Operational Manual

PROTON HFR

1 Table of Content

2 Welcome

Dear content creator,

thank you for choosing our PROTON HFR for your next project.

PROTON HFR is the smallest high frame rate broadcast camera in the market with full image control and amazing 12 bit dynamic.

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	36x36x85 mm +5mm with C mount adapter
Weight	150 grams
Operation voltage	12 V – 30 V (Camera has reverse polarity protection)
Power	16 W (P60 / P240)
Operational temperature	-30 … 60 °C
Lens mount	C mount with CS mount support.
Sensor	2/3" 1920x1080 4.5 µm pixel 8.64 mm x 4.86 mm – 11 mm diagonal 12 bit dynamic (72 dB)
ISO Base sensitivity	*Tbd.*
Shutter	6 µs … 1/FPS
Video modes	1-4 phases 1920x1080 SDI 1.5G / 3G P23, P24, P25, P29, P30, P50, P59, P60 Optional: 4K 12G SDI SQD or 2SI mode
Audio	2x 3.5 mm stereo microphone audio socket. 48 Khz sampling rate 24 bit. 80 dBA Signal-to-Noise-Ration.

3.2 Dimensions

The camera has a size of 36x36x85 mm, check the technical drawing below for details.

PROTON HFR

PROTON CAMERA INNOVATIONS
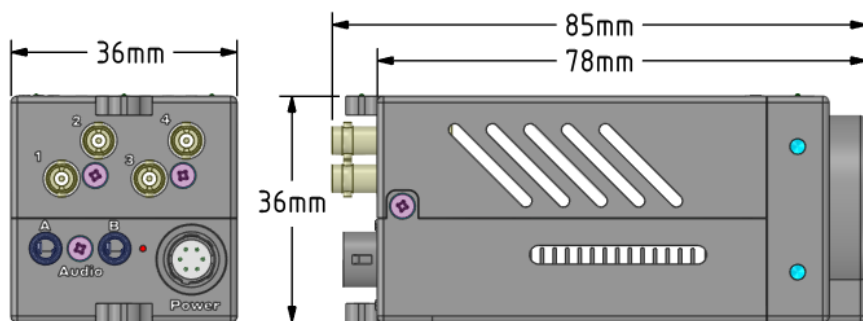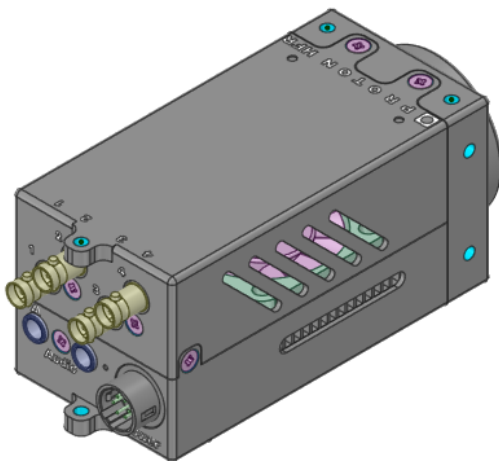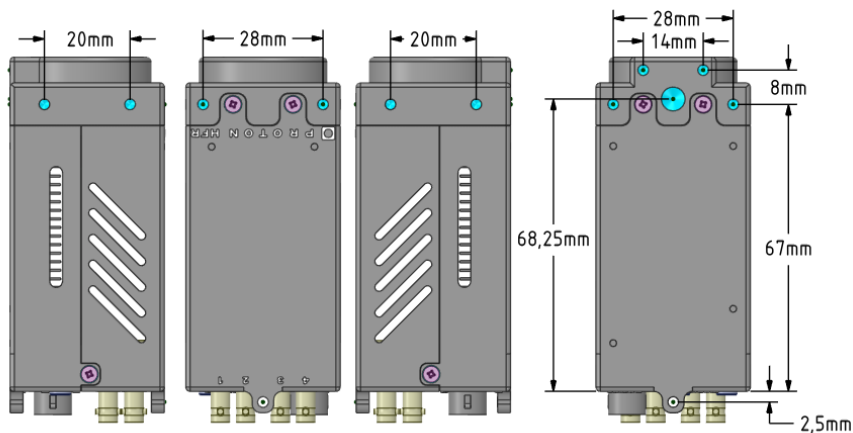
3.3 Camera Mount

At the top and bottom of the camera is a ¼" tripod thread for easy mounting.

For custom mounts, there are 12 M3x4 around the housing.

Check diagram for details.

PROTON HFR

P R O T O N
CAMERA INNOVATIONS
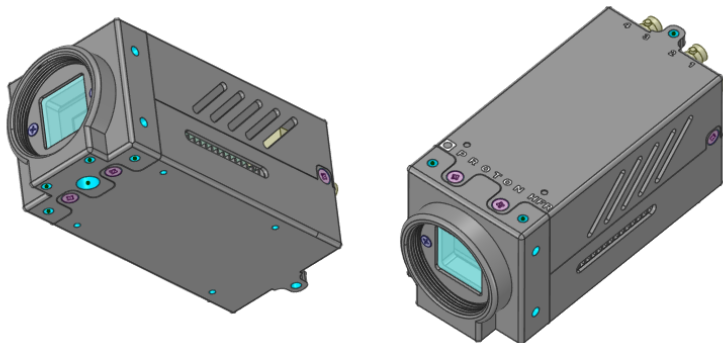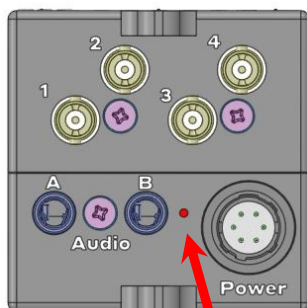
3.4 LEDs

The camera has an RGB LED for operational status on the backside:

- o Green / Cyan blinking: Boot
- o Blue blinking: Operation
- o Yellow blinking: Busy
- o Red blinking: Error

Please refer to the Reference Manual for more details.

Operational Status
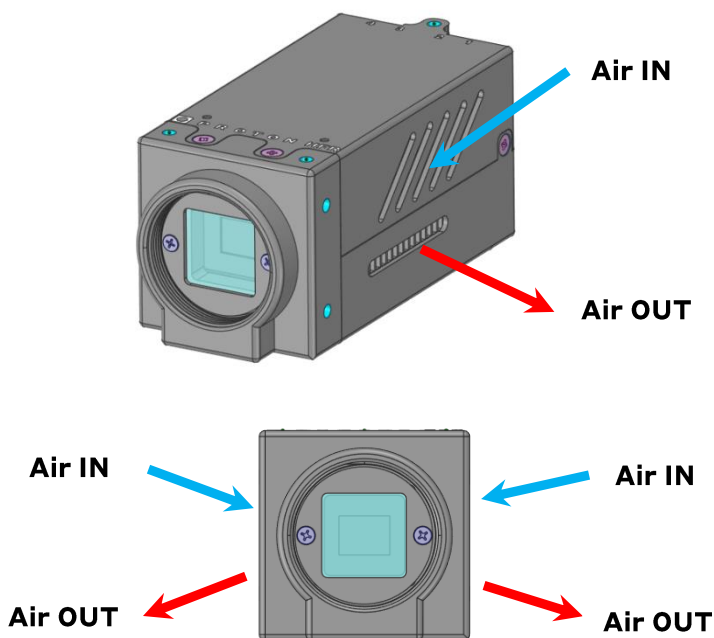
PROTON HFR

PROTON CAMERA INNOVATIONS

3.5 Power and Heat Management

PROTON HFR requires constant good cooling to handle 16 W of power. For this the camera has inbuild active cooling.

The cooling requires good airflow from the top area of the camera to the bottom area as shown below.

The temperature of the camera is constantly monitored to prevent damage.

On normal operation the camera will run in the range of 65 °C.

Good mounting and airflow improve cooling performance.

PROTON
CAMERA INNOVATIONS

3.5.1 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.

Usually this only happens in a very hot environment (e.g. desert, direct sunlight).

PROTON
CAMERA INNOVATIONS

4 Connection

All connectors are on the backside of the camera.

4x

SDI Video

2x

Audio
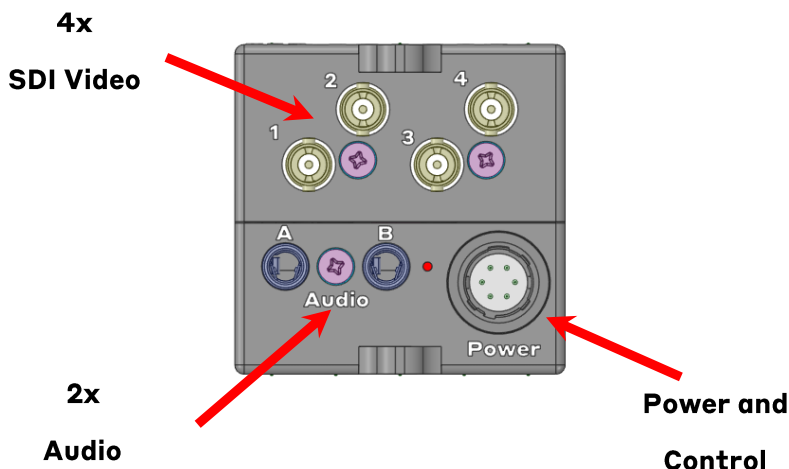
Power and

Control

- **Power / Control**
  - o Hirose HR10A-7R-6P(73)
- **SDI Video**
  - o HD-BNC
- **Audio**
  - o Audio 3.5mm socket

4.1 Power / Control

Use a PROTON connection cable **PCI-ACC—CAM—02** (sold separately) to power and control the PROTON HFR.

PROTON HFR

PROTON
CAMERA INNOVATIONS

Connector pinout:

HFR connector HR10A-7R-6P pin	Signal
1	RS485 A+
2	RS485 B+
5	GND
6	Power

Power can be supplied in 3 ways:
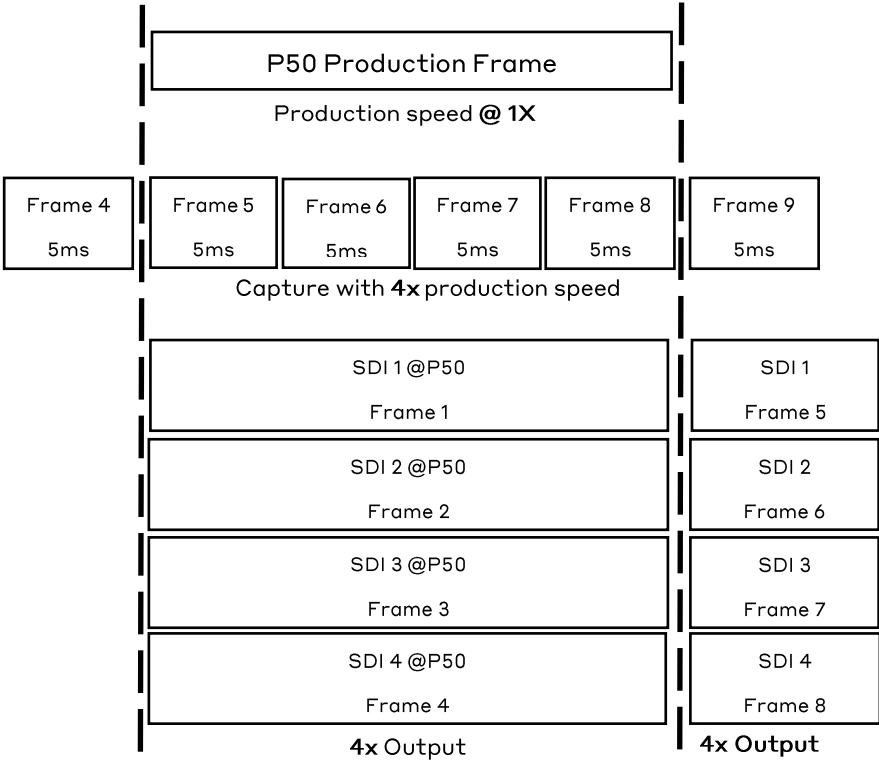
- Connect to a CyanView CIO:
  https://support.cyanview.com/docs/Manuals/CI0/CI0Manual
- Connect to a power supply (sold separately: PCI-ACC-PSU-24-1) via a PROTON PIO box (sold separately: PCI-ACC-PIO).
- You can build your own cable by using the mating HR10A-7P-6S(73) connector.

PROTON
CAMERA INNOVATIONS

4.2 SDI Video

The SDI outputs support formats up to 12G SDI (sold separately) and their usage depends on the output mode.

4.2.1 Single Phase (3G)

The camera uses each of the 4 independent video outputs for one phase of the high frame rate stream. All 4 frames are displayed on each SDI output at the start of the next production frame. Please refer to the diagram below.

P50 Production Frame

Production speed **@ 1X**

Frame 4 5ms	Frame 5 5ms	Frame 6 5ms	Frame 7 5ms	Frame 8 5ms	Frame 9 5ms

Capture with **4x** production speed

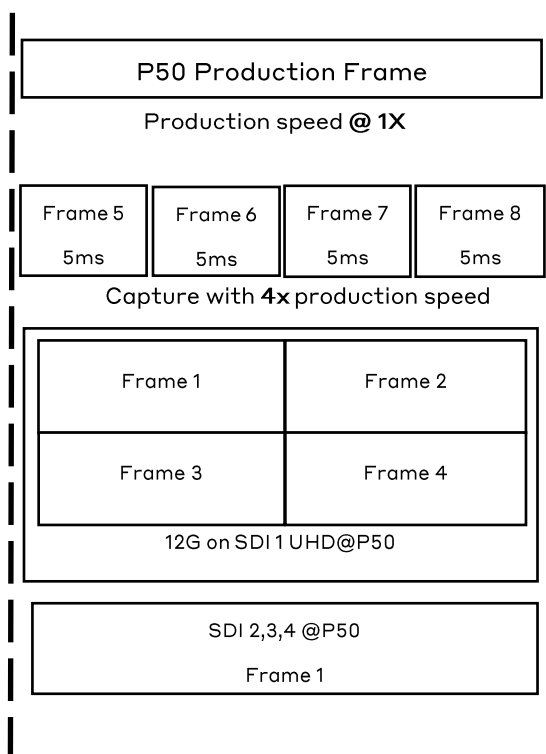| SDI 1 @P50 Frame 1	SDI 1 Frame 5
SDI 2 @P50 Frame 2	SDI 2 Frame 6
SDI 3 @P50 Frame 3	SDI 3 Frame 7
SDI 4 @P50 Frame 4	SDI 4 Frame 8

4x Output   **4x Output**

The capture is done with up to 4X of production speed.

These 4 phases will go into a production server to create a 4x slow motion out of the 4 frames.

4.2.2 SQD (12G)

12G SDI can be used for the optional SQD mode (square division). In that case SDI 1 shows 4x 1080 packed in a 2x2 grid as a single UHD frame:

P50 Production Frame

Production speed **@ 1X**

Frame 5 5ms	Frame 6 5ms	Frame 7 5ms	Frame 8 5ms

Capture with **4x** production speed

Frame 1	Frame 2
Frame 3	Frame 4

12G on SDI 1 UHD@P50

SDI 2,3,4 @P50 Frame 1

The other outputs (SDI 2, 3 and 4) show the image of phase 1 for monitoring. For unused phases a black image is inserted into the quad image.

This mode is ideal when using a video codec for compression as the image geometry stays intact.

4.2.3 2SI (12G)

In 2SI mode (2-sample interleave) each phase is directly mapped to one of the four sub images of the 12G SDI stream on SDI 1.

Like in Quad mode the other outputs (SDI 2, 3 and 4) show the image of phase 1. For unused phases the sub image is set to black.

This mode is ideal when transmitting the SDI signal uncompressed as it allows for easy decoding without a frame buffer.

NOTE: Make sure that in 12G mode your cable and connector are 12G graded. A lot of HD-BNC cables are tested only up to 6G.

PROTON
CAMERA INNOVATIONS

4.3 Audio Connector

The two 3.5mm audio sockets can be used for microphones or line input.

Pinning of audio sockets:

Pin	Signal
1	Left
2	Right
3	GND

The ADC includes an analogue amplifier with 40dB gain to adapt to any application.

The audio connector supports 3 types of input signals.

- **Electret microphone**
  - o 2.5 V bias can be enabled in PROTON Control
- **Dynamic microphone**
- **Any line-in signal**
  - o Wireless receiver
  - o Amplifier with line out
  - o Computer (isolation transformer recommended)

PROTON HFR

**PROTON** CAMERA INNOVATIONS

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:
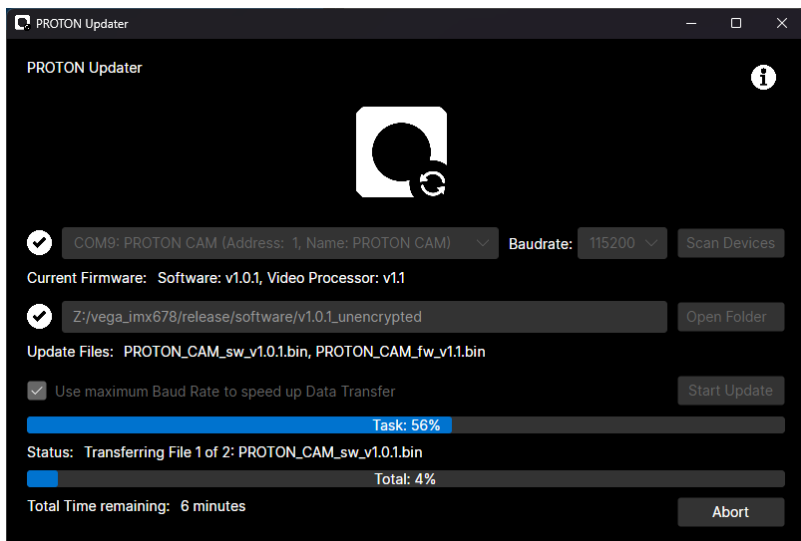www.proton-camera.com/downloads
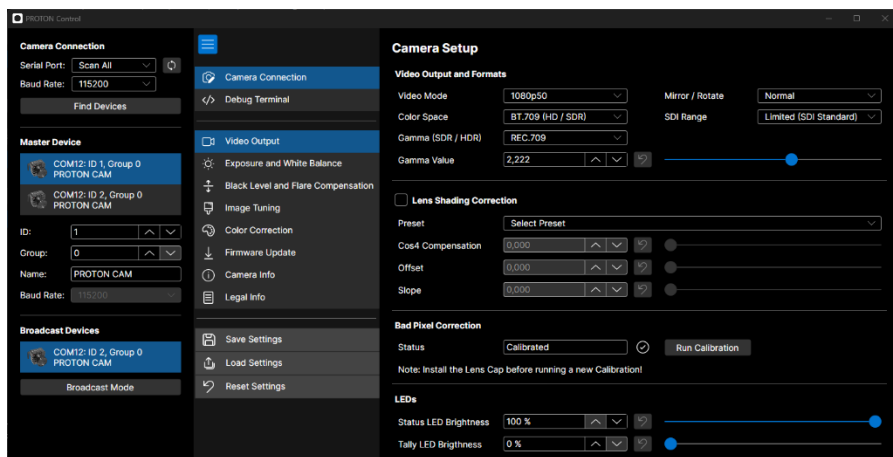
6 Firmware Update

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

7.1 CS / C mount

The Proton HFR is a CS mount camera with a fixed back focus of 12.5 mm.

With a 5 mm adapter (included with the camera) the back focus can be adjusted to C-mount back focus of 17.5 mm.

7.2 Back focus settings.

The back focus of CS and C mount lenses are usually not very precise.

This means that in case the camera has a perfect back focus (12.5 mm / 17.5 mm) it is possible that your lens cannot focus on infinity.

To address this problem, we set the back focus about **~50 um short** in factory on purpose. By this you always get focus in infinity.

Depending on your lens it is possible to get out of focus in infinity when turning too far. In this case, adjust your lens focus a little back to compensate this.

If you want to adjust the back focus matching your lens, please add 25 mm shims to the CS mount thread.

On request we can shim the camera to your lens internally. Contact our sales department if you have demand for that.

8 Safety

The camera gets warm during operation. This is normal on a 16 W device, even with active cooling.

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.

The product is tested safe according to EN 62368-1 (2025-01).

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

PROTON
CAMERA INNOVATIONS

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 WETHER 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.

PROTON CAMERA INNOVATIONS

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.