

# xPC Target 4

## Perform real-time rapid prototyping and hardware-in-the-loop simulation using PC hardware

xPC Target™ provides a high-performance host-target environment that enables you to connect your Simulink® and Stateflow® models to physical systems and execute them in real time on low-cost PC-compatible hardware. xPC Target includes proven capabilities for rapid prototyping, hardware-in-the-loop testing, and application deployment in an open hardware architecture.

With xPC Target, you design your models on a host PC, generate code with Real-Time Workshop® and Stateflow Coder™, and download the code to a target PC running the xPC Target real-time kernel. You can use 32-bit or 64-bit x86-based computers as real-time target PCs. The software runs in 32-bit mode.

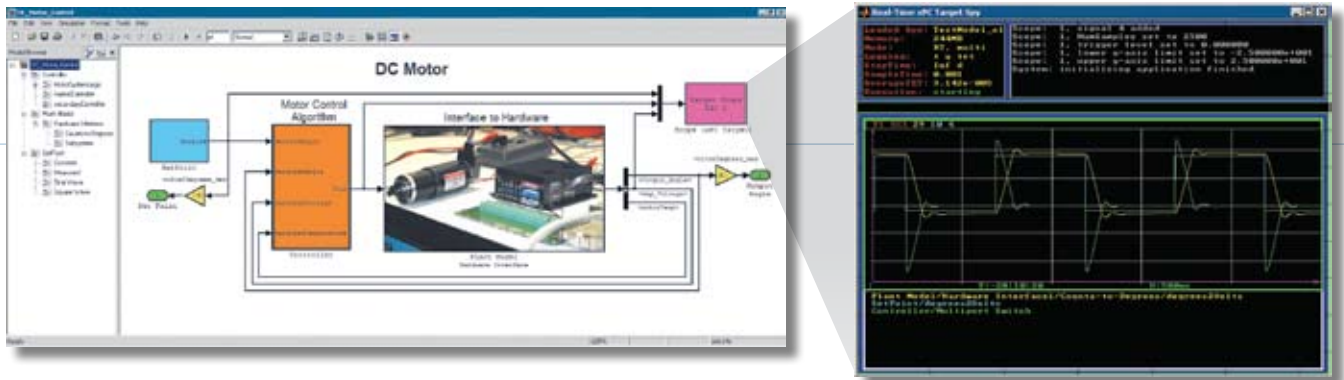
Using xPC Target Embedded Option™, available separately, you can deploy real-time embedded systems on standalone target PC hardware for production, control, signal processing, data acquisition, calibration, and test applications. A host PC is not required to use xPC Target Embedded Option.

### KEY FEATURES

- Real-time kernel for running applications generated from Simulink and Stateflow models on PC-compatible hardware
- Real-time operation using a variety of PC platforms including desktop PC, PC/104, PC/104+, CompactPCI, industrial PC, and single-board computers
- Flexible boot options, including CD, hard disk, CompactFlash, network, and floppy disk
- Sample rates approaching 50 KHz, depending on processor performance level, model size, and I/O complexity
- Real-time tuning of application parameters
- Real-time signal display and data logging for post-test analysis
- Support for more than 300 commercial off-the-shelf I/O boards in an extensive device driver library
- Open hardware driver environment, supporting third-party drivers from system integrators and hardware manufacturers
- C and COM APIs, letting you programmatically develop graphical user interfaces to access and control real-time applications



Host-target prototyping environment using a laptop PC as the host computer and an industrial PC as the real-time target.



DC motor model (above), created with Simulink and converted to a real-time application that runs on the target PC with the display (right) showing the real-time signals.

## Working with xPC Target

With a host PC development environment including MATLAB®, Simulink, Real-Time Workshop, xPC Target, and a C compiler, you can create Simulink models and deploy them to target PCs, where they run as real-time applications. You control execution of the target PC from MATLAB, using a GUI or the command line, a standard Internet browser, or the target PC command line. You can interactively control and monitor the target application, tune model parameters, and acquire, view, and log signal data.

## High-Performance Real-Time Kernel

Using standard PC hardware and commercial off-the-shelf I/O boards, xPC Target converts a PC into a real-time rapid prototyping or hardware-in-the-loop system by booting the target PC with the provided high-performance kernel. Model sample rates approaching 50 KHz in interrupt mode and 100 KHz in polling mode are achievable.

## Communicating Between Host and Target Systems

A single communications link connects the host and target PCs. You design your Simulink model on the host PC and download it over the host-target link to the target PC, where it executes as a real-time application. The same communications interface is used to pass commands, parameter updates, and signal data between the host and target PCs. RS-232 and TCP/IP connections are supported. xPC Target includes both an RS-232 cable and a PCI Ethernet card for the target PC.

## Accessing the Target System

There are several ways to access and communicate with the target system. A keyboard and monitor connected to the target PC provide a direct interface for issuing control commands and status monitoring. From the host PC, via the host-target link, you can use the MATLAB command line or xPC Target Explorer, a windowing GUI tool that runs in MATLAB. xPC Target Explorer simplifies configuration and control of the target PC. You can even access and control multiple target PCs running concurrently. Once you have access to the target system, you can perform target application control, parameter tuning, and signal (data) acquisition.

## Controlling the Target Application

Control functions let you download applications to the target PC, start and stop test execution, and change the sample time, stop time, and other application properties. Statistics and metrics related to run-time performance and CPU usage are also available.

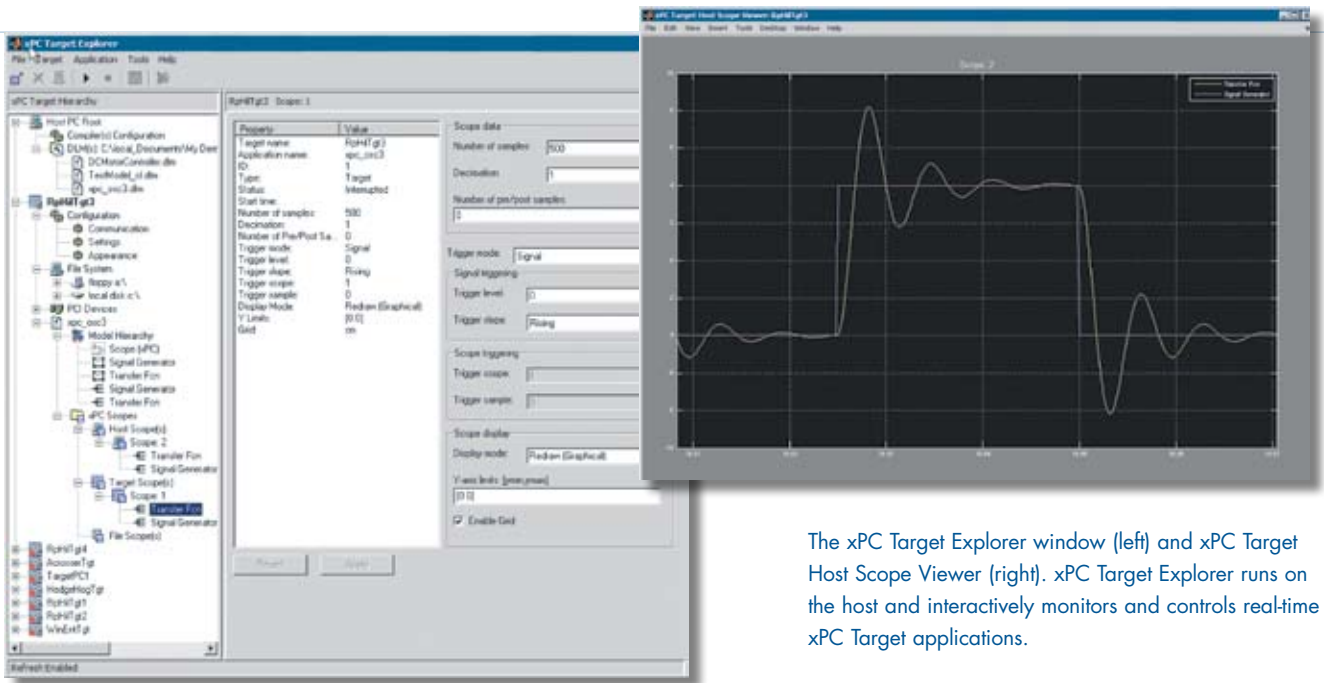
You communicate with and control the target application using an object-oriented command-line interface in MATLAB. You can also include the commands in M-files for automated batch testing. xPC Target Explorer enables you to configure, control, and monitor operations of the target PC in a window-based environment.

## Tuning Parameters

xPC Target includes several methods for tuning application parameters. After downloading the application to the target PC, you can use the command-line interface or xPC Target Explorer to modify parameter values before, during, or after real-time execution. You can also use Simulink external mode for parameter tuning. In this mode, the Simulink model running on the host PC operates as a GUI to the target application. When you change a parameter in your Simulink model, the parameter value is automatically downloaded to the target PC and updated in the target application.

## Monitoring and Acquiring Signals

With xPC Target, you can monitor, trace, and log signal data while the application is running. Signal monitoring is an instantaneous view of signal values at the current sample time. Signal tracing lets you capture, store, and display bursts of data, similar to the behavior of a digital oscilloscope. Use signal logging to acquire signals during the entire test execution. Options are available to log data to the target PC memory or file system. The acquired data can be uploaded to the host PC during the test, or upon completion, for display, analysis, or archiving.



The xPC Target Explorer window (left) and xPC Target Host Scope Viewer (right). xPC Target Explorer runs on the host and interactively monitors and controls real-time xPC Target applications.

## Defining and Controlling Scopes

Scopes are graphical display components that can be used to monitor and acquire signal data on the host or target PC. Scopes support several trigger modes, which can be used to control the acquisition timing and duration of data collection. Multiple signals can be displayed in a single scope, and multiple scopes can be included in a single model.

## Programming Custom GUIs

Two application programming interfaces (APIs) are included for custom GUI development. The xPC Target C API and xPC Target component object model (COM) API provide full access to the target PC control, parameter, and signal management functions. Development environments supported by these APIs include Visual Basic®, C, C++, Java™, .NET managed languages including C# and VB.NET, and any other programming languages that support COM. You can link to the APIs from your development environment to create custom host PC GUIs that run outside MATLAB.

## Interfacing with I/O Devices

To interface with sensors, actuators, and other physical devices, xPC Target provides device drivers that let you choose PCI, CompactPCI, PC/104, PC/104+, PMC (on a PCI carrier), and ISA bus I/O boards from leading hardware vendors.

Supported I/O boards include:

- Analog input and output (including audio and frame-based)
- Digital input and output
- Pulse train generation and capture (PWM)
- Incremental encoder, LVDT/RVDT, and Synchro/Resolver
- Shared/Reflective memory
- Ethernet (UDP/IP and real-time raw Ethernet)
- Serial (RS-232/422/485)
- Communication data buses (CAN, J1939, ARINC 429, MIL-STD-1553)

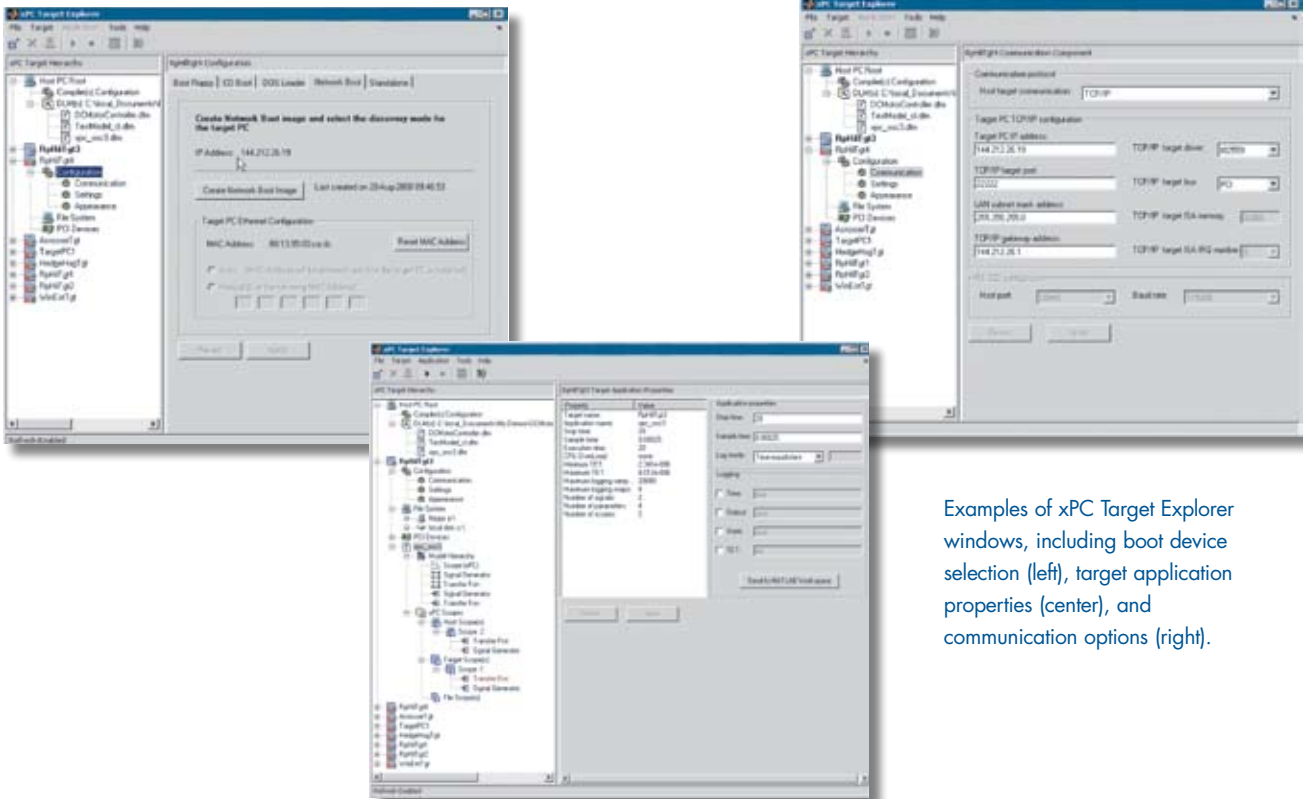
For a complete list of supported I/O boards, visit [www.mathworks.com/xpctarget/hardware](http://www.mathworks.com/xpctarget/hardware)

## Programming Custom Device Drivers

xPC Target provides device drivers for a variety of third-party boards. These drivers are available as Simulink blocks in the xPC Target library. If a driver for your board is not supplied with xPC Target, you can write your own. Tools, guides, examples, and source code are provided with xPC Target to assist you in driver development.

## Deploying Real-Time Applications with xPC Target Embedded Option

xPC Target Embedded Option is an extension to xPC Target that binds the application and the xPC Target kernel into a single image, enabling you to automatically start an application on the target PC after the kernel boots. You install this image on a hard drive or flash drive on your target PC. The combined image can then load and execute on the target PC without a connection to a host PC.



Examples of xPC Target Explorer windows, including boot device selection (left), target application properties (center), and communication options (right).

## Selecting and Configuring Target Hardware Systems

For information on compatible target PC hardware, including configuration details for a variety of PC systems, refer to the xPC Target Selecting Hardware Guide at [www.mathworks.com/xpctarget/hardware](http://www.mathworks.com/xpctarget/hardware)

## Required Products

MATLAB®  
 Simulink®  
 Real-Time Workshop®

## Related Products

**Stateflow®**  
 Design and simulate state machines and control logic

**Stateflow Coder™**  
 Generate C code from Stateflow charts

## Platform and System Requirements

For platform and system requirements, visit [www.mathworks.com/products/xpctarget](http://www.mathworks.com/products/xpctarget) ■

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