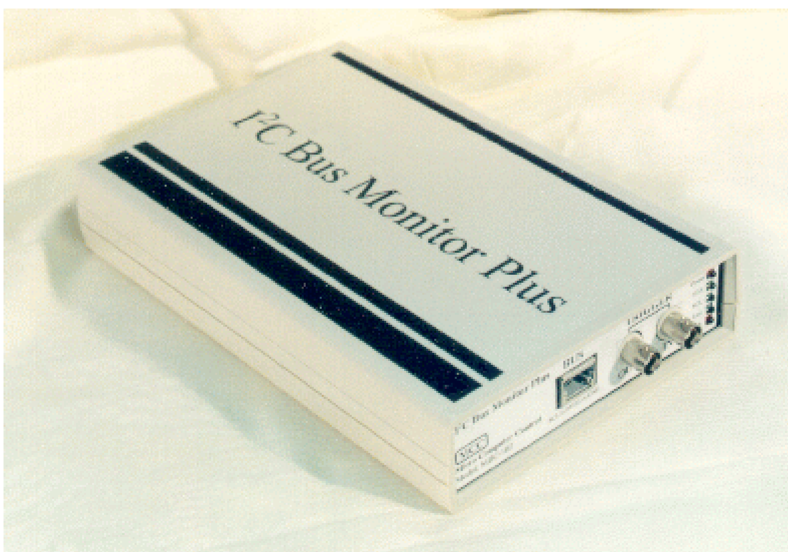
Programmer's Guide

I^2C Bus Monitor Plus Software Development Kit for Windows

MS Visual C++ Edition

Version 1



MCC
Micro Computer Control
Small Area Network Specialists

www.mcc-us.com

This document defines the Application Program Interface (API) for MCC's I2C Bus Monitor Plus Software Development Kit Version 1 for 32-bit Windows operating systems.

NOTE
For the latest information on this product, see Readme.TXT document file.

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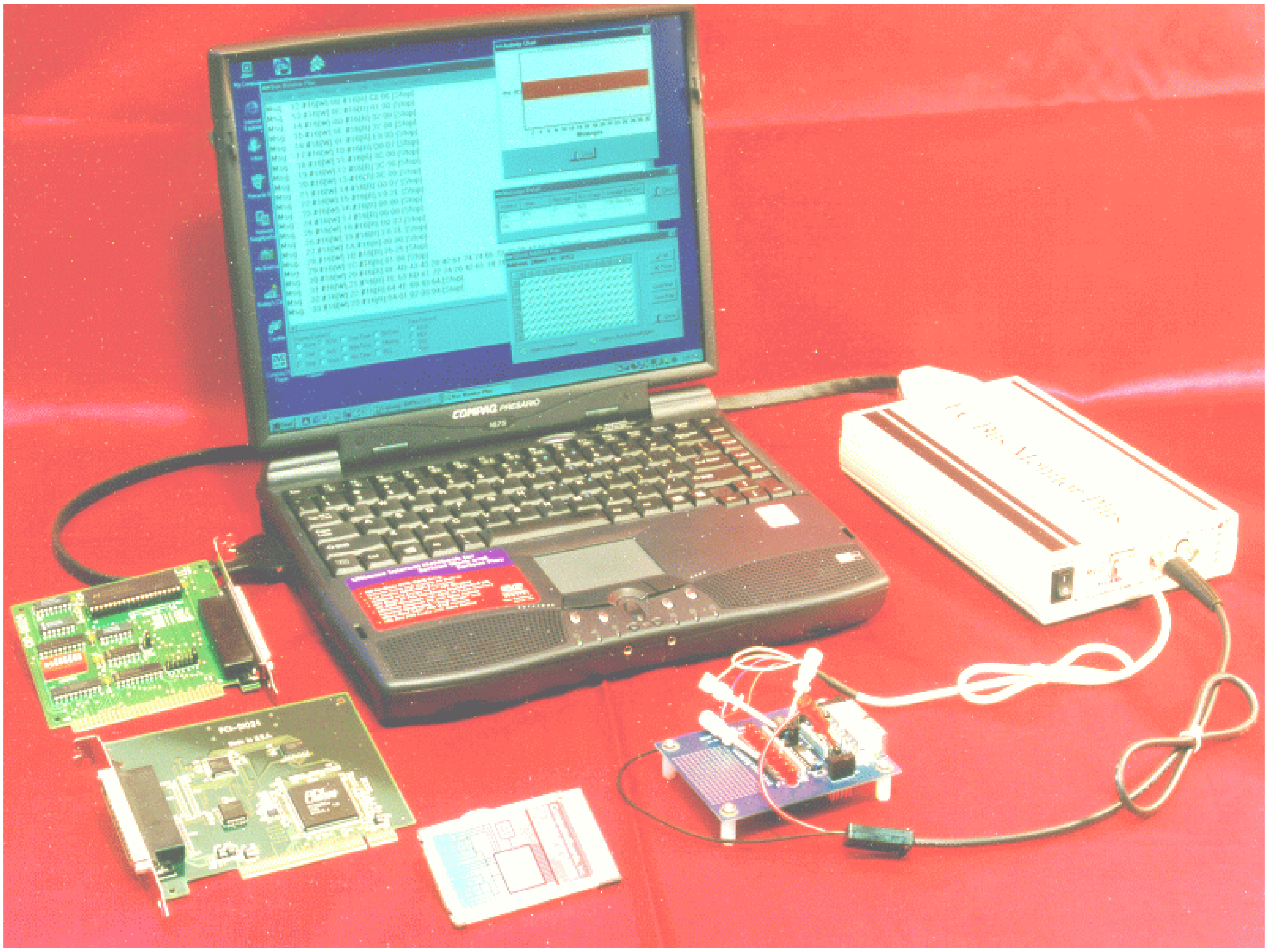
Introduction

The I^2C Bus Monitor Plus

The **I^2C Bus Monitor Plus (iBMP)** is a laboratory grade troubleshooting instrument for the Inter-Integrated Circuit (I^2C) Bus developed by Philips Semiconductors. When connected to an I^2C Bus or SMBus and a host computer, the I^2C Bus Monitor Plus captures and displays bus communications.



The complete I^2C Bus Monitor Plus package consists of an external pod, interface card, connecting cables, and Windows based software.

Features

The I^2C Bus Monitor Plus includes the following features:

- Non-intrusive trace of bus traffic to 400KHz.
- Compatible with low voltage logic.
- 256K byte data recording memory.
- Microsecond time stamping on bus events and bit, byte, or message data.
- Captures Start/Stop events, device addresses, read/write requests, acknowledgments, and data.
- Trigger Input for synchronization with external event.
- Trigger Output on bus events or pattern match for triggering external test equipment.

The Software Development Kit

The **MS VC++ I^2C Bus Monitor Plus Software Development Kit** (**iBMP SDK**) supports the development of custom 32-bit Windows application software. This kit enables Microsoft Visual C++ software developers and test engineers to integrate the extensive data collection capabilities of the I^2C Bus Monitor Plus (#MIIC-102) into custom real-time data analysis and test applications.

The iBMP SDK is designed to make it easy to develop custom monitoring, analysis, and test applications for I^2C Bus and SMBus based systems. To accomplish this, the iBMP SDK provides three key ingredients; driver, parser, and sample applications.

1. Driver

A driver is a software component that allows a custom application to control the real-time data collection features of the I^2C Bus Monitor Plus pod, and provides a method of reading pod data packets generated by bus message traffic.

iBMP SDK V1 includes a DLL based driver for conventional code-based programming.

2. Parser

A parser is a software component that accepts a stream of pod generated data packets, interprets the meaning of the packets, identifies, filters, and highlights specific bus activity of interest, and translates bus activity into a meaningful representation for presentation to an application user.

iBMP SDK V1 includes an I^2C Bus ASCII-Hex parser in source code form, suitable for the creation of custom parsers.

3. Sample Applications

Sample applications show how to use the driver and parser included in the kit, and provide the basis for creating customized applications.

The iBMP SDK includes sample application programs in Microsoft's Visual C++. These sample programs include the source code for controlling the I^2C Bus Pod and analyzing bus message data and time-stamp information, and provide an excellent framework for the developer or test engineer constructing custom I^2C Bus or SMBus test or analysis applications.

Monitoring and Analysis System Components

An I^2C Bus and/or SMBus monitoring and analysis system based upon the iBMP SDK consists of five major components. These include:

The iBMP SDK Driver Architecture

The iBMP SDK drivers use a layered architecture. Each layer derives much of its functionality from lower layers. This layered architecture includes:

Application Layer
iBMP DLL (Dynamic Linked Library)
iBMP Interface Card Driver
iBMP Interface Card
iBMP Pod

iBMP Pod

In this architecture, the iBMP Pod is the lowest layer, and provides a physical connection to the I^2C Bus and/or SMBus in the system under test. The components in the pod allow it to capture, timestamp, store, and upload bus activity.

The iBMP Pod is included with the I^2C Bus Monitor Plus (#MIIC-102).

iBMP Interface Card

The iBMP Interface Card provides a physical connection between the system's host computer and the pod. PCI, ISA, and PC Card versions of the interface card are currently supported.

The iBMP Interface Card is included with the I^2C Bus Monitor Plus (#MIIC-102).

iBMP Interface Card Driver

The iBMP Interface Card Driver provides software access to the interface card and its attached pod.

The iBMP Interface Card Driver is included with the I^2C Bus Monitor Plus (#MIIC-102).

iBMP DLL (Dynamic Linked Library)

The iBMP DLL (Dynamic Linked Library) provides low level access to the iBMP pod's features and functions. This layer supports an Application Program Interface (API) that can be accesses from conventional code-based programming applications.

The iBMP DLL is included with the iBMP SDK.

Application Layer

The Application is a user developed software component customized to meet the needs of the user. An application will initialize and control the iBMP pod, and may contain a parser to analyze the stream of pod data, and identify bus activity of interest. A parser can be built into the application source code, or it can be an add-on component.

The iBMP SDK includes an application source code examples that demonstrate how to use the iBMP DLL along with an I2C Bus ASCII Hex parser that can be use as the basis for creating a custom application.

The iBMP DLL API and sample application programs that use this interface can be found in later sections of this guide.

System Requirements

To use the iBMP SDK, your PC must meet the following requirements:

MCC I^2C Bus Monitor Plus (#MIIC-102) ISA, PCI, or PC Card version
Microsoft Windows (95, 98, ME, NT 4.0, 2000, XP)
Microsoft Visual C++ Version 6 or above.

Installation

An installation program is provided on the distribution disk which will allow you to install the iBMP SDK. TO run the installation, insert the diskette or CD into your drive. If the installation program does not start automatically, you should start Windows Explorer and navigate to the root folder on the diskette or CDROM, and double-click on the SETUP.EXE program file to start the installation.

The iBMP SDK installation supports the installation of the following components:

Drivers (DLL)

iBMP32100.DLL
iBMP32Key.DLL

iBMP Pod Configuration File

BMPlus.POD

Sample Applications

Phase 1, Establishing communications.
Phase 2. Displaying pod data.
Phase 3, Customizing output.
Phase 4, Expanding control.
Phase 5, Adding user controls.

See Packlist.TXT for components installation information.

Application Development

This guide uses a step-by-step approach to application program development. From starting a new project, through adding simple capabilities, to creating a robust application. The sample applications cover all aspects of bus data collection and display.

You may find that your specific test requirements do not require all of the flexibility incorporated into our samples. Reducing program flexibility can take the form of hard coding a parameter value, rather than providing a graphical interface to let a user set a parameter value dynamically. Tailoring program flexibility to your specific needs can significantly reduce program development efforts.

Complete source code for each sample application is copied to the development system during iBMP SDK installation. Each sample application includes project, source, and support files and folders. Sample applications assume that the appropriate version of the development tool has been installed on the development computer system.

Note: Since the sample applications that follow communicate with the iBMP pod, and collect and display data from an active I^2C Bus or SMBus, we suggest that you first complete the installation of the I^2C Bus Monitor Plus package and run the monitoring software program included with that package. Once you successfully capture and display bus messages with this software, you should be ready to start custom application development using the iBMP SDK.

Application Development - Visual C++

Microsoft Visual C++ (MSVC) provides a good environment for "rapid application development" under Windows. The following sections provide sample program applications that support the DLL programming model.

Note: The following sample programs require the MSVC program development package, Version 6 or above. If you are new to MSVC, we suggest that you review the materials, tutorials, and help system supplied with MSVC.

Do I need to type in all the sample application source code?

No. Complete projects with source code for each sample application is copied to the development system during iBMP SDK installation. Each sample application includes project, source, and support files and folders. To launch an application in MSVC, double-click on the applications workspace file (PROJECT1.DSW) in the installed project folder.

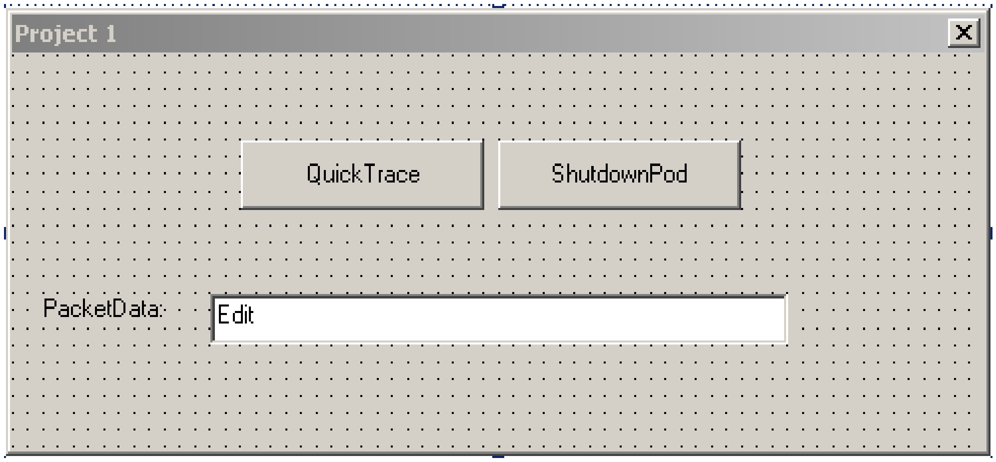
Dynamic Linked Library (DLL) Programming

Note: The following sample programs use header (*.H), dynamic linked library (*.DLL), and import library (*.LIB) files of the iBMP SDK. To complete the application development steps below, you will need to have installed the iBMP SDK.

The following will provide you with step-by-step instructions on creating an application program that will allow you to control the I^2C Bus Monitor pod, monitor I^2C Bus or SMBus message activity, and display bus activity on the screen of your PC.

1. Phase 1, Establishing Communications.

In this initial phase of application development, our goal is to establish communications with the iBMP pod. We will be using two iBMP DLL functions and a timer to interface with the iBMP pod. When we are done with this section, our dialog application should look something like this:



To create this application, start MSVC and create a new project. For this example use "MFC App Wizard (EXE)". Set the project name to “Project 1.” Choose a directory location, and click OK.

On the MFC App Wizard - Step 1 screen, indicate you want to create a dialog based application. Then click Next.

On the MFC App Wizard - Step 2 screen, make sure that “ActiveX Controls” is checked, then click Finish to accept the defaults for the remaining steps. On the New Project Information screen, click OK.

MSVC MFC App Wizard creates the required folders and files for an MFC based dialog application, and opens the Resource Editor on the dialog box ready for editing. The App Wizard added a “TODO:” static control to the dialog. Click on this control and press the Delete key to remove the control from the dialog box.

2. Teaching MSVC about the iBMP DLL.

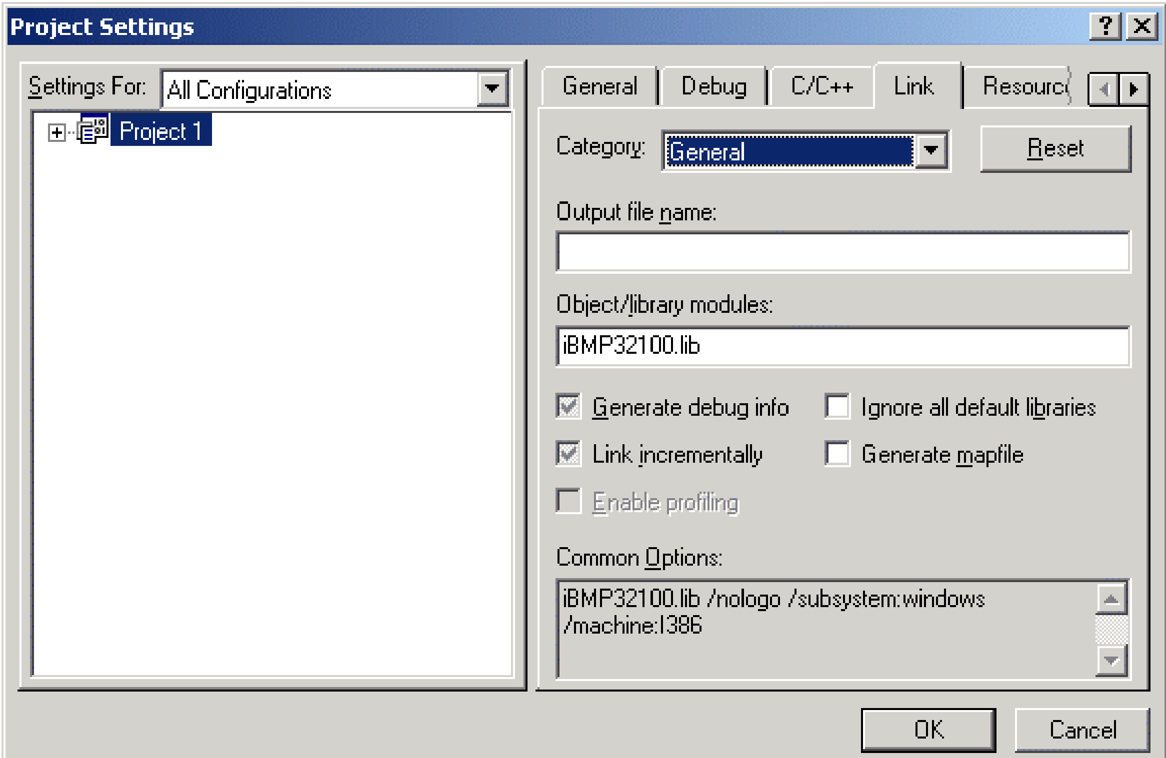
Control of the iBMP pod is accomplished with the iBMP Dynamic Linked Library (iBMP32100.DLL) that was installed with the iBMP SDK. This DLL contains functions that allow a MSVC program to access and control the iBMP pod. To help MSVC work with the DLL, the iBMP SDK also includes a DLL declaration header file (iBMP32100.H) that declares DLL functions, data types, and constants for the MSVC compiler, and a DLL import library file (iBMP32100.LIB) that does the same for the MSVC linker. An MSVC application program uses these declarations when interfacing with the DLL.

For an MSVC application to use the DLL, the DLL declaration header file must be included in the application’s source file. To do this, click on the dialog’s source file (.CPP) in the workspace FileView pane. Add the following **highlighted** code to the file.

```
// Project 1Dlg.cpp : implementation file
//

#include "stdafx.h"
#include "Project 1.h"
#include "Project 1Dlg.h"

#include "iBMP32100.H"
```

```
#ifdef _DEBUG
#define new DEBUG_NEW
#undef THIS_FILE
static char THIS_FILE[] = __FILE__;
#endif
```

Now we need to tell the MSVC linker about the DLL import library file. To do this, click on Project|Settings... on the MSVC menu bar. This will activate the Project Setting dialog.

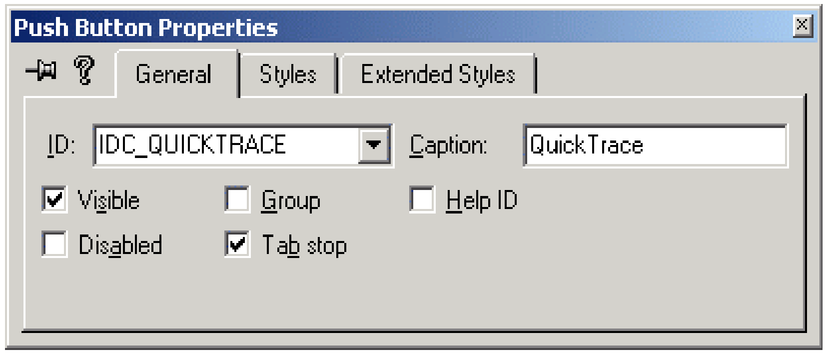


Click on the Link tab to bring up the linker settings. In the Object/library modules edit box, add iBMP32100.lib, and click OK. The MSVC linker uses declarations in the import library file to help it generate the application program executable file (.EXE) that will be dynamically linked with the iBMP DLL when the program is run.

3. Adding buttons, and edit box controls.

The easiest way to control the iBMP pod is with the iBMP BmpQuickTrace function. This function performs a number of operations, including finding the pod, initializing the pod, and starting a bus activity trace using default parameters. To provide user control of the BmpQuickTrace function, we will add a QuickTrace button to the program dialog.

To add this button to your dialog, click on the Button control in the MSVC Controls toolbar and then use the mouse to draw a control on the dialog box. While the control is selected, type QuickTrace to open the properties window and set the control's caption property to QuickTrace. Now, since we will be referring to this control later, set the control's ID to IDC_QUICKTRACE. When done, the QuickTrace control's property window should look like this:



The iBMP DLL also provides a function to terminate bus monitoring activity and shut down the pod. This is the ShutdownPod function. We will provide user control of this function with the ShutDownPod button.

To add this button to your form, repeat the steps as for the QuickTrace button above, but set the control's caption property to ShutdownPod, and its ID to ID_SHUTDOWN.

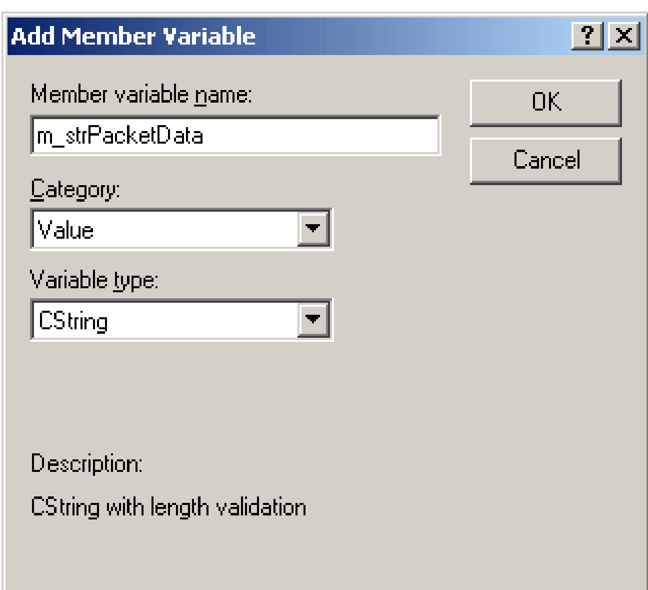
We will need a way to display bus activity. As this sample application progresses, we will expand display capabilities, but for this initial phase, we simply display pod packet data as it is received. We will provide the user with a edit box that displays pod data packets in hexadecimal format.

To add Packet Data edit box to your dialog, click on the Edit Box control on the Controls toolbar and then use the mouse to draw a control on the dialog box. Right-click on the edit box and select Properties from the pop-up menu. Set the control's ID property to IDC_PACKETDATA.

We can also add a static text control to the dialog that will identify the PacketData edit box for the application user. Do this by drawing a Static Text control on the dialog box and entering the appropriate caption property.

4. Adding a member variable.

Now that we have the edit box control on the dialog box, we need to have a way to get data to and from it. To have Microsoft Foundation Class (MFC) help us, we need to set up a member variable that can exchange data with the edit box.



To add the member variable for our edit box, hold down the CTRL key and double-click on the edit box in the dialog editor. This will activate the Add Member Variable dialog.

We need to add the member variable to our dialog class, so our program can access the edit box on the application dialog. Since we will be storing data as a string using MFC's CString class, give the data member the name m_strPacketData, the category Value, and the Variable type CString. Click on OK to add the new data member to the class. This member variable is visible in the ClassView page of the MSVC Workspace Window.

Once the data member is added dialog class, MFC automatically handles member initialization and the transfer of data from the member variable to edit box control.

5. Adding member functions.

MFC may take care of updating the edit box from the data member, however our application is responsible for updating the data member. To be able to update the m_strPacketData data member from within our program, we need to add a member function to our dialog class. To do this, add the following **highlighted** member function to the class definition in the dialog header file, between the constructor and the dialog data.

```
// CProject1Dlg dialog

class CProject1Dlg : public CDialog
{
// Construction
public:
	CProject1Dlg(CWnd* pParent = NULL);  // standard constructor


// Properties
public:
	void PutPacketData(const CString& str)
	{	m_strPacketData = str; }

// Dialog Data
```

6. Adding message handlers for button clicks.

Now we need to add some code to the application that will handle QuickTrace and ShutdownPod button clicks.

Double-click on the QuickTrace button in the dialog editor to display the OnQuickTrace button click event function. The function MSVC creates is a shell that performs no specific actions. To get the program to communicate with the iBMP pod, we need to add the following **highlighted** code to this function.

```
void CProject1Dlg::OnQuickTrace()
{
	long lRetCode = BmpQuickTrace();  // Start Trace

	if (lRetCode != BMP_ERR_NONE)
	{
		CString lsText;
		lsText.Format("Error Code = %4X", lRetCode);
		 PutPacketData(_T(lsText));  // Display Error Code
	}
	else
	{
		PutPacketData(_T("Waiting for data"));
		SetTimer(1, 100, NULL); // Start Pod Packet Retrieval Timer
	}

	UpdateData(FALSE);		// Update display data
}
```

This code executes when the user clicks on the QuickTrace button. The main goal here is to call the BmpQuickTrace function, and enable the packet retrieval timer so we can collect pod data. Like all good applications, we have also added code to detect BmpQuickTrace error conditions, take appropriate action, and notify the user of system status. A complete list of DLL error codes can be found in the iBMP32100.H file installed in the \Include folder during installation.

Now, double-click on the ShutdownPod button to display the OnShutdownPod button click event function. Add the following **highlighted** code to this function.

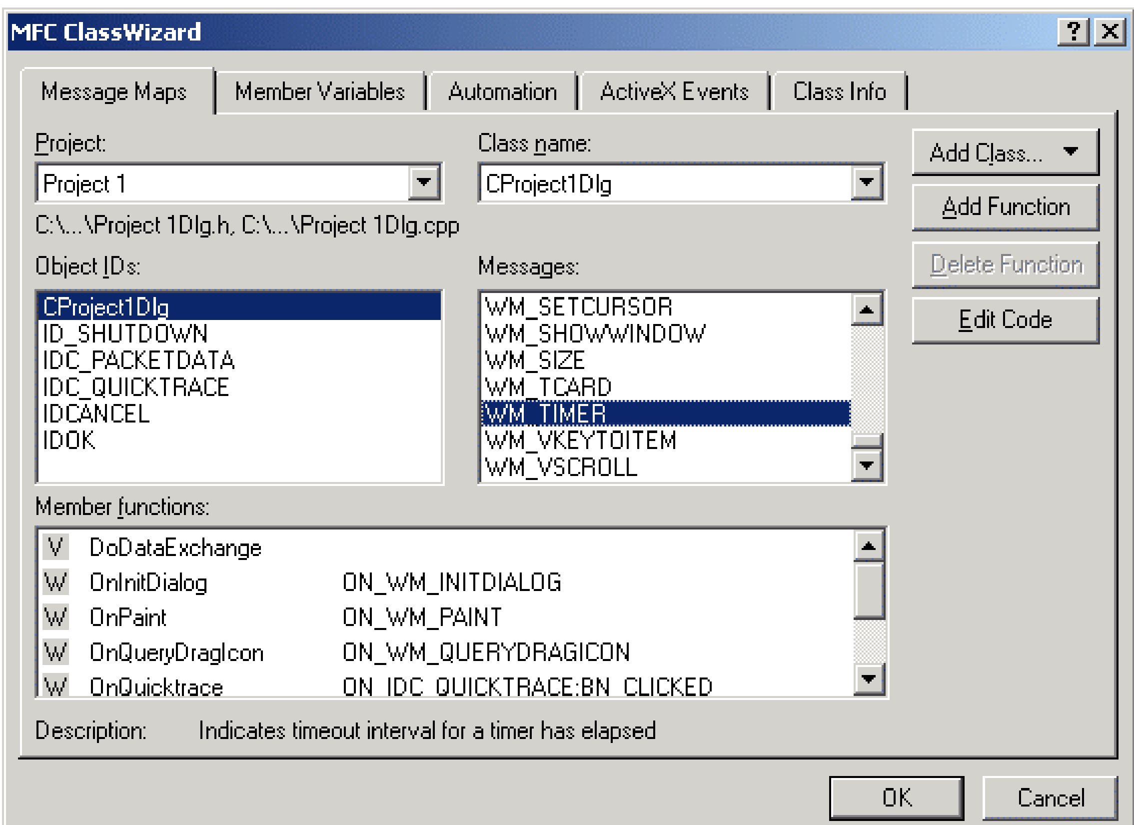
```
void CProject1Dlg::OnShutdownPod()
{
        KillTimer(1); // Stop Pod Packet Retrieval Timer

        BmpShutdown(); // Shutdown the iBMP Pod
        PutPacketData(_T("Trace Terminated"));

        UpdateData(FALSE);          // Update display data
}
```

This code executes when the user clicks the ShutdownPod button. Here we call BmpShutdown function to shutdown the pod, disable the packet retrieval timer, and notify the user of system status.

7. Displaying pod data.

Now we need to add some code to the application that will retrieve and display data packets received from the pod. To do this, we will need to add a WM_TIMER message handler to our dialog class. We have already added the code to enable or disable this timer is the OnQuickTrace and OnShutdownPod functions above.

Hold down the CTRL key and double-click on a blank area of the dialog box in the dialog editor. This will activate the MFC ClassWizzard dialog. On the Messages Maps page, select the WM_TIMER entry in the Messages window, then click Add Function. This will add the OnTimer member function to the dialog class.



Click Edit Code and add the following **highlighted** code to this function.

```
void CProject1Dlg::OnTimer(UINT nIDEvent)
{
        CString lsText;

        // Process Packets
        for (long PacketsToProcess = 1; PacketsToProcess < 100; ++PacketsToProcess)
        {
```

```
                unsigned long Packet = BmpReadPacket(); // Read Packet from Pod

                switch(Packet)      // Look for Special Pod Packets
                {
                        case BMP_PACKET_DATA_NOT_PRESENT:
                        return;

                        case BMP_PACKET_TRACE_COMPLETE:
                        OnShutdownPod();
                        PutPacketData(_T("Trace Complete"));
                        UpdateData(FALSE);          // Update display data
                        return;

                        case BMP_PACKET_POD_NOT_DETECTED:
                        OnShutdownPod();
                        PutPacketData(_T("Pod Not Detected"));
                        UpdateData(FALSE);          // Update display data
                        return;

                        case BMP_PACKET_POD_NOT_INITIALIZED:
                        OnShutdownPod();
                        PutPacketData(_T("Pod Not Initialized"));
                        UpdateData(FALSE);          // Update display data
                        return;
                }

                lsText.Format("%8X", Packet);
                PutPacketData(_T(lsText)); // Display New Packet

                UpdateData(FALSE);          // Update display data

        }

        CDialog::OnTimer(nIDEvent);
}
```

This code executes every timer interval. A 32-bit packet of data is read into the application for processing. The pod packet can contain information on pod status, and on bus activity and timing. Bus activity usually generates a stream of pod packets that a program can analyze to extract specific information. Here we look for some special pod packets that represent pod status. If the data received from the pod is not one of these special packets, we convert the pod packet data to hexadecimal representation and display the data in the PacketData edit box. Complete details on the iBMP pod packet information are explained in an appendix of this guide.

8. Testing pod communications.

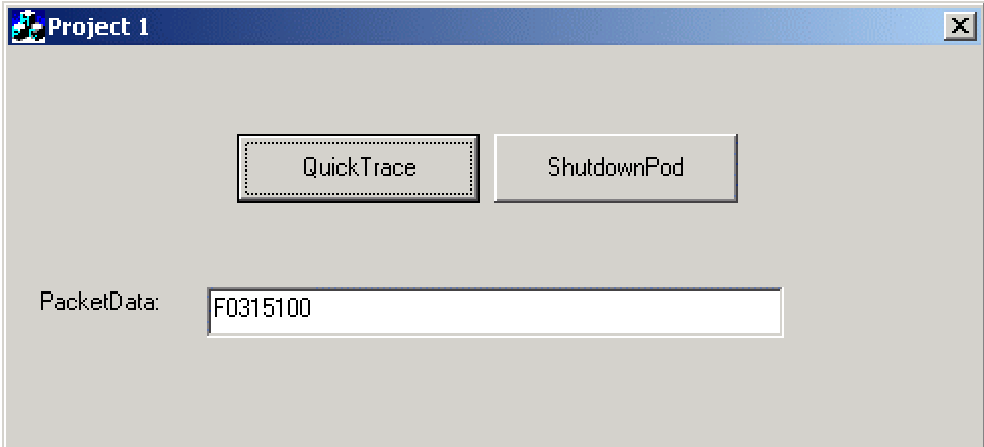
You can now build and run the first phase of this sample application. This phase of the application uses the iBMP DLL QuickTrace method to find, initialize, and initiate bus data collection by the iBMP pod. It also uses the BmpReadPacket function to read pod data packets and display them in simple hexadecimal format.

To save your work, click File|Save Workspace on the MSVC menu bar.

To build the program, click Build|Build Project on the menu bar. Correct any errors displayed in the MSVC Debug window.

To run the program, click Build|Execute Project on the menu bar.

At this time your running program should look something like this:



If everything is working correctly, you should see pod packet data being displayed in the PacketData edit box.

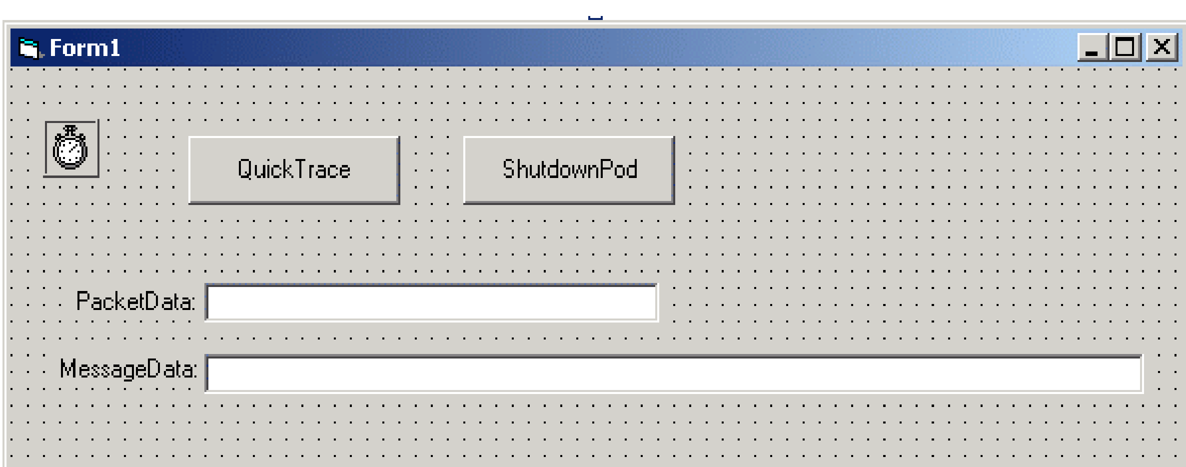
Note: Remember, this program requires a properly installed iBMP pod, with the pod connected to an active I^2C or SMBus. If you are having problems here, you should exit MSVC and run tests with the standard software included with the iBMP package.

9. Phase 2, Displaying pod data in a more meaningful way.

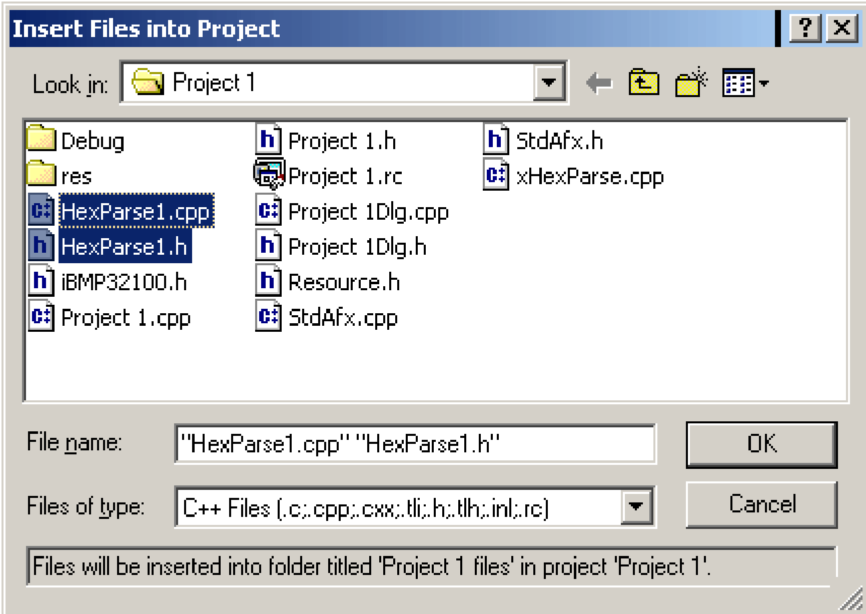
Our goal in this phase of program development is to get more sophisticated with our display of bus message activity. We could write some MSVC code to analyze a stream of pod packets, looking for bus events of interest, and provide the program user with a display of relevant information.

In this application we are going to use the MSVC parser class included with the iBMP SDK. This class includes a HexParse member function that accepts a stream of iBMP pod packets, analyzes the packets, and creates a string of text representing bus activity observed by the pod.

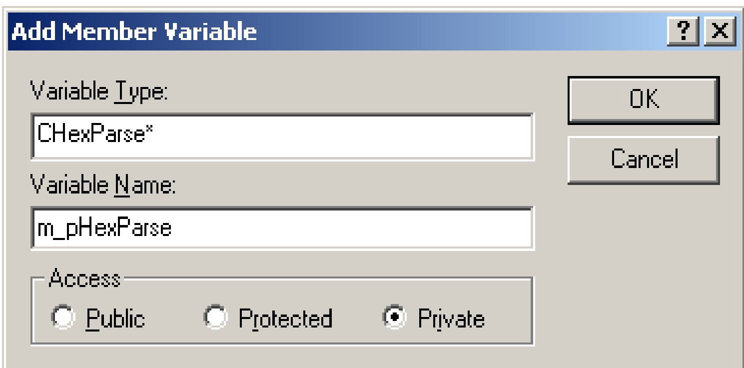
We will add the HexParse class to our MSVC application, and an edit box control to display parser output. When we are done with this section, our form will look something like this:



The HexParse class provides a number of parser output control variables that can be used to control its operation. At this phase of development, our application will use the default action of the parser, which is to display all bus information.



For a MSVC application to use the HexParse class, the class must be added to the to the application's project. To do this, choose Add To Project under the MSVC Project menu, and click on the Files. Select HexParse1.cpp and HexParse1.h, and click OK.



We will also need to add a data member to our dialog class to give our program access to the parser object we will create. To do this, right-click on the dialog class in the ClassView panel, and select Add Member Variable. Since we will be using this member variable as a pointer the HexParse class object, give it the type CHexParse*, and the name m_pHexParse., and click on OK.

To give our application access to the HexParse class, you must include the parser header file in your application's dialog header file. To do this, add the following **highlighted** include statement to the beginning of the dialog header file.

```
// Project 1Dlg.h : header file
//

#include "HexParse1.h"

#if _MSC_VER > 1000
#pragma once
#endif // _MSC_VER > 1000
```

To add the parser object to our program, we need to create the object when the program begins to execute. To do this, add the following **highlighted** statements to the OnInitDialog() function.

```
// TODO: Add extra initialization here

m_pHexParse = new CHexParse(); // Allocate HexParse Object

if (m_pHexParse == NULL)
{
        // allocate failed

        AfxMessageBox("Error Allocating HexParse Object");
}
```

This code creates a new HexParse object, and initializes the object pointer. This pointer will provide program access to the parser object.

We will also need to deallocate the parser object. We will do this in the dialog class destructor. To do this, add the following **highlighted** class destructor.

```
// Destructor to free memory allocated by new
CProject1Dlg::~CProject1Dlg()
{
  delete m_pHexParse; // Free memory assigned to dialog
}
```

To complete the destructor code, add the following **highlighted** dialog destructor declaration to the dialog header file.

```
class CProject1Dlg : public CDialog
{
// Construction
public:
        CProject1Dlg(CWnd* pParent = NULL);  // standard constructor
        ~CProject1Dlg();                     // destructor
```

To add the Message Data edit box to your form, click on the edit box control on the control toolbar and then use the mouse to draw a control on the form. Right-click on the edit box and select Properties from the pop-up menu. Set the control's ID property to IDC_MESSAGEDATA.

We need to add the member variable to our dialog class, so our program can access the new edit box on the application dialog. Since we will be storing data as a string using MFC's CString class, give the data member the name m_strMessageData, the category Value, and the Variable type CString. Click on OK to add the new data member to the class. This member variable is visible in the ClassView page of the MSVC Workspace Window.

To be able to update the m_strMessageData data member from within our program, we need to add a member function to our dialog class. To do this, add the following **highlighted** member function to the class definition in the dialog header file, between the constructor and the dialog data.

```
// CProject1Dlg dialog

class CProject1Dlg : public CDialog
{
// Construction
public:
        CProject1Dlg(CWnd* pParent = NULL);  // standard constructor
        ~CProject1Dlg();                             // destructor

// Properties
public:
        void PutPacketData(const CString& str)
        {       m_strPacketData = str; }
        void PutMessageData(const CString& str)
        {       m_strMessageData = str; }
```

10. Parsing the pod data packet stream.

Adding the HexParse class to the project allows us to add code to the application that makes use of this new tool. This new code will be added to the QuickTrace button click event to initialize the parser, and to the OnTimer event function to send pod packets to the parser and to display parsed message text.

To add the code to the QuickTrace subroutine, double-click on the QuickTrace button. Add the following **highlighted** code to this function.

```
void CProject1Dlg::OnQuickTrace()
```

```
{
	CString lsText;

	long lRetCode = BmpQuickTrace();  // Start Trace

	if (lRetCode != BMP_ERR_NONE)
	{
		lsText.Format("Error Code = %4X", lRetCode);
	   PutPacketData(_T(lsText));		// Display Error Code
	}
	else
	{
	   PutPacketData(_T("Waiting for data"));

		if (m_pHexParse != NULL)
		{
			m_pHexParse->Init(); // Initialize HexParser
		}

		SetTimer(1, 100, NULL); // Start Pod Packet Retrieval Timer
	}

	PutMessageData(_T("")); // Clear Message Display

	UpdateData(FALSE);		// Update display data
}
```

This code initializes the parser, and clears the newly added MessageData edit box.

To add the code to the OnTimer function, double-click on the dialog class OnTimer function member in the ClassView panel. Add the following **highlighted** code to this function.

```
void CProject1Dlg::OnTimer(UINT nIDEvent)
{
	CString lsText;

	// Process Packets
	for (long PacketsToProcess = 1; PacketsToProcess < 100; ++PacketsToProcess)
	{
	unsigned long Packet = BmpReadPacket(); // Read Packet from Pod

	switch(Packet)		// Look for Special Pod Packets
	{
		case BMP_PACKET_DATA_NOT_PRESENT:
		return;

		case BMP_PACKET_TRACE_COMPLETE:
		OnShutdownPod();
		PutPacketData(_T("Trace Complete"));
		UpdateData(FALSE);		// Update display data
		return;

		case BMP_PACKET_POD_NOT_DETECTED:
		OnShutdownPod();
		PutPacketData(_T("Pod Not Detected"));
		UpdateData(FALSE);		// Update display data
		return;

		case BMP_PACKET_POD_NOT_INITIALIZED:
		OnShutdownPod();
		PutPacketData(_T("Pod Not Initialized"));
		UpdateData(FALSE);		// Update display data
		return;
	}

	lsText.Format("%8X", Packet);
	PutPacketData(_T(lsText)); // Display New Packet

	if (m_pHexParse != NULL)
	{
		if (m_pHexParse->Parse(Packet) == HP_PS_MSG_COMPLETE) // Send Packet to HexParser, if Message Complete
			PutMessageData(_T(m_pHexParse->GetCompleteMsgStr())); // Display Complete Message
	}
```

```
        UpdateData(FALSE);          // Update display data
    }

        CDialog::OnTimer(nIDEvent);
}
```

This new code sends pod packets to HexParse and monitors parser return status. This status provides information on the packet parsing operation, and can be used to detect when parser output is available. The message text generated by the parser is available from the HexParse GetCompleteMsgStr() function. Here we display parser output of complete bus messages with the MessageData edit box control.

11. Testing default parser output.

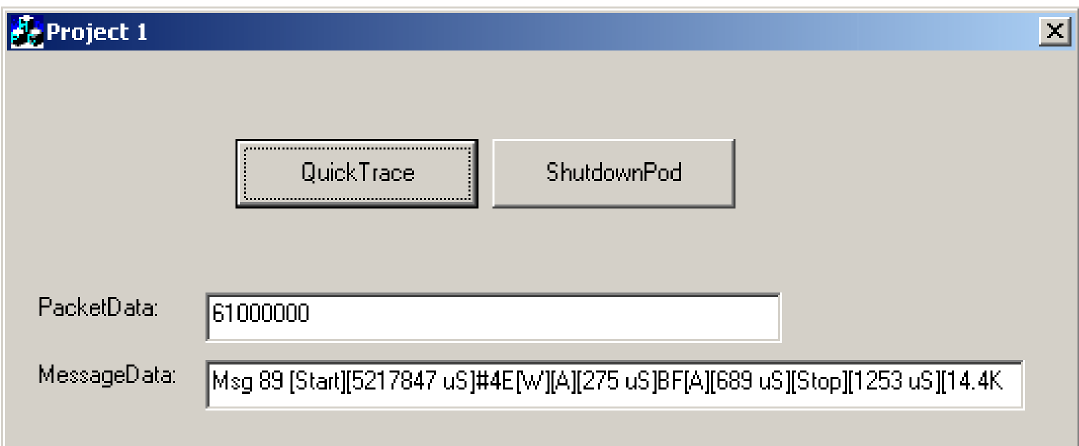
You can now build and run the second phase of this sample application. This phase of the application uses the HexParse class to displayed bus messages in a human readable format.

To save your work, click File|Save Workspace on the MSVC menu bar.

To build the program, click Build|Build Project on the menu bar. Correct any errors displayed in the MSVC Debug window.

To run the program, click Build|Execute Project on the menu bar.

At this time your running program should look something like this:



If everything is working correctly, you should see pod packet data being displayed in the PacketData edit box and bus messages being displayed in the MessageData edit box.

12. Phase 3, Customizing parser output.

Our application currently uses parser default settings to display bus messages. But the HexParse class supports a number of member functions that can be used to customize parser operation. Our goal in this phase of program development is give the program control of parser output.

We could add individual controls to the form to set or clear parser member functions, but a test system may or may not need this amount of flexibility. To keep things simple, our application will simply set the HexParse member functions in the OnQuickTrace function, right after we initialize the parser. To add the code to the OnQuickTrace function, double-click on the QuickTrace button. Add the following **highlighted** code to this function.

```
void CProject1Dlg::OnQuickTrace()
{
CString lsText;

long lRetCode = BmpQuickTrace();        // Start Trace

if (lRetCode != BMP_ERR_NONE)
        {
        lsText.Format("Error Code = %4X", lRetCode);
        PutPacketData(_T(lsText));    // Display Error Code
        }
else
        {
        PutPacketData(_T("Waiting for data"));

        if (m_pHexParse != NULL)
                {
                m_pHexParse->Init();            // Initialize HexParser

                // Set Parser Output Control Variables
                m_pHexParse->SetShowStart(TRUE);            // Show [Start] or [RptStart]
                m_pHexParse->SetShowStop(TRUE);             // Show [Stop]
                m_pHexParse->SetShowReadWrite(TRUE);        // Show [R] or [W]
                m_pHexParse->SetShowAck(FALSE);             // Show [A]
                m_pHexParse->SetShowNak(TRUE);              // Show [N]
                m_pHexParse->SetShowBitData(FALSE);                 // Show Bit Data (0 or 1)
                m_pHexParse->SetShowByteData(TRUE);                 // Show Byte Data (00...FF)
                m_pHexParse->SetShowAbsTime(TRUE);                  // Show Absolute Time
                m_pHexParse->SetShowStartTime(TRUE);                // Show Start Time
                m_pHexParse->SetShowBitTime(FALSE);                 // Show Bit Time
                m_pHexParse->SetShowByteTime(FALSE);                // Show Byte Time
                m_pHexParse->SetShowBitRate(FALSE);                 // Show Msg Ave Bit Rate
                m_pHexParse->SetCompleteOnRepeat(FALSE);            // Complete on Repeat

                // Slave Address Naming
                m_pHexParse->SetSlaveAddrName(0x4e, "#PCF8574");    // Slave Address 4E = "#PCF8574"
                m_pHexParse->SetSlaveNamingEnable(TRUE);            // Enable Slave Address Naming

                // Slave Address Filtering // Enable Message if:
                m_pHexParse->SetSlaveAddrEnabled(0x50, FALSE);      // Slave Address is NOT 0x50
                m_pHexParse->SetSlaveAddrFilterEnable(TRUE);        // Enable Slave Address Filtering

                // Message Data Filtering          // Enable Message if:
                m_pHexParse->SetMsgFilterStr(0,"");         // Slave Address is Don't Care
                m_pHexParse->SetMsgFilterStr(1,"=AK");      // Slave Address is Acked
                m_pHexParse->SetMsgFilterStr(2,"=7Fdf");    // 1st Data 0x7F or 0xDF
                m_pHexParse->SetMsgFilterStr(3,"=AK");      // 1st Data Byte is Acked
                m_pHexParse->SetMsgFilterEnable(TRUE);      // Enable Msg Filtering
                }
                SetTimer(1, 100, NULL);         // Start Pod Packet Retrieval Timer
        }
        PutMessageData(_T(""));         // Clear Message Display
        UpdateData(FALSE);              // Update display data
}
```

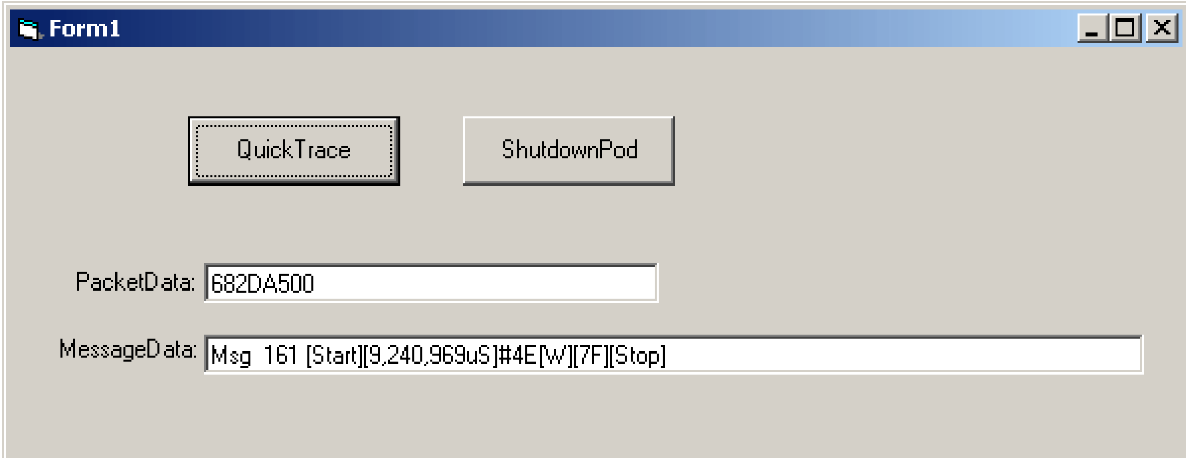
This code sets certain parser properties True or False to control the parser output. During the program testing that follows, you can experiment by changing these properties and examining the associated changes to the parser output displayed in the MessageData text box.

13. Testing display control options

You can now build and run the third phase of this sample application. This phase of the application uses parser properties to customize the displayed bus messages.

Save your work, build, and run the program.

At this time your running program should look something like this:



If everything is working correctly, you should see pod packet data being displayed in the PacketData edit box and customizable bus messages being displayed in the MessageData edit box.

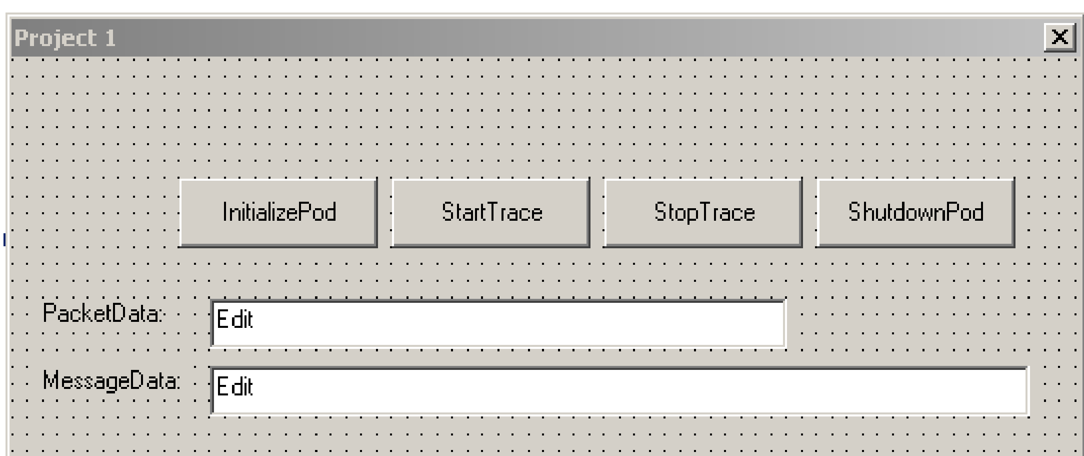
14. Phase 4, Expanding control of the iBMP pod.

Up to this point we have been using the iBMP DLL QuickTrace function to initialize the pod and start a trace. QuickTrace works fine, but it forces the application to use a set of default parameters. Now its time to start using some of the expanded and real-time capabilities of the pod. These capabilities allow the pod to:

1. Synchronize data collection with an external trigger.
2. Generate bit timing information.
3. Generate a trigger out signal in coordination with a specified bus event.
4. Modify its bus voltage logic level.

To add these new capabilities to our application, we will need to call upon a few additional iBMP DLL functions. To give a program user control over these new capabilities, we will need to add three (3) new command buttons to the form.

When we are done with this phase, our form should look something like this:



Since we will no longer be using the QuickTrace button, we can delete it from the form. Do this by selecting the button with the mouse, and pressing the delete key on the keyboard. We will continue to use the ShutdownPod button as before.

To add the three (3) new buttons to your form, resize the form if required, reposition the ShutDown button. Click on the command button control on the MSVC toolbar and draw the buttons on the dialog. Set the control's caption properties to InitializePod, StartTrace, and StopTrace, and their IDs to IDC_INITIALIZEPOD, IDC_STARTTRACE, and IDC_STOPTRACE.

15. Add code to support the expanded controls.

Now we are ready to add code for the three (3) new buttons we added to the form.

Double-click on the InitializePod button to open the click event function. Add the following **highlighted** code to this function.

```
void CProject1Dlg::OnInitializepod()
{
        CString lsText;

        KillTimer(1); // Stop Pod Packet Retrieval Timer

        long lRetCode = BmpInitPod(1);          // Connect using IOBoard 1

        if (lRetCode != BMP_ERR_NONE)
        {
           // iBMP Pod Initialize Failure
          lsText.Format("Error Code = %4X", lRetCode);
          PutPacketData(_T(lsText));   // Display Error Code
        }
        else
        {
           // iBMP Pod Initialize Success
           PutPacketData(_T("Pod Initialization Complete"));
           GetDlgItem(IDC_STARTTRACE)->SetFocus();
        }

        UpdateData(FALSE);          // Update display data
}
```

This code calls the iBMP DLL BmpInitPod function to initialize the pod. This function prepares the pod for bus monitoring activities, and accepts a single argument, the number of the interface board connected to the iBMP pod. Board numbers are assigned during board installation. The iBMP SDK supports up to ten (10) interface boards in a system. Here we are using board zero (1). The BmpInitPod function performs the pod initialization sequence previously performed as part of the BmpQuickTrace function.

Next we will need to add code to command the pod to start collecting data from the bus. To do this, we will add some code to the StartTrace command button click event. To enter this code, double-click on the StartTrace command button, and add the following **highlighted** code to this function.

```
void CProject1Dlg::OnStarttrace()
{
        static BmpTrigOutMem PatternMem;         // Trigger Out Bit Pattern Memory
        static BmpTrigOutMem DontCareMem;        // Trigger Out Don't Care Memory
        static BmpTrigOutMem TrigPosMem;         // Trigger Out Position Memory
        CString lsText;

        // Initialize pod trigger out arrays
        for (int index = BMP_TRIG_OUT_MIN; index <= BMP_TRIG_OUT_MAX; ++index)
        {
           PatternMem[index] = 0x00;        // Pattern match on 0's
           DontCareMem[index] = 0xFF;       // Don't care about any bits
           TrigPosMem[index] = 0x00;        // Disable all trigger out points
        }

        // Set Pod to Trigger Out if 1st message data byte is Hex 55

        // Setup match data, don't care bits, and trigger out point
        PatternMem[BMP_TRIG_OUT_MIN+1] = 0x55;         // Pattern match on 0x55
```

```
        DontCareMem[BMP_TRIG_OUT_MIN+1] = 0x00;         // All bits much match
        TrigPosMem[BMP_TRIG_OUT_MIN+1] = 0x01;          // Trigger out on 1st data byte

        // Command iBMP Pod to start trace
        long lRetCode = BmpTraceStart(
                                FALSE,                  // EnableBitTiming
                                FALSE,                  // StartExtTrig
                                BMP_TRIG_OUT_MATCH,     // Trigger Out Control
                                PatternMem,             // Bit Pattern Memory
                                DontCareMem,            // Don't Care Memory
                                TrigPosMem,             // Trigger Position Memory
                                250                     // Logic Level Threshold
                                );

        if (lRetCode != BMP_ERR_NONE)
        {
                // iBMP Pod Trace Start Failure

                lsText.Format("Error Code = %4X", lRetCode);
                PutPacketData(_T(lsText));   // Display Error Code

                KillTimer(1); // Stop Pod Packet Retrieval Timer
                GetDlgItem(IDC_INITIALIZEPOD)->SetFocus();
        }
        else
        {
                // iBMP Pod Trace Start Success

                PutPacketData(_T("Waiting for data"));

                if (m_pHexParse != NULL)
                {
                        m_pHexParse->Init();            // Initialize HexParser

                        // Set Parser Output Control Variables
                        m_pHexParse->SetShowStart(TRUE);                // Show [Start] or [RptStart]
                        m_pHexParse->SetShowStop(TRUE);                 // Show [Stop]
                        m_pHexParse->SetShowReadWrite(TRUE);            // Show [R] or [W]
                        m_pHexParse->SetShowAck(FALSE);                 // Show [A]
                        m_pHexParse->SetShowNak(TRUE);                  // Show [N]
                        m_pHexParse->SetShowBitData(FALSE);             // Show Bit Data (0 or 1)
                        m_pHexParse->SetShowByteData(TRUE);             // Show Byte Data (00...FF)
                        m_pHexParse->SetShowAbsTime(TRUE);              // Show Absolute Time
                        m_pHexParse->SetShowStartTime(TRUE);            // Show Start Time
                        m_pHexParse->SetShowBitTime(FALSE);             // Show Bit Time
                        m_pHexParse->SetShowByteTime(FALSE);            // Show Byte Time
                        m_pHexParse->SetShowBitRate(FALSE);             // Show Msg Ave Bit Rate
                        m_pHexParse->SetCompleteOnRepeat(FALSE);        // Complete on Repeat

                        // Slave Address Naming
                        m_pHexParse->SetSlaveAddrName(0x4e, "#PCF8574");  // Slave Address 4E = "#PCF8574"
                        m_pHexParse->SetSlaveNamingEnable(TRUE);          // Enable Slave Address Naming

                        // Slave Address Filtering              // Enable Message if:
                        m_pHexParse->SetSlaveAddrEnabled(0x50, FALSE);    // Slave Address is NOT 0x50
                        m_pHexParse->SetSlaveAddrFilterEnable(TRUE);      // Enable Slave Address Filtering

                        // Message Data Filtering               // Enable Message if:
                        m_pHexParse->SetMsgFilterStr(0,"");             // Slave Address is Don't Care
                        m_pHexParse->SetMsgFilterStr(1,"=AK");          // Slave Address is Acked
                        m_pHexParse->SetMsgFilterStr(2,"=7Fdf");        // 1st Data 0x7F or 0xDF
                        m_pHexParse->SetMsgFilterStr(3,"=AK");          // 1st Data Byte is Acked
                        m_pHexParse->SetMsgFilterEnable(TRUE);          // Enable Msg Filtering
                }
                SetTimer(1, 100, NULL);      / Start Pod Packet Retrieval Timer
                GetDlgItem(IDC_STOPTRACE)->SetFocus();
        }

        UpdateData(FALSE);              // Update display data
}
```

This code calls the iBMP DLL BmpTraceStart function to tell the pod to start collecting bus data. The BmpTraceStart function takes seven (7) parameters which are defined in an appendix of this guide. Here we:

a. Disable pod bit timing generation.
b. Start the trace immediately.
c. Generate a trigger out if the first data byte is a 0x55.
d. Set the logic level threshold to 2.50 volts.

If the TraceStart function is successful, we initialize the HexParse parser by calling its Init function, and enable OnTimer events just as we did with the QuickTrace button earlier.

Now we will command the pod to stop collecting data from the bus. To do this, we will add some code to the StopTrace button click event. To enter this code, double-click on the StopTrace button, and add the following **highlighted** code to this function.

```
void CProject1Dlg::OnStoptrace()
{
	KillTimer(1); // Stop Pod Packet Retrieval Timer
	BmpTraceStop();
	PutPacketData(_T("Trace Terminated"));
	GetDlgItem(IDC_STARTTRACE)->SetFocus();

	UpdateData(FALSE);		// Update display data
}
```

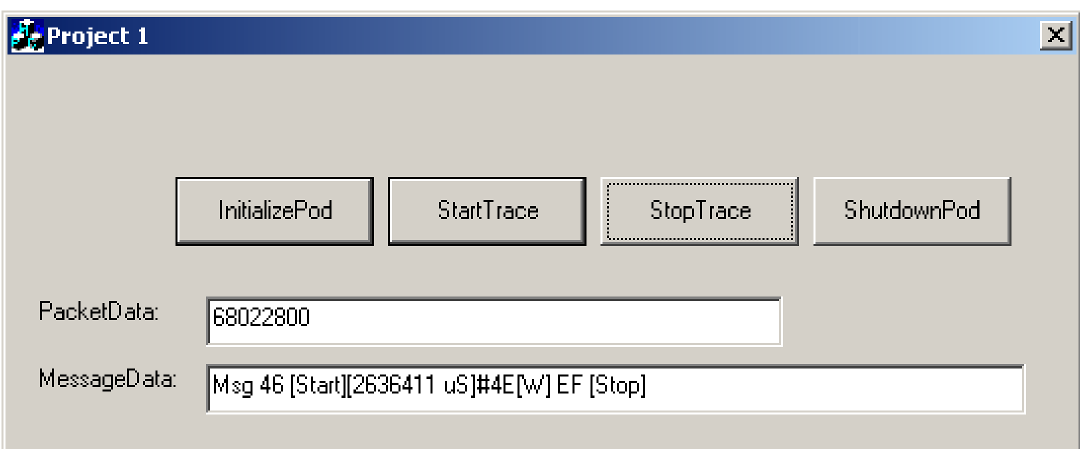
This code disables OnTimer events, and calls the iBMP DLL BmpTraceStop function to command the pod to stop collecting bus data.

16. Testing parser control options.

You can now build and run the forth phase of this sample application. This phase of the application uses iBMP DLL BmpInitPod, BmpTraceStart, and BmpTraceStop functions to add additional control to our bus monitoring activities.

Save your work, build, and run the program.

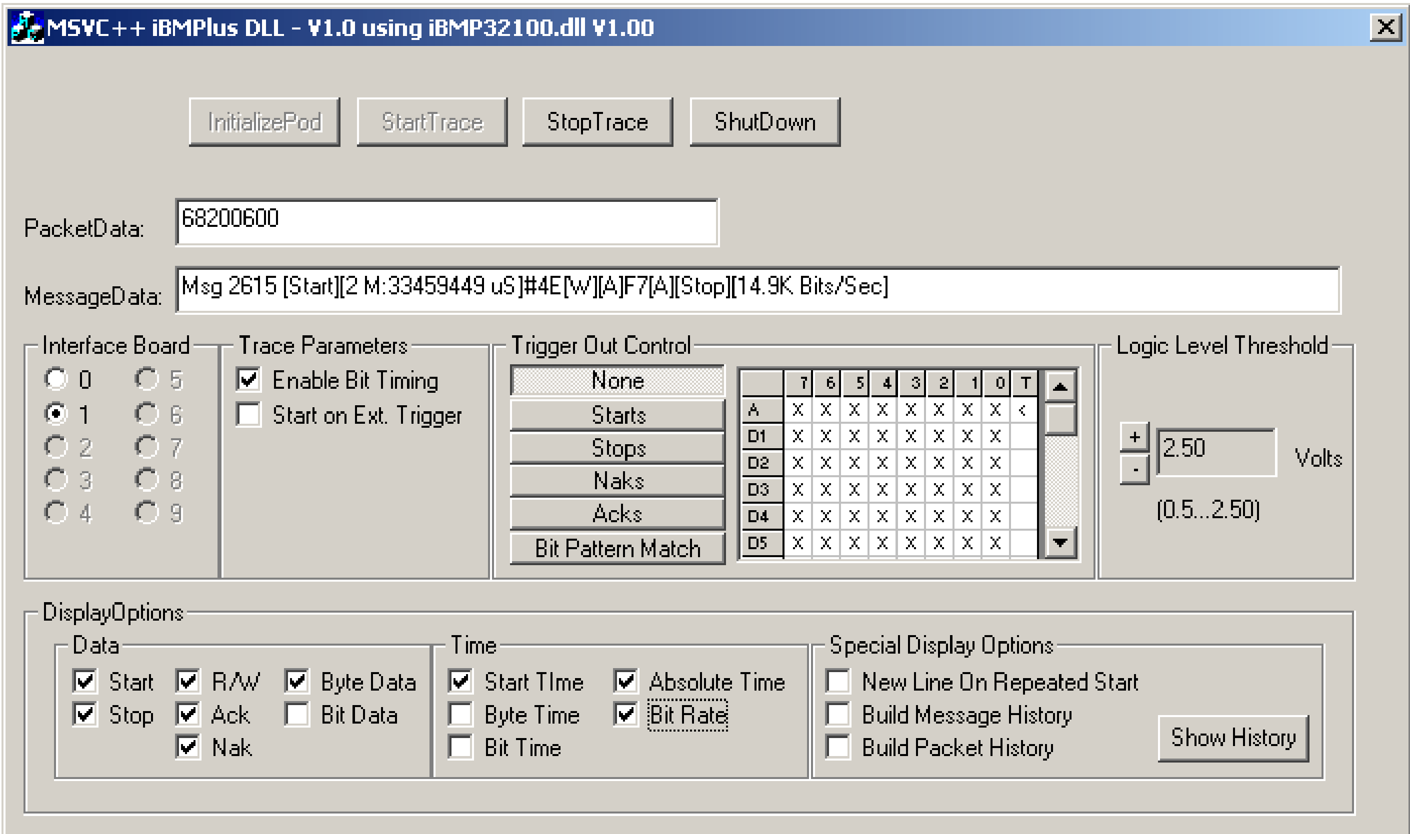
At this time your running program should look something like this:



At this point in program development, we have complete control over pod data collection and parser presentation of bus traffic using hard-coded parameters within the application code.

17. Phase 5, Adding user controls

To complete our sample application, we can now add controls to the form that will allow a user to control some or all aspects of pod and parser operation. Since a test program based on the iBMP SDK may not need this level of control, we provide source files for Phase 5 only. In operation, Phase 5 of the running program will look something like this:



Appendix A. iBMP DLL Application Interface Descriptions

Visual C++

Dynamic Linked Library (DLL)

BmpDllVer() - Get I2C iBMP DLL Revision

Purpose: This function retrieves iBMP DLL revision information.

Usage: Called by an application to retrieve a iBMP DLL revision information.

Arguments: None

Return: (XX.XX) Major.Minor

Example:

```
// Add DLL Version to Dialog Title Bar

CString DllVerStr;
DllVerStr.Format(_T("MSVC++ iBMP DLL Test - V1.0 using %s V%x.%02x"),
                                        BMPdllname,          // iBMP DLL Name
                                        BmpDllVer()>>8 ,     // DLL Major Revision
                                        BmpDllVer()&0xff     // DLL Minor Revision
                        );
this->SetWindowText(DllVerStr); // Update Title Bar Caption
```

BmpQuickTrace() - Quick Trace

Purpose: This function:

1. Finds an external Bus Monitor Plus Pod.
2. Initializes the Pod.
3. Starts a trace using default parameters (see below).

Usage: The BmpQuickTrace() function is a quick way to start a trace. The function searches the host computer for an externally attached iBMP pod. Once a Pod is found, it is automatically initialized, and a trace is started using the following default parameters:

1. Bit Timing Disabled
2. Start Trace Immediate (without External Trigger In)
3. No Trigger Out
4. 2.5V Logic Level Threshold

See BmpTraceStart() below for default parameter descriptions.

The host computer is searched for an externally attached iBMP pod by using interface board numbers established with the Measurement Computing (previously ComputerBoards) InstaCal board installation and configuration program. InstaCal provides the driver for the iBMP interface board. InstaCal is installed from the Measurement Computing (previously ComputerBoards) InstaCal CD.

Argument: None

Return:	BMP_ERR_NONE	= No Error Detected
	BMP_ERR_PODNOTREADY	= Pod Not Ready

Example:

```
RetCode = BmpQuickTrace; // Start Trace

if (RetCode == BMP_ERR_NONE) // if initialization successful
{
        // iBMP Pod QuickTrace Success
}
else
{
        // iBMP Pod QuickTrace Failure
}
```

BmpCheckBoardNumber() - Check I2C iBMP Interface Board Number

Purpose: This function checks for the presence of a iBMP Interface Board at the specified board number.

Usage: Called by an application to determine if a specific iBMP Interface Board is present in the system.

Arguments: BoardNumber (0...9)

Return: TRUE if board is present.

Example:

```
// Find Installed iBMP Interface Boards

for (int BoardNum = 0; BoardNum <= 9; ++BoardNum) // for all possible Interface Boards
{
        if (BmpCheckBoardNumber(9 - BoardNum)) // if Interface Board detected
        {
                pWnd = (CWnd*) GetDlgItem(aiIDC[9 - BoardNum]);  // Enable Board Button
                pWnd->EnableWindow(TRUE);
        }
}
```

BmpInitPod() - Initialize iBMP Pod

Purpose: This function initializes the external Bus Monitor Plus Pod.

Usage: The BmpInitPod() function is called with a single parameter that indicates which interface board (0 to 9) is connected to the iBMP pod.

The interface board number is established with the Measurement Computing (previously ComputerBoards) InstaCal board installation and configuration program. InstaCal provides the driver for the iBMP interface board. InstaCal is installed from the Measurement Computing (previously ComputerBoards) InstaCal CD.

Argument: BoardNumber (0...9) = iBMP Interface Board Number

Return:	BMP_ERR_NONE	=	No Error Detected
	BMP_ERR_BOARDNUMRANGE	=	Board Number Out-Of-Range
	BMP_ERR_BOARDNUMINVALID	=	Invalid Board Number
	BMP_ERR_PODFILENOTFOUND	=	Pod Config File Not Found
	BMP_ERR_PODNOTREADY	=	Pod Not Ready

Example:

```
BeginWaitCursor(); // switch to HourGlass cursor

RetCode = BmpInitPod(InterfaceBoardNumber); // Initialize iBMP Pod

EndWaitCursor(); // restore cursor

if (RetCode == BMP_ERR_NONE) // if initialization successful
{
        // iBMP Pod Initialize Success

}
else
{
        // iBMP Pod Initialize Failure
}
```

BmpTraceStart() - Trace Start

Purpose: This function configures the external Bus Monitor Plus Pod and commands the Pod to start collecting message data.

Usage: The BmpTraceStart() function is called by an application to start bus data collection.

Once commanded to start collecting data, Pod data collection begins with either:

a. The next Start condition on the bus, or
b. If StartExtTrig is enabled, with the next Start condition following a Pod Trigger In signal.

Data collected is held within the external Pod until the BmpReadPacket() function is called by the application to read Pod data. For more information see the OnTimer() function in this application.

Arguments: This function is called with the following parameters:

1. EnableBitTiming

This boolean flag enables bit timing data collection.

2. StartExtTrig

This boolean flag enables data collection only after the pod receives an external trigger (high to low) on its Trigger In Port.

3. Trigger Out Control

This BYTE parameter controls the iBMP Trigger Out Port. The Trigger Out Port can generate at signal (high to low) upon the detection of:

a. Bus Start conditions (BMP_TRIG_OUT_START).
b. Bus Stop conditions (BMP_TRIG_OUT_STOP).
c. Bus Naks (BMP_TRIG_OUT_NACK).
d. Bus Acks (BMP_TRIG_OUT_ACK).
e. A Bit Pattern Match on a message slave address or within the first 15 data bytes of a message (BMP_TRIG_OUT_MATCH).

Set Trigger Out Control to BMP_TRIG_OUT_NONE to disable Trigger Out generation.

4. Bit Pattern Memory

An array of 16 bytes used to specify a data bit pattern, where:

```
0,      1,      2,      3,      4       ...15
[A      D1      D2      D3      D4      ...D15]
|       |       |       |       |       |
|       |       |       |       |       |
|       |________________________________|
|                                       |
|________________                       |
Address         R/W                     Data
|---------------|                       |-------------|
[0000000        0]                      [0000 0000]
```

a. Array byte [0] is the bit pattern for the message slave address and R/W bit.
b. Array bytes [1...15] are the bit patterns for the first 15 data bytes of a message.

Each bit of each array byte is matched with each bit of the message slave address or data byte. The Acknowledge bit following each message byte is skipped. Don't Care bits (see below) are not tested.

5. Don't Care Memory

An array of 16 bytes used to specify Don't Care bits, where:

a. Array byte [0] is the Don't Care bit pattern for the message slave address.
b. Array bytes [1...15] are the Don't Care bit patterns for the first 15 data bytes of a message.
c. 1 = Don’t Care.

The Most Significant Bit (MSB) of each array byte is matched with the MSB of the message slave address or data byte. The Acknowledge bit following each message byte is skipped.

Don't Care bits (bit value = 1) are not tested. All other message bits, up to the Trigger Position (see below), are tested.

6. Trigger Position Memory

An array of 16 bytes used to specify the Trigger Position, where:

a. Array byte [0] is the Trigger Position for the message slave address.
b. Array bytes [1...15] are the Trigger Positions for the first 15 data bytes of a message.

Trigger Position only uses the Least Significant Bit (LSB) of each array byte. This LSB marks the position within a message where the Trigger Out signal is generated if all non-Don't Care message data bits up to this point in the message matched the Bit Pattern data. The Acknowledge bit following each message byte is skipped.

7. Logic Level Threshold

This BYTE parameter configures the iBMP Logic Level Threshold. Once configured, bus Clock (SCL) and Data (SDA) signals below the specified voltage are consider to have a zero (0) logic lever.

Set parameter value in the decimal range of 50 to 250 for 0.50 to 2.50 Volts.

If BmpTraceStart() is successful, the Hex Parser is initialized, the User Interface is updated, and the Pod Packet Retrieval Timer is started.

The Pod Packet Retrieval Timer executes its event handler at evenly spaced intervals. This handler retrieves packets from the iBMP Pod, pre-processes the packets, passes the packets to the Hex Parser, and updates the User interface.

The Hex Parser processes a stream of iBMP Pod packets, detects bus events, and generates a stream of text strings suitable for presentation to the User interface.

Return:	BMP_ERR_NONE	=	No Error Detected
	BMP_ERR_BOARDNUMRANGE	=	Board Number Out-Of-Range

BMP_ERR_BOARDNUMINVALID	=	Invalid Board Number
BMP_ERR_PODFILENOTFOUND	=	Pod Config File Not Found
BMP_ERR_PODNOTREADY	=	Pod Not Ready

Example:

```
// Trigger Out Memory Arrays
BmpTrigOutMem PatternMem;
BmpTrigOutMem DontCareMem;
BmpTrigOutMem TrigPosMem;

// Command iBMP Pod to start trace

RetCode = BmpTraceStart(
                TRUE,                   // EnableBitTiming
                FALSE,                  // StartExtTrig
                BMP_TRIG_OUT_NONE,      // Trigger Out Control
                PatternMem,             // Bit Pattern Memory
                DontCareMem,            // Don't Care Memory
                TrigPosMem,             // Trigger Position Memory
                250                     // Logic Level Threshold
                );

if (RetCode == BMP_ERR_NONE)
{
    // iBMP Pod Trace Start Success
}
else
{
    // iBMP Pod Trace Start Failure
}
```

BmpReadPacket() - Read iBMP Pod Packet

Purpose: To retrieve a iBMP pod data packet.

Usage: Called by an application to retrieve a iBMP pod data packet following a Start Trace command.

A packet is an unsigned 32-bit number representing iBMP pod status or bus events. There are two types of data packets, standard packets, and special packets.

Standard Packets

Standard packets represent I2C Bus events. Each standard packet consists of three (3) fields (ID, Time, and Data) with the following definitions:

Packet ID (0xXX000000)

The packet ID field is used to identify the pod events that generated the packet, and bus conditions present at the time the packet was generated. More than one event can occur in a single packet. Pod events/conditions include:

Events (which caused the packet to be generated)

BMP_INFO_RAP_EVENT — Pod Timer Overflow

The iBMP pod includes a 16-bit timer that increments on a 1 microsecond interval. This event occurs when the timer overflows. Upon overflow, the timer continues counting from zero.

Unitialized timer counting begins when an Initialize Pod command is issued to the pod. BMP_INFO_RAP_EVENT events are withheld by the pod until the first bus Start condition is detected following a Start Trace command.

BMP_INFO_BITTIME_EVENT — Bit Detected

If pod bit timing is enabled, this event occurs when the pod detects a rising edge on the bus SCL line.

BMP_INFO_START_EVENT — Start Detected

Occurs when the pod detects a falling edge on the bus SDA line while the SCL line is high. The first standard packet generated following a Start Trace command will always be a Start event.

BMP_INFO_STOP_EVENT — Stop Detected

Occurs when the pod detects a rising edge on the bus SDA line while the SCL line is high.

BMP_INFO_DATA_EVENT — Byte Detected

Occurs when the pod detects a rising edge on the bus SCL line during the byte Acknowledge (9th) bit time. This event occurs on all bus byte transfers, including slave address bytes, extended addressing bytes, and message data bytes.

Conditions (present at the time the packet was generated)

BMP_INFO_SCL_BIT — SCL Signal Level

Logical signal level (pod threshold controlled) of the bus Clock (SCL) line.

BMP_INFO_SDA_BIT — SDA Signal Level

Logical signal level (pod threshold controlled) of the bus Data (SDA) line. Can be used to determine the logic level of a data bit at a Bit event.

BMP_INFO_NAK_BIT	Acknowledge Bit Signal Level Logical signal level (pod threshold controlled) of the bus Data (SDA) line on Acknowledge (9th) bit SCL rising edge.

Packet Time (0x00XXXX00)

Packet Time is an unsigned 16-bit field that can be used to identify when bus events occur.

The iBMP pod includes a 16-bit timer that increments on a 1 microsecond interval. The timer counting begins when an Initialize Pod command is issued to the pod. The packet Time field identifies the pod timer count when a packet was generated. Upon reaching a timer overflow, the pod generates a BMP_INFO_RAP_EVENT event and continues counting from zero.

Since pod packets are held within the iBMP pod in internal FIFO memory until read out by the host computer, the packet Time field represents a real-time recording of bus activity, and provides for non-real-time processing of bus events by the host computer with microsecond accuracy.

Making Time Measurements

If timing is a critical measurement in a bus test procedure, a host computer program controlling the test will need to determine elapsed time between an initial and final bus event. To make this measurement, the computer program will record the packet Time on the initial bus event (Start, Bit, Data, Stop) and will reset a Timer Over Flow count program variable. The computer program will then count any Timer Overflow events, and record the packet Time for the final bus event (Start, Bit, Data, Stop).

The elapsed time between the bus events (in microseconds) can then be computed by:

Elapsed Time = (Final Packet Time + (Timer Overflow Count * 0x10000)) - (Initial Packet Time)

For example, if:

a. The initial packet Time is 0xFFFE.
b. The pod timer overflows 4 times during the measurement.
c. The final packet Time is 0x0002.

then:

Elapsed Time = (2 + (4 * 0x10000)) - (0xFFFE) = 0x3004 = 196,612 uSec

Packet Data (0x000000XX)

Packet Data is an unsigned 8-bit field that can be used to identify the value of a message byte. The first (and second for 10-bit addressing) byte following a bus Start event is the message slave address, and subsequent bytes are message data.

Special Packets

Special packets are used to insert iBMP pod status into the packet stream. Each special packet is identified by its specific value. These packets include:

BMP_PACKET_DATA_NOT_PRESENT	Data Not Present iBMP pod FIFO is empty. No data available.
BMP_PACKET_TRACE_COMPLETE	Trace Complete Trace terminated on FIFO overflow. All pod data collected up to the point of FIFO overflow has been read.
BMP_PACKET_POD_NOT_DETECTED	Pod Not Detected The iBMP pod or interface board not detected.
BMP_PACKET_POD_NOT_INITIALIZED	Pod Uninitialized Attempt to read data from an uninitialized pod.

Example:

```
void CMSVCBMPlusDLLTestDlg::OnTimer(UINT nIDEvent)
{
	unsigned long PodPacket;
	long PacketsToProcess;

	for (PacketsToProcess = 1; PacketsToProcess < 100; ++PacketsToProcess) // Process Packets
	{
		PodPacket = BmpReadPacket(); // Read Packet from iBMP Pod

		if (PodPacket == BMP_PACKET_DATA_NOT_PRESENT) // if no Packets available
			return;

		ProcessPacket(PodPacket); // Process Packet
	}

	CDialog::OnTimer(nIDEvent);
}
```

BmpTraceStop() - Trace Stop

Purpose: This function stops message data collection.

Usage: The BmpTraceStop() function is called by an application to stop bus data collection. Once stopped, data collection can be restarted with the BmpTraceStart() or BmpQuickTrace functions.

Arguments: None

Return: BMP_ERR_NONE = No Error Detected

Example:

BmpTraceStop(); // Command iBMP pod to stop trace

BmpShutdown() - iBMP Pod Shutdown

Purpose: This function terminates iBMP Pod activity.

Usage: The BmpShutdown() function is called by an application to terminate iBMP Pod activity. Once shutdown, the pod can be restarted with the BmpInitPod() or BmpQuickTrace functions.

Arguments: None

Return: BMP_ERR_NONE = No Error Detected

Example:

BmpShutdown(); // Terminate iBMP pod activity