HARDWARE AND OPERATION

Thank you for choosing this Cubert GmbH product!

Before bringing the camera system into service do read this hardware operation guide, especially the safety notes, carefully.

Please keep this document at a safe location.

News and current information on this product can be found on our official webpage:

www.cubert-gmbh.de
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1 Safety notes

Avoid vibration or shocks on the camera. This is a high-precision device.

Do not use the camera whilst driving a vehicle, airplane or other machine. Inappropriate usage may cause an accident.

Never point the camera into the sun or any other very bright light source. Camera must not be subject to high energy laser beams.

The camera’s case provides a certain protection against liquid entry or intrusion of foreign particles. However, if water, steam, other liquids or particles intrude into the camera there is a risk of fire and electric shock.

Operating the camera after a (mechanical) shock or inappropriate treatment, there is a risk of fire and electric shock.

Furthermore, the guarantee will be void.

In such cases perform the following steps:

1. Separate the power supply of the camera.
2. Separate the connections between camera and PC as well as camera and its power supply.
3. Contact Cubert support immediately.

Do not, under any circumstances, operate or store the camera at one of the following locations:

- Wet, humid or dusty location.
- Kitchens or other locations with oily smoke.
- Locations with strong vibrations.
- In the vicinity of radiators, under direct sunlight or within a closed vehicle subject to direct sunlight.
- In the vicinity of air conditioning or other locations with extreme temperatures, strong temperature changes or high humidity levels.

You must not, under any circumstances, connect devices or cables other than those ones shipped with the camera to the camera. Solely utilize original accessories and original spare parts. Connecting an inappropriate device or cable may risk fire or electric shock or may damage the camera as well the device/cable. Cubert GmbH is not liable for any damages caused by operating the camera with any PC other than the shipped one.

Do not disassemble or modify the camera, you risk electric shock, dermal burns or other injuries.
1.1 Power supply 🌐

During operation the power adaptor may get hot. This is normal and does not pose an incident.

Upon inappropriate operation of the power adaptor it may take damage. This causes risk of fire and electric shock. Thus, when operating the power adaptor do comply with the following safety measures:

- Solely use the shipped power adaptor.
- Solely use the power adaptor for power supply of the associated devices.
- Do not modify the power adaptor.
- Neither operate the power cable in the vicinity of ovens or radiators, nor subject it to direct heat.
- Do not twist or pull the power cable. Do disconnect the power cable from the plug socket with the cable’s plug, never pull the cable itself.
- Disconnect the power adaptor, if the camera is idle over a long period of term.
- Do not place heavy objects on the power adaptor.
- Do not touch the power adaptor with wet hands, there is the risk of electric shock.

If the power adaptor or the power cable is damaged, contact the Cubert support.

1.2 Battery (optional) 📄

Inobservance of the following safety measures may damage the battery, reduce its performance or reduce its lifetime. Moreover, you might risk overheating, fire or explosions.

- Solely use the specified battery type for operation
- Upon installing, ensure the correct orientation of the batteries regarding the poles.
- If you encounter strange odors, development of heat, discoloring, deformation or alike upon operation or storage of the battery, extract the battery from the camera immediately.
- Do not store the camera with batteries installed. Store batteries and camera separately to avoid battery leakage damages.
- Under no circumstances operate or store batteries in the vicinity of open flames.
- Do not subject batteries to heat or fire. Do not expose batteries to direct sun light or keep them in a closed vehicle exposed to direct sunlight or on any other location with high temperatures.
- Under no circumstances store batteries together with electrically conducting objects.
- Do not disassemble, modify or solder batteries. Do not place batteries into a heating, high-pressure device or similar devices.
- Do not expose batteries to water.
- Batteries contain liquid that can cause eye injuries. If this fluid gets into your eyes, wash your eyes immediately with a large amount of water and get medical attention immediately.
- If the battery liquid gets on your skin, wash skin immediately with water. Contact with the battery fluid for some time might cause skin irritations.
- Dispose of batteries properly and operate them with reasonable care.
1.3 Miscellaneous notes

The camera is an optical measurement device. Rapid changes in ambient conditions (temperature, air humidity) might steam up optical elements in the camera system. These condensations may give rise to malfunction.

In order to avoid condensed water place camera into a closed plastic container prior exposing to high ambient condition changes.

Leave camera in plastic container until the air temperature within the container reaches the ambient temperature.

The camera might get hot during operation. This is normal and does not pose an incident.

By default, the focal point of the camera is set to infinity. Any change of the optics (focus, aperture) might misalign the system. If you think you might have misaligned the optic check your camera system.

If it does not provide satisfactory results, please contact Cubert support for re-calibration.

The “CE” sign confirms, that this product complies with European regulations for safety, healthcare, environmental protection and operator's protection. Cameras with “CE” symbol are destined for the European market.

This symbol indicates the separate return and recycling of electric and electronic devices in EU-countries. Please do not dispose device to household waste. Please inform yourself about the respective recycling regulations in your country when disposing of the device.

This symbol indicates the separate return and recycling or batteries and rechargeable batteries within EU. Please do not dispose of batteries or rechargeable batteries to the household waste. Please inform yourself about the respective recycling regulations in your country when disposing of the batteries or rechargeable batteries.
2 Liability

- Self-disassembling or modifying the camera will void the guarantee immediately.
- For technical examination, repair or maintenance please contact Cubert support.
- Cubert GmbH is not liable for the quality of the picture or its content.
- There is not legal entitlement for the reliability or accuracy of measurement results. Cubert GmbH is not liable for any incident caused by wrong or inaccurate measurement results.

By using this product you entirely and legally agree to the following

- You waive any present or future claim against Cubert GmbH or its representatives arising from the operation of this product, the measurement results or the product components.
- You waive any claim against Cubert GmbH or its representatives arising from present or future damage, loss, breakdown, injury or other incidents that you or others might be subject to by using this product.
### 3 Components check-list

When unpacking please check if the articles listed below are included. If anything might be missing or damaged, please contact your vendor, or Cubert representative. The following components are necessary.

<table>
<thead>
<tr>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x S185 Firefly</td>
</tr>
<tr>
<td>1x hardware operation guide</td>
</tr>
<tr>
<td>1x software and installation guide</td>
</tr>
<tr>
<td>1x software CD</td>
</tr>
<tr>
<td>2x Ethernet patch cable</td>
</tr>
<tr>
<td>1x Y power cable</td>
</tr>
<tr>
<td>1x Power adaptor</td>
</tr>
<tr>
<td>1x Cubert Mini-PC server</td>
</tr>
<tr>
<td>1x Wireless-N900 Access Point</td>
</tr>
</tbody>
</table>

Extra equipment
4 Camera preparation and operation basics

Prior to any camera use, you should check for any apparent damages. Furthermore, you should perform a functional test.

Upon damage or malfunction please contact Cubert support.

The next section outlines the first steps for the operation of the camera. Please read this section carefully and follow the instructions.

4.1 Power supply

Power can be supplied either by the power adaptor or by battery. Please only use the recommended components. If you used any other power supply, do meet the voltage and current requirements. Furthermore, you should take safety measures against over-voltage. A 2.1x5.5x9.5 Pin power jack is used. Please see chapter 7 (technical data sheet, camera).

4.1.1 Mains operation
The S185 can be operated with the shipped power adaptor. Plug the Y power cable into the camera and the PC and connect it with the power adaptor. As soon as the camera and the Cubert Mini-PC server are on power, they will switch to operating mode and – with a short delay of max. 2 minutes – can be used.

4.1.2 Battery operation
The S185 can also be operated on battery. For this purpose, plug the Y power cable into the camera and the PC and connect it with the battery. As soon as the camera and the Cubert Mini-PC server are on power, they will switch to operating mode and – with a short delay of max. 2 minutes – can be used. Pay attention to a sufficient battery charge level in order to avoid outage during measurement.

4.2 Data connection

Cubert’s Hyper-Spectral camera can be operated in different modes. The different operation schemes are summarized in the software and installation guide (chapter 2). In principle, the S185 can be operated with the following two operation schemes:

4.2.1 Direct connection
For operation, directly connect your PC’s NICs to the camera via Gigabit Ethernet patch cables (RJ45 jacks, CAT5 or better). Your client PC will be used as Cubert server and Cubert client. Please refer to chapter 2, operation scheme 1 in the software and installation guide.

4.2.2 Remote controlled (recommended)
For remote-controlled operation connect your camera to the Cubert Mini-PC server with 2 Gigabit Ethernet patch cables (RJ45 jacks, CAT5 or better). It is crucial, that you connect the correct respective network ports (chapter 5, operation scheme). The Cubert Mini-PC server will automatically establish the connection to the camera and run the server process C-link upon power-up. It can be accessed by any other PC with installed client software (recommended: Cube-Pilot) via WiFi. Please refer to chapter 2, operation scheme 4 in the software and installation guide.
4.3 Connecting the control cable (optional)

The 4-poled jack at the rear of the camera can be used to enable external trigger capabilities of the camera. Please use an M8 4-pin connector. The camera will trigger on an 11V-30V/6-10mA pulse. The pins of the trigger port are used as follows:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>brown</td>
</tr>
<tr>
<td>2</td>
<td>white</td>
</tr>
<tr>
<td>3</td>
<td>blue</td>
</tr>
<tr>
<td>4</td>
<td>black</td>
</tr>
</tbody>
</table>

4.4 Mounting the camera

For mounting the camera it has a M5 screw socket at the lower planar surface. In order to avoid accidental camera release, use a screw lock. Additionally, we recommend securing the camera by implementing a back-up fixation to a UAV with a wire loop.

4.5 Mounting the tilted mirror (optional)

If your camera comes with the optional tilted mirror, you can attach it with four M2x4mm screws.
5 Operation scheme

For adequate usage of the camera and for all possible settings please also read the Software and installation guide. This section only contains details specific to the S185.

In order to connect the camera properly, follow these steps:

1. Plug in the first Ethernet cable into the lower network jack of the camera (RJ 45 NR. 1) and into the Eth1 port of the Cubert Mini-PC server.

2. Plug in the second Ethernet cable into the upper network jack of the camera (RJ 45 NR. 2) and into the Eth2 port of the Cubert Mini-PC server.

3. Connect the Y power cable with the Camera and the Cubert Mini-PC server: Connect the M8 3-pin plug with the respective port of the camera. Connect the second plug into the power supply of the Cubert Mini-PC server. The third plug is connect with the custom power supply (see chapter 4.1 “power supply”)

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If every connector is connected correctly, the camera system will power-up. This process may take up to 2 minutes. For control: During the power-on process, the yellow and orange light of the camera will start blinking.

The camera system is now fully operational. In order to turn off the system, press deep the on/off ("fitlet")-button of the Cubert Mini-PC server. Disconnect the power supply afterwards.

OR

If not connecting to the Cubert Mini-PC server, but to a custom client PC, the respective NIC’s TCP/IPv4 properties must be configured according to the following table. Upon using an USB/ExpressCard-NIC, use the Eth1 Port (192.168.100.100) for this device.

<table>
<thead>
<tr>
<th></th>
<th>Camera IP</th>
<th>PC IP</th>
<th>Netmask</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>192.168.100.100</td>
<td>192.168.100.13</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>Ethernet 2</td>
<td>192.168.200.100</td>
<td>192.168.200.13</td>
<td>255.255.255.0</td>
</tr>
</tbody>
</table>

6 Maintenance of the camera

NEVER CHANGE APERTURE AND FOCUS ON THE CAMERA, IT WILL DESTROY THE CALIBRATION

Dabs, dust and other foreign particles may influence the image capturing process. Thus, you should never touch the objective lens or the tilted mirror (if applicable).

For cleaning the front-lens, do not use non-certified optic cleaners, because on any damage on coating will ruin the calibration. Do not press too firmly on the objective lens or the tilting mirror, as they might be scratched and/or damaged which will result in malfunction of the system.

The camera case can be cleaned with a soft and dry cloth.

We recommend an annual service maintenance interval for re-calibration of the Hyper-Spectral camera. Please contact Cubert support.
### 7 Technical data sheet, camera

<table>
<thead>
<tr>
<th>Data quality</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength range</td>
<td>450 nm-950 nm (1000 nm)</td>
</tr>
<tr>
<td>Detector</td>
<td>Silicon Sony ICX285</td>
</tr>
<tr>
<td>Spectral resolution (FWHM@f=23mm)</td>
<td>8 nm (@532 nm)</td>
</tr>
<tr>
<td>Spectral sampling</td>
<td>4 nm (125 channels) (138)</td>
</tr>
<tr>
<td>Spectral sampling (physical)</td>
<td>1,05 nm/Pix@450 nm; 4,54 nm/Pix@650 nm; 8,13 nm/Pix@900 nm</td>
</tr>
<tr>
<td>Wavelength accuracy Δλ @ 532nm / 808nm@f=23mm</td>
<td>±2,5 nm / ±4,5 nm</td>
</tr>
<tr>
<td>Spatial resolution</td>
<td>1000*1000 Pixel</td>
</tr>
<tr>
<td>SNR @ 25ms</td>
<td>58 dB</td>
</tr>
<tr>
<td>Spectral Data</td>
<td>2500 Spectras/Cube</td>
</tr>
</tbody>
</table>

#### Sensor Data

| Type                                             | Silicon |
| Cooling system                                   | Passive air-cooled |
| Digitalization                                   | 12 bit |
| Integration time                                 | 0.1 ms up to 1000 ms |
| Measure frequency (UAV)                          | 3 Hz |
| Measure frequency (Lab; i5@ 3.40GHz; Realtek PCIe Dual GBE) | 12 Hz |

#### Mechanical data:

| Weight (without Lens)                            | 490 g |
| Size (without Lens)                              | approx. 200 mm * 67 mm * 60 mm |

#### Operating data:

| Dust protection                                   | IP 40 |
| Splash guard                                      | IP 40 |
| Environmental conditions                          | Not condensing |
| Operating temperature                             | 0°C up to +40°C |
| Storage temperature                               | -10°C up to +50°C |

#### Optical Data

| Focal length                                      | e.g. 12 mm, 17 mm, 23 mm, 35 mm, 50 mm |
| Aperture (angle)                                  | e.g. 30°, 20°, 15°, 10°, 5° |

#### Electronic Data

| Voltage                                          | DC 12 V |
| Power                                            | 15 W |
8 Camera dimension

Figure 4. Technical drawing, camera

Units in mm
For any questions or upon any problems please contact us:

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