COURSE TECHNOLOGY
CENGAGE Learning™

A+ Guide to Managing and Maintaining Your PC, 7e

Chapter 9

Installing and Supporting I/O Devices

Objectives

- Learn about the general approaches you need to take when installing and supporting I/O devices
- Learn about the types of I/O devices and their characteristics
- Learn how to install input devices, including the mouse, keyboard, barcode reader, fingerprint reader, and touch screen

Objectives (cont'd.)

- Learn how to install and configure several I/O devices, including ports on the motherboard, dual monitors, and expansion cards
- Learn how to troubleshoot I/O devices, including keyboards, pointing devices, and video

Basic Principles to Support I/O Devices

- I/O devices may be internal or external
- Fundamental principles and concepts:
  - Every I/O device controlled by software
  - Best guide for installation and support: manufacturer
  - Some devices need application software
  - Problems are sometimes solved by updating drivers or firmware
  - Learning about I/O devices is a moving target
  - Device Manager manages devices and device drivers
  - Some devices follow Energy Star standards

Types and Features of I/O Devices

- Topics covered:
  - Motherboard and display devices I/O ports
    - Including monitor, projector, video card, other expansion cards

I/O Ports on the Motherboard

- Ports directly off motherboard
  - Parallel, USB, FireWire
- Ports provided by expansion card

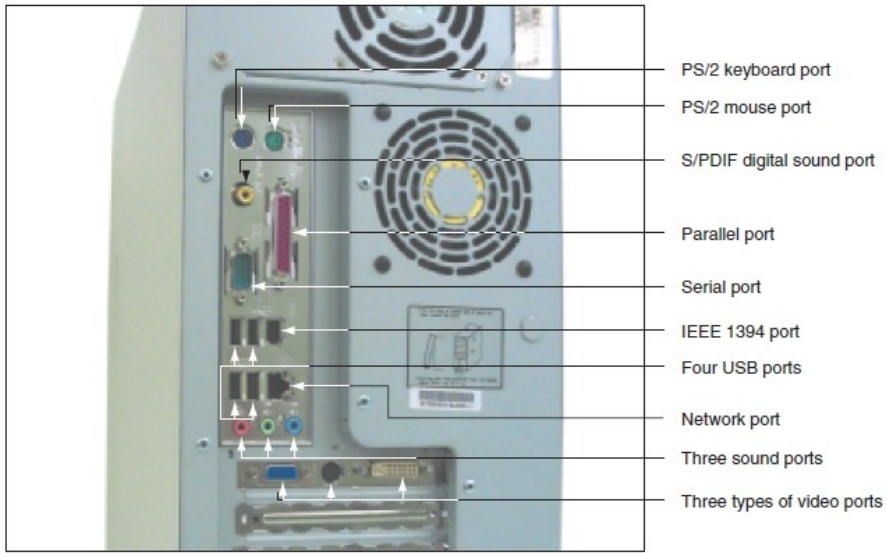

Figure 9-2 Rear of computer case showing ports; only the video ports are not coming directly off the motherboard. Courtesy: Course Technology/Cengage Learning

Port Type	Maximum Speed
SuperSpeed USB 3.0	5.0 Gbps (gigabits per second)
eSATA-300 (eSATA Version 2)	3.0 Gbps
1394b (FireWire)*	1.2 Gbps or 800 Mbps (megabits per second)**
Hi-Speed USB 2.0	480 Mbps
1394a (FireWire)	400 Mbps
Original USB (USB 1.1)	12 Mbps or 1.5 Mbps
Parallel	1.5 Mbps
Serial	115.2 Kbps (kilobits per second)

*IEEE 1394b has been designed to run at 3.2 Gbps, but products using this speed are not yet manufactured.
**FireWire 800 is the industry name for 1394b running at 800 Mbps.

Table 9-1 Data transmission speeds for various port types

I/O Ports on the Motherboard (cont'd.)

- USB Ports
  - Becoming popular ports for slower I/O devices

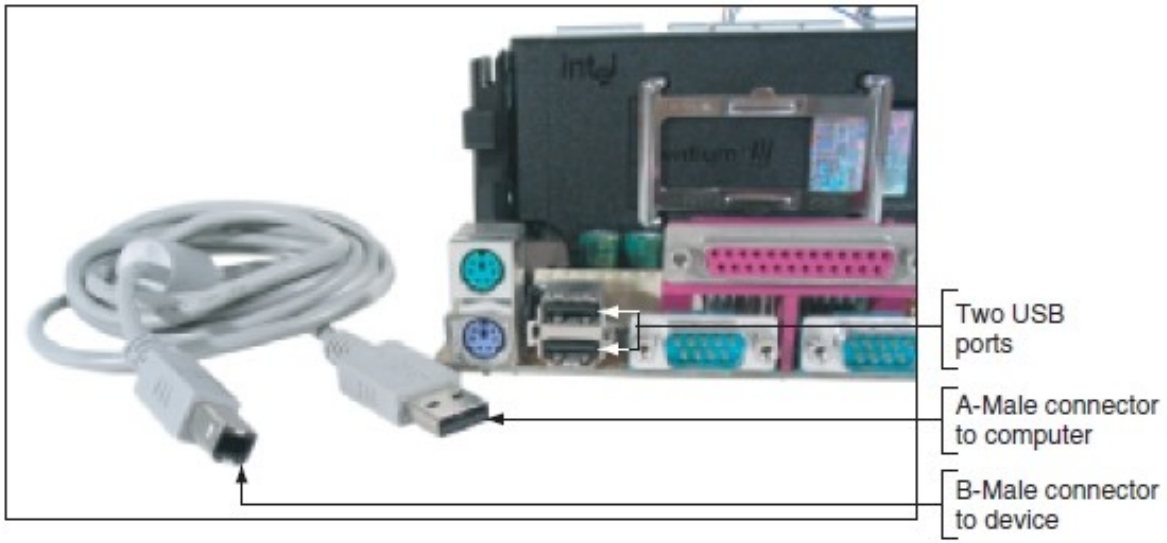

Figure 9-3 A motherboard with two USB ports and a USB cable; note the rectangular shape of the connection as compared to the nearby serial and parallel D-shaped ports
Courtesy: Course Technology/Cengage Learning

I/O Ports on the Motherboard (cont'd.)

- USB Ports (cont'd.)
  - Advantages
    - Easier to configure
    - Faster than serial or parallel ports
    - Use higher-quality cabling
    - Power drawn from USB port
    - Ports available on case front or rear
  - USB Implementers Forum, Inc.
    - Develops USB and provides product certification
  - Three versions
    - Version 1.1, Version 2.0, Version 3.0

I/O Ports on the Motherboard (cont'd.)

- USB Ports (cont'd.)
  - Can daisy chain 127 USB devices
  - USB cable wiring
    - Four wires: two for power, two for communication
  - USB cable length
    - Original USB: up to 3 meters
    - Hi-Speed USB: up to 5 meters
    - Hub is used for greater distances

I/O Ports on the Motherboard (cont'd.)

- FireWire (IEEE 1394) ports
  - Also called FireWire or i.Link
  - Similar to USB
    - Use serial data transmission, are hot-pluggable, and supports up to 63 FireWire devices daisy chained
  - Three versions
    - 1394a, 1394b, 1394c
  - Use isochronous data transfer
    - Data transferred continuously without breaks
    - Ideal for data transfers between consumer electronics products

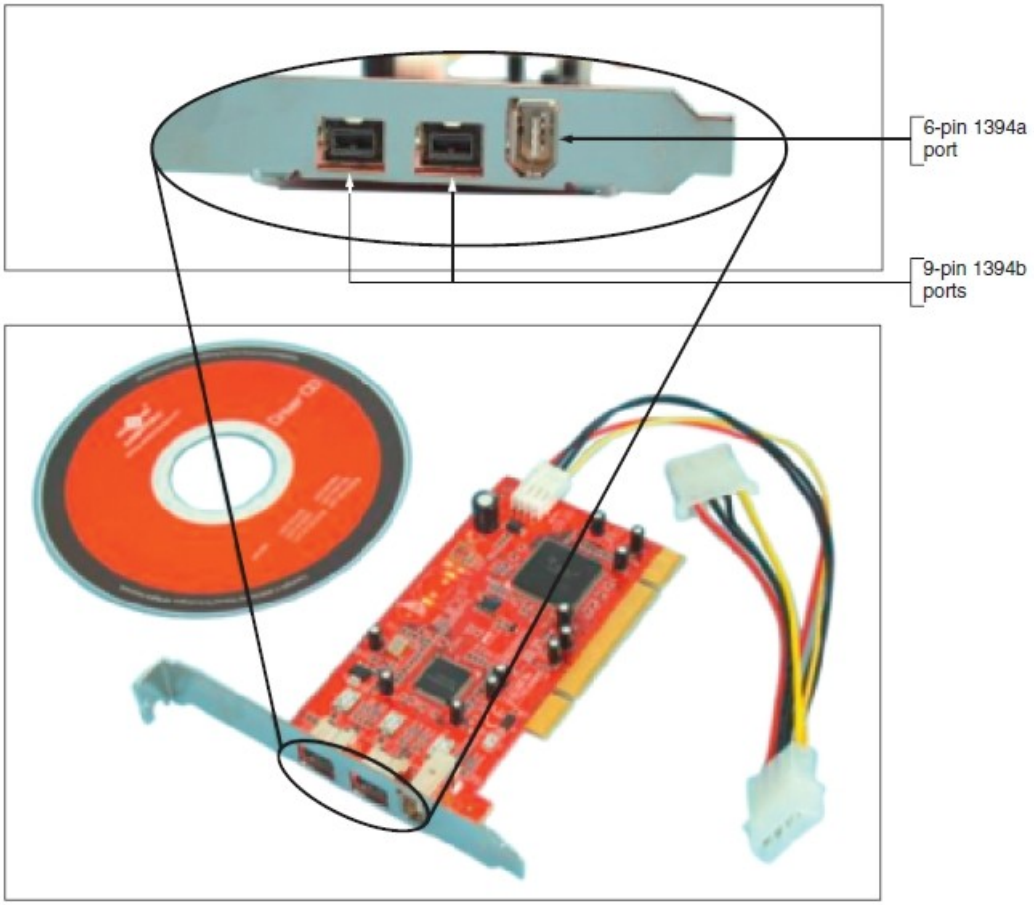

Figure 9-12 This 1394 adapter card supports both 1394a and 1394b and uses a 32-bit PCI slot. Courtesy: Course Technology/Cengage Learning

I/O Ports on the Motherboard (cont'd.)

- Serial Ports
  - Transmit data in single bits
  - Originally intended for I/O devices (e.g., mouse or modem)
  - Sometimes called DB9 and DB25
  - Conform to RS-232c interface standard
    - Sometimes called an RS-232 port
    - Also called COM1 or COM2 port
  - Universal Asynchronous Receiver-Transmitter (UART) or UART 16550
    - Motherboard controller logic

I/O Ports on the Motherboard (cont'd.)

- Parallel ports
  - Simultaneously transmit 8 bits of data
  - Primarily designed for printers
  - Being replaced by USB
  - Parallel port types
    - Standard parallel port (SPP)
    - Enhanced Parallel Port (EPP)
    - Extended Capabilities Port (ECP)

I/O Ports on the Motherboard (cont'd.)

- Infrared transceivers
  - Alternative terminology:
    - IrDA (Infrared Data Association) or IR transceiver
  - Provide infrared port for wireless communication
  - Uses
    - Television remote controls, wireless keyboards, mice, cell phones, PDAs, and printers
    - Communication between notebook and PDA
    - Connecting PC to a network
  - Motherboard uses IR headers
  - Obsolete technology due to line of sight issue

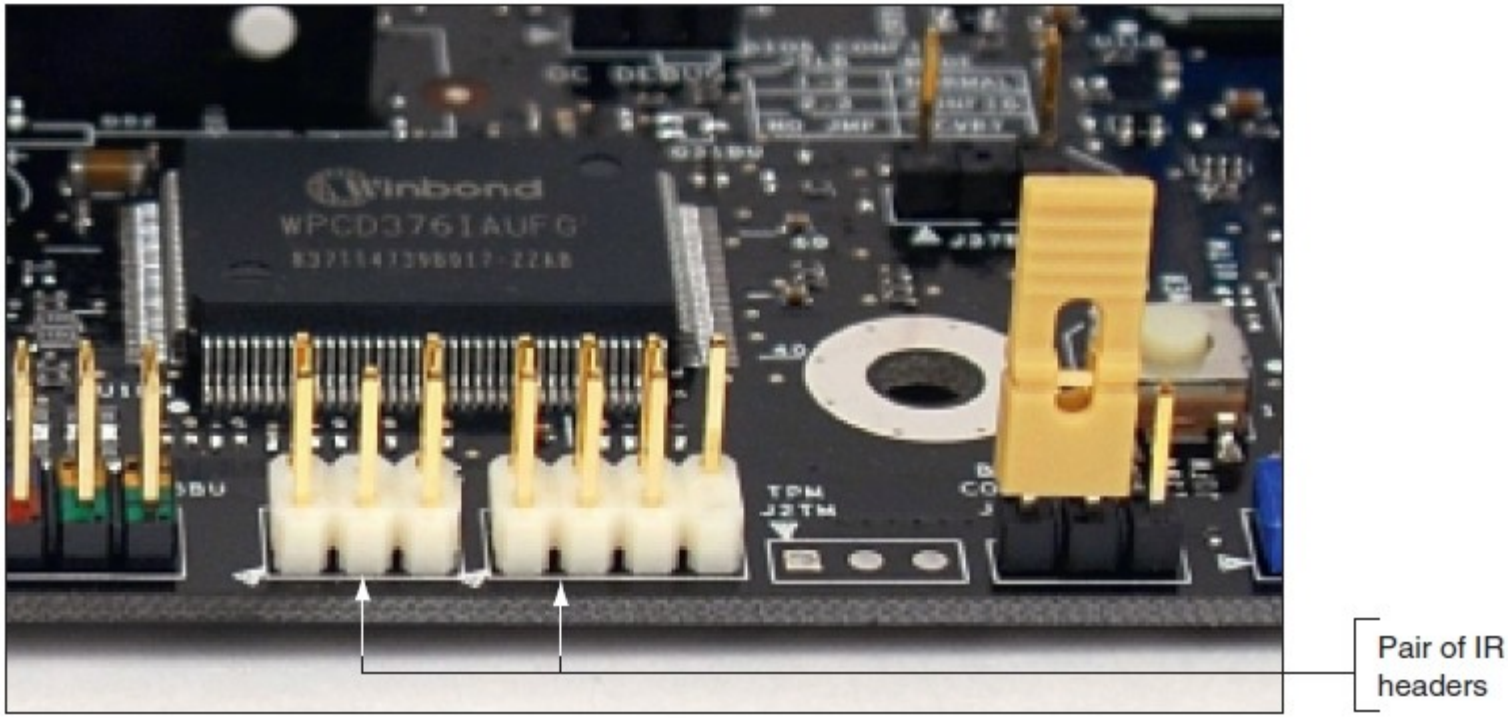

Figure 9-17 Two IR headers on this motherboard are used to install an IR receiver and IR transmitter. Courtesy: Course Technology/Cengage Learning

Display Devices

- Two categories
  - CRT (cathode-ray tube)
  - LCD (liquid crystal display)
    - Also called flat panel
- How a CRT monitor works
  - Filaments shoot electron beam to front of tube
  - Plates direct beam to paint screen from left to right
  - Control grid specifies coloring of each dot on screen
    - Controls one of three electron guns (red, green, blue)
  - Modified beam strikes phosphor to produce color

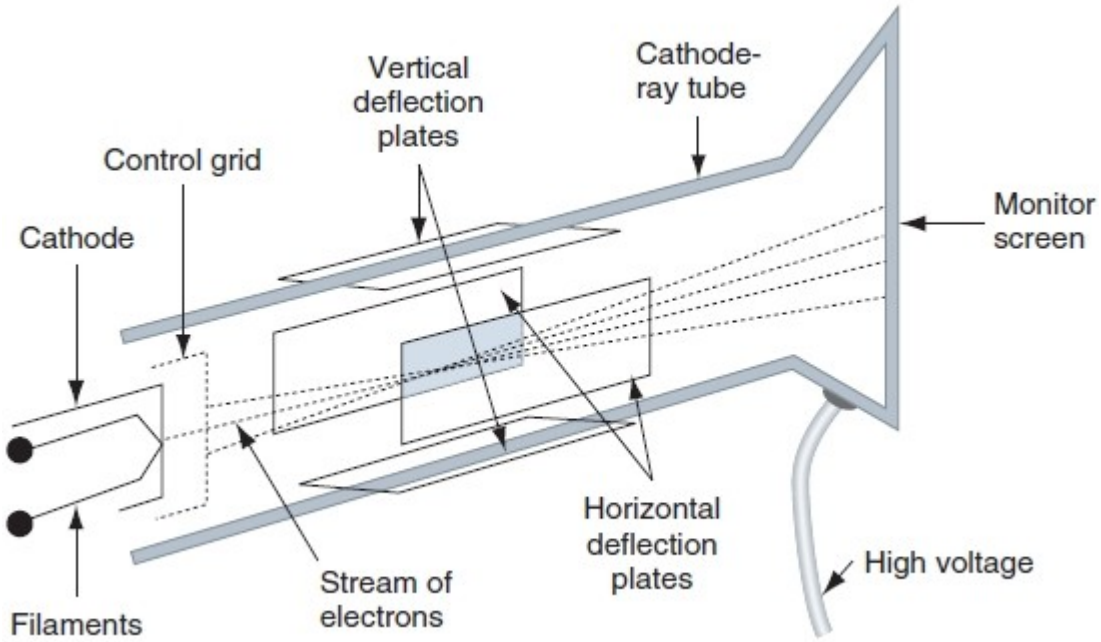

Figure 9-18 How a CRT monitor works
Courtesy: Course Technology/Cengage Learning

Display Devices (cont'd.)

- How an LCD monitor works
  - Two grids of electrodes surround center layers
    - Make up an electrode matrix of rows and columns
  - Each intersection of row and column forms a pixel
  - Software manipulates each pixel via electrodes
  - Image is formed by scanning columns and rows
  - Polarizer controls flow of light through pixels
  - Receive analog signal or digital signal from video card
    - Monitors have two ports to accommodate either signal

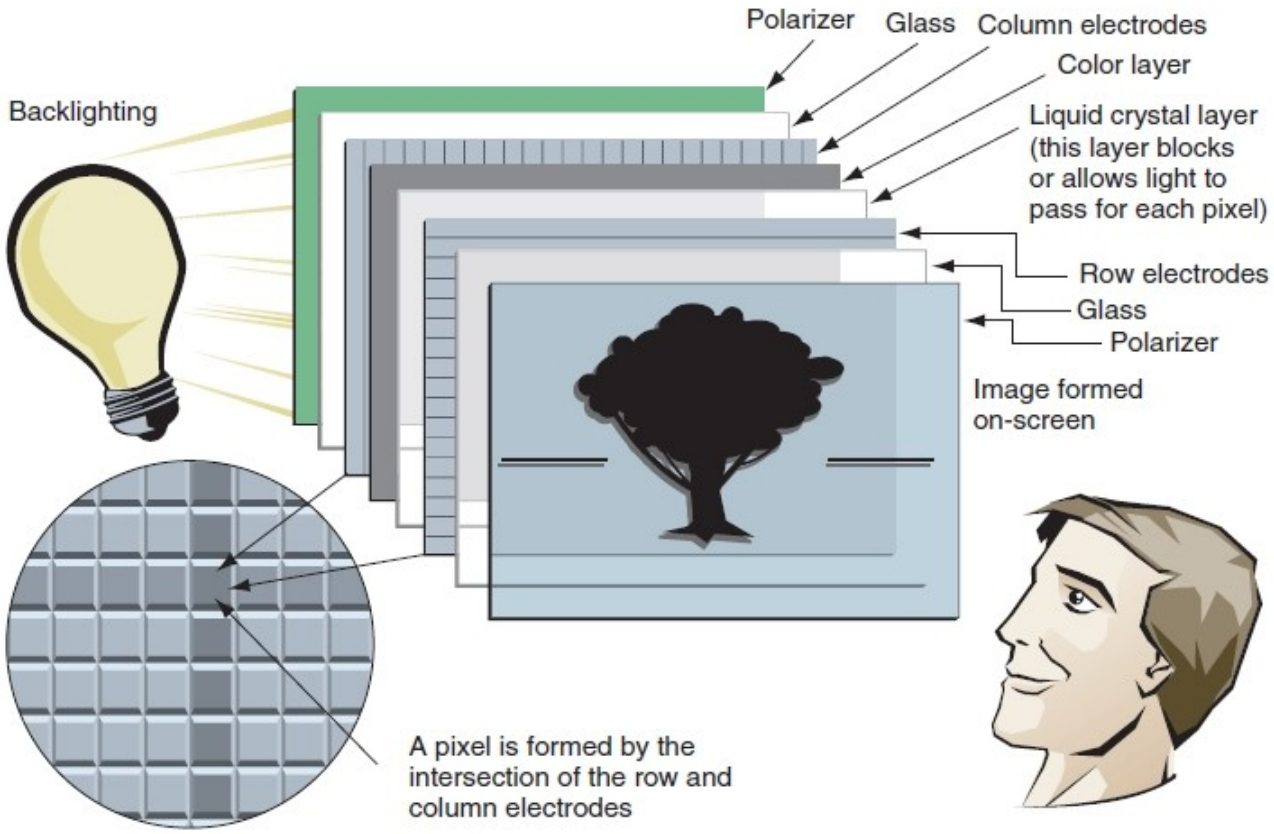

Figure 9-19 Layers of an LCD panel
Courtesy: Course Technology/Cengage Learning

Display Devices (cont'd.)

- LCD and CRT technologies
  - Refresh rate measures number of times screen built in a second
  - Response time measures time needed for LCD monitor to build one screen
  - Interlaced CRT monitors draws screen in two passes
  - Noninterlaced monitor draws screen in one pass
  - Resolution measures number of addressable pixels
  - Native resolution represents actual (and fixed) number of pixels built into the monitor

Display Devices (cont'd.)

- LCD and CRT technologies (cont'd.)
  - Different resolution standards
    - VGA (Video Graphics Array), SVGA (Super VGA)
    - SXGA (Super XGA), SXGA+
    - WSXGA+ (Wide SXGA+)
    - UXGA (Ultra XGA)
    - WUXGA (Wide UXGA)
    - QWXGA (Quad Wide XGA)
    - WQXGA (Wide Quad XGA)

Table 9-2 Important Features of a Monitor

Monitor Characteristic	CRT Monitor	LCD Monitor	Description
Screen size	X	X	Diagonal length of the screen surface. Values can range from 14 to 30 inches. (If you use an LCD television as a monitor, the size can go much higher.)
Refresh rate	X	X	The number of times a screen is built in one second. Common refresh rates are 60, 70, and 75 Hz. A monitor rated at 75 Hz can build 75 frames per second. (For comparison, a movie displays 24 frames per second.)
Interlaced	X		The electronic beam draws every other line with each pass, which lessens the overall effect of a lower refresh rate.
Response time		X	The time it takes for an LCD monitor to build one screen. The lower the better. A monitor with a 12-ms response time can build 83 frames per second, and a 16-ms monitor can build 63 frames per second.
Pixel pitch	X	X	A pixel is a spot or dot on the screen that can be addressed by software. The pixel pitch is the distance between adjacent pixels on the screen. An example of a pixel pitch is .283 mm. The smaller the number, the better.
Resolution	X	X	The number of spots or pixels on a screen that can be addressed by software. Values can range from 640 x 480 up to 1920 x 1200 for high-end monitors.
Native resolution		X	The number of pixels built into the LCD monitor.
Color quality	X	X	The number of bits used to store data about color for each pixel. Values are 8 bits, 16 bits, 24 bits, and 32 bits. Windows calls 24-bit and 32-bit color Truecolor.
Multiscan	X		CRT monitors that offer a variety of refresh rates so they can support several video cards.
Connectors	X	X	Options for connectors are VGA, DVI-I, DVI-D, and HDMI. These and other connectors used by video cards are discussed later in the chapter.
Contrast ratio	X	X	The contrast between true black and true white on the screen. The higher the contrast the better. 1000:1 is better than 700:1.
Viewing angle		X	The angle of view when an LCD monitor becomes difficult to see. A viewing angle of 170 degrees is better than 140 degrees.
Display type for CRT monitors	X		Flat screen monitors are high-end monitors that use a flat screen to help prevent glare.
Display type for LCD monitors		X	TFT (active matrix) is better than DSTN (passive matrix). TFT uses a transistor at each pixel to enhance the pixel.
Backlighting or brightness		X	For LCD monitors, some use better backlighting than others, which yields a brighter and clearer display. Brightness is measured in cd/m^2 (candela per square meter).
Other features		X	LCD monitors can also provide microphone input, speakers, USB ports, adjustable stands, and perhaps even a port for your iPod. Some monitors are also touch screen, so they can be used with a stylus as an input device.

Display Devices (cont'd.)

- Changing monitor settings
  - Monitor buttons
    - Degauss CRT monitor to eliminate accumulated or stray magnetic fields
  - Manufacturer's video card utility
    - Best performance with manufacturer's drivers
  - Windows utilities
    - Adjusts resolution and refresh rate
    - Supports a standard group of resolutions
    - Native resolution can be obtained if not displayed

Display Devices (cont'd.)

- Projectors
  - Display images for a large group
  - Example: portable XGA projector by NEC
    - Native resolution of XGA 1024 x 768
    - Connects to PC via 15-pin video port or S-Video port
  - Extra video port required
    - Desktops may need a second video card
    - Most notebooks provide a 15-pin video port
  - Function key activates projector on notebooks

Display Devices (cont'd.)

- Video cards
  - Graphic adapters, graphics cards, display cards
  - Motherboard may have integrated video controller
  - Can use AGP, PCI, PCI Express motherboard slot
  - Ports provided by video cards
    - 15-pin VGA: red, green, blue video using VGA port
    - DVI (Digital Visual Interface): used by LCD monitors
    - Composite out port: RGB mixed in the same signal
    - S-Video (Super-Video): sends two signals over cable
    - HDMI (High-Definition Multimedia Interface)
  - Processor and RAM may be supported

Display Devices (cont'd.)

- Video memory and Windows Vista
  - Aero requirements
    - 128 MB video memory, DirectX 9 or higher, Windows Display Driver Model (WDDM)
  - DirectX diagnostics program: dxdiag.exe
    - Displays information about hardware
    - Helps diagnose problems with DirectX
  - 128 MB video memory
    - Graphics memory embedded on video card, system memory, or a combination of both

Display Devices (cont'd.)

- Dual video cards
  - Work in tandem using one of two technologies
    - SLI by NVIDIA
    - CrossFire by ATI Technologies

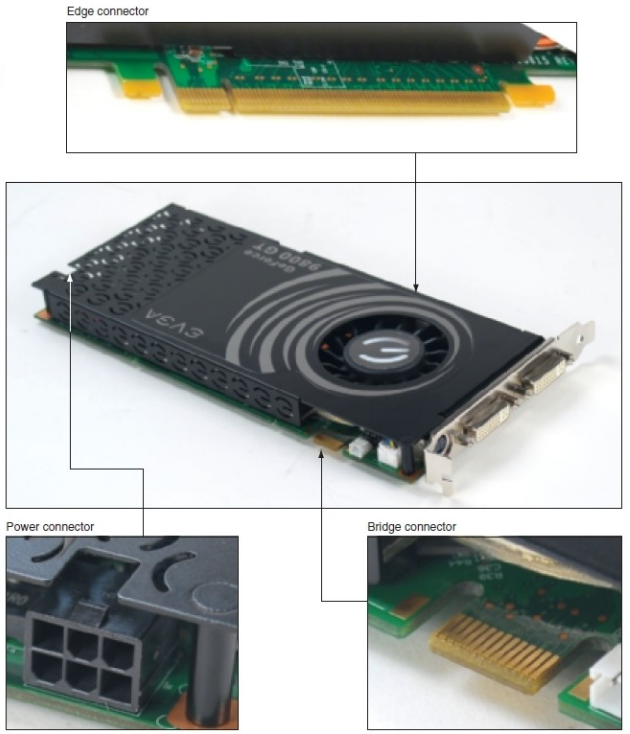

Figure 9-37 This video card is SLI compliant and can be installed with a second matching video card in a system
Courtesy: Course Technology/Cengage Learning

Expansion Cards

- Many types of expansion cards
- Selection considerations
  - Card features
  - Bus slot required
  - Operating system compatibility
  - Hardware resources required
    - Processor, RAM, free hard drive space
  - Application software compatibility

702 Installing Input Devices

- Devices require device drivers or BIOS
  - Control
  - Interface with the operating system
- Devices covered
  - Keyboard
  - Mouse
  - Touch screen
  - Barcode reader
  - Fingerprint reader

How to Install a Keyboard and Mouse

- Plug in and turn on the PC
- Four connections methods
  - 5-pin round DIN connector (mostly outdated)
  - 6-pin PS/2 connector (mini-DIN)
  - USB port
  - Wireless connection
    - Example: for a mouse, plug receiver into USB port
- Adapters are available for PS/2 device and USB

How to Install a Keyboard and Mouse (cont'd.)

- Drivers may be necessary for special features
- Most installed devices appear in Device Manager
  - USB devices are managed through Control Panel

Figure 9-42 The mouse and keyboard require drivers to use the extra buttons and zoom bar
Courtesy: Course Technology/Cengage Learning

How to Install a Keyboard and Mouse (cont'd.)

- Installing keyboard and mouse requiring driver for features
  - Insert the CD and run setup.exe program
    - Respond to Vista UAC box
  - Accept end-user license agreement (EULA)
    - Select keyboard and mouse from a list the CD supports
    - Drivers install
  - Restart the computer
    - Plug in the keyboard and mouse to USB ports
  - Use utilities to configure mouse and keyboard buttons

How to Install a Touch Screen

- Touch screen input device
  - Uses a monitor or LCD panel as the backdrop for input options
- Installation
  - Run setup.exe program to install device drivers and software to manage the device
  - Restart the computer
  - Run the management software
  - Connect USB or serial cable to the touch screen and computer
  - Use management software to calibrate

How to Install a Barcode Reader

- Barcode reader
  - Scans barcodes on products
    - Used to maintain inventory or at point of sale (POS)
  - Variety of shapes, sizes, features
  - Several interface methods
    - Wireless connection, serial port, USB port, keyboard port
- Installation
  - Install device drivers, plug device into keyboard, USB, or serial port
  - For Bluetooth connection follow documentation

How to Install a Fingerprint Reader

- Biometric device inputs a persons biological data
  - Additional authentication to control access to sensitive data
- Fingerprint reader types may:
  - Look like a mouse
  - Use wireless or USB connection
  - Be embedded on side of keyboard, flash drive
- Installation for most USB devices
  - Install software before plugging in device

How to Install a KVM Switch

- Keyboard, Video, and Mouse (KVM) switch
  - Allows use of one keyboard, mouse, and monitor for multiple computers
- Characteristics
  - Extra USB ports, sound port, support for two to sixteen computers, inexpensive
- Considerations
  - Ensure it will support the specific keyboard, mice, monitor, and devices with special features
- Installation: plug in devices

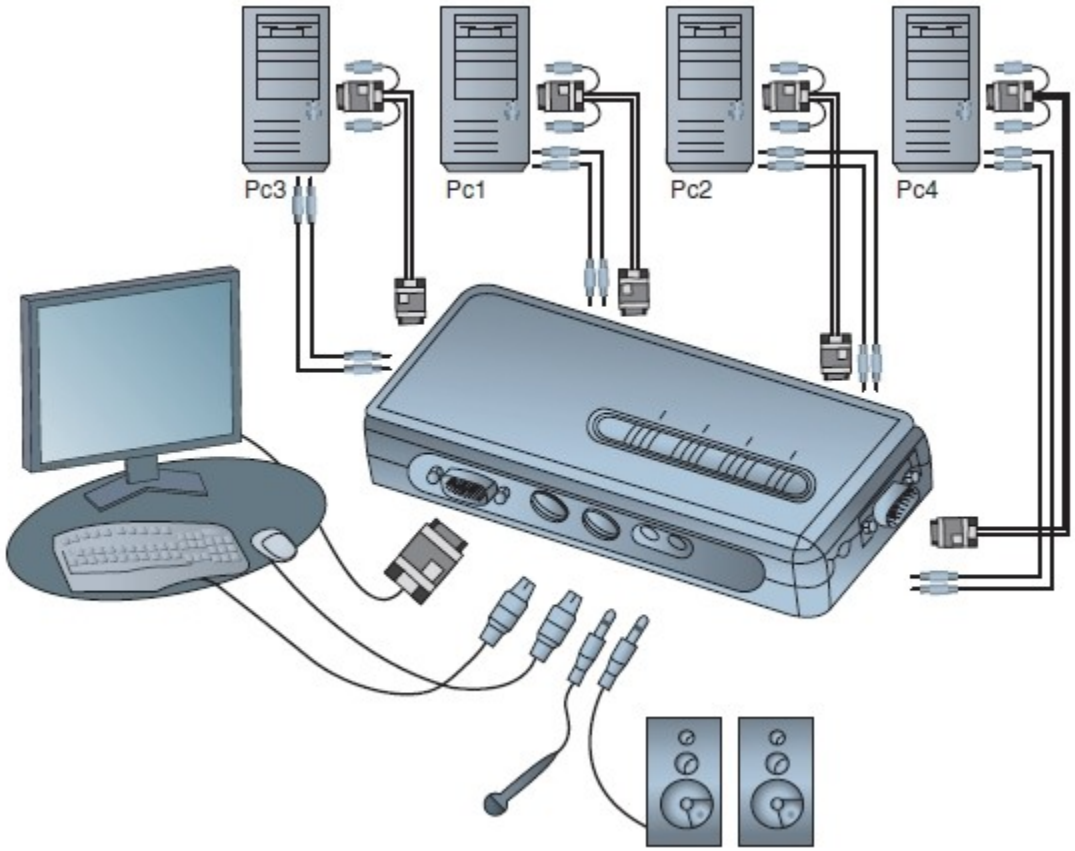

Figure 9-52 Hardware configuration for a four-port KVM switch that also supports audio. Courtesy: Course Technology/Cengage Learning

Installing and Configuring I/O Devices and Ports

- Topics covered
  - Learn how to configure and use ports on the motherboard
  - Learn how to install expansion cards
- Authority required
  - Windows XP
    - Log on as administrator
  - Vista
    - Use the User Account Control (UAC) box
- Device Manager
  - Monitors and manages most devices

Using Device Manager

- Device Manager (devmgmt.msc)
  - Primary Windows tool for managing hardware
- Vista access
  - Click Start, right-click Computer, select Properties on the shortcut menu, Click Device Manager on the System window and respond to UAC box
- Windows XP access
  - Click Start, right-click My Computer, select Properties from the shortcut menu, select Hardware tab from the System Properties window, click Device Manager

Using Device Manager (cont'd.)

- Vista or XP access
  - Enter devmgmt.msc in Vista Start Search box or XP Run box and press Enter
- Tasks available
  - Uninstall a device
  - Obtain more device information
  - Run diagnostics to test a device or report problems
  - Drivers
    - View details about installed drivers, update drivers, undo a driver update, disable, or enable a device

Using Ports on the Motherboard

- Verify device is enabled in BIOS setup first
- For ports and expansion slots:
  - BIOS setup recognizes the port or slot
    - Not the device or expansion card using that slot
- Any device showing up in BIOS setup
  - Should also be listed in Device Manager
  - The opposite is not always true
- For port problems
  - Verify port enabled in BIOS setup
  - Check Device Manager to verify the port is recognized without error

Using Ports on the Motherboard (cont'd.)

- Using USB and FireWire ports
  - Read documentation to determine driver and device installation order
  - Verify drivers are valid for the operating system
- Configuring parallel ports
  - Easy on today's motherboard with BIOS setup
    - Keep ECP default setting (DMA3)
    - BIOS manages interrupt request (IRQ) lines
- Device Manager Line Printer Terminal (LPT) assignments (LPT1, LPT2)
  - Parallel port system resources to manage print job

Using Ports on the Motherboard (cont'd.)

- Configuring serial ports
  - Examples: 3F8/IRQ4 and 2F8/IRQ3
    - 3F8 and 2F8 indicate I/O addresses used by the ports
    - IRQ4 and IRQ5 are lines the port uses to hail the CPU
  - COM ports in Device Manager
  - Serial port settings available in the properties box for the port on the Port Settings tab
    - Used by modem cards

Installing and Configuring Adapter Cards

- Initial tasks
  - Verify card fits an empty expansion slot
  - Verify correct device drivers for the OS
  - Back up important data not already backed up
  - Know your starting point

Installing and Configuring Adapter Cards (cont'd.)

- General directions to install an adapter card
  - Read the documentation
  - Replace onboard port and disable port in BIOS setup
  - Wear ground bracelet, shut down system, unplug power cords and cables, and drain power
  - Locate slot and prepare for installation
  - Insert card into expansion slot
  - Anchor card to top of the slot
  - Replace case cover, power cord, and peripherals
  - Start the system

Installing and Configuring Adapter Cards (cont'd.)

- How to install a FireWire controller card
  - Follow general directions to install the card
  - Connect power cord to card and to a 4-pin power connector
  - Start Windows
    - Automatically detects card
    - Installs its own embedded Windows IEEE 1394 drivers
  - Verify installation with Device Manager
  - Plug up FireWire devices to ports on the card
  - Resolve problems with driver CD software

Installing and Configuring Adapter Cards (cont'd.)

- How to install a video card
  - If replacing onboard video port:
    - Disable onboard in port BIOS setup
  - Follow general steps given earlier to install card
    - Use retention mechanism for stability if necessary
  - Connect power cord to video card 6-pin or 8-pin PCIe power connector
  - Found New Hardware Wizard appears
    - For best performance, cancel wizard
    - Insert driver CD, launch Setup.exe, and install drivers
  - Verify resolution and refresh rate properties

Installing and Configuring Adapter Cards (cont'd.)

- Possible problems
  - Whining sound at power up: inadequate power supply
  - Black screen at power up: disable onboard port
  - Series of beeps at power up: reseat card and check slot
  - Error messages about video when Windows starts: conflict in onboard video and video card
  - Games crash or lock up: update motherboard, video card, sound card drivers, update DirectX, and apply game patches

Installing and Configuring Adapter Cards (cont'd.)

- Requirements for installing two video cards
  - Motherboard supporting SLI or CrossFire with two PCIe x16 slots and two matching video cards
- Steps
  - Install first video card in first PCIe x16 slot
  - Power down system and install second video card
  - Leave monitor cable connected to first card
    - Reboot, install second video card drivers, and verify video cards installed using Device Manager
  - Configure video cards to work in tandem
  - Test graphics performance using optional SLI bridge

Installing and Configuring Adapter Cards (cont'd.)

- How to install a SATA, eSATA, and RAID storage controller card
  - More complex than other adapter card installations
    - Install drivers controlling SATA and eSATA connectors
    - Install utility program to manage RAID array
  - Follow manufacturer's specific instructions

Installing and Configuring Adapter Cards (cont'd.)

- General steps
  - Install controller card and attach one or more drives
  - Boot computer
    - Found New Hardware wizard appears
    - Select Locate and install driver software
    - Windows: insert card's driver CD and click Next
    - Manufacturer: insert driver CD and locate Setup.exe
    - Click Install the driver software anyway message
  - Restart system
  - Install RAID utility to manage the array

Troubleshooting I/O Devices

- Steps:
  - For a new installation suspect the device and drivers or application software
  - Verify adapter card securely seated in the slot
  - For problems after an installation verify nothing changed
  - Try to isolate the problem
  - Check simple things first
  - Exchange the device for a good one
  - Access resources
  - Document after the problem resolved

Troubleshooting Motherboard I/O Ports

- Steps:
  - Eliminate the device using the port as the cause
  - Use BIOS setup to verify port enabled
  - Check Device Manager
    - Verify Windows recognizes the port with no errors
  - Uninstall and reinstall device drivers
  - Update motherboard drivers
  - Use a loop-back plug to test the port
  - Disable the port in BIOS setup
    - Install I/O controller card to provide same type port

Troubleshooting Keyboards

- A few keys do not work
  - Dislodge debris
- Keyboard does not work at all
  - Check the cabling, swap with a known good keyboard
- PS/2 keyboard does not work
  - Try a USB keyboard
- Coffee, sugary drinks spilled on the keyboard
  - Replace keyboard
  - Try rinsing keyboard in water and reinstall after it dries

Troubleshooting Monitors and Video Cards

- Power light (LED) does not go on; no picture
  - Verify monitor and cord plugged in and tight connection
  - Look at fuse, volt switch selection, and video card
- Power light (LED) is on, no picture on power-up
  - Check contrast, brightness, and backlight adjustments
  - Check cables, reseat card, inspect for chip creep, disable video ROM shadowing, test RAM, and look for Windows issues
  - Test with good monitor, video card, and motherboard
  - For notebooks try connecting a second monitor

Troubleshooting Monitors and Video Cards (cont'd.)

- Power is on, but monitor displays the wrong characters
  - Exchange the video card
  - Exchange the motherboard
- Monitor flickers, has wavy lines, or both
  - Check the cabling and refresh rate
  - Press degauss button
  - Check for items with high electric noise

Troubleshooting Monitors and Video Cards (cont'd.)

- No graphics display or screen goes blank
  - Replace video card
  - Update drivers
  - Add video RAM
- Screen goes blank 30 seconds or one minute after the keyboard is left untouched
  - Check for standby or sleep modes
  - Enter BIOS setup and look for an Power Management option

Troubleshooting Monitors and Video Cards (cont'd.)

- Poor color display
  - Fine-tune the color
  - Exchange video cards
  - Install additional video RAM
  - Check for interference
  - Replace CRT monitor

Troubleshooting Monitors and Video Cards (cont'd.)

- Picture out of focus or out of adjustment
  - Change LCD to native resolution
  - Make adjustments with display utility
  - Check adjustment knobs
  - Change the refresh rate
  - Take it to a service center

Troubleshooting Monitors and Video Cards (cont'd.)

- CRT monitor makes a crackling sound
  - Take to service center to clean out dirt
- Display settings make the screen unreadable
  - Return to standard VGA settings using Safe mode
    - Resolution of 640 x 480

Troubleshooting Other Adapter Cards

- Steps:
  - Make sure device connected to the card works
  - Update drivers for the card
  - Uninstall the card
  - Reboot and install the drivers again
  - Reseat card or move it to a different slot
  - Search for diagnostic software
    - Driver CD or manufacturer Web site
  - Use technical resources available
  - Search the Internet
  - Replace the card with a known good card

Summary

- I/O devices may be internal or external
- Ports are located directly off motherboard or in an expansion card
- Display device categories
  - CRT and LCD
  - Projectors
  - Video cards
- There are many types of expansion cards
- Input devices require device drivers or BIOS

Summary (cont'd.)

- Input devices include:
  - Keyboard, mouse, touch screens, barcode readers, and biometric devices
- Graphics accelerators directly render images
- Port types: serial, parallel, USB, and FireWire
- Serial and parallel ports: older technologies
- Current port technologies: USB 2.0 and FireWire
- USB/FireWire devices are installed using plug and play