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APPLICATION NOTE

1. Introduction

The PC-MCAT API is part of the PC-MCAT installation.

The PC-MCAT API communicates to the PC-MCAT via a shared memory interface. This means that applications that use the PC-MCAT API must execute on the PC-MCAT itself.

The shared memory interface is used to implement access to the following.

- Parameters: system, axis and process parameters.
- I/O: digital and analogue I/O.
- Moves: the moves are loaded directly into the PC-MCAT motion buffers.
- Programs.

The PC-MCAT API for .Net consists of the following files:

- PC-MCAT API for C++
 - o pcmcat_api_x86.lib This library implements the API commands compiled for 32 bits.
 - pcmcat_api_x64.lib- This library implements the API commands compiled for 64 bits.
- PC-MCAT API for .Net
 - pcmcat_net.dll This DLL implements the .Net assembly (x86 and x64 compatible).

The PC-MCAT API for C++ libraries and headers are installed into the PC-MCAT program directory, usually C:\Program Files\TrioMotion\PC-MCAT\ApiCPP.

The PC-MCAT API for .Net DLL is installed into the PC-MCAT program directory, usually C:\Program Files\TrioMotion\PC-MCAT.

All the required dynamic libraries (DLLs) required for the C++ applications to run are installed in C:\Program Files\TrioMotion\PC-MCAT.

The source code of the examples presented below can be downloaded from the website.

2. PC-MCAT API Reference

When using the C++ version of the PC-MCAT API, the headers files found in "C:\Program



Files\TrioMotion\PC-MCAT\ApiCPP" can be used as a reference, a description of the functionality, data types and return types can be found. Below an example of the "pcmcat_api_moveabs" function, which can be found - as any of the other API functions - in "pcmcat_api.h":

```
/// <summary>
/// Summary>
/// Dispatch an absolute linear move to the Motion Coordinator.
/// This function will wait until the API move buffer is available before loading a move.
/// The API move buffer will be loaded into the Motion Generator move buffers when there are buffers available.
/// The API move buffer available then this motion will be started on the next servo cycle.
/// </summary>
/// </summary>
/// <param name="axis_count">Number of axes involved in the move.</param>
/// <param name="base_axis">Base axis for this command. If value is -1 then the default base axis is used.</param>
/// <param name="position">Absolution position of the end of the move on each axis.</param>
/// <returns>
/// </returns>
int PCMCATLIBRARY_API pcmcat_api_moveabs(int base_axis, int axis_count, double position[]);
```

The header files could also be used as a reference when using the .NET assembly, however, to avoid any confusion, the "pcmcat_net.xml" metadata file found in "C:\Program Files\TrioMotion\PC-MCAT" could be used instead, where the name of the functions, parameter passing methods and data types would match those of the .NET implementation of the API.

In addition to the "pcmcat_net.xml", the Visual Studio IntelliSense would provide all that information automatically as well. All this metadata can be consulted throughout the Object Browser in Visual Studio directly:







3. Requirements

- PC-MCAT or PC-MCAT-2.
- Visual Studio 2015 or later versions.

4. Create a 32 bit Visual C# PC-MCAT API application

• Open Visual Studio 2015 and create a new Windows Forms Application solution called WindowsForms_Cs_ApiTest.



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✓ Visual C# Get Started			Windows Forms App (.NET Framework)	Visual C#	A project for creating an application with Windows Forms user interface	3
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 Visual F# 		с# []	Windows Forms Control Library (.NET Framework)	Visual C#		
Not finding what y Open Visual St	ou are looking for? tudio Installer					
Name:	WindowsForms_Cs	_ApiTest				
Location: C:\Users\ibarr\OneDrive\Documents\Visual Studio 2017\Projects\Projects\					Browse	
Solution: Create new solution						
Solution name:	Solution name: WindowsForms_Cs_ApiTest				Create directory for solution	
Framework:	.NET Framework 4.	5.1 -			Add to Source Control	
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• Use the Build->Configuration Manager menu option to create a new configuration x86.

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• Add a reference to the PC-MCAT API .Net assembly in the folder C:\Program Files\TrioMotion\PC-MCAT.

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TestEX_API_Cpp	ApiCS	11/10/2018 10:44	File folder		
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	imotion_api_x86.dll	19/09/2018 09:55	Application extens	81 KB	
and OneDrive	🗟 pcmcat_api_x64.dll	19/09/2018 09:55	Application extens	23 KB	
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• Create two buttons: Open and Close.

🖳 Form1	
Open Close	

• Double click on the Open button to add an OnClick handler. This will open the file Form1.cs.

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Drawing;
using System.Linq;
using System.Threading.Tasks;
using System.Threading.Tasks;
using System.Windows.Forms;
namespace PC_MCAT_API_CSharp
{
    public partial class Form1 : Form
    {
        public Form1()
        {
    }
}
```



```
InitializeComponent();
    }
    private void button1_Click(object sender, EventArgs e)
    }
}
    •
```

Add the line "using TrioMotion.PCMCAT;" at the top of the file.

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;
using TrioMotion.PCMCAT;
namespace PC MCAT API CSharp
{
    public partial class Form1 : Form
    {
        public Form1()
        {
            InitializeComponent();
        }
        private void button1_Click(object sender, EventArgs e)
        {
        }
    }
                                                 ------
          Add the required code to the handler.
                       _____
private void button1_Click(object sender, EventArgs e)
{
    if (PCMCAT API.Open(null, IntPtr.Zero) == 0)
    {
       MessageBox.Show("PC-MCAT API .Net assembly opened connection correctly");
    }
    else
    {
       MessageBox.Show("Error opening the PC-MCAT API .Net assembly connection");
    }
}
```

• Repeat for the Close handler.

```
private void button2_Click(object sender, EventArgs e)
 {
     PCMCAT API.Close();
```



• Test.



• Add Open callback handler.

```
PCMCAT API.Callback CallbackDelegate;
void CallbackFunction(IntPtr Context, ref PCMCAT API.CallbackData Data)
{
    switch (Data.Type)
    {
    case PCMCAT API.CallbackType.Message:
        MessageBox.Show(Marshal.PtrToStringAnsi(Data.Data.Str));
        break;
    }
}
private void button1_Click(object sender, EventArgs e)
{
    CallbackDelegate = CallbackFunction;
    if (PCMCAT API.Open(CallbackDelegate, IntPtr.Zero) == 0)
    {
        MessageBox.Show("PC-MCAT API .Net assembly opened connection correctly");
    }
    else
    {
        MessageBox.Show("Error opening the PC-MCAT API .Net assembly connection");
    }
```



• Test.





• Get/Set VR(0).

Pen Close Set VR(0) Get VR(0)
private void button3 Click(object sender, EventArgs e)
{
<pre>ii (PCMCAT_AP1.SetVR(0, Double.Parse(textBox1.Text)) != 0) {</pre>
<pre>MessageBox.Show("Error setting VR(0) to " + textBox1.Text) }</pre>
}
<pre>private void button4_Click(object sender, EventArgs e)</pre>
1
double vru; if (PCMCAT_API.GetVR(0, out vr0) != 0)
<pre>double vr0; if (PCMCAT_API.GetVR(0, out vr0) != 0) { MessageBox.Show("Error getting VR(0)");</pre>
<pre>double vr0; if (PCMCAT_API.GetVR(0, out vr0) != 0) { MessageBox.Show("Error getting VR(0)"); } else</pre>
<pre>double vr0; if (PCMCAT_API.GetVR(0, out vr0) != 0) { MessageBox.Show("Error getting VR(0)"); } else { textBox2.Text = vr0.ToString();</pre>

} ł

i }



• Test.

🖳 Form1	
Open	
Close	
Set VR(0)	99
Get VR(0)	99

5. Create a 32 bit VB.NET PC-MCAT API application

• Open Visual Studio 2015 and create a new Windows Forms Application solution called WindowsForms_VB.NET_ApiTest.

New Project						? ×
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Azure Data Lake		V B	WPF User Control Library (.NET Framework)	Visual Basic		
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Not finding what yo Open Visual St	ou are looking for? udio Installer					
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• Use the Build->Configuration Manager menu option to create a new configuration x86.

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WindowsForms Cs AniT	Any CPU	Remov	e)	
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		Renam	e	

Close

Close



• Add a reference to the PC-MCAT API .Net assembly in the folder C:\Program Files\TrioMotion\PC-MCAT.



← → × ↑ 📙 > This PC > Loca	al Disk (C:) > Program Files > TrioMotio	n > PC-MCAT	✓ [™] Search	h PC-MCAT	Q
Organise 🔻 New folder					
P762 (PC-MCAT S)	^ Name	Date modified	Туре	Size	
PC-MCAT API	ApiCPP	11/10/2018 10:44	File folder		
TestEX_API_Cpp	ApiCS	11/10/2018 10:44	File folder		
Microsoft Visual Studio 2017	motion_api_x64.dll	19/09/2018 09:55	Application extens	75 KB	
	🚳 motion_api_x86.dll	19/09/2018 09:55	Application extens	81 KB	
international Contraction (Contraction) (Con	pcmcat_api_x64.dll	19/09/2018 09:55	Application extens	23 KB	
This PC	pcmcat_api_x86.dll	19/09/2018 09:55	Application extens	22 KB	
	💿 pcmcat_net.dll	19/09/2018 09:55	Application extens	38 KB	
so objects	🗟 RtApi.dll	03/10/2017 05:16	Application extens	200 KB	
Desktop	🚳 XmlConfig.dll	19/09/2018 09:55	Application extens	12 KB	
Documents					
🕂 Downloads					
👌 Music					
Pictures					
🗃 Videos					
🏪 Local Disk (C:)	~				
File name: pcmcat	_net.dll		~ Com	ponent Files (*.dll;	*.tlb;*.ol ~
				Add	Cancel

 \times



Create two buttons: Open and Close.



Double click on the Open button to add an OnClick handler. This will open the file Form1.vb. •

```
Public Class Form1
    Private Sub Button1 Click (sender As Object, e As EventArgs) Handles Button1.Click
    End Sub
End Class
            Import "TrioMotion.PCMCAT" and "IteropServices" adding this code at the top of the Form.vb
         •
            file.
Imports System.Runtime.InteropServices
Imports TrioMotion.PCMCAT
            Add the required code to the handler.
Public Class Form1
    Private Sub Button1_Click(sender As Object, e As EventArgs) Handles Button1.Click
        If PCMCAT_API.Open(Nothing, IntPtr.Zero) = 0 Then
            MessageBox.Show("PC-MCAT API .Net assembly opened connection correctly")
        Else
            MessageBox.Show("Error opening the PC-MCAT API .Net assembly connection")
        End If
    End Sub
End Class
        • Repeat for the Close button handler.
```

```
Private Sub Button2_Click(sender As Object, e As EventArgs) Handles Button2.Click
 PCMCAT API.Close()
End Sub
```



•	Test.
•	TC3C.

🖳 Form1	
Open	
Close	
	PC-MCAT API .Net assembly opened connection correctly
	ОК

• Add Open Callback handler.

<pre>Private Sub Button1_Click(sender As Object, e As EventArgs) Handles Button1.Click If PCMCAT_API.Open(AddressOf CallbackFunction, IntPtr.Zero) = 0 Then MessageBox.Show("PC-MCAT API .Net assembly opened connection correctly") Else</pre>
MessageBox.Show("Error opening the PC-MCAT API .Net assembly connection") End If End Sub
<pre>Private Sub CallbackFunction(Context As IntPtr, ByRef Data As PCMCAT_API.CallbackData) Select Case Data.Type Case PCMCAT_API.CallbackType.Message MessageBox.Show(Marshal.PtrToStringAnsi(Data.Data.Str)) End Select End Sub</pre>

• Test.

🖳 Form1		
Open		
Close		
	2017-09-13 13:23:07 pcmcat_api.cpp:201 Open connection to PC-MCAT	
	ОК)



🖳 Form1	
Open	
Close	
	PC-MCAT API .Net assembly opened connection correctly
	ОК
🖳 Form1	
Open	
Close	
	2017-09-13 13:24:24 pcmcat_api.cpp:162 Clear callback
	ОК

• Get/Set VR(0).

🖳 Form1	
Open	
Close	
Set VR(0)	
Get VR(0)	



```
Private Sub Button3_Click(sender As Object, e As EventArgs) Handles Button3.Click
If PCMCAT_API.SetVR(0, Double.Parse(TextBox1.Text)) <> 0 Then
MessageBox.Show("Error setting VR(0) to " + TextBox1.Text)
End If
End Sub
Private Sub Button4_Click(sender As Object, e As EventArgs) Handles Button4.Click
Dim vr0 As Double
If PCMCAT_API.GetVR(0, vr0) <> 0 Then
MessageBox.Show("Error getting VR(0)")
Else
TextBox2.Text = vr0.ToString()
End If
```

```
• Test.
```

🖳 Form1	
Open]
Close	
Set VR(0)	99
Get VR(0)	99



6. Create a 32/64 bit MFC C++ PC-MCAT API application

• Open Visual Studio 2015 and create a new MFC Application solution called MFC_Cpp_ApiTest.



• Create the MFC application with the following settings.

Dialog based MFC standard Application type options: Visual style and colors: transface Features Tabbed documents Windows Native/Default dvanced Features Document/View architecture support Enable visual style switching security Development Lifecycle (SDL) checks Resource language: compound document support Use of MFC: Use MFC in a shared DLL Compound document support: conne> Document support options: document support options: Active document server	Dialog based MFC standard Application type options: Visual style and colors: Interface Features Tabbed documents anced Features Document/View architecture support Erated Classes Dialog based options: Dialog based options: English (United States) <inone> Use of MFC: Use MFC in a shared DLL Ocument support: Compound document support: Document support options: Active document server Document server</inone>	Dialog based MFC standard Application type options: Visual style and colors: interface Features Tabbed documents inced Features Document/View architecture support interface Classes Dialog based options: Dialog based options: Enable visual style switching Resource language: Dialog based options: Image: Image:	Dialog based MFC standard Application type options: Visual style and colors: tterface Features Document/View architecture support Enable visual style switching ced Features Document/View architecture support Enable visual style switching inted Classes Dialog based options: English (United States) visual style switching Visual style switching inted Classes Dialog based options: English (United States) visual style switching Visual style switching compound document support Use of MFC: visual style support options: Active document support: conne> Ocument support conne> Active document server Active document container Support for compound files	Dialog based Application type options: Tabbed documents Document/View architecture support Document/View architecture support Security Development Lifecycle (SDL) checks Dialog based options: Compound document support: Compound document support Compound document server Active document server Active document container Support for compound files	Dialog based Application type options: terface Features Tabbed documents Document/View architecture support Document/View architecture support Security Development Lifecycle (SDL) checks Tabbed options: Tabbed options: Dialog based options: Dialog based options: Tabbed options: Compound document support: Occument support options: Active document server Active document container Support for compound files	ument Template Properties r Interface Features	Dialog based - Application type options:	
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MFC Application

User Interface Features





	Generated classes.		
Ocument Template Properties	App		
	Class name:	Header file:	
ser Interface Features	СМЕССррарнезтарр		
dvanced Features	Base class:	.cpp file:	
	CWinApp		
enerated Classes			

When adding the C++ headers and libraries to the project as explained below, make sure the
project properties are modified for All Configurations and All Platforms.

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- Once the project is generated, right click on the project in the Solution Explorer, then go to Configuration Properties->C/C++->General->Additional Include Directories and add the PC-MCAT\ApiCPP directory:
 - C:\Program files\TrioMotion\PC-MCAT\ApiCPP

Additional Include Directories	C:\Program Files\TrioMotion\PC-MCAT\ApiCPP;%(AdditionalIncludeDirectories)
Additional #using Directories	
Debug Information Format	<different options=""></different>
Support Just My Code Debugging	<different options=""></different>
Common Language RunTime Support	
Consume Windows Runtime Extension	
Suppress Startup Banner	Yes (/nologo)
Warning Level	Level3 (/W3)
Treat Warnings As Errors	No (/WX-)
Warning Version	
Diagnostics Format	Classic (/diagnostics:classic)
SDL checks	
Multi-processor Compilation	

- Within the same project properties dialogue, go to Configuration Properties->Linker->Input and add the path to the .lib files found in that directory:
 - C:\Program Files\TrioMotion\PC-MCAT\ApiCPP\pcmcat_api_x86.lib
 - C:\Program Files\TrioMotion\PC-MCAT\ApiCpp\pcmcat_api_x64.lib



Additional Dependencies	C:\Program Files\TrioMotion\PC-MCAT\ApiCPP\pcmcat_api_x86.lib;C:\Program Files\TrioMotion\PC-MCAT\ApiCPP\pcmcat_api_x64.lib
Ignore All Default Libraries	
Ignore Specific Default Libraries	
Module Definition File	
Add Module to Assembly	
Embed Managed Resource File	
Force Symbol References	
Delay Loaded Dlls	
Assembly Link Resource	

• Open the Resource View to manipulate the dialogue and remove the default static text and buttons controls.



• Create two buttons: Open and Close.





 Double click on the Open button to add a BN_CLICKED handler. This will open the file MFC_Cpp_ApiTestDlg.cpp.

```
void CMFCCppApiTestDlg::OnBnClickedButton1()
{
    // TODO: Add your control notification handler code here
}
```

• Add the "pcmcat_api.h" header file to the "MFC_Cpp_ApiTestDlg.h" file using the #include directive.

```
#include "pcmcat api.h"
```

Add the required code to the handler.

```
void CMFCCppApiTestDlg::OnBnClickedButton1()
{
    // TODO: Add your control notification handler code here
    if (pcmcat_api_open(NULL, NULL) == 0)
        MessageBoxA(this->GetSafeHwnd(), "PC-MCAT API opened connection correctly",
    "Connection Dialogue", MB_OK);
    else
        MessageBoxA(this->GetSafeHwnd(), "Error opening the PC-MCAT API connection", "Error",
    MB_OK | MB_ICONERROR);
}
```

• Repeat for the Close handler.

```
void CMFCCppApiTestDlg::OnBnClickedButton2()
{
   // TODO: Add your control notification handler code here
   pcmcat_api_close();
}
```

• Test running the application (F5).

4			_ 🗆 ×
	Open]	
	Close	Connection Dialogue	
		PC-MCAT API opened connection correctly	
		ОК	



• Add Open callback handler.

Function declaration in "MFC_Cpp_ApiTestDlg.h".

```
static void __stdcall static_pcmcat_api_callback(void *context, pcmcat_api_callback_data_t
*pcmcat_api_callback_data);
```

Function definition in "MFC_Cpp_ApiTestDlg.cpp".

```
void __stdcall CMFCCppApiTestDlg::static_pcmcat_api_callback(void * context,
pcmcat_api_callback_data_t * pcmcat_api_callback_data)
{
    if (!pcmcat_api_callback_data)
        return;
    switch (pcmcat_api_callback_data->type)
    {
        case pcmcat_api_callback_type_message:
        if (pcmcat_api_callback_data->data.str)
            MessageBoxA(((CMFCCppApiTestDlg *)context)->GetSafeHwnd(),
pcmccat_api_callback_data->data.str, "Callback Dialogue", MB_OK | MB_ICONWARNING);
    }
}
```

• Modify Open button handler.

```
void CMFCCppApiTestDlg::OnBnClickedButton1()
{
    // TODO: Add your control notification handler code here
    if (pcmcat_api_open(static_pcmcat_api_callback, this) == 0)
        MessageBoxA(this->GetSafeHwnd(), "PC-MCAT API opened connection correctly",
    "Connection Dialogue", MB_OK);
    else
        MessageBoxA(this->GetSafeHwnd(), "Error opening the PC-MCAT API connection", "Error",
    MB_OK | MB_ICONERROR);
}
```

• Test running the application (F5).







• Get/Set VR(0). Add two more buttons as below, one of them to set the VR(0) value and the other one to read it. Two Edit Controls will be added to show these values.



• Add the buttons event handlers that would Set and Get VR(0) respectively.

```
void CMFCCppApiTestDlg::OnBnClickedButton3()
{
  // TODO: Add your control notification handler code here
  CString str value;
  double value;
  ((CEdit *)GetDlgItem(IDC EDIT1))->GetWindowTextW(str value);
  value = _wtof(str_value);
  if (pcmcat_api_set_vr(0, 1, &value) != 0)
     MessageBoxW(L"Error setting VR(0) to " + str value, L"Error", MB OK | MB ICONERROR);
}
void CMFCCppApiTestDlg::OnBnClickedButton4()
{
  // TODO: Add your control notification handler code here
  CString str value;
  double value;
  if (pcmcat api get vr(0, 1, &value) != 0)
     MessageBoxW(L"Error Getting value of VR(0)", L"Error", MB OK | MB ICONERROR);
  else
  {
     str value.Format(L"%.4f", value);
     ((CEdit *)GetDlgItem(IDC EDIT2))->SetWindowTextW(str value);
  }
```



• Test running the application (F5).

R.	
Open	
Close	
Set VR(0)	453.456
Get VR(0)	453.4560

7. Create a plain 32/64 bit C++ PC-MCAT API application

• Open Visual Studio 2015 and create a new Windows Console Application solution called Console_Cpp_ApiTest.

New Project						?	×
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 Installed 			Windows Console Application	Visual C++	Type: Visual C++		
 ▶ Visual C# ▶ Visual Basic ▲ Visual C++ 			Dynamic-Link Library (DLL)	Visual C++	A project for a command- application that runs on W	ine .exe indows.	
Windows Desk Windows Univ	ktop versal		Static Library	Visual C++			
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 JavaScript 							
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 TypeScript 							
Game							
Not finding what yo Open Visual St	ou are looking for? adio Installer						
Name:	Console_Cpp_Api1	est					
Location:	C:\Users\ibar\Documents\Visual Studio 2017\Projects\ • Browse						
Solution:	Create new solution						
Solution name:	Console_Cpp_ApiT	est			Create directory for solution	'n	
					Add to Source Control		
					ОК	Can	cel

• When adding the C++ headers and libraries to the project as explained below, make sure the project properties are modified for All Configurations and All Platforms.



- Once the project is generated, right click on the project in the Solution Explorer, then go to Configuration Properties->C/C++->General->Additional Include Directories and add the PC-MCAT\ApiCPP directory:
 - C:\Program files\TrioMotion\PC-MCAT\ApiCPP

Additional Include Directories	C:\Program Files\TrioMotion\PC-MCAT\ApiCPP;%(AdditionalIncludeDirectories)
Additional #using Directories	
Debug Information Format	<different options=""></different>
Support Just My Code Debugging	<different options=""></different>
Common Language RunTime Support	
Consume Windows Runtime Extension	
Suppress Startup Banner	Yes (/nologo)
Warning Level	Level3 (/W3)
Treat Warnings As Errors	No (/WX-)
Warning Version	
Diagnostics Format	Classic (/diagnostics:classic)
5DL checks	
Multi-processor Compilation	

- Within the same project properties dialogue, go to Configuration Properties->Linker->Input and add the path to the .lib files found in that directory:
 - C:\Program Files\TrioMotion\PC-MCAT\ApiCPP\pcmcat_api_x86.lib
 - C:\Program Files\TrioMotion\PC-MCAT\ApiCpp\pcmcat_api_x64.lib

Additional Dependencies	C:\Program Files\TrioMotion\PC-MCAT\ApiCPP\pcmcat_api_x86.lib;C:\Program Files\TrioMotion\PC-MCAT\ApiCPP\pcmcat_api_x64.lib
Ignore All Default Libraries	
Ignore Specific Default Libraries	
Module Definition File	
Add Module to Assembly	
Embed Managed Resource File	
Force Symbol References	
Delay Loaded Dlls	
Assembly Link Resource	

• Open the automatically generated "Console_Cpp_ApiTest.cpp" file and include the following headers using the #include directive.

```
#include "pch.h"
#include <iostream>
#include <string>
#include <basetsd.h>
#include "pcmcat_api.h"
```

• Within the main function, add code to open a connection, Set VR(0) value according to the user input and Read the value back to check whether it has been properly set. After that close the connection.

```
int main()
{
    std::string input_str;
    double set_value;
    double get_value;
    if (0 == pcmcat_api_open(NULL, NULL))
    {
        std::cout << "Connection Open\n";
        std::cout << "Connection Open\n";
        std::cout << "Introduce the number you want VR(0) to be set to-> ";
        std::cin >> input_str;
        set_value = (double)atof(input_str.c_str());
        if (0 == pcmcat_api_set_vr(0,1,&set_value))
        {
            std::cout << "VR(0) Written -> " << set_value << "\n";
        }
        }
    }
}
</pre>
```



```
if (0 == pcmcat api get vr(0,1,&get value))
      {
        std::cout << "VR(0) Read-> "<< get value <<"\n";</pre>
        if ((get value - set value) < DBL EPSILON)
           std::cout << "VR(0) has been written correctly\n";</pre>
        else
            std::cout << "VR(0) written and read values don't match\n";</pre>
      }
     else
      {
        std::cout << "Error reading VR(0)\n";</pre>
      }
   }
   else
   {
      std::cout << "Error writting VR(0)\n";</pre>
   }
}
else
{
  std::cout << "Connection Not Open\n";</pre>
}
pcmcat_api_close();
std::cout << "---- Press 'x' plus Enter to exit -----\n";</pre>
while (input_str != "x")
  std::cin >> input str;
```

 Add the Callback function to the code and modify the pcmcat_api_close() function call accordingly.

```
_stdcall static_pcmcat_api_callback(void *context, pcmcat_api_callback_data_t
void
*pcmcat_api_callback_data);
int main()
{
  std::string input str;
  double set value;
  double get_value;
  if (0 == pcmcat_api_open(static_pcmcat_api_callback, NULL))
  {
     std::cout << "Connection Open\n";</pre>
     std::cout << "Introduce the number you want VR(0) to be set to-> ";
     std::cin >> input_str;
     set_value = (double)atof(input_str.c_str());
     if (0 == pcmcat_api_set_vr(0,1,&set_value))
     {
        std::cout << "VR(0) Written -> " << set_value << "\n";</pre>
        if (0 == pcmcat api get vr(0,1,&get value))
        {
           std::cout << "VR(0) Read-> "<< get value <<"\n";</pre>
           if ((get value - set value) < DBL EPSILON)
              std::cout << "VR(\overline{0}) has been written correctly\n";
           else
              std::cout << "VR(0) written and read values don't match\n";</pre>
        }
        else
        {
           std::cout << "Error reading VR(0)\n";</pre>
        }
     }
     else
```



```
{
         std::cout << "Error writting VR(0)\n";</pre>
      }
   }
   else
   {
      std::cout << "Connection Not Open\n";</pre>
   }
   pcmcat_api_close();
   std::cout << "---- Press 'x' plus Enter to exit -----\n";</pre>
   while (input_str != "x")
      std::cin >> input_str;
 }
 void stdcall static pemcat api callback(void *context, pemcat api callback data t
 *pcmcat_api_callback_data)
 {
    if (!pcmcat_api_callback_data)
      return;
   switch (pcmcat api callback data->type)
    {
    case pcmcat_api_callback_type_message:
      if (pcmcat_api_callback_data->data.str)
         std::cout << pcmcat_api_callback_data->data.str << "\n";</pre>
    }
```