QHY8L-C

Instruction Manual

1/4/13

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Chapter 1.

Connection and Safety Instructions

1. **The larger surface area of the CCD chip and cooling system make it more fragile than a small or medium sized CCD. Take extra care when transporting and using the device.**

2. **Do not block the cooling vents.**

3. **Connection Sequence**:

- Connect USB cable from camera to PC
- Connect 9-pin cable from camera to DC201, with EMC filter on DC201 end
- Connect 12V power to DC201

4. **Disconnection Sequence:**

- Disconnect 12V input power from DC201
- Disconnect 9-pin cable from camera
- Disconnect USB cable from PC

5. **Ensure that the power converter is properly grounded.**

DC201 Input Voltage Range and Power.

- The DC201 requires a regulated 12V input. The normal input range is 11V-13V. If you exceed 13V when using an external power supply, the higher voltage will reduce the life of the Thermoelectric Cooler (TEC) and fan. Please limit the maximum power of your cooling settings if you have to use your camera in this case. Please check "Favorite->TEC Protect" in the EZCAP software. If you are using the ASCOM driver, this has been set automatically.
- the QHY8L uses double refrigerating refrigerator, and the temperature can drop below the environment temperature by about 30 degrees Celsius.
- Service temperature of the QHY8L is from -20°C to 40°C, Relative humidity amount is from 0% to 90%.

6. **QHY8L CCD Sensor Readout Mode:**

The QHY8L uses a two frame readout CCD sensor. Due to the nature of the CCD readout mode, there are several things to which you need to pay attention during shooting and image processing.

The blue and half of the green pixels are read in the first frame. The red and half of the green pixels are read in the second frame. After the first frame exposure finished and CCD electron is being readout, the second frame is still being exposed. This will cause the exposure time of the two frames to be slightly different. In order to get the same

exposure time for both frames, the QHY8L uses two exposure modes: Single frame exposure and double frames exposure. When exposure time is short (high speed readout mode less than 1.4sec, slow mode less than 3.47 sec), the QHY8L will select double frames exposure mode automatically. It will expose twice with the same exposure time. It will readout the first frame pixels after the first exposure, and it will readout the second frame pixels after the second exposure. But double frames exposure mode will cause two exposure times. This is not appropriate for long time exposure. So in long time exposure condition, the QHY8L will use single frame exposure mode, so the QHY8L will expose only one time. It will keep the first frame exposure time same with the second exposure time through a special hardware process in the camera.

Note: In the long exposure time condition, as the first frame has already started to read the data, and the second is still in exposure, the first frame will produce amplifier glow. The time is 1.45 seconds or 3.47 seconds. Because the second frame is still being exposed, the amplifier glow will enter the second frame, so there will be a faint yellow amplifier glow on the top left corner of the image. The glow must be compensated through a dark frame calibration.

For 2*2, 4*4 binning modes, the QHY8L chip uses progressive scan mode, so there is no such problem.

7. About controlling for BLOOMING

The QHY8L CCD chip has -100dB anti-overflow foundation. It is possible to overflow when you are shooting a very bright target. For the overflow problem of the SONY CCD chip, you can install mechanical shutter. If you need a mechanical shutter, please consult QHYCCD or your area dealer.

8. **Chip moisture problems**.

In certain relative humidity conditions, when the temperature is lower than the dew point, dew or frost will appear on the surface; this is a law of nature. Ice or dew may form on the surface of the CCD chip or optical window, and they will impact your images. If dew or ice forms on the surface of the CCD chip, water can flow onto the electric board, leading to a short circuit or data corruption. You should not let this happen.

Chip surface moisture

The internal space of CCD camera is relatively airtight. If dew forms on the surface of CCD chip, this indicates that there is higher relative humidity in the CCD chamber. You must dry the chamber using the following method:

- Open the QHY8L in dry place. And put the QHY8L in a dry and airtight environment for24 hours to make it completely dry.
- Install the QHY8L in the dry environment and seal it.

Infrared cut-off glass window moisture

If the cooling temperature is too low in a high humidity environment, the infrared cut-off glass window may collect dew. This is due to the temperature of the window being too low. Please use the following method if you encounter this problem.

- Install M42 to M42 heater which produced by the QHYCCD. The heater can raise the glass window's temperature to avoid dew forming.
- Reduce the cooling power, the best temperature range for the QHY8L is from -5°C to -15°C. Please adjust the cooling temperature according to the ambient temperature.
- Do not put the glass window upside down, as the cold air may collect on the glass window

Note: You should shut off all power after you finish using your camera. If the camera is still on, any ice crystals around CCD chip will melt which can corrupt or short-circuit the PCB board.

9. **Notes about Long term use camera and Remote Observatory**

If you have to keep the camera working for a long time or the camera is working in a remote observatory, please follow the following procedures, and we recommend that you consult your area dealer for more details.

- Before using the camera, always check that the CCD chamber is sealed and dry. If there are many ice crystals around the chip-this indicates high relative humidity in the CCD chamber. You must dry the CCD chamber.
- Check the air tightness of CCD sealed chamber. You can check this by increasing the internal pressure of the CCD sealed chamber with a hand pump (do not exceed 1. 01MP). Then watch if the pressure drops. If the pressure drops quickly, this indicates a lack of air tightness. You need to check if the front cover is screwed on well.
- Put effective desiccant in the dry tube and connect continually with CCD for a long term drying.
- Don't supply power to the CCD for several days or even weeks if possible. Use a power controller to control 12V input or AC input.

10. Protection of Cooler

The double cooler of the QHY8L can reach to 33-35 C difference in environmental temperature. So it is necessary to avoid thermal shock to the cooler. Thermal shock means internal stress of cooler changes due to expansion or contraction caused by the rapid changes in the temperature of the cooler. Strong thermal shock will shorten the life of the cooler or even cause irreparable cooler damage.

This is the method of avoiding thermal shock: to avoid reaching maximum cooler power when booting camera, take care to gradually increase power of cooler. When stopping

work, please reduce the power gradually if the cooler power is high, and turn off the power of the camera.

12. **Clean the surface of CCD**

If dust particles impact your images, you can open the front of the camera to clean the surface of the CCD. We suggest using the flat field calibration method to process the images for small dust particles so as to avoid the need to open the front cover. To open the front cover, proceed as follows:

- Screw the front cover of CCD counterclockwise.
- Clean the surface of CCD with a manual air pump. You can use lens paper or a commercial available SLR camera cleaning kit to clean the dirt which cannot be cleaned up by the manual air pump.

The correct cleaning method using lens paper:

- Wash your hands with soap.
- Take a piece of lens paper and fold it once or twice (Do not fold too many times as the lens paper will get very sharp and the edges may scratch the CCD glass surface).
- Blow on CCD and use lens paper to clean the CCD surface. Make sure to maintain an appropriate pressure for CCD with your hand.
- Finish cleaning and reinstall the front cover of CCD. If there is high humidity in your environment, it is necessary to dry the inside of the CCD sealed chamber.

13. **Using the center and angle adjustment ring**

- There is M42/0.75 thread on the QHY8L, which can connect with the telescope directly. You can use the center and angle adjustment ring if you need adjust the center or the angle of CCD. But you should know that if you use this ring, the QHY8L offset (focal plane distance) will increase by about 3mm.
- Center adjustment—Loosen the three screws around the ring. The adjustment ring will fit into the dovetail slot of the QHY8L. By adjusting the position of the three screws, you can achieve about 1 mm center adjustment.
- Angle adjustment--Unscrew the three screws on the ring slightly. There is small screw on the slide side of the ring that adjusts the size of the inclination angle. If you rotate the QHY8L relative to the adjustment ring, you can obtain the correct angle.
- After finishing the adjustment you should tighten the three screws on the ring.

Chapter 2.

Driver Installation and Software Quick Start Guide

Quick Start and Driver Installation

- Please download the latest version driver for the QHY8L, double click the driver installation program, and wait for it complete.
- Using USB cable to connect the camera and your computer (do not connect the 9-pin cable), waiting patiently for a system report to prompt you complete the installation of new hardware.
- If the driver installation is successful, the camera's LED light will flash.
- Use the 9-pin cable to connect DC201 and the QHY8L. Please note: the 9-pin cable has one end with EMC filter. This end should be connected to the DC201 power supply and not to the camera.
- DC201 requires a regular 12V input. When powered the LEDs OF +15, -15, +5 on the DC201 power supply will be on. Download the EZCAP software from download page. Run EZCAP.exe, select "scan camera" in camera menu, then it should show the QHY8L camera. Select the QHY8L.
- Make sure that the DC201 FAN and TEC LED are on and the fan of the QHY8L is blowing.

Software Quick Start Guide

EZCAP

- Run EZCAP.exe.
- Select "scan camera" in camera menu, then EZCAP will show 【QHY8L】, click it, and the preview column which is located on the left of EZCAP will be opened automatically.
- Set GAIN to 0. Set OFFSET to 125 (reference value, the specific value should be set by the user).
- Set exposure time, click preview button, the camera will start to exposure and show the image. To stretch the histogram and select the appropriate range, you can adjust the B and W bars' position by observing the histogram intensity. Make them include the area which is the main histogram intensity section.
- Click the live button; this will let you achieve a continuous preview. You can select a shorter exposure time (100 ms-500 ms) for obtaining a faster preview speed.
- Adjust the lens or the telescope focus to get clear images, then stop live preview. Choose a target or a star point through click the area by your mouse. Open the FOCUS column, click the focus button to get a focus image and adjust an appropriate histogram range.

- Click live button, Click the area of the image to get a more precise target. At this point, it will show the analytic curve in the screen view column and a 5X zoom focus image. While it is exposing, the FWHM column will show the width of star and the peak intensity of the star. Generally, the smaller FWHM and the larger the peak intensity the better the focus.
- When you finish focusing, open the capture column and start to shooting. Set the appropriate value of GAIN, OFFSET and exposure time. Set 1*1 Binning mode, select low readout mode. Click capture button to shoot.

MaxIm DL (Note: only MaxIM DL Pro or higher versions will operate this camera; lower versions such as MaximDL Basic will not work. The lower versions will read FITS images from the camera, however)

- Please download the latest version of the ASCOM platform. If it has the latest UPDATE, please download it together. Install ASCOM and UPDATE.
- Download and install the ASCOM driver of the QHY8L.
- Run MaxIm DL software. Select the camera icon in the toolbar (ctrl+w). There will be a Camera Control window. Click Setup Camera button inside setup window. Then it will pop up "Setup ASCOM" window. Select ASCOM from the menu of Camera Model. Click Advanced button. Select the type of QHY8LS StarSenScie from the window of ASCOM Camera Choose, and then click Properties button to set some usual value of parameters, like the value of GAIN, OFFSET and the speed of readout. Then click OK button and go back to the Camera Control window, click Connect button to connect the camera.
- Select Expose column in the Camera Control window. Select "Find Star" from the Exposure menu. Then set the exposure time. Select "No Calibration" from the pop up menu of "Option". Set the merge mode with X and Y (Set 1*1 mode if you want to capture or 4*4 mode if you want to preview). Click Start button to exposure and shoot.
- The image will be shown when the camera finishes shooting. You can use the Screen Stretch tool to adjust the stretching of the image.

AstroART

- Please download the latest version of the ASCOM platform. If it has the latest UPDATE, please download it together, Install ASCOM and UPDATE.
- Download and install the ASCOM driver if the QHY8L.
- Install AART and put the AART CCD link libraries (you can download piccdgui.dll in AART web page) into AART installation directory. Install AART ASCOM driver.
- Run the AstroRT software, select CCDcamera from plug-in menu, then there will appear a CCD control panel window. Select ASCOM from imaging/behind camera menu in the setup column. Click setup, choose QHY8 StarSenseScei, set the appropriate GAIN and OFFSET in "properties". Then click OK button.
- AART will show temperature control window if the QHY8L connection is successful; please set the target to your required temperature value.
- Set the binning model in setting column.

- Set exposure time at the bottom of the CCD control window, click START button to shoot one picture.

Nebulosity

- Please download the latest version of the ASCOM platform. If it has the latest UPDATE, please download it together. Install ASCOM and UPDATE.
- Download and install the ASCOM driver of the QHY8L.
- Start Nebulosity program. In the drop-down box under “Capture Control”, select QHY8L.
- Set gain, offset as usual (0, 125).
- Click EDIT on top bar, then “Preferences”. Scroll down to “Processing”, and look for “Manually Override Color Reconstruction”. Tick the box then click “Done/Save”.
- Temperature and bin mode can be set by clicking the “Advanced” tab. Note: there is no temperature monitoring window.
- Click “Frame and Focus” to frame and focus image. When done click “Abort”.
- Click “Preview” to expose and download an image. Note that image will appear in greyscale; to convert to color, click “Image” on top bar. In the drop-down menu, click the first item, “De-mosaic RAW”. In the pop-up menu, change the Matrix Offset value to X=1, Y=0. To improve color, in the table set Red to 1.1, Green to 0.9, and Blue to 1.1. Then click DONE. (Note: values should only need to be set once, but “De-mosaic RAW” button must be pressed for every new image for color conversion. Images can be saved as FITS files without De-mosaicing; they can be converted to color later).
- For finer focus control, click “Fine Focus”, and then move the cross to the area on the image where you would like to do finer focusing, press the left mouse button, and focus on that small area. When done, click “Abort” and then make another exposure to check that all is satisfactory.
- When exposure is satisfactory, on top bar click “File”, then the option you prefer for saving the image. Default is FITS, but you may choose BMP, JPG, or TIFF.
- To expose a sequence, set the number of exposures desired in the Capture Control window, then click “Capture Series”.

Astrophotography Tool (APT)

- Please download the latest version of the ASCOM platform. If it has the latest UPDATE, please download it together. Install ASCOM and UPDATE.
- Download and install the ASCOM driver of the QHY8L.
- Start APT program. Click Shift Connect and choose CCD ASCOM camera. Click “Render FITS as Color” and choose Bayer Filter GBRG. Then click OK. In the ASCOM box, select QHY8L.
- Click “Cooling Aid” to get the cooler dialog box. Click START to start the cooler. CCD Temperature is displayed in the box as well as in the Status box on the left hand side of the main screen.

- Click “Live View” for focusing and framing. Click Shoot to capture an image or use the Plan function. Note that for single exposures, time information is to be entered in the box to the lower right. Be aware that focusing with this program is a bit difficult because of the long time between image refreshes on the screen when in live view mode.

ImagesPlus Camera Control

- Please download the latest version of the ASCOM platform. If it has the latest UPDATE, please download it together. Install ASCOM and UPDATE.
- Download and install the ASCOM driver of the QHY8L.
- Start ImagesPlus program. Click “Camera” in top menu, then “ASCOM Color and Mono CCD”.
- From ASCOM Camera Chooser, select QHY8L
- From the resulting popup box, click the CONNECT tab if it is not already selected, then press the CONNECT button near the bottom. Answer the popup questions, then go down and tick the box next to “Convert 1x1 Full Size Bayer Format to Color for Display”. In the drop-down box, select QHY8L.
- Click the tab CURRENT SETTINGS, look for the “CCD Temperature” box, then turn the cooler on and set a desired temperature.
- Next enter an exposure time and click EXPOSE. It will take an image and display it.
- This program does not have live view. To focus, click the FOCUS METRICS tab and press EXPOSE. In the resulting image, select a small area with stars and draw a box around it by pressing left mouse button, the press “Use Sub-image”. Select an isolated star then DONE in the popup box.
- In the bottom box tick “Loop” and the press “Expose”. This will continually expose images and give focus metric information.

Use the QHY8L as a Guider in MaxIm DL

- the QHY8L has a built-in guide port. You can use the QHY8L guide port's output signal through ASCOM to guide on a star. the QHY8L use 1*1 binning mode by default and use normal readout speed mode. You should select part of the image as a guide star image area.
- You should use a guide star cable for connecting the QHY8L guide port with equatorial guide port (ST-4 cable, not supplied with camera). Run MaxIm DL software. Select the camera icon in the toolbar (ctrl+w). There will be a Camera Control window. Click Setup Camera button inside setup window. Then it will pop up "Setup ASCOM" window. Select ASCOM from the menu of Camera Model. Click Advanced button. Select the type of QHY8LS StarSenSeci from the window of ASCOM Camera Choose, and then click Properties button to set some usual value of parameters, like the value of GAIN, OFFSET and the speed of readout. Then click OK button and go back to the Camera Control window, click Connect button to connect the camera.

- Select Guide column in the Camera Control window. Set the exposure time, the unit is second.
- Click "Settings", open the "Guider Settings" window, click "Reset" in "Exposure Settings" area, which will restore maximum viewing area, click "OK" to save.
- Click START button to shoot one picture.
- The image will be shown when the camera finishes shooting. You can use the Screen Stretch tool to adjust the stretching of image.
- Click "Settings", open the "Guider Settings" window, using your mouse to drag an area on the image which you shot in the previous step. This area is the area which CCD will shoot. Click "OK" to save.
- Find a star in the image and use mouse to drag a box which can frame the star.
- Click "Calibrate", it will start to calibrate the equatorial mount.
- After it finishes calibrating, Click "Options", select "NoCalibration", so the guide star image is not calibrated.
- Select "Track", Click "Start", it will start to guide. You can click "Graph" button, so it will display the guide error curves.

Note: The QHY8L can use the false bin1*1 mode to guide star. This mode is bin 2*2 in fact. It is amplified to bin1*1 through calibration of the software. By clicking "Normal BIN11 Mode", you can switch to this mode. It has higher sensitivity as it is bin2*2. We recommend that you use this mode guide stars.

Viewing Images Produced by QHY8L Camera

The QHY8L camera can produce the following types of images:

FITS (16 bit integer per color)

BMP (8 bit per color)

JPG (8 bit per color)

Any image editing program can read the BMP or JPG files. Many programs can read the FITS images, which are the recommended type for any serious astronomy purpose, especially because their bit depth is greater (16 vs 8 bits per pixel). However color FITS images, such as those produced by the QHY8L-C, will usually appear in greyscale when first loaded by an image editor. To convert them to color, it is necessary to invoke a software routine. The EZ-CAP software cannot do this conversion.

- In MaximDL, load the FITS image, select “Color” from the top menu bar, then “Convert Color”. In the next menu, set X=0, Y=1, then press “OK”. Image in correct color should appear.
- In Nebulosity, load the FITS image, then Click “Image”. In the drop-down menu, click the first item, “De-mosaic RAW”. In the pop-up menu, leave the table as is, but change the Matrix Offset value to X=1, Y=0. Then click DONE. Image in correct color should appear. If the color file is saved as a FITS file after de-mosaic is done, it will be recognized as a color image by FITS Liberator (see

below). Separate color layers (R,G,B) can also be created as separate FITS files using the File, Save Color Components command.

- In AstroArt, load FITS image from camera, select “Color” from top menu, then “CCD color synthesis”. Make sure XY Offset values are both set to 0. Then click OK. Color image will appear. AstroArt does a nice job of balancing the color, as well. To save the separate color components, select “Color” from top menu, then “Split RGB”. Three images will appear which can be saved as FITS files.
- Photoshop cannot natively read FITS files. To enable Photoshop to read FITS files it is necessary to load a package from NASA/ESA, the FITS Liberator, available at http://www.spacetelescope.org/projects/fits_liberator/download_v301/. The package will automatically be loaded into the Photoshop directory. Be aware that this is a 32-bit package, so to use it you must use the 32-bit version of Photoshop. If you purchased the 64-bit version, you should also have the 32-bit version installed. Look for the Adobe directory under “Program Files (x86)”. That is where the 32 bit version is installed, and where the FITS Liberator files are installed. At present this program does not separate the color layers in the files generated by the QHY8L. These layers must be separated by another program such as Nebulosity or MaximDL. The advantage of FITS Liberator is the variety of stretch algorithms that it has.

Chapter 3

Set the GAIN and OFFSET

GAIN is the pre-ADC (analog-to-digital converter) programmable gain amplifier setting. OFFSET is the ADC voltage offset setting. The correct setting of OFFSET and GAIN can change the CCD's system gain, to make the CCD output signal range match the ADC quantization range, so as to get the best dynamic range.

Suitable for most GAIN and OFFSET Settings:

1. Set the gain=0, set the exposure time to 0, cover the lens, then shoot a BIAS frame.

2. Watch the local average value of the captured images (you can use the Noise Analyze function of EZCAP, image process->noise analyze). The ideal average value is around 500 to 1000. If the value is higher, then you should reduce the OFFSET. If the value is lower, then you should increase the OFFSET. Repeat steps 1-2 to obtain the ideal OFFSET value.

3. Open the lens cover, increase the exposure time, then use a uniform light source to take a saturated exposure image. Watch the local average value of the captured images. If the value is less than 60000, you should increase the value of GAIN. If the value is 65535, you should reduce the value of GAIN. Repeat this step to obtain the appropriate GAIN value.

4. Under this GAIN value, repeat steps 1-2 to obtain more accurate OFFSET value.

Note: For some QHYCCD products when you use bin modes of 2*2, 3*3, 4*4, images may reach 65535 even the gain is 0, so you just set the gain to 0.

Chapter 4

Image Calibration

Images of stars, nebulae, etc. taken by the camera are called “light images”. Image calibration means calibrating the CCD with a BIAS field, a DARK field, and a FLAT field so to remove artifacts and nonuniformities from the light images. This includes removing thermal noise of the CCD, dark spots caused by dust on the surface of the CCD and elsewhere in the optical train, and variations in brightness caused by vignetting. Image calibration is a critical step for serious astronomical photography.

- In order to obtain accurate calibration information, you need to use the QHY8L temperature controller. The CCD should be set in regulated temperature state, and the temperature should be the same when shooting when shooting light, dark, and bias frames.
- The temperature control of EZCAP is located in Temp Control of the Setup menu bar. Select temperature regulation on the right section of the Temp Control window to set the temperature what you want. Then select the Auto Control, which will put the CCD under constant temperature control.
- It will take for some time to achieve the target temperature for the CCD. Wait until the temperature of the CCD stabilizes, then start to shoot calibration images.

The calibration principle of CCD image:

Calibrated image= (L-B) - (D-B) / (F-B) - (DF-B)] = (L-D) / (F-FD). Here L is the actual shooting image, D represents Dark Frame image, B represents BIAS image, F represents Flat Frame image, DF represents Dark Flat Frame image. Generally speaking, the Flat Frame image is bright, so we seldom use the Dark Flat Frame image. Hence we can ignore DF-B, so the calibrated image = (L-D) / (F-B).

Note: When we stack a lot of BIAS or DARK images, there will be vertical stripes on the stacked image. This is a normal situation; these stripes won't appear on the calibrated image.

Method to Capture Calibration Images:

BIAS

BIAS image refers to the image for which exposure time is zero. You need to avoid any light entering into CCD when you are shooting. Therefore, you need to cover the lens cap of camera. Set the exposure time to 0, set low readout speed, set the binning model to 1*1, then shoot 10-50 BIAS images. Save them, and then use stack software (select average model to stack, not matching stack) to get a BIAS master image. And save this image.

DARK

DARK image refers to the image in which exposure time is the same as the light images. You need to avoid any light entering into CCD when you are shooting. Therefore, you need to cover the lens cap of camera. The exposure time is set to be the same with formal shooting time, and then use the low speed, 1*1 shooting mode to shoot 10~50 DARK images. Save them, and then use stack software to get a DARK master image, and save this image.

FLAT

FLAT images can be used to rectify the problem of a lighter center light but darker edges caused by vignetting in the optical system. All optical systems exhibit vignetting to some degree. The shooting method for flat field images is the following: Point the telescope at a uniform light source, such as clouds, or make some type of uniform light source using a suitable diffuser. Set an appropriate exposure time, and start to shoot. You should shoot 10-50FLAT images. Save them, and then use stack software to get a FLAT master, and save this image.

- It is best to take FLAT images immediately before shooting or after shooting. Otherwise the position of dust on CCD surface may be moved when you dismount your equipment.
- To set an appropriate exposure time, remember that the result should be 30% or so of the maximum dynamic range, which means that the FLAT image's white pixel value should be 20000-30000.

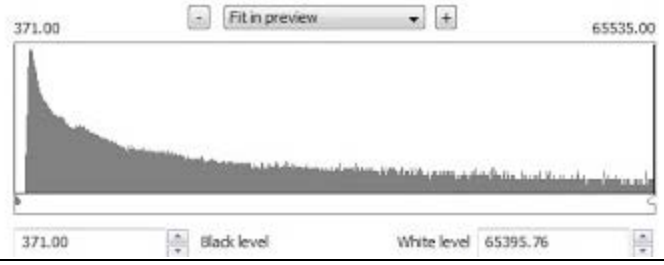
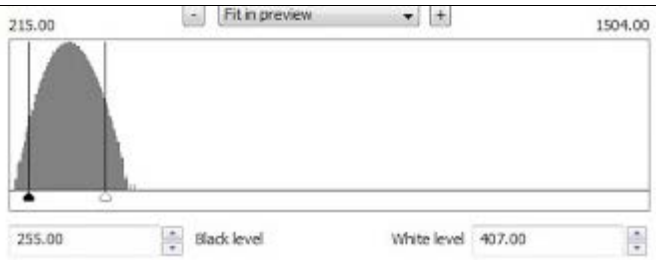
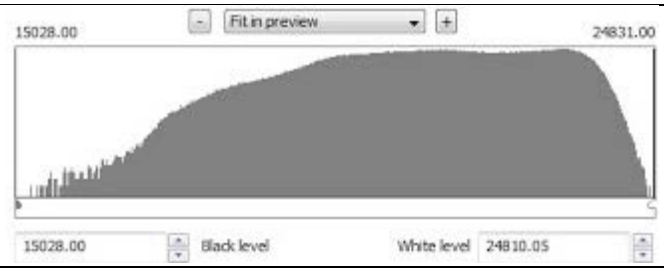
Dark Flat

Dark Flat image is a Dark image in which shooting parameters are the same as with FLAT images. If you wish to include these images, you need to cover the lens cap of camera, set low readout speed, set the binning model to 1*1, then shoot 10~50 Dark Flat images. Save them, and then use stack software to get a Dark flat master image. Then save this image.

Stacking and Combining

Registration, quality selection, and stacking of all images is easily managed by the free software package Deep Sky Stacker, http://deepskystacker.free.fr/english/index.html. After you combine and stack your images, the result can be further processed by Photoshop, PixInsight, or other programs.

The table on the following page summarizes the calibration images:

Type	Length	Temp	Optical train	Typical histogram
Lights	Any	Low	N/A	
Darks	Same as lights	Same as Lights	Binning same as lights	Similar to bias
Bias	Shortest possible	Any	Binning same as lights	
Flats	Long enough to get white level 20-30K	Any	Same as lights, including binning	

Chapter 5

Camera Attachment

The QHY8L can be used with both telescopes and lenses. The methods of attaching the camera to telescopes and lenses are given below.

1. **Direct attachment to telescope**. Simply insert the image end of the camera into a 2" draw tube, press it firmly against the drawtube end, and tighten the retaining screw. Figure 1 shows the two before insertion, and Figure 2 shows the camera inserted into the draw tube.

Figure 1. Camera and drawtube

Figure 2. Camera inserted into drawtube

2. **Attachment using drawtube adapter**. If desired, an adapter can be screwed into the camera, and then inserted into the drawtube. The adapter shown in Figure 3 has 42mm threads that mate with those in the camera, and is 5 cm long. It fits into a standard 2" drawtube. Figure 4 shows it attached to the camera. Figure 5 shows the drawtube adapter by itself (not included with the camera but available from astronomy equipment retailers).

Figure 3. Camera and drawtube adapter

Figure 4. Camera attached to drawtube adapter, ready for insertion into drawtube

Figure 5. Drawtube adapter

3. **Use Camera with regular DSLR lens**. In this method, an adapter is screwed into the front of the camera which allows it to take standard DSLR lenses. Figure 6

shows a 50mm Canon lens attached to the lens adapter, prior to attachment to the camera. Figure 7 shows the camera with the lens attached. Figure 8 shows the lens adapter (not included with the QHY8L camera but available from astronomy equipment retailers). The adapter has 42mm threads that screw into the camera. It will take standard Canon EOS lenses. The adapter shown has a 7mm spacer, which gives approximately the same distance from lens to focal plane as a DSLR.

Figure 6. Camera with Canon EOS lens adapter and 50mm lens

Figure 7. Camera with Canon EOS lens attached

Figure 8. Lens adapter for Canon EOS lenses

Chapter 6

Camera Parameters

6.0 mega pixel APS One shot COLOR CCD

Main Features

- Total pixels: 3110 x 2030
- Active pixels: 3032 x 2016
- Pixel Size: 7. 8um x 7. 8um square
- Color method: RGB BAYER film on CCD
- Effective sensor area: 28. 4 mm diagonal
- Readout noise: 6-10 e @600K pixel/s
- QE: 60% at Green (Peak), 50% at Blue and H. a
- Microlensing on chip
- Progressive Scan
- ABG: -110dB
- 16bit ADC with CDS and Preamp

- USB2. 0 High Speed interface
- Build in temperature sensor
- DC201 with TEC controller/Regular
- Ultra small size suitable for primary focus imaging and Hyperstar
- Weight: 400g

Difference Between QHY8L and QHY8PRO

	QHY8L	QHY8PRO
CCD sensor	ICX413AQ	ICX453AQ
Max Cooling	-35	-45
CCD readout Type	Two field Readout	Progressive Scan

How to select QHY8L/8PRO

the QHY8L has a low price than QHY8PRO. The major difference is the CCD sensor. the QHY8L using a Two field readout sensor. After exposure the Red and half of green pixels are readout first, then the blue and another half of green pixels are readout. QHYCCD uses technology to keep the two field exposure period the same. For long exposure there is no difference between them. To capture fast object movement or fast scene changes, we recommend the progressive scan sensor of QHY8PRO.

Chapter 7

Accessories and Interface Specification

Accessories (included with camera):

1.9-pin cable

2.USB cable

3.DC201

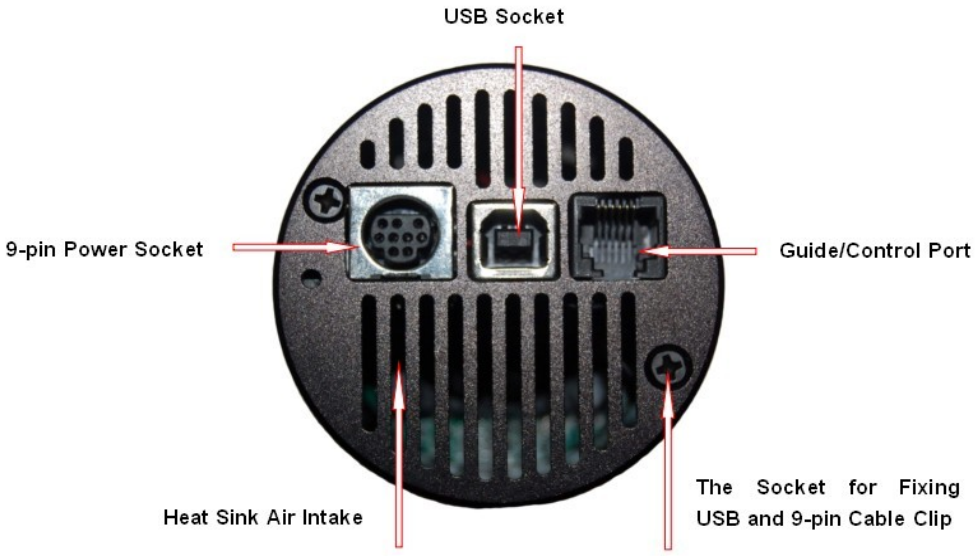
4.12V6A adapter

5.USB and 9-pin cable clip

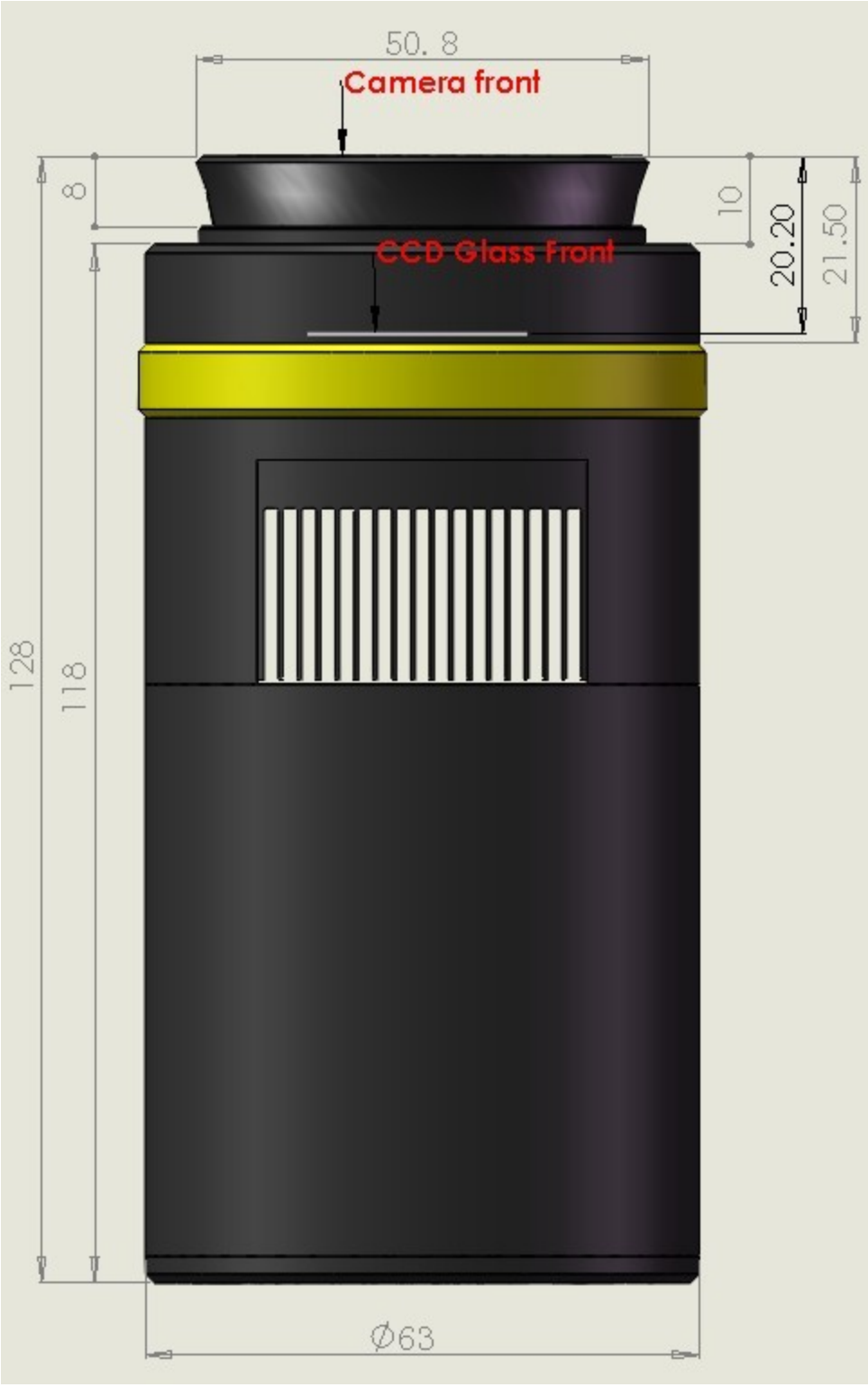
6.center and angle ajustment ring

7.silicon gel tube

QHY8L Interface Specification:



Chapter 8
QHY8L Mechanical Dimensions

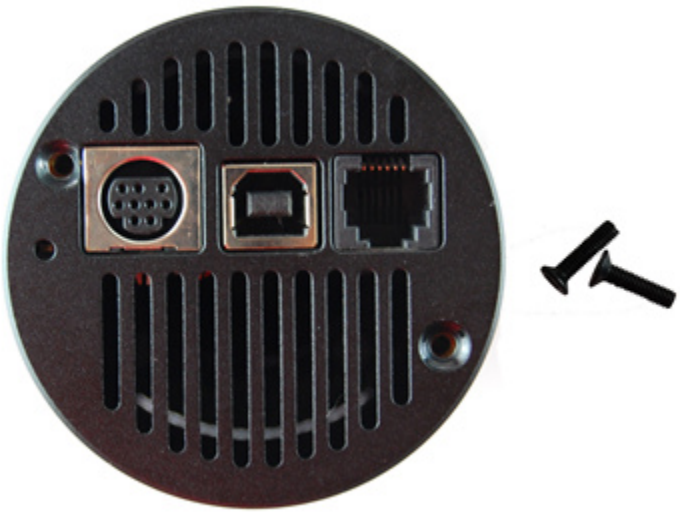


Chapter 9

Clip Installation

1. Clip for QHY8L/QHY8PRO/QHY10/QHY12 camera

2. Before installing the clip



3. Unscrew two screws at the back of the camera

4. Screw two M3*8 copper cylinders to the camera

5. Plug in the camera's USB cable and power cable

6. The front of the clip

7. The back of the camera

8. Install the clip

Note:You should use the standard Belkin USB cable, otherwise the clip cannot be installed or USB cable cannot be attached.