



# **Electronic Focuser Accessory Hand Controller Instructions**

## **EFA, firmware version 1.02**

rev 111209

## Introduction

The PlaneWave EFA Accessory uses the standard Celestron NexStar hand control for its control device. The reason is that the Celestron hand control is made in large quantities and therefore is well priced and the Celestron hand control is fairly powerful. We then write our own firmware (software for the hand control) and upload it to control the EFA Accessory. The hand control comes preloaded with the PlaneWave firmware.

Another advantage is that as we write updates to the firmware, you can update your hand control at no charge via the internet using the software PlaneWave Hand Control Update that was provided on the CDROM that came with the EFA Kit.

Since the Hand Control has many more buttons than are really necessary, a brief description of how the buttons are used is shown below. Below circled in red are the active buttons that the EFA uses.



Up/down arrows on the right hand side of the display indicate that there are other menus to scroll to using the scroll up and down buttons (6 and 9)

UNDO: Press undo to exit out of a menu item and get back to the main menu

ENTER: Press this to enter into the displayed menu item.

MOVE FOCUS MOTOR: The up arrow moves the focuser out and the down button moves the focuser in.

MENU: Only used as a special function to be described later.

Scroll up and down buttons (6 and 9): Press these to scroll up or down the menus when the Up/Down arrows are visible on the right side of the display.

RATE: Press this button to adjust the focuser rate. Press RATE and then press a number 1 thru 9 to select the rate. 9 is the fastest.

## Attaching the Hand Control and Powering up the EFA Kit

- Plug the Hand Control into the EFA Electronics Panel in the port labeled, H/C. For the CDK20 this is on the telescope face and for the CDK12.5 this is on the separate EFA Electronics Box.
- Plug in the power supply provided with the EFA kit into the jack labeled 12V DC on the EFA electronics panel.
- Turn the switch labeled POWER to the ON position.
- At this point you can turn the fan to the On position IF you want the fans run, leave it in the Off position IF you don't want the fans to run, or put the fan in the Auto position which lets you control the fans from the hand control or from a computer using the provided PWI Focus software.

## Mounting the Hand Control Bracket

The hand control mounting bracket allows the hand control to be mounted to the telescope back plate. Below is a picture of the mounting bracket kit. The kit comes with the following.



- 2 x 10-32 x 1/4" Button Head Cap Screws. (McMaster Carr # 92949A261)
- 1 x 1/4-20 Mounting Stud (part number 125386)
- 1 x Hand Control Bracket (part number 125385)

To install the kit, first place the hand control bracket on the back of the hand control.



Position the hand control bracket over the two holes on the back of the hand control and the tab of the bracket into the opening on the back of the hand control as shown in the picture below.



Use the two 10-32 screws supplied to mount the bracket to the back of the hand control as shown.



Attach the mounting stud (#125386) to the telescope back plate. The telescope has eight ¼-20 threaded holes on the back plate for mounting accessories. The holes are positioned at 2, 4, 8 and 10 o'clock on the back plate in groups of two. Thread in the mounting stud into one of the back plate holes. The stud can also be threaded in place of one of the mounting screws that mount the finder scope bracket or the EFA Electronics box (used on CDK12.5 only) shown below.



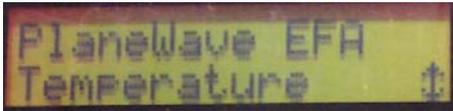
Mount the hand control via the hand control mounting bracket onto the mounting stud.





## Scrolling Through the Menu Items

When you turn on the power for the EFA kit, the display will briefly display the version of the software. After a few seconds it will display as shown below.



Press the scroll down button (button labeled "DOWN" & "9") and display will change to the next item on the menu, Position.



Press the scroll down button again to go to the next item in the menu, Fans.



Press the scroll down button again to go to the next and last item in the menu, Setup.



If you press the scroll down button again you will go back to the menu item, Temperature. You can also press the scroll up button to scroll through all the menu items.

## Using the Features

### *Temperature Menu*

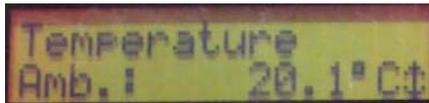
The first item on the main menu is temperature.



Press the ENTER button on the hand control and you will enter the temperature menu. In this menu, the lower line in the display will read out the current temperature of the primary mirror. The primary mirror is designated with the abbreviation, "Pri.:". The temperature reads out in either Celsius or Fahrenheit depending on what you have selected in the Setup Menu that will be covered later. You see that the arrows are displayed on the lower right side of the display. This signifies that there is something else to display.



Press the scroll down or up button to display the next item in the menu. Now the second line in the display shows the ambient temperature abbreviated by "Amb.:". There is another temperature sensor mounted in between the primary and the back plate of the telescope that reads the ambient temperature of the air.



Press the UNDO button to get back to the main menu. Press the scroll down button to get to the Position menu item.

### *Position Menu*

The second item on the main menu is Position.



Press the ENTER button on the hand control to enter the position menu. The units by default are in millimeters. You can change the units by changing the count ratio under the setup menu.





Press the UNDO button to get back to the main menu and press the scroll down button to get to the Fans menu. From the position menu, the position that is being displayed can be saved or a previously saved position can be recalled to drive the focuser to that position.

From the position menu, press the MENU button and a G will display in the upper right corner of the screen. The G stands for GOTO.



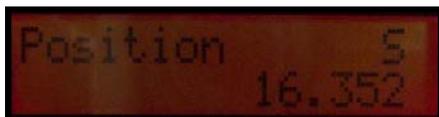
If you hit MENU again the G will change to an S. S stands for STORE. If you hit the MENU again, it will clear the upper right hand corner.

Press MENU again until the G appears in the upper right corner. Use this to GOTO a previously saved position. To GOTO a previously saved position, press the ENTER button when the G is displayed and the screen will change to

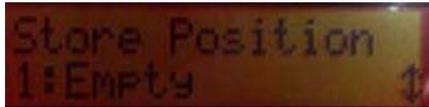


You can store up to nine different positions. The numeral "1" at the left part of the screen signifies that this is the first of the nine positions. You can scroll through the different stored positions using the UP or DOWN buttons (the "6" and the "9") on the hand control. If there is no position stored in the memory slot, then the display will read EMPTY. If there is a position stored then the position will be displayed.

If you want to move from the GOTO selection to the STORE selection hit MENU again and an S will be displayed in the upper right corner. The S stands for STORE. Use this to STORE a focus position.



Once the focuser is at a position you want to save, press the MENU key from the POSITION menu and get the S to appear in the upper right corner. There are nine memory locations to store positions. If there is nothing stored, then the display will read, EMPTY.



If there is a position stored in the location, then the display will read the focus location. You can scroll to the other memory locations using the UP and DOWN buttons (the 6 and the 9) on the hand control. Chose what location you would like to store the current focuser position in and press ENTER. The position is now stored.

### ***Fans Menu***

The third item on the main menu is Fans.



Press the ENTER button on the hand control to enter the fans menu. This puts you in the last selection you made for the fans menu. There are three different choices for the Fans menu; Auto, Off, and On. To get to each choice, use the scroll up or down button. To choice a particular setting for the fans, scroll to the setting you want, say Fans On. Then hit the ENTER button and the fans will turn on. You can then hit UNDO to go back to the main menu.



Auto: The Auto setting allows the PC software PWI Focus to control the fans. Note that the FAN switch on the EFA kit electronics panel needs to set to AUTO too.



Off: The off setting turns the fans off.



On: The on setting turns the fans on. Note that the FAN switch on the EFA kit electronics panel needs to set to AUTO too.

### ***Setup Menu***

The fourth and final item on the main menu is Setup.





## Temp Units

Press ENTER and the first item is Temp Units. In this menu you can select whether you want temperature to read out in Celsius or Fahrenheit. By default the EFA reads out in Celsius.



To choose one or the other, use the scroll up or down buttons to select the units you want. Then press ENTER to select those units. The display will step back automatically to the Setup Menu after the selection is made.

Press the scroll down button to go to the next item in the Setup Menu, Count Ratio.

## Count Ratio



Press Enter and the display will read the value 115134.423 with the cursor at the first digit (or whatever value you previously set).

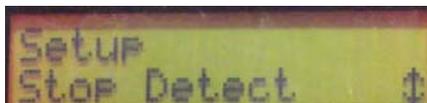


This default ratio sets the display so it reads in millimeters. If you want to edit its value you can use the keypad to do so. Enter the first digit and the cursor will move to the next digit. Enter each digit and if you make a mistake you can hit the UNDO button to scroll backwards. When you have entered the value you want, you can hit the ENTER button to activate it.

If you want to set the readout to thousandths of an inch the Count Ratio is 002924.414.

Press the UNDO button to get back to the Setup Menu then press the scroll down button to go to the next menu item, Stop Detect.

## Stop Detect



Stop Detect is a function in the motor control firmware that stops applying power to the motor if too much resistance is encountered, like hitting a stop. The motor/gearbox has a lot of torque and in order to keep from damaging the gears we can stop the power to the motors using this feature.

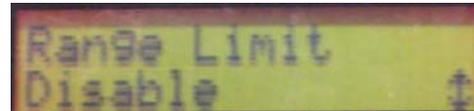
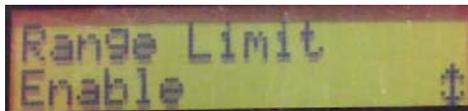


The reason you might want to override this feature is if conditions are such that the motor keeps stopping because of some unforeseen resistance. But, it is best to leave this feature on for most cases.

Press the UNDO button to get back to the Setup Menu then press the scroll down button to go to the next menu item, Range Limit.

### Range Limit

Range Limit is a feature that will stop the motors right before reaching the end of the focuser travel. This works only after the focuser has been calibrated. The calibration feature is the next setup menu item.

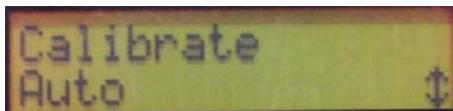


Press the UNDO button to get back to the Setup Menu then press the scroll down button to go to the next menu item, Calibration.

### Calibration



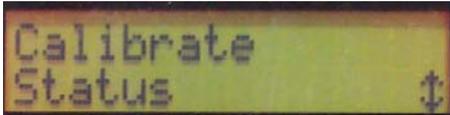
The calibration menu allows you to set the limits of the focuser. For most uses the limits are the fully racked in focuser to the fully racked out focuser. But in some cases one might need some customized set positions. The Calibrate menu allows this too. Press Enter to enter the calibration menu. The first item to come up is Auto. (Actually the menu item that comes up is the last one viewed)



Press enter at the Auto setting and the focuser will automatically slew to the fully racked in focus position, then out to the fully racked out position and then to the middle of the travel. It will also set the zero position to the fully racked in position. Press the scroll down button to go to the next menu item, Manual.



Press Enter at the manual menu setting to set the fully racked in stop position manually. This also set the zero position for the readout. Press the scroll down button to go to the next menu item, Status.



Press enter here to see if the focuser has been calibrated before or not.

Press the UNDO button to get back to the Setup Menu then press the scroll down button to go to the next menu item, Fan Control.

## Fan Control

The Fan Control allows a couple of automated ways of turning the fans on and off.



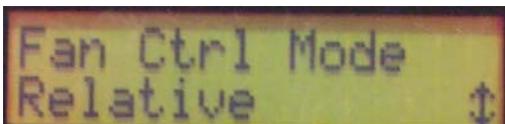
Press the ENTER button on the hand control to enter into the fan control menu.

## Mode

The first menu item is Mode.



Press the ENTER on the hand control to enter the Mode menu item. There are two items under the fan control mode menu, Relative and Absolute.



Use this mode if you want the fans to start when the difference between the Primary Mirror and Ambient temperatures reaches a set value (see **Temperature** below ). Press ENTER on the hand control to select this setting.



Use this mode if you want the fans to start when the Primary Mirror reaches a set value (see **Temperature** below). Press ENTER on the hand control to select this setting.

### Diff Sensor

From the Fan Control – Mode menu press the scroll down button on the hand control to move to the next menu item, Diff Sensor.



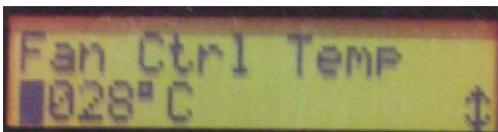
The Diff Sensor function compare a temperature difference between the primary temperature sensor and either the ambient temperature or the secondary mirror sensor. Note that the secondary mirror temperature sensor does not exist yet, but it is a plan for the future. Because of this, Diff Sensor should be set to ambient.

Press the scroll down button on the hand control to go to the last item on the Fan Control menu list, Temperature.

### Temperature



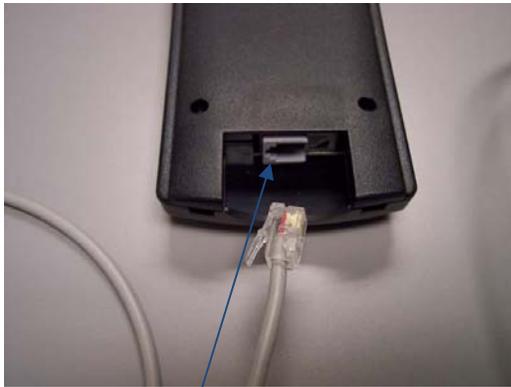
Press ENTER on the hand control to select the Temperature item on the Fan Control menu and the window to set the temperature displays.



You will set this temperature value based on what mode you chose to control the fans. For relative mode, this value is the minimum temperature difference that turn on the fans. You might set this to 2 degrees and if the difference between the primary mirror temperature and the ambient temperature becomes less than 2 degrees, the fans will turn off. For Absolute mode, this value is the temperature of the primary mirror that will turn the fans on. So you may want the fans to turn on if its temperature reaches 28 degree C.

## Using the RS232

You can control the EFA from a computer using PWIFocus, software that is included with the EFA Kit. In order to do this you need to use the supplied RS232 cable. If you have a computer with USB ports, then you will use the supplied RS232 to USB converter cable.



Plug the RS232 cable into the connector on the back side of the hand control.



RS232  
cable

USB to RS232  
converter



## Appendix 1 – The Menu Tree

### PlaneWave EFA

- ❖ Temperature
  - Pri.: 21.2 C
  - Amb.: 21.1 C
- ❖ Position
  - 17.441
- ❖ Fans
  - Off
  - On
  - Auto
- ❖ Setup
  - Temp Units
    - Celsius
    - Fahrenheit
  - Count Ratio
    - 115134.423
  - Stop Detect
    - Enable
    - Disable
  - Range Limit
    - Enable
    - Disable
  - Calibrate
    - Status
      - “Calibrated” or “Not Calibrated”
    - Auto
    - Manual
  - Fan Control
    - Mode
      - Relative
      - Absolute
    - Diff Sensor
      - Ambient
      - Secondary
    - Temperature