

USB FUNDAMENTALS

by Peter Karboulonis

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Introduction

The article is divided into smaller sections covering various topics related to the USB ports of a computer, the problems associated with these ports as well as information and guidance on how to avoid and resolve most such problems. This article has been written with Opticstar's cameras in mind but would also apply to cameras from other manufacturers.

System Requirements

USB2.0 Opticstar cameras require a modern PC running Windows XP / Vista / 7. Please make certain that you have installed the latest Windows and Direct X service packs that are available to download free of charge at www.microsoft.com.

In general a single USB2.0 port should be preferably dedicated to the camera and not shared by another bandwidth hungry device.

Also it is important to ascertain that background services do not interfere with the camera. Such services may be related to real-time virus killer software or hardware devices including TV-cards, built-in laptop cameras etc. Please refer the **Computer Performance** section in this text for more information.

Laptop Computers

USB2.0 ports are typically not fitted in old laptops and fully featured/full speed USB2.0 ports are in rare occasions are not present even in modern entry level laptops.

Please note that PCMCIA/CardBus USB2.0 cards would do not deliver full USB2.0 speeds and will not work with fast USB2.0 high resolution video cameras. To resolve such issues an ExpressCard (with a USB2.0 port) could be used instead of a PCMCIA/CardBus card due to the ExpressCard's superior speed of 2.5Gbit/s (480 Mbit/s through USB 2.0) per slot. Express type cards use a 34mm slot where PCMCIA/CardBus cards use 54mm slots. An ExpressCard should be connected directly to the computer and not via a PCMCIA/CardBus card.

Please note the ExpressCards will resolve USB related issues assuming that the laptop's data bus can support full ExpressCard speeds and is fully implemented.

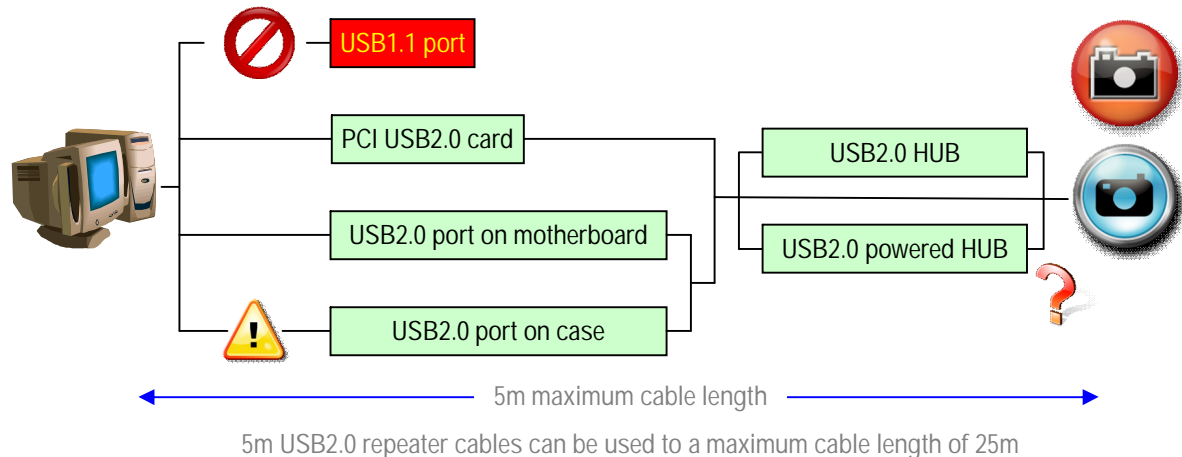
Desktop Computers

If your desktop PC does not have a built-in or operational USB2.0 port you would need to add a PCI USB2.0 card.

Connectivity Charts

The following two charts show the general setup for a desktop and laptop PCs. They would normally also apply to any other computers running Windows 2000, XP, Vista and Win 7 operating systems and should help you to avoid any problems. Please study them carefully before proceeding as they can show you the most common pitfalls.

Desktop PC Connectivity



A powered hub may be required if the USB port does not supply enough power.



Ideally a second camera should be connected to its own USB2.0 port.



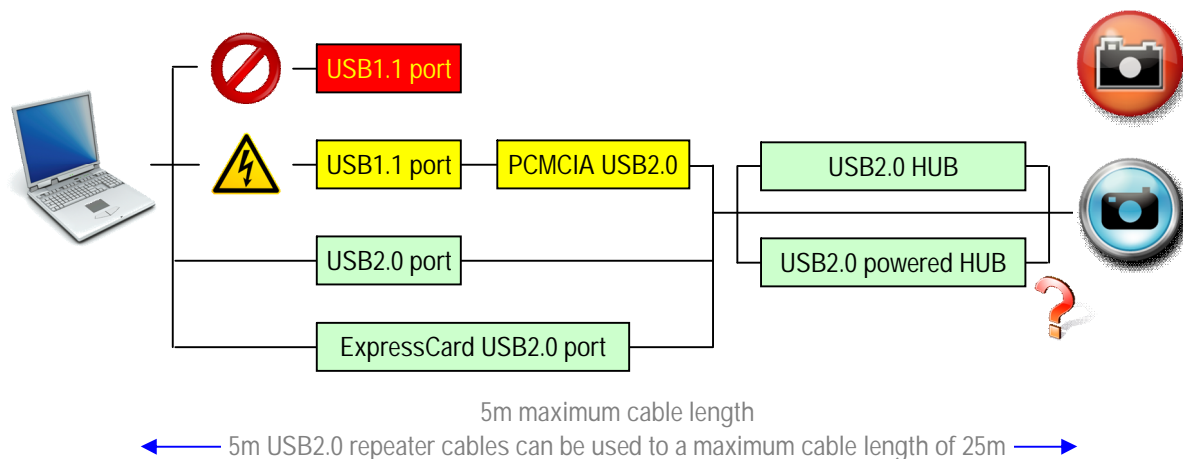
Poor implementations on a small number of desktop PCs with on-case USB2.0 hubs may have an effect on operation or performance as devices compete for the resources of a single USB controller including bandwidth and power.



Will not work.

Desktop PCs without a USB2.0 port would require a PCI type USB2.0 card. It is also worth noting that in some cases USB2.0 ports situated on the PC case may not be fully featured where USB2.0 ports situated on the motherboard (on the back of the computer) usually are. Please note the ExpressCards will resolve USB related issues assuming that the laptop's data bus can support full ExpressCard speeds and is fully implemented.

Laptop Device Connectivity



A powered hub may be required if the USB port does not supply enough power.



Ideally a second camera should be connected to a different USB2.0 port.



Will not work.



Avoid, it is unlikely that it will work!

In general you should not encounter any serious problems if you use a modern laptop with built-in USB2.0 ports. While it is possible to use a PCMCIA card to add USB2.0 functionality to older laptops with USB1.1 ports these normally do not work. This can be because the laptop bus may be too slow or because the PCMCIA USB2.0 ports do not supply enough bandwidth to the connected device.

A USB2.0 ExpressCard could be used if the USB2.0 port in your laptop does not provide the full USB2.0 bandwidth hi-speed cameras require. However ExpressCards could also be affected by a slow data bus.

A last consideration is the built-in camera of some laptops that may need to be disabled as it may interfere with the installation and operation of other cameras connected to your laptop.

It is worth noting that some laptops will re-enable the built-in camera when reset without consulting the user.

USB Extension Cable Issues

Opticstar cameras typically come with an in-situ 2.5 metres USB2.0 cable. The in-situ cable can be extended by up to 5 metres total with a standard hi-speed USB2.0 cable before a special USB2.0 repeater cable is required to further extend the total length. USB2.0 5 meter repeater cables can be used to extend the total length to an absolute maximum of 25 metres, this may well be less and will never exceed 25 meters.

USB2.0 repeater cables tend to vary in the way they work. Various devices including CCD cameras may not function with repeater cables unless the following installation procedure is followed:

1. Disconnect the camera and USB2.0 repeater cable from the PC.
2. Disconnect the USB2.0 repeater cable from the camera.
3. Connect the USB2.0 repeater cable to the PC without the camera.
4. Wait for the USB2.0 repeater cable to be identified by Windows before continuing.
Repeat steps 3 & 4 if you use additional repeaters.
5. Connect the CCD camera to the USB2.0 repeater cable.
6. Wait for the CCD camera to be identified by Windows.
7. Install the CCD camera drivers as instructed by Windows.
8. Run the camera application software.

Considerably more expensive USB2.0 amplifiers/repeaters can also be used that offer better performance and considerably longer reach.

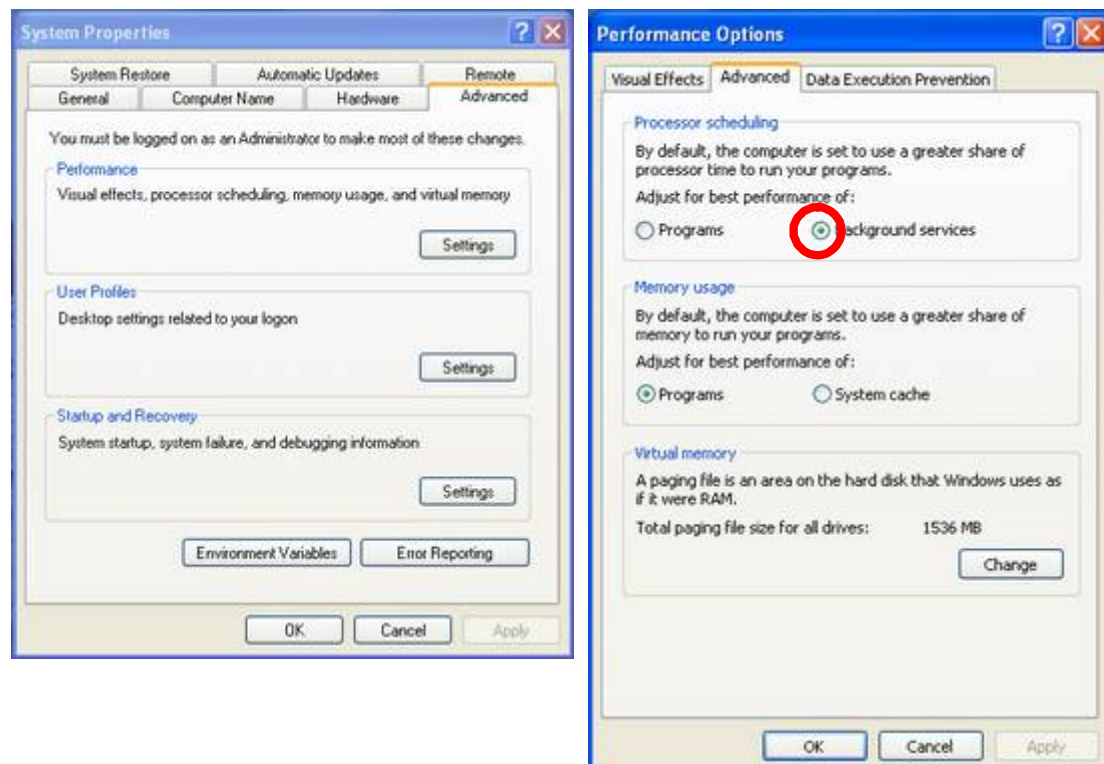
USB Port Issues

In practice not all USB ports on desktop PCs and laptops are fully featured. As such they may affect the operation of your camera. Experience has shown that USB ports found on the motherboards are the ones closest to the USB standard and as such provide the maximum power and data transfer speeds required.

In many cases USB hubs found on the front of desktop PCs or as add-on external units will not supply enough power to devices connected to them starving such devices of power. This problem in most cases can be overcome by external USB hubs that use their own mains power supplies. Keep in mind that powered USB hubs will not extend the reach of a USB cable beyond the 5 metres limit. For that you will need a USB repeater type cable.

Windows Background Services

If you still encounter problems you may need to enable Background Services for your camera to work. You can do so in Device Manager.



Installation Issues

In case Windows still fails to recognise your camera or successfully install the drivers there are certain actions you can take to solve the problem, these have been outlined below. Keep in mind that you will not be able to install the drivers unless Windows first recognises your camera once this has been connected for the first time to an operational USB2.0 port. Once Windows has recognised the camera it will be able to proceed with driver installation.

Windows does not See the Camera

If you experience camera identification issues please ensure that:

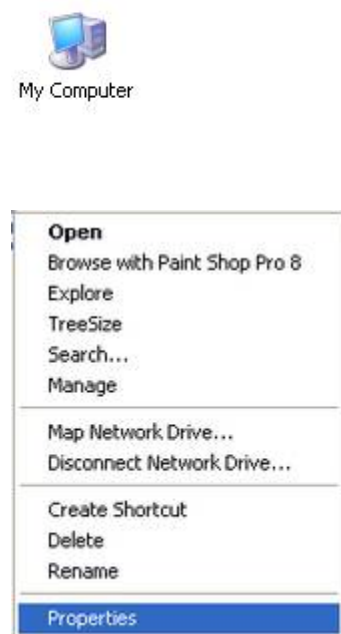
1. Your PC meets the minimum requirements for the particular USB device/camera.
2. The total length of cable from PC to camera is under 5m unless you use USB2.0 repeater cables to an absolute maximum length of 25m.
3. If you are using a laptop ensure that the built-in camera has been disabled.
4. The USB port may not supply enough power, in this case you will need a powered USB hub. This is more applicable to laptops rather than desktop computers.
5. Background Services have been enabled.

In case the PC is unable to see the camera connect the camera to a different USB port or better still to one on a different USB controller. You would expect that USB ports on the front of your PC will use a different USB controller than USB ports on the back of your PC.

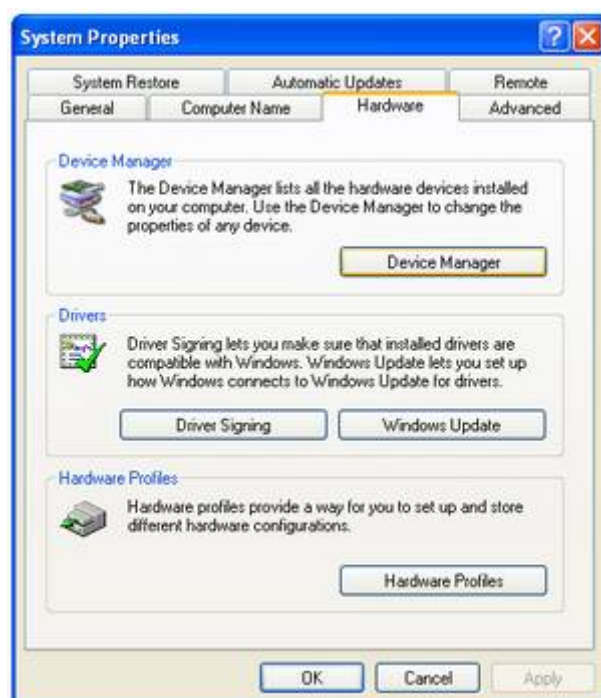
Connecting the camera to a USB2.0 port that resides on the computer's motherboard is the best way to resolve such issues. On a desktop such USB ports can be found on the back of your PC. Windows will only need to recognise your camera the first time that this has been connected to a certain USB2.0 port. Once Windows has successfully recognised the camera it will not do this again unless the camera is plugged to a different USB2.0 port.

Camera Driver Check

To check whether the camera drivers are present/operational follow the instructions below.



Right click on My Computer, then click on Properties.



Click on Hardware, then click on Device Manager

Click on **Imaging Devices** to reveal the Opticstar camera drivers. The entry may appear under **Universal Serial Bus controllers** or under **Imaging Devices**.



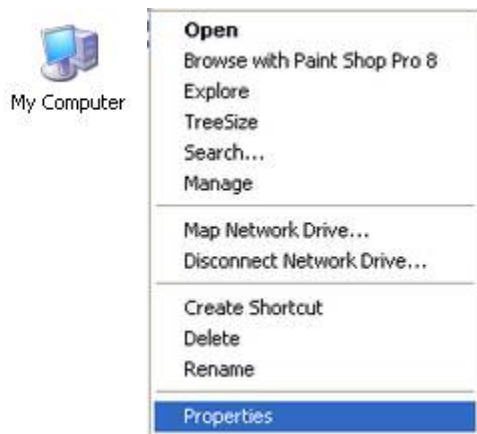
Check that the Opticstar driver entry does not show any conflicts. If there is a conflict this will appear as an exclamation mark over the Opticstar driver entry.



You will need to resolve the conflict before proceeding. A conflict may be as a result of another device being present, possibly also showing a conflict. If you are unable to resolve the conflict then you may have to remove or momentarily disable the offending driver. For more information on how to Update, Uninstall or momentarily Disable a device driver please refer to the following section in this article. You can re-enable a disabled driver at any time using the same sub-menu.

Software Camera Driver Removal Procedure

If you encounter any problems with the installation you may need to uninstall the camera drivers. You can uninstall the drivers via the **Windows Device Manager**. To uninstall the drivers please follow the procedure below.



Right click on My Computer.

Click on Properties. Click on Hardware.

Click on Device Manager.

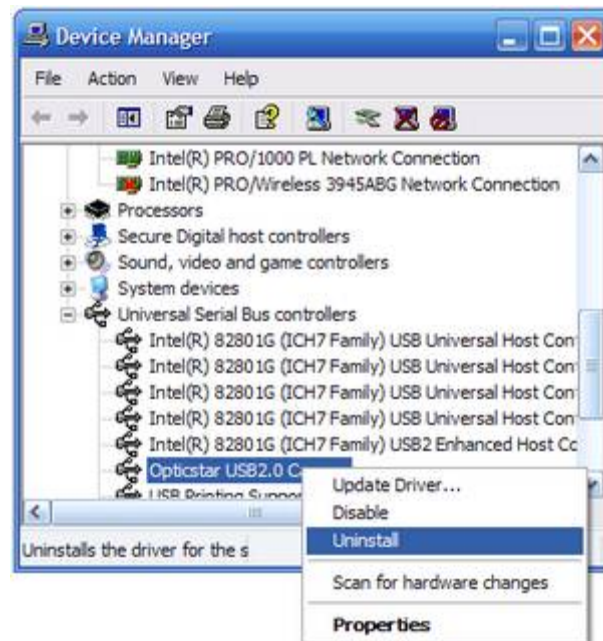


Click on Imaging Devices or Universal Serial Bus controllers where you will find the driver.

Right-click on the Opticstar driver entry.

Click on Uninstall to uninstall the drivers.

From this sub-menu you can also Update or momentarily Disable a driver if you wish.



Resolving Conflicts via the Removal of Drivers

One simple way to resolve conflicts in Device Manager is via the removal and re-installation of the camera drivers, please follow the instructions below closely.

With the camera attached to your PC:

1. Follow the instructions in the previous section to remove the drivers.
2. Disconnect the camera from the PC.
3. Switch off your PC and leave it switched off for 60 seconds.
4. Switch on your PC and re-install the camera and its drivers according to the instructions supplied with your camera.

The procedure of completely removing and re-installing the drivers can resolve most driver conflicts in Device Manager.

USB Bus Speed Issues

The type of USB2.0 port your camera is connected to will affect the speed at which an image will be transferred to your PC. Typically maximum transfer for the three different types are:

1. USB2.0-PCMCIA/2 card (varies greatly, sometimes slow)
2. USB2.0 laptops 480Mbps (typical).
3. USB2.0-PCI type card 250Mbps (or higher)
4. USB2.0 desktops 480Mbps (typical)

If at some point you decide to get a new PC you would need to make certain that the USB subsystem was already on the motherboard as this would offer the maximum bandwidth possible for your system. This is standard with almost all PC motherboards.

It is also worth keeping in mind that normally PCs have two USB controllers. Each USB controller has two or more USB ports that share a controller's bandwidth. If you use two cameras, one for guiding and one for imaging, ensure that the two cameras do not reside on the same USB controller to maximise performance. This is more important when using the camera with older laptops.

Camera Performance

Opticstar USB2.0 cameras are capable of high transfer rates when taking into account the high resolutions the cameras are capable of. The image data sent to the PC by the camera is at high resolution, non-interlaced and uncompressed. This guarantees images of the highest quality possible.

Performance will also greatly depend on the PC that the camera is connected to. The frame rate will increase if you use a computer with a faster processor or with a faster disk subsystem.

To increase performance on slower computers you may need to disable any anti-virus, spyware and adware software as these may affect the performance of your camera to a degree. Sometimes but not always these can take considerable resources especially when scanning your computer hard disks.

To ascertain that various software services and hardware devices (i.e. TV-cards) do not take up resources unnecessarily while inactive you can use latency checking utilities including DPC Latency Checker (www.thesycon.de/deu/latency_check.shtml) to help resolve any such issues.



Summary

For a successful camera and driver installation ensure that:

1. your PC has a USB2.0 port (laptop PCMCIA II USB2.0 cards do not work).
2. the total length of the USB cable is under 5m, unless you use USB repeaters.
3. your computer has the latest Windows updates (www.microsoft.com).
4. you are using the latest camera drivers and software (www.opticstar.com).
5. if possible you use a USB2.0 port on your PC's motherboard (back of the PC).
6. the USB port supplies enough power to the camera (use a powered hub if not).
7. the Background Services have been disabled (via the Device Manager).
8. any laptop built-in cameras are disabled (via the Device Manager).
9. there are no conflicts (resolve via the Device Manager).
10. you check that other hardware devices do not take resources unnecessarily.
11. you reset your PC after removing drivers and prior to re/installation.

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