DSO Camera ASI461MM Pro
Product Manual

Thank you so much for purchasing ZWO ASI camera! Before using the product, please read this manual carefully.

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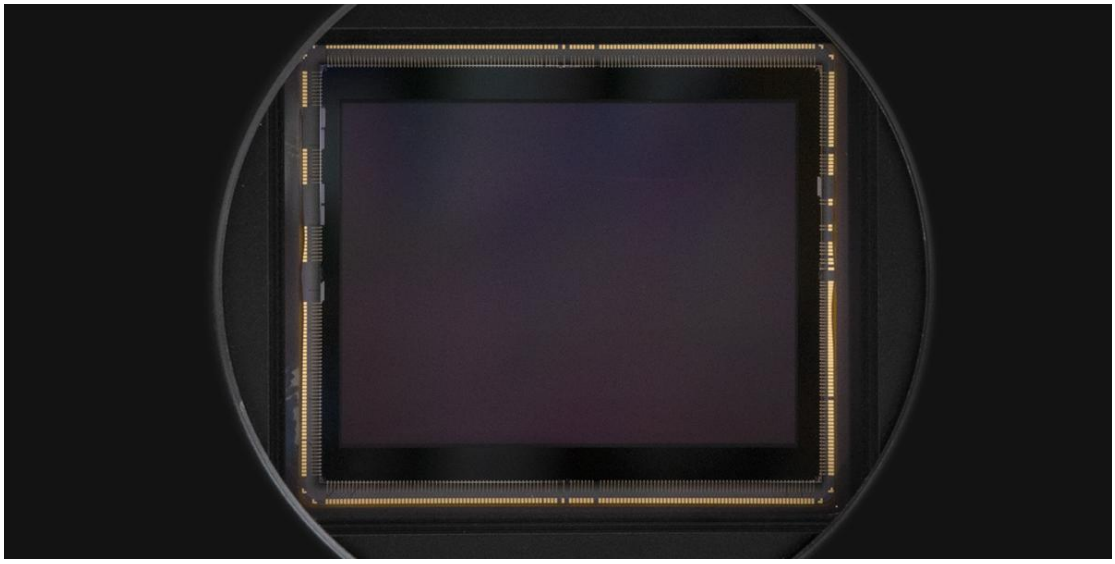
1 Product Introduction

ASI461MM Pro adopts Sony medium format IMX461 sensor. It has the native 16-bit ADC with 65536 levels, back-illuminated structure and highquantum efficiency, and a great performance in DSO imaging, milky way imaging aind scientific research It features very low readout noise and nearly zero visible fixed-pattern noise.

100mega Pixels

ASI461MM Pro is a 100MP camera with a large sensor size of 44mm×33mm and a high resolution of 11656×8750. The 3.76μm pixel accommodates an impressive full well capacity of 50.3ke. While at Bin2 mode, you can get an even larger full well capacity of 198ke and a larger pixel size of 7.5μm×7.5μm.



No Amp Glow

Traditional CMOS sensors produce a weak infrared light source during operation, which is quite often seen in the corner of uncalibrated images. This is the tell-tale signs of "amp glow". As the ASI461MM Pro uses zero amp glow circuitry, you won't have to worry aboutamp glow even when using high gain, long exposure imaging.
Note: This technology has already been implemented in firmware. No software operation is needed.

2 Notice for Use

Before using the camera, please read this manual carefully.

External power supplies are needed for all ASl cooled cameras. We recommend you use a 12V@3A~5A DC adapter (D5.5x2.1mm, center pole positive) or a lithium battery with 11-14V to power the camera. Be aware that using power supply out of this voltage range will probably lead to irreparable damage to the camera.

Note that the camera can only be used and stored under the following conditions. Usages out of the environment limits might lead to damage to the camera.

Storage temperature	-20°C ~ 60°C
Storage humidity	20% ~ 95%
Working temperature	-5℃ ~ 50℃
Working humidity	20% ~ 80%

Please do not use corrosive solutions to clean the camera to avoid corroding the oxide layer on the surface and damaging the camera. Meanwhile, please do not keep the camera exposed to the sun for a long time to avoid discoloration of the oxide layer on the camera surface.

3 Getting to Know Your Camera

3.1 External View

1. Sensor Plate — M68 x 1 thread,5mm,removable
2. AR protective window (D79.3 x 4mm)
3. Heat sink
4. USB 2.0Hub
5. USB 3.0/USB 2.0 data transmission port
6. DC power port: D5.5x2.1mm, center pole positive. 12V@3A power supply is recommended to use.
7. Ultra-quiet magnetic levitation fan: Only runs when cooling is turned on.

3.2 Camera Specifications

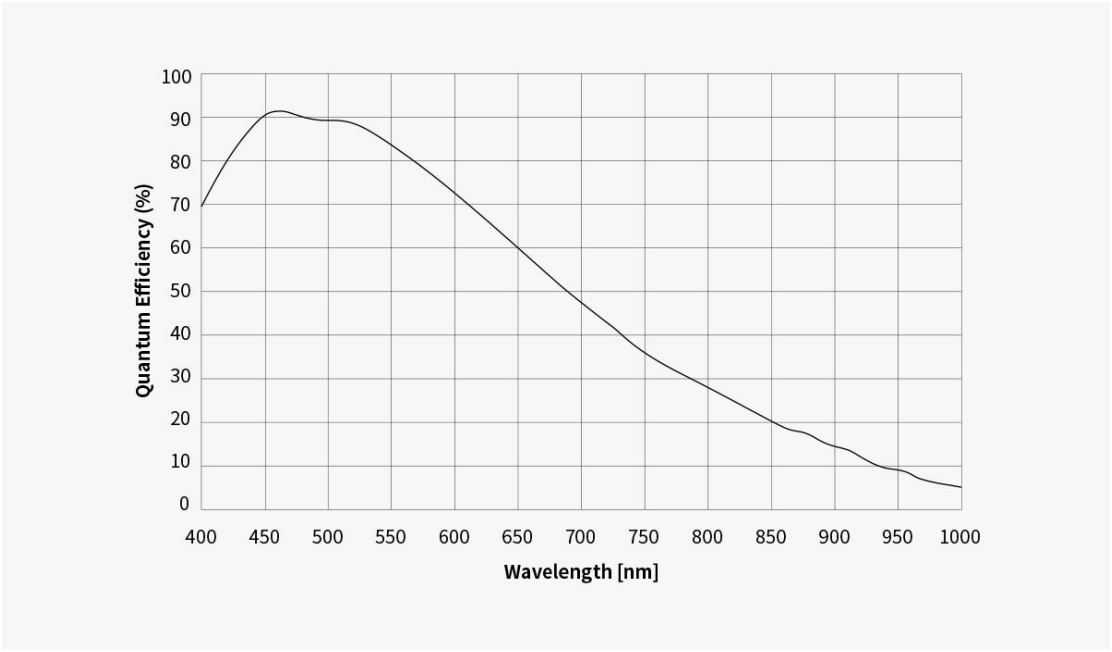
Sensor	Sony-IMX461
Sensor format	Type3.4
Diagonal	54.8mm
Resolution	10199MP (11656 x 8750)
Pixel size	3.76μm
Sensor size	43.856 x 32.9
Max frame rate	3.77fps
Shutter	Rolling shutter
Exp range	32μs~2000s
Read noise	1.0-3.3 e(0.9e@46db gain)
QE peak	91%
Full well capacity	50.3K e
ADC	16bit
DDR3 buffer	512MB
USB port	USB 3.0/USB 2.0
Connection adapter	M68 x 1
Protective window	D79.3-4 AR
Camera diagonal	ϕ106-103
Net weight	910g
Back focus distance	17.5mm/22.5mm
Cooling	2-stage TEC cooling
Delta-T	30°~35°@ environmental temperature 30°C
Power consumption (Cooling on)	12V, Max current 3A
Supported OS	Windows, Linux & Mac OSX

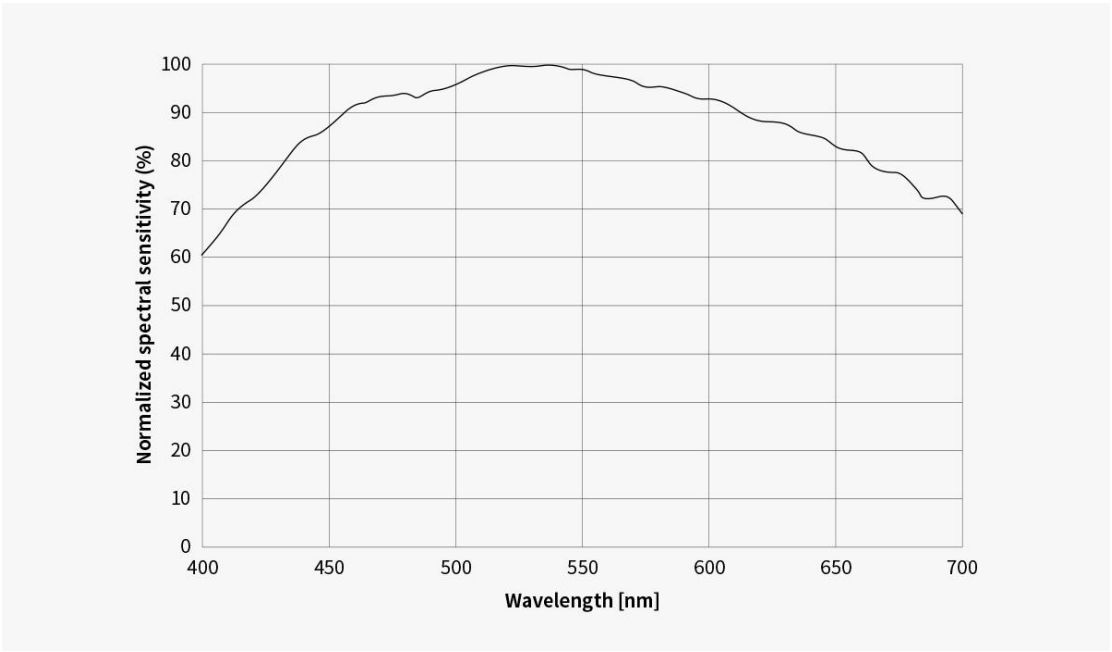
*Starting from August 2023, all cooled camera models have upgraded their DDR3 memory from 256MB to 512MB.

3.3 Quantum Efficiency & Read Noise

Quantum Efficiency

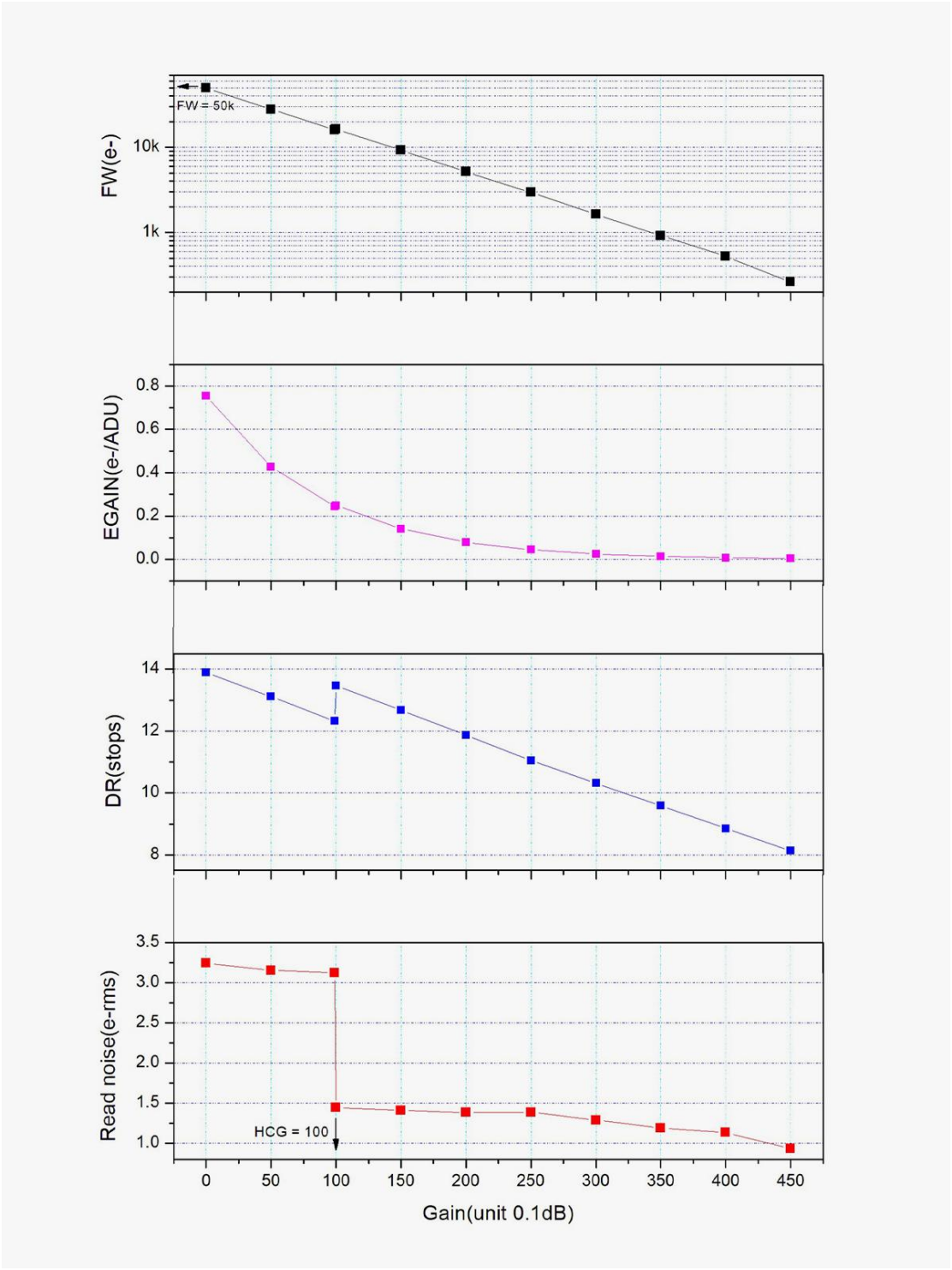
QE curve and readout noise are very important parameters to measure the camera's performance. Higher QE and lower readout noise are necessary to improve the image signal-to-noise ratio.





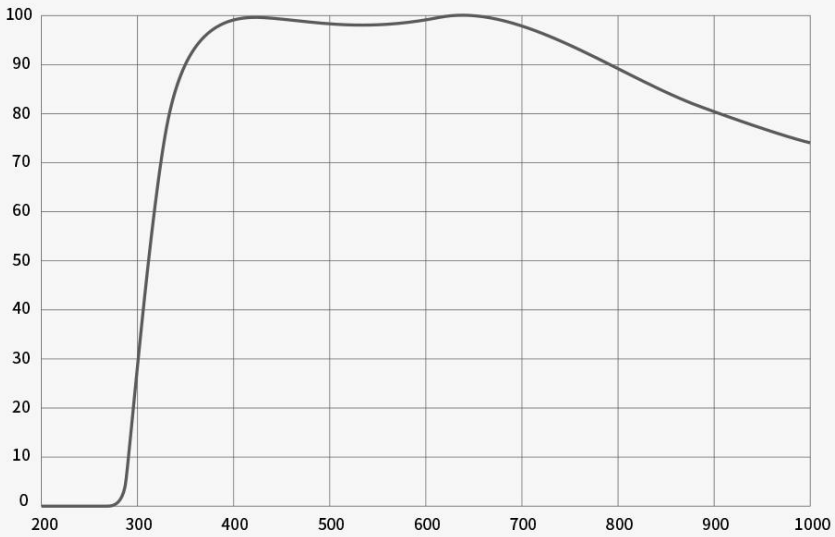
Read Noise

ASI461MM Pro has great performance and also a high dynamic range of up to 14stops.Set gain 100, then the HCG mode will be automatically turned on. The readout noise can be very low, while the dynamic range is basicaally unchanged.It is recommended to use Gain 0 or 100 for DSO imaging.



3.4 Protective Window (AR-Coated Anti-Reflection Filter)

The ASI461MM Pro camera is equipped with a 79.3mm diameter, 4mm thick AR-coated anti-reflective filter as a protective window. This filter safeguards the sensor from external damage while enhancing light transmission across the near-ultraviolet to near-infrared spectrum.



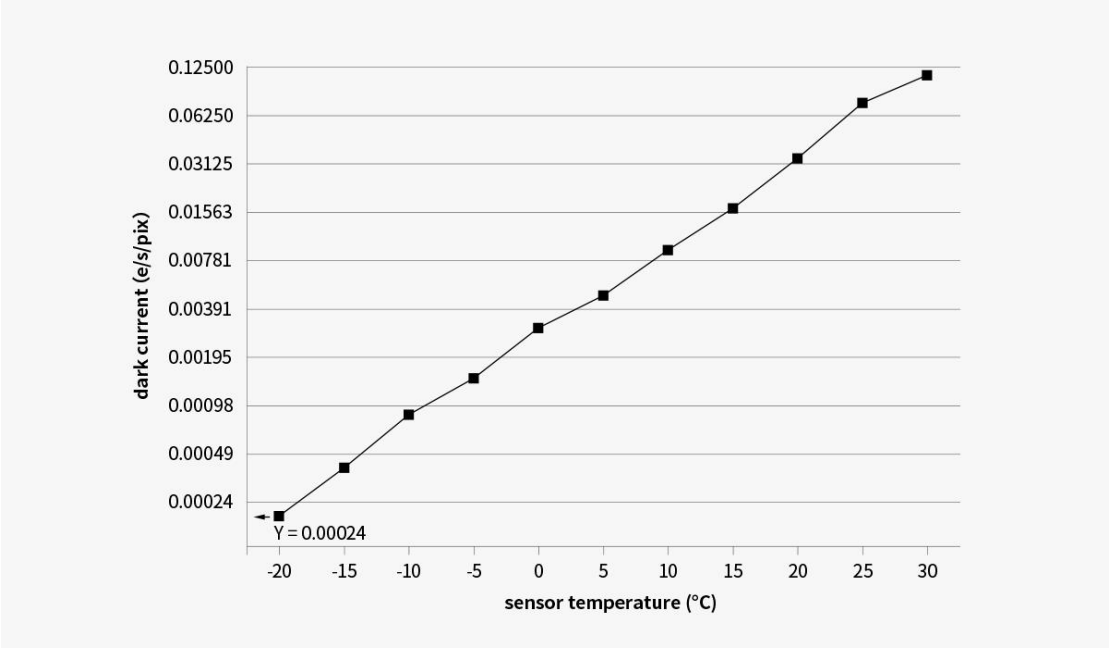
3.5 Analog to Digital Converter (ADC)

ASI461MM Pro records in 16bit ADC and 12bit ADC. You can image at a faster frame rate if you use 12bit ADC (high speed mode). Or you may also set an ROI if you want even faster frame rates. Below are the maximum speeds of ASI461MM Pro running at different USB transmission modes.

ASI461MM PRO								
	USB3.0				USB2.0			
	Normal Mode：16BIT ADC		High-speed Mode：12BIT ADC		Normal Mode：16BIT ADC		High-speed Mode：12BIT ADC	
Resolution	RAW16	RAW8	RAW16	RAW8	RAW16	RAW8	RAW16	RAW8
11664*8750	1.32	1.32	1.6	3.03	0.083	0.42	0.19	0.42
7680*4320	2.69	2.69	3.01	5.9	0.63	1.25	0.65	1.3
3840*2160	5.3	5.3	6	11.9	2.46	4.93	2.61	5.2
1920*1080	10.3	10.3	11.6	23.3	10.3	10.3	10.4	20.9
1280*720	15.1	15.1	17.1	34.1	15.1	15.1	23.5	34.1
640*480	21.9	21.9	24.7	49.5	21.9	21.9	49.5	49.5
320*240	40	40	45	90	40	40	90	90

3.6 Two-stage TEC Cooling

The ASI461MM Pro features a two-stage TEC cooling system. Under room temperature conditions, it can achieve a maximum cooling delta of approximately 35°C (tested at an ambient temperature of 30°C; note that the cooler the ambient temperature, the smaller the temperature difference).

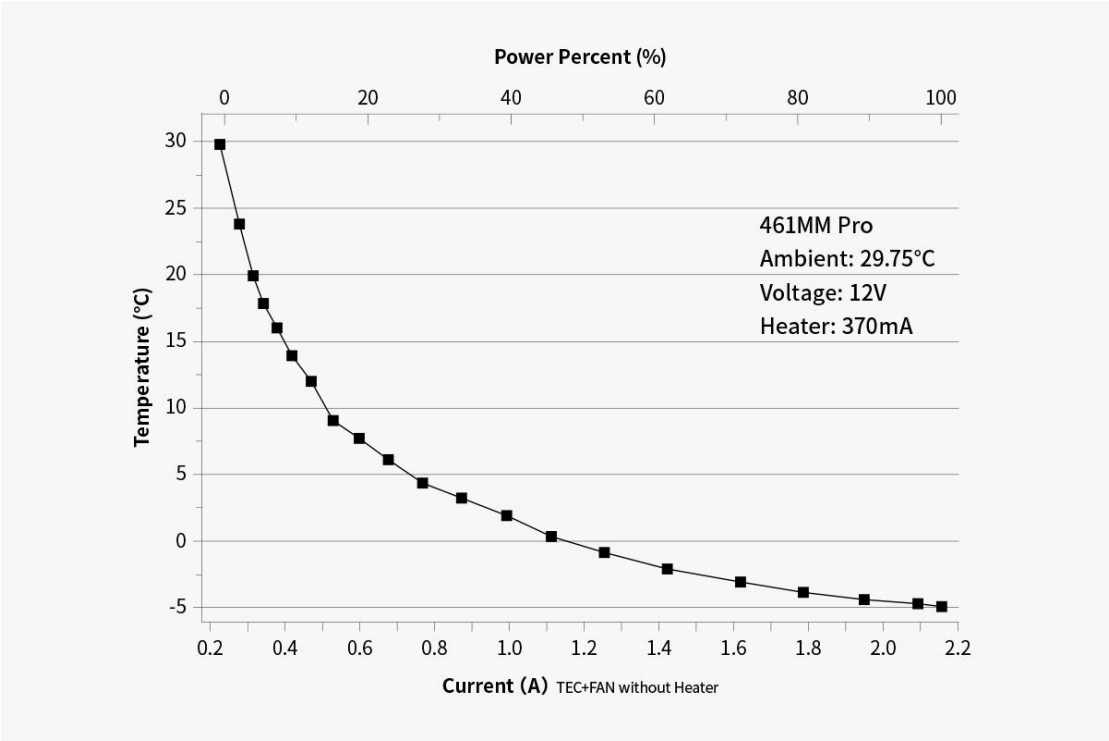


3.7 Anti-dew Protection

Glass Window Heating: The camera features a built-in heating film that warms the protective glass window directly. The film is tightly attached to the glass, allowing efficient heating to prevent fogging or dew formation. The heater consumes approximately 5W of power and can be turned off via software to conserve energy when dew prevention is not needed.

3.8 Power Consumption

The ASI461MM Pro is a low-power camera. When cooling is turned off, its maximum power consumption is only 5.51W. The chart below shows the camera's cooling efficiency—achieving a 30°C delta requires just 2.2A of current.



3.9 High Transmission Speed

USB3.0 & 512M DDR3 Memory: The ASI461MM Pro camera is equipped with a USB 3.0 transmission interface and a built-in 512MB DDR3 cache to ensure stable and secure data transmission.

3.10 Sensor Adjustment

The sensor is adjusted by three sets of screws, enabling precise calibration. (Each set consists of a push-pull screw pair.)

1.Capture an image with visible stars using the camera under normal shooting conditions. Use software to identify which direction in the image shows signs of tilt, then adjust the corresponding set(s) of tilt adjustment screws on the camera.

2.Capture another image and compare it with the previous one using the software. If the image quality improves, the adjustment was in the correct direction. If it worsens, the adjustment was in the wrong direction.

3.Repeat step 2 until the stars in all corners of the image appear near-perfect.

4 What is in the Box?

ASI461MM Pro
Camera body

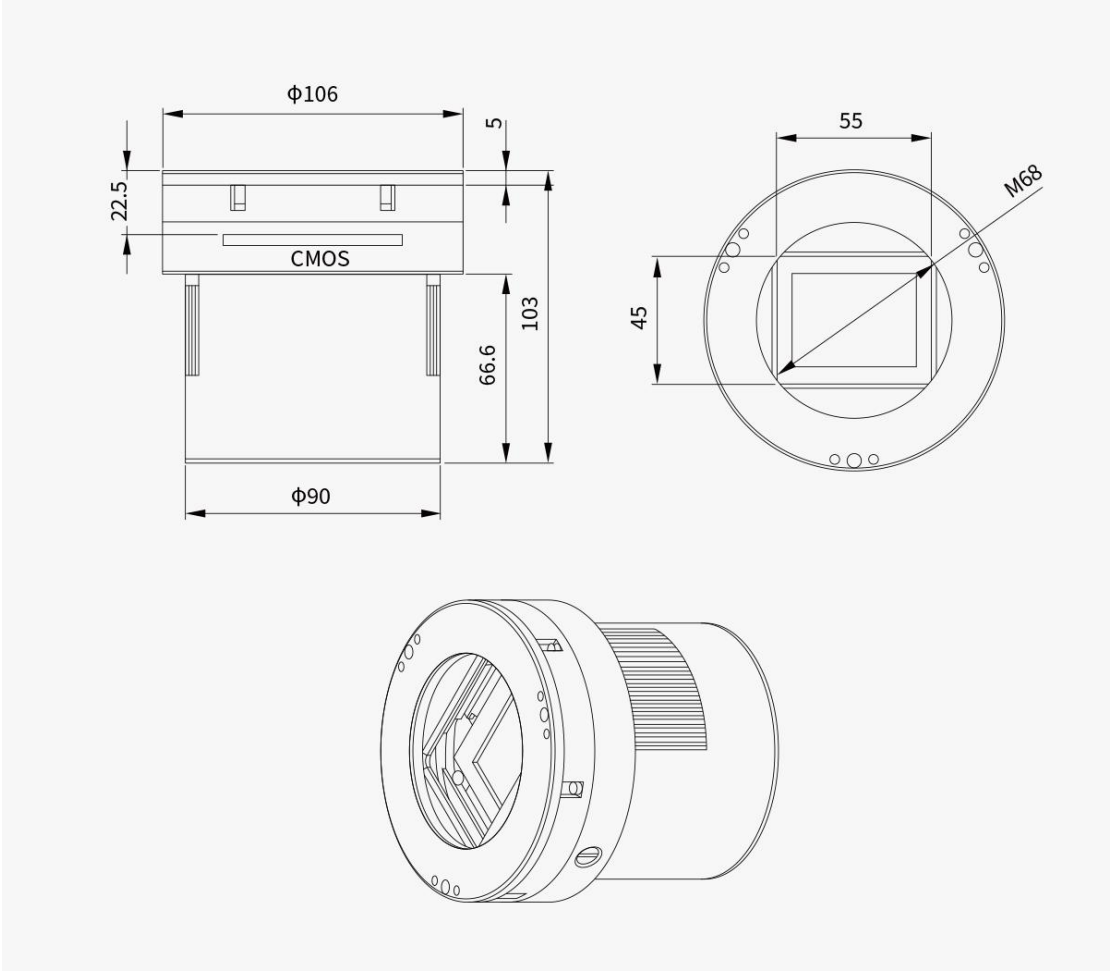
Camera bag

USB 3.0 Cable
(2m)

Quick guide

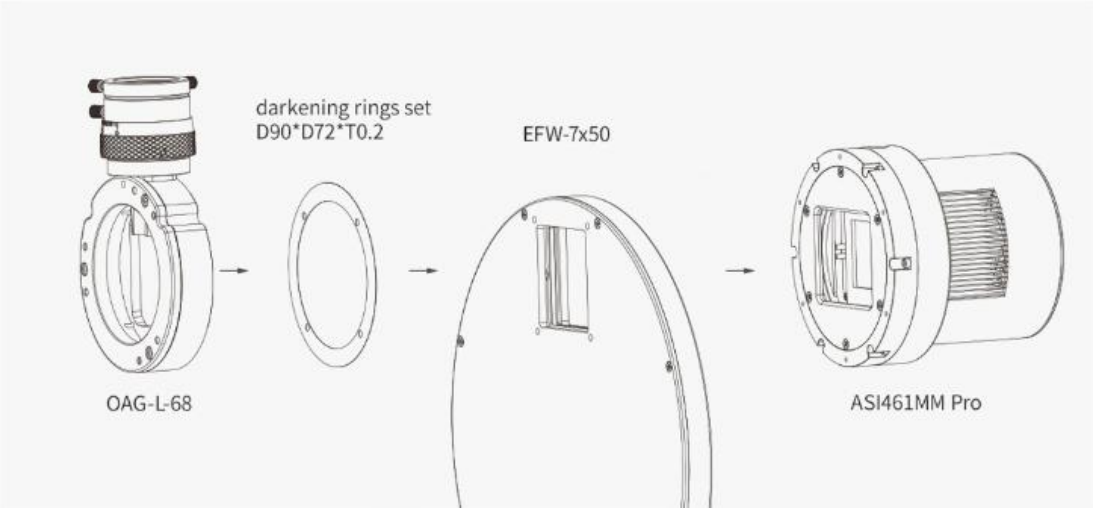
USB 2.0 Cable
(0.5m) x2

5 Structural Dimension Diagram



6 Connection Methods

6.1 Back Focus Distance: 55mm



6.2 Connecting External Devices

#A 12V power supply must be used.

7 Warranty

1. ZWO provides Users with a warranty period of 2 years for ZWO branded products. The warranty starts from the second day when the customer gets the product.

2. If a User encounters the following Dead on Arrival (DOA) and contacts ZWO within the corresponding time limit to issue the Product purchase invoice and relevant evidence, ZWO will provide door-to-door pick-up service and, as appropriate, after-sale replacement (or partial replacement), repair or return (or partial return) service for the following Products:

1) Product quality problem

Provided that a User detects a quality problem and contacts ZWO within 30 days after receipt of the Products, and ZWO support team confirms that the Products indeed have a quality problem or defect after their inspection, ZWO will provide free replacement service towards such Products;

2) Product transportation problem

Provided that a User finds obvious signs of bubbling, serious overstocking, or deformation on the outer package of the Products upon receipt of the Products, and provides ZWO with pictures of the outer package and proof of receipt within 3 days after receipt of such Products, ZWO support team will verify the actual shipper and determine the responsible party for such transportation problem. In the event that ZWO is the actual shipper, ZWO will be responsible for providing the relevant return or replacement service, however, if the Products are directly sold or transported to the User by an agent of ZWO, the agent will be responsible for providing the relevant return or replacement service.

3. If the Products are under the following circumstances, they are not within the scope of warranty service, ZWO may provide maintenance services to the Users:

1) The Warranty Period of the Products has expired; or

2) The Products are injected into liquid or affected by moisture or corrosion; or

3) The Products are damaged by an external force (such as the broken of the camera protection window glass, the deformation of the product shell, the broken of the USB port, etc.); or

4) Disassembling, repairing by a third party, refurbishment of the Products (such as downloading erroneous firmware) without the written authorization of ZWO; or

5) The product system is modified, or the maintenance notice is lost or changed; or

6) Product quality problem caused by installation not following the requirements or instructions for the Products; or

7) Physical damage or failure of the Products caused by the force majeure (such as strong vibration or extrusion such as flood, fire, earthquake, or thunder stroke); or

8) Damage caused by the improper Customer operation during the period of shooting or use, such as using without the equipment protection or direct shooting of the sun; or

9) No valid purchase invoice or warranty certificate; or

10) The Products are second-hand products.

8 Servicing

For software upgrades, please refer to “Guide & Manuals” on our official website.
https://www.zwoastro.com/guides-and-manuals/
For repairs and consultation, you can visit here:
https://support.astronomy-imaging-camera.com/
Email: info@zwoptical.com
Phone: 0512-65923102

1. For the normal repair or replacement of the Products during the Warranty Period, the User will bear the return cost. When returning the Products, Users shall specify the actual reasons for the damage to the Products, and shall provide the corresponding valid certificates, such as pictures or videos, etc.

For the Products that need to be replaced after being confirmed by ZWO in writing, the User shall return the Products with the complete package, together with all accessories, manuals, etc., to the address designated by ZWO.

By sending back the product to ZWO, the User agrees to pay out-of-warranty fees that may arise during the repair process of the product. ZWO will send back the product after charging.

2. For the Products that need to be returned for after-sales service, ZWO will provide the corresponding RMA code for reference. ZWO will not accept any products having no RMA code that have been returned privately without ZWO written confirmation.

3. If a User purchases the ZWO Products from a ZWO agent, the User may contact the ZWO agent directly for the relevant after-sales service.