

Manual

80 cm Telescope

Camera STL 1001E

Spectrograph



Emergency Phone Numbers

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General Rule: No observations if rain is announced!

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1 StartUp-Procedure

- Deactivate dehumidifier (set to position 7).
- Wipe once around underneath the rubber seal outside the dome with the plastic scraper and cloth (prepositioned on the desk).
- Main switch telescope, dome, and cameras on.
- Turn the dome around once (360°) manually with the hand control and make sure to cross the zero point (red and blue mark above the door).
- Switch on screens.
- Check the task manager of the telescope computer for *Astrooptik Server* processes, these have to be killed.

Warning: Never start *AutoSlew* again directly after closing! Always check the task manager first for remaining *Astrooptik Server* processes which have to be killed first.

- Start *TheSky*, *MaximDL*, and *AutoSlew*.
- Check whether the *altitude* in *AutoSlew* is $\approx 90^\circ$.
- Check the synchronisation of the observation computer in the log-file of *Automacron*
- Open dome.
AutoSlew: Dome – Settings – Open Dome
- Switch on *AutoSlew: Control – Com-Ports* ACL/Sky, Handbox, and Environment.
- Establish the link with the telescope in *TheSky*.
TheSky: Telescope – Link – Establish
- Open mirror cover.
AutoSlew: Telescope – Open Mirrorcover
- Select left or right focus (turnable third mirror).
AutoSlew: Telescope – Left Focus

2 Operation at Observations

- Start observation (the limit for the altitude is $\approx 20^\circ$):
 - Select the object: *AutoSlew: Galaxy symbol*, either select the object from a catalogue or enter the coordinates. Be careful with negative declinations: Enter the positive value and select south (*Süd*). When using the catalogue, make sure to close and reopen the catalogue window to select a new object.
 - or: Select object and slew to it in *TheSky*.
- Focusing: (*AutoSlew: Focus – Slew*) make sure that the focus is between -450 and 450 and do not exceed this range. Rough estimates for the approximate focus location are given in the focus menu.
- Hand Control:
 - To activate and change the slewing velocity, press the button on the left side of the box continuously and select the velocity with the *declination buttons*.
 - To select the focus velocity, press the button on the left side of the box continuously and select the velocity with the *focus buttons*.
 - To place an object in the center of an image taken with the STL 1001E camera, the hand control can be positioned like shown in the picture below (s Fig. 1). The up and down buttons then move the object up and down. The left and right buttons move the object in the reverse direction.

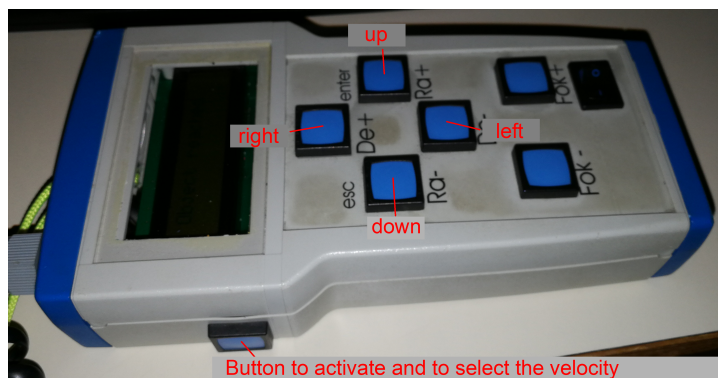


Figure 1: Illustration showing how to position the hand control of the telescope to move objects on an image.

- To control the CCD cameras, please use the check lists below.
- **Emergency-Stop:**
 1. *Stop Motors* in *AutoSlew* (*Start Motors* starts the motors again; the tracking might possibly be restarted).

2. If that does not work: Use the emergency-stop button on the left/right side of the telescope.
3. If that does not work: Use the Emergency-stop button at the fuse box of the telescope.

3 ShutDown-Procedure

If it starts to rain: Close the dome first!

- Slew the telescope to parking position
AutoSlew: House #1 – Slew (green arrow)
The notification that the slewing might be inaccurate appears. This can be ignored and *continued*.
- Terminate the link between *TheSky* and the telescope.
TheSky: Telescope – Link – Terminate
- Close the mirror cover.
AutoSlew: Telescope – Close Mirrorcover
- Close dome.
AutoSlew: Dome – Settings – Close Dome
- Deactivate the dome by clicking on the green dome symbol in *AutoSlew*.
- Close *AutoSlew* and check the task manager for *Astrooptik Server* processes. If there are some, terminate them.
Warning: Never start *AutoSlew* again directly after closing! Always check the task manager first for *Astrooptik Server* processes which have to be killed first.
- Close *TheSky* and *MaximDL*.
- Write an observation log (in *Firefox*; Report on Who, When, What).
Link to the observation logs:
<http://astro.uni-tuebingen.de/internals/telescope80cm>
- Switch off screens.
- Switch off cameras, dome, telescope.
- Tidy up in the dome (manual, ladder, notes, oculars, chairs, ...).
- Activate dehumidifier (set to position 3).
- Switch off the light and lock the door.

4 Problem solving

Basically: If you are not sure how to deal with a problem, contact L. Löbbling or H. Lenhart and do not meddle with the telescope!

Both telephone numbers can be found on the cover page of the manual.

- *Dome or the hatch do not open automatically:*
open manually with the hand control. If that does not work, switch off the dome completely, wait a bit, and try again.
- *The dome makes a loud, continuous noise at Start-Up:*
The dome cannot turn because the rubber seal adheres to the static part. Wipe once around underneath the rubber seal outside the dome with the prepositioned plastic scraper and cloth. Otherwise: Switch off the dome and wait a bit. Then switch on the dome again and turn the azimuth with the hand control.
- *Only one side of the mirror cover opens:*
Close again and try again to open the mirror cover. If again only one side opens, contact H. Lenhart or L. Löbbling.
- *At starting AutoSlew, the altitude differs significantly from 90°:*
Disconnect dome with the green dome symbol, close *AutoSlew*, and check the task manager for *Astrooptik Server* processes. Kill them if there are some. If the problem persists, call L. Löbbling (possibly a *HomeFind* can solve the problem; it may be also possible that the Heidenahin encoders have to be re-calibrated).
- *When starting the hand control, the right ascension were pressed instead of the declination buttons:*
Switch off and on the hand control.
- *The telescope cannot be moved with the hand control:*
Possibly, only a small velocity is selected; check whether the ComPort for the hand control is activated; switch off and on the hand control (contact L. Löbbling).
- *Dome does not look into the same direction like the telescope:*
Disconnect the dome (green dome symbol in *AutoSlew*, turn the dome manually across the zero point (red and blue marks above the door), activate dome again in *AutoSlew* (dome symbol). Wait until the dome recognizes the position of the telescope or redo the procedure. If the problem persists, the dome can be turned manually for short time observations (contact L. Löbbling).

- *Dome does not stop moving:*
Possibly, selecting a different telescope position with lower altitude is enough. If not: Disconnect dome (green dome symbol) and switch off dome. Wait at least 10 s and switch on dome again. Turn the dome manually across the zero point (red and blue marks above the door) and activate the dome in *AutoSlew* (dome symbol).
- *Nothing is visible:*
Open the mirror cover, check the position of the dome, select the correct focus side. Maybe there are clouds.
- *The selected object is not positioned in the middle of the image but, e.g., in lower left corner:*
The telescope needs to be recalibrated and synchronized. Maybe a simple *sync* or a *HomeFind* (house symbol with connection) in *AutoSlew* is enough. Possibly the Heidenhain encoders have to be recalibrated. Contact L. Löbling.
Warning: When synchronizing (with *sync*) telescope and object position, check whether *AutoSlew* has the right object position. This may not be the case if the object was selected from *TheSky*.
- *Telescope and object position differ significantly:*
Check date and time of the telescope computer. They may be wrong.
- *Telescope reached altitude limit and the hour axis is disabled:*
Slew the telescope manually higher declination until the altitude is green again in *AutoSlew*, then catch up with the hour axis.
- *Telescope needed to be stopped with the emergency-stop and is blocked now:*
call L. Löbling.
- *Telescope does not find the correct parking position:*
The telescope needs to be re-calibrated and synchronized. Slew the telescope with the hand control roughly to the correct parking position. Do a *HomeFind* (house symbol with connection).
- *The dome cannot be closed via AutoSlew:*
Close dome and hatch with the hand control. In the case of a power outage, the dome can be closed manually with a crank. Call H. Lenhart or L. Löbling.
- *Spectrograph camera SX H916 USB is not detected by MaximDL:*
Check whether the camera is connected to power and do not finger the cables underneath the desk. Disconnect and re-connect the USB cable with the computer.

5 Handling of the CCD-Camera STL 1001E

- Switch on camera
- Start MaximDL
- Open camera menu via button *Toggle CCD Control*
- Select camera in *Setup* (*Main CCD Camera – SBIG Universal* or *Main CCD Camera – HX H916 USB*, respectively) and the according filter wheel. (*Filterwheel – SBIG Universal* or *None*, respectively)
- Continue in *Setup*: First *Connect* and then *Cooler On*. Check after some time whether the selected temperature can be reached with 85% of the cooling power. If not, adapt the temperature.
- Select the exposure time and binning in *Focus*, activate *Continuous* and *Dark*.
- Position the object well and make sure that enough calibration stars are available for relative photometry. Optimize the focus of the telescope (without binning).
- For single exposures:
 - Select subframe (if necessary) and binning in *Settings*, activate *Simple Auto Dark*.
 - Select exposure time and filter in *Expose* and start the exposure. Save the image after exposure.
- For an exposure series (LRGB color image or photometry)
 - Select subframe (if necessary) and binning in *Settings*. Deactivate *Simple Auto Dark* and activate *None*.
 - Select a file name containing all important information in *Sequence*, e.g., `Object_binning_noRed_exptime_filter`
 - Do settings under *Options – Setup Sequence* and *Options – Destination Path*. Start the exposure series.
 - Do not forget to take darks with the according exposure times and flats as well.
- if the images shall be saved in jpeg format, respect the warning and activate *Autostretch*.
- In the end: Select *Cooler Off* in *Setup* and then *Disconnect* and close MaximDL.

6 Handling of the Spectrograph

- Mount the spectrograph to the left focus of the telescope (seen from behind the telescope facing the door).
- Plug power supply of the HX916 camera to the multi-way connector and connect the camera with the computer via the USB cable.
- Select the camera HX916 without filter wheel in MaximDL.
- Switch on the calibration lamps and leave them on until the end of observing. Please do not switch them on and off several times. Neon: red spectral region. Mercury: green and blue region.
- optical spectral range: Grid position 15 (red) to 11 (blue).
- Remove the blue filter from the light path. It is opaque below 5199 \AA and must be used for observations beyond 7500 \AA to avoid contamination of the first order with the second one.
- Connect light guide of the calibration lamps.
- Take a test spectrum and focus at the focus objective (turn only a little bit)
- Suppress the light of the calibration lamps after 5 s (Hg) and 15 s (Ne), respectively, with the aperture plate.
- Move the star to the middle slit and do the exposure.
- Be careful: If the spectrum is inclined on the image, the camera has to be rotated accordingly.

7 Short Manual: Photometry with TRIPP

Short manual for the analysis of photometry campaigns. A detailed manual for the program package TRIPP can be found here:

<https://www2.mps.mpg.de/homes/schuh/tripp/>

For the analysis of light curves, the program CAFE can be used in addition. Please see the manual and FAQ of CAFE.

The images need to end on .fits and need to have exactly four numbers prior to this ending to be readable by TRIPP (e.g., RXJ1940_2x2_20s_C-0278.fits).

Fast scan

- `tripp_monitor,"RXJ1940_2x2_20s_C-0001.fits",dt=0.1`
Beginning from the first image, every 0.1 s a new image is shown. This can be used to get an overview.

Create a dark

- `tripp_write_zero_log,"Dark_20090101.log"`
- `tripp_zero,"Dark_20090101.log"`

Create a flat field

- `tripp_write_flat_log,"Flat_20090101.log"`
- `tripp_flat,"Flat_20090101.log"`

Image reduction, light curve extraction and periodogram/ power spectrum

- `tripp_write_image_log,"star_yyyymmdd.log"`
general information about the analysis, be careful:
 - *name of instrumentaion* is STL
 - the dark needs to be entered in the Zero-field and activated
 - the original Dark-field remains empty
 - *comparison star #1* has the number *#2* and so on.
- `tripp_reduction,"star_yyyymmdd.log",/mouse`
Images are positioned and arranged and corrected for dark and flat field.
- `tripp_define_mask,"star_yyyymmdd.log",/mouse`
Object and comparison/calibration stars are selected
- `tripp_extract_flux,"star_yyyymmdd.log",/silent`
Magnitudes are extracted from the images
- `tripp_calc_relflux,"star_yyyymmdd.log"`
The relative flux is calculated
- `tripp_show_relflux,"star_yyyymmdd.log"`
- `tripp_write_relflux,"star_yyyymmdd.log"`
The fluxes for different aperture sizes are written to files. The best aperture is chosen by comparing these and needs to be updated with *tripp_write_image_log*.
- `tripp_write_final,"star_yyyymmdd.log",/mouse`
The light curve is shown and can be adapted.
- `tripp_show_final,"star_yyyymmdd.log"`
The final light curve is written into a postscript file.

Analysis of the light curve obtained with TRIPP in CAFE

- data, „../yyyymmdd_reduced/yyyymmdd.fin“,dat
Read the data, all nights placed in subgroups of one group.
- modify, x=x-55308.375833,*,*,0
Substract the start time of the first exposure from all in the group.
- modify, x=x*86400,*,*,0
Convert x-axis to seconds
- modify, y=-2.5*alog10(y),*,*,0
Convert y-axis to magnitudes
- modify, y=y-mean(y),*,*,0
Variation around the mean value.
- setplot, psym=0
Select straight line as plot-symbol.
- setplot, charsize=1.5
Select symbol size, with setplot, standard IDL commands like xtitle, xtick-layout, xticklen, xticks, etc can be used.
- plot
- set, periodout=1
- set, pmin=10
minimal period
- set, pmax=10000
maximal period
- scargle
algorithm to find periods, result in the next group
- plot, data:1
- model, const+const*sin
Generate a model light curve with y-offset, amplitude, period, and phase.
- plot, data+model
- fit
Improve the model
- plotout, datei.ps[a4]
Write a postscript file.

8 Data reduction: What to do for imaging

Mean dark current

- IDL> `tripp_write_zero_log,"zero.log"`
Fill the mask, and make sure that the filenames end on four numbers and `.fit`, e.g., `bild_0001.fit`, if not, rename the files.
- IDL> `tripp_zero,"zero.log"`
Follow the instructions.

Mean Flatfield

- IDL> `tripp_write_flat_log,"flat.log"`
Fill the mask and make sure that the filenames end on four numbers and `.fit`, e.g., `bild_0001.fit`, if not, rename the files.
- IDL> `tripp_flat,"flat.log"`
Follow the instructions.

Calibration of single exposures There are several programs for the dark and flat field correction. They can be started everywhere but it is recommended to do this in the directory of the images. It is required that:

- the image file names end on `L.fit` `R.fit` `G.fit` und `B.fit` in the case of LRGB exposures.
- the image files end on `Ha.fit`, `Hb.fit`, `He.fit`, `Oiii.fit` oder `Sii.fit` for narrow band filters.

The different programs (located in `/home/teleskop/lib/idl`) are:

- `kalib.pro` for LRGB or L
- `kalib_Halpha.pro`, `kalib_Hbeta.pro`, `kalib_He.pro`, `kalib_Oiii.pro`, `kalib_Sii.pro`

They are started in IDL:

```
IDL> .r kalib
```

Follow the instructions. The prefix for corrected images is, e.g., `korr_df`, if dark and flat field correction was applied.

Combination of images The corrected images can be combined with `MaximDL`. First the corrected color images and afterwards the mean color images can be combined to a color composite.

9 Heidenhain calibration

Warning: This can only be done after consulting L. Löbling!

- Start AutoSlew
- Start HomeFind (House with connection)
- Select a star that can be identified easily in TheSky
- Center the star in the image of the camera
- Select *Telescope* menu in TheSky click *Sync*
- *AutoSlew – Mount – Set new position*
- Slew to paring position
- Close AutoSlew
- Restart AutoSlew
- Start HomeFind (House wich connection)
- Slew to the same star as before and check whether it is positioned correctly.
If not, redo the section.

10 Create a Pointing-File

Warning: This can be done only after consulting L. Löbbling!

- Start AutoSlew
- Select the button with three cross hairs and select *Start pointing file*
- enter a name
- Slew to a star using TheSky (at first the one used for Heidenhain calibration) and center it on the CCD.
- Select the button with the green check mark (*Confirm if you have centered*)
- Redo the last two steps for ≈ 15 to 20 stars.
- Click on the button with the three cross hairs and select *Stop pointing file*.
- Select *Load pointing file*
- Select *Calculate configuration*
- *Normal optimization* is sufficient
- Select *Save, Use now, use on next start*
- Name the Config-file
- Save all (floppy disk symbol)