

- Overview

The QHY411/461 has both USB3.0 and 2*10GigaE interfaces. The 2*10GigaE version supports a higher readout speed.

QHY411/QHY461 have both mono and color version. The application of this camera includes astronomy imaging, astronomy photography, space object survey, satellite tracking, etc.

Benefiting from its back-illuminated pixel structure, the QHY411 has a large full well of 80ke-. And when using 2 * 2 binning, the full well can reach 320ke-, corresponding to a merged pixel size of 7.5um * 7.5um. Combined with the low readout noise, the camera has a large dynamic range advantage.

Updated: now QHY411 supports 3 * 3 binning, whose full well can be up to 720ke- with a large pixel size of 11um * 11um, which is much larger than any other CCD or CMOS sensor of the same pixel size. Please contact QHYCCD for details if any interest.

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Native 16 bit A/D: The new Sony sensor has native 16-bit A/D on-chip. The output is real 16-bits with **65536 levels**. Compared to 12-bit and 14-bit A/D, a 16-bit A/D yields higher sample resolution and the system gain will be less than 1e-/ADU with no sample error noise and very low read noise.



BSI: One benefit of the back-illuminated CMOS structure is improved full well capacity. This is particularly helpful for sensors with small pixels. In a typical front-illuminated sensor, photons from the target entering the photosensitive layer of the sensor must first pass through the metal wiring that is embedded just above the photosensitive layer. The wiring structure reflects some of the photons and reduces the efficiency of the sensor. In the back-illuminated sensor the light is allowed to enter the photosensitive surface from the reverse side. In this case the sensor's embedded wiring structure is below the photosensitive layer. As a result, more incoming photons strike the photosensitive layer and more electrons are generated and captured in the pixel well. This ratio of photon to electron production is called quantum efficiency. The higher the quantum efficiency the more efficient the sensor is at converting photons to electrons and hence the more sensitive the sensor is to capturing an image of something dim.



Zero Amplifier Glow: This is also a zero amplifier glow camera.



TRUE RAW Data: In the DSLR implementation there is a RAW image output, but typically it is not completely RAW. Some evidence of noise reduction and hot pixel removal is still visible on close inspection. This can have a negative effect on the image for astronomy such as the "star eater" effect. However, QHY Cameras offer TRUE RAW IMAGE OUTPUT and produces an image comprised of the original signal only, thereby maintaining the maximum flexibility for post-acquisition astronomical image processing programs and other scientific imaging applications.



Anti-Dew Technology: Based on almost 20-year cooled camera design experience, The QHY cooled camera has implemented the fully dew control solutions. The optic window has built-in dew heater and the chamber is protected from internal humidity condensation. An electric heating board for the chamber window can prevent the formation of dew and the sensor itself is kept dry with our silicon gel tube socket design for control of humidity within the sensor chamber.



Cooling: In addition to dual stage TE cooling, QHYCCD implements proprietary technology in hardware to control the dark current noise.

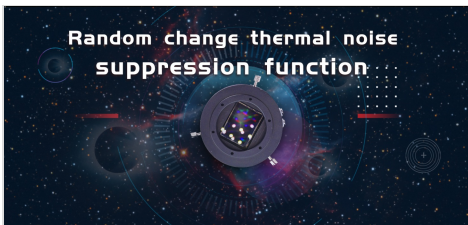
- Advanced Functions

- Reboot the camera by power off and on



The camera is designed to use the +12V to reboot the camera without disconnecting and reconnecting the USB interface. This means that you can reboot the camera simply by shutting down the +12V and then powering it back on. This feature is very handy for remote controlling the camera in an observatory. You can use a remotely controlled power supply to reboot the camera. There is no need to consider how to reconnect the USB in the case of remote control.

- Random change thermal noise suppression function

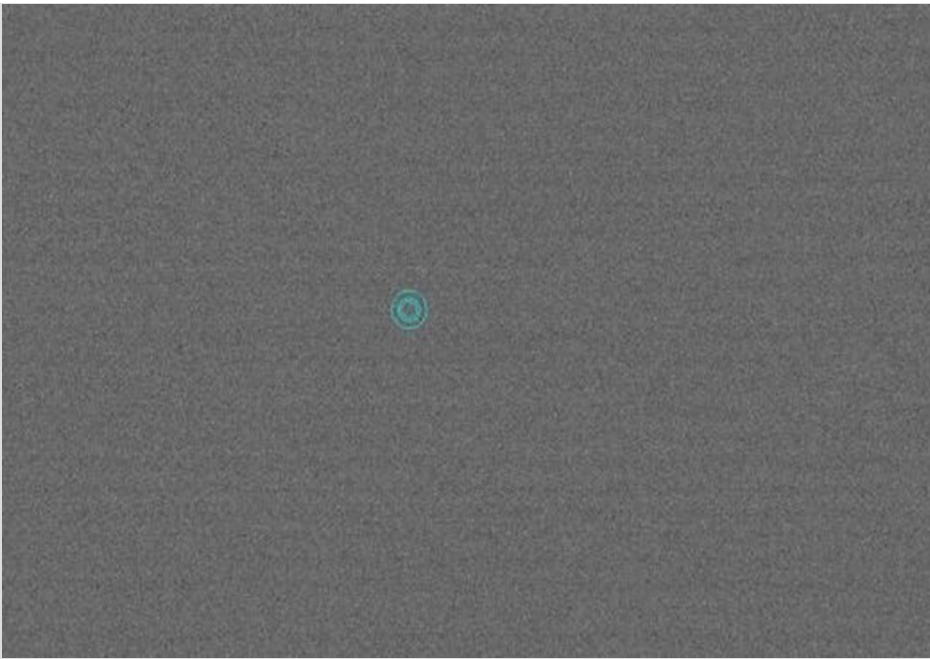


You may find some types of thermal noise can change with time in some back-illuminated CMOS cameras. This thermal noises has the characteristic of the fixed position of typical thermal noise, but the value is not related to the exposure time. Instead, each frame appears to have its own characteristics. The QHY600 / 268C uses an innovative suppression technology that can significantly reduce the apparent level of such noise.

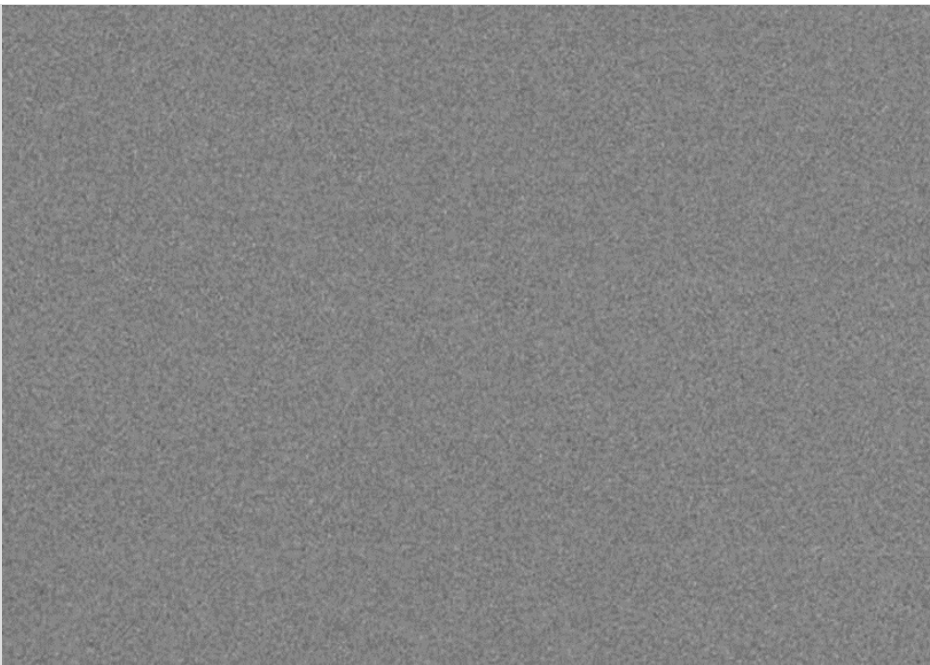
- Optimizing USB Traffic to Minimize Horizontal Banding

It is common behavior for a CMOS sensor to contain some horizontal banding. Normally, random horizontal banding can be removed with multiple frame stacking so it does not affect the final image. However, periodic horizontal banding is not removed with stacking so it may appear in the final image. By adjust the USB traffic in Single Frame mode or Live Frame mode, you can adjust the frequency of the CMOS sensor driver and it can optimize the horizontal banding appeared on the image. This optimized is very effective to remove the periodic banding in some conditions.

A typical Periodic Horizontal Noise under certain USB_TRAFFIC values.



After Adjusting the USB Traffic to avoid the periodic horizontal noise.



- Specifications

Model	QHY411	QHY461
Image Sensor	SONY IMX411 BSI CMOS Sensor	SONY IMX461 BSI CMOS Sensor
Pixel Size	3.76um x 3.76um	3.76um x 3.76um
Color / Mono Version	Both Available	Both Available
Image Resolution	14304 x 10748 (Includes the optic black area and over scan area)	11760 x 8896
Effective Pixels	151 Megapixels	102 Megapixels
Effective Image Area	54mm x 40mm	44mm x 33mm
Sensor Surface Glass	AR+AR multi-coating Clear Glass	AR+AR Multi-Coating Clear Glass

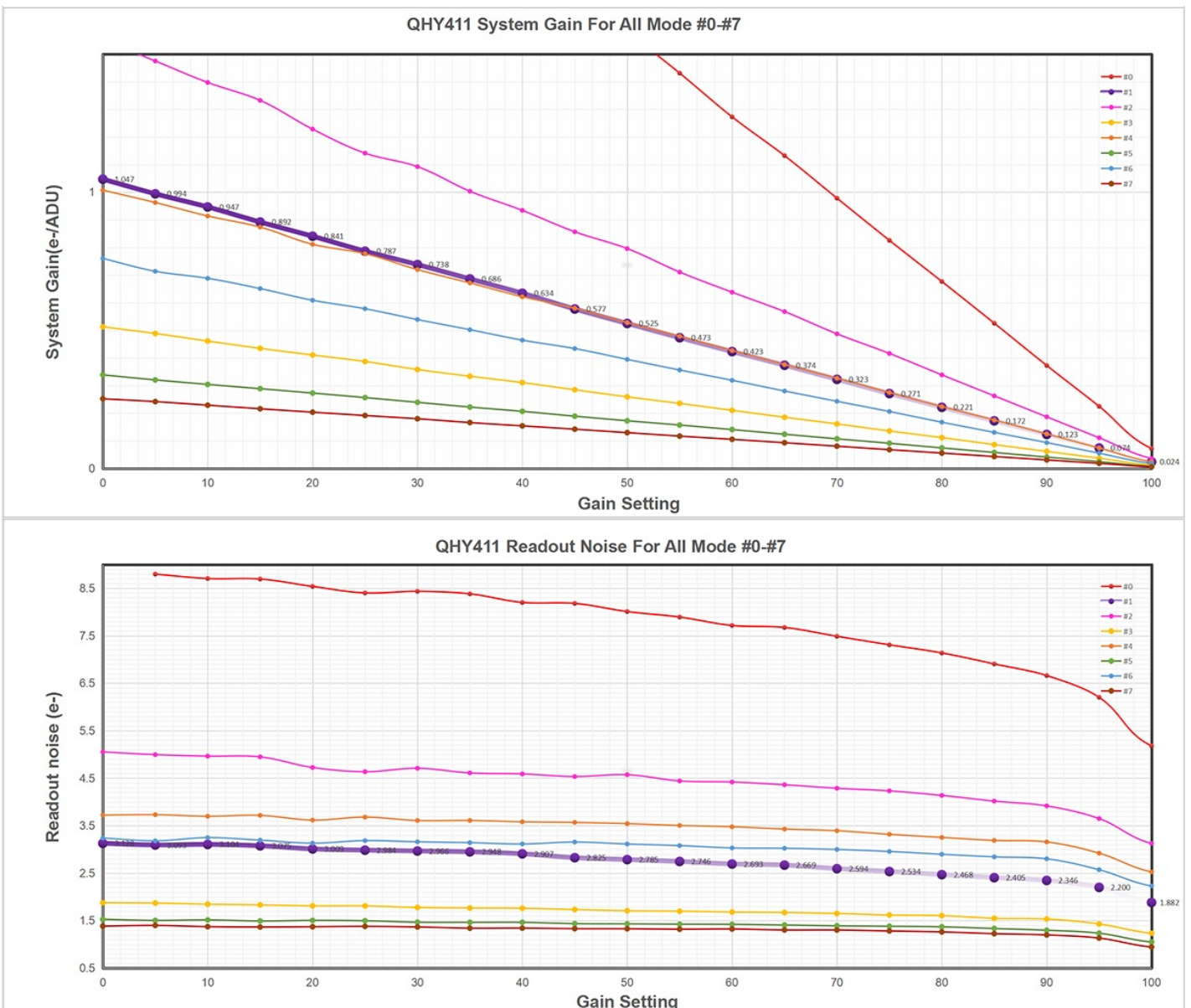
Full Well Capacity (1×1, 2×2, 3×3)	50ke- / 200ke- / 450ke- in Standard Mode 80ke- / 320ke- / 720ke- in Extend Fullwell Mode	50ke- / 200ke- / 450ke- in Standard Mode 80ke- / 320ke- / 720ke- in Extend Full Well Mode
A/D	16-bit (0-65535 greyscale)	16-bit (0-65535 greyscale) for 1X1Binning 18bit in 2X2 19BIT in 3X3 20BIT in 4*4 software Binning
Sensor Size	TYPICAL 4.2inch	TYPICAL 3.4inch
Read Noise	Apporx 1 to 3 e (in HGC Mode)	1e to 3.7e (in HGC mode)
Dark Current	Apporx 0.0011e/pixel/sec at -20C	Approx 0.003e/pixel/sec @ -20C
Exposure Time Range	20us – 3600sec	50us – 3600sec
Frame Rate	USB3.0 Port: Full Frame Resolution 2FPS @ 8BIT 1FPS @ 16BIT 5000Lines 4FPS @ 8BIT 2FPS @16BIT 3000Lines 7FPS @ 8BIT 3.3FPS @16BIT 2000Lines 10FPS@8BIT 5.5FPS @16BIT 1000Lines 20FPS@8BIT 10FPS @16BIT 500Lines 35FPS@8BIT 19FPS @ 16BITFiber Port : TBD	2.7FPS @ 8BIT 1.3FPS@16BIT on USB3.0 2.7FPS @ 16BIT 6FPS @ 14BIT on 10Gigabit Fiber
Shutter Type	Electric Rolling Shutter	Electric Rolling Shutter
Computer Interface	USB3.0 and 2*10Gigabit Fiber	USB3.0 and 2*10Gigabit Fiber
Trigger Port	Programmable TrigOut, High Speed Sync Port / GPS interface Port	Programmable TrigOut, High Speed Sync Port / GPS interface Port
Filter Wheel Interface	4PIN QHYCCD CFW Port	4PIN QHYCCD CFW Port
Built-in Image Buffer	2GByte	2GByte
FPGA Upgrade Via USB	Support	Support
Cooling System	Dual Stage TEC cooler -35C below ambient with air cooling, -45C below ambient with ambient temperature water cooling). More deltaT below ambient can be achieve by using the cooled water cooling. Test temperature +20° Fan Cooling/Water Cooling Compatible	Dual Stage TEC cooler -35C below ambient with air cooling, -45C below ambient with ambient temperature water cooling). More deltaT below ambient can be achieve by using the cooled water cooling. Test temperature +20° Fan Cooling/Water Cooling Compatible
Recommended flow rates for water-cooled versions	12ml/s	12ml/s

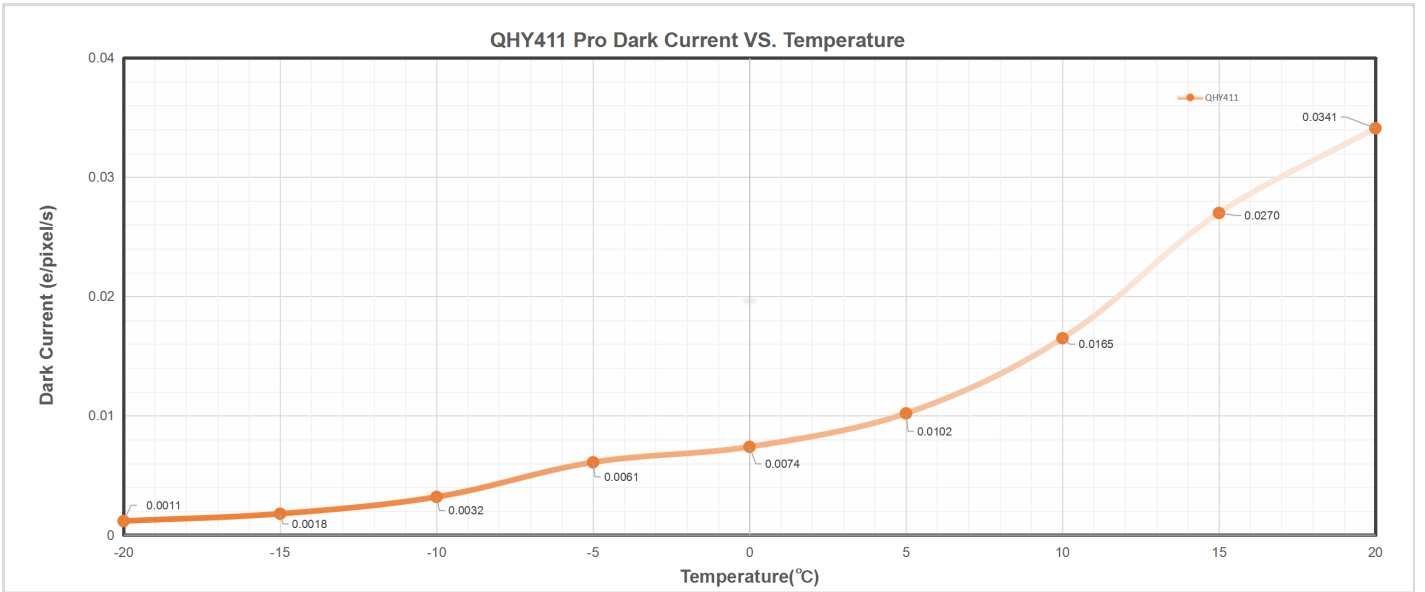
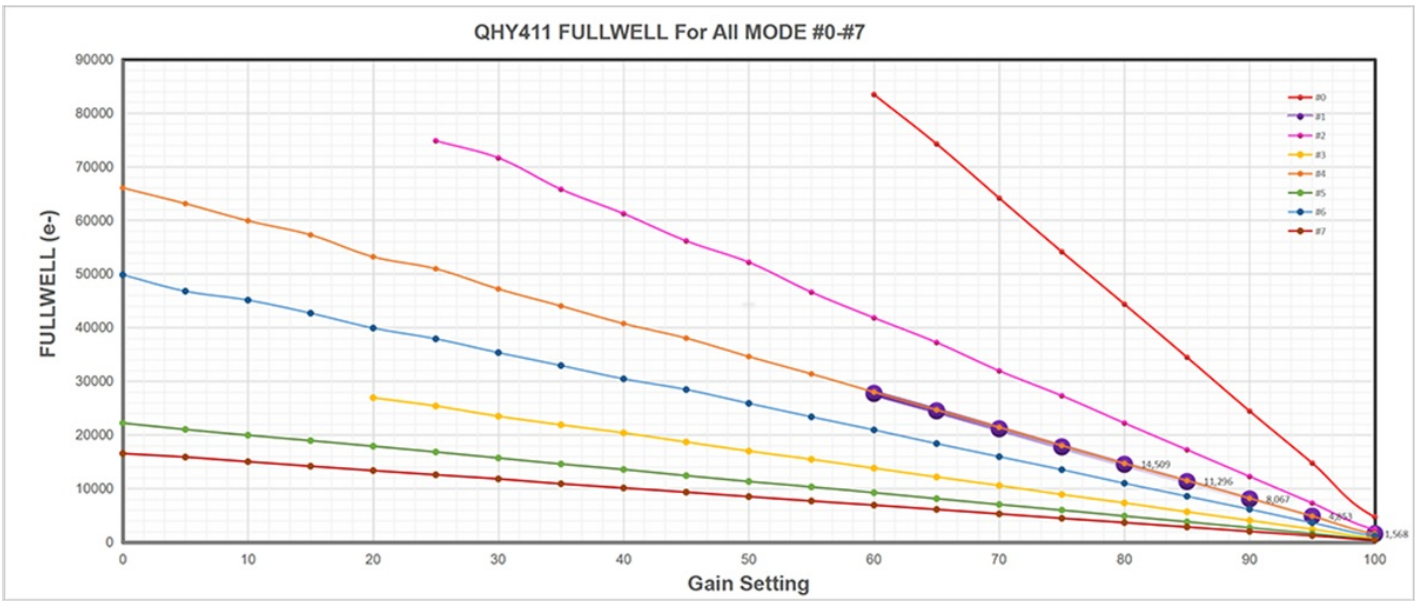
Anti-Dew Heater	Yes	Yes
Telescope Interface	Six Screw holes (See mechanical drawing)	Six Screw holes (See mechanical drawing)
Optic Window Type	AR+AR High Quality Multi-Layer Anti-Reflection Coating	AR+AR High Quality Multi-Layer Anti-Reflection Coating
Back Focal Length	16mm(without tilt adjust ring) 28.5mm (with tilt adjust ring)	16mm (without tilt adjust ring) 28.5mm (with tilt adjust ring)
Weight	TBD	TBD

- QHY411 Curves

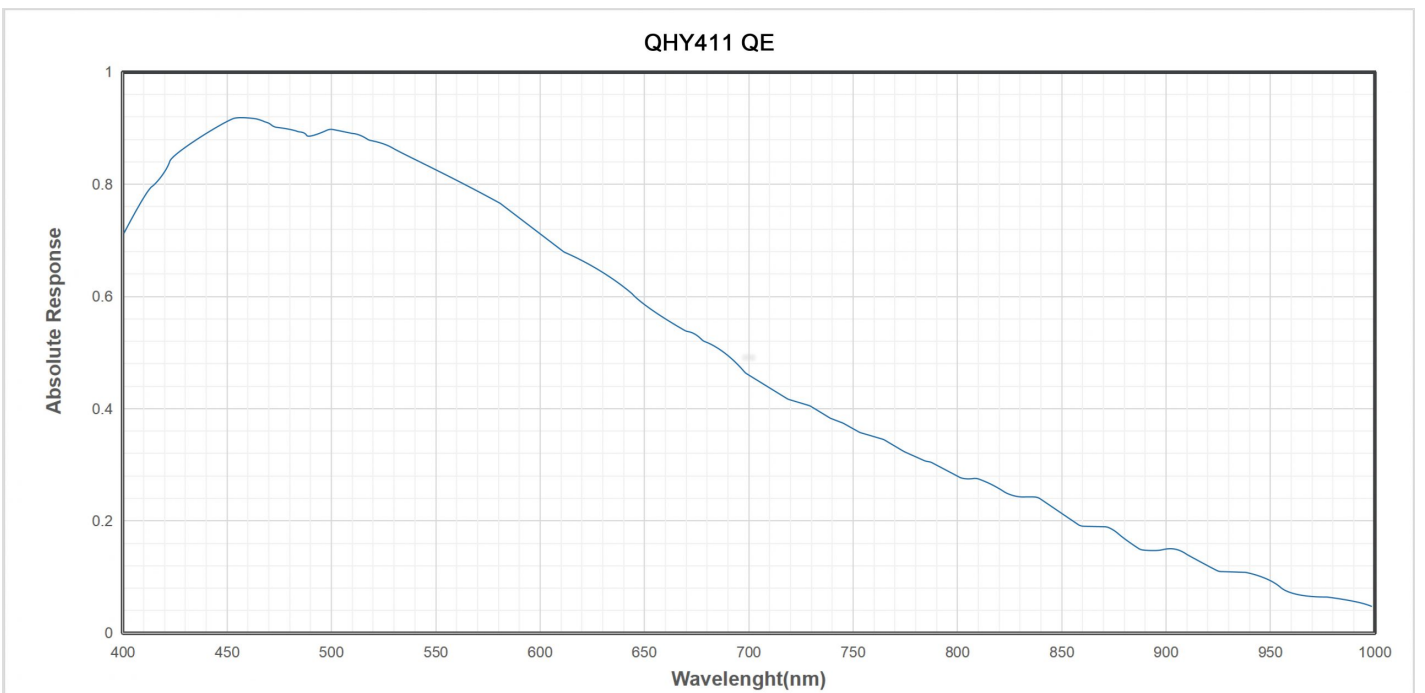
As a scientific camera, QHYCCD gives the maximum flexibility to access the setting of the camera and allow user to use all possible readout mode in the CMOS sensor. Currently there is totally 8 readout mode (In future we will active more). The eight readout modes are mode #0 to mode #7. The following graph is the system gain, readout noise and fullwell of each mode. Different mode has different behaviour in both fullwell, readout noise, and some other noise conditions. You can select the suitable mode according to the applications. You can also download the detailed measured data from this link (excel file)

[QHY411 CURVES ALLMODE - Download](#)





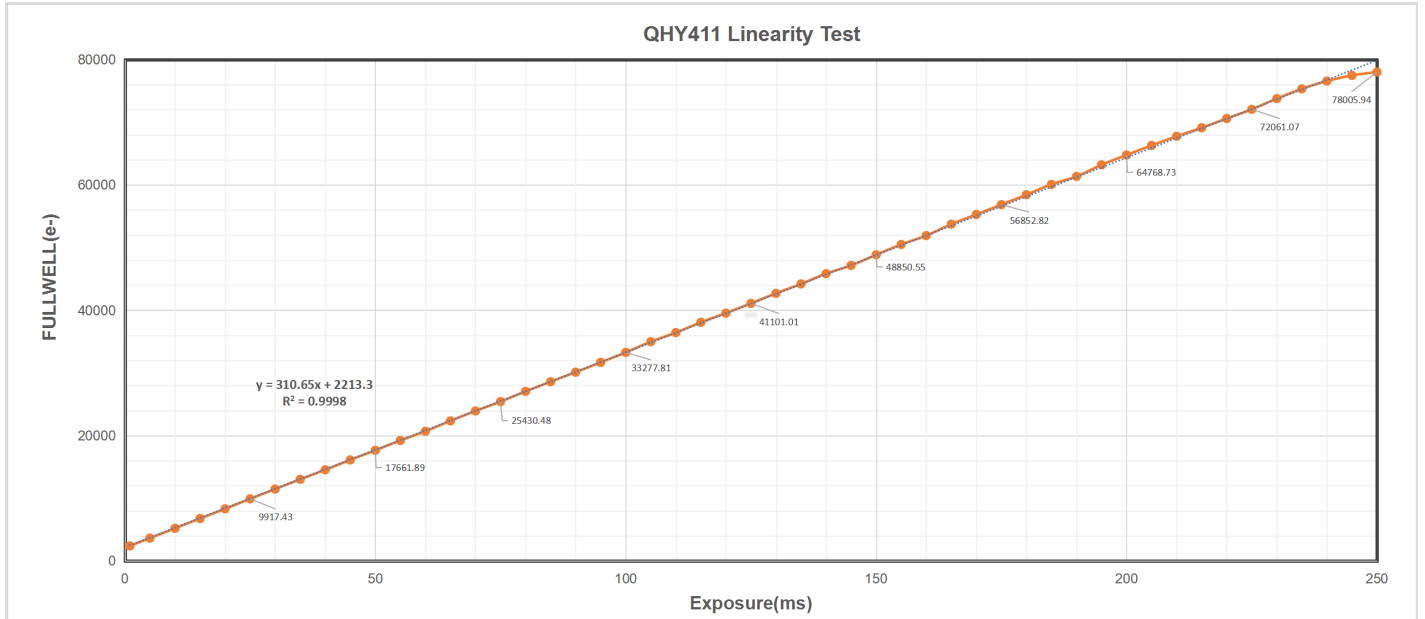
QHY411 QE. Since SONY has not release the absolutely QE curve of IMX411. There is only the relativity QE Curve. QHYCCD did some test of absolutely QE for the 3.76um BSI sensor in another model. It can be used for just a reference. This article can be found in <https://www.qhyccd.com/index.php?m=content&c=index&a=show&catid=23&id=261>



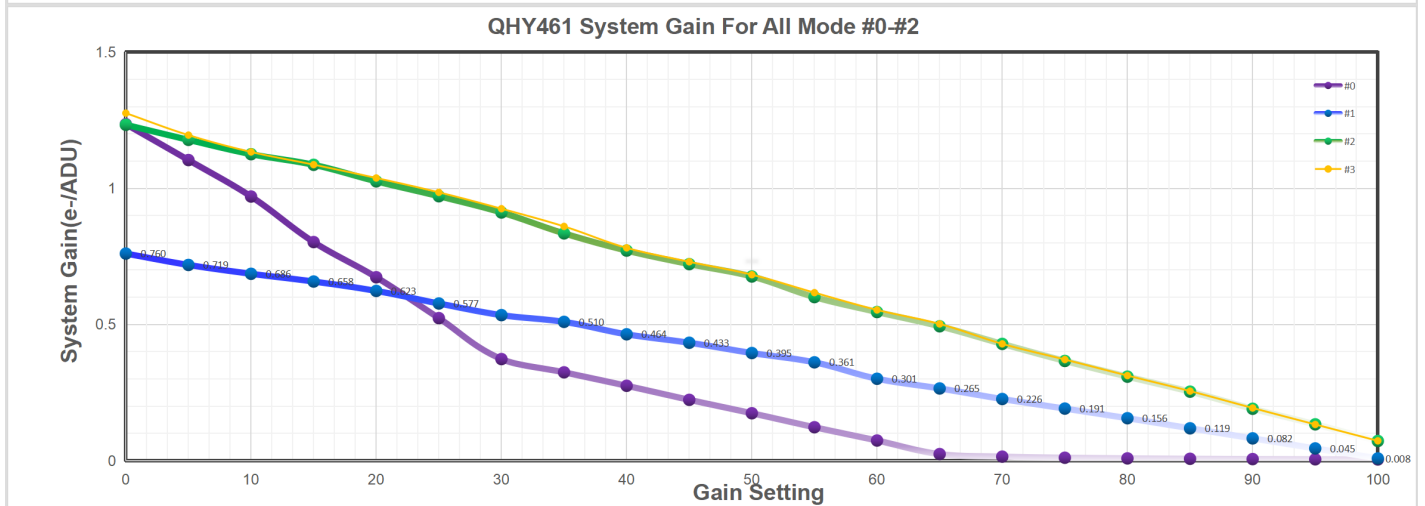
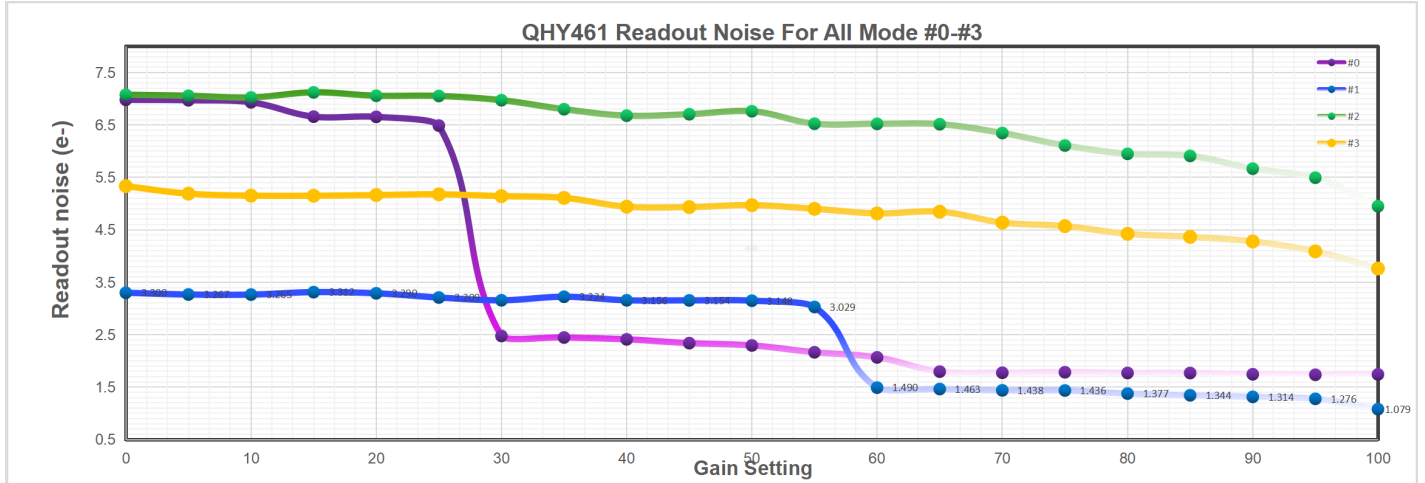
Regarding the linearity of QHY411, we conducted a preliminary linearity determination experiment. QHY411 data can be used to enable astronomical metering.

The experiment is to obtain a deviation of a fixed area by shooting the flat field plate with different exposure times. Then, after converting the conversion to a value in units of volume, the curve where the overlapping exposure time is increased and replaced by the image sensor is replaced.

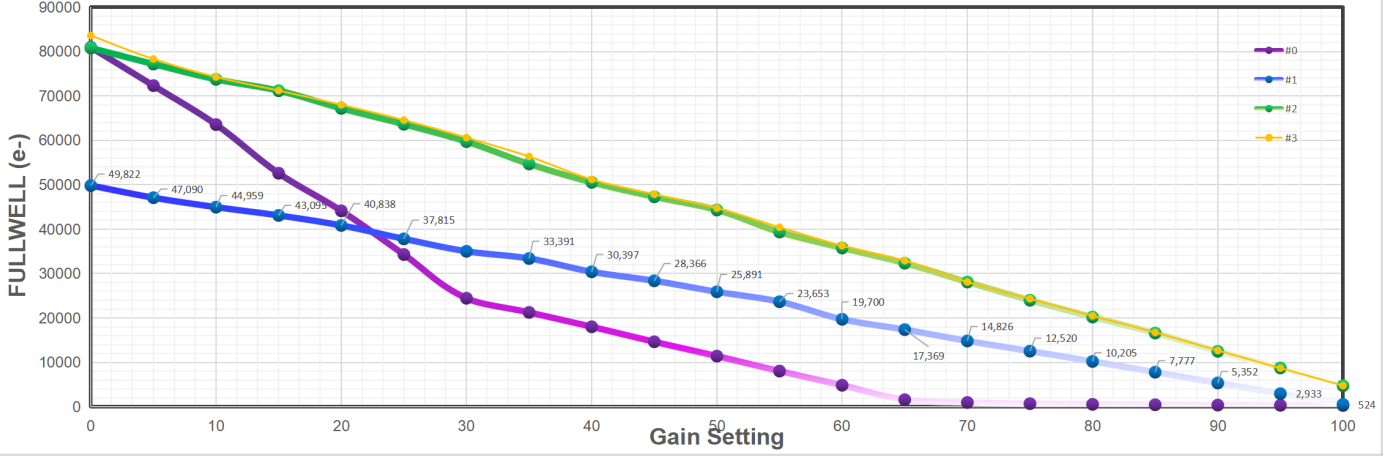
In order to obtain relatively large full-scale range data. We used the QHY411 correction mode with a gain of 0 (GAIN = 60). The obtained curve is as follows. You can see from the picture. QHY411 has very good linearity in a wide range. When the full scale is greater than 75000e, the linearity begins to decrease, and the curve conforms to the general linearity of the image sensor in the near area.



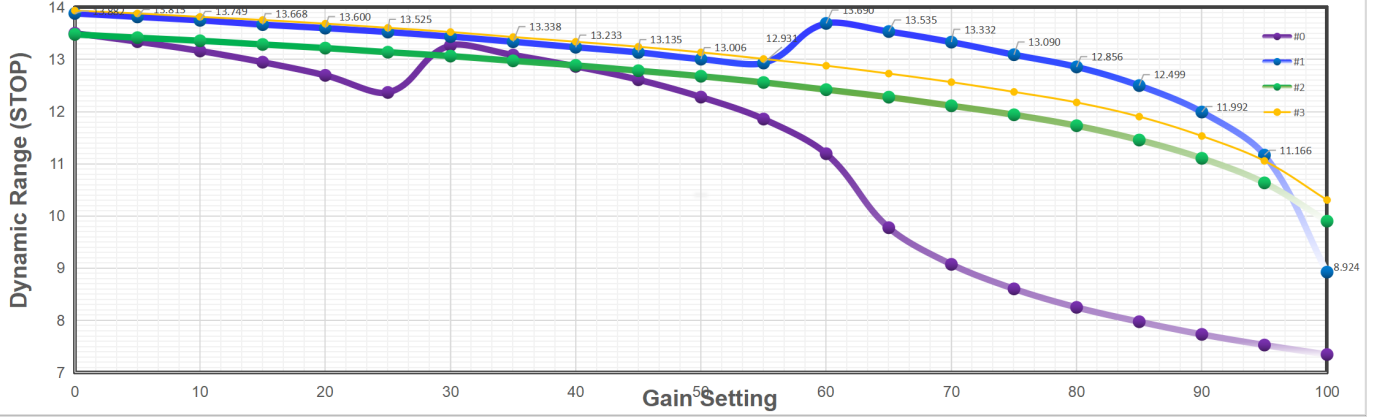
QHY461 Curves



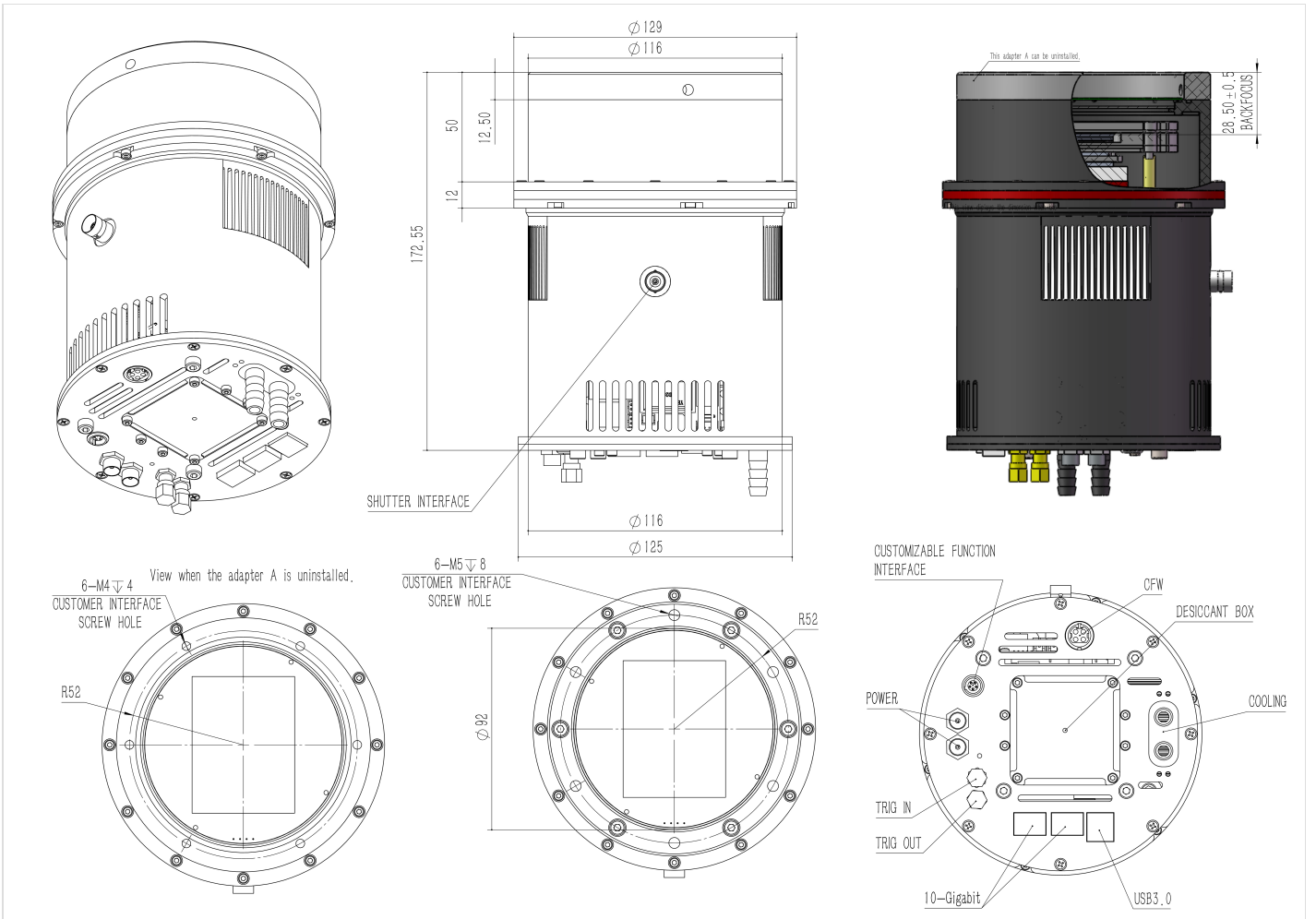
QHY461 FULLWELL For All MODE #0-#2



QHY461 Dynamic Range For All Mode #0-#2



- Mechanical Dimentions



- Reference Paper / Document

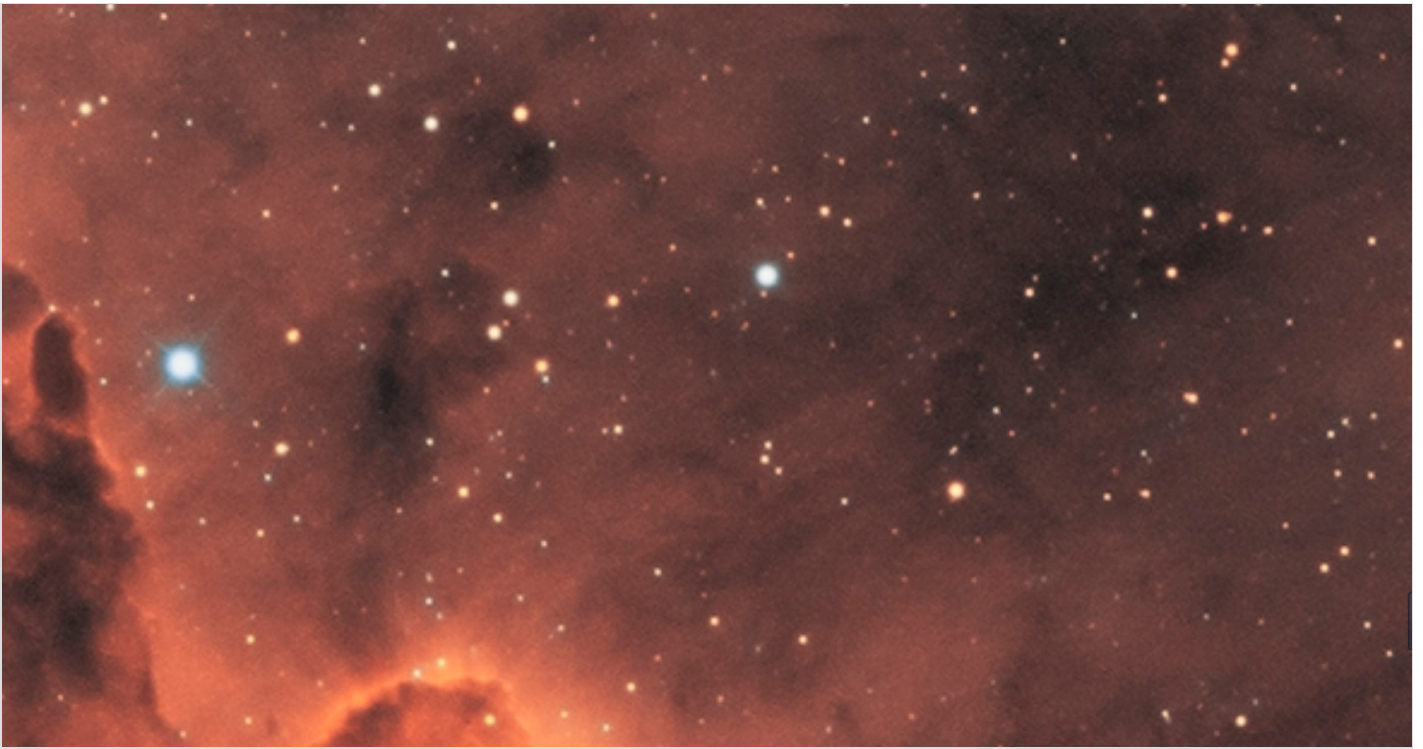
Some scholars in Italy found secrets hidden in the ancient manuscripts with the QHY411 camera.

<https://www.rainews.it/tgr/veneto/articoli/2022/05/ven-Verona-i-segreti-degli-antichi-manoscritti-della-Biblioteca-Capitolare-2e86b901-02d5-4afb-8faf-e37cffb51fad.html?fbclid=IwAR2z1Sk9qosM4cRj5filFc-amQlls-bGNSBY-XIQeWk-Qcq6hR9kgaO38KI>

- User Images

IC 1396 Elephant's Trunk Nebula in Bi-Color palette (cropped) Capture by [Denis Salnikov](#) with QHY461 camera and AG Optical 14.5" iDK telescope. [Full resolution image](#)





+ Basic User Menu

- Before Start: Install "All-In-One" Pack

All-In-One Pack (Driver, SDK and Software) for WINDOWS supports all QHYCCD USB3.0 devices only except PoleMaster and some discontinued CCD cameras. Please go to <https://www.qhyccd.com/download/> and install it.

Note:

- 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 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 opening 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** needs to be sync with the ascom platform version you installed (the latest version of Ascom is 6.5)
 - **The two sorts of Ascom CFW Drivers** correspond to two methods of controlling 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 controlling 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 execute 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.

- 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 formula is: $V(\text{drop}) = I * R$ (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.

- Connect Software

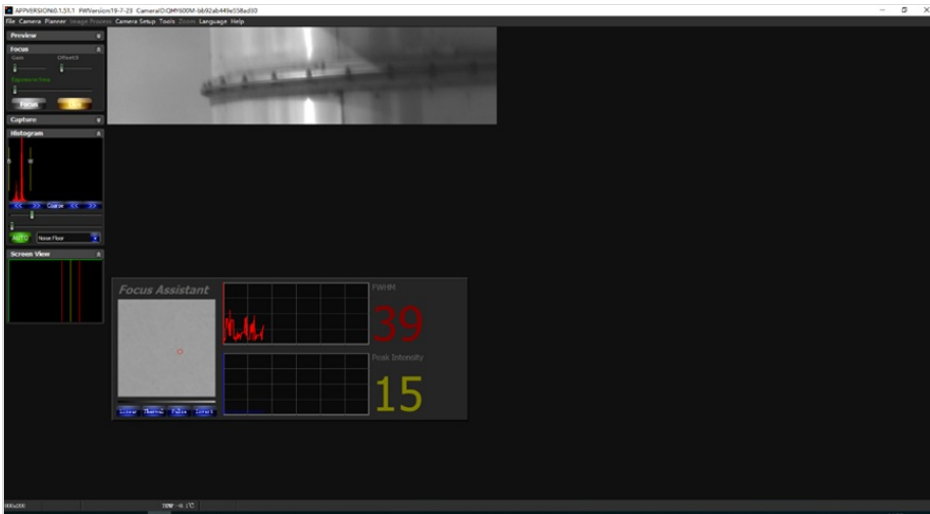
Before using software, make sure you have connected the cooling camera to the 12V power supply and connected it to the computer with a USB3.0 data cable. If it's a planetary/guiding camera, 12V power is not needed.

Note: We recommend 64-bit Software if possible, like SharpCAP x64 , N.I.N.A x64. etc., especially when you're using 16bit cameras like QHY600.

EZCAP_QT

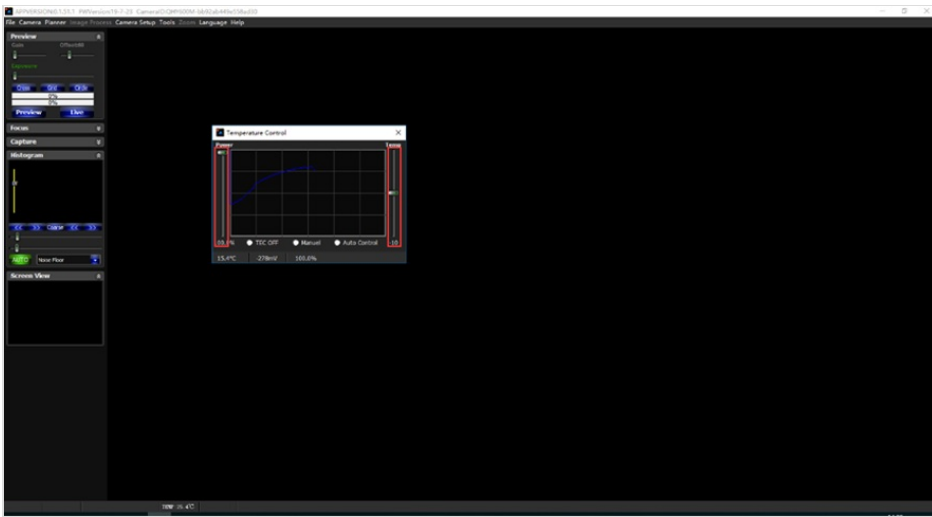
EZCAP_QT is software developed by QHYCCD. This software has basic capture functions for QHYCCD deep sky cameras.

Run EZCAP_QT. Click “Connect” in Menu -> Camera. If the camera is successfully connected, the title line of EZCAP_QT will display the camera firmware version and the camera ID as shown below.



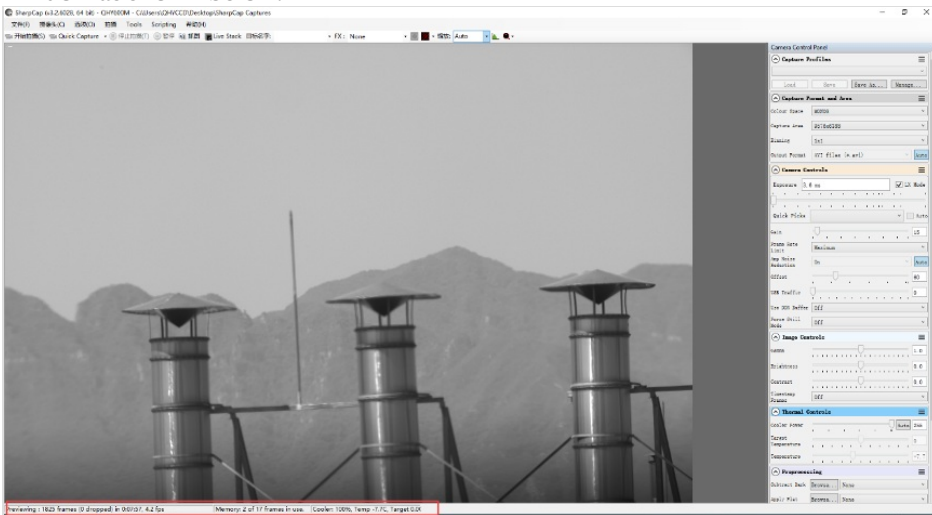
Click “Temperature Control” in “Camera Settings” to set the temperature of the CMOS sensor. You can turn on “Auto” to set the target temperature. For example, here we set the target temperature to -10C. The temperature of the CMOS sensor will drop quickly to this temperature (approximately 2-3 minutes). If you want to turn off cooling, you can choose Stop. If you just want to set the TEC power but not the temperature. You can select “Manual” and then set the percentage of the TEC power.

You can use the “preview tab” to preview and use the focus tool to focus. Then use the “capture tab” to capture the image.



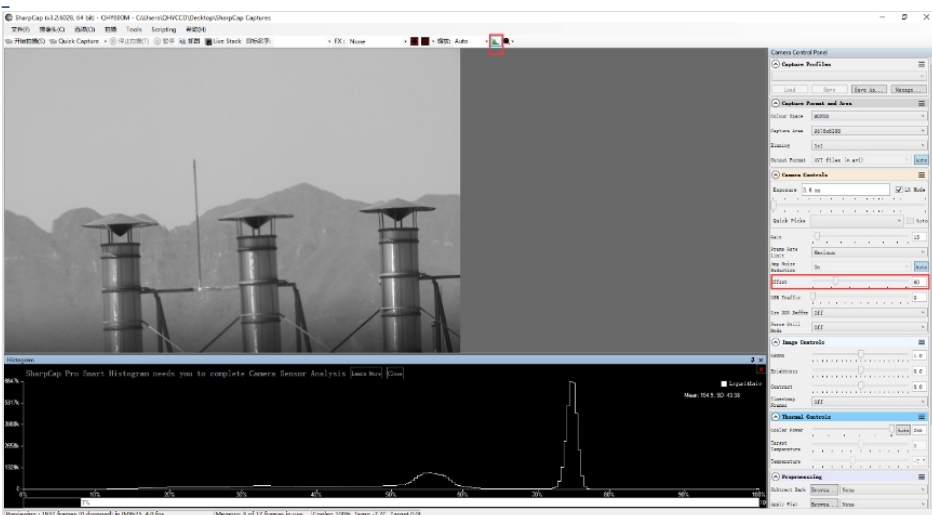
SharpCap

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.

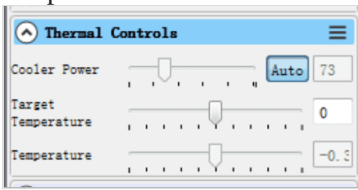
Offset adjustment. When you completely block the camera (i.e., like taking a dark frame) you may find that the image is not really zero. Sometimes this will reduce the quality of the image contrast. You can get a better dark field by adjusting the offset. You can confirm this by opening the histogram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

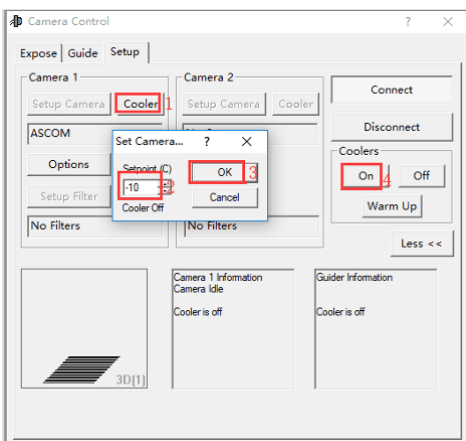
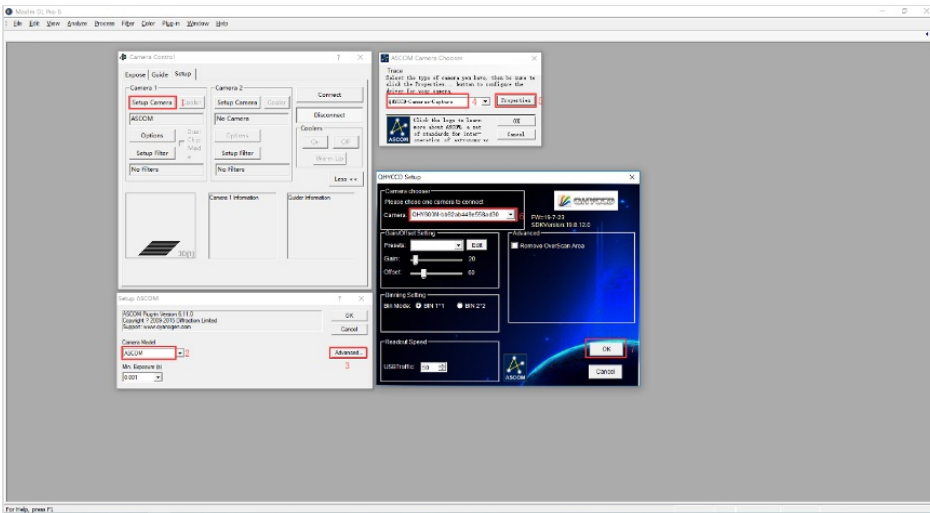
After cooling devices connected to the 12V power supply, the temperature control circuit will be activated. You can control the CMOS temperature by adjusting the settings in the figure below. Basically, you can control the temperature of CMOS by either adjusting “Cooler Power” or clicking “Auto” and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

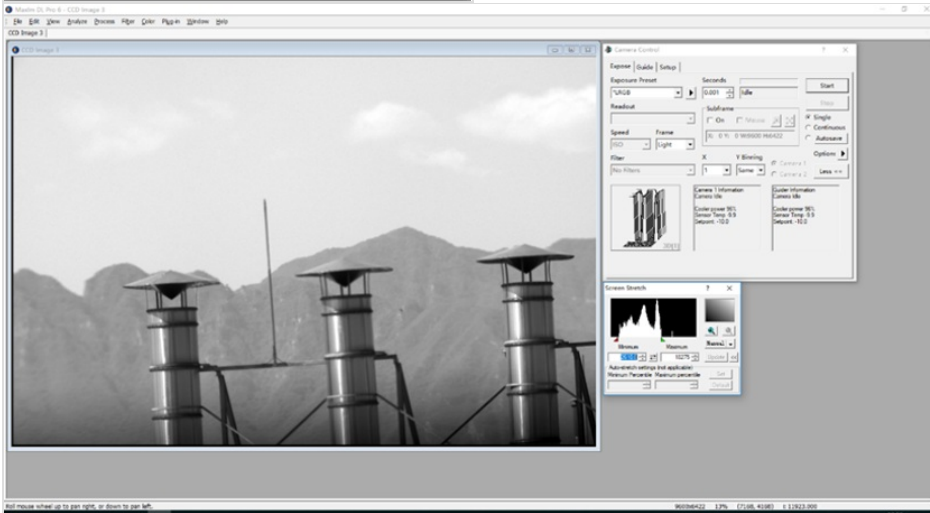
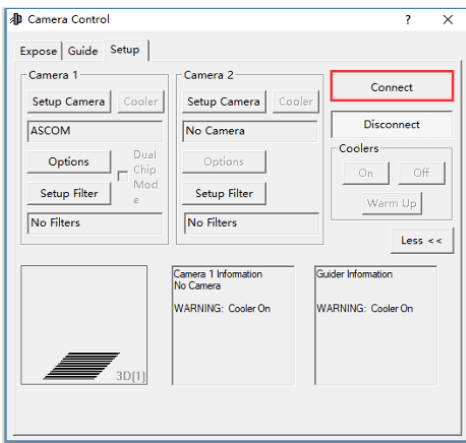


ASCOM supported software (e.g. MDL)

With ASCOM drivers, you can use the device with many software packages that support the ASCOM standard. We will use **Maxim DL** below as an example, but a similar procedure is used for The SkyX and other software packages supporting ASCOM.

First make sure you have not only loaded the ASCOM drivers but that you have also downloaded and installed the ASCOM platform from ASCOM. After both the drivers and platform are installed, start MAXIMDL. Follow the instructions shown below to finish the setup. Then Click Connect in and enter the software.



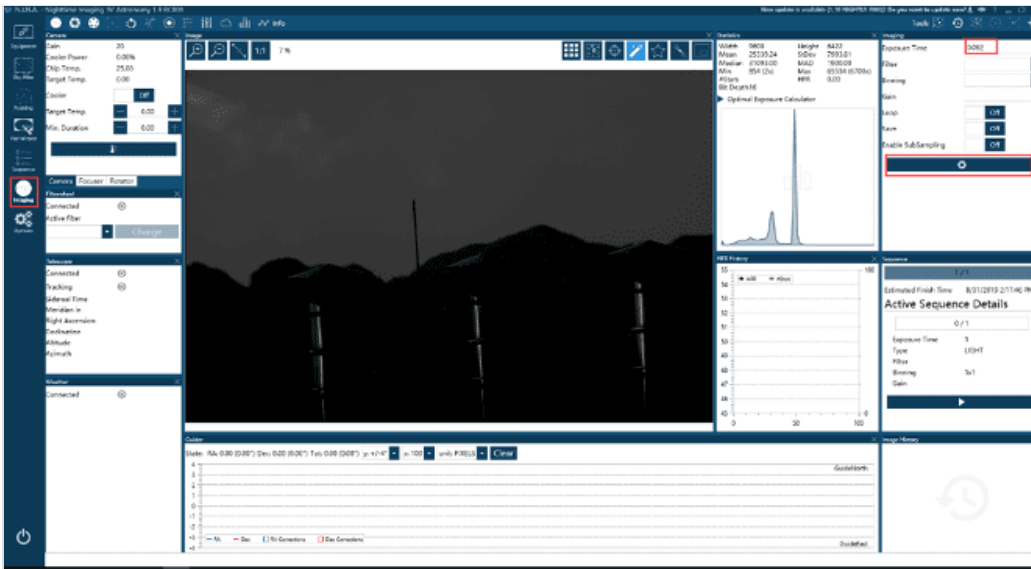


N.I.N.A

Open N.I.N.A. – Nighttime Imaging ‘N’ Astronomy. Drive connections via ASCOM.



Turn on the TE cooler to set temperature. Then set the exposure time to capture the image.

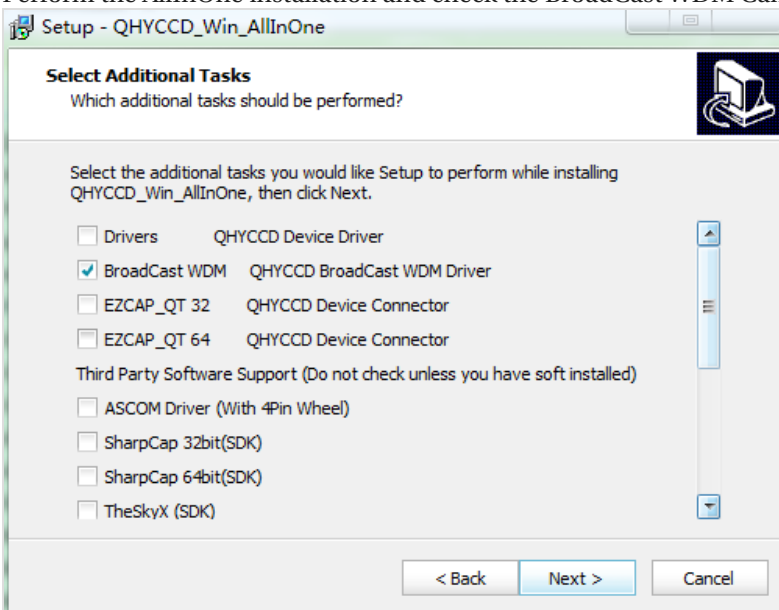


- Broadcast WDM Camera Driver

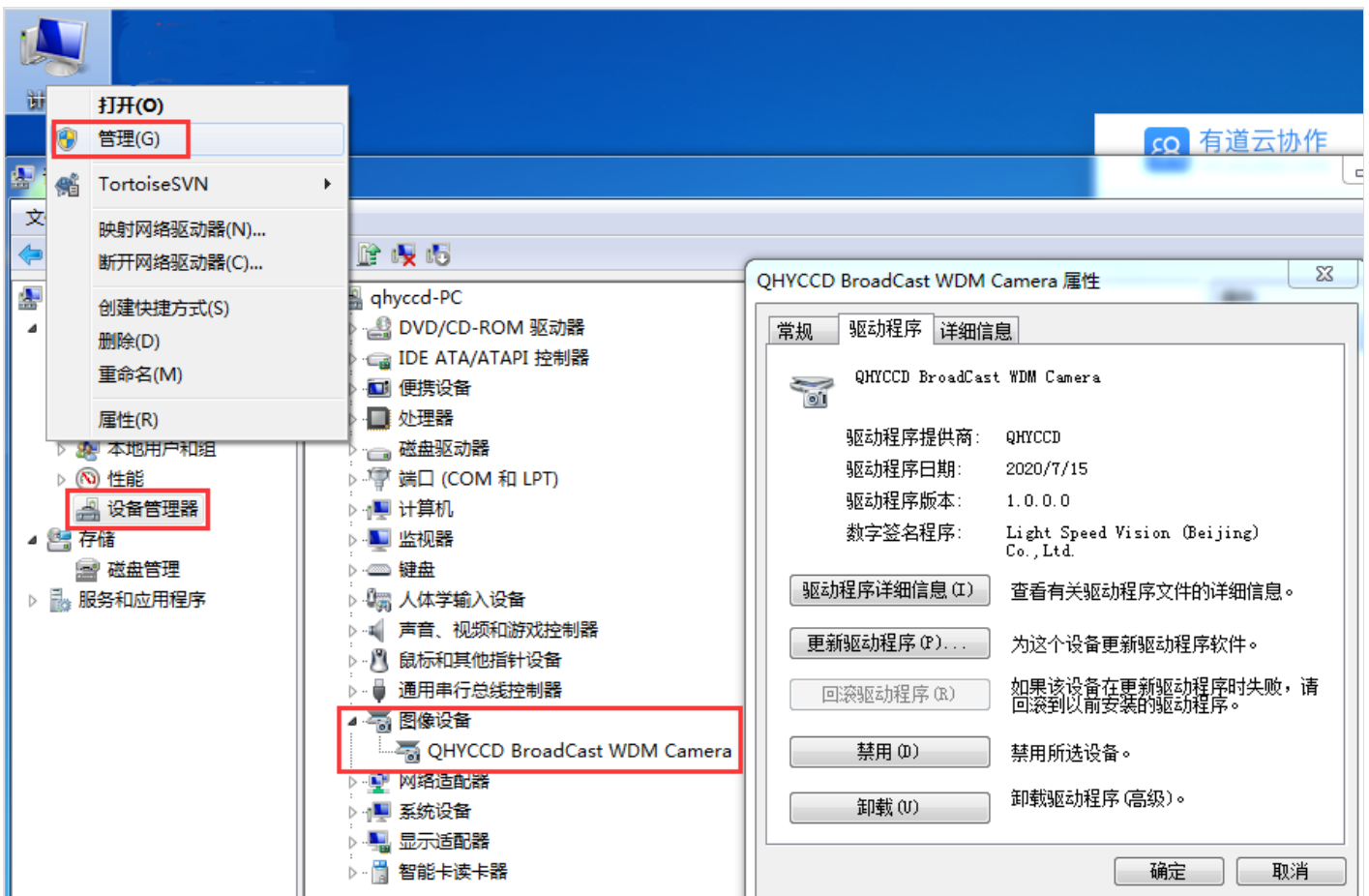
QHYCCD Broadcast WDM Camera is a broadcast driver that supports QHYCCD cameras with video broadcast function, which can meet the needs of customers to send video images to other target software. For example, use sharpcap to connect a WDM-enabled camera, and the sharpcap display video image can be sent to other WDM-supported software for display, which is suitable for video online broadcast applications.

Installation:

Perform the AllInOne installation and check the Broadcast WDM Camera option.

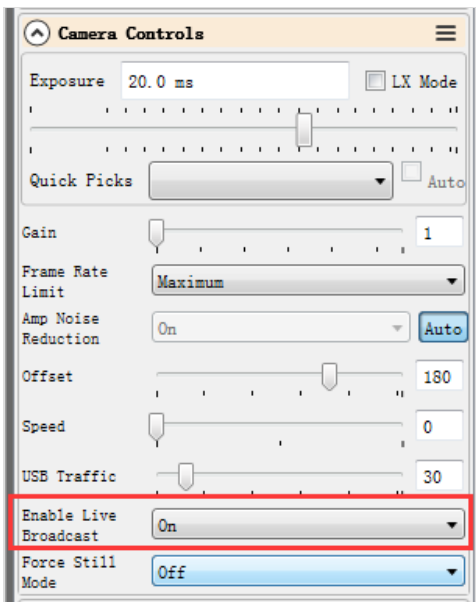


The installation process is over, right-click the computer to find the device manager, and check that the image device name is QHYCCD Broadcast WDM Camera, which means the installation is successful.

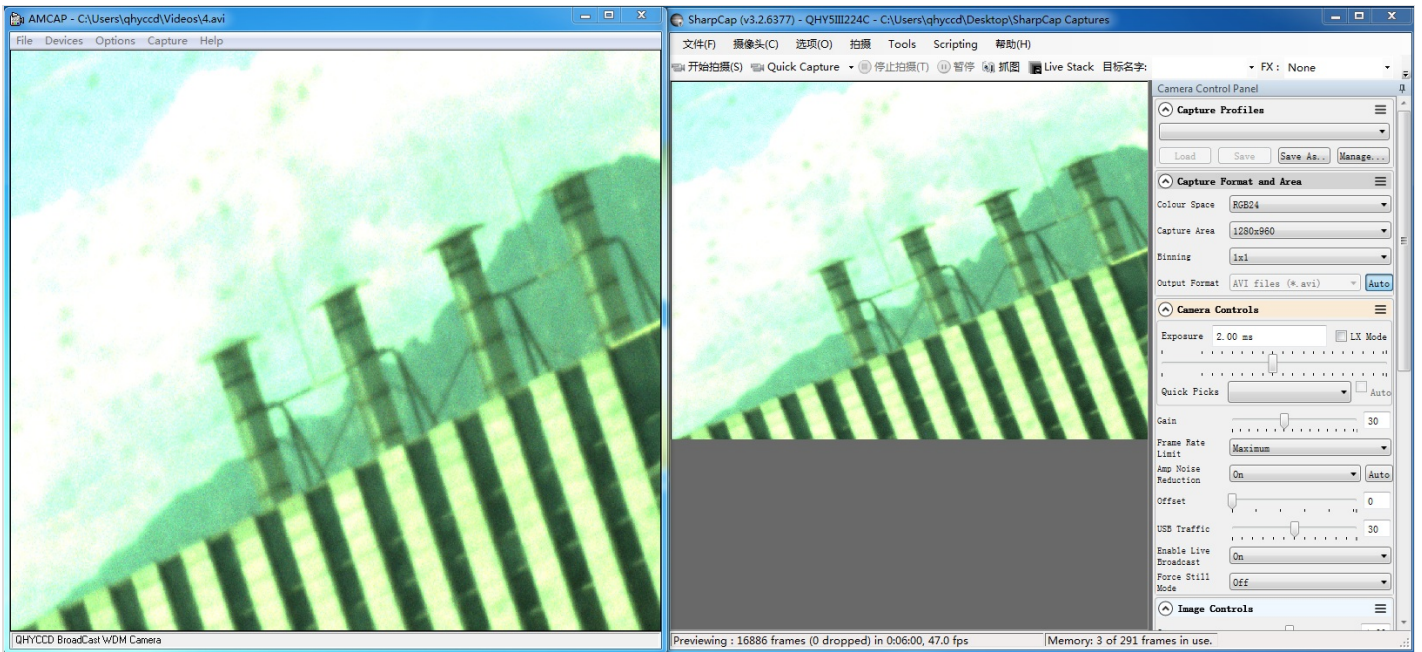


Activate the function:

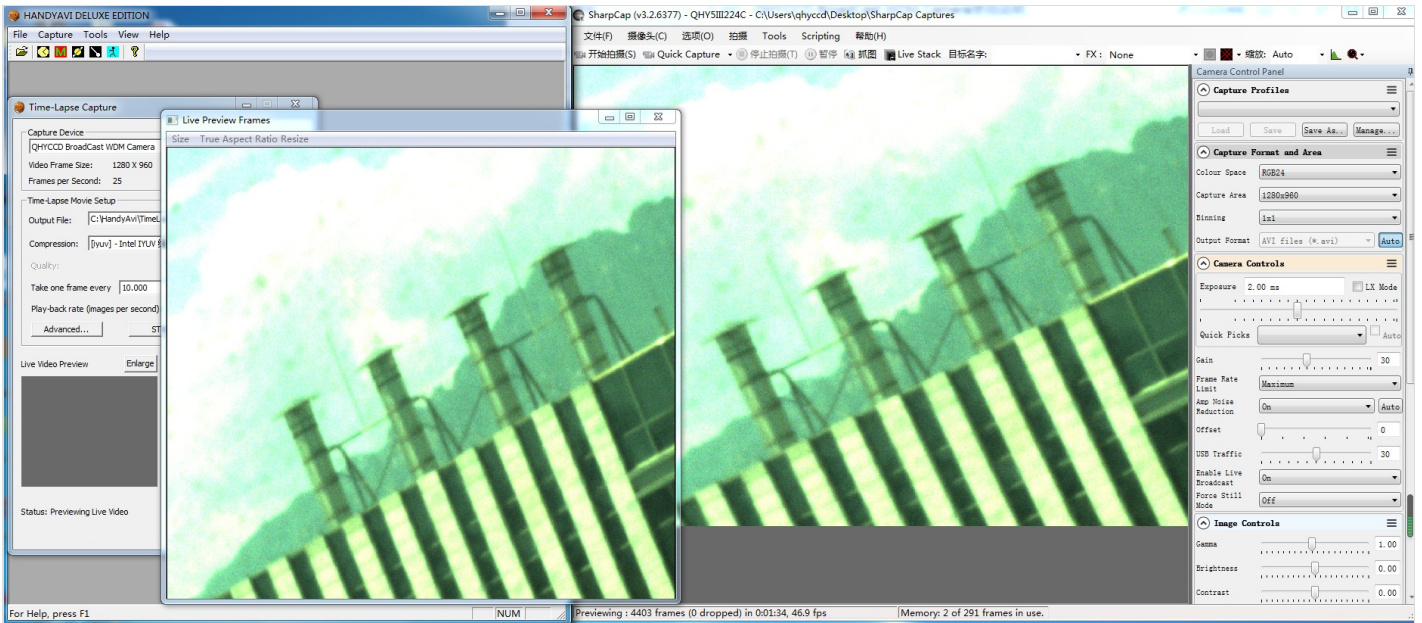
Usually sharpcap is used to connect the camera as the broadcasting terminal. After connecting the camera, you need to turn on the Enable Live Broadcast switch to broadcast.



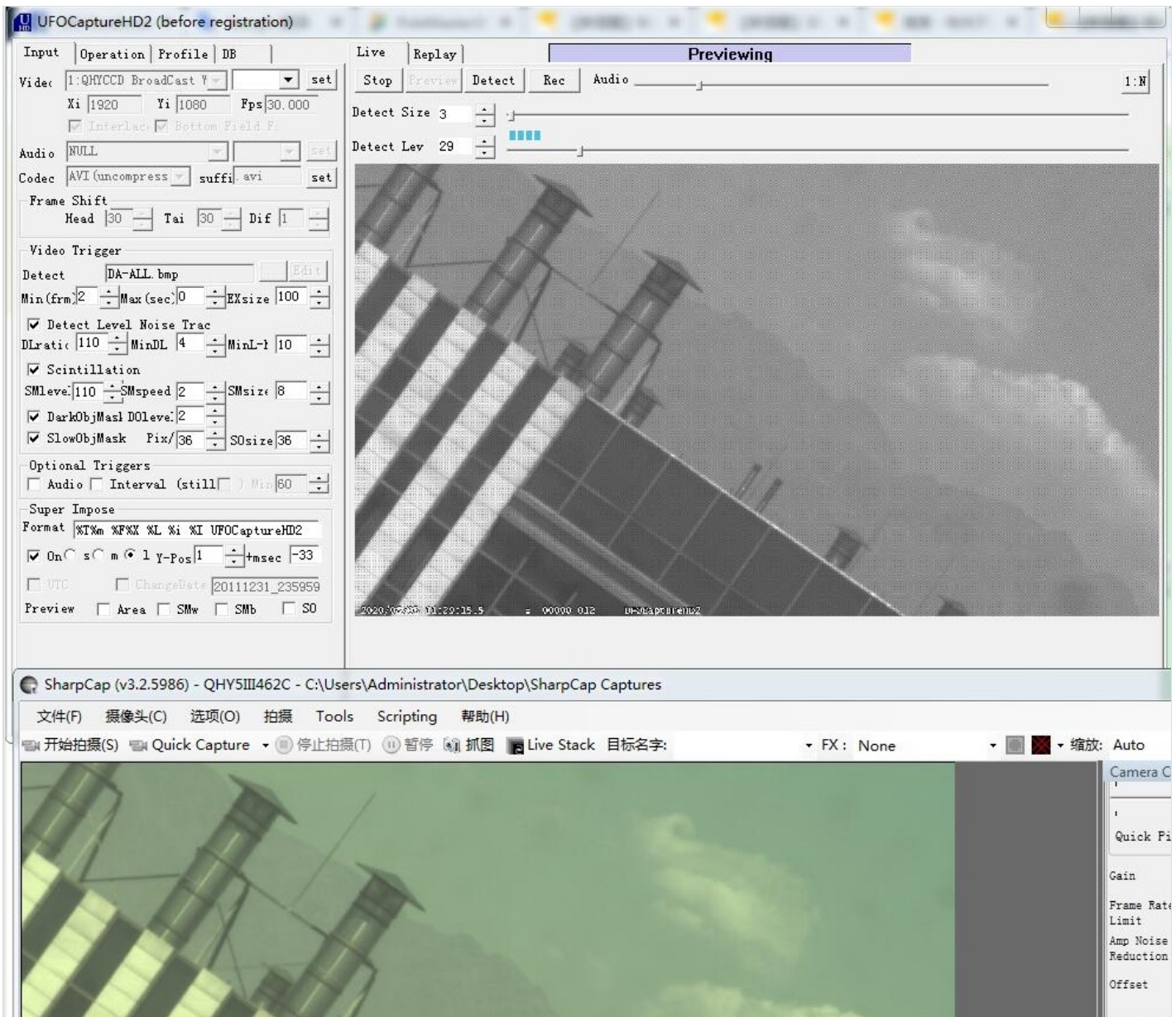
Common supporting software (ie, broadcast receiver) includes: UFOCAPTURE, HANDYAVI, QQ video functions, etc. AMcap test effect chart:



HANDYAVI test effect chart:



UFOCAPTURE test renderings:



Precautions:

Currently only supports Windows system.

Currently, the SDK does not support 16 bits for the time being.

RGB24 mode must be selected for color images, otherwise the image will appear gridded.

+ Advanced Control Tools

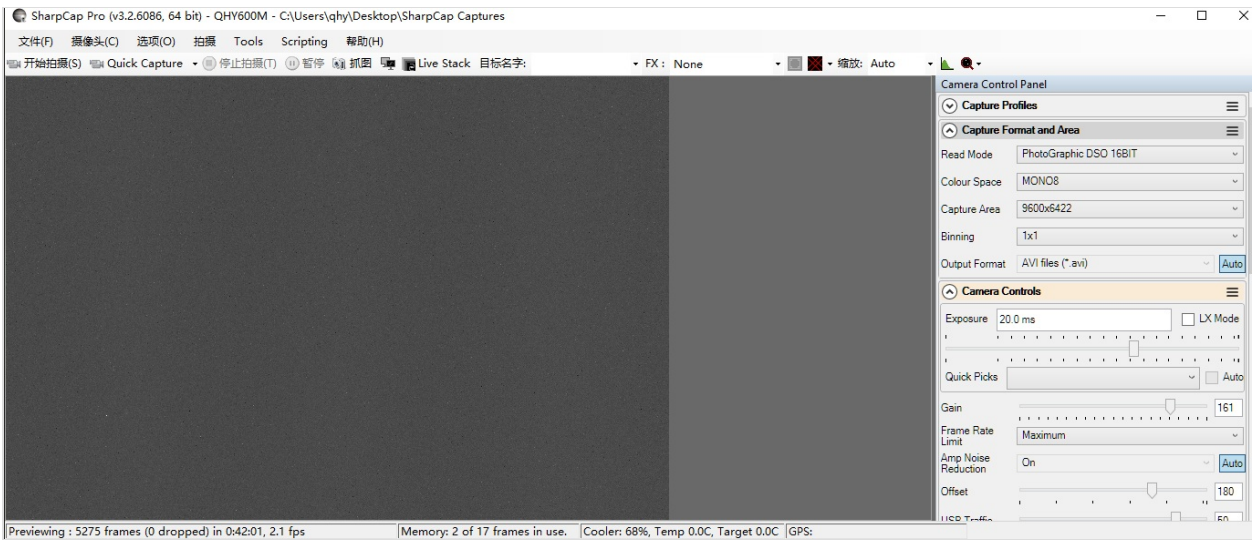


Click to download 2021.1.2

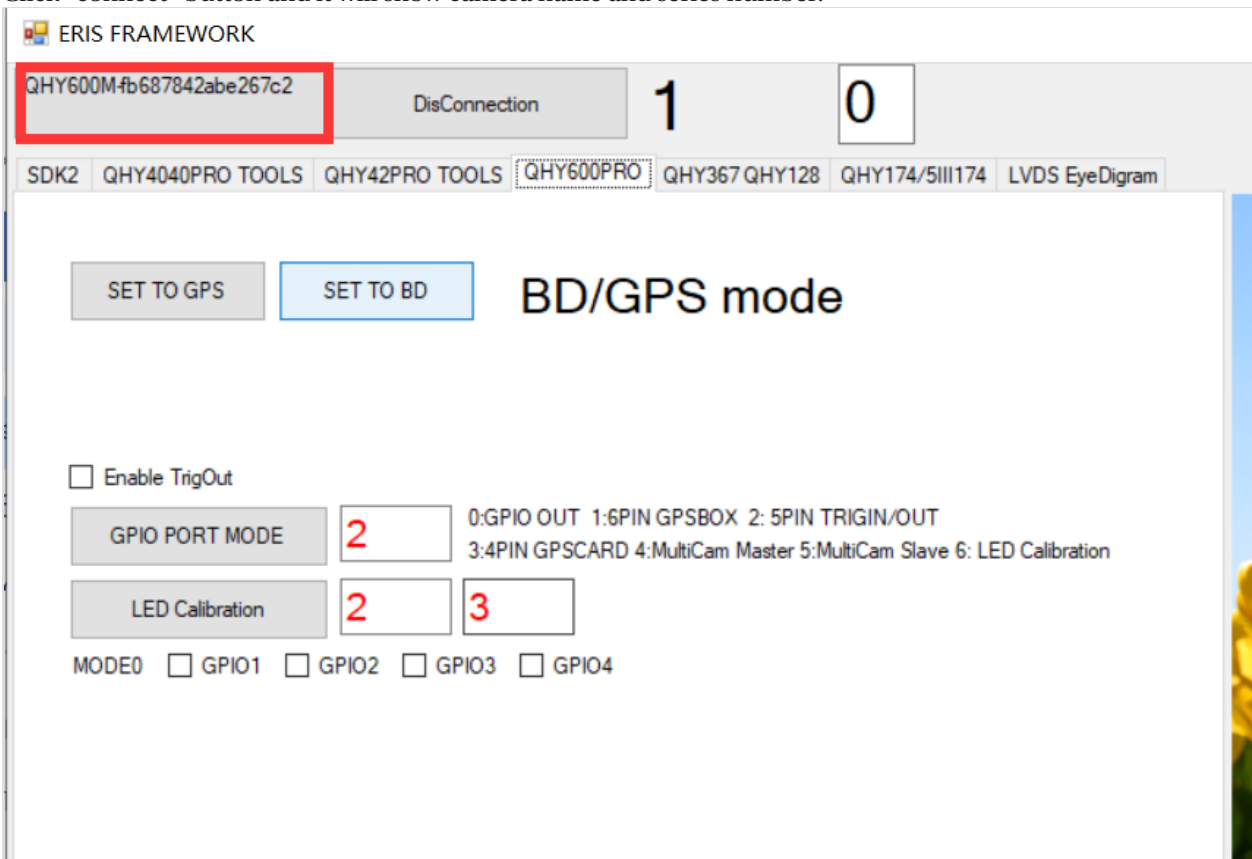
[Debug TOOL](#)

[Release TOOL](#)

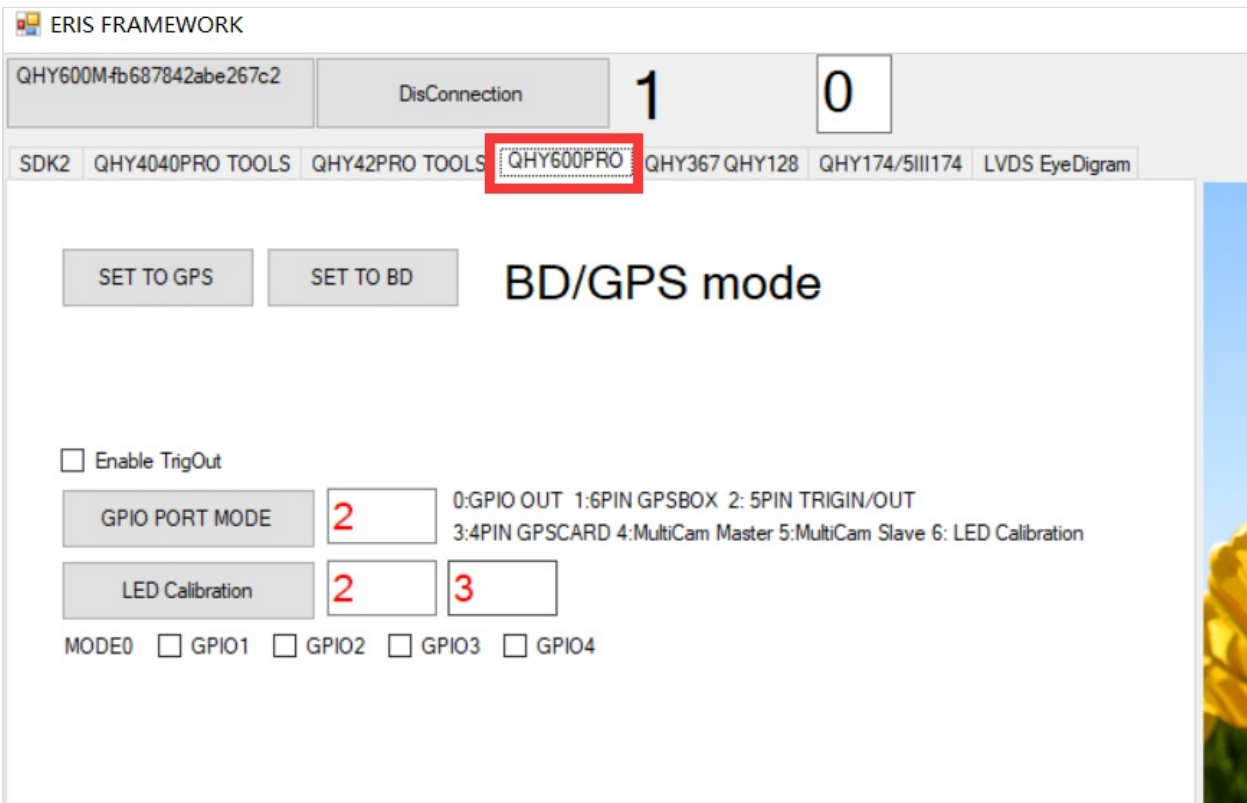
Run Sharpcap and make sure the QHY Camera works well under it. You will see the continous image appears.



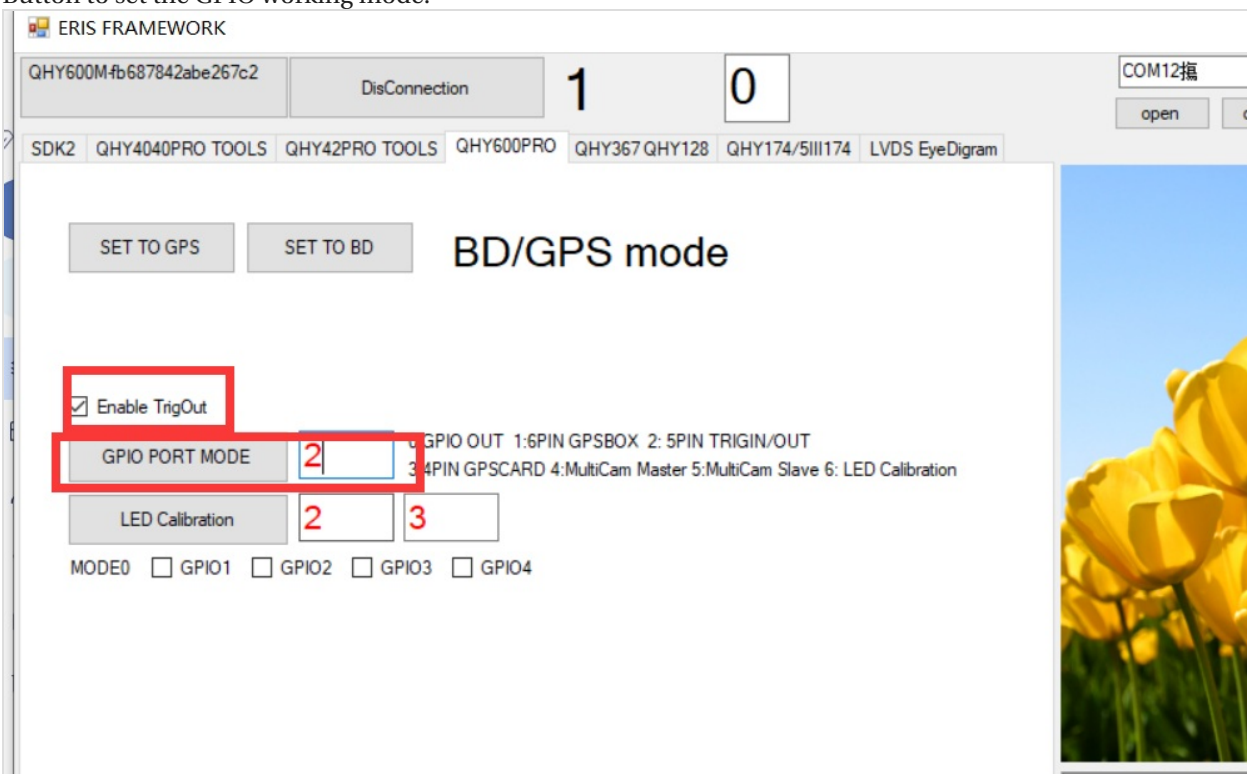
Click "connect" button and it will show camera name and series number.



select QHY Camera tabl.



check on the “Enable TrigOut” Input 2 to the textbox near to the “GPIO PORT MODE”. Then click the “GPIO PORT MODE” Button to set the GPIO working mode.



Check the waveform output from the TrigPort.

The introduction of different GPIO PORT MODE

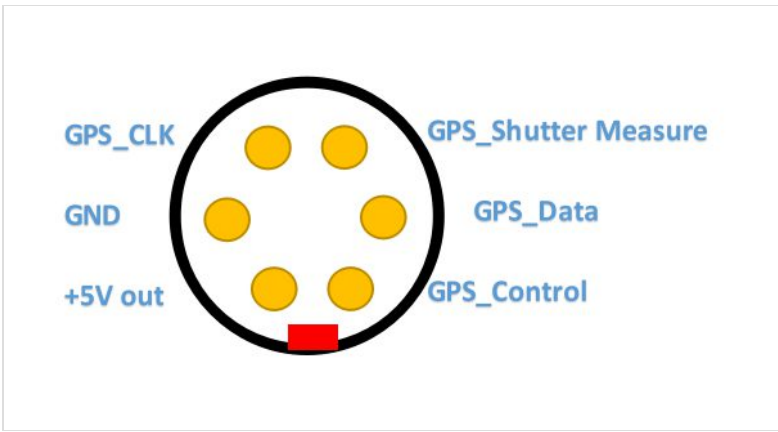
MODE0: Generic GPIO output mode / Auto Guide Port

In this mode, Four GPIO port is all output . You can control each port to output high or output low with the API. This mode does not controlled by Enable TrigOut.

You can select the check box of MODE0, GPIO1,GPIO2,GPIO3,GPIO4 to test this mode. This mode is also been used to test if the socket io port working well.

MODE1: 6PIN QHY-GPSBOX mode

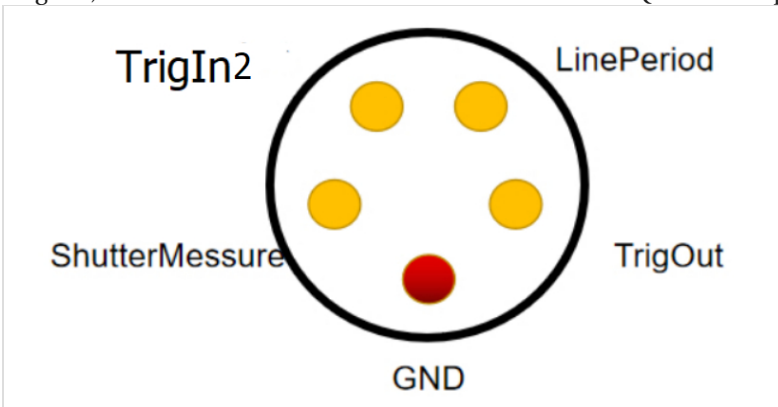
In this mode, Four GPIO port is configed as gps_clock, gps_data, shuttermeassure,gps_control. You can connect with QHYCCD-GPSBOX. The camera will output the shuttermeassure signal to GPSBOX and GPSBOX will send the data to camera. Camera will replace the first some pixel to the gps data .



MODE2: 5PIN Generic TrigOut / TrigIn mode

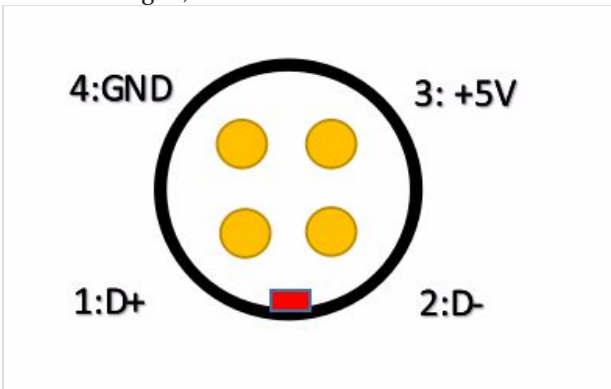
In this mode, Four GPIO port is configed as TrigOut, ShutterMeassure, TrigIn, LinePeriod . Only TrigIn pin is input direction and other three pin is output direction.

In some camera, like QHY4040,QHY2020,QHY42PRO,QHY6060, The shuttermeasure waveform rising edge is the start exposure time and falling edge is the end exposure time in other camera like QHY600,QHY268, QHY411,QHY461 etc, The shuttermeasure waveform is the vsync signal . It is near to the end of exposure time of the first row. For more information of TrigOut,LinePeriod. Please see some other document of QHYCCD supplied.



MODE3: 4PIN GPS Card TrigIn mode

In this mode. there is two pin is configured as ouput . Both of the two pins is the shuttermeasure signal but one of it is inverted. This is suitbale for some GPS card which need such a “differential signal”. But please note this is not LVDS signal. It is still TTL signa,



MODE4: Multi-Camera Master Mode

TO BE ADDED

MODE5: Multi-Camera Slave Mode

TO BE ADDED

MODE6: LED Calibration Mode

By using the controlled LED pulse, we can calibrate the distance from the TrigOut or ShutterMeassure signal to the real pixel/row start/end exposure time. To use this mode. You need to connect a LED to one GPIO pin and let the camera capture the flash that output from the camera. The start time and end time relative with the TrigOut/ShutterMeassure can be set by APIs. By check if the camera captured this pulse. You will get the delta time of the TrigOut/ShutterMeassure signal and use it to calibrate the messured GPS time.

mode 0	mode 1	mode 2	mode 3	mode 4	mode5	mode6
GPIO1	GPSBOX_Control	ShutterMessure+	ShutterMessure+	n.a	n.a	ShutterMessure+
GPIO2	GPSBOX_Data (IN	TrigIn2	ShutterMessure-	n.a	n.a	TrigIn2
GPIO3	GPSBOX_ShutterMessure	LinePeriod	n.a	HSYNC(OUT	HSYNC IN)	LinePeriod

GPIO4	GPSBOX_CLK	TrigOut	n.a	VSYNC(OUT)	VSYNC(IN)	LED(OUTPUT)
GND	GND	GND	GND	GND	GND	GND

+ UVLO Function Introduction



Note: Now only QHY600, QHY268, QHY410, QHY411, QHY461, QHY533 cameras have UVLO function.

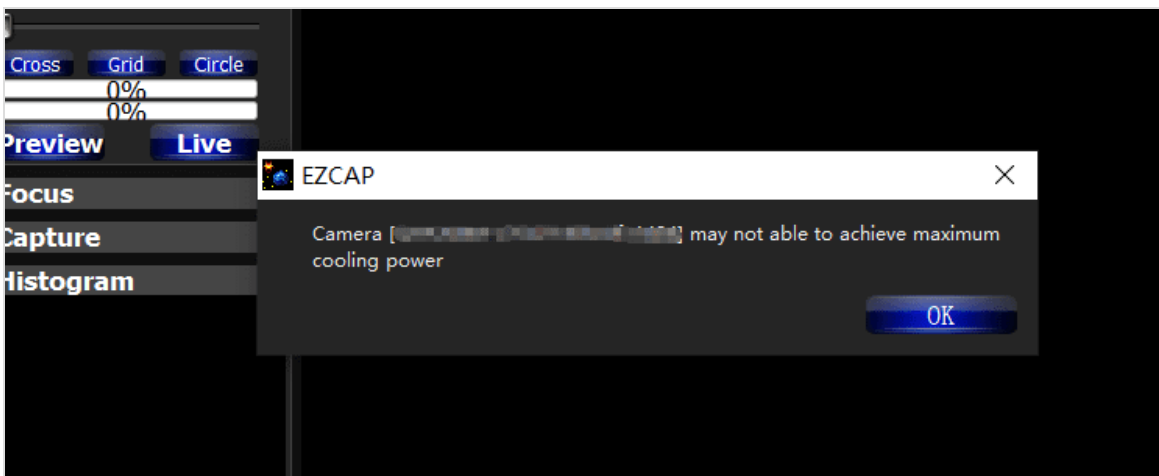
What is UVLO?

UVLO (Under Voltage Locking), is primarily intended to protect the electronic device from damage caused by abnormally low voltages.

Our daily life experience tells us that the actual operational voltage of an electrical device must not significantly exceed the rated voltage, otherwise it will be damaged. For such precision equipment as cameras, long-term work at too low input voltage can also be detrimental to the working life of the camera, and may even make some devices, such as power manager, burn up due to long-term overload. In the all-in-one driver and SDK after 2021.10.23 stable version, the camera will give a warning when the input voltage of the camera is below 11V.

UVLO warning execution

After a warning is given, the camera firmware will automatically turn off the cooler and will turn on the camera's TEC protection mode. After the camera is reconnected, it will always work in TEC protection mode (maximum power cooler power will be limited to 70%). Since many times the voltage shortage is caused by the high resistance of the power supply cable itself, resulting in a large voltage drop at high currents, the voltage will usually rise after the power is limited. But limiting the power will affect the cooling temperature difference. Therefore, it is recommended that users first check the power supply cable to solve the problem of excessive resistance of the power supply cable.



If the user has solved the problem of insufficient supply voltage, the TEC protection mode can be removed through the menu of EZCAP_QT.

How to improve the power supply?

1. Make sure the output voltage of the AC adapter is not less than 12V and the maximum output current can reach 4A or more. Otherwise, the AC adapter itself will not meet the power demand of the camera and it may cause a low voltage problem.
2. Make sure that the 12V power supply cable connecting the AC adapter to the camera has a low impedance. The impedance of the positive and negative paths should not exceed 0.1 ohms each. Or the total impedance (positive + negative) should not exceed 0.2 ohms. Otherwise, the power supply cable should be thickened.
3. When using battery power, it is recommended to add a 12V output voltage regulator. If the battery is connected directly, usually the battery voltage reaches 13.8V when fully charged, and will gradually drop during use. It is easy to cause the camera to reach the low-voltage detection threshold.

How to clear the TEC protection status triggered by UVLO?

Once a UVLO event occurs, the camera will automatically memorize it and will work in a protected mode at a maximum of 70% power after reconnection. This memory can be erased as follows:

After you find the system error, you need to turn off the device and check the power supply. After inspecting the problem, open the ezcap software and select “Camera Settings” – “Preferences” – “Reset Flash Code” to reset the error status.



Why does the warning appear even though the power supply voltage is 12 V?

1. The voltage measured inside the camera is the voltage reaching the camera, not the voltage at the power adapter end. Therefore, the voltage measured at the power adapter end does not reflect the voltage received at the camera end. This is because the power cable has its own resistance. If the resistance is large, it will cause a large voltage drop. The voltage drop can be calculated by $U = I * R$. So if the power cable has a resistance of 0.2 ohms, it will produce a voltage drop of $3.3 * 0.2 = 0.66V$. If the power adapter output is 12 V, the voltage reaching the camera is $12 - 0.66 = 11.34 V$. To actually measure the input voltage at the camera end, you can refer to the photo below.



2. For cameras produced after September 2021, the UVLO is detected by communicating directly with the power manager, and the UVLO code that appears is 9, while for cameras produced before, the indirect detection method is used, and the UVLO code that appears is 3. The indirect detection method will detect UVLO except for the low voltage problem, and any other accident that causes CMOS not to work will also trigger the UVLO=3 alarm, for example, the camera is subject to severe electromagnetic interference, causing registers inside the CMOS not to work. Therefore, if UVLO=3 occurs, it is recommended to contact QHYCCD technical support for further judgment.

- Using older versions of drivers and firmware may cause false positives (UVLO=9). Please make sure that ALL-in-one SDK version is out of stable version 2021.10.23 or higher. Please disconnect the 12V power supply during the driver installation.

+ QHYCCD BURST Mode

- QHYCCD BURST Mode

Added functions related to BURST mode in SDK. Currently, cameras that support Burst function include QHY600, QHY411, QHY461, QHY268, QHY6060, QHY4040, QHY4040PRO, QHY2020, QHY42PRO, QHY183A

This mode is a sub-mode of continuous mode. This function can only be used in continuous mode. When this function is enabled, the camera will stop outputting image data, and the software frame rate will be reduced to 0. At this time, send relevant commands to the camera, and the camera will Output the image data with the specified frame number according to the settings, for example, set Start End to 1 6, the camera will output the image data with the frame number 2 3 4 5 when receiving the command.

Note:

- When using Burst mode in fiber mode, the first Burst shot will be one less. For example, if the start end is set to 1 6, the output of 2 3 4 5 is normal, but in fact, only 3 4 will be output during the first burst shot. 5, 2 will not be received, the second and subsequent shots can normally obtain Burst images 2 3 4 5. This problem will be fixed later.
- QHY2020, QHY4040 found that the frame number that came out when the exposure time was short is [start+1,end-1] but the one that came out under long exposure was [start+2,end]
- When the camera is just connected, if the set end value is relatively large, the camera will directly output the picture after entering the burst mode. Therefore, it is necessary to set the camera to enter the IDLE state and then set the start end and related burst operations.

The following is the usage of Burst mode related functions:

1.EnableQHYCCDBurstMode

```
1 /**
2  @fn uint32_t EnableQHYCCDBurstMode(qhyccd_handle *h,bool i)
3  @brief Set camera enable or disable burst mode
4  @param h Camera control handle
5  @param i Enable or disable burst mode \n
6  true:enable burst mode \n
7  false:disable burst mode \n
8  @return
9  On success,return QHYCCD_SUCCESS \n
10 another QHYCCD_ERROR code on other failures
11 */
12 uint32_t STDCALL EnableQHYCCDBurstMode(qhyccd_handle *h,bool i);
13
14 /*
15  * Note:
16  * This function only works in LiveVideo mode. When enabled,
17  * the video stream will pause and wait the burst mode start capture command.
18  * When disabled the camera will return the live video streaming mode.
19  * In Burst Mode, you can set the camera into IDLE status at first,
20  * and then release the IDLE status, this execution will make camera output a series of frames.
21  * You can define the start and end frame number and camera will only output the limited frames.
22  *
23  * About set IDLE status, please check SetQHYCCDBurstIDLE function,
24  * about release IDLE status, please check ReleaseQHYCCDBurstIDLE function,
25  * about set start and end frame,please check SetQHYCCDBurstModeStartEnd function.
26  */
```

2.SetQHYCCDBurstModeStartEnd


```

1 /**
2  @fn uint32_t SetQHYCCDBurstModeStartEnd(qhyccd_handle *h,unsigned short start,unsigned short end)
3  @brief Set start and end frame,camera will output middle frames
4  @param h Camera control handle
5  @param start The start of frame number
6  @param end The end of frame number
7  @return
8  On success,return QHYCCD_SUCCESS \n
9  another QHYCCD_ERROR code on other failures
10 */
11 uint32_t STDCALL SetQHYCCDBurstModeStartEnd(qhyccd_handle *h,unsigned short start,unsigned short end);
12
13 /*
14  * Note:
15  * Burst mode is to output a series of frames.This function is used to define the start and the end frame.
16  * For QHY411, QHY600, QHY268, QHY410, QHY533, the minumu value is 1 max value is 65535.
17  * The frame account that output frmae is from (start+1) to (end-1). For example, start=1, end =10,
18  * the output frame is #2,#3.....#9. The #2 is the first effective image after release IDLE.
19  * For QHY2020, QHY42PRO, QHY4040, QHY6060, the minum value is 0, max value is 65535.
20  * The frame account that output frmae is from (start+1) to (end-1). For example, start=0, end =9,
21  * the output frame is #1,#2.....#8. The #1 is the first effective image after release IDLE.
22  */

```

3.SetQHYCCDBurstIDLE

```

1 /**
2  @fn uint32_t SetQHYCCDBurstIDLE(qhyccd_handle *h)
3  @brief Set camera enter IDLE status
4  @param h Camera control handle
5  @return
6  On success, return QHYCCD_SUCCESS \n
7  another QHYCCD_ERROR code on other failures
8  */
9  uint32_t STDCALL SetQHYCCDBurstIDLE(qhyccd_handle *h);
10
11 /*
12  * Note:
13  * Let the camera enter the IDLE status. When camera is in IDLE status, it will do nothing and not output any frames.
14  * This API need work with ReleaseQHYCCDBurstIDLE,and need setup a delay between these two functions,time is 20ms normally.
15  */

```

4.ReleaseQHYCCDBurstIDLE

```

1 /**
2  @fn uint32_t ReleaseQHYCCDBurstIDLE(qhyccd_handle *h)
3  @brief Set camera exit IDLE status
4  @param h Camera control handle
5  @return
6  On success, return QHYCCD_SUCCESS\n
7  another QHYCCD_ERROR code on other failures
8  */
9  uint32_t STDCALL ReleaseQHYCCDBurstIDLE(qhyccd_handle *h);
10
11 /*
12  * Note:
13  * Let the camera exit the IDLE status. After run this API, the camera will begin to output a series of the frames.
14  * This API need work with SetQHYCCDBurstIDLE,and need setup a delay between these two functions,time is 20ms normally.
15  */

```

5.SetQHYCCDBurstModePatchNumber

```

1 /**
2  @fn uint32_t SetQHYCCDBurstModePatchNumber(qhyccd_handle *h, uint32_t value)
3  @brief Setup a data patch in DDR to avoid camera can't output frames normally
4  @param h Camera control handle
5  @param Value the number of data patch, normally is 32001
6  @return
7  On success, return QHYCCD_SUCCESS\n
8  another QHYCCD_ERROR code on other failures
9  */
10 uint32_t STDCALL SetQHYCCDBurstModePatchNumber(qhyccd_handle *h, uint32_t value);
11
12 /*
13  * Note:
14  * It is best to enable DDR in the burst mode to avoid the image lost caused by the host cpu busy.
15  * The function of enable DDR is SetQHYCCDParam(camhandle, CONTROL_DDR, 1.0);
16  * The DDR will buffer the image streaming. But DDR will remain some data in its buffer,
17  * and it will cause some of the last byte can not come out from it.
18  * This function will cause the last frame in a burst series may not come out.
19  * This API can add some patch number in the end of a frame to allow all frame come out.
20  */

```

6. Reset QHYCCD Frame Counter

```

1 /**
2  @fn uint32_t ReleaseQHYCCDFrameCounter(qhyccd_handle *h)
3  @brief Reset the hardware frame counter to 0
4  @param h Camera control handle
5  @return
6  On success, return QHYCCD_SUCCESS\n
7  another QHYCCD_ERROR code on other failures
8  */
9  uint32_t STDCALL ReleaseQHYCCDFrameCounter(qhyccd_handle *h);
10
11 /*
12  * Note:
13  * Reset the hardware frame counter to 0. In fact, each time when release the IDLE will clear the frame counter,
14  * so this API is not need to call in burst mode, you can ignore this function.
15  */

```

7. Set QHYCCD Enable Live Mode Anti-RBI

```

1 /**
2  @fn uint32_t SetQHYCCDEnableLiveModeAntiRBI(qhyccd_handle *h, uint32_t value)
3  @brief Set camera enter AntiRBI mode
4  @param h Camera control handle
5  @param value The number of enable function
6  @return
7  On success, return QHYCCD_SUCCESS\n
8  another QHYCCD_ERROR code on other failures
9  */
10 uint32_t STDCALL SetQHYCCDEnableLiveModeAntiRBI(qhyccd_handle *h, uint32_t value);
11
12 /*
13  * Note:
14  * QHY600, QHY411, QHY461 support this function, and different cameras need setup different value.
15  * Disable : value = 0
16  * Enable : for QHY600, value = 0x1C00
17  *           for QHY411, value = 0x2A94
18  *           for QHY461, value = 0x2300
19  */

```

8. Enable QHYCCD Image OSD

```

1 /**
2  @fn uint32_t EnableQHYCCDImageOSD(qhyccd_handle *h, uint32_t i)
3  @brief Setup some information display on image
4  @param h Camera control handle
5  @param i Display switch
6  @return
7  On success, return QHYCCD_SUCCESS\n
8  another QHYCCD_ERROR code on other failures
9  */
10 uint32_t STDCALL EnableQHYCCDImageOSD(qhyccd_handle *h,uint32_t i);
11
12 /*
13  * Note:
14  * Some information text, eg, the hardware frame sequence number, or the GPS information etc,
15  * can be add on the left top side of the image.
16  * disable : i=0
17  * enable  : i=1
18  */

```

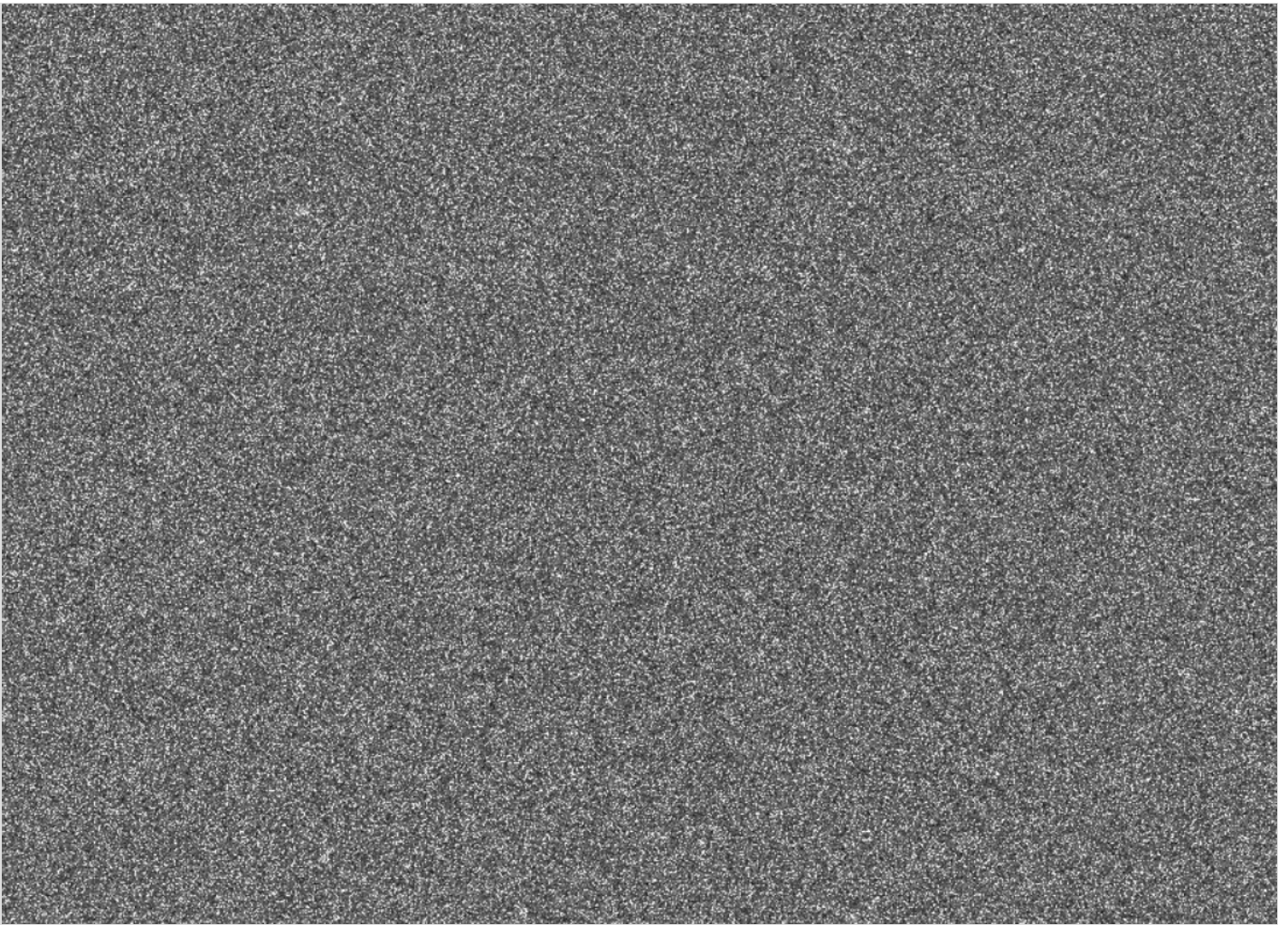
Sample Code

```

1 ret = SetQHYCCDParam(camhandle, CONTROL_DDR, 1.0);
2 ret = BeginQHYCCDLive(camhandle);
3 ret = SetQHYCCDBurstModeIDLE(camhandle);
4 ret = SetQHYCCDBurstModeStartEnd(camhadnle, 1, 3);
5 ret = SetQHYCCDBurstModePatchNumber(camhandle, 32001);
6 ret = EnableQHYCCDBurstMode(camhandle, true);
7
8 while(true)
9 {
10     ret = SetQHYCCDBurstModeIDLE(camhandle);
11     sleep(20);
12     ret = ReleaseQHYCCDBurstModeIDLE(camhandle);
13
14     ret = QHYCCD_ERROR;
15     while(ret == QHYCCD_ERROR)
16     {
17         ret = GetQHYCCDLiveFrame(camhadnle, &w, &h, &b, &c, ImgData);
18     }
19 }

```

+ QHY411/461 has abnormally large thermal noise FAQ



The abnormally large thermal noise in the picture above is caused by the failure of the internal voltage to start after the camera is powered on. You can power on the camera again and take an image to see if it can be recovered. If you encounter this problem during use, you can contact QHYCCD for hardware upgrade. This type of camera purchased before 2022.8.25 may have this problem.

+ QHY411 3×3 onchip BIN 12bit high frame rate mode update instructions

Applicable model: QHY411

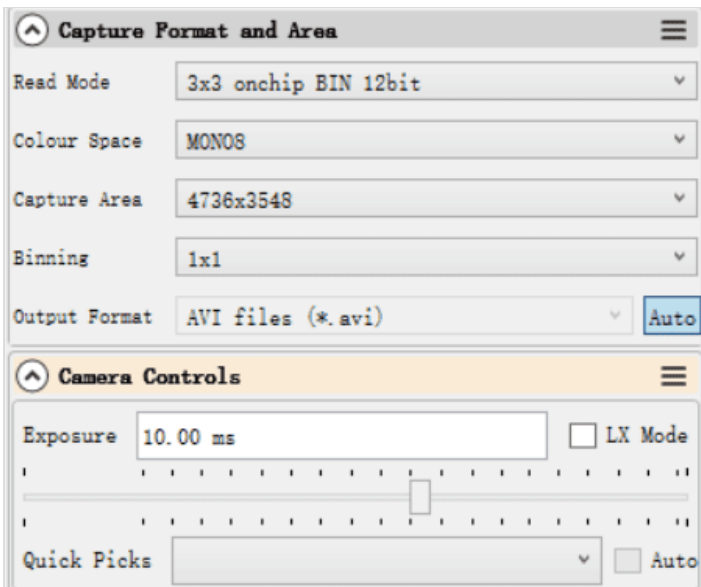
Targeted user groups and application fields: If you have certain requirements for the frame rate of the device, such as meteor monitoring, you can selectively update it.

Since most software that provides continuous mode (ie video output), such as SharpCap, etc., only support 8-bit or 16-bit mode, in 12-bit high-speed mode (3×3 onchip BIN 12bit), you need to select 8-bit mode output to achieve a frame rate boost. Data comparison (USB3.0 full resolution)

Before upgrade: 8-bit, 2fps

After upgrade: 8bit, (12bit transfer out), max 20fps

Previewing : 1985 frames (0 dropped) in 0:01:49, 20.2 fps



The realization of this function needs to update the firmware, driver, and corresponding software SDK at the same time.

The update of the driver and software SDK needs to be implemented by downloading the Allinone package (BETA) 20220817 or a later version, and checking the system driver and the required SDK to update; for the update of Allinone, please refer to the video description on the “Download” page of the official website.

Allinone package (BETA) 20220817 download address:

https://www.qhyccd.com/file/repository/publish/AllInOne/220817/QHYCCD_Win_AllInOne.22.08.17.00.exe

Firmware update: Requires downloading firmware update kit 20220824 or later. If you have an old firmware upgrade tool locally, please discard it. The compressed package contains firmware upgrade tools, new QHY411 firmware and upgrade operation instructions. Please read the upgrade instructions in the firmware installation package carefully. If you encounter any problems during the upgrade, please contact QHYCCD technical support.

Firmware upgrade kit 20220824 download address:

<https://www.qhyccd.com/file/repository/latestSoftAndDirver/other/QHY411%20bin3%20Mode%20firmware%20upgrade.zip>

Firmware upgrade instructions:

[Refer to the compressed document or web version instructions](#)

