



LACERTA MOTORFOCUS

User Manual

v2.0.2



Thank you very much for choosing our product!

The **LACERTA MFOC** is an **ASCOM** 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.

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Key features:

- remote (ASCOM) 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
- Permanent focus (automated temp.comp.after startup)
- singlestep and multistep modes
- max. positions definable (min = 0)
- backlash compensation (2 modes)
- Goto function and 9 filter offset positions
- 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 (after power off and unplugged motor)

The content of the package:

- LACERTA MFOC** hand controller
- capsuled Motor unit
- 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):
<http://www.lacerta-optics.com/MFOC>

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. You do not need any additional adaption for follwing focusers: Skywatcher Esprit 80 (4mm coupling), Lacerta Microfocus unit, Octo60, Esprit 100-150 (4 or 6mm coupling). Please visit the website mentioned above to see a video how to connect properly.

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

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!**

new in 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

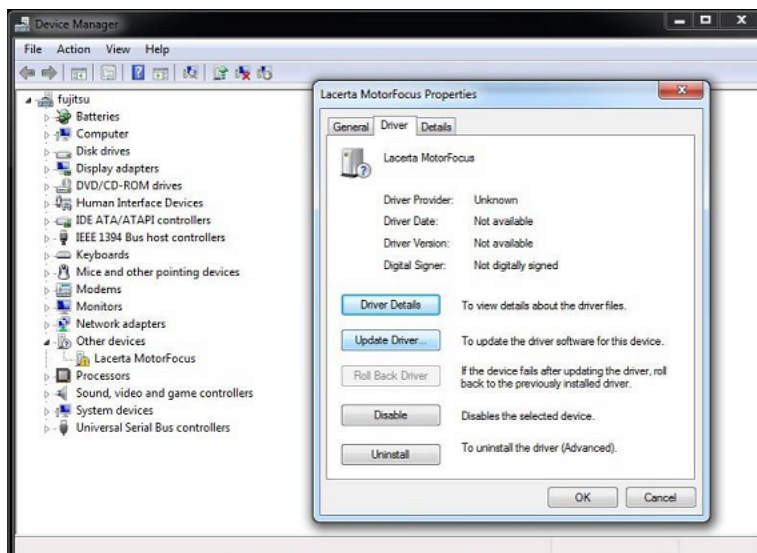
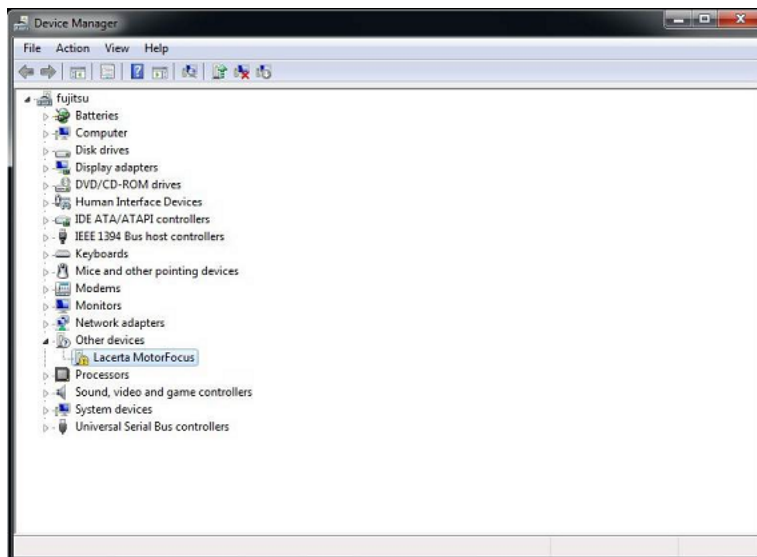
For comprehensive use of device, it's necessary to install the USB driver and PC applications first. You can see below the installation steps on a Windows 7/64 bit system

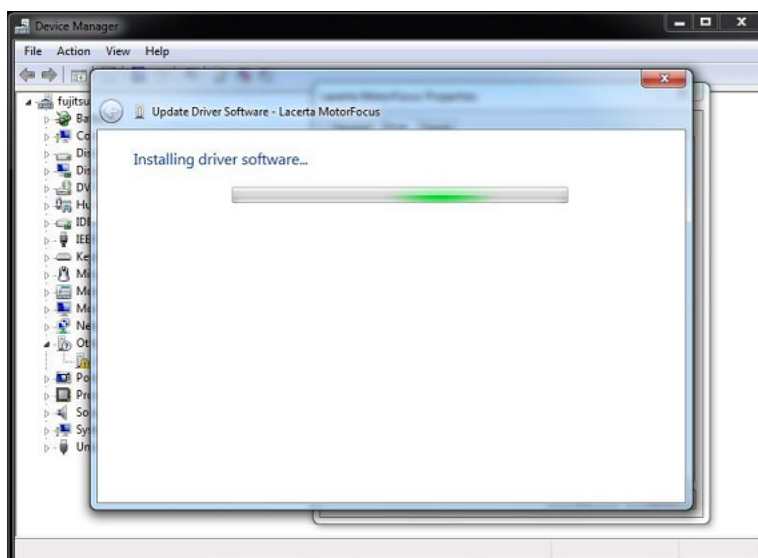
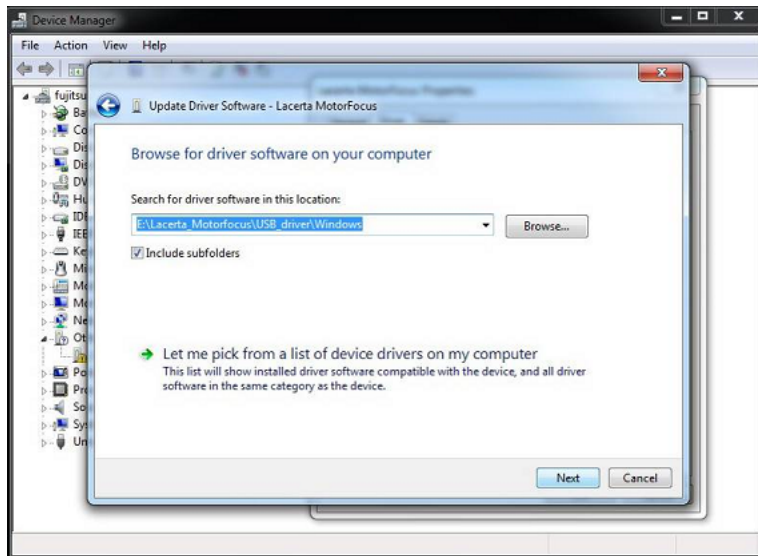
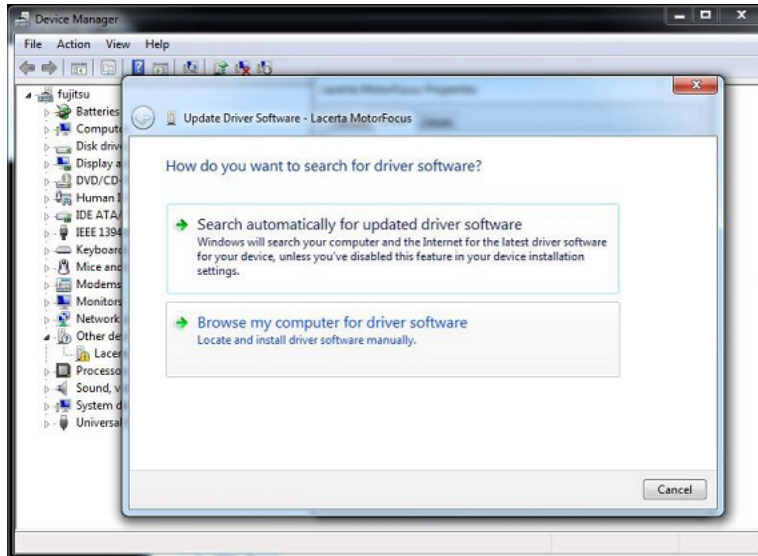
Installing the FTDI USB driver:

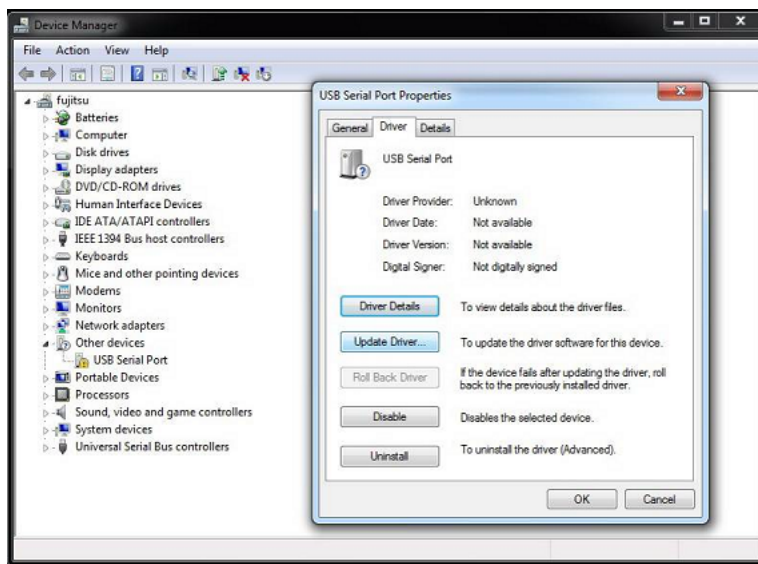
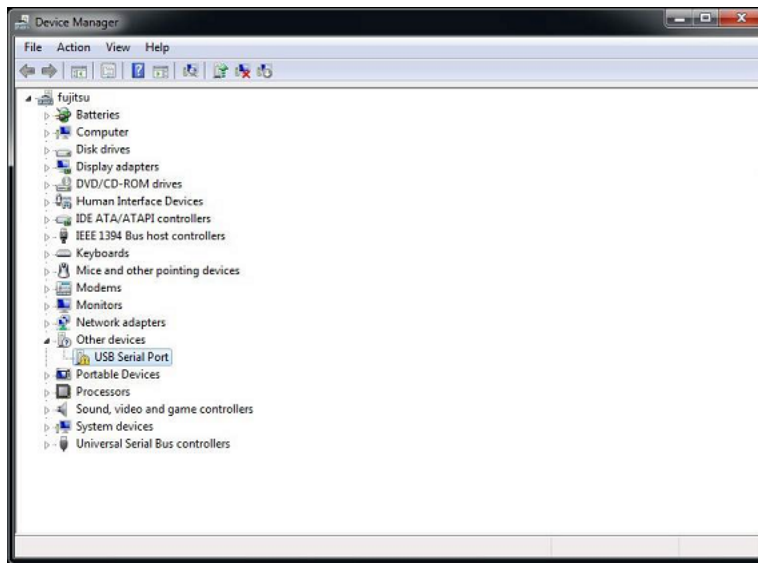
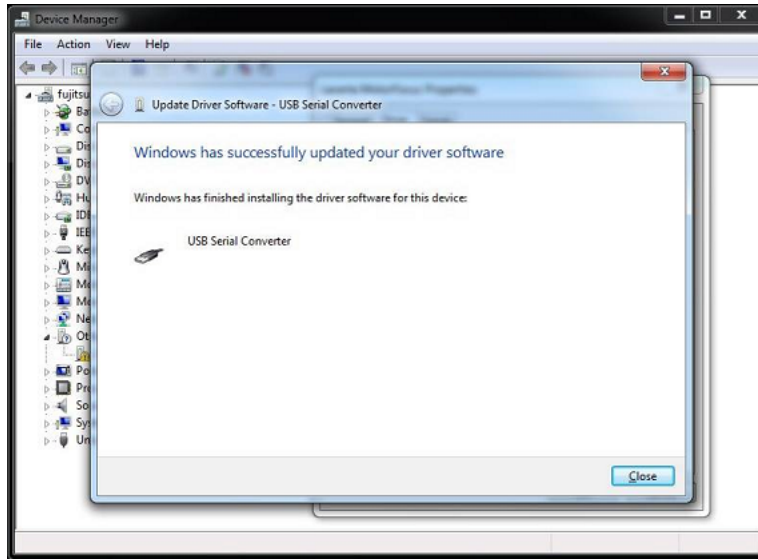
Connect **LACERTA MFOC** to PC and your power supply using accessory cables. Turn on the device. The Operating System recognizes the device and it's looking for a suitable driver. If it does not find the driver automatically, the screenshots below help you to successful install the driver after opening 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:

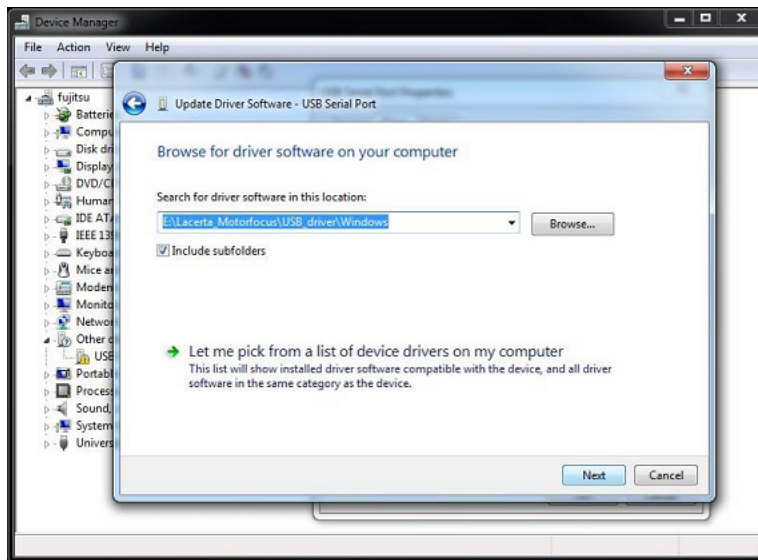
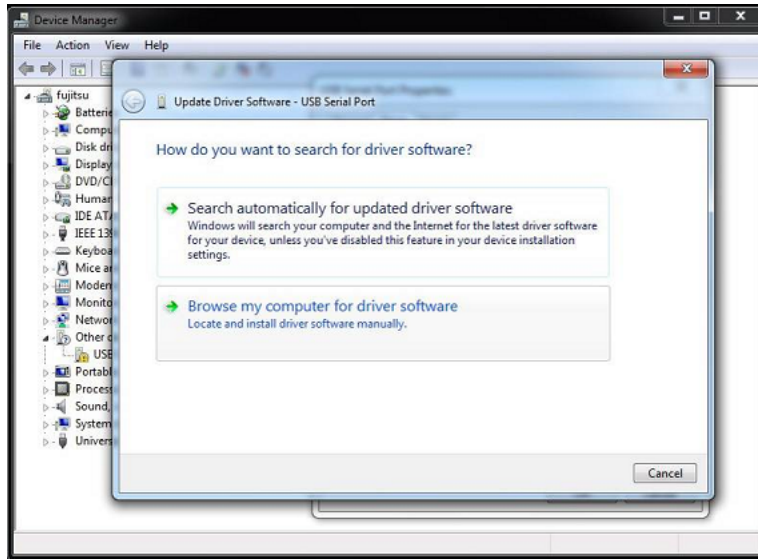
<http://www.ftdichip.com/Drivers/D2XX.htm>

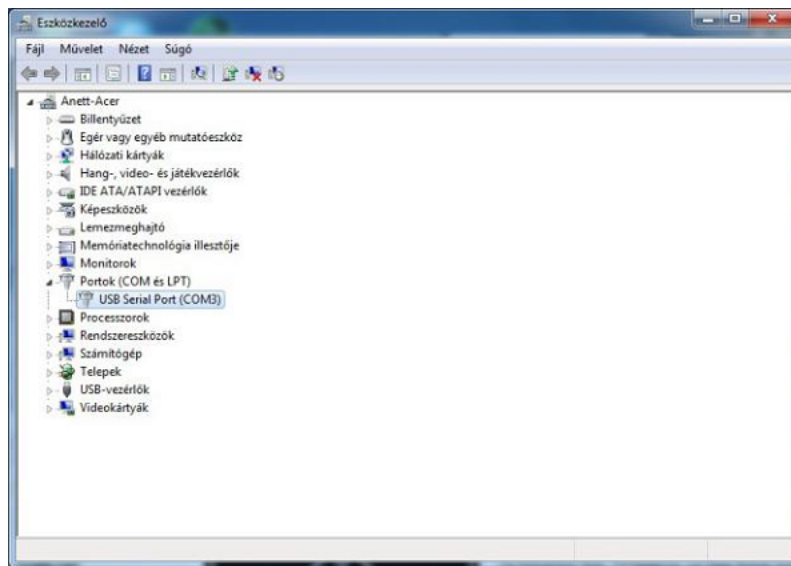
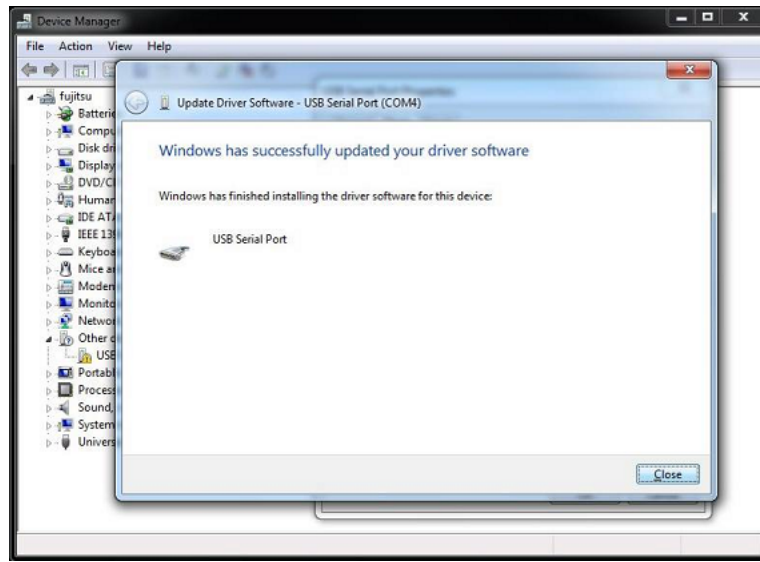
(a setup executable is provided in the column at right, and you find more installation advices there, if needed)





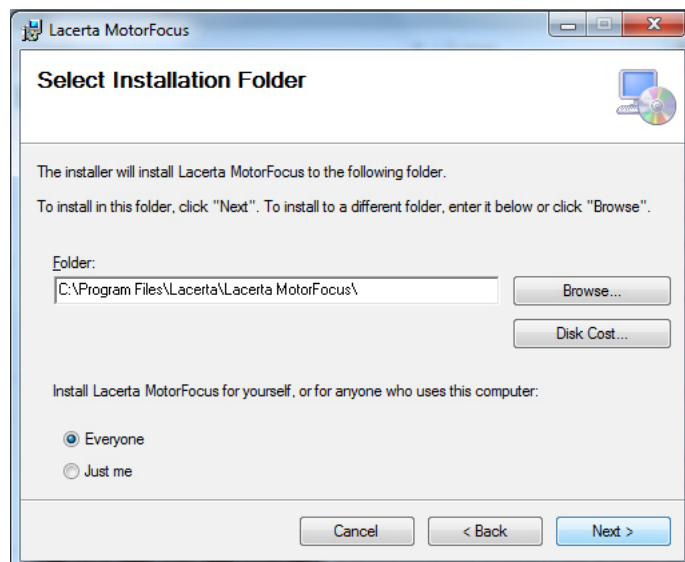
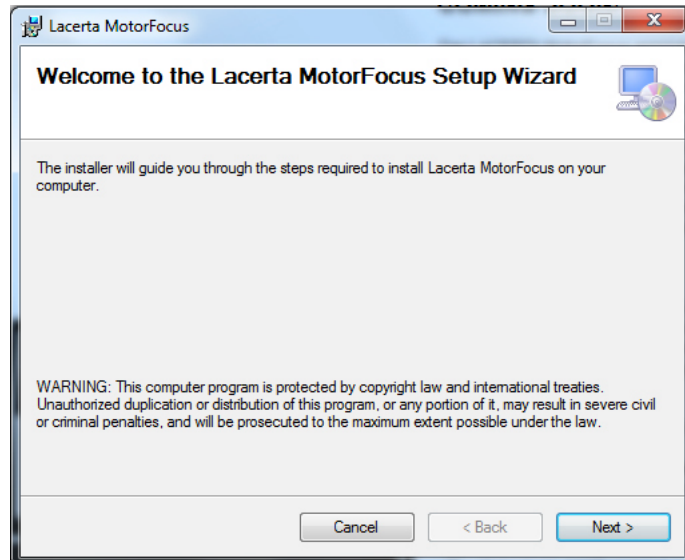


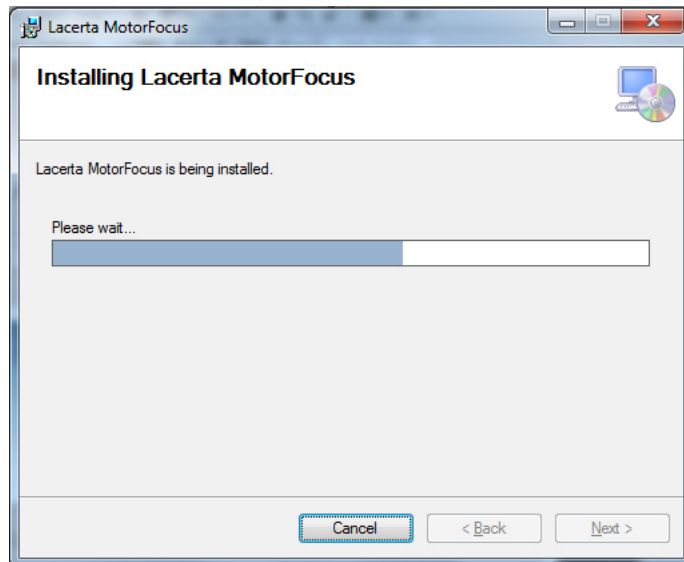
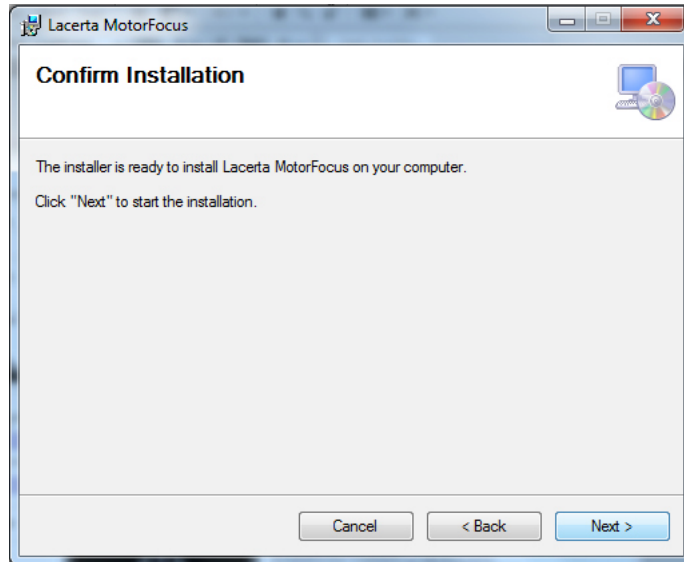




Installing the ASCOM driver:

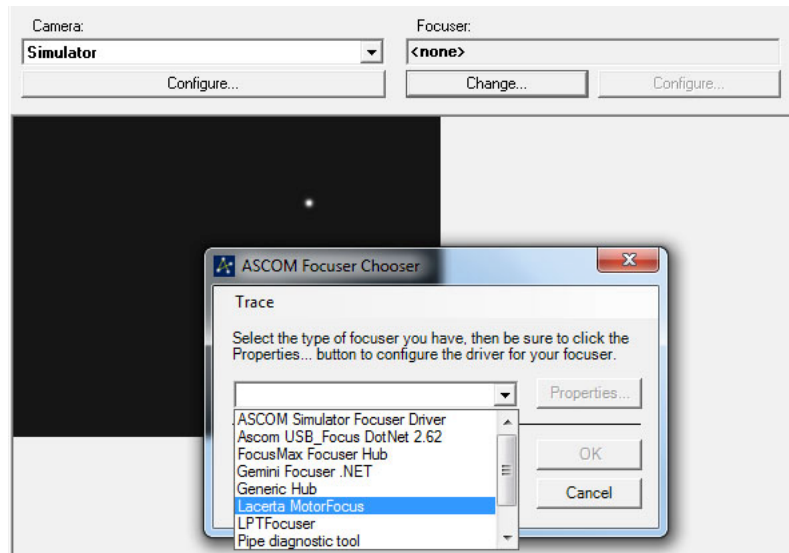
The required **setup.exe** is found in the firmware file at **x86** (32bit OS) or **x64** (64bit OS) subfolder of **ASCOM_driver** folder. **ASCOM 6.1** platform at least is needed! If it's not installed, you can download it from <http://ascom-standards.org/index.htm>



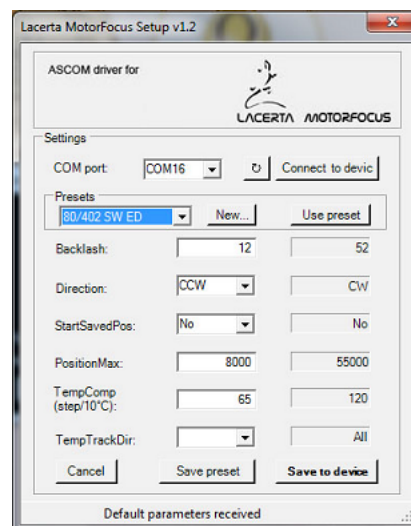


Settings of the ASCOM driver:

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

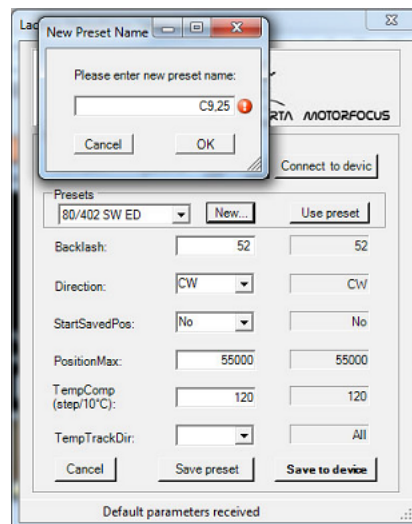
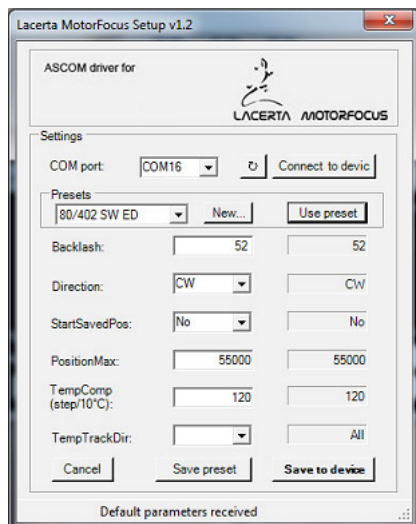


If the port was chosen previously, the device can be connected by pressing the OK button. A acoustic signal and flashing of device display indicate that the connection is created. „A” character shows in the **MFOC** display that the **ASCOM** connection is available. For device parameters press the properties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

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:

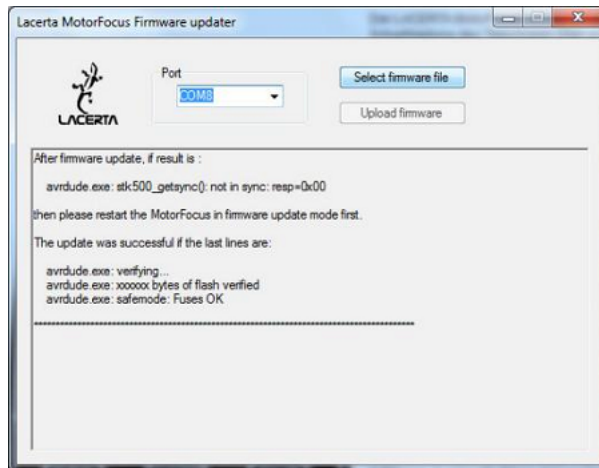
Copy the whole **Firmware Updater** folder to any folder on your PC. **Select firmware file** button opens this same folder, that's why it's recommended to copy the .hex files of the software update file into this same folder (default).

At first, connect device to your PC, after that enter the **Boot menu** by pushing and holding down the **In** and **Out** buttons 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:

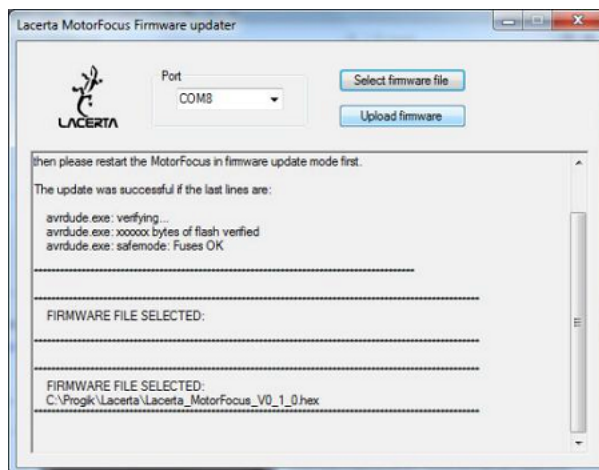
Boot menu
Factory Reset<--
Firmware Upd.

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

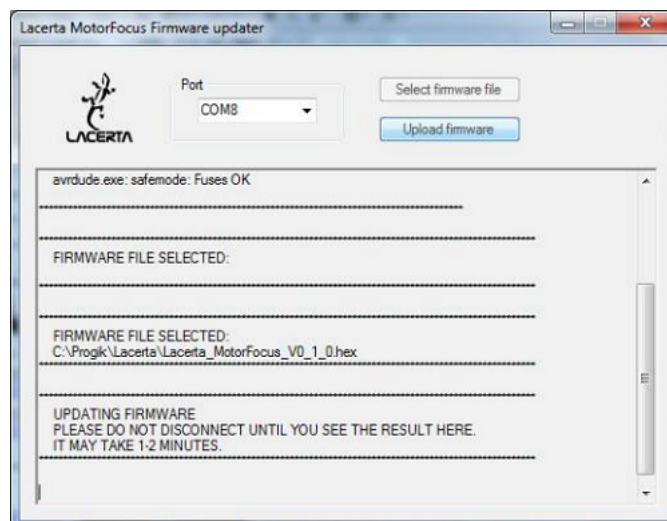
When **Factory Reset** is selected, Eeprom's stored data will be deleted while *"Cleaning Eeprom!"* is displayed. This is approx takes half a minute. Then the message *"Eeprom deleted Please restart or Please Start Firmware Update!"* is read. After restarting, the empty Eeprom is loaded with the factory 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.



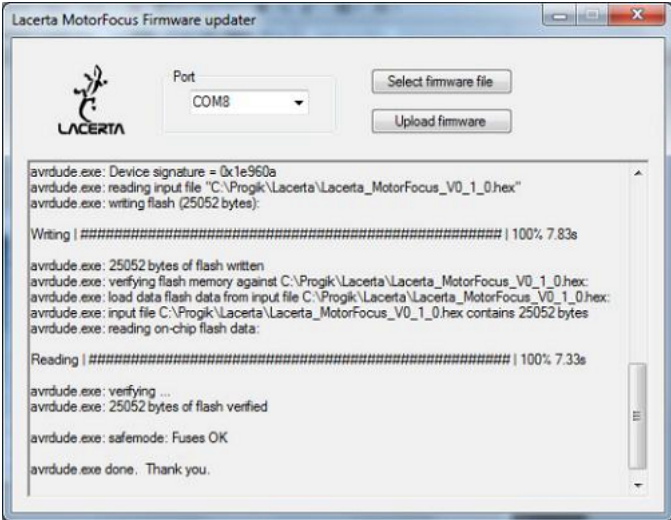
Select the port which is in use by the device (consult Device Manager if you don't know). Select the new firmware file with **Select firmware button**.



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' - ASCOM 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 **Main Menu** you can set data regarding focuser, hand controller, motor and temperature compensation. The **GotoSelect Menu** contains the main positions and filter offset settings, so you can reach your important positions easily.

GOTO quick menu (press GOTO button 1sec)	
Permanent Focus Shut Down!	After pressing ENT the motor moves to a fullstep "Home position" to enable moving to the precise position after switching on.
GotoPosition	After pressing 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.
Go Offset 0 Pos	Only works if you're in one of the "Offset" positions.
Go Offset 1-9	
SetOffset	Here you can set the value for the actual Offset position. The position comparison of the Offset 0 Pos will be stored! If the Offset 0 Pos is active, this menu doesn't appear!

Main Menu (press Esc and Ent 1sec)			
Focuser	HandControl	Motor	TempTrack
Backlash	Step/Click	hold Ampere	TempComp
Backl.Change	Backlight	move Ampere	TempTrackDir
Backl.Mutp.	Contrast	Direction	
PositionMax.	Volume		
FullStepMode	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**:

Permanent Focus/Shut Down!

Combining the precise positioning capability of **MFOC** with temperature compensation allows to have the focuser always at the proper position, temperature equilibrium provided. You may want to have this feature even, when finishing a session and continuing the next night, so you are able to start from the best focus position available. **MFOC** automatically can do that, and we call this function **Permanent Focus**.

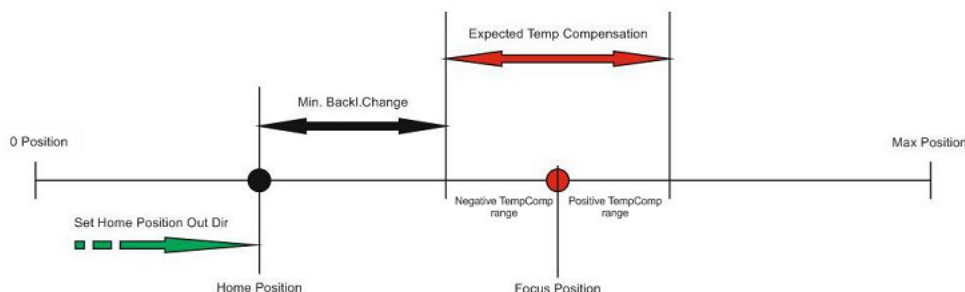
But when simply switching off power, the magnet inside the motor moves the rotator to a fullstep position, and the microstep precision would be lost. To overcome this, we need this switch-off function, in which the motor moves to a fullstep position like a "**Home Position**". If you choose to use it, the home position will be automatically calculated and the motor moves there before you switch off. After restart, **MFOC** automatically starts from this position and moves to your last used position, and the step number on the display will precisely match your focuser's position from last time. Combining with **TempComp**, **MFOC** calculates the focuser position for the new temperature too, and applies the compensation automatically. Using this feature it is possible, to get to the focus position and start the job immediately (without focusing).

Prerequisites for reliable operation are:

1. Precise **Backlash** and **TempComp** settings
2. **StartSavedPos** activation (Yes, is default)
3. the calculated shutdown position is not below min or above max. position

If you select **Permanent Focus/Shutdown** by pressing Ent, **MFOC** automatically applies the following steps:

1. a fullstep position less than the current focus position is selected
2. The distance is calculated sufficiently large, taking into account the **BacklChange** and **TempComp**! (Minimum is the sum of the expected value of the **BacklChange** x2 and **TempTrack**)
3. This position is reached in **Out** direction



The display shows "Move Home Pos." while moving, and then "Please Power Off". Now you can turn off **MFOC**.

When you turn on **MFOC** the next time, "Initialisation" is displayed first. The motor moves to the last focus position and, if necessary, adjusts for temperature deviations. The last offset position is retained.

If you stop using the **Permanent Focus** function and just switch off, you will lose the precise connexion between step numbers and real focuser position, and will have your focuser at a near fullstep position to start with.

If **StartSavedPos** is set to: **No**, the **Permanent Focus** function cannot be used ("*Can not activate*" is displayed if you try to use it).

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)

Go Offset 0 Pos:

Movement to the base filter position. This menu always shows the initial (or modified) base position. A modified position is calculated if **TempTrack** correction is activated. This is the default filter position and this is the base from which the **Offset** values are calculated. This way slightly varying filter thickness (or refractor color errors) can be balanced - e.g. there are 2 filter using Pos0, 3 filters using Pos1 and 1 filter using Pos.2. There are this base position and 9 user defined offset positions possible – 10 altogether.

Go Offset 1-9:

Moves the focuser by the respective preset value, when changing the filter wheel manually. If this is the already selected Offset, **MFOC** exits without movement from the menu after pressing 'Esc'. The chosen offset position is retained when powering off/on.

SetOffset 1-9:

To compensate focus deviations with different filters, you can set an offset of +/- 100 steps in this menu. You can define the value for actual Offset, movement of focuser position with the direction buttons. You can store the value with Ent button. The controller moves the focuser to original position with pressing of Esc. The value overflow is not

permitted, due to motor movement. If you push **Esc** or **Ent**, the device doesn't exit from whole **Goto Select Menu** to reach other **Offset** settings faster.

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, than 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.Change:

The Backlash change is the **step limit** of switching between two backlash compensation modes (the value is from 0 to 255). The „**Basic**” backlash

compensation is accurate in case of small motor movements at specified position (functionally around the right focus position), but it's not working with enough accuracy in case of large movements. That's why the method in case of large movements is approaching the desired position from **one direction only** (in or out) to eliminate any backlash. To move 15 steps out it would move e.g. 100 steps out and 85 in, to reach the position. This is very precise. Below the limit the „basic“ backlash compensation is in use, above the limit the „approaching from one direction only“ is in use.

Attention: Please use „**basic**“ backlash compensation exclusively when the **Temperature compensation** is active without **Exposure monitoring**, because the photo may defocused due to focusmotor movement while an exposure is going on!

Backl.Multip.:

(Backlash Multiplier, the value is from 1 to 10) is a factor determining the "overdose" of backlash correction for the „approaching from one direction only“ method. (**Backlash** value is multiplied with **Backl.Multip**). The movement to the **Out** direction is as usual without compensation. But if the movement is to the **In** direction, the step number of the motor is increased by the given value, and then the motor moves back in the **Out** direction by this same value to reach the desired position from the **Out** direction only. Because backlash appears in both directions, these two backlashes in different directions cancel out each other precisely and the focuser position can be reproduced exactly.

*No compensation to **Out** direction.*

*To **In** direction the formula of the compensation is the following:*

$$\mathbf{In} = \mathit{Step} + (\mathit{Backlash} * \mathit{BacklMultp})$$

$$\mathbf{Out} = (\mathit{Backlash} * \mathit{BacklMultp})$$

*In this case the final movement direction is only **Out**.*

*If the last movement direction was **In** using „Basic backlash compensation“, and the motor steps at movement to **In** direction exceed the **Backl.Change** value, then the compensation formula is the following:*

$$\mathbf{Out} = \mathit{Backlash} \text{ (position uncounted)}$$

$$\mathbf{In} = \mathit{Step} + (\mathit{Backlash} * \mathit{BacklMultp})$$

$$\mathbf{Out} = (\mathit{Backlash} * \mathit{BacklMultp})$$

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.

FullStepMode:

There are 2 options:

Enable: If the distance is more than 10.000 steps, you can approach the target position in full step mode. In finishing, the last way (approx. 1000 steps) is done by change to micro-step mode.

Disable: Only operate in micro-step mode.

This mode is helpful for setting up when you are working mobile and start with focuser retracted fully in. Your focus position will be reached faster than in Microstep mode.

Fullstep mode works only in one case: Starting from position 0 and more than 10,000 steps away. Conditions needed: StartSavedPos No, FullStepMode Enable, after the MFOC is switched on (Position: 0), the first Goto is greater than 10000.

Remark:

In FullStep mode, the motor runs more noisy. This is normal, do not worry. In case of a problem you can stop the motor stopped immediately by pressing the Esc key (or in a suitable ASCOM program by issuing the command Stop). While moving the "Full Step Mode" is displayed. Micro-step change when we read the "Micro Step Mode" message for 1 second.

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.

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!**

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**!

