandButton cmdOK
    Caption     = "OK"
```

```
Default      = -1 'True
Height       = 300
Left         = 4335
MaskColor    = &H00000000&
TabIndex     = 0
Top          = 705
Width        = 1080
End
Begin VB.Frame Frame7
Caption      = "&Echo"
Height       = 870
Left         = 2595
TabIndex     = 8
Top          = 630
Width        = 1590
Begin VB.OptionButton optEcho
Caption      = "Off"
Height       = 315
Index        = 0
Left         = 135
MaskColor    = &H00000000&
TabIndex     = 10
Top          = 360
Width        = 615
End
Begin VB.OptionButton optEcho
Caption      = "On"
Height       = 195
Index        = 1
```



```
Left      = 795
MaskColor = &H00000000&
TabIndex  = 9
Top       = 420
Width     = 555
```

```
End
```

```
End
```

```
Begin VB.Frame Frame5
```

```
Caption    = "&Flow Control"
Height     = 1770
Left       = 2595
TabIndex   = 3
Top        = 1635
Width      = 1620
```

```
Begin VB.OptionButton optFlow
```

```
Caption    = "None"
Height     = 255
Index      = 0
Left       = 180
MaskColor  = &H00000000&
TabIndex   = 7
Top        = 345
Width      = 855
```

```
End
```

```
Begin VB.OptionButton optFlow
```

```
Caption    = "Xon/Xoff"
Height     = 255
Index      = 1
Left       = 180
```

```
MaskColor = &H00000000&
TabIndex = 6
Top = 645
Width = 1095
End
Begin VB.OptionButton optFlow
Caption = "RTS"
Height = 255
Index = 2
Left = 180
MaskColor = &H00000000&
TabIndex = 5
Top = 945
Width = 735
End
Begin VB.OptionButton optFlow
Caption = "Xon/RTS"
Height = 255
Index = 3
Left = 180
MaskColor = &H00000000&
TabIndex = 4
Top = 1245
Width = 1155
End
End
Begin VB.Label Label1
Caption = "Port:"
Height = 315
```

```
Left          = 330
TabIndex      = 13
Top           = 180
Width         = 495
```

```
End
```

```
End
```

```
Begin MSComctlLib.TabStrip tabSettings
```

```
Height        = 4065
Left          = 90
TabIndex      = 1
Top           = 105
Width         = 5820
_ExtentX      = 10266
_ExtentY      = 7170
MultiRow      = -1 'True
_Version      = 393216
```

```
BeginProperty Tabs {1EFB6598-857C-11D1-B16A-00C0F0283628}
```

```
NumTabs       = 1
```

```
BeginProperty Tab1 {1EFB659A-857C-11D1-B16A-00C0F0283628}
```

```
Caption       = "Properties"
```

```
ImageVarType = 2
```

```
EndProperty
```

```
EndProperty
```

```
End
```

```
End
```

```
Attribute VB_Name = "FormCommPort"
```

```
Attribute VB_GlobalNameSpace = False
```

```
Attribute VB_Creatable = False
```

```
Attribute VB_PredeclaredId = True
```

```
Attribute VB_Exposed = False
Private iFlow As Integer, iTempEcho As Boolean

Sub LoadPropertySettings()
Dim i As Integer, Settings As String, Offset As Integer

' Load Port Settings
For i = 1 To 16
    cboPort.AddItem "Com" & Trim$(Str$(i))
Next i

' Load Speed Settings
cboSpeed.AddItem "110"
cboSpeed.AddItem "300"
cboSpeed.AddItem "600"
cboSpeed.AddItem "1200"
cboSpeed.AddItem "2400"
cboSpeed.AddItem "4800"
cboSpeed.AddItem "9600"
cboSpeed.AddItem "14400"
cboSpeed.AddItem "19200"
cboSpeed.AddItem "28800"
cboSpeed.AddItem "38400"
cboSpeed.AddItem "56000"
cboSpeed.AddItem "57600"
cboSpeed.AddItem "115200"
cboSpeed.AddItem "128000"
cboSpeed.AddItem "256000"
```

```
' Load Data Bit Settings
cboDataBits.AddItem "4"
cboDataBits.AddItem "5"
cboDataBits.AddItem "6"
cboDataBits.AddItem "7"
cboDataBits.AddItem "8"

' Load Parity Settings
cboParity.AddItem "Even"
cboParity.AddItem "Odd"
cboParity.AddItem "None"
cboParity.AddItem "Mark"
cboParity.AddItem "Space"

' Load Stop Bit Settings
cboStopBits.AddItem "1"
cboStopBits.AddItem "1.5"
cboStopBits.AddItem "2"

' Set Default Settings

Settings = FormMain.MSComm1.Settings

' In all cases the right most part of Settings will be 1 character
' except when there are 1.5 stop bits.
If InStr(Settings, ".") > 0 Then
    Offset = 2
Else
    Offset = 0
End If
```



```
cboSpeed.Text = Left$(Settings, Len(Settings) - 6 - Offset)
Select Case Mid$(Settings, Len(Settings) - 4 - Offset, 1)
Case "e"
    cboParity.ListIndex = 0
Case "m"
    cboParity.ListIndex = 1
Case "n"
    cboParity.ListIndex = 2
Case "o"
    cboParity.ListIndex = 3
Case "s"
    cboParity.ListIndex = 4
End Select

cboDataBits.Text = Mid$(Settings, Len(Settings) - 2 - Offset, 1)
cboStopBits.Text = Right$(Settings, 1 + Offset)

cboPort.ListIndex = FormMain.MSComm1.CommPort - 1

optFlow(FormMain.MSComm1.Handshaking).Value = True
If Echo Then
    optEcho(1).Value = True
Else
    optEcho(0).Value = True
End If
End Sub
```

```
Private Sub cmdCancel_Click()  
Unload Me  
End Sub  
  
Private Sub cmdOK_Click()  
Dim OldPort As Integer, ReOpen As Boolean  
  
On Error Resume Next  
  
Echo = iTempEcho  
OldPort = FormMain.MSComm1.CommPort  
NewPort = cboPort.ListIndex + 1  
  
If NewPort <> OldPort Then           ' If the port number changes,  
close the old port.  
    If FormMain.MSComm1.PortOpen Then  
        FormMain.MSComm1.PortOpen = False  
        ReOpen = True  
    End If  
  
FormMain.MSComm1.CommPort = NewPort   ' Set the new port number.  
  
If Err = 0 Then  
    If ReOpen Then  
        FormMain.MSComm1.PortOpen = True  
        frmTerminal.mnuOpen.Checked = FormMain.MSComm1.PortOpen  
        frmTerminal.mnuSendText.Enabled = FormMain.MSComm1.PortOpen  
        frmTerminal.tbrToolBar.Buttons("TransmitTextFile").Enabled =  
FormMain.MSComm1.PortOpen  
    End If
```

```
End If
```

```
If Err Then
```

```
    MsgBox Error$, 48
```

```
    FormMain.MSComm1.CommPort = OldPort
```

```
    Exit Sub
```

```
End If
```

```
End If
```

```
FormMain.MSComm1.Settings = Trim$(cboSpeed.Text) & "," & Left$(cboParity.Text,  
1) _
```

```
    & "," & Trim$(cboDataBits.Text) & "," & Trim$(cboStopBits.Text)
```

```
If Err Then
```

```
    MsgBox Error$, 48
```

```
    Exit Sub
```

```
End If
```

```
FormMain.MSComm1.Handshaking = iFlow
```

```
If Err Then
```

```
    MsgBox Error$, 48
```

```
    Exit Sub
```

```
End If
```

```
SaveSetting App.Title, "Properties", "Settings", FormMain.MSComm1.Settings
```

```
SaveSetting App.Title, "Properties", "CommPort", FormMain.MSComm1.CommPort
```

```
SaveSetting App.Title, "Properties", "Handshaking",  
FormMain.MSComm1.Handshaking
```

```
SaveSetting App.Title, "Properties", "Echo", Echo
```

```
Unload Me
```

```
End Sub
```

```
Private Sub Form_Load()
```

```
    ' Set the form's size
```

```
    Me.Left = (Screen.Width - Me.Width) / 2
```

```
    Me.Top = (Screen.Height - Me.Height) / 2
```

```
    ' Size the frame to fit in the tabstrip control
```

```
    fraSettings.Move tabSettings.ClientLeft, tabSettings.ClientTop
```

```
    ' Make sure the frame is the top most control
```

```
    fraSettings.ZOrder
```

```
    ' Load current property settings
```

```
    LoadPropertySettings
```

```
End Sub
```

```
Private Sub optEcho_Click(Index As Integer)
```

```
    If Index = 1 Then
```

```
        iTempEcho = True
```

```
    Else
```

```
        iTempEcho = False
```

```
    End If
```

```
End Sub
```

```
Private Sub optFlow_Click(Index As Integer)
```

```
iFlow = Index
```

```
End Sub
```

```
Form Main.frm
```

```
VERSION 5.00
```

```
Object = "{648A5603-2C6E-101B-82B6-000000000014}#1.1#0"; "MSCOMM32.OCX"
```

```
Object = "{831FDD16-0C5C-11D2-A9FC-0000F8754DA1}#2.0#0"; "MSCOMCTL.OCX"
```

```
Begin VB.Form FormMain
```

```
Caption = "Circle Pendulum Speed Measurement"
```

```
ClientHeight = 8265
```

```
ClientLeft = 4710
```

```
ClientTop = 525
```

```
ClientWidth = 16800
```

```
Icon = "FormMain.frx":0000
```

```
LinkTopic = "Form1"
```

```
MaxButton = 0 'False
```

```
ScaleHeight = 8265
```

```
ScaleWidth = 16800
```

```
StartPosition = 1 'CenterOwner
```

```
Begin MSComctlLib.ImageList ImageList1
```

```
Left = 15720
```

```
Top = 5160
```

```
_ExtentX = 1005
```

```
_ExtentY = 1005
```

```
BackColor = -2147483643
```

```
ImageWidth = 48
```

```
ImageHeight = 48
```

```
MaskColor = 12632256
```



```
_Version          = 393216
BeginProperty Images {2C247F25-8591-11D1-B16A-00C0F0283628}
  NumListImages   = 4
  BeginProperty ListImage1 {2C247F27-8591-11D1-B16A-00C0F0283628}
    Picture       = "FormMain.frx":030A
    Key           = ""
  EndProperty
  BeginProperty ListImage2 {2C247F27-8591-11D1-B16A-00C0F0283628}
    Picture       = "FormMain.frx":1E5E
    Key           = ""
  EndProperty
  BeginProperty ListImage3 {2C247F27-8591-11D1-B16A-00C0F0283628}
    Picture       = "FormMain.frx":39B0
    Key           = ""
  EndProperty
  BeginProperty ListImage4 {2C247F27-8591-11D1-B16A-00C0F0283628}
    Picture       = "FormMain.frx":5502
    Key           = ""
  EndProperty
EndProperty
End
Begin MSCommLib.MSComm MSComm1
  Left           = 15720
  Top            = 4680
  _ExtentX      = 1005
  _ExtentY      = 1005
  _Version      = 393216
  DTREnable     = -1 'True
  BaudRate      = 38400
```

End

Begin VB.Timer Timer1

Enabled = 0 'False

Interval = 250

Left = 15840

Top = 2880

End

Begin VB.Timer Timer2

Enabled = 0 'False

Interval = 250

Left = 15840

Top = 3240

End

Begin VB.Timer Timer3

Enabled = 0 'False

Interval = 1000

Left = 15840

Top = 3600

End

Begin VB.Timer Timer5

Interval = 1000

Left = 15840

Top = 4320

End

Begin VB.Timer Timer4

Enabled = 0 'False

Interval = 1000

Left = 15840

Top = 3960

End

Begin VB.Frame FrameMain

Caption = "Circle Pendulum Speed Measurement"

BeginProperty Font

Name = "Times New Roman"

Size = 15.75

Charset = 0

Weight = 700

Underline = 0 'False

Italic = 0 'False

Strikethrough = 0 'False

EndProperty

Height = 6495

Left = 120

TabIndex = 16

Top = 1080

Width = 16575

Begin VB.Frame FrameTimeInformation

Caption = "Timing Information"

BeginProperty Font

Name = "Times New Roman"

Size = 14.25

Charset = 0

Weight = 700

Underline = 0 'False

Italic = 0 'False

Strikethrough = 0 'False

EndProperty

Height = 5895

```
Left          = 8280
TabIndex     = 13
Top          = 360
Width        = 8055

Begin VB.TextBox TextRealTime
    Alignment  = 2 'Center
    BackColor  = &H00000000&
    BeginProperty DataFormat
        Type    = 1
        Format   = "00:00:00:00"
    HaveTrueFalseNull= 0
    FirstDayOfWeek = 0
    FirstWeekOfYear = 0
    LCID       = 1054
    SubFormatType = 0
    EndProperty
    BeginProperty Font
        Name      = "Arial"
        Size     = 39.75
        Charset   = 0
        Weight    = 700
        Underline = 0 'False
        Italic    = 0 'False
        Strikethrough = 0 'False
    EndProperty
    ForeColor   = &H00FFFF00&
    Height     = 960
    Left       = 2520
    TabIndex   = 4
```

Text = "00:00:00:00"

Top = 1080

Width = 4575

End

Begin VB.TextBox TextStopTime

Alignment = 2 'Center

BackColor = &H00000000&

BeginProperty DataFormat

Type = 1

Format = "00:00:00:00"

HaveTrueFalseNull= 0

FirstDayOfWeek = 0

FirstWeekOfYear = 0

LCID = 1054

SubFormatType = 0

EndProperty

BeginProperty Font

Name = "Arial"

Size = 39.75

Charset = 0

Weight = 700

Underline = 0 'False

Italic = 0 'False

Strikethrough = 0 'False

EndProperty

ForeColor = &H00FFFF00&

Height = 990

Left = 2520

TabIndex = 1


```
Text          = "00:00:00:00"
Top           = 3240
Width        = 4575
End
Begin VB.TextBox TextDurationTime
Alignment     = 2 'Center
BackColor     = &H00000000&
BorderStyle  = 0 'None
    BeginProperty DataFormat
Type          = 1
Format        = "00:00:00:00"
HaveTrueFalseNull= 0
FirstDayOfWeek = 0
FirstWeekOfYear = 0
LCID          = 1054
SubFormatType = 0
    EndProperty
    BeginProperty Font
Name          = "Arial"
Size         = 39.75
Charset      = 0
Weight       = 700
Underline    = 0 'False
Italic       = 0 'False
trikethrough = 0 'False
    EndProperty
ForeColor    = &H00FFFF00&
Height       = 900
Left         = 2520
```

```
    TabIndex      = 2
    Text          = "00:00:00:00"
    Top          = 4320
    Width        = 4575
End
Begin VB.TextBox TextStartTime
    Alignment      = 2 'Center
    BackColor     = &H00000000&
    BorderStyle   = 0 'None
    BeginProperty DataFormat
        Type       = 1
        Format     = "00:00:00:00"
    EndProperty
    HaveTrueFalseNull= 0
    FirstDayOfWeek = 0
    FirstWeekOfYear = 0
    LCID          = 1054
    SubFormatType = 0
    EndProperty
    BeginProperty Font
        Name       = "Arial"
        Size      = 39.75
        Charset   = 0
        Weight    = 700
        Underline = 0 'False
        Italic    = 0 'False
        Strikethrough = 0 'False
    EndProperty
    ForeColor    = &H00FFFF00&
    Height       = 915
```

```
Left      = 2520
TabIndex  = 3
Text      = "00:00:00:00"
Top       = 2160
Width     = 4560
End
Begin VB.TextBox Text1
    Height  = 885
    Left    = 2520
    TabIndex = 0
    Text    = "Text1"
    Top     = 4320
    Width   = 4575
End
Begin VB.Label LabelRealTime
    Caption = "Real Time"
    BeginProperty Font
        Name      = "Times New Roman"
        Size      = 20.25
        Charset   = 0
        Weight    = 700
        Underline  = 0 'False
        Italic    = 0 'False
        Strikethrough = 0 'False
    EndProperty
    Height     = 495
    Left       = 600
    TabIndex   = 9
    Top        = 1320
```

```
Width      = 1815
End
Begin VB.Label Label10mS
    Alignment   = 2 'Center
    AutoSize    = -1 'True
    Caption     = "10mS"
    BeginProperty Font
        Name      = "Times New Roman"
        Size      = 20.25
        Charset   = 0
        Weight    = 700
        Underline  = 0 'False
        Italic    = 0 'False
    EndProperty
    Strikethrough = 0 'False
    Height      = 465
    Left        = 6000
    TabIndex    = 8
    Top         = 600
    Width       = 1005
End
Begin VB.Label LabelSS
    Alignment   = 2 'Center
    AutoSize    = -1 'True
    Caption     = "SS"
    BeginProperty Font
        Name      = "Times New Roman"
        Size      = 20.25
        Charset   = 0
```

```
Weight      = 700
Underline   = 0  'False
Italic      = 0  'False
Strikethrough = 0  'False
```

```
EndProperty
```

```
Height      = 465
Left        = 5160
TabIndex    = 7
Top         = 600
Width       = 450
```

```
End
```

```
Begin VB.Label LabelMM
```

```
Alignment   = 2  'Center
AutoSize    = -1 'True
Caption     = "MM"
```

```
BeginProperty Font
```

```
  Name      = "Times New Roman"
  Size      = 20.25
  Charset   = 0
  Weight    = 700
  Underline = 0  'False
  Italic    = 0  'False
Strikethrough = 0  'False
```

```
EndProperty
```

```
Height      = 465
Left        = 3840
TabIndex    = 6
Top         = 600
Width       = 765
```


End

Begin VB.Label LabelHH

Alignment = 2 'Center

AutoSize = -1 'True

Caption = "HH"

BeginProperty Font

Name = "Times New Roman"

Size = 20.25

Charset = 0

Weight = 700

Underline = 0 'False

Italic = 0 'False

Strikethrough = 0 'False

EndProperty

Height = 465

Left = 2760

TabIndex = 5

Top = 600

Width = 645

End

Begin VB.Label LabelDuration

Alignment = 2 'Center

AutoSize = -1 'True

Caption = "Duration"

BeginProperty Font

Name = "Times New Roman"

Size = 20.25

Charset = 0

Weight = 700

```
        Underline = 0 'False
        Italic     = 0 'False
Strikethrough   = 0 'False
    EndProperty
    Height       = 465
    Left         = 720
    TabIndex     = 12
    Top          = 4560
    Width        = 1635
End
Begin VB.Label LabelStart
    Alignment     = 2 'Center
    Appearance    = 0 'Flat
    AutoSize      = -1 'True
    Caption       = "Start Time"
    BeginProperty Font
        Name       = "Times New Roman"
        Size       = 20.25
        Charset    = 0
        Weight     = 700
        Underline  = 0 'False
        Italic     = 0 'False
    Strikethrough = 0 'False
    EndProperty
    ForeColor     = &H80000008&
    Height        = 465
    Left          = 480
    TabIndex      = 10
    Top           = 2400
```

```
Width          = 1905
```

```
End
```

```
Begin VB.Label LabelStop
```

```
Alignment      = 2 'Center
```

```
Appearance     = 0 'Flat
```

```
AutoSize       = -1 'True
```

```
Caption        = "Stop Time"
```

```
BeginProperty Font
```

```
Name          = "Times New Roman"
```

```
Size          = 20.25
```

```
Charset       = 0
```

```
Weight        = 700
```

```
Underline     = 0 'False
```

```
Italic        = 0 'False
```

```
Strikethrough = 0 'False
```

```
EndProperty
```

```
ForeColor     = &H80000008&
```

```
Height        = 465
```

```
Left          = 600
```

```
TabIndex      = 11
```

```
Top           = 3480
```

```
Width         = 1815
```

```
End
```

```
End
```

```
Begin VB.Frame FrameMovementInformation
```

```
Caption        = "Moving Information"
```

```
BeginProperty Font
```

```
Name          = "Times New Roman"
```

```
Size          = 14.25
```

```
Charset      = 0
Weight      = 700
Underline    = 0 'False
Italic      = 0 'False
Strikethrough = 0 'False
EndProperty
Height      = 5895
Left        = 240
TabIndex    = 14
Top         = 360
Width       = 7815
Begin VB.Line Line2
BorderStyle = 4 'Dash-Dot
BorderWidth = 3
Visible     = 0 'False
X1          = 4080
X2          = 4080
Y1          = 4680
Y2          = 1200
End
Begin VB.Shape ShapeCircle4
FillColor   = &H8000000F&
FillStyle   = 0 'Solid
Height      = 615
Left        = 3720
Shape       = 3 'Circle
Top         = 3240
Width       = 735
End
```

```
Begin VB.Shape ShapeCircle2
```

```
FillColor = &H8000000F&
```

```
FillStyle = 0 'Solid
```

```
Height = 615
```

```
Left = 3720
```

```
Shape = 3 'Circle
```

```
Top = 4680
```

```
Width = 735
```

```
End
```

```
Begin VB.Shape ShapeCircle3
```

```
FillColor = &H8000000F&
```

```
FillStyle = 0 'Solid
```

```
Height = 615
```

```
Left = 6120
```

```
Shape = 3 'Circle
```

```
Top = 4080
```

```
Width = 735
```

```
End
```

```
Begin VB.Shape ShapeCircle1
```

```
FillColor = &H8000000F&
```

```
FillStyle = 0 'Solid
```

```
Height = 615
```

```
Left = 1320
```

```
Shape = 3 'Circle
```

```
Top = 4080
```

```
Width = 735
```

```
End
```

```
Begin VB.Shape Shape2
```

```
FillColor = &H8000000F&
```



```
FillStyle = 0 'Solid
Height = 1215
Left = 1800
Shape = 2 'Oval
Top = 3720
Width = 4575
End
Begin VB.Line Line4
    BorderWidth = 3
    Visible = 0 'False
    X1 = 4080
    X2 = 4080
    Y1 = 3240
    Y2 = 1200
End
Begin VB.Line Line5
    BorderWidth = 2
    X1 = 600
    X2 = 1200
    Y1 = 4440
    Y2 = 4440
End
Begin VB.Label LabelCStop
    Alignment = 2 'Center
    AutoSize = -1 'True
    Caption = "Stop"
    BeginProperty Font
        Name = "MS Sans Serif"
        Size = 12
```

```
Charset = 222
Weight = 700
Underline = 0 'False
Italic = 0 'False
Strikethrough = 0 'False
```

```
EndProperty
```

```
Height = 300
Left = 600
TabIndex = 19
Top = 4440
Width = 615
```

```
End
```

```
Begin VB.Label LabelCStart
```

```
AutoSize = -1 'True
Caption = "Start"
```

```
BeginProperty Font
```

```
Name = "MS Sans Serif"
Size = 12
Charset = 222
Weight = 700
Underline = 0 'False
Italic = 0 'False
Strikethrough = 0 'False
```

```
EndProperty
```

```
Height = 300
Left = 600
TabIndex = 18
Top = 4080
Width = 615
```

End

Begin VB.Line Line3

BorderStyle = 4 'Dash-Dot

BorderWidth = 3

Visible = 0 'False

X1 = 6480

X2 = 4080

Y1 = 4080

Y2 = 1200

End

Begin VB.Line Line1

BorderWidth = 3

Visible = 0 'False

X1 = 1680

X2 = 4080

Y1 = 4080

Y2 = 1200

End

Begin VB.Shape Shape4

FillStyle = 7 'Diagonal Cross

Height = 615

Left = 3600

Top = 600

Width = 975

End

Begin VB.Shape Shape1

FillColor = &H00FFFF00&

FillStyle = 0 'Solid

Height = 1695

```
Left = 1560
Shape = 2 'Oval
Top = 3480
Width = 5055
End
End
End
Begin MSComctlLib.StatusBar sbrStatus
Height = 435
Left = 120
TabIndex = 17
Top = 7680
Width = 16575
_ExtentX = 29236
_ExtentY = 767
_Version = 393216
BeginProperty Panels {8E3867A5-8586-11D1-B16A-00C0F0283628}
NumPanels = 3
BeginProperty Panel1 {8E3867AB-8586-11D1-B16A-00C0F0283628}
AutoSize = 2
Object.Width = 4419
MinWidth = 4410
Text = "Connect Status :"
TextSave = "Connect Status :"
Key = "Status"
Object.ToolTipText = "Communications Port Status"
EndProperty
BeginProperty Panel2 {8E3867AB-8586-11D1-B16A-00C0F0283628}
AutoSize = 1
```

```
Object.Width      = 20322
MinWidth          = 2
Text              = "Port Settings : "
TextSave          = "Port Settings : "
Key               = "Settings"
Object.ToolTipText = "Communications Port Settings"
EndProperty
BeginProperty Panel3 {8E3867AB-8586-11D1-B16A-00C0F0283628}
  AutoSize        = 2
Object.Width      = 4419
MinWidth          = 4410
Text              = "Connect Time : "
TextSave          = "Connect Time : "
Key               = "ConnectTime"
Object.ToolTipText = "Connect Time"
EndProperty
EndProperty
BeginProperty Font {0BE35203-8F91-11CE-9DE3-00AA004BB851}
  Name            = "MS Sans Serif"
  Size            = 8.25
  Charset         = 222
  Weight          = 700
  Underline       = 0 'False
  Italic          = 0 'False
  Strikethrough   = 0 'False
EndProperty
End
Begin MSComctlLib.Toolbar Toolbar1
  Align           = 1 'Align Top
```



```

Height          = 1050
Left           = 0
TabIndex       = 15
Top            = 0
Width          = 16800
_ExtentX      = 29633
_ExtentY      = 1852
ButtonWidth   = 1455
ButtonHeight  = 1799
Wrappable     = 0 'False
Appearance    = 1
Style         = 1
ImageList     = "ImageList1"
_Version      = 393216

```

```
BeginProperty Buttons {66833FE8-8583-11D1-B16A-00C0F0283628}
```

```
NumButtons     = 15
```

```
BeginProperty Button1 {66833FEA-8583-11D1-B16A-00C0F0283628}
```

```
Enabled        = 0 'False
```

```
Style          = 2
```

```
EndProperty
```

```
BeginProperty Button2 {66833FEA-8583-11D1-B16A-00C0F0283628}
```

```
Enabled        = 0 'False
```

```
Style          = 2
```

```
EndProperty
```

```
BeginProperty Button3 {66833FEA-8583-11D1-B16A-00C0F0283628}
```

```
Enabled        = 0 'False
```

```
Style          = 2
```

```
EndProperty
```

```
BeginProperty Button4 {66833FEA-8583-11D1-B16A-00C0F0283628}
```

```
Enabled          = 0  'False
Style            = 2
EndProperty
BeginProperty Button5 {66833FEA-8583-11D1-B16A-00C0F0283628}
Enabled          = 0  'False
Style            = 2
EndProperty
BeginProperty Button6 {66833FEA-8583-11D1-B16A-00C0F0283628}
Enabled          = 0  'False
Style            = 2
EndProperty
BeginProperty Button7 {66833FEA-8583-11D1-B16A-00C0F0283628}
Caption          = "Comport"
Key              = "Comport1"
Object.ToolTipText = "Comport Setting"
ImageIndex       = 1
EndProperty
BeginProperty Button8 {66833FEA-8583-11D1-B16A-00C0F0283628}
Enabled          = 0  'False
Style            = 2
EndProperty
BeginProperty Button9 {66833FEA-8583-11D1-B16A-00C0F0283628}
Style            = 3
EndProperty
BeginProperty Button10 {66833FEA-8583-11D1-B16A-00C0F0283628}
Caption          = "Start"
Key              = "Start1"
Object.ToolTipText = "Start"
ImageIndex       = 2
```

```
EndProperty
BeginProperty Button11 {66833FEA-8583-11D1-B16A-00C0F0283628}
Enabled      = 0  'False
Style        = 2
EndProperty
BeginProperty Button12 {66833FEA-8583-11D1-B16A-00C0F0283628}
Caption      = "Stop"
Key          = "Stop1"
Object.ToolTipText = "Stop"
ImageIndex   = 3
EndProperty
BeginProperty Button13 {66833FEA-8583-11D1-B16A-00C0F0283628}
Style        = 3
EndProperty
BeginProperty Button14 {66833FEA-8583-11D1-B16A-00C0F0283628}
Enabled      = 0  'False
Style        = 2
EndProperty
BeginProperty Button15 {66833FEA-8583-11D1-B16A-00C0F0283628}
Caption      = "Exit"
Key          = "Exit1"
Object.ToolTipText = "Exit"
ImageIndex   = 4
EndProperty
EndProperty
BorderStyle  = 1
End
End
```

```
Attribute VB_Name = "FormMain"  
Attribute VB_GlobalNameSpace = False  
Attribute VB_Creatable = False  
Attribute VB_PredeclaredId = True  
Attribute VB_Exposed = False  
Option Explicit  
  
Dim StartTime As Date  
Dim z As Double  
Dim t As String  
Dim MovingData As Byte  
  
Dim strbuffer As String  
Dim strbuffer1 As String  
Dim strbuffer2 As String  
  
Dim HourStart As String  
Dim MinuteStart As String  
Dim SecondStart As String  
Dim mSStart As String  
  
Dim HourStop As String  
Dim MinuteStop As String  
Dim SecondStop As String  
Dim mSStop As String  
  
Dim HourDuration As String  
Dim MinuteDuration As String  
Dim SecondDuration As String  
Dim mSDuration As String
```

```
Private Sub Form_Load()
```

```
Dim CommPort As String, Handshaking As String, Settings As String
```

```
Toolbar1.Buttons("Stop1").Enabled = False
```

```
ShapeCircle1.Visible = False
```

```
ShapeCircle2.Visible = True
```

```
ShapeCircle3.Visible = False
```

```
ShapeCircle4.Visible = False
```

```
ShapeCircle2.FillColor = &H8080FF
```

```
Shape1.Visible = False
```

```
Shape2.Visible = False
```

```
Line1.Visible = False
```

```
Line2.Visible = True
```

```
Line3.Visible = False
```

```
Line4.Visible = False
```

```
LabelCStart.Visible = False
```

```
LabelCStop.Visible = False
```

```
Line5.Visible = False
```

```
TextStartTime.Locked = True
```

```
Timer1.Enabled = False
```

```
Timer2.Enabled = False
```

```
Timer3.Enabled = False
```



```
Timer4.Enabled = False
Timer5.Enabled = True
z = Timer

sbrStatus.Panels("ConnectTime").Text = "Present Time : " & Format(Now,
"hh:nn:ss")

Settings = GetSetting(App.Title, "Properties", "Settings", "")
If Settings <> "" Then
    MSComm1.Settings = Settings
    If Err Then
        MsgBox Error$, 48
        Exit Sub
    End If
End If

CommPort = GetSetting(App.Title, "Properties", "CommPort", "")
If CommPort <> "" Then MSComm1.CommPort = CommPort

Handshaking = GetSetting(App.Title, "Properties", "Handshaking", "")
If Handshaking <> "" Then
    MSComm1.Handshaking = Handshaking
    If Err Then
        MsgBox Error$, 48
        Exit Sub
    End If
End If

On Error GoTo 0
```

End Sub

```
Private Sub MSComm1_OnComm()
```

```
'-----  
'           Recive Data  
'-----
```

```
Dim strbuffer As String
```

```
If MSComm1.CommEvent Then
```

```
    strbuffer = MSComm1.Input
```

```
End If
```

```
    strbuffer1 = Right(strbuffer1 & strbuffer, 47)
```

```
    strbuffer2 = Left(strbuffer1, 47)
```

End Sub

```
Private Sub Timer1_Timer()
```

```
'-----  
'           Send Data  
'-----
```

```
If MSComm1.PortOpen = False Then
```

```
    MSComm1.PortOpen = True
```

```
Else
```

```
    MSComm1.OutBufferCount = 0
```

```
    MSComm1.Output = Chr(&H1) & Chr(&H52) & Chr(&HD)
```

```
    MSComm1.RThreshold = 1
```

```
End If
```

End Sub

```
Private Sub Timer2_Timer()  
    MovingData = MovingData + 1  
    Select Case MovingData  
        Case "1"  
            ShapeCircle1.FillColor = &H8080FF  
            Line1.Visible = True  
            Line2.Visible = False  
            Line3.Visible = False  
            Line4.Visible = False  
        Case "2"  
            ShapeCircle2.FillColor = &H8080FF  
            Line1.Visible = False  
            Line2.Visible = True  
            Line3.Visible = False  
            Line4.Visible = False  
        Case "3"  
            ShapeCircle3.FillColor = &H8080FF  
            Line1.Visible = False  
            Line2.Visible = False  
            Line3.Visible = True  
            Line4.Visible = False  
        Case "4"  
            ShapeCircle4.FillColor = &H8080FF  
            Line1.Visible = False  
            Line2.Visible = False  
            Line3.Visible = False  
            Line4.Visible = True  
        Case "5"  
            ShapeCircle1.FillColor = &H800000FF
```

```
ShapeCircle2.FillColor = &H8000000F
ShapeCircle3.FillColor = &H8000000F
ShapeCircle4.FillColor = &H8000000F
LabelCStart.BackColor = &H8000000F
LabelCStop.BackColor = &H8000000F

    Line1.Visible = True
    Line2.Visible = False
    Line3.Visible = False
    Line4.Visible = False
    MovingData = 0
End Select
End Sub

Private Sub Timer3_Timer()
    sbrStatus.Panels("ConnectTime").Text = "Connect Time : " & Format(Now -
StartTime, "hh:nn:ss") & " "
    t = Timer - z

    HourDuration = Mid(strbuffer1, 37, 2)
    MinuteDuration = Mid(strbuffer1, 40, 2)
    SecondDuration = Mid(strbuffer1, 43, 2)
    mSDuration = Mid(strbuffer1, 46, 2)

    TextRealTime.Text = Mid(strbuffer1, 1, 11)
    TextStartTime.Text = Mid(strbuffer1, 13, 11)
    TextStopTime.Text = Mid(strbuffer1, 25, 11)
    TextDurationTime.Text = Mid(strbuffer1, 37, 11)

End Sub
```

```
Private Sub Timer4_Timer()  
    Timer3.Interval = 1000  
    Timer3.Enabled = True  
End Sub  
  
Private Sub Timer5_Timer()  
sbrStatus.Panels("ConnectTime").Text = "Present Time : " & Format(Now,  
"hh:nn:ss")  
End Sub  
  
Private Sub Toolbar1_ButtonClick(ByVal Button As MSComctlLib.Button)  
    Select Case Button.Key  
        Case "Comport1"  
            FormCommPort.Show  
  
        Case "Start1"  
            Timer1.Interval = 250  
            Timer1.Enabled = True  
            Timer2.Enabled = True  
            Timer3.Interval = 1000  
            Timer4.Enabled = True  
            Timer5.Enabled = False  
  
            sbrStatus.Panels("Status").Text = "Status : " & "Connecting"  
            sbrStatus.Panels("Settings").Text = "Port Settings : Port No.:" &  
MSComm1.CommPort & " , Speed : " & MSComm1.Settings  
  
            StartTime = Now
```



```
sbrStatus.Panels("ConnectTime").Text = "Connect Time : " &  
Format(Now - StartTime, "hh:nn:ss") & " "
```

```
Toolbar1.Buttons("Start1").Enabled = False
```

```
Toolbar1.Buttons("Comport1").Enabled = False
```

```
Toolbar1.Buttons("Stop1").Enabled = True
```

```
ShapeCircle1.Visible = True
```

```
ShapeCircle2.Visible = True
```

```
ShapeCircle3.Visible = True
```

```
ShapeCircle4.Visible = True
```

```
Shape1.Visible = True
```

```
Shape2.Visible = True
```

```
Line1.Visible = True
```

```
Line2.Visible = False
```

```
Line3.Visible = False
```

```
Line4.Visible = False
```

```
LabelCStart.Visible = True
```

```
LabelCStop.Visible = True
```

```
Line5.Visible = True
```

```
Case "Stop1"
```

```
ShapeCircle1.Visible = Fals
```

```
ShapeCircle2.Visible = True
```

```
ShapeCircle3.Visible = False
```

```
ShapeCircle4.Visible = False
```

```
ShapeCircle2.FillColor = &H8080FF
```

```
Shape1.Visible = False
```

```
Shape2.Visible = False
```

```
Line1.Visible = False
```

```
Line2.Visible = True
```

```
Line3.Visible = False
```

```
Line4.Visible = False
```

```
LabelCStart.Visible = False
```

```
LabelCStop.Visible = False
```

```
Line5.Visible = False
```

```
TextRealTime.Text = "00:00:00:00"
```

```
TextStartTime.Text = "00:00:00:00"
```

```
TextStopTime.Text = "00:00:00:00"
```

```
TextDurationTime.Text = "00:00:00:00"
```

```
Timer1.Enabled = False
```

```
Timer2.Enabled = False
```

```
Timer3.Enabled = False
```

```
Timer4.Enabled = False
```

```
Timer5.Enabled = True
```

```
MSComm1.PortOpen = False
```

```
sbrStatus.Panels("Status").Text = "Status : " & "Disconnect"
```

```
sbrStatus.Panels("ConnectTime").Text = ""
```

```
sbrStatus.Panels("ConnectTime").Text = "Present Time : " &
```

```
Format(Now, "hh:nn:ss")
```

```
    Toolbar1.Buttons("Start1").Enabled = True
```

```
    Toolbar1.Buttons("Comport1").Enabled = True
```

```
    Toolbar1.Buttons("Stop1").Enabled = False
```

```
Case "Exit1"
```

```
    Unload Me
```

```
End Select
```

```
End Sub
```

คำสั่ง โปรแกรม Scilab

คำสั่งเขียนกราฟแสดงความสัมพันธ์ระหว่าง ความสูงของกรวยวงกลม (h) กับ คาบ (T)

Startup execution:

loading initial environment

```
-->x=[0.01,0.03,0.05,0.08,0.10,0.11,0.13,0.17,0.18,0.19,0.20]'
```

```
x =  
  0.01  
  0.03  
  0.05  
  0.08  
  0.1  
  0.11  
  0.13  
  0.17  
  0.18  
  0.19  
  0.2
```

```
-->y=[0.18,0.37,0.46,0.59,0.66,0.69,0.71,0.78,0.82,0.85,0.93]'
```

```
y =  
  0.18  
  0.37  
  0.46  
  0.59  
  0.66  
  0.69  
  0.71  
  0.78  
  0.82  
  0.85  
  0.93
```

```
-->plot2d(x,y,-2)
```

```
-->xgrid(1)
```

```
-->X=[x.^2 x ones(x)]
```

```
X =
```

0.0001	0.01	1.
0.0009	0.03	1.
0.0025	0.05	1.
0.0064	0.08	1.
0.01	0.1	1.
0.0121	0.11	1.
0.0169	0.13	1.
0.0289	0.17	1.
0.0324	0.18	1.
0.0361	0.19	1.
0.04	0.2	1.

```
-->a=Xy
```

```
a =
```

```
- 13.058515  
 6.1170752  
 0.1660416
```

```
-->xx=[0:0.01:0.20]'
```

```
xx =
```

```
0.  
0.01  
0.02  
0.03  
0.04  
0.05  
0.06  
0.07  
0.08  
0.09  
0.1  
0.11  
0.12  
0.13  
0.14  
0.15  
0.16  
0.17  
0.18  
0.19  
0.2
```



```
-->yy=a(1)*xx.^2+a(2)*xx+a(3)
```

```
yy =
```

```
0.1660416  
0.2259065  
0.2831597  
0.3378012  
0.3898310  
0.4392490  
0.4860554  
0.5302501  
0.5718331  
0.6108044  
0.6471639  
0.6809118  
0.7120480  
0.7405725  
0.7664852  
0.7897863  
0.8104756  
0.8285533  
0.8440192  
0.8568735  
0.8671160
```

```
-->plot2d(xx,yy)
```

```
-->y2=a(1)*x.^2+a(2)*x+a(3)
```

```
y2 =
```

```
0.2259065  
0.3378012  
0.4392490  
0.5718331  
0.6471639  
0.6809118  
0.7405725  
0.8285533  
0.8440192  
0.8568735  
0.8671160
```

```
-->y-y2
```

```
ans =
```

```
- 0.0459065  
 0.0321988  
 0.0207510  
 0.0181669  
 0.0128361  
 0.0090882  
- 0.0305725  
- 0.0485533  
- 0.0240192  
- 0.0068735  
 0.0628840
```

```
-->(y-y2)^2
```

```
ans =
```

```
0.0021074  
0.0010368  
0.0004306  
0.0003300  
0.0001648  
0.0000826  
0.0009347  
0.0023574  
0.0005769  
0.0000472  
0.0039544
```

```
-->sum((y-y2)^2)
```

```
ans =
```

```
0.0120228
```

คำสั่งเขียนกราฟแสดงความสัมพันธ์ระหว่าง ความสูงของกรวยวงกลม (h) กับ คาบกำลังสอง (T^2)

Startup execution:

loading initial environment

```
-->x=[0.01,0.03,0.05,0.08,0.10,0.11,0.13,0.17,0.18,0.19,0.20]'
```

x =

0.01
0.03
0.05
0.08
0.1
0.11
0.13
0.17
0.18
0.19
0.2

```
-->y=[0.18,0.37,0.46,0.59,0.66,0.69,0.71,0.78,0.82,0.85,0.93]'
```

y =

0.18
0.37
0.46
0.59
0.66
0.69
0.71
0.78
0.82
0.85
0.93

```
-->t=y^2
```

t =

0.0324
0.1369
0.2116
0.3481
0.4356
0.4761

```
0.5041
0.6084
0.6724
0.7225
0.8649

-->plot2d(x,t,-2)

-->xgrid(1)

-->X=[x ones(x)]
X =

0.01  1.
0.03  1.
0.05  1.
0.08  1.
0.1   1.
0.11  1.
0.13  1.
0.17  1.
0.18  1.
0.19  1.
0.2   1.

-->a=X\t
a =

3.8273788
0.0207979

-->xx=[0:0.01:0.20]'
xx =

0.
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
```

0.11
0.12
0.13
0.14
0.15
0.16
0.17
0.18
0.19
0.2

-->yy=a(1)*xx+a(2)
yy =

0.0207979
0.0590717
0.0973454
0.1356192
0.1738930
0.2121668
0.2504406
0.2887144
0.3269882
0.3652620
0.4035357
0.4418095
0.4800833
0.5183571
0.5566309
0.5949047
0.6331785
0.6714523
0.7097260
0.7479998
0.7862736

-->plot2d(xx,yy)

-->y2=a(1)*x+a(2)
y2 =

0.0590717
0.1356192

0.2121668
0.3269882
0.4035357
0.4418095
0.5183571
0.6714523
0.7097260
0.7479998
0.7862736

-->t-y2

ans =

- 0.0266717
0.0012808
- 0.0005668
0.0211118
0.0320643
0.0342905
- 0.0142571
- 0.0630523
- 0.0373260
- 0.0254998
0.0786264

-->(t-y2)^2

ans =

0.0007114
0.0000016
0.0000003
0.0004457
0.0010281
0.0011758
0.0002033
0.0039756
0.0013932
0.0006502
0.0061821

-->sum((t-y2)^2)

ans =

0.0143031

คำสั่งเขียนกราฟแสดงความสัมพันธ์ระหว่าง ความสูงของกรวยวงกลม (h) กับ คาบ (T)

ได้จากทฤษฎีและจากการทดลอง

Startup execution:

loading initial environment

```
-->x=[0.01,0.03,0.05,0.08,0.10,0.11,0.13,0.17,0.18,0.19,0.20]'
```

x =

```
0.01
0.03
0.05
0.08
0.1
0.11
0.13
0.17
0.18
0.19
0.2
```

```
-->y=[0.18,0.37,0.46,0.59,0.66,0.69,0.71,0.78,0.82,0.85,0.93]'
```

y =

```
0.18
0.37
0.46
0.59
0.66
0.69
0.71
0.78
0.82
0.85
0.93
```

```
-->X=[x.^2 x ones(x)]
```

X =

```
0.0001  0.01  1.
0.0009  0.03  1.
0.0025  0.05  1.
0.0064  0.08  1.
0.01    0.1   1.
0.0121  0.11  1.
```

```
0.0169 0.13 1.  
0.0289 0.17 1.  
0.0324 0.18 1.  
0.0361 0.19 1.  
0.04 0.2 1.
```

```
-->a=X\y
```

```
a =
```

```
- 13.058515  
6.1170752  
0.1660416
```

```
-->xx=[0:0.01:0.20]'
```

```
xx =
```

```
0.  
0.01  
0.02  
0.03  
0.04  
0.05  
0.06  
0.07  
0.08  
0.09  
0.1  
0.11  
0.12  
0.13  
0.14  
0.15  
0.16  
0.17  
0.18  
0.19  
0.2
```

```
-->yy=a(1)*xx.^2+a(2)*xx+a(3)
```

```
yy =
```

```
0.1660416  
0.2259065  
0.2831597  
0.3378012  
0.3898310  
0.4392490
```

```
0.4860554
0.5302501
0.5718331
0.6108044
0.6471639
0.6809118
0.7120480
0.7405725
0.7664852
0.7897863
0.8104756
0.8285533
0.8440192
0.8568735
0.8671160

-->plot2d(xx,yy)

-->xgrid(1)

-->y2=a(1)*x.^2+a(2)*x+a(3)
y2 =

0.2259065
0.3378012
0.4392490
0.5718331
0.6471639
0.6809118
0.7405725
0.8285533
0.8440192
0.8568735
0.8671160

-->sum((y-y2)^2)
ans =

0.0120228

-->h=[0:0.001:0.20];

-->T=2*%pi*sqrt(h/9.7814);

-->plot2d(h,T,5)
```

คำสั่งเขียนกราฟแสดงความสัมพันธ์ระหว่าง ความสูงของกรวยวงกลม (h) กับ คาบกำลังสอง (T^2)

ได้จากทฤษฎีและการทดลอง

Startup execution:

loading initial environment

```
-->x=[0.01,0.03,0.05,0.08,0.10,0.11,0.13,0.17,0.18,0.19,0.20]'
```

x =

0.01

0.03

0.05

0.08

0.1

0.11

0.13

0.17

0.18

0.19

0.2

```
-->t=[0.03,0.13,0.21,0.34,0.44,0.47,0.51,0.61,0.67,0.73,0.86]'
```

t =

0.03

0.13

0.21

0.34

0.44

0.47

0.51

0.61

0.67

0.73

0.86

```
-->X=[x ones(x)]
```

X =

0.01 1.

0.03 1.

0.05 1.

0.08 1.

0.1 1.

0.11 1.

0.13 1.
0.17 1.
0.18 1.
0.19 1.
0.2 1.

-->a=X\t

a =

3.8576417
0.0161771

-->xx=[0:0.01:0.20]'

xx =

0.
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.11
0.12
0.13
0.14
0.15
0.16
0.17
0.18
0.19
0.2

-->yy=a(1)*xx+a(2)

yy =

0.0161771
0.0547535
0.0933299
0.1319063
0.1704827
0.2090592
0.2476356

```
0.286212
0.3247884
0.3633648
0.4019412
0.4405177
0.4790941
0.5176705
0.5562469
0.5948233
0.6333998
0.6719762
0.7105526
0.7491290
0.7877054

-->plot2d(xx,yy)

-->xgrid(1)

-->y2=a(1)*x+a(2)
y2 =

    0.0547535
    0.1319063
    0.2090592
    0.3247884
    0.4019412
    0.4405177
    0.5176705
    0.6719762
    0.7105526
    0.7491290
    0.7877054

-->sum((t-y2)^2)
ans =

    0.0143031

-->h=[0:0.001:0.20];

-->s=2*%pi*sqrt(h/9.7814);

-->T=s^2;

-->plot2d(h,T,5)
```

คำสั่งหาค่าความเร่งเนื่องจากแรงโน้มถ่วง (g) จากผลการทดลอง

Startup execution:

loading initial environment

```
-->x=[0.01,0.03,0.05,0.08,0.10,0.11,0.13,0.17,0.18,0.19,0.20]'
```

x =

```
0.01
0.03
0.05
0.08
0.1
0.11
0.13
0.17
0.18
0.19
0.2
```

```
-->t=[0.03,0.13,0.21,0.34,0.44,0.47,0.51,0.61,0.67,0.73,0.86]'
```

t =

```
0.03
0.13
0.21
0.34
0.44
0.47
0.51
0.61
0.67
0.73
0.86
```

```
-->X=[x ones(x)]
```

X =

```
0.01  1.
0.03  1.
0.05  1.
0.08  1.
0.1   1.
0.11  1.
0.13  1.
0.17  1.
```

0.18 1.

0.19 1.

0.2 1.

-->a=X\t

a =

3.8576417

0.0161771

-->g=(4*%pi^2)/a

g =

10.233822 0.

-->gg=((g-9.7814)/9.7814)*100

gg =

4.6253262 - 100.