- Introduction

QHYCFW3 filter wheels utilize a new motor with direct drive and will reverse direction to take the shortest path when moving from one filter to another. For Example, in this demonstration the wheel moves from filter position 1 to position 2 to position 3 and then back to 1 again, over to position 7 and back to position 1 without ever making a complete rotation of the carousel. This saves time if you're doing a lot of filter changes in one imaging session.

LED changes color for each filter position. The tricolor LED assigns one unique color or combination of colors to each filter position so you can tell if it's moved to the correct position without removing it from the Telescope.

The CFW3 is also thin. This feature and the short back focus of the COLDMOS cameras means you can add one of several camera lens adapters for Canon and Nikon camera lenses for wide field imaging with the filter wheel.

In the center of the back plate is a 12-volt DC power port. This port is threaded for a short extension cable that is supplied with the camera that securely attaches such that it will not accidentally disconnect while you are imaging.

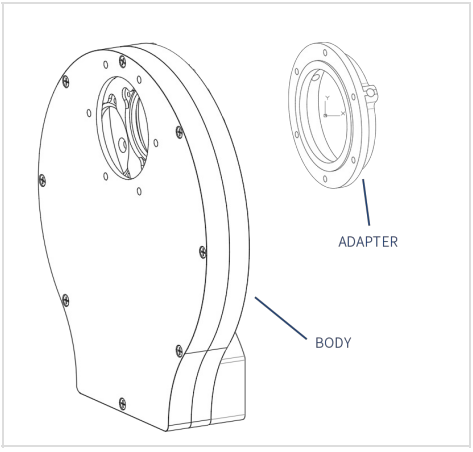
- Specifications

Filter Wheel	Filter Supported	Recommended Gears	Back Focus Consumed*	Weight	Note
CFW3S-SR CFW3S-US	7*1.25-inch mounted/31mm unmounted	QHY533M, QHY183M QHY5III Mono Planetary Cams (CFW1.25"Adapter needed	20mm (SR)+4mm (Adapter 15.5mm (SR)+4mm (Adapter	About 430g	There's no difference between S-SR and S-US expect their depth, but S-SR can be compatible with thicker 1.25" mounted filters.
CFW3M-SR	5*2-inch mounted/50mm unmounted	QHY268M, QHY600M	20.5mm+2mm (Adapter	About 720g	
CFW3M-US	7*36mm unmounted	QHY163M, QHY294M, QHY268M	17mm+2mm (Adapter	About 700g	
CFW3L	7*2-inch mounted/50mm unmounted	QHY600M (PH/Pro)	21.5mm	About 900g	
CFW3XL	9*2-inch mounted/50mm unmounted or 7*50mm square unmounted	QHY461PH QHY600M-PH SBFL	21.5mm	About 1500g	A special adapter needed when connecting QHY600 SBFL and CFW3XL, see https://www.qhyccd.com/qhy600sbfl-cfw3xl-adapter/

*Back Focus Consumed

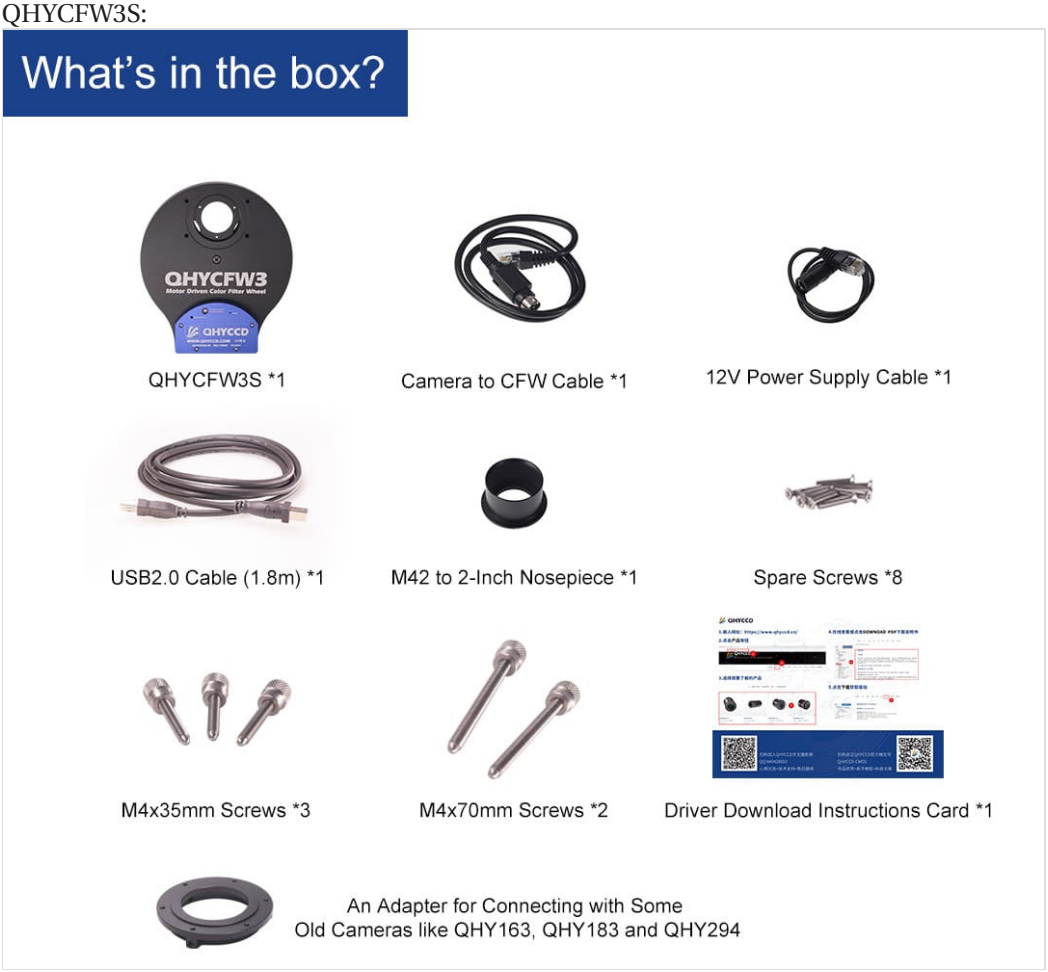
For the convenience of calculation, all the data displayed are the increase in the back focal length taken up by using the adapter, which is not necessarily equal to the thickness of the component itself. All the adapter data provided by QHYCCD are based on the focal length increment. For More information please see: https://www.qhyccd.com/astronomical-camera-adapter-bfl-solution/

The Calculation of Filter Wheel's back focus consumed includes two parts: The thickness of the filter wheel body (like the 15.5mm of CFW3S-US), and the back focus consumed (like 4mm of CFW3S-US). Now new cams don't need this adapter anymore, like QHY533M, QHY268M, QHY600M-PH SBFL, etc.



- Accessories

QHYCFW3S:



QHYCFW3M:

What's in the box?

QHYCFW3M *1

Camera to CFW Cable *1

12V Power Supply Cable *1

USB2.0 Cable(1.8m) *1

M54 to 2-Inch Nosepiece *1

Filter Masks + Screws

M4x100mm Screws *2

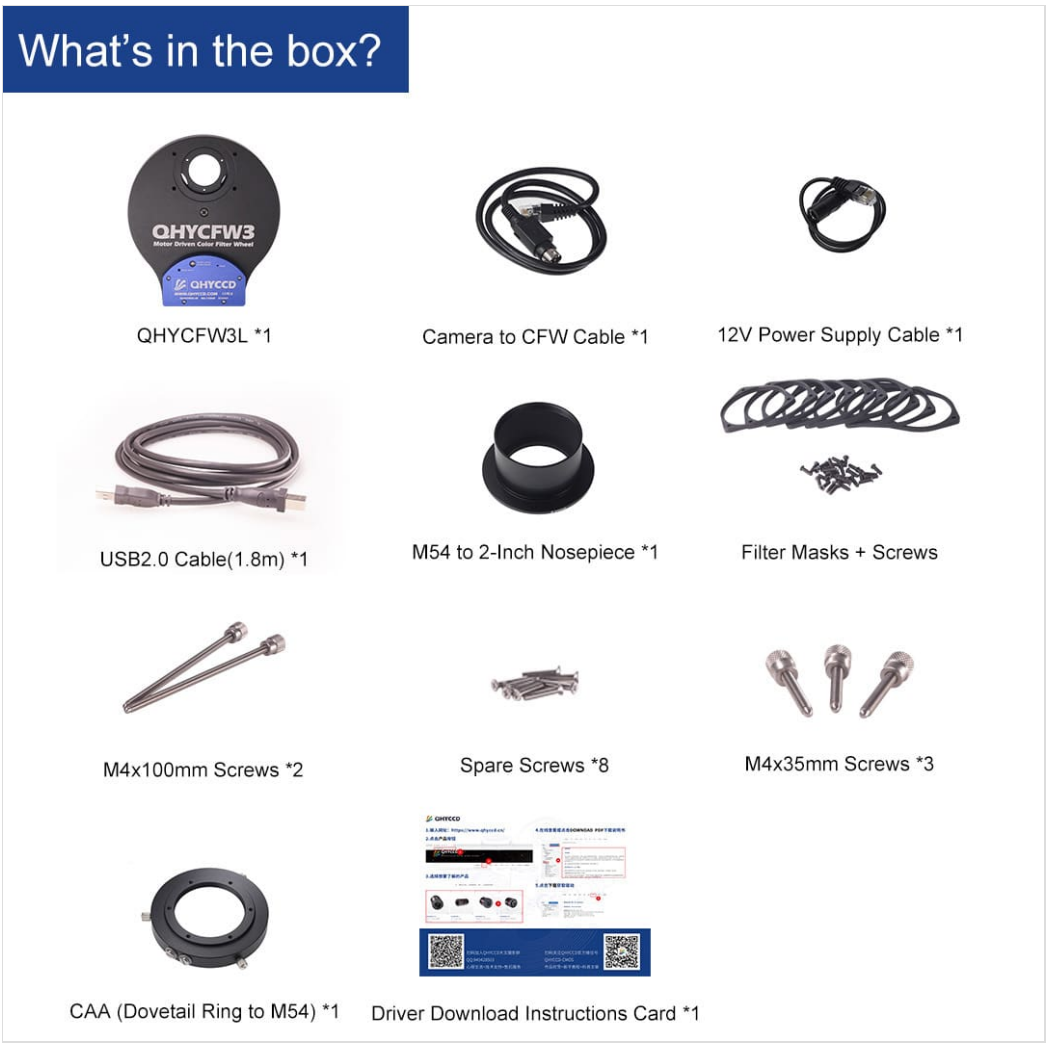
Spare Screws *8

M4x35mm Screws *3

Driver Download Instructions Card *1

An Adapter for Connecting with Some
Old Cameras like QHY163, QHY183 and QHY294

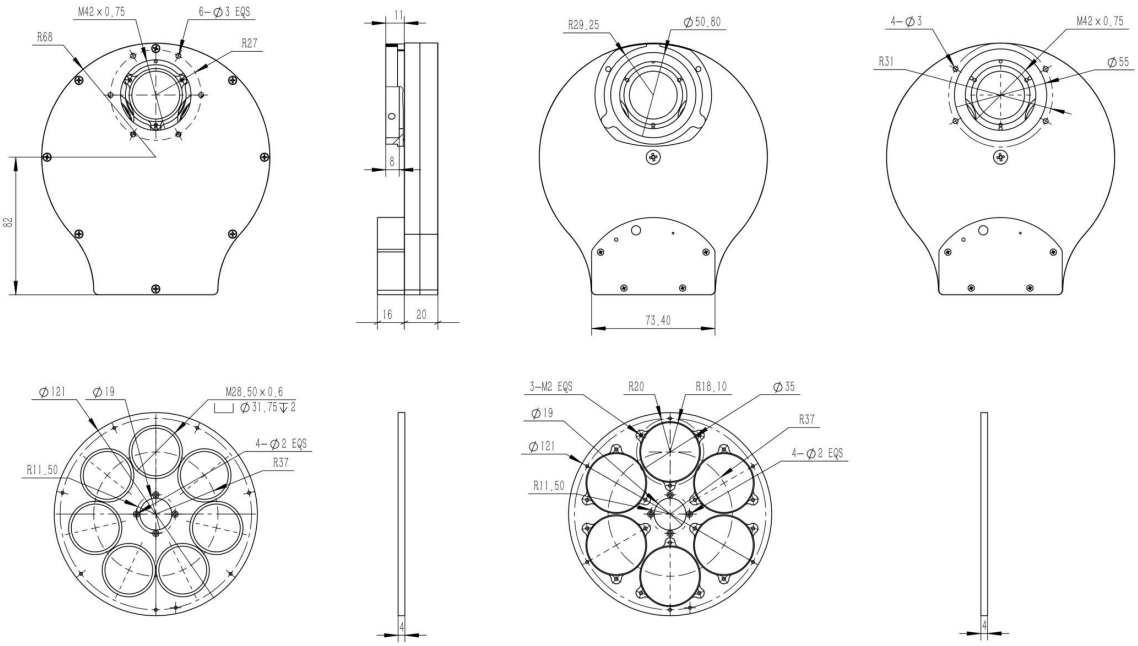
QHYCFW3L:


What's in the box?
QHYCFW3
Motor Driven Color Filter Wheel
QHYCCD
QHYCFW3L *1
Camera to CFW Cable *1
12V Power Supply Cable *1
USB2.0 Cable(1.8m) *1
M54 to 2-Inch Nosepiece *1
Filter Masks + Screws
M4x100mm Screws *2
Spare Screws *8
M4x35mm Screws *3
CAA (Dovetail Ring to M54) *1
Driver Download Instructions Card *1

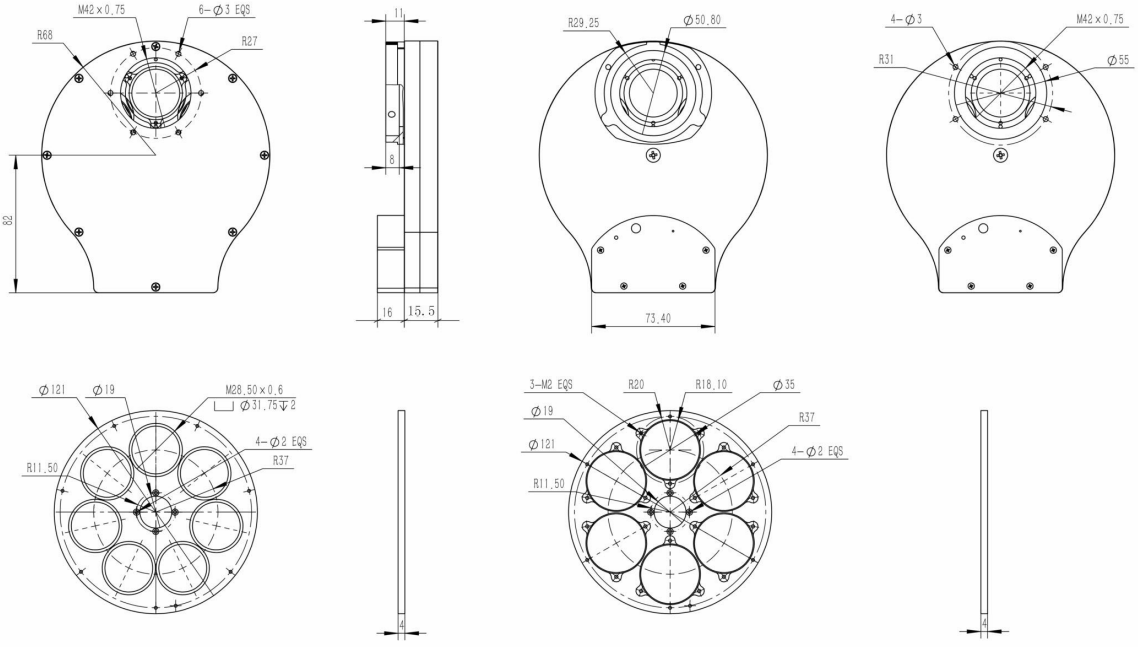
QHYCFW3XL:

- Mechanical Dimensions

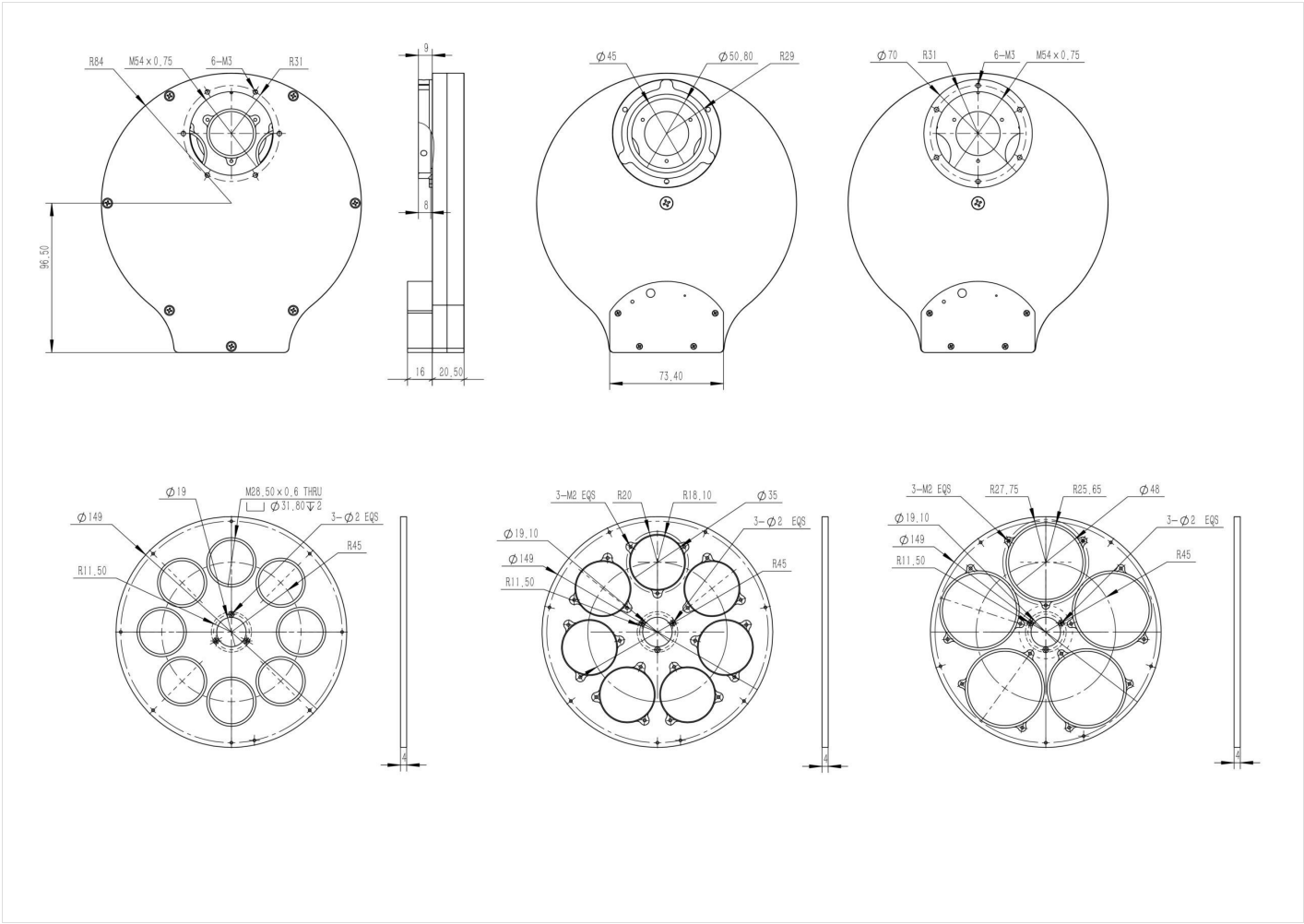
QHYCFW3-S-SR


M42×0.75
6−∅3 EQS
R68
R27
82
11
8
16
20
R29.25
∅50.80
73.40
4−∅3
M42×0.75
R31
∅55
∅121
∅19
M28.50×0.6
∅31.75↧2
4−∅2 EQS
R37
R11.50
4
3−M2 EQS
R20
R18.10
∅35
R37
4−∅2 EQS

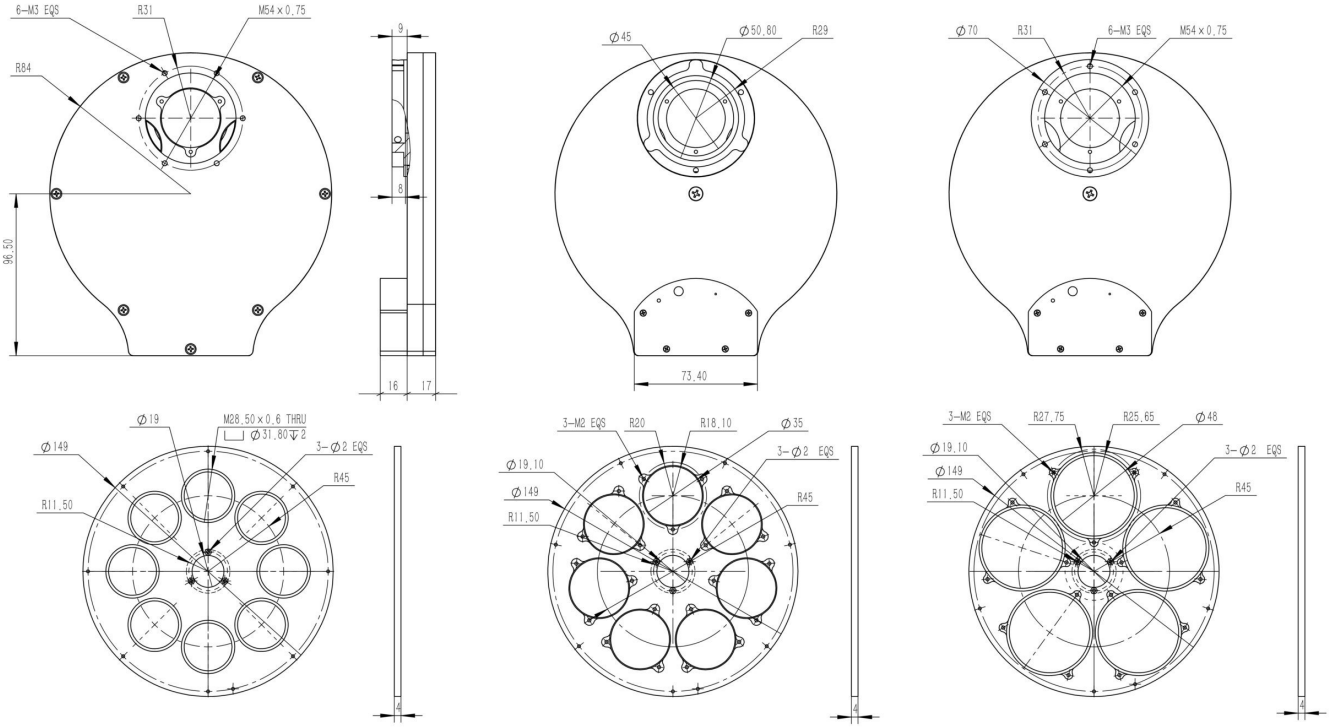
QHYCFW3-S-US


M42×0.75
6−∅3 EQS
R68
R27
82
11
8
16
15.5
R29.25
∅50.80
73.40
4−∅3
M42×0.75
R31
∅55
∅121
∅19
M28.50×0.6
∅31.75↧2
4−∅2 EQS
R37
R11.50
4
3−M2 EQS
R20
R18.10
∅35
R37
4−∅2 EQS

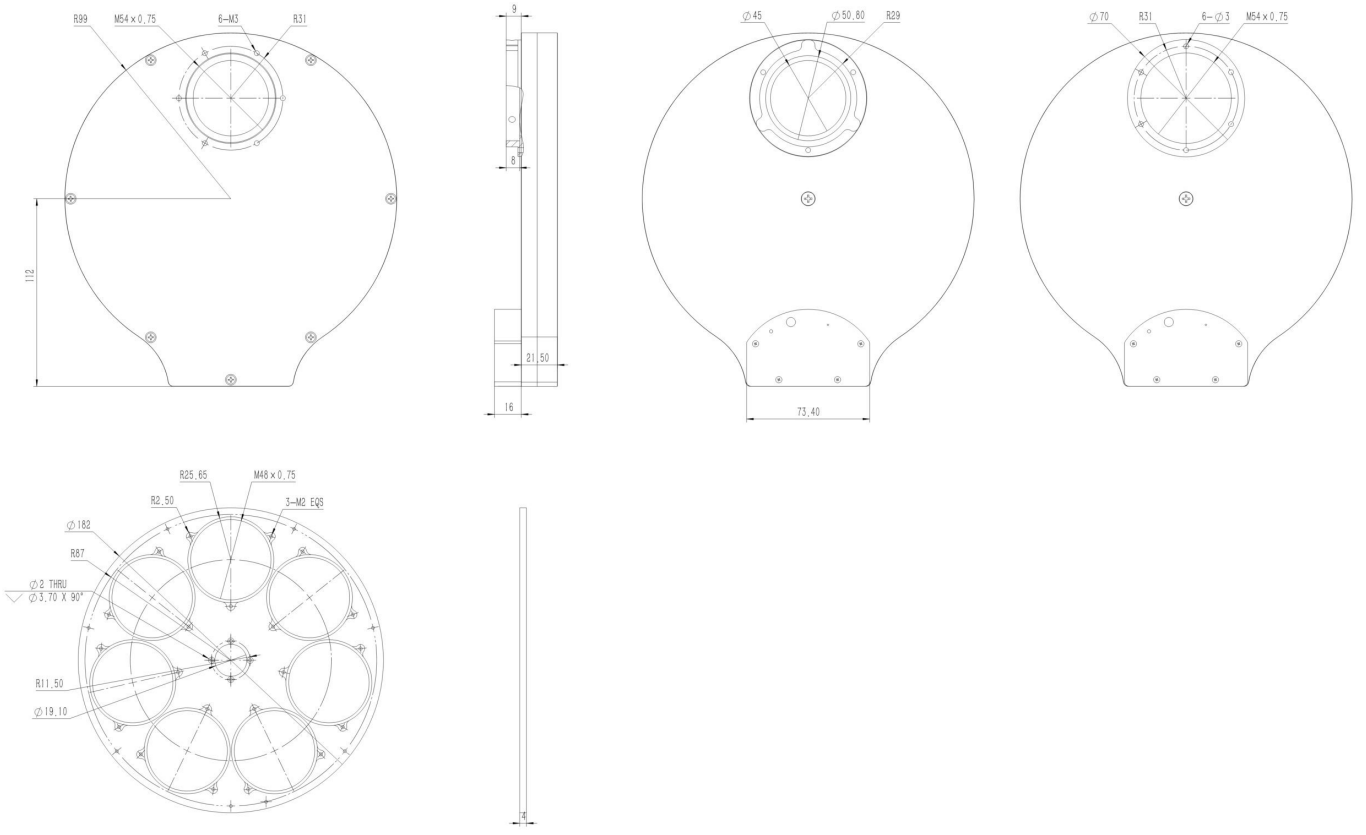
QHYCFW3-M-SR



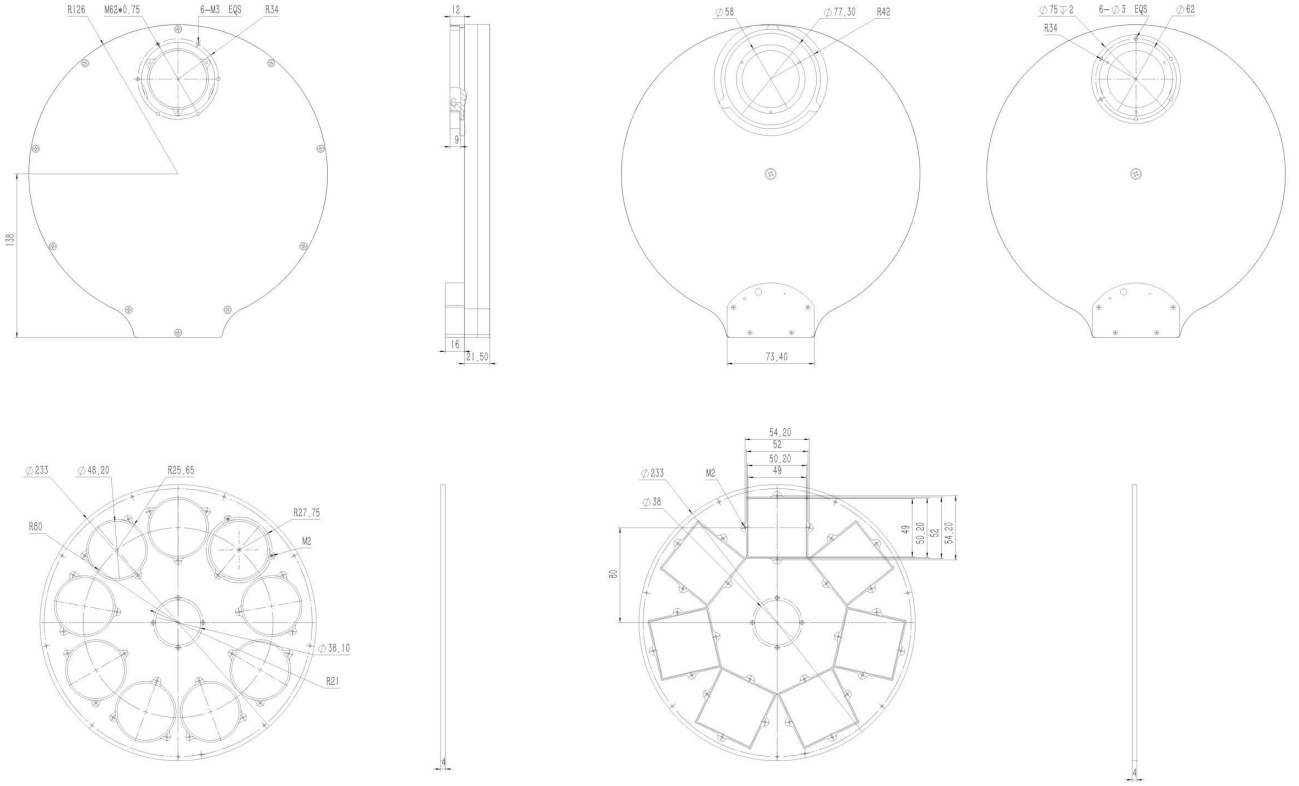
QHYCFW3-M-US


6-M3 EQS
R31
M54 x 0.75
R84
96.50
9
8
16
17
∅45
∅50.80
R29
73.40
∅70
R31
6-M3 EQS
M54 x 0.75
∅19
M28.50 x 0.6 THRU
∅31.80↧2
∅149
3-∅2 EQS
R45
R11.50
4
3-M2 EQS
R20
R18.10
∅35
3-∅2 EQS
∅19.10
∅149
R45
R11.50
4
3-M2 EQS
R27.75
R25.65
∅48
∅19.10
∅149
R11.50
3-∅2 EQS
R45
4

QHYCFW3-L


R99
M54 x 0.75
6-M3
R31
112
9
8
21.50
16
∅45
∅50.80
R29
73.40
∅70
R31
6-∅3
M54 x 0.75
R25.65
M48 x 0.75
R2.50
3-M2 EQS
∅182
R87
∅2 THRU
∅3.70 X 90°
R11.50
∅19.10
4

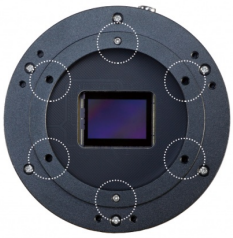
QHYCFW3-XL



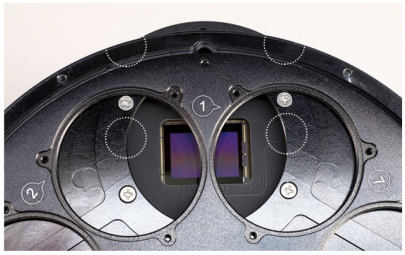
- Fix filters and match the camera

How to Connect QHY268/QHY600SBFL and QHYCFW3

1. Remove all the screws outside.

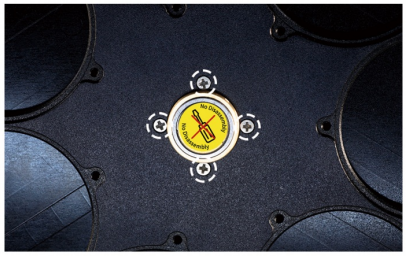


2. For QHY268 and QHY600SBFL, CFW3 needs to be connected by 4 to 6 screws (included in CFW package). A CFW adapter also needs to be removed if it's fixed on the fliter wheel .



3. We recommend you only fix these four screws when the cam is not heavy, which is firm enough and no need to remove the filter carousel.

4. Fix filters then recover the filter wheel.



NOTE: If you want to unload the filter carousel, JUST REMOVE THE FOUR SCREWS CIRCLED ONLY **(DO NOT REMOVE THE CENTER AXIS OR YOU MAY LOST WARRANTY).**

- Firmware Update 202207

Click here to update the firmware of your filter wheel. http://www.qhyccd.com/…/latestSo…/other/arduloadeFW3.zip

This firmware can keep your filter wheel rotate in one direction rather than two directions.

+ User Guide

- 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).

- Interface and accessory

1. **Control port switching button**: This button is used to set the interface mode. There is two mode: USB control mode and 4PIN conrol 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.

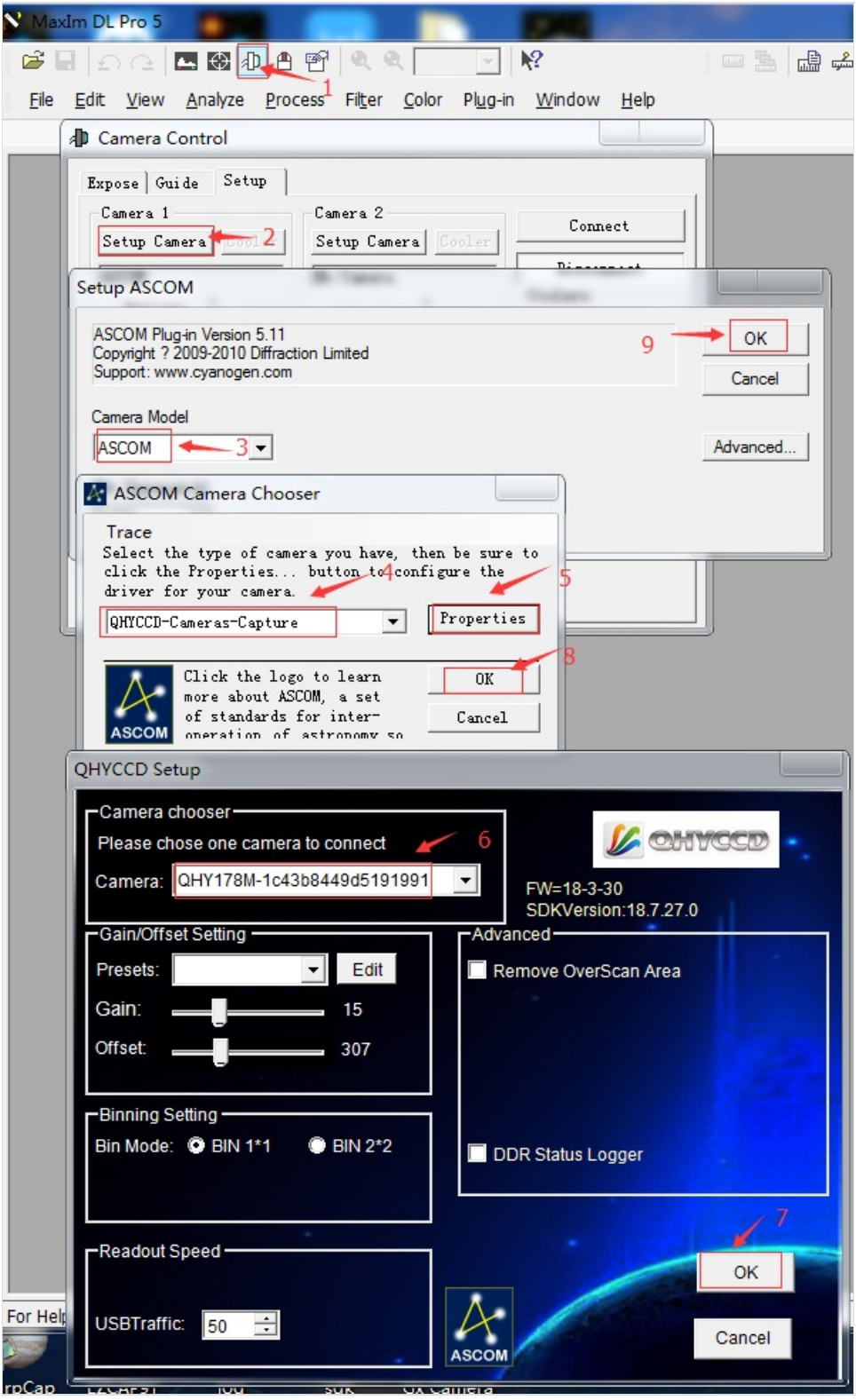
2. **Status indicator**: Each filter wheel hole position corresponds to a specific color. And this indicator will display if the CFW3 working in the USB control mode or the 4pin control mode. When power on the QHYCFW3, it will be on for one second then off. If it is red color, the QHYCFW3 is in USB control mode. If it is green, the QHYCFW3 is in 4pin mode. the indicator light is off to prevent shooting light pollution 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

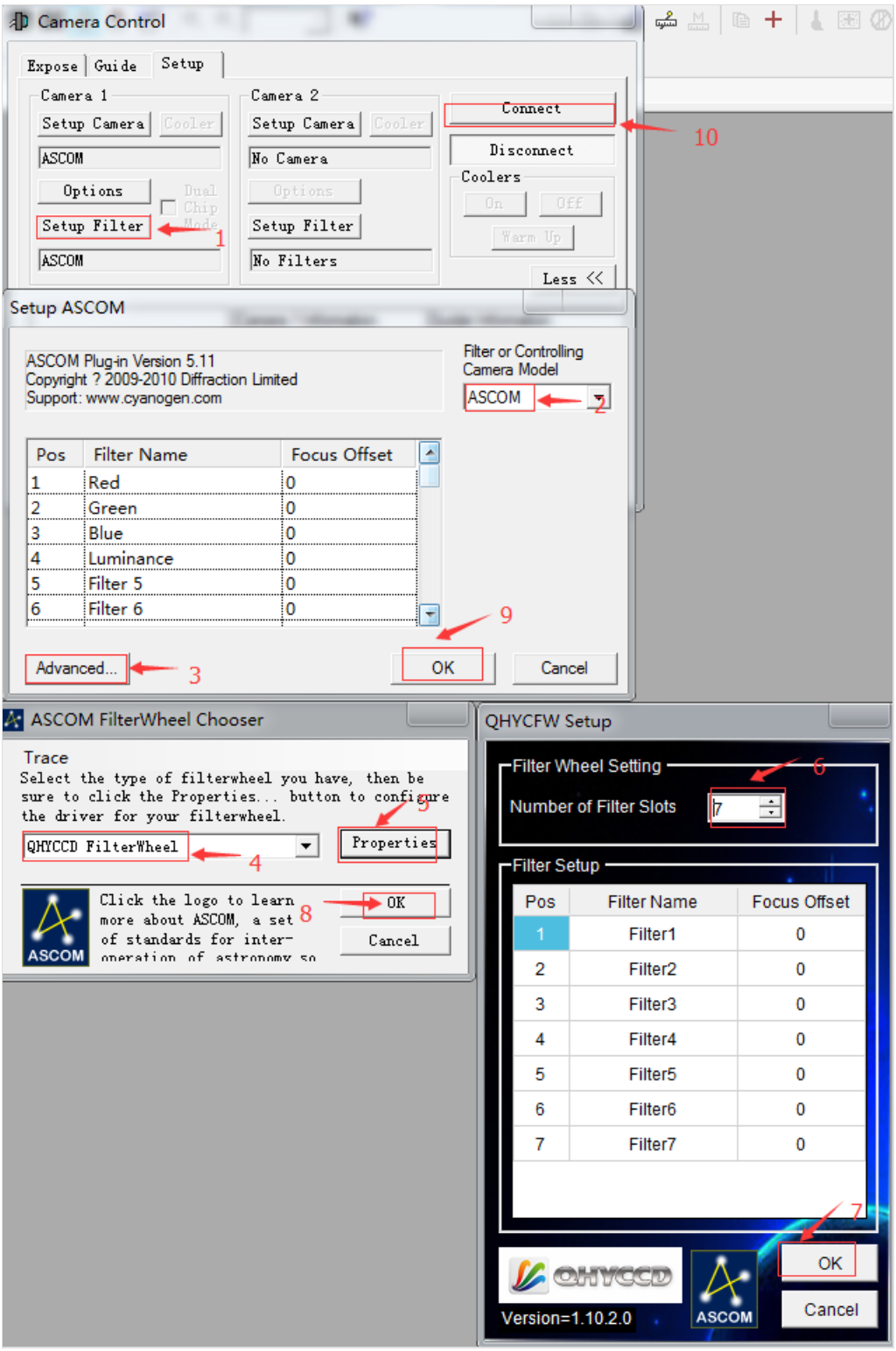
Filter wheel standard accessories
1. Filter wheel body
2. 2-inch extension tube
3. M4 metal hand screws
4. Filter fixing nails, including gasket
5. Filter wheel connected to camera control line

- Filter wheel control with ASCOM

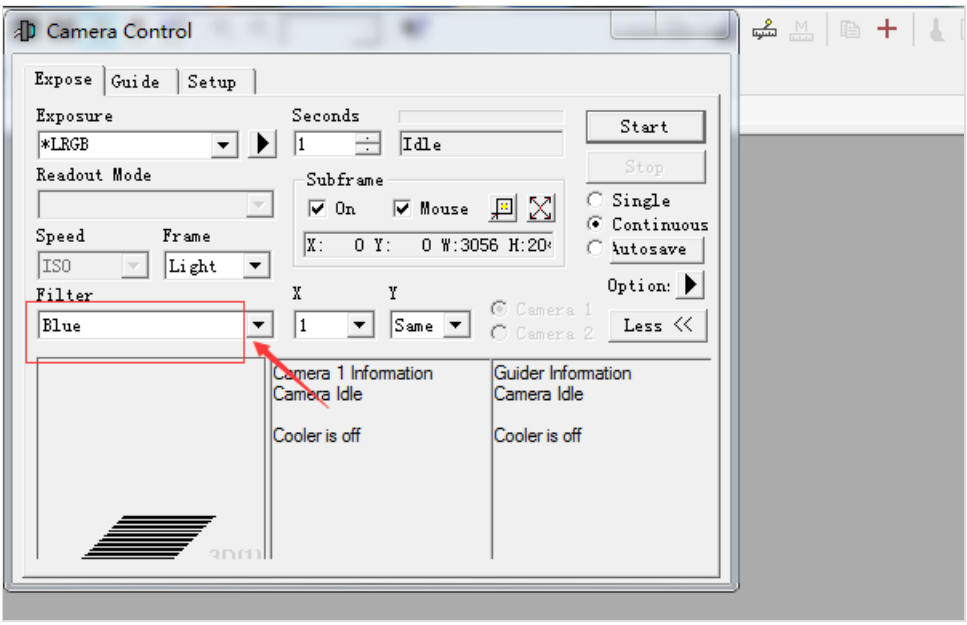
Take MDL as example. First make sure you have installed the MaxIm DL, the filter wheel driver, the camera driver, the ASCOM driver for the filter wheel [ASCOM Driver 4PIN] and the ASCOM driver for the camera.
Then, connect the filter wheel and camera with 4pin wires in sequence (except for the special 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 Contorl (the icon with a box in the picture).



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.



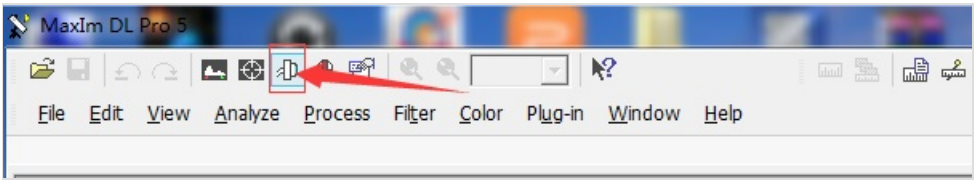
- Use USB cable to control the filter wheel

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)

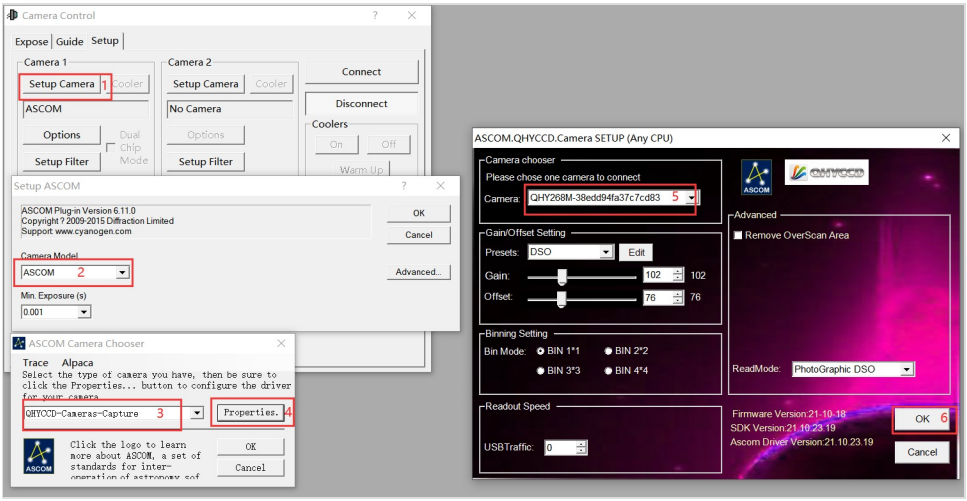
Use the USB cable to plug into the USB port of the filter wheel and the other end to connect to the computer.

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 2CP210X driver in ALL-in-one pack will need to be installed).

Open the MaxIm DL software and click on Camera Contorl. 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 Chooer, 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:

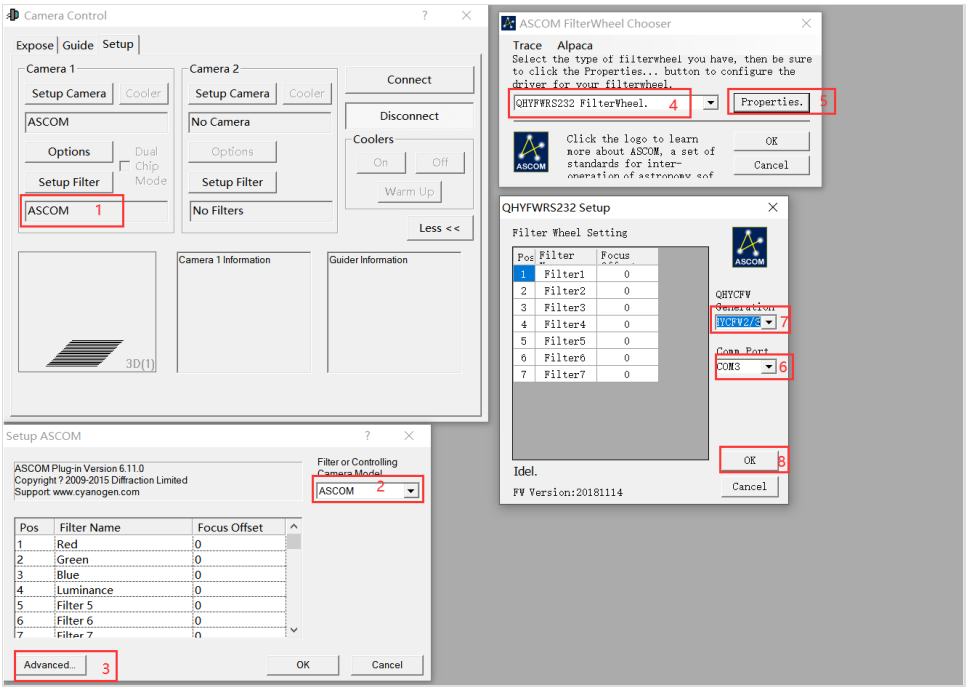


After confirming the error, click the ok button continuously. Go back to the Camera Control page.

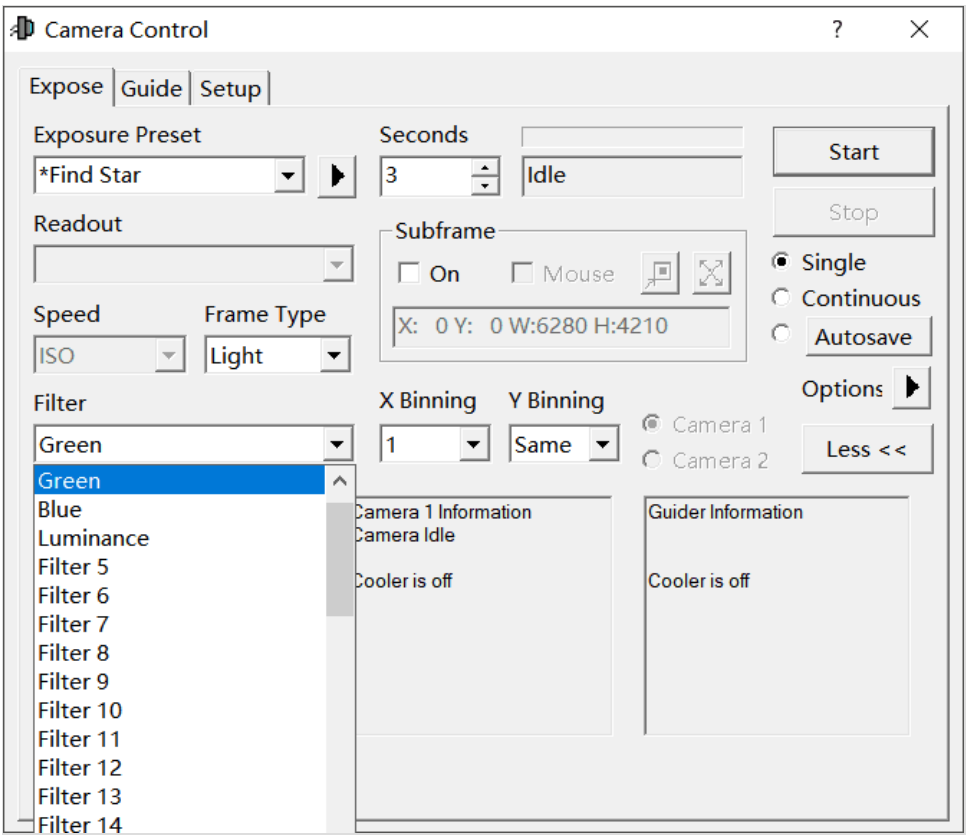
Click the Setup Filter button below the Camera Control page to bring up
First click on the drop-down menu of Filter or controlling camera model in the upper right corner to select ASCOM. Click on Advanced in the lower left corner. A new ASCOM Filterwheel Chooser window pops up. Select the connected filter

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.



- Filter wheel serial protocol

Command	CFW action	CFW return info
0(ASCII)	goto position 1	*Note 1
1(ASCII)	goto position 2	
2(ASCII)	goto position 3	
3(ASCII)	goto position 4	
4(ASCII)	goto position 5	
5(ASCII)	goto position 6	
6(ASCII)	goto position 7	
7(ASCII)	goto position 8	
8(ASCII)	goto position 9	
9(ASCII)	goto position 10	
A(ASCII)	goto position 11	
B(ASCII)	goto position 12	
C(ASCII)	goto position 13	
D(ASCII)	goto position 14	
E(ASCII)	goto position 15	
F(ASCII)	goto position 16	
VRS(ASCII)	get FW version	yyyymmdd(ASCII) eg: 20140302 *Note2
MXP(ASCII)	get the information of how many position of the current disk	(ASCII) eg: 4=5position 6=7position 9=10position F=16 position *Note3
NOW(ASCII)	get the current position that the disk is stay	(ASCII) eg: 0 (disk stay in position 1) *Note4

Note 1: When send a goto command to QHYCFW3. Motor will start goto the target position. After arrived. QHYCFW3 will send back the current position.
For example: Now QHYCFW3 is in position 1(position1=command 0) and tar(et is position 4(position4=command 3). After the color wheel arrived the target , it will send back 3(ASCII)
But if current position is 1 (position1=command 0) and you send the same position (command 0) to QHYCFW3 . Color wheel will not rotate. And in the old version (the version before 201409) the color wheel will not send back any info in this condition. In the new version . the color wheel will send the current position:
0(ASCII)
This modification is used to judge if the colorwheel has arrived the target for the host software.

VRS MXP NOW RESET