

Opticstar DS-616C XL+

Long Exposure T.E.C. Cooled CCD Camera



Set-up Guide



Microsoft Windows
(64-bit & 32-bit)
XP/Vista/7/8/10/11

OPTICSTAR

CAUTION

1. The DS camera is sealed to protect the sensor and electronics, do not open your camera, this will make the camera susceptible to moisture and dust.
2. Do not drop your camera as this can result in serious damage.
3. Only use the supplied power supply unit (12VDC 2A regulated).
4. Do not point the camera to a bright light source like the Sun without the appropriate filters.
5. Do not over-tighten adaptors attached to the camera.
6. Treat the camera glass window with the same care as you would of a photographic lens.

Opticstar DS-616C XL+ (S/N:)

Nebulosity v2 code:

Manufacturer's Warranty

This product has a 1 year back to base warranty. For after sales support, please contact Opticstar at: info@opticstar.com

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If you have any queries regarding the camera or you require after sales support, please email us at: info@opticstar.com Please include your camera's serial number as displayed on the camera's case.



The camera does not incorporate any optics and therefore it cannot reach focus by itself. A T-threaded (M42 x 0.75) mounted lens must be used with the camera or it must be attached to a telescope with the nosepiece adapter that is included with the camera.



The camera requires a computer running Microsoft Windows XP/Vista/7/8/10/11 with a fully specified USB 2.0 port. If your computer's USB 2.0 ports do not meet the full specification of the USB 2.0 standard, you may need to use a USB 2.0 Repeater cable between the computer and the camera. Please refer to the *Troubleshooting* section of this guide under *USB Extensions* for more details.

Introduction

Your **Opticstar DS-616C XL+** single shot camera will enable you to capture images of deep sky objects, the planets and their satellites as well as images of the Moon and Sun with the use of an appropriate filter. The camera incorporates thermo-electric cooling (TEC) reducing the levels of noise dramatically during longer exposures.

The **DS-616C XL+** is the latest in the XL range of high-performance scientific CCD cameras with the following features:

- Sony 1.8" colour CCD with 6.1-megapixel resolution.
- Higher frame rate for focus and preview modes.
- High light sensitivity due to Gain function in hardware.
- Colour binning modes at 1x1, 2x2 and 4x4.

Package Contents

Please ensure that you check that no parts are missing. In the event of a part missing please inform your local supplier immediately. Your camera should include the following:

1. Camera.
2. USB cable.
3. USB 2.0 repeater cable (may be required for some computers).
4. T-mount to 2" Nosepiece (for 2" telescope drawtubes).
5. Printed setup guide (this document).
6. CD with software, drivers and Nebulosity user manual.
7. Mains Power Supply Unit for powering the camera.



The 2" nosepiece can be secured on the camera using a screw driver. Remove the cap from the camera, screw the nosepiece in its place and secure it by tightening the three screws on the side of the camera's optical window.

System Requirements

You will first need to install the camera and drivers before installing the **Nebulosity** software. Please follow the instructions closely for a successful installation. You will require a PC running Microsoft Windows (64-bit or 32-bit) XP/Vista/7/8/10/11 with a free USB 2.0 port.

If you experience any difficulty during or following installation, please refer to the *Troubleshooting* section in this guide.

If you have installed the camera drivers in the past and you wish to replace the drivers to a different version you must first remove the original drivers. Please refer to the *Troubleshooting* section on how to remove the currently installed drivers.

Connecting the DS-616C XL+ to the Computer

Before installing the software drivers and applications, follow the instructions below to connect the DS-616C XL+ to your computer.

- 1.** Remove the protective cap at the front of the camera exposing the camera's female T-tread. Screw the 2" Nosepiece in its place which is bundled with the camera. This will enable the camera to be attached to a telescope with a 2" draw tube.
- 2.** Connect the power supply unit to the mains.
- 3.** Insert the power lead into the camera's 12VDC socket.
- 4.** Plug the mains power supply to a mains socket.
- 5.** Attach one end of the USB cable to the side of the camera. Additionally, you may have to attach the USB 2.0 Repeater cable too on some computers.
- 6.** Attach the other end of the USB cable to your computer. Windows will identify the camera as a new device. Please, follow the instructions in the next section to install the software.

Installing the Software Drivers

Follow the instructions below closely ensuring that you make the right selections.

1. Un-install any previous versions of the software.
2. Insert the supplied CD in the CD/DVD drive.



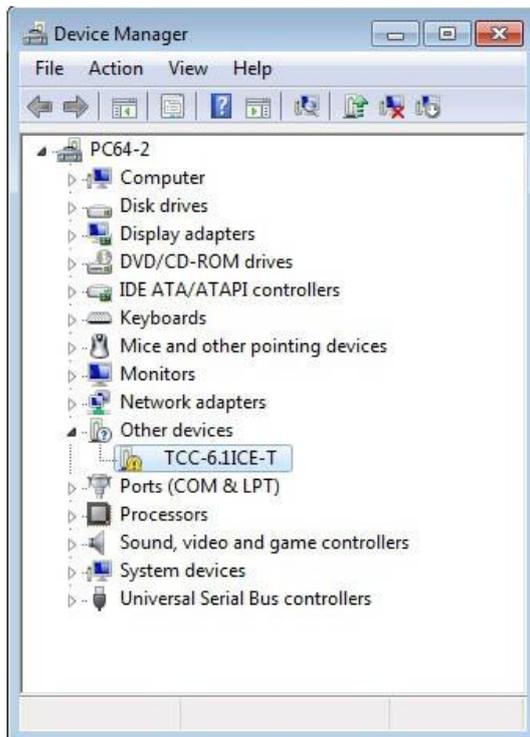
During installation do not allow Windows to automatically select the best drivers. If you allow Windows to automatically select the drivers, installation will fail.

3. Plug the camera to a USB2.0 port (ideally to one attached directly on the motherboard of your computer).

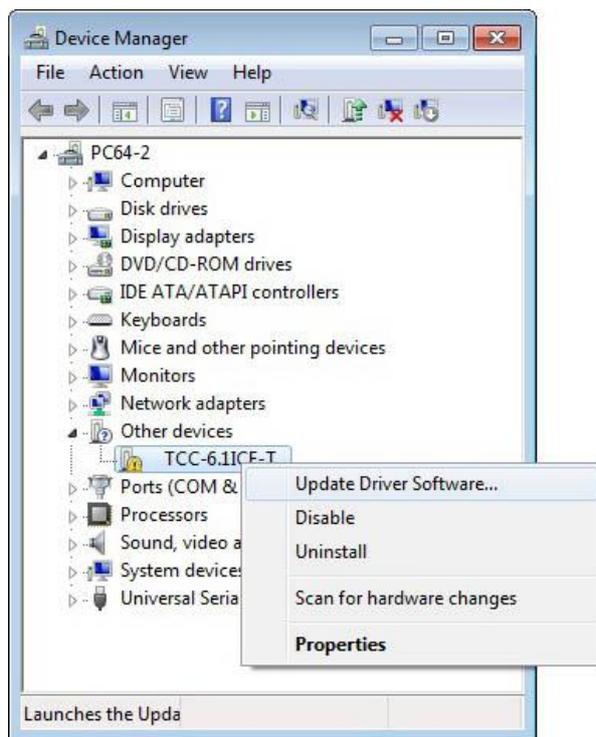


Installing device driver software ✖
Click here for status.

4. The **Windows Device Manager** will list the camera as **TCC-6.1ICE-T** as shown below.



Once connected to the computer, the **Device Manager** will show the camera.



The software drivers can also be installed by the user from the **Device Manager**.

5. The **Windows Found New Hardware Wizard** will come into view. If the wizard does not appear, you can install the drivers by right-clicking on the camera entry in **Device Manager** and select **Update Driver Software**.

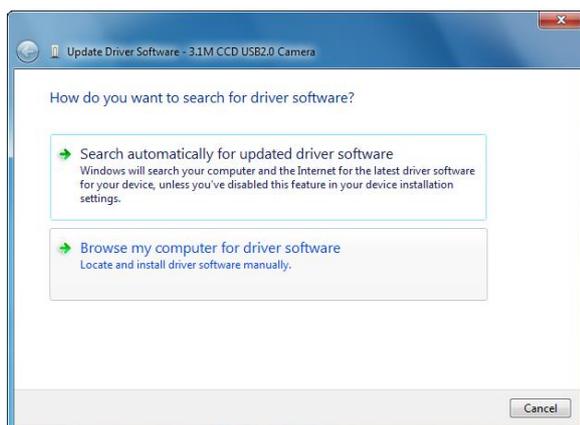


Anti-virus software may attempt to block the installation. In such cases the anti-virus software should be temporarily disabled. Alternatively, when prompted, add the installation files to the trusted list.



Windows may demand the user to have **Administrator** access rights in order to install the software. Otherwise, the installation will be terminated by Windows.

6. Do not allow Windows to search automatically for the driver software. Instead, select the **Browse my computer for driver software** option.



Select the software drivers manually.



The software drivers are situated on the CD inside the **Drivers** folder.

7. The drivers are situated on the CD inside the **Drivers** folder. These software drivers will operate on 64-bit and 32-bit Microsoft Windows XP\Vista\7\8\10\11 operating systems. The 64-bit drivers are situated in the **\Drivers\64-bit** folder and the 32-bit drivers are situated inside the **\Drivers\32-bit** folder.

8. Windows may display a warning prior to installing the driver software. Ignore the message and select **Install the driver software anyway**.



Ignore the Windows warning.

The drivers installed successfully.

9. Once the drivers have been installed, Windows will identify the camera as **Opticstar DS-616C XL**.
10. If Windows asks you to restart the computer before proceeding, please do so.
11. Your camera and drivers are now installed. Please refer to the **Troubleshooting** section in this guide if the camera and driver installation failed to complete successfully.

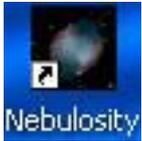


Note that if later you remove the camera from your computer and re-connect it to a different USB 2.0 port Windows may ask for the drivers again. Repeat the above procedure to re-install the drivers for the newly selected USB 2.0 port.

Software Applications

The Opticstar DS-616C XL+ camera can be controlled by **Nebulosity 2**, **AstroArt** and **MaxIm DL**.

Nebulosity



The DS-616C XL+ is bundled with a copy of **Nebulosity v2** as standard. Nebulosity is a fully featured application that provides camera control and image processing. Nebulosity needs to be installed as a first step but it will not provide DS-616C XL+ camera support by default. The DS-616C XL+ software plugin for Nebulosity must be copied into the folder where Nebulosity has been installed.

Nebulosity is ideal for astronomy. It supports long exposures, single or multiple frame capture, and semi-video modes for real time visual observation of deep sky objects.

AstroArt



Users of **AstroArt v4** or later will be interested in the DS-616C XL plugin for **AstroArt**. This plugin adds camera support with 6 binning modes including 1x1, 2x2, and 4x4 all in colour. Fast focus and preview modes are also supported. Please refer to the following pages for detailed instructions.

MaxIm DL



Users of **MaxIm DL v4** or later will need to install the DS-616C XL plugin for **MaxIm DL**. The plugin enables **MaxIm DL** full camera control with many binning modes including: 1x1, 2x2 and 4x4 binning all in colour. There is also support for fast readout speeds in most modes. Please refer to the following pages for detailed instructions.



Please note that the **AstroArt** and **MaxIm DL** software applications are not bundled with the Opticstar DS-616C XL+ camera but may be purchased separately.

Installing Nebulosity v2 and the DS-616C XL Plugin



Nebulosity v2 is a fully featured image processing software especially designed for amateur astronomers. Follow the instructions below to install the Nebulosity software.

1. Insert the supplied CD in the CD/DVD drive.
2. Navigate to the **Nebulosity2** folder on the CD.
3. Double-click (LMB) on the **setup_Nebulosity2.exe** icon.
4. Follow the on-screen instructions to install Nebulosity.

To add support for the DS-616C XL+ camera to Nebulosity v2 please carry out the following steps.

5. Navigate to the **\Plugins\Nebulosity2** folder on the CD.
6. Copy all the files present inside that folder into the folder where Nebulosity has been installed on the hard disk e.g. **C:\Program Files (x86)\Nebulosity2**.
7. To run Nebulosity, double-click (LMB) on the icon.



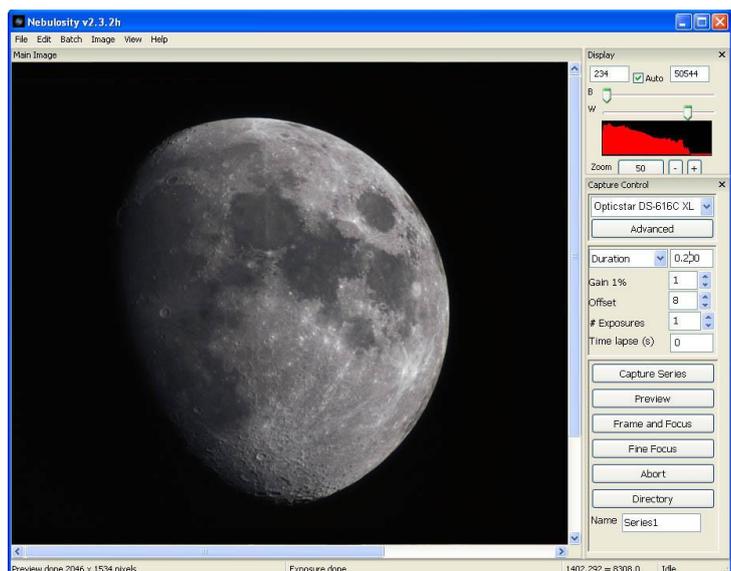
Please refer to the Nebulosity user manual found on the supplied CD in the **Nebulosity2** folder for full instructions. The **Serial Number** can be found on the inside front cover of the camera **Setup Guide** (this guide).

Running Nebulosity v2

In Nebulosity, the DS-616C XL+ can be used in real time mode or in long exposure mode. In real time mode, the camera can display colour images of deep sky objects directly to the computer as they are captured.

Nebulosity must first be configured appropriately by the user depending on the task in hand.

The first step is to select the camera model and get familiar with Nebulosity's right-hand panel settings.

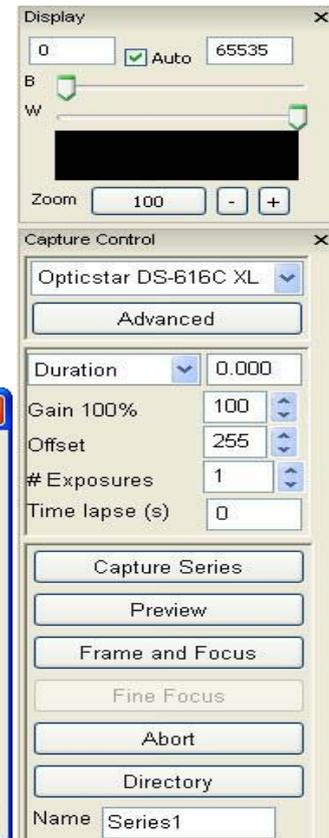
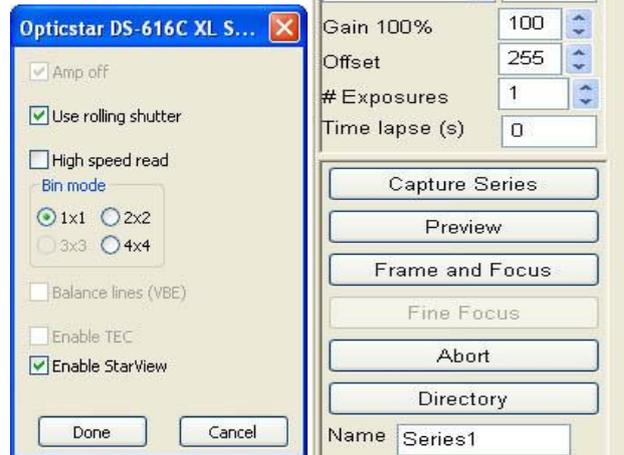


Main Panel

The camera model must be selected from the pull-down menu in the **Capture Control** section. The camera will be identified as "Opticstar DS-616C XL". Clicking on the **Advanced** button opens a small window for image capture options. Typically, these options are used when capturing data as single frames or as a series of single frames. They are not used for streaming real time video images.

Advanced Sub Panel

The **Use Rolling Shutter** option keeps the camera in continuous capture (video like behaviour) more. As soon as one frame has been captured, another one starts automatically. This ensures that there is no pause between frames. When the **High Speed read** option is selected the camera outputs 8-bit data to the computer at high speed. Otherwise the data is output in 16-bit format at standard speed.



The binning modes can be 1x1, 2x2 and 4x4. The 2x2 mode reduces the image resolution to one quarter (1516x1007) of the original but it quadruples the camera's light sensitivity. Similarly, the 4x4 mode reduces the image resolution to one sixteenth (758x503) of the original but the light sensitivity increases by 16 times. Unlike other colour cameras, the DS-616C XL+ can perform binning in colour.

The exposure time can be entered in seconds and milliseconds. Longer exposure times increase light gathering and sensitivity but reduce the camera's frame rate. The **Gain** value can be used to increase the sensitivity of the camera by up to 100%. This signal amplification takes place in the camera and it is combined with noise reduction electronics.

The **StarView** window runs semi independently of Nebulosity itself and it can be used as a very high sensitivity mini video window. It has its own controls for exposure time, gain and brightness. It displays colour video at 36 times higher sensitivity than normal. It can be used to assist in quick focusing and previews. The StarView window cannot be in use when Nebulosity itself reads data from the camera.



The **Offset** value controls the camera's **Black Level**. Typically, high data values contain more noise (bad data) than signal (useful data). The user can adjust this setting to modify at runtime the cut-off point between signal and noise. The most appropriate Offset value depends on many factors including the exposure time, gain value, the target, the binning mode, etc.

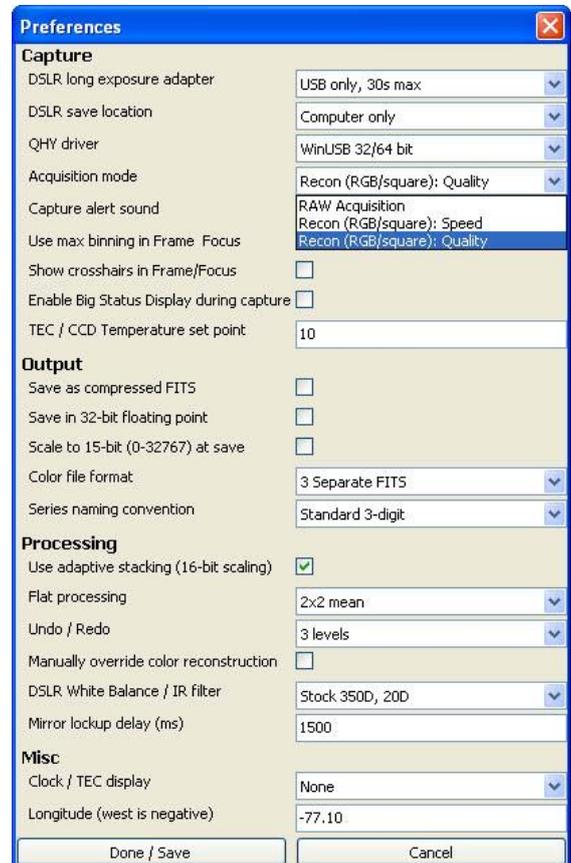
Video Mode

The camera can be set to video mode from the **Preferences** panel. On Nebulosity's main menu at the top select **Edit > Preferences**.

For colour video, in **Acquisition Mode** select **Recon (RGB/square): Quality**. For lower quality but faster video select **Recon (RGB/square): Speed**. By default, these video modes work in 2x2 binning (1516 x 1010 pixels).

The light sensitivity of the video can be increased by reducing the size of the video image by ticking the **Use max binning in Frame Focus** option. This option uses 4x4 binning (758 x 505 pixels).

Close the **Preferences** panel by clicking the **Done / Save** button. From now on, the camera can be run in video mode by clicking the **Frame and Focus** button on Nebulosity's main right-hand panel.



The camera will display video till the **Abort** button is clicked. The video mode in Nebulosity is intended to be used for real time visual observation of deep sky objects as well as planets.

For more information regarding Nebulosity please refer to the user manual on the CD.

Support

There is an active community of Nebulosity users at the following Yahoo Group: <http://tech.groups.yahoo.com/group/stark-labs-astronomy-software/>. Joining this group may be beneficial by sharing the experiences with other Nebulosity users.

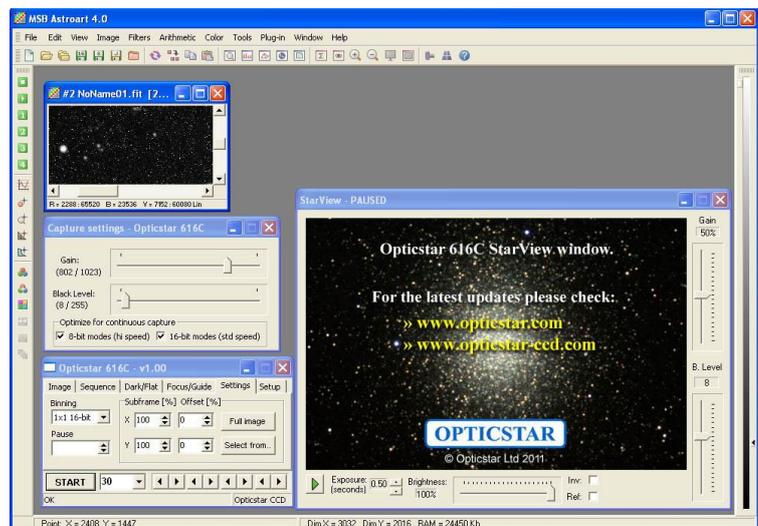
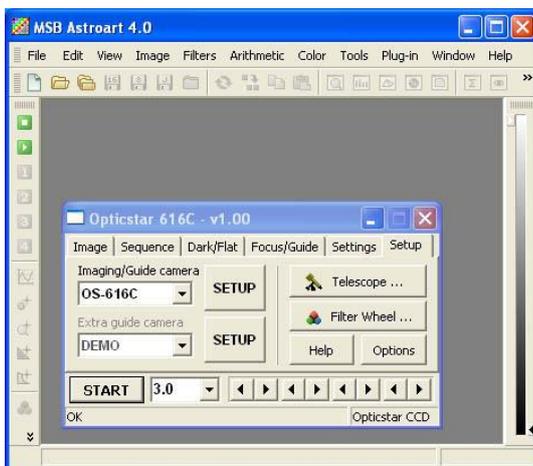
For support related to the camera or the software drivers, or the Nebulosity plugin, please email us at: info@opticstar.com

Installing the DS-616C XL Plugin for AstroArt



AstroArt is powerful image processing software especially designed for amateur astronomers. Before installing the plugin, please ensure that the camera's software drivers and AstroArt have already been installed on the computer. Follow the instructions below to add support for the DS-616C XL+ camera to AstroArt.

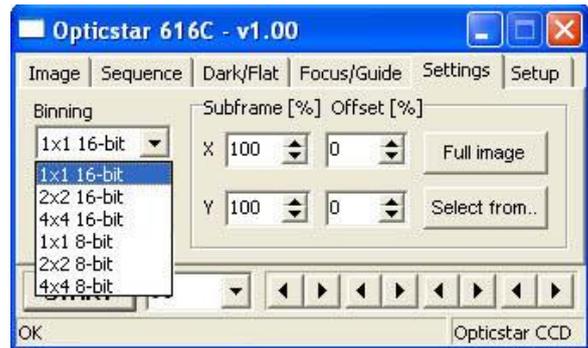
1. Insert the supplied CD in the CD/DVD drive.
2. Navigate to the **\Plugins\AstroArt** folder.
3. Copy all the files from that folder on the CD into the folder where AstroArt has been installed on the hard disk e.g. **C:\Program Files (x86)\AstroArt**.
4. Run AstroArt.
5. From the **Plug-in** menu select **CCD Camera**.
6. Select the appropriate camera model identified as **OS-616C** and click on the **Check CCD** button.



7. The camera will be initialized and the **StarView** window will appear. The **StarView** window offers real-time video for focusing and previews. This is an additional focus mode to the standard modes offered by AstroArt. A second additional window will also appear titled **Capture settings – Opticstar 616C**.

Binning Modes

There is support for 6 binning imaging modes. These modes have been included in order to maximize the performance of the camera in specific areas including: resolution, sensitivity and focusing. All binning modes produce colour data.



Mode	Binning	Bit Depth	Mono	Colour	Resolution	FPS (max)	Sensitivity
1	1x1	16-bit	yes	yes	3032x2014	0.5	X1
2	2x2	16-bit	yes	yes	1516x1007	0.5	x4
3	4x4	16-bit	yes	yes	758x503	0.5	X16
4	1x1	8-bit	yes	yes	3032x2014	1.0	X1
5	2x2	8-bit	yes	yes	1516x1007	1.0	x4
6	4x4	8-bit	yes	yes	758x503	1.0	X16

Higher Image Quality

The 16-bit modes offer the highest quality data but at a lower speed. The first three modes (1 – 3) offer colour binning in 16-bits per pixel. They offer the highest quality colour data.

Higher Speed

The 8-bit modes are (4 – 6) used for higher frame rates and data readout speeds. These modes are appropriate for focusing and fast previews (not for data analysis). Typically, when operating in these modes, the camera is in continuous video mode and it does not set/reset itself for every individual frame captures. It continuously sends to the computer the data for every frame it captures rather than waiting for the user to request the data. This ensures the highest camera speed and image acquisition.

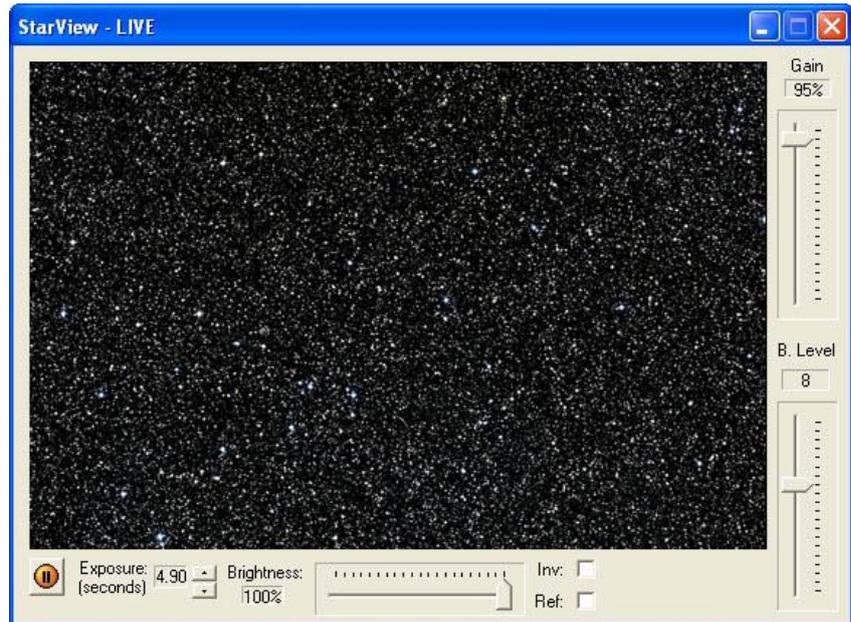
The continuous data capture option is selected by default whether the camera operates in 8-bit or 16-bit mode. The user has the option to deselect it. Please refer to the **Capture Settings** section below for more details.

When the camera is used at very short exposure times e.g. a few seconds or less (focusing, previewing, etc) it should always be used in continuous capture mode.

StarView

The **StarView** window cannot be in use simultaneously with AstroArt's capture and focus modes. StarView provides a high sensitivity preview mode (6x6 binning) in colour. The exposure time can be set between 100 milliseconds and 10 seconds.

The hardware **Gain** function can be set using the vertical slide bar on the StarView window.

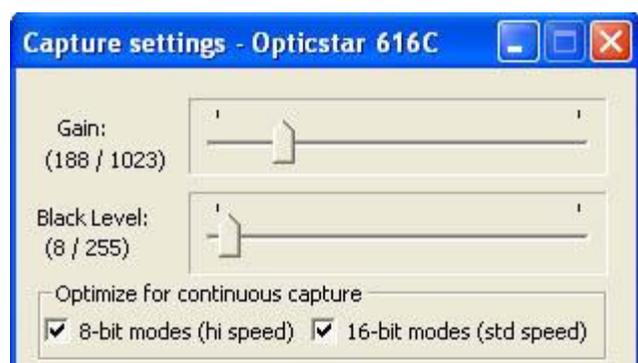


Raising the **Gain**, greatly increases the light sensitivity of the camera. This **Gain** setting only affects the StarView window. Similarly, the black level value for the StarView window can be selected on the **B Level** slide bar. This value sets the range of data captured by the camera. The **Brightness** slide bar can be used to adjust the brightness of the StarView image.

It is also possible to invert or reflect the image displayed on the StarView window by ticking the **Inv** and **Ref** options in the bottom right hand corner of the StarView window.

Capture Settings

The **Capture Settings** window includes two slide bars that control two of the camera's most important hardware functions. The **Gain** settings increases the light sensitivity of the camera dramatically when AstroArt captures image data (excludes StarView). The maximum **Gain** value can double the sensitivity of the camera but it will also introduce some noise. Setting the **Gain** at 50% will give a significant boost in sensitivity while keeping noise levels low.



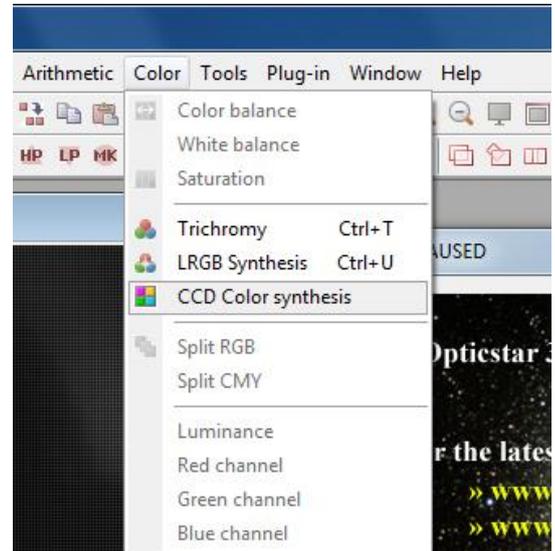
The **Black Level** function sets the lowest value of image data captured by the camera that is considered useful (e.g., signal rather than noise). Any data captured below this level is considered noise and it is discarded. This enables the camera to maximize its dynamic range with useful data.

The 8-bit and 16-bit optimization modes eliminate pauses between successive exposures as long as the exposure time remains constant and the binning mode does not change. In most cases it is preferable to set the camera in continuous capture mode for 8-bit and 16-bit binning modes.

Colour Synthesis

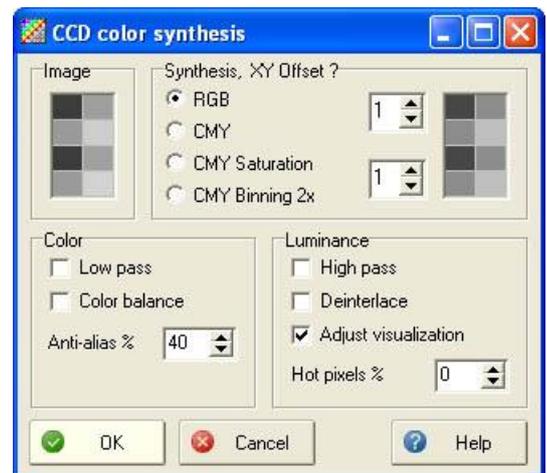
By default, all images captured in AstroArt (but not in StarView) are displayed in raw format. Raw data broadly resembles a monochrome image but in reality, it is not. The raw data includes the colour information that can be used to produce a colour image.

The process of converting raw data into a colour image is called **Colour Synthesis**. This option can be selected from AstroArt's main menu under **Color > CCD Color Synthesis**.



In order to reproduce the colour information correctly, the **RGB** layout (RGB Matrix) must be configured in AstroArt. The **X** and **Y Offset** values must be set at **1** and **1** respectively as shown on the right-hand side.

If a small region of data has been captured rather than the full CCD image area, then it is likely that the offset values may have to be set at different values. This is also the case for some of the colour binning modes. Please refer to the AstroArt documentation for more information.



Support

There is an active community of AstroArt users at the following Yahoo Group: <http://tech.groups.yahoo.com/group/AstroArt/>. Joining this group may be beneficial by sharing the experiences with other AstroArt users.

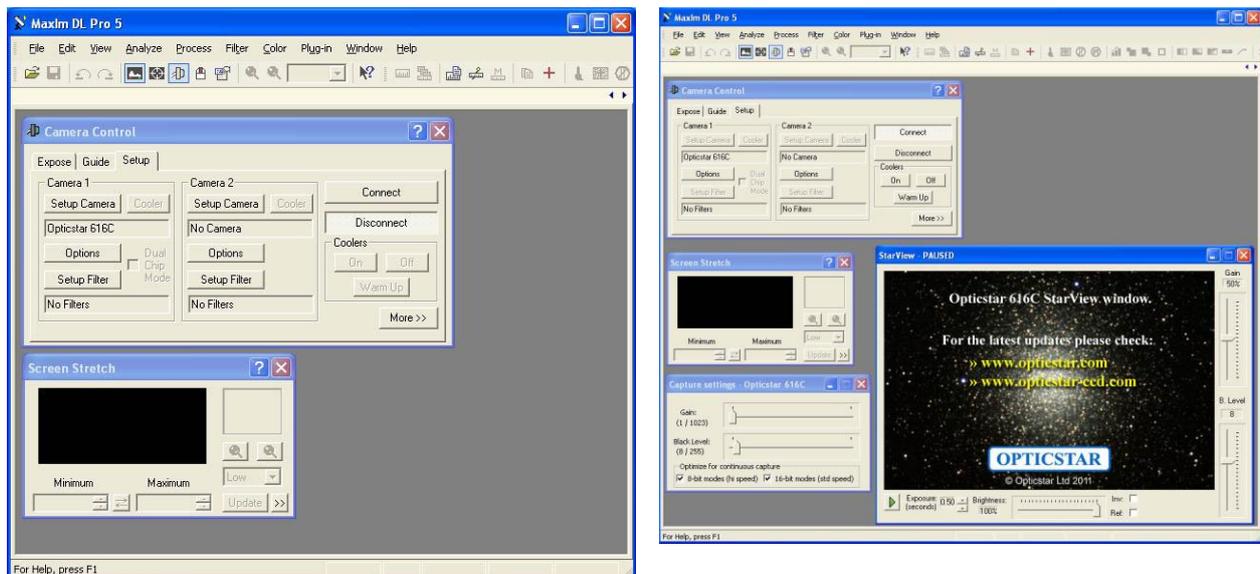
For support related to the camera or the software drivers, or the AstroArt plugin, please email us at: info@opticstar.com

Installing the DS-616C XL Plugin for Maxim DL v4/v5



MaxIm DL is a powerful image capture and processing software especially designed for amateur astronomers. Before installing the plugin, please ensure that the camera's software drivers and MaxIm DL have already been installed on the computer. Follow the instructions below to add support for the DS-616C XL+ camera to MaxIm DL.

1. Insert the supplied CD in the CD/DVD drive.
2. Navigate to the **\Plugins\MaxImDL** folder.
3. Copy all the files from that folder into the folder where MaxIm DL has been installed on the hard disk e.g.
C:\Program Files (x86)\Diffraction Limited\MaxIm DL V5.
4. Run MaxIm DL.
5. Click the **Toggle CCD Control** icon and select the DS-616C camera identified as **Opticstar 616C**.



6. The camera will be initialized and the **StarView** window will appear. The **StarView** window offers real-time video for focusing and previews. This is an additional focus mode to the standard modes offered by MaxIm DL. A second additional window will also appear titled **Capture settings – Opticstar 616C**.

Binning Modes

There is support for 6 binning imaging modes. These modes have been included in order to maximize the performance of the camera in specific areas including: resolution, colour/monochrome, sensitivity and focusing.



Mode	Binning	Bit Depth	Mono	Colour	Resolution	FPS (max)	Sensitivity
1	1x1	16-bit	yes	yes	3032x2014	0.5	X1
2	2x2	16-bit	yes	yes	1516x1007	0.5	x4
3	4x4	16-bit	yes	yes	758x503	0.5	X16
4	1x1	8-bit	yes	Yes	3032x2014	1	X1
5	2x2	8-bit	yes	Yes	1516x1007	1	x4
6	4x4	8-bit	yes	Yes	758x503	1	X16

Higher Image Quality

The 16-bit modes offer the highest quality data but at a lower speed. The first three modes (1 – 3) offer colour binning in 16-bits per pixel. They offer the highest quality colour data.

Higher Speed

The 8-bit modes are (4 – 6) used for higher frame rates and data readout speeds. These modes are appropriate for focusing and fast previews (not for data analysis). Typically, when operating in these modes, the camera is in continuous video mode and it does not set/reset itself for every individual frame captures. It continuously sends to the computer the data for every frame it captures rather than waiting for the user to request the data. This ensures the highest camera speed and image acquisition.

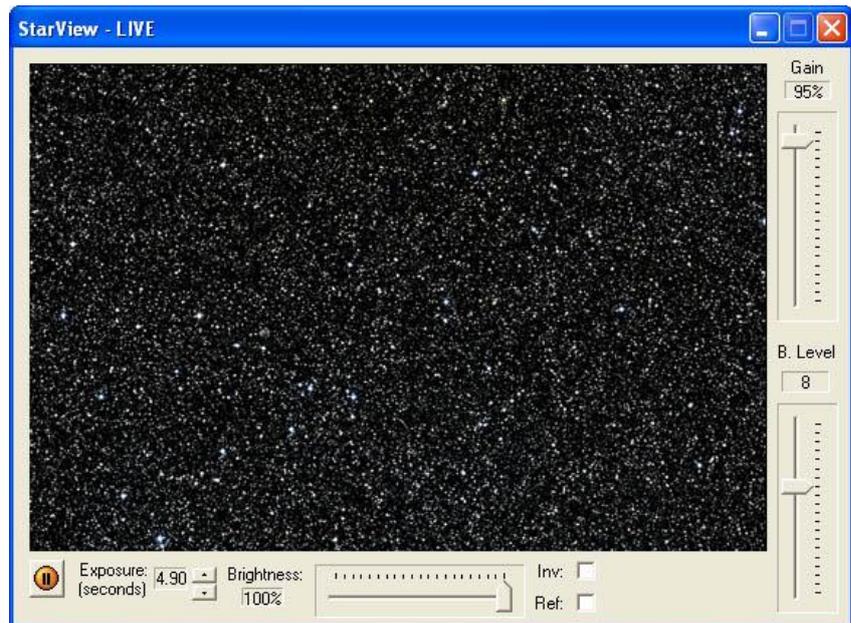
The continuous data capture option is selected by default whether the camera operates in 8-bit or 16-bit mode. The user has the option to deselect it. Please refer to the **Capture Settings** section below for more details.

When the camera is used at very short exposure times e.g., a few seconds or less (focusing, previewing, etc) it should always be used in continuous capture mode.

StarView

The **StarView** window cannot be in use simultaneously with MaxIm DL's capture and focus modes. StarView provides a high sensitivity preview mode (6x6 binning) in colour. The exposure time can be set between 100 milliseconds and 10 seconds.

The hardware **Gain** function can be set using the vertical slide bar on the StarView window.

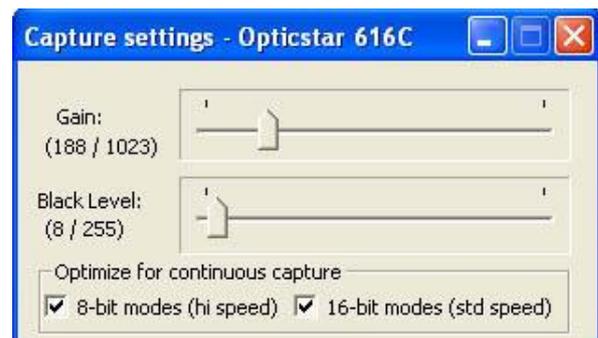


Raising the **Gain**, greatly increases the light sensitivity of the camera. This **Gain** setting only affects the StarView window. Similarly, the black level value for the StarView window can be selected on the **B Level** slide bar. This value sets the range of data captured by the camera. The **Brightness** slide bar can be used to adjust the brightness of the StarView image.

It is also possible to invert or reflect the image displayed on the StarView window by ticking the **Inv** and **Ref** options in the bottom right-hand corner of the StarView window.

Capture Settings

The **Capture Settings** window includes two slide bars that control two of the camera's most important hardware functions. The **Gain** settings increases the light sensitivity of the camera dramatically when MaxIm DL captures image data (excludes StarView). The maximum **Gain** values can double the sensitivity of the camera but it will also introduce some noise. Setting the **Gain** at 50% will give a significant boost in sensitivity while keeping noise levels low.



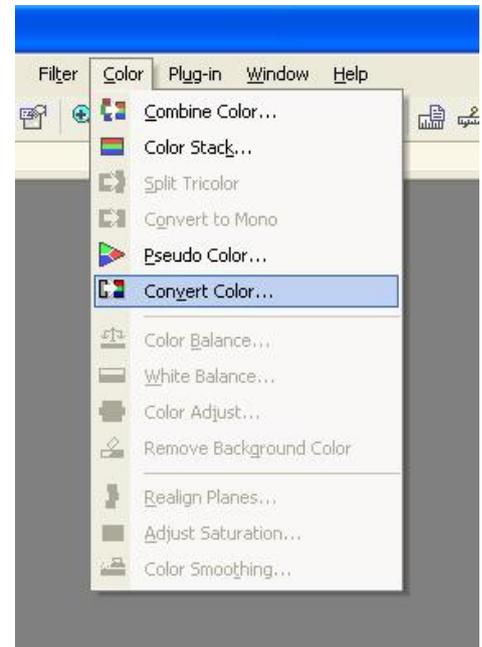
The **Black Level** function sets the lowest value of image data captured by the camera that is considered useful (e.g., signal rather than noise). Any data captured below this level is considered noise and it is discarded. This enables the camera to maximize its dynamic range with useful data.

The 8-bit and 16-bit optimization modes eliminate pauses between successive exposures as long as the exposure time remains constant and the binning mode does not change.

Colour Synthesis

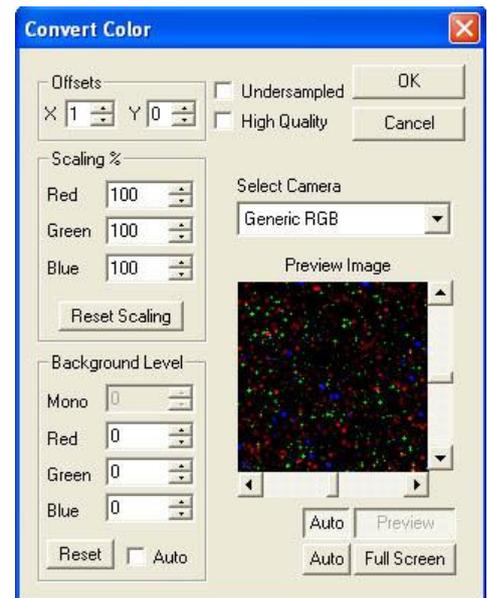
By default, all images captured in MaxIm DL (but not in StarView) are displayed in raw format. Raw data broadly resembles a monochrome image but in reality, it is not. The raw data includes the colour information that can be used to produce a colour image.

The process of converting raw data into a colour image is called **Colour Synthesis**. This option can be selected from MaxIm DL's main menu under **Color > Convert Color....**



In order to reproduce the colour information correctly, the **RGB** layout (RGB Matrix) must be configured in MaxIm DL. Select the camera as **Generic RGB**. Typically, the **X** and **Y Offset** values should be set at **1** and **0** respectively as shown on the right-hand side. However, these values are not always appropriate for all binning modes. Certain binning modes require different offset values. For example, for binning at 4x4, the offsets should be **1** and **1**.

If a small region of data has been captured rather than the full CCD image area, then it is likely that the offset values may have to be set at different values. Please refer to the MaxIm DL documentation for more information.



Support

There is an active community of MaxIm DL users at the following Yahoo Group: <http://tech.groups.yahoo.com/group/MaxImDL/>. Joining this group may be beneficial by sharing the experiences with other MaxIm DL users.

For support related to the camera or the software drivers, or the MaxIm DL plugin, please email us at: info@opticstar.com

Troubleshooting

This section is divided into smaller sections covering various topics including information on system requirements, installation, drivers, USB issues, USB cable lengths, camera performance etc.

System Requirements

The Opticstar DS series cameras require a modern PC running Microsoft Windows (64-bit or 32-bit) XP/Vista/7/8/10/11. Please make certain that you have installed the latest windows updates that are available free of charge at www.microsoft.com. A USB2.0 or USB 3.0 port is also a requirement. This port should be preferably dedicated to the camera and not shared by another bandwidth hungry device like a guide camera.

Installation Issues

In case Windows 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 when this has been connected for the first time to a working USB2.0 or USB 3.0 port. Once Windows has recognised the camera it will proceed with driver installation.

Windows does not Recognise the Camera

If you experience camera/driver installation issues please ensure that:

1. Your PC meets the minimum requirements.
2. The drivers are present in the Windows Device Manager.
3. The drivers are working properly.

In case the PC is unable to recognise the camera try connecting the camera to a different USB port that resides on a different USB controller. In other words, if installation has failed on a USB port on the front of your PC also try the USB ports on the back of your PC.



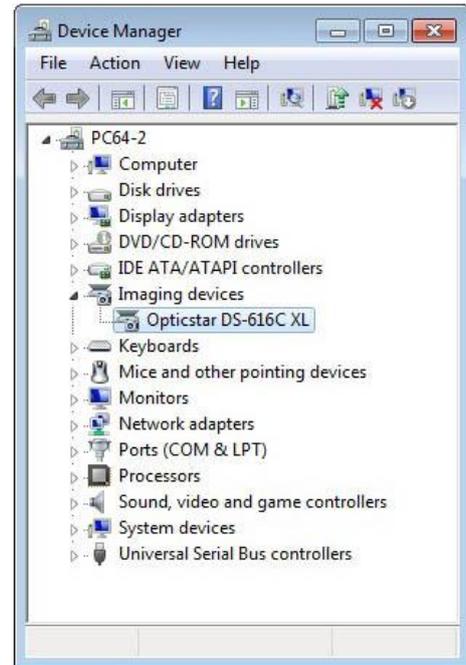
If your computer's USB ports do not meet the full specification of the USB2.0 or USB3.0 standard, you may need to use a USB 2.0 Repeater cable between the computer and the camera. Please refer to the *USB Extensions* section below for more details.

Connecting the camera to a USB2.0 port that resides on the computer's motherboard is the best way to resolve such issues. Windows will only need to recognise your camera the first time that this has been connected to a certain USB 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 have been installed correctly you must open the **Windows Device manager**. The **Device Manager** can be accessed from the Windows desktop depending on the version of the operating system. If you are not sure how to access it, press **F1** on the keyboard while on the Windows desktop to access the **Help and Support Center**. Once there, search for "Device Manager".

In **Device Manager**, the camera will be listed under **Imaging devices**.



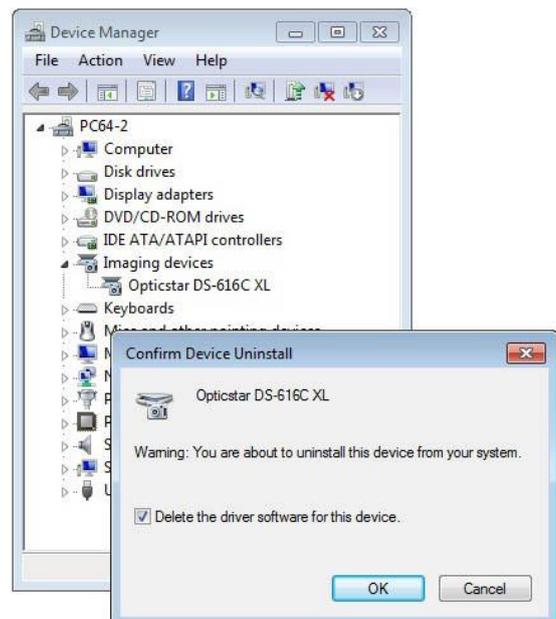
Check that the Opticstar driver entry does not show any conflicts. If there is a conflict this will appear as an exclamation mark over the Opticstar driver entry.

If there is a driver error, you will need to resolve the conflict before proceeding. A conflict may be as a result of another device being present also showing a conflict. If you are unable to resolve the conflict then you may have to remove or momentarily disable the offending driver. You can re-enable a disabled driver at any time using the same sub-menu.

Camera Driver Removal

You can uninstall the drivers while the camera is connected, via the **Windows Device Manager**. Right-click on the driver entry and select **Uninstall** to remove the drivers.

Once the drivers have been removed, disconnect the camera from the computer and wait for a few seconds before connecting it again.



Re-installing the Camera and Drivers

If you wish to re-install the camera, its drivers and software for any reason please refer to the instructions below.

1. Uninstall the camera drivers (please refer to the previous section).
2. Unplug the camera from the computer.
3. Switch off your PC and leave it switched off for at least 30 seconds.
4. Switch on your PC.
5. Refer to the installation section earlier in this document titled **Installing the Software Drivers** to re-install the camera and its drivers.

Camera Performance

The camera is capable of high transfer rates of up to 12MB/second. The image data sent to the computer by the camera is at high resolution 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.

The speed at which images will be transferred to the PC will depend on the speed of the USB2.0 bus. Please refer to the section headed USB Bus Speed later in this manual.

USB Bus Speed

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 rates for the three different types are:

1. USB2.0-PCMCIA/2 card (varies greatly, the latest laptops tend to perform well)
2. USB2.0-PCI type card is 250Mbps (typical)
3. USB2.0 is 480Mbps (USB on motherboard)

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. This is particularly important when using the camera with laptops.

USB Extensions

The camera comes with a USB2.0 cable. The cable can be extended by up to 5 metres total with a standard high-speed USB 2.0 cable before a special USB2.0 repeater cable is required to further extend the total length. USB2.0 5 metres repeater cables can be used to extend the total length to an absolute maximum of 25 metres. The DS-616C XL+ will function with standard USB2.0 repeater cables to a typical cable length of 12.5 meters depending on the type of USB2.0 repeaters used.

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 CCD 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 can also be used that offer better results 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.

Computer Latency

Certain computer devices such as video grabbers, multimedia devices, modems, Wi-Fi, etc, can cause latency even when they are not in use. This latency can be eliminated by temporarily disabling such devices in the Windows Device Manager. There are freely available latency checking programs that can be used to identify such issues.

Good Practices

Your DS camera is sealed to protect the sensor and electronics. Do not open your camera under any circumstances as this will break the seal and make the camera susceptible to moisture and dust. Do not drop your camera as this can result in serious damage to the on-board electronics and sensor.

Camera Cleaning

To clean the camera body, use a wet cloth and lukewarm water. Avoid touching the camera window as this may scratch the glass and damage the optical coatings. Only use special lens cleaning cloths and/or pressurised air, do not rub!

Camera Power Requirements

Only use the supplied power supply unit that comes with the camera. Using the wrong power supply will cause damage to the cooling subsystem and/or camera.

Overexposing the Camera to Strong Light

Never point the camera through a telescope to a bright light source like the Sun without the appropriate filters, doing so will damage the camera sensor!

Support

For support regarding the Opticstar DS-616C XL+ please email Opticstar at: **info@opticstar.com**.

Other Software

There is some freely available third-party software that may be of interest to some users. Please note that Opticstar cannot guarantee the suitability the software.

- Deep Sky Stacker. (<http://deepskystacker.free.fr>).
- RegiStax. (<http://www.astronomie.be/registax/>)

These programs can be used to post-process image files captured in other software. They can stack, align and enhance multiple frames into a single high quality "master" image.

Camera Specification

Model	Opticstar DS-616C XL+
Sensor type	Sony ICX413AQ Interline CCD
Sensor size	25.10mm x 17.64mm (1/8")
Resolution	6.1 Megapixels, 3032 x 2014 pixels
Pixel size	7.80µm x 7.80µm
G Sensitive (max)	1200 mV (Gain off)
Binning modes	1x1, 2x2 and 4x4 All modes in colour
Analogue to Digital Converter	12-bit
Minimum exposure time	1 millisecond
Maximum exposure time	~ 1 hour
Frame rate (max)	1 fps at 3032 x 2014 @ 8-bit, 0.5fps @ 16-bit
Data output	16-bit or 8-bit data in colour
Signal Amplifier	Gain in hardware with up to 100% sensitivity boost combined with noise reduction electronics
Black Level	In hardware
Cooling mechanism	Thermo Electric Cooling, up to 30°C below ambient temperature
Cooling fan	80mm x 80mm / 5000 rpm
Optical Interface	T-mount
Computer interface	USB 2.0 including cable
Housing	Robust all metal case, sealed sensor and electronics
Camera window	AR antireflection, no infra-red IR cut-off
Dimensions	108mm x 105.5mm x 57.3mm
Weight	750 grams approx.
Storage temperature	-20°C to 70°C
Software	Nebulosity v2 software for camera control and image processing. Plugins for Nebulosity 2, AstroArt & MaxIm DL.
Computer requirements	Microsoft Windows (64-bit & 32-bit) XP/Vista/7/8/10/11; USB 2.0 or USB 3.0;

All information is correct at the time of writing



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