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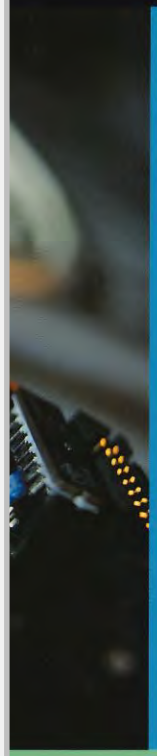
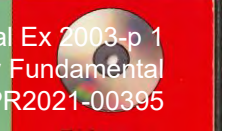


Everything You Need to Develop Custom USB Peripherals

No custom drivers needed—use the Win32 API and Visual Basic



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USB Complete

Everything You Need to Develop Custom USB Peripherals

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Published by Lakeview Research
Cover by Rattray Design. Cover Photo by Bill Bilsley Photography.

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ISBN 0-9650819-3-1

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3

Inside USB Transfers

In order to design and program a USB device, you need to know a certain amount about the inner workings of the interface. This is true even though the hardware and system software handle many of the details automatically.

This and the next three chapters are a tutorial on how USB transfers data. This chapter has the essentials that apply to all transfers. The following chapters cover the four transfer types supported by USB, the enumeration process, and the standard requests used in control transfers.

USB is complicated, and much of what you need to know is intertwined with everything else. This makes it hard to know where to start. In general, I try to begin with the big picture and work down to the details. Unavoidably, some of the things I refer to won't be explained in detail until later. And some things are repeated because they're important and relevant in more than one place.

The information in these chapters is dense. If you don't have a background in USB, you won't absorb it all in one reading. You should, however, get a

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feel for how USB works, and will know where to look later when you need to check the details.

You don't need to know every bit of this information in order to get a project up and running, but I've found that understanding something about how the transfers work helps in deciding which transfer types to use, in writing the firmware for the controller chip, and in tracking down the inevitable bugs that will occur when you try out your circuits and code.

The ultimate authority on the USB interface is the specification published by its sponsoring members. The specification document, *Universal Serial Bus Specification,* is available on the USB Implementers Forum's website. However, by design, the specification omits information and tips that are unique to any operating system or controller chip, and this type of information is essential when you're designing a product for the real world.

Transfer Basics

You can divide USB communications into two types, depending on whether they're used in initial configuration or in applications. In configuration communications, the host learns about the device and prepares it for exchanging data. Most of these communications take place when the host enumerates the device on power up or attachment. Application communications occur when applications on the host exchange data with an enumerated device. These are the communications that carry out the device's purpose. For example, for a keyboard, the application communications are the sending of keypress data to the host, to tell an application to display a character or perform other actions.

Configuration Communications

During enumeration, the device's firmware responds to a series of standard requests from the host. The device must identify each request, return the requested information, and take other actions specified by the requests.

On PCs, Windows performs the enumeration, so there's no user programming involved. However, to complete the enumeration, Windows must

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