INITIAL SETUP OF QHY9C FOR NEWBIES
Draft v1.6

This document is a compilation of many responses and suggestions found on groups and forums and the Nebulosity website. Specific detailed comments are attributed to authors where possible. Many thanks to William Behrens of CCD-Labs for his assistance and advice.

This document may be freely distributed. No responsibility is accepted for any damages to cameras, equipment or software arising from instructions in this guide. Use at your own risk. Any errors or corrections please email brown_rb@yahoo.com

Contents

Drivers

Download the latest drivers and install them (the win32/64 and ASCOM drivers)

http://www.qhyccd.com/download.html

Connections

Damage may occur to the camera if the 12V power is connected to the camera before the USB cable is connected. It is best to follow the correct sequence to prevent damage occurring to the camera.

Connecting the QHY9C
1. USB Cable (windows should detect the camera and appear as a removable device under Vista/Win7)
2. 9 pin Power cable and DC201 (the EMC ring closest to the DC201)
3. Apply 12V power
4. Now start the application (Nebulosity or Maxim DL)

Disconnecting the QHY9C
1. Close the application (Nebulosity or Maxim DL – in Maxim you need to disconnect from the camera)
2. Disconnect 12V power
3. Use Windows Safely remove Hardware to disconnect QHY9C driver
4. Disconnect USB Cable

General Information

Binning
Binning is a technique where the pixels can be grouped together to increase the pixel resolution in arc-seconds per pixel. A 2x2 binning groups 4 pixels together (2 horizontal, 2 vertical). The QHY9C supports 1x1, 2x2, 3x3 and 4x4 binning in hardware.

Advantages of Binning
- Reduced noise
- Reduced exposure time
- Makes guiding easier
- Takes advantage of poor/average seeing conditions

Disadvantages of Binning
- _Image will NOT be in colour – B/W only (2x2, 3x3, 4x4)_
- Loss of resolution (image size is effectively reduced)
- Loss of detail due to reduction in resolution

The following table lists the pixel resolution size for the QHY9C at various focal lengths.

QHY-9C Binning						
Pixel Size	5.4					
Sampling in Arc-seconds = 206.25 / Focal Length * pixel size						
Focal Length	Setup	1x1	2x2	3x3	4x4	
2032	f/10	0.55	1.10	1.64	2.19	
1280	f/6.3 Reducer	0.87	1.74	2.61	3.48	
4064	2x Barlow	0.27	0.55	0.82	1.10	
5870	18mm EPP	0.19	0.38	0.57	0.76	
12598	10mm EPP	0.09	0.18	0.27	0.35	
Effective Resolution of QHY9C						
	Horizontal	3584	1792	1195	896	
	Vertical	2574	1287	858	644	

Note: Binned images (2x2, 3x3, 4x4 are B/W)

Gain and Offset

The two important settings that you need to determine are the camera gain and the offset. The gain determines the amount of amplification of the signal, whereas offset is a value which is added to all pixels to ensure that they are not zero.

A suggested method of setting the offset is to take a bias frame. This is done with the camera cover on the lens so no light can enter the camera. Set the lowest possible exposure time (0 is fine). Using the image information window (in Nebulosity) increase the offset till the min value is about 500-1000. You need to take a number of exposures, each time adjusting the offset. This will get you relatively close. It should be somewhere around 110-140 for the QHY9C.

To set the gain of the camera, point the camera at an illuminated ceiling (not at the light source) or white wall, with the lens cap off. Set the gain to zero and take a 2 second value. Look at the max value and repeat till the majority of the pixels are at maximum value or slightly below (65536). This gets you relatively close. It should be somewhere around 5-15% for the QHY9C.

Now finally go back and re-check your offset. You may need to re-adjust it.

However, a better way of setting the gain and offset is to do this at night with the telescope pointed at a nearby building, billboard or recognizable land object.
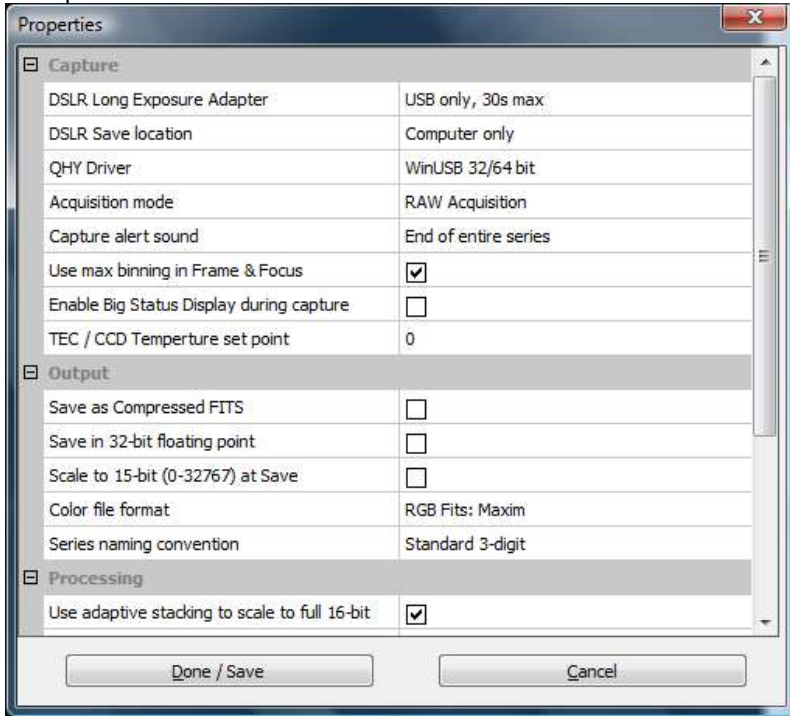
Nebulosity

Nebulosity - Preferences
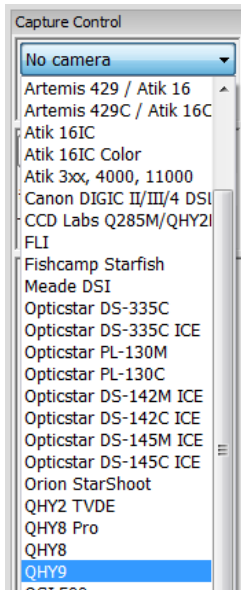Edit-Preferences
QHY Driver – WinUSB
Acquisition Mode - RAW

Nebulosity – Select Camera – Native Drivers
Try to use the latest version of nebulosity and the latest drivers.
You should see the camera QHY9C in the camera drop down box.

If the camera is not listed, it may have been disabled. On the menu bar, click Edit-Deselect Cameras and click the QHY9C box, then do this again but this time make sure the box is not checked, then click OK.
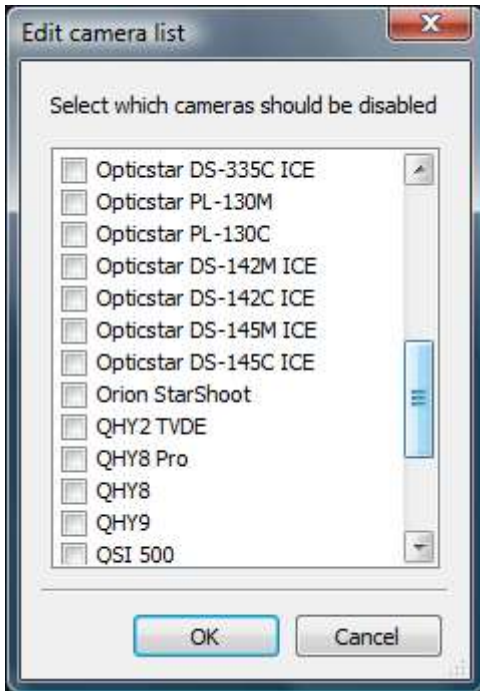
The QHY9 should appear on the camera drop down box. If its not there, you may need to remove the QHY9C drivers and then re-install them (they can be removed from control-panel).

Nebulosity – Enable TEC

On the menu bar, click View-QHY9C Control. This displays the TEC control of the QHY9C. Enable TEC, and set the setpoint to 0. The shutter should be Open.
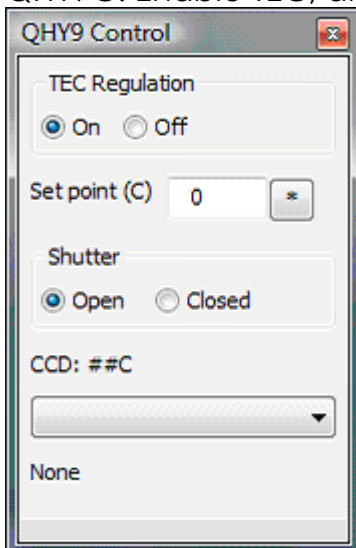
Note: When using the camera to take astrophotos, the setpoint will typically be set to a much lower value such as -20°C or -25°C in an effort to reduce the thermal noise in the camera to the lowest possible value.

Nebulosity – Setting Gain and Offset

It is highly recommended that you do NOT try to do the initial set-up during the day. The QHY9C is very sensitive, also to IR, and taking images during the day is very problematic. Here is an example picture taken through the day with 0% gain, 120 offset and 1 second exposure time.

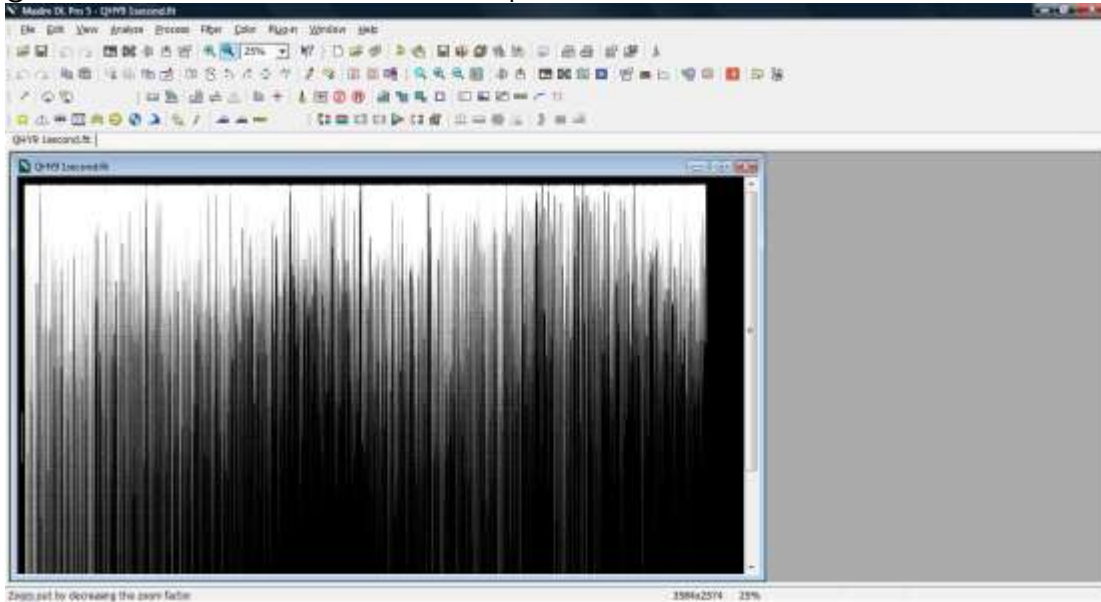It's best to wait till dark, then attach the camera to your telescope and point it at a distant building or billboard.

You will need to adjust the gain and offset for the QHY9C. A good starting point is a gain setting of 5 and an offset of 120. What you are looking for is a good picture. You need to look at the histogram in Nebulosity to ensure that the left side is not being clipped (there should be a gap between the lowest level of the image and the left side). See the following image.

It's also a good idea to display the pixel image information window so you can see the minimum background value (ADU) present in the image (it should be around 1000 – in the image below it is 1048).

Use the preview button to capture an image (make sure it is 1x1 and not binned) with an exposure time of about 2 seconds. Adjust the focus to get the image reasonably in focus.

Now look at the Pixel Stats window and read the Min: value. If it is less than 500, increase the offset by 5 and then capture another image, Keep repeating by adjusting the offset by +-5 till the Min: value is around 1000 (800-1200 is ok). Looking at the histogram you should now see a gap on the left.

If you change the gain you may need to repeat the above to get the offset in the correct range.

Nebulosity – Colour Conversion

I like to use the Zoom feature to shrink the displayed image so that's completely visible before converting to colour.
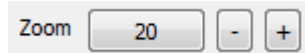
You need to convert your images to colour BEFORE ALIGNING OR STACKING THEM.

To convert the image to colour, use the menu option Image-De-Mosiac RAW (Best Quality) + Square.
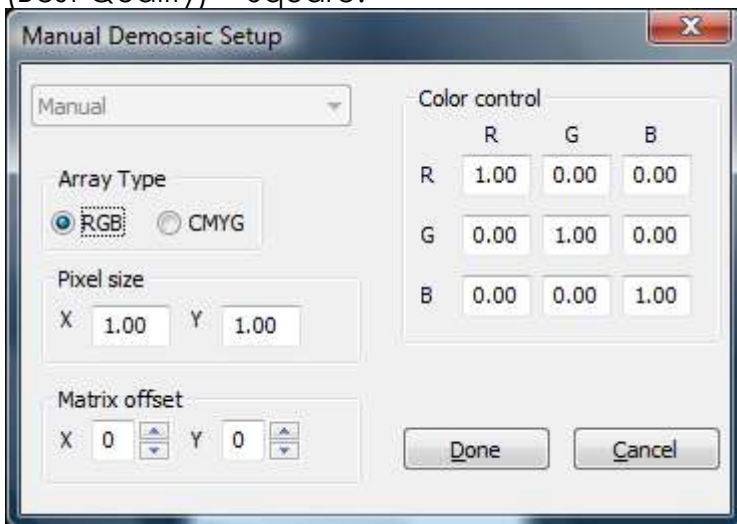
Ensure RGB is selected and click Done.

Note: Matrix Offset.
X and Y can have a value of 0 or 1, giving 4 possible combinations (00, 01, 10, 11). You can try these different combinations to see if you can get a better coloured image (after each try you can click Edit-Undo on the menu bar to undo the colour conversion then retry with a new setting).

Nebulosity - Adjusting Colour Levels

Image – Adjust Colour Scaling

You may need to experiment with the RGB sliders to alter the colour to a more natural looking image.

Tip: Take an image of the building or bill-board during the day with a DLSR then you can compare the colours side by side until you have it approximately the same. Once you have this, remember the RGB settings and you can re-use these values for all your images as a starting point.
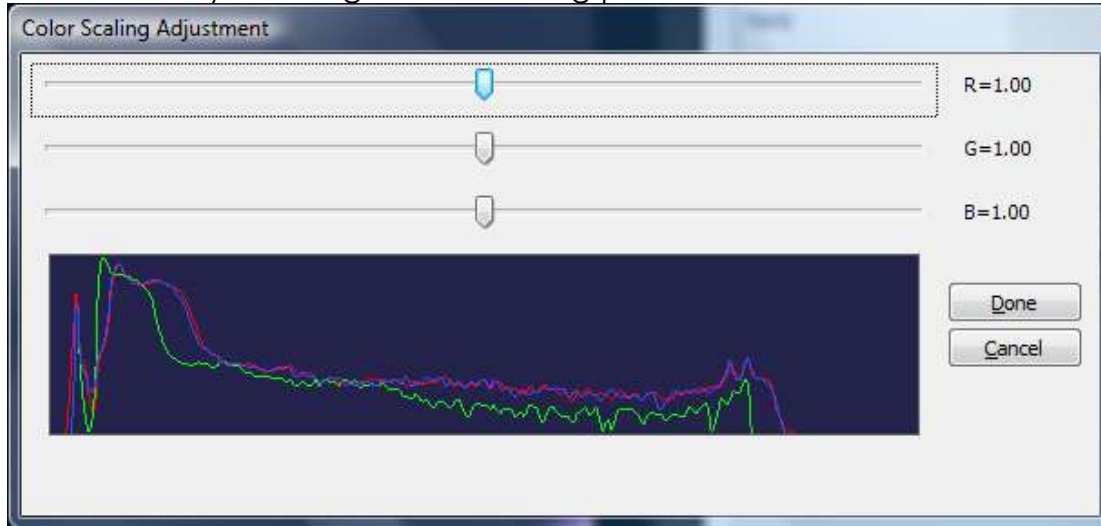
You can use the colour balance and colour offset functions in Nebulosity to compensate for the shifts in the capture. Take note of the settings that achieve a good colour balance. These settings can be added to a manual demosaic and then colour balance will be correct for every capture.

How to set up values for a manual demosaic in Nebulosity

Need to write this

Manual Demosaic Setup. Once this is done, you can batch demosaic your light frames.

Nebulosity – Frame and Focus

Nebulosity increases the gain when using frame and focus, so please don't try this during the day! By default, Nebulosity uses 4x4 binning mode for Frame and Focus. Under preferences, you can deselect the option "Use Max Binning in Frame and Focus". However, if you do this, downloads of the image capture will be slower and focusing a little more difficult.

Nebulosity – Known Issues with ASCOM

If using ASCOM with Nebulosity

1. Debayer does not work if you capture and then immediately try to debayer. The dialog box does not display for you to enter the x/y offset - so it shows B/W. What you have to do is save the fits file, then debayer it later.
2. Binning does not work, if you select 2x2 and capture you get a full 8.3mpx image at 1x1, nebulosity seems to be resetting the bin mode to 1x1 each time you press capture.

Nebulosity – Dark Frames

A dark frame is the capture of the noise in the camera that builds up during an exposure. Dark frames are used to remove the noise (from the camera) in images. A dark frame is an image taken at the same exposure duration, gain and offset settings, and temperature as your light frame (the capture of the sky object). You should take at least 10 then combine these into a single master dark frame.

You can create a set of dark frames at any time, simply by connecting the camera and keeping the lens cap on so that light does not enter the camera.

You can create a set of 10 each, at different exposure durations and temperature settings (for example 60s, 120s, 180s, 300s at -10c, -15c, -20c). It is best to save these dark frames using appropriate names (such as Dark60s-10c_001.fit). Once you have these, you can create a master dark frame from each set that can be used to remove the noise from your light frame.

Note: You can use the QHY9C window to change the "Shutter closed" for taking dark frames. Remember to reset this back to "Shutter Open" once you have captured your dark frames. Need to test this but from memory it works.

To capture a series of dark frames,

1. Change the QHY9C window option to "Shutter closed"
2. Set the number of exposures to 10
3. Set the exposure duration to the same duration as your light frame
4. Make sure the TEC temperature has stablized
5. Set the directory (Directory button) where you want the dark frames to be saved
6. Enter the name of the series (below the directory button)
7. Click Capture Series and wait for Nebulosity to finish the captures
8. Change the QHY9C window option to "Shutter open" when done

To create a master dark from the captured dark frames,

1. Batch – Align and Combine Images
2. Select "None" for the Alignment method, Average for Stacking function and check "Save stack"

3.   Click OK
4.   Select the dark frames (you may need to browse to the correct folder) and click Open
5.   Nebulosity will align and stack the dark frames. A dialog box will ask you for a filename to save the master dark – give it a meaningful name such as, DarkMaster120s-10c.fit
6.   You are done

Nebulosity – Flat Frames

Flat frames are used to remove the optical defects (such as dust spots, uneven illumination and vignetting) from your images. For flat frames to work, they should be at the same gain/offset settings, as well as camera angle, optical train (ie, barlows or reducers) and focus. In other words, everything the same as for your light frame (except of course the exposure time will be different), and are often taken using a light box or ELP (electro-luminescent panel) that gives an even illuminated light source (it's attached to the front of the telescope).

The exposure duration is adjusted so that the ADU value is around 1/3rd of maximum. This means an average pixel value of around 20,000 ADU (you can read this from the image stats window).

It is best to capture a minimum of 10 flat frames and then combine these into a single flat master.

Flat frames generally cannot be re-used and the optical defects in the flat frame won't line up with images taken at a later date (because you will be using a different camera angle and maybe optical train). So they are specific to a particular imaging session or object capture. If you imaged three objects in one night and didn't change the optical configuration or camera angle or focus, you could use the same flat frames for all three objects.

A suggested exposure time of around 2s will avoid shutter problems (which can occur if the exposure is less). This will mean adjusting the brightness of the ELP to achieve the recommended ADU value of 1/3rd or around 20,000.

To capture flat frames, simply attach the ELP light box to the front of the telescope and adjust the brightness to a lower level. Set the exposure duration to 2s and take a preview exposure. Check the mean ADU value and repeat (adjust the brightness of the ELP) taking exposures till the mean ADU value is correct. Once this is achieved, capture at least 10 flat frames.

To create a master flat frame, follow the steps outlined previously, but give the file a meaningful name that includes the object name, such as masterflat_ngc222. In this way you can match the flat with the light frame more easily.

Nebulosity – Bias Frames

A bias frame is basically a 0s dark frame that captures the minimum noise in the camera (read out noise).

You can use the previous techniques to capture a series (at least 10) of Bias frames and then generate a master bias frame from these.

To create a master bias frame, follow the steps outlined previously, but give the file a meaningful name, such as masterbias.fit.

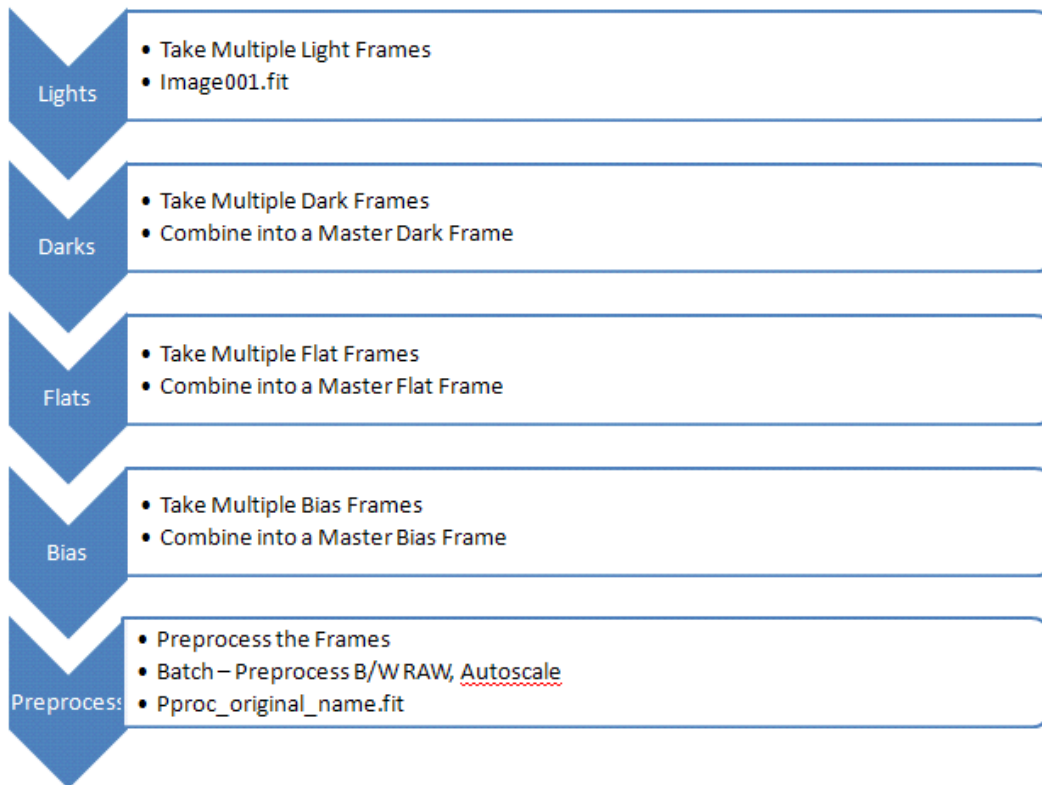## Nebulosity – Basic imaging processing sequence

Once you have captured all your dark, flat, bias and light frames it's time to think about processing the light frames.

Ref:
http://www.stark-labs.com/help/nebulositytutorials/files/Processing_HowTo.pdf

1. Batch – Pre-process B/W Raw Images
   a. Click Dark – select the master dark frame
   b. Click Bias – select the master bias frame
   c. Click Flat – select the master flat frame
   d. Check autoscale dark
   e. Click OK
   f. The files will be saved as pproc_original_name.fit
2. Normalize your light frames (batch normalize) – the files will be saved as norm_original_name.fit
3. Convert your light frames to colour (Batch – Demosaic and select the norm_orginal_name.fit files) – the files will be saved as recon_original_name.fit
4. Grade and remove bad light frames (optional) (Batch – Grade Image Quality, select your recon_orginal_name.fit files)
5. Align and combine the light frames (Batch – Align/Combine)
   a. Save Stack, Use Translation, Average/Default (for GEM)
   b. Select all good quality light frames
   c. Click on a suitable star (not fat, big, bloated, or core at 65536)
   d. Nebulosity advances to next light frame, star should be circled
   e. If circle is on correct star – Ctrl-Click (else click on the star)
   f. Enter a filename to save the aligned/combined image
6. Crop the image
   a. Draw a rectangle around the part you want to keep
   b. Image – Crop
   c. Save file
7. Remove the skyglow
   a. Image – Adjust Color Offset
   b. Accept default values, click OK
   c. Save file
8. Stretch the image to bring out the finer detail

  a. Image – Levels / Power Stretch

  b. Turn off autoscale

  c. Watch the histogram whilst moving the sliders, avoid clipping on left (B slider) and right (W slider)

  d. P slider adjusts contrast – use to bring out finer detail (try 0.6)

  e. Experiment with different values, save file often

9. You are done.

Lights
- Take Multiple Light Frames
- Image001.fit

Darks
- Take Multiple Dark Frames
- Combine into a Master Dark Frame

Flats
- Take Multiple Flat Frames
- Combine into a Master Flat Frame

Bias
- Take Multiple Bias Frames
- Combine into a Master Bias Frame

Preprocess
- Preprocess the Frames
- Batch – Preprocess B/W RAW, Autoscale
- Pproc_original_name.fit

Normalize
- Normalize Light Frames
- Batch - Normalize
- Select all Pproc_orginal_name.fit files
- Norm_original_name.fit

Colour
- Convert light frames to color
- Batch – Demosaic B/W
- Select all Norm_orginal_name.fit files
- Recon_original_name.fit

Grading
- (Optional)
- Batch – Grade Image Quality
- Select all Recon_original_name.fit files
- Files graded – preview and delete poor quality images

Align and Combine
- Batch – Align Combine
- Save Stack, Translation, Average/Default
- Select all light frames of good quality
- Save file

Crop
- Use mouse to define a rectangle around best part
- Image - Crop
- Save file as Crop_Original_Name.fit

Remove Sky Glow
- Image – Adjust Colour Offset
- Accept Default values
- Save file as RSG_orginal_name.fit files

Stretch
- Use the histogram, turn off auto-scaling
- Image – Levels/Power Stretch
- Move B slider so that the bottom end approaches the left side of the histogram
- Move W slider so that top end approaches the right side of the histogram
- The P slider adjusts the contrast – try values less than 1 (like 0.6) to bring out the contrast
- Save the file often

Done!
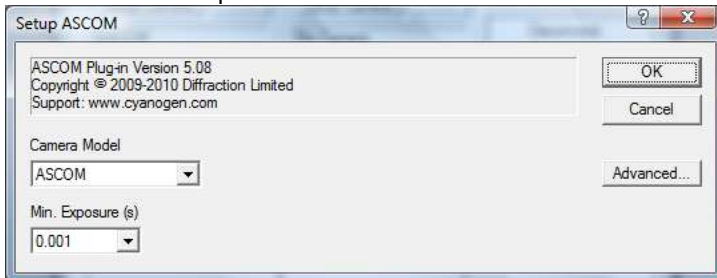- Read the Nebulosity manual for further or additional processing options

Maxim DL

Use the ASCOM drivers for Maxim DL. Ensure the latest ASCOM platform and updates are installed.
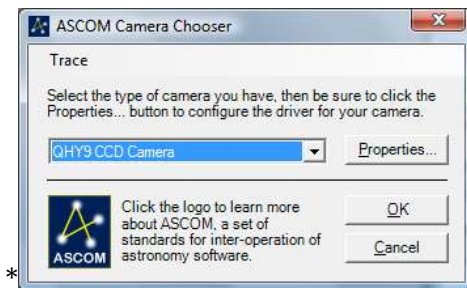
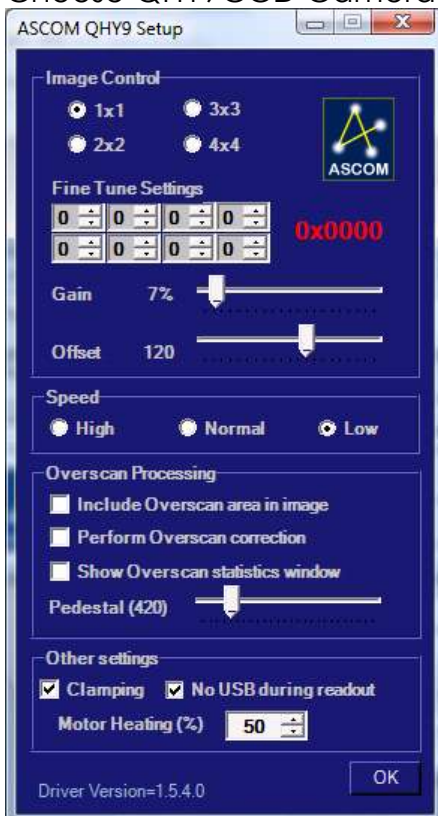## Maxim – Connecting the Camera

Click Setup Camera

Select ASCOM and click Advanced

*

Choose QHY9CCD Camera and click properties

Select 1x1 binning, set Gain to about 7% and Offset to 120, Speed Normal, then click OK.

Click OK (for the ASCOM Choose dialog box).
Click OK on the Camera Setup dialog box.
To connect to the camera, click Connect.

Clamping
Clamping should be ON (Enabled). This function reduces (clamps) the shadow streaking from bright stars that are either saturated, or very high level. If you don't enable it, then you may have some stars that show a shadow of the star across the screen. Some don't use it when doing work on galaxies, etc, that don't have any bright stars in the field. Just depends on your imaging and exposure times. The shorter the exposure the less you need clamping.
(Theo)

No USB During Readout
Some cameras can suffer from horizontal banding, where a darker band is visible during image capture (especially flats or bias frames). This can be caused by noise from USB data transfers during readout of the CCD. Using the latest drivers and enabling "No USB During Readout" can help minimize this.

Speed
High speed should only be used for focusing and sub-frames. Using the Slow speed is recommended for image capture.

Pedestal
This is a value that is added to all pixels in the image IF you have selected "Perform Overscan Correction". When the image has been pre-processed by performing an overscan correction, some pixels may end up as zero. The pedestal ensures that this is not the case.

Ascom File Locations
When you install the ASCOM drivers, they are installed in \Program Files\Common Files\ASCOM\Camera. The two files are
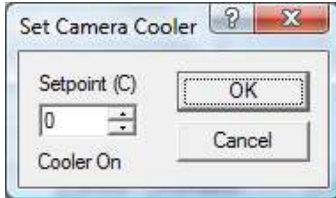   ASCOM.CCDQHY9.CAMERA.DLL
    qhy9dll.dll

Note: If you want to roll back to a previous version of ASCOM, you can delete the above two files and then run the ASCOM installer for the QHY9.

Maxim – Enable TEC

In the Camera Control Window Click Coolers On.
Click the cooler button

Set the temperature to the desired setpoint and click Ok.
For best results, wait till the camera temperature has stabilized before capturing images. This may take up to 15-20 minutes,

Maxim – Image Capture

Expose, 2 seconds, subframe off, mouse off, single, binning x=1, y=1, click Start. Maxim will expose the camera and download the image and displays it in B/W (the colour information will need to be extracted using the colour convert command).

Maxim – Colour Convert

Some cameras generate images that are slightly offset from the starting position. When you try to colour convert these images, this results in an image with incorrect colour. You can correct this misalignment in offset by adjusting the Offset X and Offset Y values; simply try different values until you get reasonable looking colour. There are only four settings to choose from (x=0 or 1, y=0 or 1). Most users of the QHY9C have found that x=0 and y=1 often produces the best looking colour image.
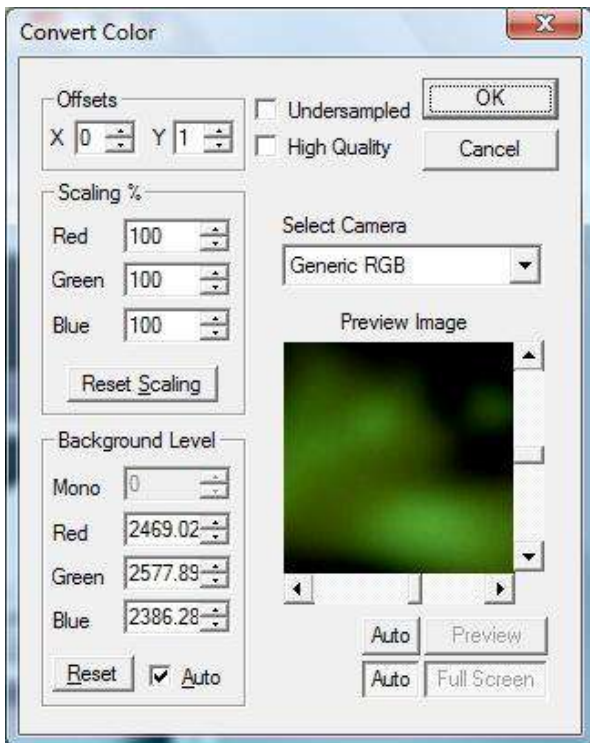
Colour images often require a background level adjustment. This is accomplished by bringing the background level (or bias) in each colour plane down to zero. Each of the Background Level values is subtracted from every image pixel in its colour plane. Any pixel values that become negative are forced to zero. The Reset button resets the background level subtraction to zero on all planes. The Auto button automatically determines the settings necessary to equalize the image background in all three colour planes.
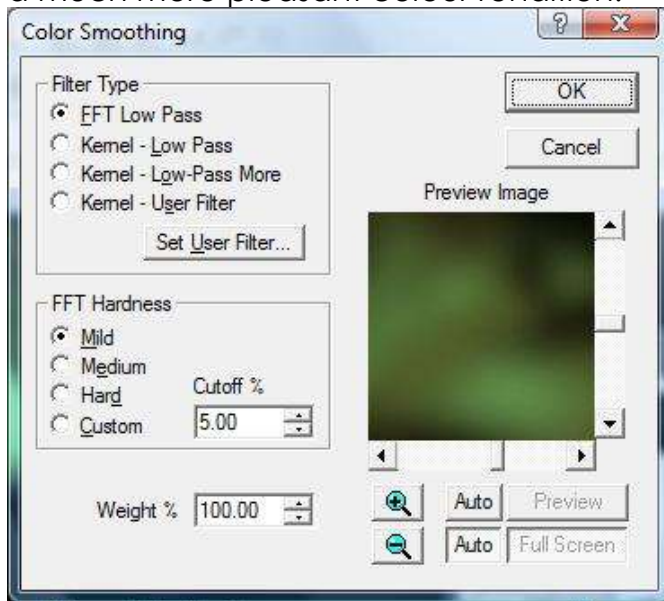
Maxim – Colour Adjust

The colour adjust command can be used to alter the colour levels (RGB) of the image. You can click on each of the image thumbnails to see if it generates a better coloured image.

Maxim – Colour Smoothing

The colour smoothing command can be used to smoothen out the colours giving a much more pleasant colour rendition.

Maxim – Screen Stretch
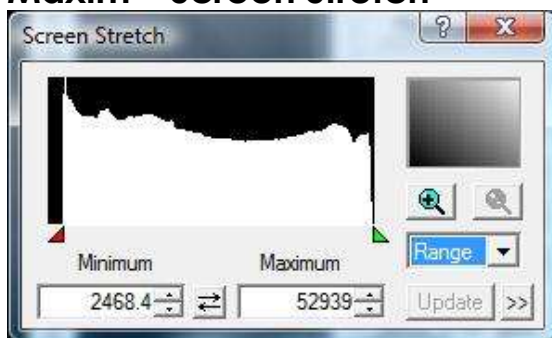
Selecting Range often works best in giving better colour images. Try experimenting with the different options to determine which works best.

Maxim – White Balance

White Balance is useful when the colours of an image don't look right, but the image contains an object that you know is white. Click on the object you know is white. This can often generate a better looking colour image.

This command is similar to the Colour Balance command but is easier to use if the image contains an area that is known to be white.

Maxim – Camera Options

The Orientation controls allow you to determine the rotation or orientation of the image when it is downloaded from the camera. Select one of No Rotation, Rotate Image 90° CW (clockwise), or Rotate Image 90° CCW (counterclockwise). You can also check either or both Flip Horizontally (left-right) or Flip Vertically (top-bottom); selecting both is equivalent to a 180° rotation. However, this will affect the X and Y offsets in the Colour Convert option and you will need to change these when you convert the image to colour. Whenever you change the way you image (ie, rotating the image on download), you will need to adjust the X/Y offsets accordingly. You will need to experiment with these options if you intend to do this, and make a note of the appropriate settings that work.
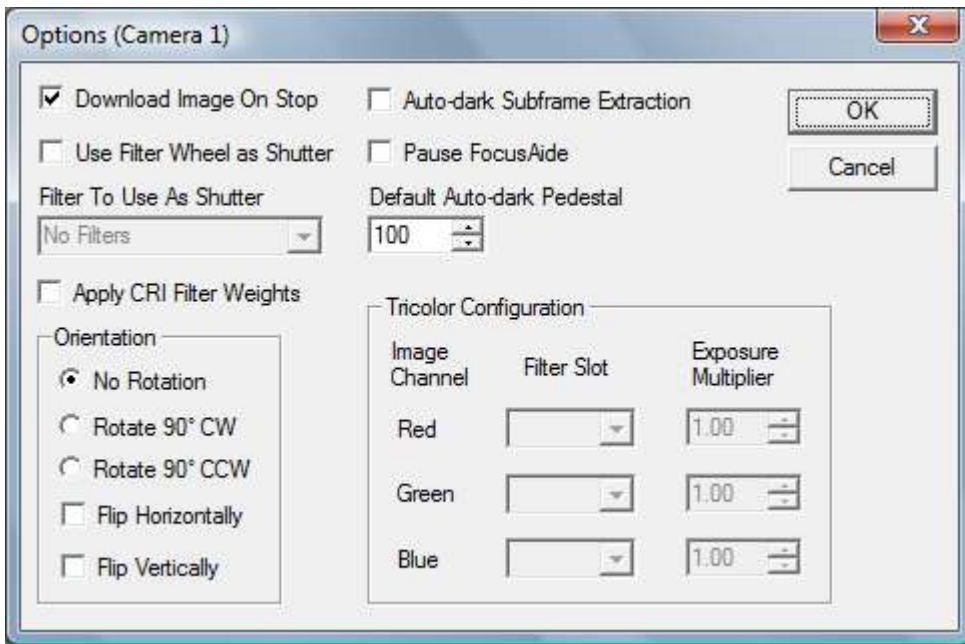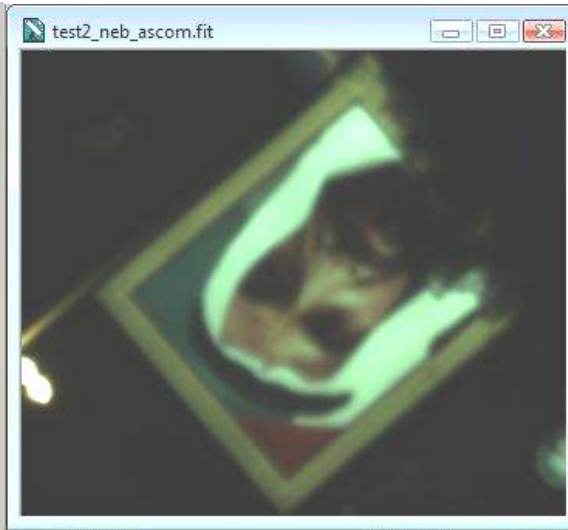
Sample Pictures

Image captured with DLSR - day   Image captured with QHY9C - night

Additional Information

CCD Sensor Sizes

	NexImage	EOS 500D	QHY9C	OSSAG
Chip Size (in mm)	4.6 x 3.97	22.3 x 14.9	17.96 x 13.52	13x13 (1/2")
Pixel size (in µm)	5.6	4.7	5.4	5.2
Effective Pixels	659 x 494	4752 x 3168	3584 x 2574	1280 x 1024
Distance to Sensor	5mm	35mm	29mm	15mm
Pixel Resolution in arc-seconds	0.57	0.48	0.55	0.53
FOV in arc-minutes	6.5' x 4.5'	37.8' x 25.2'	30.38' x 22.87'	11.2' x 9'

QHY9C Eyepiece Projection – C8 SCT

QHY-9C, 5.4um pixel size, 3584 x 2574											
Tele-extender length in mm	Eyepiece FL in mm	Eyepiece Length in mm	T-Ring	QHY-9C FPL	Total Length eyepiece to QHY-9C	Effective Focal Ratio	Effective Focal Length in mm	Magnification	Pixel Resolution in arc-seconds per pixel	Coverage Area of Sky in arc-minutes (W)	Coverage Area of Sky in arc-minutes (H)
122	2.3	90	0	29	61	255.2	51,860	25.5	0.021	1.281	0.920
122	5	85	0	29	66	122.0	24,790	12.2	0.045	2.680	1.925
122	8	73	0	29	78	87.5	17,780	8.8	0.063	3.737	2.684
122	10	65	0	29	86	76.0	15,443	7.6	0.072	4.303	3.090
122	12.5	53	0	29	98	68.4	13,899	6.8	0.080	4.781	3.434
122	18	67	0	29	84	36.7	7,451	3.7	0.149	8.918	6.405
122	25	55	0	29	96	28.4	5,771	2.8	0.193	11.514	8.269
122	40	65	0	29	86	11.5	2,337	1.2	0.476	28.435	20.422
Prime Focus						10.0	2,032		0.547	32.700	23.485
2x Barlow						20.0	4,064		0.274	16.350	11.743
f/6.3 FR						6.3	1,280		0.869	51.912	37.283
f/3.3 FR						3.3	670		1.660	99.175	71.227

QHY9C Focal Reducer Spacing – C8 SCT

Spacing for Focal Reducers with QHY9C									
Manufacturer	Focal ratio	Thread	Lens to CDD Sensor distance in mm	QHY9C ccd-t-thread distance in mm	Adapter	Part Number	Adapter Length in mm	Spacer t-thread required in mm	Rear Cell
Meade	0.33	SCT	55	29	Orion SCT to T-Thread	052619	10	16	SCT
GSO	0.5	2"	43	29	Baader Ultra Short	BP-2227	5	9	Baader SCT to 2" Quick Lock
Celestron	0.63	SCT	105	29	SLR Camera Adapter	93633-A	49	27	SCT
Celestron	0.63	SCT	105	29	Celestron OAG	94176	53	23	SCT
Celestron	0.63	SCT	105	29	Orion OAG	OR5521	28	48	Baader SCT to 2" Quick Lock
Antares	0.7	2"	55	29	Baader Ultra Short	BP-2227	5	21	Baader SCT to 2" Quick Lock

WHERE TO GO FOR HELP

http://qhyccd.com/ccdbbs/index.php

http://tech.groups.yahoo.com/group/QHYCCD/

http://www.stark-labs.com/help/nebulositytutorials/tutorials.html

http://panisse.lbl.gov/snphot/ccd.pdf (about overscan correction)

SOFTWARE

http://www.qhyccd.com/download.html

http://www.ascom-standards.org/

http://www.stark-labs.com/nebulosity.html

http://www.cyanogen.com/maxim_main.php

GENERAL QUESTIONS AND ANSWERS

These have appeared on the QHYCCD forum or QHYCCD yahoo group.

Q: "There are two different optic glass on the front of the QHY9C. The optic glass for CCD chamber is the AR/AR coating. Another optic glass is IR blocking ". How can I tell which optic glass I have? My QHY9C came with one, but I don't know which one it is?
A: The easy way is to tilt the filter on a 45 degree angle, and look at reflection. If it is green reflections, it is a clear filter. If it is pinkish/red, it is UVIR block.

Q: I have now noticed that the CCD-chip in my QHY9 is not perfectly orthogonal to an optical axel. When fast focal ratios are used this comes more obvious, stars are not in focus in the other side of the image. CCD-inspector tells me the same story. Is there a method to adjust this or do I have to make up a DIY solution?
A: The CCD should be parallel with the camera back case. Because the CCD sensor is located with the TEC and TEC is located with the back case. You can adjust the front case. There are three screws to fix the front case. If the front case is not parallel with back case, this problem may happen.

Q: Debayer sometimes does not give me the correct colours. Could you recommend optimized X,Y value of offset and scaling of RGB or other

recommendations for the QHY9-C? When I set the X=0, Y=1 value in Maxim DL, I could get the more natural colour then X=0, Y=0

A: The offset is a number to experiment with. The image is built up or 2 type of lines, one with alternating Red/Green (RG) pixels and another with alternating Green/Blue (GB) pixels. The algorithm uses the RG/GB pixels configuration to restore the colour information in the image. In order to do this properly the program needs to know how the R/G/G/B pixels are structured in the image. This is where the offset comes in to align the image to the algorithm. The offset may change when you make subframes instead of full frame exposures. Typically, two offset pairs will result in clearly wrong images while the other two may look more natural. Only one of the two is correct though. Best is to judge the colour from something you know. If all else fails, just put a lens in front of the camera and make a picture of e.g. a box of water colour paints during daylight using the very same subframe settings as the image you want to convert. Note that you will not get accurate colours on these images due to the fact that IR light is not cut and most pixels (RGB) have a large amount of IR sensitivity so IR washes out the image resulting in duller colours, but at least Red should be red and blue should be blue when using the correct XY offset pair. Also, you may want to change the levels of red, green or blue when doing the conversion as well.

Q: I'm having the random horizontal banding issue in both dark and light frames. Also the dark frame seems divided into two zones by this band, one with narrow black stripes running down to the bottom and one (the upper) with no such stripes. I shot 16 600s dark frames today and the banding is in all of them but drifts up and down and so remains in my master dark. I also discovered the banding in 600s light frames shot at a dark sky 15 days ago.

A: Please use the No USB during readout. This is just to solve this problem. It avoids the USB data transfer during readout the pixel. The USB data transfer will cause some noise so you will see the banding.

Q: What is the overscan Histogram in the ASCOM driver for?

A: The overscan area information histogram starts from 0 on the left and contains all values up to the highest value that is present in the image (the lines above contain this value). When all of the graph turns red, you definitely need to do something about the offset value you are using (means all of them are 0).

Q: What is Pedestal in the ASCOM driver?

A: This is a value that is added to all pixels in the image IF you have selected "Perform Overscan Correction". When the image has been pre-processed by performing an overscan correction, some pixels may end up as zero. The pedestal ensures that this is not the case.

**Q: What is overscan correction in the ASCOM driver?**

A: When an image is taken using 0s exposure, it consists of 3 main parts, an overscan level (the mean level of all pixels - varies depending upon temperature and time), bias (the individual pixel-to-pixel variations) and read-out noise. Each CCD has an overscan region (which is an extra set of pixels down one or more

sides) and give a measure of the average signal value that is introduced when the CCD image is read. This overscan level should be subtracted from your image. To do this, you can check the "Perform Overscan Correction" in the ASCOM dialog box and the driver will do this automatically. If applying overscan correction, you should also use a Pedestal value to ensure that no pixel value ends up as zero once the overscan correction has been done.

Q: What is clamping in the ASCOM driver?
A: Clamping should be ON (Enabled). This function reduces (clamps) the shadow streaking from bright stars that are either saturated, or very high level. If you don't enable it, then you may have some stars that show a shadow of the star across the screen. Some don't use it when doing work on galaxies, etc, that don't have any bright stars in the field. Just depends on your imaging and exposure times. The shorter the exposure the less you need clamping.

Q: I am getting some faint vertical banding in Bias and Dark frames. What is causing this?

Master_Bias_1_Neb.fit
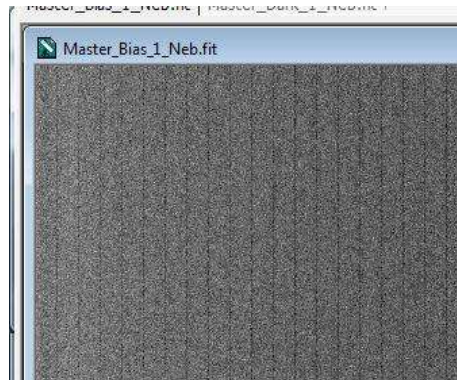
A: This is read-out noise. First make sure that you have set the speed to LOW. If banding is still there, it may be able to be reduced by adjusting the fine-tone settings in ASCOM. It is controlled by #3 of fine tone adjustment and can only be done in EZCAP or using the ASCOM drivers.
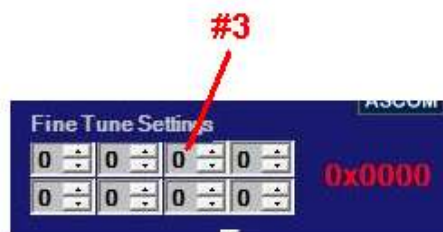
There are 8 adjustment bars. Each bar has 4 positions. The sequence of the bar is
    ASCOM
        #1 #2 #3 #4
        #5 #6 #7 #8
    EZCAP
        #1   #5
        #2   #6
        #3   #7
        #4   #8

For #3, there are 4 different settings. What you need to do is take bias or dark frames at each of the different settings for #3, and see if a particular setting results in reduced banding. Note that you can only do this with EZCAP or the ASCOM drivers.

Q: What are the Fine Tone Settings?

A: See above. Also,
#7 #8 #1 has relationship with CCD drive timing
#2 #3 #4 has relationship with ADC timing
#6 is no use
#5 has relation with readout clock

For vertical lines (banding) you can try #2 #3 #4 especially #3.

Q. What is the relationship between binning mode and readout noise?

A: The binning mode can help reduce the readout noise. If you read 4 pixels and then combine in software, each readout will bring a readout noise.

In n*n bin mode, for hardware binning, the SNR to readout noise is:
$$SNR = n*n/readout\ noise$$

In n*n binning by software then SNR is
$$SNR = n*n/(n*readout\ noise)$$

So SNR for hardware bin will be n times more than binning by software. This may be of benefit for weak or faint objects.

Q. What is the debayer pattern for QHY9C - I am using deep sky stacker

A: GBRG

Q: Can I use my QHY9C to do Narrowband imaging?

A: Yes. The basic steps are
    1) Install the Narrowband filter
    2) Shoot light frames at 1x1
    6) For Ha, extract the R channel from the colour image. The G and B are mostly noise.
    3) Calibrate, align & stack frames as normal
    4) Set colour saturation to 0
    5) You will now have a narrowband image in greyscale
    6) For the luminance, take an exposure without the filter. Use the RGB image and 0 colour saturation for luminance.
Note that you will need to increase exposure times.
["*Brian W. Allan*"]