User Guide

ZEISS Axiocam 512 color/mono

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Original Manual

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Content

1 General information

1.1 Introduction

Welcome Welcome to the Axiocam 512 user documentation.

The camera is a professional digital camera for universal light microscopy with a high resolution 12 Megapixel sensor and a USB 3.0 interface.
To set up the camera correctly, follow the instructions in this guide step by step.

Content

Chapter	Content
About this guide	Includes an introduction and overview about this guide.
Safety	Provides important information on a safe handling with the Axiocam 512. **Read this chapter, before unpacking the camera and putting it into operation.**
Shipment	Describes the contents of delivery and optional attachments.
Technical data	Includes all technical data to your camera.
Connecting the camera	Provides detailed instructions on connecting and using the camera.
Installing software and drivers	Describes how to install ZEISS software and camera drivers.
Trouble-shooting	Includes some solutions to various problems. If you can not solve your problem, contact the ZEISS support.
Maintenance	Describes some measures for the maintenance and care of your camera. For greater damage always contact the ZEISS support.
Disposal and Recycling	Includes important instructions for disposal and recycling.

1.2 Explanation warning messages and additional information

The safety notes in this document follow a system of risk levels, defined in the following manner:

> ⚠ **CAUTION**
>
> **Risk of personal injury**
>
> CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate personal injury.

> **NOTICE**
>
> **Risk of property damage**
>
> NOTICE indicates a property damage message. In addition, NOTICE is used for data loss or corrupt data.

> **Info**
>
> Indicates useful additional information. It helps you to make your daily work easier, but it is optional. There is no risk for personal injury or property damage involved.

1.3 Text formats and conventions

Bold texts

Bold is used for texts within the software like names of GUI elements (e.g. buttons, sections, tools, menus), buttons on a device, and product names (e.g. **MTB 2011**).

Font type "Courier"

```
Used for programming code, e.g. macro code as well as for any-
thing that you would type literally when programming, includ-
ing keywords, data types, constants, method names, variables,
class names, and interface names.
```

Shortcuts and key commands

Shortcuts are written like *Crtl*+*C*, meaning you should press *Crtl*-Key and *C*-Key simultaneously.

Procedures

The following formats are used for procedures (instructive sequences):

Prerequisite ✓ stands for a condition which must be fulfilled before starting with the action.

1. stands for a single step the user is asked to perform.

Web-Links

Web links appear in blue text. To open the linked website, simply click on the link. Please make sure you have an internet connection established before opening the web link.

2 Safety

2.1 Safety notes

The camera has been manufactured and tested by ZEISS according to the regulations specified in CE and has left the manufacturer's premises in perfect working order. In order to ensure that this condition is maintained and to avoid any risks when operating the system, the user must comply with any notes and warnings contained in this manual. The manufacturer shall be exempt from statutory liability for accidents should the operator fail to observe the safety regulations.

⚠ **CAUTION**

Personal Injury

To avoid personal injury, read and adhere to the safety notes below.

‣ To avoid the risk of fire or explosion, do not use the camera near inflammable liquids or gases.

‣ Setup, expansions, re-adjustments, alterations, and repairs must be carried out only by persons who have been authorized by ZEISS.

‣ Do not allow any cables, particularly power cords, to trail across the floor, where they can be snagged by people walking past.

‣ Protect the cables from excessive heat (e.g. halogen lamps, microscope fluorescence illumination).

NOTICE

To avoid equipment damage, data loss, or corrupted data, read and adhere to the safety notes below.

‣ Protect the camera against mechanical impact. External damage may affect the operation of inner components.

‣ Keep chemicals and fluids away from the camera.

‣ Make sure there is sufficient ventilation of the camera head. Avoid direct exposure to sunlight and locations near heat sources (radiators, stoves). Overheating can cause noisy images.

‣ Use the camera in a clean and dry location.

‣ Attach all connectors firmly and securely.

‣ Use only the accessories supplied by ZEISS, when applicable.

‣ Use only normal microscope cleaning material to clean the camera housing.

‣ Contact your local ZEISS service organization if a repair is necessary.

‣ Save all your data, such as images, measurement data, archives, reports, forms and documents, at regular intervals on an external storage medium. Otherwise it cannot be avoided that access to this data may be lost as a result of operational errors or hardware defects. ZEISS accepts no liability for consequential damage resulting from insufficient data protection.

2.2 Limitation of liability

No warranty shall be assumed by ZEISS during the warranty period if the equipment is operated without observing the safety regulations. In any such case, ZEISS shall be exempt from statutory liability for accidents resulting from such operation.

2.3 Warranty

ZEISS shall be exempt from any warranty obligations should the user fail to observe the safety regulations. ZEISS only guarantees the safety, reliability, and performance of the system if the safety notes are closely observed.

3 Technical Data

3.1 Axiocam 512 color/mono

Feature	Value
Sensor Model	**Axiocam 512 color:** Sony ICX 834AQG, EXviewHAD CCD II ™, Progressive Scan, Quad-Port Readout, pre-selected sensor quality **Axiocam 512 mono:** Sony ICX 834ALG, EXviewHAD CCD II™, Progressive Scan, Quad-Port Readout, pre-selected sensor quality
Sensor Pixel Count	12 Megapixel: 4250 (H) × 2838 (V)
Pixel Size	3,1 µm x 3,1 µm
Sensor Size	Image Diagonal 15,8 mm, equivalent to 1" Sensor Format Image Field 13,1 mm x 8,8 mm
Spectral Sensitivity	**Axiocam 512 color:** app. 400 nm-720 nm, coated Hoya C5000 IR Cut Filter, RGB Bayer color filter mask **Axiocam 512 mono:** App. 350 nm-1000 nm, coated BK7 protection glass, broadband coated
Max Full Well Capacity (typical)	9.000 e- per pixel
Signal Amplification	Adjustable analog amplification 1x, 2x, 3x
Digitization	14 Bit / Pixel
Read Out Speed	39 MHz, 13 Mhz, switchable readout clock speed
Readout Noise (typical)	6.8 e- at 39 Mhz 6.5 e- at 13 Mhz
Dynamic Range (typical)	1:1380 (63dB)
Dark Current (typical)	< 0,1 e-/p/s at 23 °C sensor temperature
Cooling	Regulated Peltier-Cooling, (power supplied through USB 3.0 and USB 2.0 ports), Delta-T 20° C, sensor temperature 23°C
Dark Current Compensation	Digital Dark Current Compensation for optimum low light performance at long exposure times, Automatic Hot Pixel Correction
Exposure Time Range	250 µs to 60 s
Color Interpolation Modes	**Axiocam 512 color:** "High Speed": optimum speed color interpolation "High Quality": optimum quality color interpolation
Data-Post Processing (optional)	▪ Objective specific shading correction ▪ Sharpening, Noise Filter, Color Enhancement

Feature	Value
	▪ Black Reference, Dark Current Compensation
Special Features	▪ Time Stamp from Camera for precise acquisition time point
	▪ Auto Switch Mode for Single Port/Dual Port/Quad Port Readout
	▪ Adjustable intensity of status LED
Special Preset Modes	Eight pre-loadable sets of imaging parameters for speed-optimized multi-modal image acquisition, overlapping exposure and readout for fast time lapse imaging
Switchable Sensor Output Amplifier	Single Port Readout mode for long exposure times for maximum signal quality, Dual Port and Quad Port Readout Mode for improved readout speed at full resolution, automatic port activation mode or full manual mode
Region of Interest (ROI)	User defined imaging sub area for improvement of readout speed and reduction of amount of data
Hardware Trigger	Galvanic isolated I/O signals, three output signals: exposure time, readout time, trigger ready (i.e. for controlling external mechanical shutters), one trigger input for exposure control, 5V auxiliary voltage, GND
Status LED	Top LED: Camera Status (acquisition, power, cooling, speed)
	Back LED: Trigger status
Interface	USB 3.0 SuperSpeed (5 Gbit/s), bandwidth max. 240 Mbytes/s USB 2.0 optional, with lower speed
Optical Interface	C-Mount (17.5 mm)
Max. File Size per image	**Axiocam 512 color:** app. 72.2 MB per image with 4248 x 2832 Pixels at 3 x 14 Bit/Pixel (36 Bit color depth)
	Axiocam 512 mono: app. 24 MB per image with 4248 x 2832 Pixels at 14 Bit/Pixel
Operating Systems	Microsoft® Windows 7 Enterprise and higher
Size / Weight	10.8 cm x 7.8 cm x 4.3 cm / 500 g
Housing	Blue anodized aluminum, ¼" thread for camera equipment, zero Vibration by convection-cooling with optimized cooling fins, teflon coated C-mount thread
Certificates	CE

Feature	Value
Power Supply	7W power supply by USB 2.0 and USB 3.0-Bus from PC for maximum performance connection to USB 3.0 and USB 2.0 required, dual connection cabling provided with camera
Ambient Conditions (Operation)	+5° ... +35° Celsius max. 80% relative humidity, non-condensing, free air circulation required,
Ambient Conditions (Storage)	-15° ... +60° Celsius 90% relative humidity at +40° Celsius, 80% relative at +20° Celsius, non-condensing

3.1.1 Binning Mode and Frame Rate

Axiocam 512 color

Binning	H x V	Mode	FPS @ 1ms
1x1	4248 x 2832	Color/Mono	10
2x2	2120 x 1416	Mono	19
3x3	1416 x 944	Color/Mono	26
4x4	1056 x 708	Mono	31
5x5	848 x 564	Color/Mono	35
ROI	1936 x 1080	Color/Mono	22
ROI	1936 x 512	Color/Mono	36

Axiocam 512 mono

Binning	H x V	Mode	FPS @ 1ms
1x1	4248 x 2832	Mono	11
2x2	2120 x 1416	Mono	20
3x3	1416 x 944	Mono	27
4x4	1056 x 708	Mono	32
5x5	848 x 564	Mono	36
ROI	1936 x 1080	Mono	23
ROI	1936 x 512	Mono	36

3.1.2 Live Image Frame Rates

Axiocam 512 color Max. Ratings at optimum hardware settings, Color Enhancement off:

Max. Frame Rate	Binning Factor / Mode	Pixel Count
10 frames/s	1 / slow	4248 x 2832
26 frames/s	3 / medium	1416 x 944
35 frames/s	5 / fast	848 x 564

Axiocam 512 mono Max. Ratings at optimum hardware settings:

Max. Frame Rate	Binning Factor / Mode	Pixel Count
10 frames/s	1 / slow	4248 x 2832
19 frames/s	2 / medium	2120x1416
26 frames/s	3 / fast	1416x944

Info

Computer hardware, operating system and software may decrease the frame rates. Selecting a part of the sensor area or applying binning can increase the frame rate. All specifications are subject to change without notice.

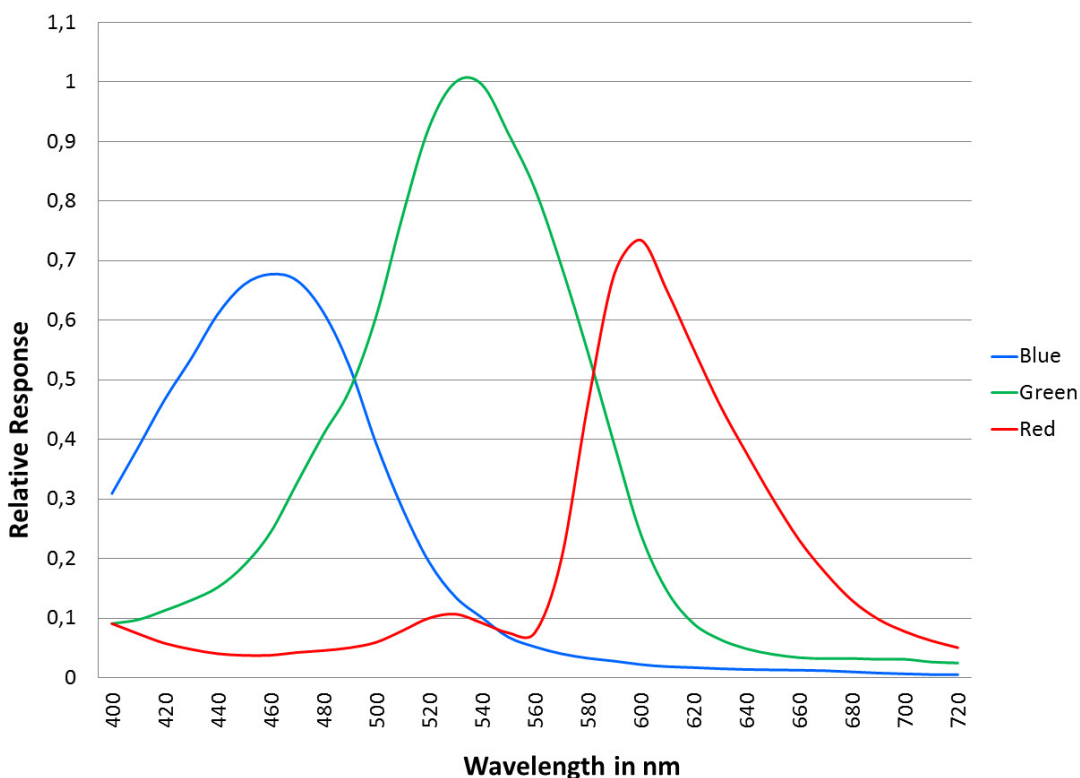### 3.1.3 Spectral Sensitivity

Axiocam 512 color

Fig. 1: Axiocam 512 color incl. Hoya C5000 IR Cut Filter

Axiocam 512 mono

Fig. 2: Spectral Sensitivity Axiocam 512 mono

4 Shipment

Content	Order Number
1 x Axiocam 512 color camera **or** 1 x Axiocam 512 mono camera	426560-9000-000 426560-9020-000
1 x USB cable (2 in one) for power supply (USB 2.0 = black cable) and data transfer (USB 3.0 = blue cable)	
1 x PCI express interface card (4 x USB 3.0)	
1 x 15 Pin SATA power connector cable	
1 x DVD with device driver for ZEISS software as well as this guide as a PDF file.	

Accessory (optional)

Fig. 3: Axiocam trigger cable

Content	Order Number
Trigger cable	426557-0001-000

5 Connecting the Camera

5.1 Camera Overview

Camera connections

Fig. 4: Camera back

Number	Description
1	Trigger connection
2	USB 2.0 connection for power supply and cooling
3	USB 3.0 connection for image / controller data and power supply
4	¼ " photo thread (tripod connection)

5.2 Building in the interface card

This chapter describes how to build in the PCI express interface card (4 x USB 3.0) into your PC.

> **NOTICE**
>
> **Static Electricity**
>
> Static electricity can damage electronic components. To protect electronic components against static electricity, do not touch them until you have grounded yourself to the casing of the device. Never touch the contacts of the electronic components. We also recommend that you work only on an antistatic mat.

Prerequisite ✓ You have read the documentation of the interface card and of your computer before inserting the interface card.

1. Switch off your PC and all connected peripherals.
2. Disconnect the PC and the peripherals from the mains and open the computer case.
3. Examine your PC's power supply to see if it has Molex type connectors or SATA type connectors. Choose the appropriate power connector cable for the following steps. If your PC's power supply has both connector types, choose only one cable.

4. Connect the appropriate power connector cable to one of the open connectors from your computer's power supply.
5. Connect the other end of the power cable to the PCIe interface card.
6. Insert the PCIe interface card into the appropriate slot on your computer.
7. Close the computer case and reconnect the peripherals.

You can now mount the camera on the microscope and connect it to the PC via the USB 3.0 interface, see chapter *Connecting the camera to the PC [▶ 16]*.

5.3 Mounting the camera on the microsope

To mount the camera onto your microscope's TV port, use a C-mount adapter. The adapter is not included in the shipment. You will find some suitbale examples for adapters in the list below:

Port	Name	Order Number
44	Video Adapter 44 C 2/3" 1,0x	452995-0000-000
60	Camera Adapter 60 C 1" 1,0x	456105-9901-000
60	Video Adapter 60 C 2/3" 0,63x	000000-1069-414
60N	Camera Adapter 60N-C 1" 1,0x	426114-0000-000
60N	Camera Adapter 60N-C 2/3" 0,63x	426113-0000-000

NOTICE

Loss of warranty

The Axiocam 512 color is delivered with an integrated IR filter (infrared cut filter). The Axiocam 512 mono is delivered with an integrated BK7 protective glas. This will protect the camera against dust and reduces optical interferences.

▸   The IR filter is situated approx. 5 mm behind the outer edge of the C-mount opening in the camera.

▸   Due to this pre-mounted IR barrier filter, C-mount adapters that screw more than 5 mm into the thread cannot be screwed into the camera.

▸   Do not remove the filter or the protective glas otherwise the warranty will be lost.

1. Remove the dust cap from the camera's C-mount port.
2. Screw the adapter in as far as it will go.
3. Mount the camera onto the microscope's TV port. Ensure that no dust enters the opening of the camera or the microscope's TV port.

5.4 Connecting the camera to the PC

1. Lay the USB cable (2 in 1) carefully between the camera and the PC.
2. Connect the USB cables to the USB 3.0 interface card of the PC.
3. Connect the USB cables with the camera.
4. If you switch on the PC, the camera will be also switched on.

Power is supplied via the USB 3.0 cable. The USB 2.0 cable supplies the peletier cooling. By switching off the PC, the camera will be switched of as well. If the camera is installed correctly, the status LED will be red. If you start the software the LED will turn blue. You`ll find a detailed description of the LED status light in the chapter *Function indicator [▶ 18]*.

5.5 Connecting the trigger cable

In this chapter you will learn how to connect the trigger cable (optional) to the camera and the SVB (signal distribution box).
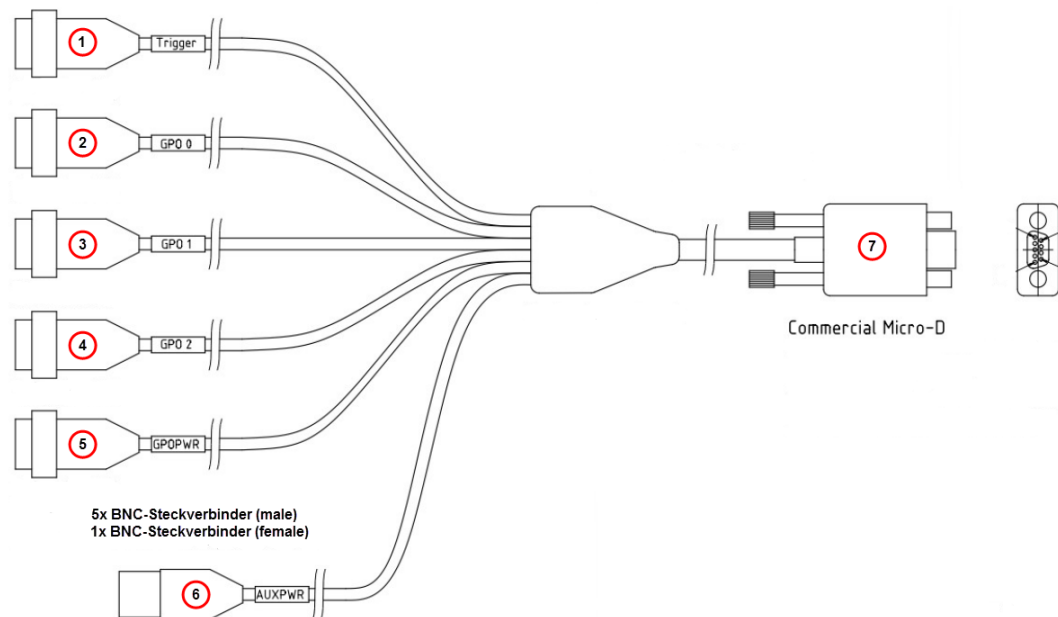

Fig. 5: Trigger cable

Number	Description
1	**Trigger** (Trigger-In)
2	**GPO 0** (Trigger Out, for exposure time incl. predelay, coresponding to shutter control
3	**GPO 1** (Trigger Ready, for Readout Time data)
4	**GPO 2**
5	**GPOPWR**
6	**AUXPWR**
7	**Commercial Micro-D**

The numbers in brackets in the guide below refer to the connectors shown in the illustration "Trigger cable" and described in the table below it.

1. Plug the connector **Commercial Micro D (7)** in the trigger connector on the back of the camera, see *Camera Overview [▶ 15]*.

2. Plug the connector **Trigger (1)** in the socket **Trigger Out** of the SVB (Signal distribution box).
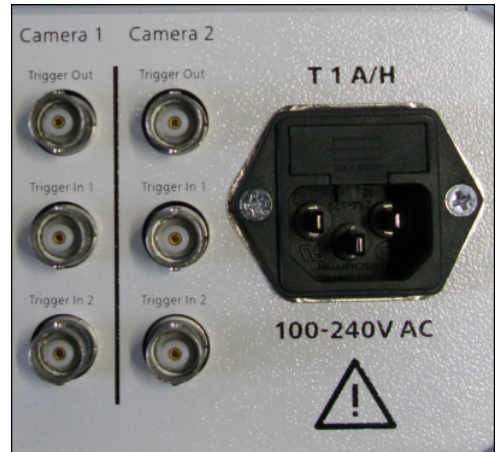

Fig. 6: Signal distribution box (SVB) backside

3. Plug the connector **GPO 0 (2)** in the socket **Trigger In 1** of the SVB (Signal distribution box).
4. Plug the connector **GPO 1 (3)** in the socket **Trigger In 2** of the SVB.
5. Connect the connectors **GPOPWR (5)** and **AUXPWR (6)** of the trigger cable together.
   → GPO 2 (4) is not connected.

5.6 Function indicator

Signal color	Description
Blue	USB 3.0 connection (Camera) connected with USB 3.0 connection (PC) Power supply (USB 2.0 cable) attached Recommended configuration for best camera performance
Green	USB 3.0 connection (Camera) connected with USB 2.0 connection (PC) Power supply (USB 2.0 cable) attached
Violet	USB 3.0 connection (Camera) connected with USB 3.0 connection (PC) Power supply (USB 2.0 cable) not attached
Yellow	USB 3.0 connection (Camera) connected with USB 2.0 connection (PC) Power supply (USB 2.0 cable) not attached
Red	Power supply attached, no driver loaded, camera not yet initialized
No light	No power supply or software shut down (camera in power down mode)

6 Installing software and drivers

Prerequisite ✓ To acquire images with the Axiocam 512 on a PC, you must install ZEISS software (e.g. ZEN or AxioVision). You will find the software installation on the DVD delivered. The camera drivers will be installed automatically during the installation of the software.

✓ Before starting the installation of the software and drivers, the camera must be connected to the PC.

1. Install the software according to the installation guide delivered with the software.
2. During the installation you will be asked to install the camera drivers. Follow the procedure by confirming the upcoming messages.
3. Restart your PC after the installation.
4. You can check in the device manager if the driver installation was successful.

You have installed the software and the camera drivers. You can now start acquiring images with your camera using ZEISS software. For more information, please read the software documentation.

7 Troubleshooting

7.1 Software

7.1.1 The camera does not appear in the menu of selectable cameras

- Make sure that you have connected the camera and installed the software and drivers in accordance to the instructions in this manual.
- Make sure that you installed the software and drivers with administrative rights. Install the driver with administrative rights again if necessary.

7.1.2 You don't see a camera image on your screen

- Check the light path setting of the microscope.
- Is the status LED on the camera on? If not, check the cable connections between camera and computer.
- Execute a reset of the camera.
- Execute an automatic exposure measurement.
- Check the display adjustments for the live image.
- Check the aperture diaphragm of the microscope.
- Check the position of the beam splitter between the ocular and the TV port.

7.1.3 The color of my image does not correspond to the impression through the ocular

In case of color cameras:

- Check white balance and, if necessary, repeat white balance.
- Check the monitor's color temperature setting. If necessary, reduce this to the lowest value that can be set (usually 5200 K).

In case of monochrome cameras:

- Images of monochrome cameras are displayed by using overlay colors to represent the colors of fluorescence dyes on the monitor. If the color is different to the visual impression in the eyepiece, select a different overlay color.

7.2 Hardware

7.2.1 Vibrations

Sudden jolt, vibration or moving objects during the acquisition can detract from the image quality. The light intensity during exposure can change as well.

- To avoid jolts, use damping systems on your microscope.
- Repeat the acquisition and take care to ensure the conditions remain calm.

8 Maintenance

8.1 Optical System

The internal optical components of the camera should always be protected. If no lens, or TV adapter with optics, is screwed into the camera's C-Mount thread, the camera's sensor and protective glass must be protected by screwing the protective cap onto the camera's C-Mount thread.

8.2 Cleaning the infrared filter or protective glass

Contamination of the IR filter (for color cameras only) or the protective glass has an adverse effect on the quality of the resulting image (dark points, cloudy structures in the image). If there is dry dust on the front side of the infrared filter or protective glass, you can clean it with a soft brush or with cotton (wool). Use cleaning fluid for optics/lenses only to clean the IR filter. Do not use tap water to clean the IR filter.

9 Disposal and Recycling

This product has been developed, tested and manufactured in accordance with the applicable environmental provisions and directives of the European Union:

- The product and its accessories comply with EU directives 2002/95/EC (RoHS) and 2002/96/EC (WEEE), insofar as these apply to this product.
- ZEISS has implemented a take-back and recycling process that ensures that proper recycling is carried out in accordance with the aforementioned EU directives.
- Please contact your ZEISS sales/service organization for details relating to disposal and recycling.
- This product must not be disposed of with domestic waste or using municipal waste disposal services. In the event of resale, the seller must inform the buyer of the need to dispose of the product appropriately.

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