ZWO DSO Camera
ASI533MC/MM Pro
Product Manual



Thank you for purchasing the ZWO ASI camera! Please read this manual carefully before using this product. The copyright and modification rights of this manual and other related materials belong to Suzhou ZWO Co., Ltd. (hereinafter: ZWO)

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1. Product Introduction



Entry-level Camera for Deep Space Photography

The ASI533MM Pro utilizes the SONY back-illuminated IMX533CLK-D sensor and the ASI533MC Pro utilizes the SONY back-illuminated IMX533CQK-C sensor. With a 1-inch square format, it is particularly suitable for astrophotography needs. The ASI533 series can be regarded as an upgrade of the ASI183 series. Not only does it retain the high-quality features of the ASI183, such as high QE and high frame rate, it also features no amp glow, read noise as low as 1.0e, pixel size of 3.76 um and a 2-stage TEC cooling. It is highly recommended for beginners of deep sky astrophotography.



One-inch Square Frame

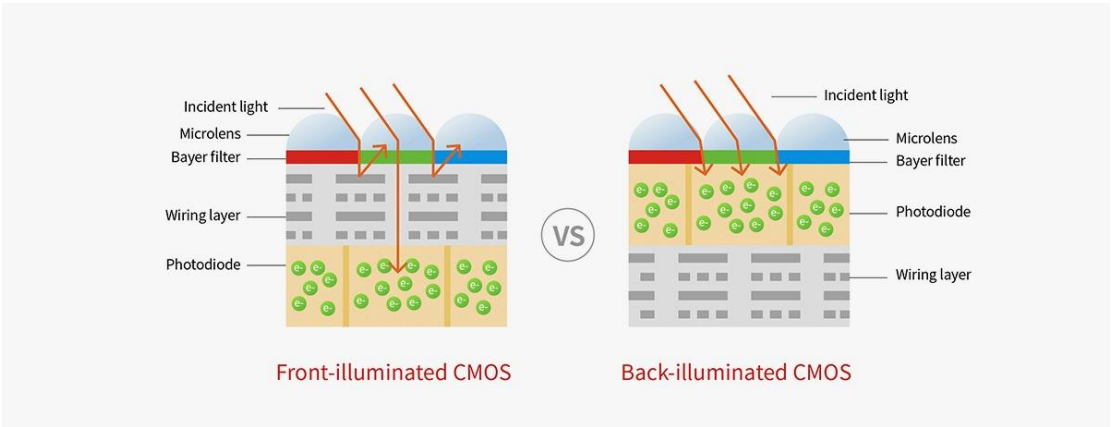
The IMX533 is a one-inch square frame CMOS image sensor with approximately 9M effective pixels at a pixel size of 3.76um. In ADC 14bit mode it can output 20 fps resolution with read noise as low as 1.0e, which is comparable to SCMOS or EMCCD sensors for users requiring high resolution and low noise.



IMX533 Back-illuminated Sensor

The traditional CMOS sensor is a photodiode with a layer of metal wiring, the light will be blocked or reflected when passing through the wiring layer, resulting in the photodiode can only absorb 70% of the light or even less;

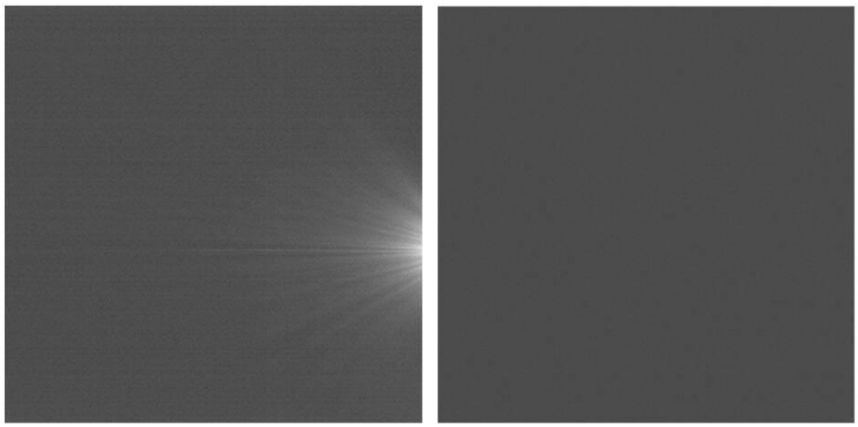
The back-illuminated sensor reverses the position of the metal wiring layer and photodiode, and the light reaches the photodiode without blockage, resulting in a higher absorption rate and higher image quality.



Zero Amp Glow

Traditional CMOS sensor can generate weak infrared light, which is equivalent to a light source during exposures. The ASI533MC/MM Pro uses a no-glow circuitry to ensure best quality images

regardless of gain or exposure length.



With amp glow
300 seconds exposure

with no amp glow
300 seconds exposure

2. Notice for Use

Before using the camera, please read this notice carefully.
External power supplies are needed for all ASI 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. Usage outside of the environment limits might lead to damage to the camera.

Storage temperature	-20℃ ~ 60℃
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. Heat sink
2. T2 extender ring: Internal M42 thread, 11mm thick, removable
3. Protective window, AR coating, D32*2mm
4. USB 2.0 hub
5. USB 3.0/USB 2.0 data transmission port
6. Led indicator
7. Cooling power supply DC port: size 5.5*2.1mm, inside positive and outside negative, 12V3A power supply is recommended
8. Ultra-quiet magnetic levitation fan: only runs when cooling is turned on

The camera can be supported by the ZWO holder ring. There is a 1/4” screw port at the base of the ring.



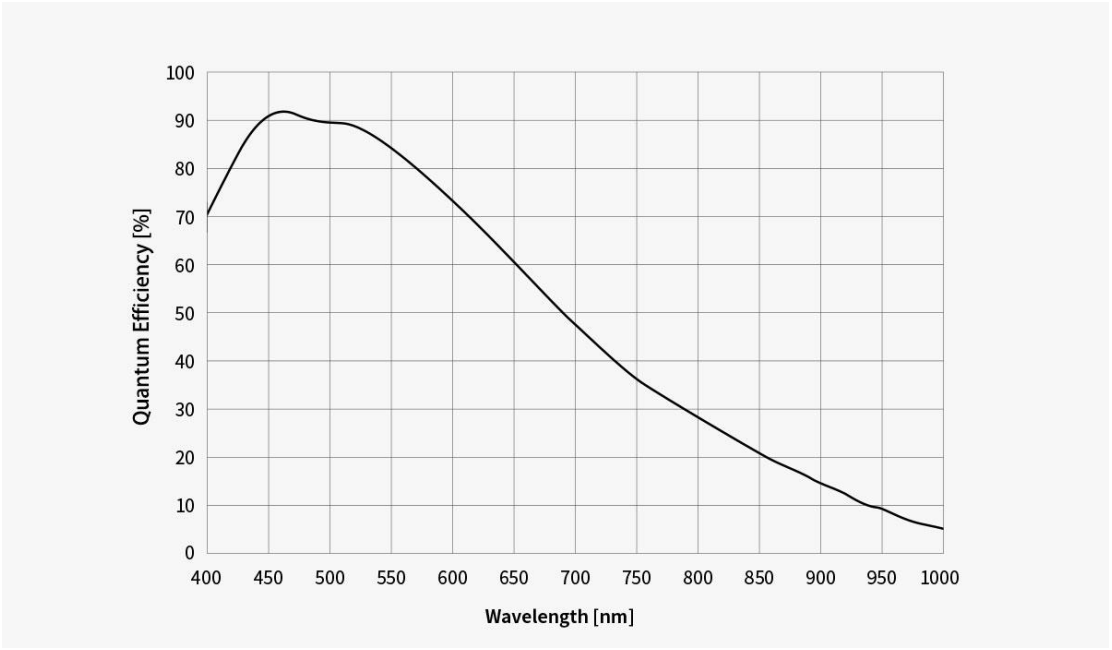
3.2 Camera Specifications

Sensor	CMOS IMX533CLK-D (Mono) CMOS IMX533CQK-C (OSC)
Sensor format	1″
Diagonal	16mm
Resolution	9MP (3008*3008)
Pixel size	3.76μm
Sensor size	11.31mm*11.31mm
Max frame rate	20FPS
Shutter	Rolling shutter
Exposure range	32μs-2000s
Read noise	1.0e-3.8e
QE peak	91% (Mono) Over 80% (OSC)
Full well capacity	50ke
ADC	14bit
DDR3 buffer	256MB
USB port	USB 3.0/USB 2.0
Adapter	2″ / M42 x 0.75
Protective window	AR coating
Camera diameter	78mm
Net weight	410g
Back focus distance	17.5mm/6.5mm
Cooling	2-stage TEC cooling
Cooling temperature	Below ambient temperature 30°C~35°C
Power consumption (Cooling on)	12V, max current 3A
Supported OS	Windows, Linux & Mac OSX

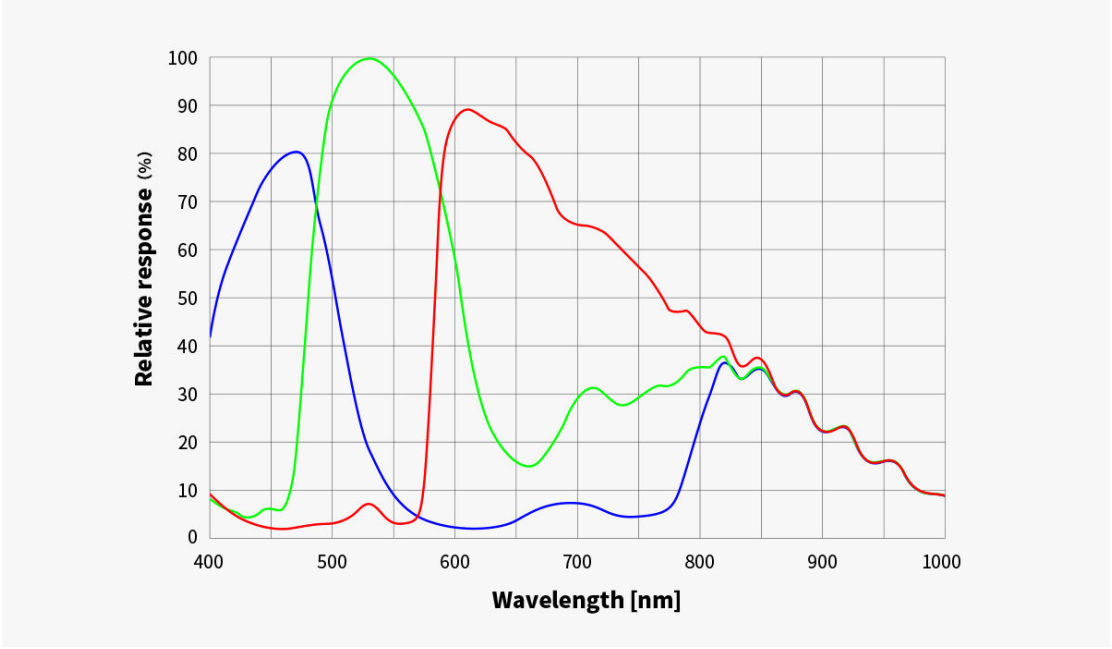
3.3 Quantum Efficiency & Read Noise

Quantum Efficiency (QE)

According to our test results, the QE peak value of ASI533MM Pro is 91%. For ASI533MC Pro, the QE peak value is above 80%.



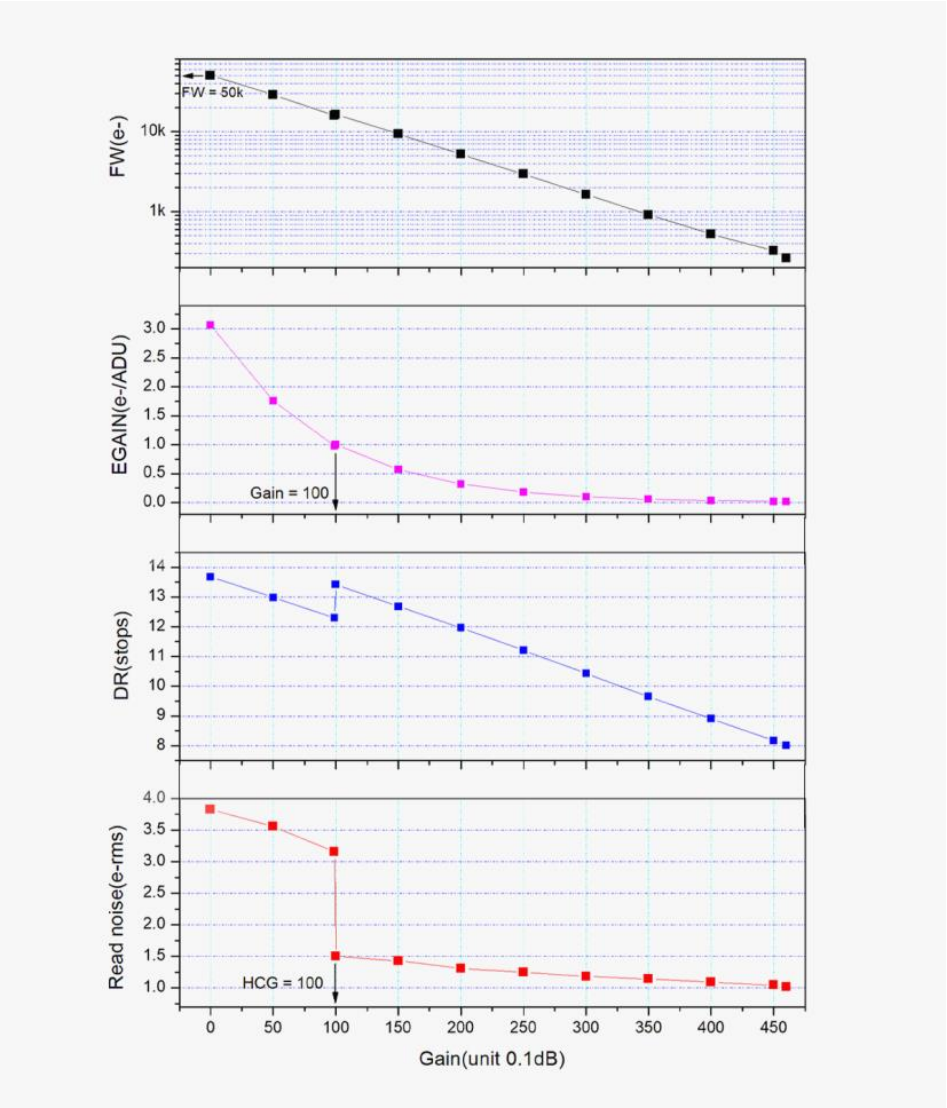
ASI533MM Pro



ASI533MC Pro

Read Noise

Low read noise, high dynamic range.



3.4 Analog to Digital Converter (ADC)

The ASI533MC/MM Pro camera has a built-in 14bit ADC. 12bit ADC mode output will be used for hardware Bin. The ASI533 also supports customized ROI partial readout mode for faster frame rate at small ROI resolution.

The graph below shows the frame rate of ASI533 in 14bit mode for different resolutions:

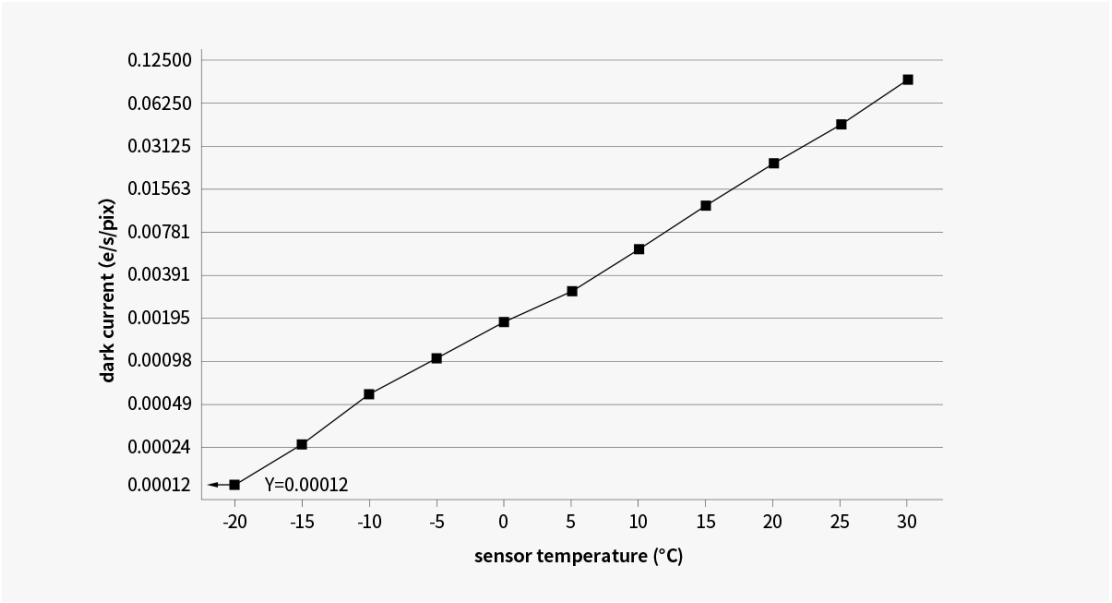
Resolution	14Bit ADC	
	USB 2.0	USB 3.0
3008*3008	2fps	20fps
1920*1080	10fps	54fps
1280*720	24fps	80fps
640*480	70fps	117fps
320*240	216fps	216fps

3.5 Two-stage TEC Cooling

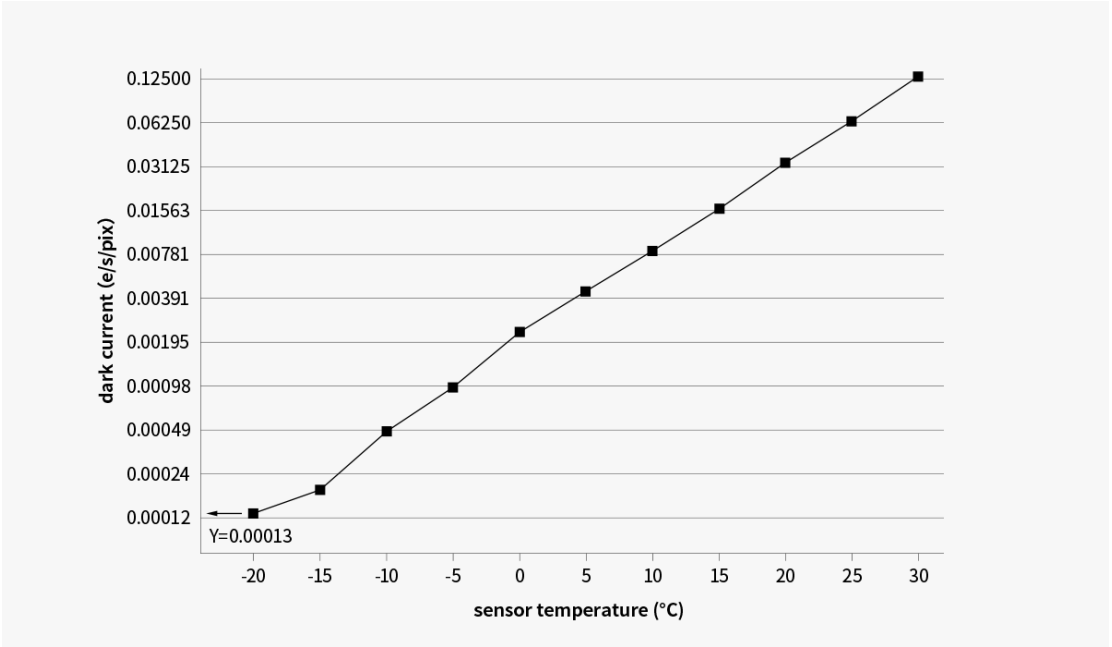
Thanks to the two-stage TEC cooling, ASI533 can lower the CMOS sensor temperature to 35 degrees Celsius below ambient temperature (based on testing at 30 degrees ambient temperature). Intense cooling effectively suppresses the generation of dark current, and noise is minimal even for long exposures of hundreds of seconds.

*The lower the temperature, the smaller the temperature difference.

The following graph shows the dark current profile of the ASI533MC/MM Pro sensor between -20°C and 30°C:



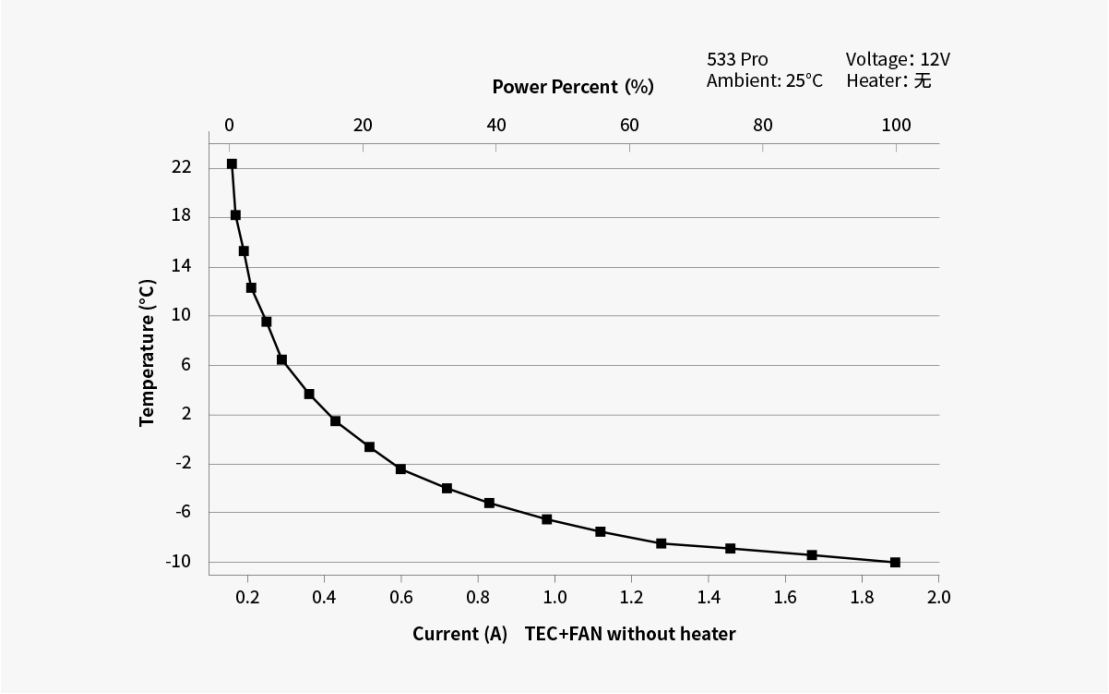
ASI533MM Pro



ASI533MC Pro

3.6 Power Consumption

All ASI cameras have low power consumption, with a maximum power consumption of only 2.5W when not cooled.
The graph below shows the cooling efficiency of the ASI533MC/MM Pro camera.



3.7 DDR Buffer

USB 3.0 & 256MB DDR3 buffer： The ASI533MC/MM Pro is equipped with a USB 3.0 transmission interface. It outputs frame rates up to 20 fps even in ADC 14bit mode;



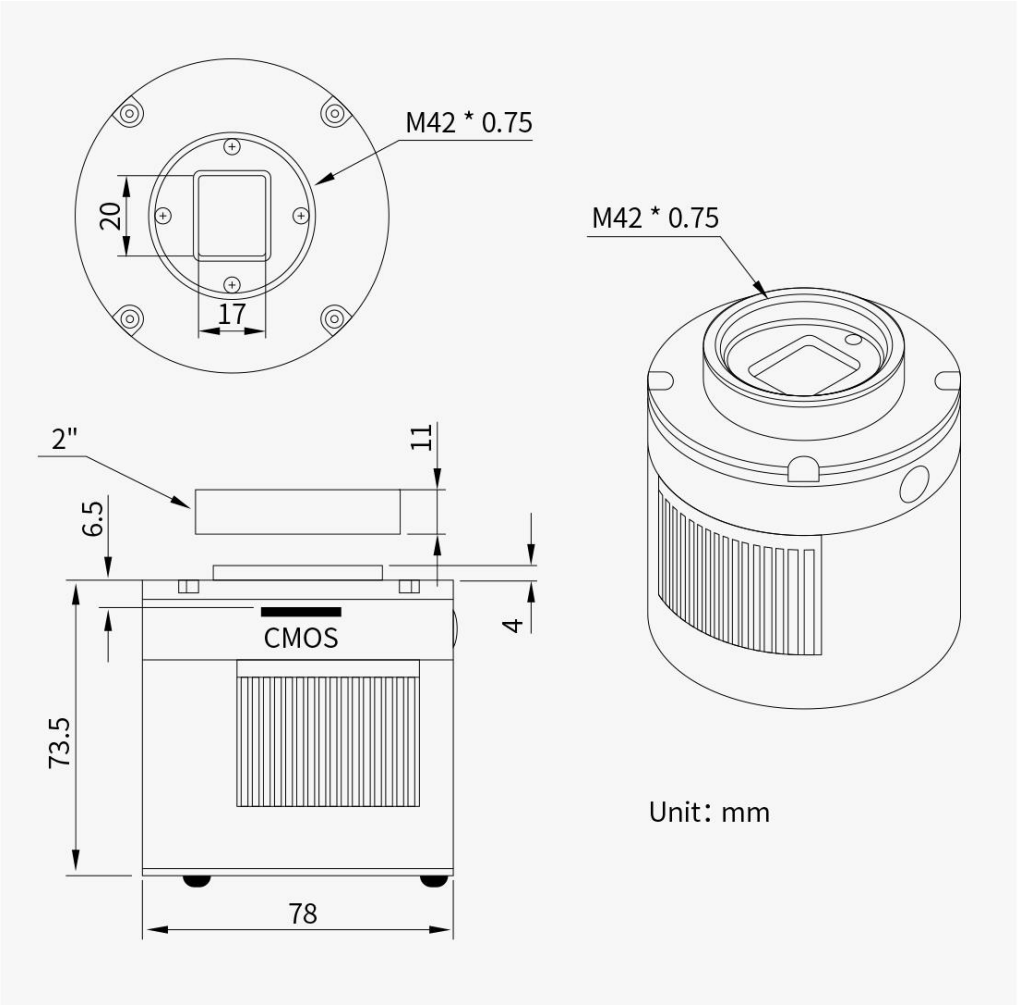
The 516MB of DDR3 buffer ensures stable data transfer without frame loss during long exposures, and also reduces the hardware requirements for the computer used for photography.

4. What's in the Box?



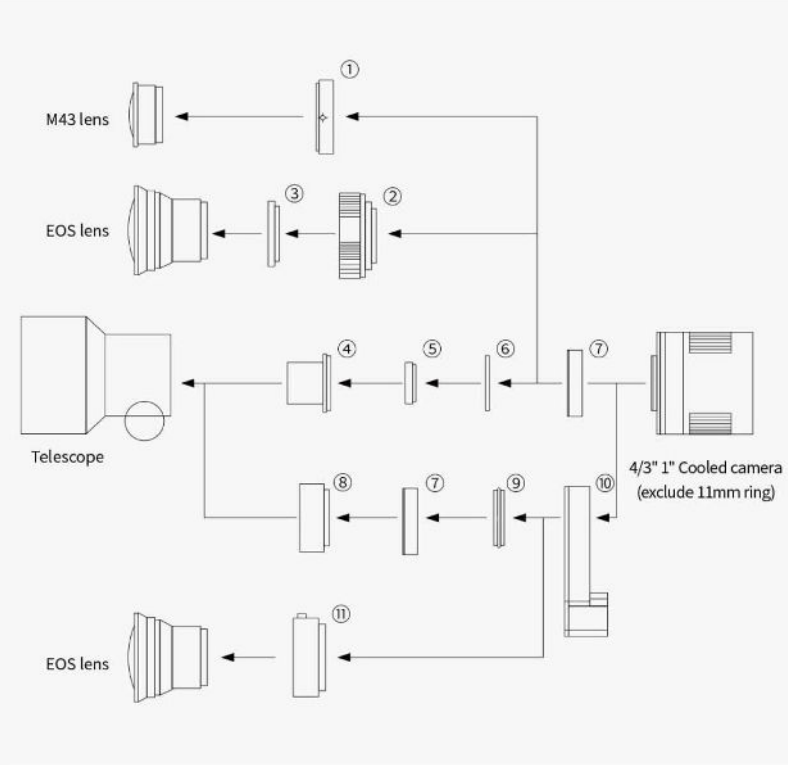
It comes standard with 1 long USB cable and 2 short USB cables, which is convenient for different usage scenarios. For example, choose a long cable for computer guiding, choose a short cable for ASIAIR or EAF guiding.
Spacer*4: 0.1mm 1pc; 0.2mm 2pcs; 0.5mm 1pc

5. Structural Dimension Diagram



6. Connection Methods

6.1 Connecting to Nikon/Canon Lens



1. M43-T2 adapter
2. EOS-T2 adapter ring
3. 2” filter (optional)
4. 1.25” T mount
5. 1.25” filter (optional)
6. M42-1.25” adapter
7. T2 extender ring 11mm
8. M42-M48 extender 16.5mm
9. M42-M42 adapter
10. EFW mini/1.25”/36mm/31mm
11. EOS-EFW adapter

6.2 Solutions for 55mm best back focus distance



6.3 Connecting to external devices



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) Quality problems with product accessories or other parts are not a condition for returning the product. Users can request to replace new accessories separately.

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 solid vibration or extrusion such as flood, fire, earthquake, or thunder stroke); or

8) Damage caused by the improper User 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.