xPC Target

For Use with Real-Time Workshop®

- Modeling
- Simulation
- Implementation

API User's and Reference Guide

Version 2

The MathWorks

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Contents

Preface

The xPC Target API and xPC Target COM API libraries enable you to write custom applications to control real-time MATLAB Simulink applications running on a target PC. This chapter includes the following sections:

Required Products

Refer to the preface of the xPC Target Getting Started Guide for a list of the required xPC Target products. In addition, you need the following products:

- **Third-Party Compiler** — Use a third-party compiler to build a custom application that calls functions from the xPC API library. Although the xPC API library is written in C, you can write the application that calls these functions in another high-level language, such as C++. You can use any compiler that can generate code for Win32 systems.

  To write a non-C application that calls functions in the xPC Target API library, refer to the compiler documentation for a description of how to access functions from a library DLL. You must follow these directions to access the xPC Target API DLL.
- **Third-Party Graphical Development Environment**— Use a third-party graphical development environment to build a custom application that references interfaces in the xPC COM API library. Layered on top of the xPC API library, the xPC COM API library enables you to write custom applications using a component object model library. You can use any compiler that can work with component object model (COM) objects.

Using This Guide

To help you read and use this guide effectively, this section provides a brief description of the chapters.

The following table lists the organization of this xPC Target User's and Reference Guide.

Chapter	**Description**
Chapter 1, "Introduction"	This chapter is an overview of the xPC Target API and xPC Target COM API libraries.
Chapter 2, "xPC Target API"	This chapter describes how to use the xPC Target API library, including how to create, build, and run such an application.
Chapter 3, "xPC Target COM API"	This chapter describes how to use the xPC Target COM API library, including how to create, build, and run such an application.
Chapter 4, "xPC Target API Function Reference"	This chapter describes the xPC Target API library, including function synopses and error returns.

Typographical Conventions

This manual uses some or all of these conventions.

Item	Convention	Example
Example code	`Monospace` font	To assign the value 5 to `A`, enter `A = 5`
Function names, syntax, filenames, directory/folder names, and user input	`Monospace` font	The `cos` function finds the cosine of each array element. Syntax line example is `MLGetVar ML_var_name`
Buttons and keys	**Boldface** with book title caps	Press the **Enter** key.
Literal strings (in syntax descriptions in reference chapters)	**`Monospace bold`** for literals	`f = freqspace(n,'`**`whole`**`')`
Mathematical expressions	*Italics* for variables Standard text font for functions, operators, and constants	This vector represents the polynomial $p = x^2 + 2x + 3$.

MATLAB output	`Monospace font`	MATLAB responds with
		`A =`
		`    5`

Menu and dialog box titles	**Boldface** with book title caps	Choose the **File Options** menu.
New terms and for emphasis	*Italics*	An *array* is an ordered collection of information.
Omitted input arguments	(...) ellipsis denotes all of the input/output arguments from preceding syntaxes.	`[c,ia,ib] = union(...)`
String variables (from a finite list)	*`Monospace italics`*	`sysc = d2c(sysd,'`*`method`*`')`

Introduction

Using either the xPC Target API dynamic link library (DLL) or the xPC Target component object model (COM) API library, you can create custom applications to control a real-time application running on the target PC. You generate real-time applications from Simulink models.

This chapter includes the following sections:

xPC Target API versus xPC Target COM API

The xPC Target API and xPC Target COM API interfaces provide the same functionality for you to write custom applications. There is no difference in performance or functionality between applications written against either library.

The xPC Target API DLL consists of C functions that you can incorporate into any high-level language application. The xPC Target COM API consists of a suite of interfaces that you can reference while building a graphic user interface (GUI) application. You can incorporate these interfaces using programming environments that work with COM objects. A user can use an application written through either interface to load, run, and monitor an xPC Target application without interacting with MATLAB. With the xPC Target API, you write the application in a high-level language (such as C, C++, or Java) that works with an xPC Target application; this option requires that you are an experienced programmer. With xPC Target COM API, you use a graphical development environment to create a GUI that works with an xPC Target application. Designed to work with Microsoft COM, the xPC Target COM API conforms to the component object model standard established by Microsoft.

The xPC Target API is distributed with two dynamic link libraries (DLLs) that make it easier to integrate with various development tools, tailoring the development environment to your needs:

- A function library (`xpcapi.dll`)
- A component library (`xpcapicom.dll`)

The following sections describe each library:

- "What Is xPC Target API?" on page 1-4
- "What Is xPC Target COM API?" on page 1-6

Note In this book, second-person references apply to those who write the xPC Target API and COM API applications. For example, “You can assign multiple labels to one tag.” Third-person references apply to those who run the xPC Target API and COM API applications. For example, “You can later distribute this executable to users, who can then use the GUI application to work with target applications.”

What Is xPC Target API?

The xPC Target API consists of a series of C functions that you can call from a C or C++ application. These functions enable you to

- Establish communication between the host PC and the target PC via an Ethernet or serial connection
- Load the target application, a `.dlm` file, to the target PC
- Run that application on the target PC
- Monitor the behavior of the target application on the target PC
- Stop that application on the target PC
- Unload the target application from the target PC
- Close the connection to the target PC

The `xpcapi.dll` file contains the xPC Target API dynamic link library. It contains over 90 functions that enable run-time linking rather than static linking at compile time. The functions provide all the information and accessibility needed to access the target application. Accessing the xPC Target API DLL is beneficial when you are building applications using development environments such as Microsoft Foundation Class Library/Active Template Library (MFC/ATL), DLL, Win32 (non-MFS) program and DLL, and console programs integrating with third-party product APIs (for example, Altia).

All custom xPC Target API applications must link with the `xpcapi.dll` file (xPC API DLL). Also associated with the dynamic link library is the `xpcinitfree.c` file. This file contains functions that load and unload the xPC Target API. You must build this file along with the custom xPC Target API application.

The documentation reflects the fact that the API is written in the C programming language. However, the API functions are usable from other languages and applications, such as C++ and Java.

Note To write a non-C application that calls functions in the xPC Target API library, refer to the compiler documentation for a description of how to access functions from a library DLL. You must follow these directions to access the xPC Target API DLL.

The following chapters describe the xPC Target API in more detail:

- Chapter 2, "xPC Target API," describes how to create a C xPC Target API application.
- Chapter 4, "xPC Target API Function Reference," describes the xPC Target API functions.

What Is xPC Target COM API?

The xPC Target COM API is an open environment application program interface designed to work with Microsoft COM and the xPC Target API. The xPC Target COM API provides the same functionality as the xPC Target API. It is a programming layer that sits between you and the xPC Target API. The difference is that while the xPC Target API is a dynamic link library of C functions, the xPC Target COM API dynamic link library is an organized collection of objects, classes, and functions. You access this collection through a graphical development environment such as Microsoft Visual Basic. Using such a graphical development environment, you can create a custom GUI application that can work with one xPC Target application. While the xPC Target API requires you to be an accomplished C or C++ programmer, the xPC Target COM API makes no such demand.

The xPC Target COM API library depends on `xpcapi.dll`, the xPC Target dynamic link library. However, the xPC Target API is independent of the xPC Target COM API.

The xPC Target COM API has the following features:

- **A DLL component server library** — `xpcapicom.dll` is a component server DLL library COM interface consisting of component interfaces that access the target PC. The COM API library enhances the built-in functionality of a programming language by allowing you to easily access the xPC Target API for rapid development of xPC Target GUI.
- **Built on top of the xPC Target API** — Via an application such as Visual Basic, `xpcapicom.dll`, using a structured object model hierarchy, provides full access to all the data and methods needed to interface with an xPC Target application. It also enables search functionality and bidirectional browsing capabilities. Generally, you view object models by selecting a type and viewing its members. Using the xPC Target COM API library, you can select a member and view the types to which it belongs.
- **Programming language independent** — This section describes how to create an xPC Target COM API application using Visual Basic. However, the xPC Target COM API interface is not limited to this third-party product. You can add the COM API Library to any development environment that can access COM libraries, such as Visual C++ or Java, as well as different scripting languages such as Perl, Python, and Basic.

- **Ideal for use with Visual Basic** — The xPC Target COM API works well with Visual Basic, and extends the event-driven programming environment of Visual Basic.

See Chapter 3, “xPC Target COM API,” for a description of how to use the xPC Target COM API library.

xPC Target API

This chapter describes how to write a custom application using the xPC Target API. This API enables you to write high-level language applications to load an xPC Target application, and run and control it. The chapter describes how to create and run a C application in the following sections:

Before You Start

Before you start, read this section for important notes on writing custom applications based on the xPC Target API. It is assumed that you already know how to write C or C++ code.

This chapter provides tutorials on how to generate a C application for xPC Target. It also provides some guidelines on using the xPC Target API. Refer to "Visual C Example" on page 2-4 for tutorials that you can follow to create, build, and run a sample Visual C program.

For the xPC Target API function synopses and descriptions, refer to Chapter 4, "xPC Target API Function Reference."

Important Guidelines

This section describes some guidelines you should keep in mind before beginning to write xPC Target API applications with the xPC Target API DLL:

- You must carefully match the data types of the functions documented in the API function reference. For C, the API includes a header file that matches the data types.
- To write a non-C application that calls functions in the xPC Target API library, refer to the compiler documentation for a description of how to access functions from a library DLL. You must follow these directions to access the xPC Target API DLL.
- If you want to rebuild the model `sf_car_xpc.mdl`, or otherwise use MATLAB, you must have xPC Target Version 2.0. This is the version of xPC Target that comes with Release 13 (MATLAB 6.5).

  To determine the version of xPC Target you are currently using, at the MATLAB command line, type

  ```
  xpclib
  ```

  This opens the xPC Target Simulink blocks library. The version of xPC Target should be at the bottom of the window.
- You can work with xPC Target applications with either MATLAB or an xPC Target API application. If you are working with an xPC Target application simultaneously with a MATLAB session interacting with the target, keep in mind that only one application can access the target PC at a time. To move

from the MATLAB session to your application, in the MATLAB Command Window, type

```
close(xpc)
```

This frees the connection to the target PC for use by your xPC Target API application. Conversely, you will need to quit your application, or do the equivalent of calling the function `xPCClosePort`, to access the target from a MATLAB session.

There are a few things that are not covered in Chapter 4, “xPC Target API Function Reference,” for the individual functions, since they are common to almost all the functions in the xPC Target API. These are

- Almost every function (except `xPCOpenSerialPort`, `xPCOpenTcpIpPort`, `xPCGetLastError`, and `xPCErrorMsg`) has as one of its parameters the integer variable *`port`*. This variable is returned by `xPCOpenSerialPort` and `xPCOpenTcpIpPort`, and is the placeholder for the communications link with the target PC. The returned value from these two functions should be used in the other functions to ensure that the proper communications channel is used.
- Almost every function (except `xPCGetLastError` and `xPCErrorMsg`) sets a global error value in case of error. The application obtains this value by calling the function `xPCGetLastError`, and retrieves a descriptive string about the error by using the function `xPCErrorMsg`. Although the actual values of the error numbers are subject to change, a zero value always means that the operation completed without errors, while a nonzero value typically signifies an error condition. Note also that the library resets the error value every time an API function is called; therefore, your application should check the error status as soon as possible after a function call.

  Some functions also use their return values (if applicable) to signify that an error has occurred. In these cases as well, you can obtain the exact error with `xPCGetLastError`.

Visual C Example

This release includes an example using the xPC Target API to create a Win32 console application written in C. You can use this example as a template to write your own application.

Before you start, you should have an existing xPC Target application that you want to load and run on a target PC. The following tutorials use the target application `sf_car_xpc.dlm`, built from the Simulink model `sf_car_xpc.mdl`, which models an automatic transmission control system. The automatic transmission control system consists of modules that represent the engine, transmission, and vehicle, with an additional logic block to control the transmission ratio. User inputs to the model are in the form of throttle (%) and brake torque (pound-foot). You can control the target application through MATLAB with the Simulink External Model interface, or through a custom xPC Target API application, which you can create using the tutorials in this chapter.

The topics in this section are

- “Directories and Files” on page 2-4
- “Building the xPC Target Application” on page 2-6
- “Creating a Visual C Application” on page 2-6
- “Building a Visual C Application” on page 2-10
- “Running a Visual C xPC Target API Application” on page 2-11
- “Using the xPC Target API C Application” on page 2-11
- “C Code for sf_car_xpc.c” on page 2-17

Directories and Files

This directory contains the C source of a Win32 console application that serves as an example for using the xPC Target API. The necessary `sf_car_xpc` files are in the directory

```
C:\<MATLAB root>\toolbox\rtw\targets\xpc\api\VisualC
```

Filename	Description
`sf_car_xpc.mdl`	Simulink model for use with xPC Target
`sf_car_xpc.dlm`	Target application compiled from Simulink model
`sf_car_xpc.dsp`	Project file for API application
`sf_car_xpc.c`	Source code for API application
`sf_car_xpc.exe`	Compiled API application
`xpcapi.dll`	xPC Target API functions for all programming languages

The necessary xPC Target API files are in the directory

```
C:\<MATLAB root>\toolbox\rtw\targets\xpc\api
```

You will need the files listed below for creating your own API application with Microsoft Visual C++.

Filename	Description
`xpcapi.h`	Mapping of data types between xPC Target API and Visual C
`xpcapiconst.h`	Symbolic constants for using scope, communication, and data-logging functions
`xpcinitfree.c`	C functions to upload API from `xpcapi.dll`
`xpcapi.dll`	xPC Target API functions for all programming languages

Building the xPC Target Application

The tutorials in this chapter use the prebuilt xPC Target application

```
C:\<MATLAB root>\toolbox\rtw\targets\
xpc\api\VisualC\sf_car_xpc.dlm
```

You can rebuild this application for your example:

1 Create a new directory under your MathWorks directory. For example:

```
D:\mwd\sf_car_xpc2
```

2 Create a Simulink model and save to this directory. For example:

```
sf_car_xpc2.mdl
```

3 Build the target application with Real-Time Workshop and Microsoft Visual C++. The target application file `sf_car_xpc2.dlm` is created.

Using Another C/C++ Compiler

The tutorials in this chapter describe how to create and build C applications using Microsoft Visual C++. However, to build an xPC Target API C application, you can use any C/C++ compiler capable of generating a Win32 application. You will need to link and compile the xPC Target API application along with `xpcinitfree.c` to generate the executable. The file `xpcinitfree.c` contains the definitions for the files in the xPC Target API and is located at

```
C:\<MATLAB root>\toolbox\rtw\targets\xpc\api
```

This section provides some notes on what to do if you are

Creating a Visual C Application

This tutorial describes how to create a Visual C application. It is assumed that you know how to write C applications. Of particular note when writing xPC Target API applications,

- Call the function `xPCInitAPI` at the start of the application to load the functions.
- Call the function `xPCFreeAPI` at the end of the application to free the memory allocated to the functions.

To create a C application with a program such as Microsoft Visual C++, 1 From the previous tutorial, change directory to the new directory. This is your working directory. For example:

```
D:\mwd\sf_car_xpc2
```

2 Copy the files `xpcapi.h`, `xpcapi.dll`, `xpcapiconst.h`, and `xpcintfree.c` to the working directory. For example:

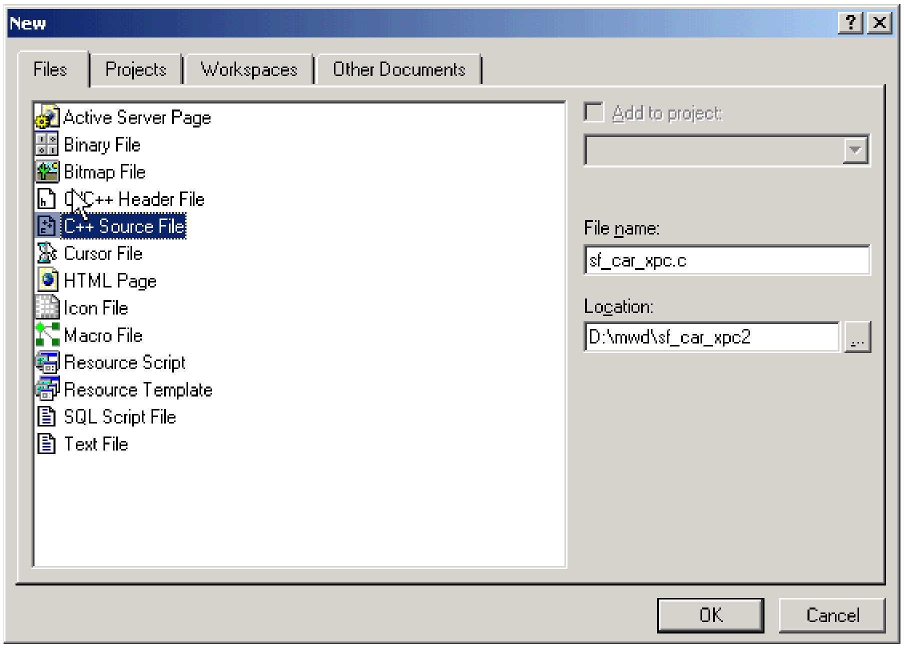
```
D:\mwd\sf_car_xpc2.
```

3 Click the **Start** button, choose the **Programs** option, and choose the **Microsoft Visual C++** entry. Select the **Microsoft Visual C++** option.

   The Microsoft Visual C++ application is displayed.

4 From the **File** menu, click **New**.

5 At the **New** dialog, click the **File** tab.



File name: sf_car_xpc.c

Location: D:\mwd\sf_car_xpc2

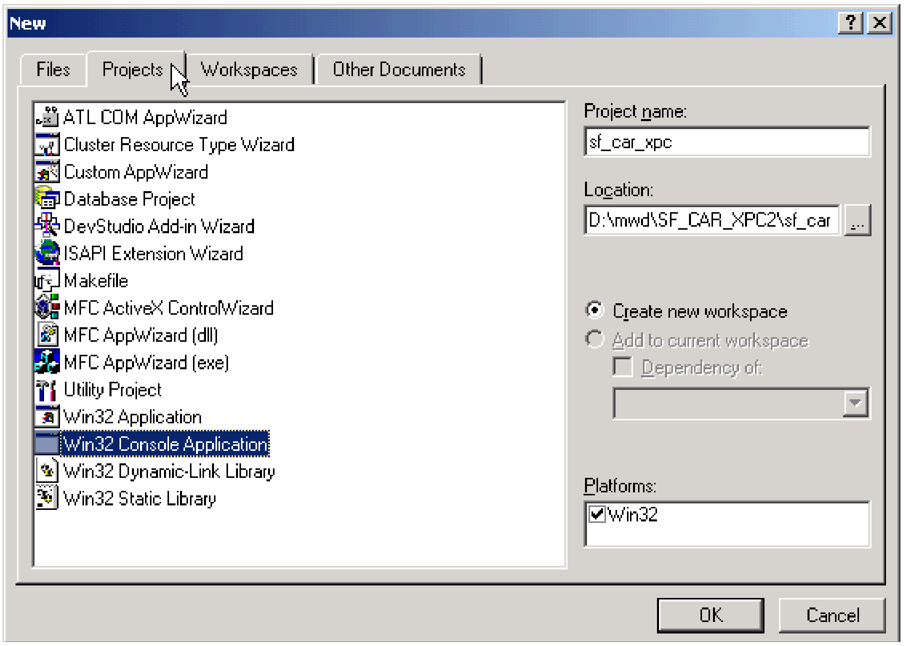
6 In the left pane, select **C++ Source File**. In the right, enter the name of the file. For example, `sf_car_xpc.c`. Select the directory. For example, `C:\mwd\sf_car_xpc2`.

7 Click **OK** to create this file.

8 Enter your code in this file. For example, you can enter the contents of `sf_xpc_car.c` into this file.

9 From the **File** menu, click **New**.

10 At the **New** dialog, click the **Projects** tab.



ATL COM AppWizard
Cluster Resource Type Wizard
Custom AppWizard
Database Project
DevStudio Add-in Wizard
ISAPI Extension Wizard
Makefile
MFC ActiveX ControlWizard
MFC AppWizard (dll)
MFC AppWizard (exe)
Utility Project
Win32 Application
Win32 Console Application
Win32 Dynamic-Link Library
Win32 Static Library

Project name: sf_car_xpc

Location: D:\mwd\SF_CAR_XPC2\sf_car

(●) Create new workspace
( ) Add to current workspace
[ ] Dependency of:

Platforms: [✓] Win32

11 In the left pane, select **Win32 Console Application**. On the right, enter the name of the project. For example, `sf_car_xpc`. Select the working directory from step 1. For example, `C:\mwd\sf_car_xpc2`.

12 To create the project, click **OK**.

A **Win32 Console Application** dialog is displayed.

13 To create an empty project, select **An empty project**.

14 Click **Finish**.

15 To confirm the creation of an empty project, click **OK** at the following dialog.

16 To add the C file you created in step 7, from the **Project** menu, select the **Add to Project** option and select **Files**.

17 Browse for the C file you created in step 7. For example:

```
D:\mwd\sf_car_xpc2\sf_car_xpc.c.
```

Click **OK**.

18 Browse for the `xpcinitfree.c` file. For example, `D:\mwd\xpcinitfree.c`. Click **OK**.

Note The code for linking in the functions in `xpcapi.dll` is in the file `xpcinitfree.c`. You must compile and link `xpcinitfree.c` along with your custom application for `xpcapi.dll` to be properly loaded.

---

19 If you did not copy the files `xpcapi.h`, `xpcapi.dll`, and `xpcapiconst.h` into the working or project directory, you should either copy them now, or also add these files to the project.

20 From the **File** menu, click **Save Workspace**.

When you are ready to build your C application, go to "Building a Visual C Application" on page 2-10.

Placing the Target Application File in a Different Directory

The `sf_car_xpc.c` file assumes that the xPC Target application file, `sf_car_xpc.dlm`, is in the same directory as `sf_car_xpc.c`. If you move that target application file (`sf_car_xpc.dlm`) to a new location, change the path to this file in the API application (`sf_car_xpc.c`) and recompile the API application. The relevant line in `sf_car_xpc.c` is in the function `main()`, and looks like this:

```
xPCLoadApp(port, ".", "sf_car_xpc"); checkError("LoadApp: ");
```

The second argument (".") in the call to `xPCLoadApp` is the path to `sf_car_xpc.dlm`. The "." indicates that the files `sf_car_xpc.dlm` and `sf_car_xpc.c` are in the same directory. If you move the target application, enter its new path and rebuild the xPC Target API application.

Building a Visual C Application

This tutorial describes how to build the Visual C application from the previous tutorial, or to rebuild the example executable `sf_car_xpc.exe`, with Microsoft Visual C++:

1. To build your own application using the xPC Target API, ensure that the files `xpcapi.h`, `xpcapi.dll`, `xpcapiconst.h`, and `xpcinitfree.c` are in the working or project directory.

2. If Microsoft Visual C++ is not already running, click the **Start** button, choose the **Programs** option, and choose the **Microsoft Visual C++** entry. Select the **Microsoft Visual C++** option.

3. From the **File** menu, click **Open**.

   The **Open** dialog is displayed.

4. Use the browser to select the project file for the application you want to build. For example, `sf_car_xpc.dsp`.

5. If a corresponding workspace file (for example, `sf_car_xpc.dsw`) exists for that project, a dialog prompts you to open that workspace instead. Click **OK**.

6. Build the application for the project. From the **Build** menu, select either the **Build** `project_name.exe` or **Rebuild All** option.

Microsoft Visual C++ creates a file named `project_name.exe`, where `project_name` is the name of the project.

When you are ready to run your Visual C Application, go to “Running a Visual C xPC Target API Application” on page 2-11.

Running a Visual C xPC Target API Application

Before starting the API application `sf_car_xpc.exe`, ensure the following:

- The file `xpcapi.dll` must either be in the same directory as the xPC Target API application executable, or it must be in the Windows system directory (typically `C:\windows\system` or `C:\winnt\system32`) for global access. The xPC Target API application depends on this file, and will not run if the file is not found. The same is true for other applications you write using xPC Target API functions.
- The compiled target application `sf_car_xpc.dlm` must be in the same directory as the xPC Target API executable. Do not move this file out of this directory. Moving the file requires you to change the path to the target application in the API application and recompile, as described in "Running a Visual C xPC Target API Application" on page 2-11.

Using the xPC Target API C Application

Any xPC Target API application requires you to have a working target PC running at least xPC Target Version 2.0 (Release 13).

This tutorial assumes that you are using the xPC Target API application `sf_car_xpc.exe` that comes with xPC Target. In turn, `sf_car_xpc.exe` expects that the xPC Target application is `sf_car_xpc.dlm`.

If you are going to run a version of `sf_car_xpc.exe` that you compiled yourself using the `sf_car_xpc.c` code that comes with xPC Target, you can run that application instead. Ensure that the following files are in the same directory:

- `sf_car_xpc.exe`, the xPC Target API executable
- `sf_car_xpc.dlm`, the xPC Target application to be loaded to the target PC
- `xpcapi.dll`, the xPC Target API dynamic link library

  If you copy this file to the Windows system directory, you do not need to provide this file in the same directory.

How to Run the sf_car_xpc Executable

1. Create an xPC Target boot disk with a serial or network communication. If you use serial communications, set the baud rate to `115200`. Otherwise,

create the boot disk as directed in the getting started with xPC Target documentation.

2 Start the target PC with the xPC Target boot disk.

   The target PC displays messages like the following in the top rightmost message area.

   ```
   System: Host-Target Interface is RS232 (COM1/2)
   ```

   or

   ```
   System: Host-Target Interface is TCP/IP (Ethernet).
   ```

3 If you have downloaded target applications to the target PC through MATLAB, in the MATLAB window, type

   ```
   close(xpc)
   ```

   This command disconnects MATLAB from the target PC and leaves the target PC ready to connect to another client.

4 On the host PC, open a DOS window. Change directory to

   ```
   C:\<MATLAB root>\toolbox\rtw\targets\xpc\api\VisualC
   ```

   If you are running your own version of `sf_car_xpc.exe`, change to the directory that contains the executable and xPC Target application. For example:

   ```
   D:\mwd\sf_car_xpc2
   ```

5 From that DOS window, enter the command to start the demo application on the host PC and download the target application to the target PC.

   The syntax for the demo command is

   ```
   sf_car_xpc {-t IpAddress:IpPort|-c COMport}
   ```

   If you set up the xPC Target boot disk to use TCP/IP, then give the target PC's IP address and IP port as arguments to `sf_car_xpc`, along with the option `-t`. For example, at the DOS prompt, type

```
sf_car_xpc -t 192.168.0.1:22222
```

If you set up the xPC Target boot disk to use RS-232, give the serial port number as a command-line option. Note that indexing of serial ports starts from 0 instead of 1. For example, if you are using serial communication from COM port 1 on the host PC, type

```
  sf_car_xpc -c 0
```

On the host PC, the demo application displays the following message.

```
*---------------------------------------------------------------*
*          xPC Target API Demo: sf_car_xpc.                     *
*                                                               *
* Copyright (c) 2002 The MathWorks, Inc. All Rights Reserved. *
*---------------------------------------------------------------*

Application sf_car_xpc loaded. SampleTime 0.001 StopTime: -1

R  Br  Th G  VehSpeed   VehRPM
- ---- -- - ---------- ---------
N    0  0 0    0.000    1000.000
```

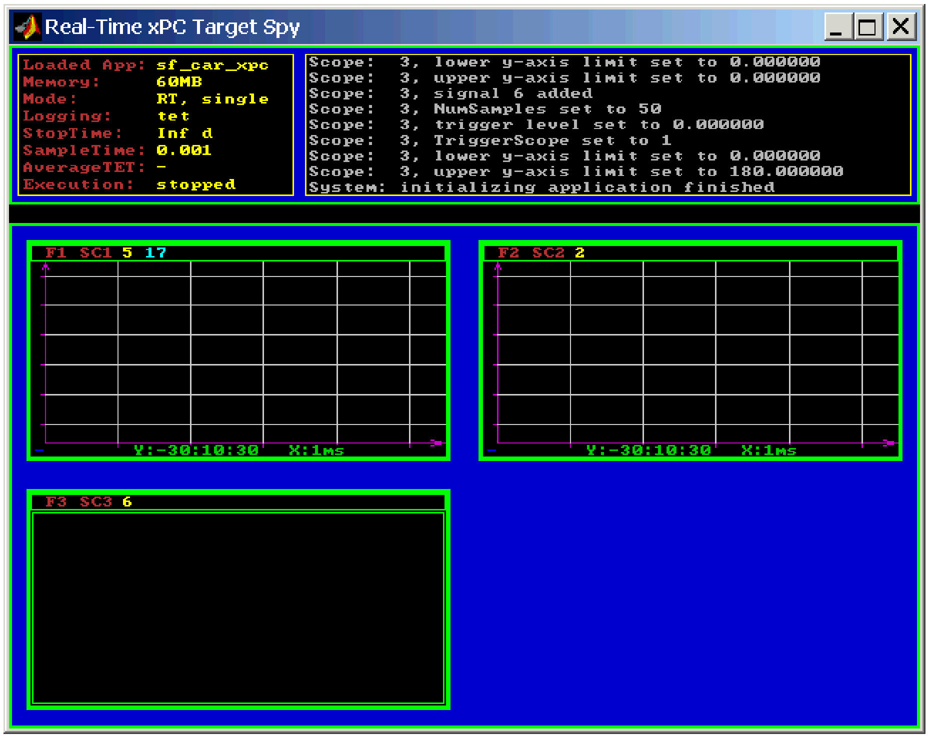
The relevant line here is the last one, which displays the status of the application. The headings are as follows:

R	The status of the target application: R if running, N if stopped
Br	The brake torque; legal values range from 0 to 4000
Th	The throttle as a percentage (0 - 100) of the total
G	Gear the vehicle is in (ranges between 1 and 4)
VehSpeed	Speed of the vehicle in miles per hour
VehRPM	Revolutions per minute of the vehicle engine (0 to 6000)

From this screen, various keystrokes control the target application. The following list summarizes these keys:

Key	Action
s	Start or stop the application, as appropriate.
T	Increase the throttle by 1 (does not go above 100).
t	Decrease the throttle by 1 (does not go below 0).
B	Increase the brake value by 20 (does not go above 4000). Note that a positive value for the brake automatically sets the throttle value to 0, and a positive value for the throttle automatically sets the brake value to 0.
b	Decrease the brake value by 20 (does not go below 0).
Q or **Ctrl+C**	Quit the application.

The target PC displays the following messages and three scopes.

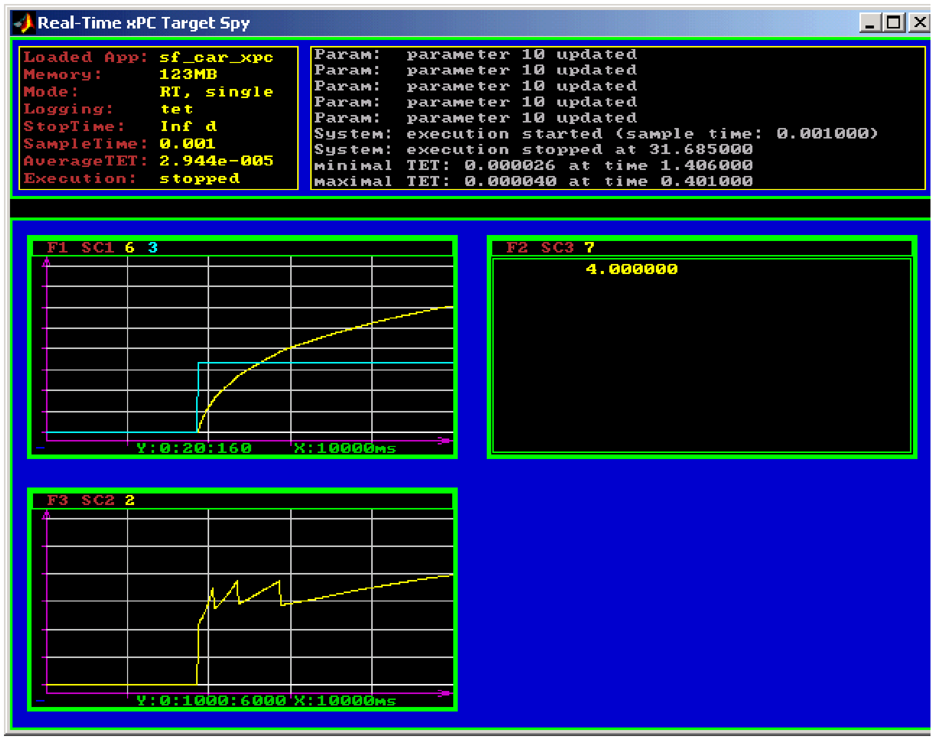


```
Loaded App: sf_car_xpc
Memory:     60MB
Mode:       RT, single
Logging:    tet
StopTime:   Inf d
SampleTime: 0.001
AverageTET: -
Execution:  stopped
```

```
Scope:  3, lower y-axis limit set to 0.000000
Scope:  3, upper y-axis limit set to 0.000000
Scope:  3, signal 6 added
Scope:  3, NumSamples set to 50
Scope:  3, trigger level set to 0.000000
Scope:  3, TriggerScope set to 1
Scope:  3, lower y-axis limit set to 0.000000
Scope:  3, upper y-axis limit set to 180.000000
System: initializing application finished
```

6 Hold down the **Shift** key and hold down **T** until the value of `Th` reaches 100.

7 Press **s** to start the application.



```
Loaded App: sf_car_xpc
Memory:     123MB
Mode:       RT, single
Logging:    tet
StopTime:   Inf d
SampleTime: 0.001
AverageTET: 2.944e-005
Execution:  stopped
```

```
Param:   parameter 10 updated
Param:   parameter 10 updated
Param:   parameter 10 updated
Param:   parameter 10 updated
Param:   parameter 10 updated
System:  execution started (sample time:  0.001000)
System:  execution stopped at 31.685000
minimal  TET:  0.000026 at time 1.406000
maximal  TET:  0.000040 at time 0.401000
```

The first scope (SC1) shows the throttle rising to a maximum value of 100 and the vehicle speed gradually increasing. The third scope (SC3) shows the vehicle RPM. Notice the changes in the vehicle RPM as the gears shift from first to fourth gear as displayed in the third numerical scope (SC2).

8 When you are done testing the demo application, type

Q or **Ctrl+C**

The demo application is disconnected from the target PC, so you can reconnect to MATLAB.

C Code for sf_car_xpc.c

This section contains the C code for the sf_car_xpc.c application.

```
/* File:     sf_car_xpc.c
* Abstract: Demonstrates the use of the xPC Target C-API in
* Human-Machine interaction. This file generates a Win32 Console
* application, which when invoked loads the sf_car_xpc.dlm compiled
* application on to the xPC Target PC.
*
* To build the executable, use the Visual C/C++ project
* sf_car_xpc.dsp.
*
* Copyright (c) 2002 by The MathWorks, Inc. All Rights Reserved.*/

/* Standard include files */
#include <stdio.h
#include <stdlib.h
#include <limits.h
#include <ctype.h
#include <conio.h
#include <windows.h

/* xPC Target C-API specific includes */
#include "xpcapi.h"
#include "xpcapiconst.h"

#define SERIAL 0
#define TCPIP  1

/* max and min are defined by some compilers, so we wrap them in
#ifndef's */
#ifndef max
#define max(a, b) (((a) > (b)) ? (a) : (b))
#endif
#ifndef min
#define min(a, b) (((a) < (b)) ? (a) : (b))
#endif

/* Global Variables */
int   mode = TCPIP, comPort = 0;
int   port;
int   thrPID, brakePID, rpmSID, speedSID, gearSID;
char *ipAddress, *ipPort, *pathToApp = NULL;

/* Function prototypes */
double getParam(int parIdx);
void   setParam(int parIdx, double parValue);
void   findParam(char *block, char *param, int *id);

void   findSignal(char *sig, int *id);
void   Usage(void);
void   cleanUp(void);
void   checkError(char *str);
void   processKeys(void);
void   parseArgs(int argc, char *argv[]);
int    str2Int(char *str);

/* Function: main
==================================================================
* Abstract: Main function for the sf_car_xpc demo                */
int main(int argc, char *argv[]) {
    printf("\n"
"*------------------------------------------------------------*\n"
"*          xPC Target API Demo: sf_car_xpc.                  *\n"
"*                                                            *\n"
"* Copyright (c) 2002 The MathWorks, Inc. All Rights Reserved.*\n"
"*------------------------------------------------------------*\n"
"\n");

    parseArgs(argc, argv);
    atexit(cleanUp);

/* Initialize the API */
    if (xPCInitAPI()) {
        fprintf(stderr, "Could not load api\n");
        return -1;
    }

    if (mode == SERIAL)
        port = xPCOpenSerialPort(comPort, 0);
    else if (mode == TCPIP)
        port = xPCOpenTcpIpPort(ipAddress, ipPort);
    else {
        fprintf(stderr, "Invalid communication mode\n");
        exit(EXIT_FAILURE);
    }

    checkError("PortOpen: ");

    xPCLoadApp(port, ".", "sf_car_xpc");
    checkError("LoadApp: ");
    printf("Application sf_car_xpc loaded, SampleTime: %g  StopTime:
           %g\n\n", xPCGetSampleTime(port), xPCGetStopTime(port));
           checkError(NULL);

    findParam("Throttle", "Value", &thrPID);
    findParam("Brake", "Value", &brakePID);
    findSignal("Engine/rpm", &rpmSID);
    findSignal("Vehicle/mph", &speedSID);
    findSignal("shift_logic/ SFunction /p2", &gearSID);

    processKeys();                    /* Heart of the application */

    if (xPCIsAppRunning(port)) {
        xPCStopApp(port);
    }
    return 0;
} /* end main() */
```

```
/* Function: processKeys
===================================================================
* Abstract: This function reads and processes the keystrokes typed
* by the user and takes action based on them. This function runs for
* most of the program life.                                       */

void processKeys(void) {
    int    c = 0;
    double throttle, brake;

    throttle = getParam(thrPID);
    brake    = getParam(brakePID);
    fputs("\nR    Br    Th  G     VehSpeed     VehRPM  \n", stdout);
    fputs(  "-   ----   --  -    ----------   -------- \n", stdout);
    while (1) {
    if (_kbhit()) {
        c = _getch();
        switch (c) {
            case 't':
            if (throttle)
                setParam(thrPID, --throttle);
                break;
              case 'T':
                    if (brake)
                    setParam(brakePID, (brake = 0));
                    if (throttle < 100)
                    setParam(thrPID, ++throttle);
                break;
              case 'b':
                setParam(brakePID, (brake = max(brake - 200, 0)));
                if (brake)
                    setParam(thrPID, (throttle = 0));
                break;
              case 'B':
                if (throttle)
                    setParam(thrPID, (throttle = 0));
                setParam(brakePID, (brake = min(brake +200,4000)));
                break;
              case 's':
              case 'S':
                if (xPCIsAppRunning(port)) {
                    xPCStopApp(port);  checkError(NULL);
                } else {
                    xPCStartApp(port); checkError(NULL);
                }
                break;
              case 'q':
              case 'Q':
                return;
                break;
              default:
                fputc(7, stderr);
                break;
           }
        } else {
            Sleep(50);
        }
        printf( "\r%c   %4d  %3d  %1d  %10.3f   %10.3f",
                (xPCIsAppRunning(port) ? 'Y' : 'N'),
                (int)brake, (int)throttle,
                (int)xPCGetSignal(port, gearSID),
                xPCGetSignal(port, speedSID),
                xPCGetSignal(port, rpmSID));
    }
} /* end processKeys() */
```

```
/* Function: Usage
==================================================================
* Abstract: Prints a simple usage message. */
void Usage(void) {
    fprintf(stdout,
            "Usage: sf_car_xpc {-t IPAddress:IpPort|-c num}\n\n"
            "E.g.:  sf_car_xpc -t 192.168.0.1:22222\n"
            "E.g.:  sf_car_xpc -c 1\n\n");
            return;
} /* end Usage() */


/* Function: str2Int
==================================================================
* Abstract: Converts the supplied string str to an integer. Returns
* INT_MIN if the string is invalid as an integer (e.g., "123string"is
* invalid) or if the string is empty.                              */

    int str2Int(char *str) {
    char *tmp;
    int   tmpInt;
    tmpInt = (int)strtol(str, &tmp, 10);

    if (*str == '\0' || (*tmp != '\0')) {
        return INT_MIN
    }

    return tmpInt;
    } /* end str2Int */
```

```
/* Function: parseArgs
=================================================================
* Abstract: Parses the command-line arguments and sets the state of
* variables based on the arguments.                              */
void parseArgs(int argc, char *argv[]) {


    if (argc != 3) {
        fprintf(stderr, "Insufficient command-line arguments.\n\n");
        Usage();
        exit(EXIT_FAILURE);
    }

    if (strlen(argv[1]) != 2               ||
        strchr("-/",   argv[1][0]) == NULL ||
        strchr("tTcC", argv[1][1]) == NULL) {
        fprintf(stderr, "Unrecognized Argument %s\n\n", argv[1]);
        Usage();
        exit(EXIT_FAILURE);
    }
    mode = tolower(argv[1][1]) == 'c' ? SERIAL : TCPIP;
    if (mode == SERIAL) {
        int tmpInt;
        if ((tmpInt = str2Int(argv[2])) > INT_MIN) {
             comPort = tmpInt;
        } else {
            fprintf(stderr, "Unrecognized argument %s\n", argv[2]);
            Usage();
        }
    } else {
        char *tmp;
        ipAddress = argv[2];
        if ((tmp = strchr(argv[2], ':')) == NULL) {
            /* memory need not be freed as it is allocated only once,
             * will hang around till app ends.                     */
            if ((ipPort = malloc(6 * sizeof(char))) == NULL) {
                fprintf(stderr, "Unable to allocate memory");
                exit(EXIT_FAILURE);
            }
            strcpy(ipPort, "22222");
        } else {
            *tmp      = '\0';
            ipPort    = ++tmp;
        }
    }
    return;
} /* end parseArgs() */



/* Function: cleanUp
==================================================================
* Abstract: Called at program termination to exit in a clean way. */
void cleanUp(void) {
    xPCClosePort(port);
    xPCFreeAPI();
    return;
} /* end cleanUp() */



/* Function: checkError
=================================================================
* Abstract: Checks for error by calling xPCGetLastError(); if an
* error is found, prints the appropriate error message and exits. */
void checkError(char *str) {
    char errMsg[80];
    if (xPCGetLastError()) {
        if (str != NULL)
            fputs(str, stderr);
        xPCErrorMsg(xPCGetLastError(), errMsg);
        fputs(errMsg, stderr);
        exit(EXIT_FAILURE);
    }
    return;
} /* end checkError() */
```

```
/* Function: findParam
=================================================================
* Abstract: Wrapper function around the xPCGetParamIdx() API call.
* Also checks to see if the parameter is not found, and exits in that
* case.                                                              */

void findParam(char *block, char *param, int *id) {
    int tmp;
    tmp = xPCGetParamIdx(port, block, param);
    if (xPCGetLastError() || tmp == -1) {
        fprintf(stderr, "Param %s/%s not found\n", block, param);
        exit(EXIT_FAILURE);
    }
    *id = tmp;
    return;
} /* end findParam() */


/* Function: findSignal
=================================================================
* Abstract: Wrapper function around the xPCGetSignalIdx() API call.
* Also checks to see if the signal is not found, and exits in that
* case.                                                              */
void findSignal(char *sig, int *id) {
    int tmp;
    tmp = xPCGetSignalIdx(port, sig);
    if (xPCGetLastError() || tmp == -1) {
        fprintf(stderr, "Signal %s not found\n", sig);
        exit(EXIT_FAILURE);
    }
    *id = tmp;
    return;
} /* end findSignal() */
```

```
/* Function: getParam
==================================================================
* Abstract: Wrapper function around the xPCGetParam() API call. Also
* checks for error, and exits if an error is found.              */
double getParam(int parIdx) {
    double p;
    xPCGetParam(port, parIdx, &p);
    checkError("GetParam: ");
    return p;
} /* end getParam() */


/* Function: setParam
==================================================================
* Abstract: Wrapper function around the xPCSetParam() API call. Also
* checks for error, and exits if an error is found.              */
void setParam(int parIdx, double parValue) {
    xPCSetParam(port, parIdx, &parValue);
    checkError("SetParam: ");
    return;
} /* end setParam() */


/** EOF sf_car_xpc.c **/
```

xPC Target COM API

This chapter describes how to write a custom application using the xPC Target COM API. This COM API enables you to write COM applications to load, run, and control an xPC Target application. This chapter describes how to create and run a COM application in the following sections:

Before You Start

Before you start, read this section for guidelines on writing custom applications based on the xPC Target COM API. You do not need to be a seasoned C or C++ programmer to follow the procedures in this chapter, or to write custom applications with the xPC Target COM API. You should, however, have some rudimentary programming knowledge.

This chapter provides procedures on how to create xPC Target COM API applications using Microsoft Visual Basic:

- The procedures in this example use the model `xpctank.mdl`. If you want to rebuild this model, or otherwise use MATLAB, you must have xPC Target Version 2.0. This is the version of xPC Target that comes with Release 13 (MATLAB 6.5).

  To determine which version of xPC Target you are currently using, at the MATLAB command line, type

  ```
  xpclib
  ```

  This opens the xPC Target Simulink blocks library. The version of xPC Target should be at the bottom of the window.
- You can work with xPC Target applications with either MATLAB or an xPC Target COM API application. If you are working with an xPC Target application using an xPC Target COM API application simultaneously with a MATLAB session interacting with the target, keep in mind that only one application can access the target PC at a time. To move from the MATLAB session to your application, in the MATLAB Command Window, type

  ```
  close(xpc)
  ```

  This frees the connection to the target PC for use by your xPC Target COM API application. Conversely, you will need to have your COM API application call the `Close` method to enable users access to the target from a MATLAB session.
- Although you are building an xPC Target COM API application, you still need to access the `xpcapi.dll`.

Example Visual Basic GUI Using COM Objects

For demonstration purposes this chapter uses the Simulink model `xpctank.mdl` and requests that you enter tags for signals and parameters to create the Simulink model `xpc_tank1.mdl`. You will then build the real-time target application `xpc_tank1.dlm` and the GUI `xpc_tank1_COM.exe` application using the xPC Target COM API library and Microsoft Visual Basic. This section includes the following topics:

- "Description of Simulink Water Tank Model" on page 3-4 — Describes the Simulink `xpctank` model that comes with xPC Target. The chapter uses this model as a working example for creating a stand-alone GUI application using the xPC Target COM API library.
- "Creating a Simulink Target Model" on page 3-6 — Describes how to create a Simulink model containing model equations describing the dynamic behavior of the application you want to run in real time on the target PC.
- "Tagging Block Parameters" on page 3-7 — Describes how to tag block parameters in your Simulink model.
- "Tagging Block Signals" on page 3-10 — Describes how to tag block signals in your Simulink model.
- "Creating the Target Application and Model-Specific COM Library" in Chapter 3 — Describes how to create a target application and model-specific COM library, and how to download the target application to the target PC. The model-specific COM library is a library that you can generate for the tagged signals and parameters of your model.
- "Creating a New Visual Basic Project" on page 3-19 — Describes how to create a project directory, project, and form, and how to copy the API, COM library, and xPC Target application files to this directory.
- "Referencing the xPC Target COM API and Model-Specific COM Libraries" on page 3-20 — Describes how to reference the xPC Target COM API library file so that Visual Basic can use it in the current project.
- "Creating the Graphical Interface" on page 3-24 — Describes how to create a simple GUI using Visual Basic and the xPC Target COM API objects.
- "Setting Properties" on page 3-27 — Describes how to set properties for a Visual Basic project.
- "Writing Code" on page 3-29 — Describes how to write the code behind your Visual Basic GUI.

- "Creating the General Declarations" on page 3-30 — Describes how to create general declarations for your Visual Basic project.
- "Creating the Load Procedure" on page 3-31 — Describes how to write the load procedure for your Visual Basic form.
- "Creating Event Procedures" on page 3-32 — Describes how to write the event procedures for your Visual Basic objects.
- "Testing the Visual Basic Application" on page 3-41 — Describes how to test your new Visual Basic application before compiling it.
- "Building the Visual Basic Application" on page 3-42 — Describes how to build and compile your xPC Target COM API application.
- "Deploying the API Application" on page 3-42 — Describes how to deploy your xPC Target COM API application.

Note This section assumes that you know how to create projects and forms in Microsoft Visual Basic, and that you are familiar with the concept of automatic code completion. For further details on Visual Basic, refer to your Microsoft product documentation.

Description of Simulink Water Tank Model

xPC Target includes the Simulink model `xpctank.mdl`. This is a model of a water tank with a pump, drain, and valve controller (see Figure 3-1, xPC Tank Model, on page 3-5).

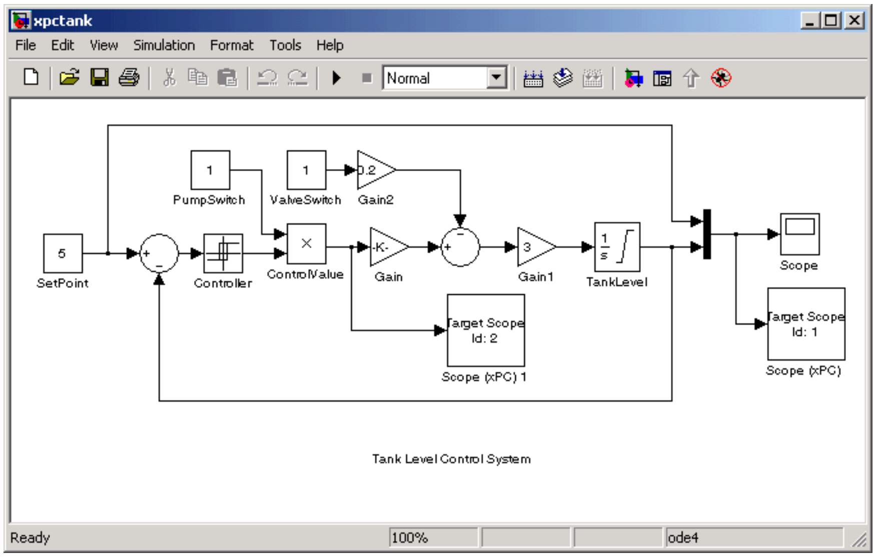


Figure 3-1: xPC Tank Model

TankLevel — The water level in the tank is modeled using a limited integrator named TankLevel.

PumpSwitch — The pump can be turned off manually to override the action of the controller. This is done by setting PumpSwitch to 0. When PumpSwitch is 1, the controller can use the control valve to pump water into the tank.

ValveSwitch (drain valve) — The tank has a drain valve that allows water to flow out of the tank. Think of this as water usage or consumption that reduces the water level. This behavior is modeled with the constant block named ValveSwitch, the gain block Gain2, and a summing junction. The minus sign on the summing junction has the effect of producing a negative flow rate (drain), which reduces the water level in the tank.

When ValveSwitch is 0 (closed), the valve is closed and water cannot flow out of the tank. When ValveSwitch is 1 (open), the valve is open and the water level is reduced by draining the tank.

Controller — The controller is very simple. It is a bang-bang controller and can only maintain the selected water level by turning the control valve (pump valve) on or off. A water level set point defines the desired median water level.

Hysteresis enables the pump to avoid high-frequency on and off cycling. This is done using symmetric upper and lower bounds that are offsets from the median set point. As a result, the controller turns the control valve (pump valve) on whenever the water level is below the set point minus the offset. The summing junction compares this lower bound against the tank water level to determine whether or not to open the control valve. If the pump is turned on (PumpSwitch is 1) water is pumped into the tank. When the water level reaches or exceeds the set point plus the upper bound, the controller turns off the control valve. When the water level reaches this boundary, water stops pumping into the tank.

Scope blocks — A standard Simulink Scope block is added to the model for you to view signals during a simulation. xPC Target Scope blocks are added to the model for you to view signals while running the target application. Scope-Id1 displays the actual water level and the selected water level in the tank. Scope-Id2 displays the control signals. Both scopes are displayed on the target PC using a scope of type target.

The `xpctank.mdl` model is built entirely from standard Simulink blocks and scope blocks from xPC Target. It does not differ in any way from a model you would normally use with xPC Target.

Creating a Simulink Target Model

A target application model is a Simulink model that describes your physical system and its behavior. You use this model to create a real-time target application, and you use this model to select the parameters and signals you want to connect to a custom graphical interface.

You do not have to modify this model when you use it with the Virtual Reality Toolbox or other third-party graphical elements.

Create a target application model before you tag block parameters and block signals to create a custom graphical interface:

1 In the MATLAB Command Window, type

```
xpctank
```

A Simulink model for a water tank opens. This model contains a set of equations that describe the behavior of a water tank and a simple controller.

The controller regulates the water level in the tank. This model contains only standard Simulink blocks and you use it to create the xPC Target application.

2 From the **File** menu, click **Save as** and enter a new filename. For example, enter `xpc_tank1` and then click **OK**.

Note If you save your own copy of `xpctank`, be sure to be in the directory that contains that model before calling it from the MATLAB Command Window.

Your next task is to mark the block properties and block signals. See “Tagging Block Parameters” on page 3-7 and “Tagging Block Signals” on page 3-10. Building an xPC Target application that has been tagged generates a model-specific COM library, `model_nameifaceCOM.dll`, which you can later reference when writing your xPC Target COM API application.

Tagging Block Parameters

Tagging parameters in your Simulink model enables you to generate a model-specific COM library to provide access to model parameter IDs via the xPC Target COM API library. These interface blocks contain the parameters you connect to control devices (such as sliders) in your model. Tagging parameters makes it easier for you to refer to these parameters later, when you write your xPC Target COM API application.

Note If you do not tag parameters before you generate your Simulink model, you must specify model parameters manually. See “Referencing Parameters and Signals Without Using Tags” on page 3-38 for this procedure.

This procedure uses the model `xpc_tank1.mdl` (or `xpctank.mdl`) as an example. See “Creating a Simulink Target Model” on page 3-6.

Note The `xpctank` model that comes with xPC Target contains tags from the example for creating custom user interfaces in the xPC Target User's Guide documentation. As you follow the procedures in this section and the section "Tagging Block Signals" on page 3-10, you should remove any existing tags before adding the new tags.

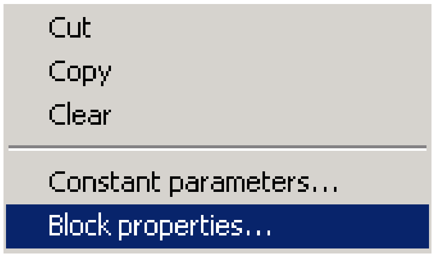
---

1 Open a Simulink model. For example, in the MATLAB Command Window type

```
xpc_tank1 or xpctank
```

2 Point to a Simulink block, and then right-click. For example, right-click the SetPoint block.

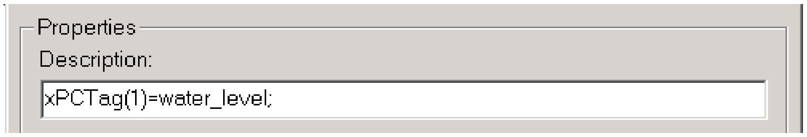
3 From the menu, click **Block Properties**. Do not click **Constant Parameters**.



A block properties dialog box opens.

4 In the **Description** box, enter a tag to the parameters for this block.

For example, the SetPoint block is a constant with a single parameter that selects the level of water in the tank. Enter the tag shown below.


Properties
Description:
xPCTag(1)=water_level;

The tag has the following format:

```
xPCTag(1, . . . index_n)= label_1 . . . label_n;
```

`index_n`	Index of a block parameter. Begin numbering parameters with an index of `1`.
`label_n`	Name for a block parameter to connect to a property for the parameter you tag in the model. Separate the labels with a space, not a comma.

You can assign multiple labels to one tag, such as

```
xPCTag(1)=label;xPCTag(1)=label2;
```

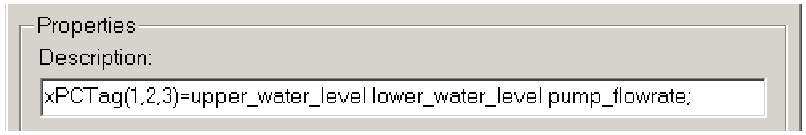
You might want to assign multiple labels if you want to tag a parameter for different purposes. For example, you can tag a parameter to create a model-specific COM library. You might also want to tag a parameter to enable the function `xpcsliface` to generate a user interface template model.

You can also issue one tag definition per line, such as

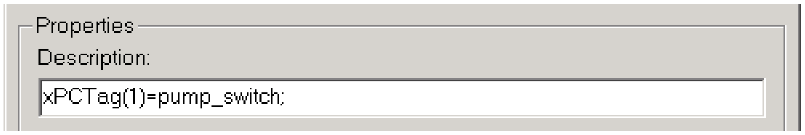
```
xPCTag(1)=label;
xPCTag(2)=label2;
```

5 Repeat step 4 for the remaining parameters you want to tag.

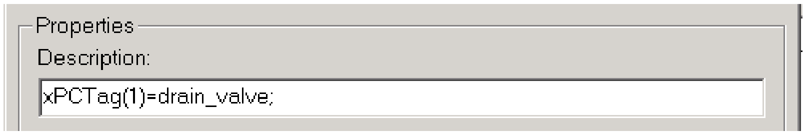
For example, for the Controller block, enter the tag


Properties
Description:
xPCTag(1,2,3)=upper_water_level lower_water_level pump_flowrate;

For the PumpSwitch and ValveSwitch blocks enter the tags



xPCTag(1)=pump_switch;



xPCTag(1)=drain_valve;

To tag a block with four properties, use the following syntax:

```
xPCTag(1,2,3,4)=label_1 label_2 label_3 label_4;
```

To tag a block for the second and fourth properties with at least four properties, use the following syntax:

```
xPCTag(2,4)=label_1 label_2;
```

6 From the **File** menu, click **Save as**. Enter a filename for your model. For example, enter

```
xpc_tank1
```

You next task is to tag block signals if you have not already done so, and then create the model. See “Tagging Block Signals” on page 3-10.

Tagging Block Signals

Tagging signals in your Simulink model enables you to generate a model-specific COM library to provide access to model signal IDs via the COM API library. These interface blocks contain the signals you connect to display devices (such as labels) in your model. Tagging signals makes it easier for you to refer to these signals later, when you write your xPC Target COM API application. After you tag signals, you will be ready to build your xPC Target application.

Note If you do not tag signals before you generate your Simulink model, you must specify model signals manually. See “Referencing Parameters and Signals Without Using Tags” on page 3-38 for this procedure.

This procedure uses the model `xpc_tank1.mdl` (or `xpctank.mdl`) as an example. See “Creating a Simulink Target Model” on page 3-6.

Note The `xpctank` model that comes with xPC Target contains tags from the example for creating custom user interfaces in the xPC Target User’s Guide documentation. As you follow the procedures in this section and the section “Tagging Block Parameters” on page 3-7, you should remove any existing tags before adding the new tags.

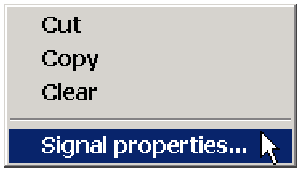
Notice that you cannot select signals on the output ports of any virtual blocks such as Subsystem and Mux blocks. Also, you cannot select signals on any function call signal output ports.

1 Open a Simulink model. For example, in the MATLAB Command Window type

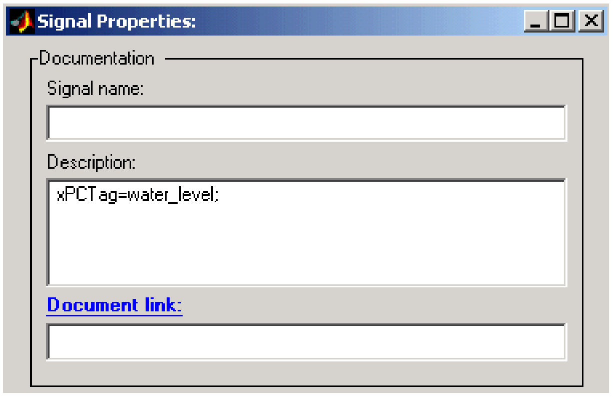
```
xpc_tank1 or xpctank
```

2 Point to a Simulink signal line, and then right-click.

3 From the menu, click **Signal Properties**. For example, right-click the signal line from the TankLevel block.



A **Signal Properties** dialog box opens.



Signal name:

Description:

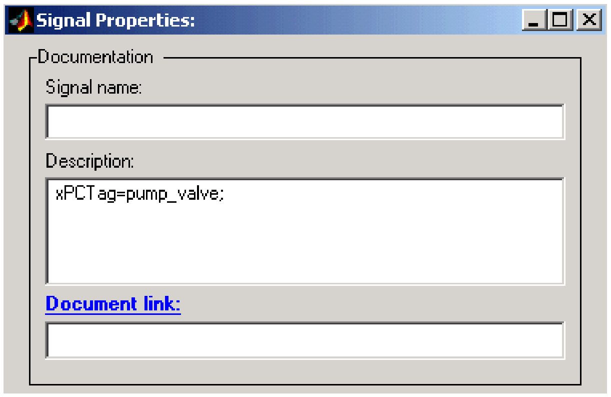
xPCTag=water_level;

4 In the **Description** box, enter a tag to the signals for this line.

For example, the TankLevel block is an integrator with a single signal that indicates the level of water in the tank. Enter the tag shown.

5 Repeat step 4 for the remaining signals you want to tag.

For example, for the signal from the ControlValve block, enter the tag `pump_valve`.



Signal name:

Description:

xPCTag=pump_valve;

Signal tags have the following syntax:

```
xPCTag(1, . . . index_n)=label_1 . . . label_n;
```

`index_n`	Index of a signal within a vector signal line. Begin numbering signals with an index of `1`.
`label_n`	Name for a signal to connect to a property for the signal you tag in the model. Separate the labels with a space, not a comma.

For single-dimension ports, the following syntax is also valid:

```
XPCTag=label;
```

You can assign multiple labels to one tag, such as

```
xPCTag(1)=label;xPCTag(1)=label2;
```

You might want to assign multiple labels if you want to tag a signal for different purposes. For example, you can tag a signal to create a model-specific COM library. You might also want to tag a signal to enable the function `xpcsliface` to generate a user interface template model.

You can also issue one tag definition per line, such as

```
xPCTag(1)=label;
xPCTag(2)=label2;
```

To tag a signal line with four signals (port dimension of 4) use the following syntax:

```
xPCTag(1,2,3,4)=label_1 label_2 label_3 label_4;
```

To tag the second and fourth signals in a signal line with at least four signals, use the following syntax:

```
xPCTag(2,4)=label_1 label_2;
```

6 From the **File** menu, click **Save as**. Enter a filename for your model. For example, enter

```
xpc_tank1
```

Create the target application. See “Creating the Target Application and Model-Specific COM Library” on page 3-14.

Creating the Target Application and Model-Specific COM Library

Use this procedure to create a target application that you want to connect to a GUI application and the model-specific COM interface library (`model_nameCOMiface.dll`).

After you copy a Simulink model and tag the block parameters and block signals, you can create a target application and download it to the target PC. This procedure uses the Simulink model `xpc_tank1.mdl` (or `xpctank.mdl`) as an example. See “Creating a Simulink Target Model” on page 3-6:

1. Start or reset the target PC with an xPC Target boot disk in the floppy drive. Ensure that there is no other application currently loaded on the target PC.

2. If this is a new release of the product, ensure that you have configured the host PC with the appropriate settings, including the compiler.

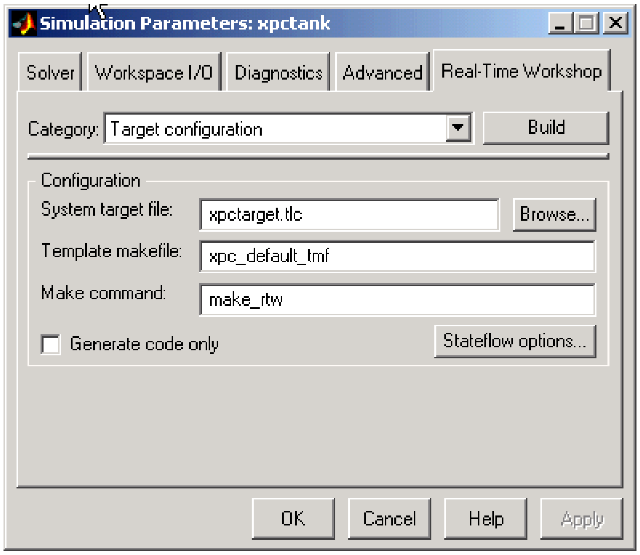
3. In the MATLAB Command Window, type

   ```
   xpc_tank1 or xpctank
   ```

   A Simulink window opens with the model `.mdl` file.

4. From the **Simulation** menu, click **Simulation parameters**.

   The **Simulation parameters** dialog box opens.


Simulation Parameters: xpctank

Solver | Workspace I/O | Diagnostics | Advanced | Real-Time Workshop

Category: Target configuration

Configuration

System target file: xpctarget.tlc

Template makefile: xpc_default_tmf

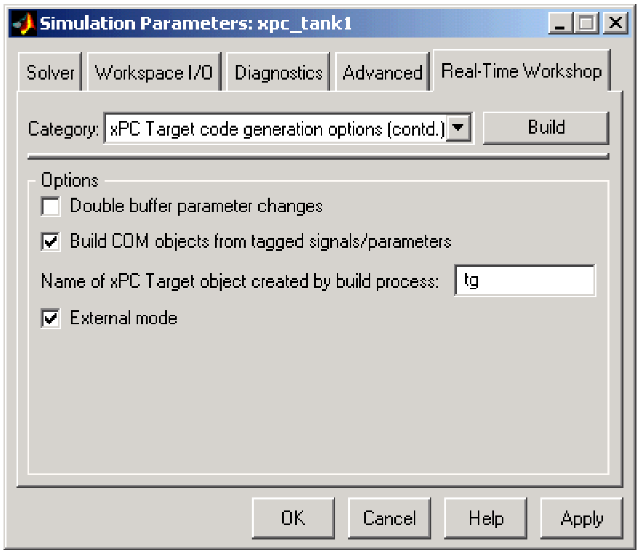
Make command: make_rtw

Generate code only

5 Click the **Real-Time Workshop** tab and, from the **Category** list, choose **Target configuration**.

6 Click the **Browse** button at the **System target file** browser dialog box. Click **xpctarget.tlc**, and then click **OK**.

7 From the **Category** list, choose **xPC Target code generation options (contd.)**. The lower part of the dialog box changes to a section labeled Options. Select the **Build COM objects from tagged signals/parameters** check box.


Simulation Parameters: xpc_tank1

Category: xPC Target code generation options (contd.)

Options

☐ Double buffer parameter changes

☑ Build COM objects from tagged signals/parameters

Name of xPC Target object created by build process: tg

☑ External mode

8 Click the **Solver** tab, and check that the **Stop time** is long enough for you to interact with the target application.

9 Click **OK** to save and exit.

10 From the **Tools** menu, point to **Real-Time Workshop**, and then click **Build model**.

Real-Time Workshop, xPC Target, and a third-party C compiler create the target application `xpc_tank1.dlm` and the COM object library `xpc_tank1COMiface.dll`. The target application is also downloaded to the target PC.

11 If you want, you can close MATLAB.

Your next task is to create a Visual Basic API application using COM objects. This API application connects and controls the target application. See “Creating a New Visual Basic Project” on page 3-19. For more information about model-specific COM interface library, refer to “Model-Specific COM Interface Library (model_nameCOMiface.dll)” on page 3-17.

Model-Specific COM Interface Library (model_nameCOMiface.dll)

The generated model-specific COM interface library is a DLL component server library that enhances programming using the xPC Target COM API library. A model-specific COM interface library is specific to the model from which it is generated; do not reference a model-specific library for another model. If you choose not to generate a model-specific COM interface library, refer to "Referencing Parameters and Signals Without Using Tags" on page 3-38 for a description of how to otherwise reference parameters and signals in the xPC Target COM API application.

The mode-specific COM interface library allows users easy access to preselected tagged signals and desired tagged parameters for use in conjunction with the xPC Target COM API xPC Target and xPCScope Object Signal monitoring and parameter member functions such as `xPCGetParam`, `xPCSetParam`, and `xPCGetSignal`.

The xPC Target COM generated objects are of two types:

- `model_namebio`
- `model_namept`

where `model_name` is the name of the Simulink model. The `model_namebio` type is for tagged block I/O signals and the `model_namept` type is for tagged parameters.

Model-Specific COM Signal Object Classes

Model-specific COM signal classes have two types of members in which you are interested, the `Init` function and class properties. You will find these members in the `model_namebio` class, where `model_name` is the name of your model.

The `Init` function invokes the `Init` method once, passing it the `Ref Property` from the `xPCProtocol` class. This method initializes the object to communicate with the appropriate target PC to access the signal identifiers when accessing the object's properties. Refer to the call in the Visual Basic code example in "Creating the Load Procedure" on page 3-31.

Each class has a list of properties (specified in the `Tag` syntax in the **Description** field of the signal property). These properties return the xPC Target signal identifiers or signal numbers of the tagged signals. The generated property name is the name specified in the tagged signal description using the following syntax:

```
xPCTag=Property name;
```

For example, in the model `xpc_tank1.mdl`, there are two signal tags in the **Description** field:

- The output from the integrator block labeled TankLevel is tagged `xPCTag=water_level`.
- The output from the multiply block labeled ControlValve is tagged `xPCTag=pump_valve`.

Model-Specific COM Parameter Object Classes

Model-specific COM signal classes have two types of members in which you will be interested, the `Init` function and class properties. You will find these members in the `model_namept` class, where `model_name` is the name of your model.

The `Init` function invokes the `Init` method once, passing it as input the `Ref` property from the `xPCProtocol` class. This method initializes the object to communicate with the appropriate target PC to access the parameter identifiers when accessing the object's properties. Refer to the call in the Visual Basic code example in "Creating the Load Procedure" on page 3-31.

Each class has a list of properties (specified in the `Tag` syntax in the **Description** field of the block property). These properties return the xPC Target parameter identifier of the tagged parameters. The generated property name is the name specified in the tagged signal description using the following syntax:

```
xPCTag(1)=Property name;
```

For example, in the model `xpc_tank1.mdl`, there are two parameter tags in the **Description** field:

- The parameter for SetPoint blocks is tagged `xPCTag=set_water_level;`
- The parameters for the Controller block are tagged `xPCTag(1,2,3,)=upper_water_level lower_water_level pump_flowrate;`

Creating a New Visual Basic Project

The following procedures describe how you can create a Visual Basic project to take advantage of the xPC Target COM API to create a custom GUI for the xPC Target application. The procedures build on the `xpctank` (`xpc_tank1`) model you saved earlier (see “Creating the Target Application and Model-Specific COM Library” on page 3-14). The Visual Basic environment allows you to interact with your target application using a GUI while the target application is running in real time on the target PC.

1 Create a new project directory.

   From the directory `<MATLABroot>\toolbox\rtw\targets\xpc\api`, copy the file `xpcapi.dll` (API library) to this new project directory. You do not need to copy `xpcapiCOM.dll` (the COM API library) into the current directory, but ensure that it is registered in your system (see “Registering Dependent Dynamic Link Libraries” on page 3-43.)

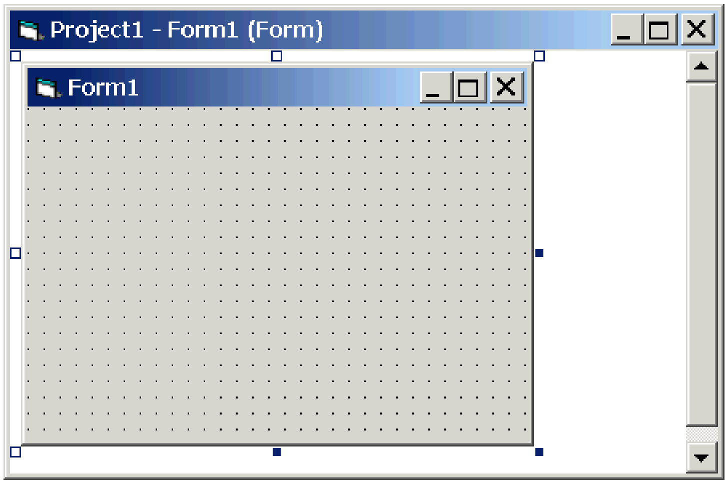
2 From your MATLAB working directory, copy the files `model_name.dlm` (target application) and `model_nameCOMiface.dll` (model-specific COM library) to the new project directory.

3 Open Visual Basic. From the **File** menu, click **New Project**.

   The **New Project** dialog box opens.

4 Select **Standard EXE**, and then click **OK**.

   The Visual Basic Integrated Development Environment opens with a blank form.



5 From the **File** menu, click **Save Project As** and enter a filename for the form and the project. For example, for the form, enter

```
xpc_tank1_COM.frm
```

At the project prompt, enter

```
xpc_tank1_COM.vpb
```

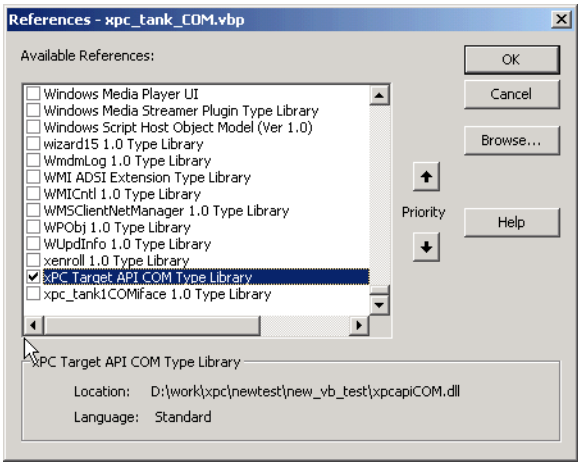
Referencing the xPC Target COM API and Model-Specific COM Libraries

You need to reference the xPC Target COM API and model-specific COM libraries so that Visual Basic will use them in the current project. Assuming that you created the Visual Basic project as described in the preceding procedure, reference the library as described in this procedure:

1 From the **Project** menu, click **References**.

The **References - xpc_tank1_COM.vdp** dialog box opens.

2 Scroll down the **Available References** list to the bottom. Select the **xPC Target API COM Type Library** check box. Click **OK**.



- [ ] Windows Media Player UI
- [ ] Windows Media Streamer Plugin Type Library
- [ ] Windows Script Host Object Model (Ver 1.0)
- [ ] wizard15 1.0 Type Library
- [ ] WmdmLog 1.0 Type Library
- [ ] WMI ADSI Extension Type Library
- [ ] WMICntl 1.0 Type Library
- [ ] WMSClientNetManager 1.0 Type Library
- [ ] WPObj 1.0 Type Library
- [ ] WUpdInfo 1.0 Type Library
- [ ] xenroll 1.0 Type Library
- [x] xPC Target API COM Type Library
- [ ] xpc_tank1COMiface 1.0 Type Library

xPC Target API COM Type Library

Location: D:\work\xpc\newtest\new_vb_test\xpcapiCOM.dll

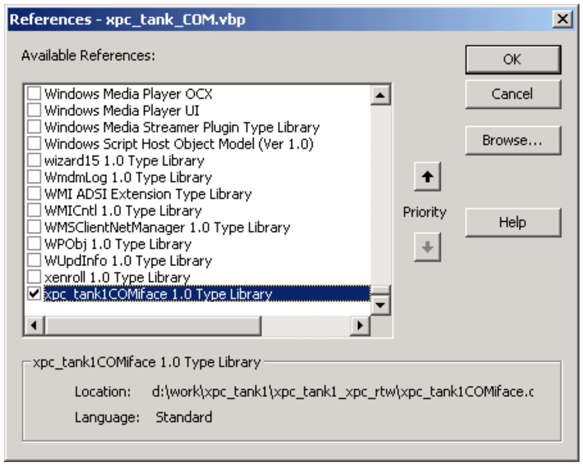
Language: Standard

The xPC Target COM API Type library (`xpcapiCOM.dll`) is now available for use in your project.

3 To add the model-specific COM library, click **References** again from the **Project** menu.

The **References - xpc_tank1_COM.vbp** dialog box opens.

4 Scroll to find your model name. Select the check box **xpc_tank1COMiface 1.0 Type Library**. Click **OK**.



- [ ] Windows Media Player OCX
- [ ] Windows Media Player UI
- [ ] Windows Media Streamer Plugin Type Library
- [ ] Windows Script Host Object Model (Ver 1.0)
- [ ] wizard15 1.0 Type Library
- [ ] WmdmLog 1.0 Type Library
- [ ] WMI ADSI Extension Type Library
- [ ] WMICntl 1.0 Type Library
- [ ] WMSClientNetManager 1.0 Type Library
- [ ] WPObj 1.0 Type Library
- [ ] WUpdInfo 1.0 Type Library
- [ ] xenroll 1.0 Type Library
- [x] xpc_tank1COMiface 1.0 Type Library

xpc_tank1COMiface 1.0 Type Library

Location: d:\work\xpc_tank1\xpc_tank1_xpc_rtw\xpc_tank1COMiface.c

Language: Standard

The model-specific COM API Type Library (xpc_tank1`COMiface.dll`) is now available for use in your project. Sections "Viewing Model-Specific COM Signal Object Classes" on page 3-22 and "Viewing Model-Specific COM Parameter Object Classes" on page 3-23 describe how to look at class objects.

Because the xPC Target COM API is an add-on to Visual Basic, it might help to know a bit about Visual Basic before going much farther with using the COM API. The section "Creating the Graphical Interface" on page 3-24 guides you through using Visual Basic to create a project for the `xpctank` or (`xpc_tank1`) model.

Viewing Model-Specific COM Signal Object Classes

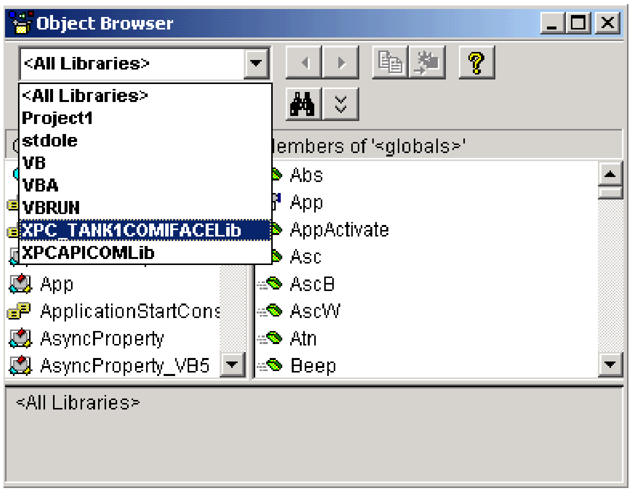
After you create a Visual Basic project and reference the xPC Target COM API and model-specific COM libraries, you can use the Visual Basic Object browser (click the **View** menu and select **Object Browser**) to look at the objects for the `xpctankbio` or `xpc_tank1bio` class:

1 From the **View** menu, select **Object Browser**.

   A dialog box pops up with a drop-down list containing all the type library information for a project.

2 Select the dropdown list for the project/library.

A list of the project libraries appears.



3 Select `model_nameCOMIFACELib`.

The classes in your model appear.

4 To view the objects of a class, select that class.

The objects in your class appear.

The `xpctankbio` (or `xpc_tank1bio`) class contains the function `Init` and the two properties:

- `water_level`
- `pump_valve`

Viewing Model-Specific COM Parameter Object Classes

After you create a Visual Basic project and reference the xPC Target COM API and model-specific COM libraries, you can use the Visual Basic Object browser (click the **View** menu and select **Object Browser**) to look at the objects for the `xpctankpt` or `xpc_tank1pt` class:

1 From the **View** menu, select **Object Browser**.

   A dialog box pops up with a dropdown list containing all the type library information for a project.

2 Select the dropdown list for the project/library.

   A list of the project libraries appears.

3 Select `model_nameCOMIFACELib`.

   The classes in your model appear.

4 To view the objects of a class, select that class.

   The objects in your class appear.

The `xpctankpt` (or `xpc_tank1pt`) class contains the method `Init` and the member properties:

- `pump_switch`
- `upper_water_level`
- `lower_water_level`
- `pump_flowrate`
- `water_level`
- `drain_valve`

Creating the Graphical Interface

Forms are the foundation for creating the interface of a Visual Basic application. You can use forms to add windows and dialog boxes to your Visual Basic application. You can also use them as containers for items that are not a visible part of the application's interface. For example, you might have a form in your application that holds a timer object.

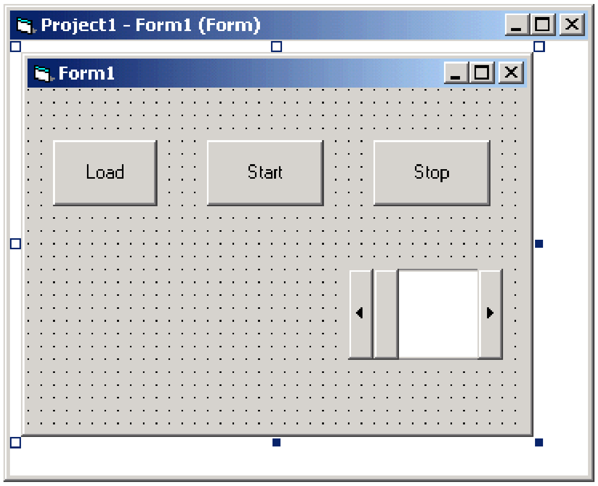
The first step in building a Visual Basic application is to create the forms that are the basis for your application's interface. Then you create the objects that make up the interface on the forms. This section assumes that you have a Visual Basic project (see “Creating a New Visual Basic Project” on page 3-19). For this first application, you will use four types of controls from the toolbox:

- Button

- Timer
- Label
- Scrollbar

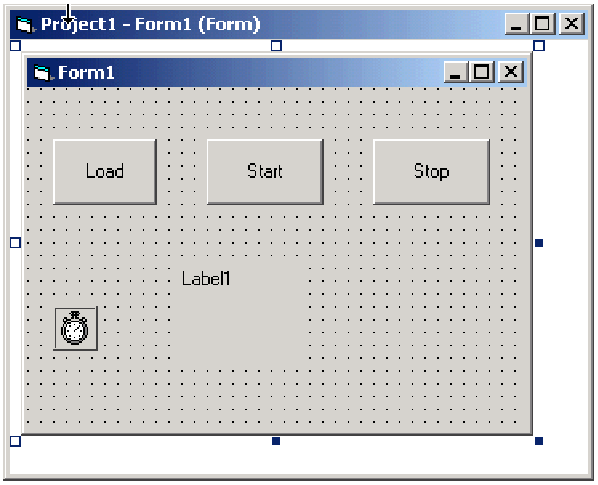
1. Open `xpc_tank1_COM.vbp`.
2. On the left, from the **General** tool panel, click and drag the **Button** icon to the form to create a button.
3. Repeat for a second button.
4. If you want to view signal data on the host, return to the **General** tool panel and click and drag the **Timer** icon to the form to create a timer.
5. If you want to view signal data on the host, add a **Label** control to the form. Return to the **General** tool panel and click and drag the **Label** icon to the form to create a label.
6. If you want to be able to vary the parameter input to the target, return to the **General** tool panel and click and drag the **HScrollBar** icon to the form.
7. Next, name your new form objects. Right-click the first button and select **Properties**. This brings up the **Properties** dialog box. In the **Caption** box, enter `Load`. Repeat for the second button, but enter `Start`. Repeat for the third button, but enter `Stop`. (If you are unsure about how to work with properties, refer to the procedure "Setting Properties" on page 3-27.) After you name your new form objects and set whatever other parameters you want (for example, if you use a timer you must increase the `Interval` parameter), you can write the code behind these objects using the Visual Basic code editor window (refer to "Writing Code" on page 3-29).

   If you added a scroll bar to your project, it should look similar to the figure below.



If you added a timer and label to your project, it should look similar to the figure below.

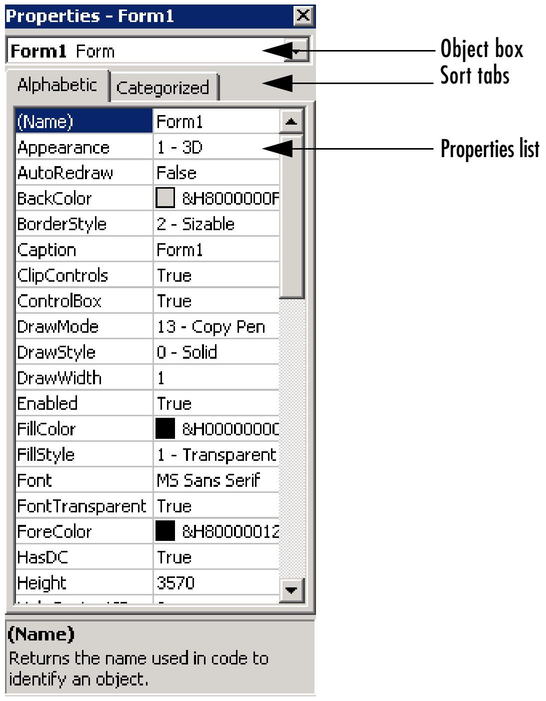
Note If you add a timer, remember to increase the interval of the timer to a value greater than the default value of `0`. Right-click the timer and select **Properties**. This brings up the **Properties** dialog box. In the **Interval** box, enter a value greater than `0`, for example `100`.



Setting Properties

This procedure describes how to set properties for the Visual Basic objects you created on your form. If you already know how to set properties for Visual Basic objects, proceed to “Writing Code” on page 3-29.

The **Properties** window (Figure 3-2, Visual Basic Properties Window) provides an easy way to set properties for all objects on a form. To open the **Properties** window, choose the **Properties Window** command from the **View** menu, click the **Properties Window** button on the toolbar, or use the context menu for the control.



Properties - Form1

Form1 Form

Alphabetic | Categorized

(Name)	Form1
Appearance	1 - 3D
AutoRedraw	False
BackColor	☐ &H8000000F
BorderStyle	2 - Sizable
Caption	Form1
ClipControls	True
ControlBox	True
DrawMode	13 - Copy Pen
DrawStyle	0 - Solid
DrawWidth	1
Enabled	True
FillColor	■ &H00000000
FillStyle	1 - Transparent
Font	MS Sans Serif
FontTransparent	True
ForeColor	■ &H80000012
HasDC	True
Height	3570

(Name)
Returns the name used in code to identify an object.

Figure 3-2: Visual Basic Properties Window

The **Properties** window consists of the following elements:

- Object box — Displays the name of the object for which you can set properties. Click the arrow to the right of the object box to display the list of objects for the current form.
- Sort tabs — Choose an alphabetic listing of properties or a hierarchical view divided by logical categories, such as those dealing with appearance, fonts, or position.
- Properties list — The left column displays all the properties for the selected object. You can edit and view settings in the right column.

To set properties from the **Properties** window,

1. From the **View** menu, choose **Properties**, or click the **Properties** button on the toolbar.

   The **Properties** window displays the settings for the selected form or control.

2. From the properties list, select the name of a property.

3. In the right column, type or select the new property setting.

   Enumerated properties have a predefined list of settings. You can display the list by clicking the down arrow at the right of the settings box, or you can cycle through the list by double-clicking a list item.

You can also set object properties directly in the code by using the following dot notation: `Object.propertyname=value.`

Writing Code

The code editor window is where you write Visual Basic code for your application. Code consists of language statements, constants, and declarations. Using the code editor window, you can quickly view and edit any of the code in your application.

The code editor window has three panes. The top leftmost pane is the object list box. It is a dropdown list that contains all the form controls in your project, plus a general section for generic declarations. The top rightmost pane contains a procedure list box. For the selected or active control in the object list box, the procedure list box displays the available procedures, or events. Visual Basic predefines the possible procedures. The third pane contains the code for the Visual Basic application. See Figure 3-3 for a sample code editor window.

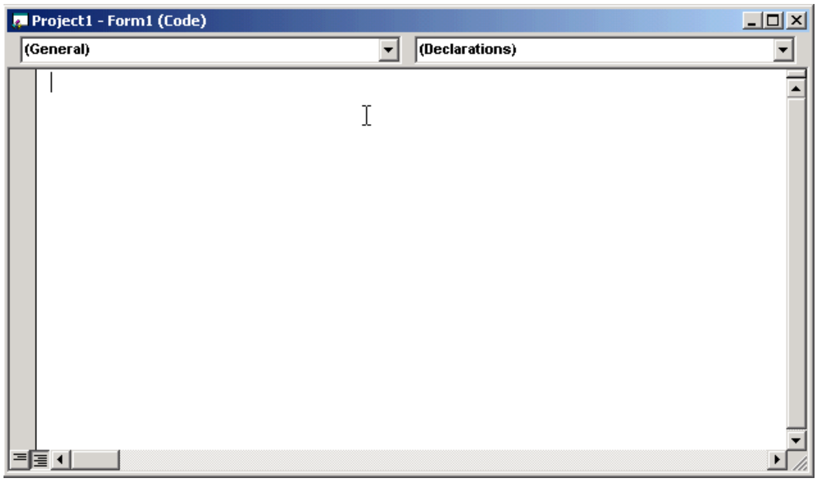


Figure 3-3: Sample Code Editor Window

In the general declarations section, declare a reference to the xPC Target COM objects that you are using to interface with the xPC Target objects. The following are the objects you need to declare:

- **xPCProtocol** — Reference the classes corresponding to the target PC running the target application and initialize the xPC Target API dynamic link library. At a minimum, you must declare this object.
- **xPCTarget** — Reference the classes for interfacing with the target application. At a minimum, you must declare this object.
- **xPCScope** — If the API application requires signal data, reference the class for interfacing with xPC Target scopes. You need to declare a scope if you want to acquire data from scopes or display data on scopes.
- **model_namept** — This is the COM object for tunable model/application parameters.
- **model_namebio** — This is the COM object for model/target application signals.

Creating the General Declarations

This procedure describes how to create the general object declarations for the `xpctank` (or `xpc_tank1`) model:

1 Double-click the form or, from the **View** menu, select **Code**.

   The code editor window box opens for the control.

2 Select the General object.

3 Select **Declarations** in the procedure list box.

   A *template* for the declarations procedure is now displayed in the code editor window.

4 Enter declarations for the xPC Target COM objects you are using.

```
Dim protocol_obj As xPCProtocol
Dim target_obj As xPCTarget
Dim scope_obj As xPCScopes
```

5 Enter declarations for the model-specific COM objects you are using.

```
Dim parameters_obj As xpc_tank1pt
Dim signals_obj As xpc_tank1bio
```

Creating the Load Procedure

This procedure describes how to program a load target application procedure for the form. You might or might not want to allow users to download target applications to the target PC. However, if you do want to allow this action, you need to provide a control on the GUI for the user to do so. "Creating Event Procedures to Load Applications" on page 3-33 describes how to do this:

1 In the project window, double-click the Form object.

   The code editor window opens.

2 In the procedure list box, select **Load**.

3 Create and initialize the objects for the `Load` method in the form.

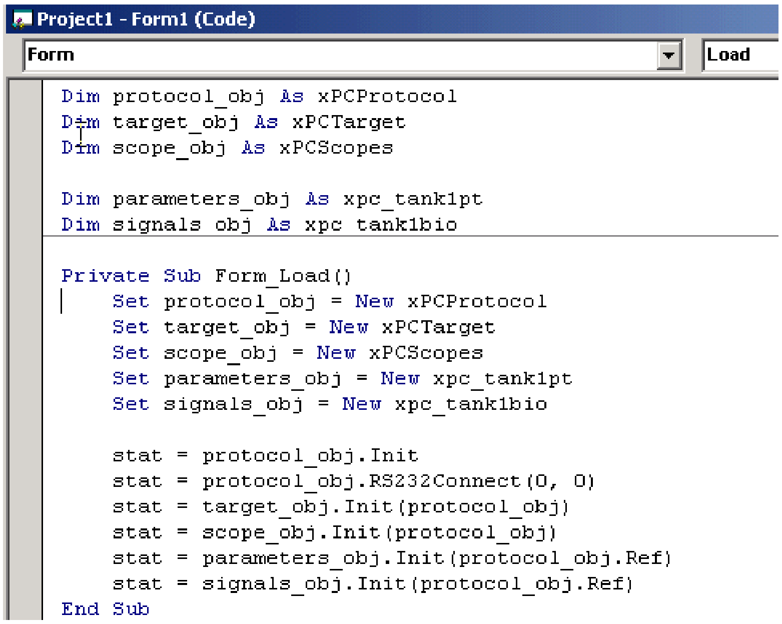
```
Private Sub Form_Load()
    Set protocol_obj = New xPCProtocol
    Set target_obj = New xPCTarget
    Set scope_obj = New xPCScopes
    Set parameters_obj = New xpc_tank1pt
```

```
        Set signals_obj = New xpc_tank1bio

        stat = protocol_obj.Init
        stat = protocol_obj.RS232Connect(0, 0)
        stat = target_obj.Init(protocol_obj)
        stat = scope_obj.Init(protocol_obj)
        stat = parameters_obj.Init(protocol_obj.Ref)
        stat = signals_obj.Init(protocol_obj.Ref)
    End Sub
```

You can add more code to the `Load` method. This is the minimum code you should enter for this method.

Your code editor window should look similar to the following.



```
Dim protocol_obj As xPCProtocol
Dim target_obj As xPCTarget
Dim scope_obj As xPCScopes

Dim parameters_obj As xpc_tank1pt
Dim signals obj As xpc tank1bio

Private Sub Form_Load()
    Set protocol_obj = New xPCProtocol
    Set target_obj = New xPCTarget
    Set scope_obj = New xPCScopes
    Set parameters_obj = New xpc_tank1pt
    Set signals_obj = New xpc_tank1bio

    stat = protocol_obj.Init
    stat = protocol_obj.RS232Connect(0, 0)
    stat = target_obj.Init(protocol_obj)
    stat = scope_obj.Init(protocol_obj)
    stat = parameters_obj.Init(protocol_obj.Ref)
    stat = signals_obj.Init(protocol_obj.Ref)
End Sub
```

Creating Event Procedures

Code in a Visual Basic application is divided into smaller blocks called *procedures*. Event procedures, such as those you create here, contain code that mainly calls the Target API component methods. For example, when a user clicks a button, that action starts the xPC Target application. This code is also responsible for the feedback action (such as enabling a timer control, disabling/enabling controls) when an event occurs. An event procedure for a control combines the control's name (specified in the Name property), an underscore (_), and the event name. For example, if you want a command button named **Command1** to invoke an event procedure when it is clicked, call the procedure `Command1_Click`. The following procedures illustrate how to create event procedures, using the `xpctank` (or `xpc_tank1`) model as an example.

Creating Event Procedures to Load Applications

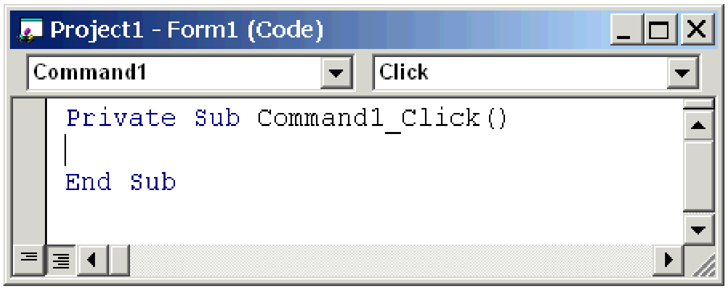
This procedure describes how to program the command button **Command1** to load an application to the target PC through a serial connection. Provide a procedure like this to allow users to download target applications to the target PC:

1. Double-click the form or, from the **View** menu, select **Code**.

2. From the object list box, select the name of an object in the active form. (The *active* form is the form that currently has the focus.) For this example, choose the command button **Command1**.

3. In the procedure list box, select the name of an event for the selected object.

   Here, the `Click` procedure is already selected because it is the default procedure for a command button.



```
Private Sub Command1_Click()

End Sub
```

4. To load the target application, enter the path to the target application. If the target application is in the same folder as the API application, enter ".". Enter the name of the target application without the extension.

   ```
   stat = target_obj.LoadApp(".", "xpc_tank1")
   ```

When you are done, the contents of your code editor window should look similar to the code below:

```
Private Sub Command1_Click()
    stat = target_obj.LoadApp(".", "xpc_tank1")
End Sub
```

Creating Event Procedures to Start and Stop Applications

This procedure describes how to program the command buttons **Command2** and **Command3** to start and stop an application on a target PC:

1. If you are not already in the code editor window, double-click the form or, from the **View** menu, select **Code**.

2. From the object list box, select the name of an object in the active form. (The *active* form is the form that currently has the focus.) For this example, choose the command button **Command2**.

3. In the procedure list box, select the name of an event for the selected object. Here, select the `Click` procedure.

4. To start the target application, select the `StartApp` method for the command button **Command2** (this is the button you named `Start`).

   ```
   stat = target_obj.StartApp
   ```

5. To stop the target application, select the `StopApp` method for the command button **Command3** (this is the button you named `Stop`). Be sure to select the `Click` procedure in the procedure list box.

   ```
   stat = target_obj.StopApp
   ```

When you are done, the contents of your code editor window should look similar to the code below:

```
Private Sub Command2_Click()
    stat = target_obj.StartApp
End Sub
```

```
Private Sub Command3_Click()
    stat = target_obj.StopApp
End Sub
```

Creating Event Procedures to Vary Input Values

You can provide controls to allow users to vary the parameters of their applications. The Scroll procedure is one way of varying input. The following code uses the Visual Basic `HScrollBar` object to vary the `water_level` parameter. It takes the value from the HScrollBar object and sends that value to the target as a parameter change.

Note This section assumes that you have tagged block parameters and created your own model-specific COM library. Refer to "Getting Parameter IDs with the GetParamIdx Method" on page 3-38 for a description of how to manually perform the equivalent of using tagged parameters.

---

1 If you are not already in the code editor window, double-click the form or, from the **View** menu, select **Code**.

2 From the object list box, select the name of an object in the active form. (The *active* form is the form that currently has the focus.) For this example, select the `HScroll1` object.

   The cursor jumps to the `HScroll1` object template of the code editor window.

3 In the procedure list box, select the name of an event for the selected object. Here, select the `Scroll` procedure.

4 Declare the `slideVal` variable as a double. The `slideVal` variable will contain the value of the scrollbar.

   ```
   Dim slideVal(0) As Double
   ```

5 Assign to the `slideVal` variable the result of `CDbl`. The `CDbl` function reads the value of an object property. In this example, the object `HScrollBar` has the property `slideVal(0)`. `CDbl` reads the value of `HScroll1.Value` and returns that value to `SlideVal`.

```
slideVal(0) = CDbl(HScroll1.Value)
```

6 Set the value of `water_level` to the scroll bar value `slideVal`, which is from HScrollBar. The `COM` object `target_obj` has the method `SetParam`, which has the syntax `SetParam(parIdx, newparVal)`. The `SetParam` method references `parIdx` from the model-specific `COM` object (type `xpc_tank1pt`). To set the value of `water_level` to the scroll bar value `slideVal`, select `SetParam` and continue typing. A list of the parameters you tagged in the Simulink model then pops up, and you can select the parameter `water_level` and continue typing. The call to `SetParam` should look like the following:

```
stat = target_obj.SetParam(parameters_obj.water_level,
slideVal)
```

When you are done, the contents of your code editor window should look similar to the code below:

```
Private Sub HScroll1_Scroll()
    Dim slideVal(0) As Double

    slideVal(0) = CDbl(HScroll1.Value)
    stat = target_obj.SetParam(parameters_obj.water_level,
slideVal)
End Sub
```

Creating Event Procedures to Display Signal Values at the Host

You can provide controls to view signal values at the host. To do this, use a combination of the timer and label controls. The following code uses the Visual Basic timer control to display the `water_level` signal on the label control.

Note This section assumes that you have tagged signals and created your own model-specific COM library. Refer to "Getting Signal IDs with the GetSignalIdx Method" on page 3-40 for a description of how to manually perform the equivalent of using tagged signals.

Before you start, check that the Timer1 `Interval` property is greater than `0`.

1 From the object list box, select the `Timer1` object.

2 Assign to the `Label1.Caption` object the value of the `water_level` signal. The `COM` object `target_obj` has the method `GetSignal(sigNum)`. Reference the `sigNum` parameter by passing it `signals_obj.water_level`. The `CStr` function converts the returned value to a string so that it can be displayed on the `Label1` object.

When you are done, the contents of your code editor window should look similar to the code below:

```
Private Sub Timer1_Timer()

    Label1.Caption =
CStr(target_obj.GetSignal(signals_obj.water_level))

End Sub
```

Note Although you add both a timer and label object to the Visual Basic application, only the label appears on the GUI itself when the Visual Basic application is run. The timer is not visible.

Creating Unload and Termination Procedures

You should write Form Unload and Termination procedures to ensure that users are able to stop and unload the application appropriately, and to close the communication between the host PC and target PC.

Note Provide Form Unload and Termination procedures to ensure that the communication channel between the host PC and target PC properly closes between each run of the GUI application.

The Terminate procedure controls the behavior of the Visual Basic **Run** menu **End** option. The Unload procedure controls the behavior of the Visual Basic **Close** button:

1 From the object list box, select the `Form` object.

2 From the procedure list box, select `Terminate`.

3 You are going to close the connection with the target PC, so type `protocol_obj` and select the `Close` method for that object.

```
protocol_obj.Close
```

4 From the procedure list box, select `Unload`.

5 Repeat step 3.

When you are done, the contents of your code editor window should look similar to the code below:

```
Private Sub Form_Terminate()
   protocol_obj.Close
End Sub
Private Sub Form_Unload(Cancel As Integer)
   protocol_obj.Close
End Sub
```

Referencing Parameters and Signals Without Using Tags

The sample code in "Creating Event Procedures to Vary Input Values" on page 3-35 and "Creating Event Procedures to Display Signal Values at the Host" on page 3-36 illustrate how to reference parameters that you tagged before building the Simulink model. This section describes how to reference these same parameters and signals from the COM API application code if you did not opt to tag signals and parameters.

Getting Parameter IDs with the GetParamIdx Method

When working with parameters in the context of varying input values, you use the `SetParam` and `GetParamIdx` methods. The `SetParam` method has the syntax

```
SetParam(parIdx As Long, newparVal() As Double) As Long
```

where **`parIdx`** is the identifier that corresponds to the parameter you want to set. To obtain the parameter ID, **`parIdx`**, for `SetParam`, you need to call the `GetParamIdx` method. This method has the syntax

```
GetParamIdx(blockName As String, paramName As String) As Long
```

The following procedure describes how to obtain the appropriate GetParamIdx block name and parameter name for the Visual Basic HScrollBar object. You need to reference the block name and parameter from the model_namept.m file:

1 Open a DOS window.

2 Change the directory to the directory that contains your prebuilt model.

3 Open the file model_namept.m. For example, you can use the notepad text editor.

```
notepad xpc_tank1pt.m
```

The editor opens for that file. If you are not in the directory in which the xpc_tank1pt.m file resides, be sure to type the full path for xpc_tank1pt.m.

4 Search for and copy the string for the block of the parameter you want to reference. For the xpc_tank1 example, search for the SetPoint block if you want to reference the water level. For example:

```
xpc_tank1/SetPoint
```

5 Return to the code editor window for your project.

6 In the line that contains the call to GetParamIdx, enter the path for the blockName variable.

7 Return to the editor window for model_namept.m.

8 Search for and copy the string for the name of the parameter you are interested in. For example:

```
Value
```

If you do not know the name of the block parameter you are interested in, refer to the “Model and Block Parameter” chapter of the Using Simulink documentation.

9 Return to the code editor window for your project.

10 In the line that contains the call to GetParamIdx, enter the path for the paramName variable. For example:

```
stat = target_obj.SetParam(target_obj.GetParamIdx("xpc_tank1/
SetPoint", "Value"), slideVal)
```

When you are done, the contents of your code editor window should look similar to the code below:

```
Private Sub HScroll1_Scroll()
    Dim slideVal(0) As Double

    slideVal(0) = CDbl(HScroll1.Value)
    stat =
target_obj.SetParam(target_obj.GetParamIdx("xpc_tank1/
SetPoint", "Value"), slideVal)

End Sub
```

Getting Signal IDs with the GetSignalIdx Method

When working with signals in the context of displaying signal values, you use the `GetSignal` and `GetSignalIdx` methods. The `GetSignal` method has the syntax

```
GetSignal(sigNum As Long) As Double
```

where `sigNum` is the identifier that corresponds to the signal you want to set. To obtain the signal ID, `sigNum`, for `GetSignal`, you call the `GetSignalIdx` method. This method has the syntax

```
GetSignalIdx(sigName As String) As Long
```

The following procedure describes how to obtain the appropriate `GetSignalIdx` block name for the Visual Basic timer object. You need to reference the block name and signal from the `model_namebio.m` file:

1. Open a DOS window.
2. Change the directory to the directory that contains your prebuilt model.
3. Open the file `model_namebio.m`. For example:

```
notepad xpc_tank1bio.m
```

The editor opens for that file. If you are not in the directory in which the `xpc_tank1bio.m` file resides, be sure to type the full path for `xpc_tank1bio.m`.

4 Search for and copy the string for the block of the signal you want to reference. For the `xpc_tank1` example, search for the `TankLevel` block to reference the tank level. For example:

   ```
   xpc_tank1/TankLevel
   ```

5 Return to the code editor window for your project.

6 In the line that contains the call to `GetSignalIdx`, enter the path for the `SigName` variable.

When you are done, the contents of your code editor window should look similar to the code below:

```
Private Sub Timer1_Timer()
   Label1.Caption =
CStr(target_obj.GetSignal(target_obj.GetSignalIdx("xpc_tank1/
TankLevel")))
End Sub
```

Testing the Visual Basic Application

While creating your Visual Basic application, you might want to see how the application is progressing. Visual Basic allows you to run your application while still in the Visual Basic project. From the Visual Basic task bar, you can click the Run button ▶. Alternatively, you can follow the procedure:

1 If you have MATLAB and a target object connected, close the port. For example, at the MATLAB command line, type

   ```
   tg.close
   ```

2 From within the project, go to the **Run** menu.

3 Select **Start** or **Start with Full Compile**. The **Start** option starts your application immediately. The **Start with Full Compile** option starts the application after compilation.

The form you are working on pops up. Test your application. Ensure that only one version of the application is running at any given time. To stop the application from within Visual Basic, you can click the **End** button ■ from the task bar. Alternatively, you can go to the **Run** menu and select **End**.

Note If your Visual Basic application opens a communication channel between the host PC and the target PC for the target application, be sure to close that open channel between test runs of the Visual Basic application. Not doing so can cause subsequent runs of the Visual Basic application to fail. “Creating Unload and Termination Procedures” on page 3-37 describes how to write a procedure to disconnect from the target PC. If you want to return control to MATLAB, be sure to close the Visual Basic project first.

Building the Visual Basic Application

After you finish designing, programming, and testing your Visual Basic GUI application, build your application. You can later distribute the GUI application to users, who can then use it to work with target applications:

1. From within the project, go to the **File** menu.
2. Select **Make** `project_name_COM.exe`, where `project_name` is the name of the Visual Basic project you have been working on.
3. At the pop-up box, select the directory in which you want to save the executable. Optionally, you can also rename the executable.

   The compiler generates the `project_name_COM.exe` file in the specified directory.

Deploying the API Application

This section assumes that you have built your xPC Target application and your Visual Basic xPC Target COM GUI application. If you have not yet done so, refer to “Creating the Target Application and Model-Specific COM Library” on page 3-14 and “Building the Visual Basic Application” on page 3-42, respectively.

When distributing the Visual Basic model application to users, provide the following files:

- `project_name_COM.exe`, the executable for the Visual Basic application
- `model_name.dlm`

  Provide `model_name.dlm` if you expect the user to download the target application to the target PC. If you expect that the target application is already loaded on the target PC when the user runs the Virtual Basic GUI application, you might not want him or her to be able to load the target application to the target PC. If you do expect the user to download the target application, ensure that you have enabled an application load event on the Visual Basic interface (refer to “Creating the Load Procedure” on page 3-31).
- `model_nameCOMiface.dll`, if you tag the signals and parameters in the model
- `xpcapiCOM.dll`, the xPC Target COM API dynamic link library
- `xpcapi.dll`, the xPC Target API dynamic link library

Have the user ensure that all the files are located in the same directory before he or she executes the Visual Basic application.

You must also ensure that the user knows how to register the application-dependent dynamic link libraries (refer to “Registering Dependent Dynamic Link Libraries” on page 3-43).

To run the application and download an xPC Target application, users need to have `project_name_COM.exe` and `model_name.dlm`, if provided, in the same directory.

Registering Dependent Dynamic Link Libraries

This procedure uses `xpc_tank1` as an example:

1. Open a DOS window.

2. Change the directory to the directory containing the API application files.

3. From the directory in which `xpcapiCOM.dll` resides, register the xPC Target COM API DLL by typing

```
regsvr32 xpcapiCOM.dll
```

DOS displays the message

```
DllRegisterServer in xpcapiCOM.dll succeeded
```

If you are not in the directory in which the `xpcapiCOM.dll` file resides, be sure to type the full path for `xpcapi.dll`.

4. If you tag the signals and parameters in the model, register the model-specific COM interface dynamic link library by typing

   ```
   regsvr32 xpc_tank1COMiface.dll
   ```

   DOS displays the message

   ```
   DllRegisterServer in xpc_tank1COMiface.dll succeeded
   ```

xPC Target API Function Reference

This chapter includes the following sections:

Alphabetical Listing of Functions and Structures

For a listing of functions and structures by category, see “Categorical Listing of Functions and Structures” on page 4-9.

Function or Structure	Description
`lgmode`	Type definition for a structure holding logging options
`scopedata`	Type definition for a structure holding scope data
`xPCAddScope`	Create a new scope on the target PC
`xPCAverageTET`	Return the average task execution time (TET)
`xPCCloseConnection`	Close the RS-232 or TCP/IP communication channel
`xPCClosePort`	Close the RS-232 or TCP/IP communication channel
`xPCDeRegisterTarget`	Delete the target communication properties from the xPC Target API library
`xPCErrorMsg`	Return the text description for an error message
`xPCGetAppName`	Return the name of a target application
`xPCGetEcho`	Return the display mode for the target message window
`xPCGetExecTime`	Return the execution time for the target application
`xPCGetLastError`	Return the number of the last error

Function or Structure	Description (Continued)
`xPCGetLoadTimeOut`	Return the current timeout value for initializing a target application
`xPCGetLogMode`	Return the logging mode and increment value for the application
`xPCGetNumOutputs`	Return the number of outputs
`xPCGetNumParams`	Return the number of tunable parameters
`xPCGetNumSignals`	Return the number of signals
`xPCGetNumStates`	Return the number of states
`xPCGetOutputLog`	Copy the output log data to an array
`xPCGetParam`	Retrieve the parameter value and copy that value to an array
`xPCGetParamDims`	Retrieve the row and column dimensions of a parameter
`xPCGetParamIdx`	Return the parameter index
`xPCGetParamName`	Retrieve the name of a parameter
`xPCGetSampleTime`	Return the sample time in seconds
`xPCGetScope`	Retrieve and copy scope data to a structure
`xPCGetScopes`	Retrieve and copy a list of scope numbers
`xPCGetSignal`	Return the value of a signal
`xPCGetSignalIdx`	Return the index for a signal
`xPCGetSignalName`	Copy the name of a signal to a character array
`xPCGetSignals`	Return a vector of signal values

Function or Structure	Description (Continued)
`xPCGetSignalWidth`	Return the width of a signal
`xPCGetStateLog`	Copy the values of the state log to an array
`xPCGetStopTime`	Return the stop time
`xPCGetTETLog`	Copy the TET log to an array
`xPCGetTimeLog`	Copy the time log to an array
`xPCInitAPI`	Initialize the xPC Target DLL
`xPCIsAppRunning`	Return running status for target application
`xPCIsOverloaded`	Return overload status for the target PC
`xPCIsScFinished`	Return data acquisition status for a scope
`xPCLoadApp`	Load a target application onto the target PC
`xPCMaxLogSamples`	Return the maximum number of samples that can be in the log buffer
`xPCMaximumTET`	Copy the maximum task execution time to an array
`xPCMinimumTET`	Copy the minimum task execution time to an array
`xPCNumLogSamples`	Return number of samples in the log buffer
`xPCNumLogWraps`	Return the number of times the log buffer wraps
`xPCOpenConnection`	Open a connection to the target PC

Function or Structure	Description (Continued)
`xPCOpenSerialPort`	Open an RS-232 connection to an xPC Target system
`xPCOpenTcpIpPort`	Open a TCP/IP connection to an xPC Target system
`xPCReboot`	Reboot the target PC
`xPCReOpenPort`	Reopen an existing communication channel
`xPCRegisterTarget`	Register a target with the xPC Target API library, but do not open a connection
`xPCRemScope`	Remove a scope from the target PC
`xPCScAddSignal`	Add a signal to a scope
`xPCScGetData`	Retrieve and copy scope data to an array
`xPCScGetDecimation`	Return the decimation of a scope
`xPCScGetNumPrePostSamples`	Return the number of pre or post samples before triggering a scope
`xPCScGetNumSamples`	Return the number of samples in one data acquisition cycle
`xPCScGetSignals`	Copy a list of signals to an array
`xPCScGetStartTime`	Return the start time for the last data acquisition cycle
`xPCScGetState`	Return the state of a scope
`xPCScGetTriggerLevel`	Return the trigger level for a scope
`xPCScGetTriggerMode`	Return the trigger mode for a scope
`xPCScGetTriggerScope`	Return the trigger scope

Function or Structure	Description (Continued)
`xPCScGetTriggerScopeSample`	Retrieve the sample number for a triggering scope
`xPCScGetTriggerSignal`	Return the trigger signal for a scope
`xPCScGetTriggerSlope`	Return the trigger slope for scope
`xPCScGetType`	Return the type of scope
`xPCScRemSignal`	Remove a signal from a scope
`xPCScSetDecimation`	Set the decimation of a scope
`xPCScSetNumPrePostSamples`	Set the number of pre or post samples before triggering a scope
`xPCScSetNumSamples`	Set the number of samples in one data acquisition cycle
`xPCScSetTriggerLevel`	Set the trigger level for a scope
`xPCScSetTriggerMode`	Set the trigger mode of a scope
`xPCScSetTriggerScope`	Select a scope to trigger another scope
`xPCScSetTriggerScopeSample`	Set the sample number for a triggering scope
`xPCScSetTriggerSignal`	Select a signal to trigger a scope
`xPCScSetTriggerSlope`	Set the slope of a signal that triggers a scope
`xPCScSoftwareTrigger`	Set the software trigger of a scope
`xPCScStart`	Start data acquisition for a scope
`xPCScStop`	Stop data acquisition for a scope
`xPCSetEcho`	Turn the message display on or off
`xPCSetLastError`	Set the last error to a specific value

Function or Structure	**Description (Continued)**
`xPCSetLoadTimeOut`	Change the timeout value for initialization
`xPCSetLogMode`	Set the logging mode and increment value of a scope
`xPCSetParam`	Change the value of a parameter
`xPCSetSampleTime`	Change the sample time, in seconds, for a target application
`xPCSetScope`	Set the properties of a scope
`xPCSetStopTime`	Change the stop time of a target application
`xPCStartApp`	Start a target application
`xPCStopApp`	Stop a target application
`xPCTargetPing`	Ping the target PC
`xPCTgScGetGrid`	Return the grid line display mode for a particular scope of type `target`
`xPCTgScGetMode`	Return the scope mode for displaying signals
`xPCTgScGetViewMode`	Return the view (zoom) mode for the target PC display
`xPCTgScGetYLimits`	Copy the y-axis limits for a scope of type `target` to an array
`xPCTgScSetGrid`	Set the grid line display mode for a scope of type `target`
`xPCTgScSetMode`	Set the display mode for a scope of type `target`
`xPCTgScSetViewMode`	Set the view (zoom) mode for the target PC display

Function or Structure	Description (Continued)
`xPCTgScSetYLimits`	Set the y-axis limits for a scope of type `target`
`xPCUnloadApp`	Unload target application

Categorical Listing of Functions and Structures

The functions and structures in the xPC Target API can be divided into several categories. This section includes the following category tables:

- Logging and Scope Structures
- Communications Functions
- Target Application Functions
- Data Logging Functions
- Scope Functions
- Target Scope Functions
- Monitoring/Tuning Functions
- Miscellaneous Functions

Many functions have get/set pairs. In those instances, the table lists first the set function, then the associated get function.

For an alphabetical listing of functions and structures, see "Alphabetical Listing of Functions and Structures" on page 4-2.

Logging and Scope Structures

Structure	Description
`lgmode`	Type definition for a structure holding logging options
`scopedata`	Type definition for a structure holding scope data

Communications Functions

Communication Function	Description
`xPCOpenSerialPort`	Open an RS-232 connection to an xPC Target system
`xPCOpenTcpIpPort`	Open a TCP/IP connection to an xPC Target system
`xPCReOpenPort`	Reopen an existing communication channel
`xPCClosePort`	Close the RS-232 or TCP/IP communication channel
`xPCRegisterTarget`	Register a target with the xPC Target API library, but do not open a connection
`xPCDeRegisterTarget`	Delete the target communication properties from the xPC Target API library
`xPCOpenConnection`	Open a connection to the target PC
`xPCCloseConnection`	Close the RS-232 or TCP/IP communication channel
`xPCTargetPing`	Ping the target PC
`xPCReboot`	Reboot the target PC
`xPCSetLoadTimeOut`	Change the timeout value for initialization
`xPCGetLoadTimeOut`	Return the current timeout value for initializing a target application

Target Application Functions

Target Application Function	Description
`xPCSetStopTime`	Change the stop time of a target application
`xPCGetStopTime`	Return the stop time
`xPCSetSampleTime`	Change the sample time, in seconds, for a target application
`xPCGetSampleTime`	Return the sample time in seconds
`xPCGetExecTime`	Return the execution time for the target application
`xPCGetAppName`	Return the name of a target application
`xPCStopApp`	Stop a target application
`xPCStartApp`	Start a target application
`xPCIsAppRunning`	Return running status for target application
`xPCIsOverloaded`	Return overload status for the target PC
`xPCAverageTET`	Return the average task execution time (TET)
`xPCMinimumTET`	Copy the minimum task execution time to an array
`xPCMaximumTET`	Copy the maximum task execution time to an array
`xPCLoadApp`	Load a target application onto the target PC
`xPCUnloadApp`	Unload target application

Data Logging Functions

Data Logging Function	Description
`xPCGetNumOutputs`	Return the number of outputs
`xPCGetNumStates`	Return the number of states
`xPCSetLogMode`	Set the logging mode and increment value of a scope
`xPCGetLogMode`	Return the logging mode and increment value for the application
`xPCNumLogSamples`	Return number of samples in the log buffer
`xPCMaxLogSamples`	Return the maximum number of samples that can be in the log buffer
`xPCNumLogWraps`	Return the number of times the log buffer wraps
`xPCGetStateLog`	Copy the values of the state log to an array
`xPCGetOutputLog`	Copy the output log data to an array
`xPCGetTETLog`	Copy the TET log to an array
`xPCGetTimeLog`	Copy the time log to an array

Scope Functions

Scope Function	Description
`xPCGetScopes`	Retrieve and copy a list of scope numbers
`xPCScGetType`	Return the type of scope
`xPCAddScope`	Create a new scope on the target PC
`xPCRemScope`	Remove a scope from the target PC
`xPCScAddSignal`	Add a signal to a scope
`xPCScRemSignal`	Remove a signal from a scope
`xPCScStart`	Start data acquisition for a scope
`xPCScStop`	Stop data acquisition for a scope
`xPCIsScFinished`	Return data acquisition status for a scope
`xPCScGetData`	Retrieve and copy scope data to an array
`xPCScGetState`	Return the state of a scope
`xPCScGetStartTime`	Return the start time for the last data acquisition cycle
`xPCScGetSignals`	Return a vector of signal values
`xPCSetScope`	Set the properties of a scope
`xPCGetScope`	Retrieve and copy scope data to a structure
`xPCScSetDecimation`	Set the decimation of a scope
`xPCScGetDecimation`	Return the decimation of a scope

Scope Function (Continued)	Description
`xPCScSetNumSamples`	Set the number of samples in one data acquisition cycle
`xPCScGetNumSamples`	Return the number of samples in one data acquisition cycle
`xPCScSetTriggerLevel`	Set the trigger level for a scope
`xPCScGetTriggerLevel`	Return the trigger level for a scope
`xPCScSetTriggerMode`	Set the trigger mode of a scope
`xPCScGetTriggerMode`	Return the trigger mode for a scope
`xPCScSetTriggerScope`	Select a scope to trigger another scope
`xPCScGetTriggerScope`	Return the trigger scope
`xPCScSetTriggerScopeSample`	Set the sample number for a triggering scope
`xPCScGetTriggerScopeSample`	Retrieve the sample number for a triggering scope
`xPCScSoftwareTrigger`	Set the software trigger of a scope
`xPCScSetTriggerSignal`	Select a signal to trigger a scope
`xPCScGetTriggerSignal`	Return the trigger signal for a scope
`xPCScSetTriggerSlope`	Set the slope of a signal that triggers a scope
`xPCScGetTriggerSlope`	Return the trigger slope for scope
`xPCScSetNumPrePostSamples`	Set the number of pre or post samples before triggering a scope
`xPCScGetNumPrePostSamples`	Return the number of pre or post samples before triggering a scope

Target Scope Functions

Target Scope Function	Description
`xPCTgScSetGrid`	Set the grid line display mode for a scope of type `target`
`xPCTgScGetGrid`	Return the grid line display mode for a particular scope of type `target`
`xPCTgScSetYLimits`	Set the *y*-axis limits for a scope of type `target`
`xPCTgScGetYLimits`	Copy the *y*-axis limits for a scope of type `target` to an array
`xPCTgScSetMode`	Set the display mode for a scope of type `target`
`xPCTgScGetMode`	Return the scope mode for displaying signals
`xPCTgScSetViewMode`	Set the view (zoom) mode for the target PC display
`xPCTgScGetViewMode`	Return the view (zoom) mode for the target PC display

Monitoring/Tuning Functions

Monitoring/Tuning Function	Description
`xPCGetNumParams`	Return the number of tunable parameters
`xPCGetNumSignals`	Return the number of signals
`xPCGetParamDims`	Retrieve the row and column dimensions of a parameter

Monitoring/Tuning Function	Description
`xPCGetSignalWidth`	Return the width of a signal
`xPCGetSignalIdx`	Return the index for a signal
`xPCGetParamIdx`	Return the parameter index
`xPCGetParamName`	Retrieve the name of a parameter
`xPCGetSignalName`	Copy the name of a signal to a character array
`xPCSetParam`	Change the value of a parameter
`xPCGetParam`	Retrieve the parameter value and copy that value to an array
`xPCGetSignal`	Return the value of a signal
`xPCGetSignals`	Return a vector of signal values

Miscellaneous Functions

Miscellaneous Function	Description
`xPCInitAPI`	Initialize the xPC Target DLL
`xPCSetLastError`	Set the last error to a specific value
`xPCGetLastError`	Return the number of the last error
`xPCErrorMsg`	Return the text description for an error message
`xPCSetEcho`	Turn the message display on or off
`xPCGetEcho`	Return the display mode for the target message window

xPC Target API Error Messages

The following table is a list of xPC Target API error constants and messages:

Error Constant	Error Message
ECOMPORTACCFAIL	`COM port access failed`
ECOMPORTISOPEN	`COM port is already opened`
ECOMPORTREAD	`ReadFile failed while reading from COM port`
ECOMPORTWRITE	`WriteFile failed while writing to COM port`
ECOMTIMEOUT	`timeout while receiving: check serial link`
EFILEOPEN	`LoadDLM: error opening file`
EINTERNAL	`Internal Error`
EINVADDR	`Invalid IP Address`
EINVBAUDRATE	`Invalid value for baudrate`
EINVCOMMTYP	`Invalid communication type`
EINVCOMPORT	`COM port can only be 0 or 1 (COM1 or COM2)`
EINVLOGID	`Invalid log identifier`
EINVNUMSIGNALS	`Invalid number of signals`
EINVPARIDX	`Invalid parameter index`
EINVPORT	`Invalid Port Number`
EINVSCIDX	`Invalid Scope Index`
EINVSCTYPE	`Invalid Scope type`
EINVSIGIDX	`Invalid Signal index`

Error Constant	Error Message
EINVTRIGMODE	`Invalid trigger mode`
EINVTRIGSLOPE	`Invalid Trigger Slope Value`
EINVTRSCIDX	`Invalid Trigger Scope index`
EINVARGUMENT	`Invalid Argument`
EINVDECIMATION	`Decimation must be positive`
EINVLGDATA	`Invalid lgdata structure`
EINVLGINCR	`Invalid increment for value equidistant logging`
EINVLGMODE	`Invalid Logging mode`
EINVNUMSAMP	`Number of samples must be nonnegative`
EINVSTARTVAL	`Invalid value for "start"`
EINVTFIN	`Invalid value for TFinal`
EINVTS	`Invalid value for Ts (must be between 8e-6 and 10)`
EINVWSVER	`Invalid Winsock version (1.1 needed)`
ELOGGINGDISABLED	`Logging is disabled`
EMEMALLOC	`Memory allocation error`
ENODATALOGGED	`No data has been logged`
ENOERR	`No error`
ENOFREEPORT	`No free Port in C API`
ENOMORECHANNELS	`No more channels in scope`
ENOSPACE	`Space not allocated`
EPARNOTFOUND	`Parameter not found`

Error Constant	Error Message
EPARSIZMISMATCH	`Parameter Size mismatch`
EPINGCONNECT	`Could not connect to Ping socket`
EPINGPORTOPEN	`Error opening Ping port`
EPINGSOCKET	`Ping socket error`
EPORTCLOSED	`Port is not open`
ERUNSIMFIRST	`Run simulation first`
ESCTYPENOTTGT	`Scope Type is not "Target"`
ESIGNOTFOUND	`Signal not found`
ESOCKOPEN	`Socket Open Error`
ESTARTSIMFIRST	`Start simulation first`
ESTOPSCFIRST	`Stop scope first`
ESTOPSIMFIRST	`Stop simulation first`
ETCPCONNECT	`TCP/IP Connect Error`
ETCPREAD	`TCP/IP Read Error`
ETCPTIMEOUT	`TCP/IP timeout while receiving data`
ETCPWRITE	`TCP/IP Write error`
ETETLOGDISABLED	`TET Logging is disabled`
ETGTMEMALLOC	`Target memory allocation failed`
ETOOMANYSAMPLES	`Too Many Samples requested`
ETOOMANYSCOPES	`Too many scopes are present`
EUSEDYNSCOPE	`Use DYNAMIC_SCOPE flag at compile time`
EWRITEFILE	`LoadDLM: WriteFile Error`

Error Constant	Error Message
EWSINIT	`WINSOCK: Initialization Error`
EWSNOTREADY	`Winsock not ready`

Purpose Type definition for a structure holding logging options

Prototype

```
typedef struct {
    int    mode;
    double incrementvalue;
} lgmode;
```

Arguments

mode	This value indicates the type of logging you want. Specify LGMOD_TIME for time-equidistant logging. Specify LGMOD_VALUE for value-equidistant logging.
incrementvalue	If you set *mode* to LGMOD_VALUE for value-equidistant data, this option specifies the increment (difference in amplitude) value between logged data points. A data point is logged only when an output signal or a state changes by *incrementvalue*. If you set *mode* to LGMOD_TIME, *incrementvalue* is ignored.

Description The lgmode structure specifies data logging options. The *mode* variable accepts either the numeric values 0 or 1 or their equivalent constants LGMOD_TIME or LGMOD_VALUE from xpcapiconst.h.

See Also API functions xPCSetLogMode, xPCGetLogMode

scopedata

Purpose Type definition for a structure holding scope data

Prototype

```
typedef struct {
   int    number;
   int    type;
   int    state;
   int    signals[20];
   int    numsamples;
   int    decimation;
   int    triggermode;
   int    numprepostsamples;
   int    triggersignal
   int    triggerscope;
   int    triggerscopesample;
   double triggerlevel;
   int    triggerslope;
} scopedata;
```

Arguments

number	The scope number.	
type	Determines whether the scope is displayed on the host computer or on the target computer. Values are one of the following:	
	1	Host
	2	Target
state	Indicates the scope state. Values are one of the following:	
	0	Waiting to start
	1	Scope is waiting for a trigger
	2	Data is being acquired
	3	Acquisition is finished
	4	Scope is stopped (interrupted)
	5	Scope is preacquiring data

signals	List of signal indices from the target object to display on the scope.
numsamples	Number of contiguous samples captured during the acquisition of a data package.
decimation	A number, N, meaning every Nth sample is acquired in a scope window.
triggermode	Trigger mode for a scope. Values are one of the following: 0 FreeRun (default) 1 Software 2 Signal 3 Scope
numprepostsamples	If this value is less than 0, this is the number of samples to be saved before a trigger event. If this value is greater than 0, this is the number of samples to skip after the trigger event before data acquisition begins.
triggersignal	If *triggermode* = 2 for signal, identifies the block output signal to use for triggering the scope. You identify the signal with a signal index.
triggerscope	If *triggermode* = 3 for scope, identifies the scope to use for a trigger. A scope can be set to trigger when another scope is triggered.
triggerscopesample	If *triggermode* = 3 for scope, specifies the number of samples to be acquired by the triggering scope before triggering a second scope. This must be a nonnegative value.
triggerlevel	If *triggermode* = 2 for signal, indicates the value the signal has to cross to trigger the scope and start acquiring data. The trigger level can be crossed with either a rising or falling signal.

triggerslope	If *triggermode* = 2 for signal, indicates whether the trigger is on a rising or falling signal. Values are	
	0	Either rising or falling (default)
	1	Rising
	2	Falling

Description

The scopedata structure holds the data about a scope used in the functions xPCGetScope and xPCSetScope. In the structure, the fields are as in the various xPCGetSc* functions (for example, *state* is as in xPCScGetState, *signals* is as in xPCScGetSignals, etc.).

See Also

API functions xPCSetScope, xPCGetScope, xPCScGetType, xPCScGetState, xPCScGetSignals, xPCScGetNumSamples, xPCScGetDecimation, xPCScGetTriggerMode, xPCScGetNumPrePostSamples, xPCScGetTriggerSignal, xPCScGetTriggerScope, xPCScGetTriggerLevel, xPCScGetTriggerSlope

Purpose

Create a new scope on the target PC

Prototype

```
void xPCAddScope(int port, int scType, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scType	Enter the type of scope.
scNum	Enter a number for a new scope. Values are `1, 2, 3...`

Description

The `xPCAddScope` function creates a new scope on the target PC. For *scType*, scopes can be of type host or target, depending on the value of *scType*:

- `SCTYPE_HOST` for type host
- `SCTYPE_TARGET` for type target

Constants for *scType* are defined in the header file `xpcapiconst.h` as `SCTYPE_HOST` and `SCTYPE_TARGET`.

Calling the `xPCAddScope` function with *scNum* having the number of an existing scope produces an error. Use `xPCGetScopes` to find the numbers of existing scopes.

See Also

API functions `xPCScAddSignal`, `xPCScRemSignal`, `xPCRemScope`, `xPCSetScope`, `xPCGetScope`, `xPCGetScopes`

Target object method `addscope`

xPCAverageTET

Purpose Return the average task execution time (TET)

Prototype

```
double xPCAverageTET(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return The `xPCAverageTET` function returns the average task execution time (TET) for the target application.

Description The `xPCAverageTET` function returns the TET for the target application. You can use this function when the target application is running or when it is stopped.

See Also API functions `xPCMaximumTET`, `xPCMinimumTET`

Target object property `AvgTET`

xPCCloseConnection

Purpose

Close the RS-232 or TCP/IP communication channel

Prototype

```
void xPCCloseConnection(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Description

The `xPCCloseConnection` function closes the RS-232 or TCP/IP communication channel opened by `xPCOpenSerialPort`, `xPCOpenTcpIpPort`, or `xPCOpenConnection`. Unlike `xPCClosePort`, it preserves the connection information such that a subsequent call to `xPCOpenConnection` succeeds without the need to resupply communication data such as the IP address or port number. To completely close the communication channel, call `xPCDeRegisterTarget`. Calling the `xPCCloseConnection` function followed by calling `xPCDeRegisterTarget` is equivalent to calling `xPCClosePort`.

See Also

API functions `xPCOpenConnection`, `xPCOpenSerialPort`, `xPCOpenTcpIpPort`, `xPCReOpenPort`, `xPCRegisterTarget`, `xPCDeRegisterTarget`

xPCClosePort

Purpose

Close the RS-232 or TCP/IP communication channel

Prototype

```
void xPCClosePort(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Description

The `xPCClosePort` function closes the RS-232 or TCP/IP communication channel opened by either `xPCOpenSerialPort` or by `xPCOpenTcpIpPort`. Calling this function is equivalent to calling `xPCCloseConnection` and `xPCDeRegisterTarget`.

See Also

API functions `xPCOpenSerialPort`, `xPCOpenTcpIpPort`, `xPCReOpenPort`, `xPCOpenConnection`, `xPCCloseConnection`, `xPCRegisterTarget`, `xPCDeRegisterTarget`

Target object method `close`

xPCDeRegisterTarget

Purpose

Delete the target communication properties from the xPC Target API library

Prototype

```
void xPCDeRegisterTarget(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Description

The `xPCDeRegisterTarget` function causes the xPC Target API library to completely “forget” about the target communication properties. It works similarly to `xPCClosePort`, but does not close the connection to the target machine. Before calling this function, you must first call the function `xPCCloseConnection` to close the connection to the target machine. The combination of calling the `xPCCloseConnection` and `xPCDeRegisterTarget` functions has the same effect as calling `xPCClosePort`.

See Also

API functions `xPCRegisterTarget`, `xPCOpenTcpIpPort`, `xPCOpenSerialPort`, `xPCClosePort`, `xPCReOpenPort`, `xPCOpenConnection`, `xPCCloseConnection`, `xPCTargetPing`

xPCErrorMsg

Purpose Return the text description for an error message

Prototype

```
char *xPCErrorMsg(int error_number, char *error_message);
```

Arguments

error_number	Enter the constant of an error.
error_message	The `xPCErrorMsg` returns a string associated with the error *error_number*.

Return The `xPCErrorMsg` function returns a string associated with the error *error_number*.

Description The `xPCErrorMsg` function returns *error_message*, which makes it convenient to use in a `printf` or similar statement. Use the `xPCGetLastError` function to retrieve the constant for which you are retrieving the message.

See Also API functions `xPCSetLastError`, `xPCGetLastError`,

xPCGetAppName

Purpose Return the name of a target application

Prototype

```
char *xPCGetAppName(int port, char *model_name);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
model_name	The `xPCGetAppName` function returns the name of the target application and copies it in *model_name*.

Return The `xPCGetAppName` function returns a string with the name of the target application.

Description The `xPCGetAppName` function returns the name of the target application. Since the return value is *model_name*, you can use it in a `printf` or similar statement. In case of error, the string is unchanged. Be sure to allocate enough space to accommodate the longest target name you have.

See Also API function `xPCIsAppRunning`

Target object property `Application`

xPCGetEcho

Purpose Return the display mode for the target message window

Prototype

```
int xPCGetEcho(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return The `xPCGetEcho` function returns the number indicating the display mode. Values are

1	Display is on. Messages are printed to the message display window on the target.
0	Display is off.

Description The `xPCGetEcho` function returns the display mode of the target PC using communication channel *port*. Messages include the status of downloading the target application, changes to parameters, and changes to scope signals.

See Also API function `xPCSetEcho`

Purpose

Return the execution time for the target application

Prototype

```
double xPCGetExecTime(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCGetExecTime` function returns the current execution time for a target application.

Description

The `xPCGetExecTime` function returns the current execution time for the running target application. If the target application is stopped, the value is the last running time when the target application was stopped. If the target application is running, the value is the current running time.

See Also

API functions `xPCSetStopTime`, `xPCGetStopTime`

Target object property `ExecTime`

xPCGetLastError

Purpose Return the constant of the last error

Prototype

```
int xPCGetLastError(void);
```

Return The `xPCGetLastError` function returns the error constant for the last reported error. If there is no error, this function returns 0.

Description The `xPCGetLastError` function returns the constant of the last reported error by another API function. This value is reset every time you call a new function. Therefore, you should check this constant value immediately after a call to an API function. For a list of error constants and messages, see “xPC Target API Error Messages” on page 4-17.

See Also API functions `xPCErrorMsg`, `xPCSetLastError`

Purpose

Return the current timeout value for initializing a target application

Prototype

```
int xPCGetLoadTimeOut(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCGetLoadTimeOut` function returns the number of seconds allowed for the initialization of the target application. If there is an error, this function returns `-1`.

Description

The `xPCGetLoadTimeOut` function returns the number of seconds allowed for the initialization of the target application.

When you load a new target application onto the target PC, the function `xPCLoadApp` waits for a certain amount of time before checking to see if the initialization of the target application is complete. In the case where initialization of the target application is not complete, the function `xPCLoadApp` returns a timeout error. By default, `xPCLoadApp` checks five times to see whether the target application is ready, with each attempt taking about 1 second. However, in the case of larger models or models requiring longer initialization (for example, those with thermocouple boards), the default of about 5 seconds might not be sufficient and a spurious timeout is generated. The function `xPCSetLoadTimeOut` sets the timeout to a different number.

Use the `xPCGetLoadTimeOut` function if you suspect that the current number of seconds (the timeout value) is too short. Then use the `xPCSetLoadTimeOut` function to set the timeout to a higher number.

See Also

API functions `xPCLoadApp`, `xPCUnloadApp`, `xPCSetLoadTimeOut`

"Increasing the Time Out Value" on page 3-33 in the xPC Target Getting Started Guide.

xPCGetLogMode

Purpose Return the logging mode and increment value for the application

Prototype

```
lgmode xPCGetLogMode(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return The `xPCGetLogMode` function returns the logging mode in the `lgmode` structure. If the logging mode is `1` (`LGMOD_VALUE`), this function also returns an increment value in the `lgmode` structure. If an error occurs, this function returns `-1`.

Description The `xPCGetLogMode` function gets the logging mode and increment value for the current target application. The increment (difference in amplitude) value is measured between logged data points. A data point is logged only when an output signal or a state changes by the increment value.

See Also API function `xPCSetLogMode`

API structure `lgmode`

xPCGetNumOutputs

Purpose Return the number of outputs

Prototype

```
int xPCGetNumOutputs(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return The `xPCGetNumOutputs` function returns the number of outputs in the current target application.

Description The `xPCGetNumOutputs` function returns the number of outputs in the target application. The number of outputs equals the sum of the input signal widths of all output blocks at the root level of the Simulink model.

See Also API functions `xPCGetOutputLog`, `xPCGetNumStates`, `xPCGetStateLog`

xPCGetNumParams

Purpose

Return the number of tunable parameters

Prototype

```
int xPCGetNumParams(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCGetNumParams` function returns the number of tunable parameters in the target application.

Description

The `xPCGetNumParams` function returns the number of tunable parameters in the target application. Use this function to see how many parameters you can retrieve or modify.

See Also

API functions `xPCGetParamIdx`, `xPCSetParam`, `xPCGetParam`, `xPCGetParamName`, `xPCGetParamDims`

Target object property `NumParameters`

xPCGetNumSignals

Purpose

Return the number of signals

Prototype

```
int xPCGetNumSignals(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCGetNumSignals` function returns the number of signals in the target application.

Description

The `xPCGetNumSignals` function returns the total number of signals in the target application that can be monitored from the host. Use this function to see how many signals you can monitor.

See Also

API functions `xPCGetSignalIdx`, `xPCGetSignal`, `xPCGetSignals`, `xPCGetSignalName`, `xPCGetSignalWidth`

Target object property `NumSignals`

xPCGetNumStates

Purpose

Return the number of states

Prototype

```
int xPCGetNumStates(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCGetNumStates` function returns the number of states in the target application.

Description

The `xPCGetNumStates` function returns the number of states in the target application.

See Also

API functions `xPCGetStateLog`, `xPCGetNumOutputs`, `xPCGetOutputLog`

Target object property `StateLog`

Purpose

Copy the output log data to an array

Prototype

```
void xPCGetOutputLog(int port, int first_sample, int num_samples,
int decimation, int output_id, double *output_data);
```

Arguments

port	Enter the value returned by either the function xPCOpenSerialPort or the function xPCOpenTcpIpPort.
first_sample	Enter the index of the first sample to copy.
num_samples	Enter the number of samples to copy from the output log.
decimation	Select whether to copy all the sample values or every Nth value.
output_id	Enter an output identification number.
output_data	The log is stored in *output_data*, whose allocation is the responsibility of the caller.

Description

The xPCGetOutputLog function retrieves the output log and copies that log to an array. You retrieve the data for each output signal in turn by specifying *output_id*. Output IDs range from 0 to (N-1), where N is the return value of xPCGetNumOutputs. Entering 1 for *decimation* copies all values. Entering N copies every Nth value.

For *first_sample*, the sample indices range from 0 to (N-1), where N is the return value of xPCNumLogSamples. Retrieve the maximum number of samples by calling the function xPCNumLogSamples.

See Also

API functions xPCNumLogWraps, xPCNumLogSamples, xPCMaxLogSamples, xPCGetNumOutputs, xPCGetStateLog, xPCGetTETLog, xPCGetTimeLog

Target object method getlog

Target object property OutputLog

xPCGetParam

Purpose

Retrieve the parameter value and copy that value to an array

Prototype

```
void xPCGetParam(int port, int paramIndex, double *paramValue);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
paramIndex	Enter the index for a parameter.
paramValue	The function returns a parameter value as an array of doubles.

Description

The `xPCGetParam` function returns the parameter as an array in *paramValue*. *paramValue* must be of sufficient size to hold the parameter. You can query the size by calling the function `xPCGetParamDims`. Retrieve the parameter index by calling the function `xPCGetParamIdx`. The parameter matrix is returned as a vector, with the conversion being done in column-major format. It is also returned as a double, regardless of the data type of the actual parameter.

For *paramIndex*, values range from `0` to (`N-1`), where `N` is the return value of `xPCGetNumParams`.

See Also

API functions `xPCSetParam`, `xPCGetParamDims`, `xPCGetParamIdx`, `xPCGetNumParams`

Target object method `getparamid`

Target object properties `ShowParameters`, `Parameters`

xPCGetParamDims

Purpose

Retrieve the row and column dimensions of a parameter

Prototype

```
void xPCGetParamDims(int port, int paramIndex, int *dimension);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
paramIndex	Parameter index.
dimension	Dimensions (row, column) of a parameter.

Description

The `xPCGetParamDims` function retrieves the dimensions (row, column) of a parameter with *paramIndex* and stores them in *dimension*, which must have at least two elements.

For *paramIndex*, values range from `0` to (`N`-1), where `N` is the return value of `xPCGetNumParams`.

See Also

API functions `xPCGetParamIdx`, `xPCGetParamName`, `xPCSetParam`, `xPCGetParam`, `xPCGetNumParams`

Target object method `getparamid`

Target object properties `ShowParameters`, `Parameters`

xPCGetParamIdx

Purpose

Return the parameter index

Prototype

```
int xPCGetParamIdx(int port, const char *blockName,
                   const char *paramName);
```

Arguments

`port`	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
`blockName`	Enter the full block path generated by Real-Time Workshop.
`paramName`	Enter the parameter name for a parameter associated with the block.

Return

The `xPCGetParamIdx` function returns the parameter index for the parameter name. If there is an error, this function returns `-1`.

Description

The `xPCGetParamIdx` function returns the parameter index for the parameter name (*`paramName)`* associated with a Simulink block (*`blockName`*). Both *`blockName`* and *`paramName`* must be identical to those generated at target application building time. The block names should be referenced from the file `model_namept.m` in the generated code, where *`model_name`* is the name of the model. Note that a block can have one or more parameters.

See Also

API functions `xPCGetParamDims`, `xPCGetParamName`, `xPCGetParam`

Target object method `getparamid`

Target object properties `ShowParameters`, `Parameters`

Purpose

Retrieve the name of a parameter

Prototype

```
void xPCGetParamName(int port, int paramIdx, char *blockName,
char *paramName);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
paramIdx	Enter a parameter index.
blockName	String with the full block path generated by Real-Time Workshop.
paramName	Name of a parameter for a specific block.

Description

The `xPCGetParamName` function retrieves the parameter name and block name for a parameter with the index *paramIdx*. The block path and name are returned and stored in *blockName*, and the parameter name is returned and stored in *paramName*. You must allocate sufficient space for both *blockName* and *paramName*. If the *paramIdx* is invalid, `xPCGetLastError` returns nonzero, and the strings are unchanged. Retrieve the parameter index from the function `xPCGetParamIdx`.

See Also

API functions `xPCGetParam`, `xPCGetParamDims`, `xPCGetParamIdx`

Target object properties `ShowParameters`, `Parameters`

xPCGetSampleTime

Purpose

Return the sample time in seconds

Prototype

```
double xPCGetSampleTime(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCGetSampleTime` function returns the sample time, in seconds, of the target application. If there is an error, this function returns `-1`.

Description

The `xPCGetSampleTime` function returns the sample time, in seconds, of the target application. You can retrieve the error by using the function `xPCGetLastError`.

See Also

API function `xPCSetSampleTime`

Target object property `SampleTime`

Purpose

Retrieve and copy scope data to a structure

Prototype

```
scopedata xPCGetScope(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCGetScope` function returns a structure of type `scopedata`.

Description

The `xPCGetScope` function retrieves properties of a scope with *scNum* and copies the properties into a structure with type `scopedata`. You can use this function in conjunction with `xPCSetScope` to change several properties of a scope at one time. See `scopedata` on page 4-22 for a list of properties. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API functions `xPCSetScope`, `scopedata`

Target object method `getscope`

xPCGetScopes

Purpose Retrieve and copy a list of scope numbers

Prototype

```
void xPCGetScopes(int port, int *data);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
data	List of scope numbers in an integer array (allocated by the caller) as a list of unsorted integers and terminated by `-1`.

Description The `xPCGetScopes` function retrieves the list of scopes currently defined. You can use the constant `MAX_SCOPES` (defined in `xpcapiconst.h`) as the size of *data*.

See Also API functions `xPCSetScope`, `xPCGetScope`, `xPCScGetSignals`

Target object property `Scopes`

xPCGetSignal

Purpose

Return the value of a signal

Prototype

```
double xPCGetSignal(int port, int sigNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
sigNum	Enter a signal number.

Return

The `xPCGetSignal` function returns the current value of signal *sigNum*.

Description

The `xPCGetSignal` function returns the current value of a signal. For vector signals, use `xPCGetSignals` rather than call this function multiple times. Use the `xPCGetSignalIdx` function to retrieve the signal number.

See Also

API function `xPCGetSignals`

Target object properties `ShowSignals`, `Signals`

xPCGetSignalIdx

Purpose Return the index for a signal

Prototype

```
int xPCGetSignalIdx(int port, const char *sigName);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
sigName	Enter a signal name.

Return The `xPCGetSignalIdx` function returns the index for the signal with name *`sigName`*. If there is an error, this function returns `-1`.

Description The `xPCGetSignalIdx` function returns the index of a signal. The name must be identical to the name generated when the application was built. You should reference the name from the file `model_namebio.m` in the generated code, where *`model_name`* is the name of the model. The creator of the application should already know the signal name.

See Also API functions `xPCGetSignalName`, `xPCGetSignalWidth`, `xPCGetSignal`, `xPCGetSignals`

Target object method `getsignalid`

Purpose

Copy the name of a signal to a character array

Prototype

```
char *xPCGetSignalName(int port, int sigIdx, char *sigName);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
sigIdx	Enter a signal index.
sigName	String with the name of a signal.

Return

The `xPCGetSignalName` function returns the name of the signal.

Description

The `xPCGetSignalName` function copies and returns the signal name, including the block path, of a signal with *sigIdx*. The result is stored in *sigName*. If *sigIdx* is invalid, `xPCGetLastError` returns a nonzero value, and *sigName* is unchanged. The function returns *sigName*, which makes it convenient to use in a `printf` or similar statement. This function assumes that you already know the signal index.

See Also

API functions `xPCGetSignalIdx`, `xPCGetSignalWidth`, `xPCGetSignal`, `xPCGetSignals`

Target object properties `ShowSignals`, `Signals`

xPCGetSignals

Purpose

Return a vector of signal values

Prototype

```
int xPCGetSignals(int port, int numSignals, const int *signals,
double *values);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
numSignals	Enter the number of signals to be acquired (that is, the number of values in *signals*).
signals	Enter the list of signal numbers to be acquired.
values	Returned values are stored in the double array *values*.

Return

The `xPCGetSignals` function returns `0` upon success. If there is an error, this function returns `-1`.

Description

The `xPCGetSignals` function is the vector version of the function `xPCGetSignal`. This function returns the values of a vector of signals (up to 10) as fast as it can acquire them. The signal values are not guaranteed to be at the same time step (for that, define a scope of type `SCTYPE_HOST` and use `xPCScGetData`). `xPCGetSignal` does the same thing for a single signal, and could be used multiple times to achieve the same effect. However, the `xPCGetSignals` function is faster, and the signal values are more likely to be spaced closely together. The signals are converted to doubles regardless of the actual data type of the signal.

For *signals*, the list you provide should be stored in an integer array. Retrieve the signal numbers with the function `xPCGetSignalIdx`.

See Also

API function `xPCGetSignal`

Purpose

Return the width of a signal

Prototype

```
int xPCGetSignalWidth(int port, int sigIdx);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
sigIdx	Enter the index of a signal.

Return

The `xPCGetSignalWidth` function returns the signal width for a signal with *`sigIdx`*. If there is an error, this function returns `-1`.

Description

The `xPCGetSignalWidth` function returns the number of signals for a specified signal index. Although signals are manipulated as scalars, the width of the signal might be useful to reassemble the components into a vector again. A signal's width is the number of signals in the vector.

See Also

API functions `xPCGetSignalIdx`, `xPCGetSignalName`, `xPCGetSignal`, `xPCGetSignals`

xPCGetStateLog

Purpose

Copy the values of the state log to an array

Prototype

```
void xPCGetStateLog(int port, int first_sample, int num_samples,
int decimation, int state_id, double *state_data);
```

Arguments

port	Enter the value returned by either the function xPCOpenSerialPort or the function xPCOpenTcpIpPort.
first_sample	Enter the index of the first sample to copy.
num_samples	Enter the number of samples to copy from the output log.
decimation	Select whether to copy all the sample values or every Nth value.
state_id	Enter a state identification number.
state_data	The log is stored in *state_data*, whose allocation is the responsibility of the caller.

Description

The xPCGetStateLog function retrieves the state log. It then copies the log into *state_data*. You retrieve the data for each state signal in turn by specifying the *state_id*. State IDs range from 1 to (N-1), where N is the return value of xPCGetNumStates. Entering 1 for *decimation* copies all values. Entering N copies every Nth value. For *first_sample*, the sample indices range from 0 to (N-1), where N is the return value of xPCNumLogSamples. Use the xPCNumLogSamples function to retrieve the maximum number of samples.

See Also

API functions xPCNumLogWraps, xPCNumLogSamples, xPCMaxLogSamples, xPCGetNumStates, xPCGetOutputLog, xPCGetTETLog, xPCGetTimeLog

Target object method getlog

Target object property StateLog

Purpose

Return the stop time

Prototype

```
double xPCGetStopTime(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCGetStopTime` function returns the stop time as a double, in seconds, of the target application. If there is an error, this function returns `-10.0`. If the stop time is infinity (run forever), this function returns `-1.0`.

Description

The `xPCGetStopTime` function returns the stop time, in seconds, of the target application. This is the amount of time the target application runs before stopping. If there is an error, this function returns `-10.0`. You will then need to use the function `xPCGetLastError` to find the error number.

See Also

API function `xPCSetStopTime`

Target object property `StopTime`

xPCGetTETLog

Purpose

Copy the TET log to an array

Prototype

```
void xPCGetTETLog(int port, int first_sample, int num_samples,
int decimation, double *TET_data);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
first_sample	Enter the index of the first sample to copy.
num_samples	Enter the number of samples to copy from the TET log.
decimation	Select whether to copy all the sample values or every `N`th value.
TET_data	The log is stored in *TET_data*, whose allocation is the responsibility of the caller.

Description

The `xPCGetTETLog` function retrieves the task execution time (TET) log. It then copies the log into *TET_data*. Entering `1` for *decimation* copies all values. Entering `N` copies every `N`th value. For *first_sample*, the sample indices range from `0` to (`N`-1), where `N` is the return value of `xPCNumLogSamples`. Use the `xPCNumLogSamples` function to retrieve the maximum number of samples.

See Also

API functions `xPCNumLogWraps`, `xPCNumLogSamples`, `xPCMaxLogSamples`, `xPCGetNumOutputs`, `xPCGetStateLog`, `xPCGetTimeLog`

Target object method `getlog`

Target object property `TETLog`

Purpose

Copy the time log to an array

Prototype

```
void xPCGetTimeLog(int port, int first_sample, int num_samples,
int decimation, double *time_data);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
first_sample	Enter the index of the first sample to copy.
num_samples	Enter the number of samples to copy from the time log.
decimation	Select whether to copy all the sample values or every `N`th value.
time_data	The log is stored in *time_data*, whose allocation is the responsibility of the caller.

Description

The `xPCGetTimeLog` function retrieves the time log and copies the log into *time_data*. This is especially relevant in the case of value-equidistant logging, where the logged values are not necessarily uniformly spaced in time. Entering `1` for *decimation* copies all values. Entering `N` copies every `N`th value. For *first_sample*, the sample indices range from `0` to (`N`-1), where `N` is the return value of `xPCNumLogSamples`. Use the `xPCNumLogSamples` function to retrieve the number of samples.

See Also

API functions `xPCNumLogWraps`, `xPCNumLogSamples`, `xPCMaxLogSamples`, `xPCGetStateLog`, `xPCGetTETLog`, `xPCSetLogMode`, `xPCGetLogMode`

Target object method `getlog`

Target object property `TimeLog`

xPCInitAPI

Purpose

Initialize the xPC Target DLL

Prototype

```
int xPCInitAPI(void);
```

Arguments

none

Return

The `xPCInitAPI` function returns `0` upon success. If there is an error, this function returns `-1`.

Description

The `xPCInitAPI` function initializes the xPC Target dynamic link library. You must execute this function once at the beginning of the application to load the xPC Target API DLL. This function is defined in the file `xpcinitfree.c`. Link this file with your application.

See Also

API functions `xPCNumLogWraps`, `xPCNumLogSamples`, `xPCMaxLogSamples`, `xPCGetStateLog`, `xPCGetTETLog`, `xPCSetLogMode`, `xPCGetLogMode`

Purpose

Return running status for target application

Prototype

```
int xPCIsAppRunning(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

If the target application is stopped, the `xPCIsAppRunning` function returns `0`. If the target application is running, this function returns `1`. If there is an error, this function returns 0.

Description

The `xPCIsAppRunning` function returns `1` or `0` depending on whether the target application is stopped or running. If there is an error, use the function `xPCGetLastError` to check for the error string constant.

See Also

API function `xPCIsOverloaded`

Target object property `Status`

xPCIsOverloaded

Purpose

Return overload status for the target PC

Prototype

```
int xPCIsOverloaded(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

If the application is running properly, the `xPCIsOverloaded` function returns `1`. If the CPU is overloaded, the `xPCIsOverloaded` function returns `0`. In case of error, this function returns `-1`.

Description

The `xPCIsOverloaded` function returns 1 if the target application is running properly and has not overloaded the CPU. It returns 0 if the target application has overloaded the target PC (CPU Overload).

See Also

API function `xPCIsAppRunning`

Target object property `CPUoverload`

Purpose

Return data acquisition status for a scope

Prototype

```
int xPCIsScFinished(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

If a scope finishes a data acquisition cycle, the `xPCIsScFinished` function returns `1`. If the scope is in the process of acquiring data, this function returns `0`. If there is an error, this function returns `-1`.

Description

The `xPCIsScFinished` function returns a Boolean value depending on whether scope *scNum* is finished (state of `SCST_FINISHED`) or not. You can also call this function for scopes of type target; however, because target scopes restart immediately, it is almost impossible to find these scopes in the finished state. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API function `xPCScGetState`

Scope object property `Status`

xPCLoadApp

Purpose

Load a target application onto the target PC

Prototype

```
void xPCLoadApp(int port, const char *pathstr,
                const char *filename);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
pathstr	Enter the path to the target application file.
filename	Enter the name of a compiled target application (`*.dlm`) without the file extension.

Description

The `xPCLoadApp` function loads the compiled target application to the target PC. *`pathstr`* must not contain the trailing backslash. *`pathstr`* can be set to NULL or to the string "`nopath`" if the application is in the current directory. The variable *`filename`* must not contain the target application extension.

Before returning, `xPCLoadApp` waits for a certain amount of time before checking whether the model initialization is complete. In the case where the model initialization is incomplete, `xPCLoadApp` returns a timeout error to indicate a connection problem (for example, `ETCPREAD`). By default, `xPCLoadApp` checks for target readiness five times, with each attempt taking approximately 1 second (less if the target is ready). However, in the case of larger models or models requiring longer initialization (for example, those with thermocouple boards), the default of about 5 seconds might be insufficient and a spurious timeout can be generated. The functions `xPCGetLoadTimeOut` and `xPCSetLoadTimeOut` control the number of attempts made.

See Also

API functions `xPCStartApp`, `xPCStopApp`, `xPCUnloadApp`, `xPCSetLoadTimeOut`, `xPCGetLoadTimeOut`

Target object method `load`

Purpose

Return the maximum number of samples that can be in the log buffer

Prototype

```
int xPCMaxLogSamples(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCMaxLogSamples` function returns the total number of samples. If there is an error, this function returns `-1`.

Description

The `xPCMaxLogSamples` function returns the total number of samples that can be returned in the logging buffers.

See Also

API functions `xPCNumLogSamples`, `xPCNumLogWraps`, `xPCGetStateLog`, `xPCGetOutputLog`, `xPCGetTETLog`, `xPCGetTimeLog`

Target object property `MaxLogSamples`

xPCMaximumTET

Purpose Copy the maximum task execution time to an array

Prototype

```
void xPCMaximumTET(int port, double *data);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
data	Array of at least two doubles.

Description The `xPCMaximumTET` function retrieves the maximum task execution time (TET) that was achieved during the previous target application run. This function also returns the time at which the maximum TET was achieved. The `xPCMaximumTET` function then copies these values into the *data* array. The maximum TET value is copied into the first element, and the time at which it was achieved is copied into the second element.

See Also API functions `xPCMinimumTET`, `xPCAverageTET`

Target object property `MaxTET`

Purpose

Copy the minimum task execution time to an array

Prototype

```
void xPCMinimumTET(int port, double *data);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
data	Array of at least two doubles.

Description

The `xPCMinimumTET` function retrieves the minimum task execution time (TET) that was achieved during the previous target application run. This function also returns the time at which the minimum TET was achieved. The `xPCMinimumTET` function then copies these values into the *data* array. The minimum TET value is copied into the first element, and the time at which it was achieved is copied into the second element.

See Also

API functions `xPCMaximumTET`, `xPCAverageTET`

Target object property `MinTET`

xPCNumLogSamples

Purpose

Return the number of samples in the log buffer

Prototype

```
int xPCNumLogSamples(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCNumLogSamples` function returns the number of samples in the log buffer. If there is an error, this function returns `-1`.

Description

The `xPCNumLogSamples` function returns the number of samples in the log buffer. In contrast to `xPCMaxLogSamples`, which returns the maximum number of samples that can be logged (due to buffer size constraints), `xPCNumLogSamples` returns the number of samples actually logged.

See Also

API functions `xPCGetStateLog`, `xPCGetOutputLog`, `xPCGetTETLog`, `xPCGetTimeLog`, `xPCMaxLogSamples`

Purpose Return the number of times the log buffer wraps

Prototype

```
int xPCNumLogWraps(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return The `xPCNumLogWraps` function returns the number of times the log buffer wraps around. If there is an error, this function returns `-1`.

Description The `xPCNumLogWraps` function returns the number of times the log buffer wraps around.

See Also API functions `xPCNumLogSamples`, `xPCMaxLogSamples`, `xPCGetStateLog`, `xPCGetOutputLog`, `xPCGetTETLog`, `xPCGetTimeLog`

Target object property `NumLogWraps`

xPCOpenConnection

Purpose Open a connection to the target PC

Prototype

```
void xPCOpenConnection(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Description The `xPCOpenConnection` function opens a connection to the target PC whose data is indexed by *port*. Before calling this function, set up the target information by calling `xPCRegisterTarget`. A call to either `xPCOpenSerialPort` or `xPCOpenTcpIpPort` can also set up the target information. If the port is already open, calling this function has no effect.

See Also API functions `xPCOpenTcpIpPort`, `xPCClosePort`, `xPCReOpenPort`, `xPCTargetPing`, `xPCCloseConnection`, `xPCRegisterTarget`

Purpose

Open an RS-232 connection to an xPC Target system

Prototype

```
int xPCOpenSerialPort(int comPort, int baudRate);
```

Arguments

comPort	Index of the COM port to be used (`0` is COM1, `1` is COM2, and so forth).
baudRate	*baudRate* must be one of the following values: 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200.

Return

The `xPCOpenSerialPort` function returns the port value for the connection. If there is an error, this function returns `-1`.

Description

The `xPCOpenSerialPort` function initiates an RS-232 connection to an xPC Target system. It returns the port value for the connection. Be sure to pass this value to all the xPC Target API functions that require a port value.

If you enter a value of 0 for *baudRate*, this function sets the baud rate to the default value (115200).

See Also

API functions `xPCOpenTcpIpPort`, `xPCClosePort`, `xPCReOpenPort`, `xPCTargetPing`, `xPCOpenConnection`, `xPCCloseConnection`, `xPCRegisterTarget`, `xPCDeRegisterTarget`

Purpose

Open a TCP/IP connection to an xPC Target system

Prototype

```
int xPCOpenTcpIpPort(const char *ipAddress, const char *ipPort);
```

Arguments

ipAddress	Enter the IP address of the target as a dotted decimal string. For example, "192.168.0.1".
ipPort	Enter the associated IP port as a string. For example, "22222".

Return

The `xPCOpenTcpIpPort` function returns a nonnegative integer that you can then use as the port value for any xPC Target API function that requires it. If this operation fails, this function returns `-1`.

Description

The `xPCOpenTcpIpPort` function opens a connection to the TCP/IP location specified by the IP address. It returns a nonnegative integer if it succeeds. Use this integer as the *ipPort* variable in the xPC Target API functions that require a port value. The global error number is also set, which you can retrieve using `xPCGetLastError`.

See Also

API functions `xPCOpenSerialPort`, `xPCClosePort`, `xPCReOpenPort`, `xPCTargetPing`

Purpose Reboot the target PC

Prototype

```
void xPCReboot(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Description The `xPCReboot` function reboots the target PC. This function returns nothing. This function does not close the connection to the target PC. You should either explicitly close the port, or call `xPCReOpenPort` once the target PC has rebooted.

See Also API function `xPCReOpenPort`

Target object method `reboot`

xPCReOpenPort

Purpose Reopen a communication channel

Prototype

```
int xPCReOpenPort(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return The `xPCReOpenPort` function returns 0 if it successfully reopens a connection. If there is an error, this function returns `-1`.

Description The `xPCReOpenPort` function reopens the communications channel pointed to by *`port`*. The difference between this function and `xPCOpenSerialPort` or `xPCOpenTcpIpPort` is that `xPCReOpenPort` uses the already existing settings, while the other functions need to be set up properly.

See Also API functions `xPCOpenTcpIpPort`, `xPCClosePort`

Purpose

Register a target with the xPC Target API library, but do not open a connection

Prototype

```
int xPCRegisterTarget(int commType, const char *ipAddress, const
char *ipPort, int comPort, int baudRate);
```

Arguments

commType	Specify the communication type (TCP/IP or RS-232) between the host and the target.
ipAddress	Enter the IP address of the target as a dotted decimal string. For example, "192.168.0.1".
ipPort	Enter the associated IP port as a string. For example, "22222".
comPort	*comPort* and *baudRate* are as in xPCOpenSerialPort.
baudRate	The *baudRate* must be one of the following values: 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200.

Return

The xPCRegisterTarget function returns the port number.

Description

The xPCRegisterTarget function works similarly to xPCOpenSerialPort and xPCOpenTcpIpPort, except that it does not try to open a connection to the target PC. In other words, xPCOpenSerialPort or xPCOpenTcpIpPort is equivalent to calling xPCRegisterTarget with the appropriate parameters, followed by a call to xPCOpenConnection.

Use the constants COMMTYP_TCPIP and COMMTYP_RS232 for *commType*. If *commType* is set to COMMTYP_RS232, the function ignores *ipAddress* and *ipPort*. Analogously, the function ignores *comPort* and *baudRate* if *commType* is set to COMMTYP_TCPIP.

If you enter a value of 0 for *baudRate*, this function sets the baud rate to the default value (115200).

See Also

API functions xPCDeRegisterTarget, xPCOpenTcpIpPort, xPCOpenSerialPort, xPCClosePort, xPCReOpenPort, xPCOpenConnection, xPCCloseConnection, xPCTargetPing

xPCRemScope

Purpose Remove a scope from the target PC

Prototype

```
void xPCRemScope(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Description The `xPCRemScope` function removes the scope with number *scNum*. Attempting to remove a nonexistent scope causes an error. For a list of existing scopes, see `xPCGetScopes`. Use the `xPCGetScope` function to retrieve the scope number.

See Also API functions `xPCAddScope`, `xPCScRemSignal`, `xPCGetScopes`

Target object method `remscope`

xPCScAddSignal

Purpose Add a signal to a scope

Prototype

```
void xPCScAddSignal(int port, int scNum, int sigNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
sigNum	Enter a signal number.

Description The `xPCScAddSignal` function adds the signal with number *`sigNum`* to the scope *`scNum`*. The signal should not already exist in the scope. You can use `xPCScGetSignals` to retrieve a list of the signals already present. Use the function `xPCGetScope` to retrieve the scope number. Use the `xPCGetSignalIdx` function to retrieve the signal number.

See Also API functions `xPCScRemSignal`, `xPCAddScope`, `xPCRemScope`, `xPCGetScopes`

Scope object method `addsignal`

xPCScGetData

Purpose

Copy scope data to an array

Prototype

```
void xPCScGetData(int port, int scNum, int signal_id, int start,
int numsamples, int decimation, double *data);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
signal_id	Enter a signal number.
start	Enter the first sample from which data retrieval is to start.
numsamples	Enter the number of samples retrieved with a decimation of *decimation*, starting from the *start* value.
decimation	Enter a value such that every *decimation* sample is retrieved in a scope window.
data	The data is available in the array *data*, starting from sample *data.*

Description

The `xPCScGetData` function retrieves the data used in a scope. Use this function for scopes of type `SCTYPE_HOST`. The scope must be either in state `"Finished"` or in state `"Interrupted"` for the data to be retrievable. (Use the `xPCScGetState` function to check the state of the scope.) The data must be retrieved one signal at a time. The calling function must allocate the space ahead of time to store the scope data. *data* must be an array of doubles, regardless of the data type of the signal to be retrieved. Use the function `xPCScGetSignals` to retrieve the list of signals in the scope for *signal_id*. Use the function `xPCGetScope` to retrieve the scope number for *scNum*.

See Also

API functions `xPCGetScope`, `xPCScGetState`, `xPCScGetSignals`

Scope object property `Data`

Purpose

Return the decimation of a scope

Prototype

```
int xPCScGetDecimation(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetDecimation` function returns the decimation of scope *scNum*. If there is an error, this function returns `-1`.

Description

The `xPCScGetDecimation` function returns the decimation of scope *scNum*. The decimation is a number, `N`, meaning every `N`th sample is acquired in a scope window. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API function `xPCScSetDecimation`

Scope object property `Decimation`

xPCScGetNumPrePostSamples

Purpose

Return the number of pre or post samples before triggering a scope

Prototype

```
int xPCScGetNumPrePostSamples(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetNumPrePostSamples` function returns the number of samples for pre- or posttriggering for scope *scNum*. If an error occurs, this function returns the minimum integer value (`-2147483647-1`).

Description

The `xPCScGetNumPrePostSamples` function returns the number of samples for pre- or posttriggering for scope *scNum*. A negative number implies pretriggering, whereas a positive number implies posttriggering samples. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API function `xPCScSetNumPrePostSamples`

Scope object property `NumPrePostSamples`

Purpose

Return the number of samples in one data acquisition cycle

Prototype

```
int xPCScGetNumSamples(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetNumSamples` function returns the number of samples in the scope *scNum*. If there is an error, this function returns `-1`.

Description

The `xPCScGetNumSamples` function returns the number of samples in one data acquisition cycle for scope *scNum*. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API function `xPCScSetNumSamples`

Scope object property `NumSamples`

xPCScGetSignals

Purpose Copy a list of signals to an array

Prototype

```
void xPCScGetSignals(int port, int scNum, int *data);
```

Arguments

port	Value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
data	Integer array allocated by the caller as a list of nonnegative integers terminated by `-1`.

Description The `xPCScGetSignals` function retrieves the list of signals defined for scope *scNum*. You can use the constant `MAX_SIGNALS`, defined in `xpcapiconst.h`, as the size of *data*. Use the `xPCGetScope` function to retrieve the scope number.

See Also API functions `xPCScGetData`, `xPCGetScopes`

Scope object property `Signals`

xPCScGetStartTime

Purpose

Return the start time for the last data acquisition cycle

Prototype

```
double xPCScGetStartTime(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetStartTime` function returns the start time for the last data acquisition cycle of a scope. If there is an error, this function returns `-1`.

Description

The `xPCScGetStartTime` function returns the time at which the last data acquisition cycle for scope *scNum* started. This is only valid for scopes of type `SCTYPE_HOST`. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API functions `xPCScGetNumSamples`, `xPCScGetDecimation`

Scope object property `StartTime`

xPCScGetState

Purpose

Return the state of a scope

Prototype

```
int xPCScGetState(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetState` function returns the state of scope *scNum*. If there is an error, this function returns `-1`.

Description

The `xPCScGetState` function returns the state of scope *scNum*, or `-1` upon error. Use the `xPCGetScope` function to retrieve the scope number.

Constants to find the scope state, defined in `xpcapiconst.h`, have the following meanings:

Constant	Value	Description
`SCST_WAITTOSTART`	0	Scope is ready and waiting to start.
`SCST_PREACQUIRING`	5	Scope acquires a predefined number of samples before triggering.
`SCST_WAITFORTRIG`	1	After a scope is finished with the preacquiring state, it waits for a trigger. If the scope does not preacquire data, it enters the wait for trigger state.
`SCST_ACQUIRING`	2	Scope is acquiring data. The scope enters this state when it leaves the wait for trigger state.

Constant	Value	Description
`SCST_FINISHED`	3	Scope is finished acquiring data when it has attained the predefined limit.
`SCST_INTERRUPTED`	4	The user has stopped (interrupted) the scope.

See Also

API functions `xPCScStart`, `xPCScStop`

Scope object property `Status`

xPCScGetTriggerLevel

Purpose

Return the trigger level for a scope

Prototype

```
double xPCScGetTriggerLevel(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetTriggerLevel` function returns the scope trigger level.

Description

The `xPCScGetTriggerLevel` function returns the trigger level for scope *scNum*. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API functions `xPCScSetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`

Scope object property `TriggerLevel`

Purpose Return the trigger mode for a scope

Prototype

```
int xPCScGetTriggerMode(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return The `xPCScGetTriggerMode` function returns the scope trigger mode. If there is an error, this function returns `-1`.

Description The `xPCScGetTriggerMode` function retrieves the trigger mode for scope *scNum*. Use the `xPCGetScope` function to retrieve the scope number. Use the constants defined in `xpcapiconst.h` to interpret the trigger mode. These constants include the following.

Constant	Value	Description
TRIGMD_FREERUN	0	There is no trigger mode. The scope always triggers when it is ready to trigger, regardless of the circumstances.
TRIGMD_SOFTWARE	1	Only a user can trigger the scope. It is always possible for a user to trigger the scope; however, if you set the scope to this trigger mode, user intervention is the only way to trigger the scope. No other triggering is possible.

Constant	Value	Description
TRIGMD_SIGNAL	2	Signal must cross a value before the scope is triggered.
TRIGMD_SCOPE	3	Scope is triggered by another scope at the trigger point of the triggering scope, modified by the value of `triggerscopesample` (see `scopedata` on page 4-22).

See Also

API functions `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`

Scope object method `trigger`

Scope object property `TriggerMode`

Purpose Return the trigger scope

Prototype

```
int xPCScGetTriggerScope(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return The `xPCScGetTriggerScope` function returns a trigger scope. If there is an error, this function returns `-1`.

Description The `xPCScGetTriggerScope` function returns the trigger scope for scope *scNum*. Use the `xPCGetScope` function to retrieve the scope number.

See Also API functions `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`

Scope object property `TriggerScope`

xPCScGetTriggerScopeSample

Purpose

Retrieve the sample number for a triggering scope

Prototype

```
int xPCScGetTriggerScopeSample(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetTriggerScopeSample` function returns a nonnegative integer for a real sample, and `-1` for the special case where triggering is at the end of the data acquisition cycle for a triggering scope. If there is an error, this function returns `INT_MIN` (`-2147483647-1`).

Description

The `xPCScGetTriggerScopeSample` function retrieves the number of samples a triggering scope (*scNum*) acquires before starting data acquisition on a second scope. This value is a nonnegative integer for a real sample, and `-1` for the special case where triggering is at the end of the data acquisition cycle for a triggering scope. Use the `xPCGetScope` function to retrieve the scope number for the trigger scope.

See Also

API functions `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`, `xPCScSetTriggerScopeSample`

Scope object property `TriggerSample`

Purpose

Return the trigger signal for a scope

Prototype

```
int xPCScGetTriggerSignal(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetTriggerSignal` function returns the scope trigger signal. If there is an error, this function returns `-1`.

Description

The `xPCScGetTriggerSignal` function returns the trigger signal for scope *scNum*. Use the `xPCGetScope` function to retrieve the scope number for the trigger scope.

See Also

API functions `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`

Scope object method `trigger`

Scope object property `TriggerSignal`

xPCScGetTriggerSlope

Purpose

Return the trigger slope for scope

Prototype

```
int xPCScGetTriggerSlope(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetTriggerSlope` function returns the scope trigger slope. If there is an error, this function returns `-1`.

Description

The `xPCScGetTriggerSlope` function returns the trigger slope of scope *scNum*. Use the `xPCGetScope` function to retrieve the scope number for the trigger scope. Use the constants defined in `xpcapiconst.h` to interpret the trigger slope. These constants have the following meanings:

Constant	Value	Description
TRIGSLOPE_EITHER	0	The trigger slope can be either rising or falling.
TRIGSLOPE_RISING	1	The trigger slope must be rising when the signal crosses the trigger value.
TRIGSLOPE_FALLING	2	The trigger slope must be falling when the signal crosses the trigger value.

See Also

API functions `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`

Scope object method `trigger`

Scope object properties `TriggerMode`, `TriggerSlope`

Purpose

Return the type of scope

Prototype

```
int xPCScGetType(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCScGetType` function returns the scope type. If there is an error, this function returns `-1`.

Description

The `xPCScGetType` function returns the type (`SCTYPE_HOST` for host or `SCTYPE_TARGET` for target) of scope *scNum*. Use the constants defined in `xpcapiconst.h` to interpret the return value. A scope of type `SCTYPE_HOST` is displayed on the host PC while a scope of type `SCTYPE_TARGET` is displayed on the target PC screen. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API functions `xPCAddScope`, `xPCRemScope`

Scope object property `Type`

xPCScRemSignal

Purpose Remove a signal from a scope

Prototype

```
void xPCScRemSignal(int port, int scNum, int sigNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
sigNum	Enter a signal number.

Description The `xPCScRemSignal` function removes a signal from the scope with number *scNum*. The scope must already exist, and signal number *sigNum* must exist in the scope. Use `xPCGetScopes` to determine the existing scopes, and use `xPCScGetSignals` to determine the existing signals for a scope. Use this function only when the scope is stopped. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScope` function to retrieve the scope number.

See Also API functions `xPCScAddSignal`, `xPCAddScope`, `xPCRemScope`, `xPCGetScopes`, `xPCScGetSignals`, `xPCScGetState`

Scope object method `remsignal`

xPCScSetDecimation

Purpose Set the decimation of a scope

Prototype

```
void xPCScSetDecimation(int port, int scNum, int decimation);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
decimation	Enter an integer for the decimation.

Description The `xPCScSetDecimation` function sets the *decimation* of scope *scNum*. The decimation is a number, `N`, meaning every `N`th sample is acquired in a scope window. Use this function only when the scope is stopped. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScope` function to retrieve the scope number.

See Also API functions `xPCScGetDecimation`, `xPCScGetState`

Scope object property `Decimation`

xPCScSetNumPrePostSamples

Purpose

Set the number of pre or post samples before triggering a scope

Prototype

```
void xPCScSetNumPrePostSamples(int port, int scNum, int prepost);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
prepost	A negative number means pretriggering, while a positive number means posttriggering. This function can only be used when the scope is stopped.

Description

The `xPCScSetNumPrePostSamples` function sets the number of samples for pre- or posttriggering for scope *scNum* to *prepost*. Use this function only when the scope is stopped. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API functions `xPCScGetNumPrePostSamples`, `xPCScGetState`

Scope object property `NumPrePostSamples`

Purpose

Set the number of samples in one data acquisition cycle

Prototype

```
void xPCScSetNumSamples(int port, int scNum, int samples);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
samples	Enter the number of samples you want to acquire in one cycle.

Description

The `xPCScSetNumSamples` function sets the number of samples for scope *scNum* to *samples*. Use this function only when the scope is stopped. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScope` function to retrieve the scope number.

See Also

API functions `xPCScGetNumSamples`, `xPCScGetState`

Scope object property `NumSamples`

xPCScSetTriggerLevel

Purpose

Set the trigger level for a scope

Prototype

```
void xPCScSetTriggerLevel(int port, int scNum, double level);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
level	Value for a signal to trigger data acquisition with a scope.

Description

The `xPCScSetTriggerLevel` function sets the trigger level *`level`* for scope *`scNum`*. Use this function only when the scope is stopped. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScope` function to retrieve the scope number for the trigger scope.

See Also

API functions `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`, `xPCScGetState`

Scope object property `TriggerLevel`

Purpose

Set the trigger mode of a scope

Prototype

```
void xPCScSetTriggerMode(int port, int scNum, int mode);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
mode	Trigger mode for a scope.

Description

The `xPCScSetTriggerMode` function sets the trigger mode of scope *scNum* to *mode*. Use this function only when the scope is stopped. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScopes` function to retrieve a list of scopes.

Use the constants defined in `xpcapiconst.h` to interpret the trigger mode. These constants include the following.

Constant	Value	Description
TRIGMD_FREERUN	0	The scope always triggers when it is ready to trigger, regardless of the circumstances. This is the default.
TRIGMD_SOFTWARE	1	Only a user can trigger the scope. It is always possible for a user to trigger the scope; however, if you set the scope to this trigger mode, user intervention is the only way to trigger the scope. No other triggering is possible.

Constant	Value	Description
TRIGMD_SIGNAL	2	Signal must cross a value before the scope is triggered.
TRIGMD_SCOPE	3	Scope is triggered by another scope at the trigger point of the triggering scope, modified by the value of `triggerscopesample` (see `scopedata` on page 4-22).

See Also

API functions `xPCGetScopes`, `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScGetTriggerMode`, `xPCScGetState`

Scope object method `trigger`

Scope object property `TriggerMode`

Purpose

Select a scope to trigger another scope

Prototype

```
void xPCScSetTriggerScope(int port, int scNum, int trigScope);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
trigScope	Enter the scope type to be triggered.

Description

The `xPCScSetTriggerScope` function sets the trigger scope of scope *scNum* to *trigScope*. This function can only be used when the scope is stopped. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScopes` function to retrieve a list of scopes.

The scope type can be `SCTYPE_HOST` or `SCTYPE_TARGET`.

See Also

API functions `xPCGetScopes`, `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`, `xPCScGetState`

Scope object property `TriggerScope`

xPCScSetTriggerScopeSample

Purpose

Set the sample number for a triggering scope

Prototype

```
void xPCScSetTriggerScopeSample(int port, int scNum, int
trigScSamp);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
trigScSamp	Enter a nonnegative integer for the number of samples acquired by the triggering scope before starting data acquisition on a second scope.

Description

The `xPCScSetTriggerScopeSample` function sets the number of samples (*trigScSamp*) a triggering scope acquires before it triggers a second scope (*scNum*). Use the `xPCGetScopes` function to retrieve a list of scopes.

For meaningful results, set *trigScSamp* between `-1` and (*nSamp*`-1`). *nSamp* is the number of samples in one data acquisition cycle for the triggering scope. However, no checking is done, and using a value that is too big causes the scope never to be triggered.

If you want to trigger a second scope at the end of a data acquisition cycle for the triggering scope, enter *trigScSamp* = `-1`.

See Also

API functions `xPCGetScopes`, `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`, `xPCScGetTriggerScopeSample`

Scope object properties `TriggerMode`, `TriggerSample`

Purpose Select a signal to trigger a scope

Prototype

```
void xPCScSetTriggerSignal(int port, int scNum, int trigSig);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
trigSig	Enter a signal number.

Description The `xPCScSetTriggerSignal` function sets the trigger signal of scope *scNum* to *trigSig*. The trigger signal *trigSig* must be one of the signals in the scope. Use this function only when the scope is stopped. You can use `xPCScGetSignals` to retrieve the list of signals in the scope. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScopes` function to retrieve a list of scopes.

See Also API functions `xPCGetScopes`, `xPCScGetState`, `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScSetTriggerSlope`, `xPCScGetTriggerSlope`, `xPCScGetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`

Scope object property `TriggerSignal`

xPCScSetTriggerSlope

Purpose

Set the slope of a signal that triggers a scope

Prototype

```
void xPCScSetTriggerSlope(int port, int scNum, int trigSlope);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
trigSlope	Enter the slope mode for the signal that triggers the scope.

Description

The `xPCScSetTriggerSlope` function sets the trigger slope of scope *scNum* to *trigSlope*. Use this function only when the scope is stopped. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScopes` function to retrieve a list of scopes.

Use the constants defined in `xpcapiconst.h` to set the trigger slope. The possible slope mode constants include

Constant	Value	Description
`TRIGSLOPE_EITHER`	0	The trigger slope can be either rising or falling.
`TRIGSLOPE_RISING`	1	The trigger signal value must be rising when it crosses the trigger value.
`TRIGSLOPE_FALLING`	2	The trigger signal value must be falling when it crosses the trigger value.

See Also

API functions `xPCGetScopes`, `xPCScSetTriggerLevel`, `xPCScGetTriggerLevel`, `xPCScGetTriggerSlope`, `xPCScSetTriggerSignal`, `xPCScGetTriggerSignal`, `xPCScSetTriggerScope`, `xPCScGetTriggerScope`, `xPCScSetTriggerMode`, `xPCScGetTriggerMode`, `xPCScGetState`

Scope object property `TriggerSlope`

Purpose

Set the software trigger of a scope

Prototype

```
void xPCScSoftwareTrigger(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Description

The `xPCScSoftwareTrigger` function triggers scope *scNum*. The scope must be in the state `"Waiting for trigger"` for this function to succeed. Use `xPCScGetState` to check the state of the scope. Use the `xPCGetScopes` function to retrieve a list of scopes.

You can use the `xPCScSoftwareTrigger` function to trigger the scope, regardless of the trigger mode.

See Also

API functions `xPCGetScopes`, `xPCScGetState`, `xPCIsScFinished`

Scope object method `trigger`

Scope object property `TriggerMode`

Purpose

Start data acquisition for a scope

Prototype

```
void xPCScStart(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Description

The `xPCScStart` function starts or restarts the data acquisition of scope *scNum*. If the scope does not have to preacquire any samples, it enters the "`Waiting for Trigger`" state. The scope must be in state "`Waiting to Start`", "`Finished`", or "`Interrupted`" for this function to succeed. Call `xPCScGetState` to check the state of the scope or, for host scopes that are already started, call `xPCIsScFinished`. Use the `xPCGetScopes` function to retrieve a list of scopes.

See Also

API functions `xPCGetScopes`, `xPCScGetState`, `xPCScStop`, `xPCIsScFinished`

Scope object method `start`

Purpose Stop data acquisition for a scope

Prototype

```
void xPCScStop(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Description The `xPCScStop` function stops the scope *scNum*. This sets the scope to the `"Interrupted"` state. The scope must be running for this function to succeed. Use `xPCScGetState` to determine the state of the scope. Use the `xPCGetScopes` function to retrieve a list of scopes.

See Also API functions `xPCGetScopes`, `xPCScStart`, `xPCScGetState`

Scope object method `stop`

xPCSetEcho

Purpose Turn the message display on or off

Prototype

```
void xPCSetEcho(int port, int mode);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.	
mode	Valid values are	
	`0`	Turns the display off
	`1`	Turns the display on

Description On the target PC screen, the `xPCSetEcho` function sets the message display on the target PC on or off. You can change the mode only when the target application is stopped. When you turn the message display off, the message screen no longer updates.

See Also API function `xPCGetEcho`

Purpose

Set the last error to a specific string constant

Prototype

```
void xPCSetLastError(int error);
```

Arguments

error	Specify the string constant for the error.

Description

The `xPCSetLastError` function sets the global error constant returned by `xPCGetLastError` to *error*. This is useful only to set the string constant to `ENOERROR`.

See Also

API functions `xPCGetLastError`, `xPCErrorMsg`

xPCSetLoadTimeOut

Purpose

Change the timeout value for initialization

Prototype

```
void xPCSetLoadTimeOut(int port, int timeOut);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
timeOut	Enter the new initialization timeout value.

Description

The `xPCSetLoadTimeOut` function changes the timeout value for initialization. The *`timeOut`* value is the time the function `xPCLoadApp` waits to check whether the model initialization for a new application is complete before returning. It enables you to set the number of initialization attempts to be made before signaling a timeout. When a new target application is loaded onto the target PC, the function `xPCLoadApp` waits for a certain time to check whether the model initialization is complete before returning. If the model initialization is incomplete within the allotted time, `xPCLoadApp` returns a timeout error.

By default, `xPCLoadApp` checks for target readiness five times, with each attempt taking approximately 1 second (less if the target is ready). However, in the case of larger models or models requiring longer initialization (for example, models with thermocouple boards), the default of about 5 seconds might be insufficient and a spurious timeout can be generated.

See Also

API functions `xPCGetLoadTimeOut`, `xPCLoadApp`, `xPCUnloadApp`

xPCSetLogMode

Purpose Set the logging mode and increment value of a scope

Prototype

```
void xPCSetLogMode(int port, lgmode logging_data);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
logging_data	Logging mode and increment value.

Description The `xPCSetLogMode` function sets the logging mode and increment to the values set in *`logging_data`*. See the structure `lgmode` for more details.

See Also API function `xPCGetLogMode`

API structure `lgmode`

Target object property `LogMode`

xPCSetParam

Purpose Change the value of a parameter

Prototype

```
void xPCSetParam(int port, int paramIdx, const double
*paramValue);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
paramIdx	Parameter index.
paramValue	Vector with at least the correct size.

Description The `xPCSetParam` function sets the parameter *`parIdx`* to the value in *`paramValue`*. For matrices, *`paramValue`* should be a vector representation of the matrix in column-major format. Although *`paramValue`* is a vector of doubles, the function converts the values to the correct types (using truncation) before setting them.

See Also API functions `xPCGetParamDims`, `xPCGetParamIdx`, `xPCGetParam`

xPCSetSampleTime

Purpose

Change the sample time, in seconds, for a target application

Prototype

```
void xPCSetSampleTime(int port, double ts);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
ts	Sample time for the target application.

Description

The `xPCSetSampleTime` function sets the sample time, in seconds, of the target application to *ts*. Use this function only when the application is stopped.

See Also

API function `xPCGetSampleTime`

Target object property `SampleTime`

xPCSetScope

Purpose Set the properties of a scope

Prototype

```
void xPCSetScope(int port, scopedata state);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
state	Enter a structure of type `scopedata`.

Description The `xPCSetScope` function sets the properties of a scope using a *`state`* structure of type `scopedata`. Ensure that this structure contains the properties you want to set for the scope. You can set several properties at the same time. For convenience, call the function `xPCGetScope` first to populate the structure with the current values. You can then change the desired values. Use this function only when the scope is stopped. Use `xPCScGetState` to determine the state of the scope.

See Also API functions `xPCGetScope`, `xPCScGetState`, `scopedata`

Scope object method `set`

Purpose Change the stop time of a target application

Prototype

```
void xPCSetStopTime(int port, double tfinal);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
tfinal	Enter the stop time, in seconds.

Description The `xPCSetStopTime` function sets the stop time of the target application to the value in *`tfinal`*. The target application will run for this number of seconds before stopping. Set *`tfinal`* to `-1.0` to set the stop time to infinity.

See Also API function `xPCGetStopTime`

Target object property `StopTime`

xPCStartApp

Purpose Start a target application

Prototype

```
void xPCStartApp(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Description The `xPCStartApp` function starts the target application loaded on the target machine.

See Also API function `xPCStopApp`

Target object method `start`

Purpose

Stop a target application

Prototype

```
void xPCStopApp(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Description

The `xPCStopApp` function stops the target application loaded on the target PC. The target application remains loaded, and all parameter changes made remain intact. If you want to stop and unload an application, use `xPCUnloadApp`.

See Also

API functions `xPCStartApp`, `xPCUnloadApp`

Target object method `stop`

xPCTargetPing

Purpose Ping the target PC

Prototype

```
int xPCTargetPing(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return The `xPCTargetPing` function returns `1` if it successfully reaches the target. If there is an error, the function returns `0`.

Description The `xPCTargetPing` function pings the target PC and returns `1` or `0` depending on whether the target responds or not. This function returns an error string constant only when the input is incorrect (the port number is invalid or *`port`* is not open). All other errors, such as the inability to connect to the target, are ignored.

See Also API functions `xPCOpenSerialPort`, `xPCOpenTcpIpPort`, `xPCClosePort`

Purpose

Return the status of a grid line for a particular scope

Prototype

```
int xPCTgScGetGrid(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

This function returns the status of the grid for a scope of type `SCTYPE_TARGET`. If there is an error, this function returns `-1`.

Description

The `xPCTgScGetGrid` function gets the state of the grid lines for scope *scNum* (which must be of type `SCTYPE_TARGET`). A return value of `1` implies grid on, while `0` implies grid off. Note that when the scope mode (as set or retrieved by `xPCTgScGetMode`/`xPCTgScSetMode`) is set to `SCMODE_NUMERICAL`, the grid is not drawn even when the `grid` mode is set to `1`. Use the `xPCGetScopes` function to retrieve a list of scopes.`xPCStopApp`

See Also

API functions `xPCGetScopes`, `xPCTgScSetGrid`, `xPCTgScSetViewMode`, `xPCTgScGetViewMode`, `xPCTgScSetMode`, `xPCTgScGetMode`, `xPCTgScSetYLimits`, `xPCTgScGetYLimits`

xPCTgScGetMode

Purpose

Return the scope mode for displaying signals

Prototype

```
int xPCTgScGetMode(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Return

The `xPCTgScGetMode` function returns the value corresponding to the scope mode. The possible values are

- `SCMODE_NUMERICAL = 0`
- `SCMODE_REDRAW = 1`
- `SCMODE_SLIDING = 2`
- `SCMODE_ROLLING = 3`

If there is an error, this function returns `-1`.

Description

The `xPCTgScGetMode` function retrieves the mode (`SCMODE_NUMERICAL`, `SCMODE_REDRAW`, `SCMODE_SLIDING`, `SCMODE_ROLLING`) of the scope *scNum*, which must be of type `SCTYPE_TARGET`. Use the `xPCGetScopes` function to retrieve a list of scopes.

See Also

API functions `xPCGetScopes`, `xPCTgScSetGrid`, `xPCTgScGetGrid`, `xPCTgScSetViewMode`, `xPCTgScGetViewMode`, `xPCTgScSetMode`, `xPCTgScSetYLimits`, `xPCTgScGetYLimits`

Scope object property `Mode`

Purpose

Return the view mode for the target PC display

Prototype

```
int xPCTgScGetViewMode(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Return

The `xPCTgScGetViewMode` function returns the view mode for the target PC screen. If there is an error, this function returns `-1`.

Description

The `xPCTgScGetViewMode` function returns the view (zoom) mode for the target PC display. If the returned value is not zero, the number is of the scope currently displayed on the screen. If the value is `0`, then all defined scopes are currently displayed on the target PC screen. In the latter case, no scopes are in focus (that is, all scopes are unzoomed).

See Also

API functions `xPCGetScopes`, `xPCTgScSetGrid`, `xPCTgScGetGrid`, `xPCTgScSetViewMode`, `xPCTgScSetMode`, `xPCTgScGetMode`, `xPCTgScSetYLimits`, `xPCTgScGetYLimits`

Target object property `ViewMode`

xPCTgScGetYLimits

Purpose

Copy the *y*-axis limits for a scope to an array

Prototype

```
void xPCTgScGetYLimits(int port, int scNum, double *limits);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
limits	The first element of the array is the lower limit while the second element is the upper limit.

Description

The `xPCTgScGetYLimits` function retrieves and copies the upper and lower limits for a scope of type `SCTYPE_TARGET` and with scope number *scNum*. The limits are stored in the array *limits*. If both elements are zero, the limits are autoscaled. Use the `xPCGetScopes` function to retrieve a list of scopes.

See Also

API functions `xPCGetScopes`, `xPCTgScSetGrid`, `xPCTgScGetGrid`, `xPCTgScSetViewMode`, `xPCTgScGetViewMode`, `xPCTgScSetMode`, `xPCTgScGetMode`, `xPCTgScSetYLimits`

Scope object property `YLimit`

Purpose

Set the grid mode for a scope

Prototype

```
void xPCTgScSetGrid(int port, int scNum, int grid);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
grid	Enter a grid value.

Description

The `xPCTgScSetGrid` function sets the grid of a scope of type `SCTYPE_TARGET` and scope number *scNum* to *grid*. If *grid* is `0`, the grid is off. If *grid* is `1`, the grid is on and grid lines are drawn on the scope window. When the drawing mode of scope *scNum* is set to `SCMODE_NUMERICAL`, the grid is not drawn even when the grid mode is set to `1`. Use the `xPCGetScopes` function to retrieve a list of scopes.

See Also

API functions `xPCGetScopes`, `xPCTgScGetGrid`, `xPCTgScSetViewMode`, `xPCTgScGetViewMode`, `xPCTgScSetMode`, `xPCTgScGetMode`, `xPCTgScSetYLimits`, `xPCTgScGetYLimits`

Scope object property `Grid`

xPCTgScSetMode

Purpose

Set the display mode for a scope

Prototype

```
void xPCTgScSetMode(int port, int scNum, int mode);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
mode	Enter the value for the mode.

Description

The `xPCTgScSetMode` function sets the mode of a scope of type `SCTYPE_TARGET` and scope number *scNum* to *mode*. You can use one of the following constants for *mode*:

- `SCMODE_NUMERICAL = 0`
- `SCMODE_REDRAW = 1`
- `SCMODE_SLIDING = 2`
- `SCMODE_ROLLING = 3`

Use the `xPCGetScopes` function to retrieve a list of scopes.

See Also

API functions `xPCGetScopes`, `xPCTgScSetGrid`, `xPCTgScGetGrid`, `xPCTgScSetViewMode`, `xPCTgScGetViewMode`, `xPCTgScGetMode`, `xPCTgScSetYLimits`, `xPCTgScGetYLimits`

Scope object property `Mode`

Purpose Set the view (zoom) mode for a scope

Prototype

```
void xPCTgScSetViewMode(int port, int scNum);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.

Description The `xPCTgScSetViewMode` function sets the target PC screen to display one scope with scope number *`scNum`*. If you set *`scNum`* to `0`, the target PC screen displays all the scopes. Use the `xPCGetScopes` function to retrieve a list of scopes.

See Also API functions `xPCGetScopes`, `xPCTgScSetGrid`, `xPCTgScGetGrid`, `xPCTgScGetViewMode`, `xPCTgScSetMode`, `xPCTgScGetMode`, `xPCTgScSetYLimits`, `xPCTgScGetYLimits`

Target object property `ViewMode`

xPCTgScSetYLimits

Purpose

Set the *y*-axis limits for a scope

Prototype

```
void xPCTgScSetYLimits(int port, int scNum, const double
*Ylimits);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.
scNum	Enter the scope number.
Ylimits	Enter a two-element array.

Description

The `xPCTgScSetYLimits` function sets the *y*-axis limits for a scope with scope number *scNum* and of type `SCTYPE_TARGET` to the values in the double array *Ylimits*. The first element is the lower limit, and the second element is the upper limit. Set both limits to `0.0` to specify autoscaling. Use the `xPCGetScopes` function to retrieve a list of scopes.

See Also

API functions `xPCGetScopes`, `xPCTgScSetGrid`, `xPCTgScGetGrid`, `xPCTgScSetViewMode`, `xPCTgScGetViewMode`, `xPCTgScSetMode`, `xPCTgScGetMode`, `xPCTgScGetYLimits`

Scope object property `YLimit`

xPCUnloadApp

Purpose

Unload target application

Prototype

```
void xPCUnloadApp(int port);
```

Arguments

port	Enter the value returned by either the function `xPCOpenSerialPort` or the function `xPCOpenTcpIpPort`.

Description

The `xPCUnloadApp` function stops the current target application, removes it from the target PC memory, and resets the target PC in preparation for receiving a new target application. The function `xPCLoadApp` calls this function before loading a new target application.

See Also

API function `xPCLoadApp`

Target object methods `load`, `unload`

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