Mini-Circuits Portable Test Equipment (PTE) Programming Manual

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Chapter 1 - Introduction and Overview

1.1 - Overview

This Programming Manual is intended for customers wishing to create their own interface for Mini-Circuits' USB controlled Portable Test Equipment (PTE). For instructions on using the supplied GUI program, or connecting the PTE hardware, please see the User Guide of the relevant model.

Mini-Circuits offers support over a variety of operating systems, programming environments and third party applications.

Support for Windows® operating systems is provided through the Microsoft®.NET® and ActiveX® frameworks to allow the user to develop customized control applications. Support for Linux® operating systems is accomplished using the standard libhid and libusb libraries.

Mini-Circuits has experience with a wide variety of environments including (but not limited to):

- Visual Basic®, Visual C#®, Visual C++®
- Delphi®
- Borland C++®
- CVI®
- LabVIEW®
- MATLAB®
- Python®
- Agilent VEE®

The Mini-Circuits PTE CD package includes a GUI program installation, DLL Objects (32/64 bit), Linux support, project examples for third party software, and detailed user manuals. The latest CD version is available for download at:

http://www.minicircuits.com/support/software_download.html

For details on individual models, application notes, GUI installation instructions and user guides please see:

http://www.minicircuits.com/products/PortableTestEquipment.shtml

Files made available for download from the Mini-Circuits website are subject to Mini-Circuits' terms of use which are available on the website.

1.2 - Operating in a Windows Environment

1.2.1 - The DLL (Dynamic Link Library) Concept

The Dynamic Link Library concept is Microsoft's implementation of the shared library concept in the Windows environment.

DLLs provide a mechanism for shared code and data, intended to allow a developer to distribute applications without requiring code to be re-linked or recompiled.

Mini-Circuits' CD package provides DLL Objects designed to allow your own software application to interface with the functions of Mini-Circuits' PTE, see Figure 1.
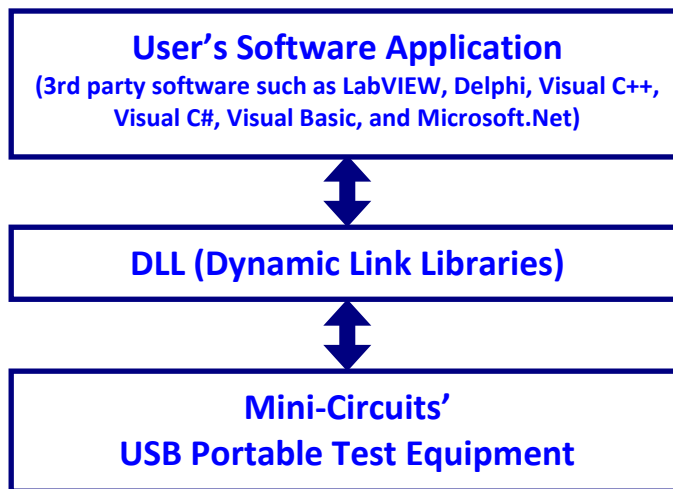
User's Software Application
(3rd party software such as LabVIEW, Delphi, Visual C++, Visual C#, Visual Basic, and Microsoft.Net)

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DLL (Dynamic Link Libraries)

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Mini-Circuits'
USB Portable Test Equipment

Figure 1: DLL Interface Concept

Mini-Circuits' CD package provides two DLL files, the choice of which file to use is dictated by the user's operating system:

1. **ActiveX com object**
    Designed to be used in any programming environment that supports third party ActiveX COM (Component Object Model) compliant application.
    The ActiveX file should be registered using RegSvr32 (see following sections for details).

2. **Microsoft.NET Class Library**
    Designed to be a logical unit of functionality that runs under the control of the Microsoft.NET system.

1.2.2 - Summary of DLL Files for the Mini-Circuits PTE Range

ActiveX Com objects and Microsoft.Net class libraries can be downloaded from the Mini-Circuits website at:

http://www.minicircuits.com/support/software_download.html

Product Family	ActiveX Com Object	.Net Class Library
RF Switch Matrices	mcl_rf_switch_controller.dll	mcl_rf_switch_controller64.dll
Signal Generators	mcl_gen.dll	mcl_gen64.dll
Power Meters	mcl_pm.dll	mcl_pm64.dll
Frequency Counters	mcl_freqcounter.dll	mcl_freqcounter64.dll
Digital Step Attenuators	mcl_rudat.dll	mcl_rudat_64.dll
Input/Output Control Boxes	mcl_usb_to_io64.dll	mcl_usb_to_io64_64.dll
USB/RS232/SPI Converters	mcl_rs232_usb_to_spi.dll	mcl_rs232_usb_to_spi_64.dll

1.2.3 - ActiveX COM Object

ActiveX COM object DLL files are designed to be used with both 32 bit and 64 bit Windows operating systems. A 32 bit programming environment that is compatible with ActiveX is required. To develop 64 bit applications, the Microsoft.NET Class library should be used instead.

Supported Programming Environments

Mini-Circuits' PTE devices have been tested in the following programming environments. This is not an exhaustive list and the DLL file is designed to operate in most environments that support ActiveX functionality. Please contact Mini-Circuits for support.
- Visual Studio® 6 (Visual C++ and Visual Basic)
- LabVIEW 8.0 or newer
- MATLAB 7 or newer
- Delphi
- Borland C++
- Agilent VEE
- Python

Installation

1. Copy the DLL file to the correct directory:
    a. For 32 bit Windows operating systems this is C:\WINDOWS\System32
    b. For 64 bit Windows operating systems this is C:\WINDOWS\SysWOW64
2. Open the Command Prompt:
    a. For Windows XP® (see Fig 1.1.2a):
        i. Select "All Programs" and then "Accessories" from the Start Menu
        ii. Click on "Command Prompt" to open
    b. For later versions of the Windows operating system you will need to have Administrator privileges in order to run the Command Prompt in "Elevated" mode (see Fig 1.1.2b):
        i. Type "Command Prompt" in the Start Menu search box
        ii. Right-click on the link to the Command Prompt link
        iii. Select "Run as Administrator"
        iv. You may be prompted to enter the log in details for an Administrator account if the current user does not have Administrator privileges on the local PC
3. Use regsvr32 to register the DLL:
    a. For 32 bit Windows operating systems (see Fig 1.1.2c) type:
        \WINDOWS\System32\Regsvr32 \WINDOWS\System32\mcl_pm.dll
        (where mcl_pm.dll is the name of the relevant DLL)
    b. For 64 bit Windows operating systems (see Fig 1.1.2d) type:
        \WINDOWS\SysWOW64\Regsvr32 \WINDOWS\SysWOW64\mcl_pm.dll
        (where mcl_pm.dll is the name of the relevant DLL)
4. Hit enter to confirm and a message box will appear to advise of successful registration.
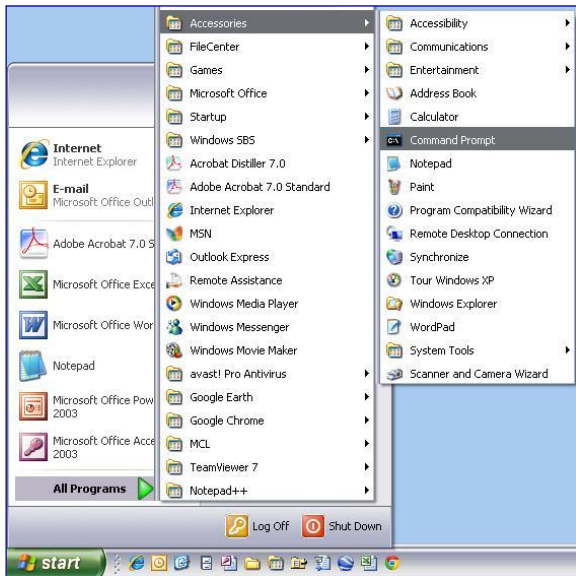
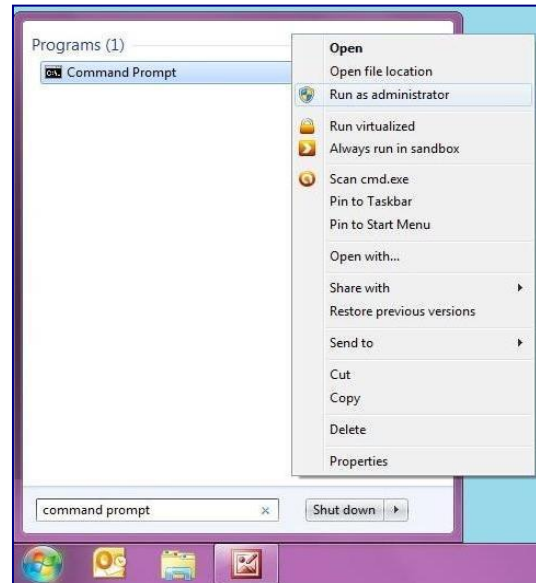Fig 1.1.2a: Opening the Command Prompt in Windows XP   Fig 1.1.2b: Opening the Command Prompt in Windows 7®
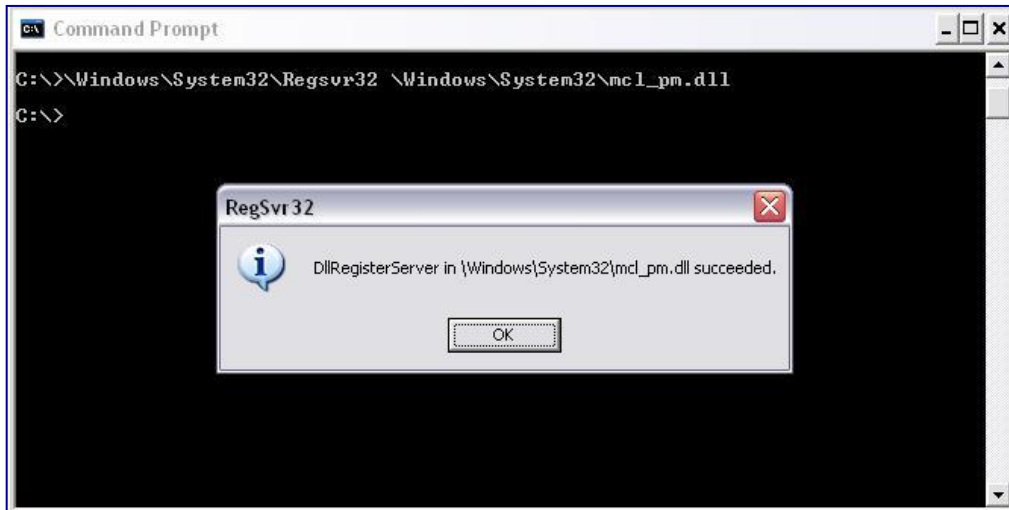

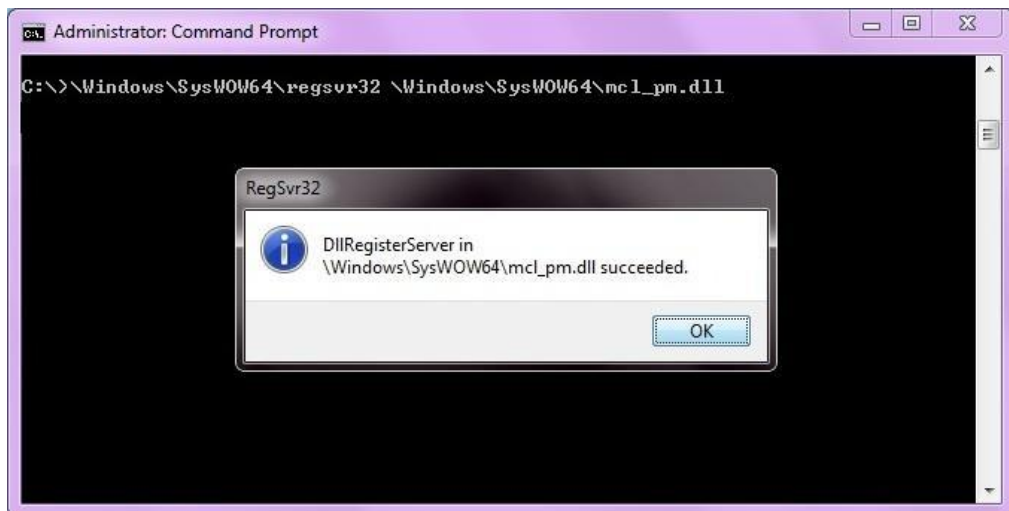Fig 1.1.2c: Registering the DLL Using the Command Prompt in Windows XP

Fig 1.1.2d: Registering the DLL Using the Command Prompt in Windows 7

1.2.4 - Microsoft.NET Class Library

Microsoft.NET class libraries are designed to be used with both 32 bit and 64 bit Windows operating systems. To develop 64 bit applications the user must have both a 64 bit operating system and 64 bit programming environment. However, the Microsoft.NET class library is also compatible with 32 bit programming environments.

Supported Programming Environments

Mini-Circuits' PTE devices have been tested in the following programming environments. This is not an exhaustive list and the DLL file is designed to operate in most environments that support Microsoft.NET functionality. Please contact Mini-Circuits for support.
- National Instruments CVI
- Microsoft.NET (Visual C++, Visual Basic.NET, Visual C# 2003 or newer)
- LabVIEW 2009 or newer
- MATLAB 2008 or newer
- Delphi
- Borland C++

Installation

1. Copy the DLL file to the correct directory
   a. For 32 bit Windows operating systems this is C:\WINDOWS\System32
   b. For 64 bit Windows operating systems this is C:\WINDOWS\SysWOW64
2. **No registration is required**

1.3 - Operating in a Linux Environment

To open a connection to Mini-Circuits PTE devices, the Vendor ID and Product ID are required:
- Mini-Circuits Vendor ID: 0x20CE
- Mini-Circuits Product IDs:
    - Switch Matrices: 0x22
    - Signal Generators: 0x12
    - Power Meters: 0x11
    - Frequency Counters: 0x10
    - Digital Step Attenuators: 0x23
    - Input/Output Control Boxes: 0x21
    - USB/RS232/SPI Converters: 0x25

Communication with each PTE device is carried out by way of USB Interrupt. The transmitted and received buffer sizes are 64 Bytes each:
- Transmit Array = [Byte 0][Byte1][Byte2]…[Byte 63]
- Returned Array = [Byte 0][Byte1][Byte2]…[Byte 63]

In most cases, the full 64 byte buffer size is not needed so any unused bytes become "don't care" bytes; they can take on any value without affecting the operation of the PTE.

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