SANXO-Scope HD User manual

Digital microscope application v5.3

SANXO

Table of Contents

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Introduction

Thank you for choosing the SANXO-Scope HD digital microscope application!

This document is a user manual to the SANXO-Scope HD digital microscope product. It will present what is included in the package and go through the features and usage of the product.

SANXO-Systems Ltd.

SANXO-Systems Ltd. is a growing technology company that provides a wide range of software and hardware solutions for machine vision, automation, robot guidance, intelligent optical sensors, protocol and functional testing and measuring systems.

Terms of use

Modifying the hardware or the software of the SANXO-Scope results in voiding all warranty. SANXO-Systems cannot be held liable for any damage or injury resulting from improper use.

Installing the system

The SANXO-Scope HD digital microscope application is modularly designed product and therefore the user has to assemble the different parts himself after shipping.

Hardware

SANXO-Scope HD product ships with the following components unless otherwise agreed and specified:

- Adjustable stand
- Heavy-duty platform
- ESD mat
- Full HD resolution monitor with HDMI-DVI cable and power supply
- Gigabyte Computer, with power supply
- Mouse, keyboard
- 5-18 MPix color camera with Ethernet/USB cable and power supply
- Tamron Megapixel lense
- Calibration card
- User manual

Software

- Operating System: Ubuntu16 64-bit
- SANXO-Scope graphical user interface

Workspace requirements

SANXO-Scope HD has the following requirements:

- Free area in shape of a square prism (base: 60x60 cm, height: 80 cm),
- One electric outlet within a distance of 1 meter from the edge of the workspace.

Assembly

Assemble the parts using the screws and bolts found in the shipped package. The correctly assembled SANXO-Scope HD should look like as below in figure 1:

Figure 1: SANXO-Scope HD E

It is advised to connect the power cable to an extension cord with a switch so that the power can be completely switched off from the system after it is turned off.

How to...

In the following chapter you will get information on the basic functions and on how to operate the SANXO-Scope HD product.

Turning the system on and off

The system is started by simply turning on the computer by pressing the power button. The PC is attached to the backside of the monitor. The computer boots up and the SANXO-Scope application launches automatically. The software is ready for normal use once the automatic camera configuration is finished and the live picture is visible on the display.

Note: *the Autofocus-liquid lens has a "boot-up" time. It needs 30-60 seconds to work properly.*

Note: *in the first few (c.a) minutes – while the whole system stands up properly - there can be lagging in the live image.*

When not in use, the system may be turned off the same way as it is turned on: by pressing the power button twice. The software exits and the computer shuts down automatically. (If it doesn't work: push once the power button and select the "Shut Down" option in the list.) Once the computer is shut down (after approximately 6 seconds) the system can be completely powered off by disconnecting the power.

Opening this help file

You can open this help file at any time by clicking on the "Open User Guide" button in the right click menu or with the Ctrl + H hotkey combination.

Zooming

By default, three zooming levels (zoom profiles) are configured for the SANXO-Scope digital microscope application. They are as follows:

- Profile 0 (full view): The entire view captured by the camera sensor is displayed on the monitor.
- Profile 1: A Full HD (1920x1080 pixel resolution) section from the camera sensor is displayed on the monitor.
- Profile 2: A 1280x720 pixel resolution section from sensor is displayed on the monitor.

Note that the image may appear resampled and/or stretched depending on the profile resolution and the aspect ratio.

Use the mouse wheel to switch between the zooming profiles: (Note that from the first and the last profile you cannot zoom out and in respectively)

- Scroll up to zoom in
- Scroll down to zoom out

Switching between profiles always attempts to put the location of the mouse pointer in the previous profile to the center of the screen in the new profile. An overlay graphic on the top right corner provides information on the current size, number and location of the zoom state. More

information on the currently used profile can be seen in the Status Info by bringing up the toolbar menu (mouse right click).

Panning

If the currently active profile only shows a section of the camera sensor's image, then the currently shown part becomes movable. This panning is used by dragging with the mouse while holding the left mouse button. Again, an overlay on the top right corner of the screen gives the user feedback on the current state of the pan: the outer rectangle represents the full camera sensor, while the inner rectangle shows the relative position of the panned view.

Saving images

The SANXO-Scope HD digital microscope application allows the user to save snapshots of the live image. (Hotkey: Ctrl+S)

The image saving functions can be accessed through the toolbar, by clicking the right mouse button. You can use the currently selected save feature by left clicking the icon. Right clicking lets you change to a different save setting:

- Image source
    - Full sensor: the image saving function saves the whole image from the sensor.
    - AOI: the displayed image – on the screen - will be saved.
- Overlay (With/Without): the image saving function saves the previously made overlay graphics with the image or not.
- HDR (With/Without): the image saving function save the High Dynamic Range image or the normal image. (See more details about the HDR below)
- .CSV export: save the measurements to a separate .csv file at the image saving

The images are saved to '/home/sanxo/Pictures' folder or to an external USB drive if one is present. Priority is on the USB drive. The image save format is uncompressed PNG and the filenames are assigned with a timestamp as follows: 'img_YYYY.MM.DD_hh.mm.ss.png'. Note that in case a USB drive was used the path will be as follows: '/media/sanxo/<name of the USB device>'.

The taken screenshots can be accessed through the file manager. Switch to windowed mode through the SANXO-Scope toolbar menu and double click on the 'home' icon on the desktop.

HDR snapshot and image freeze

By toggling the HDR button a High Dynamic Range image can be made from three snapshots using three different exposition times. The snapshot can take up to 4 seconds. The HDR image compensates the light differences in the picture. The HDR snapshot is a still image, and it will stay

visible until the HDR snapshot function is turned off. You can turn it off by clicking the icon a second time.

The HDR function has two methods: (available in the Settings/HDR menu)

- Exposure fusion: this is the default setting
- Real HDR: in some cases, it can provide better result, than the Exposure fusion

You can change the button function to Image freeze mode by right clicking the button. The image freeze mode does not use the HDR feature, but it keeps the image still. The still image will be visible until the image freeze mode is turned off by clicking the button a second time.

Calibration and distance measurement

Using the calibration feature, distance between two points displayed on the screen can be measured using either pixel units or calibrated real-world units.

Calibration

The calibration process can be performed using the calibration glass provided with the SANXO-Scope HD.

- Place the calibration glass into the camera view so that **at least** 3 whole cells cover the vertical direction from the chessboard pattern visible on the screen. You should use the side of the glass, on which the dark cells appear darker and less blue.
- You may use any zoom profile as long as the other conditions are satisfied.
- Make sure the calibration settings are correct. See 1
- Run the calibration by clicking the calibration icon in the toolbar menu (right-click menu). Overlay text on the screen will indicate the calibration progress.
- If the calibration was successful, 'Calibration complete' and the found pattern will pop up on the screen. Otherwise 'Calibration pattern not found' will pop up.
- If despite all this the calibrations are still unsuccessful, check that the calibration parameters are correct in the Settings, and read the extra suggestions found in the "Calibration tab" in the Advanced part of this guide.

Additional notes:

Make sure that the plane that the calibration card represents matches the one where distances are to be measured—the calibration is simple and does not take perspective or changes in the working distance into account.

You may have only one calibration present at a time. A new successful calibration always overwrites the old one. The calibration is preserved through application closing and system shut down.

The system should be always recalibrated if the working distance changes or if the optical characteristic such as focal length are changed. Changing between zoom profiles after calibration, however, is supported as the calibration ratio is associated with the sensor pixels, not the screen.

Overlays

Drawing overlays is done by clicking the middle mouse button (the scroll wheel). The type of overlay can be changed by right clicking on the overlay icon. You can also change the unit of distance measurements between pixels ('px') or, if a calibration is present, the chosen real-world units ('mm' by default). See images below.

The overlays can be cleared from the same menu.

The overlay functions are self-explanatory, except for the Canny circle detector. First, you have to select a rectangular area where you want to detect the circle. Then the program automatically looks for circles in the selected area, and draws the best fit. If no circles are found, a message is displayed.

Aborting the current overlay adjust task you can use the 'Esc' button. Undo the overlay elements in historical order are also possible with the 'Ctrl+Z' hotkey combination.

Overlay types

Ruler		
Code Reader		
Coordinate system		
Arrow		
Rectangle		
Freehand		
Textbox		
Angle		
Circle by 3 points		
Canny circle detector		

Code Reader

Supported barcode types:

- QR code
- Data Matrix
- Code 128 (GS1)
- Code 93
- Code 39
- Codabar
- UPC-E
- UPC-A
- UPC-EAN-Extension

- RSS-14
- RSSExpanded
- PDF417
- MaxiCode
- EAN-8
- EAN-13
- ITF
- Aztec Code

Video recording

You can record a video by pressing the "Start record" button in the right click menu. You can stop recording by clicking the same button, which will change to a "Stop" icon. The recording will be saved in the picture folder chosen in the settings. The recorded video is never saved to USB, because the encoding process is too slow for USB access.

Full screen/windowed mode

The SANXO-Scope application starts in full screen mode and is designed to be used in full screen mode using only a mouse. Accessing external features, such as browsing the screenshot folder or establishing remote support connection, require exiting the full screen mode to access the OS desktop. You may switch between the full screen and the windowed mode by clicking the window mode toggle button on the toolbar menu. The button is only visible if the "Show full screen / windowed toggle" option is enabled in the settings that can only be accessed with the admin password. (Hotkey 'F11')

Status Info

Status info is collected information displayed as a popup when hovering over the Settings toolbar button. Status info lists the following information:

- Camera sensor size (maximum resolution of the camera)
- Calibration mode (unit and ratio if calibrated value)
- Current magnification (only if calibration is enabled)

Hyperfocus image and 3D

The Hyperfocus menu can be opened with this icon. With only a few clicks, you can make a Hyperfocus image or a 3D model of the product under the camera. A Hyperfocus image means that (ideally) all parts of the image are in focus in a single image. This can be achieved by fusing multiple images of the same object together, so an alternatively it can be called a Focal Stack. Our software can create both point clouds and coloured meshes, with true to life proportions and measurable distances.
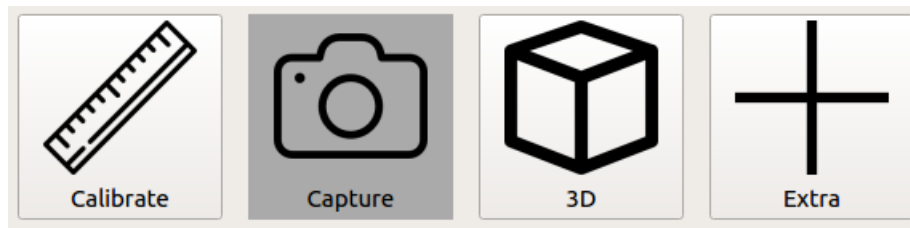

The Hyperfocus menu comprises of 3 major parts. The "Calibration" tab is where calibration of the physical setup of the SANXO-Scope, and it is a necessity for accurate results. The calibration process itself only needs to be performed once for a given physical setup. The "Capture" tab is where the Focal Stacking process takes place, and results in a viewable Hyperfocus image. The "3D" tab is where 3D meshes and point clouds can be generated from the information extracted during the Focal Stacking process.

All functionalities within the Hyperfocus menu require a working Optotune lens.

3D Calibration tab

The 3D Calibration tab serves mostly as a hub for selecting the desired calibration file for use in the later processes, and for viewing the properties of this file.
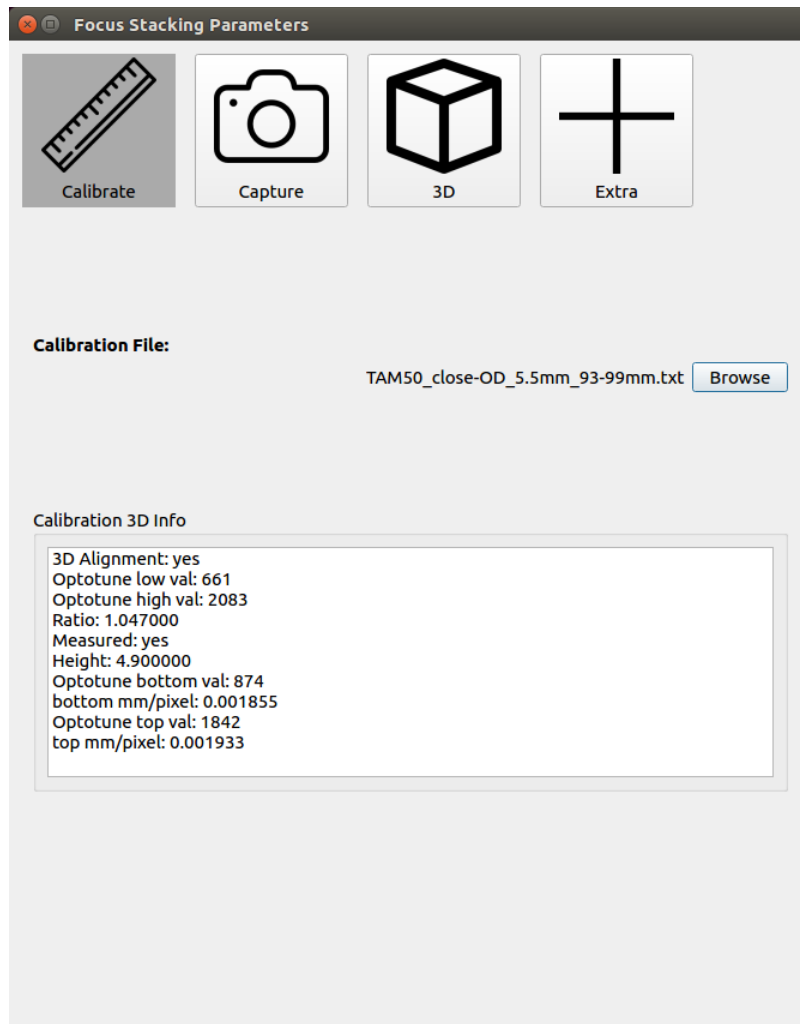
The actual 3D calibration process takes place in the Settings Menu, under the "calibration" tab.

3D Calibration

This longer and more complex form of calibration needs to be performed only when the physical setup of the SANXO-Scope device is changed (e.g. a change in the height or the focal length of the camera). This process, which consists of 4 major calibration steps, is necessary in order to achieve accurate 3D model generation, and results in a single and concise text file at the end.

The process:

Place the calibration glass under the camera. At first, place it so, that it is at a height, which is close to the **middle** of the full **height-range** you will be using later. Make sure there is a **white piece of paper** (or similar) under the glass. Rotate it, so that it is at a 90-degree angle, i.e. the corners of the screen align with the edges of the cells in the chessboard pattern.

Try including half-cells around the edges of the screen (approximately).

1. (this step is usually the hardest)

1. **Fully Close the Iris,** place glass in **middle** of height-range, and **raise** the **exposition** time of the zoom profile, so that the chessboard pattern is visible. What is important is to have clear visible internal corners alternating from black to a light color within the chessboard pattern. So try making it not too bright, otherwise the white corners start blending into the black, but also bright enough that there is enough of a difference between the dark and light colors.
2. Bring the **Optotune** focus **down** as much as possible. At certain Optotune values a light artifact can be observed in the middle. Try avoiding it, if possible, or try placing it exactly into the middle of a black or white cell.
3. Click **"Mid Min"**
4. If the values are saved and red lines can be observed on the screen, move onto step 2, otherwise try adjusting the setup (or increasing Optotune value), and try again.

2.

1. Bring Optotune focus high as possible.
2. Click **"Mid Max"**
3. If it succeeds, you can move onto step 2A or 3, otherwise try lowering Optotune value, so that the edges become sharper, or try adjusting the setup.

2A

1. If you are not interested in making any measurements, you can skip the last 3 steps, otherwise move onto step 3.
2. Make sure that the "Measured" checkbox is unticked, and click the "Generate File (Perspective) button, then select the generated file in the "Calibration" tab.

3.

1. **Open the Iris**, place calibration glass **vertically** as **low** as the lowest range you will be using during focus stacking.
2. Adjust Optotune value for **maximum sharpness**, then click "Bottom"

4.

1. Rise the calibration glass up, vertically, to the highest point you'll be using later.

2. Adjust "Height" box value, to match the difference in height between the previous and the current position.
3. Adjust Optotune for maximum sharpness, and click "Top"

5.

Make sure the "Measured" checkbox is ticked, and click "Generate File (Perspective), and select the saved calibration file in the Focus Stacking GUI panel "Calibration" tab.

Extra Tips:

To achieve the best results with the calibration, consider these suggestions:

- it is very important to place the pattern orthogonal with the rectangle of the monitor so that the edge lines on the pattern become parallel with the edges of the screen.

- at least 3 whole cells must be visible in the vertical, and 3 cells in the horizontal direction

- Adjust the exposure and the iris, so that the image is not too bright because otherwise the white cells might overpower the black ones, which results in fewer calibration successes, and reduced accuracy. Also try to not make things too dark because then the software might struggle with distinguishing the white cells from the black ones.

- try to prevent having very thin rows and columns around the edges of the screen, aim to have at least 1/4 of a cell visible on each edge

Capture tab

On this tab multiple images are taken of the same setup in rapid succession with the purpose of creating a Focal Stack, which can be viewed as a Hyperfocus Image, or transformed into 3D objects in the "3D" tab.

The HDR values listed at the top will be used during the stacking process. If you would not like to use HDR because the lighting on the object observed by the scope is sufficient on its own, then make sure to only have a single exposure value inside of the list. For example, on the image below, only one picture is taken per layer with an exposition time of 20 milliseconds, but if multiple values were present in the list, multiple pictures would be taken per layer, and then fused to make a HDR image.

Also keep in mind that the more exposure values used, the longer time the process will take. The HDR image fusion will take place in parallel with the image capturing process, but since the capturing of images is faster, the HDR times will accumulate. The HDR method used during the process is determined by the selection inside the Settings→ HDR tab, but using RealHDR is not recommended here as it takes a very long time.

The capturing process

1.

    1. Adjust the top slider so that the lowest physical point on the object to be measured is in focus (going a bit lower is allowed, and encouraged with the Robust algorithm).

    2. Adjust the bottom slider so that the highest physical point on the object to be measured is in focus (going a bit higher is allowed, and encouraged with the Robust algorithm).

2.

    1. Choose the number of resolution steps (layers) to use. With higher numbers, the precision will be better, but runtime will increase. (on a computer with 8Gb of RAM, the maximum number of usable layers without RAM overflow on a full sensor zoom profile with binning of 2 is ~90).

    2. Turning on averaging will result in a longer runtime, and possibly reduced camera noise.

    3. Choose the desired algorithm ("Sensitive Discrete" is the default)

        a) Sensitive Discrete can result in smooth surfaces if the sliders are set accurately, and is also the recommended option for pointy objects (e.g. connector pins).

        b) Robust V2 is an all-round balanced algorithm, with complex interpolating measures, and is also the recommended option for curved objects.

    4. Two methods can be chosen for image alignment, "feature points" and "calibration", but the first choice should only be used if calibration is unavailable. If the used calibration file does not contain measurement info (see "3D Calibration" section). Also make sure that a calibration file is selected is selected in the calibration tab, as otherwise the software will default to using feature point.

    5. The "Full Sensor" option at the bottom makes the camera default to a full sensor zoom profile with a binning of 2, for the sake of convenience. Running the process on different zoom profiles is possible, just make sure to untick the "Full Sensor" checkbox.

    6. Push the "Start" button, and wait for the process to finish.

    7. Afterwards, you can open the Image Viewer, where you can see the Hyperfocus image, which you can add overlays to, and/or save.

    8. Optionally move onto the 3D tab, to transform the focal stack into a 3D model.

3D tab
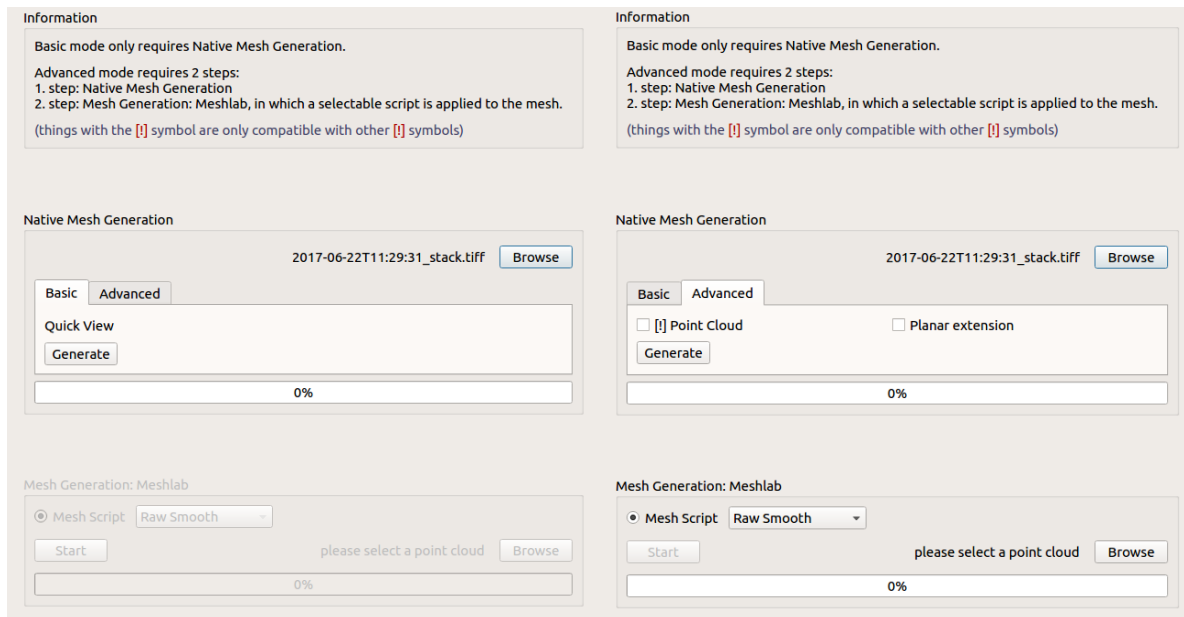
- Basic mode: This is the default mode. Unless the user selects the "Advanced" tab, our basic meshing and smoothing algorithms will run in the background, and the generated mesh will be displayed in a new window upon completion. Unless otherwise specified, the latest result of focal stacking process will be used by the algorithm.

- In Advanced mode, you have to choose the method at the bottom of the window too.
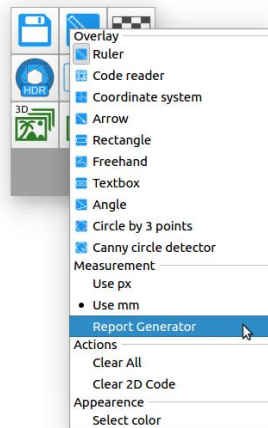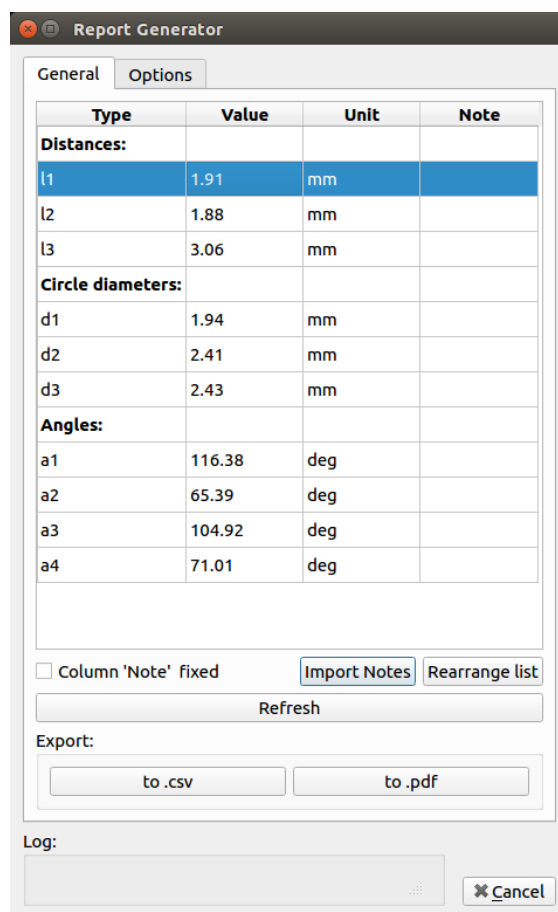
Image Viewer

With this icon, you can open the Image Viewer, where you can see the previously made Hyper-focus image. (Hotkey: Ctrl+E)

Report Generator

The report generator module is available under the Overlay local menu Measurement section.

An example of the Report Generator user interface:

Report Generator Features

Import notes:

Import notes from a previously exported .csv file. The function will work correctly only if the current measurements count is match with the imported file contents.
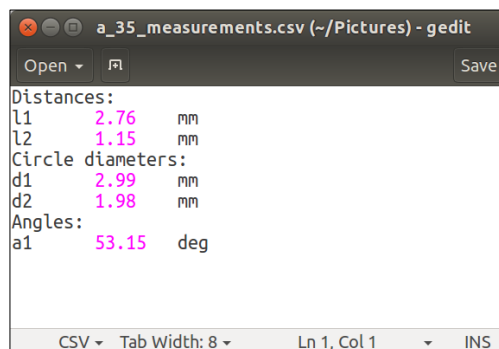
Rearrange list:

Rearrange the measurements inside the same category (e. g. Distances). It is useful if you want change the sequence of the values in order to correct the name convention which you followed earlier. If you check the 'Column Note fixed' checkbox the notes will not move with the numbers under the exchange method, they will stay in the original position.

Export:

Export to .csv file

The measurement values are separated with tab character in the exported file.

Export to .pdf file

The exported pdf file contains all of the measurements in a table and the current camera image with the overlay graphics. It includes also the name of the person who took the measurement with date and time labels.

Options tab

Operator name

The name which will be visible in the PDF file if it is filled.

Image orientation

(Landscape/Portrait) The orientation of the image in the exported PDF file.

Settings (Advanced)

The password protected advanced settings are accessible through the toolbar menu 'Settings' button.

Warning! Only change these settings if you know what you are doing. For recovering the 'factory defaults' contact SANXO support at support@sanxo.eu or info@sanxo.eu, or if 'Linux savvy', delete the config file by executing the following command from the terminal (CTRL+ALT+T) and restart the application:

```
rm /home/sanxo/.config/sanxo/sanxoscope-settings.conf
```

The password for the settings is 'admin'.

General tab
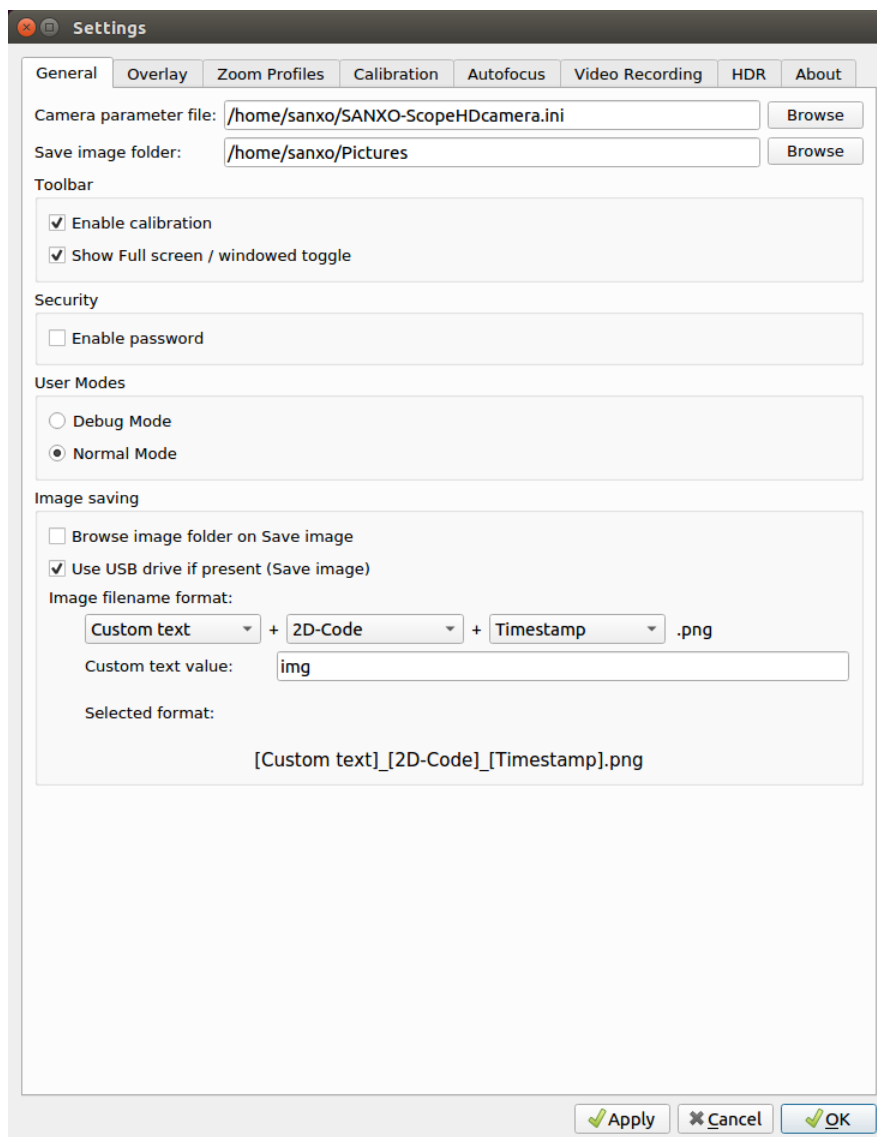
Camera parameter file

Path to the camera '.ini' parameter file. The parameter file is extremely important as the SANXO-Scope application assigns the image capture target values according to the parameters defined by this file. The important parameters include camera pixelclock, exposure, frame rate, sensor gain, auto gain, auto exposure, white balance settings etc. If you wish to change the parameters, use the uEye cockpit application to access the advanced camera settings, set the parameters and save them to a new '.ini' file, then load the new parameter file in the SANXO-Scope application.

Save image folder

The save image folder defines the local folder into which the images are saved unless a USB drive is used and present.

Toolbar buttons (enabled/disabled)

Enable/disable toolbar menu buttons.

Security

When checked, it requires a password for the advanced settings.

User Modes

In Debug mode, it displays some information about the Optotune-lens and autofocus mode.

Image saving options:

- **Browse image folder on Save image**
  When checked, a window will pop-up, where you can find the folder into which the image is saved.
- **Use USB drive if present (Save image)**
  When checked, USB storage device is used when present for image saving. Otherwise images are always saved to the local folder.
- **Image filename format**
  The customised filename may consist of 3 different element:
  - **Custom text:**
    The content of the 'Custom text value' input, defined arbitrary by the user.
  - **2D Code:**
    The latest decoded 2D code.
  - **Timestamp:**
    The actual system time in the following format: YYYY.MM.DD_hh.mm.ss
  The parts are divided by underscore character ('_').

  Note: In the case of multiple identical filename (e.g., without the Timestamp, every picture name would be the same) the software automatically start numbering the files, to avoid the file overwriting. (file_1.png, file_2.png …)

Overlay tab
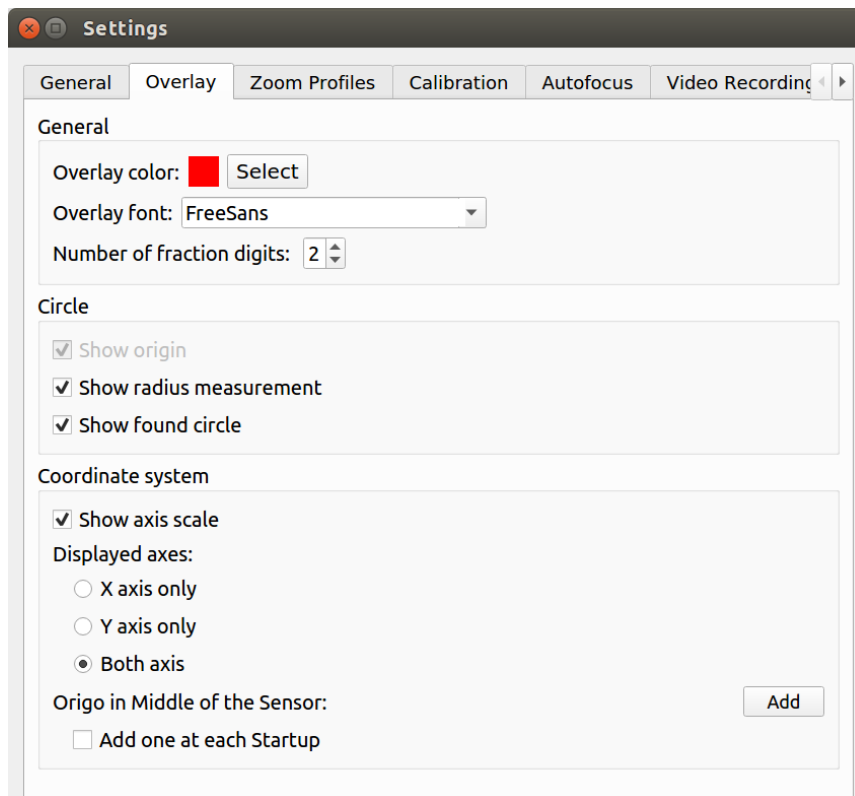
General

Here the overlay color, font and the displayed numbers' precision can be changed.

Circle

The circle overlays have two more options: show radius measurement and show found circle. These options can disable drawing the radius or the circumference of newly added circle overlays respectively.
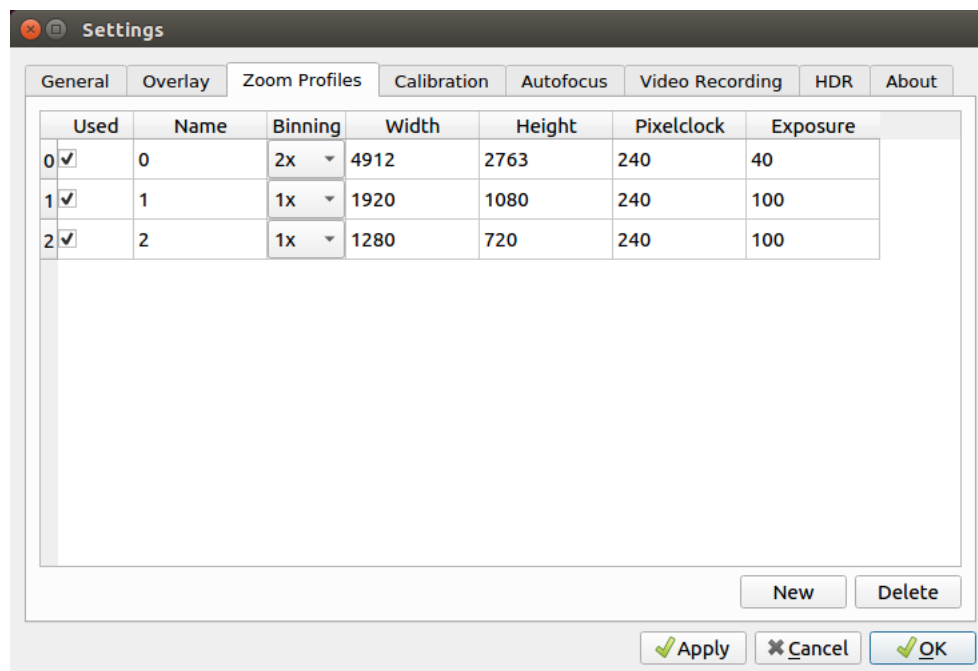
Coordinate system

Options that can be changed with the coordinate system:

- Show the numbers on the axes
- Show only the selected axis

Clicking the 'Add' button, a new coordinate system will be visible, and the origin of the new element will be the center of the camera sensor. This operation can be timed for each software start also.

Zoom Profiles tab

Configure the zoom profiles. The number of the profiles is changeable by the New and the Delete buttons.

Binning

The 10MPix uEye camera of the SANXO-Scope HD supports binning. Binning 'bins' neighbouring pixels on the sensor into one pixel increasing the light and halving the resolution (with 2x binning). It is recommended to use 2x binning if the profile camera image resolution is at least twice as big as the display resolution in both directions (e.g. the default settings for zoom profile #0). Binning can be also used to gain a lot of extra light on the expense of resolution. Currently the application compensates to the extra light gained by the binning in order to maintain equal brightness between the zoom profiles, contact support for help on how to set up a light increasing binning configuration.

Resolution

Currently, 'Custom' resolutions are recommended. Changing the values are enabled after a double click on the chosen cell. Make sure that the camera supports the given resolutions. Also, note that the binning is not to be taken into account when entering the resolution, thus defining 2x binning will result in a halved resolution of what was given.

Pixelclock

The basic parameter for camera timing is the pixel clock. It determines the speed at which the sensor cells can be read out. (given in MHz)

Exposure

The exposure time is generally understood to mean the time span for which the film of a camera sensor is actually exposed to the light so as to record a picture. (given in ms)

Calibration tab

The calibration tab functions as a hub for two separate types of calibration.

1. **2D Calibration**: Calibrations for adjusting the millimeter to pixel ratio, used for making measurements on 2D images.
2. **3D Calibration**: Calibrations necessary for a properly aligned Focus Stacking process, and calibrations with the purpose of gaining 3D measurement data for the generated 3D models.

2D Calibration:

Using our engraved calibration glass (IMT- calibration glass; $\pm$ 0.5 μm accuracy), the software can adaptively identify the chessboard pattern that is visible on screen, and perform a calibration without the need of the user inputting information about the pattern on screen.

During calibrating, consider these points:

- it is very important to place the pattern orthogonal with the rectangle of the monitor so that the edge lines on the pattern become parallel with the edges of the screen

- at least 3 whole cells must be visible in the vertical, and 3 cells in the horizontal direction

- try to prevent having very thin rows and columns around the edges of the screen, aim to have at least 1/4 of a cell visible on each edge

- If all else fails, adjust the exposure so that the image is not too bright because otherwise the white cells can overpower the black ones, which results in fewer calibration successes, and reduced accuracy. Also try to not make things too dark because then the software might struggle with distinguishing the white cells from the black ones.

Old 2D Calibration:

Our older calibration method which uses paper cards with chessboard patterns on them is still available, and its method is described in this subsection.

The newer and more accurate 2D calibration by default replaces the old one in the right-click-menu, but the older method is still accessible from the same button, except in Settings under the Calibration tab the "2D Calibration Method" dropdown list needs to be changed accordingly.
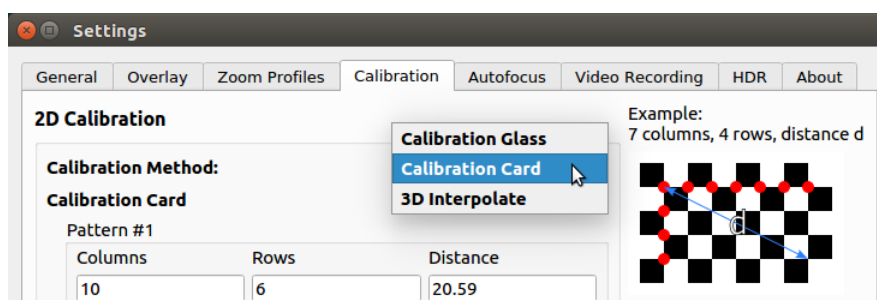
This calibration can be done with multiple distances and chessboard patterns. Use these settings to, for example, change the calibration unit, change the apparent true distance in the pattern or to use your own calibration chessboard pattern.

The values for the standard SANXO-Scope calibration card:

| Columns	Rows	Pattern size	Distance (mm)
10	6	small	5.165
10	6	big	20.59
13	8	medium	13.94
15	7	large	60.93

1. Table: Calibration values

'Columns' and 'rows' represent the number of corners between two dark squares. 'Distance' represents the true distance in units defined by 'Unit' between the first (top left) and the last (bottom right) corner. **Note that a corner is defined by a meeting point between dark squares and thus the outermost edges are excluded!** See the example image for help.

Focusing

The system provides three focusing options, which can be selected and configured in the Settings→ Autofocus tab. Autofocusing requires a USB connected Optotune lens.

Classic
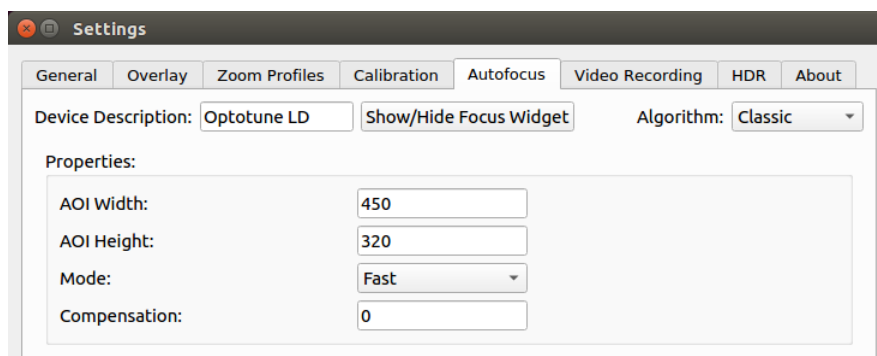
In case of this mode, the focusing is triggered by a double-click on the target image part. Fast and accurate presets are available.

Map based (outdated)

When this mode is active, the focusing requires two steps. The map creation takes place after a double-click, and it takes several seconds. After finishing, you can focus simply by hovering the mouse over the desired image part.

Continuous

In this mode the focusing algorithm tries to keep the object in the middle of the screen in focus. There are three selectable profiles.

Wide range: designed for 25mm lens on top + Optotune lens at the bottom. It provides a wide focusable range at the cost of less magnification.

Narrow range: designed for Optotune lens on top + 50mm lens at the bottom. It provides a smaller focusable range with more magnification.

Advanced: The parameters of the autofocusing algorithm can be manually selected. The parameters are discussed below. The "Reset to default" button sets the parameters to be the same as in the "Wide range" setup. The picture above shows the default values.

Minimum score: It can be set on the slider independently from the three profiles. If the algorithm gets stuck in an out-of-focus state, try increasing it. If it sweeps too often, decrease it.

SWEEP_STEP: In the sweep state the algorithm scans the whole available range $(0 - 4059)$ with this step size. Higher values mean faster operation, but less accuracy. Recommended values are between $60 - 160$.

FOLLOW_STEP: In the follow state the algorithm tries to fine-tune the focus with a medium step size. Too high values can make the program get stuck in a back-and-forth focusing motion. It should be less than half of SWEEP_STEP.

HOLD_STEP: In the hold state the algorithm tries to keep the image sharp in case of small movements. The step size should be small enough that the focusing movements are not noticeable. Recommended values: $5 - 10$.

HOLD_TO_SWEEP: It is a parameter between 0 and 1. Higher values mean that the algorithm sweeps less often.

FOLLOW_TO_HOLD: It is a parameter between 0 and 1. Higher values mean that the algorithm switches to the Hold state earlier, with less precision. If this parameter is set too high, the Follow state can get stuck in an infinite back-and-forth motion.

HOLD_COEFF: When the object is moved, the algorithm tries to follow it with an adaptive step size adjustment. The HOLD_COEFF value is the maximum allowed step size. Recommended values are between $12 - 40$.

Some useful advice for the better work:

- Before you chose continuous focus mode, it is better to press the button "d". A manual slider will appear, using that you can check if the object is within the range.

- Depending on the surface and the color of the object, you may need to change the threshold for the algorithm. This is the "Minimum score" slider in the setting window.

- If it seems the algorithm is stacked – so it does not found the focus, put your hand above the lens to block the light for a moment. This will trigger a sweep, so the algorithm will find again the focus.

Video recording
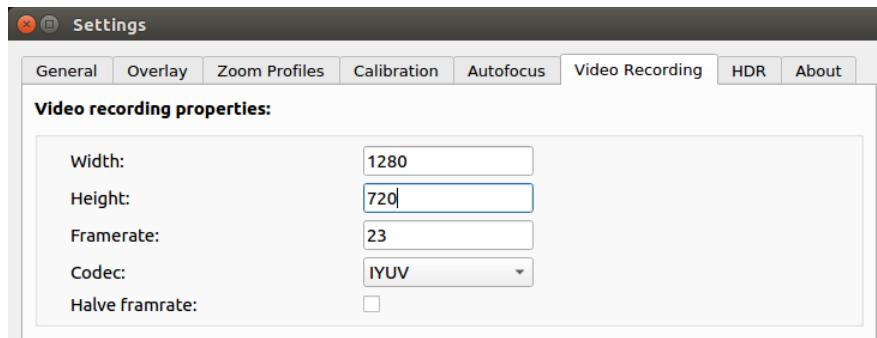
Here the video width and height and the framerate can be changed.

HDR
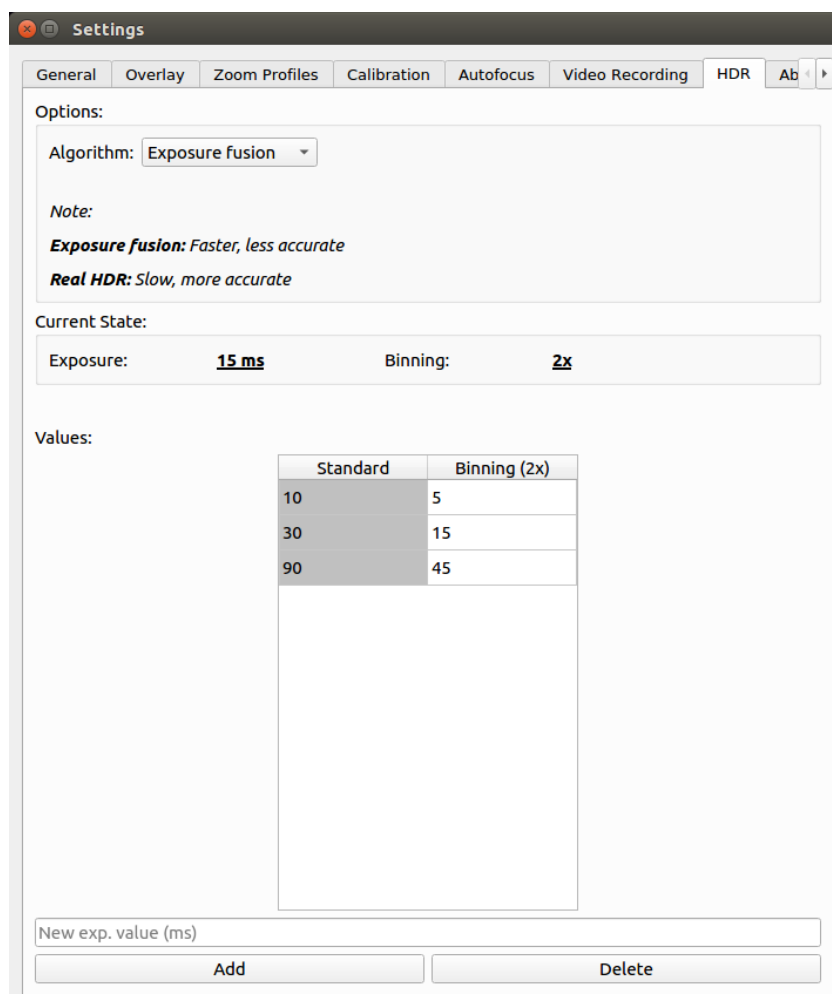
Under the algorithm option you are able to change the used method for the HDR image creation. Both algorithm uses the same exposure values which are defined below in the list. The new exp. value will be added to the column which is match with the currently used profile. (the other column of the row will be filled out automatically – the standard values are twice the binning version, since the used 2x binning feature of the camera)

Under the Current state some information is seen, helping the process to choose the appropriate exposure values.

About

You can find here some information about the camera and the Focus Lens.

Troubleshooting

Here are listed a few troubleshooting tips for the SANXO-Scope HD.

Camera connections problems

Generally pressing the "P" button the camera will restart and be initialized again.

In case of Ethernet camera (SANXO-Scope HD E) the camera connection problems may occur especially after making changes to the network settings. See the checklist below for tips for solving these problems, most of the time restarting the driver Ethernet daemon (on bold below) is what is needed (some of these require the windowed mode to access for example the network manager):

- Check that the Ethernet cable between the PC and the camera is connected.
- Check that the camera has power; you should see lights next to the camera Ethernet port to indicate this.
- Check that the 'Ethernet Internet' is not connected (move mouse to bottom right corner, click on the network manager applet with a wireless or arrows icon, if there is disconnect option below 'Ethernet Internet' then it's ON and you should click the disconnect).
- Check that the 'uEye Camera Connection' connection is connected instead (again in network manager applet: if it has disconnect below it, it's connected, otherwise click on the 'uEye Camera Connection' to connect).
- Generally pressing the "P" button the camera will be restarted and be initialized again.
- Try restarting the PC.

Command line flags

Command line flags are written after the application name when running the application from the terminal, for example:

```
/home/sanxo/SCOPE/SANXO-Scope -v
```

Command line flags can also be set in the icon properties on the linux desktop as shown on the picture below. The flags set in the icon properties will also apply when the program starts up automatically after the PC is turned on.
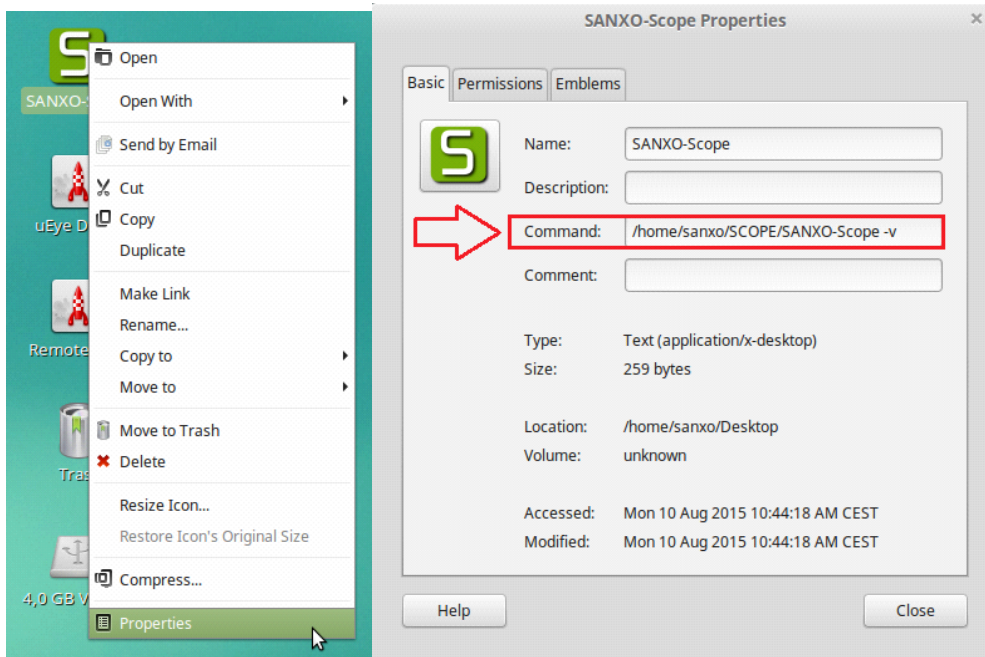
Figure 2: Command line flags usage

The flags are case sensitive, type them exactly as shown.

Keyboard Shortcuts:

F1, F2, F3	Autofocus modes (disable, classic, continuous)
F11	Fullscreen/ windowed switch
Ctrl + E	Open EditorWindow
Ctrl + F	FocusWidget show/hide
Ctrl + H	Open Manual (Help file)
Ctrl + M	Switch modes (Debug, normal)
Ctrl + S	Save image
Ctrl + Z	Undo last overlay
Esc	Abort the current overlay draw

Logging level

The SANXO-Scope creates a log file called log.txt with important information as the program runs. The log file is always growing, it is recommended to delete the file occasionally. The log file is used for troubleshooting purposes. The following options change the logging level:

Flag	Meaning
-d0	Disable debugging output
-d1	Important messages only (default)
-d2	All messages are written to the log file
-v	Same as -d2

If you encounter a bug, please send us the log file, and the steps taken to reproduce the bug, if possible.

Disable Optotune features (autofocus)

When the program starts up, it tries to connect to the port of a connected Optotune lens. This can take up to 20 seconds, and the program is not responding during this time. This can be undesirable if no Optotune lens is connected to the computer. The Optotune features can be disabled, thus speeding up the startup process using the following flag:

Flag	Meaning
-noOptotune	Disable Optotune lens features

Administration of the PC

By default, the user does not need to do any task regarding the Linux administration. In case you need to do legal action contact first SANXO (support@sanxo.eu) then after receiving our suggestion you may use the administrator password "sanxo". Using this administration right you may change the computer settings, so you can do it on your own risk.

Feedback and Suggestions

At SANXO we are continuously looking for ways to improve our services, products and documentation. Feel free to submit feedback and suggestion to us at info@sanxo.eu.

Thank you!