Apollo-M MAX Camera Manual

V1.0

Dec, 2024

Table of Contests

Product Features

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

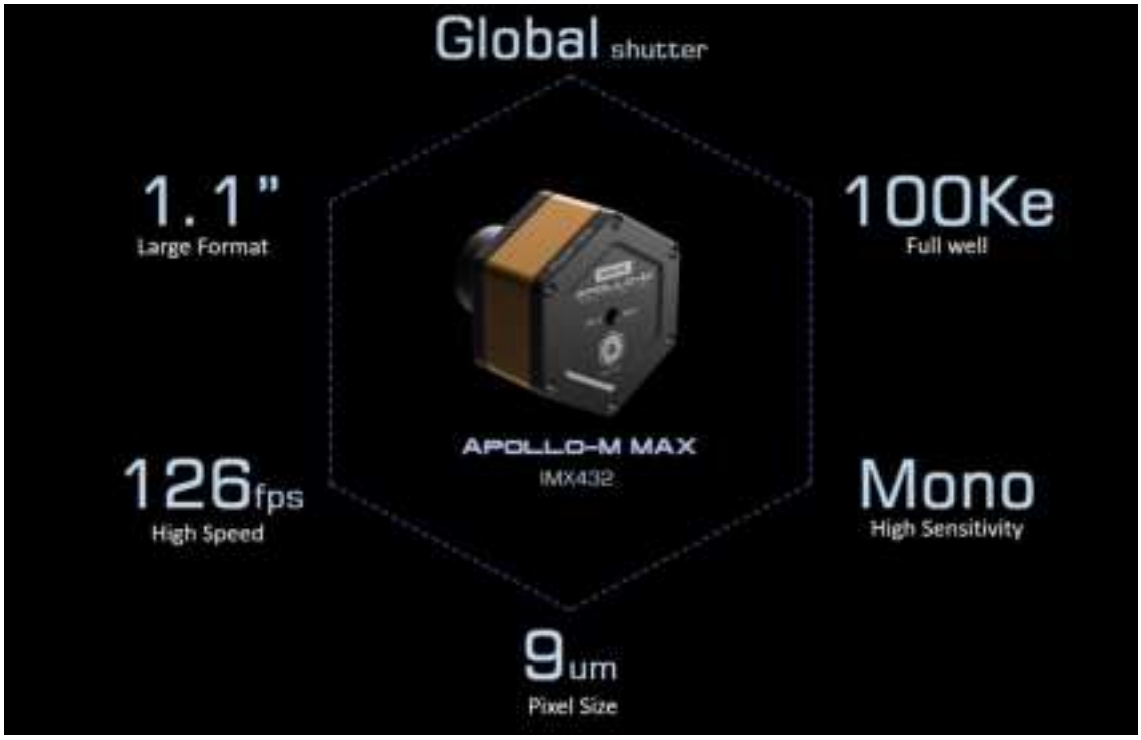
The Apollo series features Sony sensors with global shutters and a focus on monochrome sensors.

Technical parameters

Sensor	SONY IMX432 1.1" CMOS (mono)
Diagonal	17.5mm
Total Pixels	1.7 Mega Pixels
Max Resolution	1608×1104
Pixel Size	9μm
Chip Size	14.5mm×9.9mm
Frame Rate	126FPS（12bit）
Shutter	Global shutter
Exposure Range	32μs-2000s
Readout Noise	22.9e~2.6e
QE Peak	≈79%
Full Well	100k 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 12bit ADC 1608×1104 126FPS More resolution options could be setup in capture software!

Product Description

Apollo-M MAX is a solar camera developed by Player One Astronomy, which adopts the Sony IMX432 **1.1" format** monochrome sensor. The **9um pixel size** accommodates a well depth of **100ke** with a total of **1.7MP** (the resolution is 1608*1104)**,** and the diagonal is **17.5mm**.

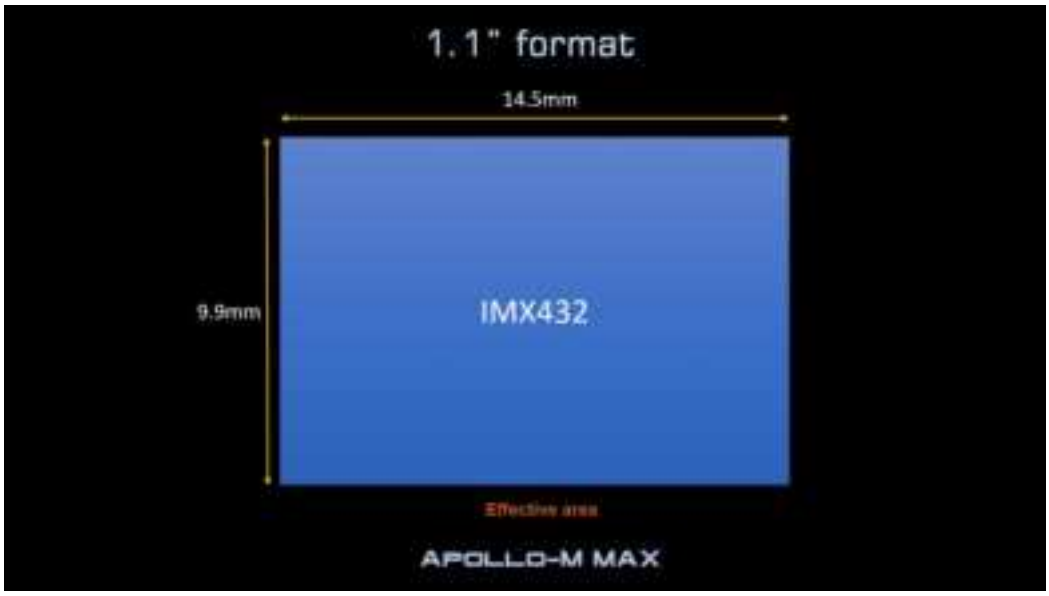


Pregius Technology

Apollo-M MAX (IMX432) is based on **Pregius** 3rd Generation. But IMX432 is quite different. According to the introduction of technical documents, pixel size of 3rd Gen usually is 4.5um, and full well is 25Ke. But this sensor has 9um pixel, and of course the full well up to 4x (100Ke).

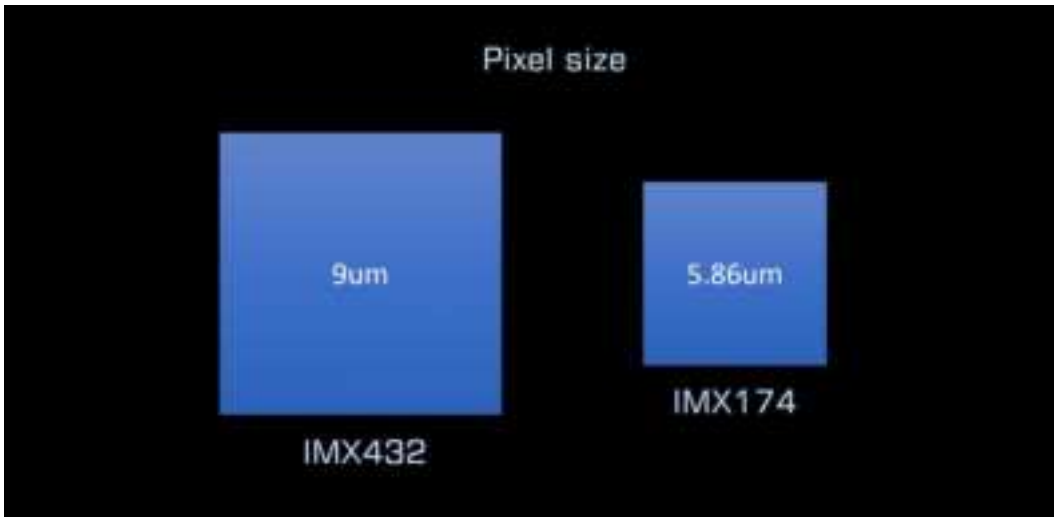
Format

Apollo-M MAX (IMX432) has 1.1″format, it is pretty big, almost twice of IMX174 chip.



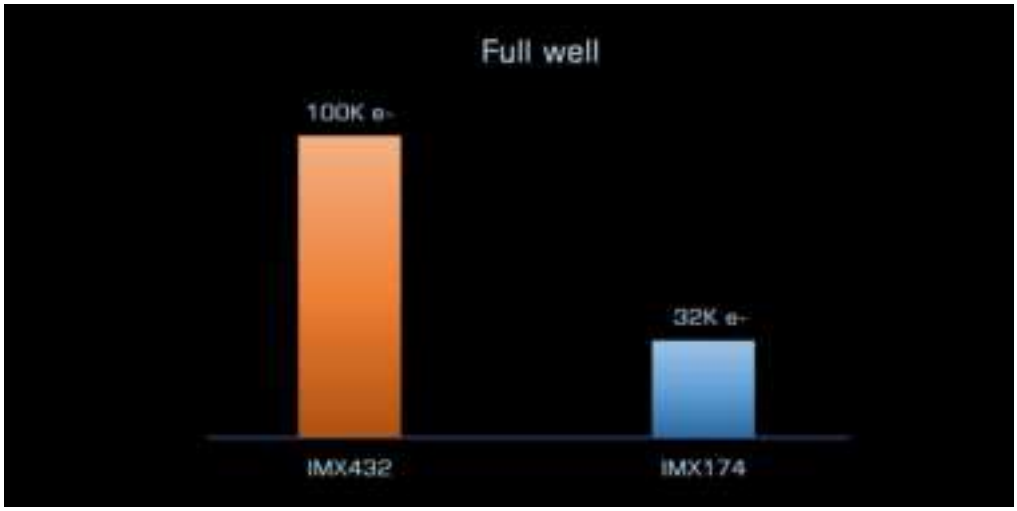
Pixel size

9um pixel size is 1.5 times bigger than IMX174 camera, which means it can work at longer focal ratio, such as SCT + Daystar filter (with 4.2X).



Full Well

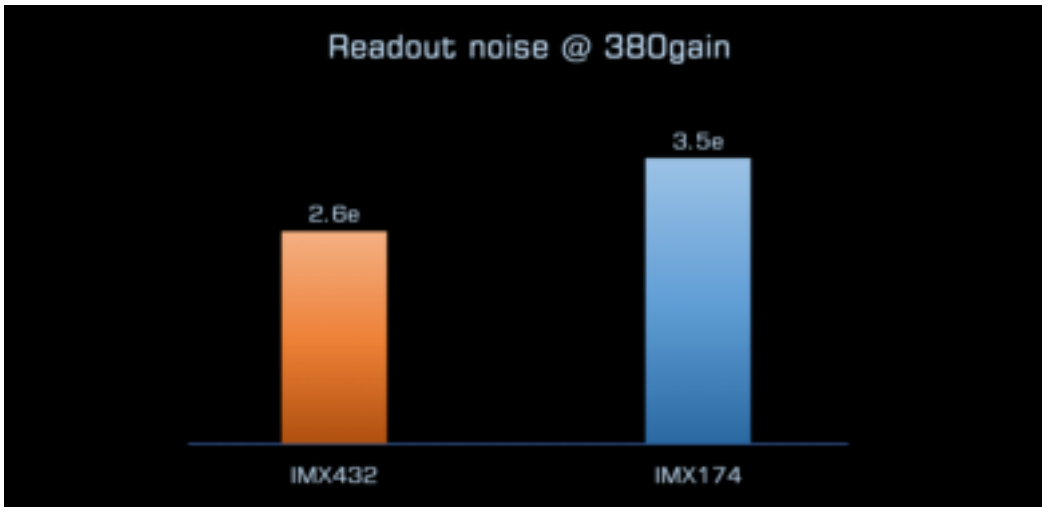
100Ke full well, is 3 times bigger than IMX174. This feature will bring some new possibility in imaging. What we can imagine is HDR the Sun and prominence, or maybe the bright and dark side of the Moon.



HCG and Noise

HCG mode will automatic open when Gain ≥145, readout noise will drop to 4.6e. And dynamic range will rise to 12 drops again.

At 380 gain, readout noise of Apollo-M MAX (IMX432) camera is 2.6e, it is lower than IMX174. And full well will still bigger than IMX174.

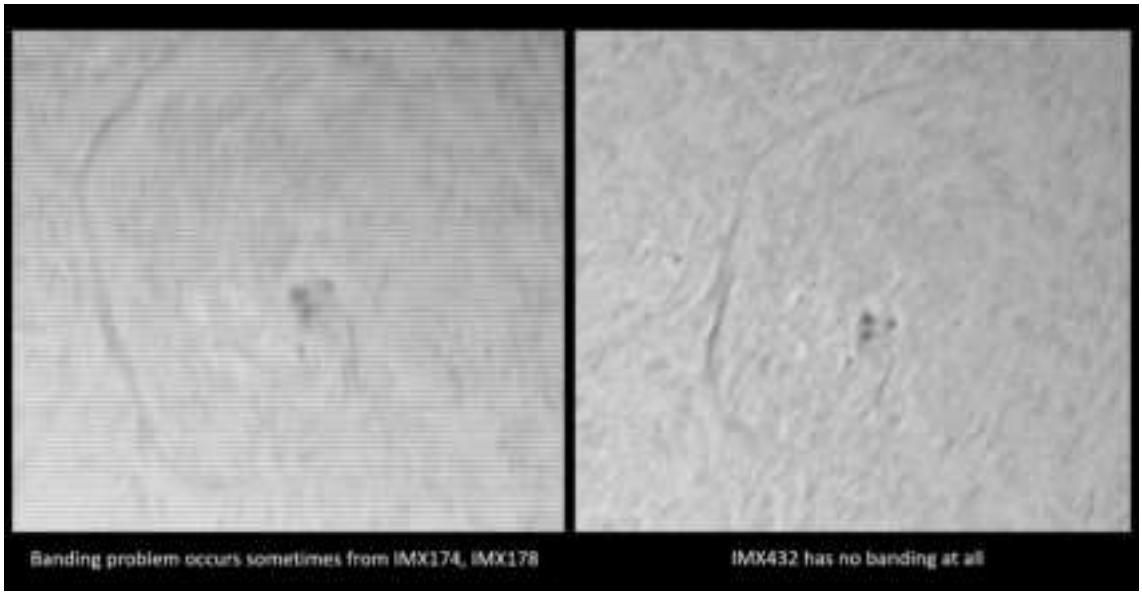


No banding

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-M MAX is, we found that images of IMX432 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.



With global shutter, Apollo-M MAX are very suitable for sun and space station imaging.

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/

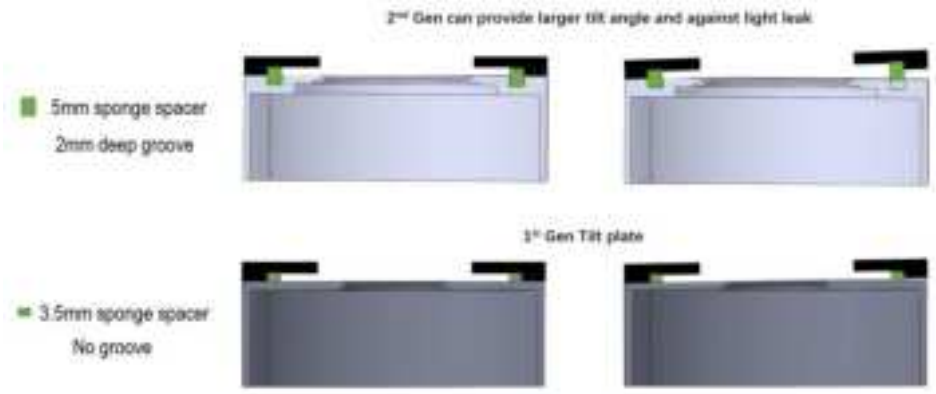
Cutting-edge Design

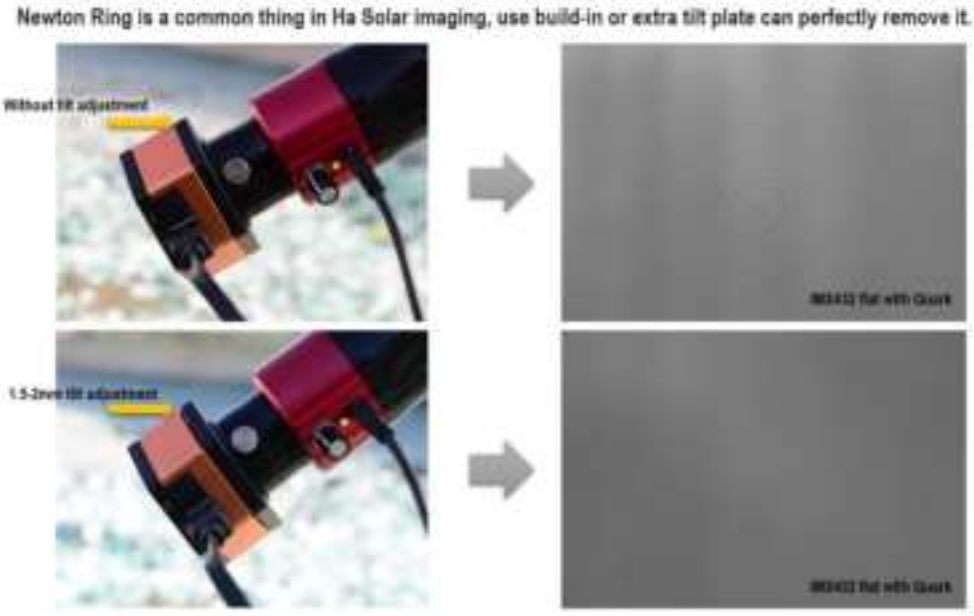
The planetary cameras developed by Player One Astronomy uses a scientific and technological regular hexagon to construct the main body line, supplemented by round chamfers to achieve both rigidity and flexibility. The positive orange, which is imply solar, is matched with the low-key and steady black, and the super-fine frosting process on the entire surface makes the camera look luxurious and cool, highlighting the style of high-end players, can't take my eyes off

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.

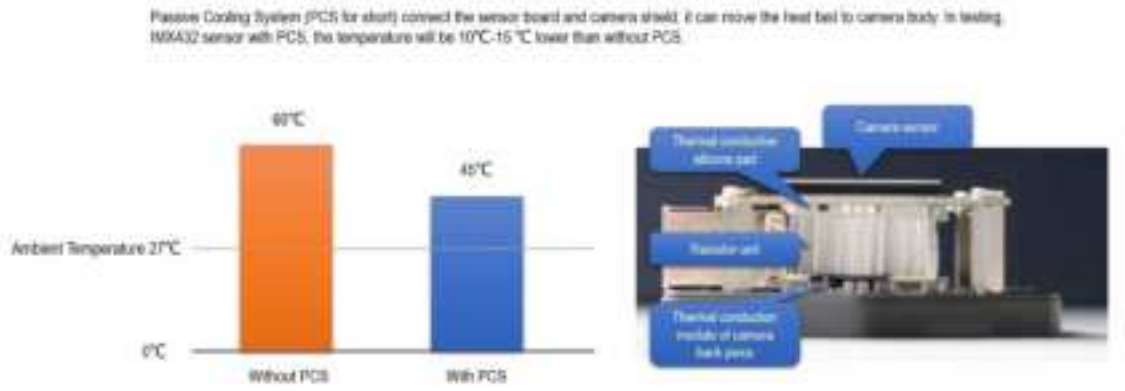
The built-in high-density sponge shading pad can block the light from the side slits without any side leakage.





Passive Cooling System

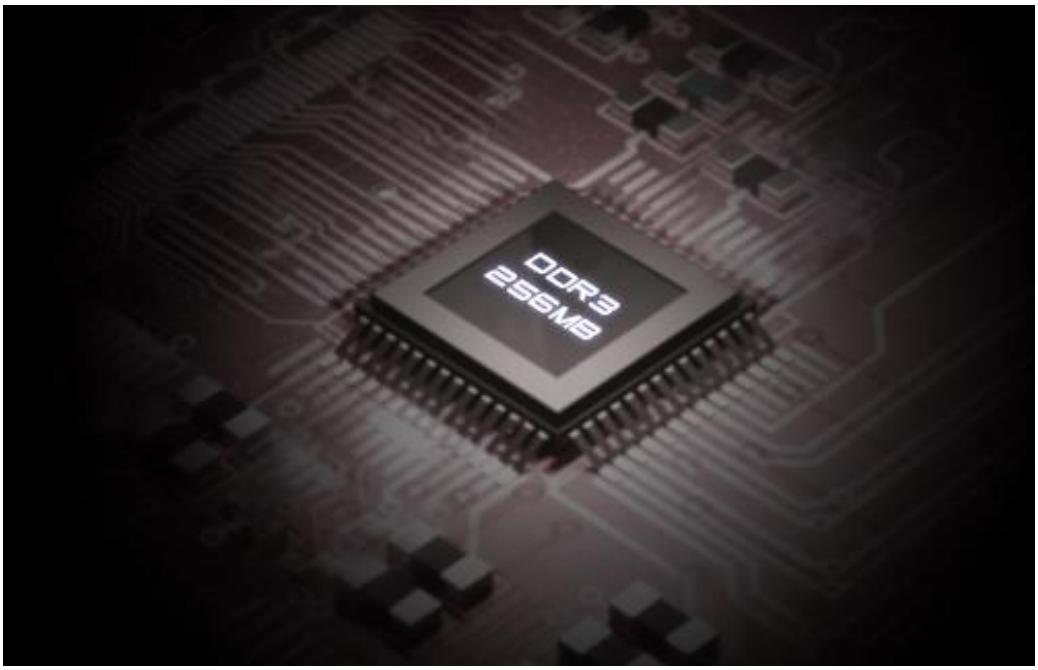
Solar cameras working in daylight, temperature could be much higher than night. Heat of global shutter sensors will be a problem, especially some big format like IMX432. Player One add one new feature called **Passive Cooling System** to conduct the heat from the sensor out.



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

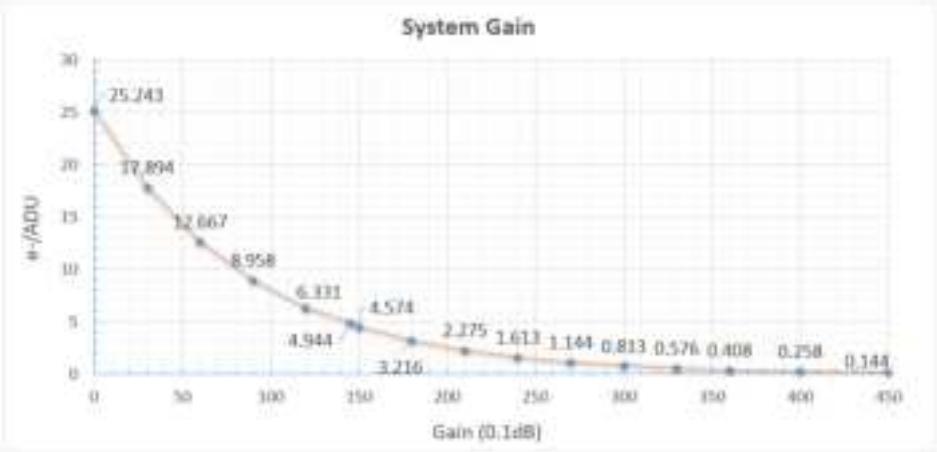
Player One cameras produced by the number one player ensures the safety of your camera and other equipment through overvoltage and overcurrent protection mechanisms.

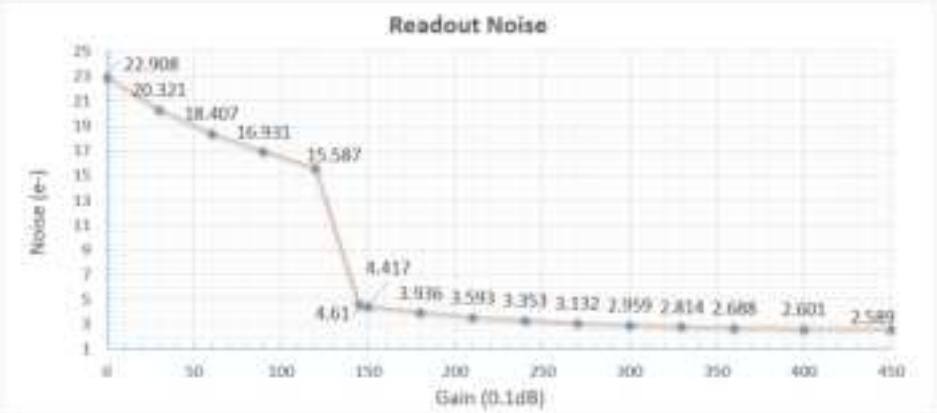
Data Port

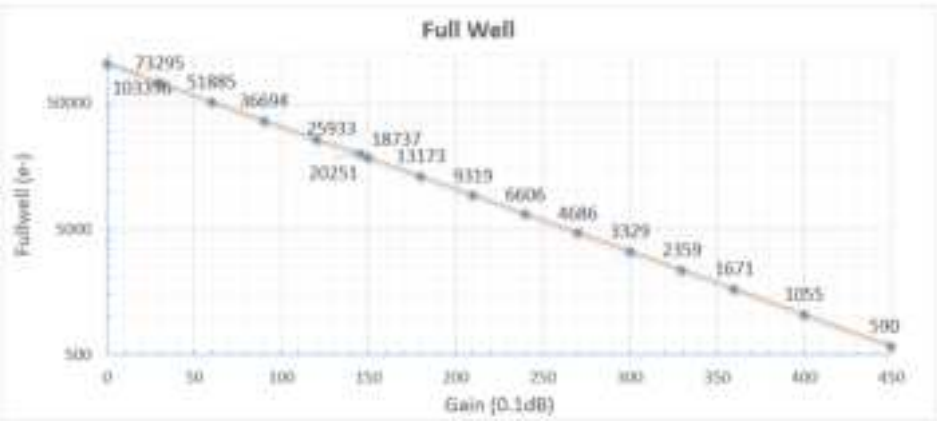
When the camera is connected to the USB3.0 interface and full-resolution preview is used, **it can reach 109FPS in 12bit (RAW16) and 126FPS 10bit(RAW8) mode**. When recording images, since the actual writing speed will be affected by the writing speed of the hard disk itself, when the hard disk writing 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.

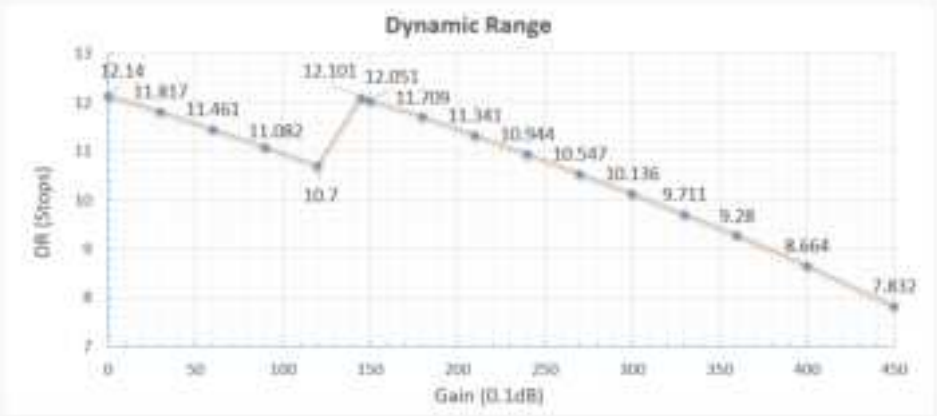
Use the ST4 guide cable to connect the camera and the AUTO GUIDE port of the equatorial mount to do guiding.

Performance





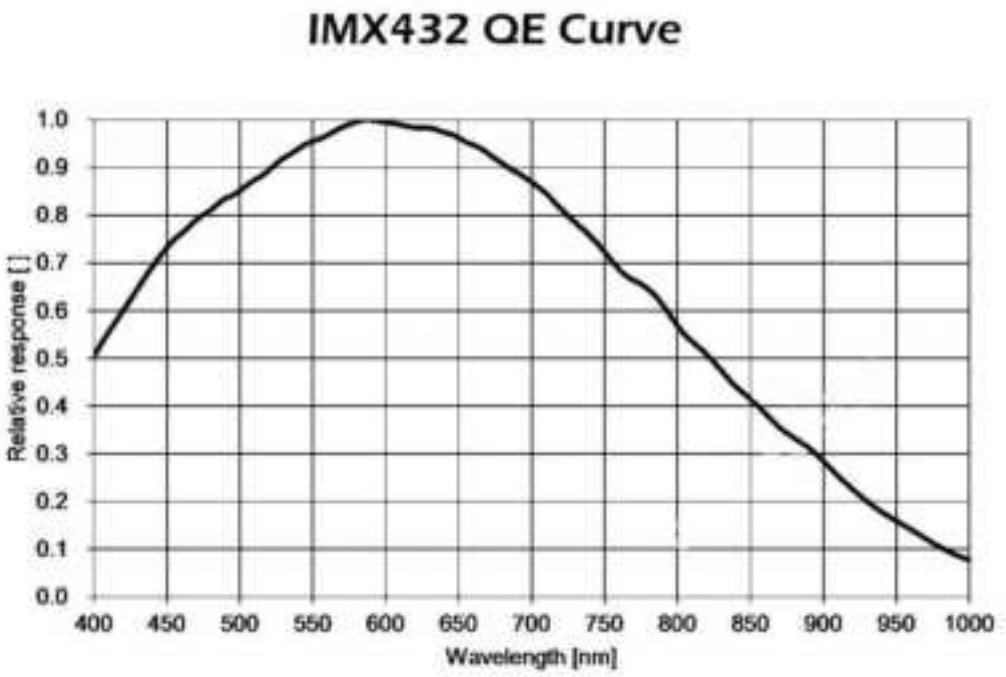




Readout Noise

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 2.6e at a gain of 380.
If you are interested in readout noise testing, you may try it yourself, which is very simple.

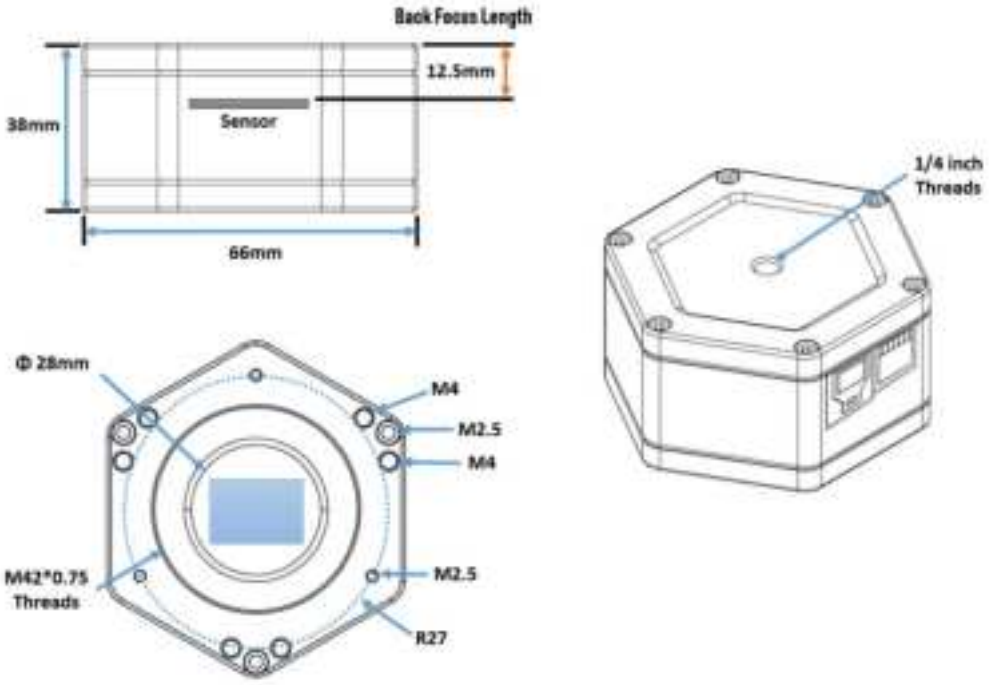
QE Curve



HCG Mode

The Apollo-M MAX camera has a unique HCG mode, which will automatically turn on when the camera gain setting is >145. 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.