Introduction

QHY1253 has IMX253 Global shutter CMOS sensor with the special Polarize version. Monochrome and color version are also available. Compared with QHY550P, 1253P has a bigger sensor. It has important applications in gemstone, geology and material science, biology science.

QHY1253 has build-in two stage TEC cooler. It can cooled the sensor to -35C below ambient and reduce the dark current, which greatly improving the dark signal detect performance. Especially for detect the tiny difference of the polarize light. This is necessary for the astronomy, life science and optical lab.

Polarize Sensor

With the on-pixel four direction polarize filter, A ploarize sensor can capture the polarize image at only one exposure. No need change the polarize filter for three times. Polarize detector can be used in industry image to detect the scratch, transmissible object and getting the no-reflection pictures.

Since the polarizer is formed during the semiconductor process, form and formulation of polarizer, uniformity, mass productivity and durability are excellent compared to conventional polarization sensors. Furthermore, The Polarization sensor is covered with an anti-reflection layer which helps to reduce reflectance and avoids poor flare and ghost characteristics.
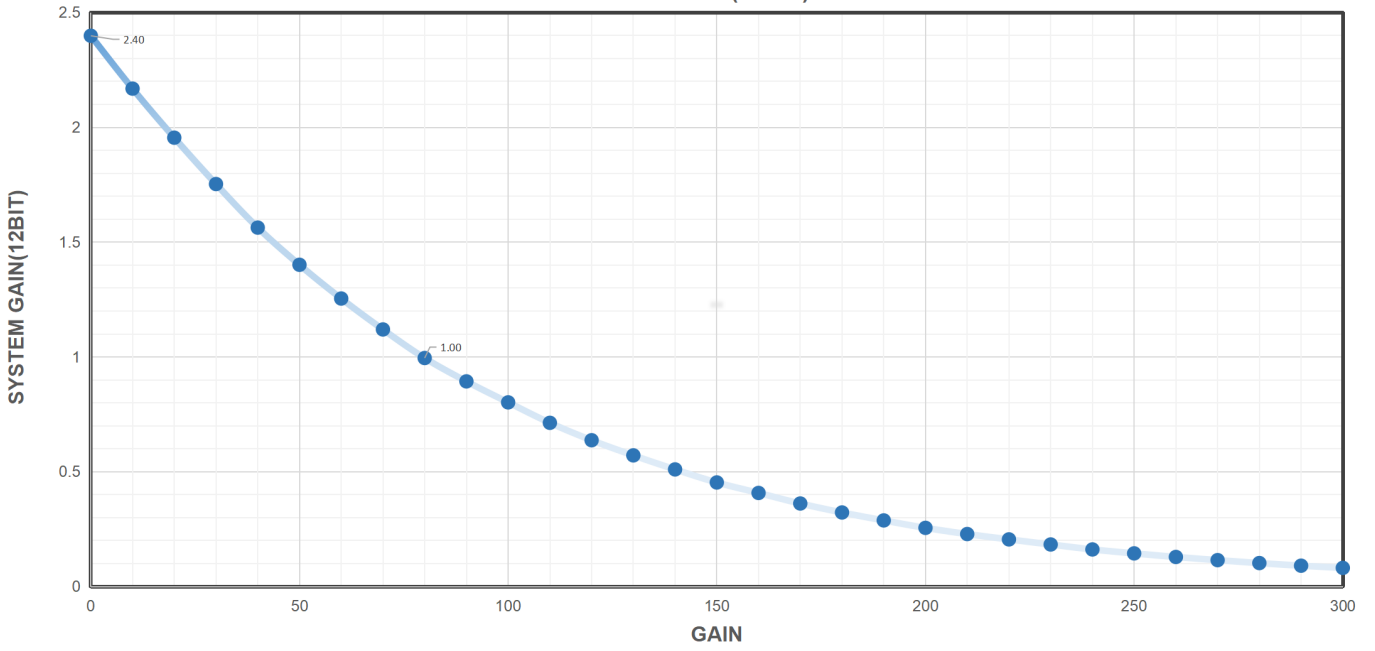
Global Shutter

Unlike the rolling shutter technology used in most CMOS cameras, a global shutter guarantees that the exposure time for the whole image area is uniform, beginning and ending at exactly the same time. This type of shutter is ideal for high precision applications. For high speed moving object and the atmospheric agitation the global shutter can generate undisborted imaging and realizes high picture quality.
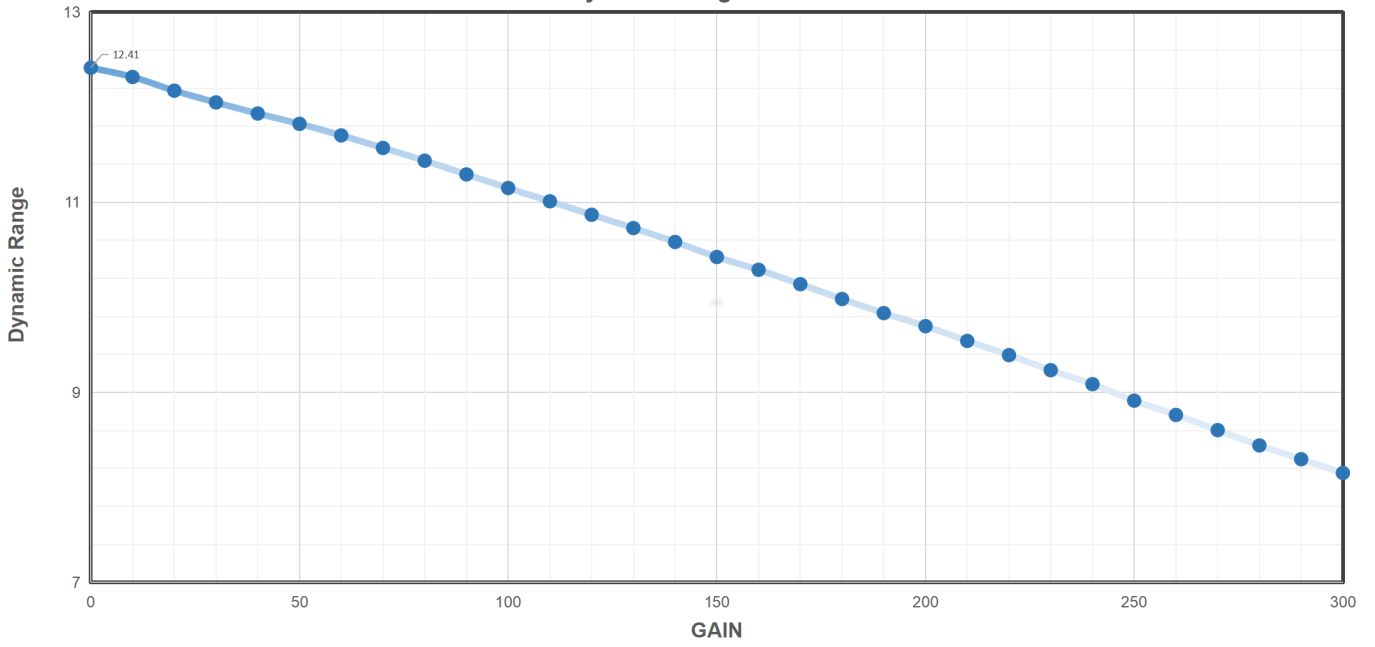
Specifications

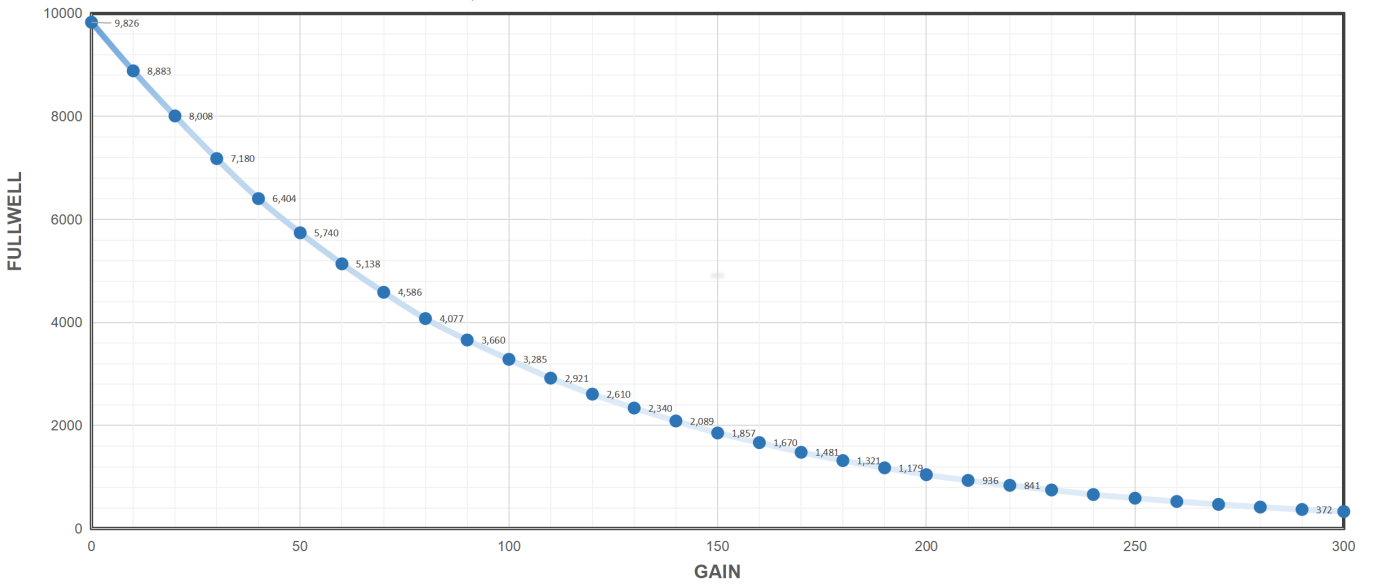| Model	QHY1253
COMS Sensor	IMX253
Sensor Type	Polarize
Sensor Size	13.91mm x 10.34mm
Effective Pixels	12MP
Pixel Size	3.45um x 3.45um
Effective Pixel Area	4032 (H) x 2998 (V)
Shutter Type	Electric Global Shutter
Fullwell	9.8Ke-
Readout Noise	1.17e –
Dynamic Range	74dB
Dark Current	TBD
Full Frame Rate	14.5fps @ 8Bit 10fps @16Bit

Curves

QHY1253 SYSTEM GAIN(12BIT) VS. GAIN

2.40

1.00

GAIN

SYSTEM GAIN(12BIT)

QHY1253 Dynamic Range VS. Gain

12.41

Dynamic Range

GAIN

QHY1253 FULLWELL VS. Gain

9,826
8,883
8,008
7,180
6,404
5,740
5,138
4,586
4,077
3,660
3,285
2,921
2,610
2,340
2,089
1,857
1,670
1,481
1,321
1,179
936
841
372

FULLWELL

GAIN

QHY1253 Readout noise VS. Gain

Readout noise vs GAIN — data points: 1.80, 1.58, 1.45, 1.35, 1.26, 1.23, 1.17

QHY1253 QE

QE x FF (%) vs Wavelength(nm)

- **Mechanical Dimensions**

POWER

CFW

USB3.0

GUIDE

TRIGGER

17.5±0.5 BACK FOCUS

CMOS

4 × M3

M4

92.50

81

6 × M3 EQS

R31

Ø 67.50

1-32 UN 2A

Ø 34

50.50

43.50

R38.50

50
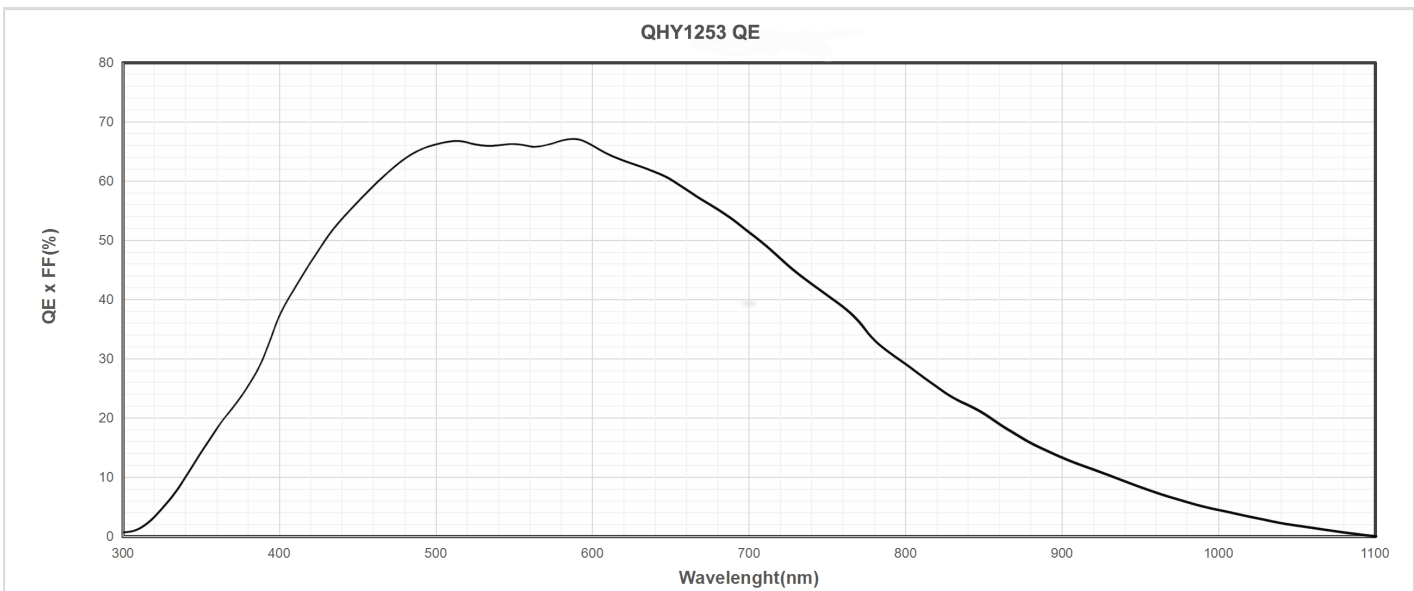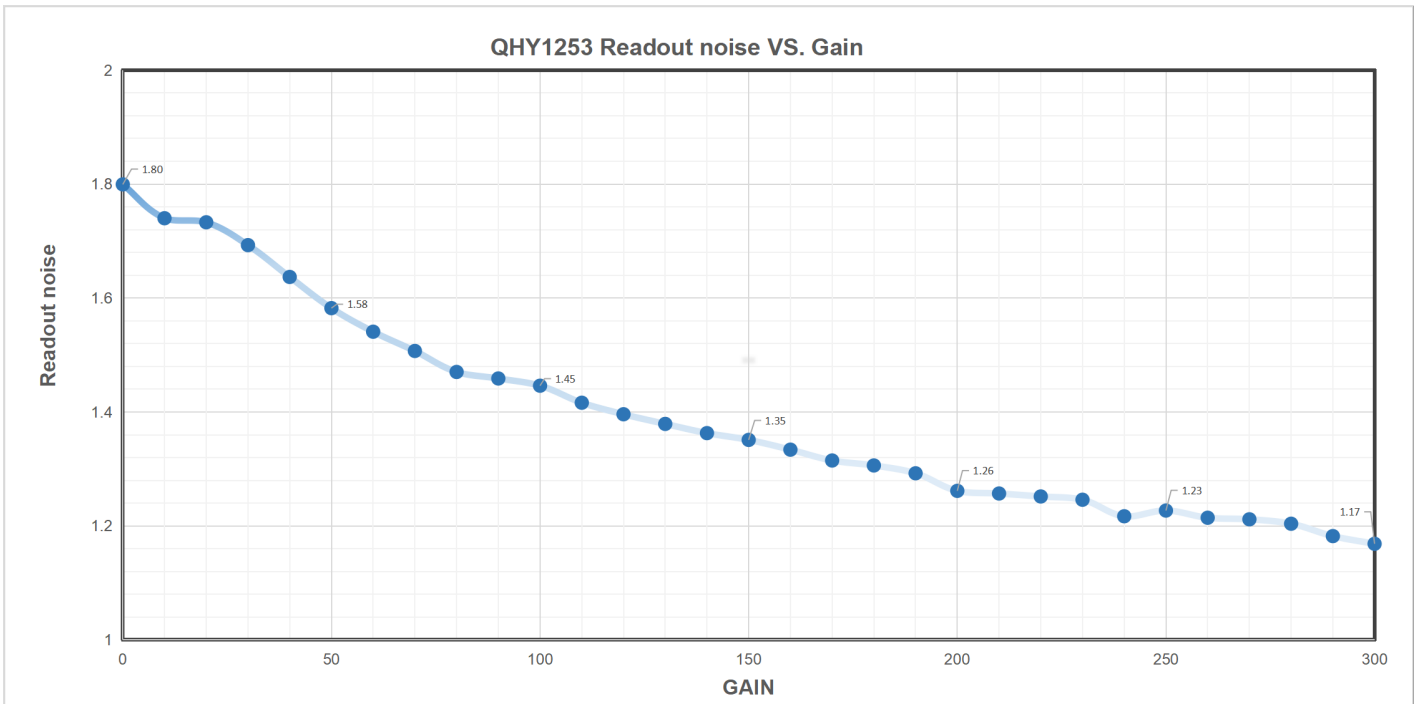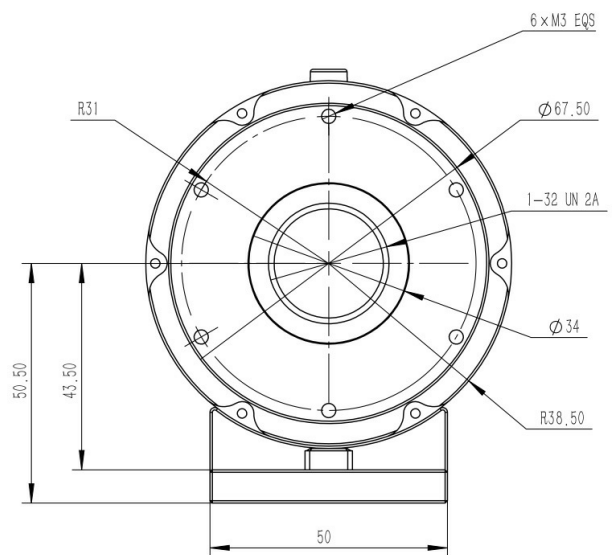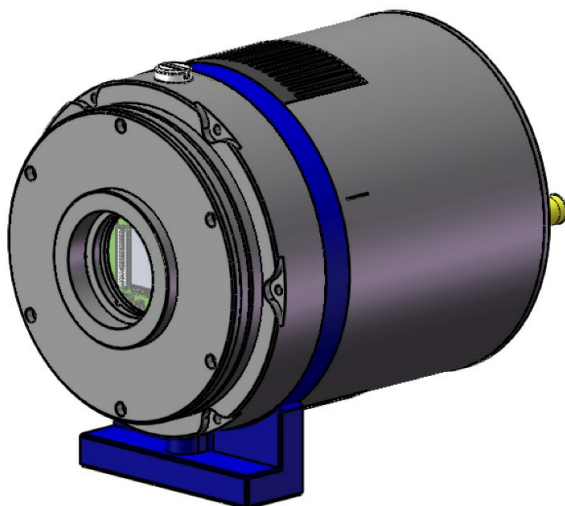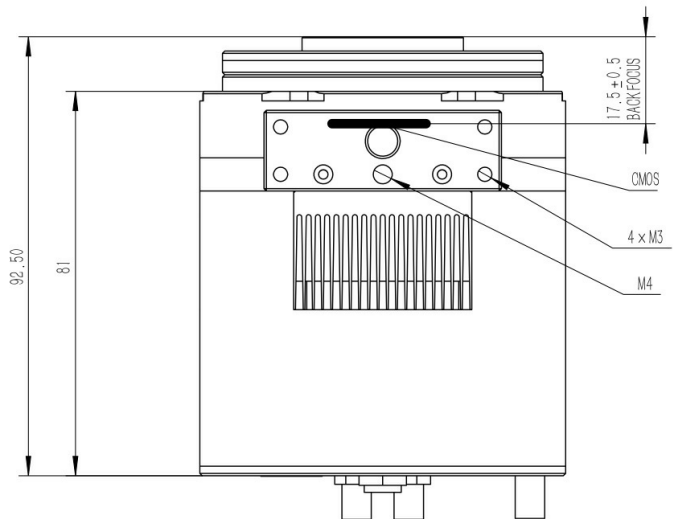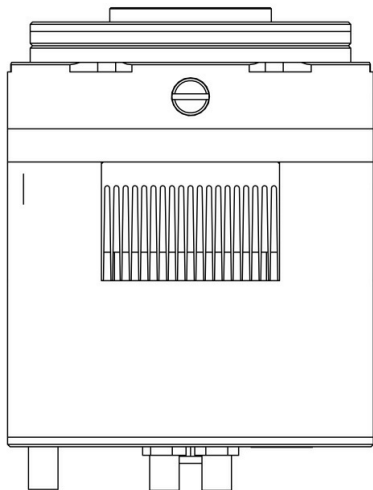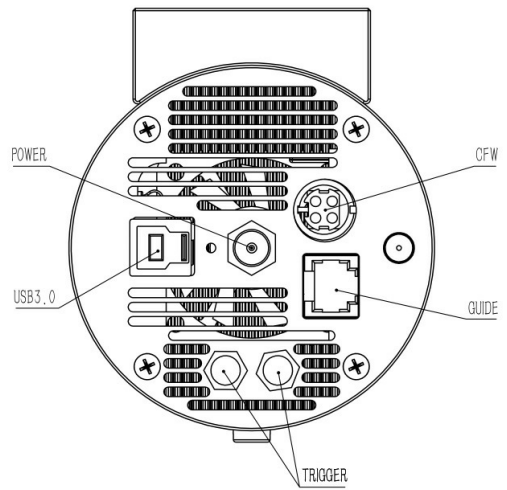
- Install "All-In-One" Driver&SDK Pack

Before Start: Input Voltage Requirements

The camera requires an input voltage between 11V and 13.8V. If the input voltage is too low the camera will stop functioning or it may reboot when the TEC power percent is high, causing a drain on the power. Therefore, please make sure the input voltage arrived to the camera is adequate. 12V is the best but please note that a 12V cable that is very long or a cable with small conductor wire may exhibit enough resistance to cause a voltage drop between the power supply and the camera. The formular is: V(drop) = I * R (cable). It is advised that a very long 12V power cable not be used. It is better to place the 12V AC adapter closer to the camera.

First connect the 12V power supply, then connect the camera to your computer via the USB3.0 cable. Make sure the camera is plugged in before connecting the camera to the computer, otherwise the camera will not be recognized. When you connect the camera for the first time, the system discovers the new device and looks for drivers for it. You can skip the online search step by clicking "Skip obtaining the driver software from Windows Update" and the computer will automatically find the driver locally and install it. If we take the 5IIISeries driver as an example (shown below), after the driver software is successfully installed, you will see QHY5IIISeries_IO in the device manager.

Please note that the input voltage cannot be lower than 11.5v, otherwise the device will be unable to work normally.

Install "All-In-One" System Pack

All-in-one Pack supports most QHYCCD models only except PoleMaster and several discontinued CCD cameras.

Download Page: https://www.qhyccd.com/download/

Video Tutorial: https://www.youtube.com/embed/mZDxIK0GZRc?start=1

- Since most of the contents of All-in-one package are plug-ins that support third-party software, **the third-party capturing software that you want to use must be installed before the All-in-one package.** Otherwise the program will report an error.
- **ALL-IN-ONE Pack contains:**
  - **System Driver,** which is necessary for the camera operation and must be installed.
  - **WDM Broadcast Driver**, which can provide a live signal to Obs and other live software, you can install it if you have such needs like opeing a live show.
  - **EZCAP_QT** , which is developed by QHYCCD and can be used in QHY devices tests, and management of updates. So even if you won't use EZCAP_QT for capturing, we suggest you install it.
  - **Ascom driver,** which is necessary for the camera used in Ascom (the latest version of Ascom is 6.6).
  - **The two sorts of Ascom CFW Drivers** correspond to two methods of controling the filter wheel: USB control and camera serial control. It is recommended that both drivers should be installed if you have a filter wheel.
  - **CP210X_VCP** is a serial driver. Some computers come with the driver, but the computer without the driver may be failed of controling the filter wheel.
  - **SDKs for Third-party Software**: Just pick and install the corresponding SDK according to the software you want to use. Don't forget to check whether the software you are using is 32-bit or 64-bit and select the right SDKs.
  - **SHARPCAP** is also included in the pack, you can choose 32-bit or 64-bit to install. This is authorized by SHARPCAP.
  - **QT LIB** is a plug-in to ensure that 64-bit software can exeuate normally on some computers with poor compatibility.
- **Difference between Stable version and Beta Version:** Beta version is the latest version, which gives priority to support for the latest products (the stable version may not be compatible with those yet), and has some of the latest optimized ,but experimental features. The stable version is older than the beta version but more stable, so it is recommended for beginners who are not using the latest products.
- **Don't let the camera connect to the computer during the All-in-one pack installation process**, connect it to the computer after all the installation is complete.

- Connect DSO Imaging Software (e.g. NINA)

Before using software, make sure you have connected the cooling camera to the 12V power supply and connected it to the computer with a USB3.0 data cable. If it's an uncooled camera, 12V power is not needed. We recommend 64-bit Software, like SharpCAP x64 , N.I.N.A x64. etc., especially when you're using 16bit cameras.

In NINA, you can select the device to connect to QHY Camera directly without ASCOM driver.

If connecting to the camera via ASCOM is desired, first make sure you have installed both the QHYCCD ASCOM Drivers and ASCOM Platform. Then you would select the appropriate camera driver under the ASCOM section. Then click the

Connect icon. Here we take NINA as an example, but it's similar to other software packages supporting ASCOM, like MaxDL, The SkyX, etc.

- **Connect Planetary Imaging Software (e.g. SharpCap)**

Launch SharpCap. If the software and drivers mentioned above are installed successfully, the video image will appear automatically about 3 seconds after the software loads. You will also see the frame rate in the lower left corner of the software window as shown below.
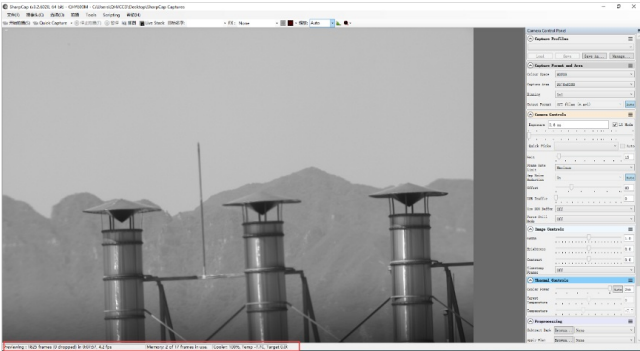
If you have already started the SharpCap software before connecting the camera, in order to open the camera, click on the "camera" in the menu bar and then select the device.

Offset adjustment. When you completely block the camera (i.e., like taking a dark frame) you may find that the image is not really zero. Sometimes this will reduce the quality of the image contrast. You can get a better dark field by adjusting the offset. You can confirm this by opening the histogram as indicated in the figure below.

If you want to enter the 16-bit image mode, select the "RAW16" mode.

By selecting the "LX" mode you can expand the exposure setting range and take long exposures.

After cooling devices connected to the 12V power supply, the temperature control circuit will be activated. You can control the CMOS temperature by adjusting the settings in the figure below. Basically, you can control the temperature of CMOS by either adjusting "Cooler Power" or clicking "Auto" and setting "Target Temperature". You can also see the CMOS temperature at the lower-left corner of the software window.
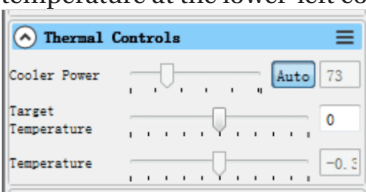
- **Camera Maintenance**

- **Drying the camera CMOS chamber**

1. There are holes in the two sides of the camera near the front plate that is normally plugged by a screw with an o-ring. If there's moisture in the CMOS chamber that causes fog, you can connect the desiccant tube to this hole for drying. There would better be some cotton inside to prevent the desiccants from entering the CMOS chamber.


   Please note that you may need to prepare desiccants yourself, because for most countries and regions desiccants are prohibited by air transport. Since QHY always deliver your goods by air, sorry that we can't provide desiccants for you directly.
2. **Cyclic Drying:** The front end of the camera body is equipped with two drying interfaces with M5 threads, which are used in conjunction with drying tubes and circulation pumps for drying treatment inside the sensor chamber. The position of the drying interface is indicated by the red circle in the figure below (take the QHY600 as an example):

Cyclic Drying System
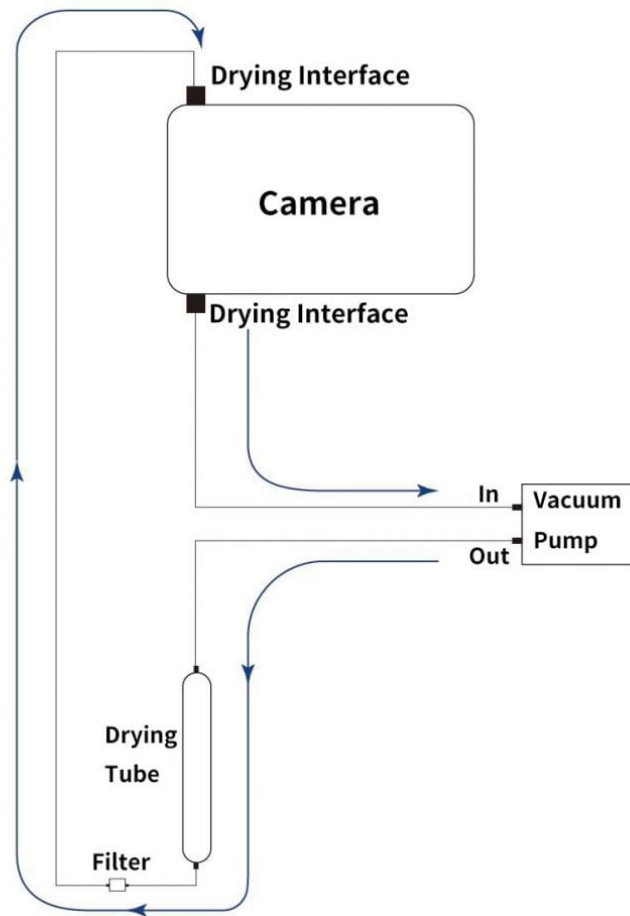
Under the vacuum pump, the gas inside the sensor chamber is drawn out through one drying interface, enters the drying tube, and then undergoes filtration. It is then reintroduced into the camera through the other drying interface, circulating back and forth for drying.

Note:1.Do not reverse the order of the intake and exhaust ports

2.Before circulating drying, it is necessary to turn off the refrigerator, and then turn on circulating drying after the temperature returns to normal temperature. Only by following this step can the water vapor in the sealed chamber be effectively removed. If the cooler is turned on, the cooler inside the camera will absorb water vapor, causing more water vapor to condense inside the camera instead of being absorbed by the desiccant.

- Cleaning the CMOS sensor and optical window

If you find dust on the CMOS sensor, you can first unscrew the front plate of the cam and then clean the CMOS sensor with a cleaning kit for SLR camera sensors. Because the CMOS sensor has an AR (or AR/IR) coating, you need to be careful when cleaning. This coating can scratch easily so you should not use excessive force when cleaning dust from its surface.

- Preventing fogging of the CMOS chamber

All QHY cooling cameras have built-in heating plates to prevent fogging. However, If the ambient humidity is very high, the optical window of the CMOS chamber may have condensation issues. Then try the following:

1. Avoid directing the camera towards the ground. The density of cold air is greater than of hot air. If the camera is facing down, cold air will be more accessible to the glass, causing it to cool down and fog.

2. Slightly increase the temperature of the CMOS sensor .

3. Check if the heating plate is normally working. If the heating plate is not working, the glass will be very easy to fog, the temperature of the heating plate can reach 65-70 °C in the environment of 25 °C. If it does not reach this, the heating plate may be damaged. Please contact us for maintenance.

- TE Cooler Maintenance

Please avoid thermal shock during use. Thermal shock refers to the internal stress that the TE cooler has to withstand due to the thermal expansion and contraction when the temperature of the TEC suddenly rises or falls. Thermal shock may shorten the life of the TEC or even damage it.

Therefore, when you start using the TEC to adjust the CMOS temperature, you should gradually increase the TEC power rather than turning the TEC to maximum power. If the power of the TEC is high before disconnecting the power supply, you should also gradually reduce the power of the TEC and then disconnect the power supply.

- External Trigger Mode Manual

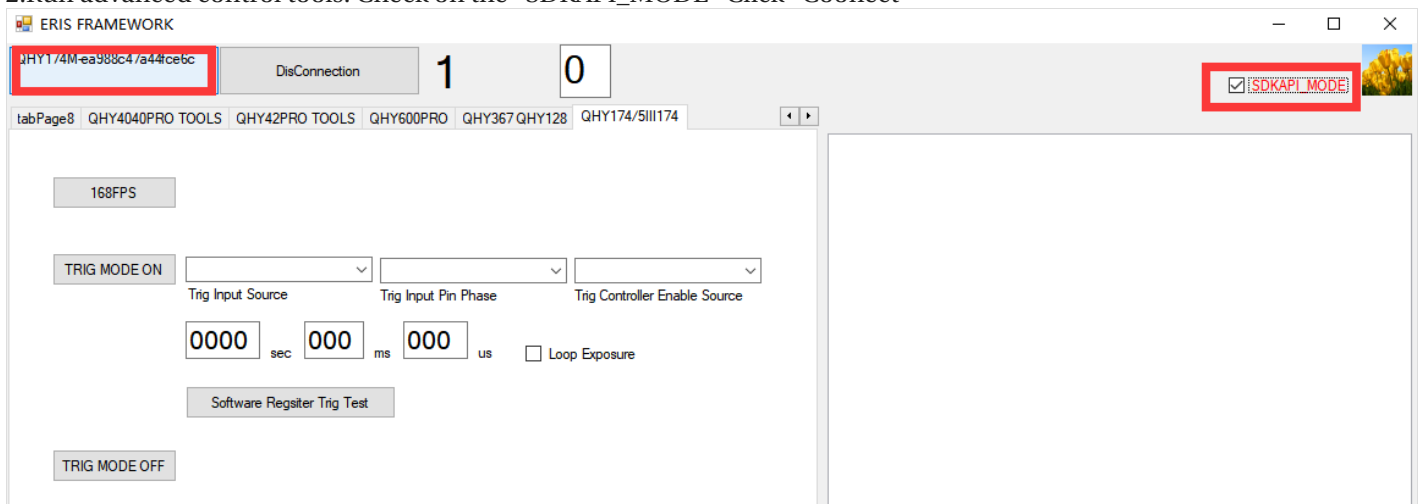## -

Suitable for the following camera with a global shutter.
Advanced Control Tools Download:
Use Sharpcap software as the capture software. QHYCCD Advnanced tools as the External trigger mode setting software.
1.Run SharpCAP, You will see the live video appearing
2.Run advanced control tools. Check on the "SDKAPI_MODE" Click "Coonect"

Mode 1 Hardware External Trigger. The exposure time is depent on the external pulse width
In the Trig Input Souce trigger input source drop-down selection, select Trig Input Pin Direct. The meaning is to trigger the input source as the external trigger input port of the camera (opto-coupled isolated, RCA gold plug); Select one in Trig Controller Source (the marquee doesn't make sense for this mode, so choose one)
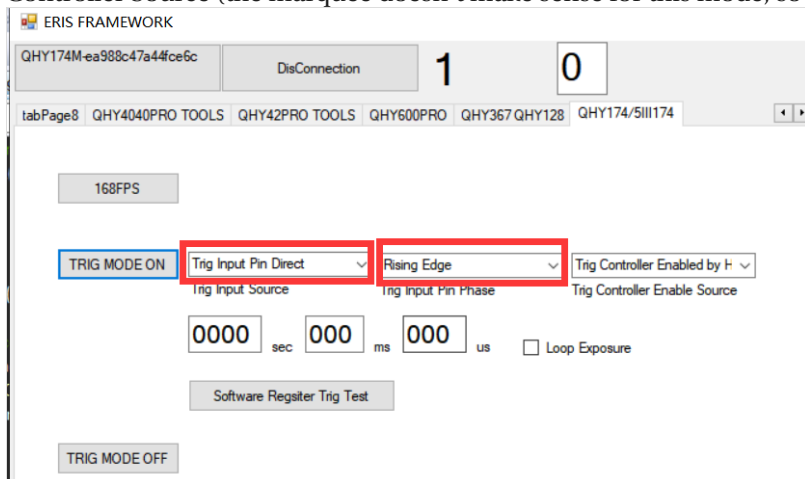

Press the TRIG MODE ON button. You will find that the video image in sharpCAP software stops. The camera has entered a waiting outside trigger state. Trigger the input port via the photoelectric isolation and enter a high level. You'll find that

the image takes a frame, and the longer the duration of the high level, the longer the image will be exposed. In this mode, the exposure time is equal to the duration of the high level.

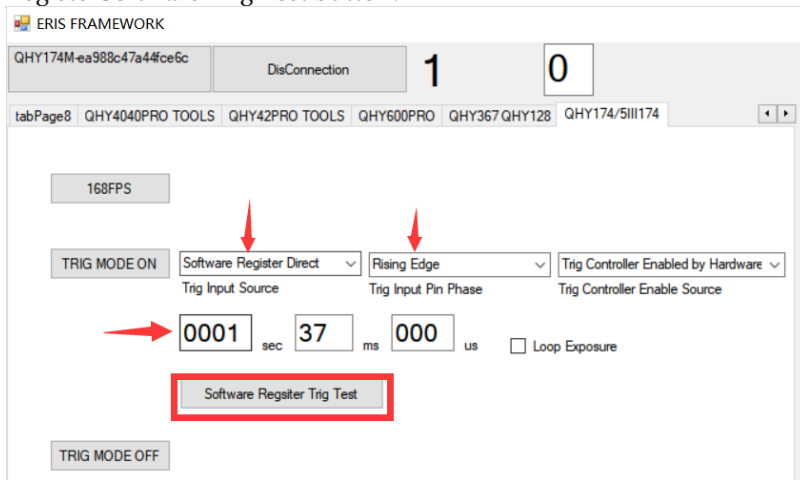**Mode 2 Out-of-hardware trigger, exposure time set by the software**
Press the diagram to set it up. Choose XTRIG CONTROLLER in Trig Input Source, Trig Input Phase to Rise Edge, Trig Controller Controller Enable Source select Trig Controller by Hardware. And enter exposure time, such as 50ms. Then click the TRIG MODE ON button to complete the setting of the mode and the exposure time setting.
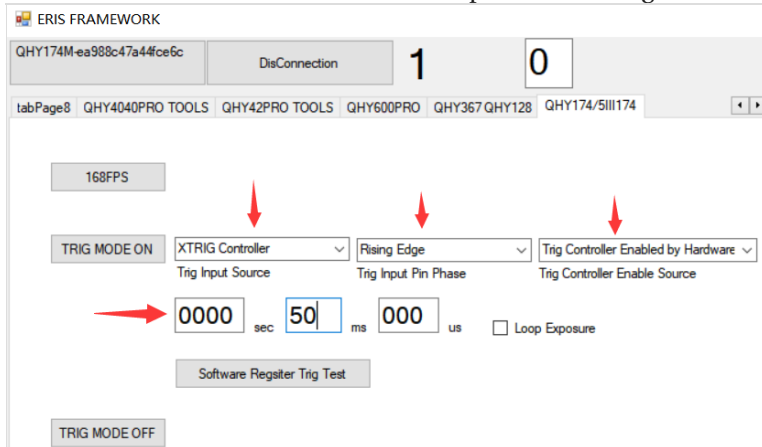
By triggering the input interface outside the photoelectric isolation, a short high level is entered and a frame is captured on the image in SHARPCAP. Note that if the input is consistently high, the camera continues to shoot under the setting of a longer exposure time. To avoid continuous shooting, the high-level time of the input trigger is short, e.g. 1ms

Mode 3 Out-of-software trigger, exposure time is determined by the software command interval
In this mode, the software sends a start exposure instruction through the software, and then the software waits for a delay. Then send an end exposure instruction. A trigger for software control is possible. Its exposure time is equal to the time between the start and end exposure commands. Just follow the settings below. Once set up, click TRIG MODE ON to feed the instruction. Then click on the Software Register Trig Test button to observe the shooting. To modify the exposure time, you only need to modify the value sits in the exposure time box, instead of clicking TRIG MODE ON, just click the RegisterSoftware Trig Test button.

Mode 4 Out-of-software trigger, exposure time set by the software
In Mode 3, there is a problem with a less stable and accurate exposure time. The reason is that the time interval between the two instructions sent by the upper computer is not so precise and will be affected by CPU delay, busyness and other factors. Therefore, mode 4 is also provided. Set the pattern as shown below.
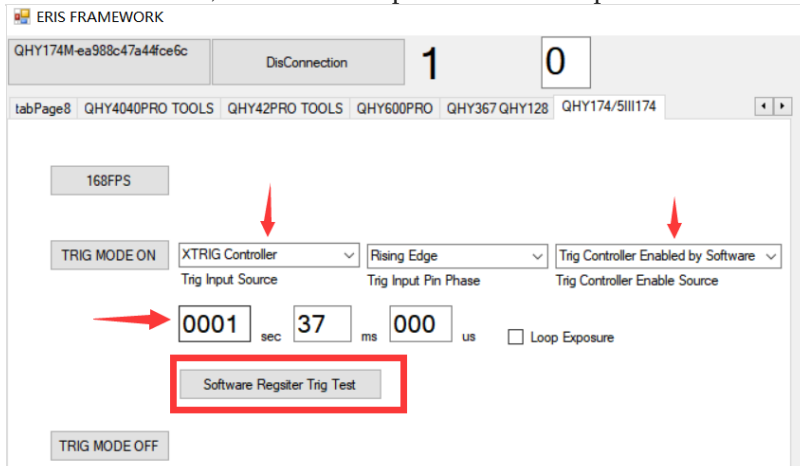

In this mode, exposure time is set by the software and performed by the hardware inside the camera, rather than by the interval between the two commands that the upper machine starts and ends exposure, so the exposure time is accurate

and repeatability is very good. The upper machine only needs to issue a start exposure and end exposure instructions. The interval between the two instructions is as short as possible, for example, about 1ms. The camera will be exposed according to the exposure time set by the software, not the command interval.

**Mode 5: Out-of-hardware trigger, sequence shooting**

In this mode, continuous shooting can be achieved by means of external triggering. The camera is waiting until a trigger signal is given, and once a trigger signal is given, the camera starts shooting continuously. Exposure time is set by the software.

Follow the figure below to set it up. Once set up, press the TRIG MODE ON button to keep the camera waiting, and then enter a high-level pulse from the optically isolated trigger input to trigger continuous shooting by triggering continuous shooting by the camera. (It is important to note that QHY174 does not work when the exposure time is short, and the exposure time is longer.) If you want to enter the next wait state, click TRIG MODE ON to restore the camera to the waitstate and wait for the next external trigger pulse to arrive.
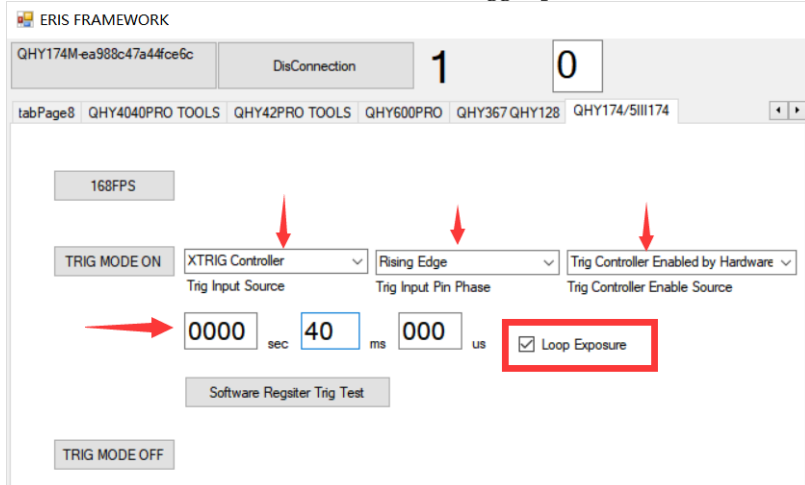
Mode 6: Out-of-software trigger, sequence shooting

Similar to Mode 5, the trigger source is entered from external hardware to software control. After pressing the diagram to set up, click TRIG MODE ON, the camera waits, at this time click on the Software Register Trig Test button, after the start signal, you can see the start of continuous shooting.
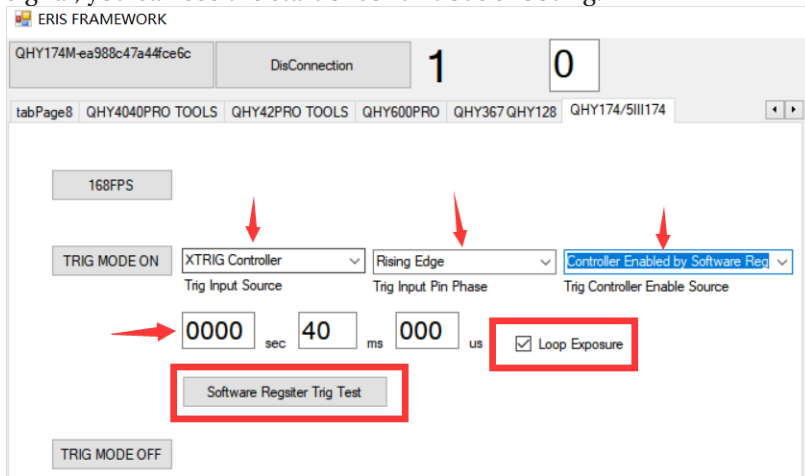
Additional instructions:

The SHARCAP software has a random horizontal horizontal stripe noise reduction feature in the right menu bar. CMOS of the global shutter, such as 174, horizontal random horizontal stripes are more obvious at high gain, and this column can be adjusted appropriately. Comparing the image below, there is no on and off effect, and the difference can be seen.