Apollo 428M MAX Pro Camera Manual

V1.0

Dec, 2024

Table of Contests

Product Features

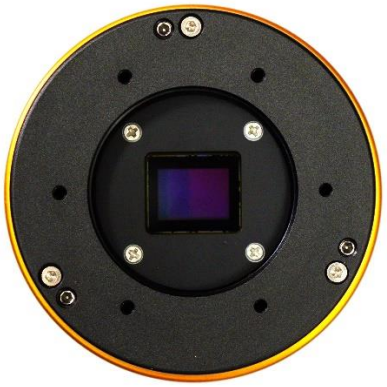
DSO cooled camera line is the most advanced product line in Player One history. We start the project from 2021, through a lot of modify and rebuild we made this final version. It brings our newest technology and design to everyone, we are very proud to introduce this camera line.

Technical parameters

Sensor	New SONY IMX428 1.1" CMOS (mono)
Diagonal	17.5mm
Total Pixels	7.1 Mega Pixels
Max Resolution	3216×2208
Pixel Size	4.5μm
Chip Size	14.5mm×9.9mm
Frame Rate	51FPS（10bit）
Shutter	Global shutter
Exposure Range	32μs-2000s
Readout Noise	22.9e~2.6e
Full Well	25.3k e
QE Peak	≈79%
ADC	12 bit
Cooling System	High quality 2 stage TEC cooling Component
Cooler Power Consumption	12V – 3A Max
Delta T	35°C-40°C (below ambient)
Working Temperature and Humidity	Working Temperature: -10°C—60°C Working Relative Humidity: 0%—80%
Protective Window	D32*2MM High Quality AR Plus (Anti Reflection) Multi-Layer Coating
Data Port	USB3.0/USB2.0
Adapter	1.25″ / M42X0.75
Back Focal Length	17.5mm
Diameter	78mm
Weight	420g
Resolution and FPS	Under USB3.0 mode Resolution 10bit 12bit ADC 3216×2208 51FPS 27FPS More resolution options could be setup in capture software!

Product Description

Apollo 428M MAX Pro camera is developed by Player One Astronomy, a real cooled camera for solar imaging. Apollo-M MAX Pro camera, which adopts **Sony IMX428 1.1" format** monochrome sensor. The **4.5um pixel size** accommodates a well depth of **25.3ke** with a total of **7.1MP** (the resolution is 3216*2208)**,** and the diagonal is **17.5mm**.

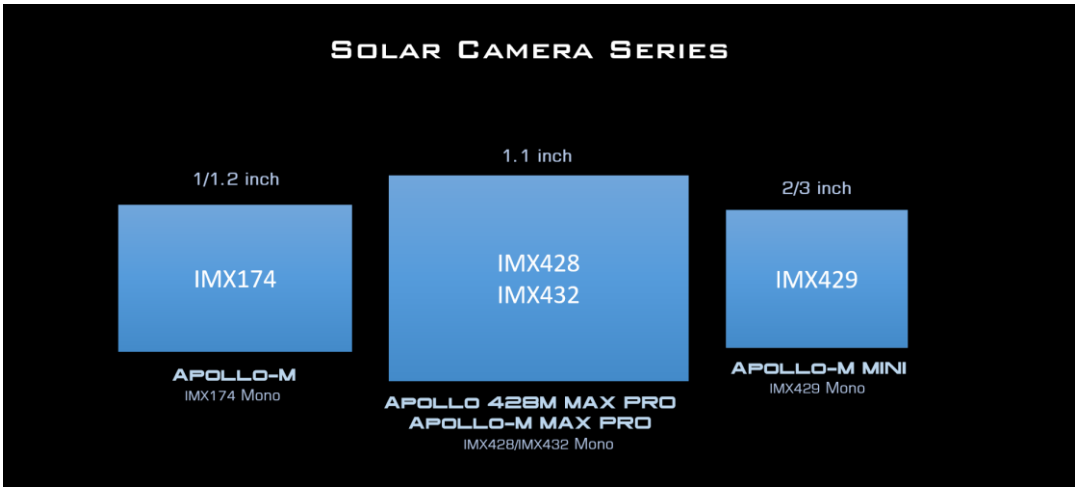


Pregius Technology

Apollo 428M MAX Pro based on **Sony Pregius 3rd Gen technology**, it is global shutter technology used in CMOS sensors.

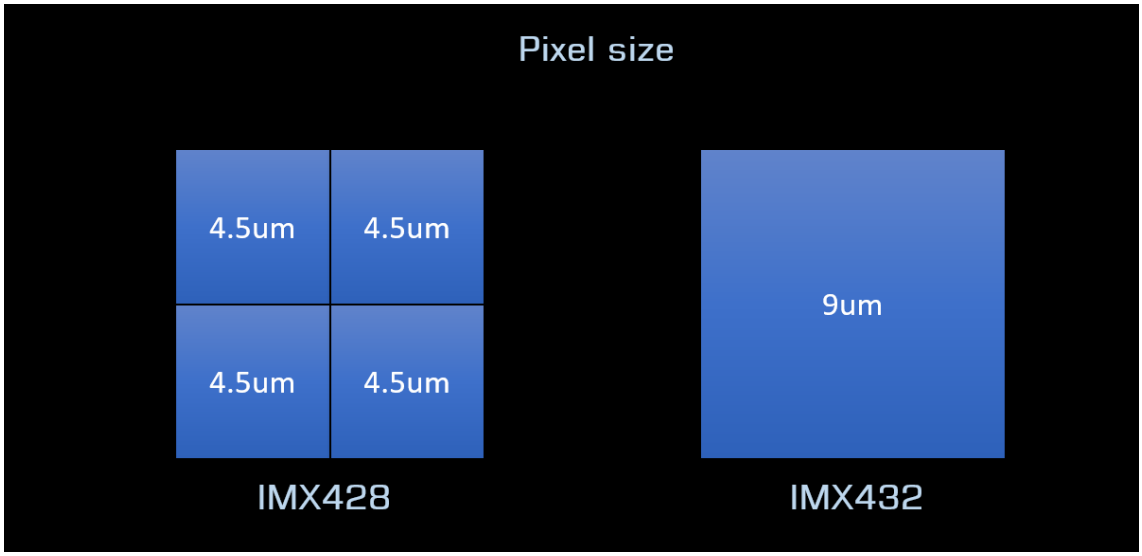
Format

Apollo 428M MAX Pro has 1.1″ format, it is the biggest sensor in entire solar camera series currently, this size is quite big for imaging.



Pixel size

4.5um pixel size is half of IMX432 camera, which means it will have 4X resolution than classic Apollo-M MAX camera.



Interesting BIN Mode

As we know Apollo 428M MAX Pro has 4.5um pixel size, half size of Apollo-M MAX. If we use bin2, it will more like an Apollo-M MAX, and 3 combination bin mode will have some advantages:

MONO8 hardware BIN2 mode: full well up to 4x (100Ke),10bit ADC, **FPS will up to 135FPS**.

MONO16 hardware BIN2 mode: full well up to 4x (100Ke),12bit ADC, **FPS will up to 109FPS**.

MONO16 Software BIN2 mode (sum mode): full well up to 4x (100Ke), **date bit depth up to 14bit**, **FPS will stay at 27FPS.**

Cutting-edge Design

The Apollo 428M MAX Pro cooled camera using same design as Ares cooled series, but a little difference! With a round body, a golden and black color scheme, and using carbon fiber to keep weight down and cutting-edge outlook. We also integrated the sensor tilter plate and anti-dew PCB board. This series of designs makes the camera not only light and cool, but also functional!

Front 3P and Rear 4P tilter plate

When shooting deep sky objects, the sensor tilt plate can be used to adjust the sensor tilt angle to make the stars at the corners more rounded. Apollo 428M MAX Pro camera provide both front and Rear tilter plate fulfill all usage scenarios.

Front 3P tilter plate is the default part on camera, we believe most users has experience with this before. it works well in a lot of basic scenarios.

Rear 4P tilter plate is an alternate part for camera, when use filter wheel/filter drawer and OAG with fixed angel, it is necessary. And it is also convenient for RASA users to adjust the sensor tilt angel.

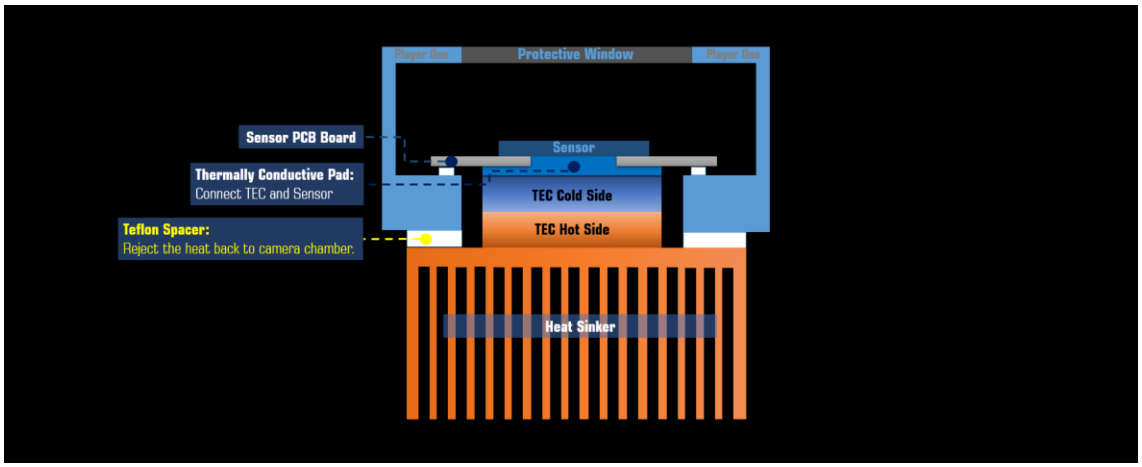
The built-in high-density sponge shading pad can block the light from the side slits without any side leakage.

Carbon fiber and light weight

The Apollo 428M MAX Pro uses a carbon fiber in camera housing and has been optimized for weight reduction in its structural design. The camera weighs only 420 grams, making it one of the lightest models on the market.

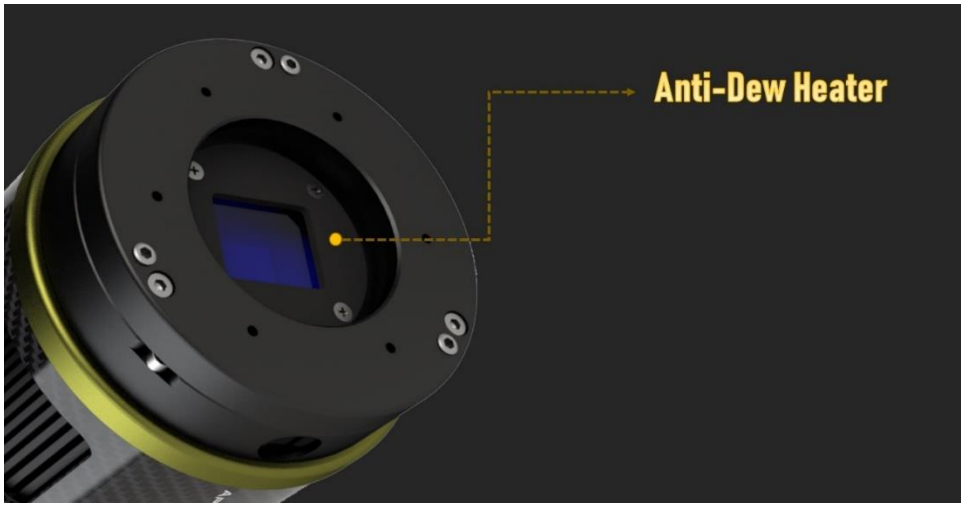
Deep Cooling

Player One cooled camera series use 2 Stage TEC Cooling unit, after improved the structure design to reject the heat back to camera chamber, Camera **Delta-T** can reach **35-40℃**.



Anti-Dew heater

In the design of lightweight cooled cameras, Player One still pursuing the perfection, any necessary features must have, especially anti-dew system, is the problem that a lot of small cooled cameras ignored.



HCG and Noise

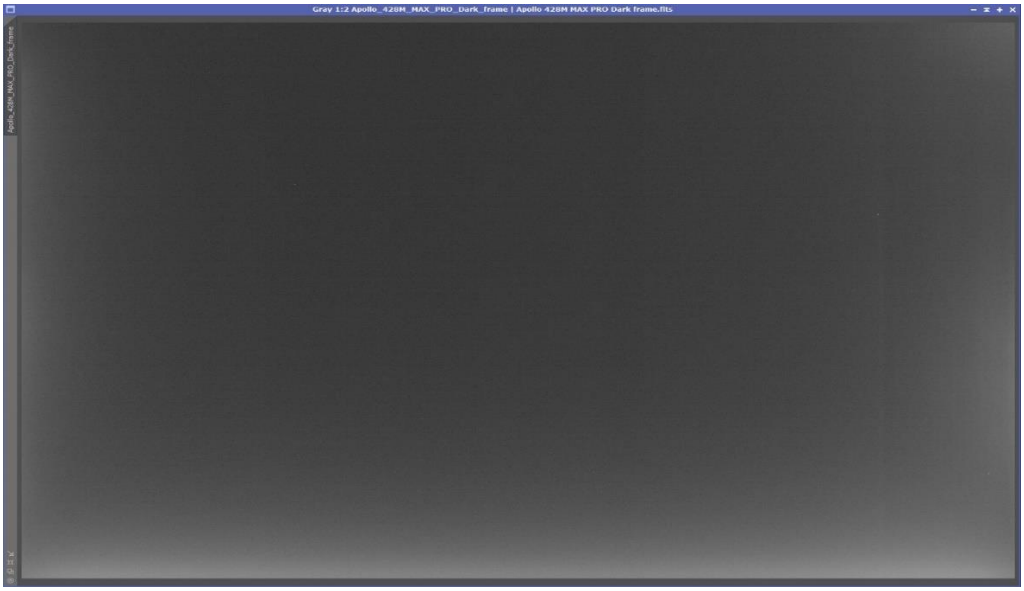
HCG mode will automatic open when Gain ≥70, readout noise will drop to 2.4e. And dynamic range will rise to 12 drops again.

At 450 gain, readout noise of Apollo 428M MAX Pro camera is 1.4e, it is lower than IMX432.

Amp-Glow performance

Apollo 428M MAX Pro is not a non-amp-glow camera, but it's amp-glow is very smooth, we believe it will be easier to be calibrated. In solar imaging, it won't be a problem at all.

300s@gain=0, -10 degree, Dark frame of Apollo 428M MAX Pro camera: DOWNLOAD

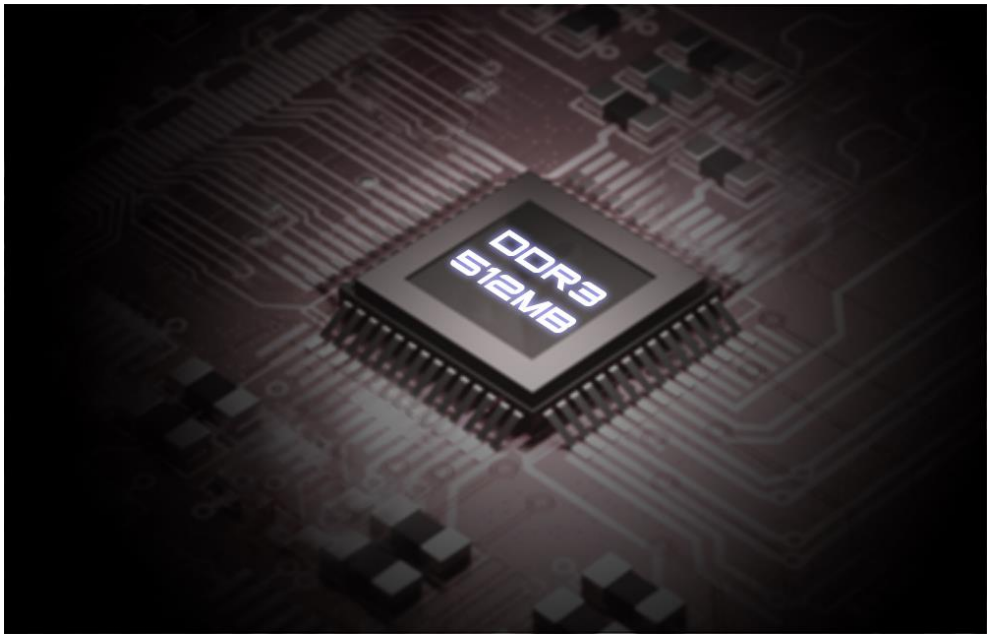


Preview of Dark frame: Exposure=300s, gain=0, temp=-10℃ STF auto-Stretch in Pixinsight 1.86

512MB DDR3 Cache

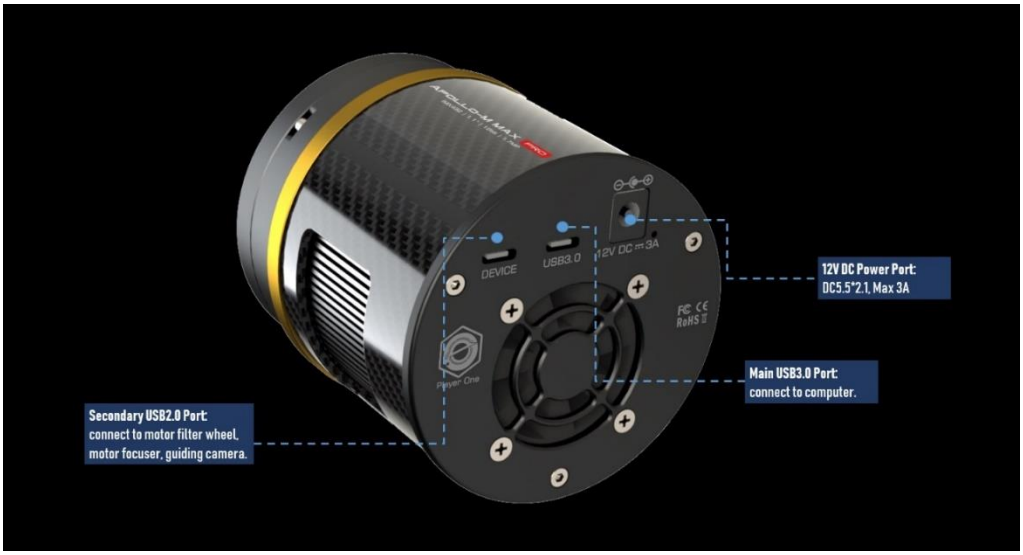
As an improvement, DDR3 cache in cooled cameras are increased to 512MB. It helps stabilize and secure data transmission, it effectively avoids frame dropping and greatly reduces readout noise.

With the DDR3 cache, the camera does not have high demands on computing needs any longer, it will still have excellent performance even if it is connected to a USB 2.0 port.



Type-C Data port and Power port

Back piece of cooled camera has 2 Type-C data port and 12V DC 5.5×2.1mm power port.

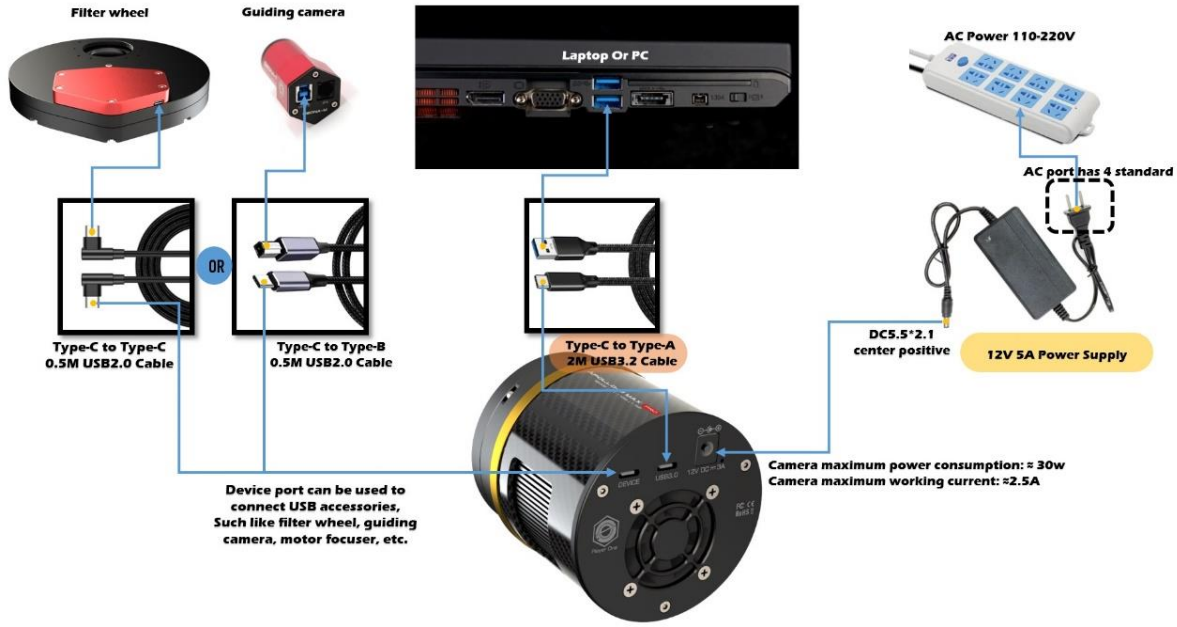


Main data port support USB3.0 protocol, type-C port is easier to plug in when assemble the imaging equipment in night. When the camera is connected to the USB3.0 interface and full-resolution preview is used, **it can reach 51FPS at 10bit(RAW8) mode and 27FPS at 12bit (RAW16)** .

When recording images, since the actual writing speed will be affected by the writing speed of the hard disk itself, when the hard disk writing speed is slow, the recording may not reach the theoretical speed. It is recommended that you use a high-quality solid state drive to record data to give full play to the performance of the camera.

The camera has 12V DC5.5*2.1mm port to provide enough power to TEC cooling system. If you don't need to power up cooling, only need to connect the main Type-C port, the camera will work as a uncooled camera.

Standard Cable Usage



Cooling System and Anti-Dew Heater

In ASCOM window, we provide 3 adjustable parameters: Target temperature, Fan Speed and Anti-Dew power.

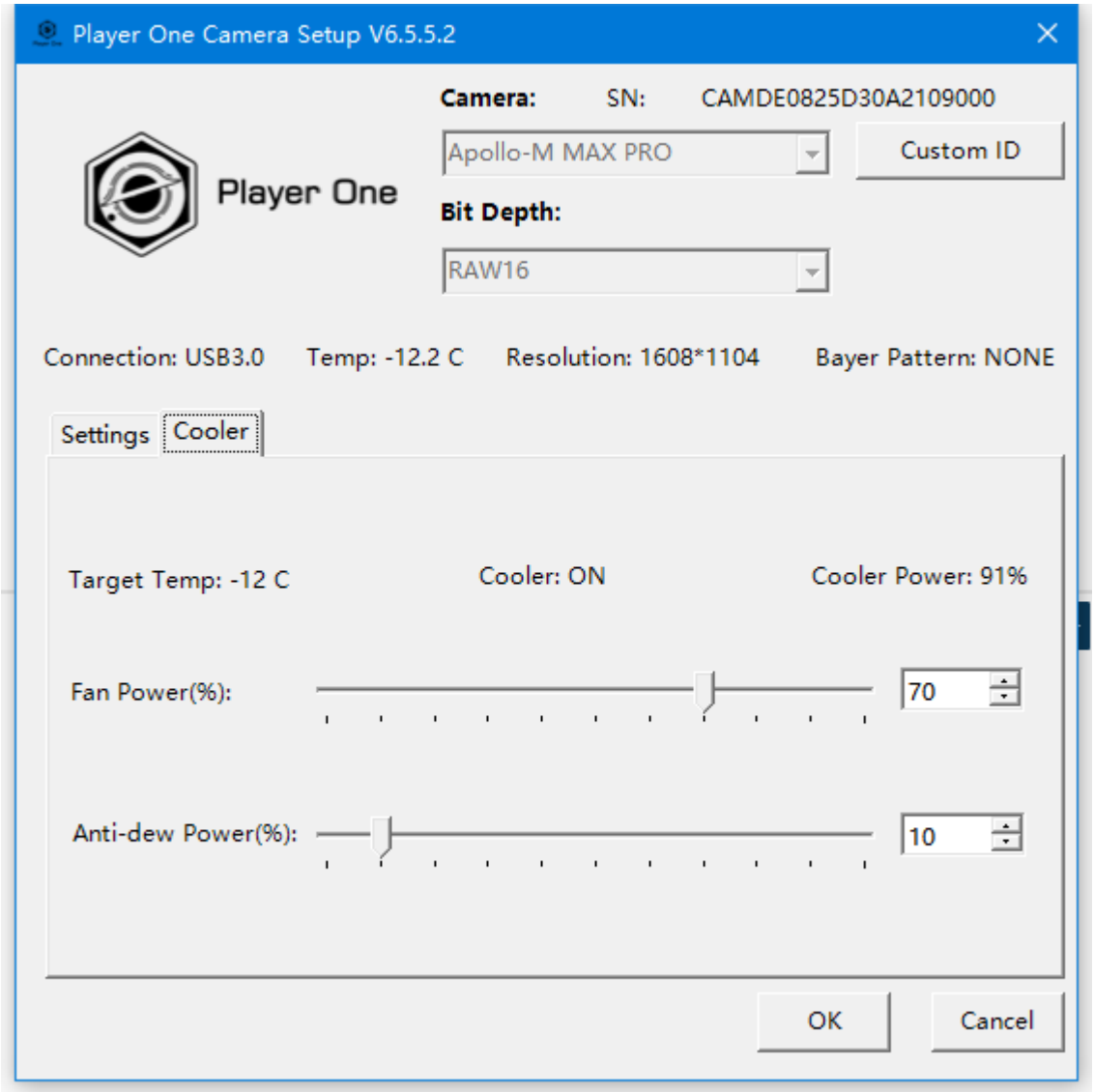
Standard Delta-T : 35℃-40℃**(Long exposure mode**）, 30℃**(Video mode**）**,**

when **ambient temp 30℃, fan speed 100%, dew heater 1%**.

Recommend Delta-T settings: 30℃-35℃ **below ambient, fan speed 50-70%, dew heater 10%, power consumption 40- 60%.**

The rotation speed of cooling fan is also adjustable, the **default value is 50%** speed.

Dew problem is the biggest enemy in astro imaging, the camera integrated anti-dew heater in front of the camera. The heat power is adjustable.

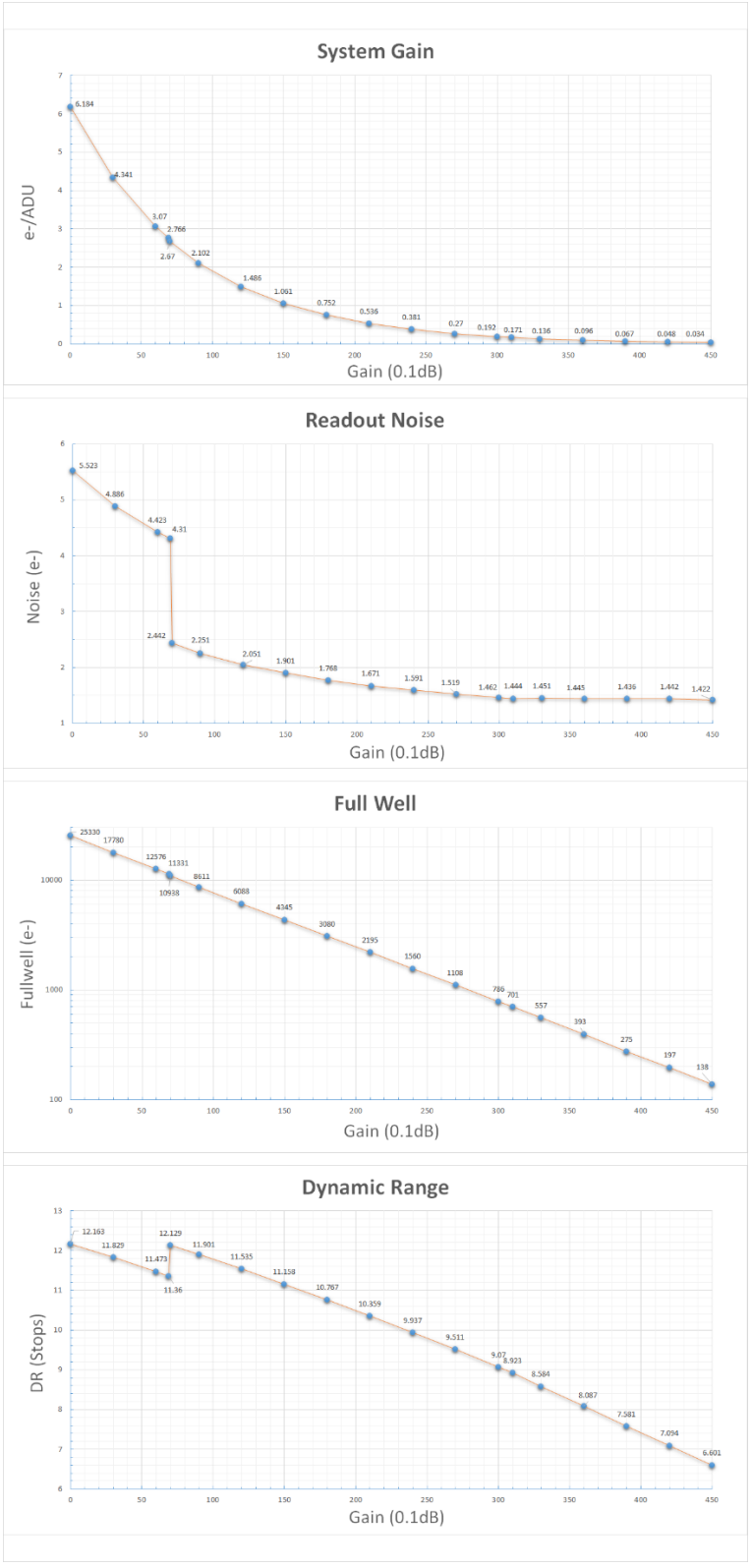


Overvoltage and overcurrent protection mechanism

Player One cameras produced by the number one player ensures the safety of your camera and other equipment through overvoltage and overcurrent protection mechanisms.

Performance

HCG open at gain=70.



Readout Noise

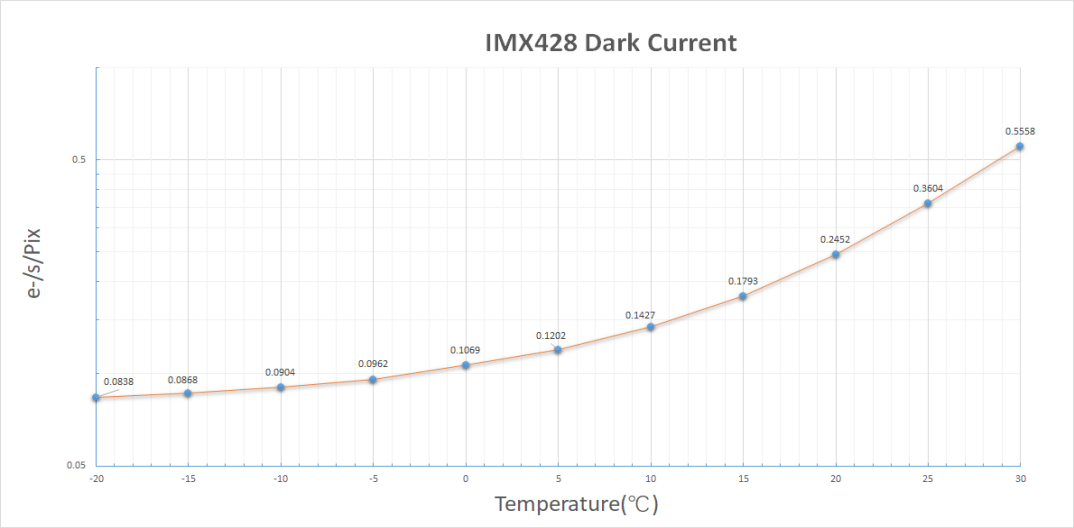
Regarding readout noise, we solemnly promise that all values are obtained from actual tests. And for users, you could use Sharpcap 4 for testing. SC4 has a function called **Sensor Analysis**, provide a very simple way to test readout noise.

We wrote a tutorial on our website: https://player-one-astronomy.com/service/manuals/

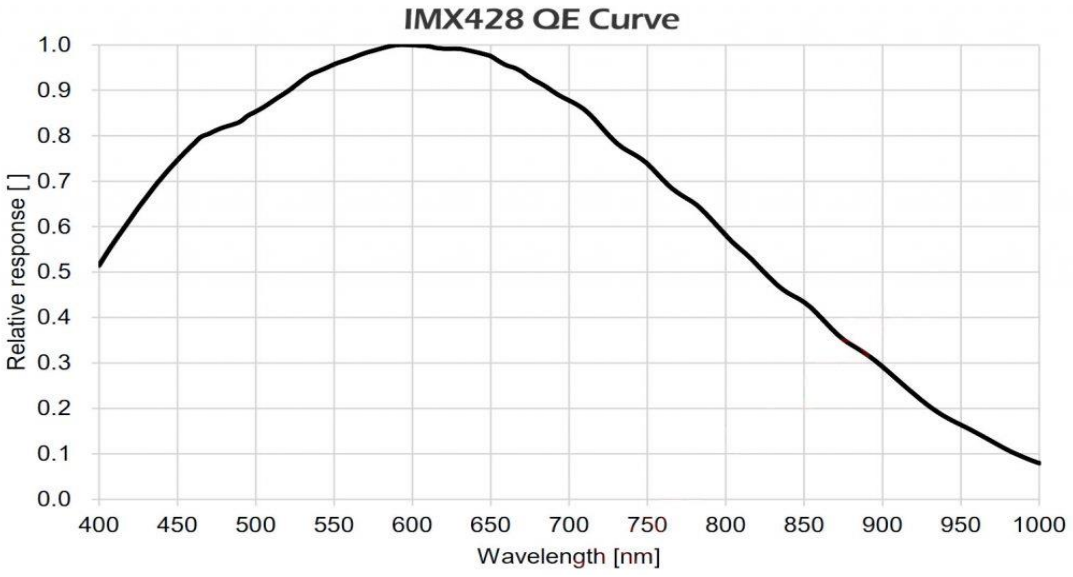
If you are interested in readout noise testing, you may try it yourself, which is very simple.

Dark current

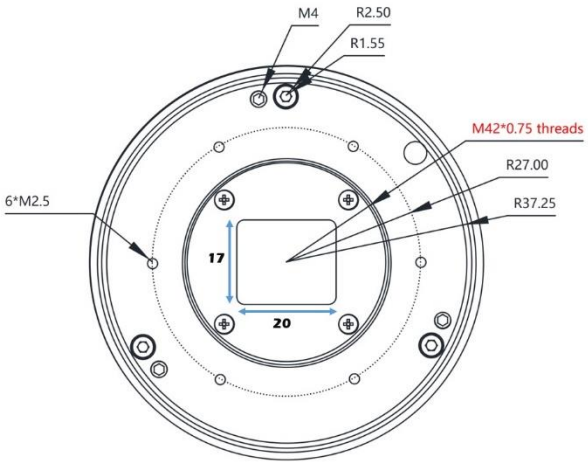
The dark current is 0.08e/s/pix at -20℃, and 0.1e/s/pix at 0℃.



Relative QE Curve

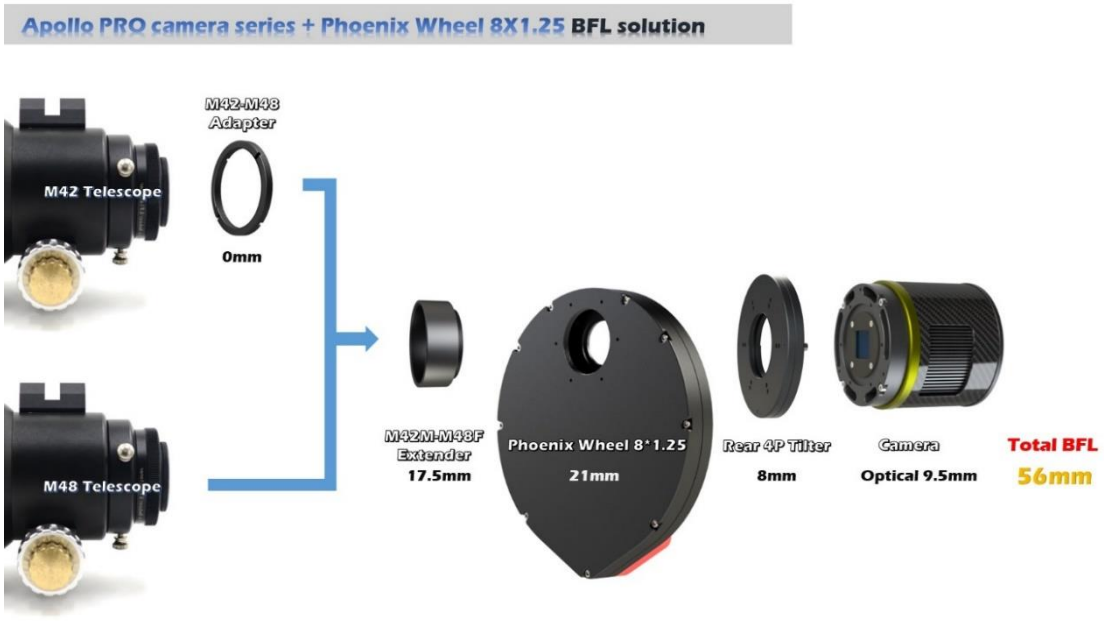


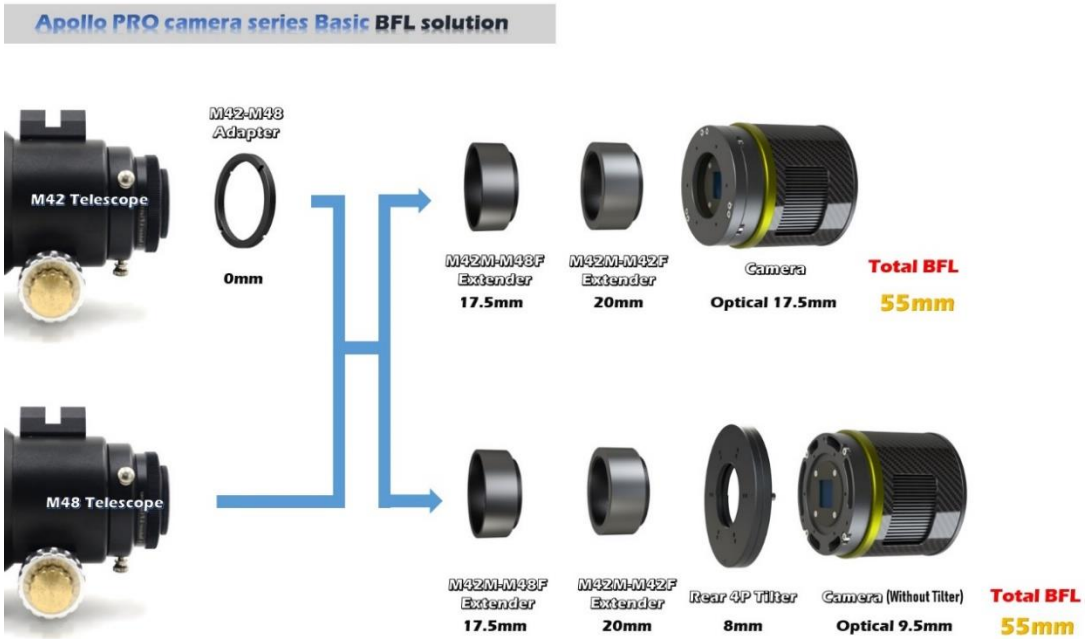
Mechanical Drawing



BFL Solutions

Following is some recommend 55mm BFL solution for this camera. If don't consider about BFL, the connection way is various.





Notice: Some BFL solution is 56mm (Compensate light path differences which caused by filters)

Package List

Warranty & Shipping Policy

Payment method

We provide *PayPal* and *PayPal checkout* on our website.

Shipping and Delivery

Shipping Fee:

- Amount >= 299USD: free express shipping
- Amount < 299USD: 29.9USD for express shipping

Shipping Services:

- We usually use DHL, UPS, FedEx, TNT for shipping.
- Make sure your email is correct, we maybe will contact with you through emails in case of emergency.

If customer wants to designate a shipping company or has special requirement, please send an email to *support@player-one-astronomy.com* and tell us your detailed requirement.

Shipping time:

- Usually 7-14 days.
- Tracking number will be updated in 3 days after paid.

For orders from areas where transportation is not easy, such as islands, town in mountainous regions, delivery time will be slightly longer.

Please send an email to *support@player-one-astronomy.com* immediately, if the following occurs:

- Shipping delayed or has some abnormal information.
- The packing is badly damaged on arrival, take pictures and do not sign.

Tax

- The price on our website without tax.
- Please note that buyers are liable to charge tax involved, such as Import tax, VAT, customs handling fee, etc.
- Those fees possibly will be collected at the time of delivery by courier.

For best experiences, we recommend customers to purchase our products form local dealers.

After-sales Service

Warranty Policy

2-year free warranty (time start from delivered) for Player One products. If the product has any issue, please send the image or video and description to support@player-one-astronomy.com for further check to confirm.

- Purchase from Player One official online store, we will provide warranty service directly.
- Purchase form dealer, we will provide warranty service through dealer.

Repair in warranty, customer only pay the shipping fee of shipping back the product to us or dealer, and no other extra fees.

Replacement Policy

You can request our Replacement Service:

√ Within 30 calendar days of receiving the product if the product does not match the original description of the product in one or more significant respects.

√ Within 30 calendar days of receiving the product if the product suffers performance failure.

Please contact our After-Sales team by email to *support@player-one-astronomy.com* within 30 calendar days of receiving the products. Player One shall be responsible for the two-way replacement freight for any products sent in for replacement due to performance faults.

Warranty and Replacement Policy Exceptions:

× Warranty service time or replacement service time expired.

× Legal proof-of-purchase, receipts, or invoices are not provided, or are reasonably believed to have been forged or tampered with.

× A product sent to Player One for replacement does not include all original accessories, attachments and packaging, or contains items damaged by user error.

× A product is found to have no defects after all appropriate tests are conducted by Player One.

× Any fault or damage of the product is caused by unauthorized use or modification of the product, including exposure to moisture, entry of foreign bodies (water, oil, sand, etc.) or improper installation or operation.

× Product labels or serial numbers show signs of tampering or alteration.

× Damage is caused by uncontrollable external factors, including falling down, fires, floods, or lightning strikes, etc.

× Proof of damage during transit issued by the carrier cannot be provided.

× Other circumstances stated in this policy.

In those situations, repair the product might have extra cost, we will estimate cost and email customer to know the information before send product back.