



LACERTA MOTORFOCUS

User Manual

v3.1.xx



Thank you very much for choosing our product!

The **LACERTA MFOC** is an **ASCOM** and **INDI** compatible focusmotor controller with position feedback, temperature and backlash compensation and exposure monitoring possibility. It can also be used as a standalone focus controller with advanced features. Precision is 1 μ m and lifting power 8kg.

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Key features:

- remote (ASCOM or INDI), or standalone modes
- handbox with digital display showing all relevant infos, control buttons and USB port
- completely encapsulated gear and powerful stepper motor driving and holding >5kg
- temperature probe (approx. 180cm)
- automated temperature compensation
- max. positions definable (min = 0)
- backlash compensation (two selectable direction)
- Goto function
- 250000 steps, reproducibility 0,001mm (if focuser allows for)
- DSLR shutter signal recognition
- ASCOM driver compatible to most software (FocusMax, MaximDL, APT, ...)
- free download of new firmware
- manual focussing possible (new in V3: safety part, cable may be kept plugged in)

The content of the package:

- LACERTA MFOC** hand controller
- capsuled Motor unit
- inlay spacer rings to mount the coupling on 4, 6, 8 and 9.5mm worms
- Temperature probe 1,8m
- USB cable, 1,9m (for PC connection)
- RJ45 cable 2m (for motor unit connection)
- DC power cable 3m with cigarette lighter plug.

Please visit Lacerta Motorfocus' website to check for drivers and additional information, firmware updates (free), or links to user discussions. Download the latest firmware files from the Support Tab (and check the readme file there):
<https://lacerta-optics.com/MFOC#nav-support>

Connection details:

Connections on the hand controller



12V DC socket(5,5/2,1mm center positive) _ Off-On switch _ USB-B mini _ RJ45

Connections on the motor unit



left side: 2,5mm stereo socket (from MGEN's camera port)
3,5mm stereo socket (to DSLR)
right side: RJ45 (from handbox)
3,5mm stereo socket (temperature probe)

Connection to the focuser:

The Lacerta **MFOC** is compatible to a growing number of focusers. For some focusers you will need an extra adapter ring (please refer to the MFOC website or ask), but it will fit all Lacerta and Skywatcher focusers (except the older simple R&P found on Achromates).

Using one of the 3 provided Inlays and the proper hex screws the MFOC coupler fits worms of different diameters:

- smallest Inlay - for 4mm worm
- medium Inlay - for 6mm worm
- large Inlay - for 8mm worm (Takahashi)
- without Inlay - for 9.5mm worm (Feathertouch)



Slip the spacer Inlay over the worm and align the holes with the threads in the coupler, so the screws are able to contact the worm directly. Using the proper length hex screws (2 pcs, 180° positions) fix the coupler to the worm, but at first not tightly. Move the focuser worm manually to let the coupler align with the worm, when done only then fix the coupler to the worm tightly, and the motor to the worm housing.

Technical data:

Size:	79x117x24mm (120gr)
Main power:	12V DC (9-15V) Plug size: 5.5/2.1mm, center positive polarity (with polarity protection).
Fuse:	built-in regenerating fuse
Stepper motor:	200 step/revolution, 2 phase bipolar, 800mA / coil max. current.
Motor connection:	RJ45-8p8c, pinout: 1 = Temperature signal

	2 = Motor coil A-Plus 3 = Exposure signal 4 = Motor coil A-Minus 5 = +5V 6 = Motor coil B-Plus 7 = GND 8 = Motor coil B-Minus Only use with 1:1 UTP cable. NEVER use reverse UTP (cross-link) cable!
PC connection:	USB-B mini
Display:	3 row 16 characters LCD, black background, amber-yellow characters.
Temperature Probe	180cm long with hole to be screwed somewhere, 3,5mm stereo jack

version 3.1.01, 2.1.01:

- new improved Ascom driver V 3.0.0 is adapted
- Access the Boot menu by pressing and holding the Esc key while powering on
- Termination of certain functions
- bugfixes

version 3.0.1:

- new safety hardware part is built in to prevent generated current by manual focusing from destroying the handbox
- new improved Ascom driver V 1.7.4 is adapted
- improved bootsequence
- bugfixes

version 2.0.4:

- adaption to the new Ascom driver V 1.6.0

version 2.0.3:

- bugfixes: occasional boot error fixed (dark display), other bugfixes

version 2.0.2:

- the last used position will be displayed automatically after startup
- Permanent Focus/Shutdown: To use this function the shutdown procedure is necessary, to move the motor intermediately to a fullstep position. After shutdown and startup Temp Comp. automatically calculates the new focus position for the new temperature and moves the focuser accordingly.
- step range is now 250000 steps
- step/click value now to be set between 2 and 5000 steps
- TempComp factor can be set to +/- 5000 steps / 10°C
- menu entries renewed/rearranged

Installation

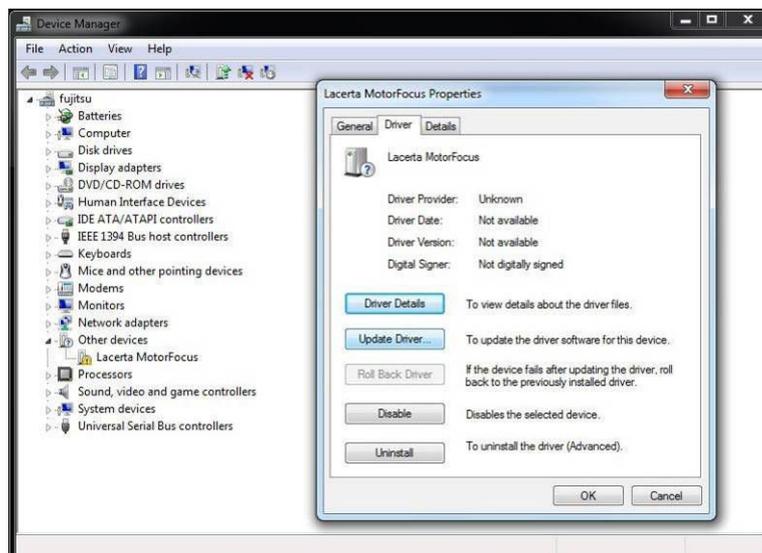
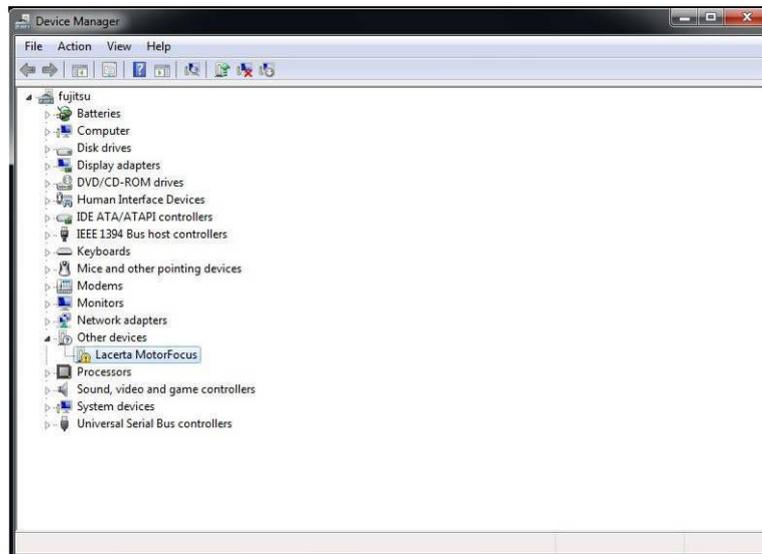
For comprehensive use of device, it's necessary to install the USB driver and PC applications first. You can see below the installation steps on a Windows 7/64 bit system

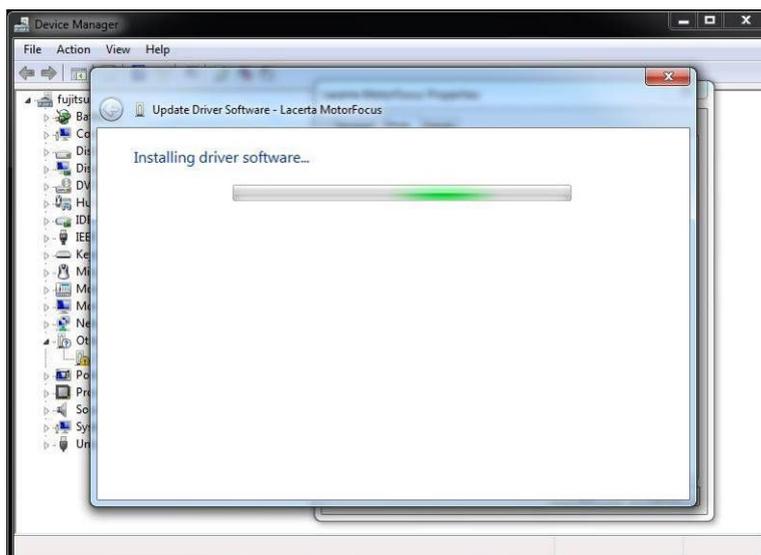
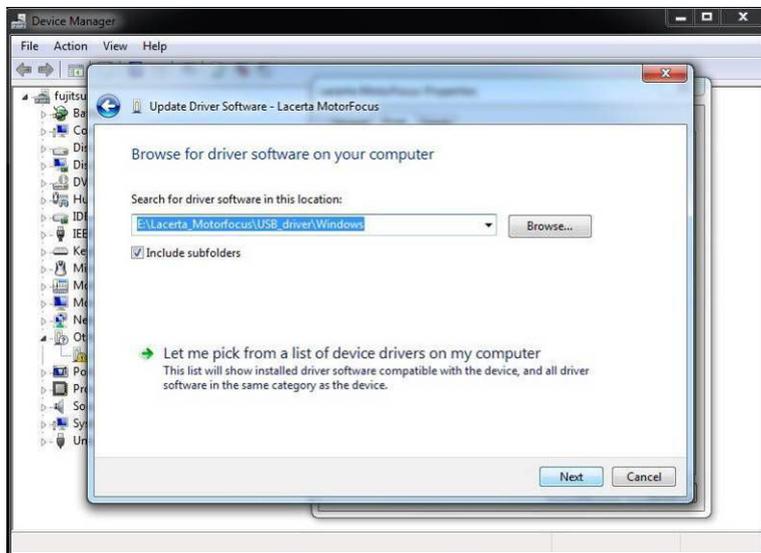
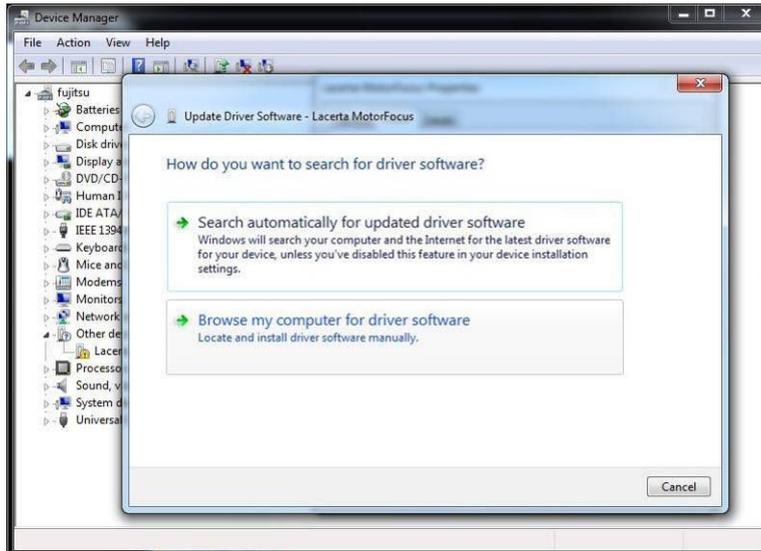
Installing the FTDI USB driver:

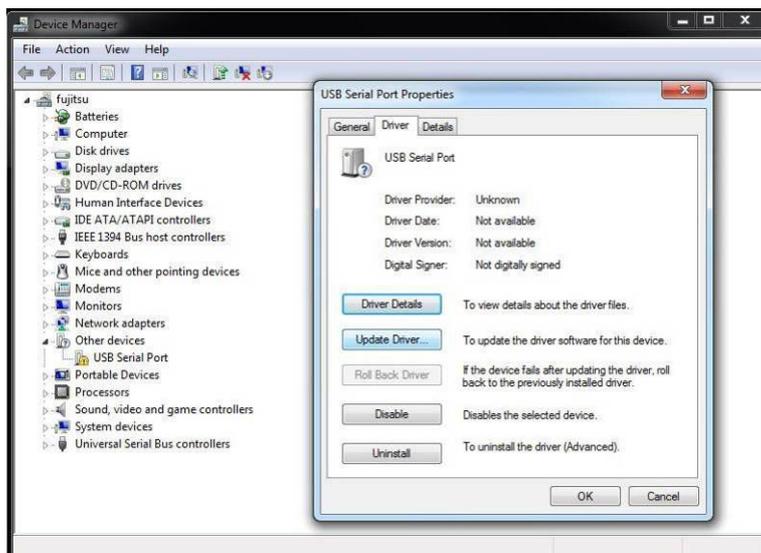
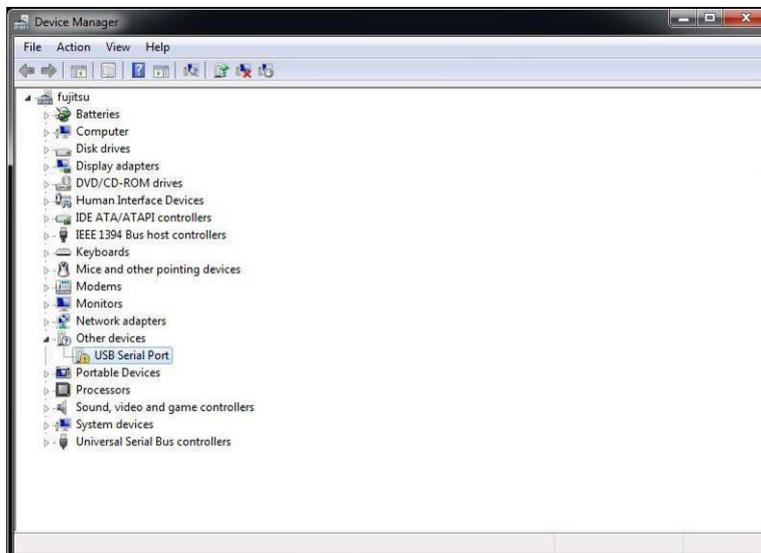
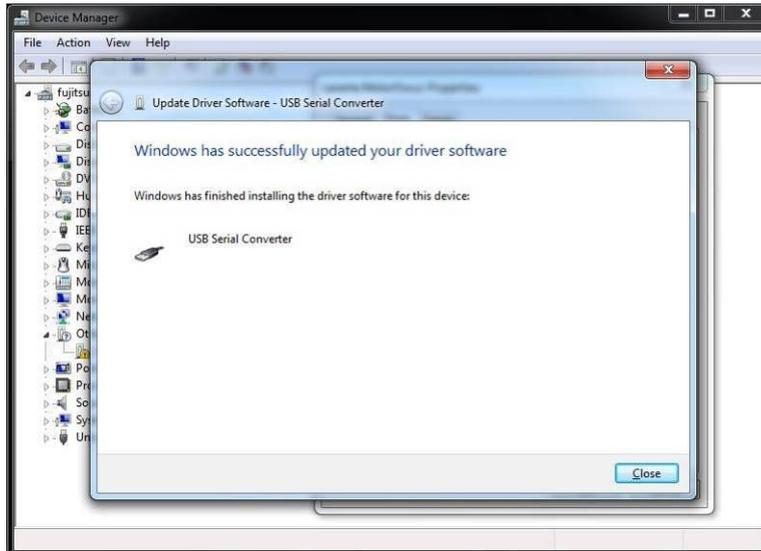
Connect **LACERTA MFOC** to PC and your power supply using accessory cables. Turn on the device. The Operating System recognizes the device and it's looking for a suitable driver. If it does not find the driver automatically, the screenshots below help you to successful install the driver after opening the Device Manager. The FTDI USB driver is found either in the firmware zip file at the USB_driver folder, or you can download the newest version from the FTDI website:

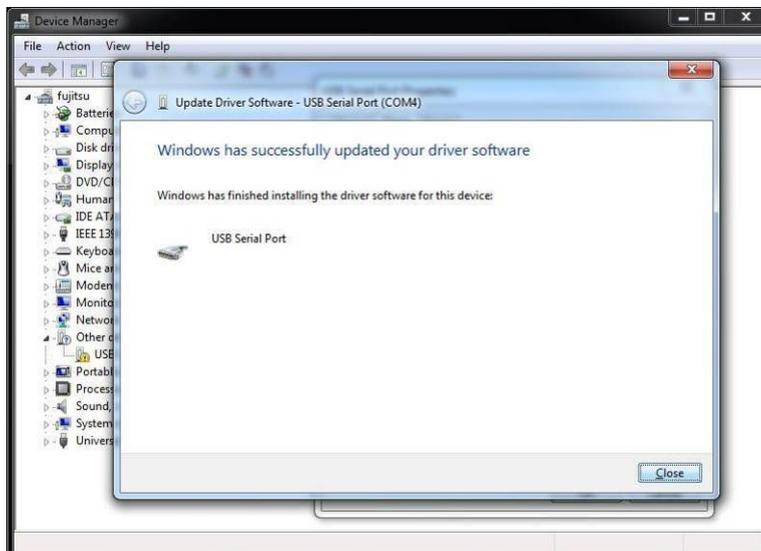
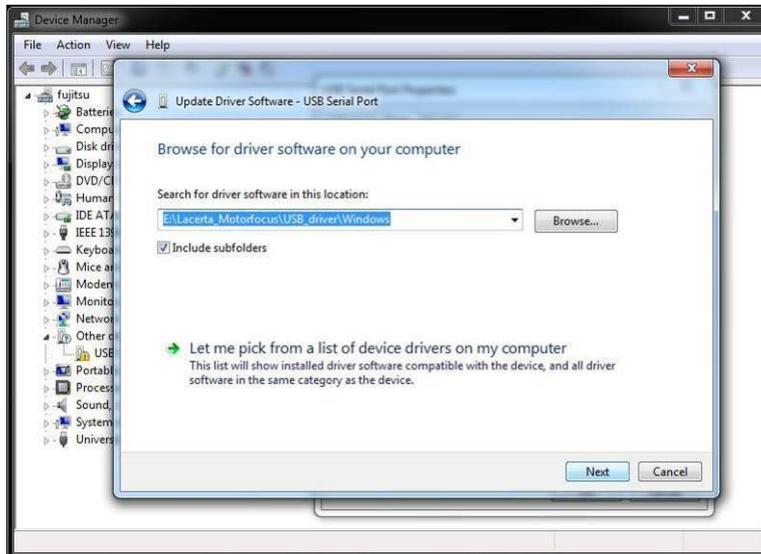
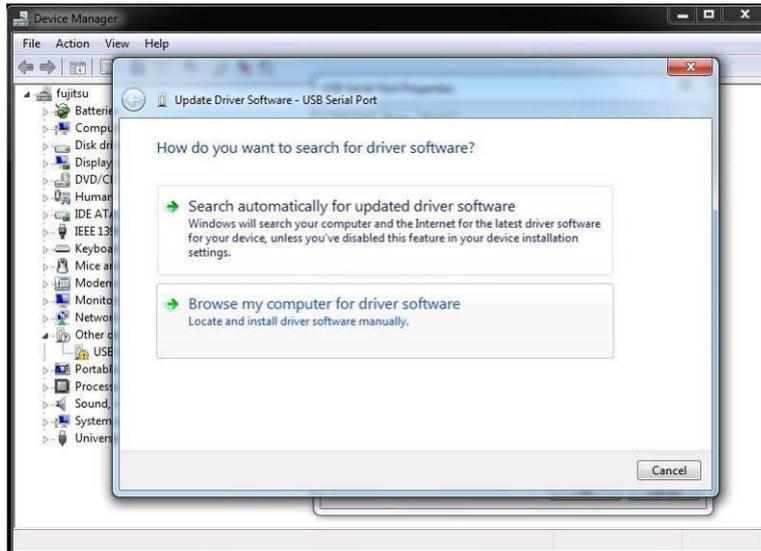
<http://www.ftdichip.com/Drivers/D2XX.htm>

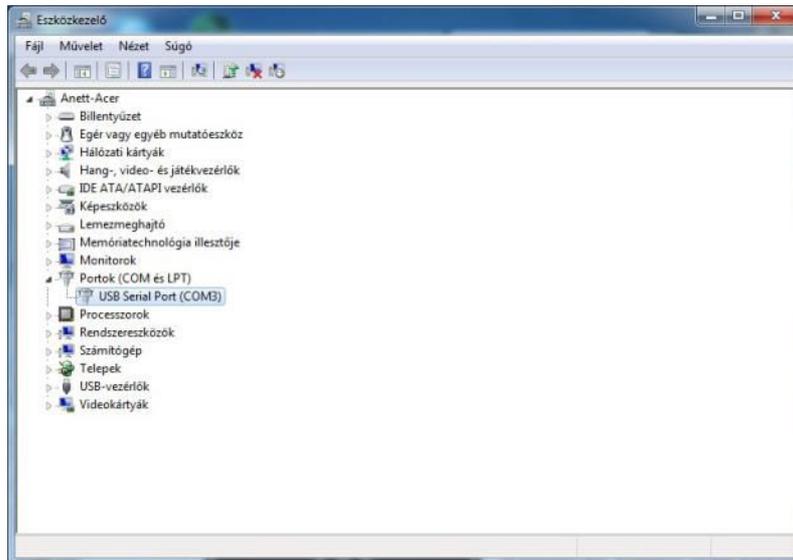
(a setup executable is provided in the column at right, and you find more installation advices there, if needed)







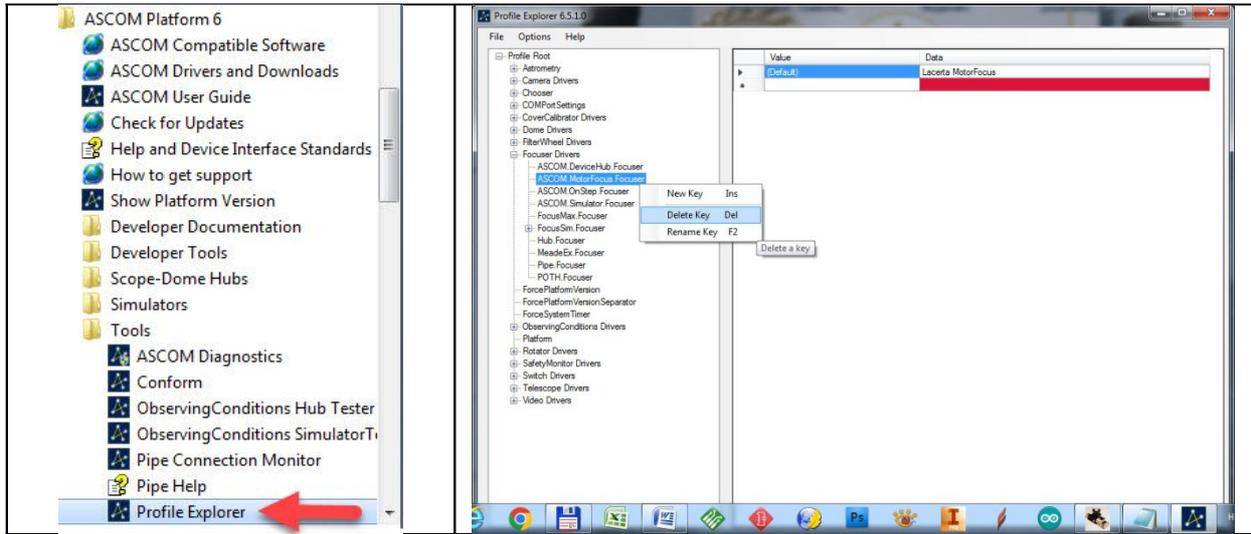




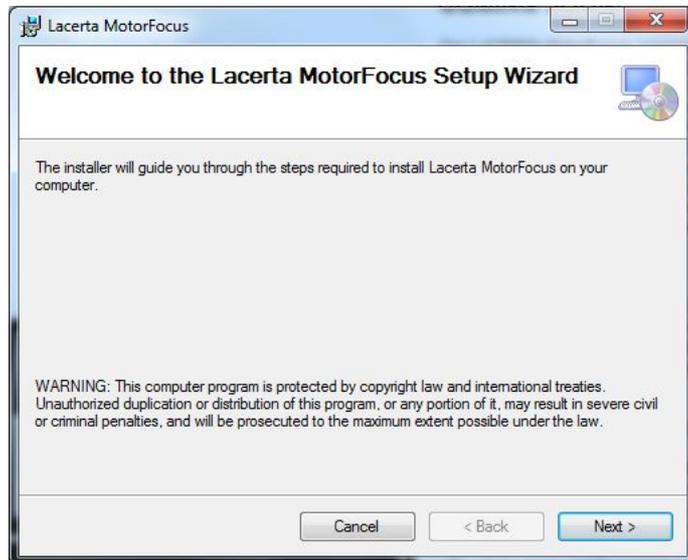
Installing the ASCOM driver:

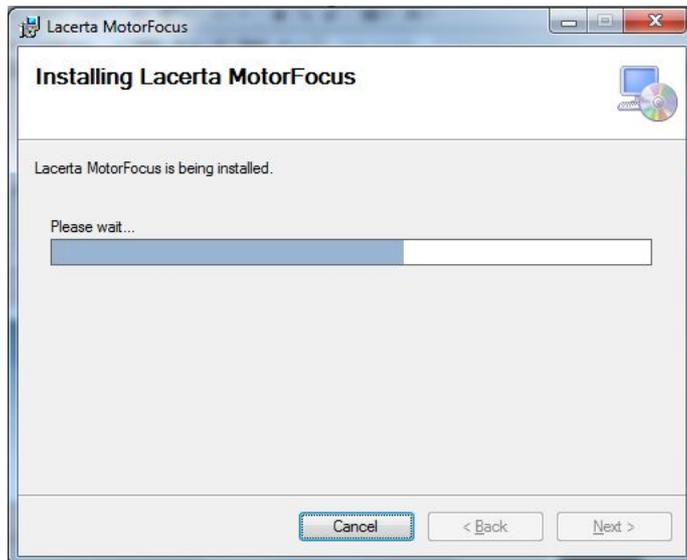
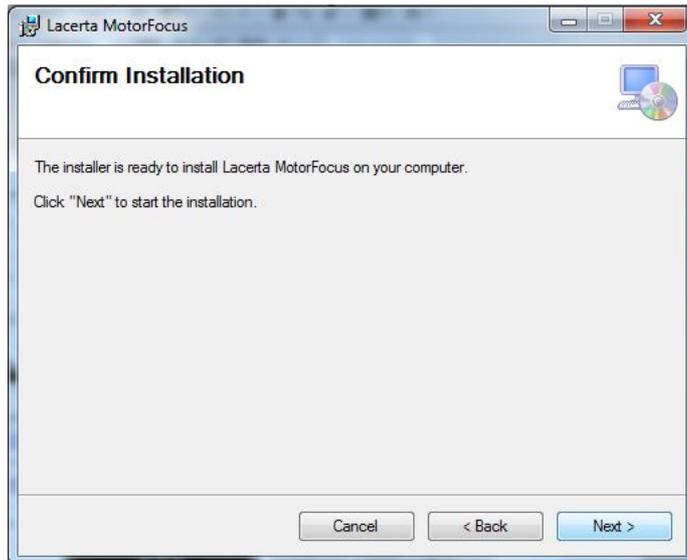
The required **setup.exe** is found in the firmware file at **x86** (32bit OS) or **x64** (64bit OS) subfolder of **ASCOM_driver** folder. **ASCOM 6.4** platform at least is needed! If it's not installed, you can download it from <http://ascom-standards.org/index.htm>

If an older Ascom driver was already installed, it must be deleted first. After the deletion is complete, run the Ascom Profile Explorer. If Motorfocus is visible in the list that appears, right-click on it and delete it using the delete key:



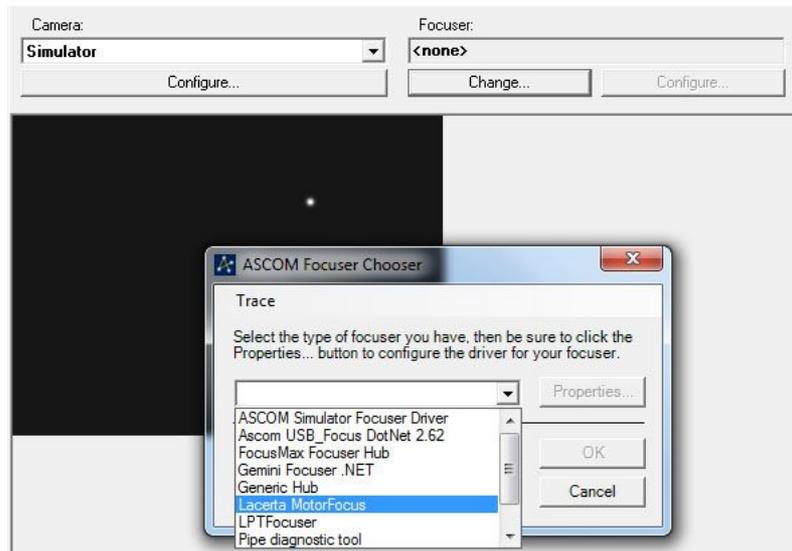
Only then start the installation:



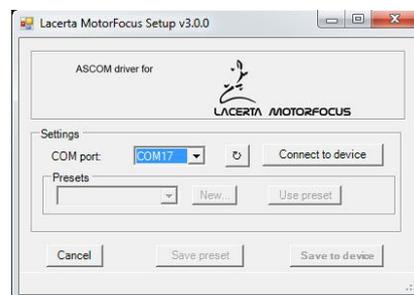


Settings of the ASCOM driver:

Choose **LACERTA MFOC** on the ASCOM Focuser Chooser drop-down panel in your compatible software (MaximDL, APT...).



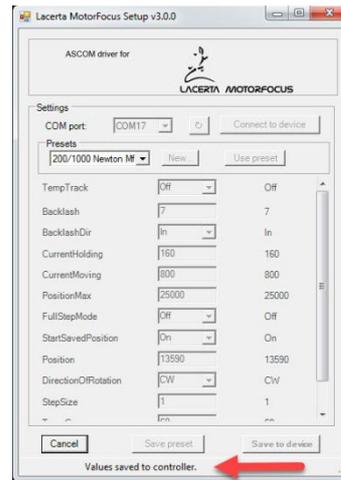
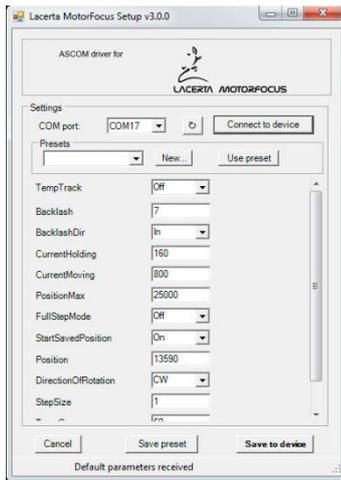
If the port was chosen previously, the device can be connected by pressing the OK button. A acoustic signal and flashing of device display indicate that the connection is created. „A” character shows in the **MFOC** display that the **ASCOM** connection is available. For device parameters press the properties button.



The serial port of **LACERTA MFOC** can be selected in the COM port drop-down menu. When the connection is created, parameters are loaded from Eeprom. After parameter modification click the „Save to device” button to write changes into the Controller. Depending on the controller's own characteristics, you can override the submitted value.

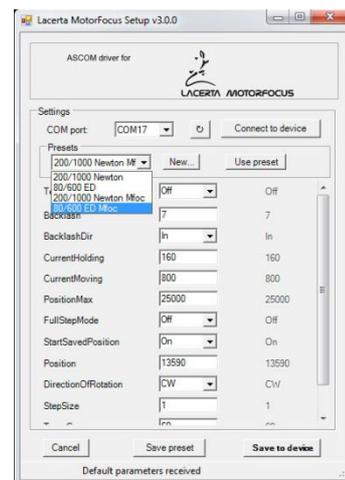
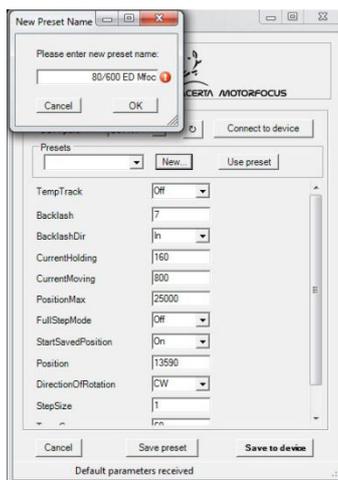
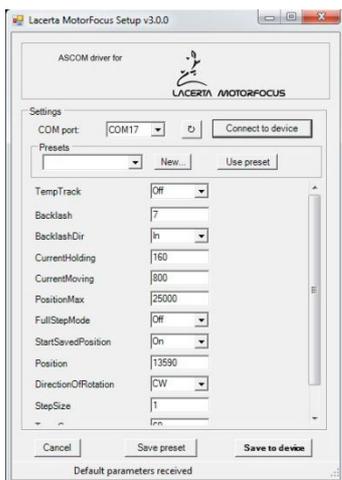
For example:

160, 400, 600 and 800mA current can be set in the controller. If we enter 1000, the set value will be 800mA. If we send 456, the set value will be 400mA.



After successful uploading, you will receive feedback at the bottom of the window. Then we can access the ASCOM Setup window.

Presets: It is possible to recall stored presets. Select the desired telescope from the drop-down list. Then the right-hand column shows the configuration data of this telescope. Click on the "Use preset" button to load the data to the left-hand column, where you can modify them if necessary. Use the "Save Preset" button to save the contents of the list, then select "Save to device" to load the data into the **MFOC**.



Click on the "New" button to create a new list.

Write the name of the new telescope, and then click "OK" to save it. Then press the "Save Preset" button, and it will be filed to the list of configuration data.

Installation of Firmware Updates / factory reset:

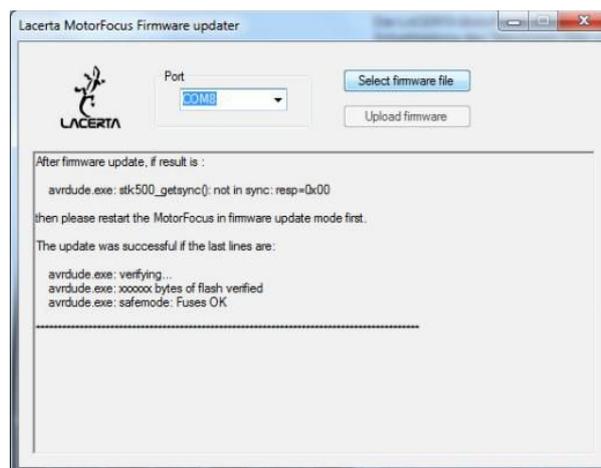
Copy the whole **Firmware Updater** folder to any folder on your PC. **Select firmware file** button opens this same folder, that's why it's recommended to copy the .hex files of the software update file into this same folder (default).

At first, connect device to your PC, after that enter the **Boot menu** by pushing and holding down the **Esc** button at the same time, and then turn on the device. Release the buttons after you can hear the acoustic signal and you can read **release buttons** on the display. After some seconds you can hear the signal again and the display reads:

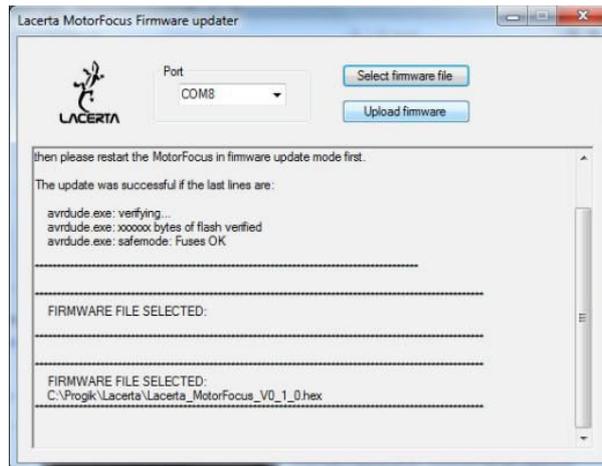
Boot menu
Factory Reset<--
Firmware Upd.

With the **In / Out** buttons you can choose from the two options and start by pressing **SET**.

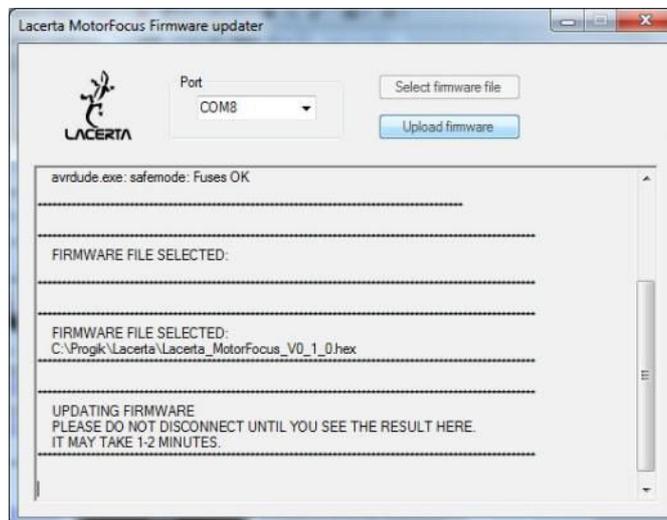
When **Factory Reset** is selected, Eeprom's stored data will be deleted while "*Cleaning Eeprom!*" is displayed. This is approx takes half a minute. Then the message "*Eeprom deleted Please restart or Please Start Firmware Updater*" is read. After restarting, the empty Eeprom is loaded with the factory settings data. When **Firmware Upd.** is selected, start the **Updater** program **MotorfocusV2.exe** in the install folder. It may occur that your antivirus software prevents the operation of **Updater** program. In this case you need to turn off antivirus.



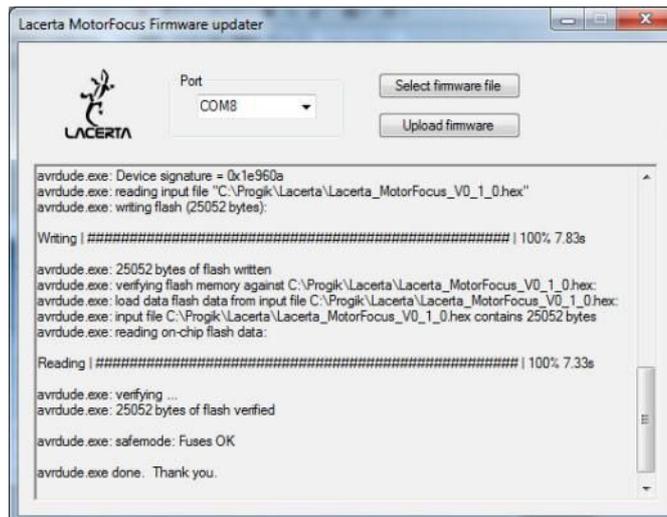
Select the port which is in use by the device (consult Device Manager if you don't know). Select the new firmware file with **Select firmware button**.



The name of the selected HEX file is shown at the bottom side of window.



To start uploading, press the **Upload firmware** button. An uploading message at the bottom of the window shows the process status. When the uploading is in progress, the display of the Hand Controller is dark and the LED light of the serial communication is flashing. Red flashing is the sign of back reading.



When the process is complete, the device is restarting and the display shows the new version number.

Usage of LACERTA MFOC

basic functions and concepts

The hand controller is equipped with a digital display that shows a wealth of status informations, like position of your focuser, temperature, direction of movements, backlash compensation, filter slot and so on. You may enter the menu by pressing **Esc** and **Ent** together at the same time, and change all important parameters. There are nine filter offset positions definable, relative to the main filter position, which step number also can be stored. The Temperature probe can be mounted near the most sensitive part of your telescope (preferably isolated against outside air), to pick up Temp. information from there and automatically compensate for focus drifts. A backlash compensation can be designed to be active from a certain step distance, and your focus position will be reached from one movement direction only. If you use Lacerta MGEN superguider, you may connect its camera control and focus corrections will take place only between exposures. The resulting precision (if your focuser allows for) is usually in 1 micron range (0,001mm). That provides ample possibility to measure V-curves using compatible programs, or watch the Bahtinov pattern at the live screen of your camera, and achieve best possible focus all the time.

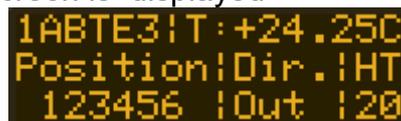
Informations on the screen:

The device name and firmware version number appears after turning on



```
LACERTA
Motor focus
Version: v2.0.2
```

1,5s later the normal main screen is displayed



```
1ABTE3!T:+24.25C
Position!Dir.!HT
123456 !Out !20
```

It shows some important Informations:

- '1' - 1 step mode active or '*' if the multistep mode is active.
- 'A' - **ASC**OM connection is active or '_' if inactive.
- 'B' - Backlash compensation is active or '_' if inactive.
- 'T' - Temperature compensation is active or '_' if inactive.
- 'E' - Exposure is in progress or '_' if not.
- '3' - **Offset** number for the currently selected filter.
- 'T:' - Current temperature. (Without temperature sensor: 'NC!')
- 'Position:' - The current position is shown beneath this text.
- 'Dir.' - The Direction of last movement is shown beneath this text (In / Out)
- 'HT' - The display heating power in percent is under this text, or '##' if there is an error. A typical error is, that the ambient temperature probe is not connected.

The Menu structure – Overview

There are two menus available: In the **GotoSelect Menu** contains the main positions, so you can reach your important positions easily. In the **Main Menu** you can set data regarding focuser, hand controller, motor and temperature compensation.

GOTO quick menu (press GOTO button 1sec)	
Move Home!	
GotoPosition	After pressing ENT the motor moves to a 0 position ENT "Set" is displayed change value with In/Out. Press "Ent" button to confirm, and once more and the motor moves to the desired position. If StartSavedPosition is Disabled, it offers the last saved position.

Main Menu (press Esc and Ent 1sec)			
Focuser	HandControl	Motor	TempTrack
Backlash	Step/Click	hold Ampere	TempComp
Backl.Dir.	Backlight	move Ampere	TempTrackDir
PositionMax.	Contrast	Direction	
	Volume		
	StartSavedPos		
	LcdHeating		

there are 2 functions that can be switched quickly:

Shortcuts	
Esc (Press 1sec)	Change between multi and single step mode (display * or 1)
Ent (Press 1sec)	Switch TempTrack function (display T or _)

Direction buttons (In / Out)

They serve to move your focuser in/out, and in the menu to move through the menu and edit values. The position counter starts from the last position normally. One time

pressing the in/out buttons means the motor takes 1 step, or the number specified under steps/click (multistep mode).

To switch back and forth between 1 step or multistep mode, just press the **Esc** button for 1 second. Then, on the display the first character at the upper row will change to '*' with an acoustic signal, and pressing in/out now takes the **Step/Click** value which can be set in the menu (the default value is 50). If you would like to return to 1 push / 1 step mode, just push again the **Esc** button for 1 second. The '*' character will become '1'.)

If you push down the direction button permanently, the motor will accelerate continuously until it reaches terminal velocity. After releasing the button the motor slows down continuously until it stops.

The position cannot take values below 0, and also not more than the **PositionMax** value, which is setable in the Menu (default value is 15000). If the motor reaches the min position limit, an error message will be shown on the display with sounding a signal.

Use the In and Out buttons also for scrolling up and down the menus, and for changing values. In some menus the value input is dynamic: With continuously pressing the button, and the value steps are more than 10, the counting will be in tens. If the value steps are more than 100, the counting will be in hundreds. If the value steps are more than 1000, the counting will be in thousands. If the counting reaches the limit, the opposite limit will be the next value. (Example: In case of **GotoPosition** menu the next value after 250000 is the 0 and inversely.)

Function buttons (Ent, Esc, Goto) and menus

Ent button

- general use for entering to menus and confirming.
- Switch on/off Temperature compensation (**TempTrack**) by pressing down for 1 sec. If **TempTrack** is active, „T” character will be shown in the upper row on the display.
- enter the Main menu by pressing **Ent** together with **Esc** button.

Esc button

- general used to exit from menus, or cancelling changes.
- switch between 1 step/button pressing and **StepsPerClick** stepping mode by pressing down **Esc** for 1 sec. „1” or „*” is shown at the upper row on the display.
- enter the Main menu by pressing **Esc** together with **Ent** button.

Goto button

To reach the **Goto** quick menu, press this button for 1 sec.

Goto Select Menu

This menu contains often used functions and position settings.

Press the **In** or **Out** buttons to scroll through the menu items in a circle, and finish by **Esc**:

Goto Home!

After pressing ENT the motor moves to a 0 position

If **StartSavedPos** is set to: It offers the last saved position.

GotoPosition:

Movement to the specified position: After pressing **Ent** button ("**Set**" is shown on the display) the value is modifiable by the **In/Out** buttons. You can move the focuser to the selected position by pressing again **Ent** button. If you would like to exit from this menu, press **Esc** button. After moving the motor, the new position, temperature, offset, etc. will be automatically saved. The offered position will always be the actual position. When the focuser is under movement, the position value on the screen becomes „**Move**“. The focuser moves dynamic. Long voice signal indicates when the focuser reaches required position, then the controller leaves the **Goto Select Menu** automatically. The focuser stops immediately when you push **Esc** button for 0,5 seconds! (Emergency stop)

Main menu

Push **Esc** and **Ent** at the same time to reach the Main menu, Use **In/out** to select an entry and press **Ent** to enter it. Here you can find the following settings:

Focuser Menu:

The Focuser menu contains data that physically belongs to the focuser and should be set accordingly by the user. We recommend to determine the values at first use, so MFOC can do its work properly from beginning.

Backlash:

The value of basic backlash compensation (the value can be between 0 and 255). Backlash compensation takes place only when the rotational direction of the motor is changing (in/out). The movement of motor increases by this value, without counting the backlash steps, when the direction of motor rotation is changing. The idea is to correlate the counter with the focuser position, not the motor position.

The process when the direction of motor revolution is changing:

Backlash (position uncounted) + Steps (position counted)

If this function is activated (the value is not 0) the '**B**' character will appear at the upper row of the display.

Of course it is necessary to determine the backlash of your system first. You can measure the correct value of backlash using the following simple method indoors, or under the sky use a star to determine the respective focus positions reached by moving in and out:

Mount a Dial indicator to your focuser, then move focuser to any position (e.g. **Pos: 1000**). Reset dial indicator and **Backlash** value. Activate single stepping mode, then move focuser further in the same direction (e.g. **Pos: 1050**). After that move back the focuser, until the dial indicator reaches 0 again. Read the position on the display (e.g. **Pos: 975**). Because the motor needs 25 more steps to reach the absolute position, write 25 to Backlash value and repeat the process to recheck.

Tip!

This process is also suitable to define the resolution of our system (mm/step). Do this calibration method at focus position, because the backlash is not equal in every focuser position due to deviations of gear teeth profiles and motor stepping angles (approx. +/- 5% at full step).

Backl.Dir:

It is possible to set the direction of backlash compensation.

If **In** is specified, the method is as follows:

Push **In** button:

In = *Step + Backlash*

Out = *Backlash*

Push **Out** button:

Out = *Step*

If **Out** is specified, the method is as follows:

Push **In** button:

In = *Step*

Push **Out** button:

Out = *Step + Backlash*

In = *Backlash*

PositionMax.:

Limits the maximal focuser position. This value is adjustable dynamically between **300** and **250000**. (The default value is 15000, the maximum travel of Octo60 focuser.)

Tip!

If you would like to set a high value, you can do it easier with the Ascom driver panel.

Handcontrol Menu:

The Handcontrol menu contains parameter that can be changed at any time to match the users preferences.

Steps/Click:

Multistep mode allows moving the focuser an user defined number of steps per pressing the In/Out buttons once. This value can be set here and is adjustable between 2 and 5000. (good for definable defocus, for photometry)

Backlight:

Display brightness adjustment, from 1 to 10.

Volume:

3 options for adjusting the sound volume:

Mute
Silent
Loud

Contrast:

Display contrast adjustment, from 1 to 10.

StartSavedPos: Yes or No (default: Yes)

By **Yes**, the actual position is stored after each movement. When switched off and on, the same position (step number) will be shown in the display. To have the focuser more precise at this position, you should use **Permanent Focus**. When disabled (**No**), the start position is 0 (Zero), and the last used position that is always stored in **GotoPosition** and can be used to move the focuser from zero to the last position (e.g. if your focuser is fully retracted for transport).

LCD Heating:

For keeping the display temperature to 10°C to ensure readability.

3 options are available:

Off (Switched off)

On (Constant working)

Economy (Working until activation of TempTrack) -

after activation of TempTrack many astrophotographers don't look at the display anymore

Connecting the temperature sensor is required to operate!

Motor Menu:

hold Ampere:

Setting of motor holding current:

160mA, 400mA, 600mA, 800mA

Motor holding current gets active 3 seconds after last movement.

move Ampere:

Peak of motor moving current:

160mA, 400mA, 600mA, 800mA

Direction:

Direction of motor revolution in **Out** direction. (**CW** or **CCW**)

Clockwise or counter clockwise. To correlate the revolution of the motor with the focusers movement direction.

TempTrack Menu:

TempComp/10C:

Step numbers per 10 degrees temperature difference, this value may be between +/- 5000. Mostly the focuser must be moved inwards to compensate for falling temperatures. Use then negative numbers.

remark:

The temperature data refreshes about every 30 sec, or at the end of exposure. The initial temperature and **Focuser position** will be saved, these will be the base of **Temperature compensation**. If the **Focuser position** is modified manually or by **ASCOM**, this new position will be the base of **Temperature compensation**.

Tip – how to calculate the TempComp value

*Adjust focus at two different temperatures. E.g the accurate focus position is at position 540 when the temperature is 18,2°C. Later, the accurate focus position is at 558 position at 15,5°C. Calculate the compensation value with the following formula: $((18 \text{ steps} / 2,7^\circ\text{C}) * 10^\circ\text{C} = \underline{66 \text{ steps} / 10^\circ\text{C}}$*

TempTrackDir:

Direction of temperature compensation, to prevent the activation of backlash compensation in a certain direction if the temperature changing is only small and probably random:

- **In**
- **Out**
- **All**

e.g. when temperatures are generally dropping during the night, a refractor will only need **In** compensations, and any **Out** compensation can be ignored. Select **In**.

Activate temperature compensation with pressing **Ent** button for 1 sec (or with **ASCOM**). In this case 'T' character will be at the upper row of display.

remark: *This function is switchable by **ASCOM** compatible software! (MaximDL, FocusMax) If the motor reaches the limit, the TempTrack function will switch off automatically! This function is inactive after swiching on the device, but it has function button (**Ent**) to reach faster this function. Do not forget to set enough time between exposures for temperature compensation!*

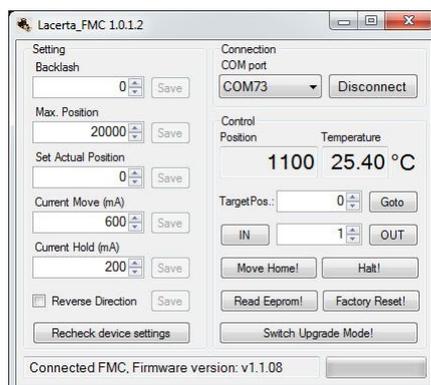
Exposure monitoring:

A speciality of **LACERTA MFOC** is, that it has the possibility of **exposure monitoring** when using **Lacerta MGEN autoguider**. Plug in a camera cable coming from MGEN into the 2,5mm stereo plug at the motor, and plug in another camera cable from the 3,5mm plug to connect to your camera. The motor then recognizes if the shutter signal is active, and that prevents temperature compensation movements while an exposure is going on. Only at the end of the exposure, when the shutter signal is off, the controller starts temperature compensation if it is necessary. With Ascom, that is a function your Ascom program should be capable of.

The Lacerta FMC ClickOnce Windows application:

It allows controlling remotely from a Windows PC.

Extract the "*LacertaFMC_PC_v1.0.1.2.zip*" file to a temporary directory. then start the setup.exe file from there and follow the instructions. Let's run the application:



After connecting, you can see the name of the connected device and the firmware number at the bottom of the window. After entering the values, press Enter to activate the Save button, press Enter again to load the entered data into the controller.

Adjustable values:

Backlash:

Its value should be 0 if the compensation is to be used from a PC program. If we still want the FMC to perform backlash compensation, enter the desired value here. The FMC performs backlash compensation using the uncounted step method: for every change of direction, it takes the step specified here in addition, so that the steps are not added to the display of the Position!

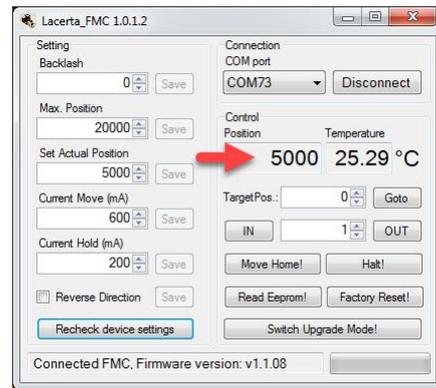
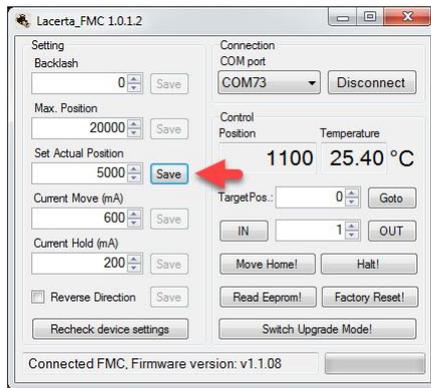
Max. Position:

The value of the maximum available position. It can be a maximum of 250,000, which means a 250mm path with 0.001mm steps, which is sufficient for all focusers. To avoid collisions, do not use a value greater than what our focuser allows.

Set Actual Position:

It is possible to overwrite the current position. The value entered here will be the current position entered in the device! It is advisable to use it with a fully wrapped focuser and with a value of 0 so that the limits cannot be exceeded.

Danger of collision!



CurrentMove (mA):

The value of the moving current is in milliamperes. In the case of MFOC, this value can be increased to 800mA.

Depending on the controller's own characteristics, you can override the submitted value.

For example:

160, 400, 600 and 800mA current can be set in the controller. If we enter 1000, the set value will be 800mA. If we send 456, the set value will be 400mA.

Current Hold (mA):

The value of the holding current is in milliamperes. In the case of the FMC, this value can be increased to 1000mA, but in practice, we should not use a holding current higher than necessary, in order to avoid undue heating of the controller. 160-200mA is sufficient in almost all cases.

Depending on the controller's own characteristics, you can override the submitted value.

For example:

160, 400, 600 and 800mA current can be set in the controller. If we enter 1000, the set value will be 800mA. If we send 456, the set value will be 400mA.

Reverse Direction:

It is used to set the direction of rotation of the motor. Increasing the position value should cause the engine to move the draft outward. If this is not the case, the direction of rotation must be changed, check it.

Command buttons:

The **Goto** by pressing the button, it is possible to send the draft to the desired position under Target pos. after filling in the field.

The **In/Out** can also be used to control the movement: by pressing a button, the focus pen moves with the value written in the field between them.

The **Move Home!** by pressing the button (after confirmation) the focus marker can be sent to the 0 position.

The **Halt!** the movement can be stopped at any time by pressing the button.

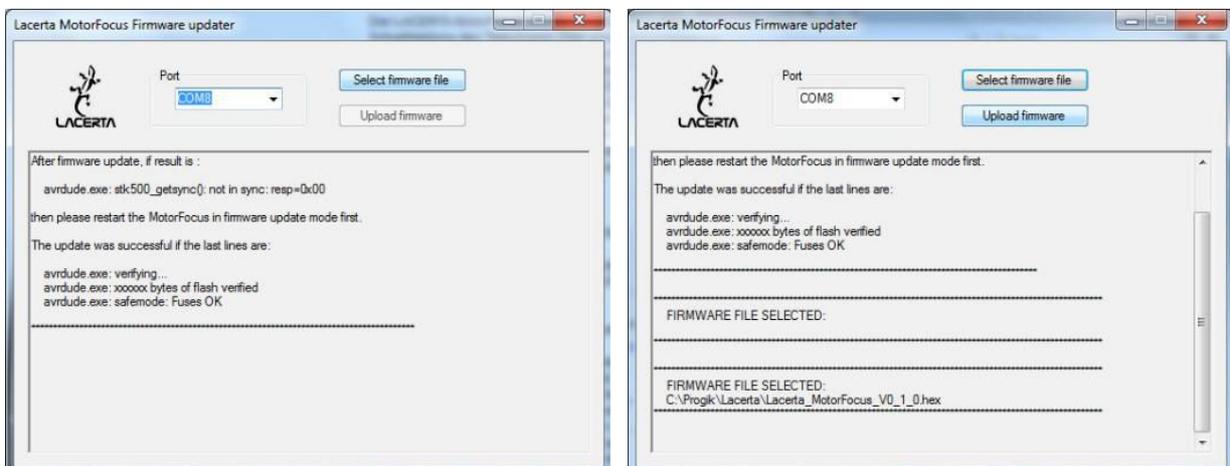
The **Read Eeprom!** by pressing the button (after confirmation), we can start saving the setting data written in the Eeprom of the device to the file. (C:\Users\...\AppData\Roaming\Lacerta_FMC, Log file is also saved here)

The **Factory Reset!** button (after confirmation) Deletes the Eeprom and after a reboot or firmware update, it is loaded with the factory values. The process is also shown by the blinking of the Power Led. After the deletion is complete, it will ask you to restart the device or put it in Upgrade mode.

The **Switch Upgrade Mode** button (after confirmation), the device goes into Upgrade mode, which is indicated by the flashing of the Power Led.

How to use the Firmware Updater:

Extract the "*LacertaMotorfocusFirmwareUpdaterV1.zip*" file to a temporary directory. We will also copy the HEX file of the program updates here, as the program opens this directory by pressing the Select firmware file button. Click on the *MotorfocusV1.exe* file to run the program. We select the port and the firmware to be uploaded. The name of the selected HEX file is shown at the bottom side of window.



We also start the FMC_PC program, and after connecting, the **"Switch Upgrade Mode!" button**, after confirmation in the pop-up window, in the case of FMC, you can see that the upgrade mode has been entered by the flashing of the Power led. In the new pop-up window that appears, select the NO button, then Disconnect!

You can then start the upload via the Firmware Updater.

If it is necessary to upload Eeprom with new starting data, then the **Factory Reset!** we use the function **Upgrade Mode!** instead of After deleting the Eeprom (which can be seen by the flashing of the Power led), it offers to put the device in Update mode. If we choose this, we can see on the display or when the Power led flashes that the device is in upgrade mode, then Disconnect!

You can then start the upload via the firmware updater. It may happen that some anti-virus programs prevent the Updater from working. In such a case, temporarily disable our anti-virus application.

To start uploading, press the **Upload firmware** button. An uploading message at the bottom of the window shows the process status. When the uploading is in progress, the display of the Hand Controller is dark and the LED light of the serial communication is flashing. Red flashing is the sign of back reading.

When the process is complete, the device is restarting and the display shows the new version number.

Reconnected to the Lacerta FMC PC application, the new firmware number can also be read at the bottom of the window.

ASCOM mode:

The **LACERTA MOTORFOCUS** is controllable by **ASCOM** compatible software on PC (tested with Astroart 4, Astro Photography Tool 2.82, Backyard Eos 3.19, DSLR Focus V3, FindFocus 1.2.0.0, FocusMax 3.8.0.20, Maxim DL 5.15, SharpCap 1.5.0.344, Sequence Generator Pro 2.6.0.24, FireCapture v2.5.11 x64).

After connection the 'A' character will automatically appear at the upper row of display. **ASCOM** reads the current position of **MFOC**, the measured temperature and the value of **PositionMax**. All buttons on the handbox are still functional. Operations of different softwares are different. E.g. the AA4, APT, FocusMax and MaximDL refresh position data every second, so the position adjustment on **MFOC**, the position change appears immediately in program. Other tested programs refresh values only after giving a command for movement to a new position, so you can't see changes of values on the PC screen after position adjustment on the device directly. Some of **ASCOM** compatible softwares support **Backlash compensation** and **Temperature compensation**.

If you would like to use **Backlash compensation** from PC software, set this value to 0 in **MFOC** menu! DSLR Focus, FocusMax and MaximDL use approaching from one side method to eliminate backlash. Approaching direction is adjustable (In or Out).

The temperature compensation function of suitable **ASCOM** compatible software use the feature of **MFOC**, which is activatable or not. Device settings will be overwritten by **ASCOM**. Some **ASCOM** compatible software have a custom algorithm for temperature compensation. If you would like to use this custom method, set the value in **TempComp** menu to 0 and deactivate **TempTrack** on **MFOC**.

Tips for easy starting and usage

We recommend at **first use** to start with focuser fully in (Position shown is 0), and move outwards to the maximum position. This value should be set in the **Focuser menu/max.Position** to define the range of your focuser. Then focus using the Motorfocus, and now try to determine the **backlash** of your focuser as precise as possible (see **Focuser menu/backlash** for details). These are the main parameters **MFOC** needs to know about your focuser for best operation. If you want to use temperature compensation, **MFOC** also needs to know the correct factor for your telescope, see **TempTrack** section for how to measure it easily.

For mobile astrophotographers (focuser is fully in for transport), we recommend to focus roughly manually first, with Motorfocus cable not connected. Then switch on **MFOC** and do fine focusing. If your focus point is already known and above 10000, you may also use **StartSavedPos – No** and **Fullstep mode** to **Goto** there quickly. After switching on, start to measure the star profile, V-curve or use your Bahtinov mask to achieve best focus. Now you can switch on **TempComp** and **Backlash compensation**. MFOC will do the work for you. It's easy!

In an observatory setup you of course leave the focuser and camera on their positions, and the next time you can resume immediately. For your convenience we recommend using the **Permanent Focus** feature, that refocuses automatically at startup according to the temperature. Remember to enable the stored Start position in **MainMenu / HandcontrolMenu / StartSavedPos - Yes**.

If you prefer the starting position being 0 after power up (**StartSavedPos - No**), and due to the first GOTO command it should move over 10000 steps, the motor can be switched to fullstep-mode. So the focus can really fast reach the starting position. (e.g. for refractors).

Filter offsets: Mostly the filtersets aren't quite precisely homofocal (or your refractor has slightly different color foci), you can measure their offsets and conveniently refer them to the 9 available offset positions. Mostly, the Lumi filter will be convenient to serve as a base and takes Filter 0 position. If you change filter, choose the appropriate offset position.

If the focuser is oscillating on TempComp, disable the compensation to opposite direction of thermal expansion trend in **MainMenu / TempTrack / TempTrackDir** menu.

At the end of the work, mobile users can turn just off the device. **Attention! Be aware that Manual turning of the focuser is possible, but only if UTP cable to handbox is DISCONNECTED, otherwise the possibly induced voltage may cause damage of MOTORFOCUS if using a V2 version (from V3 there is protection)!**

Fixed instrument users may choose shutdown by the the **Permanent Focus** command to move the motor to a "*Home position*". This way, at the next turn-on, **MFOC** automatically moves to a temperature compensated focus point.

Troubleshooting:

If you encounter problems with your **MFOC**, please refer first to the following advices, before you contact your dealer. It may help to regain full functionality.

- the focuser moves out when pressing **IN**:
Reverse motor direction in motor menu
- the motor is moving, but the focuser is not:
Check if the coupler is connected properly to the focuser worm
- the motor is not moving:
is it at min or max position? Change the cable (Ethernet cable, not crossed),
See if the PIN contacts in the jacks are ok and clean
- the motor sounds irregular sometimes:
especially when not connected to the focuser worm, there are resonances
- the worm is connected, but at some rotation position it feels tighter:
make the motor fixation slightly loose and turn the worm manually, to allow
the motor to settle in respect to the focuser worm
- after firmware update the screen is dark:
restart in in update mode and do a factory reset
- when power on, **MFOC** always starts with Position 0 (zero):
set **StartSavedPos** to **Yes**.
- my computer does not connect to **MFOC**:
Check the USB driver installation. Sometimes it is needed to run the installer
with administrator rights (right-click on setup.exe and "install as administrator")
- the temperature is not displayed at MFOC's display:
Check if the temperature probe is plugged in properly.

We wish you clear skies and great success using **Lacerta MFOC**!

