Computer Controlled Flip Mirror and Focuser

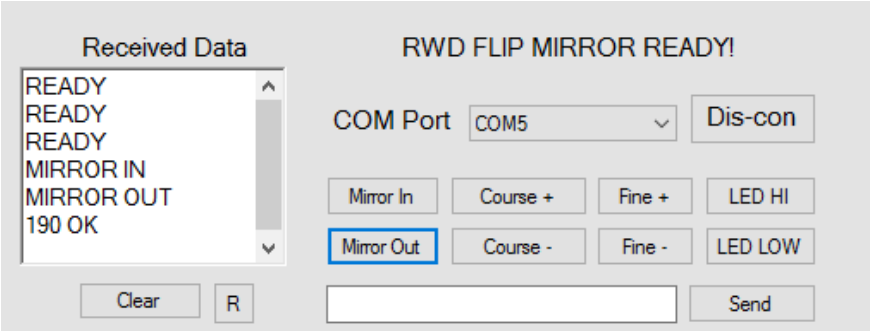


Fig. 1

General Description & Typical Use

The ability to switch between two cameras and focus one of them remotely is very useful, this enables the astronomer with a remote control set-up, to carry out flipping and focussing operations without the need to continually visit the telescope.
The positions of the astrophotography camera and the DSLR camera on the flip mirror assembly can be interchanged, but lack of a liquid crystal display on the astrophotography camera prohibits local focus adjustment without the use of a computer screen to view the image.
Light losses and distortion through the flip mirror assembly are minimal, so high quality images are possible in either orientation. However to use the auto focuser it is necessary to attach the astrophotography camera in the position with the mirror in the light path.
The current trend towards armchair astronomy requires complete control of equipment by computer from a remote location. This assembly provides computer controlled, remote flipping and focusing as a low cost, reliable, solution.

Please Note: Additional back focus of 60mm is required.

This multifunction integrated flip mirror and focuser allows two cameras, or one camera and an eyepiece, to be selectively introduced into the light path of a telescope. The focuser option, if purchased, allows a camera or eyepiece to be remotely focused independently, with the mirror in the light path.
Focus is achieved by a motor driven toothed belt that adjusts a non-rotating, helical focuser.
The switching and focus functions are controlled either locally by the operation of push switches, or remotely by computer over a USB connection.
At the heart of the unit is an Arduino micro-computer controlling two actuator motors, one to change the position of the flip mirror and the other, when fitted, to focus a camera or eyepiece. Each actuator is controlled over a USB port by software running on a locally or remotely connected computer.

No additional power supply is required as the micro and actuators are powered over the USB port.

The software presents the user with a simple to use, on screen graphic, see Fig 1. that controls the flip and focus facilities and controls the USB connection, acknowledging each command sent and received.
The flip function is labelled as MIRROR IN or MIRROR OUT and the focus function is labelled as course IN or OUT and fine IN or OUT.
Additionally there are two LEDs one red (Mirror out) and one green (Mirror In), to indicate the position of the mirror locally. The brightness of the LEDs is adjustable through software by selecting LED HI or LED LOW.
The focus function moves a non-rotating helical focuser by small or large steps to achieve sharp focus.
The software is compatible with windows 7, 8 and 10.

Using the Flip Mirror Assembly to Centralise the image in a camera:

When photographing astronomical subjects at prime focus with a reduced field astrophotography camera it can be difficult to locate and centralise the image. A large field non astrophotography camera mounted on the flip mirror box in the straight through position makes the task easier.

Proprietary software that comes free with most DSLR cameras, make it possible to remotely operate the DSLR camera by computer. Such software allows the user to centralise an image in the frame by combining the live view function with the telescope movement software preferably through the ASCOM platform. Errors in the GOTO function of any computer controlled telescope are always present.
Pre-Focus of the large field camera is carried out at the telescope by use of the camera's LCD display. Once the image from the DSLR camera has been centralised in the frame on the computer display or locally on the LCD of the DSLR camera, the light path can then deflected through 90 degrees by the flip mirror, under the control of the software provided.
Using this method it possible to achieve excellent centralisation of a desired image on the CCD of an astrophotography camera.

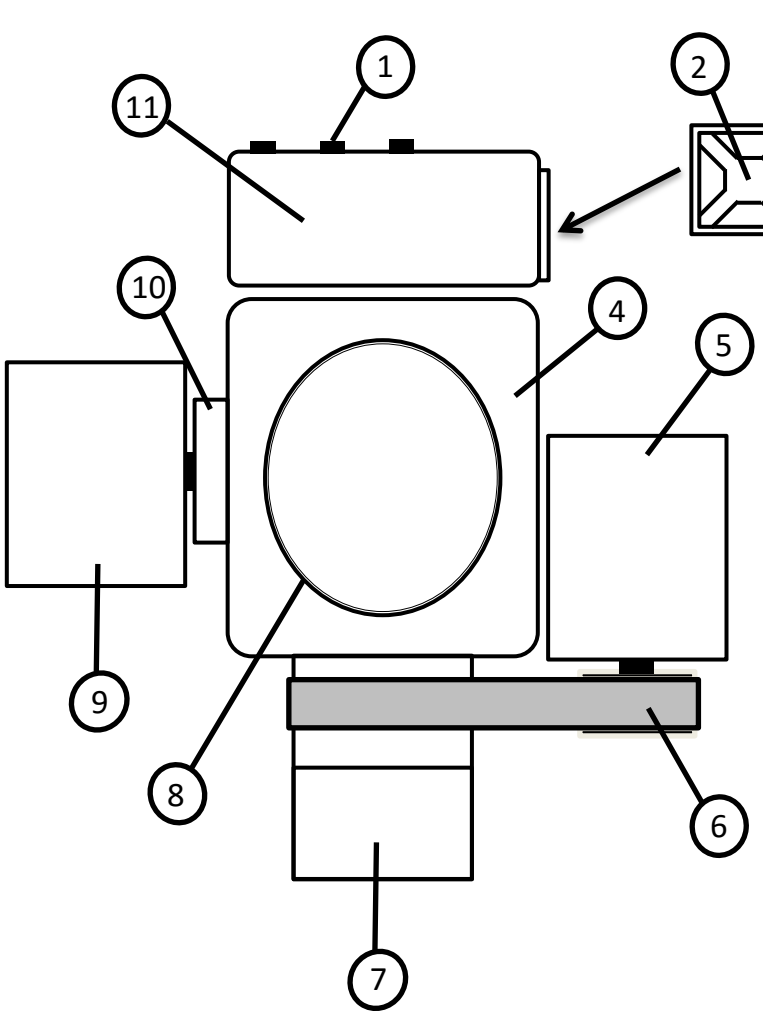
Focusing the Image:

The non-rotating helical focuser (when fitted) allows the user to achieve sharp focus of the centralised image on the CCD of the astrophotography camera. The image from the astrophotography camera will be displayed on the computer by the software that comes with the camera. Typically astrophotography cameras have a reduced field of view and therefore any small errors in the centring of the image will be magnified. Fine adjustment of the telescopes position using the ASCOM platform can now be carried out.
If you have not purchased the focusing option then you will need to manually adjust the distance to prime focus of a second camera.
Although you may not need to use the focuser too often, it is an incredibly useful tool to aid set-up as most telescopes will have some shift in prime focus due to temperature changes throughout the seasons.

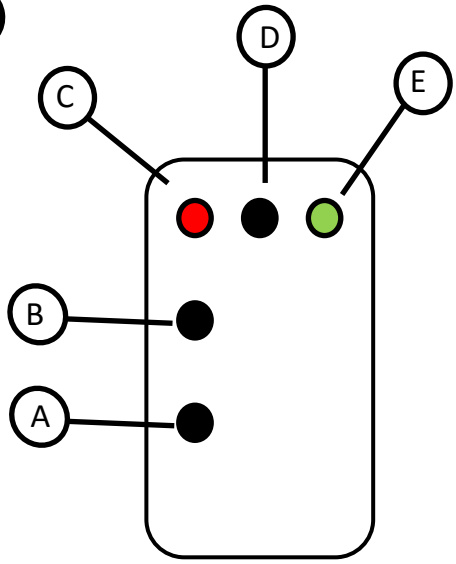
Installation of the equipment:

Step1. Load the software onto your computer.
Step2. Connect the flip box to the computer via a USB port (3M lead provided)
Step3. Attach the flip box assembly to the focuser of the telescope.
***Please ensure the USB cable is strain relieved at the flip mirror as failure to do so could lead to damage of the unit.**
Attach cameras/eyepiece as required (you may require adaptors, all readily available)
Step4. Focus the DSLR on a bright star with the aid of the LCD.
Step5. Using the flip/focus software select the position for the mirror.
*Step6. Use the focus function provided by the software to get sharp focus of the desired subject matter. (**When Fitted**).

Automated Flip Mirror Main Components



Control Panel

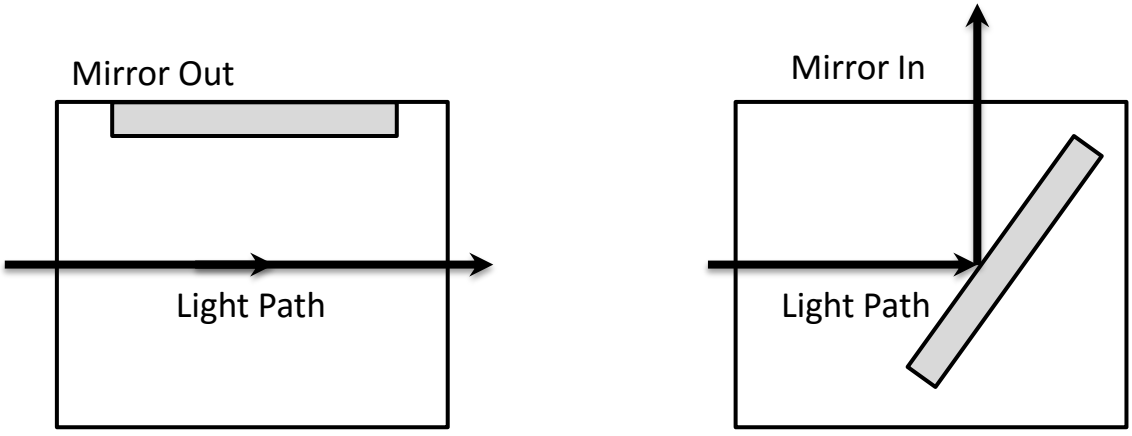


1 – Control Panel
2 – USB Cable Strain Relief
3 – Micro USB Socket
4 – Flip Mirror Enclosure
5 – Focus Motor*
6 – Focus Drive & Belt*
7 – Non Rotating Focuser*
8 – Camera Aperture
9 – Flip Mirror Motor
10 – Manual Flip Knob
11 – Arduino Enclosure

* Focuser Version Only

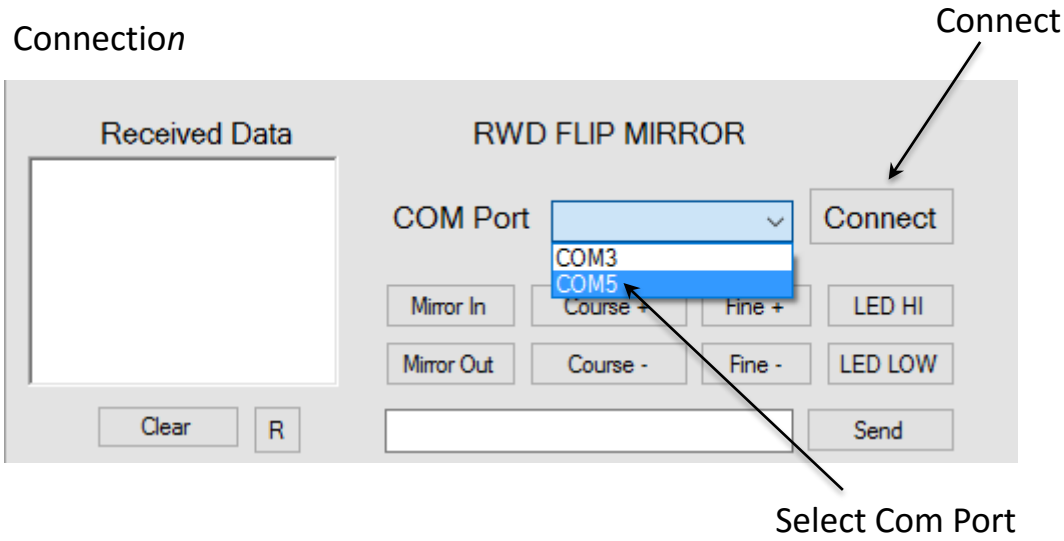
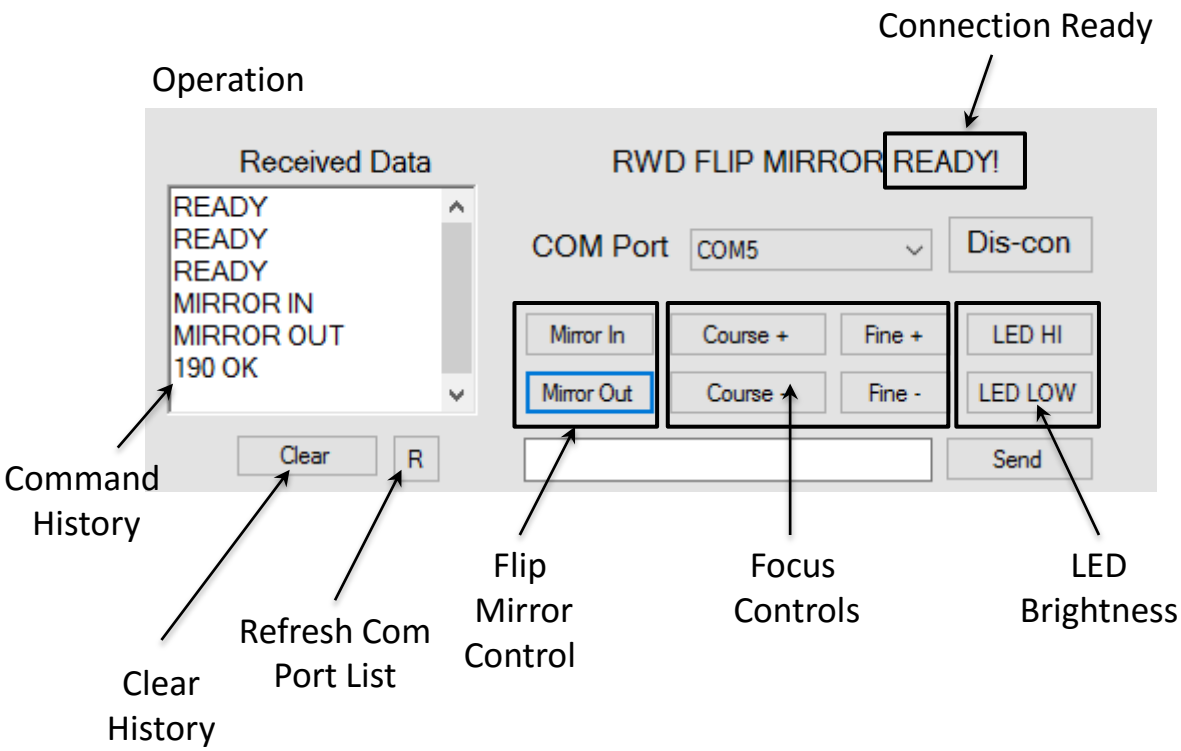
A – Manual Focus In Button*
B – Manual Focus Out Button*
C – Mirror Out LED (RED)
D – Flip Mirror In/Out Button
E – Flip Mirror In LED (GREEN)

Light Path vs Mirror Position



Software Control

Connection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