

## FocusCube v2

### Operating Manual

v1.1

Dear valued customer, congratulations and thank you for buying Pegasus Astro - FocusCube v2. This manual will give you a brief introduction to your FocusCube v2. Before using the FocusCube v2, please take some time to read it thoroughly and if you have any other questions, feel free to contact us at [info@pegasusastro.com](mailto:info@pegasusastro.com)

The evolution of technology in astronomy requires a system which will assist the focusing of the telescope with great accuracy. Fast optics and modern camera devices require automatic focusing in every small period of time as temperature can affect focal length and modify the optimal focus position. Pegasus FocusCube v2 has been developed to meet these requirements. This device can easily **lift more than 6kg** (212 ounces) of imaging equipment when the telescope points to the zenith!

Designed in high quality with modern electronics it can provide digital precise focus control from a PC. FocusCube v2 includes a stepper motor for absolute position focusing. Electronics and stepper motor are enclosed in a compact sized box.

#### Controller Design Overview



Back View



Side View (Universal Bracket)



FocusCube v2 - SCT Bracket

## What is in the box

Name	Quantity
FocusCube v2 Controller	1
DC Cable (2.1m) to Cigarette Lighter (3A fused)	1
USB2 Cable Type B (1.8 meters)	1
Temperature Sensor (RJ45 plug)	1
Black Anodized Bracket (Universal L shaped or SCT model) * SCT Model includes 2 pulleys	1
Different sizes of bolts and spacers	5 pairs
Motor Couplers (solid - different sizes from 3mm to 8mm)	6

## Optional Accessories

- Hand Controller

## Controller Care

- Controller is not waterproof and it should be kept clean and dry. Moisture can damage electronics and connectors.
- Do not allow solvents or chemicals to come into contact with the device
- Store controller indoor in a dry room when not in use
- Do not touch the internal components as they may get hot when in use

## Stepper Motor

FocusCube has an embedded high-resolution geared stepper motor (**Step Angle (Deg) 7.5 / 120 (Gearbox reduction rate = 0.06255 Deg per step)**). Its gearbox has low backlash and high torque, suitable to focus in micron scale.

**⚠ DO NOT TRY TO MOVE THE MOTOR MANUALLY WITHOUT POWER. MOTOR ACTS A BRAKE. IF YOU TRY TO ROTATE SHAFT OF MOTOR MANUALLY MIGHT CAUSE DAMAGE TO THE METAL GEARS OF THE MOTOR. USE ONLY THE HAND CONTROLLER.**

## Power Supply

Unit has been designed with reverse polarity protection. If you accidentally reverse the DC power source polarity the unit will cut off the power.

The controller is fitted with a standard **2.1mm** centre positive DC power connection which powers on the controller. It can accept DC 11-15V. Please use a power supply that can provide DC 12V-13.8V / **1A** (at least).

Insert the 2.1mm plug on the DC power cable. Controller will initialize (led will fast blink 3 times) and the green led will turn solid on after 4 seconds. This means that firmware was loaded successfully and controller is fully operational.

## Temperature Sensor Socket

The probe is an external temperature measurement device which is attached to the controller. It comes with length of 0.6m cable with a RJ45 plug. Probe measures temperatures from -55°C to +125°C.

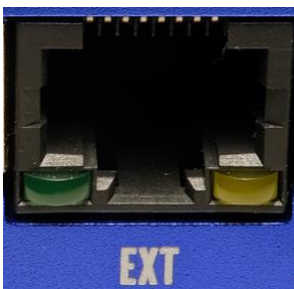
Accuracy of the probe is  $\pm 0.5^\circ\text{C}$  from -10°C to +85°C. The controller detects the presence of the probe and requests temperature readings at 30 sec intervals. When using multiple controllers and probes, the reported temperature may differ slightly between units due to small differences between individual sensor readouts.

This does not affect the operation of the units, as they respond to measured temperature change, not to the actual temperature.

**⚠ Please notice that you have to connect the sensor before you power on the controller. You can also connect it later but you will need to wait for 30 sec for sensor detection and calibration.**

## External Connector

The controller is fitted with a RJ45 Female Jack for auxiliary usage. In this socket you can **ONLY** plug the temperature sensor or the optional Hand Controller.



### IMPORTANT NOTICE:

**DO NOT CONECT ANY MOTOR OUTPUT OF AN EXTERNAL CONTROLLER SUCH AS ULTIMATE POWERBOX OR DUAL MOTOR FOCUS INTO THE RJ45 PORT. THIS MIGHT CAUSE DAMAGE TO THE DEVICE!**

## Status Led

Two LED indicators are fitted right and left of the RJ45 socket. The light displayed by the led indicates the status of the device.

Permanently Green Light	Controller is operational
Permanently Orange Light ON	Motor is moving
Orange Light Off	Motor is not moving

## USB Connection

Unit has been designed with a USB type B connector. Plug one end into a spare USB 2.0 port on the computer or USB Hub, the other end into the USB type B receptacle on the controller labelled USB.



Controller will be identified as “FocusCube revX” and a serial port will be appeared to the operating system.

## Hand Controller - Rotary Encoder Knob

An optional [hand controller](#) for manual focus control can be acquired for those who might want to add this functionality. Please refer to the Hand Controller manual for operating instructions.



## Operating Instructions:

- Plug the temperature sensor to the RJ45 socket.
- Plug the supplied USB type B cable to the device.
- Plug DC 12V/1-2Amps power cable into the DC 2.1mm socket.
- Device will boot after three seconds and the green indication LED will blink three times. This means that firmware was loaded successfully and the “FocusCube v2” is now fully operational.
- Download USB drivers, standalone software or ASCOM drivers from [pegasusastro.com/support](https://pegasusastro.com/support) in order to connect to the device.

## Focuser Compatibility (Universal Bracket)

We have successfully installed our Universal L shape bracket on:

- Takahashi TSA120
- Takahashi FS60
- Takahashi FSQ85
- Takahashi FSQ106
- Skywatcher Esprit Series (80 ED, 100ED, 120ED, 150ED)
- Skywatcher PDS 130
- Explore Scientific ED Series (ED80, ED102, ED127, ED152)
- Explore Scientific ED-FCD100 Series (ED80-FCD100, ED102-FCD100, ED127-FCD100)
- Explore Scientific FPL53 (ED140, ED115)
- Feathertouch Focuser 2.5"
- Feathertouch Focuser 3"
- Feathertouch Focuser 3.5"
- Vixen VC200L
- Altair Wave Series Telescopes (All models)
- Celestron SCT C 6,8,9.25,11,14
- Celestron SCT Edge 6,8,9.25,11,14
- Celestron RASA 8,11
- Orion ED80T

## Focuser Compatibility (SCT Bracket)

A special shaped black anodised aluminium bracket, hard to bend, can be attached to most of the Celestron SCT telescopes. **We provide three SCT versions.** The difference is in the metal pulley bore diameter & the screw length in the package. Make sure you have selected the correct type.

- Celestron **EdgeHD** 8, 9.25 , 11, 14 (13mm bore)
- Celestron SCT C6, C8, C925, C11, C14 (22mm bore)
- Celestron **RASA 8** (13mm bore)
- Celestron **RASA 14"** (22mm bore)

## Warranty

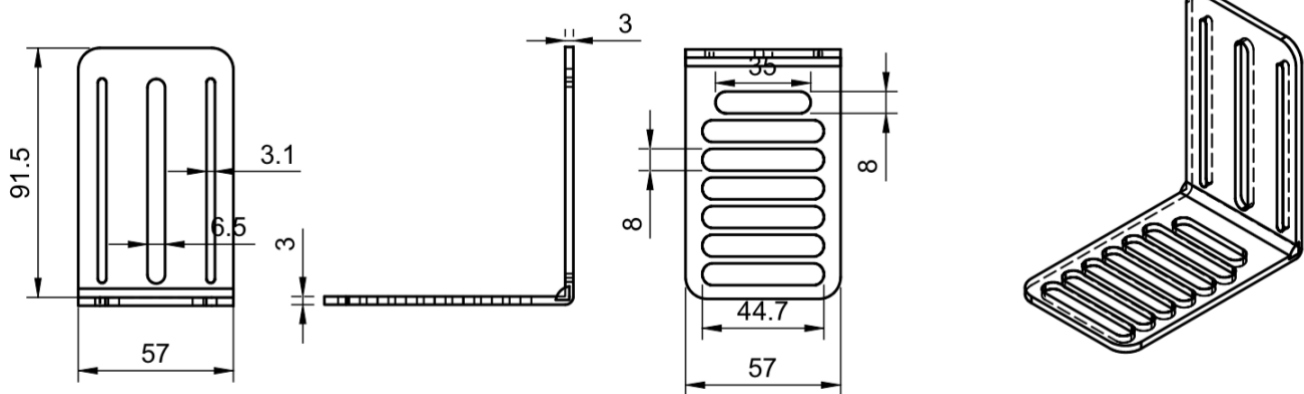
We provide 1-year warranty for our products. We will offer the repair service for free or replace the item for free if the unit does not work properly within the warranty period. After the warranty period, we will continue to provide repair support and service on a charged basis. This warranty does not apply to damage that occurred because of abuse or misuse, or damage caused by a fall, or any other accidental failures after purchase. The customer must pay for shipping when shipping the camera back for repair or replacement. If you get a faulty unit, please contact us as soon as possible through email: [info@pegasusastro.com](mailto:info@pegasusastro.com).

Please describe the problem in detail, and we will do our best to solve the problem. Most instances are perceived problems which are caused by a bad driver install or software configuration.

## Technical Specifications

Supply Voltage	DC 12V – 13.8V
Motor Compatibility	Stepper Motor is inside the enclosure
Motor Output	None (Stepper Motor is in the enclosure)
Motor Specification	High resolution geared stepper motor (Step Angle (Deg) 7.5 / 120 (Gearbox reduction rate = 0.06255 Deg). 5755 steps per circle of rotation. <b>* Firmware implements half step drive so one motor cycle is 5755 x 2 = 11510 steps</b> Very low backlash
USB Connectivity	USB 2.0 Type B plug
Thermal Sensor Resolution	9-bit Celsius temperature measurements – External Sensor with RJ45 plug
Power Input Connector	2.1mm Centre Positive Socket
Dimensions	56mm x 63mm x 39 mm / 300 grams

## Universal Bracket



## Troubleshooting guide

Problem	Cause	Cure
Controller LED is off	Power supply is not connected	Connect Power and wait for a solid green light
Stepper motor does not move	You have specified a "max speed" larger than motor can support	Set mode to "stepper motor" setting and retry
Stepper motor makes strange noises or step gaps when accelerates	You have specified a "max speed" larger than motor can support	Go to "Settings" and limit the max speed (try between 200-400). Every stepper motor has a maximum speed or else it will jump and loose steps. <a href="#">Pegasus Astro Stepper Motor support max speed up to 400.</a>
Sensor does not report temperature	Check that sensor is in place	Check connectivity of the sensor. Recycle power and retry or wait for 1 minute for sensor recalibration.
Controller randomly loses USB connectivity	Check that your USB cable does not exceed 5m length.	Use a shorter cable or a powered USB hub. The USB 2.0 specification limits the length of a cable between USB 2.0 devices (Full Speed or Hi-Speed) to 5 meters.

## Software installation

Latest software and drivers release can be found at Pegasus Support site:

<http://pegasusastro.com/support>

Please download and install the following:

- ASCOM Focus Driver
- Focus Controller (Stand Alone application)
- USB Drivers (FTDI)

INDI (Open Astronomy Instrumentation) supported

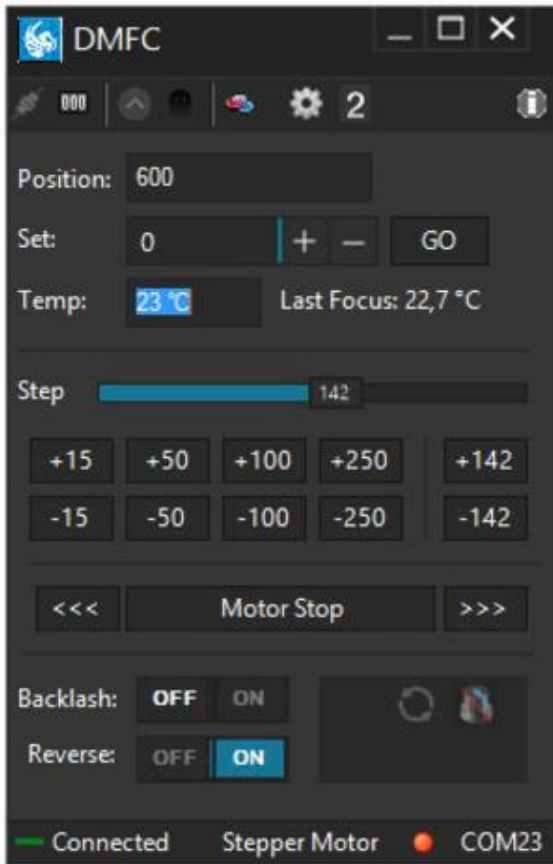
Pegasus Focuscube v2 is fully compatible with INDI. Driver is included in stable libindi.

Official Indi Driver : <http://indilib.org/devices/focusers/pegasus-dmfc.html>



## Standalone DMFC Application

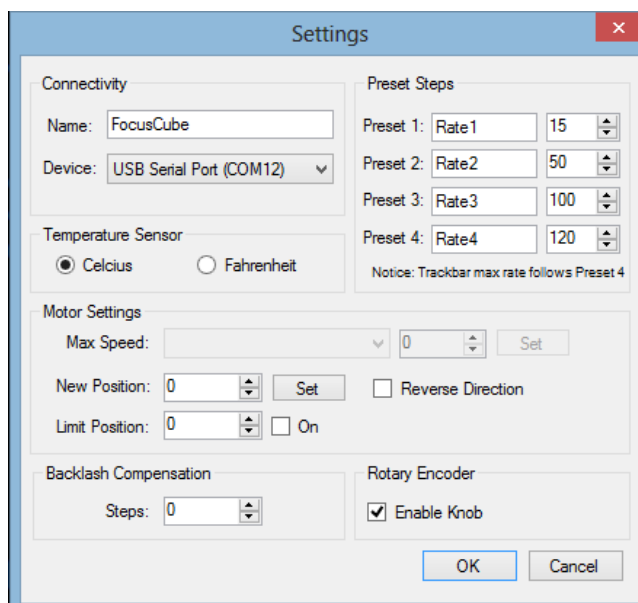
Standalone application does not require ASCOM drivers and it can configure / operate the FocusCube controller.




In order to connect from the supplied software to the controller, you need to first configure the serial port

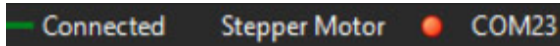
- Click on “Settings” icon 

The following window appears



- Click “Device”. A drop-down list of discovered DMFC controller will appear. Choose the “FocusCube” and click “OK”

- Press “Connect” button 
- Application will connect to the controller and the “**Connected**” status will appear on the bottom taskbar.



### Led status

You can operate the led indicator on the top of controller on demand. Click the circle “LED” icon and switch on or off the LED of the controller.



### Motor Settings – Max Speed

All stepper motors have limits of the max speed they can achieve. If you set “max speed” faster than your motor can support, it will probably jump / loose steps and make weird noises as it cannot keep up with the controller’s designated steps.

How to connect max speed:

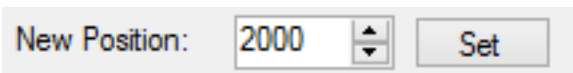
- Connect to the controller
- Go to settings and check “Motor Settings”
- Set steppers motor “Max Speed” and click “Set”. Setting will be stored to controller’s memory (EEPROM)
- Power cycle controller to verify new setting and apply max step speed.

**WE STRONGLY SUGGEST TO LEAVE THE MAX SPEED TO DEFAULT SETTINGS  
AS IT IS OPTIMIZED FOR THE PEGASUS MOTOR**

### Motor Settings - New Position

If you need to change the current position of the controller, you can do it through this option.

- Type new position and press “Set” Button



- Controller will instantly set new position the value you specified.  
**Notice** that controller will not move motor. Controller will only change value of reported current position

This feature is very useful when you need to zero the position of the focuser or set another value.

You can also zero the position of the focuser by clicking the “000” button in the top taskbar of the application.



## Custom Rates

You can easily set and save custom names and step / pulse values in the following section of “Setup” page.

Preset Steps

Preset 1: Rate1 15

Preset 2: Rate2 50

Preset 3: Rate3 100

Preset 4: Rate4 120

Notice: Trackbar max rate follows Preset 4

Click “OK” and your rate settings will appear in the main window of the application.

## Control Motor

From these buttons you will control the steps of the stepper motor or pulses from the DC motor.

- Set the “Step” to the value you want (bigger the step / pulse count, larger the movement of the motor shaft)

Step 90

+15 +50 +100 +250 +90

-15 -50 -100 -250 -90

You can also quick select the predefined values you specified in “Custom Rates”

- Click once the “step number” button. This is how many steps the motor will move forward (+ steps) or backwards (- steps).


*Notice that “Position” indicator will change its value and will confirm your command*

Position: 100

There are two more buttons (<<< & >>>) that will forward / reverse accelerate the motor. Keep mouse down and the motor will start accelerating to the director you clicked.

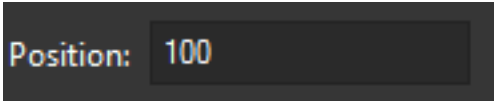
<<< Motor Stop >>>

**Use these buttons only if you need to quickly move in or out your focuser (be careful not to exceed focuser limits!)**

 In every motor movement, final position (when motor stops) is saved after 10 secs into controller’s EEPROM memory. This will ensure that next time you power on the controller, last saved position will be retrieved from its memory.

### Current Motor Position

Controller continuously (every 500 milisec) reports motor / focuser position. Reading can be found in the following image:



### Set A New Motor Position

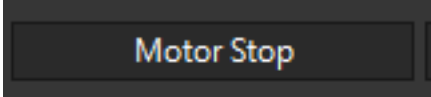
You can easily specify a new motor position. Set the value and click “GO” button.

Motor will start moving to the new position you defined.



### Emergency Motor Stop

Click the “STOP” yellow button and the motor will instantly stop. This can save you if you specified a wrong position and the focuser is quickly extended reaching its limits.

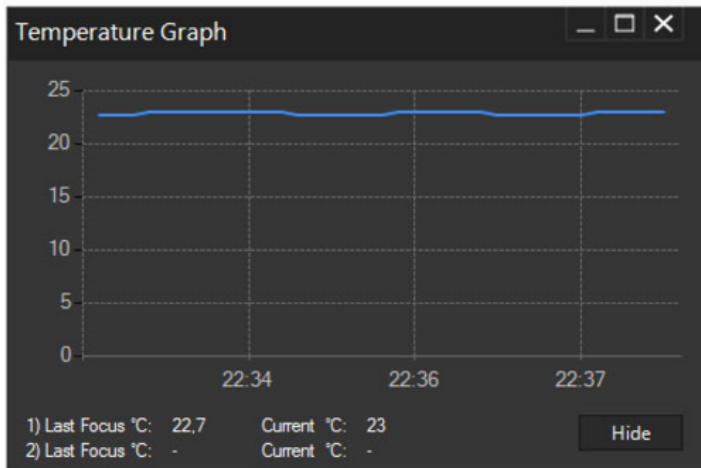


### Temperature of sensor

Existing environmental temperature of the sensor can be seen in the following reading.



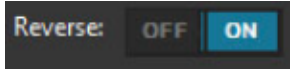
Click the graph icon and a graph which displays temperature over time will appear



You can easily check when was the last focus temperature so you can know exactly if it is time to refocus.

### Reverse Direction

In case you need to invert the motor in anti-clockwise rotation you can click the “Reverse Direction” option from settings. This option can be useful if you use gears to transmit motor’s movement to your focuser.



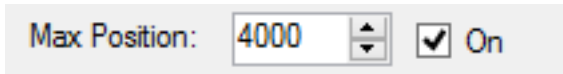
An anti-clockwise icon will appear on the status window of the main application pointing that you have selected this option.



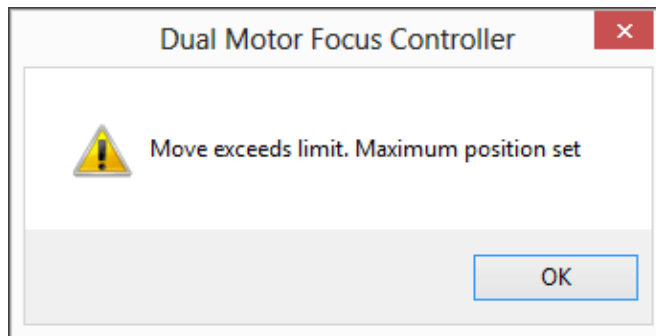
### Maximum Position

You have the option to specify the maximum steps of the motor. This will enforce the controller to disallow a motor move to the direction you are about to exceed this limit. This is a useful option to prevent the focuser to fully move in or out.

Move to settings and type the numeric limit in the “Max Position” section you need to enforce. Click the “On” check button



When you try to exceed this limit the controller will deny to increase steps and it will notify you that the limit was about to exceed.



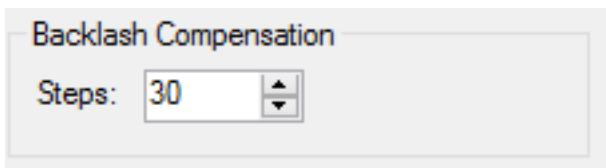
## Backlash Compensation

Backlash, sometimes called lash or play, is clearance or lost motion in a mechanism caused by gaps between the parts. Motor's gearbox or other components in the focuser can have an amount of backlash.

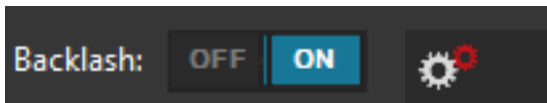
Compensation will be invoked when the move is in opposite of the compensation direction. Just make sure the amount specified is more than needed to remove the backlash.

To enable backlash compensation, choose the extra steps you need to be calculated in compensation and enable the feature by clicking ON.

**Setting is stored in the EEPROM and calculates the backlash steps by using PC or Manual Knob**



An indication on the main status bar will notify you that the backlash compensation functionality is enabled.



## Knob Encoder Disabled

If you want to disable knob on the side of the controller

- Press the knob for two (2) seconds.
- You can also disable it from the settings of the standalone software.


Led indicator will turn to orange and the software will report the disabled status of the knob.

A red knob will appear on the status bar or the software (check following image)



Press the knob one more time to enable the encoder functionality

## Firmware and Software Version

Connect to controller and click the “informational”  button on the taskbar of the main application.



In this window you can verify the firmware version of the controller including the version of the standalone application. Keep in mind that software supports new feature combined with the latest firmware release.

Please check <http://pegasusastro.com/support> for latest firmware & software updates of “FocusCube”.

Launch 2<sup>nd</sup> instance of the software

Click **2** button. It will spawn a 2<sup>nd</sup> instance with different settings so you can use both of them in parallel.