

Quick guide on using QHY cameras

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Version 1.0

Change log

Version	Date	Description
0.1	2020-11-06	Initial release
1.0	2020-11-12	Added description of -n (multiple exposures) and -w (windowing). Clarified filter command

Names

Camera names are TWFC1 (on axis) and TWFC2 (off axis). TWFC stands for Tiny Wide Field Camera.

Observing system

Commands can be run **either** from taurus or sextans. You must use obsys before using commands.

To distribute processing load, it may be worth running the skysar GUI on sextans.

Check camera settings

For this you must use skysar GUI. Select camera TWFC1 or TWFC2 as usual.

Gain

Check the value of gain at the bottom of the screen. Currently the default is 30, but this may change during initial testing.

Cooling

The cameras are thermoelectrically cooled. Initial tests have shown that -10 degree C is a safe value. It is possible to cool lower, but may produce problems at high readout rates. If the temperature is not at the required setting, enter the demand temperature in the GUI and activate the cooling checkbox. Verify that the cooling power is not 0. **Avoid having the cooler power of more than 80 % in stationary state!** At the start of cooling the power jumps to 100 % until the temperature approaches the demand value.

Note that after the camera server restart the server might not report correctly the current cooling power and status (off/on), although the camera will show low temperature, for example -10 degrees. This problem goes away once you apply cooling demand from the GUI.

Command line

The command name is `indicam`. This is the recommended way to take exposures (see section about `skysar`).

List cameras

To check that the cameras are online:

```
indicam list
```

This should print two lines (assuming both TWFC1 and TWFC2 are online) containing information about the available cameras.

Making an exposure

```
indicam run TWFC1 1
```

This will take a 1-second exposure with the current window settings, **binning 2**. The default binning 2 is chosen because the pixel size on sky is very small – 0.066 arc-seconds, therefore strongly oversampling the seeing disk. In most realistic situations (seeing 0.7 arc-second or more) you should use binning 4.

Binning

To specify the binning manually use `-b` switch:

```
indicam -b 1 run TWFC2 10
```

Ten-second exposure with binning 1 with camera TWFC2.

```
indicam -b 4 dark TWFC2 60
```

60-second dark with binning 4 with TWFC2.

This camera model only supports binning 1, 2 and 4. Binning 3 is **not** supported!

Windowing

It is possible to define the readout window using `indicam` command. Example:

```
indicam -b 4 -w "[4000:5000,3000:4000]" run TWFC1 10
```

Caveats:

- Previous window settings are always overwritten, regardless whether the window has been specified by `indicam`
- If no window is specified, the full frame will be read out

- Window specification **must** be within quotes
- If window exceeds sensor resolution, the image will still be taken using specified size, however it will contain some garbage outside the sensor area
- When you are using binning, be aware that the window is always specified with reference to unbinned (or binning 1) image. For example, command

```
indicam -b 4 -w "[4000:5000,3000:4000]" run TWFC1 1
```

will produce an image of 250 x 250 pixels corresponding to position 4000, 3000 in unbinned image or 1000, 750 in bin 4 image.

Darks

The QHY camera does not have a mechanical shutter. Therefore to take darks you must assure that the camera is in complete darkness. In addition, you might want to select the H alpha filter (if available) to further block any light pollution. The command dark is as follows:

```
indicam dark TWFC1 10
```

This will take a 10-s exposure dark with binning 2 (the default). The only difference with “run” is that some FITS header keywords will have different values.

Biases

Biases are darks with integration time 0. The same comments as for darks apply. The exposure time is not specified.

```
indicam -b 4 bias TWFC1
```

A binning 4 bias on TWFC1.

Flats

Flats are just normal exposures, however the FITS header will contain value “Flat” in the OBJECT field if you use this command:

```
indicam -b 4 flat TWFC1 7
```

Making multiple exposures with one command

When multiple exposures using the same parameter are required, it is possible to set the number of repetitions with the -n switch. For example, to make 20 flats of 5 second exposures with TWFC2 you would type

```
indicam -n 20 flat TWFC2
```

Since the binning wasn’t specified, all flats would be taken with the default binning 2.

Filters

You can change filters using the filter command. Please note the peculiar syntax:

indicam filter TFWC2 -f “H alpha”

You cannot combine filter change and exposure commands. Filter command is **nonblocking**, meaning that it will not wait until the filter is in position. It takes about 10 s for filter change.

Skytsar

You can check the names of available filters in the skytsar GUI. Currently (2020-11-11) on both cameras these are R, G, B, and “H alpha” in positions 2, 3, 4 and 5, respectively. Empty slots have names like “Empty 1”.

Skytsar has been updated to support some of the QHY camera features, such as cooling, gain and filters, so you will need to use it.

All other functionality is the same as for the other cameras.

Other clients

Due to the INDI interface, the cameras can be used from other clients, however this is beyond the scope of this document. It can be useful as engineering interface. Note that the images taken other clients will not have the ING related FITS headers.

Note about FITS headers

The camera software is configured to contain the following FITS headers:

1. Selected headers provided by INDI, including filter name
2. TCS headers
3. WEAVE prime focus headers (FTS and ADC)
4. SQM headers