

Apollo 428M MAX Camera Manual

V1.0

Dec, 2024

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Product Features

Focus on Solar imaging!

Apollo series is the world's first camera line designed specifically for solar photography, named after Apollo.

The Apollo series features Sony sensors with global shutters and a focus on monochrome sensors.



Technical parameters

Sensor	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	5.5e~1.4e
QE Peak	≈79%
Full Well	25.3k e
ADC	12 bit
Data Port	USB3.0/USB2.0
Adapter	1.25″ / M42X0.75
Back Focal Length	12.5mm
Protective Window	D32*2MM High Quality AR Plus (Anti Reflection) Multi-Layer Coating
Diameter	66mm
Weight	160g
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 camera is a new solar camera developed by Player One Astronomy, which adopts the 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**.

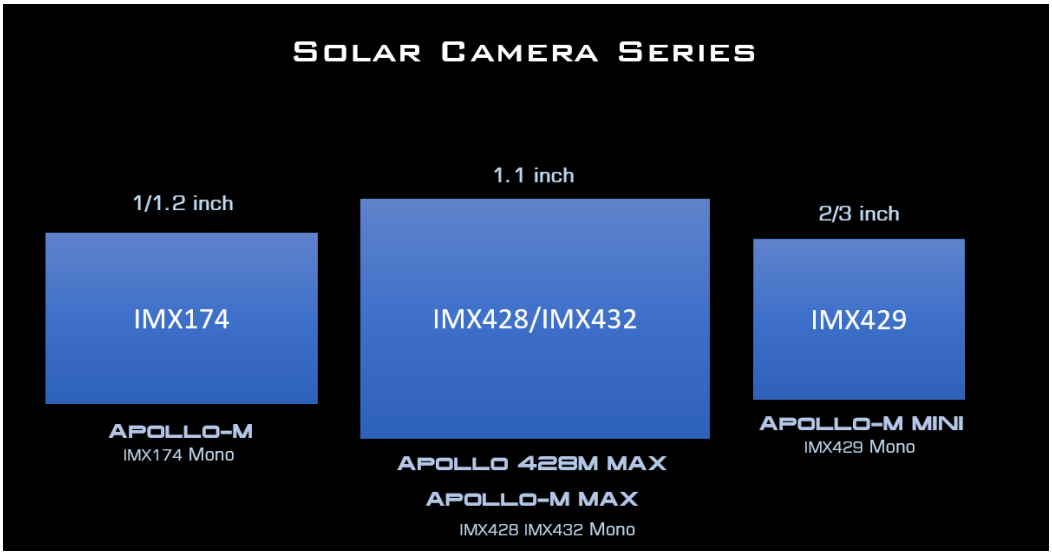


Pregius Technology

Apollo 428M MAX (IMX428) is based on **Pregius** 3rd Generation. IMX428 is a high resolution version of IMX432, it has 4.5um, and full well is 25Ke. But if you use BIN2 mode, IMX428 will has 9um pixel and of course the full well up to 4x (100Ke).

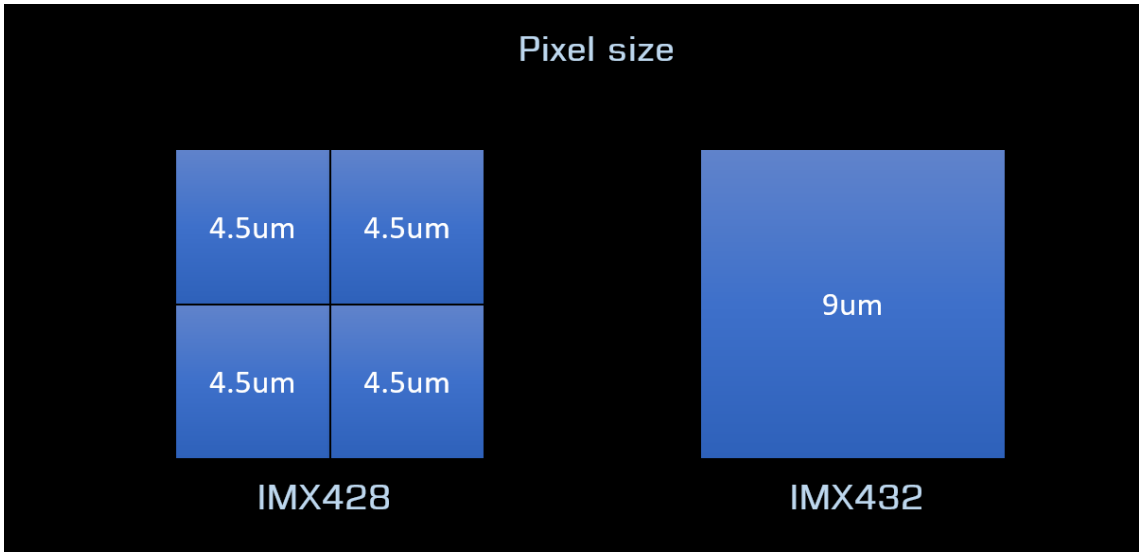
Format

Apollo 428M MAX (IMX428) has 1.1″ format, same as Apollo-M MAX. It is pretty big, almost twice of IMX174 chip.



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.

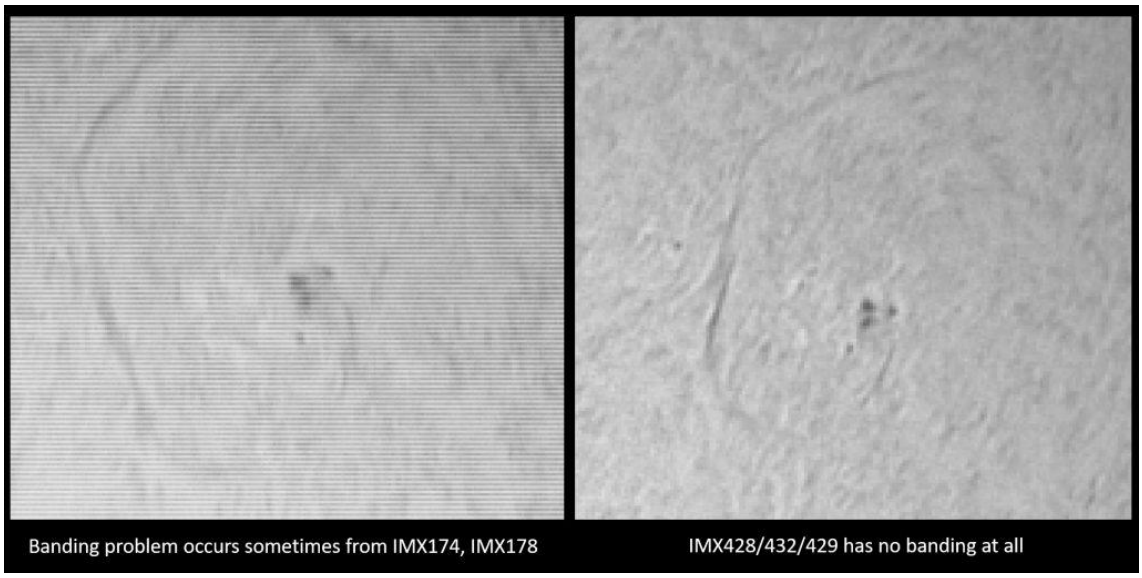
HCG and Noise

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 (IMX428) camera is 1.4e.

No banding

Row noise problem is a big trouble in solar imaging. When we use IMX174 or IMX178 cameras, bandings occur sometimes. Although we can make it slight in post-processing, but it still does negative affect on the details.
The biggest surprise in testing Apollo 428M MAX is, we found that images of IMX428/432/429 are so smooth, no annoying horizontal banding. So that, we can focus on

capture details in any focal ratio, in any way (full disk mosaic or ROI), never need to worry about banding issue in post-processing.



Recommended accessories

ACS (Active Cooling System)

ACS is an external air-cooled system, designed for solar and big format planetary cameras which already has PCS (Passive Cooling System). ACS can provide much better temperature control. When camera has PCS + ACS, temperature is only 7℃ higher than ambient, camera body is a little warm but won't hot! ACS is not only can be used in daylight for solar imaging, it also could be used in night for DSO lucky imaging.
https://player-one-astronomy.com/product/active-cooling-system-acs-for-uncooled-cameras/

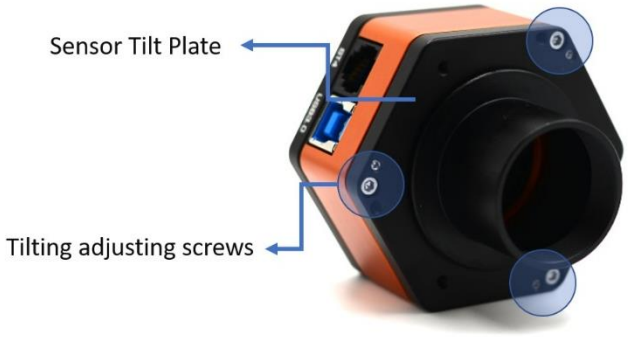


Features

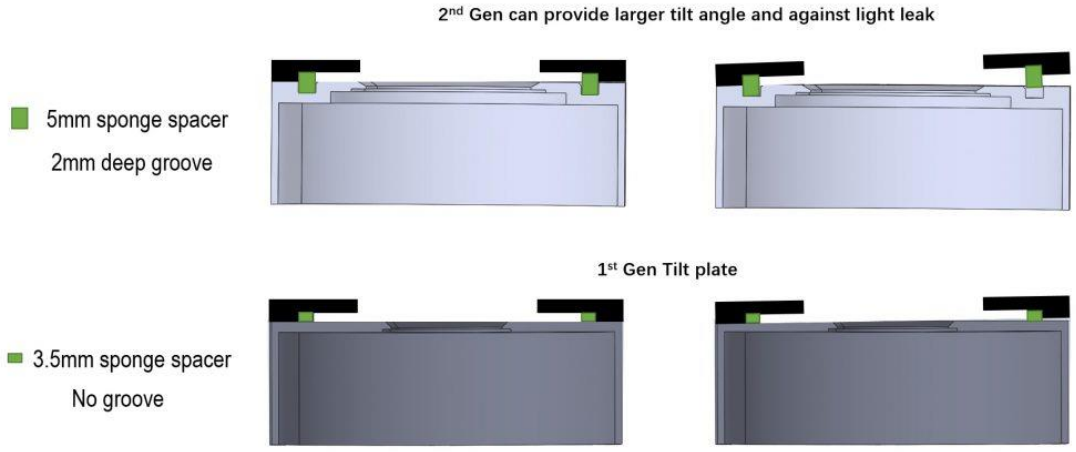
The naming of Player One Astronomy cameras is unique. Solar camera line, named after Apollo, the god of the sun. The suffix of the name describes the camera's biggest feature.
Drivers and software download:
http://player-one-astronomy.com/service/software/
Manuals download:
http://player-one-astronomy.com/service/manuals/

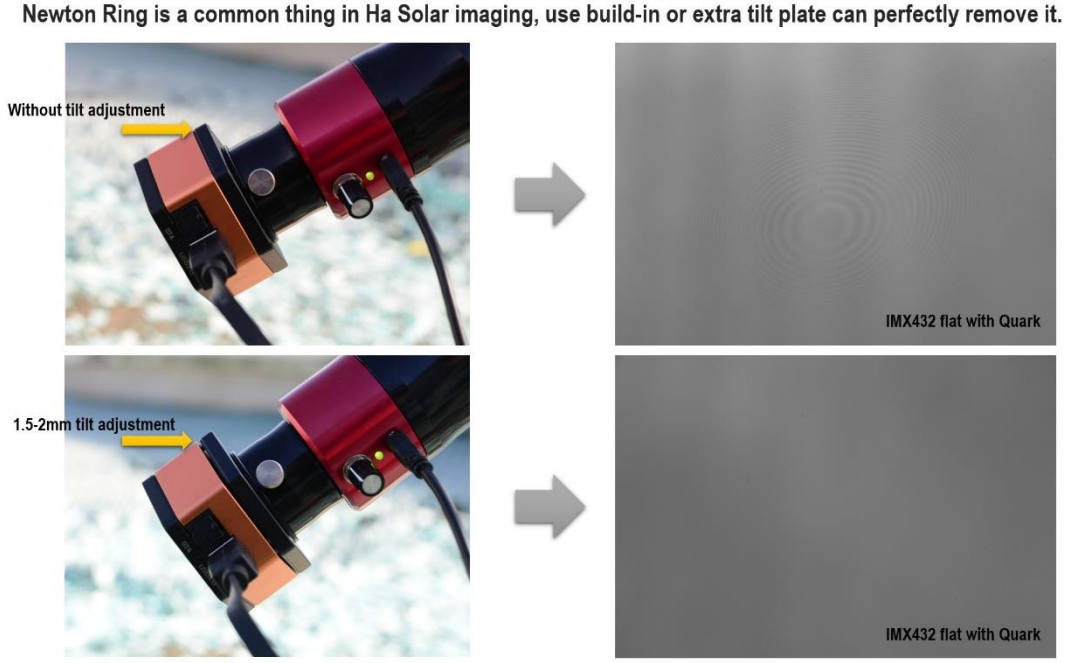
2nd Gen – Sensor Tilt Plate

When taking solar photograph with prominence telescope, the Newton ring is annoying. Smoother solar image without Newton ring could be taken by adjusting the focal plate. Get a much smaller field curvature of the telescope.



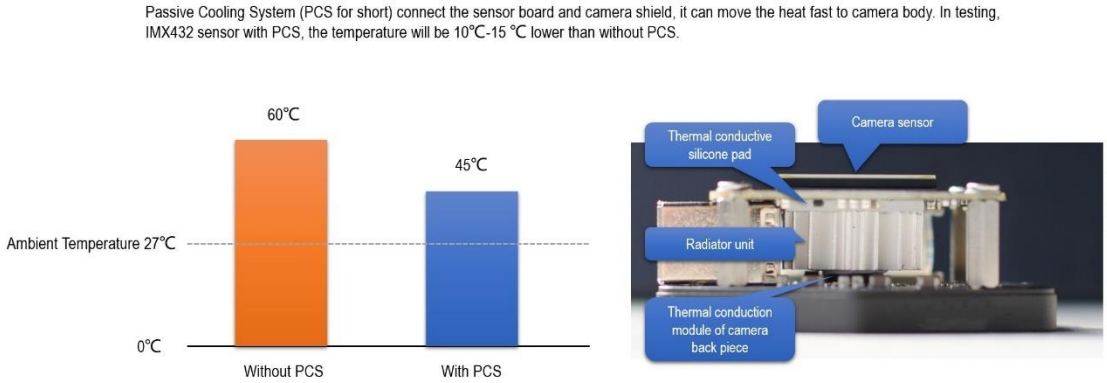
The built-in high-density sponge shading pad can block the light from the side slits without any side leakage.





Passive Cooling System

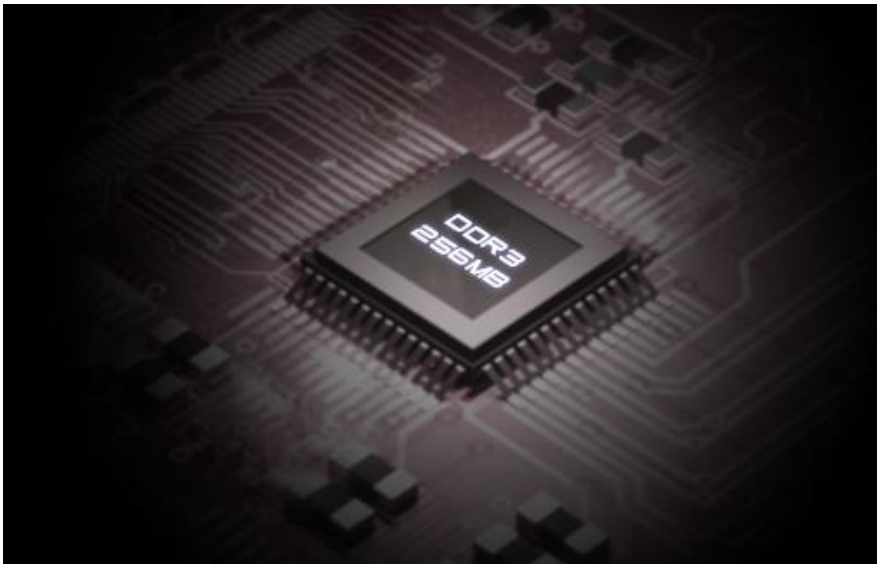
Solar cameras working in daylight, temperature could be much higher than night. Heat of global shutter sensors will be a problem, especially some big format like IMX428. Player One add one new feature called **Passive Cooling System** to conduct the heat from the sensor out.



256M DDR3 Cache

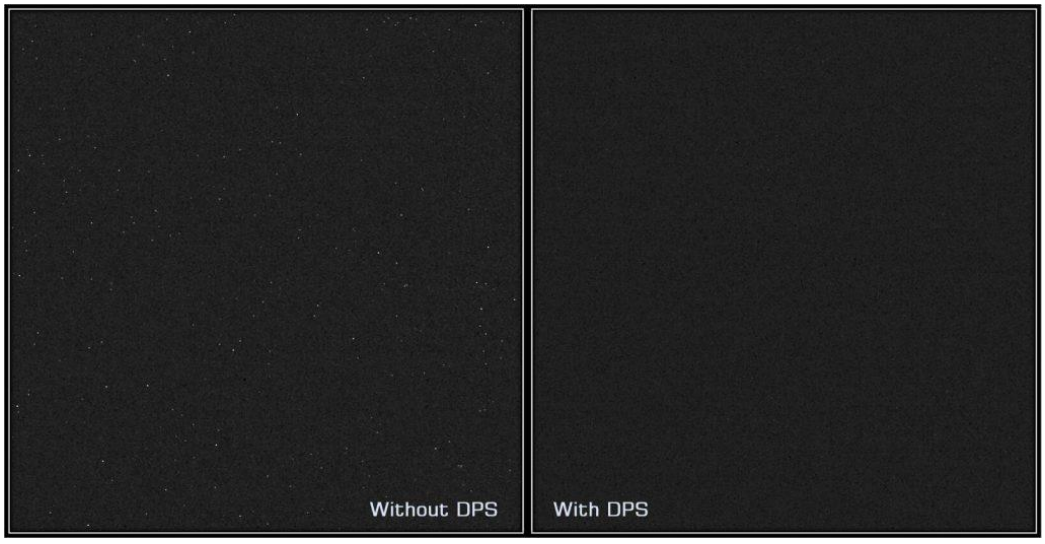
Player One Astronomy cameras are the first one who adopts the DDR3 cache in all planetary cameras in the world! It helps stabilize and secure data transmission, it effectively avoids frame dropping and greatly reduces readnoise.

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.



DPS technology

The planetary cameras from Player One Astronomy have DPS (Dead Pixel Suppression) technology. The DPS is analyses many dark frames to find out those fixed abnormal pixel and record the map in camera memory. In imaging, each exposure frames, those position of dead pixels will be given a median value according to the active pixels around that abnormal pixel.

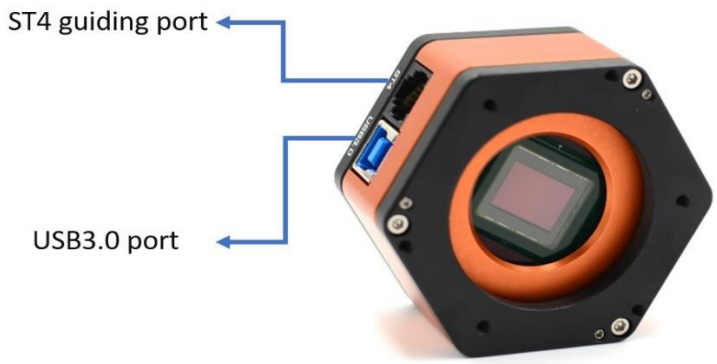


Overvoltage and overcurrent protection mechanism

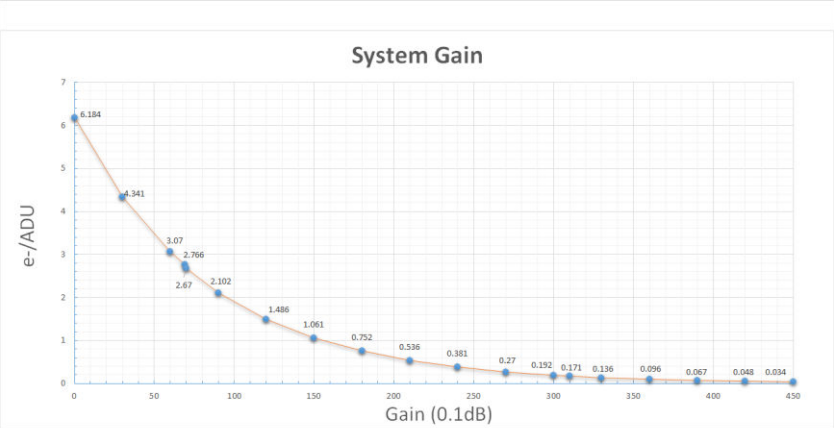
Player One cameras produced by the number one player ensures the safety of your camera and other equipment through overvoltage and overcurrent protection mechanisms.

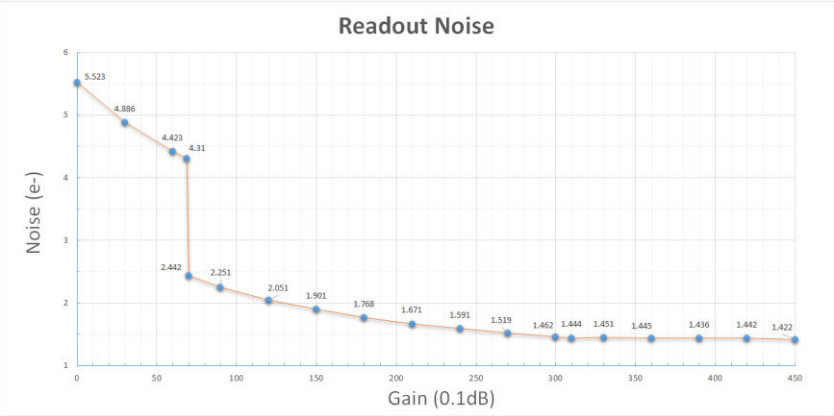
Data Port

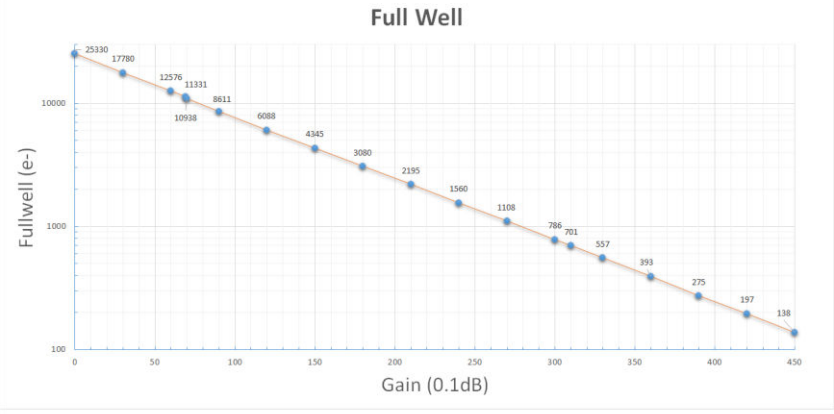
When the camera is connected to the USB3.0 interface and full-resolution preview is used, **it can reach 51FPS at 10bit(RAW8) mode and 27FPS at 12bit (RAW16)**. When recording images, since the actual writing speed will be affected by the writing speed of the hard disk itself, when the hard disk writing 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.
Use the ST4 guide cable to connect the camera and the AUTO GUIDE port of the equatorial mount to do guiding.

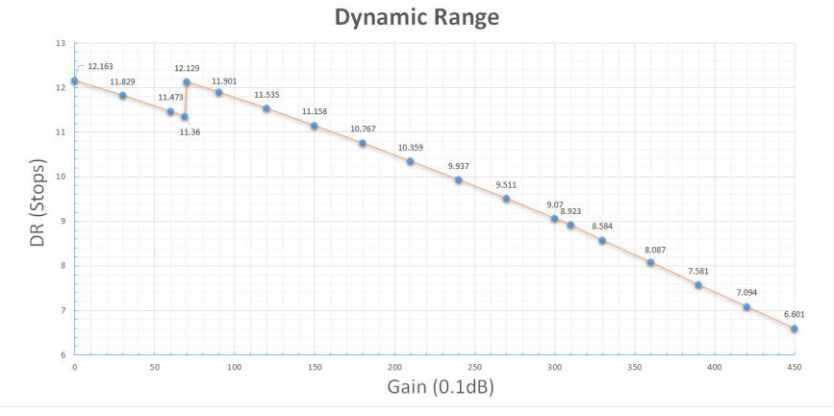


Performance





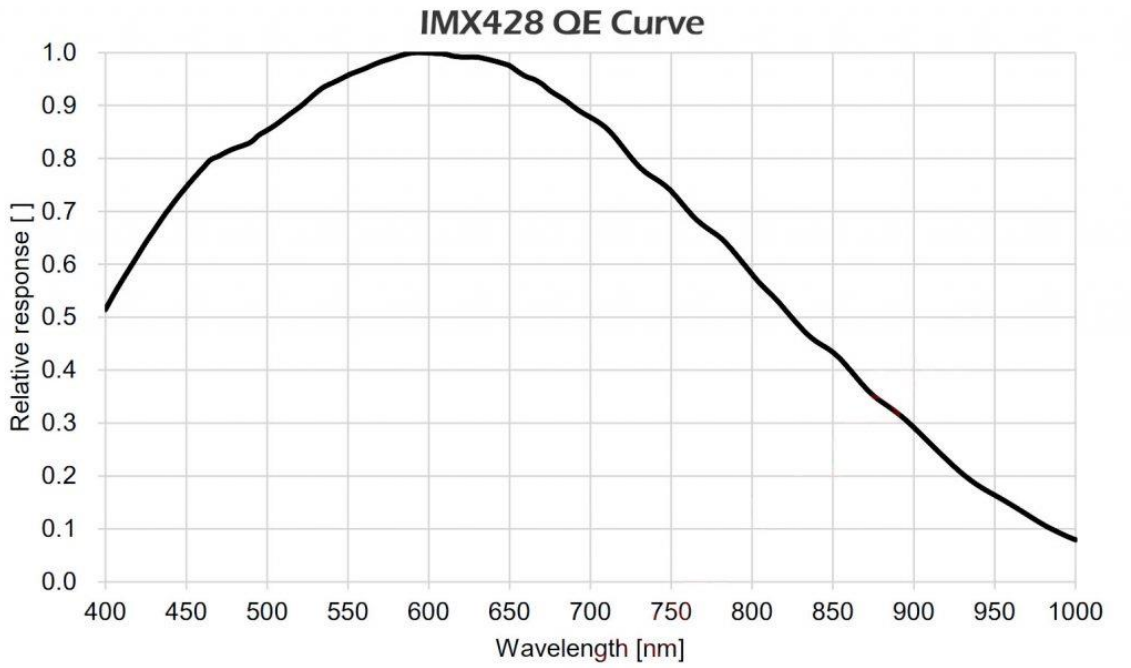




Readout Noise

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/
After many rigorous readout noise tests, this camera can reach a low readout noise of 1.4e at a gain of 450.
If you are interested in readout noise testing, you may try it yourself, which is very simple.

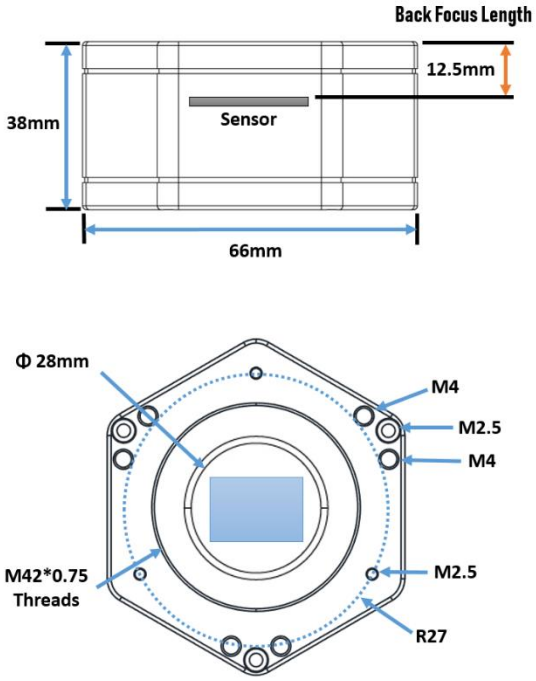
QE Curve

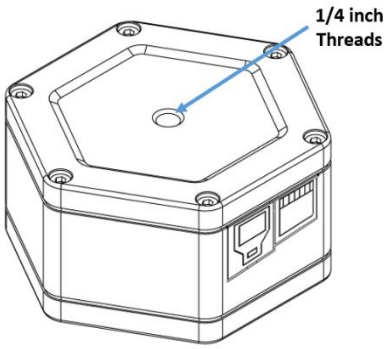


HCG Mode

The Apollo 428M MAX camera has a unique HCG mode, which will automatically turn on when the camera gain setting is >=70. The HCG mode can greatly reduce the readout noise and retain the same high dynamic range as the low gain.

Mechanical Drawing





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.