

ASI294 Manual

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1. Instruction

Congratulations and thank you for buying one of our ASI Cameras！This manual will give you a brief introduction to your ASI camera. Please take the time to read it thoroughly, if you have any questions, feel free to contact us.

info@zwoptical.com.

ASI294 Cameras are designed for astronomical photography. The excellent performance and multifunctional usage will impress you a lot!

For software installation instructions and other technical information please refer to “ASI USB3.0 Cameras software Manual”

https://astronomy-imaging-camera.com/

2. Camera Models and Sensor Type

There are 2 types of ASI294 cameras:

Models	Mono or Color	Regulated TEC Cooling	Sensor
ASI294MC	Color	No	Sony IMX294
ASI294MC Pro	Color	Yes	Sony IMX294

Which camera to choose:

TEC cooling will help to reduce dark current noise for long exposures. For short exposures, such as under one second, the dark current noise is very low, however cooling is recommended for DSO imaging when long exposures are required.

3. What's in the box?

ASI294MC



ASI294MC Pro



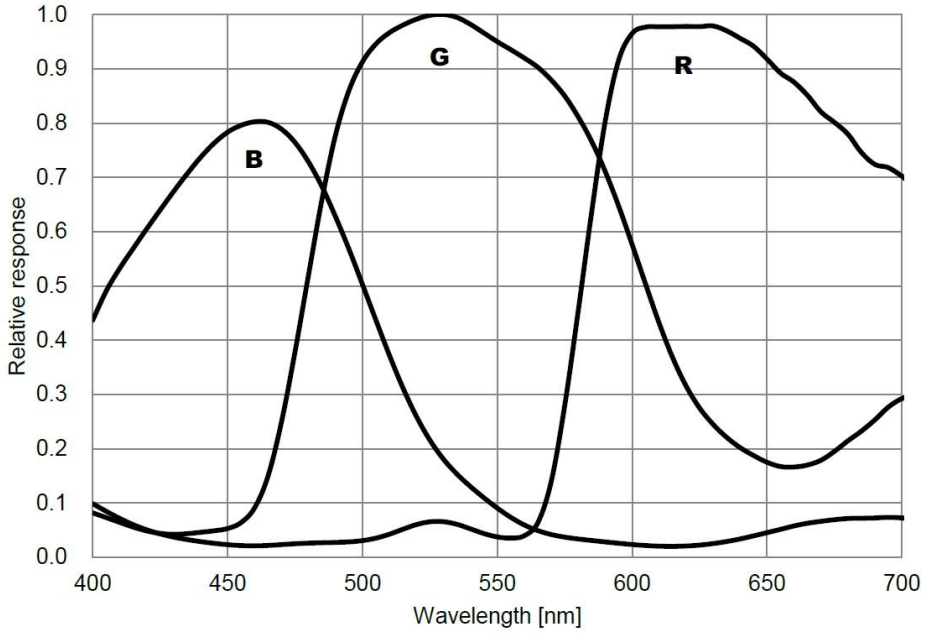
4. Camera technical specifications

Sensor	SONY IMX294 CMOS
Diagonal	23.2mm
Resolution	11.7 Mega Pixels 4144*2822
Pixel Size	4.63μm
Image area	19.2mm*13mm
Max FPS at full resolution	19FPS
Shutter	Rolling shutter
Exposure Range	32μs-2000s
Read Noise	1.2e @35db gain
QE peak	TBD
Full well	63.7k e
ADC	14 bit
DDR3 buffer	256MB
Interface	USB3.0/USB2.0
Adapters	M42*0.75
Protect window	AR window
Dimensions	78mm Diameter
Weight	420g
Back Focus Distance	6.5mm
Cooling:	Regulated Two Stage TEC
Delta T	35°C -40°C below ambient
Cooling Power consumption	12V at 3A Max
Supported OS	Windows, Linux & Mac OSX
Working Temperature	-5°C~45°C
Storage Temperature	-20°C~60°C
Working Relative Humidity	20%~80%
Storage Relative Humidity	20%~95%

5. QE Graph & Read Noise

QE and Read noise are the most important parts to measure the performance of a camera. Higher QE and Lower read noise are needed to improve the SNR of an image.

Relative QE Curve

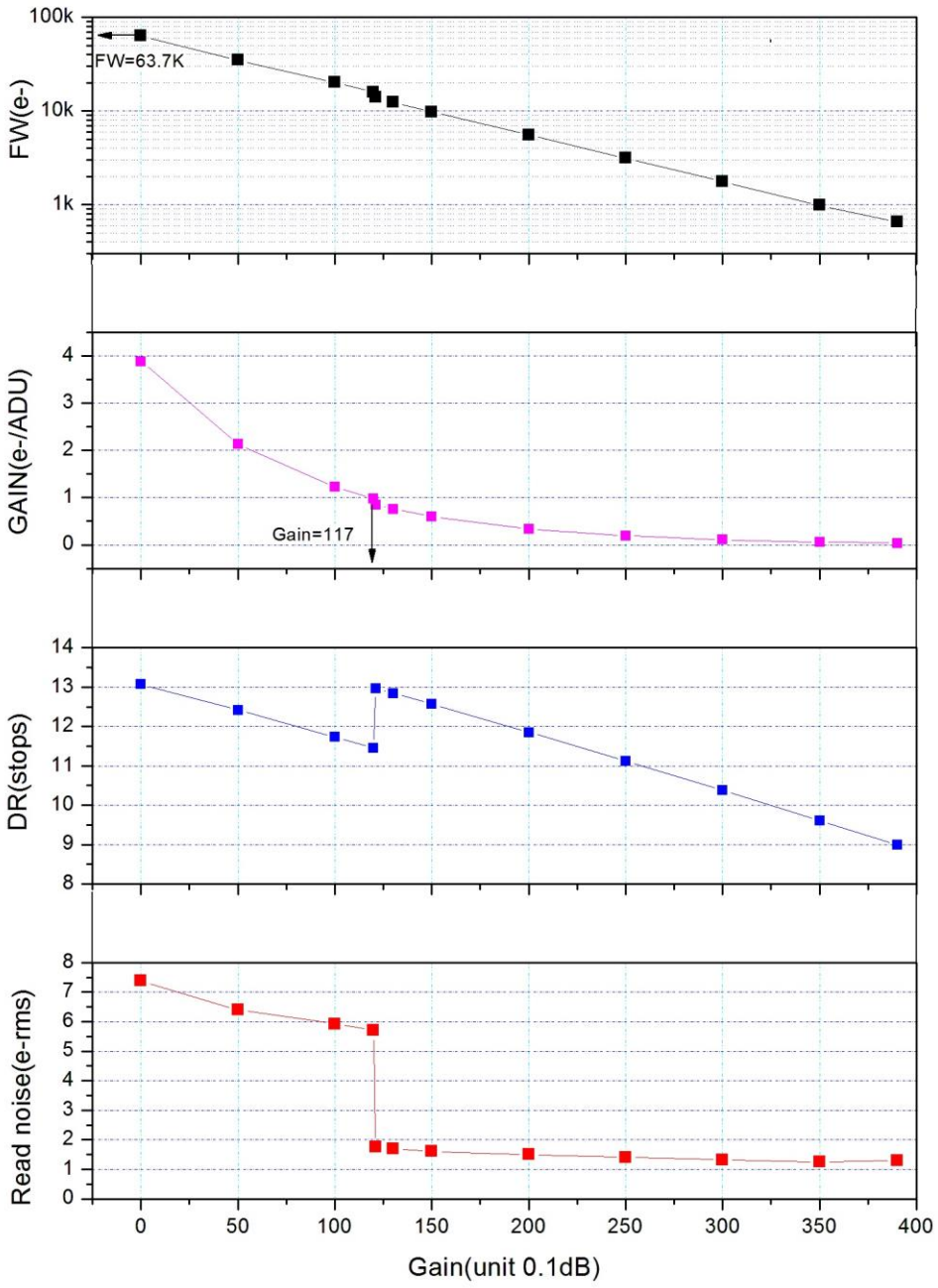


Read noise includes pixel diode noise, circuit noise and ADC quantization error noise, and the lower the better.

The Read Noise of the ASI294 cameras is special. HCG (high conversion gain) mode, which reduces read noise to even lower levels at higher gain without loss to dynamic range, is automatically enabled when the gain setting is 120 or higher. Read noise will drop to under 2e-, while dynamic range will remain at 13 stops.

Depending on your target, you can set the gain lower for higher dynamic range (longer exposure) or set the gain higher for lower noise (such as short exposure or lucky imaging).

Read noise, full well, gain and dynamic range for ASI294



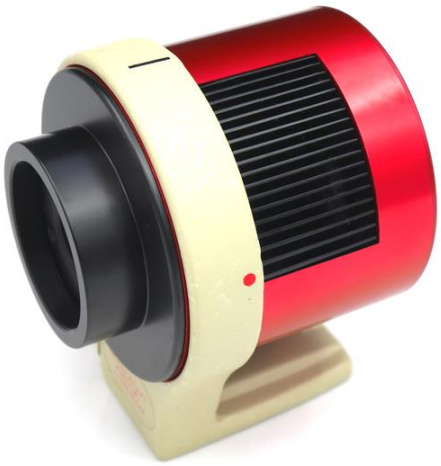
6. Getting to know your camera

6.1 External View



*The first generation of cooled camera we used a ST4 port instead of USB2.0 hub

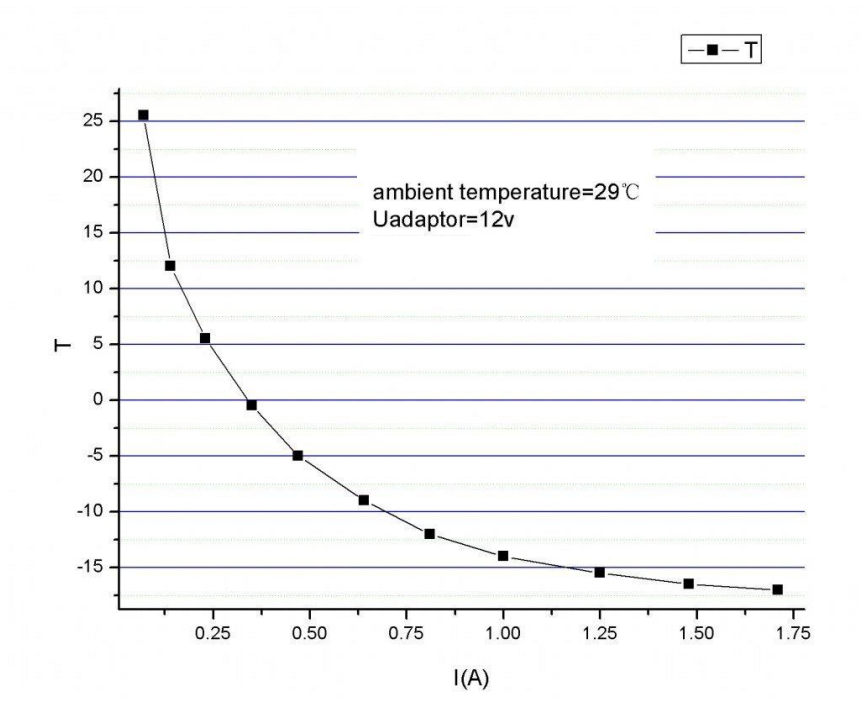
You can order the holder ring from us or our dealer to mount the cooled camera to tripod. There is 1/4″ screw under the holder



6.2 Power consumption

ASI cameras are designed to have very low power consumption which is around 300ma@5V. You only need the USB cable to power up the camera, however you will need a separate power supply to activate the cooler. Recommended cooler power supply: 12V @ 3-5A (or more) DC adapter (2.1x5.5mm, center pole positive). Also suitable: DC battery with 9-15V. Using a battery with 9-15V is also suitable for the cooler power supply.

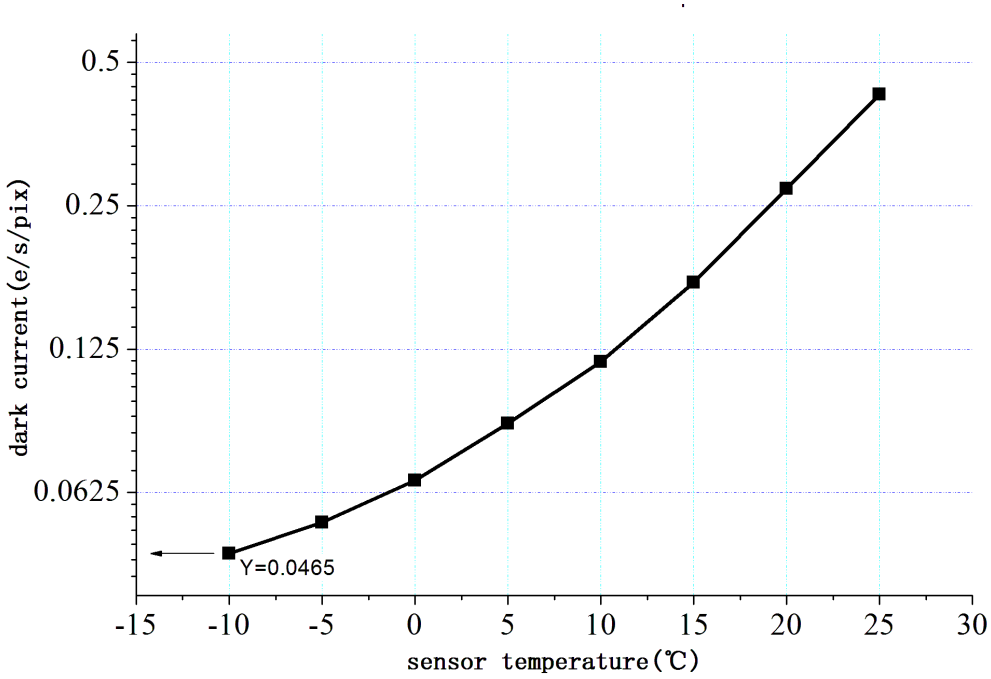
Here is a test result of the cooler power consumption of our cooled camera. It only needs 0.5A to cool the camera to 30℃ below ambient.



6.3 Cooling system

The ASI294 Pro camera have a robust, regulated cooling system, which means that the camera sensor can be kept at the desired temperature throughout your imaging session. The super low readout noise, combined with efficient cooling and adjustable gain setting, allows you to do short or lucky DSO imaging unlike the traditional CCD cameras which need very long exposures for each frame. However, keep in mind that cooling won't help with very short exposures such as less than 100ms. The lowest temperature that can be set is -35℃~-40℃ below ambient.

Here is a dark current test result of 294Pro sensor at various temperatures.

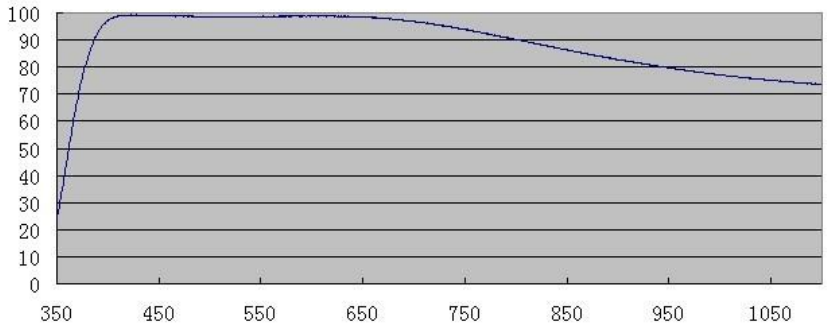


6.4 Back focus distance

When 11mm T2 Extender is removed from camera, back focus length is reduced to 6.5mm.

6.5 Protect Window

There is a protect window before the sensor of ASI294 camera.
It's an AR-AR coated BK7 glass, diameter is 32mm and 2mm thick.



6.6 Analog to Digital Converter (ADC)

The ASI294 camera can records in 14bit ADC and 10bit ADC. You can image at a faster fps rate if you choose to use 10bit ADC (high speed mode). This camera also supports ROI (region of interest) shooting, and smaller ROI range support faster fps. You can uncheck "high speed" and choose 8bit output on software to enable 10bit ADC output, otherwise this camera will use 14bit ADC.

Here is the maximum speed of ASI294 running at 10bit ADC or 14bit ADC.

Resolution	**USB3.0**	
	10Bit ADC	**14Bit ADC**
4144x2822	19fps	16fps

6.7 Binning

The ASI294 camera supports software bin2, bin3 and bin4 modes.

6.8 DDR Buffer

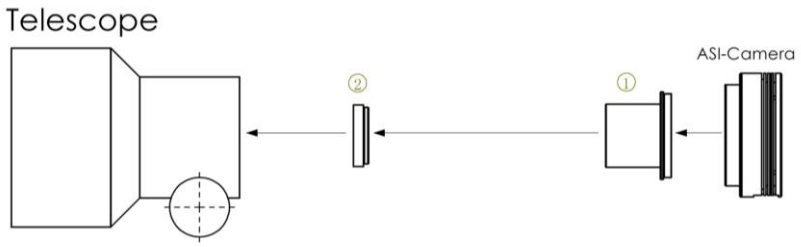
ASI294 Pro camera includes a 256MB DDR3 memory buffer to help improve data transfer reliability. Additionally, the use of a memory buffer minimizes amp-glow, which is caused by the slow transfer speeds when the camera is used with a USB 2.0 port.

DDR memory buffer is the main difference between ASI "Cool" and "Pro" cameras.

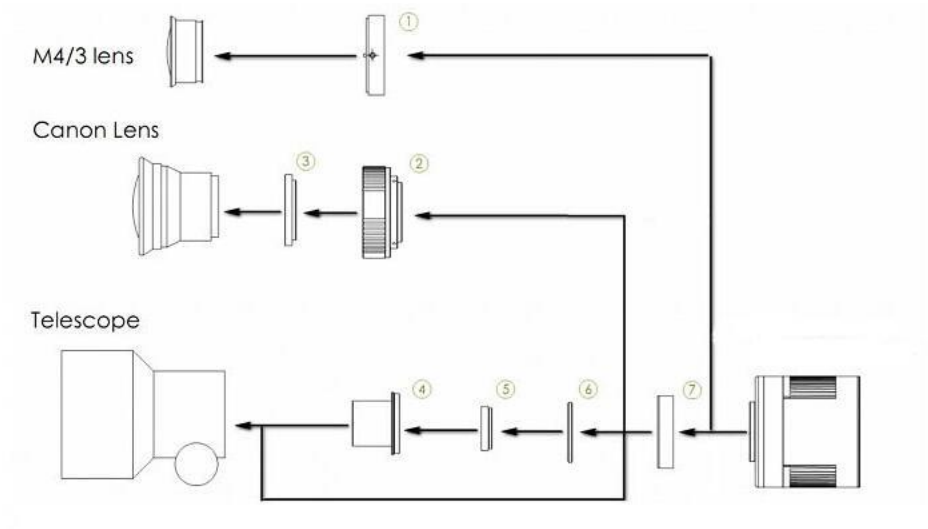
7. How to use your camera

There are many adapters available for this camera for connecting to your scope or lens. Some are included with the camera and others you can order from our site:

Color camera connecting drawing:

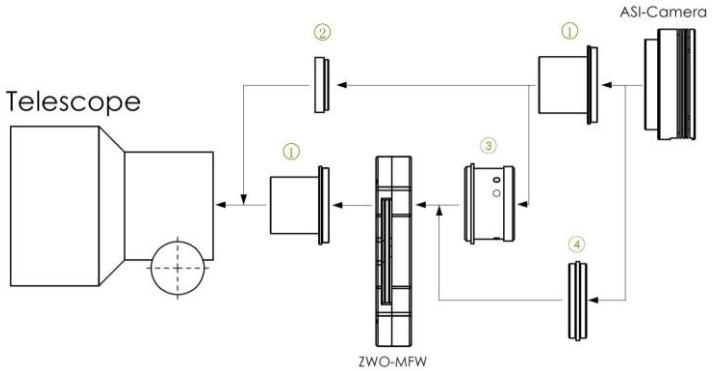


1. 1.25” T-Mount
2. 1.25”filter(optional)

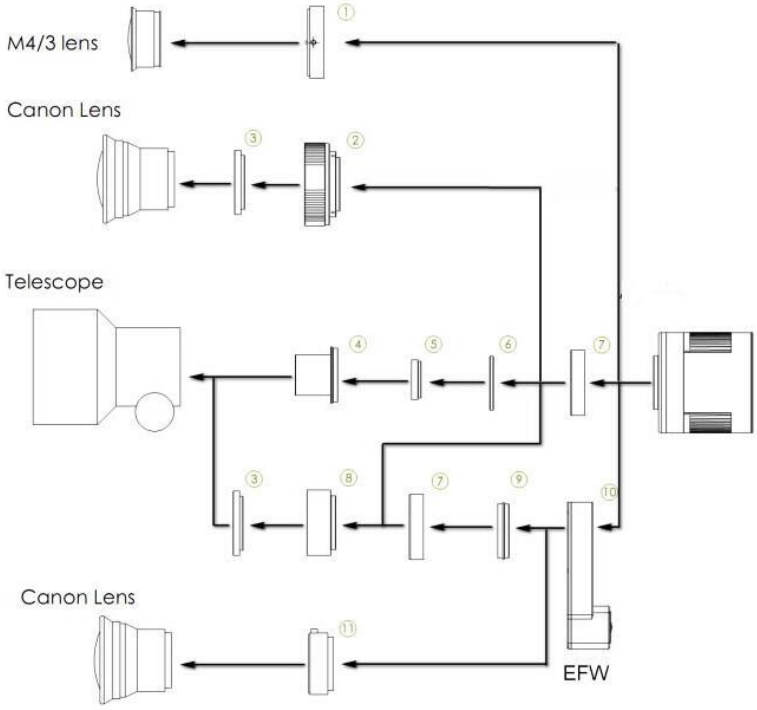


1. M43-T2 adapter
2. EOS-T2 adapter
3. 2”Filter (optional)
4. 1.25” T-Mount
5. 1.25” Filter (optional)
6. M42-1.25” Filter (optional)
7. T2 extender 11mm

Mono camera connecting drawing:



1. 1.25” T-Mount
2. 1.25” filter(optional)
3. M42-1.25” adapter
4. M42-M42（Male screw thread）



1. M43-T2 adapter
2. EOS-T2 adapter
3. 2”Filter (optional)
4. 1.25” T-Mount
5. 1.25” Filter (optional)
6. M42-1.25” Filter (optional)
7. T2 extender 11mm
8. M42-M48 extender 16.5mm
9. T2-T2 adapter
10. EFW mini
11. EOS adapter for EFW

Planetary/Guide Cameras
External Device Connecting Drawing

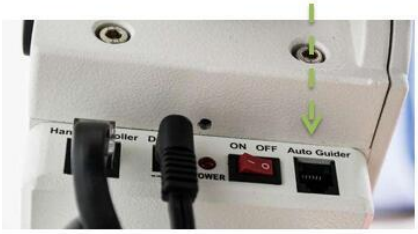


1/4" Screw



ST4 Cable

USB3.0/USB2.0 Cable





Auto Guider Port of Mount

Computer USB3.0/USB2.0 Port

Cooled Cameras
External Device Connecting Drawing



USB Hub For accessaries

12V Power Adapter



USB2.0 Cable

USB3.0/USB2.0 Cable



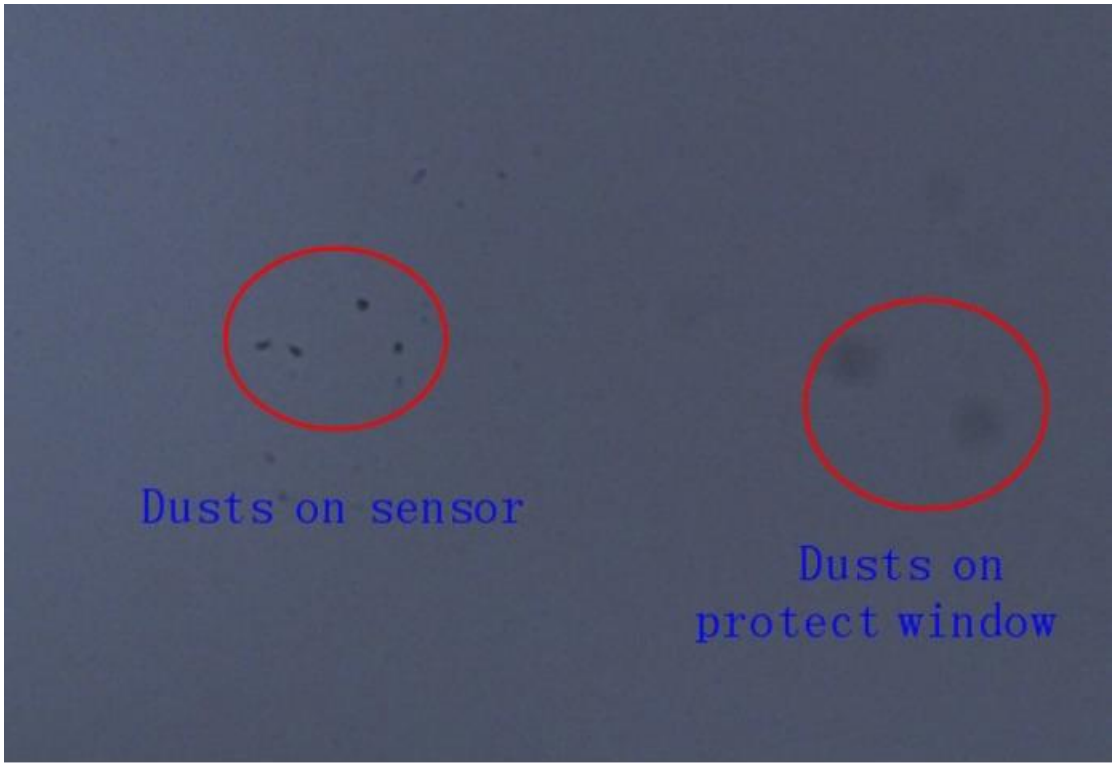


Accessaries

Computer USB3.0/USB2.0 Port

8. Cleaning

The camera comes with an AR protect window, which can protect the sensor from dust and humidity. Should you need to clean the sensor, it's better to do so during the daytime. To see the dust, you just need to setup your telescope and point it to a bright place. One barlow lens is required to see these dusts clear. Then attach the camera and adjust the exposure to make sure not over exposed. You can see an image like below if it's dirty.



The big dim spot on the image (at right) are the shadows of dust on the protective window.

The very small but very dark spot in the image (at left) are the shadows of the dusts on the sensor.

The suggested way to clean dust on protective window is try to blow them away with a manual air pump. To clean the dust on the sensor you will need to open the camera chamber.

We have a very detailed instruction on our website:

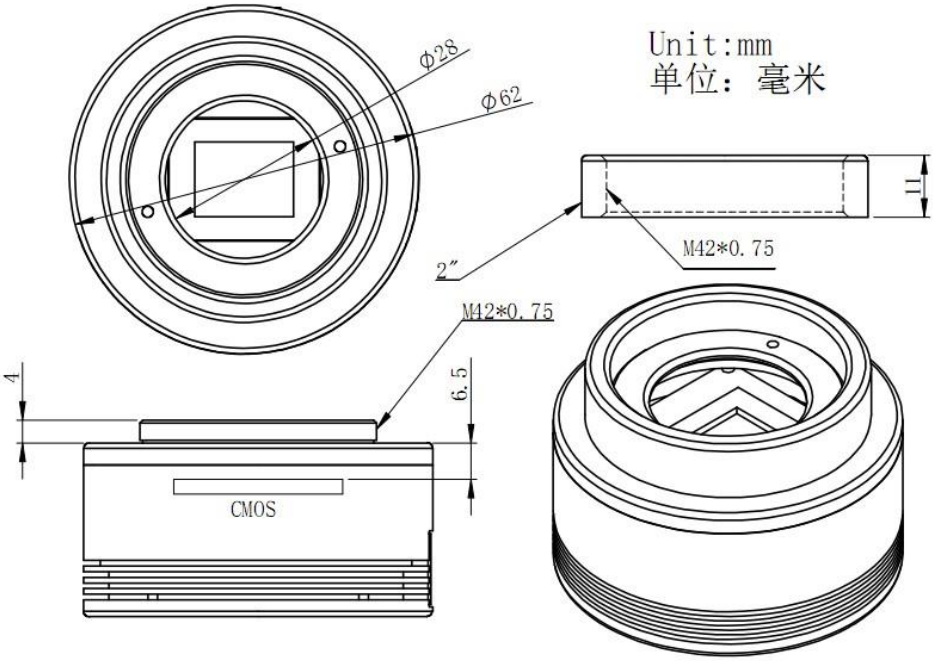
https://astronomy-imaging-camera.com/manuals/

Quickguide

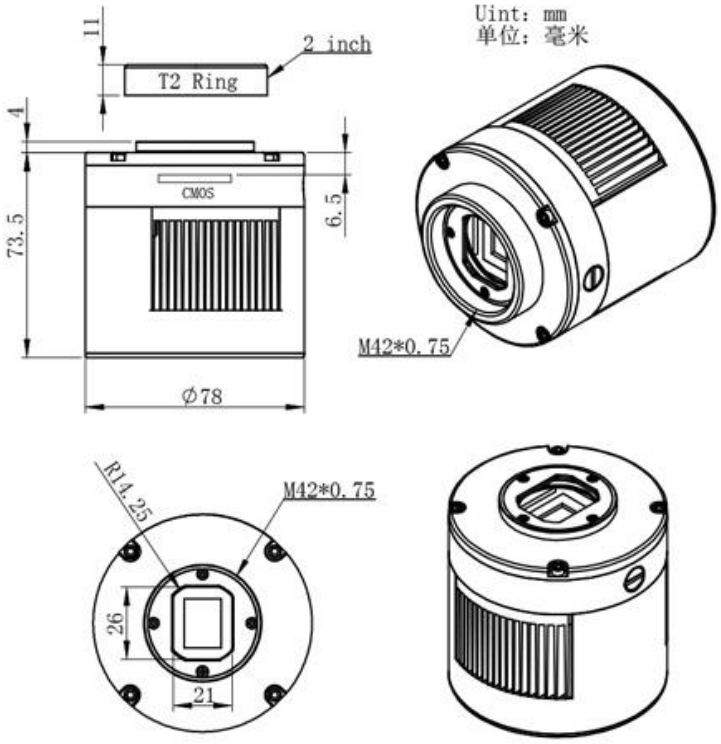
- ZWO ASI Camera Quick Guide
- ZWO ASI Cooled Camera Quick Guide
- How to clean ASI camera and redry the desiccant

9. Mechanical drawing

ASI294MC



ASI294MC Pro



10. Servicing

Repairs, servicing and upgrades are available by emailing info@zwoptical.com

For customers who bought the camera form your local dealer, dealer is responsible for the customer service.

11. Warranty

We provide 2-year warranty for our products, we will offer the repair service for free or replace for free if the camera doesn't work within warranty period. After the warranty period, we will continue to provide repair support and service on a charged basis.

This warranty does not apply to damage that occurred as a result of abuse or misuse, or caused by a fall or any other transportation failures after purchase.

Customer must pay for shipping when shipping the camera back for repair or replacement

If you get a faulty camera, please contact us as soon as possible though email: info@zwoptical.com. Please describe the problem in detail and we will do our best to help you solve the problem. Most instances perceived problems are simply bad driver install or software configuration.