ICS ELECTRONICS
division of Systems West Inc.

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IEEE 488 APPLICATION BULLETIN

CONTROLLING ICS's 8065 WITH AGILENT's SICL LIBRARY

INTRODUCTION

ICS's new 8065 Ethernet-to-GPIB Controller is a VXI-11 compatible device. The 8065 responds to all VXI-11.2 interface commands to operate as an IEEE-488.1 GPIB Controller and control the GPIB interface. This includes transfer data to/from a device, pulse the IFC line, send Device Clear and Device Triggers, set/reset REN, set/reset ATN, perform Serial Polls and to read back the status of the REN, NDAC and SRQ lines. The 8065 also responds to the VXI-11.3 device commands as a Ethernet-to-GPIB gateway to communicate with a GPIB instrument. Note that VXI-11.3 commands only let the 8065 communicate with a GPIB device and do not include the GPIB Controller functions.

VISA layers or libraries were created in the early 1990s to give the Test and Measurement community a standard Application Interface that could be called by anyone's test program. The VISA layers connected with the manufacturer's existing drivers and also provided a VXI-11 client output. VISA libraries were initially used with graphical programs like Agilent's VEE and National Instruments' LabView. Later other programmers begin writing C and Visual Basic language programs with VISA calls.

The problem is most VISA libraries handle VXI-11.3 commands with only minimal or no VXI-11.2 support. This limits the 8065's use as a GPIB Controller since without the VXI-11.2 interface commands, you can not implement IEEE-488.2 protocols like FindLstn nor do simple IEEE-488.1 functions such as writing GPIB Command strings.

AGILENT'S VISA/SICL LIBRARY

Hewlet-Packard (now Agilent) had written their SICL library before the VISA Specification was generated. Their SICL Library was essentially the same concept as the VISA Specification except it did not have the VISA standard API. However it has a complete VXI-11.2 and VXI-11.3 capability. Agilent's VISA layer sits on top of their SICL library and calls the SICL library to interface with the hardware drivers and to be the VXI-11 client. Unfortunately Agilent's VISA layer appears to only make VXI-11.3 calls which limits its usefulness with the 8065.

THE SOLUTION

The solution is to write programs for the 8065 that make SICL calls and to bypass Agilent's VISA layer altogether. SICL's VXI-11.2 commands enable all of the 8065's GPIB Controller capabilities and give the programmer a complete IEEE-488.1 and 488.2 capability. At the same time, direct SICL calls speed up the program and eliminate a useless software layer.

This Application Note covers how to write a SICL program in Visual Basic and includes a complete example program (SICL_kybd) that you can use as the starting point for your own program. SICL_kybd is an interactive keyboard control program that lets you control GPIB instruments directly from your keyboard. The example is complete with the source files, comments and a help file.

C and other language programmers can follow the steps outlined in this Application Note to create their own SICL program.

SICL LIBRARY AVAILABILITY

Agilent has upgraded their VISA/SICL libraries with their latest release of the Agilent IO Libraries Suite 14.1. The IO Libraries Suite can be downloaded from Agilent's website and is currently licensed at no charge to any user of their equipment. (If you don't have an HP/Agilent instrument in your company, you probably shouldn't be reading this application note.)

Agilent supplies an excellent guide to SICL programming (SICL User's Guide) that lists all of SICL's functions and provides easy to follow instructions for creating a LAN Session and for controlling GPIB devices through a LAN Interface like the 8065. The on-line Help file defines all of the SICL functions.

If you have done any amount of GPIB programming, the SICL library is pretty easy to use. The SICL keyboard example includes functions for completeness that the average programmer might never implement and uses just 15 SICL functions. These are the SICL functions for GPIB Device Sessions, GPIB Interface Sessions and some SICL LAN Functions.

PROGRAM EXAMPLE

ICS has written an interactive SICL keyboard program to show how to use Agilent's SICL Library. Figure 1 shows the SICL_kybd program's main form . The program listing is shown in Figure 2 at the end of this Application Note.

SICL_kybd is a fairly simple program that creates links to the 8065 and to a device so that the 8065 can transfer data to/from the device and send it other GPIB commands. VB Control buttons are provided to initiate the functions. They are enabled as the user steps through the program to give the user a feel for what he/she can do next. Two timer routines are included as part of the program.

Timer1 runs the IDN and the CMD loops which the user can turn on or off. The IDN loop continuously queries a device's IDN message until stopped. The IDN message is placed in the txtResults window. The CMD Loop executes the command in the comboCmd box. If the command string contains a '?', the read function is called to query the device. The response is placed in the txtResults window. A loop counter is incremented each time Timer1 executes the command.

Timer2 runs the background KeepAlive function. Refer to the Keep Alive comments on page 3 and in the 8065 Instruction Manual.

The program is not as complicated as it looks like at first glance. The functions include many VB Control commands that enable/ disable the controls to guide the user through the program. Since SICL_kybd was adapted from an existing GPIB program it also has many variables for GPIB commands. Ignore them and just look for the SICL-GPIB control commands. The complete SICL_kybd program can be downloaded from ICS's website.

The remainder of this application note describes how the program was put together.

LAN PROGRAMMING BASICS

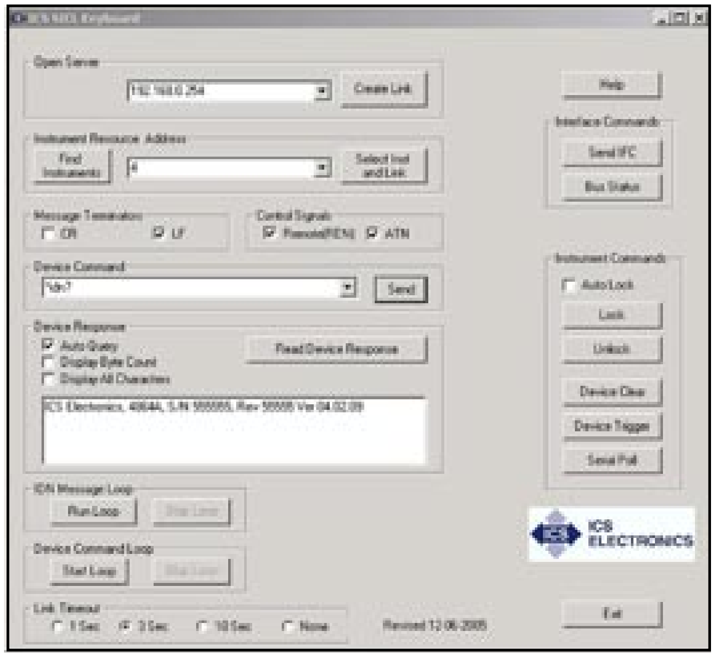
VXI-11 compliant products with LAN interfaces like the 8065 need to be identified and linked to before you can use the 8065 to control the GPIB bus. The SICL_kybd program has a comboBox where the user can enter the 8065's IP address. The Create Link button calls the cmdLink function that closes any open links and then opens an interface link to the 8065's IP address.

The hardest part of the cmdLink function and the SICL library programming was formatting the iopen command for an IP address. The correct interface link format for the 8065 is:

```
intfc = iopen(“lan;vxi-11[192.168.0.254]:gpib”)
```

Note that the command ends with just 'gpib' specified for the interface link to the 8065. The IP address shown above is for the 8065's default IP address. The program actually inserts the IP address from the comboBox if the user entered an address in the comboBox.

At this point you can send the 8065 commands to pulse the ICS line, to set/reset the ATN and REN lines, and to read back some GPIB bus signals.



Open Server: 192.168.0.254

Instrument Resource Address: 4

Message Termination: CR [✓ LF]

Control Signals: [✓ Remote(REN)] [✓ ATN]

Device Command: *idn?

Device Response: [✓ Auto Query] Display Byte Count Display All Characters

ICS Electronics, 4864A, S/N 555555, Rev 55555 Ver 04.02.09

Link Timeout: 1 Sec [✓ 3 Sec] 10 Sec None

Revised 12-06-2005

SICL Keyboard with IDN message

INSTRUMENT COMMUNICATION

VXI-11 instrument communication requires that you identify and link to the instrument that you want to control. The SICL_kybd program has a Find Instruments button that calls cmdFindInst. cmdFindInst is a simple 488.2 Find Listener protocol routine that only checks for devices with primary GPIB addresses. The results are shown in the comboInst box next to the Find Instrument button. The user selects the desired instrument address and clicks the Create Link button to link to the instrument.

The cmdFindInst routine checks all GPIB addresses from 0 to 30 for a low NRFD line from an addressed GPIB device. It skips the 8065's GPIB address and it does not check for secondary addresses. The user can add secondary addresses to the test to create a true general purpose Find Listener routine. The routine creates an address list, addrlist(I), which can be saved and used in other 488.2 protocols such as FindRQS.

The Create (Instrument) Link button calls the cmdLinki function which closes any open device link and then opens a link to the specified device. The SICL_kybd program was designed to control only one device at a time. However in a real application, the user would create links to multiple devices at the same time in his program. The correct device link format is:

```
dev = iopen(“lan;vxi-11[192.169.0.254]:gpib,”) + Str$(Device)
```

The IP address is the same address used for the 8065 link. Note that the device link command ends with 'gpib,n' to specify a GPIB device with primary address of *n*.

At this point all of the device GPIB functions like write/read, Device Trigger, Device Clear and Serial Poll can be exercised. If the Device Trigger or Device Clear commands are called with the devices's handle, dev, the device is addressed to listen and the GPIB SDC or GET command is sent to the specified device.

LIMITED NUMBER OF FUNCTIONS

Table 1 lists the 15 SICL functions used in the SICL_kybd program. Most GPIB programs use a less than 15 functions to communicate with and control GPIB instruments. A SICL program adds four additional functions to open/close links and to lock/unlock links.

Most of SICL_kybd's functions include an 'On Error GoTo ErrorHandler' line before calling the SICL function and an Error handler routine at the end of the function. The SICL library returns errors as a Visual Basic error. For more details refer to Agilent's SICL User Guide.

INSTRUMENT LOCKING

Instrument locking is important if you are using the 8065 in a situation where it can be accessed by multiple client applications. Without locking you would have no assurance that another client could not access one of your devices and change its settings and alter your test results. Locking is not necessary in the engineering lab but it should be incorporated into the program before it is released to production.

Locking is best done at the device level. By locking the devices, you prevent a second user from accessing them until you release the locks. See the section on locking in the 8065 manual.

The SICL_kybd program has an Auto Lock feature that can be used to automatically lock an instrument when a command or query is sent to an instrument and then unlock it after the command or when 8065 has received the response to the query.

CLOSING LINKS AND THE KEEP ALIVE FUNCTION

All LAN links need to be closed when you exit the program. Keep track of any open links and close all of them in the Exit routine. See the cmdExit routine.

The 8065 and your client may close the links when they discover that they have been inactive for a period of time. If your application has to pause for a period of time, such as over lunch breaks, equipment setup changes or UUT changes, it is best to implement a background KeepAlive function that will prevent link closure. The SICL_kybd program does this in the Timer2 function by momentarily opening and closing a second link to the device and by checking the GPIB bus status on the 8065 interface link. This is done on a once a minute basis when the main portion of the program is idle.

PROGRAM DEBUGGING

ICS provides an ErrorLog Utility program that retrieves error messages from the 8065 and displays them in a DOS box. The ErrorLog Utility is useful to run during program development time since it helps correct command syntax and other errors.

Note that SICL's iopen function has two minor VXI-11 errors that are displayed by the ErrorLog Utility. They are a REN call to an instrument and a bad docomand. They cause the 8065 to blink its ERR LED and record the errors but do not stop the 8065 from opening the interface link. Agilent has prepared a patch to correct this problem.

TABLE 1 SICL_KYBD COMMANDS
(USED IN SICL_KYBD PROGRAM)

Function	Description
iclear	Performs a GPIB interface clear (pulses IFC), which resets the GPIB interfaces or clears a device.
iclose	Closes a SICL session
igpibatnctl	Sets or clears the ATN line.
igpibbusstatus	Returns requested GPIB bus data.
igpibrenctl	Sets or clears the REN line.
igpibsendcmd	Sends data with ATN line set.
ilock	Locks a session to ensure exclusive use of a resource.
iopen	Opens a SICL session.
iread	Reads the data from a specified device or interface.
ireadstb	Reads the status byte from a specified device (Performs a Serial Poll)
itermchr	Definess a termination character condition.
itimeout	Sets GPIB bus timeout.
itrigger	Sends a GPIB trigger command (GET) to a specified device or interface.
iunlock	Unlocks a session to free the resource.
iwrite	Sends the data to a specified device or interface.

SUMMARY

This Application Note has shown how to overcome the lack of VXI-11.2 commands in the popular VISA libraries by programming ICS's 8065 Ethernet-to-GPIB Controller with calls to Agilent's SICL library. LabView and LabWindows users can install SICL by installing the Agilent VISA as the secondary VISA. This leaves the NI VISA in place and yet provides a way to make VXI-11.2 calls through the SICL library.

This Application Note also described how to write a Visual Basic program by examining ICS's SICL_kybd program. SICL_kybd is an interactive instrument control program that was adapted from ICS's VXI-11kybd program. Because it is general purpose program it includes many flags and variables that are not necessary in a user's test program. It also has extensive error checking to alert the user to any problem he may encounter. Notes and programming instructions are included to help the programmer avoid time consuming pitfalls.

SICL turned out to be a very easy library to use. Agilent's documentation is very clear and easy to follow. The hardest part of converting a GPIB program to one that uses SICL calls was getting the address format correct for the iopen function.

```
'*******************************************************
'  Visual Basic SICL _kybd Program                        12-20-05
'  Copyright 2005 ICS Electronics div Systems West, Inc.
'
'  Program controls VXI-11.2 Interfaces and VXI-1.3 Instruments
'  11-30-05 Adapted from VXI-1 Keyboard Program for Agilent SICL
                            Library
' *******************************************************
'  Project Changes
'  12-05-05 Cleaned up KeepAlive and AutoLock
'  12-06-05 Revised help file for SICLkybd
'  12-20-05 Cleaned up for AB48-40
' *******************************************************


'Option Explicit
Dim intfc As Integer           'interface handle
Dim dev As Integer             'device handle
Dim CmdStr As String
Dim SPACE80S As String
Dim OutFlag
Public Linknum As Long          'from create link
Public LinknumI As Long         'from create linki
Dim server As String            'from cmdLink
Public NL
Public Sendlock                'Send locked device flag
Public Msg_Format$
Public cmd$
Public FirstTimeFlg
Public MsgSentFlg               'set by cmdSend, reset by Timer2
Public Setpointoff
Public Ctlraddr%
Public Device                  'ppss address form
Public pad%                    'from findList
Public sad%                    'from findList
Public eos%
Public Er%
Public vtmo%                    'current Timeout Setting
Public Testnum
Public IDNTestFlg
Public CMDloopFlg
Public LpCount
Public TestHalt                'stops any test loop
Public founddev%                'address of the first found device
Public FoundFlg     'flag indicates a device was found or address set
Public FoundNum                 'number of found devices
Dim Devlist%(64)                'list of found devices
Const winPictureBox = 2016002
Const winCommandButton = 2007557
Dim Outbuf As String * 6000
Dim Inbuf As String * 10000

Private Sub ckATN_Click()
   txtError.Visible = False
   If intfc <> 0 Then
      If ckATN.value = 1 Then
          mode& = 1
      Else
          mode& = 0
      End If
      On Error GoTo ErrorHandler
       Call igpibatnctl(intfc, mode&)                       'set/clear
                            ATN
      If mode& = 1 Then
         txtResults.Text = "ATN Asserted"
      Else
         txtResults.Text = "ATN deasserted"
      End If
   End If
GoTo atnexit:
ErrorHandler:
   txtError.Text = "Check ATN error" & NL & Error$ & " - Retry"
   txtError.Visible = True
   Beep
atnexit:
End Sub

Private Sub ckAutoLock_Click()
   If ckAutoLock.value = 1 Then
      If Sendlock = 1 Then                    'test for existing lock
         ckAutoLock.value = 0
      Else
         cmdLock.Enabled = False
         cmdUnlock.Enabled = False
      End If
   Else
      cmdLock.Enabled = True
      cmdUnlock.Enabled = True
   End If
End Sub

Private Sub ckCR_Click()
   On Error GoTo ErrorHandler
   If ckCR.value = 1 Then
     term% = 13                             'set termination for CR or EOI
     Call itermchr(dev, term%)
   End If
   GoTo ckCRexit:
ErrorHandler:
    txtError.Text = "Termination character error" & NL & Error$ & "
                            - Retry"
   txtError.Visible = True
   Beep
ckCRexit:
End Sub

Private Sub ckLF_Click()
   On Error GoTo ErrorHandler
   If ckLF.value = 1 Then
     term% = 10                             'set termination for LF or EOI
     Call itermchr(dev, term%)
   End If
   GoTo ckLFexit:
ErrorHandler:
    txtError.Text = "Termination character error" & NL & Error$ & "
                            - Retry"
   txtError.Visible = True
   Beep
ckLFexit:
End Sub

Private Sub cmdDT_Click()
   txtError.Visible = False
   combCmd.Text = ""
   txtResults.Text = ""
   If dev = 0 Then
       txtResults.Text = "No devices linked. Select and link to a de-
```

Figure 1   SICL Keyboard Program Listing

```
                              vice”
        txtError.Visible = True
        Beep
        GoTo DTexit:
    End If
    On Error GoTo ErrorHandler
    Call itrigger(dev)
    txtError.Visible = False
    txtResults.Text = “Device Trigger sent to device “ & Str$(pad%)
    MsgSentFlg = 1       ‘sets flag to show that the link was exercized
    GoTo DTexit:
ErrorHandler:
     txtError.Text = “Device Trigger error” & NL & Error$ & “ - Re-
                              try”
    txtError.Visible = True
    Beep
DTexit:
End Sub

Private Sub cmdFindInst_Click()
    txtError.Visible = False
    cmdLinki.Enabled = False
    cmdSend.Enabled = False
    cmdRead.Enabled = False
    cmdIDNtst.Enabled = False
    cmdIDNtstoff.Enabled = False
    cmdCmdtst.Enabled = False
    cmdCmdtstoff.Enabled = False
    cmdLock.Enabled = False
    cmdUnlock.Enabled = False
    cmdSDC.Enabled = False
    cmdDT.Enabled = False
    cmdSpoll.Enabled = False
    ckCR.Enabled = False
    ckLF.Enabled = False
    ckCR.value = 0
    ckLF.value = 1
    ckAutoQuery.Enabled = False
    ckAutoLock.Enabled = False
    ckAutoLock.value = 0
    ckByteCnt.Enabled = False
    combInst.Clear
    combCmd.Text = “”
    NOADDR = -1
    If dev <> 0 Then                    ‘disable any prior device link
        Call iclose(dev)
        lbliLock.Visible = False
        dev = 0
    End If
    Call igpibbusstatus(intfc, 8, result%)     ‘get intfc GPIB addr
    Ctlraddr% = result%

    Dim addrlist%(32)
    limit% = 32
    foundaddr& = 0
     txtResults.Text = “FindInst: Wait while looking for VXI-11 de-
                              vices”
    txtResults.Refresh
    On Error GoTo ErrorHandler                ‘install error handler
    i = 0
    For id = 0 To 30                          ‘all GPIB primary addr
        If id <> Ctlraddr% Then
            CmdStr$ = Chr$(63) + Chr$(64 + Ctlraddr%) + Chr$(32 +
                              id)
            Call igpibsendcmd(intfc, CmdStr$, 3)
            Call igpibatnctl(intfc, 0)
            Call igpibbusstatus(intfc, 3, result%)  ‘get NDAC status
            If result% <> 0 Then
                addrlist%(i) = id
                i = i + 1
            End If
            CmdStr$ = Chr$(63)
            Call igpibsendcmd(intfc, CmdStr$, 1)
        End If
    Next id
    addrlist%(i) = NOADDR             ‘NOADDR = GPIB address of -1

    For i = 0 To 63                         ‘put found device addr in combbox
        If addrlist%(i) = NOADDR Then Exit For
        combInst.AddItem addrlist%(i), (i)
    Next i
    If i = 0 Then
        txtResults.Text = “FindInst: No VXI-11 devices found”
        GoTo finddexit:
    ElseIf i = 1 Then
         txtResults.Text = “FindInst: Found “ & Str$(i) & “ VXI-11 de-
                              vice”
    Else
         txtResults.Text = “FindInst: Found “ & Str$(i) & “ VXI-11 de-
                              vices”
    End If
    txtResults.Text = txtResults.Text & NL & “Select a device and press
                              Create Link”
    cmdLinki.Enabled = True
    MsgSentFlg = 1     ‘sets flag to show that the link was exercized
    GoTo finddexit:
ErrorHandler:
     txtError.Text = “Create device link error” & NL & Error$ & “
                              - Retry”
    txtError.Visible = True
    Beep
finddexit:
End Sub

Private Sub cmdLink_Click()                ‘create Server link
    txtError.Visible = False
    txtError.Refresh
    cmdFindInst.Enabled = False
    cmdLinki.Enabled = False
    cmdIFC.Enabled = False
    cmdStatus.Enabled = False
    cmdSend.Enabled = False
    cmdRead.Enabled = False
    cmdIDNtst.Enabled = False
    cmdIDNtstoff.Enabled = False
    cmdCmdtst.Enabled = False
    cmdCmdtstoff.Enabled = False
    cmdIFC.Enabled = False
    cmdStatus.Enabled = False
    cmdLock.Enabled = False
    cmdUnlock.Enabled = False
    cmdSDC.Enabled = False
    cmdDT.Enabled = False
    cmdSpoll.Enabled = False
```

Figure 1 SICL Keyboard Program Listing Continued

```
   ckCR.Enabled = False
   ckLF.Enabled = False
   ckRen.Enabled = False
   ckATN.Enabled = False
   ckAutoLock.Enabled = False
   ckAutoLock.value = 0
   ckCR.value = 0
   ckLF.value = 1
   ckAutoQuery.Enabled = False
   ckByteCnt.Enabled = False
   combInst.Clear
   combCmd.Text = ""
   If dev <> 0 Then                  'disable any prior device link
      Call iclose(dev)
      lbliLock.Visible = False
      dev = 0
   End If
   If intfc <> 0 Then                'disable any prior link
      Call iclose(intfc)
      intfc = 0
   End If

   On Error GoTo ErrorHandler            'install error handler
   ip$ = combSrvrs.Text
   If ip$ = "" Then ip$ = "192.168.0.254"
    CmdStr$ = "lan;vxi-11[" + ip$ + "]:gpib"    'lan[128.10.0.3]:gpib
                              Correct)
   intfc = iopen(CmdStr$)              'intfc refers to the 8065

   cmdFindInst.Enabled = True
   cmdIFC.Enabled = True
   cmdStatus.Enabled = True
   ckRen.Enabled = True
   ckATN.Enabled = True
   ckRen.value = 1
   ckATN.value = 1
   combSrvrs.Text = ip$
   server = ip$
   txtResults.Text = "Link created to server " & server
   optTimeout(0).Enabled = True
   optTimeout(1).Enabled = True
   optTimeout(2).Enabled = True
   optTimeout(3).Enabled = True
   optTimeout(1).value = True
   MsgSentFlg = 1      'sets flag to show that the link was exercized
   GoTo linkexit:
ErrorHandler:
    txtError.Text = "Create interface link error" & NL & Error$ & "
                              - Retry"
   txtError.Visible = True
   Beep
linkexit:
End Sub

Private Sub cmdLinki_Click()
   txtError.Visible = False
   cmdSend.Enabled = False
   cmdRead.Enabled = False
   cmdIDNtst.Enabled = False
   cmdIDNtstoff.Enabled = False
   cmdCmdtst.Enabled = False
   cmdCmdtstoff.Enabled = False
   cmdLock.Enabled = False
   cmdUnlock.Enabled = False
   cmdSDC.Enabled = False
   cmdDT.Enabled = False
   cmdSpoll.Enabled = False
   ckCR.Enabled = False
   ckLF.Enabled = False
   ckAutoLock.Enabled = False
   ckAutoLock.value = 0
   ckCR.value = 0
   ckLF.value = 1
   ckAutoQuery.Enabled = False
   ckByteCnt.Enabled = False
   combCmd.Text = ""
   If dev <> 0 Then                  'disable any prior device link
      Call iclose(dev)
      lbliLock.Visible = False
      dev = 0
   End If
   Device = combInst.Text
   If Device >= 0 And Device <= 30 Then
      pad% = Device
      sad% = 0
   ElseIf Device > 100 And Device <= 3030 Then
      L = Len(combInst.Text)     'get new device primary address
      If L = 3 Then
         pad% = Val(Left$(combInst.Text, 1))
         sad% = Val(Mid$(combInst.Text, 2, 2))
      ElseIf L = 4 Then
         pad% = Val(Left$(combInst.Text, 2))
         sad% = Val(Mid$(combInst.Text, 3, 2))
       Else
         txtError.Text = "Length of address is out of range, reenter"
         txtError.Visible = True
         GoTo Linkiexit:                 'cmdLinki error exit
      End If
   End If
   On Error GoTo ErrorHandler
   ip$ = combSrvrs.Text
      CmdStr$ = "lan;vxi-11[" + ip$ + "]:gpib," + Str$(Device)
                        'lan[128.10.0.3]:gpib,device Correct)
   dev = iopen(CmdStr$)       'dev refers to the GPIB device
   txtResults.Text = "Link created to instrument at " & server & "," &
                        Str$(pad%) & "," & Str$(sad%)
   cmdSend.Enabled = True
   cmdRead.Enabled = True
   cmdIDNtst.Enabled = True
   cmdIDNtstoff.Enabled = False
   cmdCmdtst.Enabled = True
   cmdCmdtstoff.Enabled = False
   cmdLock.Enabled = True
   cmdUnlock.Enabled = True
   cmdSDC.Enabled = True
   cmdDT.Enabled = True
   cmdSpoll.Enabled = True
   ckCR.Enabled = True
   ckLF.Enabled = True
   ckAutoLock.Enabled = True
   ckCR.value = 0
   ckLF.value = 1
   ckAutoQuery.Enabled = True
   ckByteCnt.Enabled = True
   If optTimeout(0).value = True Then Call optTimeout_Click(0)
   If optTimeout(1).value = True Then Call optTimeout_Click(1)
   If optTimeout(2).value = True Then Call optTimeout_Click(2)
   MsgSentFlg = 1      'sets flag to show that the link was exercized
   GoTo Linkiexit:
```

Figure 1   SICL Keyboard Program Listing Continued

```
ErrorHandler:
      txtError.Text = “Create device link error” & NL & Error$ & “
                               - Retry”
   txtError.Visible = True
   Beep
Linkiexit:
End Sub

Private Sub cmdLock_Click()
   On Error GoTo ErrorHandler
   Call ilock(dev)
   txtError.Visible = False
   txtResults.Text = “Device “ & Str$(pad%) & “ locked”
   lbliLock.Visible = True
   lbliLock.Refresh
   Sendlock = 1                ‘sets locked flag
   MsgSentFlg = 1       ‘sets flag to show that the link was exercized
   GoTo lockexit:
ErrorHandler:
   txtError.Text = “Lock error” & NL & Error$ & “ - Retry”
   txtError.Visible = True
   Beep
lockexit:
End Sub

Private Sub cmdSDC_Click()
   txtError.Visible = False
   combCmd.Text = “”
   txtResults.Text = “”
   If dev = 0 Then
         txtResults.Text = “No devices linked. Select and link to a de-
                               vice”
      txtError.Visible = True
      Beep
      GoTo SDCexit:
   End If
   On Error GoTo ErrorHandler
   Call iclear(dev)
   txtError.Visible = False
   txtResults.Text = “Device Clear sent to device “ & Str$(pad%)
   MsgSentFlg = 1       ‘sets flag to show that the link was exercized
   GoTo SDCexit:
ErrorHandler:
   txtError.Text = “Check REN error” & NL & Error$ & “ - Retry”
   txtError.Visible = True
   Beep
SDCexit:
End Sub

Private Sub cmdStatus_Click()
   txtError.Visible = False
   On Error GoTo ErrorHandler
   Call igpibbusstatus(intfc, 1, result%)                   ‘get REN
   If result% <> 0 Then result% = 1 ‘corrects SICL 256 response to 1
   txtResults.Text = “REN =” & Str$(result%)
   Call igpibbusstatus(intfc, 2, result%)                   ‘get SRQ
   If result% <> 0 Then result% = 1
      txtResults.Text = txtResults.Text & NL & “SRQ =” &
                               Str$(result%)
   Call igpibbusstatus(intfc, 3, result%)                  ‘get NDAC
   If result% <> 0 Then result% = 1
      txtResults.Text = txtResults.Text & NL & “NDAC =” &
                               Str$(result%)
```

```
   MsgSentFlg = 1       ‘sets flag to show that the link was exercized
   GoTo queryexit:
ErrorHandler:
   txtError.Text = “Read Status error” & NL & Error$ & “ - Retry”
   txtError.Visible = True
   Beep
queryexit:
End Sub

Private Sub cmdUnlock_Click()
   On Error GoTo ErrorHandler
   Call iunlock(dev)
   txtError.Visible = False
   txtResults.Text = “Device “ & Str$(pad%) & “ unlocked”
   lbliLock.Visible = False
   Sendlock = 0                ‘clears locked flag
   MsgSentFlg = 1    ‘sets flag to show that the link was exercized
   GoTo unlockexit:

ErrorHandler:
   txtError.Text = “Unlock error” & NL & Error$ & “ - Retry”
   txtError.Visible = True
   Beep
unlockexit:
End Sub

Private Sub combInst_Change()
   cmdLinki.Enabled = True
End Sub

Private Sub combSrvrs_Change()
  ‘ cmdLink.Enabled = True
End Sub

  Private Sub Form_DblClick()
       CommonDialog1.HelpFile = “C:\VB6\VXI-11kybd\help\VXI-
                          11kybd_help.chm”
    CommonDialog1.HelpCommand = cdlHelpContents
    CommonDialog1.ShowHelp
  End Sub

Private Sub Tdelay(delaytime)
  starttime = Timer
  Do Until Timer >= starttime + delaytime
  Loop
End Sub

Private Sub ckRen_Click()
   txtError.Visible = False
   If intfc <> 0 Then
      If ckRen.value = 1 Then
         mode& = 1
      Else
         mode& = 0
      End If
      On Error GoTo ErrorHandler
      Call igpibrenctl(intfc, mode&)
      If mode& = 1 Then
         txtResults.Text = “REN Asserted”
      Else
         txtResults.Text = “REN deasserted”
      End If
   End If
```

Figure 1   SICL Keyboard Program Listing Continued

```
    GoTo renexit:

ErrorHandler:
    txtError.Text = “Check REN error” & NL & Error$ & “ - Retry”
    txtError.Visible = True
    Beep
renexit:
End Sub

Private Sub cmdCmdtst_Click()
        If combCmd.Text = “” Then
            Beep
            txtResults.Text = “No command specified.  Enter a command
                        before starting the Command Loop”
        Else
            CMDloopFlg = 1
            TestHalt = 0
            Timer1.Interval = 250
            cmdCmdtst.Enabled = False
            cmdCmdtstoff.Enabled = True
        End If
End Sub

Private Sub cmdCMDtstoff_Click()
    CMDloopFlg = 0
    cmdCmdtst.Enabled = True
    cmdCmdtstoff.Enabled = False
    If (CMDloopFlg = 0) And (IDNTestFlg = 0) Then
        txtCount.Visible = False
        lblCount.Visible = False
        LpCount = 0
        TestHalt = 0
        Timer1.Interval = 0                ‘turn timer off
    End If

End Sub

Private Sub cmdExit_Click()
    If dev <> 0 Then                        ‘disable any prior device link
        Call iclose(dev)
        lbliLock.Visible = False
        dev = 0
    End If
    If intfc <> 0 Then                      ‘disable any prior interface link
        Call iclose(intfc)
    End If
    End
End Sub

Private Sub cmdHelp_Click()
   ‘ HTML Help file launched in response to a button click:
      ‘Private Sub HH_DISPLAY_Click()
      ‘hWnd is a Long defined elsewhere to be the window handle
      ‘that will be the parent to the help window.
       Dim hwndHelp As Long
            ‘The return value is the window handle of the created help
                        window.
      hwndHelp = HtmlHelp(hWnd, “SICLkybd_help.chm”, HH_DIS-
                        PLAY_TOPIC, 0)
        ‘ cdbHelp.HelpFile = “\help\SICLkybd_help.chm”
        ‘ cdbHelp.ShowHelp
End Sub
```

```
Private Sub cmdIDNtst_Click()
    combCmd.Text = “*idn?”
    Timer1.Interval = 250
    IDNTestFlg = 1
    TestHalt = 0
    cmdIDNtst.Enabled = False
    cmdIDNtstoff.Enabled = True
End Sub

Private Sub cmdIDNtstoff_Click()
    IDNTestFlg = 0
    cmdIDNtst.Enabled = True
    cmdIDNtstoff.Enabled = False
    If (CMDloopFlg = 0) And (IDNTestFlg = 0) Then
        txtCount.Visible = False
        lblCount.Visible = False
        LpCount = 0
        TestHalt = 0
        Timer1.Interval = 0
    End If
End Sub

Private Sub cmdIFC_Click()
    txtError.Visible = False
    combCmd.Text = “”
    On Error GoTo ErrorHandler
    Call iclear(intfc)                      ‘pulse IFC
    ckRen.value = 1
    ckATN.value = 0
    IDNTestFlg = 0
    cmdIDNtst.Enabled = True
    cmdIDNtstoff.Enabled = False
    CMDloopFlg = 0
    cmdCmdtst.Enabled = True
    cmdCmdtstoff.Enabled = False
    txtCount.Visible = False
    lblCount.Visible = False
    txtResults.Text = “IFC Sent”
    GoTo IFCexit:
ErrorHandler:
    txtError.Text = “Send IFC error” & NL & Error$ & “ - Retry”
    txtError.Visible = True
    Beep
IFCexit:
End Sub

Private Sub cmdIOloop_Click()
    IOloopFlg = 1
End Sub

Private Sub cmdIOloopoff_Click()
   IOloopFlg = 0
   If (IOloopFlg = 0) And (IDNTestFlg = 0) Then
      txtCount.Visible = False
      lblCount.Visible = False
      LpCount = 0
   End If
End Sub

Private Sub cmdRead_Click()
    txtError.Visible = False
    If dev = 0 Then
        txtResults.Text = “No devices linked. Select a device and create
                        link”
```

Figure 1   SICL Keyboard Program Listing Continued

```
      txtError.Visible = True
      Beep
      GoTo Readexit:
   End If
    If ckAutoLock.value = 1 And Sendlock = 0 Then Call cmdLock_
                        Click
   Sendlock = 0                          'reset Sendlock flag
   term% = 0
   Flags& = 0
   Instring$ = SPACE80S                     '100 spaces
   InCount& = Len(Instring$)
   bufsize& = Len(Instring$)
   If (CMDloopFlg = 0) And (IDNTestFlg = 0) Then
      txtResults.Text = "Device Read: Waiting for device response"
      txtResults.Refresh
   End If
   On Error GoTo ErrorHandler
   Call iread(dev, Instring$, bufsize&, term%, InCount&)
   MsgSentFlg = 1      'sets flag to show that the link was exercized
   If ckAutoLock.value = 1 Then
      Call cmdUnlock_Click
      If Er% <> 0 Then
         Beep
         GoTo Readexit:
      End If
   End If
   If ckDispAll.value = 0 Then
      L = InStr(Instring$, Chr$(13))          'check for CR
      If L <> 0 Then
         Instring$ = Left$(Instring$, L - 1)
      Else
         L = InStr(Instring$, Chr$(10))        'check for LF
         If L <> 0 Then
            Instring$ = Left$(Instring$, L - 1)
         End If
      End If
   End If
   txtError.Visible = False
   txtResults.Text = RTrim$(Instring$)
   If ckByteCnt.value = 1 Then
         txtResults.Text = txtResults.Text + NL + "Byte count= " +
                        Str$(InCount&)
   End If
   GoTo Readexit:
ErrorHandler:
   txtError.Text = "Send IFC error" & NL & Error$ & " - Retry"
   txtError.Visible = True
   Beep
Readexit:
End Sub

Private Sub cmdSend_Click()                'send command string
   txtError.Visible = False
   If dev = 0 Then
      txtResults.Text = "No devices found. Select and link a device"
      txtError.Visible = True
      Beep
      GoTo Sendexit:
   End If

   If ckAutoLock.value = 1 Then Call cmdLock_Click
   Sendlock = 1                'set Sendlock flag for read routine
   Outstring$ = combCmd.Text
   If Outstring$ = "" Then
      txtResults.Text = "Device command box empty, nothing sent to
                     the device"
      Beep
      GoTo Sendexit:
   End If

   If ckCR = 1 Then Outstring$ = Outstring$ & Chr$(13)
   If ckLF = 1 Then Outstring$ = Outstring$ & Chr$(10)
   bufsize& = Len(Outstring$)
   endi% = 1                        'assert EOI
   On Error GoTo ErrorHandler
   Call iwrite(dev, Outstring$, bufsize&, endi%, outcount&)
   txtError.Visible = False
   MsgSentFlg = 1      'sets flag to show that the link was exercized
     If (ckAutoQuery.value = 1) And (InStr(Outstring$, "?") <> 0)
                     Then
      Call cmdRead_Click
   Else
      txtResults.Text = "Send String => " + Outstring$
      If ckAutoLock.value = 1 Then Call cmdUnlock_Click
      Sendlock = 0                              'reset flag
   End If
   GoTo Sendexit:
ErrorHandler:
   txtError.Text = "Send error" & NL & Error$ & " - Retry"
   txtError.Visible = True
   Beep
Sendexit:
End Sub

Private Sub cmdSPoll_Click()
   txtError.Visible = False
   Outstring$ = combCmd.Text
   txtResults.Text = ""
   If dev = 0 Then
         txtResults.Text = "No devices linked. Select and link to a de-
                     vice"
      txtError.Visible = True
      Beep
      GoTo Spollexit:
   End If
   On Error GoTo ErrorHandler
   Call ireadstb(dev, rdg%)
   txtError.Visible = False
   txtResults.Text = "Serial poll response => " + Str$(rdg%)
   MsgSentFlg = 1       'sets flag to show that the link was exercized
   GoTo Spollexit:
ErrorHandler:
     txtError.Text = "Read Status Byte error" & NL & Error$ & " -
                     Retry"
   txtError.Visible = True
   Beep
Spollexit:
End Sub

Private Sub Form_Load()
   Rev$ = "Revised 12-20-2005"
   cmdLink.Enabled = True
   cmdLinki.Enabled = False
   cmdFindInst.Enabled = False
   cmdSend.Enabled = False
   cmdRead.Enabled = False
```

Figure 1 SICL Keyboard Program Listing Continued

```
    cmdIDNtst.Enabled = False
    cmdIDNtstoff.Enabled = False
    cmdCmdtst.Enabled = False
    cmdCmdtstoff.Enabled = False
    cmdIFC.Enabled = False
    cmdStatus.Enabled = False
    cmdDT.Enabled = False
    cmdSDC.Enabled = False
    cmdSpoll.Enabled = False
    cmdLock.Enabled = False
    cmdUnlock.Enabled = False
    cmdExit.Enabled = True
    ckAutoLock.Enabled = False
    ckATN.Enabled = False
    ckRen.Enabled = False
    ckCR.Enabled = False
    ckLF.Enabled = False
    ckAutoQuery.value = 1
    ckByteCnt.value = 0
    lbliLock.Visible = False
    lblKeepAliveMsg.Visible = False
    optTimeout(0).Enabled = False
    optTimeout(1).Enabled = False
    optTimeout(2).Enabled = False
    optTimeout(3).Enabled = False
    SPACE80S = Space$(100)                  '100 spaces
    NL = Chr(13) + Chr(10)
    txtRev.Text = Rev$
    txtError.Text = ""                      'clear label and text box
    txtResults.Text = ""
    combCmd.Text = ""
    TypeVar = "GPIB"                        'default to GPIB control
    OutFlag = 0
    FoundFlg = 0
    BD% = 0                                 'define initial values
    dev = 0
    intfc = 0
    bddev% = 0
    addr% = 4
    Device = 4
    eos% = 10
    Testnum = 100
    IDNTestFlg = 0
    CMDloopFlg = 0
    IOloopFlg = 0
    txtCount.Visible = False
    LpCount = 0
    Timer1.Interval = 0
    txtResults.Enabled = True
    txtError.Enabled = False
    ErrFlag = 0
    IDNTestFlg = 0
    IOloopFlg = 0
    combCmd.AddItem "*esr?", 0
    combCmd.AddItem "*idn?", 1
    combCmd.AddItem "*stb?", 2
    FirstTimeFlg = 0
    App.HelpFile = App.Path & "\GPIBkybd2.chm"
End Sub

Private Sub optTimeout_Click(Index As Integer)
    Select Case Index
        Case 0
            Call itimeout(intfc, 1000)      'time in milliseconds
            If dev <> 0 Then Call itimeout(dev, 1000)
        Case 1
            Call itimeout(intfc, 3000)      'time in milliseconds
            If dev <> 0 Then Call itimeout(dev, 3000)
        Case 2
            Call itimeout(intfc, 10000)     'time in milliseconds
            If dev <> 0 Then Call itimeout(dev, 10000)
        Case 3
            Call itimeout(intfc, 0)         'no timeout
            If dev <> 0 Then Call itimeout(dev, 0)
    End Select
End Sub

Private Sub Timer1_Timer()
    If (CMDloopFlg = 0) And (IDNTestFlg = 0) Then
        'txtCount.Visible = False
        'LpCount = 0
        GoTo Timerexit:
    End If

    If TestHalt = 1 Then GoTo Timerexit:

    If IDNTestFlg = 1 Then
        If ckAutoLock.value = 1 Then
            Call cmdLock_Click
            If Er% <> 0 Then
                Beep
                IDNTestFlg = 0
                GoTo Timerexit:
            End If
            Sendlock = 1                    'set Sendlock flag for read routine
        End If
        Outstring$ = "*IDN?"
        If ckCR = 1 Then Outstring$ = Outstring$ + Chr$(13)
        If ckLF = 1 Then Outstring$ = Outstring$ + Chr$(10)
        bufsize& = Len(Outstring$)
        endi% = 1                           'assert EOI
        On Error GoTo ErrorHandler
        txtError.Text = "Write error" & NL & Error$ & " - Retry"
        Call iwrite(dev, Outstring$, bufsize&, endi%, outcount&)
        txtError.Visible = False
        MsgSentFlg = 1     'sets flag to show that the link was exercized
         If (ckAutoQuery.value = 1) And (InStr(Outstring$, "?") <> 0)
                         Then
            txtError.Text = "Read error" & NL & Error$ & " - Retry"
            Call cmdRead_Click
        End If
    End If

    If CMDloopFlg = 1 Then      'loop use the string in the combCmd.
        If combCmd.Text = "" Then
            Beep
            txtError.Text = "Command box empty"
            txtError.Visible = True
        Else
            If ckAutoLock.value = 1 Then
                Call cmdLock_Click
                If Er% <> 0 Then
                    Beep
                    CMDloopFlg = 0
                    GoTo Timerexit:
                End If
                Sendlock = 1                'set Sendlock flag for read routine
            End If
            txtError.Visible = False
            Outstring$ = combCmd.Text
```

Figure 1 SICL Keyboard Program Listing Continued

```
            If ckCR = 1 Then Outstring$ = Outstring$ + Chr$(13)
            If ckLF = 1 Then Outstring$ = Outstring$ + Chr$(10)
            bufsize& = Len(Outstring$)
            endi% = 1                       ‘assert EOI
            On Error GoTo ErrorHandler
            txtError.Text = “Write error” & NL & Error$ & “ - Retry”
            Call iwrite(dev, Outstring$, bufsize&, endi%, outcount&)
            MsgSentFlg = 1                  ‘sets flag to show that the link was
                        exercized
              If (ckAutoQuery.value = 1) And (InStr(Outstring$, “?”) <>
                        0) Then
                txtError.Text = “Read error” & NL & Error$ & “ - Retry”
                Call cmdRead_Click
            End If
        End If
    End If

Timerexit1:     txtCount.Visible = True
    lblCount.Visible = True
    LpCount = LpCount + 1
    txtCount.Text = LpCount
    GoTo Timerexit:
ErrorHandler:
    txtError.Visible = True
    Beep
    If ckAutoLock.value = 1 Then Call cmdUnlock_Click
    Sendlock = 0                ‘reset flag
    IDNTestFlg = 0
    CMDloopFlg = 0
Timerexit:
End Sub

Private Sub txtAddr_Change()
    cmdSet.Enabled = True
End Sub

Private Sub combCmd_KeyPress(KeyAscii As Integer)
    If KeyAscii = (13) Then
        Call cmdSend_Click
    End If
End Sub
```

```
Private Sub Timer2_Timer()      ‘runs 1 minute link keep-alive func-
                        tions
    If MsgSentFlg = 0 And intfc <> 0 Then      ‘0 needs a keep alive
                        exercize
      lblKeepAliveMsg.Visible = True
      lblKeepAliveMsg.Refresh
      If dev <> 0 Then
        CmdStr$ = “lan;vxi-11[192.168.0.254]:gpib,” + Str$(Device)
                        ‘lan[128.10.0.3]:gpib Correct)
        dev2 = iopen(CmdStr$)
        Call iclose(dev2)
        ‘txtResults.Text = “Keep Alive Timer exercized the link”
      End If
      Call igpibbusstatus(intfc, 1, result%)   ‘get REN
      Call Tdelay(0.1)
      lblKeepAliveMsg.Visible = False
    End If
    MsgSentFlg = 0             ‘clears flag - link exercized
End Sub
```

Figure 1   SICL Keyboard Program Listing Continued

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