

## **Third generation filter wheel safety instructions and precautions**

### **Safety instructions:**

1. Do not insert your fingers into the round holes on the filter wheel, otherwise the filter disc may cause finger injury.
2. The copper nails in the filter wheel cannot be disassembled, otherwise the filter wheel will loosen and affect normal use.
3. When the camera uses the control line to control the filter wheel, it is forbidden to use the USB cable to connect the filter wheel at the same time to prevent the power supply from damaging the filter wheel.
4. For the frameless filter, when using the screw to press the lens, it must be pressed by the plastic gasket, but not directly with the metal nut of the screw. Otherwise there is a risk of crushing the lens.

### **Precautions:**

1. Open the package, check the product, check whether the accessories are complete, and check the "Filter Wheel QHYCFW3 Accessories Table"
2. Before installation, you need to prepare the tools needed to install the filter wheel: tweezers, medium cross screwdriver, clock screwdriver.
3. After the installation is complete, please use the software to control the color wheel rotation to see if the rotation is smooth and whether every position can come. Whether there is a serious card in the middle (if there is a slight card in the middle, it will not affect the use, the color wheel will continue to rotate until it reaches the target).
4. Do not push hard when installing the filter wheel. Failure to do so may result in bearing crushage and other malfunctions or damage.

### **Important Notes:**

QHYCFW3 support two socket mode. One is the 4PIN QHYCFW socket. If your QHYCCD camera has the 4PIN socket you can connect it directly with QHYCFW3. There is the 12V power in the 4PIN socket . So it does not need any extra power supply. If you have no QHYCCD camera or the camera has no 4PIN QHYCFW socket. You can use the USB socket to connect with the computer. And the QHYCFW3 can be powered and controlled with USB port. Please note the current requirement when using the USB cable is higher (780mA) than the USB2.0 port can supply and some computer will limit the current to 500mA. In this condition, QHYCFW3 can draw the power from the QHYCFW socket port (the 6PIN RJ11 port in the QHYCFW3) and you need a 12V to RJ11 cable to power the QHYCFW2. When using this method. The current drawing from USB cable will reduce to less than 100mA when motor rotating. (\* The 12V to RJ11 cable is in the standard item list after 2019.4).

Third generation filter wheel port introduction:

## QHYCFW3 parameter summary

unit: mm

model	Overall thickness (without cover part)	Maximum thickness space for the filter that can be assembled	Threaded interface
QHYCFW3S-US	15.5	5.5	M42×0.75
QHYCFW3S-SR	20	10	M42×0.75
QHYCFW3M-SR	20.5	10	M54×0.75
QHYCFW3M-US	17	5.5	M54×0.75
QHYCFW3-L	21.5	10	M54×0.75
QHYCFW3-XL	21.5	10	M62×0.75



- 1. Control port switching button:** This button is used to set the interface mode. There is two mode: USB control mode and 4PIN control mode. If you use the USB cable to control QHYCFW3 you need to select the USB control mode. If you use the 4pin QHYCFW socket cable to control the QHYCFW3 from QHYCCD camera, you need to select the 4PIN control mode. This switch button is inside the case. You can push it on and off. But since it is inside the case, you can not know which position it is. So QHYCFW3 has a LED indicator to tell you of it. When the filter wheel is powered on , if the indicator light flashing for one second and it is red color, the filter wheel is in the USB control mode; if green color the filter wheel is in the 4PIN control mode.
- 2. Status indicator:** Each filter wheel hole position corresponds to a specific color. And this indicator will display if the CFW3 working in the USB control mode or the 4pin control mode. When power on the QHYCFW3, it will be on for one second then off. If it is red color, the QHYCFW3 is in USB control mode. If it is green, the QHYCFW3 is in 4pin mode. the indicator light is off to prevent shooting light pollution
- 3. Reset button:** After pressing, the filter wheel hardware is reset, the turntable returns to the initial position, the default hole 1

### **QHYCFW3 uses the drivers and accessories involved**

- 1.USB cable
- 2.QHY9 filter wheel control line, 4pin serial control line  
(QHY series camera matching accessories)
- 3.12V power splitter  
(QHY9 camera power supply for filter wheel)
- 4.CP210x\_VCP USB to serial port driver  
(USB must be driven when controlling the filter wheel)
- 5.ASCOM driver, QHYFW[RS232]ASCOM driver

QHY cameras use ASCOM drivers when using third-party software (Max, SGP, etc.) to control the filter wheel; QHYFW[RS232]ASCOM driver is required when using third-party software to control the filter wheel in USB mode.

### **Filter wheel standard accessories**

1. Filter wheel body
2. Two inch extension tube
3. M4 metal hand screw
4. Filter fixing nails, including gasket  
(Note: 1.25 inch is threaded, no such accessory)
5. Filter wheel connected to camera control line  
(Note: Because QHY9 is connected differently with other QHY cameras, please contact the agent if you purchase QHY9 filter wheel)

### Third generation filter wheel connection QHY174/178/290/21/22/23 Instructions:

This description applies to QHY174, QHY178, QHY290, QHY21/22/23 connection filter wheel

The third generation filter wheel filter wheel mounting adapter ring is installed inside the filter wheel. To avoid cumbersome, we have already installed it at the time of shipment.

The first step is to install the filter: the medium filter wheel standard version and the thin plate have 5 holes 2 inches and 7 holes 36mm two models of the wheel, the filter is mainly divided into frameless lenses and framed lenses.

Frameless filter installation:

1. First, we unscrew the eight screws on the back of the filter wheel and open the filter wheel.
2. We put the frameless filter on the hole of the filter disc. We need the spacer to be placed in the three circular grooves around the filter. The number of the spacer depends on the thickness of the filter. Keep the gasket and filter thickness consistent. For example, a 0.5mm lens requires only a  $\phi 2*4$  red spacer (0.5mm thick), and a slightly larger spacer is placed over the placed spacer to cover the edge of the filter. . To push a 1mm lens like this, you need 2  $\phi 2*4$  red gasket gaskets. However, the 2mm lens does not need to be padded, just use a slightly larger spacer to fix it.
3. Finally align the hole of the gasket with the standard lens fixing screw and tighten with a Phillips screwdriver. Install the filter in turn using the above method, and you can successfully install the filter on the filter tray.

Installation with framed filters:

1. First, we unscrew the eight screws on the back of the filter wheel and open the filter wheel.
2. Framed filter is installed with special screws made of M2 screw with gasket and M2 screw guide. The standard 7mm requires two spacers, and the other can adjust the number of spacers and the number of guide posts according to the height of the frame. Thereby achieving the desired result.
3. Place the screw with the spacer into the three grooves around the filter and tighten the screws. Install in order until the installation is complete.





### Step 3 Close the top cover

Attach the upper shell to the alignment position and secure the eight holes on the edge of the filter wheel with eight flat head screws. The filter wheel is installed.



### Step 4 Install the camera

1. Fix the camera and filter wheel with M4\*10cm and M4\*3.5cm hand screws. For symmetry and beauty, place two M4\*10cm thumbscrews under the camera and M4\*3.5cm thumbscrews on top of the camera. The state of the screw is as shown in the figure below.



2. Insert the front end of the camera into the ring of the filter wheel, and then screw the screw in the position shown above. Make sure you have to tighten and the camera will be fixed.



#### Step 5 Install the telescope

The other side of the filter wheel can be connected to the telescope by screwing on a standard M54 (M) to 2 inch ring.

#### Step 6 Power connection

The crystal head 4pin control line is used to connect the QHY camera, directly inserting the crystal head into the interface of the filter wheel, and the other end is connected to the interface on the camera.

Finally, use software for verification. During the normal rotation of the filter wheel, the multi-color lamp will continue to be bright. When the filter wheel turntable stops, the multi-color lamp will be extinguished; the color of each of the three color lights in each filter hole position will be different (each filter) The hole position corresponds to one color). The specific control method is shown in the third part.

#### **Third generation filter wheel connection QHY9 instructions:**

The third generation filter wheel filter wheel mounting adapter ring is installed inside the filter wheel. To avoid cumbersome, we have already installed it at the time of delivery. The status is as shown below.



## Step 1 Install the filter

1. First, we unscrew the eight screws on the back of the filter wheel and open the filter wheel.



2. We put the frameless filter on the hole of the filter disc. We need the spacer to be placed in the three circular grooves around the filter. The number of the spacer depends on the thickness of the filter. Keep the gasket and filter thickness consistent. For example, a 0.5mm lens requires only a  $\phi 2*4$  red spacer (0.5mm thick), and a slightly larger spacer is placed over the placed spacer to cover the edge of the filter. . To push a 1mm lens like this, you need 2  $\phi 2*4$  red gasket gaskets. However, the 2mm lens does not need to be padded, just use a slightly larger spacer to fix it.

3. Finally align the hole of the gasket with the standard lens fixing screw and tighten with a Phillips screwdriver. Install the filter in turn using the above method, and you can successfully install the filter on the filter tray.



Step 2 Close the top cover: Snap the upper case at the alignment position and secure the eight holes on the edge of the filter wheel with eight flat-head screws. The filter wheel is installed.



Step 3 Install the camera



1. Fix the camera and filter wheel with M4\*70mm and M4\*35mm hand screws. For symmetry and beauty, place two M4\*70mm thumbscrews under the camera and an M4\*3.5cm thumb screw on top of the camera. The state of the screw is as shown in the figure below.
2. Insert the front end of the camera into the adapter ring and screw the thumb screw into the position shown above to ensure that the camera is secured by tightening.



#### Step 4 Install the telescope

The other side of the filter wheel can be connected to the telescope by screwing on a standard M42 (M) to 2 inch ring.

#### Step 5 Power connection

Connect the camera with the special crystal head external trigger control line connected to QHY9. Insert the filter wheel interface into the crystal head. The golden interface is connected to the body. Because the control line is connected to the QHY9 camera to control the filter wheel, it needs external connection. The 12V power supply provides the working power of the filter wheel, so the other connector is connected to the power supply.

Finally, use software for verification. During the normal rotation of the filter wheel, the multi-color lamp will continue to be bright. When the filter wheel turntable stops, the multi-color lamp will be extinguished; the color of each of the three color lights in each filter hole position will be different (each filter) The hole position corresponds to one color). The specific control method is shown in the third part.

Note 1: Another connection method for the new version of QHY9

The new version of the QHY9 has six threaded holes in the top cover, so you can also choose to connect directly to the holes in the filter theory (you can of course continue to use the old method).

If you want to connect with the new method, step one will not need to install the filter wheel special ring, but use four screws to fix the filter theory on the QHY9 from the inside of the filter wheel. A black sponge gasket is required between the QHY9 and the filter theory to ensure no light leakage.

## Control instructions for the third generation filter wheel in EZCAP-QT:

First we have to make sure we have to have EZCAP software, filter wheel drive, camera drive. These can be downloaded to the latest version on our official website.

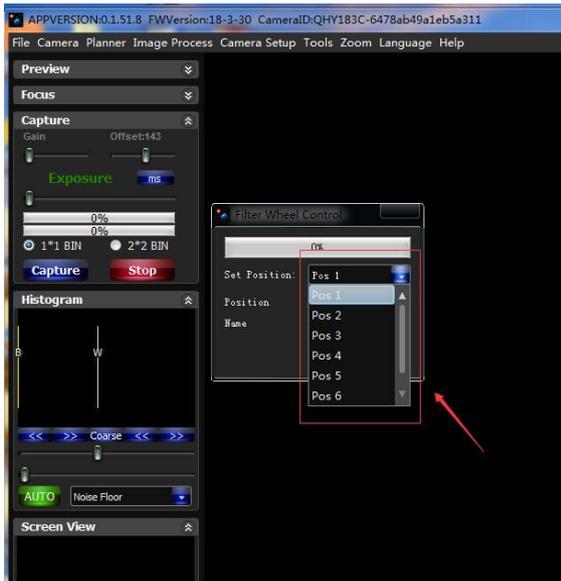
Then, connect the filter wheel and camera with 4pin wires in sequence (except for the special trigger cable except QHY9), connect the camera and computer with USB cable, and also need to connect a 12V power supply to power the camera. After the correct connection, the second generation filter wheel will automatically rotate two turns and then rest.

Open EACAP and click Camera to select the corresponding camera.

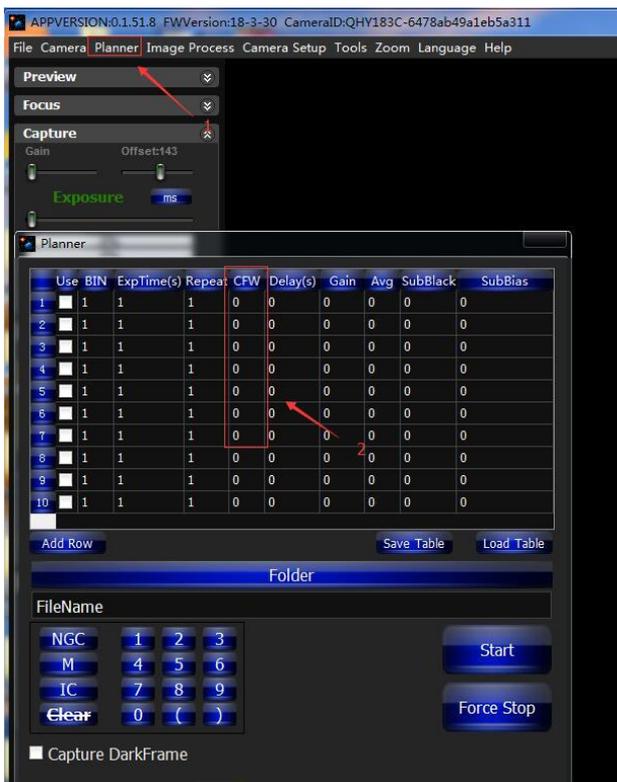
Then click on the Color wheel under Camera Setup. For the first time, you need to set the number of filter wheel holes in the Setup.

As shown below:





The EZCAP software has a shooting plan function, and setting the corresponding filter wheel hole position in the shooting plan will make shooting easier.



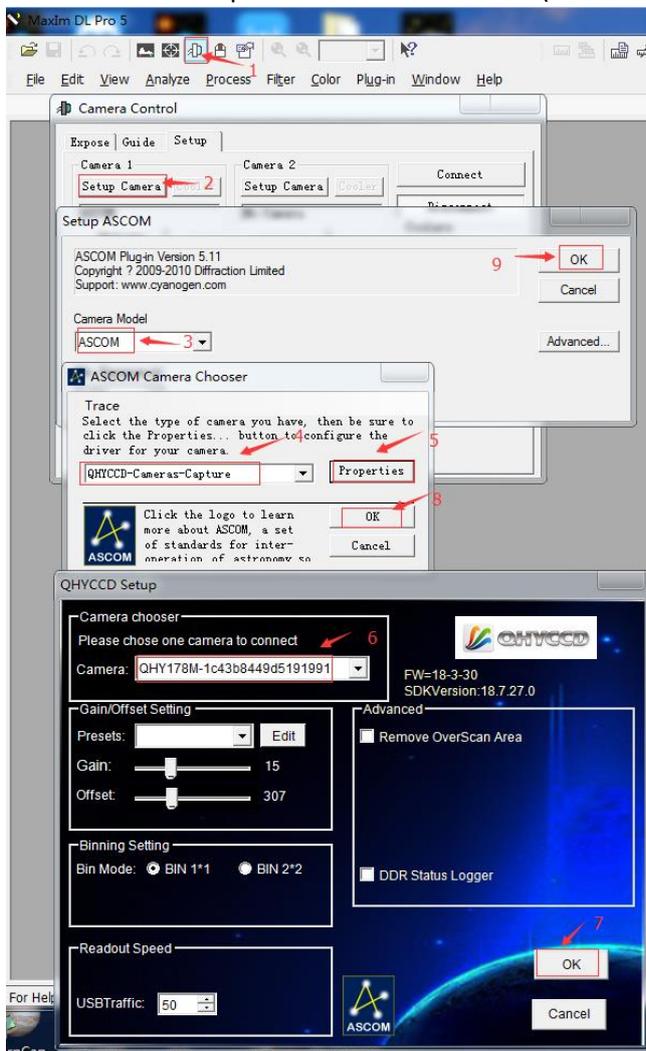
### Third-generation filter wheel with QHY camera third-party software MaxIM DL. Filter wheel control with ASCOM under MaxIm DL:

First, we also need to install the MaxIm DL, the filter wheel drive, the camera drive, the ASCOM driver for the filter wheel ([ASCOM Driver \(4PIN\)](#)) and the ASCOM driver for the camera.

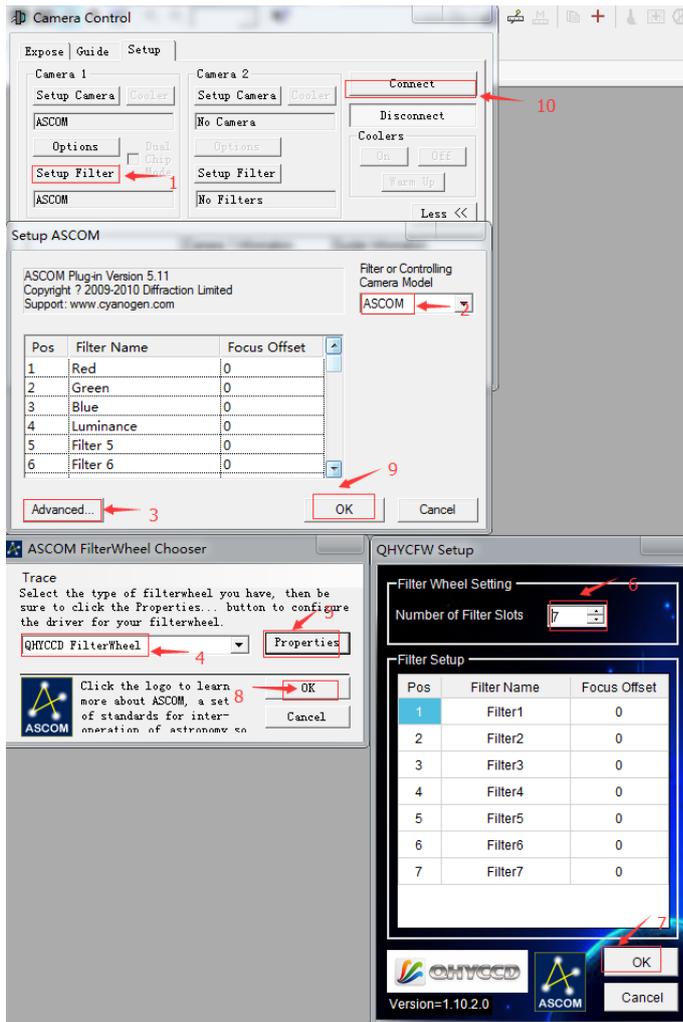
Then, connect the filter wheel and camera with 4pin wires in sequence (except for the special trigger cable except QHY9), connect the camera and computer with USB cable, and connect a 12V power supply to power the camera. After the correct connection, the third generation filter wheel will automatically rotate two turns and then rest.

Open MaxIm DL, take QHY178 as an example, click on Camera Control (the icon with a box in the picture).

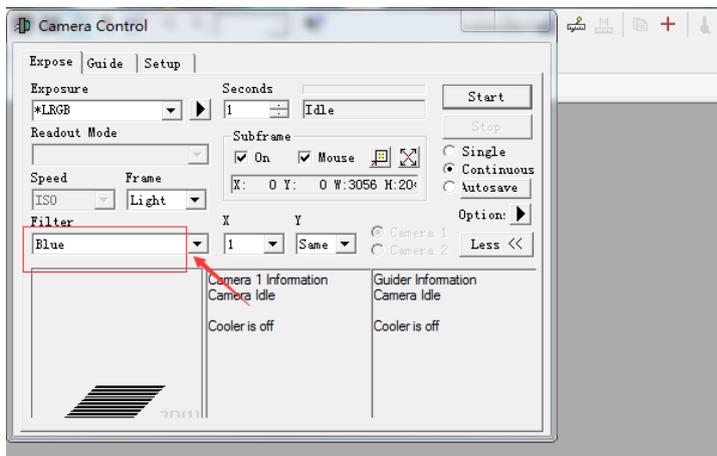
First follow the steps to connect the camera (as shown)



After connecting the camera, go back to the interface and select Setup Filter to select the filter wheel. Follow the steps (as shown).



Select the appropriate hole position to operate.



**The third generation medium filter wheel with USB cable control instructions:**

Use the USB cable to control the filter wheel

This method is implemented by ASCOM, which requires only a USB cable to control the filter wheel without connecting the camera. First, we need to switch the control port button (shown by the red arrow in the figure below) to implement USB port control. (Observation indicator red light indicates USB control mode)

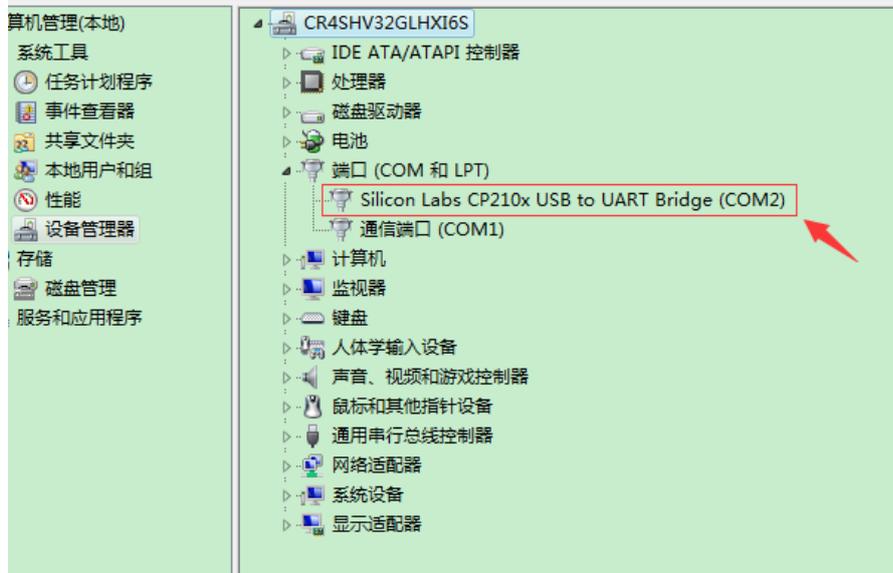


**QHYCFW3 Driver and Software**

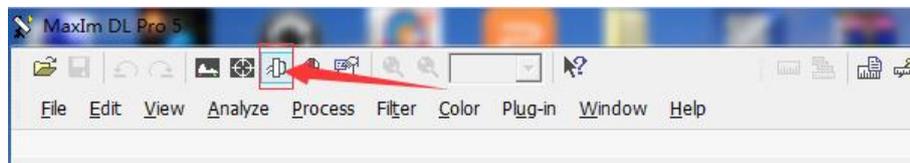
<b>ASCOM Driver (4PIN)</b> when using 4PIN socket to connect the QHYCCD camera	<a href="#">Last Version</a>
<b>ASCOM Driver (USB)</b> when using USB cable to connect the computer	1 <a href="#">Last Version</a>
<b>USB to Serial Port Converter Driver</b> when using USB cable to connect the computer, computer need this system driver.	2 <a href="#">Last Version</a>
<b>SDK for Development</b>	<a href="#">SDK Document</a>

Use the USB cable to plug into the USB port of the filter wheel and the other end to connect to the computer. First install the MaxIm DL, the ASCOM driver of the filter wheel, and also install the USB serial port driver ([1.ASCOM Drive \(USB\)](#)).

Open the device manager to check the port number (if the driver is installed on the computer, the driver to be installed will be detected automatically, otherwise the [2.CP210X](#) driver will need to be installed).



Open the MaxIm DL software and click on Camera Control. As shown

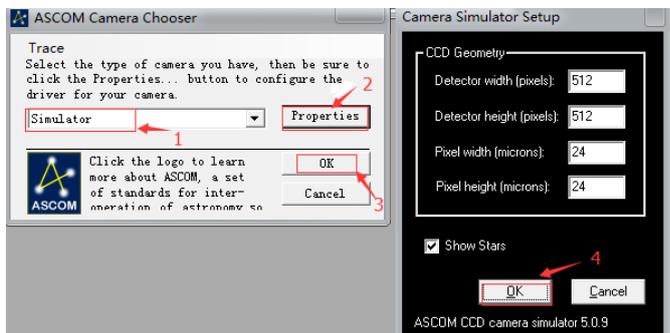
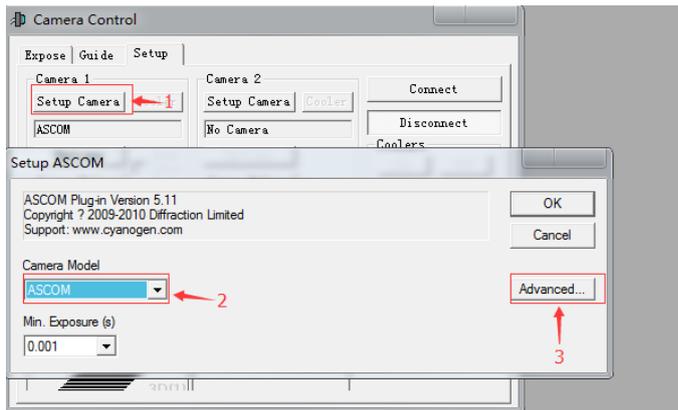


Popup page

Click on Setup and then click on the Camera model drop-down menu in the Setup Camera to select the ASCOM option.

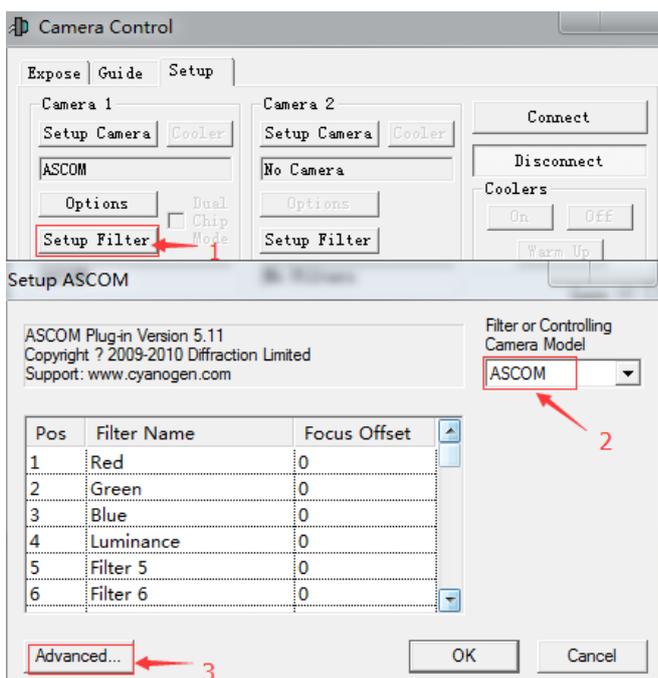
Then, click the Advanced button on the right to bring up a new window for ASCOM Camera Chooser, and then select a virtual camera model from the drop-down menu. This will ensure that the software runs in an orderly manner.

As shown below:



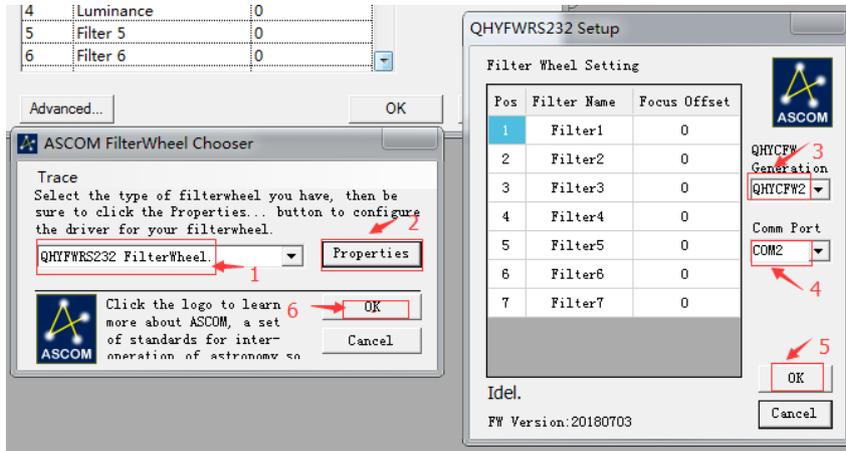
After confirming the error, click the ok button continuously. Go back to the Camera Control page.

Click the Setup Filter button below the Camera Control page to bring up  
 First click on the drop-down menu of Filter or controlling camera model in the upper right corner to select ASCOM. Click on Advanced in the lower left corner. A new ASCOM Filterwheel Chooser window pops up. Select the connected filter wheel in the strip box.



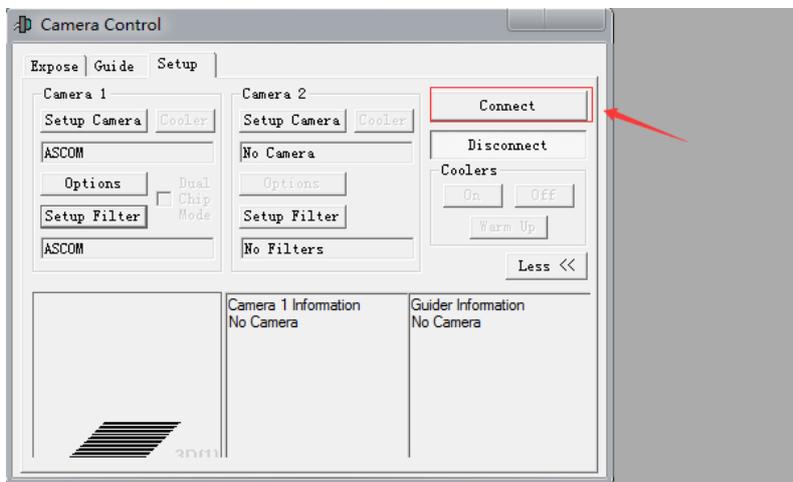
A new ASCOM Filterwheel Chooser window pops up. Select the connected filter wheel in the strip box.

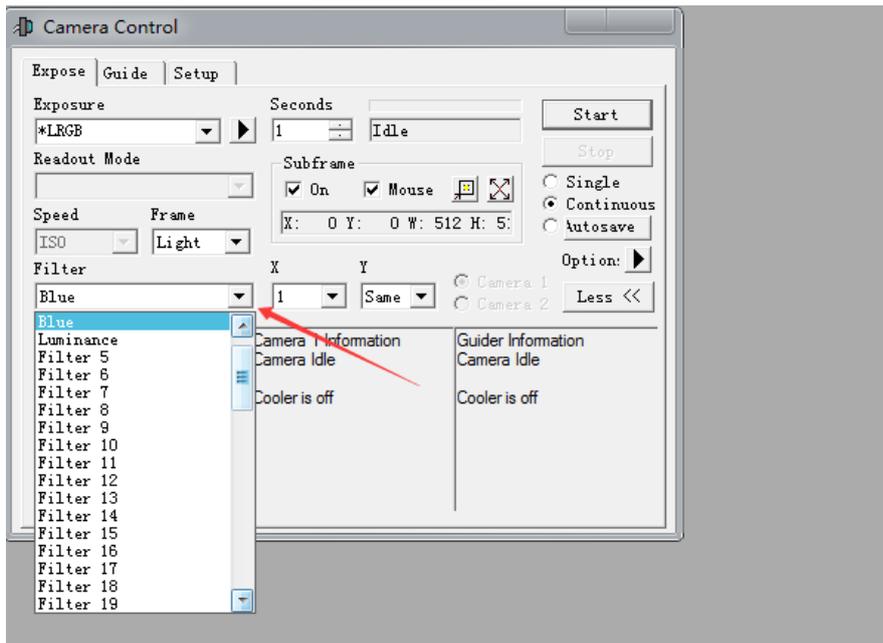
Click on Properties to determine the filter wheel properties. Make sure to select the port that matches the previous download driver, click ok to return to the Camera Control page.



After returning to the Camera Control page, click the connect link in the top right corner.

Finally, switch to the Expose page, click the Filter button in the lower left corner, select the options in the drop-down menu, select the option, the filter wheel rotates, and the operation is successful.。





### Third generation filter disk replacement method:

Since the third-generation medium filter wheel is divided into five-hole two-inch and seven-hole 36-mm filter discs, how to realize the replacement of two discs, let us share the precautions and methods.

Take the seven-hole filter wheel as a five-hole filter disc as an example. It should be noted that in addition to the replacement of the disc, it is also necessary to replace the 2-inch adapter and the camera connection ring. Because the 5-hole filter disk uses a 2-inch filter, the caliber is relatively large. The 7-hole filter disk uses a 36mm filter, and the aperture is relatively small. Therefore, the 2-inch ring corresponding to the 7-hole filter and the inner diameter of the camera connecting ring are also smaller, which helps to prevent light from passing through other holes.

First of all, in addition to a five-hole and two-inch filter disc, we also need a 42-turn 2 inch camera adapter with an inner diameter of 45mm (40mm for 7-hole adapter) and a chassis inner diameter of 47mm. M54 to 2 inch extension ring. (The inner diameter of the 7-hole extension ring is 42 mm).



Note: The A series and the medium-cooling COMS series do not need to be connected to the camera with an adapter ring. There is no need to change the adapter ring when replacing.

First step We need to unscrew the 7 screws to open the top cover of the filter wheel.



Step 2 Unscrew the upper screw in the middle of the filter disc, loosen the screw of the optocoupler plate, and remove the filter disc.



Step 3 Unscrew the 6 screws on the bottom of the filter wheel and remove the original adapter ring.



Step 4 Align the new adapter ring with the 6 holes at the bottom of the filter wheel and tighten with screws. (Medium refrigeration COMS series does not need to add adapter ring)



Step 5 Place the five-hole filter disc in the filter wheel, corresponding to the three holes in the middle, and tighten the screws.



Chapter 6 Close the upper cover and tighten the screws. The five-hole filter disc is replaced. Finally, screw the M54Z to 2 inch extension ring with a 47mm inner diameter.

For the same reason, the five-hole for seven-hole discs, only need to change the corresponding disc, extension ring and adapter (medium refrigeration COMS series does not need to add adapter ring)

### Third generation filter wheel firmware update step:

QHYCFW3 firmware update step

1. Using tools / tools

2. Download the latest firmware [QHYCFW3](#)

3. Set to USB debug mode, click the filter wheel control port switch button (see status indicator turns red) to install [USB serial port driver](#)

4. Open [arduloder.exe](#), select hex path, serial port, board type, you can burn.

