

Operational Manual

PROTON 4K



1 Table of Content

1 Table of Content.....2

2 Welcome..... 4

3 Technical data.....5

 3.1 Overview.....5

 3.2 Dimensions.....6

 3.3 Camera Mount.....7

 3.4 LEDs..... 8

 3.5 Power and Heat Management.....9

 3.5.1 Cooling Fan 10

 3.5.2 Overtemperature Protection 11

4 Connection..... 12

 4.1 Power / Control Cable..... 12

 4.2 Coax Cable 13

 4.3 Coax Cable Extension 14

 4.4 Cable Handling 15

5 Control..... 16

6 Firmware Update 17

7 Lenses..... 18

 7.1 Lens Mount and Standard Lens 18

7.2 Focus Adjustment..... 18

7.3 Change Lens 19

8 Safety..... 21

9 Warranty.....22

10 Certifications 24

11 Recycling..... 25

2 Welcome

Dear content creator,

thank you for choosing our PROTON 4K for your next project.

PROTON 4K is the smallest broadcast camera in the market with full image control, amazing 12 bit dynamic and ultra wide-angle shots.

This will give you spectacular new perspectives without compromising on quality.

The only limit is your imagination.

This **Operational Manual** gives you a short overview of how to operate the camera. Detailed information about the control interface can be found in the **Reference Manual**.

In case you are missing a feature in on our product, feel free to share your thoughts with us. We love to get your feedback to bring even more innovation into our products.

Your PROTON CAMERA INNOVATIONS Team.

FUTURE. MINI. CAMERA.

3 Technical data

3.1 Overview

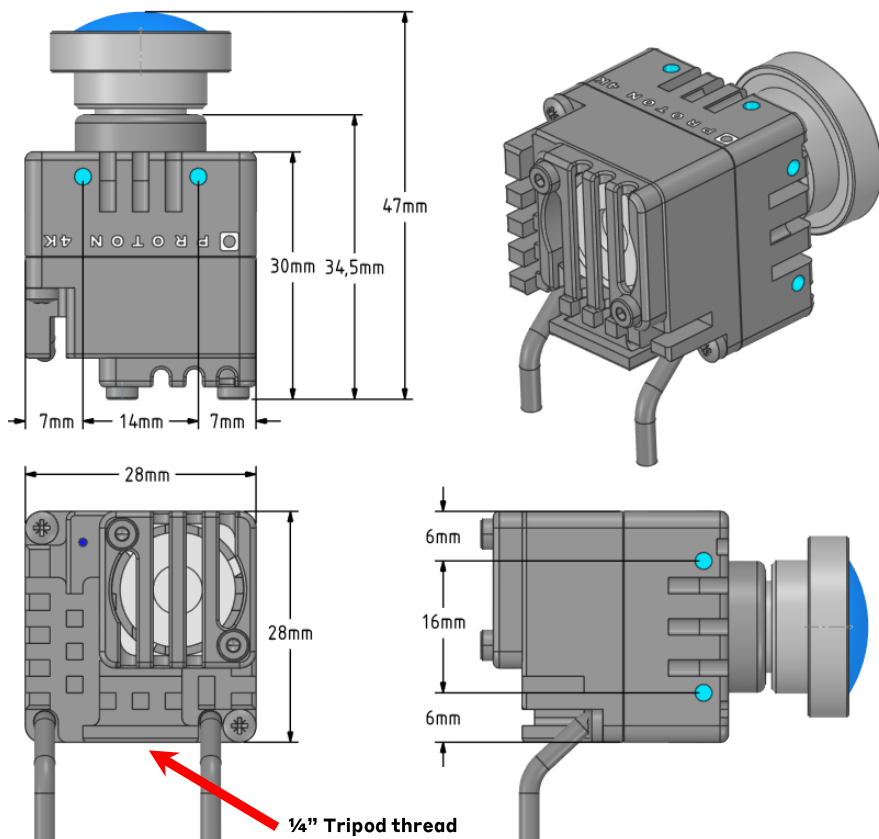
Size	28x28x34.5 mm
Weight	31 g body only 5.5 g lens 3.2 mm / 97 degree 57 g cable (≈30 g per meter (3 feet))
Operation voltage	10,5 V – 25 V (Camera has reverse polarity protection)
Power	6 W (4KP60, cold camera)
Operational temperature	-30 ... 60 °C
Lens mount	M12 / S-mount Inbuild high quality IR cut filter. Supporting lenses with no IR filter with perfect color reproduction.
Sensor	4 µm pixel – 1/1.8" – 8.8 mm diagonal 12 bit dynamic (72 dB)
FOV	124 / 85 degree (H / V) with a 2.2 mm lens 97 / 64 degree (H / V) with a 3.2 mm lens (factory lens is 3.2mm)
ISO	75 – 2400 200 – 6400 (low light mode)
Shutter	6 µs ... 1/FPS

Video modes

UHD + FHD SDI 12G, 6G, 3G, 1.5G
P23, P24, P25, P29, P30, P48, P47, P50, P59, P60
FHD also supports I50, I59, I60

3.2 Dimensions

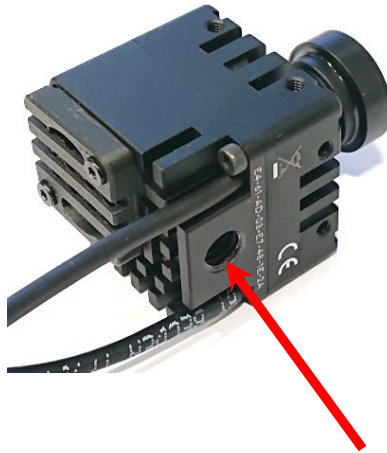
The camera has a size of 28x28x34.5 mm, refer to the technical drawing below for details.



3.3 Camera Mount

The camera offers 6 M2.5 mount holes for custom mounting according to the dimensions diagram.

At the bottom of the camera is a ¼" tripod thread for easy integration. This mount point is preferred for best cooling.



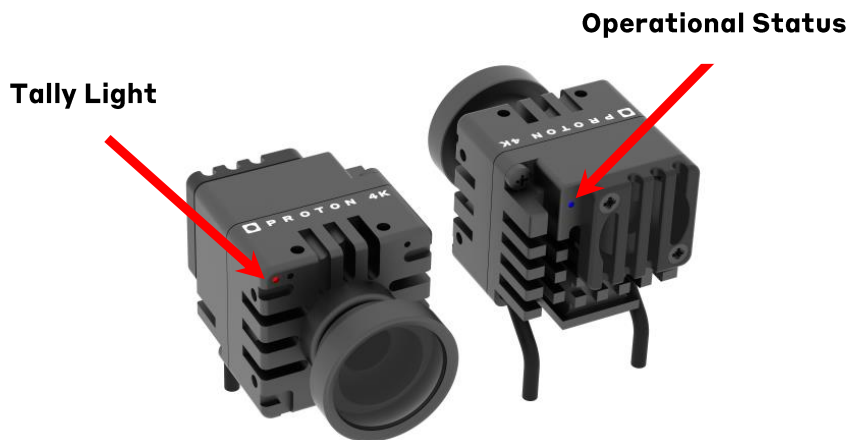
¼" Tripod thread

3.4 LEDs

The camera has two status lights:

- RGB LED for operational status on the backside:
 - Green / Cyan blinking: Boot
 - Blue blinking: Operation
 - Yellow blinking: Busy
 - Red blinking: Error
- Red Tally LED on the front: Can be controlled via software (**system tally** command)

Please Refer to the Reference Manual for more details.



3.5 Power and Heat Management

PROTON 4K has the lowest power consumption on the mini camera market ($\sim 5\text{-}6\text{ W}$), but due to the extremely small form factor the camera can get hot ($75\text{-}85\text{ }^{\circ}\text{C}$).

These are the power factors that can be optimized:

Factor	Action
Temperature	<p>The hotter the camera gets, the more power it will use:</p> <p>$+20\text{ }^{\circ}\text{C}$ (e.g. $60^{\circ}\text{C} \rightarrow 80\text{ }^{\circ}\text{C}$) = $+1\text{ W}$.</p> <p>Better mounting \rightarrow Better cooling \rightarrow Lower power consumption</p> <p>A cool camera consumes $\sim 5\text{ W}$ at 4Kp60. In a hot environment it can go up to 6 W</p>
Operational voltage	<p>The efficiency of the power supply depends on the operating voltage.</p> <p>Best efficiency is achieved around 12 V, worst at 25 V ($+300\text{ mW}$).</p>
Video mode	<p>p60 and i60 video modes have the highest power consumption. In case high frame rates are not needed, by switching to p24 the power will go down to 4.5 W</p>

3.5.1 Cooling Fan

PROTON 4K is the smallest 4K camera for broadcast with lowest power in market. This small size needs some thermal considerations.

6W cannot be passively cooled with a very small housing.

To guarantee stable and uninterrupted operation, the camera has an inbuild fan. The fan keeps the camera operational in difficult situations.

The camera will shut down at 90 °C but this does not happen if the environment temperature is not too high and there is some airflow.

Here are example mountings and fan temperatures as reference:

Use case	Passive cooling	Fan temperature	Note
Camera on desk, no mount	None	Any settings	Fan always on. Temperature up to 85 degrees
Camera on mini Tripod	Limited cooling	70 °C	Fan will turn on and off every 3 minutes
Camera on mini Tripod	Limited cooling	80 °C	Camera hot, but fan may stay off. Internal audio can be used
Camera on metal tripod / metal bar	Solid mount with metal to spread heat	80 °C	Fan will never go on. Camera will run ~65 degrees Internal audio can be used

3.5.2 Overtemperature Protection

The camera has internal temperature monitoring and will shut down when over temperature is detected (90 °C). When the temperature drops sufficiently, the camera resumes operation.

Over temperature events are logged and can be checked using the **system error** and **system temp count** commands (see Reference Manual for details). Note that the error log is not persistent and must be read before the camera gets powered off. The over temperature event counter is stored persistently.

4 Connection

The camera has two connection cables:

- **Power / Control Cable:** Hirose HR10A-7P-6P(73)
 - Power
 - RS485 (120 Termination in camera)
- **Coax Cable:** Belden 179DT with BNC Plug

Power can be supplied in 4 ways:

- Connect to a CyanView CIO:
<https://support.cyanview.com/docs/Manuals/CIO/CIOManual>
- Connect to a power supply (sold separately: PCI-ACC-PSU) or a PC with a PROTON PIO box (sold separately: PCI-ACC-PIO).
- Use a breakout cable (sold separately, ref: PCI-ACC-FOUT).
- Cut the power cable and use a custom power supply.

4.1 Power / Control Cable

Signal	Cable color	Breakout Cable	HR10A-7P-6P pin
RS485 A+	white	white	1
RS485 B+	black	green	2
GND	blue	black	5
Power	brown	red	6

The Hirose HR10A-7P-6P(73) connector is directly compatible with a **Cyanview CIO** (www.cyanview.com) for simple integration.

4.2 Coax Cable

The coax cable transports the 12 Gbit SDI video signal. Bad extension cables or unprofessional shortening may cause signal loss. This work should only be done by trained experts and checked with an SDI analyzer to confirm the required performance is achieved.

The following components and tools from www.coax-connectors.com are used in the camera:

- Cable: Belden 179DT
- BNC Straight Jack: 75R 12GHz - 10-500-W126
- Stripper: 96-312D
- Crimping Tool: 96-336J
- BNC Plug 75R: 10-005-B36-ABI

4.3 Coax Cable Extension

12G signals are very sensitive to bad cables or wrong way of cable extension. This leads to no or instable image (drop out).

The camera has a 1.8m (6 feet) cable but can be extended with **ONE HIGH QUALITY barrel connector** or SDI extension cable.

For extension the following cables have been tested as a reference. SDI defines 40dB loss for maximum cable length.

This table is based on conservative 35dB for additional headroom.

Cable type	Length 3G SDI
RG179	5m
RG-59	5m
Vector 08/3.7	10m
Belden 1694A	40m
Belden 4694A	50m

4.4 Cable Handling

The cables are directly mounted into the camera and are clamped internally, so they will not slip out.

The design of the housing is done in a way that enables the cables to be routed in different directions. This simplifies integration in tight spaces.

The cables are sensitive to breaking. Therefore, do not bend the cables many times around tight corners.

In case the camera is mounted permanently, this is not an issue. For rental cameras, hard bending is not recommended since the cable can develop an internal break. Please advise the rental partner.

Damage to the cable is not covered by the warranty but can be repaired at our service center for a fee.

The camera is very tough but be nice to it 😊.



5 Control

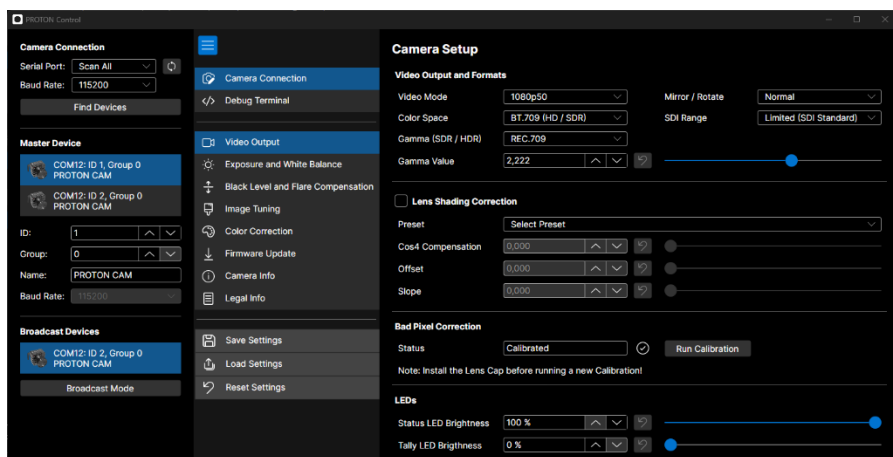
The camera is controlled via an RS485 interface. Details about the PROTON OS protocol can be found in the Reference Manual.

The camera is supported by Cyan View RCPs with CIO. Just plug and play to operate the camera:

www.cyanview.com

The camera can also be controlled by our easy-to-use PROTON Control software which is available for PC and MAC and can be downloaded here:

www.proton-camera.com/downloads



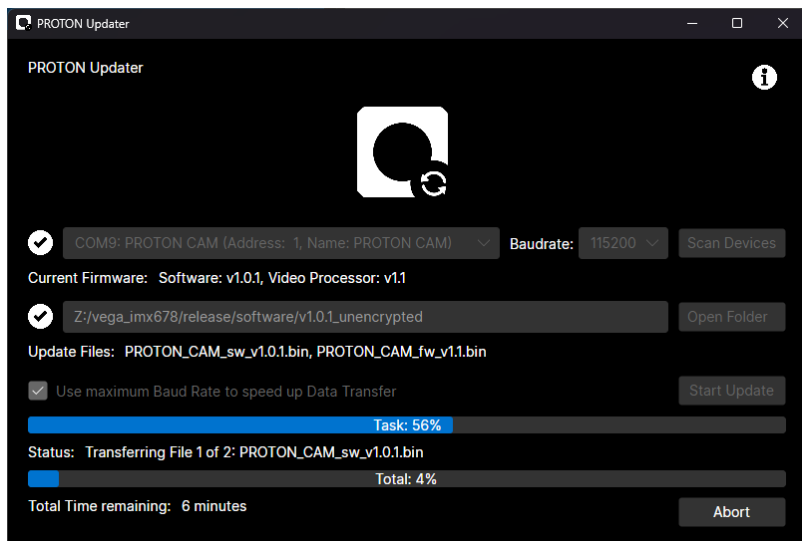
6 Firmware Update

The camera's firmware can be updated by the customer. For this a PROTON PIO (ref: PCI-ACC-PIO) and a PC or MAC are required.

The PROTON Updater software can be found on:

www.proton-camera.com/downloads.

Refer to the Reference Manual for details on the firmware update process.



7 Lenses

WARNING: The camera supports ultra-wide angle and is very compact. Therefore, the distances between the lens, the inbuild IR cut filter and sensor are VERY short.

You can screw the lens into the filter and damage it.

Read the instructions below carefully to prevent damage to the camera.

7.1 Lens Mount and Standard Lens

The PROTON 4K does have a M12 lens mount.

The camera is equipped with the following lens:

- 3.2 mm F2.3 distortion free lens
- 97 / 68 degree (H/V)

The lens can be changed by the user. PROTON is offering a wide range of tested high quality lenses. Visit our webpage for details.

7.2 Focus Adjustment

The focus can be changed by turning the lens.

IMPORTANT: To prevent damage to the IR cut filter, **NEVER turn the lens inside the camera without monitoring the live image.**

Only this way you can “see” if the lens is screwed in too far and is about to touch the filter. **The IR cut filter is 9 mm away from the outer thread edge.**

Procedure to set the focus:

1. Start the camera to get live image
2. Turn the lens OUT (turn left)
 - a. Check if focus gets better
 - i. Yes → Continue until focus is set
 - ii. No → Go to step 3
 - b. Minor toggling in both directions until focus is good
3. Turn the lens IN (turn right)
 - a. Check if focus gets better
 - i. Yes → Continue until focus is set
 - b. Minor toggling in both directions until focus is good
 - c. In case you are losing focus go back to step 2

The “safe” zone is small ($\sim 0.5\text{mm}$ = 1 full turn), be careful.

7.3 Change Lens

IMPORTANT: To prevent damage to the IR cut filter, **NEVER turn the lens inside the camera without monitoring the live image.**

Only this way you can “see” if the lens is screwed in too far and is about to touch the filter.

Change procedure:

1. Turn the lens OUT (turn left) until it falls out (about 8 mm)
2. Start turning the new lens IN (turn right)
 - a. The first 2.5 mm is no resistance, it is very smooth
 - b. Then you should feel a resistance (there is an O-ring to lock the lens)

c. Turn ON the camera to get life image before you proceed!

- d. After about 5mm in there is a 2nd O-ring, so the resistance increases slightly.
- e. The focus is around 1.5 mm further in.

→ Continue with the “set focus” procedure as described in chapter Fehler! Verweisquelle konnte nicht gefunden werden..

8 Safety

The camera gets hot during operation. This is normal on a passively cooled device.

Especially in a hot temperature environment the temperature can reach above 80 °C.

Touching may be harmful or cause burns on longer contacts.

In case you operate the camera in those scenarios, take precautions when handling the camera.

It is recommended to use a solid camera mount to improve cooling, see chapter 3.5 for details on power and heat management.

The internal temperature is monitored to get an indicator of current operating condition. The camera is protected from over temperature. It will shut down in this case. When the temperature drops, the camera will resume operation. See chapter 3.5.1 for details on the over temperature protection.

9 Warranty

PROTON Camera Innovations GmbH warrants that this product will be free from defects in materials and workmanship for a period of **6 months** from the date of purchase. If a product proves to be defective during this warranty period, PROTON Camera Innovations GmbH, at its option, either will repair the defective product without charge for parts and labor or will provide a replacement in exchange for the defective product.

To obtain service under this warranty, you the Customer, must notify PROTON Camera Innovations GmbH of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. The Customer shall be responsible for packaging and shipping the defective product to a designated service center nominated by PROTON Camera Innovations GmbH, with shipping charges pre-paid. Customer shall be responsible for paying all shipping changes, insurance, duties, taxes, and any other charges for products returned to us for any reason.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. PROTON Camera Innovations GmbH shall not be obligated to furnish service under this warranty: a) to repair damage resulting from attempts by personal other than PROTON Camera Innovations GmbH representatives to install, repair or service the product, b) to repair damage resulting from improper use or connection to incompatible equipment, c) to repair any damage or malfunction caused by

the use of non PROTON Camera Innovations GmbH parts or supplies, or d) to service a product that has been modified or integrated with other products when the effect of such a modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY PROTON Camera INNOVATIONS GMBH IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. PROTON Camera INNOVATIONS GMBH AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. PROTON Camera INNOVATIONS GMBH'S RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE WHOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER PROTON Camera Innovations GmbH OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES. PROTON Camera INNOVATIONS GMBH IS NOT LIABLE FOR ANY ILLEGAL USE OF EQUIPMENT BY CUSTOMER. PROTON Camera INNOVATIONS GMBH IS NOT LIABLE FOR ANY DAMAGES RESULTING FROM USE OF THIS PRODUCT. USER OPERATES THIS PRODUCT AT OWN RISK.

10 Certifications

This equipment has been tested and found to comply with the limits for a Class B digital device in a residential environment according to the following rules:

- European Council Directive- EMC Directive 2014/30/EU.
- General Product Safety Directive (GPSD)
- RoHS Directive 2011/65/EU + 2015/863
- FCC rules part 15.

11 Recycling

You can return an old or damaged PROTON Camera Innovations product for recycling. The recycling is free of charge.

For recycling, please request an RMA form for your device via email from

weee@proton-camera.com

We need the following information:

- Subject: Recycling
- Product name
- Product serial number
 - Can be found on bottom of product

Please ship the product at your expense to our office, including the RMA form.

PROTON Camera Innovations GmbH
Fockestraße 10
30827 Garbsen
Germany

By sending in the product, it will be owned by Proton Camera Innovations GmbH and will be recycled according to German law.