

# QHY4040

Scientific CMOS Camera



**Contents**

01 PACKAGE CONTENTS..... 3

02 SOFTWARE INSTALLATION ..... 4

04 INTERFACE INTRODUCTION..... 5

05 USE QHY4040 IN SHARPCAP..... 5

06 USE QHY4040 WITH ASCOM ..... 7

07 USE QHY168M IN EZCAP\_QT ..... 10

09 FAQ ..... 13

10 QHY4040 MECHANICAL SIZE..... 16

11 SPECIFICATIONS ..... 17

## 01 Package Contents

3.0 USB cable	1
Power cable with locker	1
12V AC Power Adapter	1*
Silicon gel tube and silicon gel	1
M54 to 2inch T-ring	1
Center/tilt adjust ring	1
Camera Cover	1
Warrentee Card	1
Driver Download Card	1
Test Report	1
Camera body	1

\* The 12V power adapter is depend on the area/country. Some country/area has no this item.



QHY4040



USB3.0 cable



12V power supply



Self-locking power cord



M54-2 inches



power cable



Drying tube

## 02 Software Installation

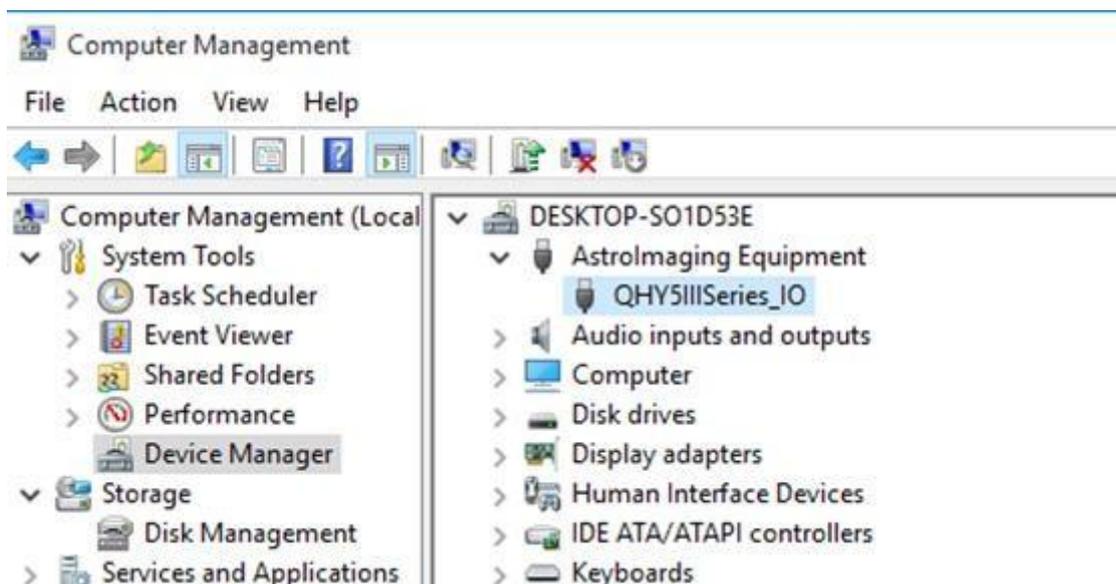
1. Download and install [camera system driver \(link\)](#)  
(The driver for Windows10 can be installed directly; when installing the driver for Win7 system, please check the driver installation instructions first)
2. [Download and install the ASCOM platform \(link\)](#)
3. [Download and install the ASCOM driver \(link\)](#)

As you most probably want to use your QHY168M as an expose camera, please download the Capture version. If you want to use it as a guide camera, please download the Guide version.

4. QHY4040 uses the SharCAP software as the default video display and capture software. Please download and install SharpCap, QHY4040 can work in SharpCap 2.9 or higher version. You may need to use the last QHYCCD sdk (QHYCCD.DLL) in the sharpcap. Please go to the QHYCCD SDK download page to download it and read how to replace the QHYCCD.DLL in sharpcap.

Note that for the latest version of SharpCap, QHY600 also needs the latest qhyccd.dll, for which QHYCCD has written the SharpCap patch, please download and install it. You can also download from QHYCCD SDK page to obtain it. The original filename qhyccd\_x64.dll. You can rename it to qhyccd.dll and overwrite the old file in SharpCAP X64 folder.

5. Connect the 12V power supply for QHY4040. Then connect the USB3.0 cable between QHY4040 and computer. Please make sure you are connected on the computer USB3.0 port. The QHY4040 cannot work under USB2.0 port under the live video mode (in single frame mode it works) due to the high data bandwidth. Please make sure the 12V is connected otherwise the camera maybe not get recongized by computer. When first connecting , the windows will report new device found and looking for the driver. You can click "ignore obtain driver from windows" to get it faster. The computer will looking for the driver in local disk. Since the QHY4040 system driver is installed before. So it should find it and start to install hardware. After successfully installed, you can see QHY5IIISeries\_IO in the hardware manager.



## 04 Interface Introduction

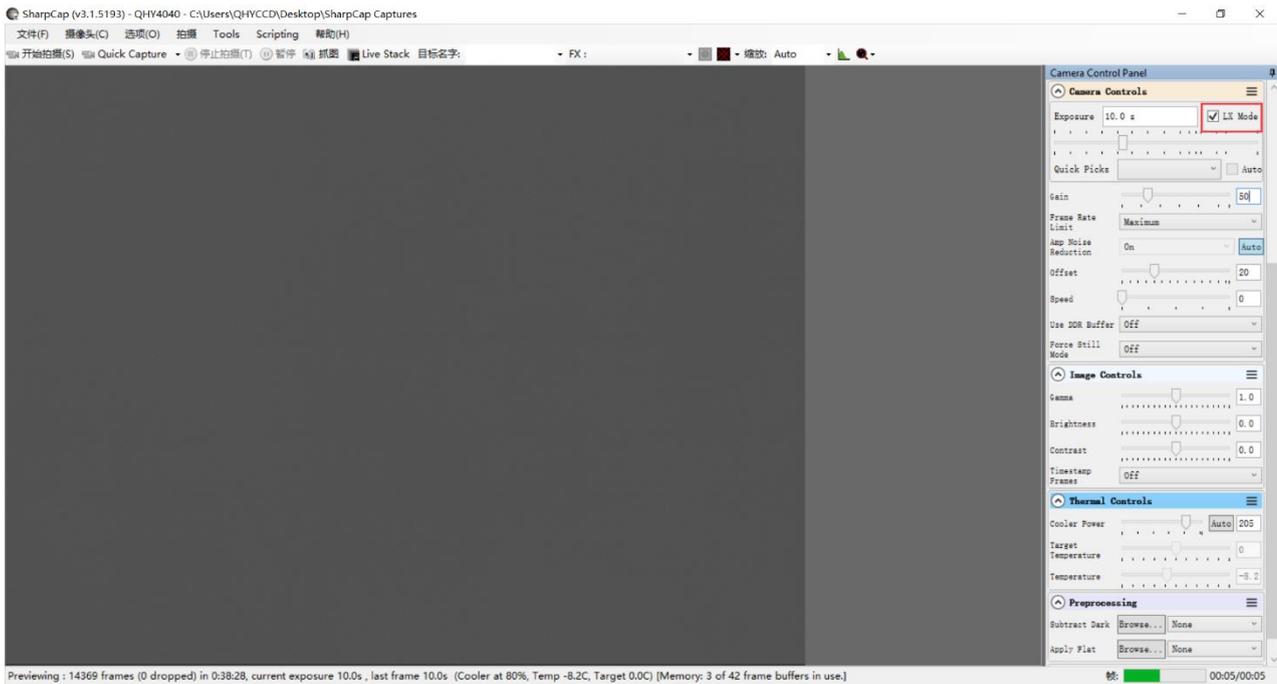
On front of the camera, you can connect the center/tilt adjust ring. The ring has M54/0.75 female thread. On backside of the camera there is the 12V DC power input port and USB3.0 port. On the side of the front part of the camera, there is a silicon gel tube socket.

## 05 Use QHY4040 in SharpCap

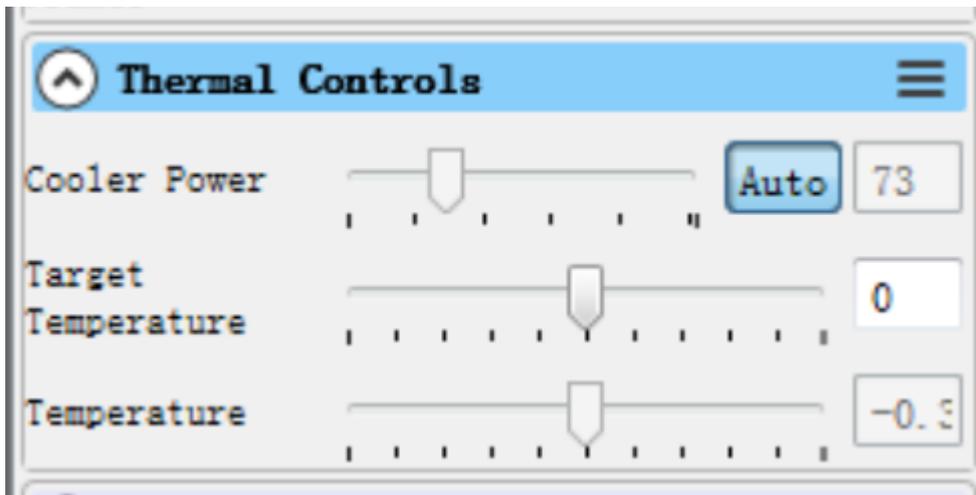
1. Connect 12V power cable and USB3.0 cable.
2. Run SharpCap software. And select the QHY4040 in the "camera" menu. If everything is ok, the video image will appear on the display window and you will see the frame rate on left bottom of the software.



3. Turn on SharpCap. If you cannot find the QHY4040 in the "camera" menu, you can try "re-scan" camera in this menu.
4. Adjust offset. You can cover the lens and check the image. The image maybe not very dark. You need to adjust the offset. You can open the histogram window to help you to find a suitable offset. Normally speaking, you need to adjust the offset and let the background peak in the histogram to visible, above zero and near to zero. It is best to keep the whole peak is above zero.
5. By check the "LX" mode, you can expand the exposure time in the exposure time progress bar. You can try some longer exposure and you will see some hot pixel appears; you can set the cooler and cooling the cmos sensor and reduce the dark current. The hot pixel will become less. The following picture is a typical picture of -10C, 10sec exposure and gain = 50.



- The following adjust tools is for temperature regular control. When set to Auto , you can set the target temerperature. The QHY4040 has maxium -35C delta T below ambinet. You can set a suitable target temperature according the enviroment temperature. Please reserver some degree to avoid the camera working in just -35 delta T, otherwise when enviroment get higher , you can not get the target temperature and cause the dark frame calibration has problems. When set Auto off, you can set the cooler power to adjust the TEC power. The range is 0% to 100%. In this mode, the sensor temeperature is not regulated. Just the power is constant



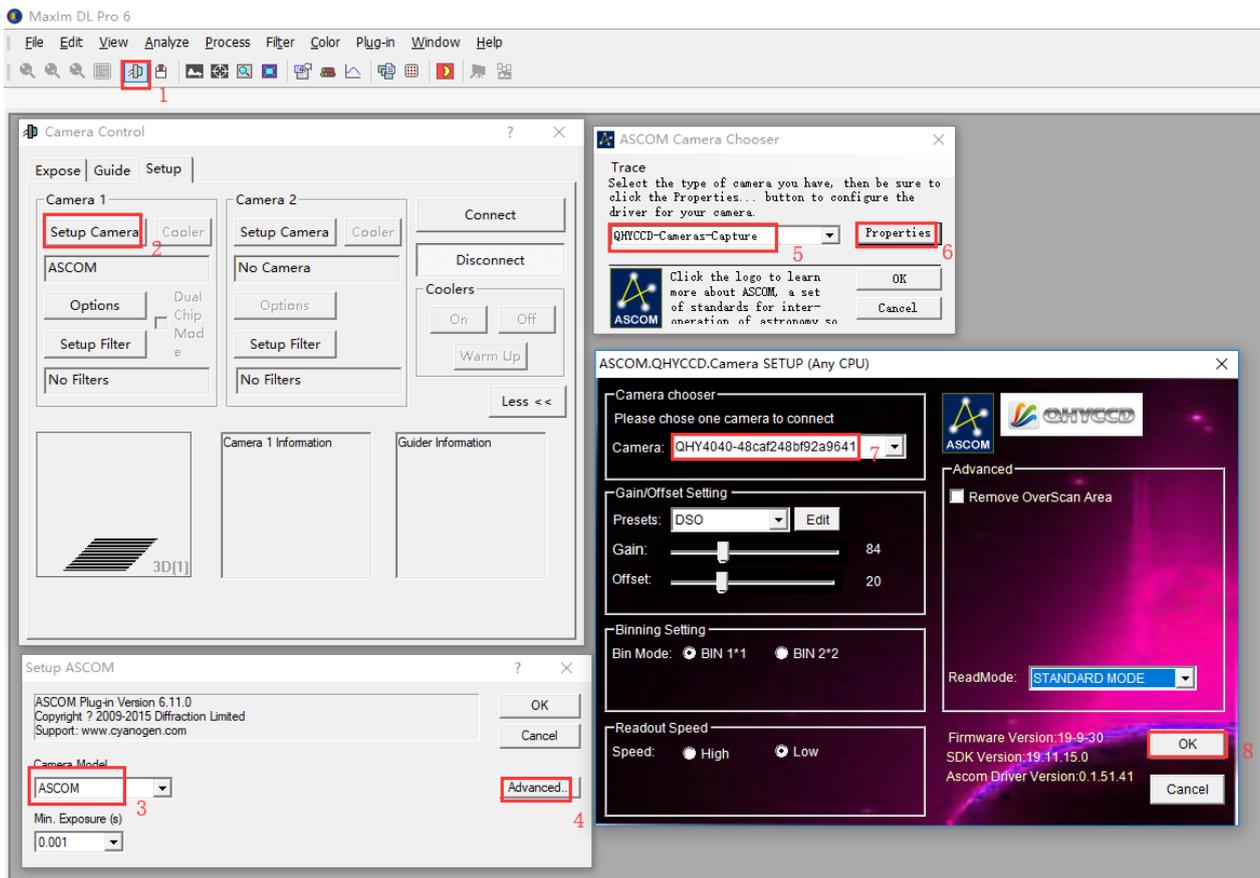
Before using the cooler, it is best to read the "how to protect the cooler" in the FAQ.

## 06 Use QHY4040 with ASCOM

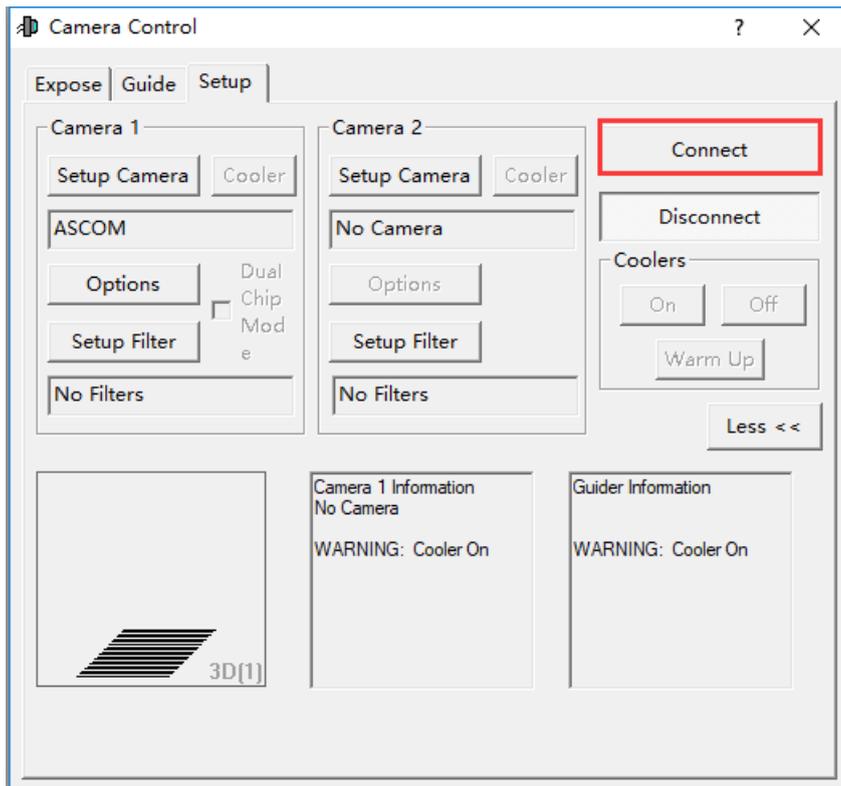
With the ASCOM driver support, the QHY4040 can work in many software, which support ascom interface. Please note QHY4040 will use the 16-bit mode under ascom and use the single frame mode under ASCOM. Currently it does not support the ASCOM VIDEO DRIVER. The ADC in QHY4040 is 12bit. So for 16bit format, the bit alignment is MSB alignment. It will patch four zero in last four bit. It means the 0-4095 will be mapped to 0-65535 by multiple 16.

### MAXIMDL

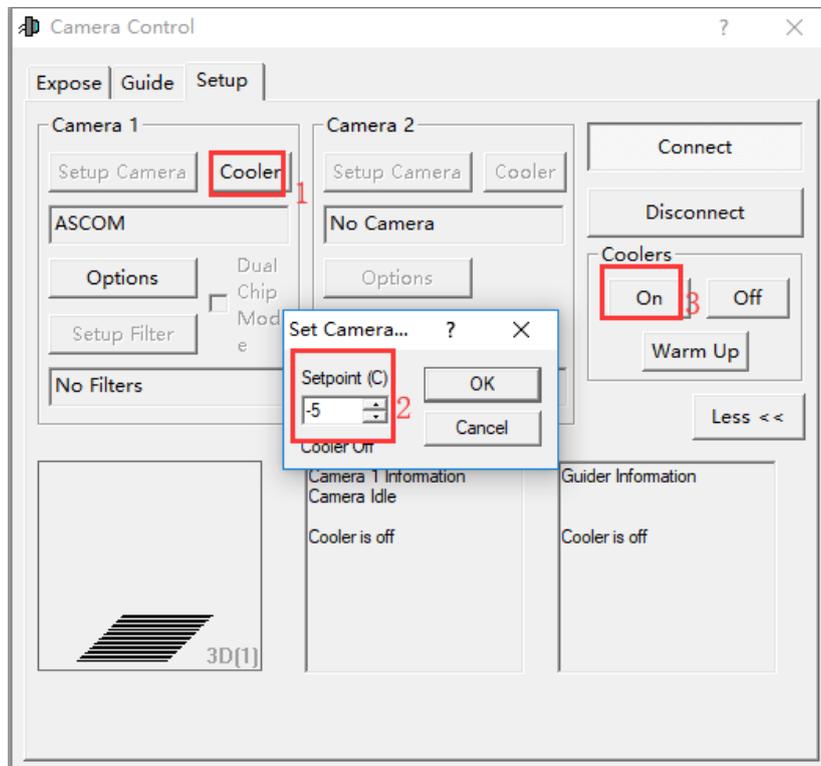
1. First you have to make sure that both ASCOM Platform and ASCOM driver have been installed. If not, please install it first.
2. Start MAXIMDL
3. Follow the instructions shown below to finish the setup



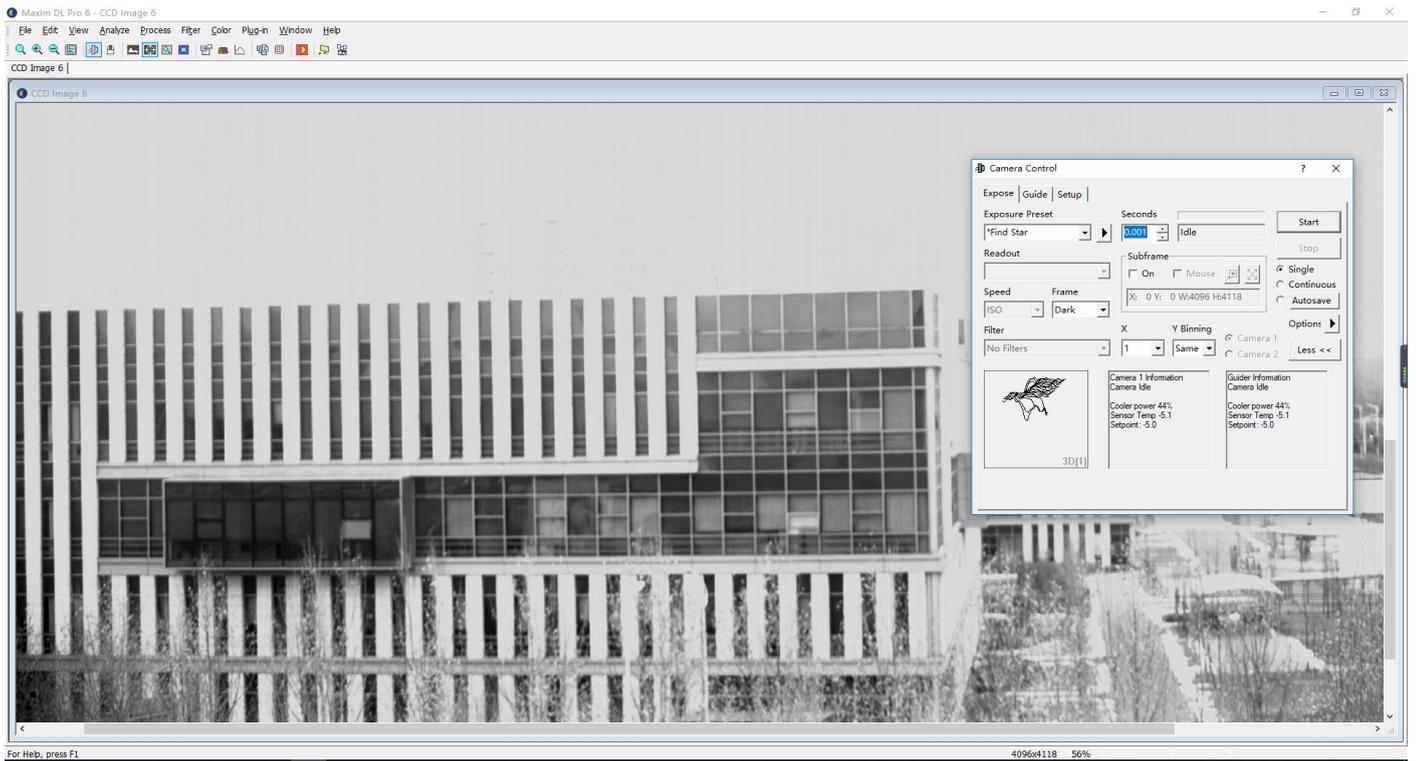
Need to click Connect before shooting.



After connecting the software, follow the steps to set the cooling temperature.



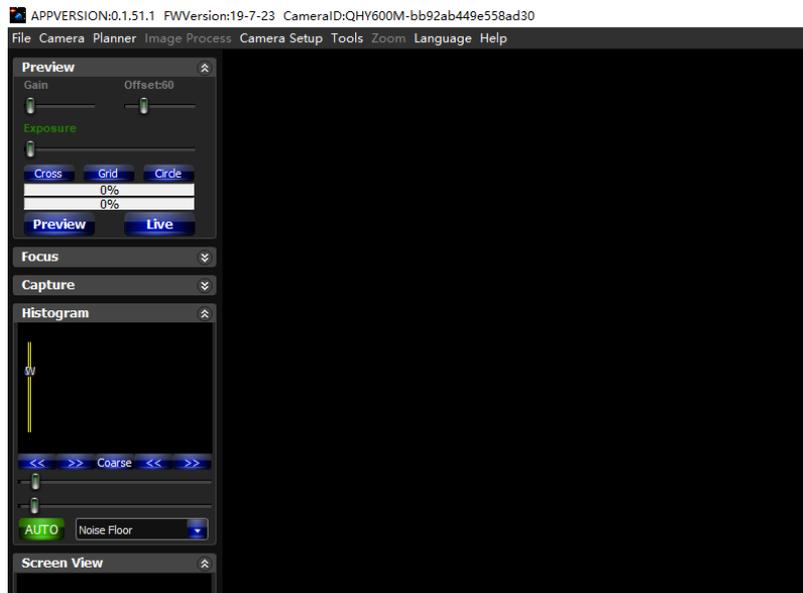
Click "Start" to capture one frame.



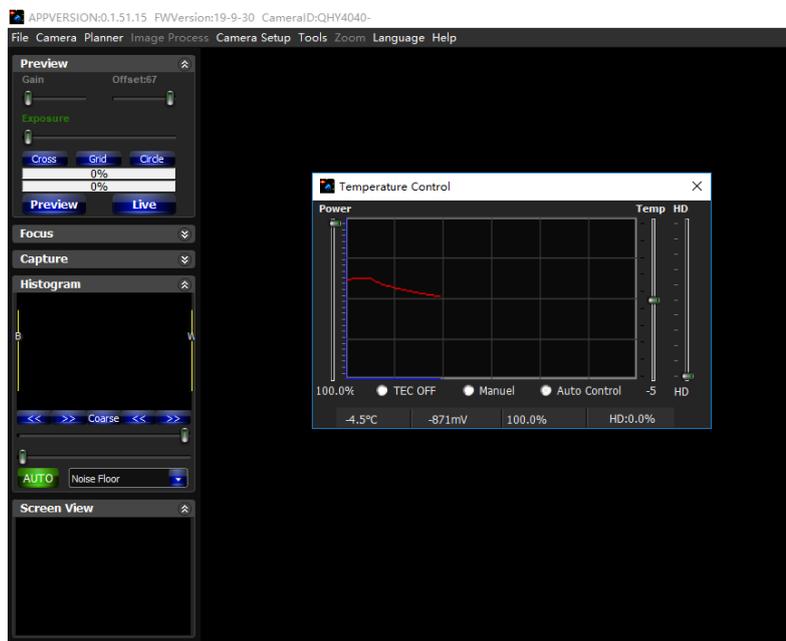
## 07 Use QHY168M in EZCAP\_QT

[EZCAP\\_QT \(V0.1.51.18\)](#) is a software made by QHYCCD. This software has both windows, linux and MAC/OS version. This software created with the opensource QT software. This software can be modified if you want the source code. It has the basic capture function and working in single frame mode.

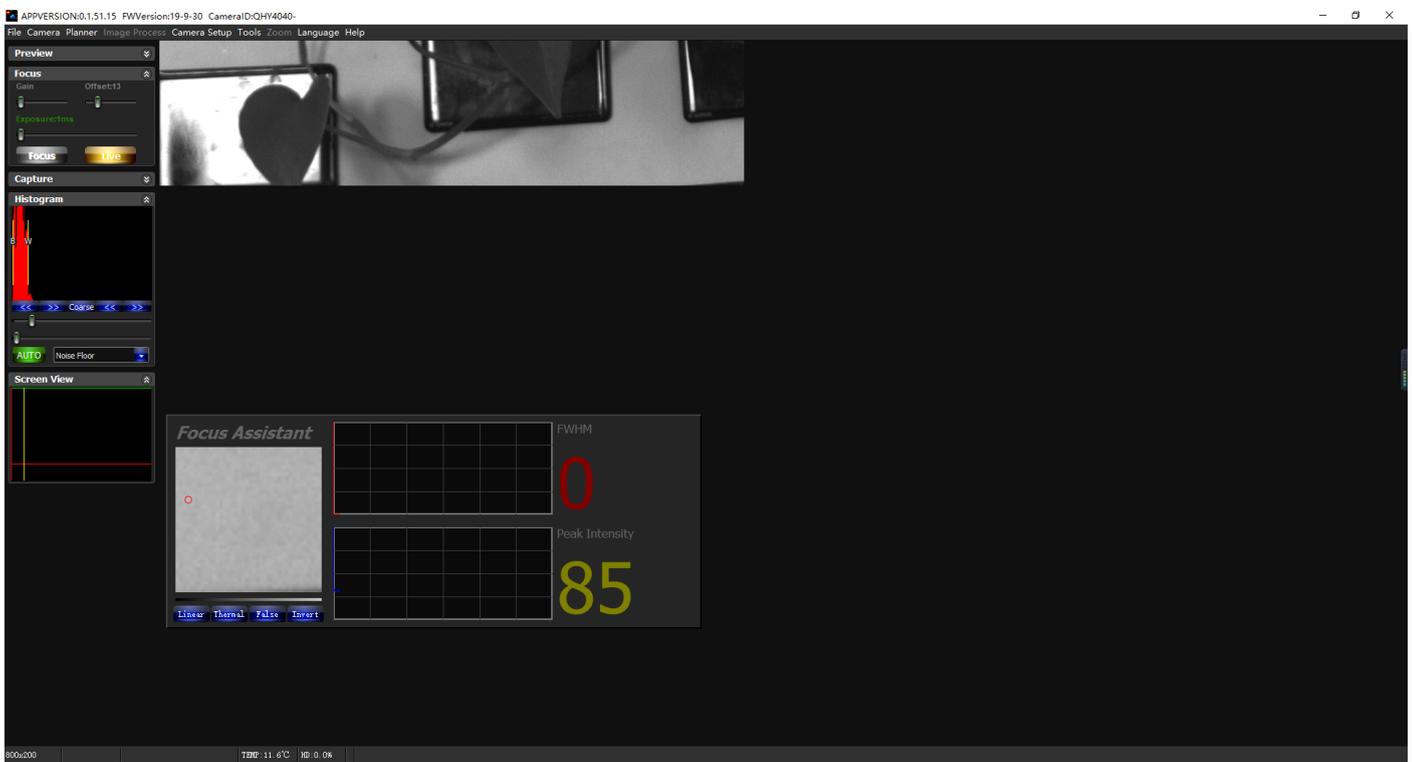
1. Install EZCAP\_QT software.
2. Connect your QHY4040 to 12V power supply. Connect your QHY4040 to your computer with USB3.0 cable.
3. Run EZCAP\_QT. Select “Connect” in Menu->Camera. If the camera is successfully connected. The title of EZCAP\_QT will display the camera firmware version and the camera ID as shown below. You can change the language of the software at menu->language.



4. In menu->camera setting->temperature setting, you can set the power and target temperature. In AUTO mode, you can set the target temperature. And in manual, you can set the TEC power percent. It may need some minutes to get the temperature to target.

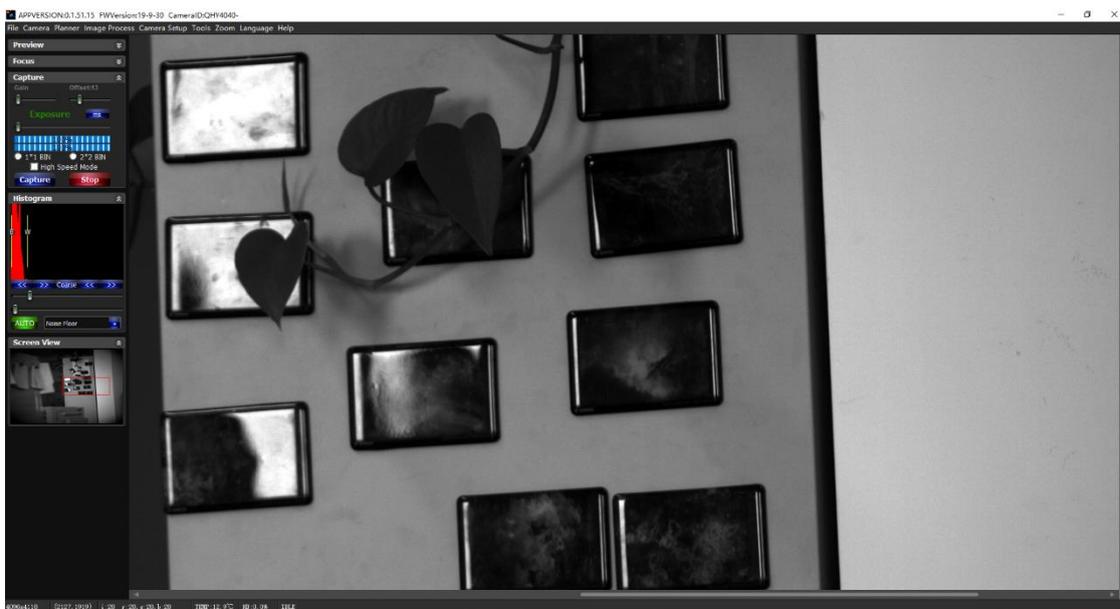


- 5. One left of the software there is some TAB. You can use the preview TAB to do some preview. And you can select an area in the preview image area and use the focus TAB to do focusing. And then use the Capture TAB to capture the image



7. There is a planner in the EZCAP\_QT. You can do a sequence capture with this planner.

	UseBIN	ExpTime(s)	Repeat	CFW Delay(s)	Gain	Avg	SubBlack	SubBias
1	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0
2	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0
3	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0
4	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0
5	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0
6	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0
7	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0
8	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0
9	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0
10	<input checked="" type="checkbox"/>	1	1	1	0	0	0	0



## 09 FAQ

### 1. How to avoid camera stuck?

If the camera is stuck all the time, it may be caused by a variety of reasons, you can follow the prompts below to check.

- 1) Whether your computer is configured with a VIA chipset or some type of motherboard, it does not appear on SharpCap (but works on ASCOM). In this case, you need to turn on the camera's DDR buffer.
- 2) Is your computer and equatorial device leaking? This may cause leakage current to be transferred from the computer to the camera through GND. This may affect USB transmission, loss of data packets, and camera jam. You need to make sure the computer and the equatorial mount are well grounded.
- 3) Is the voltage of the USB interface high enough? Some computers have a USB interface voltage of less than 5V. This may cause the camera to get stuck. In this case, you can choose to connect the computer to the camera by using the USB3.0 Hub with power supply, which ensures that the camera gets 5V.
- 4) Is the CPU usage too high? If the CPU usage is too high, it will cause many frames to be lost and the camera will be stuck. You can increase the USB traffic value to lower the FPS for more stable image transmission.
- 5) Is the USB cable securely connected? Sometimes problems with the connection of the camera to the USB cable and problems with the connection of the computer to the USB cable can result in loss of signal and jamming of the camera. Especially when the USB cable is moving. In this case, you can try applying some silicone oil to the USB connector and the socket section. This will make the USB connection more stable.
- 6) Avoid static electricity. Sometimes static electricity carried on the human body can cause the camera to become stuck. Before touching the camera, you can touch the computer case to discharge static electricity.
- 7) Some computers have a front USB interface that is not suitable for high-speed data transmission (because they are connected to the motherboard through a cable, which makes signal integrity worse). If you find that the camera is stuck when the front USB port is in use, you can try connecting the camera to its rear USB port (they are directly connected to the motherboard's chipset).

### 2. How to clean the CMOS sensor and optical window?

If you find dust on the CMOS sensor, you can first unscrew the front half of the QHY4040 and then clean the CMOS sensor with the cleaning kit for the SLR camera sensor. Because the QHY4040 CMOS sensor has an AR coating, care must be taken during the cleaning process. The glass window has an infrared filter coating and an anti-reflection coating. Therefore, care must be taken during the cleaning process. You can also use the SLR cleaning tool or lens paper for cleaning. Note that the force should not be too large, because the coating is very fragile and can be easily scratched.

3. QHY4040's glow suppression function guarantees zero glow in the picture.

### 4. What is the camera's built-in DDR buffer? What are its advantages?

QHY4040 has a built-in 128MB DDRII image buffer. It has two advantages:

It can buffer the entire image to avoid loss during USB transfer. Because once the CMOS sensor starts to work, it will continuously expose, output images, and start and end again. However, the computer will temporarily suspend the USB transmission due to the multi-tasking characteristics of the operating system. If the pause time is too long, the buffer with a small storage capacity in the USB will be full, resulting in the loss of upcoming data. It may also cause a part of the data of a frame to be lost to form a bad frame. For short exposures, this may not cause much of a problem, but for long exposures, this means losing one long exposure image. The 128MB DDRII buffer can solve this problem by storing and transmitting the entire frame of image. No data is lost even if USB transfer is paused for a long time.

Another advantage is that when using some computers that are not fast or support USB 3.0, it will make the video images more delicate and smooth. These computers cannot perform high-speed data transmission well, data will often be lost. Buffer, which can buffer a lot of image data and send it to the computer. Even if USB3.0 often suspends transmission, it will guarantee that data will not be lost. There are options in SharpCap to turn DDR buffering on or off. The current version of the ASCOM driver has been working in DDR mode.

### 5. How to protect the refrigerator?

The QHY4040 refrigerator can achieve an ambient temperature difference of nearly 35 ° C. You should

avoid thermal shock during use. The so-called thermal shock refers to the internal strong stress that the refrigerator must withstand due to the principle of thermal expansion and contraction when the temperature of the refrigerator suddenly rises or falls. The thermal shock of distance will shorten the life of the refrigerator. It even completely damages the refrigerator.

Therefore, when you start to use the refrigerator to adjust the temperature of the CMOS, you should avoid turning the refrigerator on to the maximum power in one click, and you should gradually increase the power of the refrigerator. Before disconnecting the power, if the power of the refrigerator is relatively high, you should also gradually reduce the power of the refrigerator before disconnecting the power.

#### **6. When the camera runs for a period of time with the DDR mode turned on, the frame rate drops to 0.**

Some users report that the frame rate of their cameras with DDR modules dropped to zero after running on SharpCap for a period of time; such problems are caused by the high output rate of the CMOS chip and the slow reception rate of the computer. Once the CMOS sensor starts to work, it will continuously expose, output images, and start and end again and again, without stopping. If the computer suspends USB transmission too frequently due to the operating system, it will cause DDR data to overflow, causing bad frames to continue to occur. None of the images entering the DDR is complete, so the frame rate is zero.

Solution:

The first method is to replace a better computer. For a computer with poor performance, we recommend replacing it to ensure that the camera runs normally.

The second method is to turn off the DDR mode in SharpCap, but for computers with poor performance, this method may not be effective due to its slower data transmission speed.

#### **7. How to avoid horizontal noise in QHY4040**

When the camera is connected to a USB port with high noise, a horizontal noise image will appear. Replace the USB interface and get a clean image when the camera is on a good USB port. [Click for details](#)

#### **8. Camera maintenance**

Dry Camera CMOS Cavity

The CMOS sensor is located in a CMOS cavity. There is a hole in the side of the front of the QHY4040 camera. If there is moisture in the CMOS cavity that causes the sensor glass to fog, you can connect a silicone tube through this hole to dry it.

Please put an effective silica gel desiccant in the silicone rod and make sure there is cotton inside to prevent the silicone from entering the CMOS cavity.

#### **9. How to prevent fogging of optical window of CMOS sealed cavity**

If the ambient humidity is very high, the optical window of the CMOS sealed cavity may have condensation problems. The QHY4040 has a built-in heating plate to heat it to prevent fogging. In most cases, its effect is very obvious. If the fogging problem persists, try this:

1. Avoid directing the camera to the ground. The density of the cold air is greater than the density of the hot air. If the camera is facing down to the ground, the cold air will more easily contact the glass and cause it to cool down and condense.

2. Increase the temperature of the CMOS sensor. You can increase the temperature of the CMOS sensor slightly to prevent fogging of the glass.

3. Check whether the heating plate is working. If the heating plate is not working, the glass will be easily fogged. Generally, the temperature of the heating plate can reach 65-70 ° C in a 25 ° C environment. If it is not so hot, it may be because the heating plate is damaged, you can contact us to replace the heating plate.

**10. Regarding external trigger control, QHY4040 hardware supports external trigger function. If necessary, please contact QHYCCD to install this function before purchasing.**

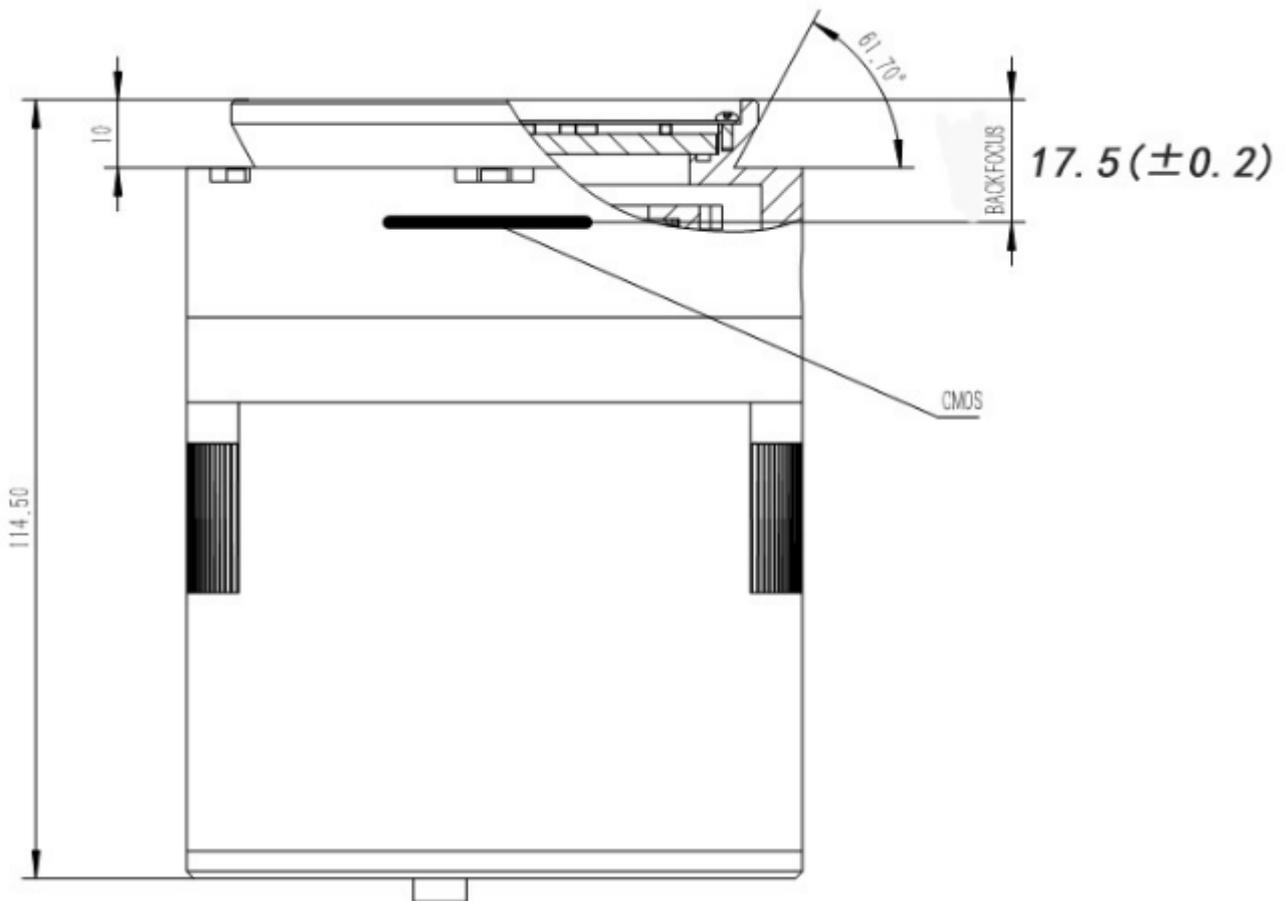
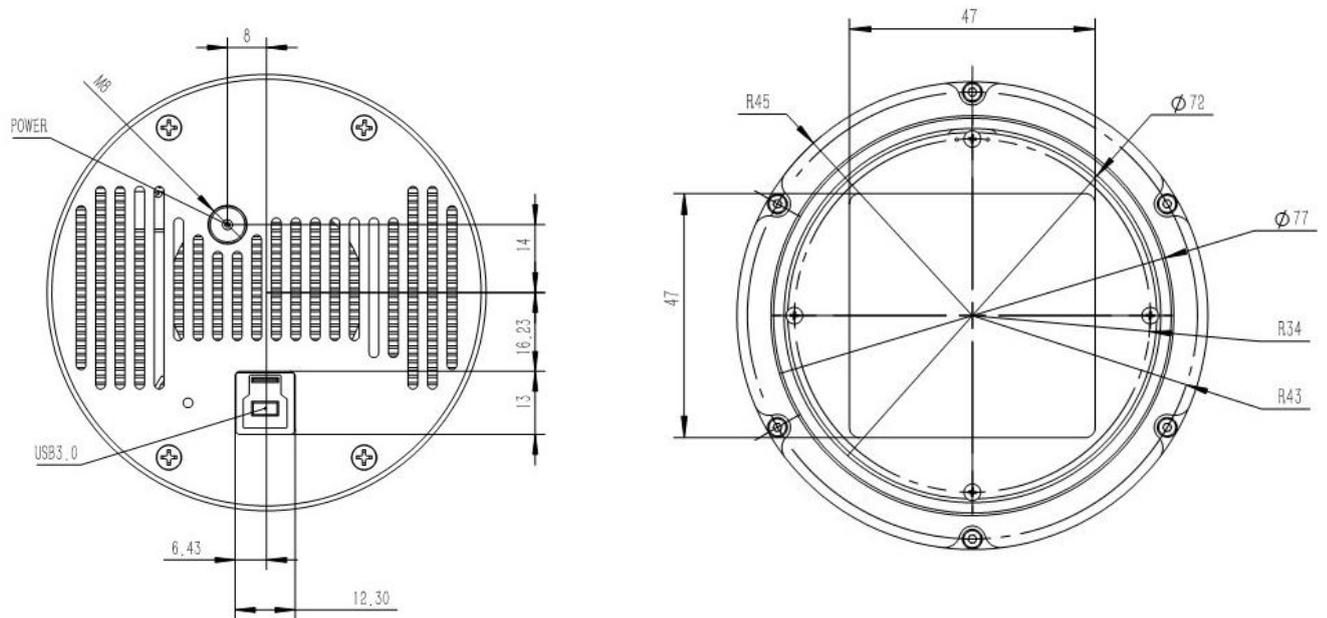
**11. Speer settings in SharpCap**

When the camera is at a high speed, the image may be out of phase. Try lowering the Speed to solve the problem.

In the software's Speed setting, the number of steps will appear at 0 frames and cannot be displayed. See the table below to set the Speed.

8bit Speed	0	1	2	3	4
Use DDR Buffer Off	Yes	Yes	Yes	Yes	Yes
Use DDR Buffer On	Yes	Yes	Yes	No	No
16bit Speed	0	1	2	3	4
Use DDR Buffer Off	Yes	No	No	No	No
Use DDR Buffer On	Yes	No	No	No	No

**10 OHY4040 Mechanical Size**



## 11 Specifications

Model	QHY4040U3FSI (In STOCK) QHY4040U3G20FSI (Available in the end of 2019) QHY4040U3G20BSI (Available in winter of 2020 )
CMOS Sensor	Gpixel Gense4040 FSI version
Pixel Size	9.0um x 9.0um
Sensor Surface Glass	Clear Glass
CMOS Chamber Optic window glass	AR+AR multiple layer coating anti-reflection glass
Effective Pixel Area	4096 x 4096
Effective Pixels	16.8 Megapixels
Effective Image Area	36.9mm x 36.9mm
Fullwell	Pixel >70ke. For single high gain channel max fullwell is 26ke @ gain 0
AD Sample Depth	Single 12-bit output 12-bit/8-bit output Note: Due to the limitation of USB3.0 transfer speed.The current USB3.0 version of QHY4040 only supports single A/D channels. For dual A/D channels please wait for the QHY4040 10GigaE version. It will be available at the end of 2019.
Sensor Size	36.9mm*36.9mm
Full Frame Rate	20FPS@4096*4096 8bit (Clock Speed 4) 18FPS@4096*4096 8bit (Clock Speed 3) 16FPS@4096*4096 8bit (Clock Speed 2) 12FPS@4096*4096 8bit (Clock Speed 1) 8FPS@4096*4096 8bit (Clock Speed 0) 8FPS@4096*4096 12bit (Clock Speed 0)
Readout Noise	Typical 4e- @ Gain31 (16.5x)
Dark Current	0.05e/pixel/sec @ -15C
Exposure Time Range	20us - 600sec
Shutter Type	Electric Rolling Shutter
Computer Interface	USB3.0 (in QHY4040U3) (In stock) 10GigaE Fiber (in QHY4040U3G20) (Under development)
Built-in Image Buffer	128MByte (512Mb) DDR2 memory in QHY4040FSI-USB3 2GByte (8Gb) DDR3 memory in QHY4040FSI-10G

Non-volatile memory / On camera storage	Build-in total 512Kbytes Flash Memory. 100Kbytes user-accessible space for stellar ROI frames for analysis of exoplanet investigation, occultations, atmospheric seeing measurement, focus, optic analysis etc. Support 100*100 image x 10frames 50*50 image x40frames. 25*25 image x160frames 10*10 image * 1000 frames (total frame numbers is based on 8bit image)
Exposure Ending Hardware Pulse Output	Yes. With the Trig-Out signal in the camera
GPIO	Four High Speed FPGA Controlled GPIO . Can be used for high precise GPS timestamp socket. Or the Electric Shutter on/off waveform output for GPS Card. Or Multiple Camera Synchronized Port and so on.
Cooling System	Dual Stage TE Cooler (-35C below ambient)
Fan Cooling / Water Cooling	Default setup is fan cooling. QHYCCD also supply the water cooling version.
Anti-Dew Heater	Yes
Telescope Interface	M54/0.75 female thread on the fast installer/center adjust ring
Optic Window Type	AR+AR High Quality Multi-Layer Anti-Reflection Coating
Back Focal Length	17.5mm (±0.2)
Weight	TBD