



Uncompressed
LIVE

4K Video

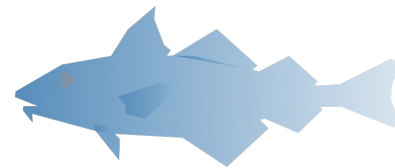
1 Cam

www.subcinaging.com



1Cam Mk6

4K, HD and digital stills
20x zoom and advanced optics



SubC excels at reliable **custom** product configurations.

Newfoundland, Canada +1 709-702-0395
www.SubCImaging.com

Built on the maturity and reliability of the 1Cam, the Mk6 is designed to exceed the highest requirements of underwater systems for the oil and gas, marine research, and cinema industries. It features top-of-the-line specs:

- Multiple front-end optics options:
 - Flat port with lasers [for modeling and computer/machine vision]
 - [LiquidOptics](#) water-correction [for cinematography]
 - [UltraOptics](#) wide angle [140 degree FOV for situational awareness]
- Multiple back-end transmission options:
 - SD composite
 - 3G-SDI (HD video) over coaxial cable
 - 4K/UHD over **fiber optics**
- Retained the **small** dimensions of the Mk5 [266mm x 88mm]
- **Lower cost** than any other 4K solution on the market
- **Internal 4K recording** at 100Mbps and **16.6 megapixel** digital stills
- Great **low light** with optimized 4K sensor and no pixel binning
- 20x **optical zoom**
- True **LED strobe/lamp sync** from the back end of the camera



Control: RS232, RS485 or Ethernet

Max video record: 4K Ultra HD 24/30p

Live resolutions: 4K Ultra HD 25/30p, 1080/50/59.94p, 1080/50/59.95i

Sensitivity: 1.2 Lux [HD Low Lux]

Focusing system: Manual, Auto

Memory: 512GB

Max still resolution: 5440 x 3056 [16.6 megapixel]

Max image speed: 0.33 Hz (1 still every 3 seconds)

Voltage range: 15 – 32Vdc (48–72Vdc version available)

Sensor: 1/2.5" Back-illuminated Exmor R CMOS

Lens:

- Zeiss T* Zoom 20× (Optical)
- Aperture: F2.0 – F3.8
- Focal length: 26.8 – 536 @ Aspect Ratio: 16:9 / 32.8 – 656 @ Aspect Ratio: 4:3

Video recording bitrates and storage:

The following list shows the bit-rate, pixels and aspect ratio of each recording mode for movies (movie + audio, etc.)

AVCHD (HD)

1920 x 1080p / 60 fps (28 Mbps)

1920 x 1080p / 30 fps (24 Mbps)

1920 x 1080p / 30 fps (17 Mbps)

1920 x 1080p / 24 fps (24 Mbps)

1920 x 1080p / 24 fps (17 Mbps)

1920 x 1080i / 60 fps (24 Mbps)

1920 x 1080i / 60 fps (17 Mbps)

1440 x 1080i / 60 fps (9 Mbps)

1440 x 1080i / 60 fps (5 Mbps)

XAVC S (UHD):

3840 x 2160p / 30 fps (100 Mbps)

3840 x 2160p / 24 fps (100 Mbps)

1920 x 1080p / 60 fps (60 Mbps)

1920 x 1080p / 30 fps (60 Mbps)

1920 x 1080p / 24 fps (60 Mbps)

Stills information

JPEG: 16.6 Megapixel, 5440 x 3056 (16:9)

JPEG: 12.5 Megapixel, 4080 x 3056 (4:3)

JPEG: 8.3 Megapixel, 3840 x 2160 (16:9)

JPEG: 6.2 Megapixel, 2880 x 2160 (4:3)

JPEG: 2.1 Megapixel, 1920 x 1080 (16:9)

JPEG: .3 Megapixel, 640 x 480

Image storage @ 16.6 megapixel:

512GB: 106,000 images, 11 hours of 4K video.



SubC Imaging Support and general inquiries

Page 4

Please read this manual carefully before setting up and using your unit. The electronic version of this document is the controlled copy. Therefore, all printed versions of this document are uncontrolled.

This is the manual for **ALL** 1Cam models. For details on your specific model number please see its corresponding datasheet.

For additional information, please see the SubC Underwater Photography Guide at
(http://www.subcimaging.com/manuals/SubC_Underwater_Photography_Guide.pdf)

The latest version will always be available with the link. A version is also on the USB stick that was shipped with your product.



For technical support, contact your local agent or SubC Control:



Telephone	+ 1 (709) 702-0392
Fax	+ 1 (866) 571-1265



Email	support@subcimaging.com
Internet	www.SubCImaging.com



Mail	SubC Control Ltd 317 Memorial Drive Clareville, NL Canada A5A 1R8
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SubC equipment is designed to work a various depth ratings on un-manned vehicles. Designs are tested to their full pressure rating. Production units are pressure tested to a nominal rating to ensure no leaks. If using our equipment on vehicles which contain humans, you do so at your own discretion. Manned submersibles require equipment to have additional pressure testing to ensure safety

SubC Control Ltd. reserves the right to change, modify and update designs and specifications as part of their ongoing product development program.



Table of Contents

Page 5

Quick Start - ROV Interface Example

[1Cam Mk6 HDF + DVRO 4K](#)

Pg. 7

Establishing Connectivity with your Camera

[Installing required software](#)

Pg. 8

[Control and download through Ethernet](#)

Pg. 9

[Setting a static IP to Ethernet device](#)

Pg. 10

[Serial control via Ethernet](#)

Pg. 11

[Media download via Ethernet](#)

Pg. 12-13

[Serial control/USB download](#)

Pg. 14

[Media download via USB](#)

Pg.

15

[USB troubleshooting](#)

Pg. 16

[Reviewing images/video on camera](#)

Pg. 17

Camera Features

[Focus and known limitations](#)

Pg. 19

[Built-in LED strobe operation](#)

Pg. 20

[Built-in features: Laser control & live 3G-SDI over coax](#)

Pg. 21

[Generation 6 fiber optics](#)

Pg. 22

[Interval mode v2](#)

Pg. 23

[Autonomous scheduling \(intervals with RTC\)](#)

Pg. 24

[Other configuration options](#)

Pg. 25

[Expansion bay](#)

Pg. 26

[Troubleshooting, precautions & maintenance](#)

Pg. 27

[Interfacing with an underwater system](#)

Pg. 28

[Example of deployment](#)

Pg. 29

[SubC serial commands](#)

Pg. 30

QUICK START



Please be advised a potential issue has been discovered with the 1Cam Mk6 when the USB cable is in use.

Some computer motherboards have been damaged when the camera is connected to the camera via USB.

As a precaution we recommend following the below procedure to mitigate risk:

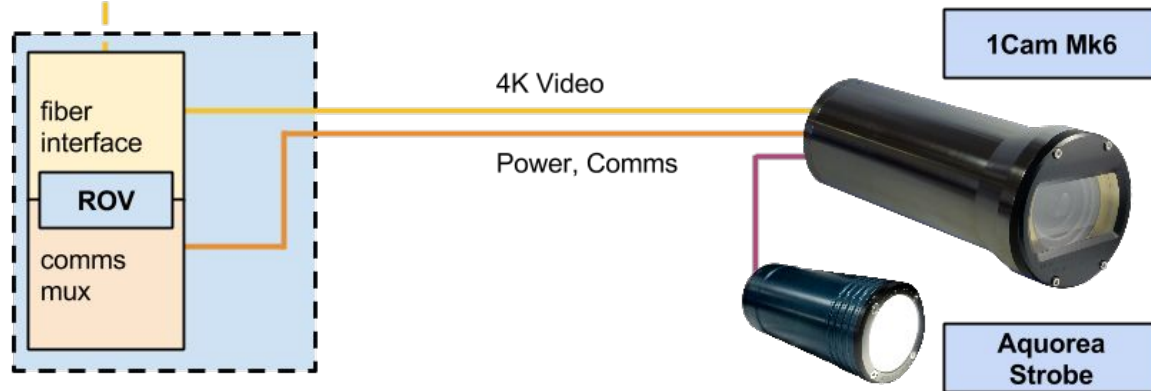
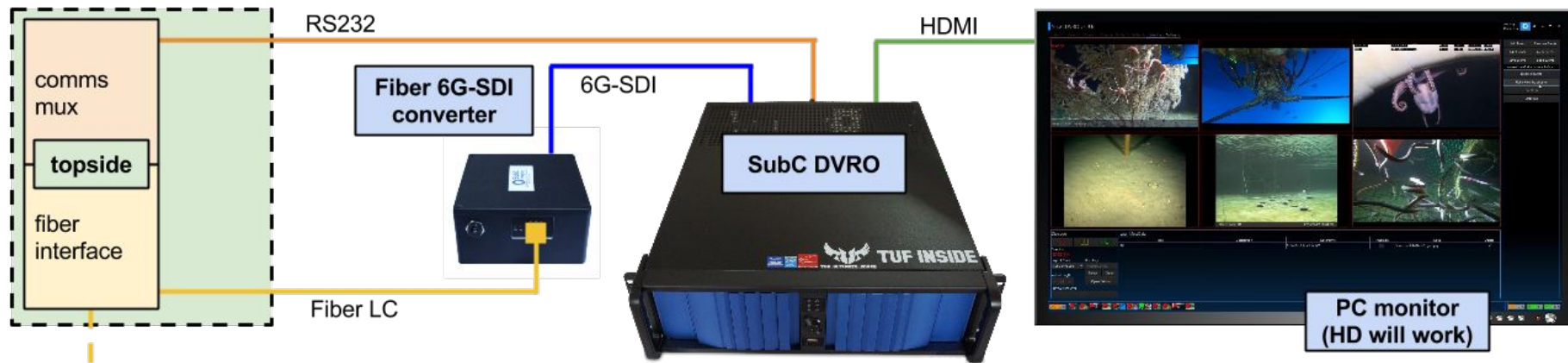
- **Do not** connect camera (via USB) to PC while LED is connected to 1Cam
- **Do not** connect camera (via USB) to PC during initial power on. Only after the camera outputs live video, and you are ready to proceed and download to the USB should you connect USB



Quick Start - ROV Interface Example

1Cam MK6 HDF + DVRO 4K: [Live 4K UHD with serial control]

Page 8



1. Bench test the camera on deck, with the supplied interface box (not shown), and the fiber converter into a SubC DVRO or equivalent – see media download section for more details.

Note: Use an attenuator for short fiber lengths. The TX is powerful and can damage the fiber RX device.

2. The SubC Live Control software (1Cam Control Software on USB stick) should be installed on the DVRO or on a separate PC.
3. Follow the DVRO quick start to set up 4K video input, overlay, recording and outputs to monitors.



Quick Start: Installing required software

Establishing connectivity with your camera

All software and manuals are supplied on the USB Drive that was shipped with your camera. If you lose the USB Drive, please contact support@subcimaging.com.

1. Run both Ethernet installers (not applicable if USB camera)



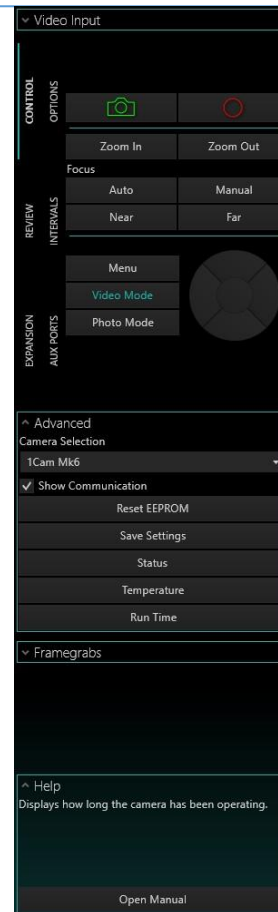
2. Install the USB-232 Driver
3. Run the Installer.exe file from the USB stick. If the program complains that .Net packages are missing, install dotNetFx40.exe

Because the software has built-in help, redundant software instructions have been omitted from this manual.

Picture

Take a picture with the camera, it is saved to the on-board memory. Shortcut Keys: Space, NumPad 0

SubC Live Control
software control panel





Quick Start: Control and download through Ethernet

Establishing connectivity with your camera

Page 10

***If using USB, go to Quick Start: Serial control, USB download**

Required Components

Camera	SubC Interface Box
Computer	Power cable
TV, DVR or Capture device	Coax or RCA cable
Cat5e Ethernet Cable	

Instructions for physical connections:

1. Connect the camera to interface box.
2. Connect the interface box to a computer using an Ethernet cable.
Note: the camera Ethernet device and computer have to be configured for static IPv4 for this to work. See instructions on next page.
3. Connect the interface box to a TV or capture device via video cable.
4. Connect the power cable to the interface box and plug in.
5. Power on the interface box. If the camera has been off for a while, the initial camera setup will need to be set up again (language, date, time and region). Open the control software, go to the [Control](#) tab and using the control button cycle through the screens. Once complete, camera image will appear.
6. In the control software, click [Comms](#) and select a com port.
7. To operate the camera follow help tooltips within the software.





Setting a static IP to Ethernet device

Establishing connectivity with your camera

Setting a static IP will enable direct downloading from the camera via Cat5e Ethernet cable connected to a PC. **The IP has to be set static on the PC and on the IP server.**

To set a static IP for device:

1. Plug Ethernet cable into a switch. Open the USB server on a PC, right-click the device, and click [Server Configurations](#).
2. Uncheck [Use DHCP](#) and fill in the IP address and subnet from the USB server. Click [Set](#) button.
3. Plug the Ethernet cable from the camera directly into the PC.
4. On the PC go to the [Control Panel](#). Go to [Network and Sharing Center](#).
5. On the left hand side, click [Change Adapter Settings](#).
6. Find the wired network adapter that the cable is plugged into. Right click and go to [Properties](#).
7. Choose [TCP/IPv4](#) from the list and click [Properties](#).
8. Select the radio button [Use the following IP address](#) and enter the correct IP, subnet mask, and default gateway that corresponds with the USB server. **Note: Change the Last IP address number; if it matches the USB server it will conflict.**
9. Click [OK](#) and exit the various windows on screen.

2 Server Configurations

Network Setting :

Server Name : SUBC15385

☐ Use DHCP

IP Address : 169 . 254 . 10 . 10

Subnet : 255 . 255 . 0 . 0

Connect automatically by port

☐ Port 1 ☐ Port 2 ☐ Port 3 ☐ Port 4

[Set](#) [Cancel](#)

5 Control Panel Home

View your basic network

[Change adapter settings](#)

[Change advanced sharing settings](#)

MYSTICGEEK-PC (This computer)

View your active networks

Network Home network

6 Control Panel > Network and Internet > Network

Organize Disable this network device Diagnose this connection

Local Area Connection Network

Intel(R) 82578DC Gigabit Network...

VMware Net Unidentified VMware Virt

Disable

Status

Diagnose

Bridge Connections

Create Shortcut

Delete

Rename

Properties

7 Connect using:

Intel(R) 82578DC Gigabit Network Connection

[Configure...](#)

This connection uses the following items:

☒ Client for Microsoft Networks

☒ VMware Bridge Protocol

☒ QoS Packet Scheduler

☒ File and Printer Sharing for Microsoft Networks

☒ Internet Protocol Version 6 (TCP/IPv6)

☒ Internet Protocol Version 4 (TCP/IPv4)

☒ Link-Layer Topology Discovery Mapper I/O Driver

☒ Link-Layer Topology Discovery Responder

[Install...](#) [Uninstall](#) [Properties](#)

8 Obtain an IP address automatically

☒ Use the following IP address:

IP address: 169 . 254 . 10 . 21

Subnet mask: 255 . 255 . 0 . 0

Default gateway: 169 . 254 . 10 . 0



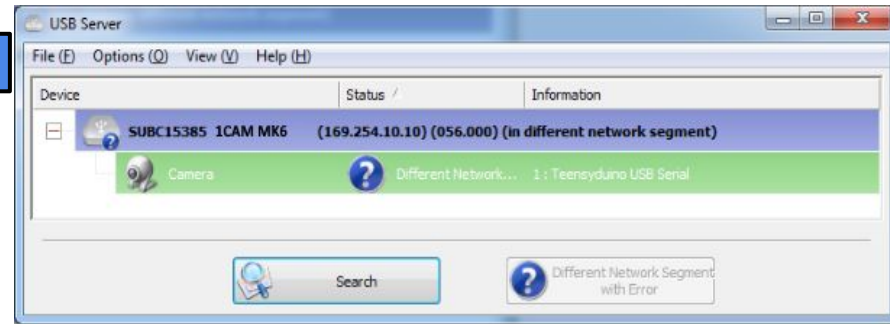
Serial control via Ethernet

The USB-IP device is built into the camera to enable the transfer of stills and video over Ethernet. It also allows control of the camera via USB-Serial emulation.

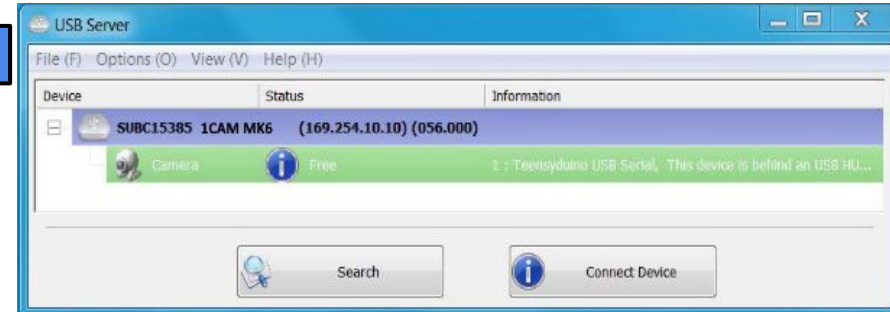
1. Run the *USB Server* from Windows Start Menu.
2. The camera should show up in the listing after approx 60 sec. If it states *(in different network segment)* it means the device is set to static IP and you are not connected directly. Follow the directions on the previous page to set/reset a static IP. A static IP will enable a quicker direct connection.
3. To enable basic Ethernet control of the camera, click on the *Camera* device and click *Connect Device*.
4. The device will now show up in the control software as a comm port.

Note: If this is the PC that will always connect to this device, you can right-click the device and select *Connect Device Automatically*. A device can only be accessed by a single PC at a time.

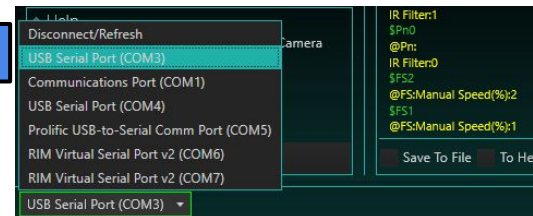
2



3



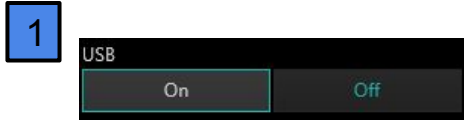
4





Media download via Ethernet

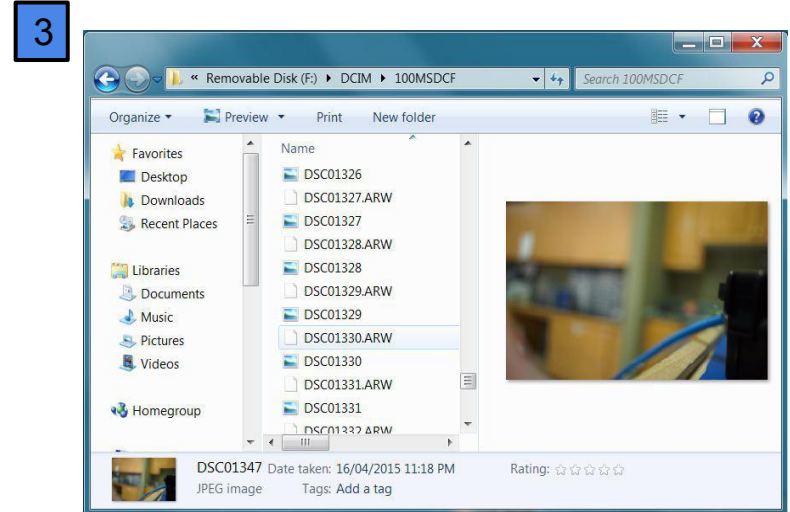
1. From the camera control software, go to [Options](#) and click [USB on](#). From a TV, or the interface box screen, the camera will show [USB Connect](#).



2. The camera storage will show up on the USB Server page. Double-click storage line.



3. To download stills, go to [Removable Disk\DCIM\###MSDCF](#). Copy and paste to the folder of your choice.

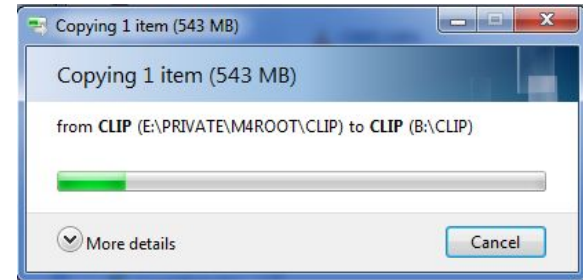
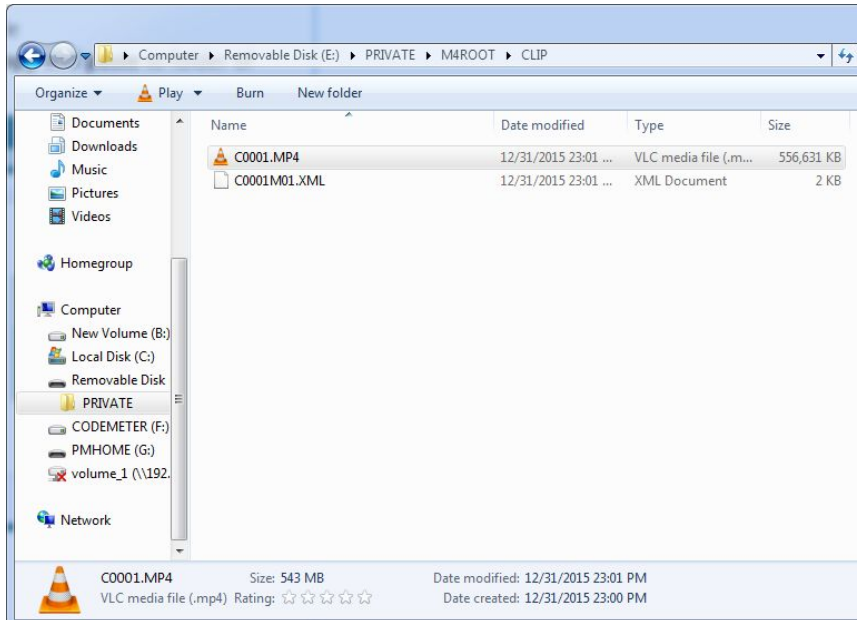




Media download via Ethernet

4. To download videos go to [Removable Disk\PRIVATE\M4ROOT\CLIP\###.MP4](#). Copy and paste to folder of your choice.

4





Quick Start: Serial control, USB download

Establishing connectivity with your camera

Page 15

***If using Ethernet, go to Quick Start: Control and download through Ethernet**

Required Components

Camera	SubC Interface Box
Computer	Power cable
TV, DVR or Capture device	Coax or RCA cable
RS232 or RS485 USB Device	USB (A) to USB (A) cable

Instructions for physical connections:

1. Connect camera to the interface box.
2. Connect the interface box to a computer using a USB to Serial device.
3. Connect the interface box to a TV or capture device via video cable.
4. If downloading, connect the interface box to a computer with the USB device.
5. Connect the power cable to the interface box and plug in.
6. Power on the interface box. If the camera has been off for a while, the initial camera setup will need to be set up again (language, date, time, region). Open the control software, go to [Control](#) tab and using the control button cycle through the screens. Once complete, camera image will appear.
7. In the control software, click [Comms](#) and select a com port (Prolific USB-to-Serial Comm).
8. To operate the camera follow help tooltips within the software.





Media download via USB

1. Refer to the Quick Start sections in your camera's manual for instructions regarding cable setup.
2. Once camera and cables are properly plugged into the camera control software, go to [Options](#) and click [USB on](#). From a TV, or the interface box screen, the camera will show [USB Connect](#).
3. Make sure the USB cable from the interface box is plugged into a computer.
4. To download stills go to [Removable Disk\DCIM\###MSDCF](#). Copy and paste to your folder of choice.
5. To download videos go to [Removable Disk\PRIVATE\M4ROOT\CLIP\###.MP4](#). Copy and paste to folder of choice.

1

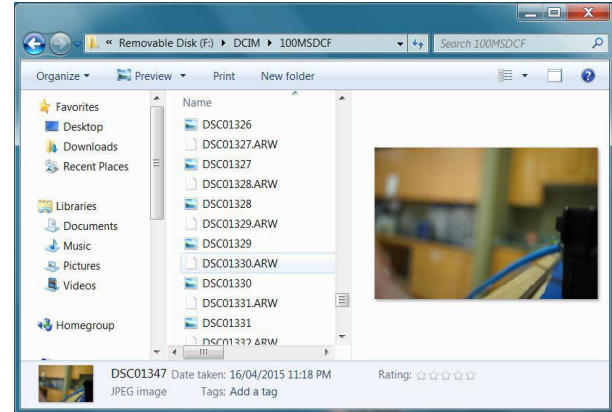
3



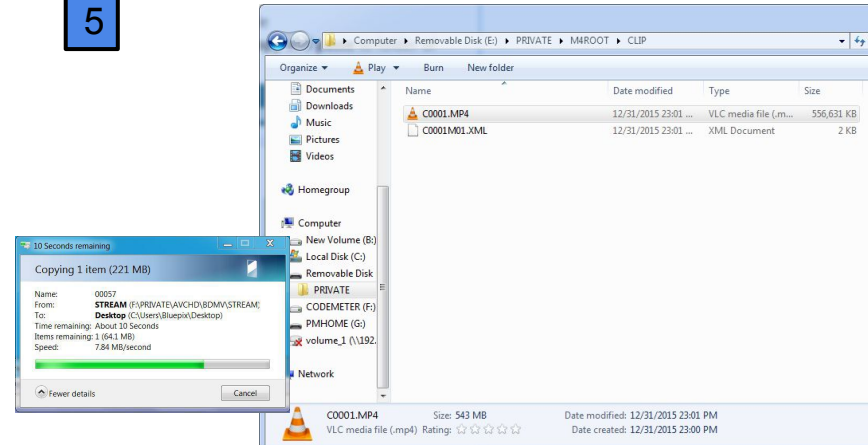
2



4



5

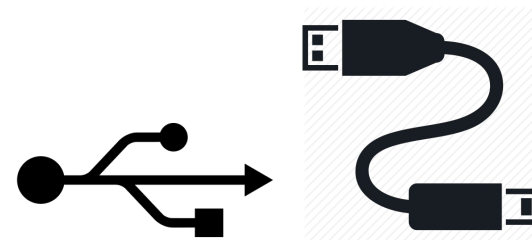




- Most SubC cameras use USB 2.0. There's typically a transfer rate of around 12 MB/s in ideal conditions, however, it can be lower depending on noise.
- There have been issues when using USB 3.0 ports. It is often difficult or impossible to get our cameras to communicate with USB 3.0.
Please use USB 2.0 ports if possible.
- Desktop PCs generally seem to have better connectivity. USB slots on the back of the machine connected directly to the motherboard often work better than USB ports on the front, due to having to travel over a few inches of copper to reach the motherboard.
- A good rule of thumb is to have the camera connected to a video source so you can see it go into USB mode to confirm that it is trying to connect.
- All USB cables are not made equal, sometimes **it's a good idea to try various cables**. Shorter is almost always better as there's less distance for the copper to act as an antenna and pick up noise.

- It is also a good practice to remove the camera from the ROV before trying to download footage. There are usually a lot of things running that can cause interference with the USB signal.
- If there are two cameras being used, try the second interface box and cable.
- Plug the USB cable in a USB 2.0 port. **Do not** plug device in a USB 1.1 port.

Note: If connecting to a desktop PC, the USB ports located on the front of the DVR are often USB 1.1 and will not connect.





Reviewing recorded video and stills

Reviewing data

- Go to the [Review](#) tab in the control software. Click the [Review](#) button. If the camera is not busy, a screen will display showing images and video that are in storage.
- The navigation wheel will move around within the review screen.
- Keyboard shortcuts are mapped to the enter and arrow keys for quicker use.
- To view videos: Press the [Center](#) wheel button or [enter](#) key.
- When reviewing a video, pressing the [Down](#) button will display the icons shown in the table to the right.
- To zoom in on an image: Press the [enter](#) key.
- “Data Display” will show the metadata while reviewing the images and video.
- To switch from stills to video: Press the [Mode](#) button.



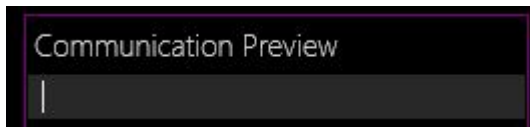
Control panel	Action during movie playback
▶	Playback
⏸	Pause
⏩	Fast forward
⏮	Fast rewind
▶⏪	Forward slow playback
⏮▶	Rewind slow playback
⏩⏸	Next movie
⏮⏸	Previous movie
⏸▶	Frame advance
⏮⏸	Frame rewind
🔊	Volume settings
⏹	Closes the control panel



Aux port LED power

Changing power limit

1. Ensure camera, LED and software are set up.
2. To view the current Aquorea Mk2 power settings, type command `>2-Z?`
3. To control the lamp wattage without changing the software, byass directory to the light. Go to the [Communications](#) tab, type in the command `>2-LPxx` with xx being the max power you want to set.
(ex. 80 watt would be `>2-LP80`)



```
~LP80
@LP:~auxsetmax:110_SUBC17732
@Supply power limit set:80.00 W
~LP120
@LP:~auxsetmax:148_SUBC17732
@Supply power limit set:120.00 W
~LP60
@LP:~auxsetmax:90_SUBC17732
@Supply power limit set:60.00 W
```



CAMERA FEATURES



Focus and known limitations

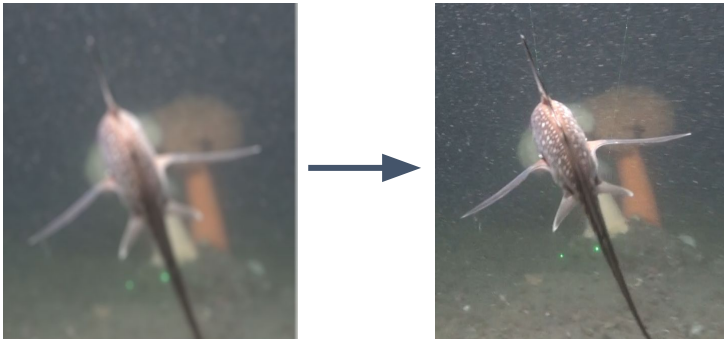
Camera features

Focus capabilities

The 1Cam Mk6 features manual and automatic focus. When there are a lot of particulates in the water column, automatic focus will sometimes begin to “hunt” and change the focus from near to far.

In this situation, it is necessary to run the camera in **manual focus** mode. The 1Cam software has control built in for switching from auto to manual with mode feedback simultaneously. In manual mode, focusing near and far can be controlled by the operator.

Note: Because the control system adjusts the lens, we cannot give feedback regarding focus distance. It is up to the operator to determine if an object is in focus.

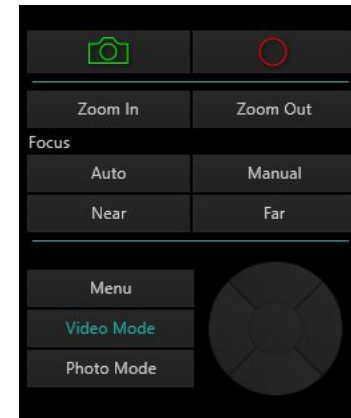


Known Limitations

This camera is subject to the same limitations of many other stills cameras. See the SubC Underwater Photography Guide (http://www.subcimaging.com/manuals/SubC_Underwater_Photography_Guide.pdf) for better understanding.

Date/time is kept accurate with a small lithium ion battery. If there is a **month of inactivity** it will likely run out of energy and the date/time will then have to be reset.

E:65:01 and other flashing indicators with the on-screen display are related to disabled stabilization. SubC has removed the motors to increase reliability and make the camera work better in an underwater setting.





Built-in LED strobe operation

Camera features

When using the camera in this mode the input voltage is between 15–32Vdc because the LED is limited to this voltage. The Aquorea can operate as a strobe for the stills cameras. In this mode the camera controls the LED automatically, reducing interface complexity.

The camera has 5 semi-automatic triggers for the LED:

Still Mode (\$Lb): The LED acts as a flash when taking pictures. Uses strobe power.

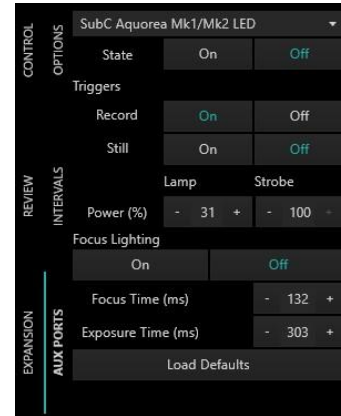
Record Mode (\$LA): The LED turns on until recording is stopped. Uses lamp power.

Picture and Record Mode (\$La): The LED acts as a lamp when recording and a flash when taking pictures.

***Note:** If already recording, the power will change to strobe power while taking a picture.

Continuous On (\$LB): If the LED is continuously on it will still flash as a strobe when taking pictures. Uses lamp power when running continuous.

Off State (\$LF): The LED can be disabled if desired.



Strobe Power: (\$Ldxxx (0-255)) Sets brightness of the LED for photos.

Lamp Power: (\$Llxxx (0-255)) Sets brightness of the LED when recording.

Focus Lighting: (\$LPx (x:1=On, 0=Off)) An optional light pulse that occurs before the main strobe pulse. The duration of this pulse can be adjusted by the focus time.

Focus Time: (\$Lfxxx (0-255)) Determines how long after pressing the Picture button it takes the LED to flash.

Exposure Time: (\$LDxxx (0-255)) Determines the duration that the LED is on during a flash.



Built-in laser control and Live 3G-SDI over coaxial cable

Camera features

Integrated Lasers

The integrated lasers are calibrated in the factory to 62mm parallel at a distance of 5m. Their purpose is to provide a general scaling reference. The camera and lasers *do not* make measurements. It is up to the user to determine measurements using the photos created.

The green lasers in SubC Smart Cameras are 5mW, class 3R.

HD-SDI Over Coax

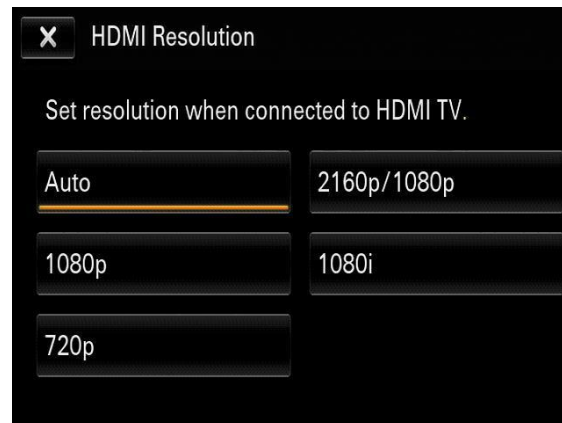
The SubC HDC standard connector is a Seacon MIN-L 1Coax/6Electric. It has a 75 ohm impedance matched connection. Because HD-SDI is a digital signal it is very noise sensitive. **Plenty of shielding is recommended for best performance.** With a digital signal you will not get degradation of the image quality, it will be pristine. If you have a noisy signal, the video will not show up at all (1 or 0, on or off – digital).

HD-SDI has a theoretical transmission distance of 300m over shielded coaxial cable. SubC has successfully tested up to 40m through underwater cable.

When using a DVR, 1080 59.94i can be interpreted as 1080 29.97p.

* The output HD-SDI resolutions can be changed by adjusting the HDMI resolution from the camera menu.

For 59.94i (which can be interpreted as 29.97p by a DVR) set the camera to HDMI 1080i in the menu. For 59.94p, set the camera to 1080p in the menu.





Generation 6 fiber optics Camera features

In all fiber optic cameras built after Q3 2015

- Tx and Rx pairs of the camera are tested for a 20dB budget
- 1270nm and 1310nm wavelengths are in stock
- Alternate CWDM wavelengths are available with extended lead time and additional cost

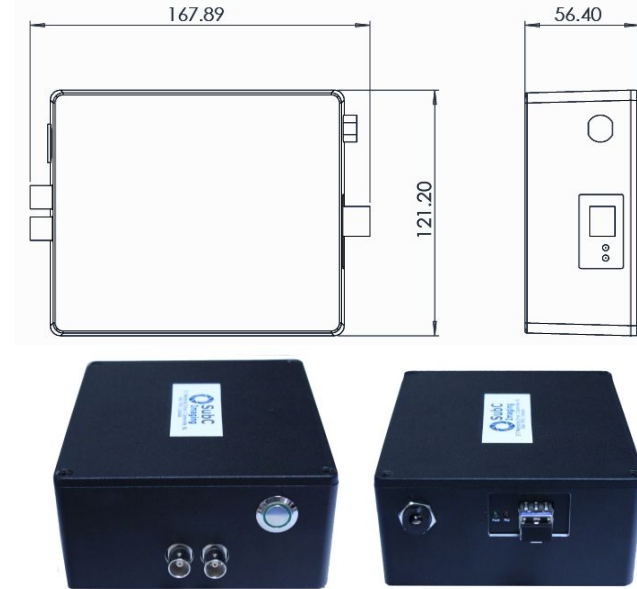


The fiber output from the camera is high power, so if using a short length of fiber (<1000m) an attenuator has to be put in line with the fiber connection. These can be provided upon request.

Topside converter

- Power: 24V - 2.1A (power adapter supplied)
- Fiber LC connection input
- HDMI output is also possible on special request.
- Topside unit operates from 0-40 degrees celsius. **For a hotter environment, an active cooling solution must be in place.**

Dimensions



Special high bandwidth coaxial cables are provided with the topside converter.





Interval mode V2

Camera features

Select *Wait Before Start*, *Record Duration* and/or *Time Between*. Click *Start* and the camera will go into interval mode. **Times will be stored and the camera will boot up and resume intervals until the Stop button is pressed.**

Normally controlled from camera software but can also be sent manually (replace x with numbers):

\$lwx - Wait before start (0 - 1440 mins) **\$lix** - Perform every (0 - 1440 mins)
\$lrx - Record duration (0 - 9999 (infinity)) **\$lsx** - Sleep while idle (0 or 1)
\$lcx - Number to take (0 - Infinity) **\$l#** - Enable interval mode
\$lpx - Time between (3 - 600 sec) **\$lI** - Disable interval mode

Wait before start (m): Sets a delay in minutes before the first action starts. This gives the system time to be deployed before intervals begin.

Record duration (s): Sets the time to record in seconds. One recording will be made in each repeat period, but long recordings will be split into 10 minute chunks. Set to 9999 to record indefinitely.

Number to take: Sets the number of still pictures to take in each repeat period.

Time between (s): Sets the time in seconds between pictures.

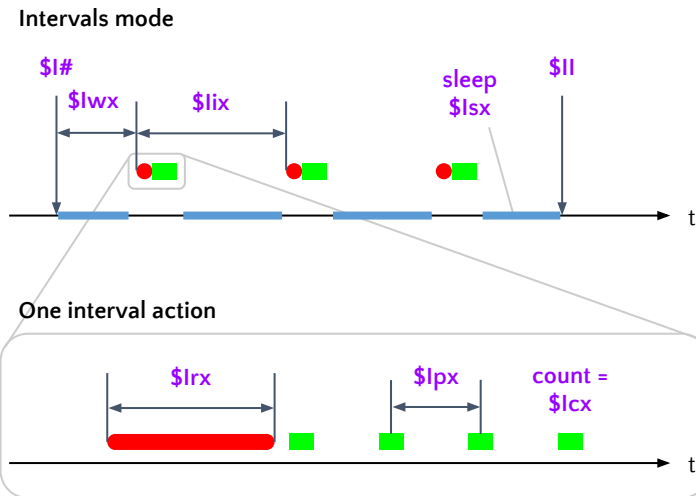
Perform every (m): Sets how often intervals will execute in minutes. This number should be greater than the combined duration of recording and pictures. Set to zero if no repeat is required or if recording or stills are set to continue indefinitely.

Sleep while idle: Sets whether the camera should go to sleep when it is not recording or taking pictures. This should be enabled unless a continuous live video feed is needed.

Start: Starts intervals. Intervals will remain enabled after a power cycle.

Stop: Stops intervals but does not change any other settings.

Act only once: (Checkbox) Performs interval set only once.





Autonomous scheduling (intervals with RTC)(*Optional)

Camera features

Page 26

The interval schedule utilizes a real-time clock to automatically set up and enable intervals at specific times. The schedule consists of a list of entries stored in the camera EEPROM. Each entry contains a date, time and action code. The action code represents a recording duration or a number of stills to take. Once the schedule is completed, the camera will sleep until retrieved.

Normally controlled from camera software but can also be sent manually (replace # with numbers):

\$IEd##-##-##t##:##a# – Add entry	\$IB# – Do backlog
\$IX – Clear schedule	\$IF# – Force schedule size
\$IJ – Enable schedule	\$IO – Print schedule
\$II – Disable schedule	

Add entry: Adds an entry to the schedule. The arguments are the date (YY-MM-DD, with 2- or 4-digit year), time (hh:mm) and action code (integer between -90 and 165 inclusive). A positive action code is a record duration in minutes, a negative action code is a number of stills. The new entry will be inserted to maintain chronological order. A maximum of 448 entries can be added.

Example: \$IEd2016-09-17t13:00a-3 (take 3 stills starting at 1pm on Sept. 17, 2016)

Clear schedule: Sets the schedule size to zero. This does not overwrite the entries in EEPROM.

Enable schedule: Starts the schedule. If basic intervals are enabled, this disables them first. The setting is retained after a power cycle, so the schedule will start from the beginning when the camera is turned on.

Disable schedule: Stops the schedule and intervals. This is the same as the disable intervals command.

Do backlog: Sets whether or not to do backlogged schedule entries. The argument is a 1 or 0. If there are schedule entries with dates in the past, 1 means that they will be executed immediately when the schedule starts, and 0 means that they will be skipped.

Force schedule size: Sets the number of entries in the schedule. The argument is the new schedule size. This is included as a contingency in case the schedule is cleared accidentally.

Print schedule: Prints the entire schedule to the console. This can be used to verify that all entries have been added correctly. Each entry is printed in the following form:
"Index:#\tDate:####-##-##\tTime:##:##\tAction code:#\n"

Setting up the interval file

Open notepad and start a new text file (.txt)

Format for schedule is as follows:

Record : yyyy-mm-dd hh-mm-ss ## (numbers are in minutes)

Stills: yyyy-mm-dd hh-mm-ss -## (number of stills) (each still takes approx. 10 s)

Example:

2016-10-25 15:45 90 (October 25, 2016 at 3:45pm the camera records for 90 minutes)

2016-03-14 00:15 -30 (March 14, 2016 at 12:15am the camera takes 30 pictures)

Save file as XXXX.txt (file name is users choice)



Other configuration options

Camera features

The 1Cam Mk6 has several features which can be configured to suit a particular application. The default values will be suitable for most users but can be modified to achieve the best performance.

Low-power priority (firmware v14.18 and later)

\$ZP#: 0 = full power (default), 1 = low power

By default, the camera manages its peripherals and video outputs for operator convenience.

When low-power mode is active, the following changes are made:

- The composite source will not switch to overlay automatically during recording, nor during HD output. The clean composite source will be black in these cases but the overlay can still be selected manually.
- The Ethernet device (if installed) will shut down 10 minutes after power is applied if no connection is established during that time.
- Internal cooling fans will be shut down depending on other peripheral states.

Backup controller

\$Z*#: 0 = default, 1 = remote, 2 = multi

The internal microcontroller communicates with the camera module through multiple channels. By default, the microcontroller will use whichever channel is most appropriate for a given command. In rare circumstances, it may be necessary to force the use of a particular channel.

Debugging output

\$Zc#: 0 = disable (default), 1 = enable

In addition to the status information and other feedback that the camera provides via its serial connection, certain low-level data and messages can be accessed in debugging mode. This information may be of use when troubleshooting.



Expansion bay (*Optional)

Camera features

Manual Control Inputs

Various *Functions* can be mapped to *Input channels* via serial:

Send **\$Ei#fXX** where # is the input channel and XX is the function to be mapped.

= (Input channel 0 - 4): Channels are mapped to bulkhead pins chosen at point of sale and activated with +-5 to 32Vdc.

XX = (Function 0 - 16): Represents possible settable functions such as zoom, focus, record, still, lasers, etc. Default to zoom in/out and focus near/far.

ZoomIn=0, ZoomOut=1, FocusFar=2, FocusNear=3, FocusAutoManual=4, Still=5, Record=6, Lasers=7, Up=8, Down=9, Left=10, Right=11, Center=12,

Example: \$Ei2f07 would toggle the lasers when +-5 to 32v was applied to channel 2.

Long Line Driver

The LLD option for the 1Cam product line builds in a remotely configurable video amplifier which compensates for attenuation and noise in long cables. Unlike other camera models which incorporate this system, physical modification of this driver is not necessary.

All adjustments are made through serial control via the control software. There are 5 settings for attenuation (**\$Pa# (0 - 4)**) and gain can be adjusted (**\$Pg### (000 - 255)**). Distances do not need to be calculated and these adjustments can be made during operations. This makes for a flexible solution.

Event Inputs

Event Inputs are assigned in a similar way as the Manual Controls. Below is how they are configured via serial commands:

\$E1#X where # is the input channel and X=1=Single, X=0=Continuous Trigger

\$EA#X where # is the input channel and X=1=Active High X=0=Active Low

\$Ed#tTTTT

Apply a delayed start to input # for TTTT

This delay only applies to "interval events", in which the input event triggers intervals. **Example:** \$Ed2t30 Delay the reaction to input 2 by 10 minutes.

\$Et1pXXYY

Input 1, **Event Type 0:** Take XX number of pictures spaced YY seconds apart

Example: \$Et1p1003 would take 10 stills, 3 seconds apart

\$Et0rZZZZ

Input 0, **Event Type 1:** Record Video for ZZZZ seconds

\$Et4pXXYYrZZZZ

Input 4, **Event Type 2:** First run Event Type 0 above, then run Event type 1.





Troubleshooting, precautions and maintenance

Common problems and solutions

Problem 1: Cannot control the camera. No RS232.

Solution 1a: If this is the first time using the unit with this particular computer then it is most likely a driver issue. Try installing the drivers from the USB stick that came with the camera. If that doesn't work, try the same steps on another computer.

Solution 1b: Double check that you are using 232 Tx from your system. Try zooming in or taking a still. You should see the camera operating. If not, comms are connected incorrectly.



Problem 2: The camera focuses on foreground silt in the water column.

Solution 2: Autofocus is enabled by default. Change it to manual focus using the "Focus Type" button. Save settings if the focus has to be locked to manual on bootup.



Problem 3: HD or 4K video flickers on and off and is showing odd artefacts.

Solution 3: Because HD is a digital signal, it is susceptible to noise. Unlike analog video which will show the noise, digital video will not arrive at the destination. This is particularly so with 4K video as it is at least 6Gbps. Try to keep the video cables away from noise sources such as AC, fans, motors, etc.



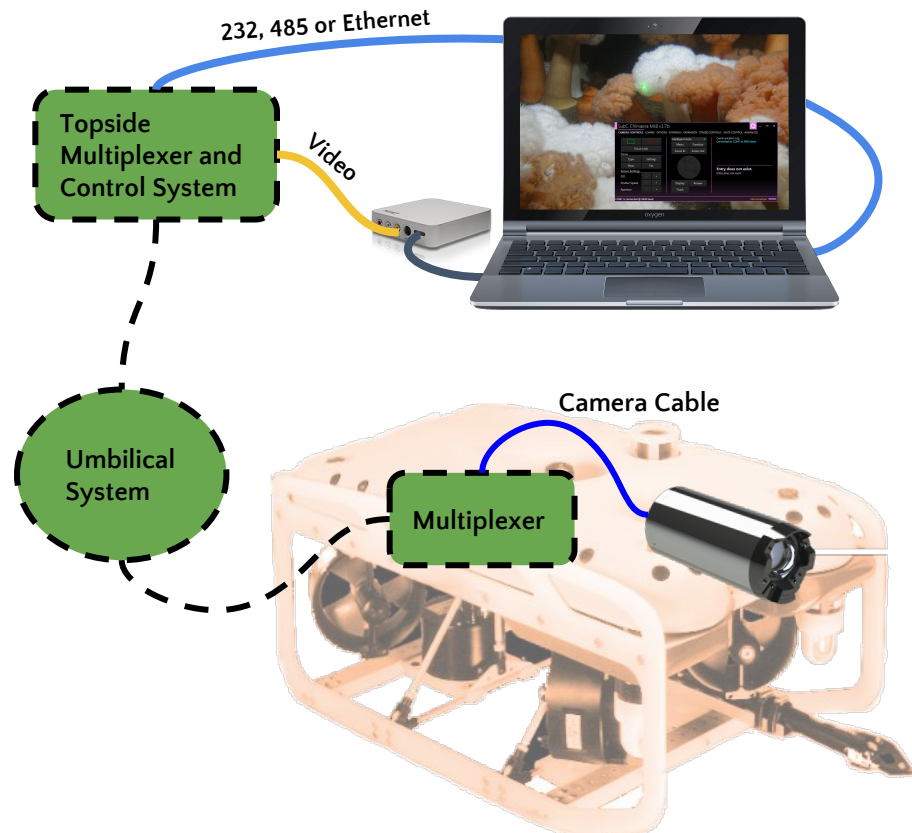
- The camera has been designed for subsea usage. Observe the operating temperature specifications before prolonged usage in air.
- The power supply is polarized. Ensure the correct polarity is used before plugging into the unit. There are many built-in protections on the camera pins, however, incorrect electrical connections may still damage the internal electronics. See your camera's QC sheet for correct wiring. Some equipment has a custom pinout selected at point of sale. Check your documentation before powering.
- Before attaching the connector to the camera, be certain that the pins are aligned, clean and lightly lubricated with appropriate silicon o-ring grease (Ultimate o-ring lubricant <http://www.ablesealanddesign.com>).
- All fasteners on the camera are metric. They should be hand tightened during regular maintenance.
- Water should not be allowed to contact the pins on the bulkheads. When not in use, use dummy plugs. If water touches the pins, use contact cleaner and compressed air to remove the water.
- SubC equipment is designed to work at various depth ratings on unmanned vehicles. Designs are tested to their full pressure rating. Production units are pressure tested to a nominal rating to ensure no leaks. **If using our equipment on vehicles which contain humans, you do so at your own discretion.** Manned submersibles require equipment to have additional pressure testing to ensure safety.



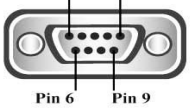
Interfacing with an underwater system

Before interfacing to your system, bench test the camera with the supplied interface box by following the Quick Start. This verifies that all is operational before interfacing to the system.

1. After following the Quick Start, the PC should be set up and ready.
2. Connect the RS232, RS485 or Ethernet from the underwater system multiplexer to the PC
3. The system will need a power source as per technical specifications (pg. 3).
4. Connect video into the system. The topside video should go to a TV, DVR or laptop capture device. On an ROV, video would be displayed on one of the panel monitors.



Pin	1	2	3	4	5	6	7	8	9
RS232 Pinout (9 Pin Male)	DCD	RXD	TXD	DTR	GND	DSR	RTS	CTS	RI



RS232 TXD of the System connects to RS232 RXD of the camera.

* GND of the System has to be connected to GND of the camera for Serial to work.

Ethernet EIA/TIA T568B

TX+	1	2	3	4	5	6	7	8
RX+	1	2	3	4	5	6	7	8



TX+ of System to TX+ of Camera
TX- of System to TX- of Camera
RX+ of System to RX+ of Camera
RX- of System to RX- of Camera



Example of deployment

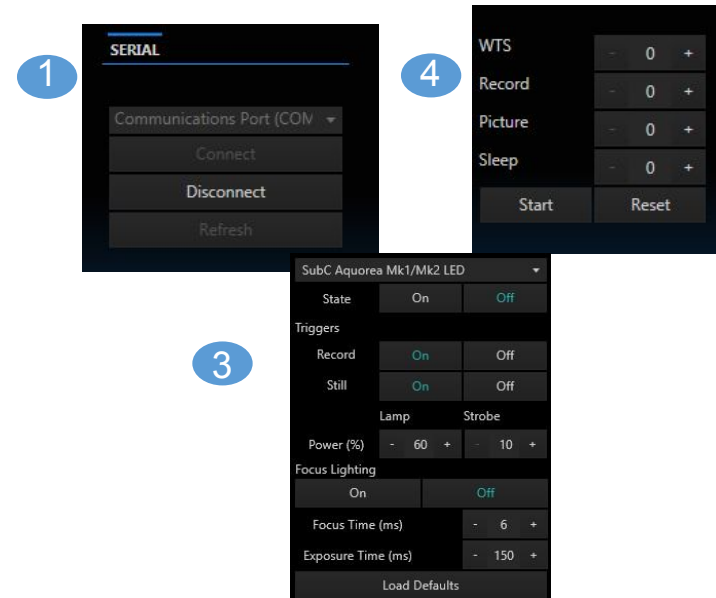
A drop camera system scenario

This section introduces the basic camera configuration steps to perform a typical recording deployment of a 1Cam as part of a [drop camera system](#) and continuous HD recording with illumination:

1. **Connect camera to the computer:** Open camera software, go to the [Comms](#) tab, select the port where the camera is plugged in, then click [Connect](#).
2. **Active HD:** Go to the [Options](#) tab, then enable HD by clicking on the [HD/SD](#) button. **Make sure infrared filter is off.**
3. **Set Light:** Click on [LED controls](#) tab. If you wish to keep the LED on at all times when there is power to the camera click the [LED on](#) button. Set lamp power to desired value.
4. **Set Intervals:** Go to the [Intervals](#) tab, set [Wait To Start \(WTS\)](#) to 3600s, and [Record](#) to 9999s. Press [Start](#). Now wait for the camera to run through its commands until it starts counting down.
5. **Disconnect:** Now that all intervals are ready, go to [Comms](#) and click [Disconnect](#).
6. **Deployment:** Take the camera out on deck and connect it to the frame, light, and battery cables. Deploy your system in water.
7. After retrieval, repeat step 1.
8. **Reset Intervals:** Go to the [Intervals](#) tab and click [Reset](#) to stop the interval configuration.
9. **Download footage:** To start downloading your footage, go to the [Options](#) tab and click on [USB](#). A window will appear accessing the folder with all your videos/pictures.

Important notes on this example:

- **Step 4:** The camera will wait for 3600 seconds before going into interval mode, and will record during 9999 seconds.
- **Step 3:** If light is **ONLY** needed while recording, then click on [Record](#) under the [Triggers](#) category. This option is better to save battery power.
- **There are two options for memory:** Internal and memory card. Internal memory has 96GB. To switch between both options go to the [Menu](#) option in the [Camera Controls](#) tab and pick your storage source.





SubC serial commands

All SubC commands start with a '\$' character and end with a '\n' newline or <CR>. Some commands are not implemented, depending on camera. Commands are case-sensitive.

Page 32

Direct Control Inputs

\$D1 – Take still
\$D2 – Start/Stop recording
\$D3 – Zoom in
\$D4 – Zoom out
\$D5 – Up
\$D6 – Left
\$D7 – Select
\$D8 – Right
\$D9 – Down

Functions

\$FA – Auto (0: auto, 1: manual)
\$FN – Focus near
\$FF – Focus far
\$FZ## – Set zoom steps (0-20)
\$FS## – Set focus steps (0-20)

Peripheral Commands

\$PO – Power toggle to save settings
\$Pv – Video mode (HD/SD)
\$Pu – USB mode toggle
\$PI – Internal laser toggle
\$PM – Menu toggle
\$Pm – Video/Photo mode toggle
\$PD – Display toggle

Review Mode

\$Rr – Review toggle
\$Rd – Data code display
\$Rp – Play
\$Ro – Pause
\$Rs – Stop
\$Rr – Rewind
\$Rf – Fast forward
\$Rz# – Review zoom (0: out 1: in)

LED Strobe/Lamp

See LED section of this manual

Intervals

See interval section of this manual

Expansion Bay

See expansion bay section of this manual for additional commands.

\$EE# – Set expansion mode (0: empty, 1: long line driver v3, 2: manual controls, 3: event inputs, 4: aux. I/O, 5: LLD v3.1+)
\$Ea# (LLD attenuation 0-4)
\$Eg# (LLD gain 0-255)

Addressing (multi-drop)

Commands can be sent to a particular camera by appending "I" (pipe) and the camera's serial number.

Example: \$D1|SUBC15000

1Cam Specific Commands

\$Pn – Infrared filter toggle
\$PC### – Set video file chunk size in minutes
\$PC##:## – Set video file chunk size in hours and minutes

1Cam 3D Specific Commands

\$Dp – ISO down
\$PD – 2D/3D toggle

Chimaera Specific Commands

\$Dp – ISO down
\$Ds – ISO up
\$D[– Aperture down
\$D] – Aperture up
\$D{ – Shutter speed down
\$D} – Shutter speed up

\$Fb# – Continuous stills (1: on, 0: off)
\$Ff# – Focus hold (1: on, 0: off)
\$Fc – C1 programmable
\$FC – C2 programmable
\$FI – C3 programmable
\$Fh – Function menu

\$Pv – Video mode (NTSC/PAL)
\$P[#] – Camera mode (0-9 P/A/S/M)

Sensors

\$Sc – Clear alarms
\$Sm – Timer mode (0-4)
\$Sr – Print total runtime
\$St – Print temperature
\$Ss – Print device state

Ancillary

\$Zd# – Driver mode (0:232 1:485)
\$Zb# – Driver baud (0:9600, 1:115200, 2:57600, 3:19200, 4:4800)
\$Z? – Print device status
\$Z^ – Reset all EEPROM to default
\$Z*# – Switch to backup control
\$Zc# – Toggle or enable/disable debugging serial output (1: on, 0: off)
\$Zn##### – Set serial number
\$ZP# – Set low power priority (0: full power default, 1: low power)