ASI1600 Manual

Revision 1.5

Aug, 2021

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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 and if you have any other questions, feel free to contact us. info@zwoptical.com

ASI1600 Cameras are designed for astronomical photography. This is the first camera in the world not only suitable for DSO imaging but also planetary imaging. 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 6 types of ASI1600 models, 2 of them are discontinue:

Models	Mono or Color	Regulated TEC Cooling	Sensor
ASI1600MM	Mono	No	Panasonic MN34230ALJ
ASI1600MC	Color	No	Panasonic MN34230PLJ
ASI1600MM Pro	Mono	Yes	Panasonic MN34230ALJ
ASI1600MC Pro	Color	Yes	Panasonic MN34230PLJ
ASI1600MM-Cool discontinue	Mono	Yes	Panasonic MN34230ALJ
ASI1600MC-Cool discontinue	Color	Yes	Panasonic MN34230PLJ

Which camera to choose:

Monochrome camera sensors are capable of higher detail and sensitivity than is possible with color sensors, but you need additional accessories such as filter wheel and filters. The post-processing is more complicated too, so a color camera is often recommended for the beginner of astrophotographer.

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?

ASI1600MM or ASI1600MC

ASI1600MM Pro or ASI1600MC Pro

4. Camera technical specifications

|	
Sensor	4/3″ CMOS
Diagonal	21.9mm
Resolution	16Mega Pixels 4656×3520
Pixel Size	3.8μm
Image area	17.6mm*13.3mm
Max FPS at full resolution	23FPS(10bitADC) 15FPS(12bitADC)
Shutter	Rolling shutter
Exposure Range	32μs-2000s
Read Noise	1.2e @30db gain
QE peak	~60%
Full well	20ke
ADC	12 bit or 10 bit
DDR3 buffer	256MB
Interface	USB3.0/USB2.0
Adapters	2″ / 1.25″ / M42X0.75
Protect window	AR window
Dimensions	Uncooled 62mm/Cooled 78mm
Weight	Uncooled 140g/Cooled 410g
Back Focus Distance	6.5mm
Cooling:	Regulated Two Stage TEC
Delta T	40°C -45°C (based on 30°C ambient temperature)
Cooling Power consumption	12V at 2A Max
Supported OS	Windows, Linux & Mac OSX
Working Temperature	-5°C—45°C
Storage Temperature	-20°C—60°
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.

For the Mono 1600 Sensor, the peak value for QE is around 60%
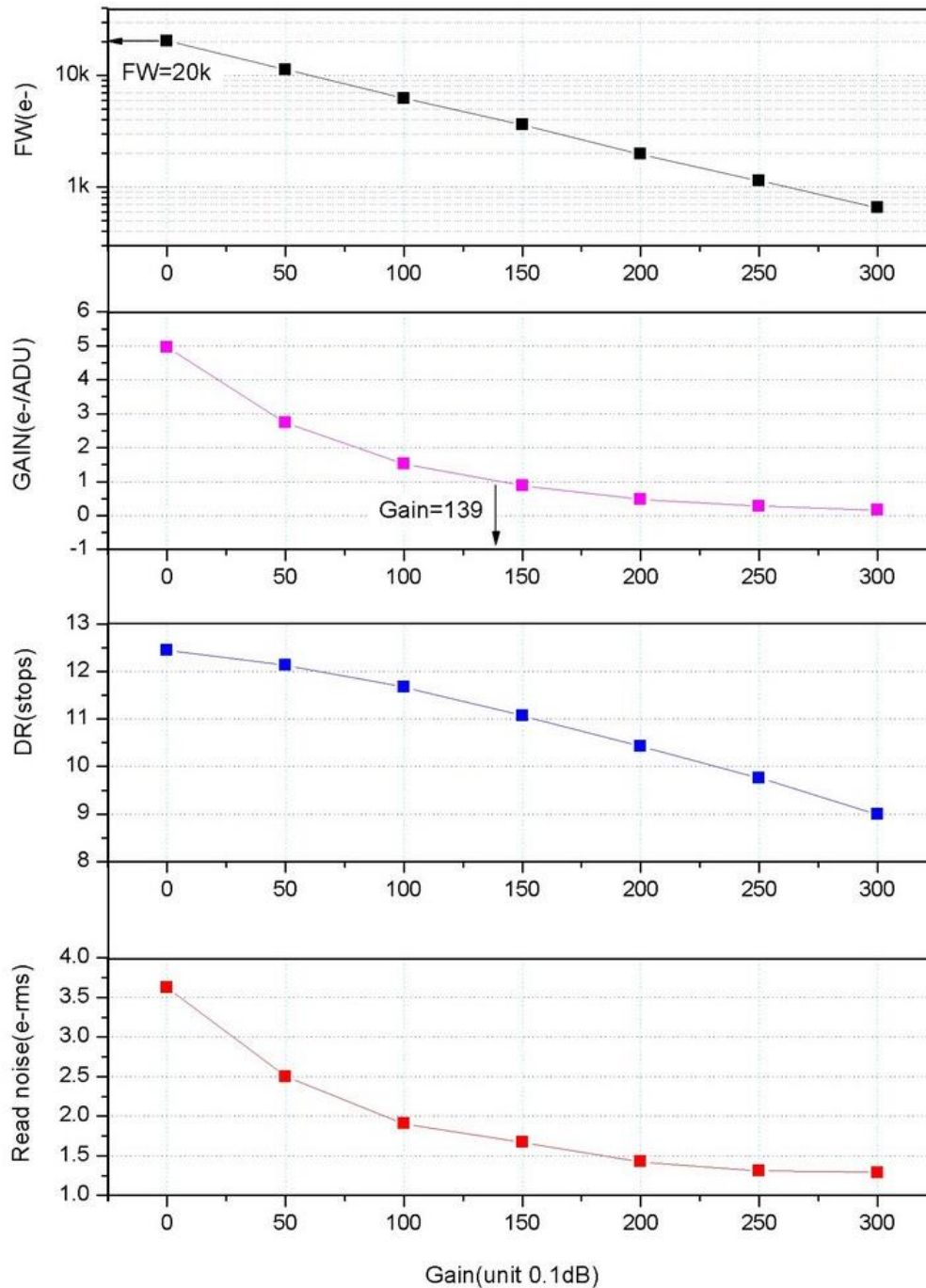
Relative QE
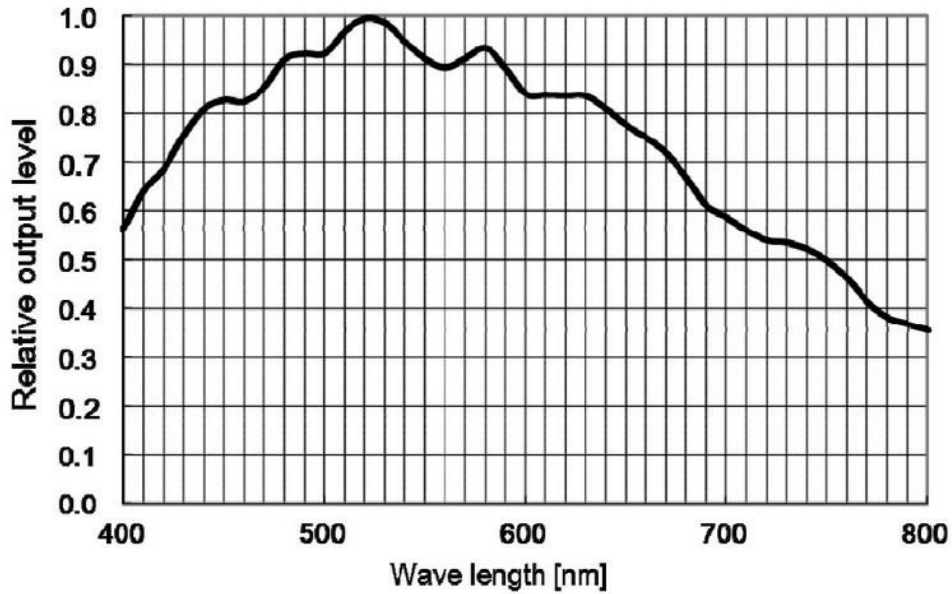
Color 1600 sensor
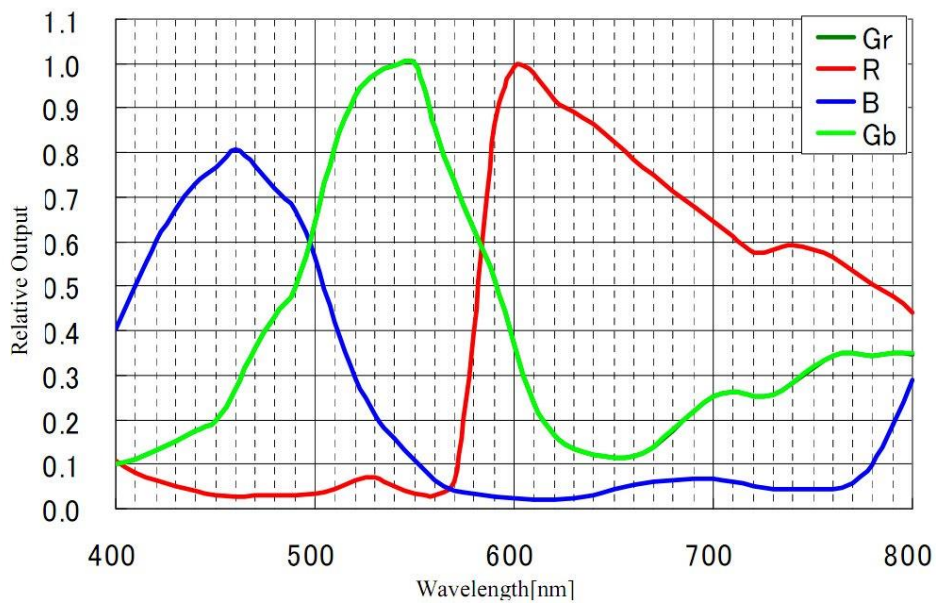
Read noise includes pixel diode noise, circuit noise and ADC quantization error noise, and the lower the better.

The Read Noise of the ASI1600 cameras is extremely low when compared with traditional CCD cameras and it is even lower when the camera is used at a higher gain.

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 ASI1600

6. Getting to know your camera

6.1 External View

T2 extender ring:
2" diameters
T2 screws inside
11mm thickness
Can be removed

Protect and sealed window
AR coated D32*2mm

Protect and sealed window
AR coated D32*2mm

Heat Sink

USB3.0 or USB2.0 IN

USB2.0 Hub*

1/4" screw
You can mount to tripod

USB2.0 OUT   USB3.0 IN

ST4 Guide Port

ASI1600MM

Cooler power supply
5.5*2.1 DC socket
12V 3A AC-DC power
supply suggested

DC 12

ASI1600MM Pro

Cooler Maglev fan
Only on when cooler
power supply is there

USB3.0 or USB2.0 IN

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. We recommend 12V at 3A or more AC-DC adapter for cooler power supply (2.1mm*5.5mm, center positive). You may also use a battery supply from 11 to 15V to power the cooler.

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.
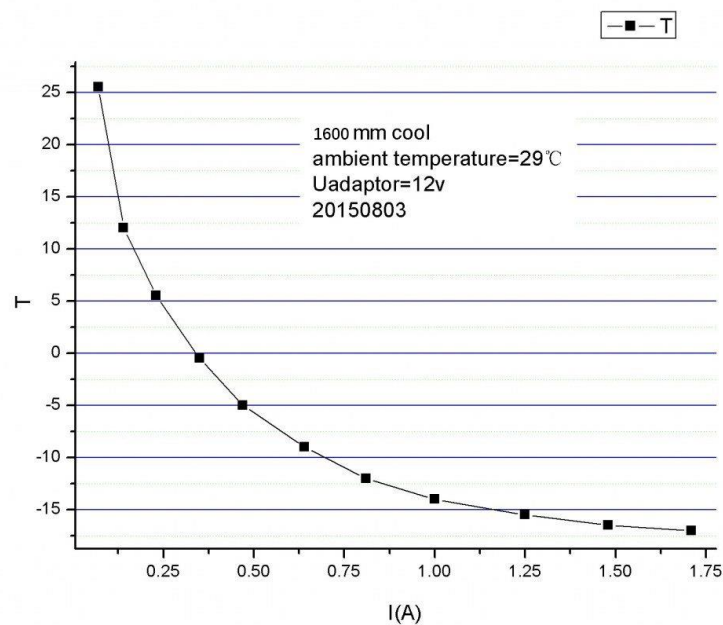
6.3 Cooling system

The cooled ASI1600 cameras 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. Based on the testing result at 30℃ ambient temperature, the Delta T of can be 40℃~45℃. Please note that the Delta T might get down when the cooling system is working for long time. Also, as the ambient temperature falls, the Delta T would also decrease.

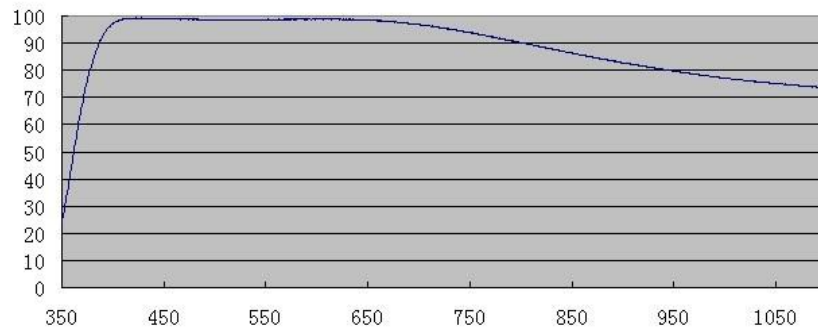Here is a dark current test result of 1600 Cool sensor at various temperatures.
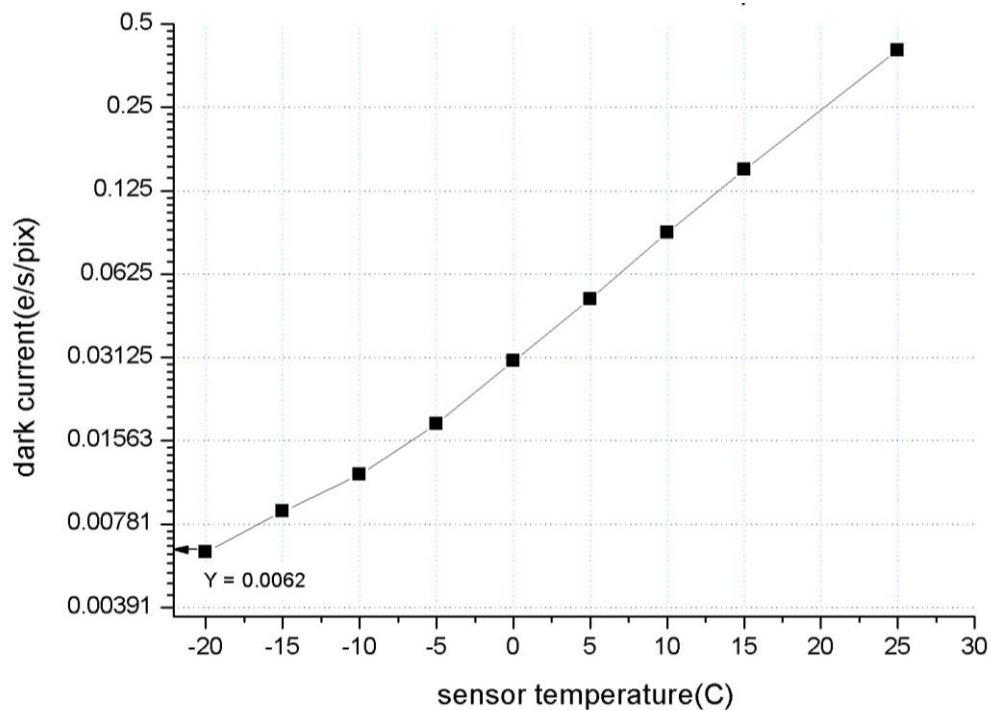
6.4 Back focus distance

When the attached 11mm T2 Extender is removed the optical distance from the sensor to the camera body is reduced to 6.5mm.

6.5 Protect Window

There is a protect window before the sensor of ASI1600 camera.

It's an AR-AR coated BK7 glass, diameter is 32mm and 2mm thick.

6.6 Analog to Digital Converter (ADC)

The ASI1600 camera records in 12bit 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 this smaller ROI has faster fps. You can uncheck "high speed" and choose 8bit output on software to enable 10bit ADC output, otherwise this camera will use 12bit ADC.

Here is the maximum speed of ASI1600 running at 10bit ADC or 12bit ADC at 8bit mode.

Resolution	USB3.0	
	10Bit ADC	12Bit ADC
4656x3520	23fps	14.7fps
3840x2160	36.2fps	23.1fps
1920x1680	57.7fps	32.9fps
1280x960	73.6fps	47.1fps
640x480	125.7fps	80.4fps
320x240	192.4fps	124.4fps

6.7 Binning

The ASI1600 camera supports hardware and software bin2, bin3 and bin4 mode. Hardware binning is supported by sensor but is done in digital domain like software binning and use 10bit ADC. The only advantage of hardware binning is faster fps. We recommend customer to use software binning if you don't care speed.

6.8 DDR Buffer

ASI1600 Pro camera includes one 256MB DDR3 memory buffer to help data transfer more stable and no amp-glow issue which is caused by the slow speed data transfer during reading out under USB2.0 Port.

DDR memory buffer is the main difference between ASI "Cool" and "Pro" cameras.
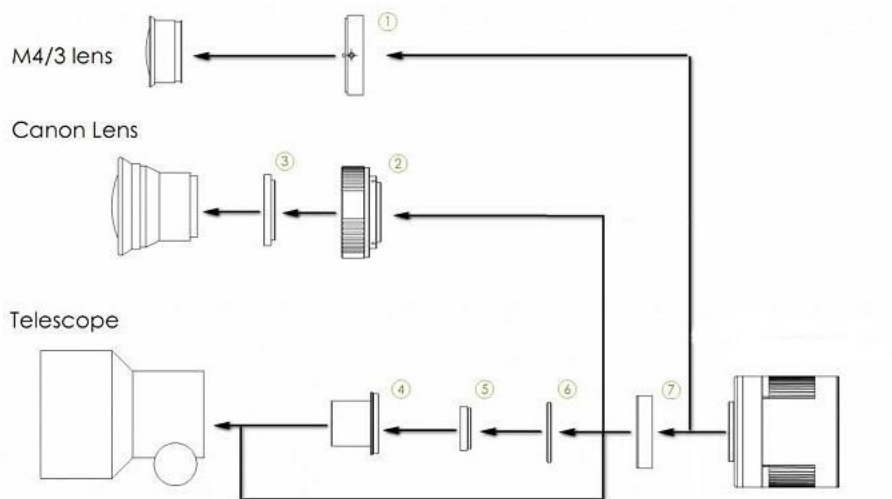
7. How to use your camera

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:
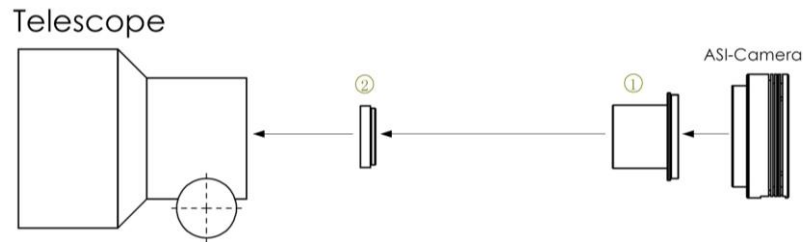
1. 1.25" T-Mount
2. 1.25"filter(optional)

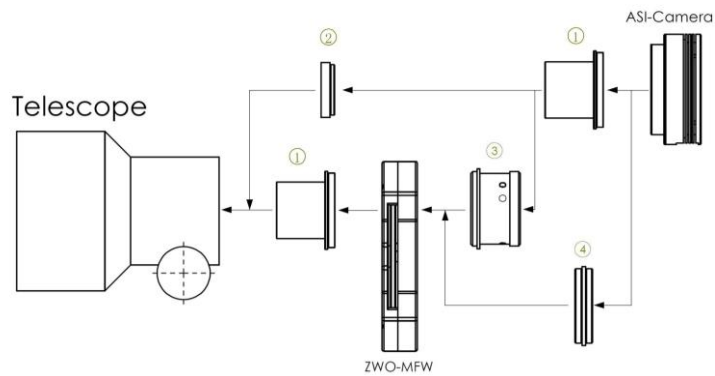1. M43-T2 adapter

2. EOS-T2 adapter

3. 2"Filter (optional)
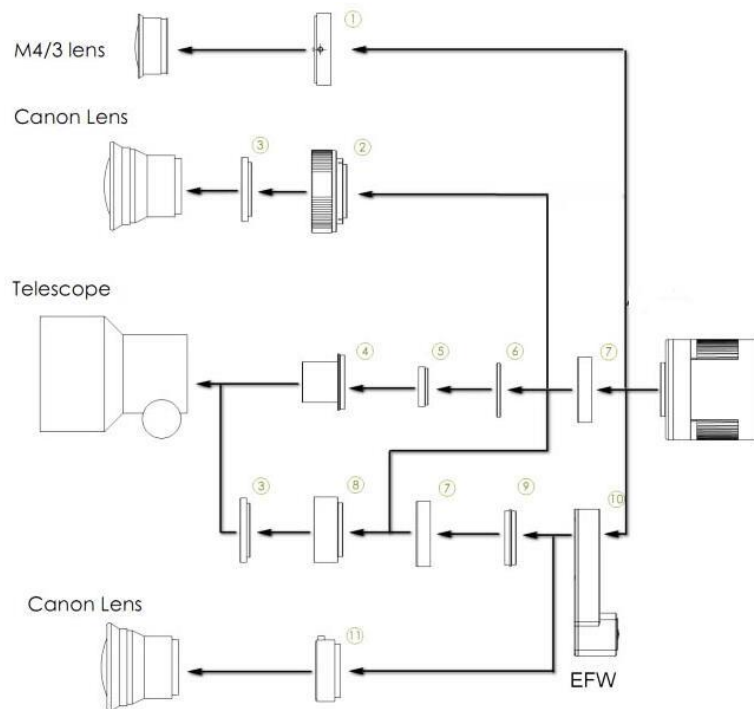
4. 1.25" T-Mount

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

ASI Camera

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

ASI Pro/Cool Camera

USB3.0/USB2.0 Cable

Accessaries

Computer USB3.0/USB2.0 Port

Here are the steps to show you how to connect mono 1600 and our EFW mini to your scopes.

Benefiting from the short back focus design, 1.25" filter can support up to F5 scope without vignetting and 31mm filter can support up to F2 scope without vignetting. 36mm filter can support all F-radio telescopes.

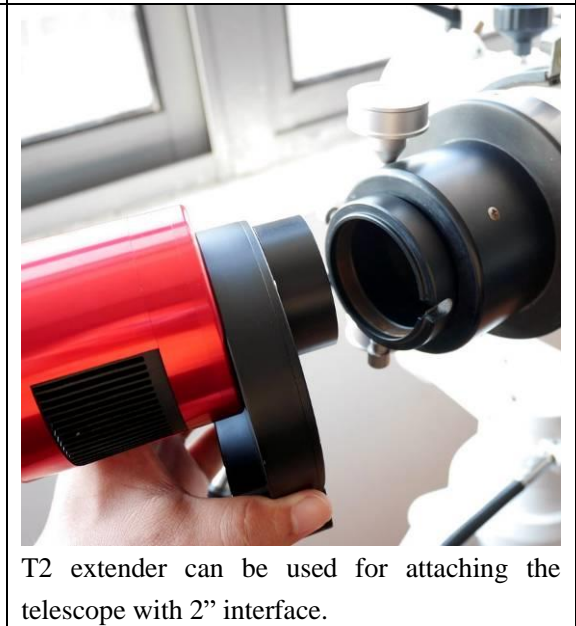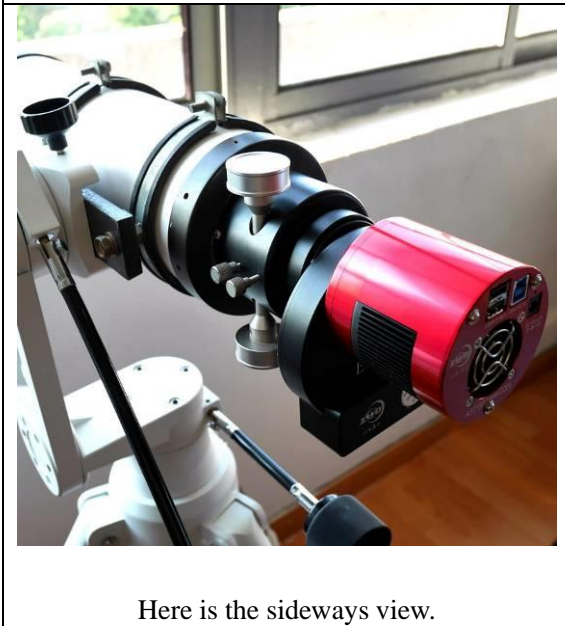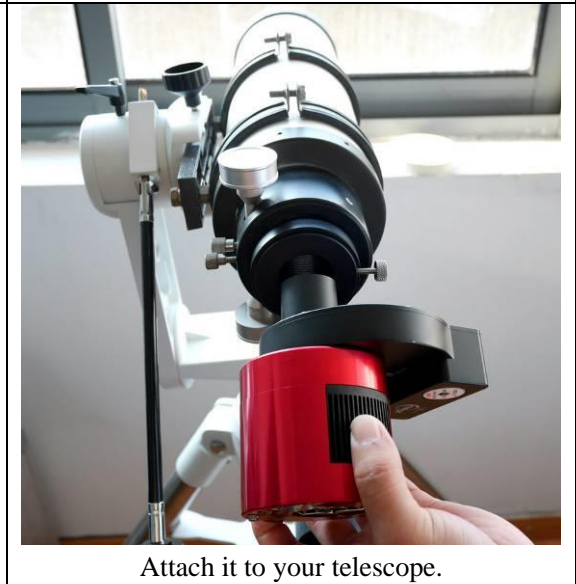|	
EFW Mini & ASI1600MM cooled camera	Unscrew the six screws.
Take the back cover off.	Screw all the filters to the right position.
Tighten back the screws.	Screw off the T2-1.25" holder on the EFW, screw off the T2 ring on the 1600 camera.

Attached the camera to the EFW as shown.

Take out the 1.25" T-Mount form the T2-1.25" holder.

Install the T-mount to the back of the EFW.

Attach it to your telescope.

Here is the sideways view.

T2 extender can be used for attaching the telescope with 2" interface.

Here is an example of the whole setup including an OAG and guider camera.

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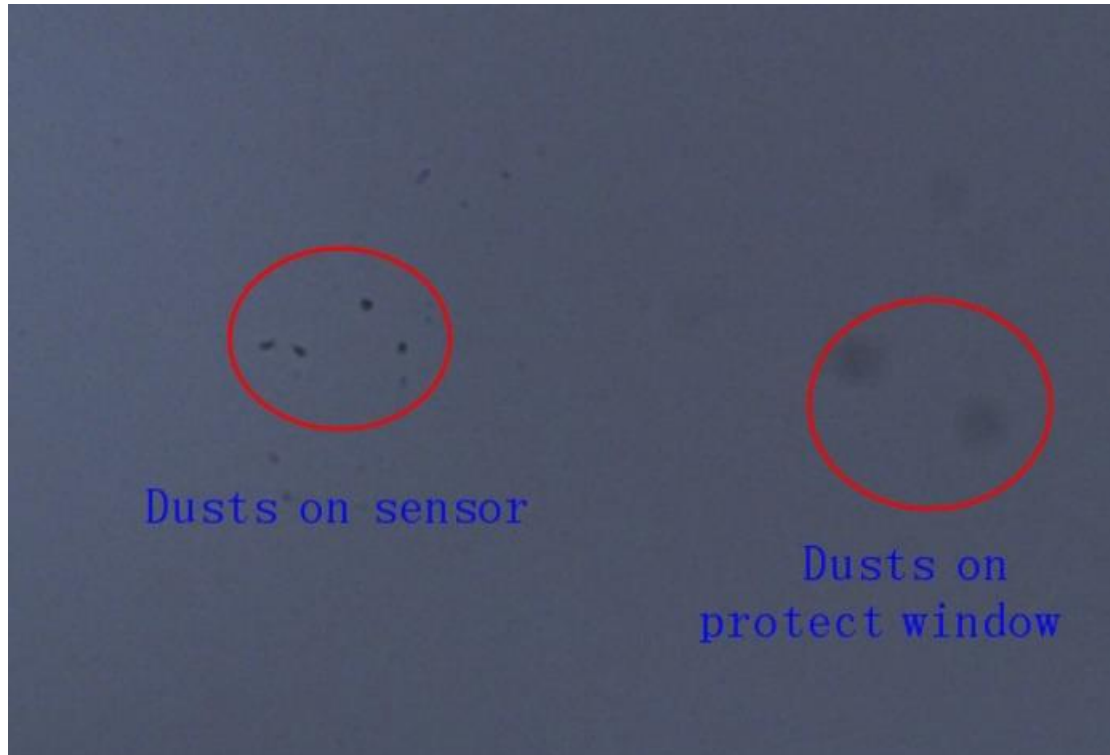
The big dim spot on the image (at right) are the shadows of dust on the protect window.

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 them 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.

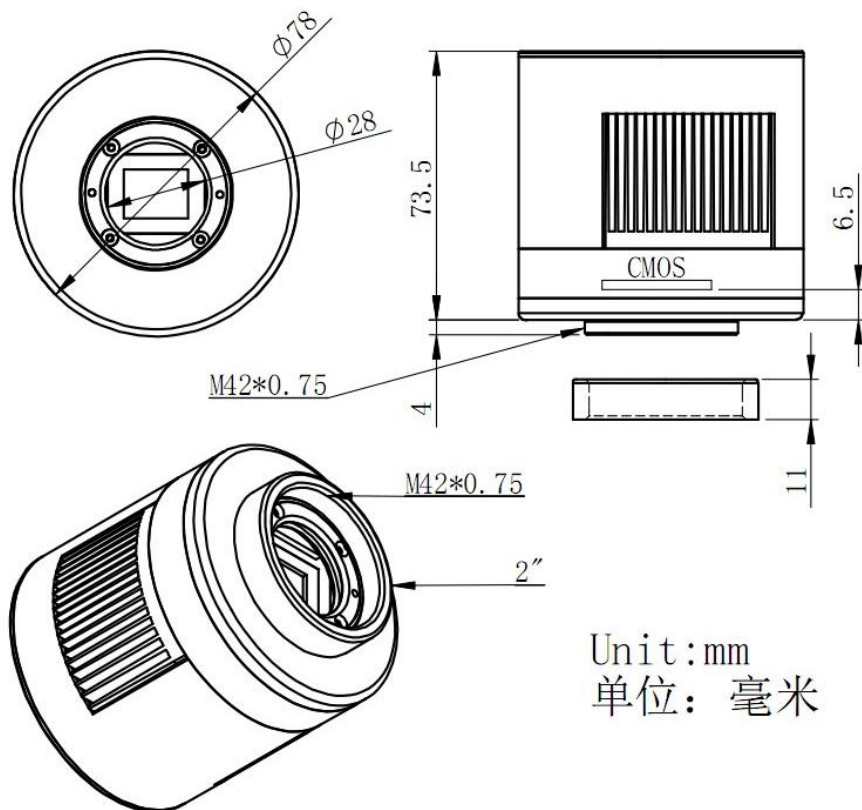We have a very detailed instruction on our website:

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

9. Mechanical drawing

ASI1600MM/ASI1600MC
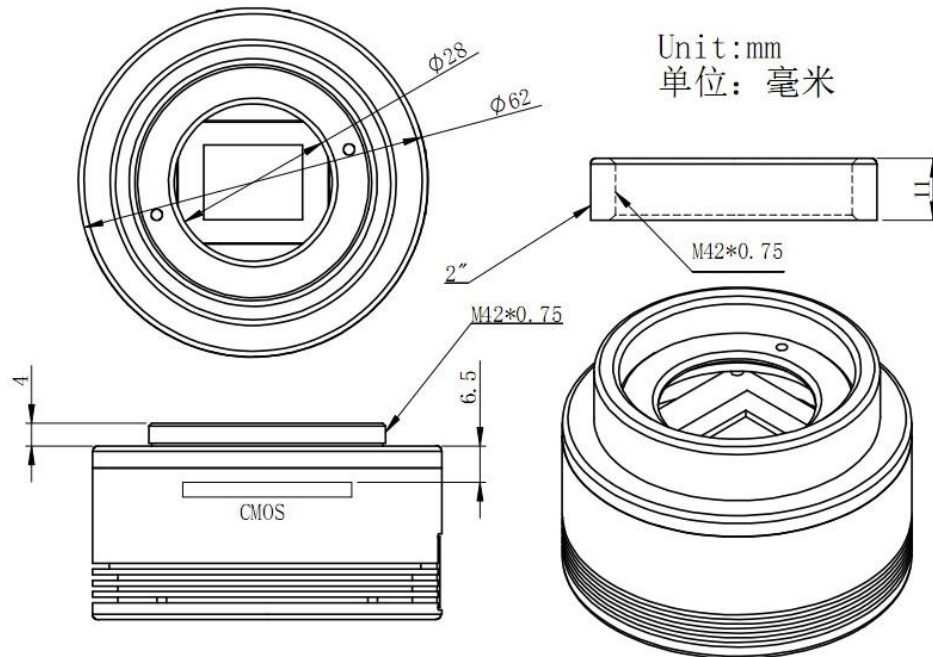
ASI1600MM Pro /ASI1600MC Pro

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 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.