

# USER MANUAL

English (Current State 1.1.2012)



This user manual makes you familiar with your new ALLUNA Optics Telescope-Control-System. It describes all important details about functionality of the hardware as well as of the software and gives helpful tips for the installation, assembly, commissioning and the practical applications of the device.

## Dear customer,

Thanks for choosing this product of ALLUNA Optics. We guarantee for quality "Made in Germany" through most modern technology and by using high-quality components. We are also confident that you took the right decision of purchasing this product.

## Application as directed

This product should be used exclusively for control functions of astronomical telescopes. Every other application has to be consulted with the manufacturer. The CE declaration of conformity loses its validity as well as all guarantee and indemnification claims are lost if changes are done to the equipment or to its configuration.

## Safety and danger warnings

**The following points have to be urgently observed in order to have pleasure with the TCS Telescope controller and so that it works properly.**

The control-software "ALLUNA Optics TCS" has been developed for the PC operating system " Microsoft Windows TM " and has been tested on different versions of " Microsoft Windows TM ". All tests have proved that TCS runs stable and generally it does not conflict with parallel running applications. Nevertheless, it is possible under certain constellations that program errors can happen. No liability will be taken for the resulting losses on the PC hardware or software or any data losses.

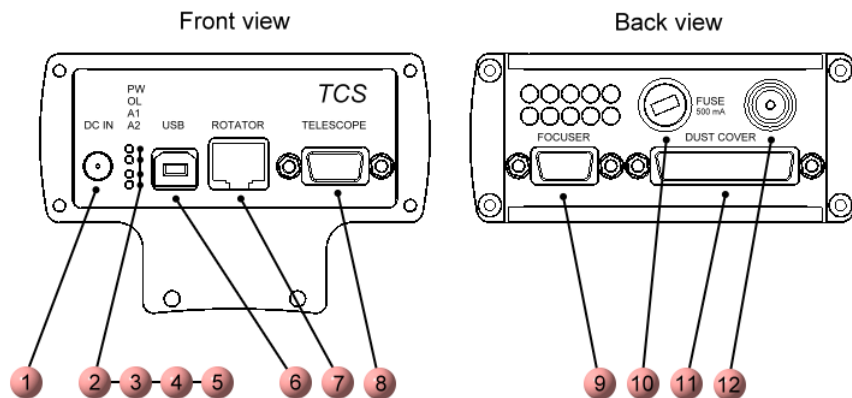
- The control should be used only with the supplied switch power supply with the operating voltage 13 - 13.5 V.
- The switch power supply as well as the controller and its components are electrically operated devices and must only be operated in a dry place. Always switch off the control when not in use by pulling out the plug of the switch power supply. Protect the components against moisture, dust, aggressive fluids and steam.
- Clean the TCS controller only with a slightly moist, fluff free cloth or with an antistatic cloth.
- Never open this device yourself and avoid contact of metal objects with the plug-in contacts.
- The USB cable of your PC/notebook should not exceed the length of 5 metres. The excess length of the USB cable can lead to data loss and with that to malfunctions.
- Never replace a burnt out fuse with a wrong value one, only use a fuse with the prescribed value of 500 milliamperes.
- Ensure that the current supplying cables as well the USB cables are firmly plugged into the sockets of the controller and cannot be taken out accidentally or independently.

## What is „ALLUNA Optics TCS“ ?

The Telescope-Control-System TCS of ALLUNA Optics is a software supported electronic control system, which has been designed for the remote control of high-quality telescopes. The entire system is operated with the PC/Notebook by the supplied Windows software. With TCS several functions are controlled and supervised at the telescope:

- Air conditioning of the optical tube and the main mirror
- Focusing of the optics
- Control of the optionally available CCD Rotator
- Control of the optionally available robotic Dust Cover

# Description of the TCS-Control Box



## 1 DC IN Current supplying socket (13,5V DC)

To operate the TCS-controller only use the supplied switch power-supply with the operating voltage 13.5 V.

## 2 PW Power LED (red)

This LED lights up red when the TCS-controller is ready to be used.

## 3 OL Online LED (green)

This LED lights up green when TCS has a data link to the PC/Notebook. Immediately after switching on the TCS control box and before a connection with the PC/Notebook this LED flashes 3 times and goes out, provided that still no USB connection has been made or the PC/Notebook is not switched on.

## 4 A1 Aux-1 LED (green)

This LED lights up green when the checkbox Aux-1 in the climate mode of the TCS software is checked. A relay switches on the non-fused and non-controlled operating voltage to the Aux-1 plug on the telescope internal connection board. (The plug is not accessible of the outside)

## 5 A2 Aux-2 LED (green)

This LED lights up green when the checkbox Aux-2 in the climate mode of the TCS software is checked. A relay switches on the non-fused and non-controlled operating voltage to the Aux-2 plug on the telescope internal connection board. (The plug is not accessible of the outside)

## 6 USB socket (Entry of the connecting cable of the PC/Notebook)

Connect the cable of the PC/Notebook to this USB socket. Please take care that the cable length is not longer than 5 metres.

## 7 CCD-Rotator (RJ48 socket)

Connect the optionally available CCD Rotator to this RJ48 socket with the supplied data cable.

## 8 Socket for telescope - SUB-D 9 pin

Connect the supplied cable for the telescope to this SUB-D socket.

## 9 Focuser socket SUB-D 9 pin

Connected to this socket is the secondary focuser of the RC-telescope or the eyepiece focuser of the newtonian-telescope.

## 10 Holder for the 1A fuse

The TCS electronics are protected against overload via a 1 Ampere fuse. To replace the fuse, use a screwdriver and push 1 – 2 mm into the slit of the fuse-holder and turn it counter clockwise.

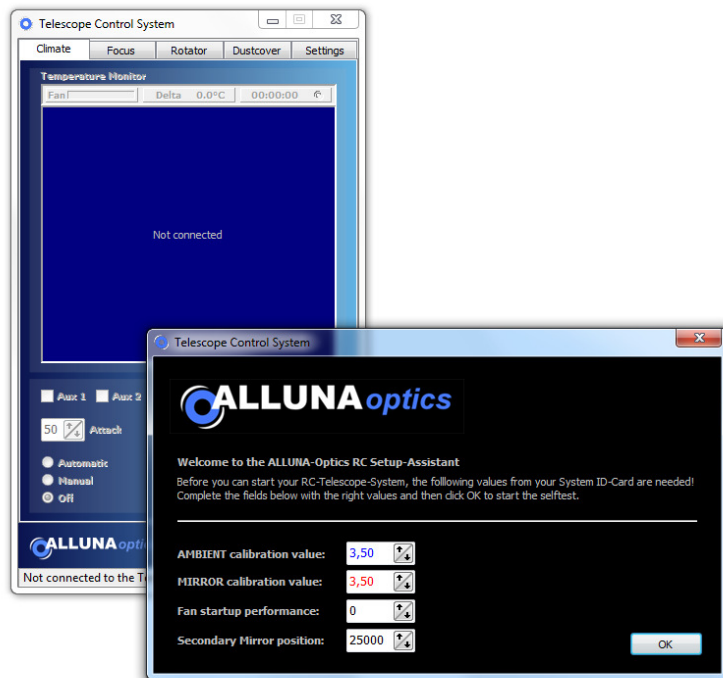
## 11 Dust Cover socket SUB-D 25 pin

If your telescope has an robotic Dust-Cover system, the plug of this is already connected to the SUB-D socket.

## 12 Sensor for the ambient temperature

The ambient temperature sensor is behind this cap. In order to receive realistic measurement results of the ambient air, the sensor cap should not be covered.

# Installation and commissioning

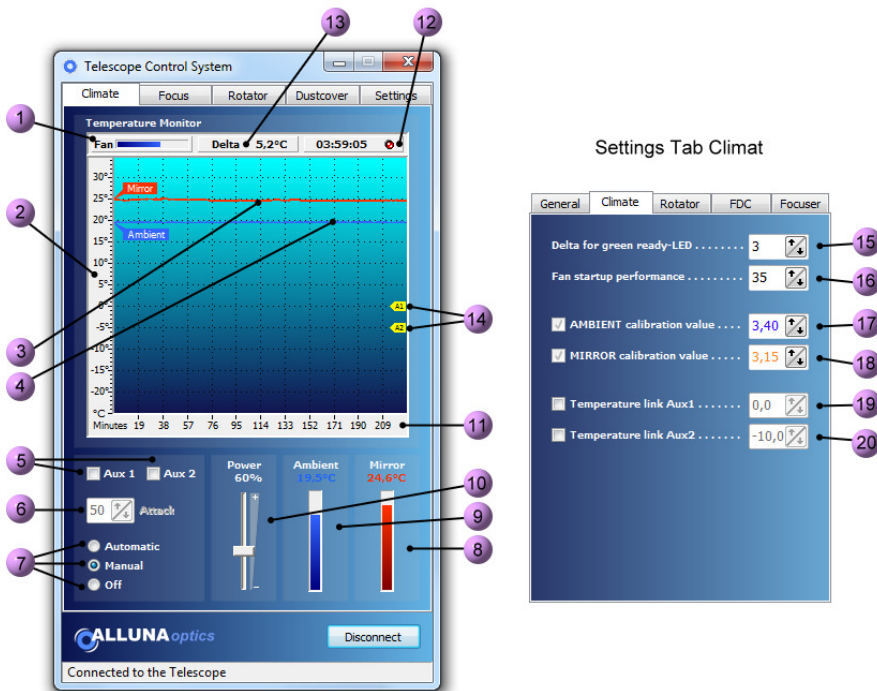


The installation of TCS is conceivably simple. Place the supplied CD in the CD/DVD drive of your PC/Notebook and start the program "ALLUNA Optics TCS Setup.exe". The installation assistant leads you then, as usual with many other programs, through the installation process. After completion the TCS control program is ready to be used. Now join the PC/Notebook with the TCS control box on the telescope with a USB cable. As a last installation step, connect the current supplying cable to the TCS control box. The red power LED lights up and signals ready. The green online LED flashes 3 times and then goes off. It remains off, provided that the USB connection has not been done or the PC/Notebook has not yet been switched on.

Start the TCS program on the desktop of your PC/Notebook and make the data link to the telescope by pressing the button **Connect**. Since it is the first start of the TCS software, the ALLUNA Optics Telescope Setup Assistant appears and asks you to enter the parameters from the telescope system ID card.

To this, insert the 4 parameters **Ambient** and **Mirror calibration value** as well as **Fan startup performance** and **Secondary Mirror position** into the entry boxes and click OK. The telescope now makes a selftest. After a few seconds, the system is ready. The message **Connected to the telescope** appears in the status line. TCS is now connected to the telescope and ready to be operated. All dialog elements are activated and the green online LED on the control box lights up. If no connection can be done, because e.g. the USB cable is not plugged in or the TCS control box has no current, the connect button remains in its initial state and the fault message **TCS hardware not found !** appears in the status line. Click the Disconnect button to logout the system. This will be confirmed with a message **Not connected to the telescope** in the status line. The green online LED goes off.

## Description Climate



### 1 Power indicator of the fans

This blue progress bar shows the current power of the fans. The maximum power is 100%. The power of the fans can be regulated either manually with the slider or automatically.

### 2 Temperature axes in degrees centigrade

The vertical temperature axes displays the temperature range of +35°C to -25°C.

### 3 Temperature measurement curve of the main mirror temperature

The temperature measurement curve of the main mirror is displayed in colour orange.

### 4 Temperature measurement curve of the ambient temperature

The temperature measurement curve of the ambient temperature is displayed in colour blue.

### 5 Switching outputs (13.5V) for e.g. heating elements or external loads

The voltage supply 13,5V for the external heating elements/consumer loads can be switched on/off by marking the check boxes Aux-1 or Aux-2. These settings are saved by TCS after finishing and are taken over after a new start. **INFO:** The plugs are not accessible of the outside.

### 6 Attack value for the fan ramp during automatic operation

An attack value for the fan ramp can be entered in the input box "Attack". Values between 5 and 95 are accepted. Default value is 50. These settings are saved by TCS after finishing and are taken over after a new start. **INFORMATION:** The current temperature difference serves as a basis for the performance of the fan. The higher this difference is the higher is the power of the fan. A conventional linear curve is the result, which however is not the optimal solution for the cooling process of the main mirror. It is preferable to drive with a progressive ramp, which means that just before reaching the ambient temperature it should be cooled down with the maximum power of the fan. The "Attack" value serves like a lever. The fans run longer with a higher speed, the higher the "Attack" value is. This accelerates the cooling process of the main mirror.

## 7 Changeover buttons for the fan control between automatic, manual and off

Choose the desired type of air conditioning with these buttons. These settings are saved by TCS after finishing and are taken over after a new start. The fans are switched off in the position **Off**. In this case the power slider and input field "Attack" are blocked. In the position **Manual** the fans run with the adjusted power on the slider. The power slider is operable; the input field "Attack" is blocked. TCS controls the fan in the position **Automatic**. The power slider is blocked; the input field "Attack" is editable. **INFORMATION:** In the automatic mode the fan control functions only when the ambient temperature is lower than the temperature of the main mirror.

## 8 Main mirror temperature metering bar

This metering bar displays the current temperature of the main mirror.

## 9 Ambient temperature metering bar

This metering bar displays the current temperature of the ambient.

## 10 Manual power-slider for the fans (0 – 100%)

The fans can be regulated with this slider between 0 and 100%. The slider is only operable in the "Manually" mode. The fans power indicator (1) shows the current value as a blue bar.

## 11 Time axes in minutes

The horizontal time axes shows the elapsed time in minutes since the beginning of the measured value recording. The stopwatch (12) shows the value in the time format. **INFORMATION:** In the beginning of a new recording phase, the two measured values (3) and (4), are straight horizontal lines, which change to curves after a while due to the temperature change. The 1st vertical time marker moves from right to left on the display after the first 5 minutes. From now on another 10 five minutes time markers follow, until the whole display is divided by 11 five minutes time markers into 12 identical sections. This period represents the first progressed hour. From now on the number of time markers does not increase, but only the time information below the time markers changes every 12 minutes.

## 12 Time period since beginning of the measured value recording and pulse LED

The stopwatch shows the time period of the measured value recording. You can make a reset by a click on it. **INFORMATION:** In order to receive a precise measured value, TCS reads both temperature sensors every second and takes the average of the measured values after 5 seconds. This average value is updated every 5 seconds which can be recognized by the flashing of the pulse LED. The pulse LED flashes red if the current temperature difference is more than the set value in (15). The pulse LED turns green as soon as the temperature difference reaches the defined value in (15). This signals that the telescope has cooled down sufficiently.

## 13 The temperature difference between ambient and main mirror

The value "Delta" shows the difference between the two temperature sensors.

## 14 Temperature link symbols for switching outputs Aux-1 and Aux-2

The temperature link symbols are displayed in the temperature monitor, provided these are activated in (19) and (20) and necessary switch-on temperature values are entered. They signal the temperature activation point on the respective temperature line.

## 15 Input box for a threshold value (Pulse-LED switch from red to green)

Here a threshold value is defined at which Delta (primary mirror/ambient temperature) the Pulse-LED (12) switches from red to green. Values between 0 and 5 degrees Celsius are accepted. Default is 3 degrees.

## 16 Input box for a starting value of the fans

Each type of fan has its specific start up voltage. Most 12V DC fans begin to turn only at a voltage of 3 - 6 V. In order to make full use of the resolution of the fan control / air conditioning, it is necessary to determine and record the described start up value in this input field. This value corresponds to the value of the manual power Sliders (10) in per cent, at which point the fans begin to turn smoothly.

**Procedure:** Leave input field (16) beginning with the default value 0; then go to climate and click the change-over switch (7) for to position "Manual" and then push the power Slider (10) slowly upward beginning at 0. Observe the fans at the same time. If all fans turn slowly, switch them **off** with switch (7) and there after **on** again in order to test whether all fans start up properly. If necessary correct the value with the power Slider (10). Repeat this procedure until an exact start up value is determined. Afterwards record this into input field (16). After recording the start up value, you can see on the power Slider (10) that the fans still register 0% power, but are already running at the slightest movement of the Slider.

### 17 Input box for calibration value of the ambient temperature sensor

Right after initial start up of TCS, the preset value of **3,50** (an average value) should be exchanged by the factory-specified value of the device, found on the attached ID-Card. Only in this way, a correct conversion of the measured temperature is possible. As background information it should be mentioned that smallest tolerances of the unit, registered on the sensitive measuring bridges of the temperature sensors, make this individual alignment necessary. The entered calibration values will then be saved.

### 18 Input box for calibration value of the main mirror temperature sensor

Right after initial start up of TCS, the preset value of **3,50** (an average value) should be exchanged by the factory-specified value of the device, found on the attached ID-Card. Only in this way, a correct conversion of the measured temperature is possible. As background information it should be mentioned that smallest tolerances of the unit, registered on the sensitive measuring bridges of the temperature sensors, make this individual alignment necessary. The entered calibration values will then be saved.

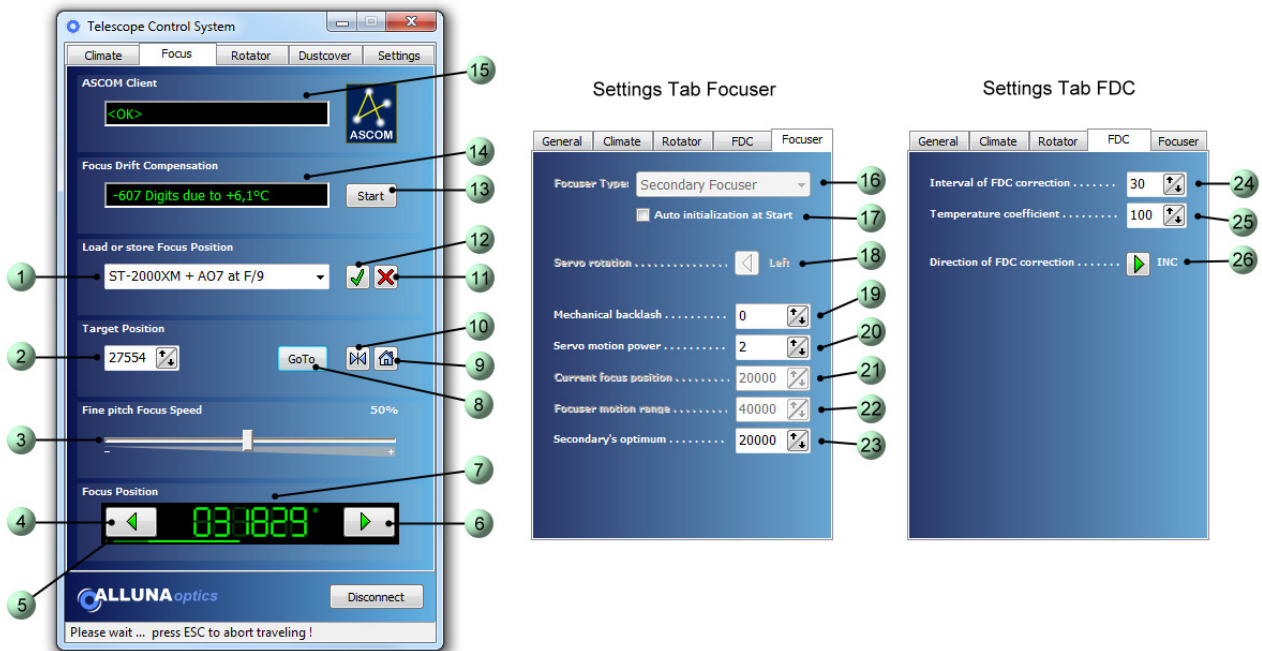
### 19 Input box for temperature link with Aux-1 channel

By marking this checkbox the Aux-1 channel is switching on automatically if the temperature has reached the activation point in degrees centigrade of the input box right beside. **INFO:** The Aux- plugs are not accessible of the outside.

### 20 Input box for temperature link with Aux-2 channel

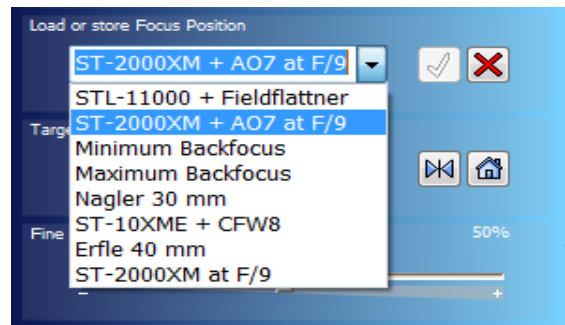
By marking this checkbox the Aux-2 channel is switching on automatically if the temperature has reached the activation point in degrees centigrade of the input box right beside. **INFO:** The Aux- plugs are not accessible of the outside.

# Description Focus



## 1 List of stored focus positions

All stored focus positions with their names are shown when the mouse is clicked on the right arrow of the combo box. The required position name can be selected with a mouse click, which is then shown on the editing display of the combo box. Simultaneously the corresponding position-value (in digits) is visible in the input box (2) (provided that it is in the defined range of the focuser MIN/MAX) and with it is ready for **GoTo** (8). If no focus position has yet been stored or the value of a loaded focus position altered by pressing the button 4/6/8, then **<new>** is displayed in the input field of the combo box. Every saved position-name has its own temperature value, which is calculated at the time of memorising and is useful for the exact compensation of the focal-drift by FDC.



## 2 Entry-Box for the target position in GoTo mode

In this entry-box the target value (in digits) can be entered manually, provided that it is within the range of the focuser. When a position-name is selected from the list in the combo box (1), the input field "Target position" automatically gets the corresponding value, provided that it is within the defined focuser range.

## 3 Focus speed slider for the focusing rate (0-100%)

The positioning speed of the focuser servo can be adjusted with this slider. With it, it is possible to cover long focal lengths as well as to approach very small increments manually and precisely. **INFORMATION:** In the case of manual positioning the focusing speed can be adjusted with the direction buttons (4) and (6). While automatic positioning via **GoTo**, **FDC** or **AutoFocus**, TCS takes over the speed control.

## 4 Direction button (back) for manual focussing

The secondary mirror can be moved to the primary mirror with this direction button. The mirror spacing will be reduced and the back-focus gets longer. If the focuser comes closer to minimum position, the speed will be automatically reduced until the focuser stops exactly at 0. It's not possible to go below 0.

## 5 Progress bar during the automatic positioning

This narrow progress bar is displayed during the automatic positioning per **GoTo**, **FDC** and **AutoFocus** and is used for orientation. During the progress, the backlash way will be displayed in a darker colour, the normal way in a lighter colour.

## 6 Direction button (forward) for manual focussing

The secondary mirror can be moved away from the primary mirror with this direction button. The mirror spacing will be extended and the back-focus gets shorter. If the focuser comes closer to maximum position, the speed will be automatically reduced until the focuser stops exactly at maximum position. It's not possible to go over this position.

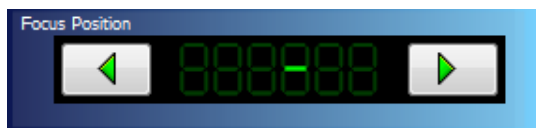
## 7 Display of the current focus position in digits

This six-digit Display shows the current focus position. A small LED right beside the numbers signals a soft servo drive. If the LED gets lighter, the electronics automatically regulates more current to the servo motor.

## 8 Starts the automatic positioning

The button **GoTo** starts the automatic positioning. The target position, from the input field (2), is approached with a high speed. All dialog elements are blocked during this procedure. The message "**Please wait ... press ESC to abort travelling !**" appears in the status line. The positioning can be aborted any time with the ESC key. After reaching the target position, an audible signal can be heard from the PC speaker and the dialog elements can be used again.

## 9 Starts the initialization of the Secondary-Focuser (Homerun)



With click on button (9) you start the reference run of the secondary focuser. This moves the focuser to a defined zero position (physical zero), on which refer all other positions. An integrated inductive capacitance-switch finds these out exactly on 1/100 mm. During the homerun procedure the six-digit display (7) goes out and a walking bar appears, which moves with fast speed from left to right and after a particular time with slow speed from right to left.

The Message „Homerun ... please wait (press ESC to abort)“ appears in the status line. This procedure takes several seconds and can be aborted with ESC at anytime. As soon as the reference position is reached, an audible signal can be heard from the PC speaker and the position-display (7) shows “000000”. The Message „Home position is achieved !“ appears in the status line.

## 10 Moves the Secondary-Focuser to the optimum position

A Ritchey Chretien telescope has a optical correct position of the secondary mirror to the primary mirror. This distance (called mirror spacing), can be changed with a Secondary-Focuser in favour of a variable backfocus. The secondary's optimum position can be entered in (23) and can be fast achieved with click on (10).

## 11 Deletes the selected focus position from the list

A position name, which is no longer required, can be removed from the combo box list by selecting it and then pressing the delete button (11). The position name and its corresponding position value as well as the temperature value are deleted.

## 12 Stores the entered focus position with its name in the list

To enter a new position, simply click the input field of the combo box (1) and give it the preferred name. Or overwrite the last visible position name. Click the save button (12) and the position name with the current focus position as well as the ambient temperature will be stored.

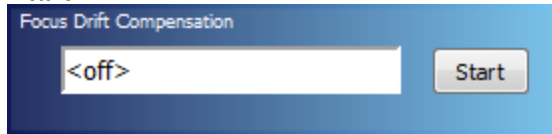
## 13 Starts or stops the automatic focus drift compensation (FDC)

To start or stop the automatic focus drift compensation use this button. Different functions are not selectable while FDC is working.

## 14 Scrolling display of the current FDC information

Current FDC informations are shown in the scrolling text field (14).

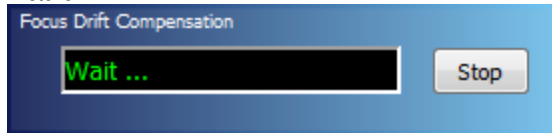
Picture 1



(Picture 1)

In the deactivated state, the scrolling text is also not active and the field is shown in white with the status **<off>**.

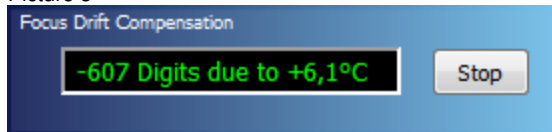
Picture 2



(Picture 2)

When FDC is activated with the button (13), the field colour changes to black and the required temperature datas are gathered. This process can take up to 5 seconds and is displayed with the status **Wait ...** If the selected focuser position has not yet been approached with GoTo (8), then it is also done during the phase **Wait ...**

Picture 3



(Picture 3)

If FDC is ready, the following informations scroll over the display:

Example: **ST-2000XM with AO7 (20,5°C) -607 Digits due to +6,1°C**

**ST-2000XM with AO7** represents the loaded position name, which was once stored at **(20,5°C)** ambient temperature. If **no** position name is loaded, the current focuser position and the current ambient temperature are valid. In this case the information line would look as follows: **<new> (18,7°C)** Here the temperature value is only hypothetical. After these information points some space is left, after which the number of corrected digits in plus or minus is shown, because of the temperature change since the start of FDC.

**Example Focuser position not loaded: <new> (18,7°C) +410 Digits due to -4,1°C**

FDC was started at 18.7°C ambient temperature. In SETUP of FDC, an increase (INC) of the focuser position was adjusted with direction button (11) at decreasing ambient temperature and a temperature coefficient of 100 digits per 1°C preset in the input field (12). This illustrates the display **+410 Digits** (positive sign). If direction button (11) would be adjusted to a reduction (DEC) of the focuser position at decreasing ambient temperature, the number of the digits would have a negative sign **as -410 Digits**. This adjustment value comes from the changed ambient temperature since FDC start, which is shown with **due to -4,1°C**. In this example the ambient temperature of 18.7°C decreased by 4.1°C since the start of FDC. A look into the climate mode would confirm that the current ambient temperature is 14.6°C. The initial position of the correction is always the focuser position valid at the start of FDC in display (7). If at the start of FDC the focuser would have been e.g 10000 digits, after the correction the counter would be at 10410 digits in the case of (INC) or 9590 digits in the case of (DEC).

**Example Focuser position loaded: ST-2000XM with AO7 (20,5°C) -607 Digits due to +6,1°C**

The position name **ST-2000XM with AO7** is loaded which was stored at **(20,5°C)**. In SETUP of FDC, an increase (INC) of the focuser position was adjusted with direction button (11) at decreasing ambient temperature and a temperature coefficient of 100 digits per 1°C preset in the input field (12). This adjustment value is because of the temperature difference between the positions own value and the current ambient temperature of 20.5°C. This illustrates the display **-607 Digits** (negative sign). **due to +6,1°C**, with a positive sign, is shown on the display as the current ambient temperature is higher than the positions own temperature. If during an observation night the ambient temperature falls below the positions own temperature, the sign changes from plus to minus and negative values are shown. The same is valid for the described example of adjustment value **-607 Digits**, only inversely. If in this case the focuser position (without FDC) would be e.g. 10000 Digits, after the correction it would be 9393 Digits. As in the above-mentioned example the FDC setup direction button (11) is set on increase (INC), the focuser position would increase during the cooling stage. It would reach again e.g. the value of 10000 Digits if the ambient temperature would sink 6.1°C, would be 0.0°C.

### Informations to FDC

Most probably you know also the problem of re-focussing during an observation or photographic night. This can become a genuine handicap, depending on the model of the telescope and the used materials, especially in the case of astro photography.

TCS eliminates this problem completely with the function "automatic focus drift compensation" abbreviated FDC. For this purpose, you need to determine experimentally only once the effective adjustment value (in digits per 1°C) and the correction direction (intra focal or extra focal) of your telescope and enter this information into the TCS "settings".

### How can you determine the temperature coefficient precisely ?

This study should be carried out in a night in which high cooling is expected. A cold winter night is certainly suitable. Before starting this experiment, however the telescopes main mirror should be tempered, to avoid falsification of the measurement results. A look onto the TCS temperature monitor gives you the certainty over it. Now focus your telescope with connected CCD-camera onto a bright star. Try to achieve the maximum focus. Write down the counter reading of the focuser display (7) in digits and the current ambient temperature in °C. You should now try to achieve a high cooling of the telescope equipment. Try to achieve as high temperature difference between the initial and the final focusing, even when it takes some hours. The higher the temperature difference the more precise the calculated temperature coefficient will be.

If the ambient temperature, since the beginning of the measurement has cooled down, by around 5°C, this is a good value for the calculation of a useful temperature coefficient. Ensure that you do not change the focuses of the telescope from the beginning till the end of the measurement and only use whole degree Centigrade for the calculations. e.g. If you began at 12.7°C, you should do the end focusing not at 7.3°C but at 7.7°C.

We stay with this example. At the beginning of your measurement, the ambient temperature was 12.7°C and your focus counter reading was 15350 digits. The ambient temperature now, after some hours of waiting, has decreased to 7.7°C, therefore, is 5 degrees lower. Focus now, as in the beginning, at the same star. Until you have achieved the maximum focus. The focuser position is now at 15980 digits. Now it is increased by 630 digits. Divide the 630 digits focuses drift by 5 degrees Centigrade of cooling. The result of 126 digits per 1 °C is the calculated temperature coefficient.

**By this experiment you found out how much the temperature coefficient is and in which direction the correction has to take place. According to our example you should enter the value 126 in the input field (25) of TCS "Settings" and turn the toggle button (26) to INC (increase), because the focus position increased by 630 digits while cooling.**

### Always the perfect focus with FDC

If you store a focus position with its own name, then it will become invisible for you that the ambient temperature has also been stored at the time. This has the advantage that the focus position of a lukewarm summer night is also exact in the case of winter with -10°C.

FDC calculates with the current ambient temperature and the available reference data, the amount of the required correction and carries it out automatically after the required intervals. Even if you have not stored any focus positions, you can start a long photographic series, provided that the FDC is activated.

## 15 ASCOM Client

The ASCOM-Client-display shows the focuser commands of the integrated ASCOM-interface. To this, the ASCOM focuser driver must be installed. If FDC is not activated, the receive state of the ASCOM interface is permanently available.

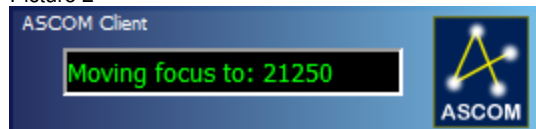
Picture 1



(Picture 1)

In the deactivated state the display field is also not active and the field is shown in white with the status `<off>`.

Picture 2



(Picture 2)

The normally color of the display is black and the ASCOM commands are shown, such as `Moving focus to: 21250`

## 16 Focuser type select box

With this popup menu you can select the desired Focuser type. Usually the select box is not available because the Focuser type is preselected (depending on the telescope type).

## 17 Checkbox „Auto initialization at start“

At marking this check box, a reference run of the secondary focuser immediately will be done at start of TCS. This function serves to take your telescope to a defined focal status after switching on.

## 18 Direction of rotation button for the servo motor

With this button you can select the direction of rotation of the servo motor. The button is enabled if the „Eyepiece-Focuser“ is selected.

## 19 Entry-Box for setting a mechanical backlash value

In this entry-box you can enter a compensation value for a mechanical backlash on the focuser. Values between 0 and 1000 digits are accepted. The entered compensation value will always be taken into account by the focuser (adjusts automatically). The progress bar (5) displays the backlash way in a darker colour.

## 20 Entry-Box for servo motor power at positioning

The power of the servo motor is here predefined on the value 2 and should be sufficient for the most requirements. If required, the servo power can be changed in the range of values between 1 to 5 in this entry field. **NOTE:** If you should determine that the servo motor cannot reach the desired final position per GoTo, FDC, AutoFocus or also by manual positioning with the use of the direction keys (4) and (6) with a very slow focus speed (3), then cancel the positioning procedure with ESC and increase the power value by one level.

## 21 Entry-Box for setting a focus position without mechanical movement

Here you can assign a new value to the focuser without it moving mechanically. This function is useful for determining the exact focuser range. For example you can move the focuser slowly to the lower or upper limit of its traversing range, and assign 0 or another value.

## 22 Entry-Box for focuser range

In this entry-box you can define the focuser range for Eyepiece focusers. The range can be from 1 to 999999 digits.

## 23 Entry-Box for optical correct position of the secondary mirror

In this entry-box the optical correct position of an RC-telescope can be defined. Therefore the entry-box is only available with the focuser type „Secondary-Focuser“.

## 24 Entry-Box for FDC correction interval

In this entry-box you can change the interval of a FDC correction. Predefined are 30 seconds, that means the focuser position is corrected automatically every 30 seconds provided a correction is required. If the ambient temperature remained stable since the last correction, the focus position also remains unchanged. If the cooling down procedure of the telescope goes very slowly, it's possible a correction will be necessary only after 10 to 20 minutes, although a short interval of e.g. 10 seconds is defined. If you transport a room warm telescope outside into a cold winter night, the cooling down is substantially more serious. In this case, if the interval was defined to 10 seconds, possibly every correction interval will be used.

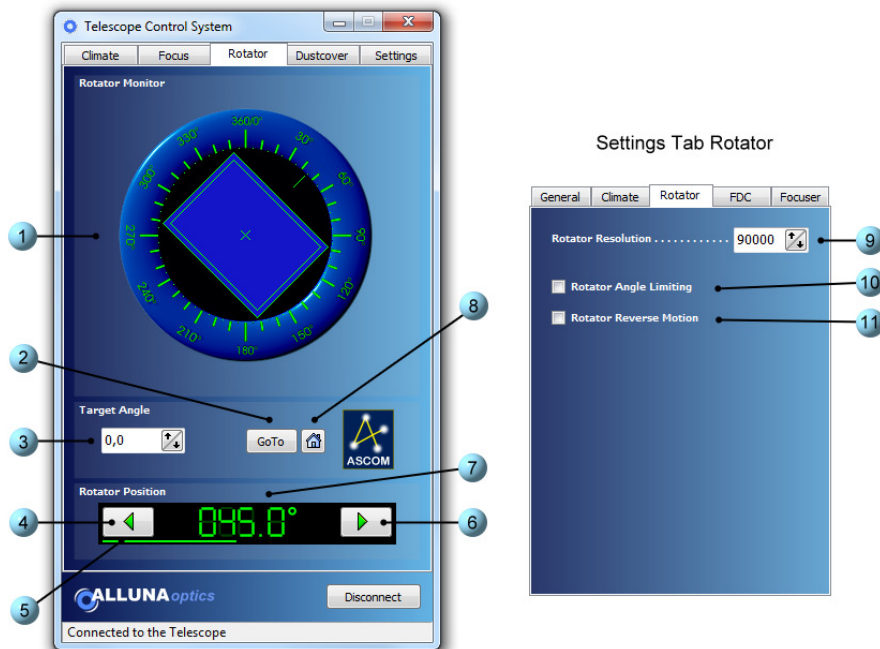
## 25 Entry-Box for FDC temperature coefficient

The temperature coefficient in Digits/C° can be set in this entry-box. Predefined is the value 100, that means if the ambient temperature falls around 1°C, the focus will be corrected around 100 Digits. The size of the temperature coefficient is dependent on the design of the telescope and his materials used and therefore must be determined experimentally.

## 26 Direction-Button for FDC focus correction

With this toggle switch you define the direction in which FDC has to correct the focus. In position (INC) the focus will increase and in (DEC) the focus will decrease.

# Funktionsbeschreibung Rotator



## 1 Rotator Monitor

Der Rotator-Monitor stellt eine virtuelle CCD-Kamera dar. Er repräsentiert immer den aktuellen Stellungswinkel des CCD-Rotators. Verändern Sie die Winkelposition mit den Pfeiltasten **4** und **6** oder per GoTo mit dem Schalter **2**, dann dreht sich das Rechteck (CCD-Chip) im Rotator-Monitor simultan mit. Die Skalen-Linie oberhalb des CCD-Chips zeigt dabei den aktuellen Winkel an der äußeren Kreisskala an. Zwei Skalen-Linien an den Breitseiten des CCD-Chips signalisieren die Position der Winkelbegrenzung, sofern diese unter Settings aktiviert wurde. Sie drehen sich **nicht** mit dem CCD-Chip mit sondern bleiben fix an der Position, an der die Winkelbegrenzung Eingeschalten wurde. Eine realistische Winkelanzeige des Rotator-Monitors ist nur möglich, wenn die befestigte CCD-Kamera im gleichen Winkel steht, also mit dem Rotator-Monitor synchronisiert ist. Sie sollten deshalb bei der Inbetriebnahme des CCD-Rotators zu aller erst einen Referenzlauf mit dem Schalter „Home“ **8** vornehmen und dann Ihre CCD-Kamera im angezeigten Winkel (Landscape) festklemmen.

## 2 GoTo Positionierung

Mit dem Schalter **2** starten Sie die automatische Winkelpositionierung. Geben Sie dazu vorher im Eingabefeld **3** „Target-Angle“ den gewünschten Zielwinkel ein. Sofern die Drehwinkelbegrenzung nicht aktiv ist, wird immer die kürzeste Wegstrecke von der aktuellen Position zum Zielwinkel gefahren. Ist jedoch die Drehwinkelbegrenzung eingeschaltet, wird die Begrenzungslinie im Rotator-Monitor nicht überfahren sondern der längere Weg in die Gegenrichtung vorgenommen. Während der automatischen Positionierung sind alle Eingabefelder blockiert und in der Statuszeile erscheint der Hinweis: „**Please wait ... press ESC to abort traveling !**“. Sie können den Positioniervorgang jederzeit mit der ESC-Taste abbrechen. Über den Rotator-Monitor **1**, dem Positionsdisplay **7** und dem Fortschrittsbalken **5** kann dabei der Positionierungs-Fortschritt abgelesen werden. Die Drehgeschwindigkeit des Rotators ist während einer GoTo Positionierung unterschiedlich schnell und von der zu überbrückenden Distanz abhängig. Bei sehr kurzen Distanzen ist es nicht ungewöhnlich dass eine Verzögerung am CCD-Rotator auftritt.

## 3 Eingabefeld für Zielwinkel (Target Angle)

Geben Sie hier den Zielwinkel für die GoTo-Positionierung ein. Mit den Pfeiltasten des Eingabefeldes können Sie den Zielwinkel in der Schrittweite 0,1 Winkelgrad verändern.

## 4 Pfeiltaste links (manuelle Winkeleinstellung)

Durch Klick auf den Schalter **4** drehen Sie den CCD-Rotator manuell nach links, also gegen den Uhrzeigersinn (sofern unter Settings kein Reverse-Modus aktiviert ist). Der virtuelle CCD-Chip im Rotator-Monitor dreht sich dabei simultan mit. Ohne aktivierte Winkelbegrenzung kann der Rotator endlos gedreht werden. Mit aktivierter Winkelbegrenzung lässt sich der Rotator hingegen nur bis zur blinkenden Begrenzungslinie drehen. Das entspricht 270° Winkelgrad.

## 5 Fortschrittsbalken während der GoTo Positionierung

Der Fortschrittsbalken wird immer während einer GoTo-Positionierung eingeblendet.

## 6 Pfeiltaste rechts (manuelle Winkeleinstellung)

Durch Klick auf den Schalter **6** drehen Sie den CCD-Rotator manuell nach rechts, also im Uhrzeigersinn (sofern unter Settings kein Reverse-Modus aktiviert ist). Der virtuelle CCD-Chip im Rotator-Monitor dreht sich dabei simultan mit. Ohne aktivierte Winkelbegrenzung kann der Rotator endlos gedreht werden. Mit aktivierter Winkelbegrenzung lässt sich der Rotator hingegen nur bis zur blinkenden Begrenzungslinie drehen. Das entspricht 270° Winkelgrad.

## 7 Positionsdisplay

Die aktuelle Winkelposition des CCD-Rotators wird neben dem Rotator-Monitor **1** auch über das Positionsdisplay **7** angezeigt.

## 8 Home Schalter für Referenzposition

Bei der Inbetriebnahme des CCD-Rotators sollten Sie zu aller erst die Referenzposition ermitteln. Klicken Sie auf den Schalter **8** um einen „Homerun“ zu starten. Währenddessen erlischt der Rotator-Monitor **1** und im Positionsdisplay **7** wird ein laufender Balken angezeigt. Wie in der Statuszeile mit dem Hinweis „Homerun ... please wait (press ESC to abort)“ signalisiert, kann der Referenzlauf jederzeit mit der ESC-Taste abgebrochen werden. Da **TCS** immer den aktuellen Rotator-Winkel gespeichert hat, ist ein Referenzlauf prinzipiell nur bei der Erst-Inbetriebnahme des CCD-Rotators erforderlich. Jeder weitere Referenzlauf kann aber im Laufe von vielen Betriebsstunden dem Erhalt der maximalen Positioniergenauigkeit dienen.

## 9 Eingabefeld für die Auflösung des CCD-Rotators

Geben Sie in diesem Eingabefeld die Anzahl an Digits ein, die Ihr CCD-Rotator bei exakt einer vollen 360°-Umdrehung erzeugt. Überschreiben Sie den Defaultwert 90000 mit dem tatsächlichen Wert, den Sie bitte den Unterlagen des CCD-Rotators entnehmen.

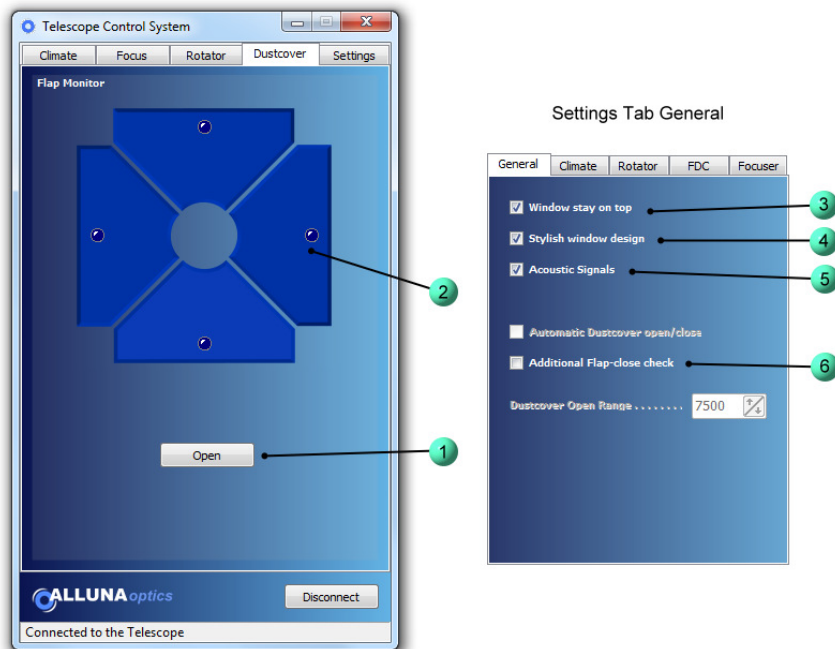
## 10 Drehwinkelbegrenzung

Um das Verdrehen der Kamerakabel zu verhindern, kann mit dieser Checkbox die Drehwinkelbegrenzung aktiviert werden. Sie können die Drehwinkelbegrenzung in jeder gewünschten Rotator-Stellung einschalten. Zwei Begrenzungslinien innerhalb des Rotator-Monitors (welche sich nicht mitdrehen) zeigen an, dass nun der CCD-Rotator in jede Richtung nur noch um 270° Winkelgrad rotieren kann. Wird der CCD-Rotator manuell über die Pfeiltasten oder per GoTo in Bewegung gesetzt, blinkt die relevante Begrenzungslinie solange bis der CCD-Rotator wieder zum Stehen kommt. Ein Überfahren der blinkenden Begrenzungslinie ist dabei nicht möglich. Die Restriktion der Drehwinkelbegrenzung gilt auch für das Anfahren der Referenzposition.

## 11 Reverse Drehrichtung

Bei bestimmten Teleskopmodellen kann es aufgrund einer Seitenverkehrtheit des Bildfeldes sinnvoll sein, den CCD-Rotator Reverse zu drehen. Mit dieser Checkbox kann dieser Modus aktiviert werden. Der Rotator-Monitor zeigt dabei keine Drehrichtungsumkehr.

# Funktionsbeschreibung Dustcover



## 1 Öffnen / Schließen – Schalter für Staubschutzklappen

Mit diesem Schalter öffnen und schließen Sie die 4 Staubschutzklappen am Teleskop.

## 2 Klappen-LED als Statusanzeige

Während des öffnens oder schließens wird immer ein Klappenpaar (Rechts/Links) und (Oben/Unten) motorisch bewegt. Simultan dazu zeigt die Klappen-LED den aktuellen Status an. Dunkel = Klappen sind geschlossen, Grün blinkend = Klappen sind in Bewegung, Grün Dauerlicht = Klappen sind geöffnet.

## 3 Checkbox „Window stay on top“

Durch die Markierung dieser Checkbox bleibt das TCS Programmfenster immer im Vordergrund.

## 4 Checkbox „Stylish Window Design“

Schalten Sie mit dieser Checkbox zwischen Black-Design und Blue-Design um.

## 5 Checkbox „Acoustic Signals“

Durch die Markierung dieser Checkbox schalten Sie die akustischen Signale ein.

## 6 Checkbox „Additional Flap-close check“

Durch das Markieren dieser Checkbox wird vor dem Öffnen der Staubschutzklappen immer zuerst auf „Flap-Close“ geprüft. Dazu bewegen sich die Staubschutzklappen kurz in Richtung schließen, bis alle vier Positionsmelder (Inis) signalisieren, dass alle Staubschutzklappen tatsächlich geschlossen sind.