

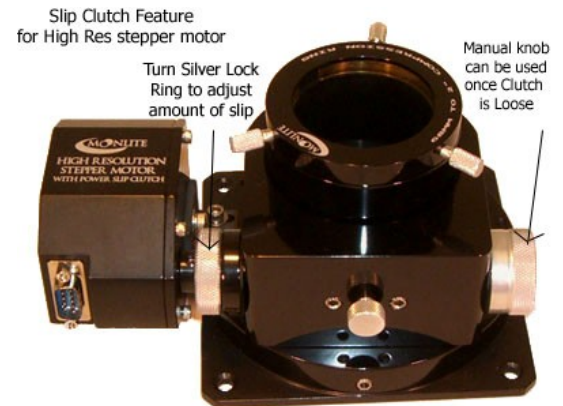
# MoonLite High Resolution Stepper Motor

MoonLite's high resolution stepper motor option comes in three configurations.

- Stepper motor only or stand alone for \$190.00 (customer provides controller)
- Stepper motor with MoonLite Mini V2 Controller for \$440.00 (mini V2 controller by itself is \$250.00)
- Stepper motor with MoonLite Dual Port DRO Display Focus Controller for \$685.00 (controller by itself is \$495.00)

MoonLite's high resolution stepper motor options use a premium, low backlash Hurst stepper motor. This provides very fine .00016" resolution (full step) and accurate position repeatability required for today's high end imaging systems. The stepper motor can also be ran in half step mode providing .00008" resolution, but it is recommended to run in full step mode with most ASCOM software. The high resolution stepper motor is offered on all single rate focuser configurations. It has such a fine variable rate that the reduction unit is not needed, so it is not offered on dual rate focusers. Adding a stepper motor gives the CS and CF focusers a 7 lb. lifting capacity. Large format focusers such as the CRL, CSL, and CFL are rated at 8 lb. vertical lifting capacity. Our small CR focuser has a 6 lb. load rating once installed. The stepper motor option features an adjustable slip clutch system so the focuser can be used manually or operated on motor at the same time. The stepper motor's 9-pin DBA connector is compatible with other stepper motor controllers such as ROBO focus, as well as MoonLite's controllers. A controller of some type must be used; the stepper motor cannot be directly connected to a PC.

The amount of slip can be adjusted on the slip clutch by adjusting the tightness of the slip clutch ring. For manual knob operation of the focuser, turn the silver knurled ring loose. For motor operation of the focuser, tighten the silver knurled ring. To adjust the knurled rings tension, it helps to hold the manual knob still with your right hand and turn the clutch ring with your left hand. Holding the manual knob in place will keep the shaft from turning, allowing the clutch ring to tighten/loosen the clutch. Note: No damage will be done if the focuser motor continues to run past the mechanical stops of the drawtubes travel. Even if the clutch is tight, it will simply slip when the travel runs out.



In most cases, the stepper motor option is picked at the time of focuser purchase; however, we do offer a user installed High Resolution Stepper Motor Kit for existing MoonLite focusers. The kit comes with different mounting brackets to fit different MoonLite focuser models. Please see our web site for additional kit information showing the different brackets available for different model MoonLite focusers.

- The high resolution stepper motor only or **stand alone option** is for customers that already have a ROBO focus controller or other brand controller and do not need a stepper motor controller. The stepper motor's DB9 connector pin out is 100% compatible with the ROBO focus controller.
- The high resolution stepper motor with **MoonLite Mini V2 controller** uses an ASCOM compliant stepper motor controller from MoonLite. The "Mini V2" controller works with all ASCOM based software packages such as Focus Max, CCDSoft, MaximDL, etc. It features a built in temp sensor and also comes with a remote temp probe. We include a USB cable and 12 volt AC adapter that has all the different plug configurations (US, Europe, UK, and Australia); however, most customers will simply use 12-volt power off their mount. This mini V2 controller is designed to be used remotely by a PC, or by the up /down buttons and speed control knob on the controller. It has all the functions of our



larger DRO display controller below but no display. Our ASCOM drivers and apps can be downloaded from our site.

- The high resolution stepper motor with **MoonLite's Dual Port DRO Display Focus Controller** can operate 2 high resolution stepper motors at the same time. Motor port #1 is for our existing high resolution stepper motor for focusing. Motor Port #2 is for our soon to be released rotating flange system. This new controller will be able to provide a complete 2 axis automated setup. The controller operates just like the Mini controller above, but has a display to show position. It also comes with a remote temp probe.

### Connection

MoonLite provides a 6 foot 9 pin DBA serial cable to go from the controller to the high resolution stepper motor on the focuser. The cable looks like a serial cable; however, the signals from the controller to the motor windings are not computer signals. We use the first 5 pins in the cable to power the stepper motors windings. Extra long (20') serial cables are available if needed. Two cables are included with the dual port DRO display controller for future use with the flange rotator option.

A universal AC adapter is included with all controllers that will operate in different countries' power (install the matching plug style in the 12 volt AC adapter you require). We include a 6 foot USB cable with the new controller. Some customers use a USB hub for long distance runs. A remote temp probe can be plugged into the controller to bypass the built in temp probe located inside the case. Once plugged in, it will defeat the internal temp sensor. The probe can be taped to the side of the telescope for better thermal reading of the OTA.



### Basic Operation for the Dual port DRO display controller

First connect all cables and power up the controller using the power switch on the left side. Please note the boot sequence:

- The Display will go from Red, Green, and Blue.
- Then display "MoonLite Telescope" and the version of the software "Ver 20".
- It will then give a message "Press a button to enter menu". Do not press any keys during that time, so the controller can go in to normal operation. If you press a button at that time it will go into advanced menu mode. To get out of advanced menu mode – just cycle the power off and back on.

Top line of display shows step count position for focus motor on port #1

Bottom line of display shows step count position for rotator motor on port #2

Right side of display will show the temp detected by either the internal or remote external temp probe.

Red buttons will increase / decrease the focuser's position (rack in / rack out).

Blue buttons will rotate the focuser, either right or left.

The focus steps are fine and slow when the button is first pressed, but will go faster if the button is held down. Please remember to rack the focuser the whole way in to zero the step count to the focuser's fully racked in position (hold the button down until the focuser is fully racked in. No harm will come to the focuser, as it will simply slip when hitting the mechanical stops).



## Advanced Menu Operation for the Dual Port DRO display controller

Press any key when prompted after unit is turned on.

### Setup Menu Structure:

Contrast Adjustment: Used to adjust the LCD contrast.  
Red Brightness: The brightness of the RED LED backlight.  
Green Brightness: The brightness of the GREEN LED backlight.  
Blue Brightness: The brightness of the BLUE LED backlight.  
Motor 1 Type: Selects Unipolar or Bipolar. (Bipolar is not supported at this time)  
Motor 1 Direction: Selects the which way results in positive step counts.  
Motor 1 Half/Full: Selects if Motor 1 is Half stepped or full stepped. Half has double the resolution, but half the speed. Focus curve will need to be re-run if this is changed.  
Motor 1 Units: The unit text to display. Steps or Degrees (for rotation).  
Motor 2 Type: Selects Unipolar or Bipolar. (Bipolar is not supported at this time)  
Motor 2 Direction: Selects the which way results in positive step counts.  
Motor 2 Half/Full: Selects if Motor 2 is Half stepped or full stepped. Half has double the resolution, but half the speed. Focus curve will need to be re-run if this is changed.  
Motor 2 Units: The unit text to display. Steps or Degrees (for rotation).  
Home Switch: Select which motor has the optional home switch. Used for zero setting to a known point.  
Temp Offset: Used to set the temperature offset for single point temperature calibration.  
Temp Scale: Used to change the scaling to allow for two point calibration.  
Reset To Defaults: Resets all of the above settings to the factory defaults. Activate by pressing both Blue Buttons at the same time.  
DONE? Exits the setup menu and saves all settings to EEPROM. If a mistake was made, simply cycle power without exiting, or use the "Reset to Defaults" option.

### Expanded Commands:

Command	Response	Description
POxx		Adjust Temperature Offset, Signed Hexadecimal
PSxx		Adjust Temperature Scale, Signed Hexadecimal
PRxx		Adjust Red Backlight Brightness
PGxx		Adjust Green Backlight Brightness
PBxx		Adjust Blue Backlight Brightness
PCxx		Adjust LCD Contrast
PXxxxx		Adjust the Scale for Motor 1
Pyxxxx		Adjust the Scale for Motor 2
PHxx		Find home for Motor, valid options are "01", "02"

The scale factor allows for stepped or scaled moves. If you have a filter wheel with a known 532 steps between positions, you can set the scale factor to 532d or 0x0214. Every button press would then move 532 steps. Remote commands remain unaffected by the scale.  
The commands remain backward compatible with the original DRO focus controller, but now add a second channel, remote temperature sense, option home switch, and an improve user interface.  
The motor move buttons are dual function. When pressed for a short time, they move the motor in very fine increments at a slow speed. When held down for longer periods of time, the motor speed picks up and fast moves are made.  
**Serial Commands:**  
All commands are preceded by a ":" symbol and finished with a "#" symbol. "x" represents a hexadecimal digit.

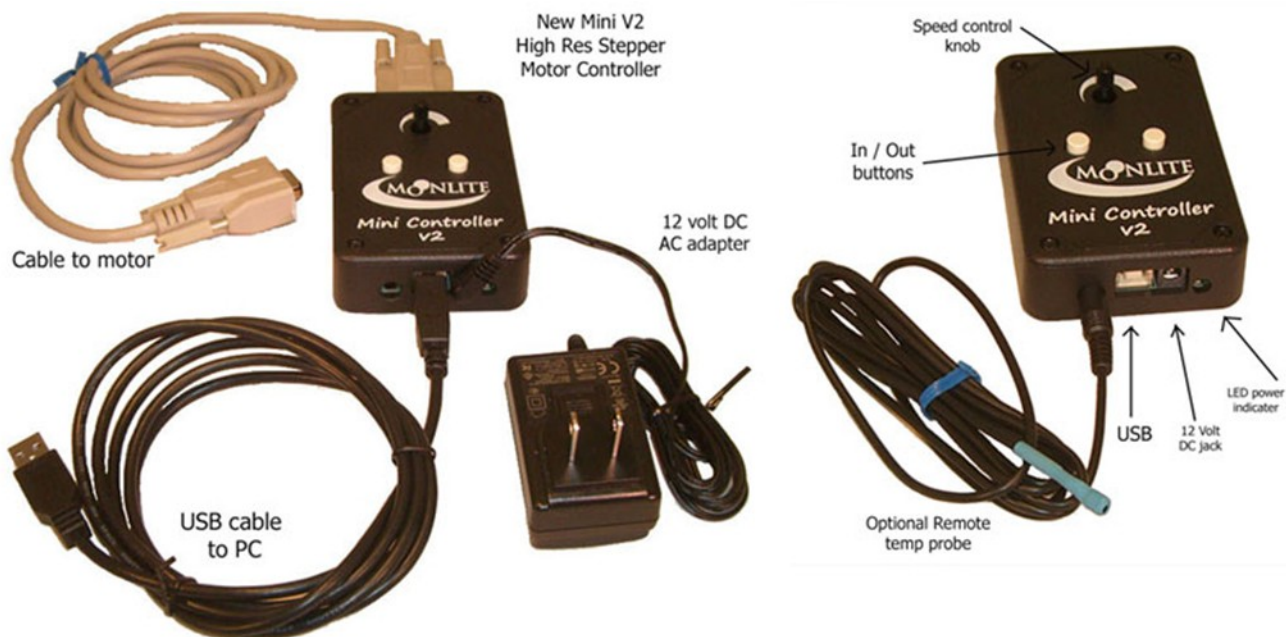
Command	Response	Description
GP	XXXX	Get Current Motor 1 Position, Unsigned Hexadecimal
GN	XXXX	Get the New Motor 1 Position, Unsigned Hexadecimal
GT	XXXX	Get the Current Temperature, Signed Hexadecimal



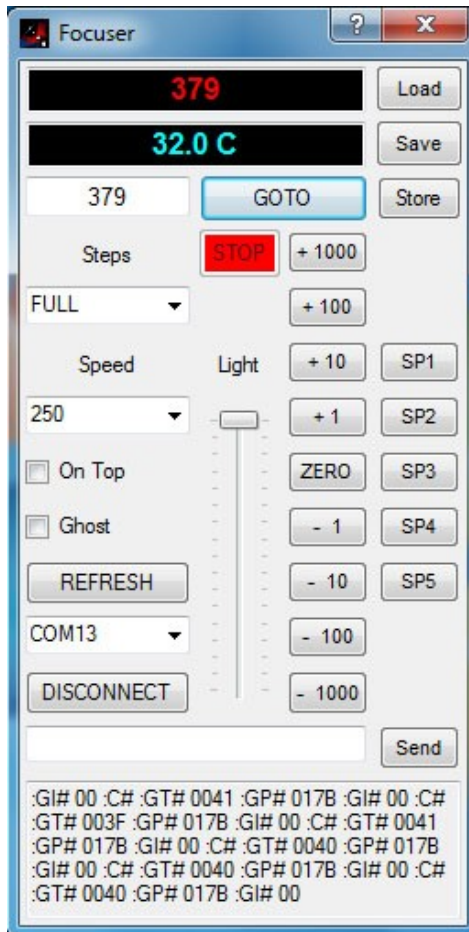
GD	XX	Get the Motor 1 speed, valid options are “02, 04, 08, 10, 20”
GH	XX	“FF” if half step is set, otherwise “00”
GI	XX	“01” if the motor is moving, otherwise “00”
GB	XX	The current RED Led Backlight value, Unsigned Hexadecimal
GV	XX	Code for current firmware version
SPxxxx		Set the Current Motor 1 Position, Unsigned Hexadecimal
SNxxxx		Set the New Motor 1 Position, Unsigned Hexadecimal
SF		Set Motor 1 to Full Step
SH		Set Motor 1 to Half Step
SDxx		Set the Motor 1 speed, valid options are “02, 04, 08, 10, 20”
FG		Start a Motor 1 move, moves the motor to the New Position.
FQ		Halt Motor 1 move, position is retained, motor is stopped.

Example: To set a new position: :SN0537#  
*For motor 2 all of the above commands are available, just precede the command with a “2”.*  
 Motor 2 Example: To set Motor 2 to a new position: :2SN0537#

### MoonLite Mini V2 controller Layout



Please note the internal temp sensor will be used if no remote temp probe cable is plugged in to the controller. Once the remote temp probe is plugged in the controller it will not use the internal unit. Manual buttons will over ride and move the focusers position reported in the software. Note speed control knob can go from no movement at all (full CCW) to a moderate rate (full CW) setting. Re zero focuser step count by racking the drawtube the whole way down in to a fully racked in position and also zero the count in the software to match.



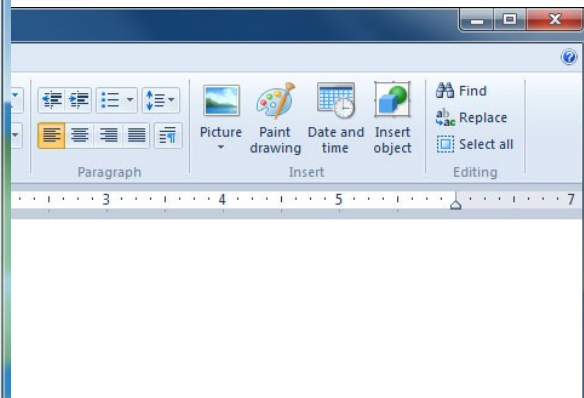
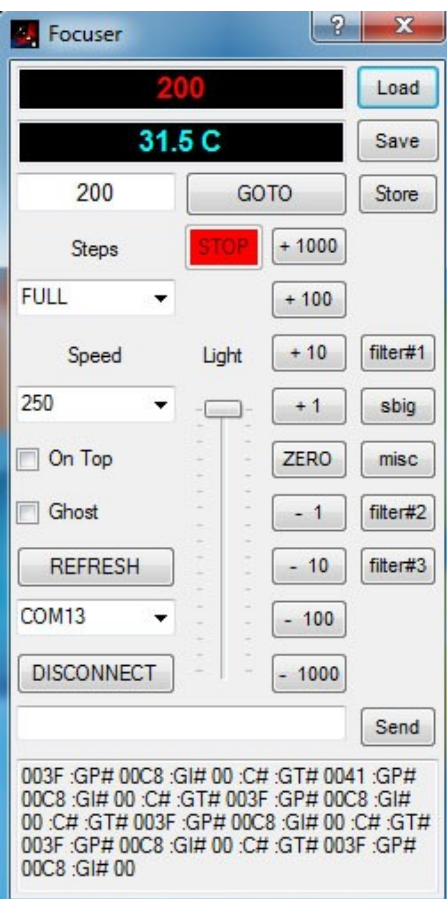
Both Mini V2 controllers and the Dual port DRO display controller work with all ASCOM based software packages such as Focus Max, CCDSoft, MaxumDL, Sequence Generator Pro, Equinox Pro, and so on.

MoonLite offers both 32 and 64 bit drivers. We also offer 2 simple non ASCOM programs for customers not running a full blown ASCOM automated system (a simple automated control app to run the focuser). Single port 1.07 version software and FCP V2 for the Dual port controller.

MoonLite's 1.07 NON ASCOM software program (photo at left). Version 1.07 will work with all MoonLite controllers. The original Mini controller, new Mini V2 controller, DRO display controller, and the new Dual port DRO display controller for Rotation. However it will only operate the first port when connected to the new Dual port DRO display Rotator controller.

The latest 1.07 version of the software has 5 user defined buttons for customers to store step count positions that are frequently used. Just go to the step count you want and then click Store and the SP button you want to assign the step count value to. Once finished with storing all 5 button values click Save and then pick a directory to save the info.

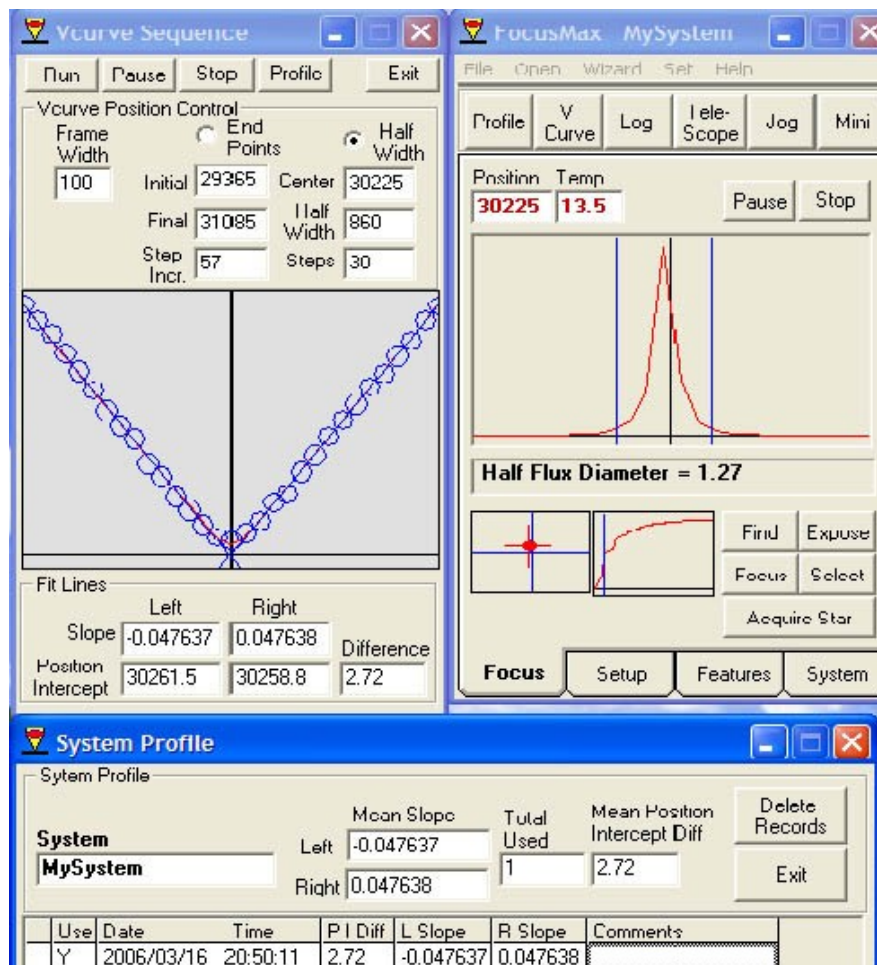
In this case I saved the file to a directly called camera positions. Once saved I can then open the file in Word pad and modify the text for the 5 buttons to label them anything that is required. Note the old SP1 button now says filter#1 and will go to a step count of 100 if clicked. Then when I hit Load and indicate the file, it will now rename all of the buttons.



The Software also has a Serial data log feature at the bottom. This allows you to monitor communications with the focuser and also send serial commands to the controller. Example if you want to adjust/ calibrate the temp display, just type in PO02 in in the box and hit send. This will change the temp positive by 1 degree. A PO04 command would adjust it by 2 2 degrees. All serial commands are in s document for more information.

Please see the download section of our web site for all drivers and software downloads.  
<http://www.focuser.com/downloads.shtml>

For controlling the focuser with your current imaging software, we personally like Focus Max and it is free to download at the following website.



<http://users.bsdwebsolutions.com/~larryweber/>

(Sample screen shot of Focus Max)



## Computer Connection Operation

Connect the controller to your PC using USB. Windows should show new hardware found and install the device automatically.

If your laptop is older, you may need to install the latest USB driver. To install the driver download the VCP (virtual com port) driver for the FT232R chip from <http://www.ftdichip.com/Drivers/VCP.htm> Unzip using your favorite zip file utility to a directory of your choice. Connect power to the focus controller and the USB cable to your computer



and the focus controller. Windows will state that it has found new hardware and needs to install drivers. When prompted, select "Have Disk" and select the directory where the files were unzipped. The installer should then complete the software installation.

Please make sure you have downloaded and installed the latest version of ASCOM <http://ascom-standards.org/> Please download our most current ASCOM driver from our website. Installation documentation and the drivers are located here <http://www.focuser.com/downloads.shtml> Please see our tutorial for setting up the focuser to run with Focus Max at <http://www.focuser.com/cgi-bin/dman.cgi?page=fmflw>

**Generic serial commands can be used to operate the controllers if needed. Please see table below for command set.**

								Serial Commands	
Command								Return	Comments
Char #								Variable	
1	2	3	4	5	6	7	8		
:	C	#						N/A	Initiate a temperature conversion; the conversion process takes a maximum of 750 milliseconds. The value returned by the :GT# command will not be valid until the conversion process completes.
:	F	G	#					N/A	Go to the new position as set by the ":SNYYYY#" command.
:	F	Q	#					N/A	Immediately stop any focus motor movement.
:	G	C	#					XX#	Returns the temperature coefficient where XX is a two-digit signed (2's complement) hex number.
:	G	D	#					XX#	Returns the current stepping delay where XX is a two-digit unsigned hex number. See the :SD# command for a list of possible return values.
:	G	H	#					00# OR FF#	Returns "FF#" if the focus motor is half-stepped otherwise return "00#"
:	G	I	#					00# OR 01#	Returns "00#" if the focus motor is not moving, otherwise return "01#"
:	G	N	#					YYYY#	Returns the new position previously set by a ":SNYYYY" command where YYYY is a four-digit unsigned hex number.
:	G	P	#					YYYY#	Returns the current position where YYYY is a four-digit unsigned hex number.
:	G	T	#					YYYY#	Returns the current temperature where YYYY is a four-digit signed (2's complement) hex number.
:	G	V	#					DD#	Get the version of the firmware as a two-digit decimal number where the first digit is the major version number, and the second digit is the minor version number.
:	S	C	X	X	#			N/A	Set the new temperature coefficient where XX is a two-digit, signed (2's complement) hex number.
:	S	D	X	X	#			N/A	Set the new stepping delay where XX is a two-digit, unsigned hex number. Valid values to send are 02, 04, 08, 10 and 20, which correspond to a stepping delay of 250, 125, 63, 32 and 16 steps per second respectively.
:	S	F	#					N/A	Set full-step mode.
:	S	H	#					N/A	Set half-step mode.
:	S	N	Y	Y	Y	Y	#	N/A	Set the new position where YYYY is a four-digit

unsigned hex number.

: S P Y Y Y Y # N/A  
 : + # N/A  
 : - # N/A  
 : P O X X # N/A

Set the current position where YYYY is a four-digit unsigned hex number.

Activate temperature compensation focusing.

Disable temperature compensation focusing.

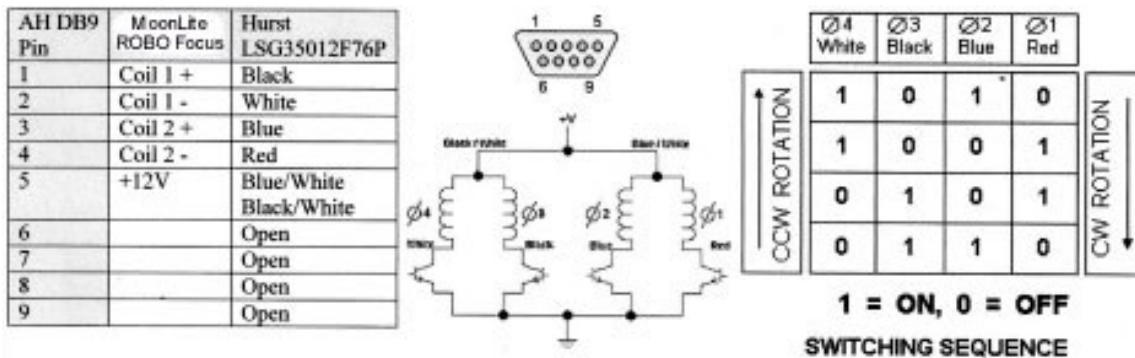
Temperature calibration offset, XX is a two-digit signed hex number, in half degree increments.

Example 1: :PO02# offset of +1°C

Example 2: :POFB# offset of -2.5°C

DB9 cable pin out and Stepper motor winding pin out.

We use a high quality Hurst unipolar 12 volt stepper motor with a fairly high reduction gearbox. There is a very small amount of backlash noted with this unit. MoonLite controllers will release idle current to the motor windings when not moving to reduce current consumption and also reduce heat generated by the motor itself; however some controllers like ROBO focuser and others will keep the current draw continuous when not in motion. That can cause the motor to get warm; however it will not damage the motor.



### Mechanical adjustment section

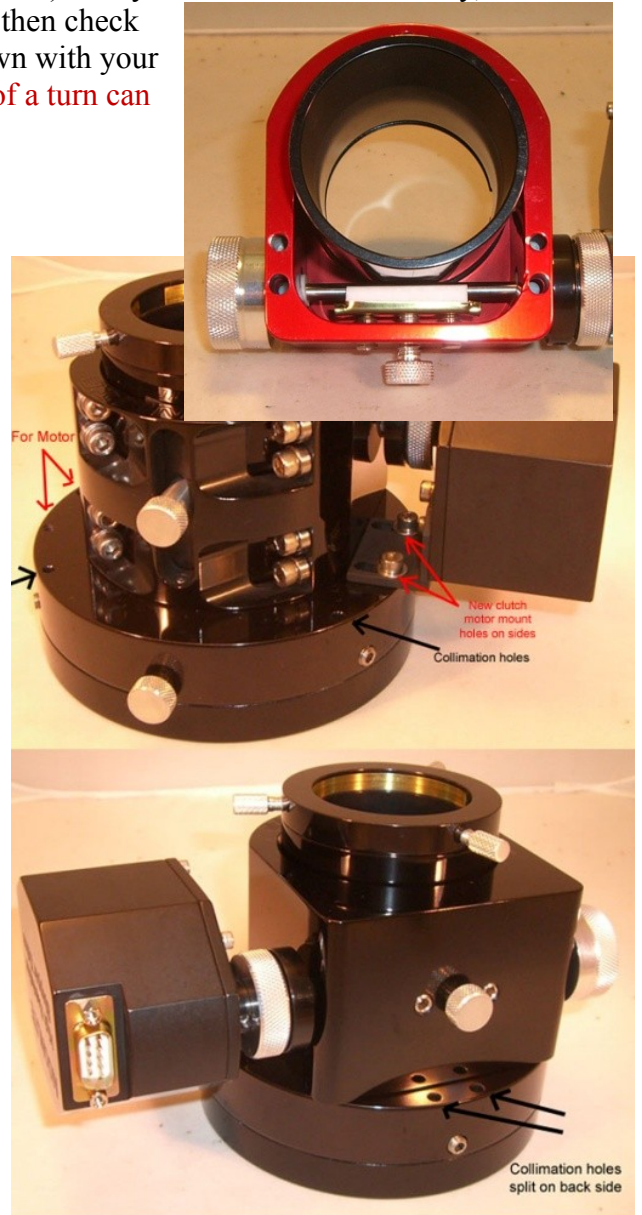


**Lifting Capacity:** The drawtube pressure can be adjusted to each user's preference. Increasing the pressure increases the load capacity (vertical lifting capacity) of the focuser. Decreasing the pressure lowers the load capacity but gives the focuser a smoother focusing action. We set the focuser at approximately 5 lbs. at time of assembly; however, you can adjust it to be more depending on your specific needs. The ideal setting is to have



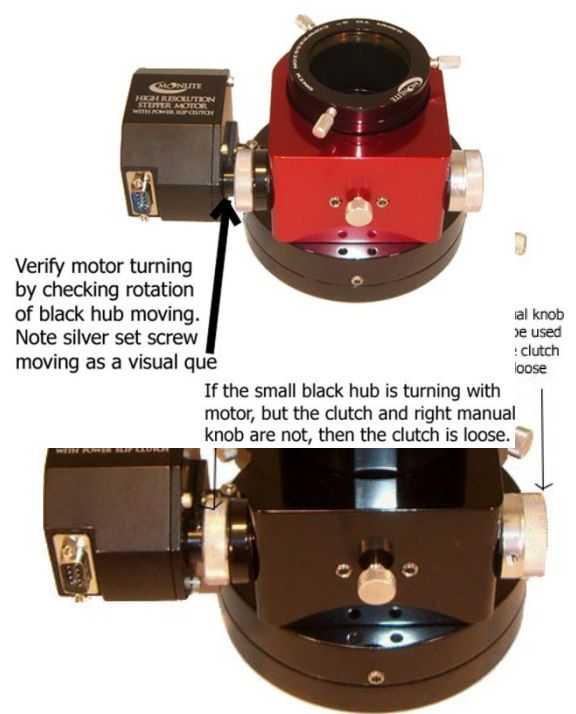
it adjusted so the focuser can hold the heaviest load presented without slipping and requiring no additional force. This will give the focuser the best feel and still provide the vertical lifting capacity required. To adjust the lifting capacity, turn the aluminum thumbscrew located between the two setscrews on the bottom of the focuser clockwise (CW) to increase load capacity. The aluminum thumbscrew can only add pressure, not take away pressure. This is due to the 2 setscrews on each side of the thumbscrew applying a minimum set pressure amount. In some rare case it may be necessary to do a coarse adjustment by turning the 2 setscrews located on each side of the aluminum thumbscrew (1/8 Allen wrench is needed) a very small amount. Normally, 1/20<sup>th</sup> of a turn or less should be made on the setscrews in a CW direction, then check the lifting capacity pressure by racking the drawtube up and down with your heaviest load. **Note: excessive pressure adjustment over 1/20<sup>th</sup> of a turn can crack the bearings!**

- **Collimation:** To adjust collimation, turn the 4 mini setscrews located in the top part of the 2-part flange. A small amount of tip/tilt (.015 max) can be made by adjusting the setscrews. We collimate each focuser dead on before shipping it so no adjustment should be required; however, if collimation is required due to some sort of OTA defect when the focuser is installed, then the tip/tilt ability of the focuser's flange will come in handy. Please Note: rotating the focuser will throw off any collimation reference once the flange is tilted off plane. So please do not collimate the focuser off center line unless it is absolutely necessary to fix a gross error in the OTA.
- **Performance:** To maintain the CF focusers performance, keep all bearing and shaft riding surfaces clean on the drawtube. All crayford style focusers require a clean bearing to drawtube surface for smooth operation. The drawtube has been polished to remove all machine marks and hard anodized resulting in the action having a super smooth feel. Keeping the surfaces clean will keep the focuser operating at optimal performance. Note: Some wear marks on the drawtube are normal over regular use and do not cause any performance issue; however, excessive wear marks on the drawtube can be seen if the drawtube is not clean. Airborne contaminants on the drawtube surface can get crushed between the bearings and the drawtube surface. The crushed particles will be abrasive causing the drawtube's anodized surface to wear quicker than normal. Please keep the drawtube clean, especially in sandy/windy areas.
- **Reduction Unit:** Dual rate focuser owners may want to break in the 8:1 reduction unit by running it up and down when first receiving the focuser. It is adjusted fairly tight at the time of assembly and requires a little use to come up to peak performance. No maintenance should be required on the reduction unit as it is packed with lithium low temperature grease for the life of its operation.



## **Motor Trouble Shooting guide**

The amount of slip can be adjusted on the slip clutch by adjusting the tightness of the slip clutch ring. For manual knob operation of the focuser, turn the silver knurled ring loose. For motor operation of the focuser, tighten the silver knurled ring. To adjust the knurled rings tension, it helps to hold the manual knob still with your right hand and turn the clutch ring with your left hand. Holding the manual knob in place will keep the shaft from turning, allowing the clutch ring to tighten/loosen the clutch



## **Focuser adjustment guide for motor options if focuser slips**

**under heavy loads.** Slipping can be caused by either a loose clutch setting or drawtube to shaft pressure setting to low. Check movement of manual knob to verify what adjustment is needed. If the manual knob on the right does not turn when the focuser is slipping, then the slip clutch is not tight enough on the motor.( tighten clutch as shown in motor documentation). If the manual knob on the right is moving but the drawtube is not moving, then the drawtube is slipping and the shaft to drawtube pressure needs increased a small amount. See lifting capacity adjustment shown above.

To verify motor is moving, check the black hub part of the clutch that is connected to the motor shaft for motion. If you look carefully at the black nub that attaches to the motor, you may be able to see it turn as a small set screw should be noted turning around with the black hub. The black hub is on the left side of the slip clutch. The black larger pad side of the clutch is set screwed on to the main shaft. As the motor turns the small black hub part of the clutch will move with it. It is set screwed on to the motor shaft. This is a good way of testing to see if the motor is actually moving. The whole clutch as a unit should rotate with the motor if it is tight. If it is loose, then only the small hub on the motor side will be turning with the motor.

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[www.focuser.com](http://www.focuser.com)

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