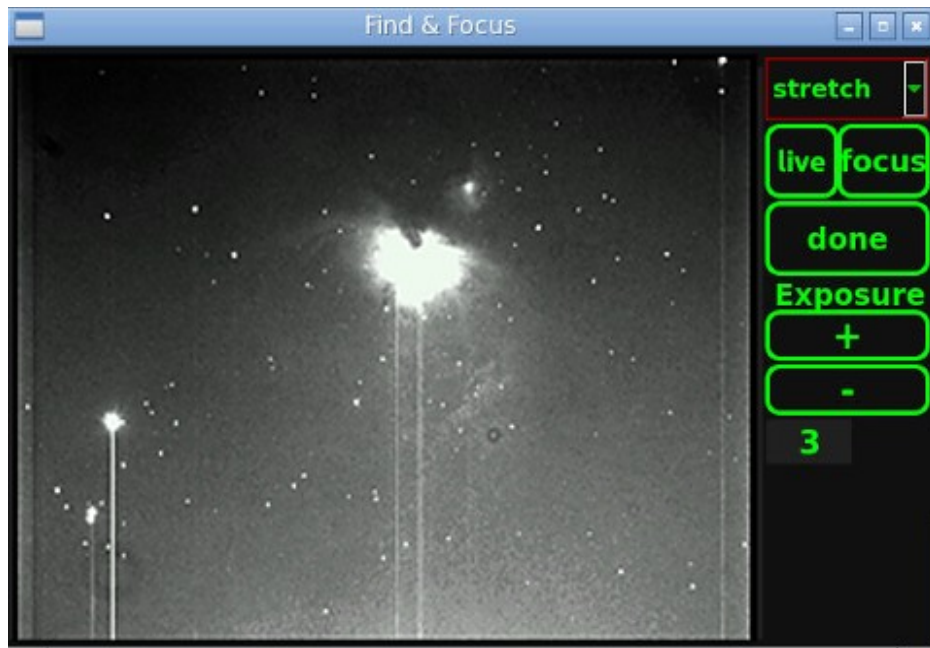


Astrel Instruments

AST-16200-B
SW TOOLS USER GUIDE
rev A

Find and Focus tool



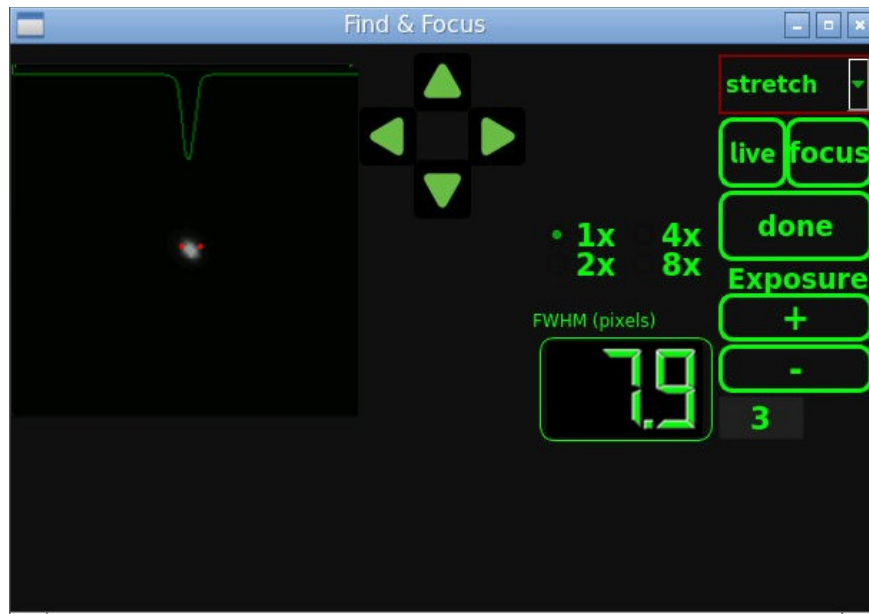
The Find and Focus tool is used to frame the desired sky view and/or to adjust focus.

Touch the **live** button to frame the photo:

- in this modality, the image is continuously refreshed using 5x10 binning
- you can vary the exposure using the **+** and **-** buttons or touching the displayed exposure (tenths of seconds) value and modifying it using the virtual keyboard
- the high binning level enables detection of very faint objects with exposures in the seconds range

When in liveview mode, you can touch the **focus** button to start the focus process:

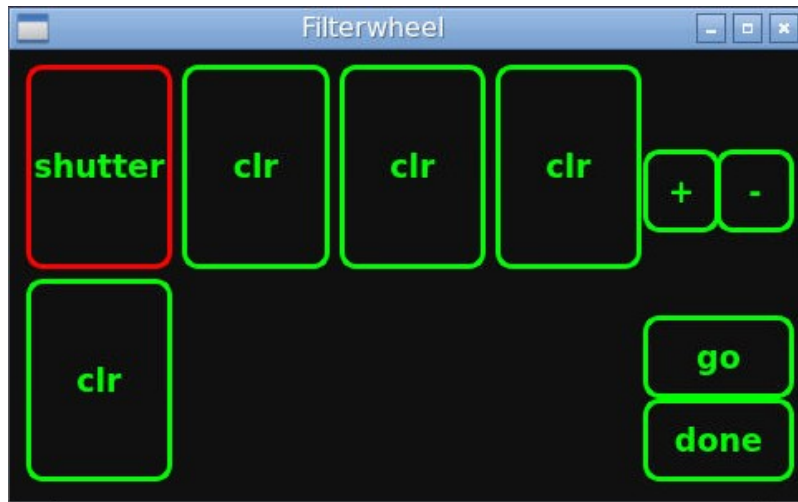
- you're asked to select a star touching it in the image displayed by the liveview mode
- after selecting the star, the focus mode window is displayed as shown in the following figure:



- the frame on the left shows an enlarged view of the selected star
- the zoom factor can be set to the following levels: **1x**, **2x**, **4x**, **8x**
- the star can be finely centered using the **arrows buttons**
- you can vary the exposure using the **+** and **-** buttons or touching the displayed exposure value and modifying it using the virtual keyboard
- during the focus process, a big led-styled number shows the **FWHM** of the star in tenths of pixel together with the intensity profile graph

Touch the **done** button to quit the tool and go back to the desktop.

Filterwheel tool



The Filterwheel tool is used to control the integrated filter wheel, to select a filter for the Find and focus and flat maker tools.

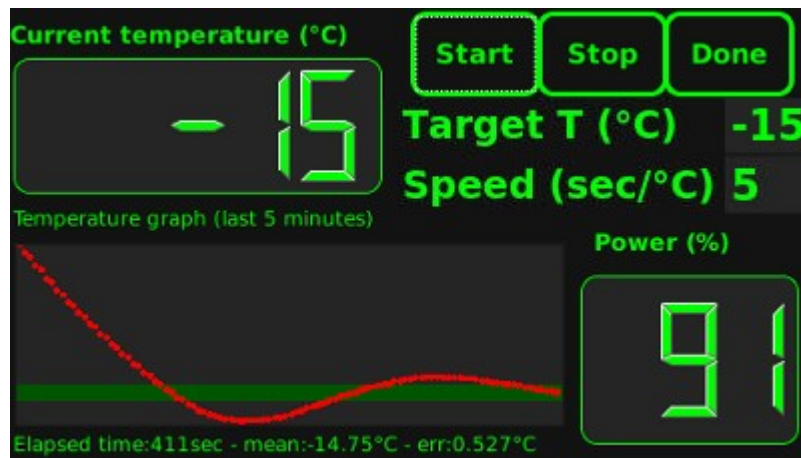
Depending on the number of positions of the filterwheel, use the **5, 6 or 7 big buttons** related to the filters and shutter positions in order to select one of them. The filters name reflects the one set using the configure app (see "*Admin Tools User Guide*" to modify them).

Touch the **go** button to move the wheel to the selected filter position.

Touch the **+/-** buttons to make small movements. This buttons are only needed during the filter installation procedure.

Touch the **done** button to leave this screen and go back to the desktop.

Temperature



The **Cooling control** tool provides means to control and monitor the CCD temperature during the cooling process and regulation.

!!!WARNING!!! do not cool the camera before removing the air inside using the vacuum pump: air inside the camera will frost on the sensor potentially causing damages and leaving dirt particles. Never open the valve without the vacuum pump connected.

The user can set the **Target T (°C)** the CCD to be reached and regulated and then touch the **Start** button to start the cooling process

In order to monitor the cooling process, the **Current temperature (°C)** is displayed as well as the **Power (%)** of the TEC.

Moreover, the interface shows a **Temperature graph** reporting the temperature values during the past 5 minutes. The graph scale is automatically adapted, while a green band indicates the ± 0.1 °C tolerance allowed around the required temperature. Finally, the interface reports also the **elapsed time** since the cooling process started, the **mean** temperature in the past five minutes and the associated standard deviation (**err**).

Touch the **Done** button to leave this tool and go back to the desktop: the cooling process will continue in background. The Temperature tool can be activated at any time and, if a cooling process is running in background, the application will connect to the process and interact with it. Touch the **Stop** button to stop the cooling process: the TEC will be progressively turned off down to 0%.

Take photos



The **Take photos** tool provides the functions to define and start a sequence of photos.

Using the tabs, for each of the seven possible filters plus the shutter close position, the user can set:

- the number of **exposures**
- the **exposure time** (sec) of each exposure
- the horizontal and vertical **binning**
- the **Enabled** checkbox to include the current filter in the photo sequence

After completing the photo sequence definition, the user can save, if needed, these settings as a preset touching the **Save** button and inserting a file name.

To recall any saved **preset** file, select it from the available ones in the listbox.

Select the **Readout Format** by choosing it from the available ones in the listbox. The ones currently available are:

- 2 samples: computes the pixel value by averaging 2 samples with download time of about 10 seconds and a typical readout noise of $8e-$
- 16 samples: computes the pixel value by averaging 16 samples with download time of about 35 seconds and a typical readout noise of $5e-$

By default the exposures from different filters are executed in sequence, for example all the exposures for Red first, then the ones for Green and finally the ones for Blue. Using **Interleave**, it is possible to interleave the exposures of a selectable number of filters. For example, assume you want to take 2 exposures for the Red, Green and Blue filters. Using interleave “none” the sequence of exposures will be: Red, Red, Green, Green, Blue, Blue, while selecting the “3-4-5” interleave, the exposures of filters number 3,4 and 5 (counted in the tab order, that is Red,

Green and Blue in the above screenshot) are interleaved, so the exposures sequence will be: Red, Green, Blue, Red, Green, Blue. When using interleaved mode, exposures time, exposures number, binning and enable can only be set for the first filter in the interleaved sequence (Red in the above example) because it is assumed that the same parameters also apply to the other filters.

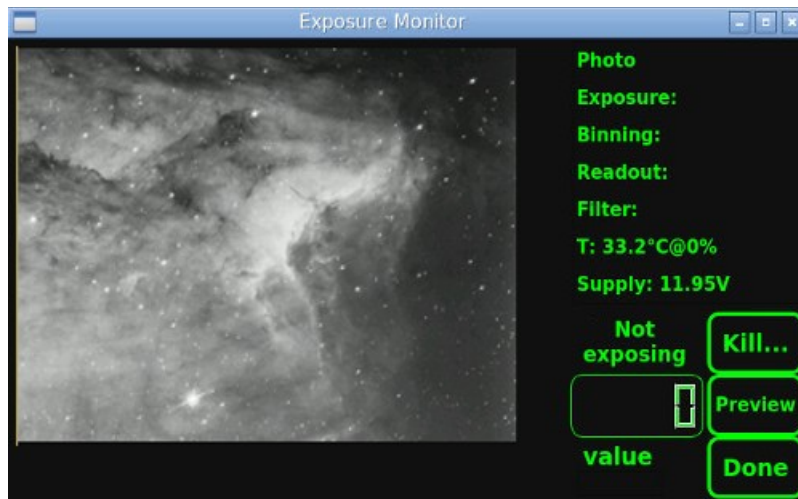
The user has to define a **Photo name** for the sequence, which will be stored by default in the camera internal SD card (use **Browse** to select a directory): each exposure will be saved in FITS format as <Photo name>_<filter number>_<exposure number>.fit

Start the exposures by touching the **Shot!** Button.

Note: During photo download from the ccd the camera turns off the display, the wifi and the ethernet connections in order to minimize read out noise. After the completion of the photo (buzzer sound signals it) all these functions turn on again. Your PC or Smartphone could need to reestablish the connection to the camera.

Touch the **Done** button to leave the Take Photos tool and go back to the desktop.

Monitor



The **Monitor** tool can be used to follow or interrupt the photo sequence currently in progress. It provides the following information related to the current exposure:

- the current **Photo** number in the sequence for that filter
- the **exposure** time (sec)
- the **binning** (pixels h x v)
- the **readout** mode
- the **filter name** of “Shutter closed” during image download
- the current **temperature** (°C) and the **TEC power** (%)
- the **supply** voltage (V)

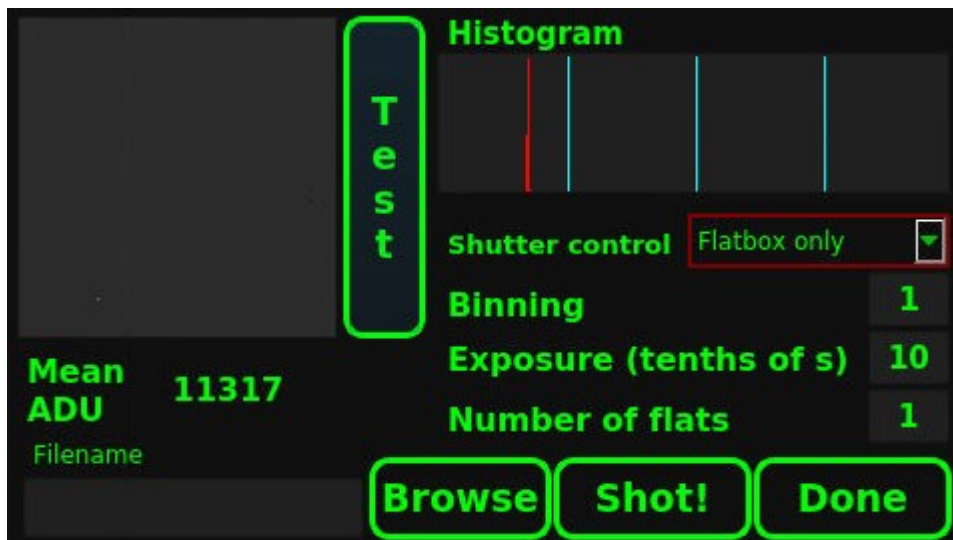
The box below (with LED digits) shows the **seconds before end** of the current exposure (sec). At the end of each exposure, touching the **preview** button, the downloaded photo will be displayed in the viewer on the left. When touching the image, the corresponding image intensity value is displayed in the **value** box.

Touch the **Kill** button to interrupt the current photo. A message box will ask whether to cancel only the current exposure or the whole photo sequence.

Touch the **Done** button to go back to the desktop.

Flat maker

The **Flat maker** tool is used to create flat sequences. **Note: before starting the Flat maker you have to select the filter using the **Filterwheel** tool: choose the filter, press go and leave the tool open while creating the flats**



The **Flat maker** tool can be used to check the flats exposure and, once the mean ADU value is the desired one, to create a sequence of flats. The user has to insert the flat **exposure** in tenth of seconds, the **binning** value and select the **shutter control**. There are 3 types of shutter control:

- **Flatbox only** (needs the optional Flatbox controller): in this modality the exposure is done by switching on and off the flatbox, without moving the internal filterwheel/shutter at all. This modality eliminates the gradients that can be created by the shutter movement, allowing very fast exposure times. On the other side, as the shutter doesn't close while reading out the sensor, the flats has to be taken in a dark environment to avoid light leaking inside from the parts of the flatbox not covered by the telescope
- **Flatbox + shutter** (needs the optional Flatbox controller): same as previous modality, but the shutter is closed after the flatbox light has been switched off. This modality eliminates the gradients that can be created by the shutter movement, allowing very fast exposure times and can be done also in moderately light environment
- **Shutter only**: this modality can be used without the optional flatbox controller, so the shutter is opened and closed during the exposure. This modality could create light gradients in the flat due to the shutter movement, so for best results exposure times should be greater than 10-15 seconds

Clicking **Test** the camera takes a fast subframe of the central portion of the flat and shows the

Mean ADU value and the **Histogram**. When the user is satisfied with the flat exposure, entering the **Number of flats**, the **Filename** and clicking **Shot!** creates and saves the flats sequence. Click **Done** to exit from the Flat maker tool.