Using the OMEGA I/O card DLL in C# 2005

This document describes how to use the OMEGA I/O card DLL file in a C# application.

[DLL driver and demo file related information]

In the past, OMEGA has provided the relevant DLL files for various I/O cards for users to drive I/O cards in Microsoft Visual C++, Visual Basic, Borland C++ builder and Delphi. By following the instructions in this document, it will be possible to use the DLLs in a C# application.

The following instructions will use the PIO-D56 add-on card in Win2000/XP as a demo. Before this issue, please install the DLL/OCX driver for Win2000/XP first. Download the pio_dio_win2k_v207.exe file from the ftp site:

ftp://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pio-dio/dll_ocx/win2k_xp/

or from the attached CD path:

CD:\NAPDOS\PCI\PIO-DIO\DLL_OCX\Win2K_XP\

After installing the DLL/OCX driver, download the existing VC sample program from the ftp site:

ftp://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pio-dio/dll_ocx/demo/

or from the attached CD path:

CD:\NAPDOS\PCI\PIO-DIO\DLL_OCX\Demo\

The source code of VC sample programs can be copied, pasted and modified to C# code.

[To modify from Visual C++ 6.0]

Download the dll_vc6_xxxxxx.exe file from the ftp site:

ftp://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pio-dio/dll_ocx/demo/

or from the attached CD path:

CD:\NAPDOS\PCI\PIO-DIO\DLL_OCX\Demo\

Extract the file to a local directory and select a suitable demo. Refer to the PIODIO.h file and the program structure to create your C# project. Insert the declaration of the functions into your class by using “DllImport” decoration.

For example, imagine an application has a class named PIODIO that will use a function called “PIODIO_InputByte(ushort wBaseAddr),” which is declared in the PIODIO.h file.

To import

EXPORTS FunctionType CALLBACK FunctionName(DataType arg1);

into the class, please modify the declaration as:

```
[DllImport("XXXX.dll",EntryPoint="FunctionName")]
        public static extern Datatype NewFunctionName(Datetype arg1);
```

Refer to example

Example :

```
EXPORTS WORD CALLBACK PIODIO_InputByte(DWORD
wPortAddr);

Convert to C# 2005

[DllImport("Piodio.dll",EntryPoint="PIODIO_InputByte")]
        public static extern ushort InputByte(uint wBaseAddr);
```

add to class .

[Data type mapping table]

Bytes	VC++ 6 data type	C# data type
2	Short WORD	Short Ushort
4	Int unsigned int	 Uint
4	unsigned long DWORD	Uint
4	Float	Float
8	Double	double
4	Int *	out int
4	float *	out float

Refer to

ftp://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pio-dio/manual/pio-dio_dll_software_manual.pdf

for more information about the functions in PIODIO.dll.

After adding the above two lines, the function can be called in an application in the following manner:

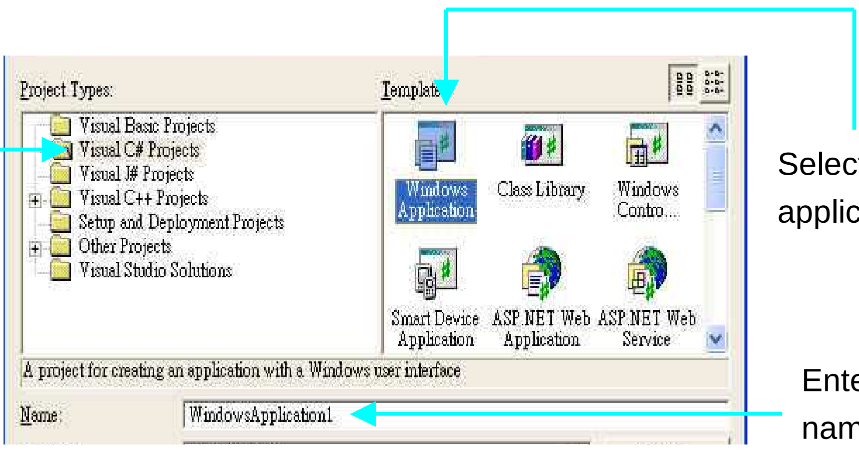
InVal1 = PIODIO. InputByte(wBaseAddr + 0xC0);
InVal2 = PIODIO. InputByte(wBaseAddr + 0xC4);
InVal3 = PIODIO. InputByte(wBaseAddr + 0xC8);

A detailed description of the procedure is as follows:

Step 1.

Start Visual Studio.Net and select File->New ->Project. Refer to the following figure for details of how to create a new project.

Select the C# Project.



A project for creating an application with a Windows user interface

Name: WindowsApplication1

Select the Windows application.

Enter the project name here.

Step 2.

Add the following lines at the start of the code.

```
using System;
using System.Drawing;
using System.Collections;
using System.ComponentModel;
using System.Windows.Forms;
using System.Data;
using System.Runtime.InteropServices;
using System.Threading;
```

Step 3.

Import the function declaration from the PIODIO.h file into the code.

The function declarations in the original PIODIO.h file:

```
// Driver functions
EXPORTS WORD   CALLBACK PIODIO_DriverInit(void);
EXPORTS void   CALLBACK PIODIO_DriverClose(void);
EXPORTS WORD   CALLBACK PIODIO_SearchCard(WORD *wBoards, DWORD dwPIOCardID);
EXPORTS WORD   CALLBACK PIODIO_GetDriverVersion(WORD *wDriverVersion);
EXPORTS WORD   CALLBACK PIODIO_GetConfigAddressSpace(
   WORD  wBoardNo, DWORD *wAddrBase, WORD *wIrqNo, WORD *wSubVendor, WORD *wSubDevice
   WORD *wSubAux, WORD *wSlotBus,  WORD *wSlotDevice);
EXPORTS WORD   CALLBACK PIODIO_ActiveBoard( WORD wBoardNo );
EXPORTS WORD   CALLBACK PIODIO_WhichBoardActive(void);

// DIO functions
EXPORTS void   CALLBACK PIODIO_OutputWord(DWORD wPortAddress, DWORD wOutData);
EXPORTS void   CALLBACK PIODIO_OutputByte(DWORD wPortAddr, WORD bOutputValue);
EXPORTS DWORD  CALLBACK PIODIO_InputWord(DWORD wPortAddress);
EXPORTS WORD   CALLBACK PIODIO_InputByte(DWORD wPortAddr);

// Interrupt functions
EXPORTS WORD   CALLBACK PIODIO_IntInstall( WORD wBoardNo, HANDLE *hEvent,
   WORD wInterruptSource, WORD wActiveMode);
EXPORTS WORD   CALLBACK PIODIO_IntRemove(void);
EXPORTS WORD   CALLBACK PIODIO_IntResetCount(void);
EXPORTS WORD   CALLBACK PIODIO_IntGetCount(DWORD *dwIntCount);

// PIOD48 Counter functions
EXPORTS void   CALLBACK PIOD48_SetCounter
   (DWORD dwBase, WORD wCounterNo, WORD bCounterMode, DWORD wCounterValue);
EXPORTS DWORD  CALLBACK PIOD48_ReadCounter
   (DWORD dwBase, WORD wCounterNo, WORD bCounterMode);
EXPORTS void   CALLBACK PIOD48_SetCounterA
   (WORD wCounterNo, WORD bCounterMode, DWORD wCounterValue);
EXPORTS DWORD  CALLBACK PIOD48_ReadCounterA(WORD wCounterNo, WORD bCounterMode);

// PIOD48 Interrupt functions
EXPORTS WORD   CALLBACK PIOD48_IntInstall
   (WORD wBoardNo, HANDLE *hEvent, WORD wIrqMask, WORD wActiveMode);
EXPORTS WORD   CALLBACK PIOD48_IntRemove();
EXPORTS WORD   CALLBACK PIOD48_IntGetActiveFlag (WORD *bActiveHighFlag, WORD *bActiveLowFlag);
EXPORTS WORD   CALLBACK PIOD48_IntGetCount(DWORD *dwIntCount);

// PIOD64 Counter functions
EXPORTS void   CALLBACK PIOD64_SetCounter
   (DWORD dwBase, WORD wCounterNo, WORD bCounterMode, DWORD wCounterValue);
EXPORTS DWORD  CALLBACK PIOD64_ReadCounter
```

```
   (DWORD dwBase, WORD wCounterNo, WORD bCounterMode);
EXPORTS void   CALLBACK PIOD64_SetCounterA
   (WORD wCounterNo, WORD bCounterMode, DWORD wCounterValue);
EXPORTS DWORD  CALLBACK PIOD64_ReadCounterA(WORD wCounterNo, WORD bCounterMode);

// PIOD48 Frequency Measurement functions
EXPORTS DWORD  CALLBACK PIOD48_Freq(DWORD dwBase);
EXPORTS DWORD  CALLBACK PIOD48_FreqA();
```

Declare a class and Import the function to be used in the application:

```
using System;
using System.Collections.Generic;
using System.Text;
using System.Runtime.InteropServices;

namespace PIODIO_Ns
{
    public class PIODIO

    {

        //****************
        //PIODIO CARD ID
        //****************

        public const uint PIOD_24=0x800140;
        public const uint PIOD_48=0x800130;
        public const uint PIOD_56=0x800140;
        public const uint PIOD_64=0x800120;
        public const uint PIOD_96=0x800110;
        public const uint PIOD_144=0x800100;
        public const uint PIOD_168=0x98800150;
        public const uint PIOD_168A=0x800150;

        //****************
        //Error Code
        //****************
```

```
public const uint NoError = 0;
public const uint DriverOpenError = 1;
public const uint DriverNoOpen = 2;
public const uint GetDriverVersionError = 3;
public const uint InstallIrqError = 4;
public const uint ClearIntCountError = 5;
public const uint GetIntCountError = 6;
public const uint RegisterApcError = 7;
public const uint RemoveIrqError = 8;
public const uint FindBoardError = 9;
public const uint ExceedBoardNumber = 10;
public const uint ResetError = 11;
public const uint IrqMaskError = 12;
public const uint ActiveModeError = 13;
public const uint GetActiveFlagError = 14;
public const uint ActiveFlagEndOfQueue = 15;

//*****************
//PIODIO ActiveMode
//*****************

// to trigger a interrupt when low -> high
public const uint ActiveHigh =1;

// to trigger a interrupt when high -> low
public const uint  ActiveLow=0;

//***********************************
//define the interrupt signal source
//***********************************
public const uint PIOD144_P2C0 = 0;   // pin29 of CN1(37 pin D-type, pin1 to pin37)
public const uint PIOD144_P2C1 = 1;   // pin28 of CN1(37 pin D-type, pin1 to pin37)
public const uint PIOD144_P2C2 = 2;   // pin27 of CN1(37 pin D-type, pin1 to pin37)
public const uint PIOD144_P2C3 = 3;   // pin26 of CN1(37 pin D-type, pin1 to pin37)

//**********************************
// Interrupt Channel for PIO-D48
```

```
 //**********************************
 public const uint PIOD48_INTCH0 = 1;  // INT_CHAN_0
 public const uint PIOD48_INTCH1 = 2;  // INT_CHAN_1
 public const uint PIOD48_INTCH2 = 4;  // INT_CHAN_2
 public const uint PIOD48_INTCH3 = 8;  // INT_CHAN_3

 //*********************************
 //Test functions
 //*********************************

[DllImport ("Piodio.dll",EntryPoint ="PIODIO_FloatSub")]
 public static extern float FloatSub(float fA,float fB);
[DllImport ("Piodio.dll",EntryPoint ="PIODIO_ShortSub")]
 public static extern short ShortSub(short nA,short nB);

[DllImport ("Piodio.dll",EntryPoint ="PIODIO_GetDllVersion")]
 public static extern ushort GetDllVersion();

//**************
// PIODIO Driver
//**************
[DllImport("Piodio.dll",EntryPoint="PIODIO_DriverInit")]
 public static extern ushort DriverInit();



 [DllImport("Piodio.dll",EntryPoint="PIODIO_DriverClose")]
 public static extern void DriverClose();
 [DllImport("Piodio.dll",EntryPoint="PIODIO_SearchCard")]
 public static extern ushort SearchCard(out ushort wBoards, uint dwPIOCardID);
 [DllImport ("Piodio.dll",EntryPoint ="PIODIO_GetDriverVision")]
 public static extern ushort GetDriverVersion(out ushort wDriverVersion);

 [DllImport("Piodio.dll",EntryPoint="PIODIO_GetConfigAddressSpace")]
 public static extern ushort GetConfigAddressSpace(
     ushort wBoardNo, out uint wAddrBase, out ushort wIrqNo,
     out ushort wSubVendor, out ushort wSubDevice, out ushort wSubAux,
     out ushort wSlotBus, out ushort wSlotDevice);
 [DllImport("Piodio.dll",EntryPoint="PIODIO_ActiveBoard")]
```

```
public static extern ushort ActiveBoard(ushort wBoardNo);
[DllImport("Piodio.dll",EntryPoint="PIODIO_WhichBoardActive")]
public static extern ushort WhichBoardActive();

// ******************************************
[DllImport("Piodio.dll",EntryPoint="PIODIO_OutputByte")]
public static extern void OutputByte(uint wBaseAddr, ushort bOutputValue);
[DllImport("Piodio.dll",EntryPoint="PIODIO_InputByte")]
public static extern ushort InputByte(uint wBaseAddr);

//*******************
//PIODIO Interrupt
//*******************


[DllImport("Piodio.dll", EntryPoint = "PIODIO_IntInstall")]
public static extern ushort IntInstall(ushort wBoardNo, out uint hEvent, _
ushort wInterruptSource, ushort wActiveMode);
[DllImport("Piodio.dll", EntryPoint = "PIODIO_IntRemove")]
public static extern ushort IntRemove();

[DllImport("Piodio.dll", EntryPoint = "PIODIO_IntGetCount")]
public static extern ushort IntGetCount(out uint dwIntCount);

[DllImport("Piodio.dll", EntryPoint = "PIODIO_IntResetCount")]
public static extern ushort IntResetCount();

//*******************
//PIODIO_48 Frequency
//*******************
[DllImport("Piodio.dll")]
public static extern uint PIOD48_Freq(uint wBaseAddr);

//********************
//PIODIO_48 Counter
//********************
[DllImport("Piodio.dll")]
public static extern void PIOD48_SetCounter(uint dwBase,ushort wCounterNo,_
ushort bCounterMode,uint wCounterValue );
```

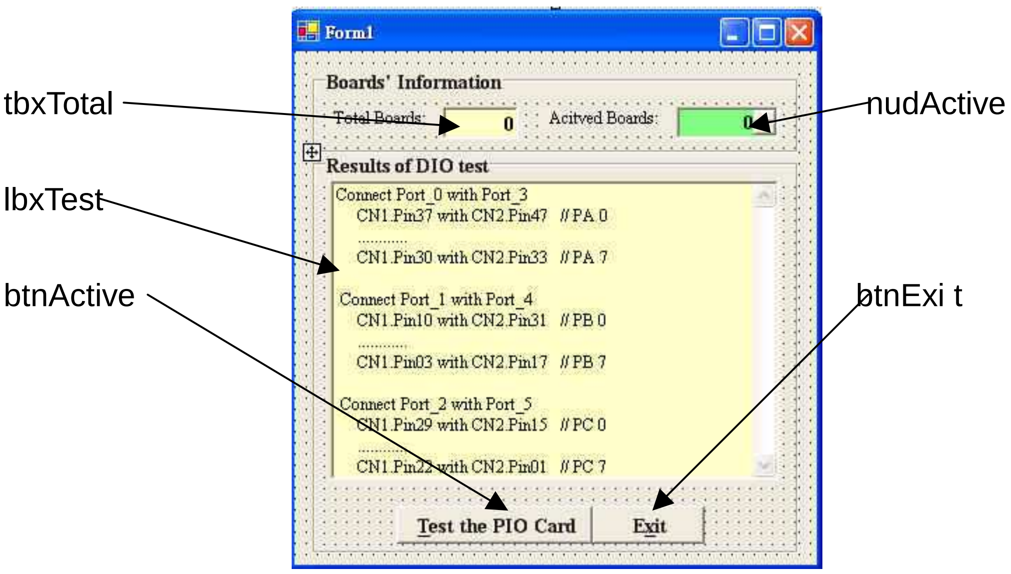
```
[DllImport("Piodio.dll")]
public static extern uint PIOD48_ReadCounter(uint dwBase,ushort wCounterNo,_
ushort bCounterMode);
[DllImport ("Piodio.dll")]
public static extern void PIOD48_SetCounterA(ushort wCounterNo, _
ushort bCounterMode,uint wCounterValue);
[DllImport ("Piodio.dll")]
public static extern uint PIOD48_ReadCounterA(ushort wCounterNo,ushort bCounterMode);

//*********************
//PIODIO_48 Interrupt
//*********************
[DllImport ("Piodio.dll")]
public static extern ushort PIOD48_IntInstall(ushort wBoardNo, out uint hEvent,_
ushort  wIrqMask, ushort  wActiveMode);

[DllImport ("Piodio.dll")]
public static extern ushort PIOD48_IntRemove();
[DllImport ("Piodio.dll")]
public static extern ushort PIOD48_IntGetActiveFlag(out ushort bActiveHighFlag, _
out ushort bActiveLowFlag);
[DllImport ("Piodio.dll")]
public static extern ushort PIOD48_IntGetCount(out uint dwIntCount);


//*******************
//PIODIO_64 Counter
//*******************
[DllImport("Piodio.dll")]
public static extern void  PIOD64_SetCounter(uint dwBase,ushort wCounterNo,_
ushort bCounterMode,uint wCounterValue);
[DllImport("Piodio.dll")]
public static extern uint PIOD64_ReadCounter(uint dwBase,ushort wCounterNo,_
ushort bCounterMode);

[DllImport("Piodio.dll")]
public static extern void PIOD64_SetCounterA(ushort wCounterNo, _
ushort bCounterMode,uint wCounterValue);
```

```
        [DllImport("Piodio.dll")]
        public static extern uint PIOD64_ReadCounterA(ushort wCounterNo, ushort bCounterMode);

        // ******************************************

        private int DriverOpened = 0;

        public PIODIO()//constroctor
        {
            DriverOpened = 0;
        }
        ~PIODIO()
        {
            if (DriverOpened != 0)
            {
                DriverOpened = 0;
                DriverClose();
            }
        }
    }
}
```

Step 4.

Design the application and use the DLL functions.

Designing the GUI:



```
Connect Port_0 with Port_3
   CN1.Pin37 with CN2.Pin47   // PA 0
   ...........
   CN1.Pin30 with CN2.Pin33   // PA 7

Connect Port_1 with Port_4
   CN1.Pin10 with CN2.Pin31   // PB 0
   ...........
   CN1.Pin03 with CN2.Pin17   // PB 7

Connect Port_2 with Port_5
   CN1.Pin29 with CN2.Pin15   // PC 0
   ...........
   CN1.Pin22 with CN2.Pin01   // PC 7
```

Using the function:

```
namespace PIOD56_Demo
{
    public partial class Form1 : Form
    {
        public uint wBaseAddr;
        public ushort wInitialCode, wTotalBoards, wIrq, wSubVendor, wSubDevice, wSubAux,
wSlotBus, wSlotDevice;
        public Form1()
        {
            InitializeComponent();
        }

        private void Form1_Load(object sender, EventArgs e)
        {

            btnActive.Enabled = false;
            if ((wInitialCode = PIODIO .DriverInit ()) != 0)
            {
                MessageBox.Show("Driver initialize error!!!");
                return;
            }

            if ((wInitialCode = PIODIO.SearchCard (out wTotalBoards, PIODIO.PIOD_56)) != 0)
            {
                MessageBox.Show("SearchCard Error");

                return;
            }

            tbxTotal.Text = wTotalBoards.ToString();
            nudActive.Maximum = wTotalBoards - 1;
            nudActive.Minimum = 0;
            btnActive.Enabled = true;
        }
        private void btnExit_Click(object sender, EventArgs e)
        {
            PIODIO.DriverClose();
            Close();
        }

        private void btnActive_Click(object sender, EventArgs e)
        {

            ushort InVal0,InVal1,InVal2,wRst;
            lbxTest .Items .Clear ();
            if (Convert.ToInt16(nudActive.Value) < 0 || Convert.ToInt16(nudActive.Value) >
Convert.ToInt16(tbxTotal.Text ))
            {
                lbxTest.Items.Add("Invalid board number,Please Retry!!!");
                btnActive.Enabled = false;
                return;
            }
            wRst = PIODIO.GetConfigAddressSpace((ushort)Convert.ToInt16(nudActive.Value), out
wBaseAddr, out wIrq, out wSubVendor, out wSubDevice, out wSubAux, out wSlotBus, out wSlotDevice);

            if(wRst !=0)
            {
                MessageBox .Show ("Get Config-Address-Space Error!!");
                btnActive.Enabled = false;
                return ;

            }
            //*************************//
            //Enable all DI/DO port    //
            //*************************//
            lbxTest.Items.Add("Enable All DI/DO");
            PIODIO.OutputByte(wBaseAddr, (ushort)1); //Enable I/O function
            lbxTest.Items.Add("");
            lbxTest.Items.Add("Setting Port 0 to Output-Mode and Port 1, 2 to Input-Mode");
            PIODIO.OutputByte(wBaseAddr + 0xCC, (ushort)0x01); //Setting Port 0 Output
            ushort ii = 1;
            while (ii <= (ushort)0x80)
            {
                PIODIO.OutputByte((wBaseAddr + 0xC0), (ushort)ii);
                InVal1 = PIODIO.InputByte(wBaseAddr + 0xC4);
                InVal2 = PIODIO.InputByte(wBaseAddr + 0xC8);

                lbxTest.Items.Add("Output Port 0 (Hex)= " + Convert.ToString(ii, 16));
                lbxTest.Items.Add("Input Port 1,2 (Hex)= " + Convert.ToString(InVal1, 16) +"
"+Convert.ToString(InVal2, 16));
                Thread.Sleep(100);
                Application.DoEvents();
                ii*= 2;
            }



            lbxTest.Items.Add("");
            lbxTest.Items.Add("Setting Port 1 to Output-Mode and Port 0, 2 to Input-Mode");
            PIODIO.OutputByte(wBaseAddr + 0xCC, (ushort)0x02); //Setting Port 1 Output
            ii = 1;
            while (ii <= (ushort)0x80)
            {
               PIODIO.OutputByte(wBaseAddr + 0xC4, (ushort)ii);
                InVal0 = PIODIO.InputByte(wBaseAddr + 0xC0);
                InVal2 = PIODIO.InputByte(wBaseAddr + 0xC8);

                lbxTest.Items.Add("Output Port 1 (Hex)= " + Convert.ToString(ii, 16));
                lbxTest.Items.Add("Input Port 0,2 (Hex)= " + Convert.ToString(InVal0, 16) + "
" + Convert.ToString(InVal2, 16));
                Thread.Sleep(100);
                Application.DoEvents();
                ii *= 2;
            }
            lbxTest.Items.Add("");
            lbxTest.Items.Add("Setting Port 2 to Output-Mode and Port 0, 1 to Input-Mode");
            PIODIO.OutputByte(wBaseAddr + 0xCC, (ushort)0x04); //Setting Port 2 Output
            ii=1;
            while (ii <= (ushort)0x80)
            {
                PIODIO.OutputByte(wBaseAddr + 0xC8, (ushort)ii);
                InVal0 = PIODIO.InputByte(wBaseAddr + 0xC0);
                InVal1 = PIODIO.InputByte(wBaseAddr + 0xC4);

                lbxTest.Items.Add("Output Port 2 (Hex)= " + Convert.ToString(ii, 16));
                lbxTest.Items.Add("Input Port 0,1 (Hex)= " + Convert.ToString(InVal0, 16) + "
" + Convert.ToString(InVal1, 16));
                Thread.Sleep(100);
                Application.DoEvents();
                ii *= 2;
            }
            lbxTest.Items .Add ("");
            lbxTest.Items.Add("Digital-Input/Digital-Output (CON1 and CON2)");

            ii = 1;
            while (ii <= (ushort)0x80)
            {
                PIODIO.OutputByte(wBaseAddr + 0xD0, (ushort)ii);
                PIODIO.OutputByte(wBaseAddr + 0xD4, (ushort)ii);
                InVal1 = PIODIO.InputByte(wBaseAddr + 0xD0);
                InVal2 = PIODIO.InputByte(wBaseAddr + 0xD4);

                lbxTest.Items.Add("Digital-Output (Hex)= "+Convert.ToString (ii,16)+"
"+Convert .ToString(ii,16));
                lbxTest.Items.Add("Digital-Input(Hex)= " + Convert.ToString(InVal1, 16) + " "
+ Convert.ToString(InVal2, 16));
                Thread.Sleep(100);
                Application.DoEvents();
                ii *= 2;
            }
        }
    }
}
```