AstroLink 4 mini II

astrojolo.com @2021

WARNING!

Do not connect or disconnect stepper motor when power is on. It may damage stepper motor controller.

Make sure the stepper hold torque is set to 0% before replacing stepper motor with motor of different type.

Main features:

- Two focuser motor control for *Robofocus*, *Moonlite*, or generic unipolar or bipolar stepper motor
- 1/8 and 1/32 micro-stepping control with 2.0A maximum current and 1.4A maximum continuous hold current
- advanced temperature compensation with scripting support and compensation calculator
- permanent focuser position – no need to park focuser after the session
- 2 adjustable PWM power outputs to control dew heaters, telescope fans, or custom Peltier coolers. The maximum load is 40W per output
- 3 switchable power outputs to power mount, cameras, or filter wheels. The maximum load is 5A per output
- 1 additional permanent power output
- 1 additional adjustable 3-10V output
- XT60 high current input voltage socket
- temperature/humidity/sky temperature sensors to monitor environmental conditions and calculate the dew point. It is also used for automatic control of dew heaters
- monitor voltage, current consumption, and total energy consumed during the session – useful when working in the field with a battery
- user-defined alerts for voltages, current, energy, and temperature changes conditions
- programmable overcurrent and overvoltage protection
- dedicated *AstroLink 4 panel* software, ASCOM drivers available

Technical data

- dimensions: 122x86x28mm
- weight: 215g
- the maximum current drawn from all outputs: 10A
- AstroLink power consumption: 2W max
- regulated PWM outputs: 40W max
- permanent 12V DC output: 5A max
- switchable 12V DC outputs: 5A max
- focuser stepper motor outputs: RJ12 6 pin, 2.0A max
- adjustable output: 2A maximum peak load, 1.5A continuous load
- sensor inputs: RJ11 4 pin I2C digital interface
- auxiliary input: RJ11 4 pin input

Device overview

PWM outputs

AstroLink 4 mini II has two RCA outputs that provide PWM (pulse width modulation) regulated voltage. Regulations cover the full 0-100% range. These outputs are usually used for powering dew cap heaters. Output can be regulated using both controls in the dedicated panel software and 3rd party software that supports the *ASCOM Switch* interface or *INDI* interface.

Switchable 12V DC outputs

The device contains three switchable DC outputs, that may provide a supply voltage for imaging setup components (camera, mount, etc.). Output can be switched using both controls in the dedicated panel software and 3rd party software that supports the *ASCOM Switch* interface or *INDI* interface.

Focusing motors control

Two focusing motors can be controlled with AstroLink 4 mini II device. Both channels are identical, the only difference is the output socket – one has a *Robofocus* DB9 socket, the second is 6 pins RJ12 socket. Both outputs support 12V unipolar motors with gearboxes and bipolar motors at 1/8 and 1/32 microstepping. Focusing motors can be controlled with dedicated panel software and via *ASCOM Focuser* or *INDI* interfaces.

Permanent 12V DC output

This output is connected directly to the input 12V XT60 socket. Can be used to provide power to a mini PC or other device powered with 12V.

Adjustable DC output

Internal switching converter provides regulated voltage in a 3-10V range that can be used to power any peripheral devices (DSLR, USB hub, etc.) Voltage can be adjusted with a 2mm flat screwdriver using a small potentiometer.

Sensors

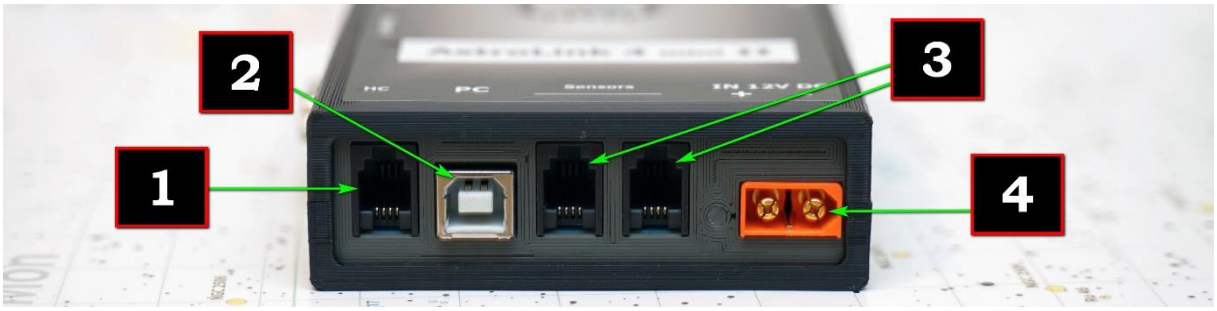
AstroLink 4 mini II has two equivalent sensor inputs, so you can plug any available sensor into any socket and it will be recognized and properly assigned. Connecting three sensors (two temperature/humidity and one sky temperature) requires an additional sensor bus splitter. Sensor readings are available in the dedicated panel software and via *ASCOM Observing Conditions* and *INDI* interfaces.

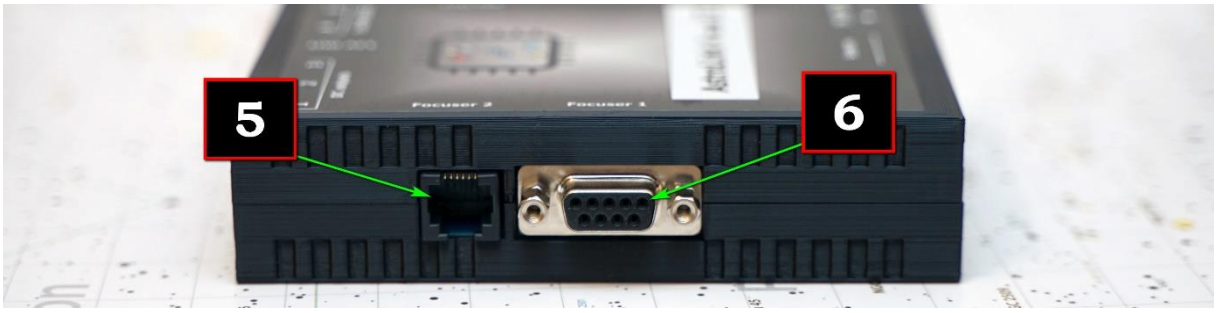
WARNING!

Do not connect or disconnect stepper motor when power is on. It may damage stepper motor controller.

Make sure the stepper hold torque is set to 0% before replacing stepper motor with motor of different type.

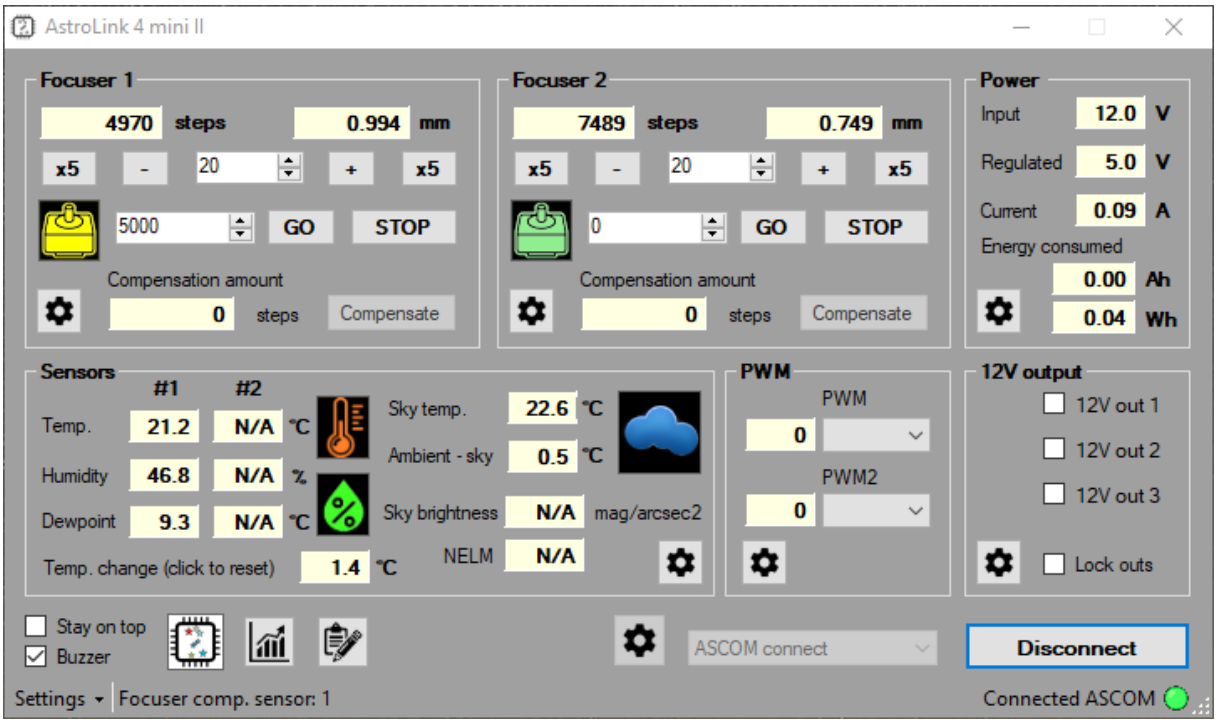
External view





1. AUX input
2. USB 2.0 input
3. Sensors inputs
4. 12V DC input
5. Focuser 2 output
6. Focuser 1 output
7. Adjustable voltage output
8. Heaters outputs
9. 12V permanent output
10. 12V switchable outputs

Panel overview



AstroLink 4 mini II panel contains several control sections. Most of the area is occupied by different controller sections, which will be described later on. Below the control section, several other controls are available.

Stay on top checkbox makes the AstroLink panel not go to the background when another application is selected.

Buzzer checkbox controls buzzer activity.

Menu

A small cogwheel menu contains shortcuts to all other settings menu windows, so they can be also opened from here. There is one additional position in this menu:

- *Manual control*. You need to check this field when you have connected the manual control box to the AstroLink device
- *Compensation calculator*. This option opens an additional popup window with the compensation calculator. See the *Compensation calculator* section for details
- *Reset device to factory defaults* - this option will reset all device settings to factory default values. The confirmation window will be opened.
- *Settings Load.../ Save...* - these options allow us to save or load all device settings and configurations. All settings, labels, initial PWM, and power output values can be stored.

Status bar

The status bar displays several different information that is visible depending on the context. It is a read-only field.

Charts and notes

Notes panel - after clicking on this button small editor will popup, where you can note down some information you need during the imaging session (like focuser positions, flat images exposure time, etc.). Its content is saved dynamically.

Charts button opens an additional window with AstroLink charts. See the *AstroLink charts* section for details.

Logo icon

After clicking on the logo icon a small information window will pop up. It contains information about firmware and software versions.

Connection controls

The panel can communicate with the device in two modes. The first one is *DIRECT connect* - then the panel connects directly to the device and no other interface can control any of the device components at the same time. The second communication mode is *ASCOM connect*. In this mode, the panel connects to the device using the installed *ASTROJOLO Focuser* driver, and as this driver is a part of a multi-driver Local Server instance many other applications can control any of ASCOM interfaces at the same time.

DIRECT connect

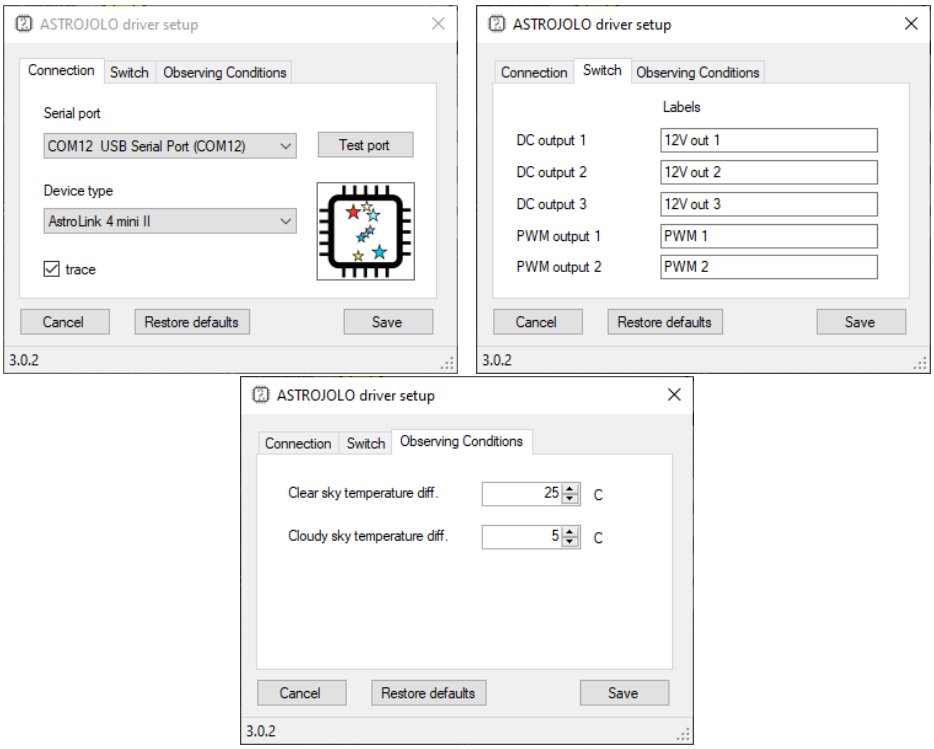
After selecting *DIRECT connect* and clicking on *Settings* button *Direct connect settings* popup will open. Then you need to select the proper *COM port* where the AstroLink device is connected and detected. After selecting the port you can click *Test port* to make sure the device is connected properly. After clicking the *Save button* settings will be saved and the software will connect to the AstroLink device each time using the selected port.

There is another option in the window called *reset AstroLink on connect*. When this field is checked each time the connection to the device is established AstroLink will reset, so its state will be restored to the power-on state. It can be useful in case when AstroLink is not responding and you work remotely and cannot switch it off and on. In all other cases, it is recommended to keep this field unchecked.

ASCOM connect (recommended)

After selecting *ASCOM connect* and clicking on the *Settings button* ASCOM Focuser Chooser window will open. You need to select the *ASTROJOLO Focuser* interface and then click the *Properties* button, so the ASCOM connection setup window will open. Here you need to select the *COM port* where the AstroLink device is connected. This driver is for all members of the AstroLink 4 family, that is why you also need to select a specific device – **AstroLink 4 mini II** in this case. You can also test the connection using the *Test port* button. When the trace check-box is checked ASCOM log file will be written with all communication between the device and any software - it can be useful to investigate errors. *Reset AstroLink on connect* works in the same way as in *DIRECT connect* mode.

There are two more tabs available for the ASCOM driver. There you can adjust sky temperature cloud coverage mapping points that correspond to clear sky and maximum cloud coverage, and set names for DC and PWM outputs that will be visible in ASCOM Switch client software.

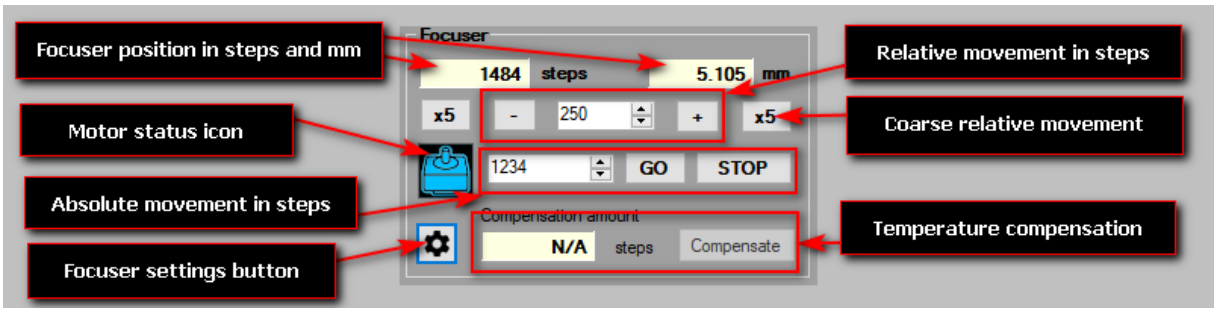


Both connection modes offer the same functionality. The only difference is that DIRECT connect works exclusively, so no other software than the panel can communicate with the device. ASCOM connect mode allows other 3rd party software to operate with the device at the same time - see 3rd party software section.

Connection status

Small indicator field with selected COM port number and light. Gray means not connected, green means connected, red means active communication.

Focuser section

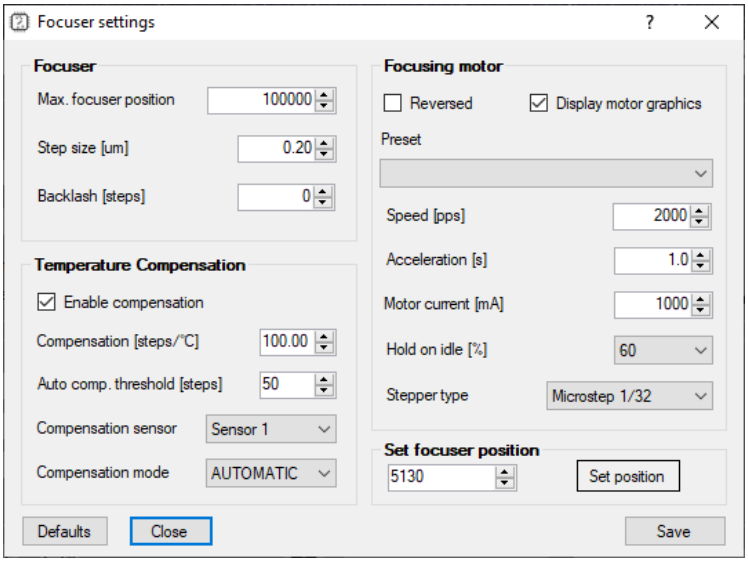


The focuser position in mm is calculated based on the focuser position in steps and step size defined in settings.

The coarse relative movement factor can be set in settings between 2 and 10.

The motor status icon may be in three colors: red means the motor is rotating, yellow means the motor is idle but holding current is applied, and green means idle and no holding current is applied.

Temperature compensation and focuser settings are described below.



Max. focuser position - here you need to enter the maximum focuser position, so the focuser will not move to any larger value. This is to prevent any mechanical damage to the focuser.

Step size [um] - this value is stored in the driver and can be provided to any 3rd party software when requested. It is not used internally in AstroLink.

Reversed - you can check this box when to select proper behavior of the focuser, so decreasing the focuser position will cause the focuser tube to move into the telescope

Backlash [steps] - this is for focuser motor backlash compensation. You may enter here backlash value that will be applied to focuser moves to cancel the stepper motor gearbox backlash. This value may be positive or negative. A positive value means, that backlash compensation will be applied for outward moves, and a negative value will be applied to inward moves. **This compensation is applied only when the motor is controlled with the AstroLink panel's button. When you use 3rd party software for focusing (FocusMax, MaxIm DL, and others) use this software backlash compensation!**

Display motor graphics – toggles displaying stepper motor status icon

Preset – select any of the predefined settings for common motor parameters. Other fields at this tab will be filled with values, but settings will be saved after the *Save* button is pressed.

Speed [pps] - focuser stepper speed in pulses per second. You need to select the appropriate value, so the focuser will move with reasonable speed, but no steps will be lost during the move. For popular unipolar stepper motors with a 7.5-degree step, it should be usually no more than 120-150. Bipolar steppers with a 1.8 degree step usually can operate at a faster rate, up to 400-500pps. Micro-stepping can operate at rates up to 2000pps.

Acceleration [s] - each time stepper starts to move, it accelerates to the speed selected in the field Speed. Here you can enter the acceleration time. So for example, when you enter here one second, then stepper motor will reach its maximum speed within one second. This value is also used for manual stepper control, but acceleration is divided by 5 for this purpose, so it is possible to do small manual corrections.

Motor current [mA] – this is the current limit set to the motor. Refer to your motor technical data to set proper current. For 12V unipolar geared motors offered in *shop.astrojolo.com* set it to 400mA or use preset.

Hold torque [%] - when this is selected to any value greater than zero, the stepper motor will be powered when stopped. It can then provide additional holding torque to your focuser, however more current will be drawn, and motor temperature will increase. **Make sure the stepper motor you use is designed to be powered constantly if you want to use this option.**

Stepper type - can be selected between Unipolar (like Robofocus compatible) or Bipolar motor full or half step motors. It can be also bipolar motor controlled with micro-steps – two options 1/8 and 1/32 stepping are available.

Enable compensation - switch compensation on or off

Compensation steps [steps/C] - this is the number of steps the focuser will move when the temperature will change from the initial value. So if you put here 35 and the temperature will drop 2C, then the focuser will move 70 steps (outwards). This value usually must be determined practically, so you can note focuser positions over long night session together with corresponding temperatures, and then calculate this coefficient

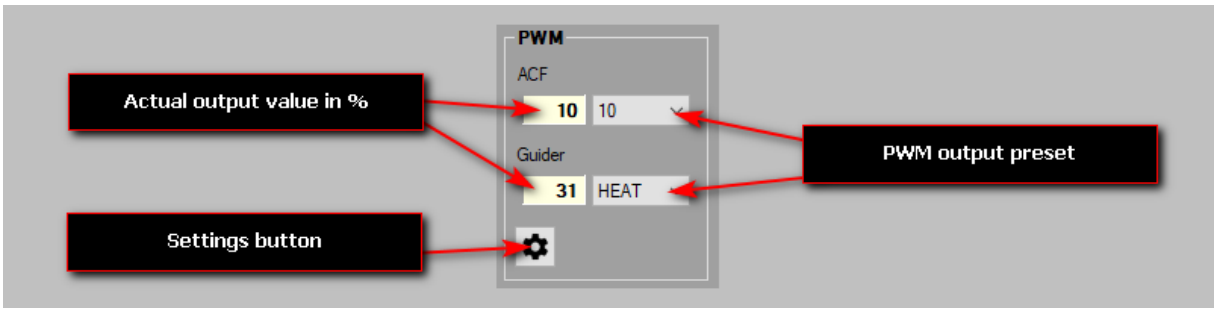
Auto compensation threshold [steps] - when compensation mode is set to *AUTO* and the calculated compensation error will exceed this value, then compensation will be automatically applied

Compensation sensor - here you can select the sensor that will be used for temperature measurements for focuser compensation

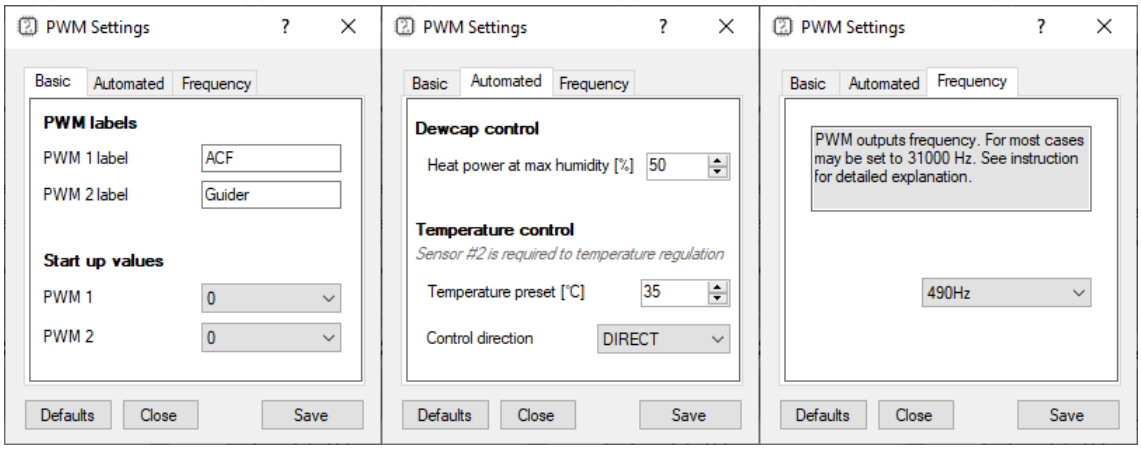
Compensation mode. When set to *MANUAL* the calculated compensation will be displayed in *Compensation difference* window, however, no compensation will be performed - it must be triggered manually with the *Compensate button* (or using script - see *Temperature compensation* section). When this option is set to *AUTO* then manual compensation will still work, but it will also be performed automatically each time when calculated compensation error will exceed the *Auto compensation threshold* value

Set focuser position - you can set any desired focuser position to calibrate it. Usually, it will be used to set a zero position. For this case you need to move the focuser tube inwards as much as possible, then enter 0 value into the field and press the *Set position* button

PWM section



PWM output value can be set between 0 and 100%. *HEAT* option controls value automatically based on current relative humidity. *AUTO* option controls value automatically to keep *Sensor #2* at a given temperature.



The first tab *Labels* contains labels for each PWM output, so it can be set for example to *'OTA dew cap'* or *'Guider cooling'*. Another two select boxes determine the startup state of PWM outputs. Any value set here will be set up to PWM output after power is on.

Second tab *Automated* contains parameters used when the *HEAT* or *AUTO* option is selected for PWM output:

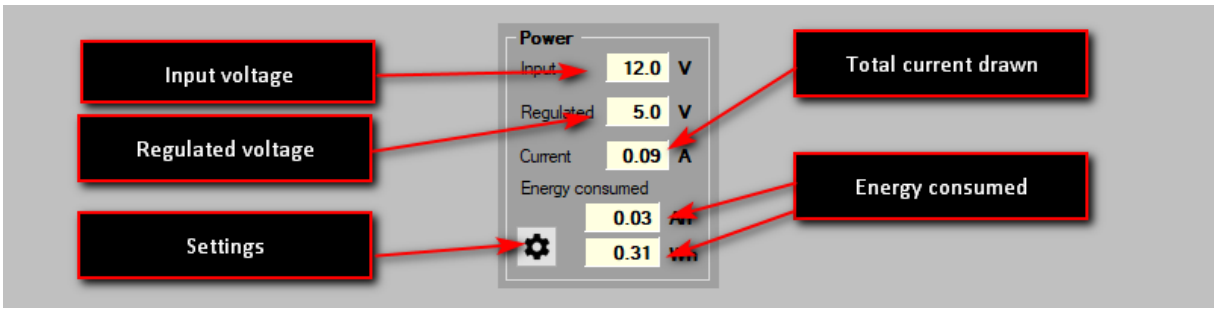
Heat power at max humidity [%] – select here the heating power when relative humidity reaches 100%. If your heater has correct power you may enter here 100%. But when your heater is oversized, you may put here a lower value.

Temperature preset [C] - PWM output power will be adjusted to keep the selected sensor at the given temperature

Control direction - when the output should increase with increased value (*DIRECT*) or should decrease with increased measured value (*REVERSED*)

The last tab is *Frequency*. Here there is only one select box where you can change the frequency of PWM output. It is usually the best approach to select the highest 31kHz frequency - this frequency is not audible by humans and also requires low-value LC filtering elements if you want to use it. But some receivers may not work well with such high frequency, and then it needs to be adjusted down.

Power section



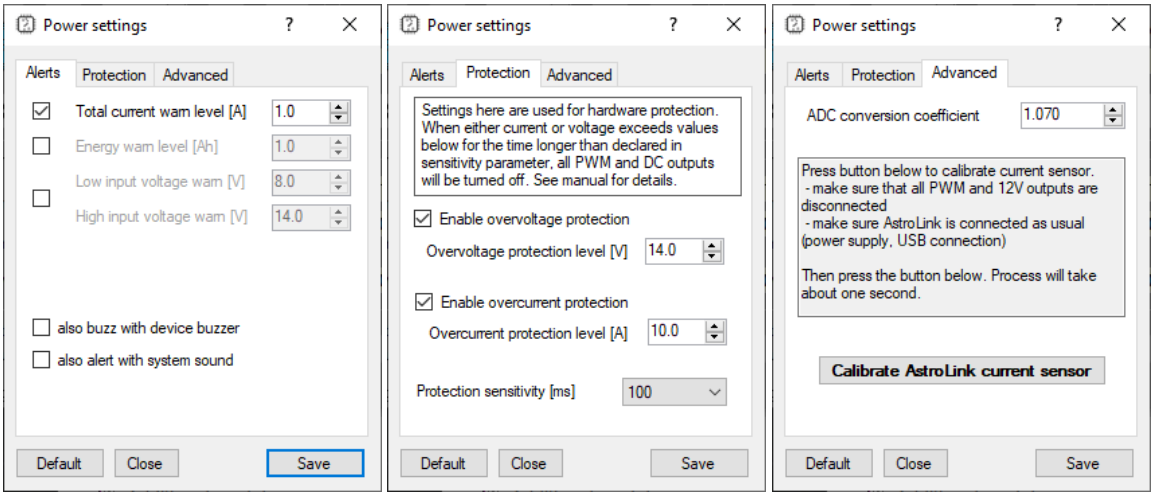
The power section helps to monitor power conditions. It displays voltage, current, and energy consumption. Under the settings button, there are some more options related to alerts and protection.

Input voltage - this field displays the current supply voltage value

Regulated voltage – displays the voltage set on the adjustable output

Total current - this field displays current drawn by the device and all attached gears from the power supply

Energy consumed - these two fields display energy consumed from the power source since the moment device has been powered on or reset. This information can be used to monitor energy when powering in the field from a battery



When any of the alert values are close to the defined limit corresponding field becomes orange. When any of the alert values exceeded the limit, the corresponding field becomes red. Additionally, if a system sound alert or device buzz alert is enabled there will be an audible sound alert.

Total current warn level - when the total current will exceed this value, an alert will be triggered

Energy warn level - when energy consumed from the power supplier will exceed this value alert will be triggered

Low input voltage warn - when input voltage will decrease below this value alert will be triggered

High input voltage warn - when input voltage will increase over this value alert will be triggered

also buzz with device buzzer - when one or more alerts is triggered there will be a sound signal emitted from the AstroLink device

also alert with system sound - when one or more alerts is triggered there will be a system sound alert played in the computer

Overvoltage protection level [V] - when input voltage will exceed this level for a time longer than specified as protection sensitivity time all PWM and DC outputs will be switched off

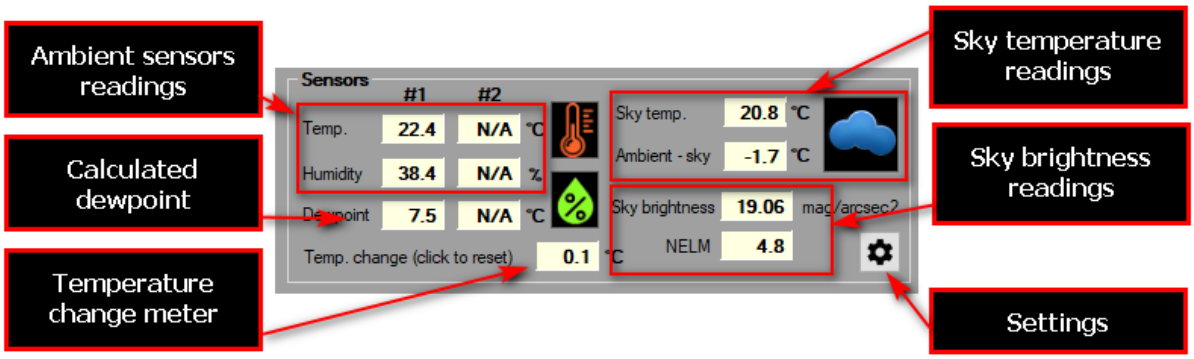
Overcurrent protection level [A] - when total output current will exceed this level for a time longer than specified as protection sensitivity time all PWM and DC outputs will be switched off

Protection sensitivity [ms] - the delay between protected condition and the moment the PWM and DC outputs will be switched off

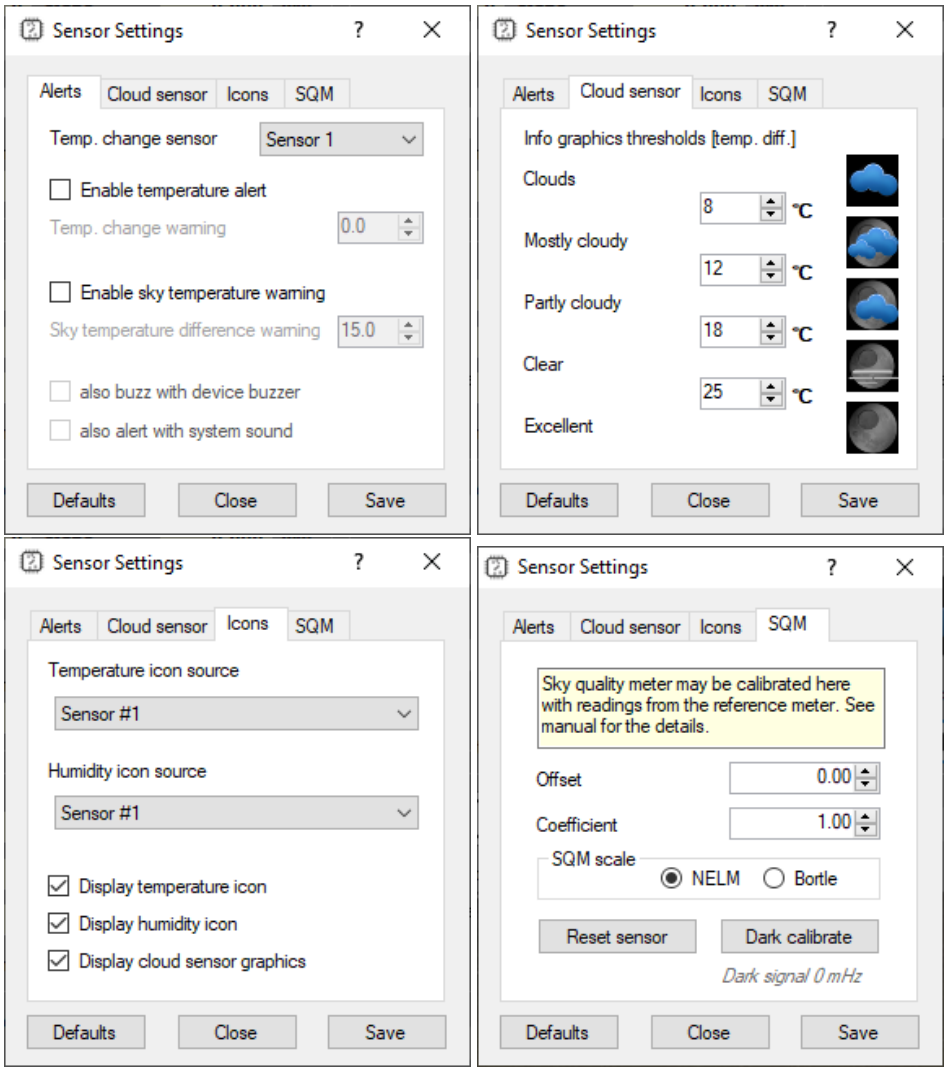
V in. ADC coefficient - this is the voltage of the internal reference source of the device. It should be 1.1V in the perfect world, however, this source is not so precise. There is a real reference voltage value printed in the box, but if you notice that measured in the panel voltage differs from the real voltage value you may adjust this coefficient.

Calibrate AstroLink current sensor. Every time you adjust the ADC coefficient also current sensor needs to be calibrated. To do it you need to disconnect all receivers from the AstroLink device and click this button. After a moment current sensor will be calibrated.

Sensors section



Sensors and PWM sections are separate ones, although they work together to provide some combined functionalities. The sensors section contains four read-only fields that labels may be changed. Sensor sockets in AstroLink are equivalent, so it does not matter where you connect the given sensor. The temperature/humidity sensors enclosures are numbered, and the sensor marked with 2 will be displayed in the #2 column in the panel. Sky brightness sensor refresh rate depends on the actual sky brightness. Darker sky requires longer integration time. Up to 30s for 21 mag/arcsec^2 sky, or up to 60s if darker.



In the tab called *Alerts* you can set temperature change monitor parameters:

Enable temperature alert - here you can enable or disable temperature alerts

Temp. change sensor - it is the sensor that temperature is taken to monitor its value. Make sure the selected sensor is connected to the device

Temp. change warning - it is the difference between the current temperature and start temperature that causes an alert to be triggered. When the temperature difference is close to this value, the temperature window becomes orange. When the limit is reached, the temperature window becomes red and alerts are emitted (if activated)

also buzz with device buzzer - when the temperature change limit is reached alert signal will be emitted from the AstroLink device buzzer

also alert with system sound - when the temperature change limit is reached system alert sound will be played

Enable sky temperature warning - when the difference between sky and ambient temperature drops below the specified threshold alert will be triggered. It usually indicates a scenario, when the sky is covered with clouds

***Cloud sensor* tab contains** threshold levels that change the icon representing sky conditions. Default values 8, 12 18 and 25 degrees are usually suitable for the average location. However, if the sensor is used in specific conditions (desert, mountains, lake, or river proximity) these threshold levels may need to be adjusted.

The third tab called *Icons* controls the displaying of environmental status icons.

Temperature icon source and *Humidity icon source* determine if icon color is controlled with values that come from the first or second sensor, from the sensor that provides higher or lower value or averages both sensor readings.

Display temperature icon toggles temperature status icon displaying

Display humidity icon toggles humidity icon displaying

Display cloud sensor graphics toggles displaying sky temperature status graphics

The last tab – SQM controls the settings of the optional sky brightness sensor. Numeric fields are used for the sensor reading calibration. If you want to calibrate the sensor to a reference sky brightness sensor, usually it is enough just to determine offset. If after applying the offset there are still significant differences between the sensors, please contact us, so we can analyze the case and provide a way to determine the *Coefficient* parameter.

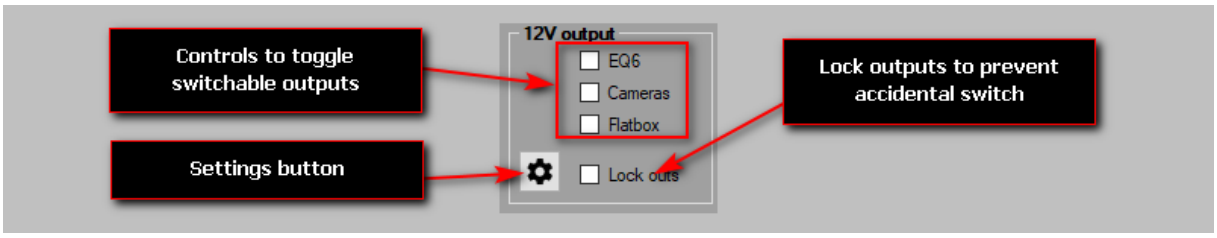
Offset – the difference between the AstroLink sensor reading and reference sensor reading

Coefficient – second parameter that controls sensor calibration

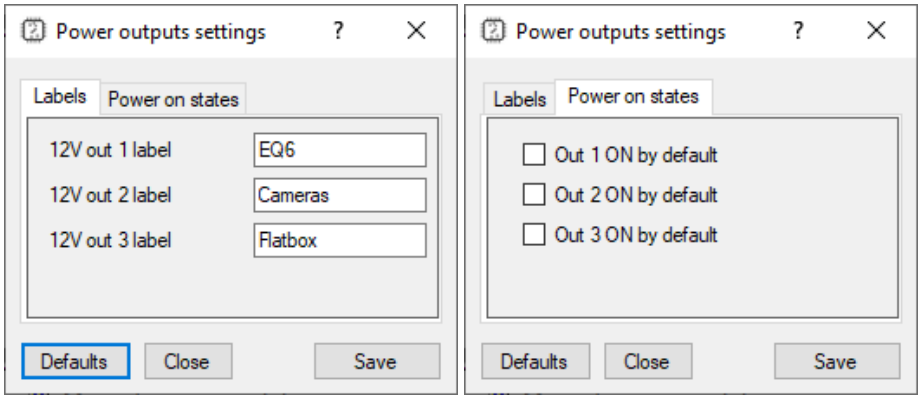
Reset sensor – reset sky brightness sensor parameters to the factory defaults (confirmation window will popup)

Dark calibrate – determines the dark signal of the sensor that will be then applied to sensor readings. The process requires sensor cover and no stray or ambient light available. It may take up to three minutes (a confirmation window will popup).

12V output section



The second section is called the *12V output*. Here we have three check-boxes that control DC outputs where you can connect supply voltage to peripheral devices like mounts, cameras, or filter wheels. *Lock outs* check-box can be checked and then three boxes above will be locked (not clickable). This way you can prevent accidentally turning on or off any of the connected devices.

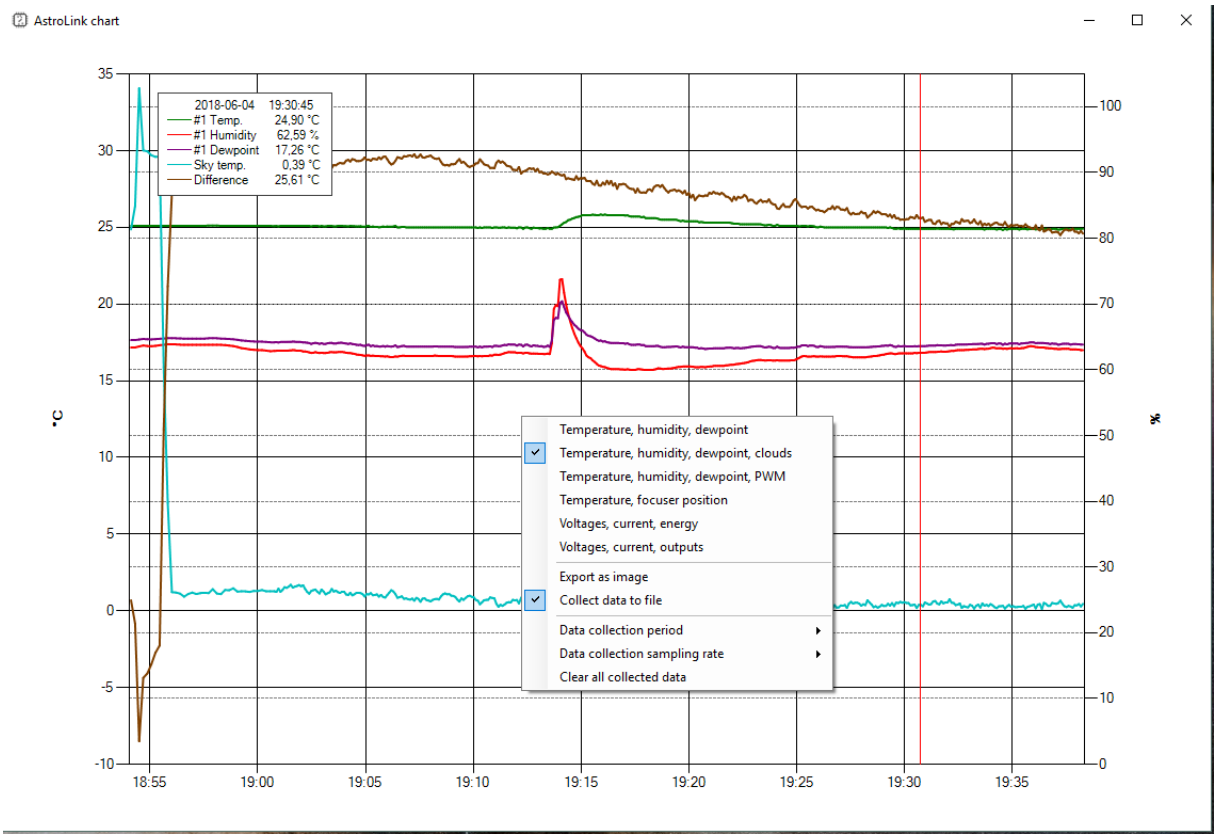


Under the cogwheel button settings windows is hidden. There are not many options, however. You can label each power output, so it can have a meaningful name like *'Mount'* or *'CCD main camera'*. On the second tab, there are three check-boxes that control power-on behavior. If the check-box is checked then the corresponding output will be on after turning on the power or resetting the device.

AstroLink charts

AstroLink charts are the tool that allows you to monitor the following data that is collected by the AstroLink device:

- temperature, humidity, and dewpoint measured by connected sensors
- sky temperature and the difference between sky and ambient temperature (if the sky temperature sensor is connected)
- focusers position in steps
- PWM outputs power in %
- switchable DC outputs states
- input voltages value
- total current draw
- total energy consumed



Charts start to collect data at the moment AstroLink panel software connects to the AstroLink device. You can open the charts window by clicking the corresponding button in the lower-left of the panel. After opening the charts window the default view is opened - that is a mixed plot of the temperature and focuser position. The chart scale is calculated automatically. You can zoom any selected chart range by selecting it with a mouse. Then the scroll bar will appear, so you can pan the graph. To cancel zoom you need to press a small button on the left side of the scroll bar. After clicking with the right mouse button in the chart area the context menu will be opened. In this menu following options are available:

- the first five options can be used to switch between different views of plots that present different data in a combined way

- *Export as image* - this option saves the current graph as a PNG image in the folder selected by the user in the dialog. The saved image will contain exactly what is visible on the chart
- *Collect data to file* - this checkbox indicates if data is saved to the file. This is checked on by default, and data files are saved in *My Documents/AstroLink* folder. Saved files may be later imported for example to an Excel sheet and processed
- *Data collection period* - here you can set the time span of the graph. If the new selected period is shorter than already collected data, then data will be truncated. This setting does not affect data collected in files.
- *Data collection sampling rate* - you may choose here how often data should be collected. Actual data is always sampled two times per second. This setting determines how many samples are averaged to create data points in the chart. Recommended values are 5 or 10 seconds unless you need to have it collected more often.
- *Clear all collected data* - clicking here causes all data in the chart to be cleared. It does not affect data collected in files.

Overcurrent and overvoltage protection

AstroLink panel contains settings to provide overcurrent and overvoltage protection. Both input voltage and total output current are monitored 200 times per second and measured values are compared to user settings. If any of these values exceeds settings for some specified time (also configured by the user) then all PWM and DC outputs will be switched off. Default protection settings are:

- voltage: 14.0V. It is also the maximum allowed input voltage for AstroLink device
- current: 10.0A. It is the maximum output current that the AstroLink device can handle safely
- protection sensitivity: 100ms

Overvoltage setting

The value here should be adjusted to the voltage that our power supply provides. If we use a regulated 12V power supply, then a reasonable value here could be 12.5 or 13V. For 13.6V regulated voltage, we can stay at the default value of 14V.

Overcurrent setting

This preset should be adjusted to the receivers that we power from AstroLink. If we have a mount that drains 2A when doing GoTo, a camera that drains 2.5A at maximum cooling power, and a dew cap heater that consumes 1.5A, then the maximum current will be 6A. Plus some current for focuser, and then 7A can be reasonable value for such configuration. Probably it is the best way to monitor the actual total current drawn in AstroLink panel software during one session, and then determine overcurrent value based on this. You can use charts for this and look for maximum power consumption.

Protection sensitivity setting

When either overcurrent or overvoltage occurs, the device is waiting for this amount of time and checks if this condition still occurs. If so, then an alert is triggered. However if during this time overcurrent or overvoltage will end, then no alert will be triggered. Usually, it is the best approach to set a short time, however, it is not always possible. When the receiver connected to AstroLink (like mount or camera) consumes much power at the moment it is switched on, then this protection sensitivity time may be increased. But it is recommended to keep this setting low, like 30 or 50ms.

Temperature compensation

Temperature compensation in *AstroLink 4 mini II* is implemented linearly. So there is only one parameter that describes how temperature affects the focus point. It is not a perfect approach, however, its accuracy is good enough for most amateur setups.

How to determine the temperature compensation coefficient?

The best way is to note the focuser position at different temperatures. When during session temperature changes, the focuser position needs to be adjusted to maintain a sharp focus. When you note these points of temperature and corresponding focuser position, then it is pretty straightforward to calculate the compensation coefficient, i.e. the number of focuser steps required to compensate for one-degree temperature change. And this value needs to be entered into the *Compensation* field in the focuser settings. When decreasing temperature requires the focuser position to decrease, then the value will be positive.

How to use compensation?

Once you enter the compensation value into the *Compensation* field of focuser settings, you need also to set the *Auto compensation threshold*. Here you need to specify a value that causes significant focus change and requires refocusing. You can determine it based on your experience, or use some CFZ (critical focus zone) calculators available on the web (http://www.wilmslowastro.com/software/formulae.htm#CFZ for example). Then you need to select a sensor that will be used to monitor temperature and select operation mode.

AUTOMATIC mode means, that when the compensation amount will exceed the *Auto compensation threshold* then compensation will be applied immediately. So it may happen (and usually happens) during the exposure and may affect image quality. When automatic mode is selected you can still monitor the compensation amount in the corresponding field and use the *Compensate* button to apply for compensation at a convenient moment.

MANUAL mode on the other hand allows you to manually apply compensation using the *Compensate* button. You can do it at a convenient moment, for example between subsequent exposures.

Another way is to apply calculated compensation using the script. An example script that can be used to apply compensation may look like this:

```
' AstroLink 4 compensation trigger script
' 2021 astrojolo.com
dim focuser
set focuser = CreateObject("ASCOM.astrojolo.Focuser")
focuser.Connected = true
focuser.CommandString("S:0:20")
focuser.Connected = false
```

The number 0 in the command string "S:0:20" is the focusing motor index (0 or 1), and the number 20 is the compensation threshold in steps. So actual compensation will be applied only if the

compensation amount will exceed the threshold value. You need to adjust this threshold value in the script according to your setup specifications, in a similar way to the *Auto compensation* threshold described before

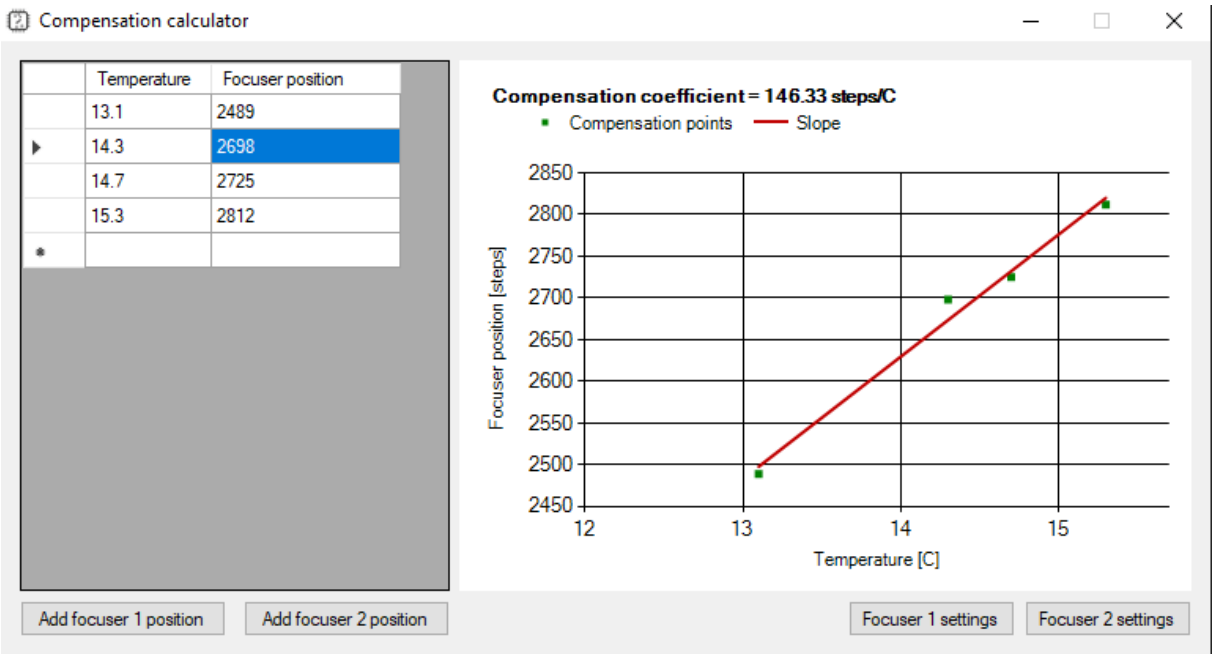
You can save the script to the file with a *VBS* extension (*astrolink-compensate.vbs* for example), so it can be executed. Of course, there is little point in running this script manually. But you can point to that script your acquisition software (like *MaxIm DL* or *Sequence Generator Pro*), so that script can be executed after every single exposure. And compensation will be applied not every time, but only when the given threshold will be exceeded. This way you can avoid changing focus point during exposure.

You can use the script only when AstroLink panel software is connected to the device in ASCOM mode.

Compensation calculator

A compensation calculator is a simple tool that can be used to calculate the compensation coefficient basing on temperature and focuser position points read from the AstroLink panel. The compensation calculator can be found in the bottom left menu.

There is a two-column table on the left part and a data points plot. Each table row is one point of data - the first cell contains temperature, and the second contains the corresponding focuser position in steps. You can either enter data manually or click *Add focuser position* button to add current values from the AstroLink panel to the last table row. When there are two or more data points available, there will be a plot visible on the right side of the window. Data points are represented as green dots, and the red line is the calculated compensation line. There is also a compensation coefficient calculated and displayed below the plot.



In the bottom right corner, there are focuser settings buttons that can be used to open the focuser settings window. There you can check the current compensation coefficient, enter a new value, and save data to the device.

Data points in the table are persisted in the file, so they will be available when you close and open the AstroLink panel again. So you can collect data to the calculator over several imaging sessions. You can edit data directly in the table. You can also remove a row or more rows by selecting them in the first column and clicking the *Delete* button.

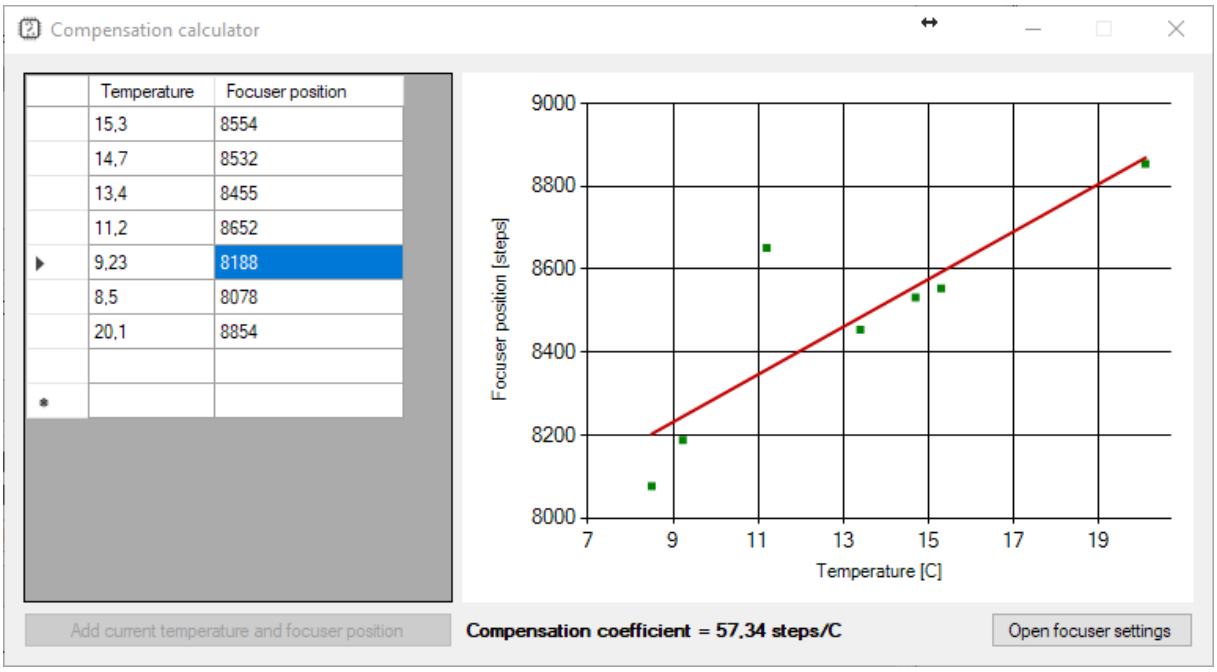
The calculated compensation coefficient may be used in several ways - you can read more on this topic in the *Temperature compensation* section.

Data points quality

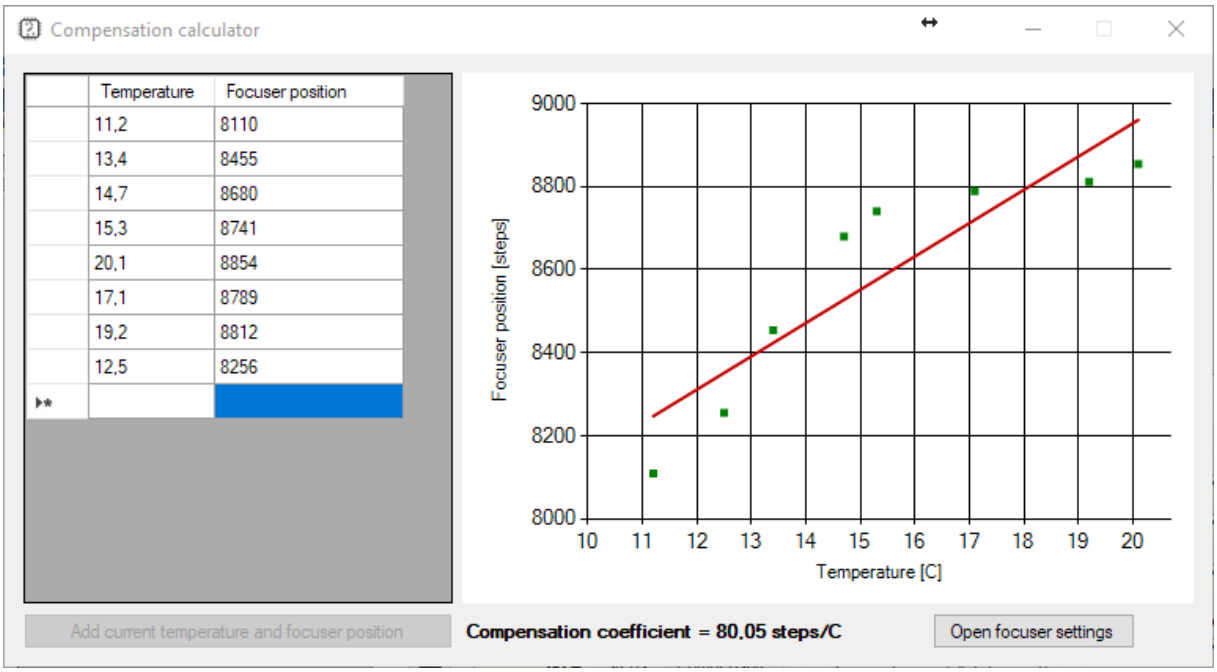
It is recommended to collect data points in a reasonably wide range of temperatures. If data points cover a temperature range of 1 or 2 degrees, then the compensation coefficient may not be accurate. It is much better to have a temperature range of 5 or 10 degrees covered.

If all points are relatively close to the calculated line (like in the example above) then the calculated coefficient should be of good quality.

If one or two points are incorrect, and all others fit straight line nicely, then these bad points may be a result of a mistake and can be removed from the data point set. You need to select them in the data table and remove them using the *Delete* key.

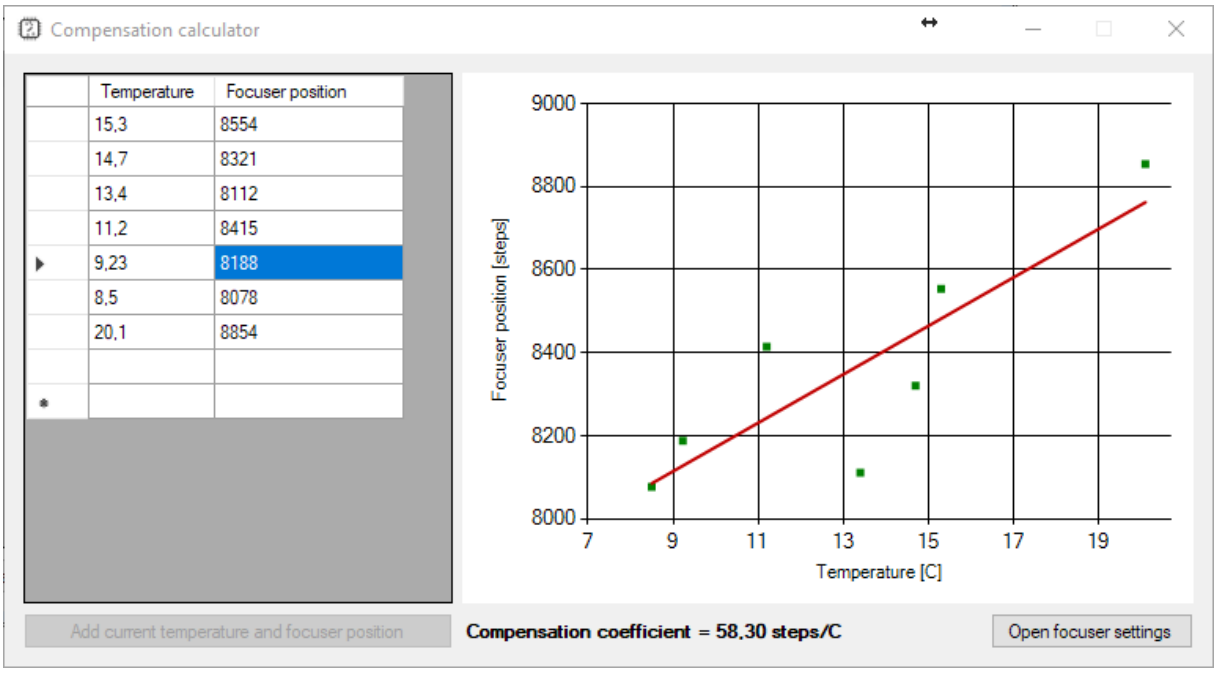


If the collected data points make the shape of a curve that crosses the calculated compensation line, it indicates that your setup focus point does not change linearly in the temperature range you choose. But you may still use compensation with a different value for different temperature ranges. In the example below the points in the range 11 to 15 degrees and 15 to 20 degrees fit straight line quite precisely:



If all points do not fit the calculated line in any reasonable way, then they are all bad quality. The coefficient calculated with these points probably should not work well. You can try to collect another

set of data points during another imaging session. If the new points will still indicate such behavior, then probably the setup you use cannot be set for compensation:



You need to enter data points collected with one filter only! There can be a focus shift between different filters, and the calculated coefficient may not be accurate.

Ground loops

The ground loop in the electrical system occurs when two points that should have the same potential have different voltages. The ground loop in the astroimaging setup may occur when the ground (i.e. minus of power supply voltage) is connected to one receiver with more than one cable path. Here are two example scenarios:

Scenario one

- the newtonian telescope has a mirror cooling fan, and this mirror fan socket is fixed in the metal mirror cell. Its minus is connected to a metal telescope tube
- the imaging camera case is also connected to the power supply minus.

Now, when you power both fan and camera from the same power supply, then the power supply ground will be connected to the camera with power supply cable, but also via the fan power socket, then metal telescope tube, focuser, and camera case.

Scenario two

- an active USB hub is powered from the regulated voltage output from AstroLink
- imaging camera is powered from DC AstroLink output
- the camera is connected to a USB hub with a cable

In this scenario, a negative voltage is supplied to the camera also in two ways. The first one is the main power cable between the camera and AstroLink. The second loop is from 5V output in AstroLink to the USB hub and then with the USB cable to the camera.

The ground loop may cause some problems with connections, that are hard to investigate. The best way is to avoid them. Possible solutions for the second scenario are:

- connect the imaging camera to the computer without an additional USB hub
- power camera from a separate supply
- power USB hub from a separate supply
- do not power the USB hub at all - maybe it is not required
- use a USB cable with galvanic isolation

Scripting support

You can also control the *AstroLink 4 mini II* device using scripts to automate the acquisition process. All ASCOM interfaces are available and can be controlled from the script. You can find a simple script example in the *Temperature compensation* section. Please remember that you can run scripts only, when AstroLink panel software is connected in ASCOM mode (or is not connected at all).

A simple script that moves focuser to position 3455 may look like this:

```
' AstroLink 4 focuser move script
' 2021 astrojolo.com
dim focuser
set focuser = CreateObject("ASCOM.astrojolo.Focuser")
focuser.Connected = true
focuser.move(3455)
focuser.Connected = false
```

and example script that turns switches on DC out 1 and 2 and sets PWM outputs values to 30 and 18%:

```
' AstroLink 4 switch example
' 2020 astrojolo.com
' 0,1,2 - are DC outputs. 3,4 are PWM outputs
dim switch, result
set switch = CreateObject("ASCOM.astrojolo.Switch")
switch.Connected = true
result = switch.SetSwitch(0, true)
result = switch.SetSwitch(1, true)
result = switch.SetSwitchValue(3, 30)
result = switch.SetSwitchValue(4, 18)
switch.Connected = false
```

The script needs to be put into the file with *VBS* extension (for *example astrolink-script.vbs*) and then it can be started just by double click.

Troubleshooting

AstroLink log files

All AstroLink log files are created in the *My Documents/AstroLink* folder. Files that name contains only the current date are data collections from AstroLink charts and can be imported to any other software (like MS Excel) for further processing. Files that name start with *AL4miniII-log-* contain errors and warnings generated by the software. You can check its content if something is not working properly. If you connected to the AstroLink device using ASCOM mode (recommended) then you can also check the *trace* option in the ASCOM driver selector, and then in the folder *My Documents/ASCOM* you will find ASCOM log files with all the communication and messages there.

AstroLink device does not beep after connecting to the power supply

- check if the power supply voltage is within the range of 11-14V DC
- check if the polarity is correct

AstroLink device is not recognized by the system after connecting to the computer - no COM port visible

- check if power is supplied (red LED is on)
- check another USB cable and another USB port in the computer
- install FTDI drivers manually from the FTDI page

Connection was lost

- usually, you can just reconnect to the device
- if the device is not responding you may check the "*reset AstroLink device on connect*" check-box in the driver options
- if there is no AstroLink COM port in the system you need to plug out and plug in the USB cable or scan Windows Device Manager for new devices
- if the problems occur more often you may try to replace the USB cable you use, USB hub, or try another USB port in the computer

The stepper motor vibrates but does not rotate

- check if a proper focusing motor type is selected
- check if the wiring is correct
- lower *Speed* parameter for stepper motor

The stepper motor becomes hot

Holding current option is enabled. Check if the stepper motor you use is designed to work under constant load. Verify if you need holding torque at all. If you use some gearbox, then it may not be necessary.

The sensor is not recognized - no value is read

Disconnect the device, turn off the power, plug out and plug in sensor and reconnect power and AstroLink panel

Some fields in AstroLink panel software are red and there are window system sound and device beeps

One or more alert levels have been exceeded. See *Power outputs* control section or *Sensors* and *PWM* outputs control section for details

The stepper motor does not rotate after clicking the plus or minus button and one beep is heard

The next move position exceeds limits (is either below zero or over *Maximum* position setting). See the *Focuser control* section for details.

AstroLink device disconnects and restarts when any power or PWM out is turned on

The reason is too much voltage drop at the moment of switching power to any connected peripherals. It can be also caused by EM interferences.

- make power cables shorter or use power cables with larger cross-section area
- use USB cables with at least one shield

The voltage or current values are not correct

You need to adjust the *ADC coefficient* and calibrate the current sensor. See *Power outputs* control topic.

Outputs are switched off and a popup window with a message opens

You need to adjust protection parameters according to your setup. See the *Overcurrent and overvoltage protection* topic.

AstroLink panel does not start

When you play with AstroLink settings and connect the AstroLink device to different computers it may happen and you need to delete the local computer AstroLink settings folder. You need to

1. uninstall AstroLink panel software
2. find *c:\Users\(your username)\AppData\Local\Microsoft* folder
3. remove *AstroLink4.exe_different_characters_here* folder
4. install AstroLink panel back

Access denied to COM port when using ASCOM driver

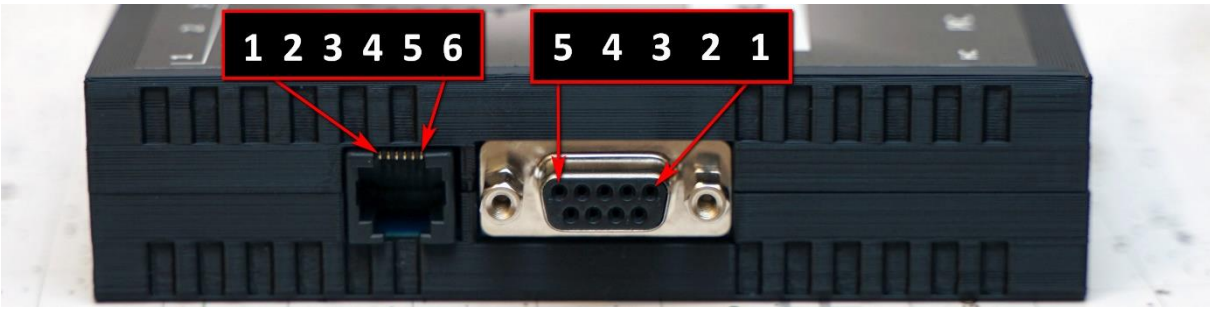
It may happen when the ASCOM driver installation is corrupted. When you reinstall the ASCOM driver you should restart the computer, then uninstall the driver and then install the new version. But once you have a message like this, you can:

1. install ASCOM driver (even if it is already installed)
2. restart the computer
3. uninstall the driver
4. restart the computer
5. open ASCOM Profile Explorer and look for "*astrolink*" or "*astrojolo*" related items in the Focuser, Observing conditions, and Switch branches. Remove them if found (right-click – delete)
6. install ASCOM driver back

Connections

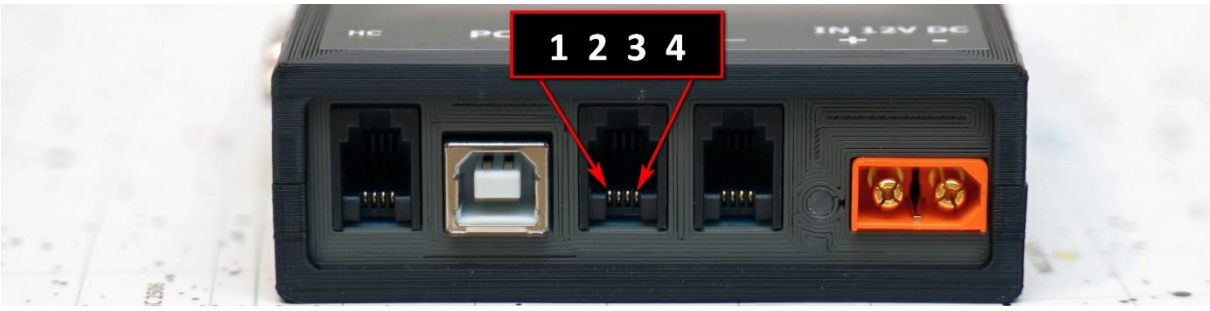
Power input

Stepper motor output



FOCUSER 2 - RJ12 SOCKET	FOCUSER 1 – DB9 SOCKET
1, 2 – +12V 3, 4 – COIL A 5, 6 – COIL B	1, 2 – coil A 3, 4 – coil B 5 – +12V

Sensors inputs



1 – 5V DC, 2 – SCL, 3 – SDA, 4 - GND

PWM outputs

PWM outputs are regular RCA sockets, tip positive.

12V DC outputs

These outputs are regular 5.5/2.1mm sockets, tip positive.

5V DC output

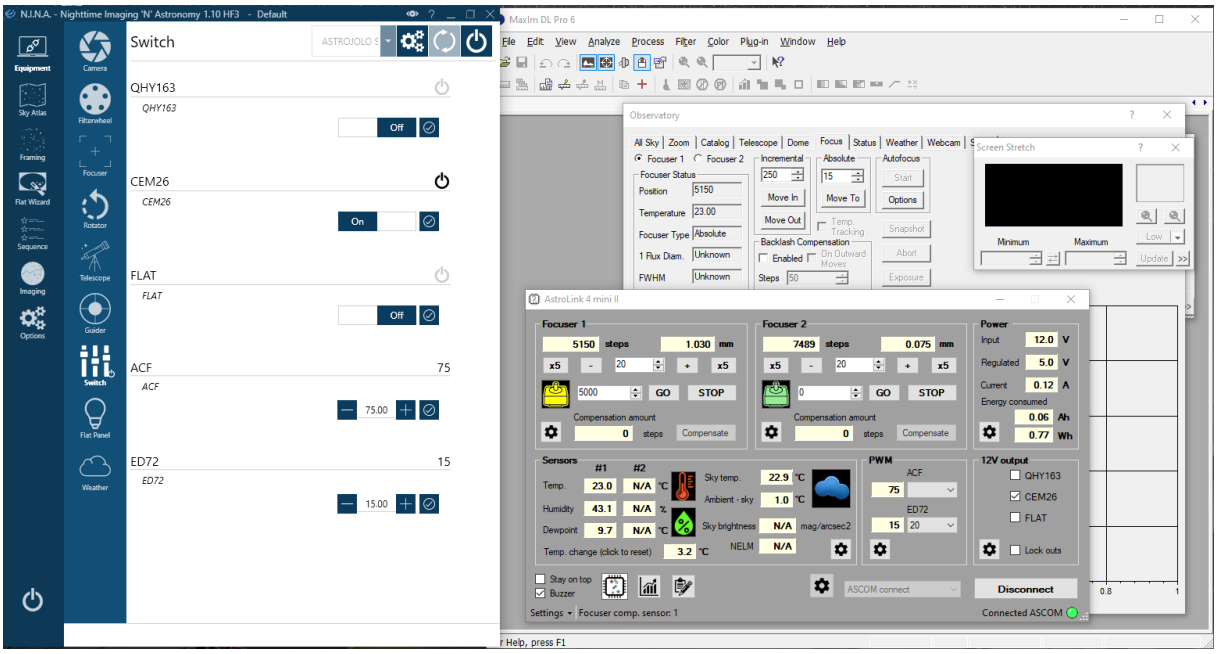
This output is a regular 5.5/2.1mm socket, tip positive.

Third-party software

When the AstroLink device is connected in **ASCOM connect** mode, all ASCOM compatible software can control the AstroLink focuser. To make it work in 3rd party software you need to select in ASCOM chooser *ASTROJOLO Focuser* interface and connect to it. Many programs (including of course AstroLink panel) can control focuser stepper at the same time. The most common scenario is to have simultaneously connected to AstroLink device:

- *AstroLink panel* in *ASCOM mode*, so you can control all AstroLink functions
- other focusing software (*MaxIm DL, FocusMax, SGPro, N.I.N.A., CCDCiel*) connected to *ASTROJOLO Focuser* interface, so you can focus automatically
- other software that supports ASCOM Switch can be connected to the *ASTROJOLO Switch* interface (*MaxIm DL, N.I.N.A.)*
- other software that supports ASCOM Observing Conditions can be connected to *ASTROJOLO Observing Conditions* interface (*SGPro, N.I.N.A.)*

In the image below – *AstroLink 4 mini II* is connected to the panel software, focuser, and switch are connected to Maxim and N.I.N.A software at the same time.



Software and firmware update

The new software version can be found at https://shop.astrojolo.com/astrolink/ page. There are two software components: *AstroLink ASCOM Local Server* driver and *AstroLink Panel*. To update the software you need to:

- download installer from the page
- disconnect AstroLink device from the computer
- uninstall previous software version (in MS Windows Control Panel)
- install the new updated version
- after connecting check if all your settings have been preserved

It may happen, that the new software update will require new firmware to be uploaded as well - in this case, you will see a warning message after connection. Please read the release notes for details.

When you notice that the AstroLink Local Server driver was not updated properly after installation, you need to perform the following steps: uninstall it again, remove manually folder *C:\Program Files (x86)\Common Files\ASCOM\Focuser\AstroLink* (or *C:\Program Files\Common Files\ASCOM\Focuser\AstroLink* in 32 bit systems) and all its content, and install local server driver one more time.

Up-to-date firmware can be found at https://shop.astrojolo.com/astrolink/ page. You need to download the zip archive with the latest firmware, unpack it and follow the instructions in the *README* file to update the firmware. Make sure the PROG jumper is set to ON position during the firmware update. After the update set *PROG* jumper to *OFF*.

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