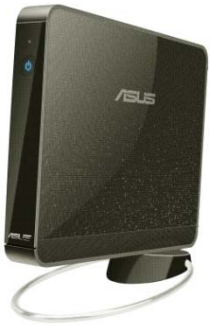
seitz
made in switzerland

roundshot
fast 360 degree panoramic equipment

Instruction Manual

Roundshot Livecam D2 HD

Software release: *4.05 (May 2013)*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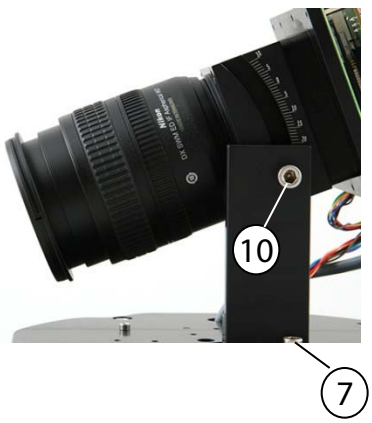
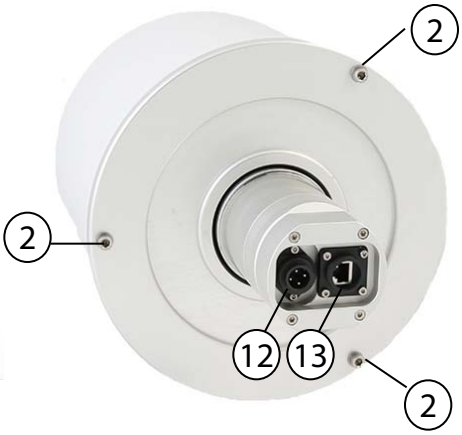
1. System Overview

1.1 Roundshot Livecam D2 HD

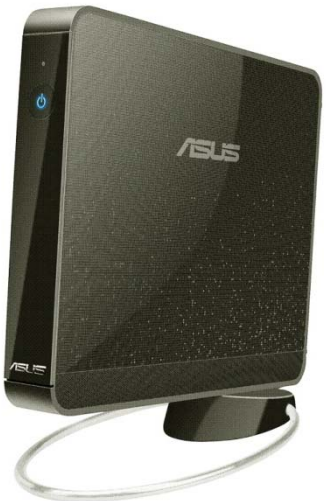




1. Waterproof cover
2. Cover screws (3)
3. Insulation ring
4. Roundshot D2 digital scan unit
5. Lens
6. Motor electronics unit
7. Camera head slide screw
8. Ventilation for front glass
9. Camera socket
10. Tilt screw
11. F-stop lever
12. Waterproof connection for power
13. Waterproof connection for ethernet

1.2 Computer

The Roundshot Livecam D2 HD software runs on Windows XP Professional, VISTA or Windows 7



For the hardware configuration of your computer we recommend the following minimum requirements:
• 160 GB hard disk
•2 GB RAM

We often use a compact computer (for example eee box small PC) for image capture and for FTP image transfer. For a worry-free operation of the website we recommend our Web-Service.

We also recommend to back up your image data on an external (removable) hard disk connected to the computer via USB 3.0.

1.3 Accessories + services

The following Roundshot Livecam D2 accessories and services are available:

Other Nikon lenses
(other than the standard 18-55mm Nikkor DX zoom lens)

Livecam installation on site

Camera computer set up
(for image taking and FTP transfer)

Freecom Mobile Drive (or similar)
for data-back up via USB 3.0

1.3 Accessories + services (continued)

ZyXEL NWA-1100 + ZyAir Antenna wireless bridge
For wireless data transfer between camera and camera computer

Erco & Gener GenPro 30e
For 3G or 2G internet access when no network or DSL is accessible.

Additional programming per day
(for example password-protected websites, changes in graphical php/html interface, etc.)

Web Service
Use of flash/html5 web technology, web admin to configure website, iphone/ipad + android app, screensaver, software to broadcast images on a network of screens, tv software

Remote maintenance
Maintenance of camera + computer via internet for trouble shooting

Maintenance on site

2. How To Get Started

2.1 Step 1: Get the mast holder ready

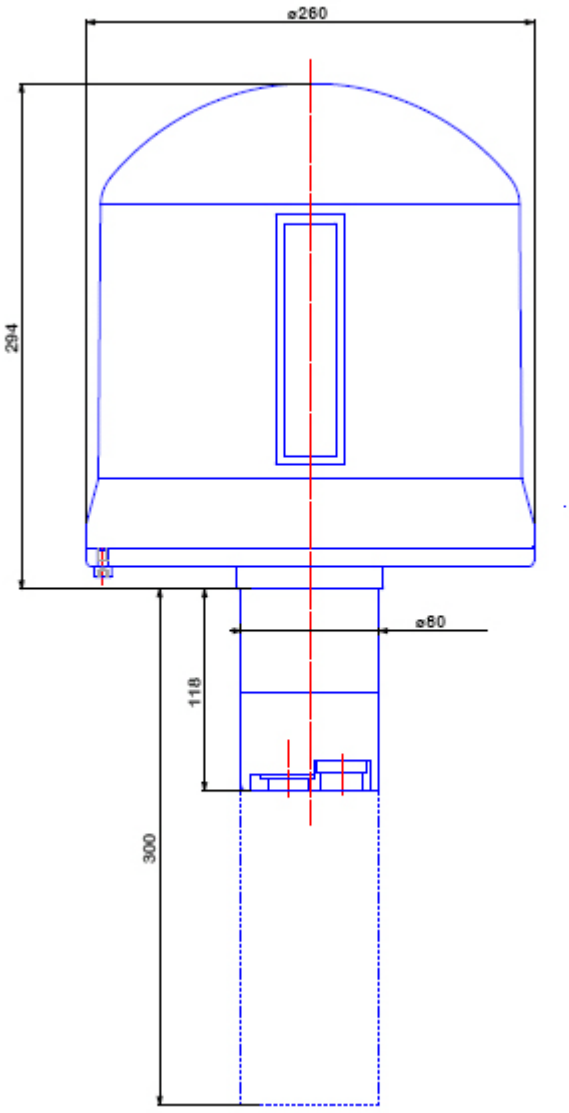
For a best possible image quality we recommend fixing the Roundshot Livecam to a **solid metal mast**.

The mast should not be too high so that **potential vibrations** from wind can be avoided.

The diameter of the camera socket is 80mm. The **inside diameter of a mast should therefore be at least 80mm**.

Make sure that there is **enough space underneath the camera socket** for the waterproof cables (for power and ethernet) – **at least 300mm**.

Drill 3 screws (M6) through the mast through which the camera can be fixed and any lateral movement can be avoided.



2.1 Step 1: Get the mast holder ready (continued)

Here are some examples of possible Livecam holders:

Mast holder

Arm holder

Tripod holder (temporary solution)

2.2 Step 2: Place the Livecam in its mast holder and connect the cables

Connect the power cable and the Ethernet cables to the camera and close the waterproof plugs firmly.

Place the Livecam in its mast holder and make sure that
• the camera is completely level
• there is no play and no potential vibration

Connect the mains adapter to the electricity supply.

Connect the Ethernet cable into your internet router or a network hub – not directly into your computer unless the internet connection is established with wireless or with 2G/3G network (see box below).

When connecting the Ethernet cable directly into the computer you will only be able to use the camera locally and there will be no internet connection. Plug the Ethernet cable into your router/hub.

2.3 Step 3: Prepare the computer

If the camera computer was preinstalled by Roundshot it is ready for use. The default user is **"Livecam"** and the default password is **"roundshot".**

If not, please follow the instructions below:

• Set up **BIOS** for the computer to restart automatically after a power loss
    • Press F2 after boot repeatedly, Enter BIOS
    • Select Power -> APM Configuration -> **Restore on AC Power Loss (Power ON)**
    • SAVE + EXIT

• Change settings of **Windows updates**: "check for updates but let me choose whether to download and install them"

• Set all **energy saving** options to **off** for the computer to be always running
    • Deactivate hard disk hibernate option
    • Put the computer to sleep = Never

• **Deactivate the User Account Control** on windows Vista or put it to the lowest level on Windows 7. This can be accessed from the "control panel -> users"

• Set automatic **time synchronisation** (lower right - clock) with: "ch.pool.ntp.org"

• Copy the contents of the installation disk to your computer, for example in C:/software.

2.3 Step 3: Prepare the computer (continued)

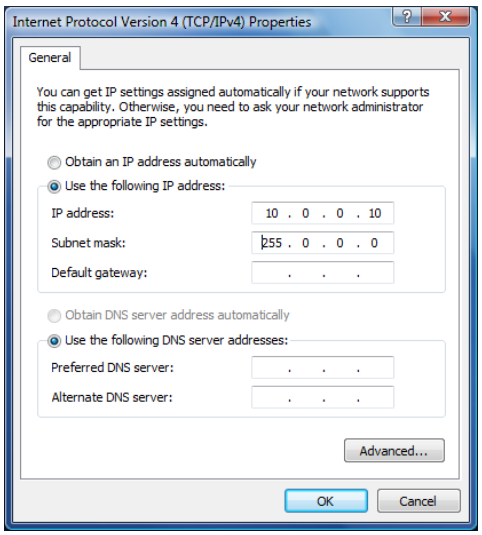
• **Install the Roundshot Livecam D2 software** by double-clicking the installer located in C:\software\1_Roundshot Livecam capture software. Select the 32bit or the 64bit installer according to your operating system.

The program set-up will start automatically and the software will be installed in the following directory: *C:\Program Files\Seitz\Digital3*

Follow the installation procedures. When the installation is successfully completed, you will be asked to restart the computer.

• **Setup the network properties** of the computer:

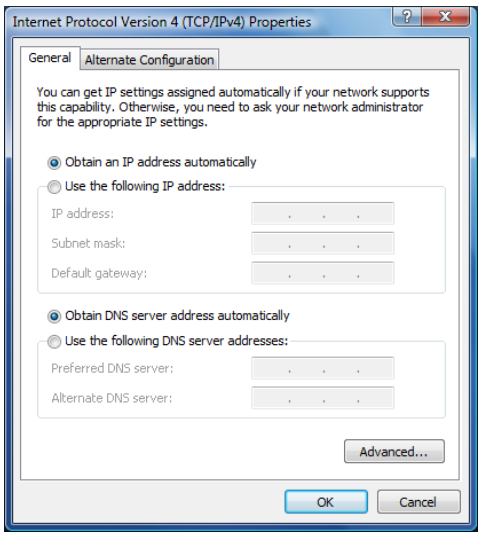
• Case1: Direct connection camera to computer



If the camera is connected directly to the computer select a fixed IP address. By default the camera IP is 10.0.0.80. So the computer IP can be set to 10.0.0.10 and the subnet mask to 255.0.0.0.

This case is only applicable when the computer is connected to internet via Wireless or 2G/3G network.

• Case2: Camera and computer connected through a network



If the camera and the computer are connected through a network select the option "Obtain an IP address automatically".

The computer will get an IP address within the range defined in the router. For example: 192.168.1.20.

To establish the connection to the camera the IP address of the camera needs to be changed to an IP within this same range. In this example 192.168.1.80.

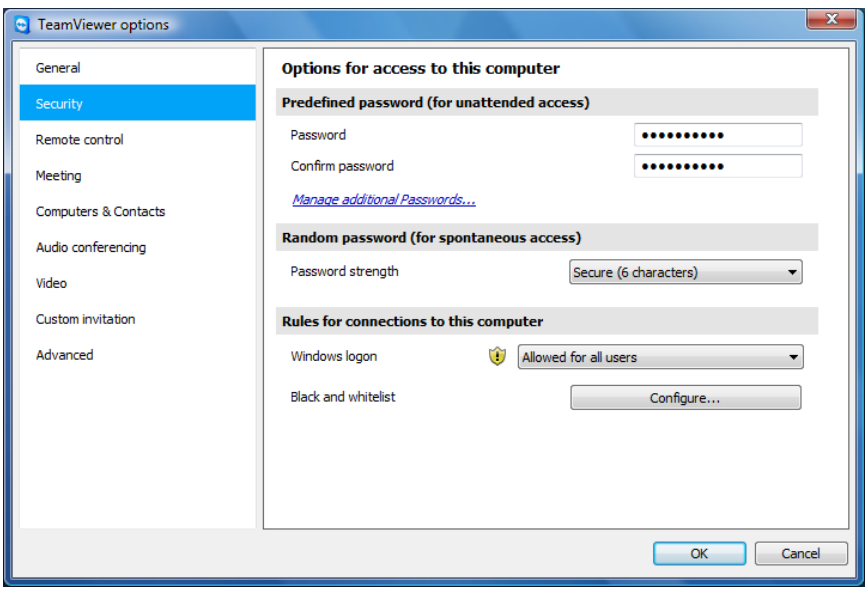
More details on how to change the camera IP address will be presented in the next sections.

2.4 Step 4: Install a remote control software (Team viewer)

As Livecam computers are often difficult to access, it is very convenient to install a remote control software. This enables changing all image capture parameter or performing fast diagnostics remotely.

Download a remote desktop application of your choice. We recommend one of the following remote control software solutions:
- Team viewer
- Log me in
- Real VNC

When installing Teamviewer, the computer will get a unique ID as shown below. In this case it is recommended to set a fixed password to be able to access the computer any time even if it is unattended:



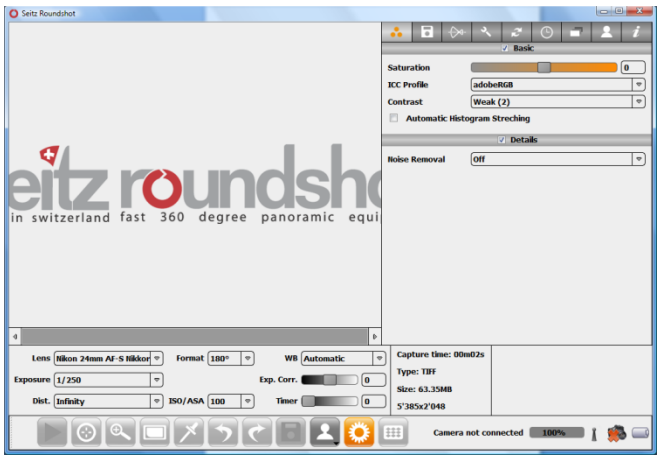
2.5 Step 5: Configure the Roundshot Livecam D2 HD

Start the Roundshot Livecam D2 HD software by double-clicking the shortcut on the desktop:

The software opens directly in the **"Shoot"** menu:

Shoot menu

Parameter menu



The **"Shoot"** menu is used for operating the camera, image taking, displaying previews, and saving. It also allow quick access to usual image capture parameters such as lens (favourite lens list), exposure time, white balancing mode or ISO/ASA. Camera status information such as connection or battery level, and image information such as histogram or size, are also directly visible on the different fields of the shoot menu.

The **"Parameter"** menu contains camera, software and image workflow advanced parameters. It is structured into different tabs for better accessibility. 8 tabs are available:

- Colour: contains image colour parameters
- Save: contains the output file options
- Lens: contains the manufacturer lens list and photographers special lenses
- Camera parameters: contains all camera adjustment parameters
- External device: allow to connect and control some external devices (GPS, Compass)
- Scheduler: used for programming camera tasks
- Custom: contains all interface options
- Info: contains all camera software and firmware information and a service menu

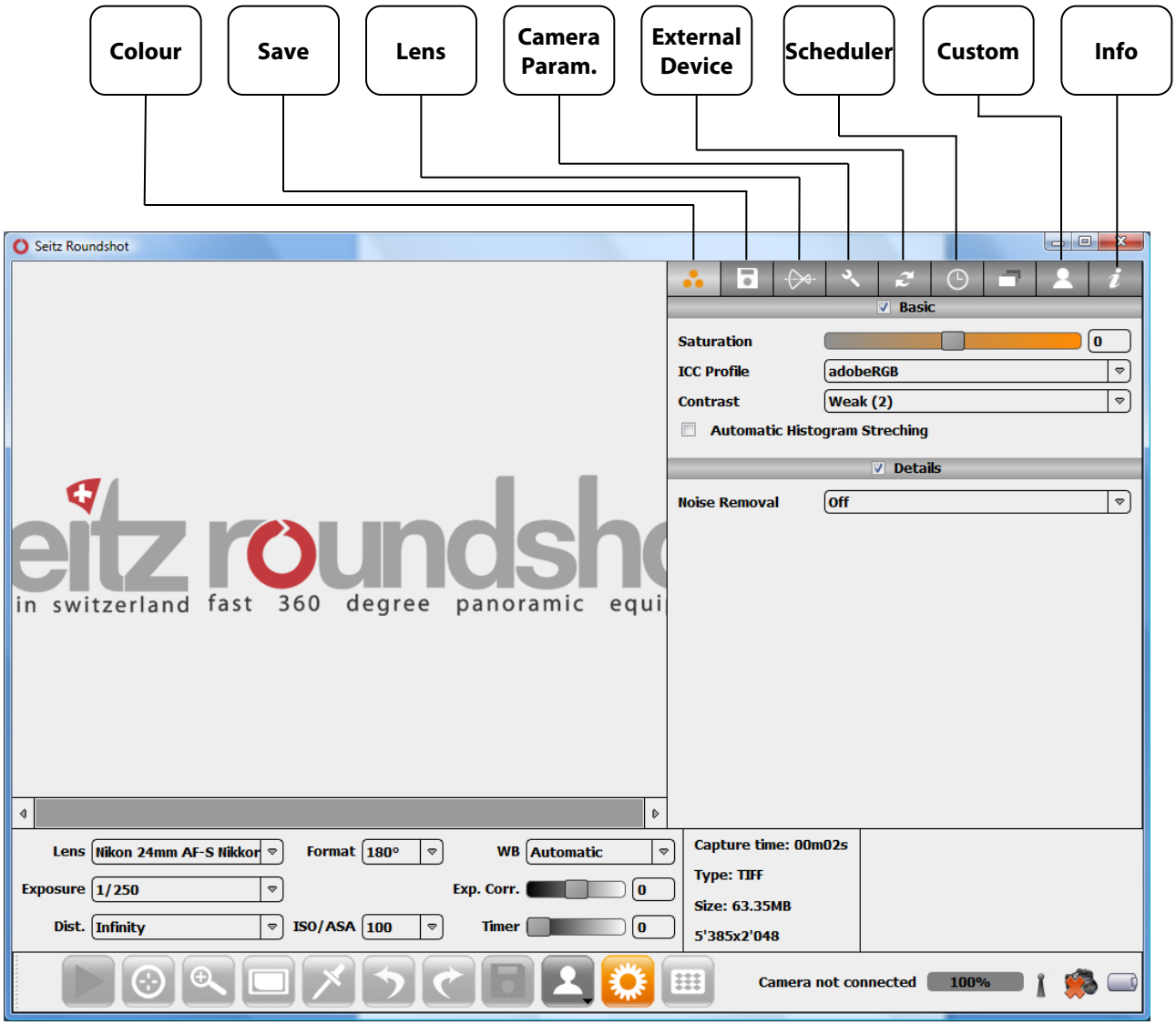
To open or close the **"Parameter"** menu press respectively

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

Parameter menu

Press to navigate to the **"Parameter"** menu.

The **„Parameter"** menu allows to set all parameters for image taking, processing and storage. It is structured in 8 tabs as described below:

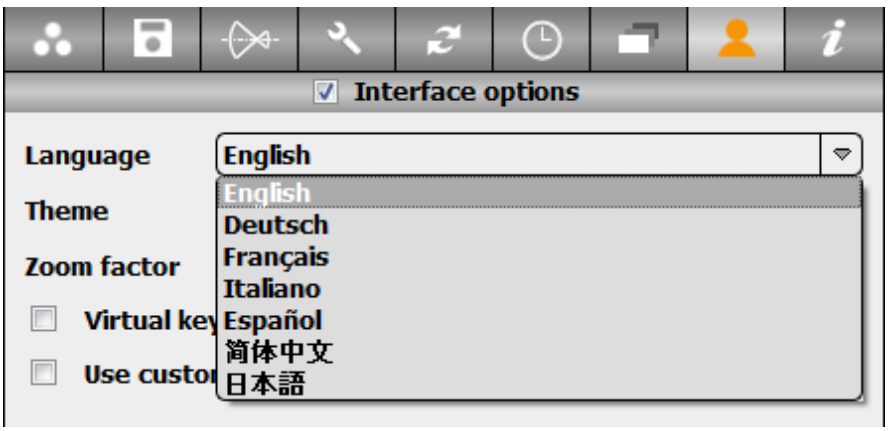


2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

Press the „Custom“ button in the „Parameter“ menu to activate the **„Custom“** tab:

Select the desired language from the options displayed in the list. Available languages are:

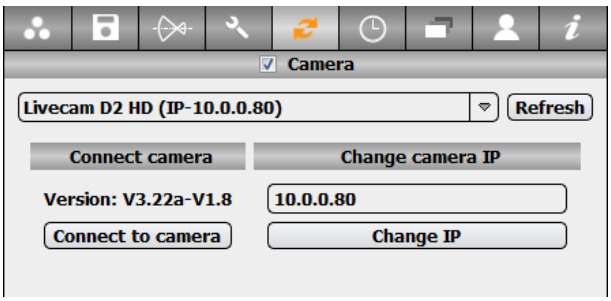
- English
- Deutsch
- Français
- Italiano
- Español
- Japanese*
- Simplified Chinese*



* These languages are only displayed if the character set for Japanese and Chinese are loaded on your computer.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

Press the „External device“ button in the „Parameter“ menu to activate the **„External device“** tab:

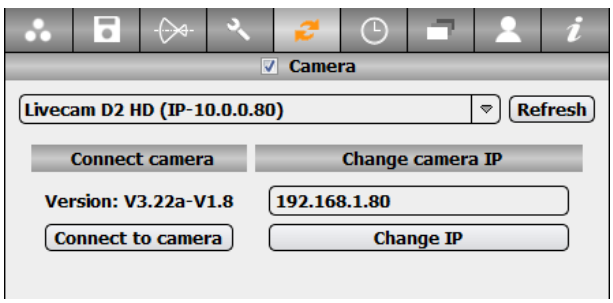


Establish the connection between the software and the camera:

The drop-down list displays all cameras in the network. Select **“Livecam D2 HD”.**

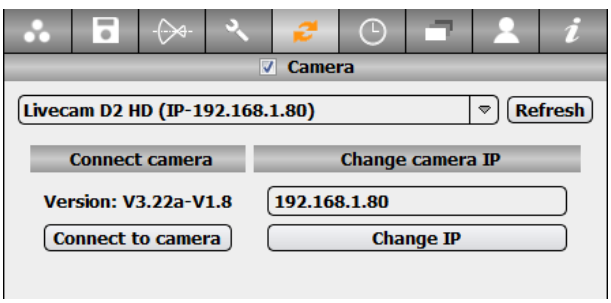
The software displays the IP of the camera as 10.0.0.80.

This is the default factory IP.



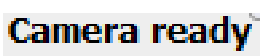
Change this IP now to bring it into the same range as the IP of the computer (or the network).

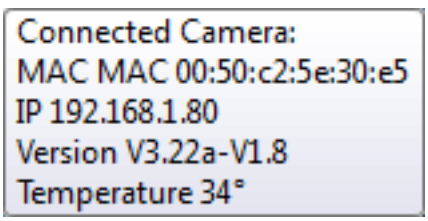
In this example change the IP of the camera to: **192.168.1.80.** Then click on **“Change IP”** and then Refresh the camera drop-down list



Click on **“connect to camera”.**

The software will now connect camera computer and camera. The connection is confirmed with the **“camera ready”** message on the lower right and the **“connected camera”** pop-up on the lower right hand corner of the computer screen:

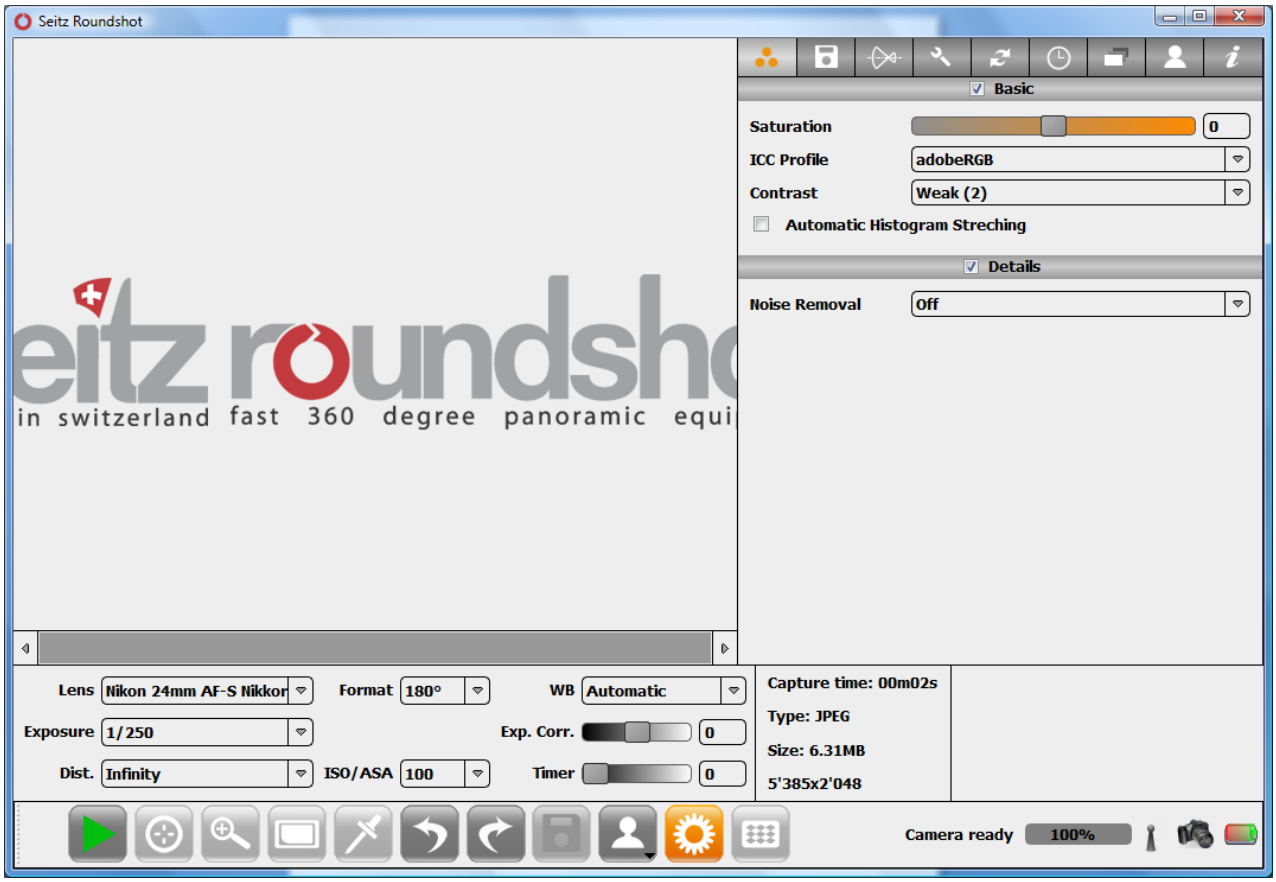




If it is the first time the software is connected to the **Livecam it is necessary to restart the software**. After restarting it the connection to the camera will be established automatically.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

To open or close the **"Parameter"** menu press respectively



The next steps consist in:

- Framing the image
- Optimising sharpness
- Defining the exposure
- Blurring certain areas to protect privacy (optional)
- Setting additional parameters
- Verifying the parameters and saving the profile(s)
- Sealing the waterproof case
- Programming the scheduler

By following these instructions step-by-step you will obtain the best possible image quality.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.1 Frame the image

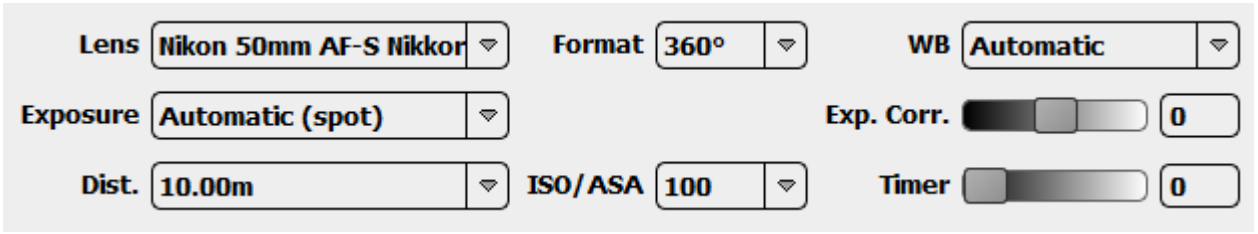
The first step consists in framing the image by choosing
• the best focal length on the zoom lens
• the best angle (degree of rotation) and starting position of the camera
• the tilting of the camera head (up/down by maximum +/- 20°)

Open the waterproof case of the Livecam by loosening the 3 screws and lift off the waterproof housing:

Set the focal length on the zoom lens, for example to 50mm.

Set the focusing distance on the lens to approximately 10m (depending on the scene).

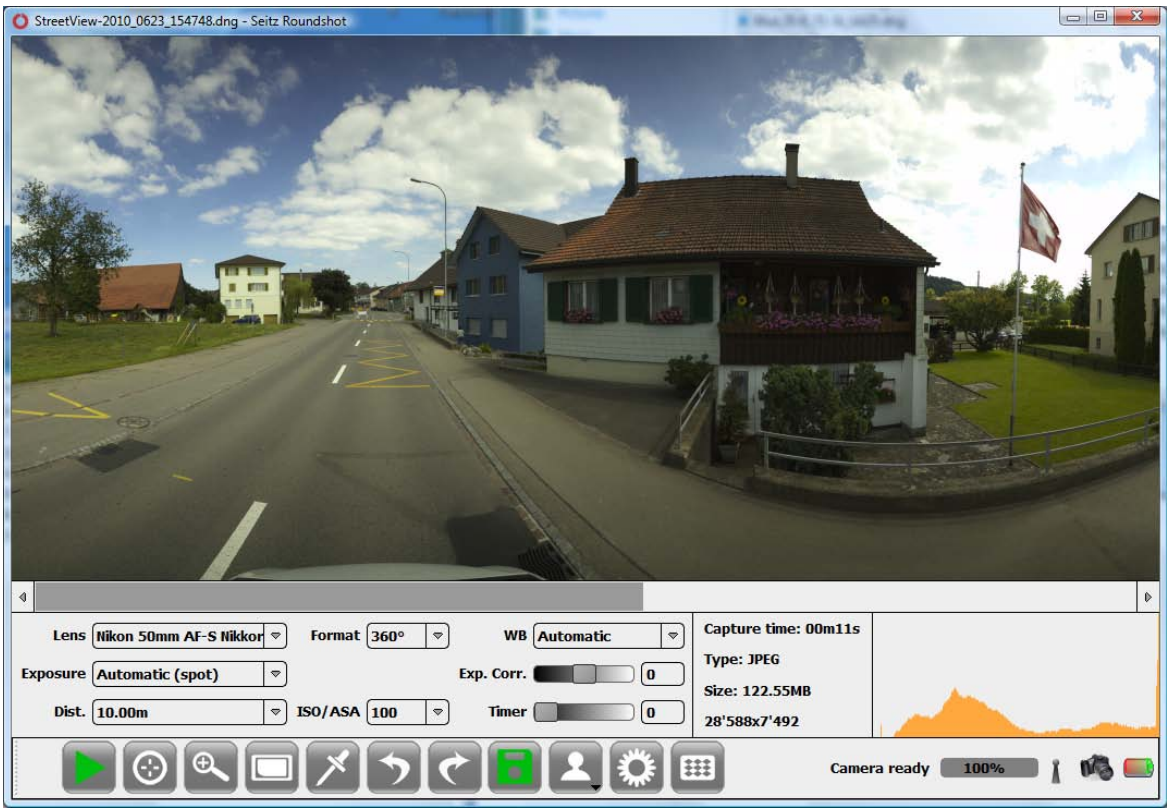
Select the parameters in the "shoot" menu as follows:



2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.1 Frame the image (continued)

Create a scan by pressing the "Start" button.



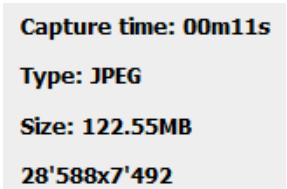
The panorama is displayed across the preview image as the scan builds up.

After image-taking the **automatic white balance** is applied on the image. The progress of these processes is displayed on the lower right corner of the software.

As a result, the final image is displayed on screen together with the image histogram.

Congratulations – you have created your first Livecam image!

The image parameters* are displayed in the menu bar:



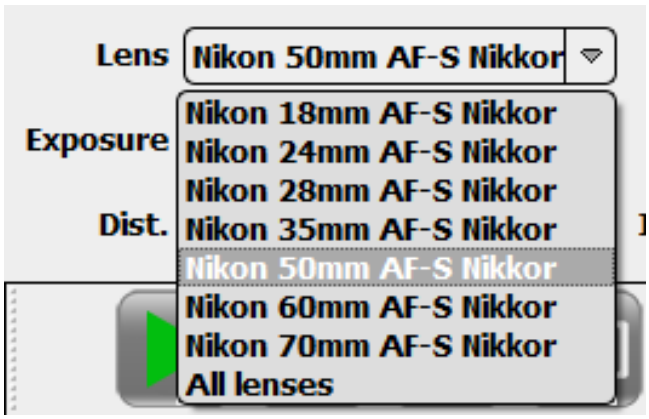
- capture time for the image (rotation time of the camera)
- final file size (without jpg compression) and image dimensions in pixels

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

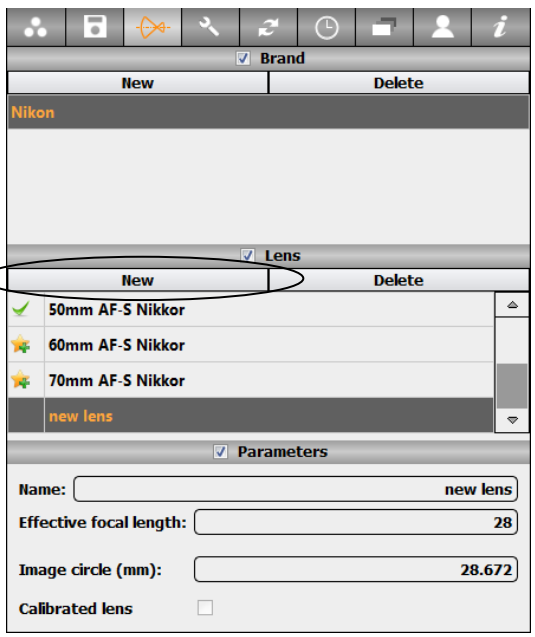
2.5.1 Frame the image (continued)

Now **change the focal length, starting position of the camera, degrees of rotation and the tilting of the camera head** until you have found the best possible image.

The **focal length** is adjusted manually on the lens. For increased accuracy choose a focal length for which a scale reading is available (for example, 18mm, 24mm, 35mm…). Select the focal length from the "shoot settings" drop-down list:



If you choose an intermediate position you will need to estimate the focal length and enter a new lens in the **lens menu** as follows:



Press the **"Parameter"** button to go to the **"Parameter"** menu.

Select the **"Lens"** tab.

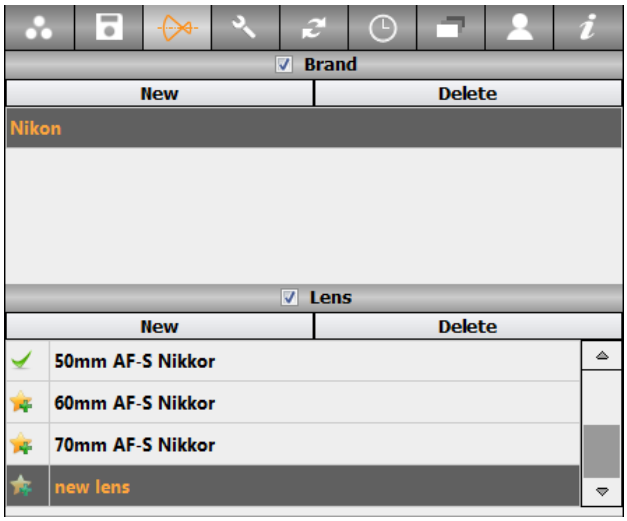
Select Nikon lens brand and click on **"New"** in the lens field**.**

Give this new lens a name (for example "40mm" and enter the effective focal length (in this example: 40).

The image circle indicates the maximum capture vertically (in mm). It is possible to crop the image at the top/bottom by entering a different image circle.

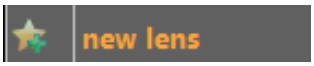
2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

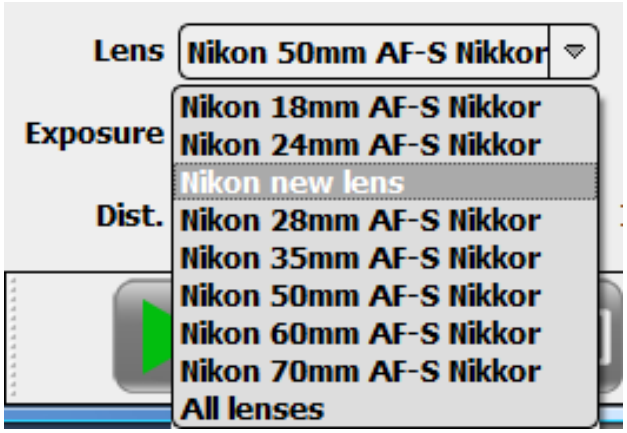
2.5.1 Frame the image (continued)



Add the lens to the favourite lens list by clicking on the box on the left side of the lens name.

A yellow star will appear as shown in the example below





The new lens can now be selected from the lens drop-down list in the shoot menu

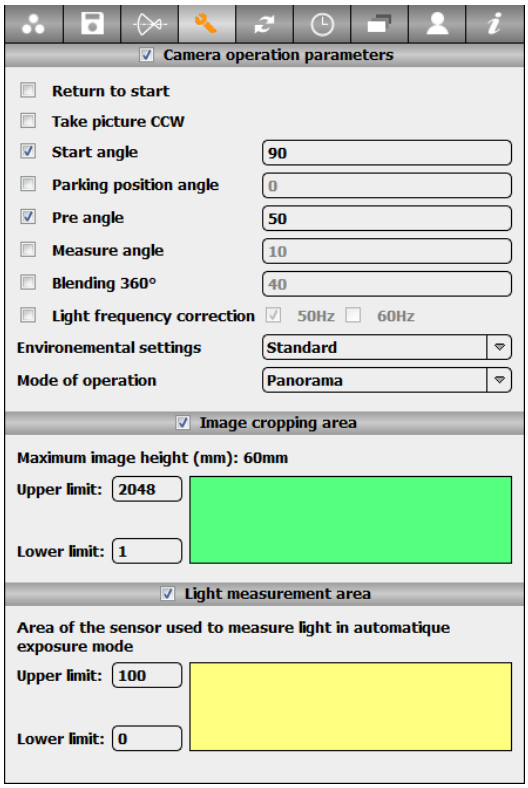
Verify the estimated focal length by photographing a circular object. If the circle appears compressed, increase the focal length in the lens list. If it appears stretched, decrease the focal length in the lens list.

Lock the focal length position (with tape), place the lens on a Nikon digital SLR camera, take a jpg picture, open it in a metadata viewer software such as PhotoMe (www.photome.de) or in Photoshop. The exact focal length will be indicated in the metadata.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.1 Frame the image (continued)

The starting position of the camera can be changed in two ways:
- By turning the camera in its camera mast
- By adjusting the image format parameters in the "Parameter" menu



Press the **"Parameter"** button to go to the **"Parameter"** menu.

Select the **"Camera parameters"** tab.

Activate **"Start angle"** and enter an angle between 1° and 359°.

The camera will move from the parking position by the selected angle clockwise to a new position for image taking.

Activate **"Pre-angle"** and enter 40° or 50°. This allows a smoother start/end exposure as the camera already scans a few degrees before the actual image-taking.

Instead of turning the camera in its camera mast it is also possible to activate **"Parking position angle"** and turn the camera to a different parking position.

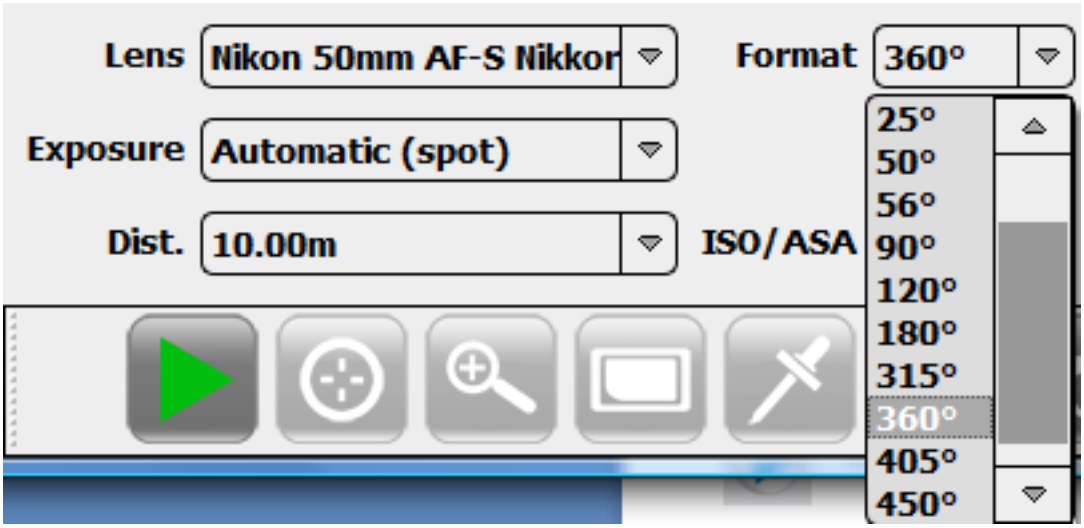
Create a test scan by pressing **"Start"**. Adjust the parameters if necessary.

For high altitude installations and for cameras in difficult weather conditions it is advisable to define a parking position of the camera away from the weather (for example against a wall).

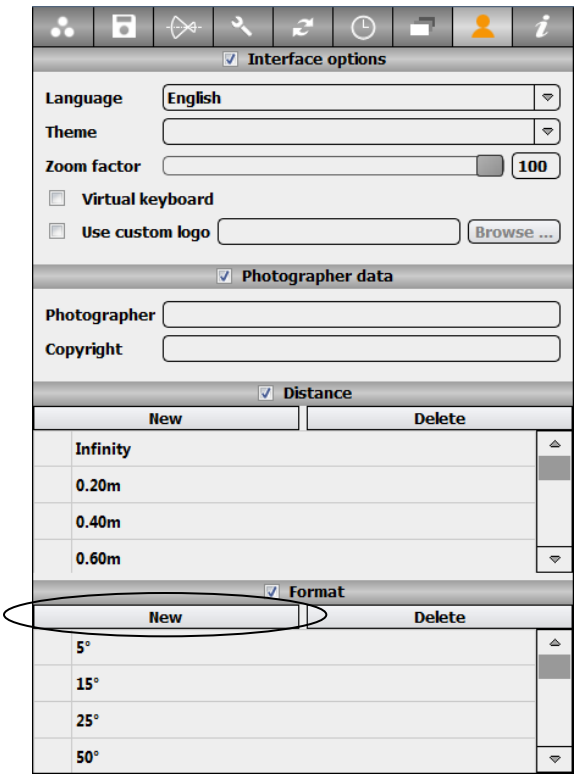
2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.1 Frame the image (continued)

Select the degrees of rotation in the "shoot settings" drop down list:



If the desired image angle is not yet in the list, create a new angle in the "Custom" tab:



Press the **"Parameter"** button to go to the **"Parameter"** menu.

Select the **"Custom"** tab.

In the **"Format"** field click on **"New"**

Enter the desired angle. Any angle between 1° and 360° can be set.

The new angle is now visible in the shoot menu distance drop-down list, and can be selected from there.

Create a test scan by pressing **"Start"**. Adjust the parameters if necessary.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.1 Frame the image (continued)

Frame the image as well vertically by tilting the camera head up or down by a maximum of +/- 20°. To do this open the tilt screw on the camera holder:

Tilt screw

Camera head slide screw

Depending on the length of the lens and the tilting it may be necessary to change the position of the camera head on the platform. To do this, loosen the camera head slide screw and slide the camera head forward or backward.

Create a test scan by pressing **"Start"**. Adjust the parameters if necessary.

Framing the image is very important and adds to the attractiveness of your webcam. Make sure you are capturing an interesting and always changing scene. Take the eye of a professional photographer when framing the image – this will define the webcam for the years to come.

Ideal are:
- Landscapes with water, open areas, sky, mountain chains
- Cityscapes with changing lights and movement
- Views away from direct sunlight

Avoid:
- Rooftops
- Buildings
- Views directly against the sun

The panorama does not necessarily have to be a full 360° - sometimes less is better and more interesting!

See how some of our customers have framed their environment by visiting our reference installations on www.roundshot.ch.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

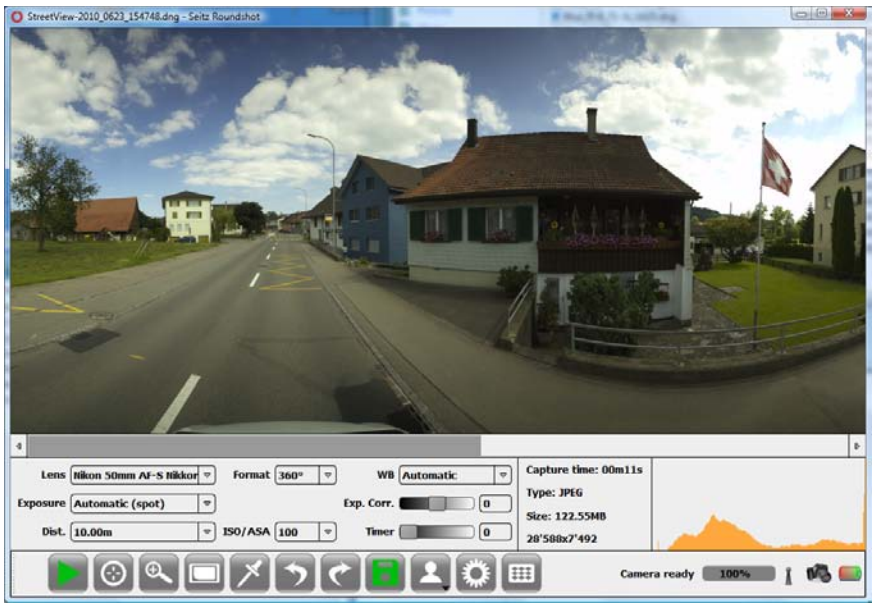
2.5.2 Optimise sharpness

The sharpness is set manually on the lens.
Open the f-stop lever on the camera and open the aperture to f=2.8 . This is necessary to allow the best possible light reading and most sensitive sharpness correction.

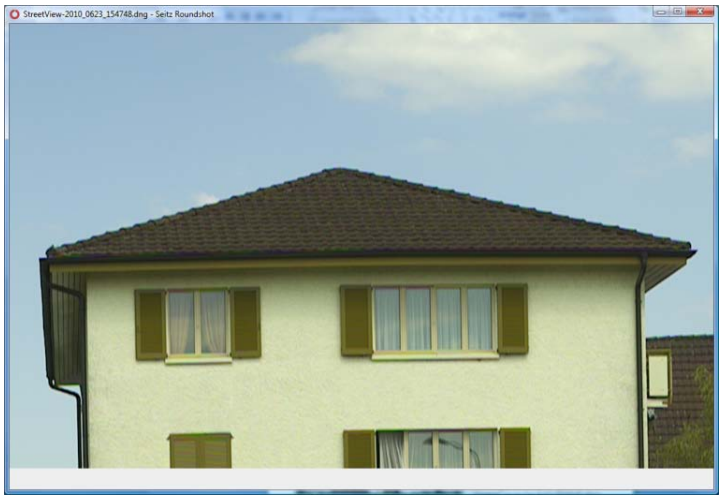
F-stop lever

To adjust the f-stop:
Loosen the screw, change the f-stop of the lens with the lever and fasten the screw again.

Then create a scan at highest resolution (1x1):



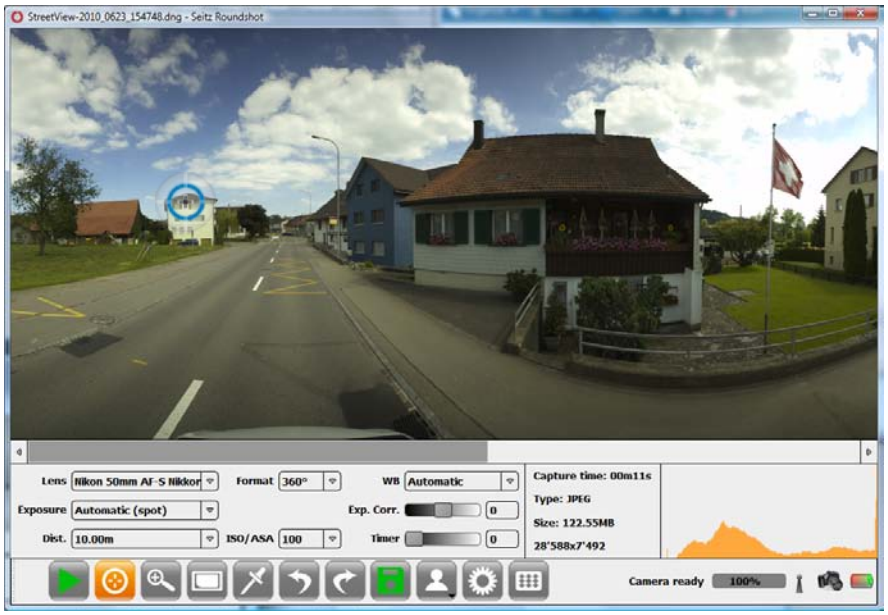
Now zoom on the area of the image for which you would like to optimise sharpness.



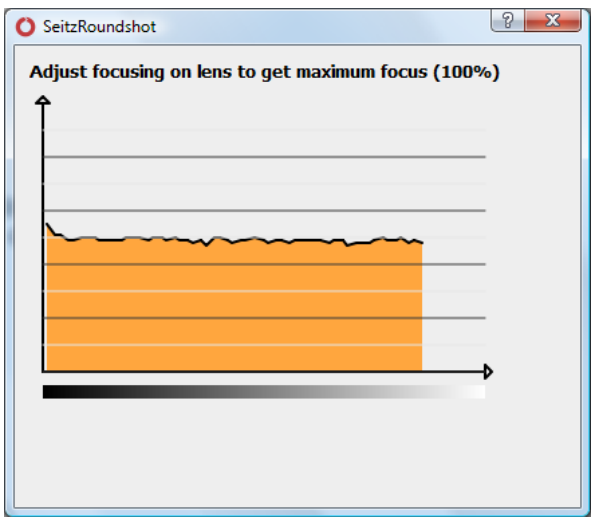
2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.2 Optimise sharpness (continued)

Place the focusing assistant tool on the point in the image for which you would like to optimise sharpness. Make sure that this point has a good contrast (no uniform shapes or surfaces):



The camera now turns to read contrast at that specific point and the following graph is displayed:



Turn the focusing ring on the camera until the highest point of sharpness is reached.

If you have no direct access to the camera work with an assistant and connect with walkie-talkies or over the mobile phone.

Once the peak is reached, close the focus assistant window to stop the focusing tool

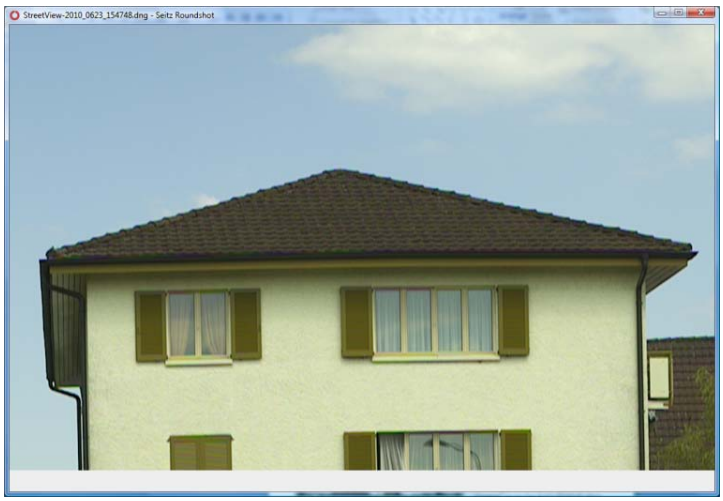
2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.2 Optimise sharpness (continued)

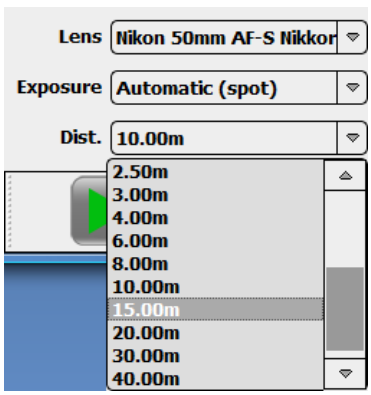
Close the aperture again to f=8 or f=11 with the f-stop lever.

Create another scan at highest resolution (1x1) and zoom again on the image to check the sharpness.

The image is now sharp.



As a last step open the **"Distance"** drop-down list and select the approximate focusing distance. The software will adjust the image format (the length of the panorama) in the software.



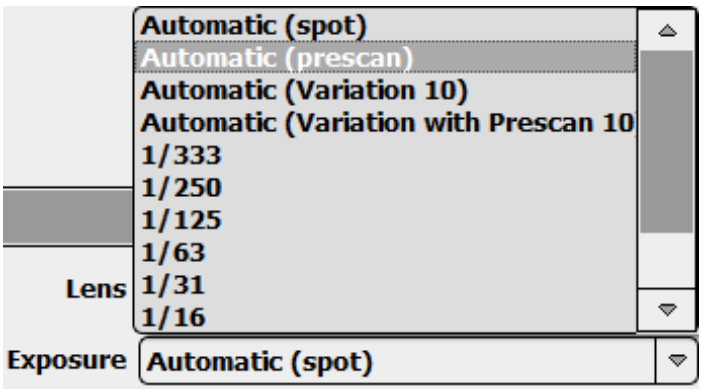
It is not possible to obtain maximum sharpness from 1m to infinity. However, with closing the aperture to f=8 or f=11 a good depth of field can be achieved. Choose a focusing point which lies before infinity (hyperfocal distance). This way you benefit from a maximum depth of field.

When focusing closer (rather than focusing at infinity) the effective focal length of the lens becomes longer, so the image will be longer (more stretched) horizontally. This adjustment is important to enhance sharpness further.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.3 Define the exposure - day

As the Roundshot Livecam works fully automatically it is necessary to define an automatic exposure. Choose from two options:
• Automatic (prescan)
• Automatic (variation)
• Automatic (variation with prescan)



Open the **"Exposure"** drop-down list and select **"Automatic (prescan)"** exposure. The camera will create a first scan for light metering and will then create a second scan for the exposure, applying the average exposure speed measured during the prescan.

Select **"Automatic (variation 10)"**. The camera will directly start to create the scan and adjusts the exposure "on the fly" according to the prevailing light. The camera scans thus with a variable speed and compensates highlights and shadows. It is also possible to define the degree of speed adaptation (variation).

"Automatic (prescan)" allows a very accurate light reading, however, it is possible that with sudden light changes (for example, a cloud passing by) the second scan (exposure) is too bright or too dark.

"Automatic (variation)" has the benefit that it balances highlights and shadows.

"Automatic (variation with prescan)" combines the two methods.

We recommend that you test the two options for your specific location.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.3 Define the exposure - day (continued)

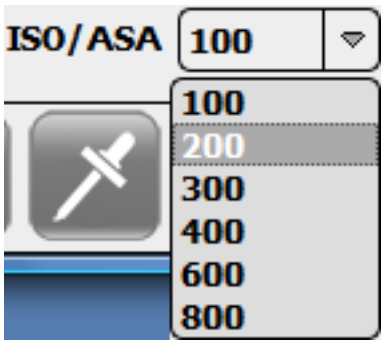
If the panorama appears generally too dark, it is possible to correct the exposure using the **"Exposure correction"** function:

Use the slider or enter directly a value in the text field between -3 and +3 f-stops.

To make the exposure **lighter increase** the exposure correction (in 0.1 aperture steps)

To make the exposure **darker lower** the exposure correction (in 0.1 aperture steps).

To increase the sensitivity for the exposure it is also possible to increase **ISO/ASA**:



ISO/ASA can be increased from 100 (default) to 200, 300, 400, 600 and 800.

Please note that high ISO/ASA settings may lead to deteriorated image quality due to a higher noise.

As the Livecam image sensor is already very sensitive, we recommend setting ISO/ASA to 100. If the scan is too slow, it can also be made faster by opening the f-stop (aperture)

It is possible to create several camera profiles (see next section) and to increase ISO/ASA for night exposures.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.3 Define the exposure - night

For the capture of images at night, automatic exposure will only work if there is enough available light or if the rhythm of image taking is reasonably slow.

In most cases a **fixed manual exposure** will be a better solution. Choose a manual exposure by **setting the exposure speed to 1/8 s or 1/4 s.**

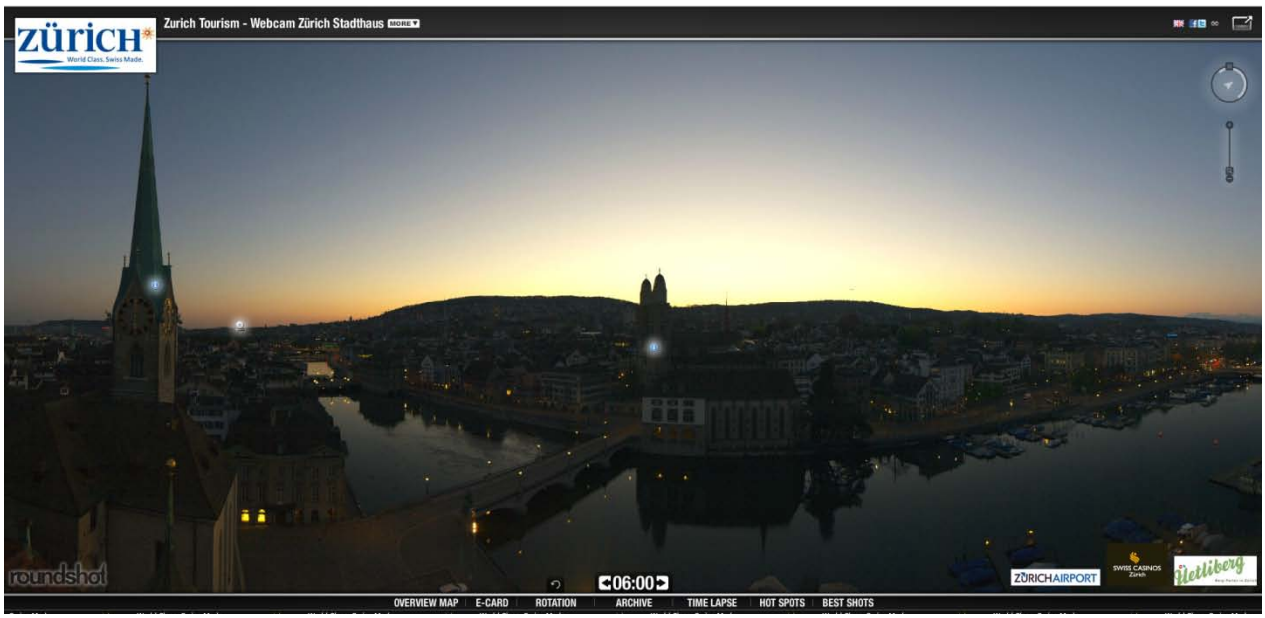
Increase the **ISO/ASA to 400, 600 or 800.**

The slower the scanning speed and the lower the ISO/ASA, the better the image quality.

All other image capture parameters are identical to a daylight capture.

Save these settings in a separate **"night" profile** – see section 2.5.6 for more information.

The night capture can be triggered by a separate **"night job" in the Scheduler**, typically starting at sunset and ending at sunrise. This alternates with the "day job" which will start at sunrise and ends at sunset. For more information about the Scheduler please consult section 2.5.8.



Only capture night panoramas in situations where there is actually something to see at night – for example in cities.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.4 Blur certain areas for privacy (optional)

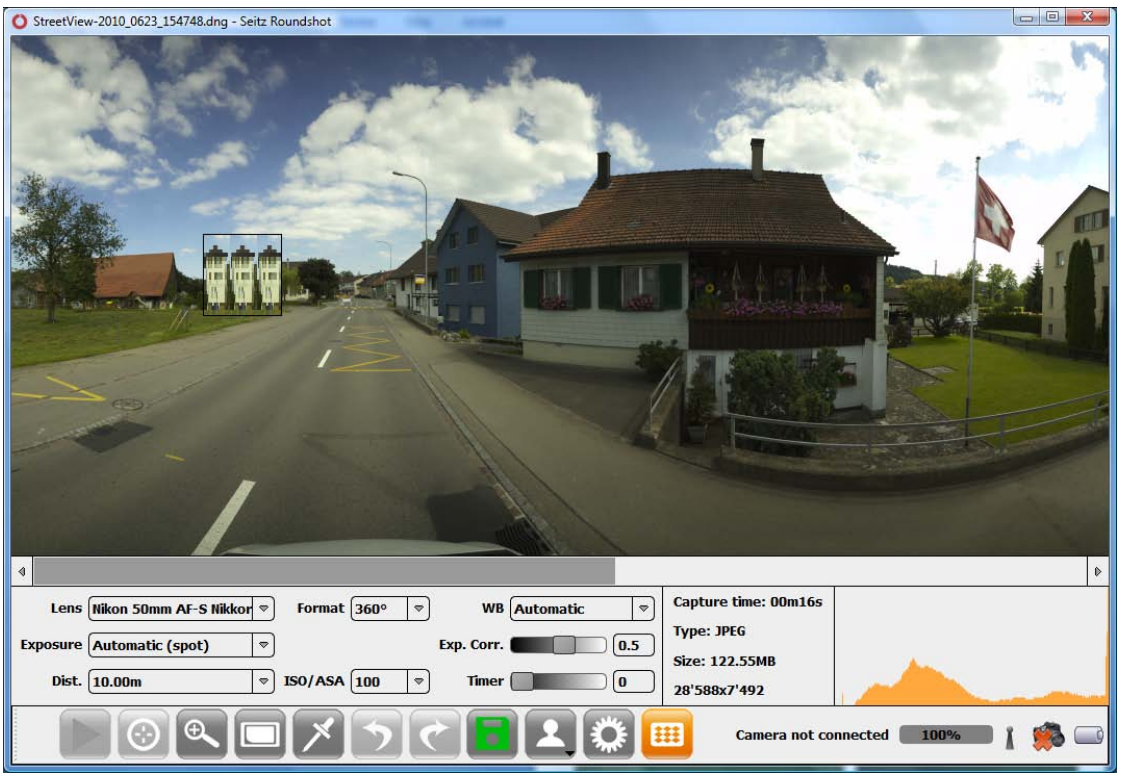
The Roundshot Livecam allows a very high resolution, especially when using longer focal lengths. For a public webcam capturing public areas it may therefore be necessary to blur certain areas of the image to protect the privacy of individuals.

If the Roundshot Livecam is used to document a private area for the purpose of surveillance, it is necessary to delete the images after a few days and all non-private areas (public areas) need to be blurred.

The Roundshot Livecam software incorporates a blurring function with which areas can be blurred using different blurring levels and methods:

Create a test scan by pressing **"Start"**. Adjust the parameters if necessary.

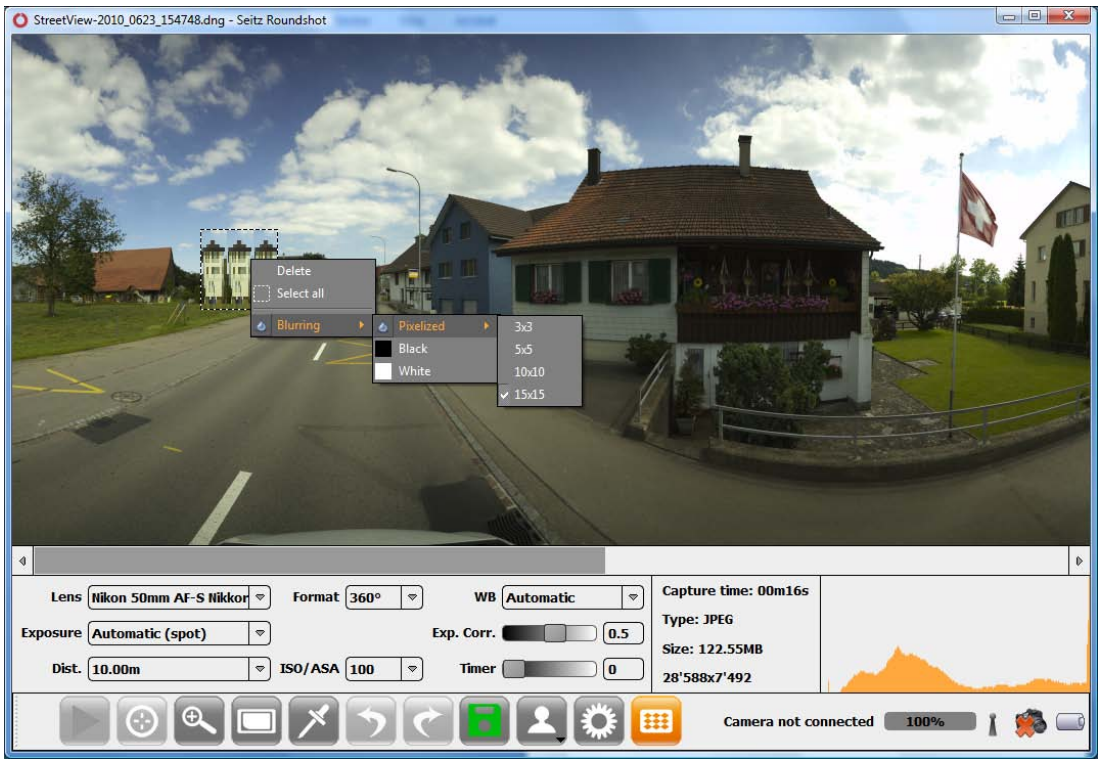
Click on the "Blurring" icon in the menu bar to activate a blurring recangle.



Move the mouse over the area that needs to be blurred and check the results.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.4 Blur certain areas for privacy (optional - continued)



To change the blurring properties make a **"right mouse click"** on the blurred rectangle.

Choose between **"Pixelized" (**3x3, 5x5, 10x10 or 15x15), **"Black"** or **"White".**

The **"Pixelized – 3x3" option** is under normal circumstances sufficient to protect the privacy of individuals (people, cars, etc.).

The blurring rectangles are shown in the image preview and are applied for all future scans.

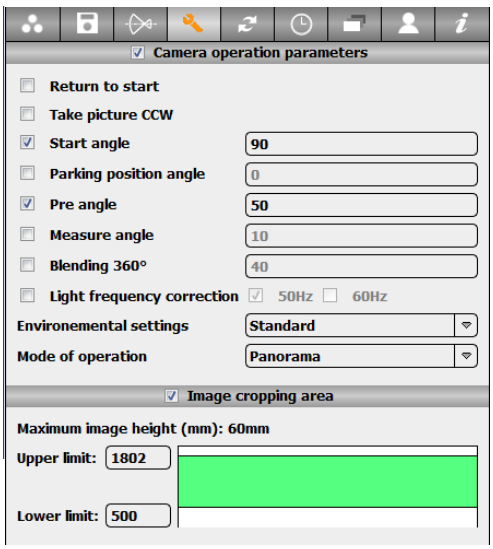
They can be deleted by making a "right mouse click" and choosing **"Delete"**.

The "Pixelized – 3x3" option has the advantage that it is discreet and cannot be seen in the image preview (400 pixel image on the website) but efficient enough in most situations so that nobody can be recognised.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.5 Set additional parameters (optional)

Use the **digital crop** function to reduce the vertical resolution:



Press the **"Parameter"** button to go to the **"Parameter"** menu.

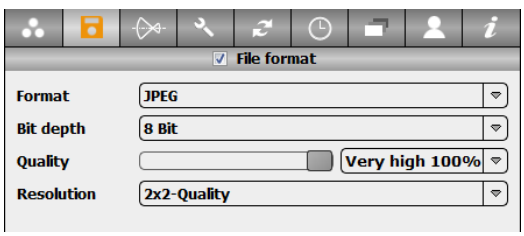
Select the **"Camera parameters"** tab.

Enter the desired vertical resolution in pixels (upper / lower limit).

In this case (1800 / 500) the camera scans only between vertical pixels 500 and 1800.

The digital crop (digital zoom) function is useful to frame the image when zooming with the lens or tilting the camera head is not possible. It is possible to create different image formats for different camera profiles (see next section).

Use the **resolution** function to reduce the total image size:



Select the **"Save"** tab.

Select **"Resolution" 2x2 Quality** or **4x4 Quality.**

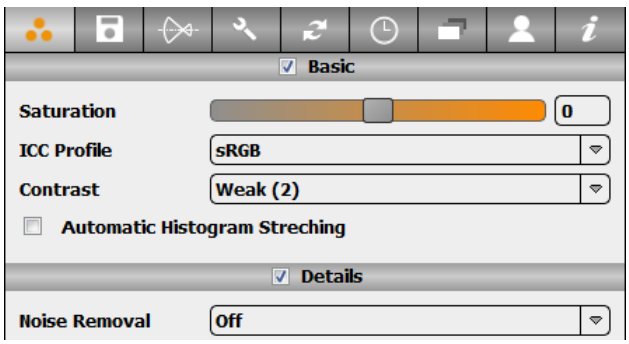
With **1x1** the resolution is 2,048 pixels vertically*. **2x2** allows 1,048 pixels (and 2x less than 1x1 in the horizontal dimension) and **4x4** 512 pixels (and 4x less than 1x1 in the horizontal dimension). When using the digital crop function, the resolution menu shows the final number of vertical pixels (after cropping, in the above example 1,300 pixels for 1x1).

* The number of horizontal pixels for a given set of parameters (lens, focal length, distance, degrees of rotation) are displayed in the menu bar

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.5 Set additional parameters (optional)

Use the **Contrast** function to change the RGB tone-mapping:

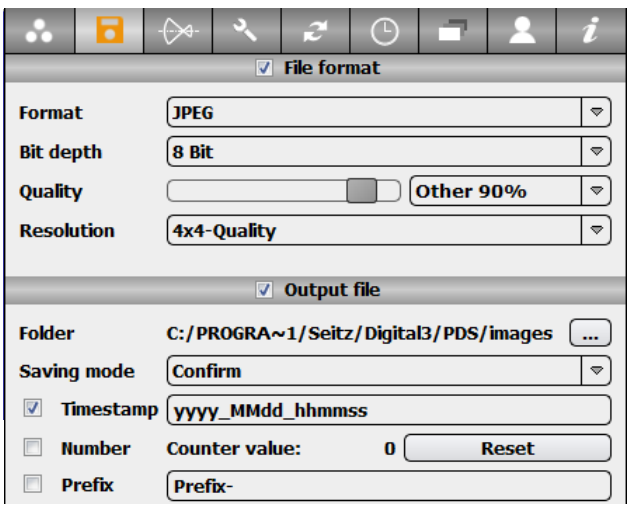


Select the **"Color"** tab.

Select between the different contrast options:
- Strong (3)
- Weak (2)
- Linear (1)

Create a test scan by pressing **"Start"**. Adjust the parameters if necessary.

Use the **JPEG options** function to reduce the JPEG file size:



Select the **"Save"** tab.

Select **"File"** and **"JPEG".**
Click on "JPEG" to open the **"JPEG options".**

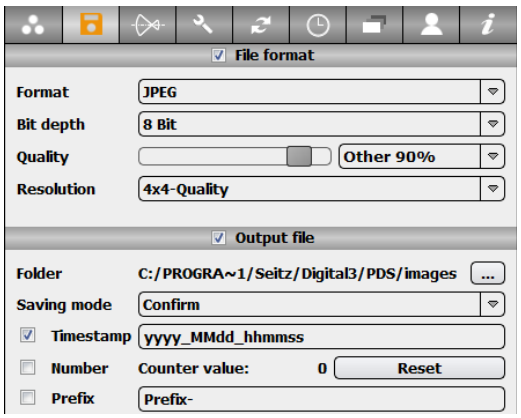
Reduce the JPEG image quality, for example to 90%. This will compress the JPEG image at the moment when the image is saved (not when it is transferred from camera to computer).

It may be beneficial to compress the JPEG image to save disk space over time and to limit data for file transfer (FTP).

Do not change the time stamp if the images are to be processed with the Roundshot php software – otherwise the image processing will not work.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.5 Set additional parameters (optional)



Select the **"Save"** tab.

Select saving **"folder"** location**.**

Define the **target folder** for file saving.

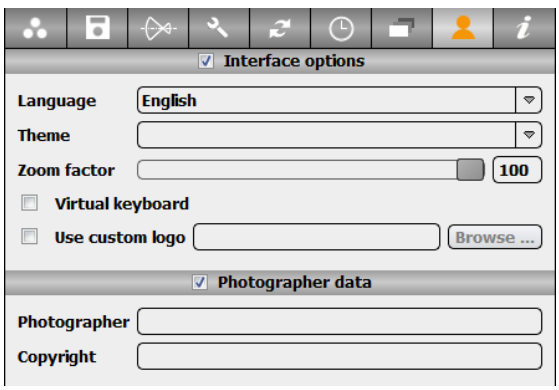
The default folder for saving is:

C:\\Program Files \Seitz\Digital3\PDS\images

This folder is created when installing the camera software.

Save a test scan by pressing **"Save"**. Check if the image is saved in the correct folder.

Please make sure to select the same image folder when setting up the image upload software. More details will come in the next sections.



Select the **"Custom"** tab.

Add your company name and the copyright information (for example: by Seitz Phototechnik AG).

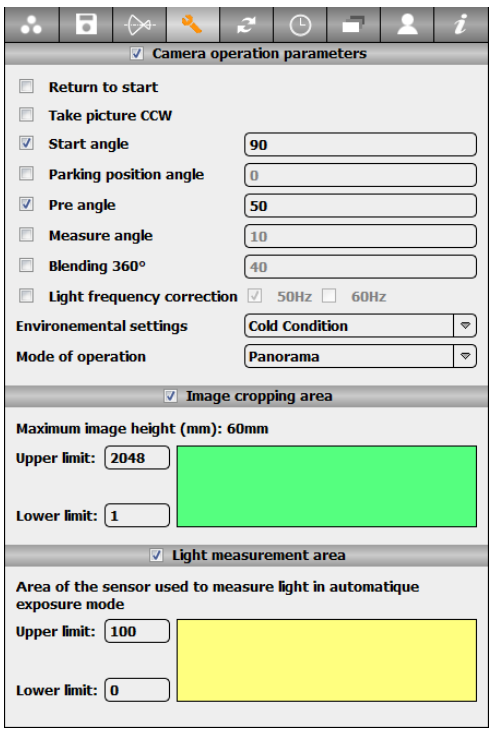
This information will be stored in the image metadata.

This information can be retrieved with a metadata viewer, for example with PhotoMe or Adobe Bridge.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.5 Set additional parameters (optional)

Use the **environment settings** function to increase the motor power for cold environments:



Select the **"Camera parameters"** tab.

Set **"Environment Settings"** to **"Cold Condition"**.

This setting will give additional power to the motor for **slow exposures** (the power for fast exposures is the same for both settings).

Increasing the motor power is only necessary when the Livecam motor starts blocking.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.6 Verify the parameters and save the profile(s)

Create a test scan by pressing **"Start"**. Check if the image is OK. If not, go back and change the parameters accordingly.

Now verify the following parameters one by one using the following **check-list**:

☑

☐ The **selected lens** corresponds to the setting on the (zoom) lens. Circular objects in the image are perfectly circular.

☐ The **degree of rotation, starting point, vertical resolution and end point** of the image are OK.

☐ The **distance setting** in the software corresponds to the distance setting on the lens and is set at **best sharpness**.

☐ The **aperture (f-stop)** of the lens is set to **f=8** or **f=11**.

☐ The **resolution** is set to your desired value (1x1, 2x2, 4x4).

☐ The **exposure** is set **"Automatic (prescan)"** or to **"Automatic (variation)"**. The **exposure correction** is set to your desired value (in 0.1 aperture steps), **ISO/ASA** is set to **100**.

☐ The **white balance** is set to **"Automatic"**, **S-curve** to **"Weak (2)"**.

☐ The **JPEG compression** is set to your desired value, **time stamp standard** (yyyy_MMdd_hhmmss), **file location** in the desired folder, **saving options "Auto save"**.

☐ Private areas in the image are **blurred**.

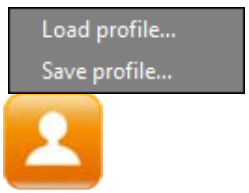
Go back and reconfigure the software/camera if any item in the above list is not OK.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.6 Verify the parameters and save the profile(s) (continued)

Use the **profile** function to save all image parameters:

In the shoot menu, press the button **„Profile“** and the following menu appear:



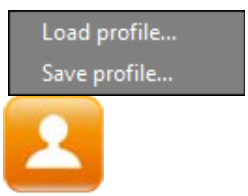
Select “save ...“ to store a profile containing all the current image taking and image processing parameters.

The image parameters will be saved to a profile (or parameter file).

The default saving path of this file is (example with 1x1 Profile):
C:\\Program Files\Seitz\Digital3\PDS\images\1x1.xml

The profile can be saved in any location, however, we recommend not to save it in the same folder as your raw images (rawfoto), because when using FTP it may be that the profile is transferred away.

Create another profile by changing the image parameters, for example change the resolution.



Select “save ...“ to store a profile containing all the current image taking and image processing parameters.

Name your profile using a logical approach so that the profile can be easily recognised later. For example, when creating a profile for day and for night capture. When using different sensitivities (ISO/ASA) use ISO100, ISO 200… or when using different image angles use 120°, 180° etc.

Your Roundshot Livecam D2 and the Livecam software are now fully configured and will now be prepared for automatic operation.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.7 Seal the waterproof case

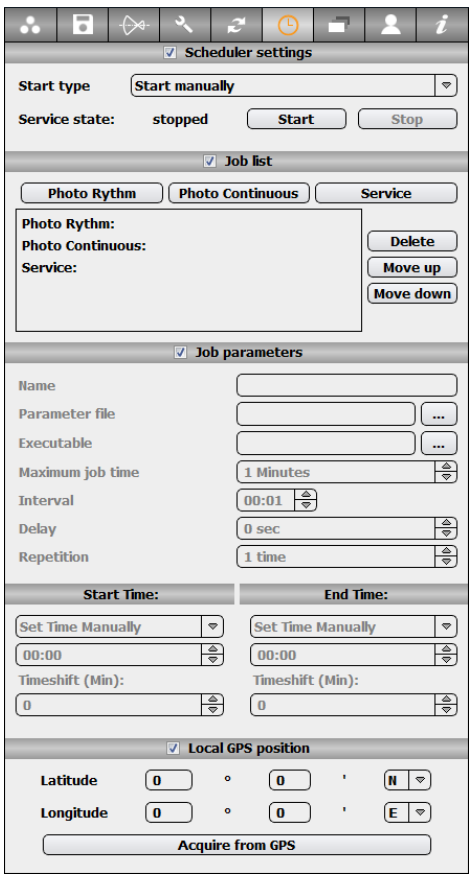
Mount the Livecam **waterproof case** on top of the camera and close it with the provided screws. Make sure that the rubber ring on the edge of the camera case sits tight and that the waterproof case is mounted straight.

Seal the waterproof case with resistent **waterproof tape** or with **silicone gel**.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.8 Program the scheduler

Access the **Scheduler** function to activate the automatic operation of the Roundshot Livecam:



In the "Parameter" menu**.** Select the **"Scheduler"** tab

The **"Scheduler settings"** define how it is launched and display its current status. It is possible to select between :

- **Start Manually**: this option is mostly used for maintenance purposes. It allows to manually start and stop the scheduler when the interface is started
- **Start Automatically with software**: this option allows the scheduler to start as soon as the Roundshot software is started. It is mostly not used with livecam
- **Start Automatically with operating system**: this option allows the scheduler to start as soon as the computer is started. This option is the default setting for all livecams in operation

In the **"Job list"** section different jobs (or tasks) can be defined:

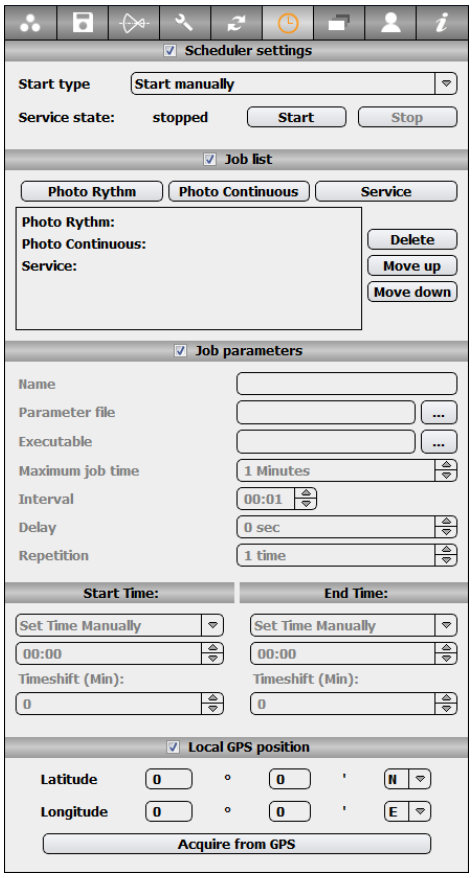
- **Photo Rhythm Job** – takes images at a defined interval
- **Photo Continuous Job** – takes images continuously in a time frame
- **Service Job** – runs scripts at defined times and interval

In the **"Job parameters"** section the selected job parameters can be defined:

- **Name**
- **Parameter file** – select the xml profile containing all image parameters that will be used during the image capture
- **Executable** (optional) – select a file containing a scrip that needs to run at the end of image capture
- **Maximum job time** – Define the Maximum time the executable file can run
- **Interval** – select the interval for photo rhythm jobs and service jobs
- **Delay** – define a delay between 2 images in case of photo continuous jobs
- **Repetition** – define how many times the job will be repeated before going to the next job for photo continuous jobs

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.8 Program the scheduler (continued)



In the **"Start time / End time"** section the time frame during which the selected job will be executed in defined. It is possible to define them **manually** or **automatically** using one of the following options:

- Sunrise
- Sunset
- Nautical Dawn
- Nautical Dusk

When automatic start/end times are defined it is also possible to adjust them using positive or negative **time shift** in minutes

All automatically generated times are dynamically adjusted according to the **local GPS position** and the **date**.

In the "**local GPS position"** section is defined the GPS coordinates of the livecam. This can be done manually by entering the Latitude and longitude values. If an external GPS device is connected to the computer it is also possible to acquire the position by pressing the button **"Acquire from GPS"**

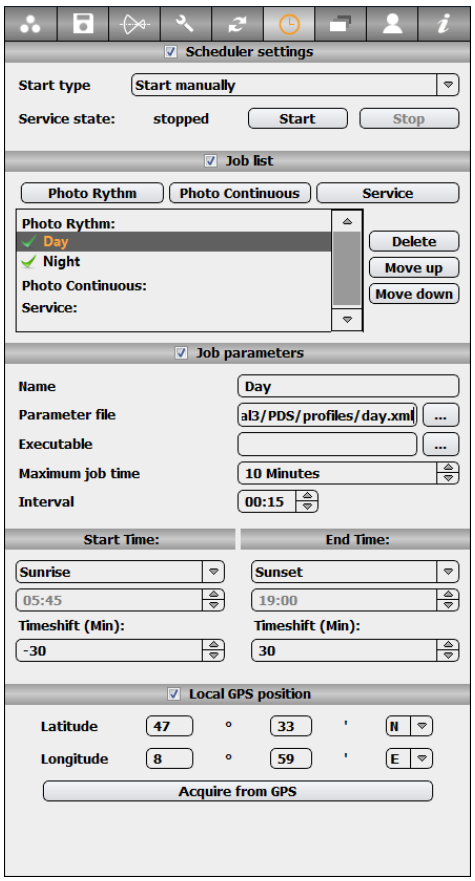
The effective start/end times are rounded according to the interval. This is used to always get images at the same times even if the start/end times changes over the seasons

It is important to define the GPS position correctly when using automatic start/end times . This way the sunset and sunrise times can be computed accurately.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.8 Program the scheduler (continued)

2.5.8.1 Photo Rhythm Job (example)



Click on **"Photo Rhythm Job"** to define a new job.

- Change its **name to "Day"**.
- Define the **parameter file** corresponding to day image parameters (with Automatic exposure time)
- Define the image **interval** (here 15min).
- Enter the **Local GPS position** of your Livecam
- Define the **start/end time** to sunrise -30min / sunset +30min.

Press **"Photo Rhythm Job"** to define a second job.

- Change its **name to "Night"**.
- Define the **parameter file** corresponding to night image parameters (with fixed exposure time)
- Define the image interval (here 15min).
- Define the **start/end time** to sunset +30min / sunrise -30min.

Verify that a green tick is displayed next to the profile name. This means the profile is active. If not double click on the name to activate it

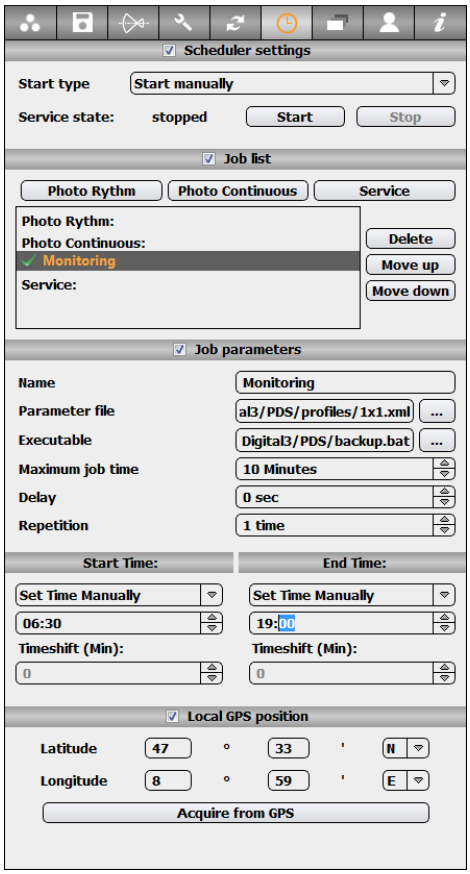
In this example we created 2 profiles with different parameters for day and night shots. As sunset and sunrise times are dynamically adjusted according to the date and location, the images will be very consistent during the entire year and no further adjustment will be necessary.

If two jobs are programmed to start at the same time, the job with the highest position on the list has the priority. The other job will be skipped at this time.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.8 Program the scheduler (continued)

2.5.8.2 Photo Continuous Job



Click on **"Photo Continuous Job"** to define a new job

- Change its **name to "Monitoring"**.
- Define the **parameter file** (with Automatic exposure time)
- Keep the **delay** to 0sec and the **repetition** to 1 to get as many images as possible.
- Define the **start/end time**

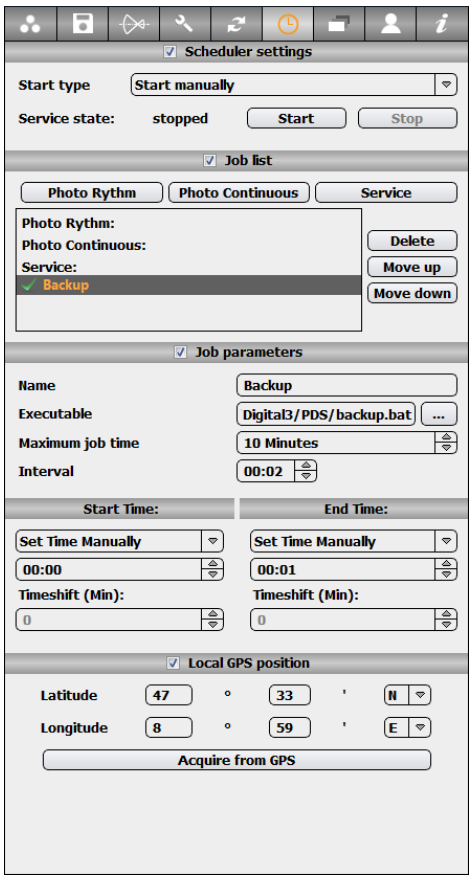
Verify that a green tick is displayed next to the profile name. This means the profile is active. If not double click on the name to activate it

Continuous Jobs are used for example for surveillance purposes where the camera is used to create as many images as possible.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.8 Program the scheduler (continued)

2.5.8.3 Service Job



Click on **"Service Job"** to define a new job

- Change its **name to "Backup"**.
- Define the **Executable** corresponding to the script running a backup routine
- Define the **interval** to 2minutes.
- Define the **start/end time** manually from 00:00 to 00:01. this means that the job will be executes only 1 time a day at midnight

Verify that a green tick is displayed next to the profile name. This means the profile is active. If not double click on the name to activate it

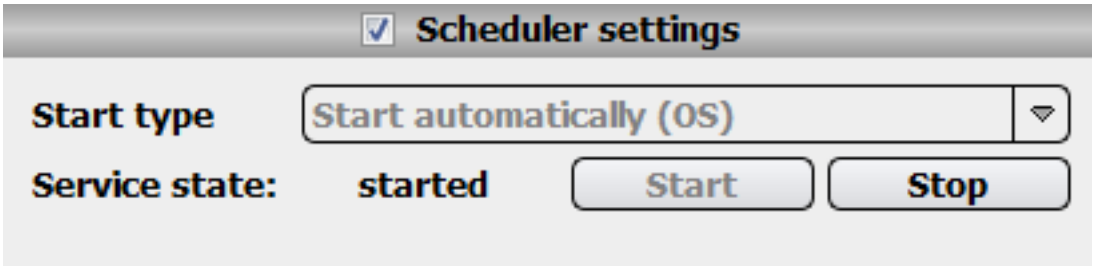
Service Jobs are used for example for back-up, for deleting old images or for importing weather data into the data base. They can be used also to integrate the images in existing and non standard web interface.

2.5 Step 5: Configure the Roundshot Livecam D2 HD (continued)

2.5.8 Program the scheduler (continued)

Once the Jobs are programmed correctly, start the scheduler.

Change the start type to **"Start automatically with operating system"**.
This makes sure that the camera resumes automatically when the computer is restarted.



The Scheduler will launch a photo job according to the time plan programmed. Stand by to observe the image taking in the software.

When the start mode **"start automatically with OS"** is selected, the software will be reconfigured and the scheduler started automatically after few seconds. During this period do not click on "start" as it might prevent the scheduler to be configured correctly

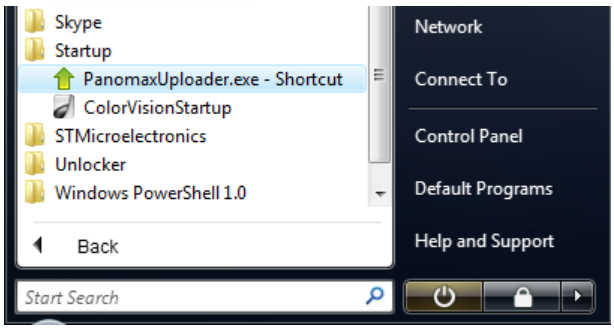
The Roundshot Livecam D2 and the Roundshot Livecam software are now fully configured. Please **close** the Roundshot Livecam capture software now.

2.6 Step 6: Configure the Livecam Uploader

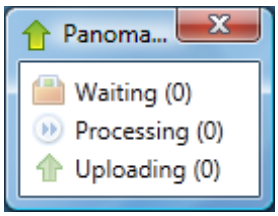
Once the Roundshot software is configured, all images are saved locally on the computer. The next step consists in **sending the images to the web server** to display them on a dedicated **web interface**.

Copy the contents of the installation disk to your computer, for example in C:/software (if not already done)

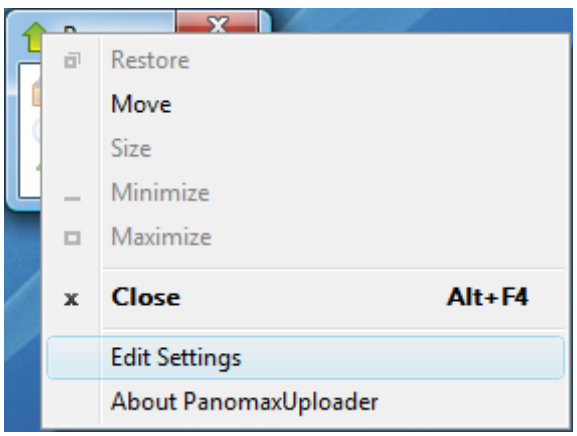
Open the folder C:/software/livecam uploader.



Drag and drop the file "**LivecamUploader.exe – Shortcut"** in the start-up menu of Windows. This will insure that the software will restart after a power loss.



Double click the file **LivecamUploader.exe.** The following window will appear.

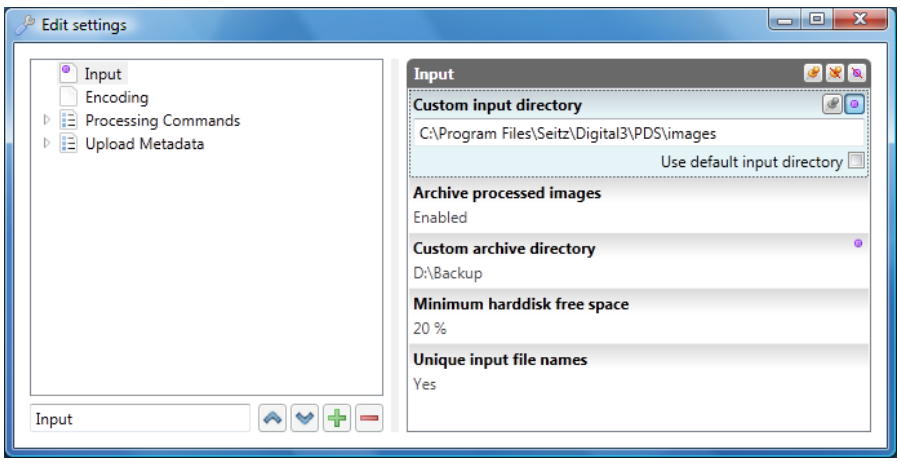


Click right on the upper left corner and select **edit settings**.

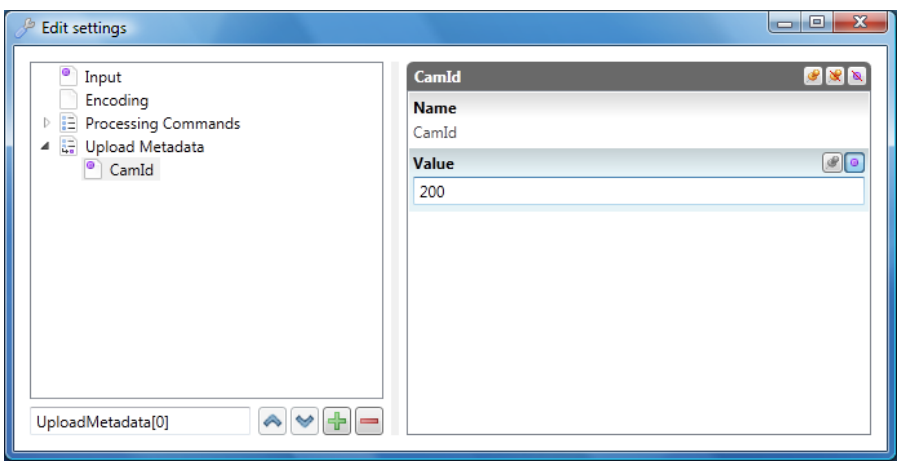
2.6 Step 6: Configure the Livecam Uploader

In the **Edit settings** window, select **Input** and change the following parameters:

- In Custom input directory define the path to the folder where all images are saved. By default the images are saved in "C:\Program Files\Seitz\Digital3\PDS\images"
- In custom archive directory select the location where backup images are to be saved (optional). Please make sure there is enough disk space available on the computer.



In the **Edit settings** window, select **Upload Metadata** and **CamID.** Change the parameter **Value** according to the value you received from Seitz. Please do not enter a random value as your images will not be uploaded.



Close the "Edit" window of the Livecam Uploader and close the Livecam Uploader. Restart the Livecam Uploader by double click.

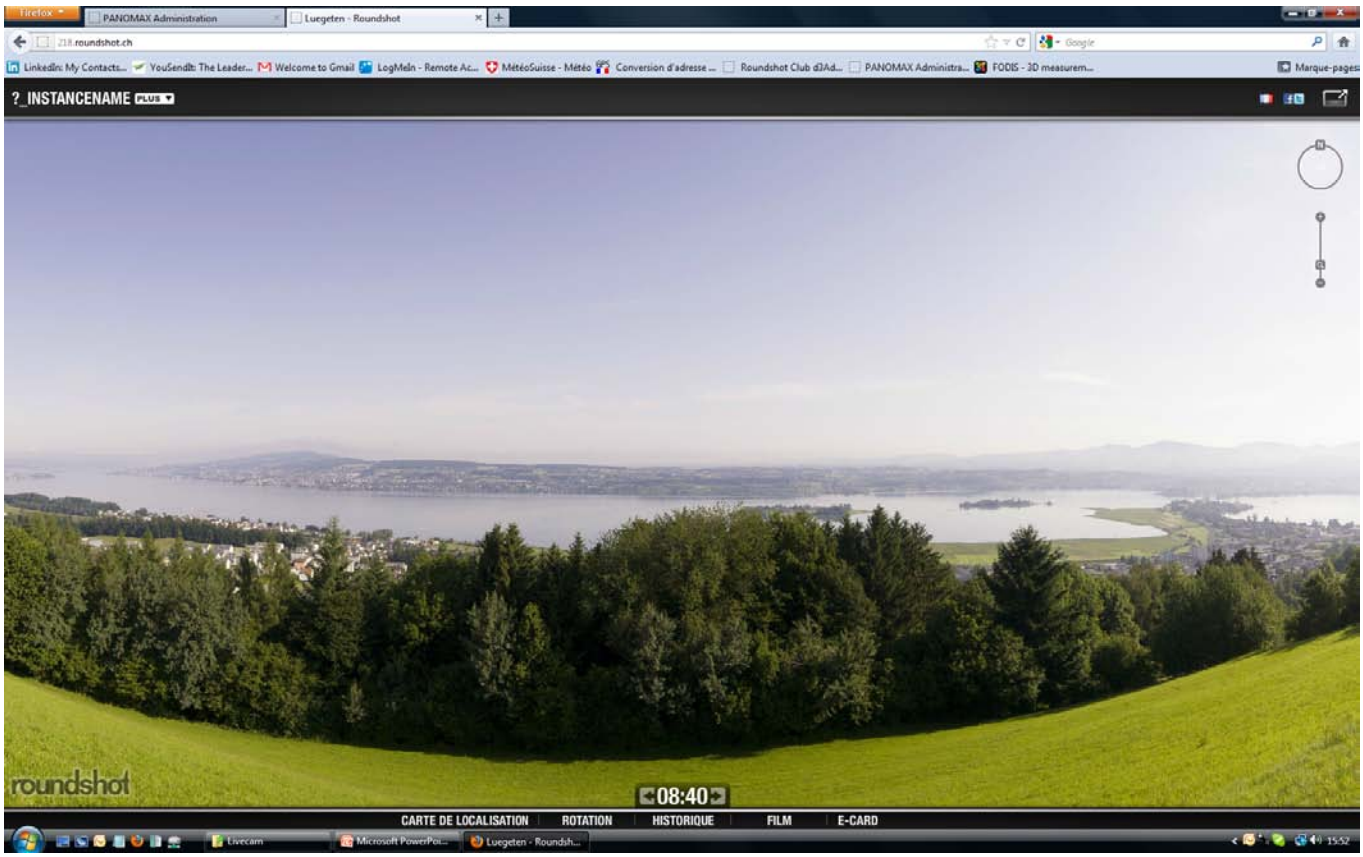
2.6 Step 6: Configure the Livecam Uploader

Congratulations!

Your Roundshot Livecam D2 HD is now fully functional and your images are uploaded on the web server.

Open a web browser and type your website address (_____.roundshot.ch)

The next step consists in configuring your web interface.



3. Configuring the Web Interface

In this section we will see how to configure the website by adding logos, links, sponsors ... All these customisations can be done using the frontend administration tool which is accessible in the following password-protected website:

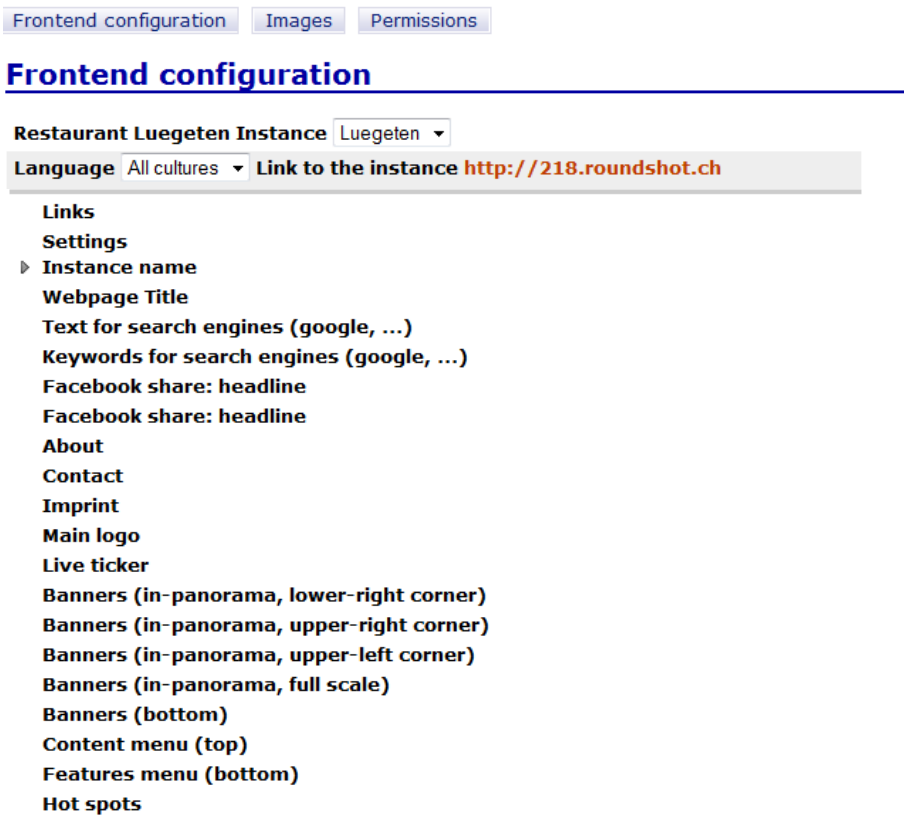
http://admin.panomax.at/login

After login, the administration tool will look as illustrated below. It contains three main sections:

- Frontend configuration: customising the web interface
- Images: managing the image database and "best shots"
- Permissions: granting access rights to the administration tool

Every section will be described in more details in the following chapters.

3.1 Frontend configuration



Please contact us if you did not receive your login and password for the website administration tool.

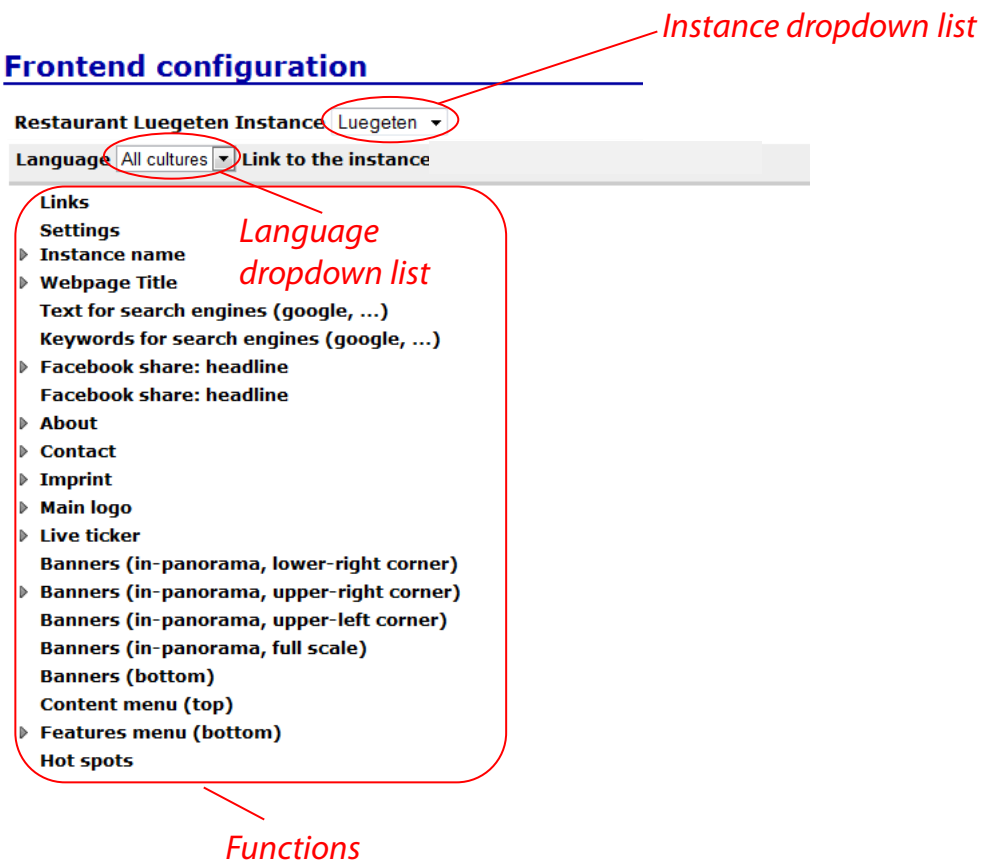
3.1 Frontend configuration (continued)

Select the instance (web interface) in the frontend configuration menu to be edited. For every instance a set of functions can be defined (such as settings, instance name, about, contact, etc.). Languages (cultures) can be assigned to these functions, ie the texts and links can be assigned to different translations.

For cameras with more than one instance (website) it is possible to **modify every instance independently by selecting it in the drop down list**. It is also possible to make a general modification that will be **applied on all instances** by selecting **"All instances"** in the dropdown list

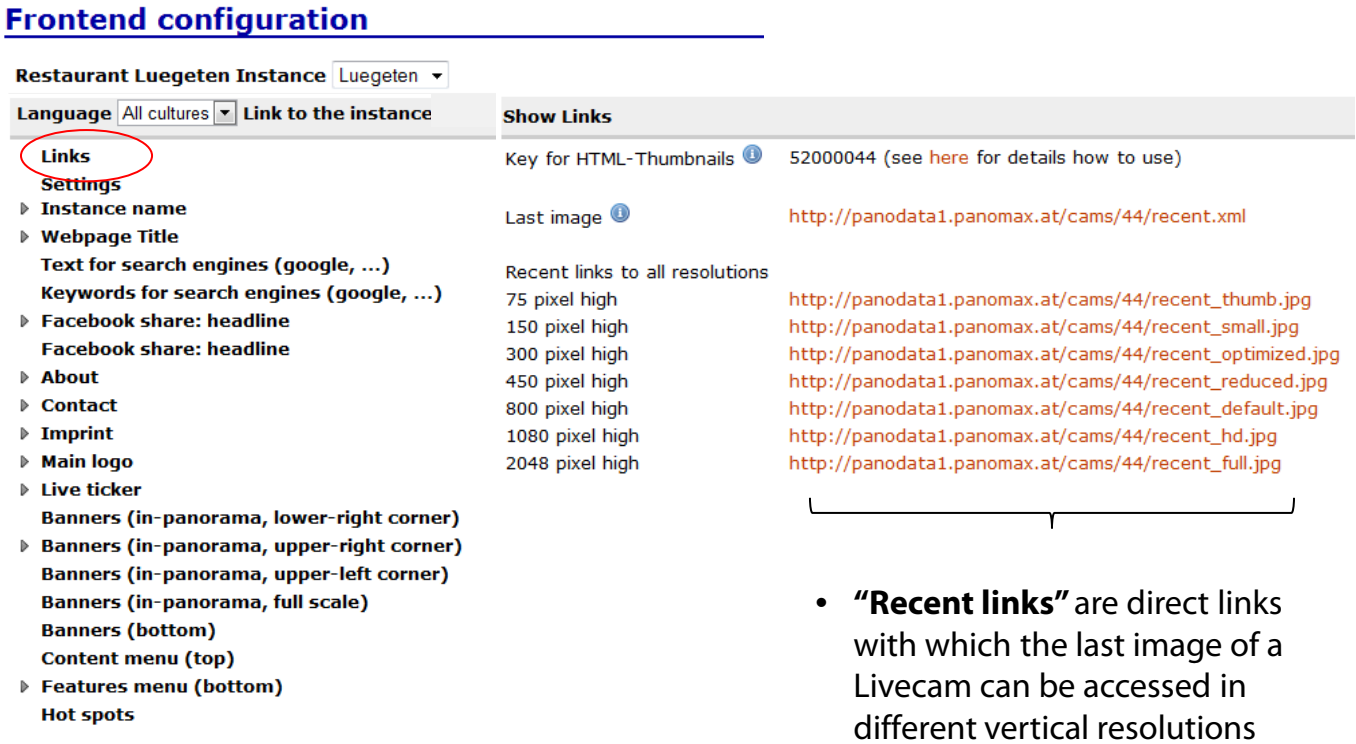
The same principle applies to language. If **"All cultures"** is selected in the drop down list, the modification will be applied on all languages. If a **specific language** is selected, every language will be modified independently. If no language (culture) is defined, the user is redirected to the default language.

More details will be given by building up an example web interface as example.



3.1 Frontend configuration (continued)

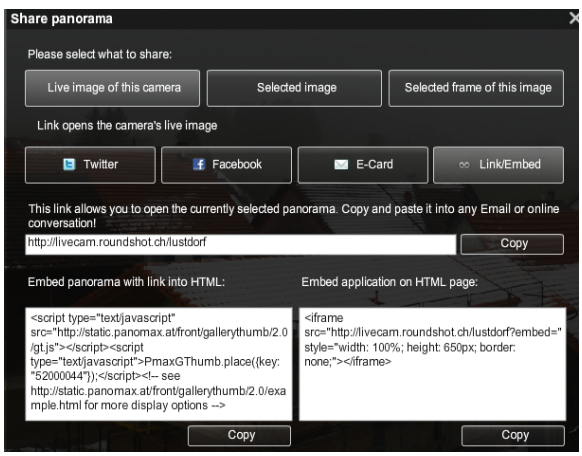
Step 1: Links



- **"Recent links"** are direct links with which the last image of a Livecam can be accessed in different vertical resolutions

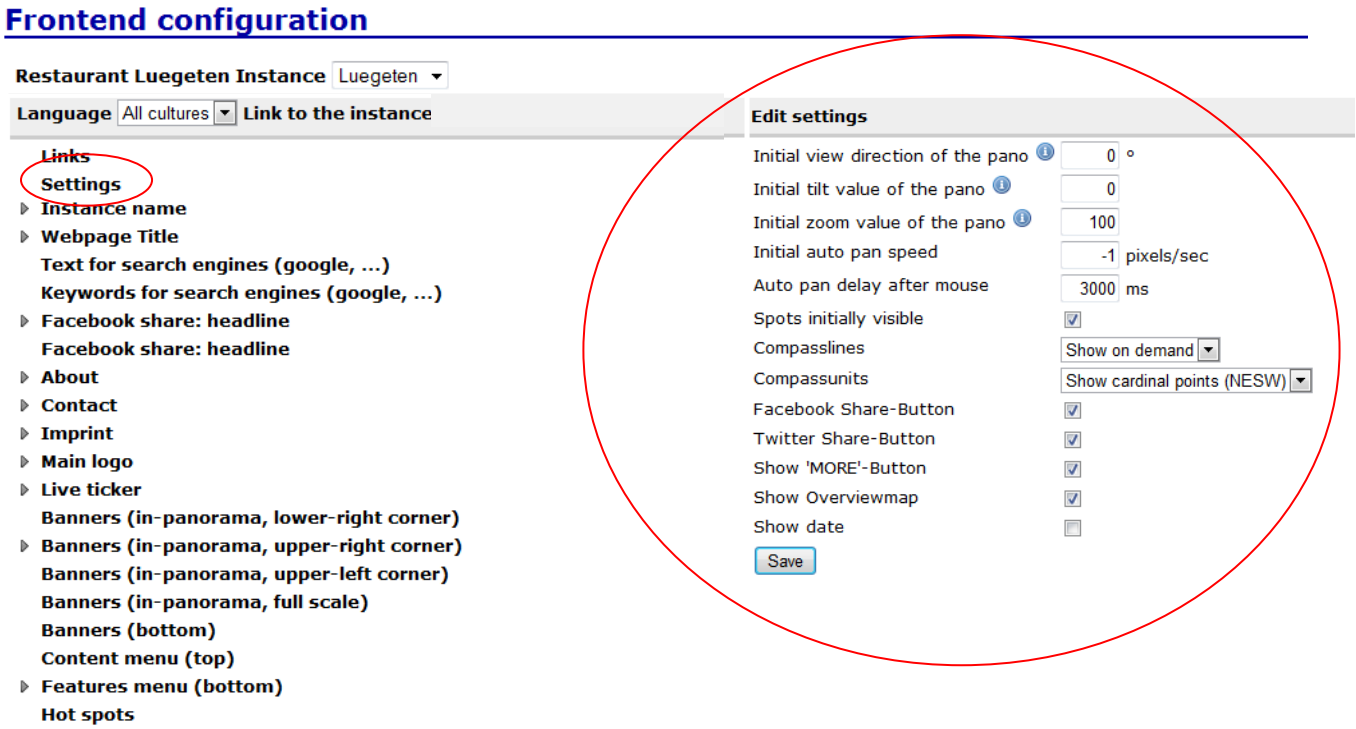
Click on **"Links"** to display the options for thumbnail links:

- **"Key for HTML-Thumbnails"** is an **8-digit short ID** which can be used with html/JAVA code to embed a rotating thumbnail in a website. The first three digits indicate the instance ID, the last three digits the camera ID. It is also possible to retrieve this code directly from the "**share panorama link"** on the top right of the website:



3.1 Frontend configuration (continued)

Step 2: Settings



Click on **"Settings"** to define the general image settings:

- **Initial view direction of the pano**: defines the angle of the initial view on the image when opening the website. It can be defined from 0° to 360°

- **Initial tilt value of the pano:** defines the initial area (center, top, bottom) of the initial view of the image. 0° displays the center, a negative value tilts down, a positive value tilts up.

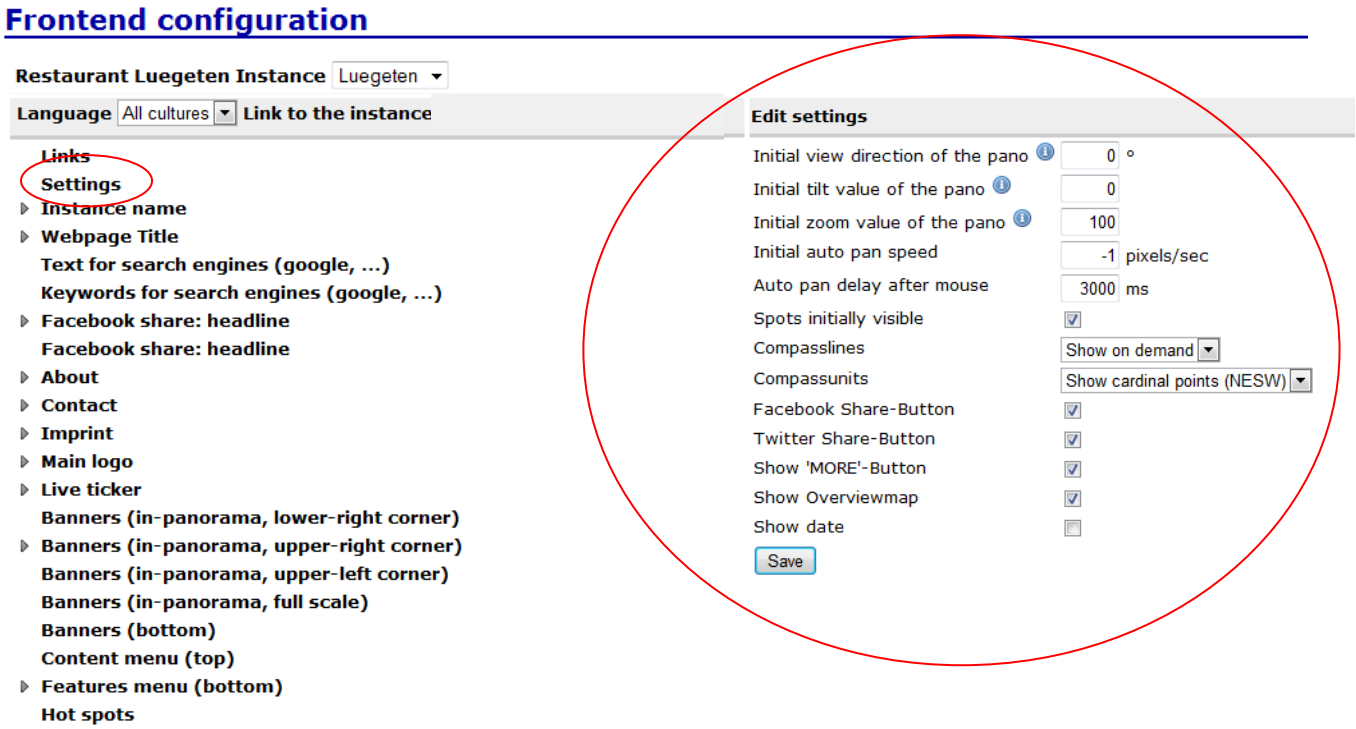
- **Initial zoom value of the pano:** defines the initial zoom state of the initial view on the image when opening the website.

- **Initial auto pan speed**: defines the default speed of rotation of the image when opening the website. The more pixels per second are set, the faster the image will rotate. Set this value to "0" to deactivate the rotation by default

- **Auto pan delay after mouse:** sets the time delay after last movement of the mouse to continue image rotation

3.1 Frontend configuration (continued)

Step 2: Settings



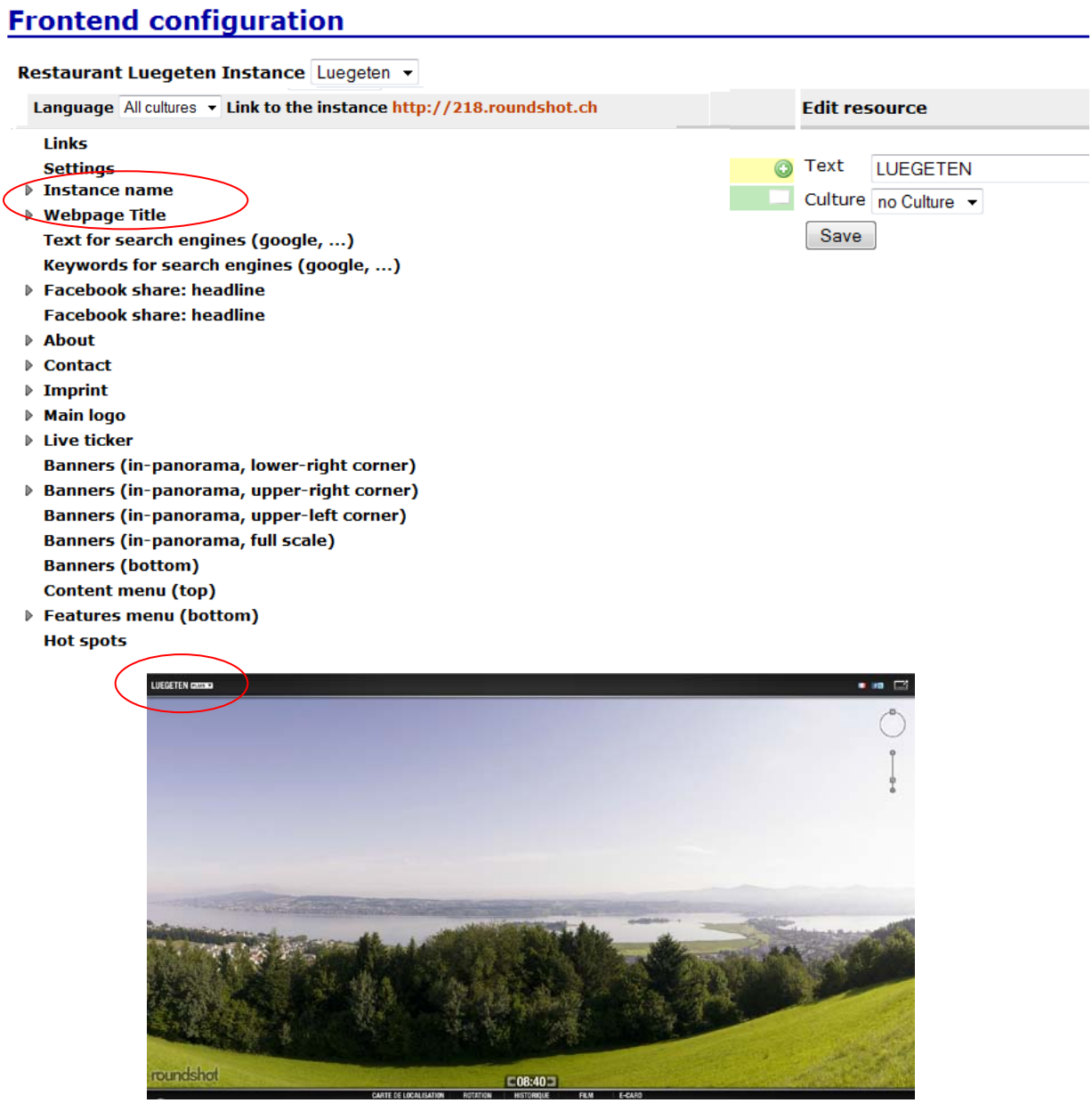
- **Spots initially visible**: defines if the hotspots will be visible when loading the website or not
- **Compass lines:** defines if the compass lines should be displayed permanently or only on demand when passing the mouse on the top area of the image
- **Compass units:** defines the units for compass display: cardinal points (NESW), degrees, maritime compass
- **Facebook share button, twitter share button:** defines whether social media buttons are accessible or not
- **Show more button:** defines whether 'more' button to navigate between instances in the same instance list is accessible on the webpage or not
- **Show overviewmap:** defines if the overviewmap is shown in the website or not
- **Show date:** defines if a special date animation is shown when loading the website or not

3.1 Frontend configuration (continued)

Step 3: Instance name + webpage title

Click on the **green plus sign** next to "Instance name" and "Webpage title" to change the title of the instance. In this example we defined the name LUEGETEN. We have also selected **"No Culture" to set this name for all languages.** Then click on "Save" to store the changes.

The **instance name** is used as a label on the top left corner of the website while the **webpage title** is used in the browser title bar as well as for the iphone/ipad/android app and the screen saver to identify the webcam.

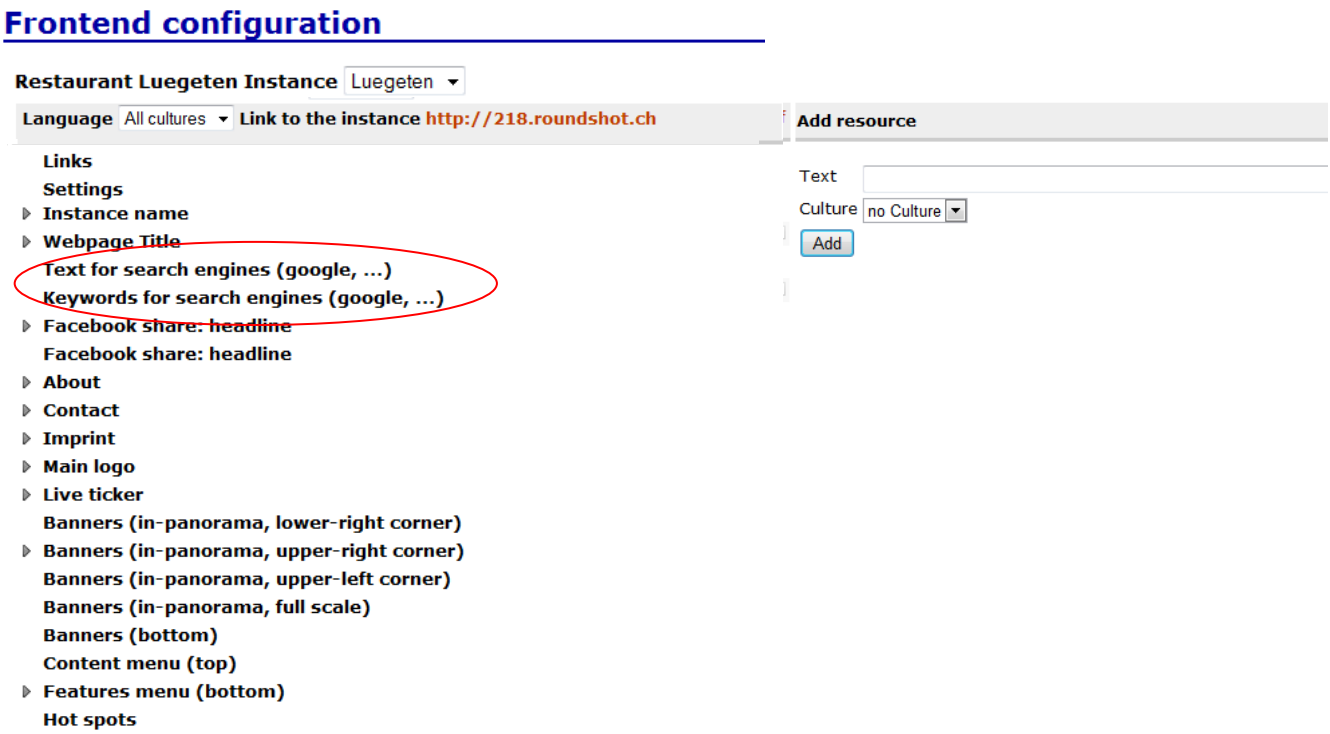


3.1 Frontend configuration (continued)

Step 4: Text + keywords for search engines (google...)

In the field **"Text for search engines (google...)"** it is possible to enter the first intro sentence as it appears when displaying the Livecam website as a result in search engines.

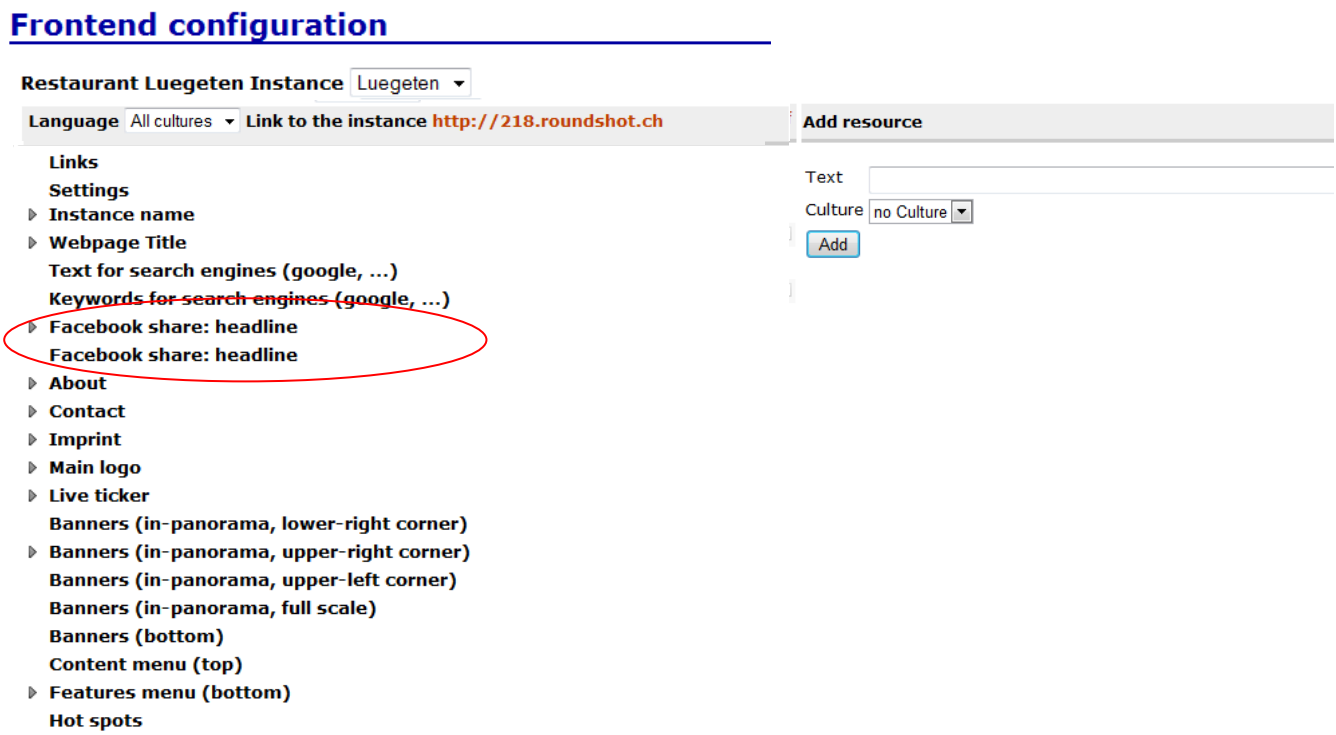
The **"Keywords for search engines (google...)"** field allows to define certain tags (such as 360 webcam, tourism, panorama, ...) which help to find the webpage more easily.

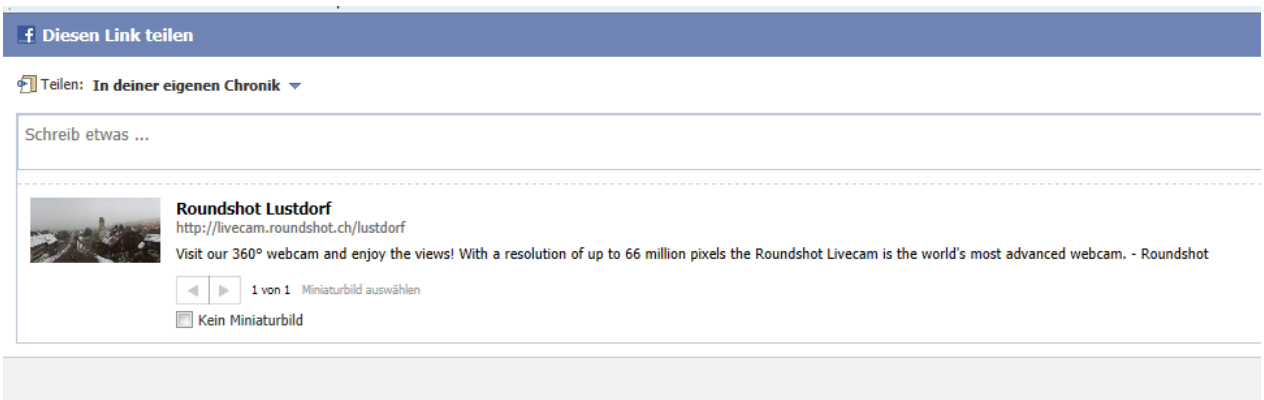


3.1 Frontend configuration (continued)

Step 5: Facebook share: headline

"Facebook share: headline" defines the standard text that appears when sharing a panorama or parts of it in social media. If no text is defined, the standard search text will be used.





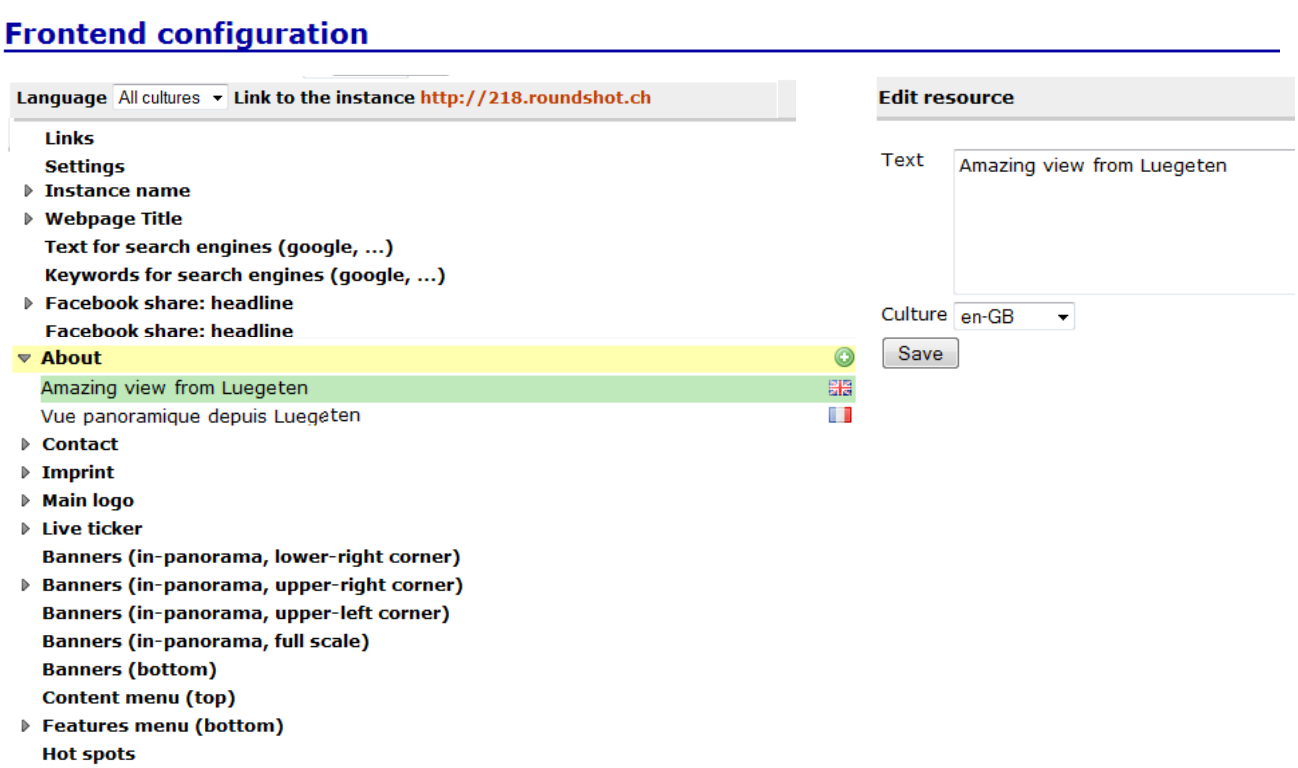
3.1 Frontend configuration (continued)

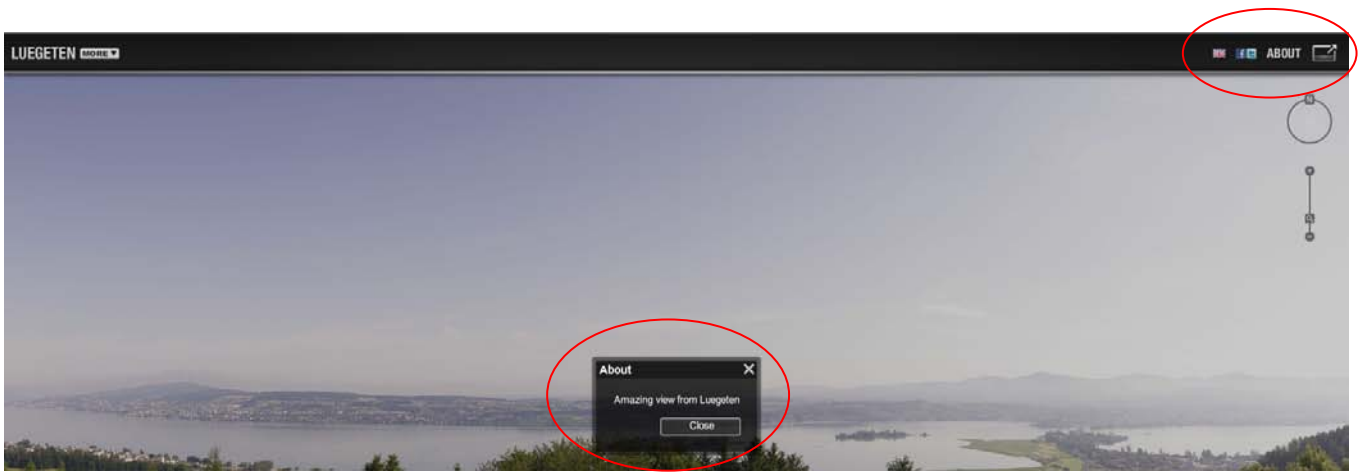
Step 6: About

Add an **"About"** menu on the top right of the window. In this example we create the content in 2 different languages:

- Click on the **green plus sign** next to "About". Select the culture "en-GB" for English, write the corresponding text and save.
- Click again on the **green plus sign** next to "About" to add a second content. This time select another language (French for example), add the corresponding text and save again.

The 2 languages will then be displayed as shown below.

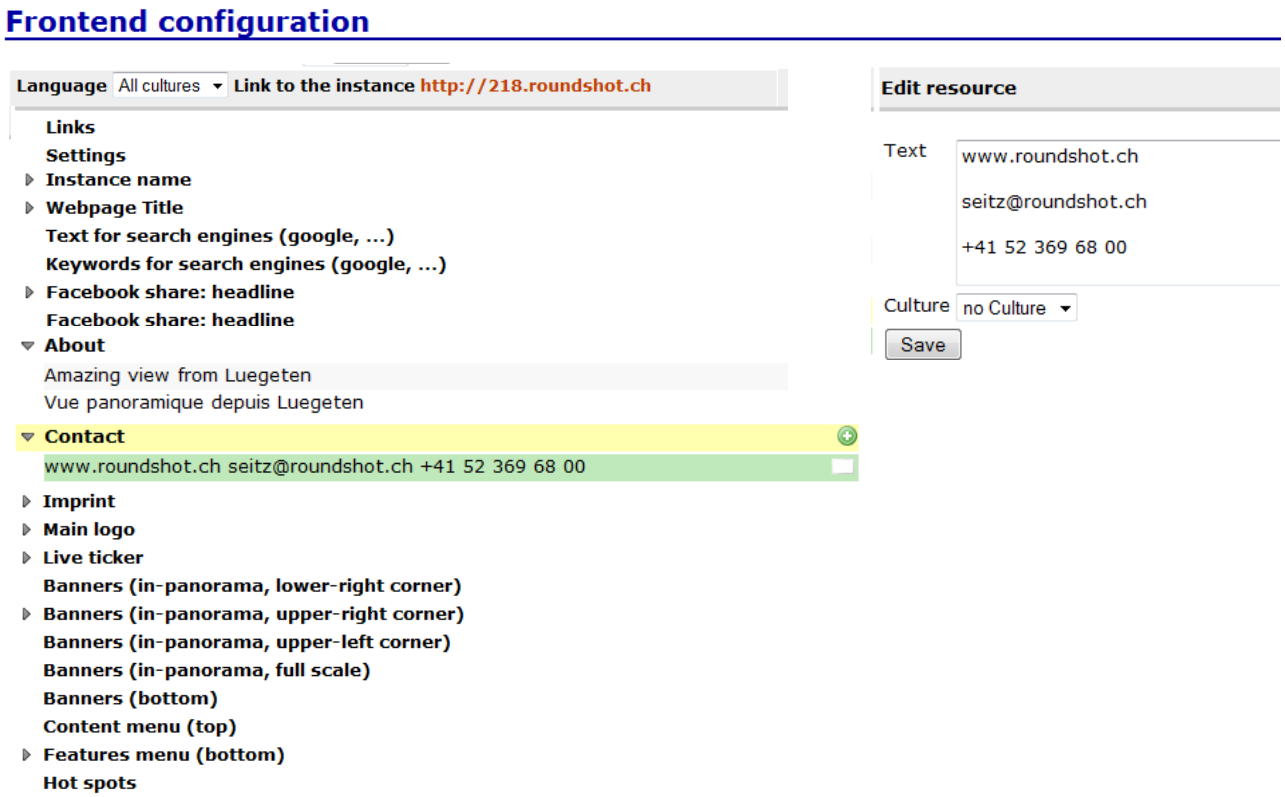




3.1 Frontend configuration (continued)

Step 7: Contact

Click on the **green plus sign** next to **"Contact"** to add a contact menu in the top right corner of the window. Enter the text and click on "Save".

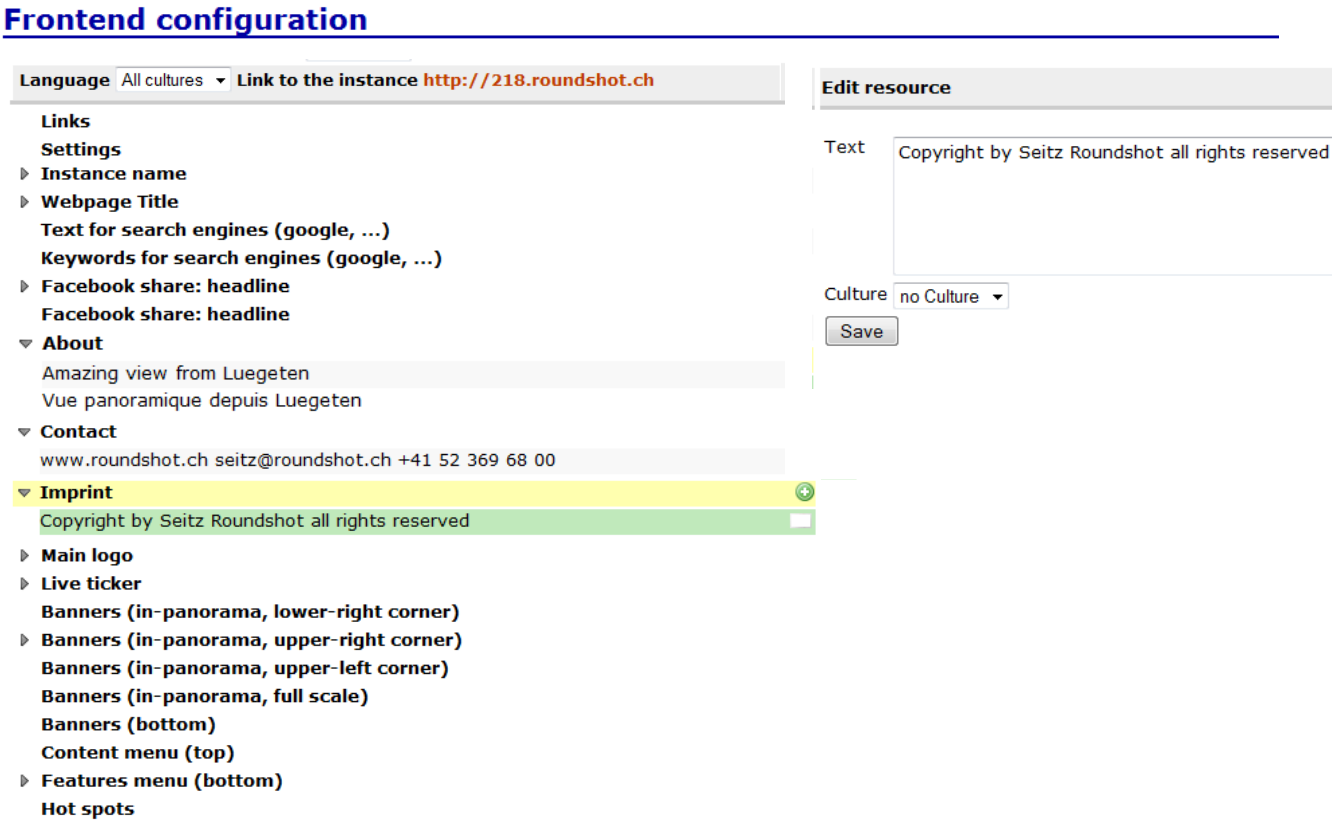


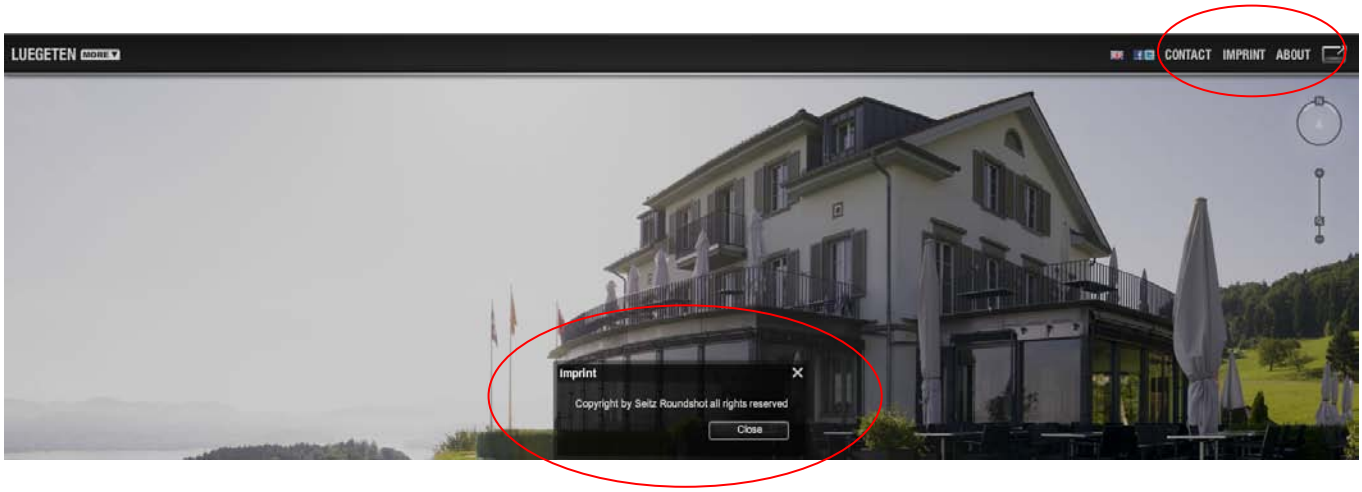
Result:

3.1 Frontend configuration (continued)

Step 8: Imprint

Click on the **green plus sign** next to **"Imprint"** to add a copyright menu in the top right corner of the window. Add the copyright text and click on "Save".





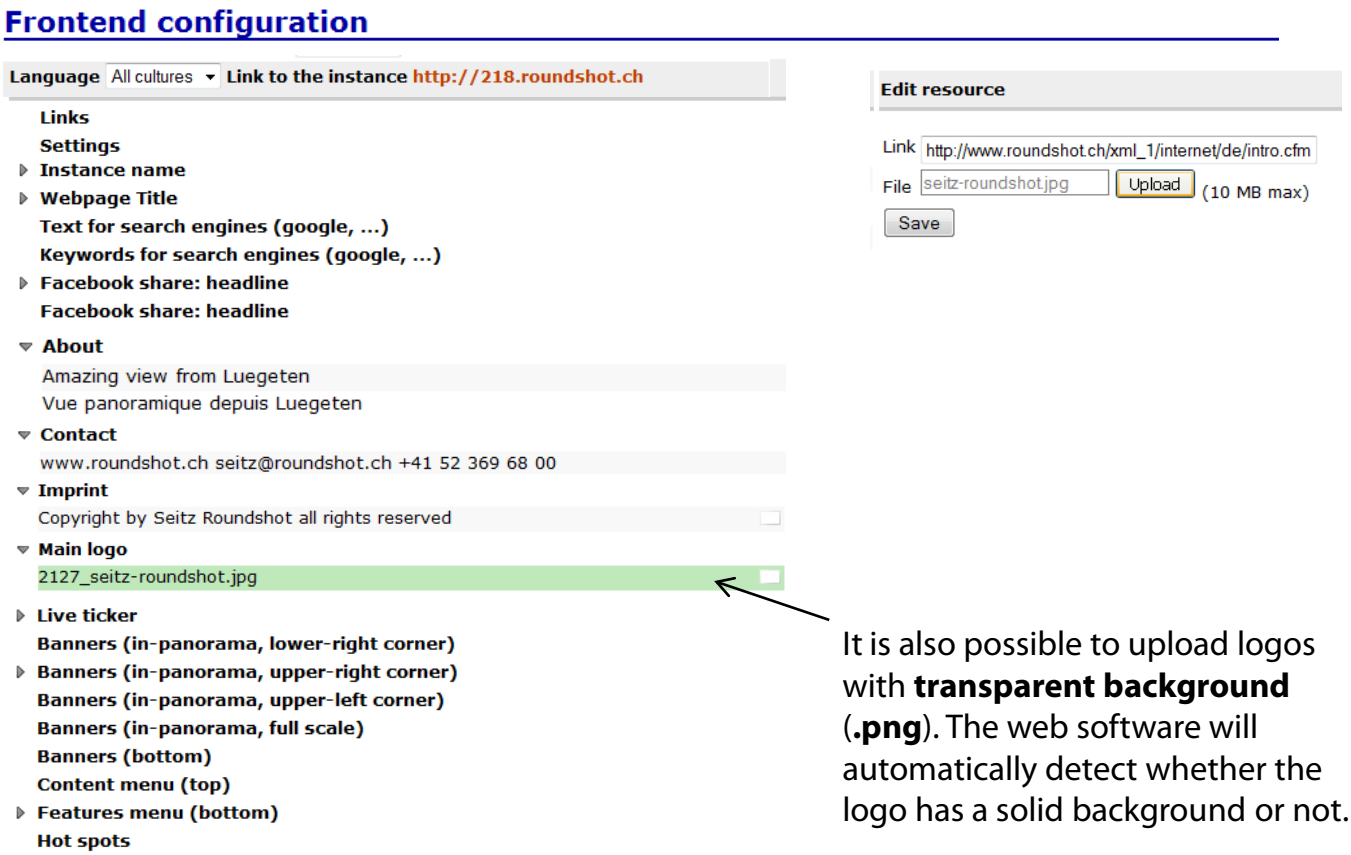
3.1 Frontend configuration (continued)

Step 9: Main logo

Click on the **green plus sign** next to **"Main logo"** to add your company logo on the top left of the window.

Select the type "File upload" to be able to select a file on your computer.

Then enter the web link where the logo should point to and select the file path by clicking on upload. Finally click on "Save".

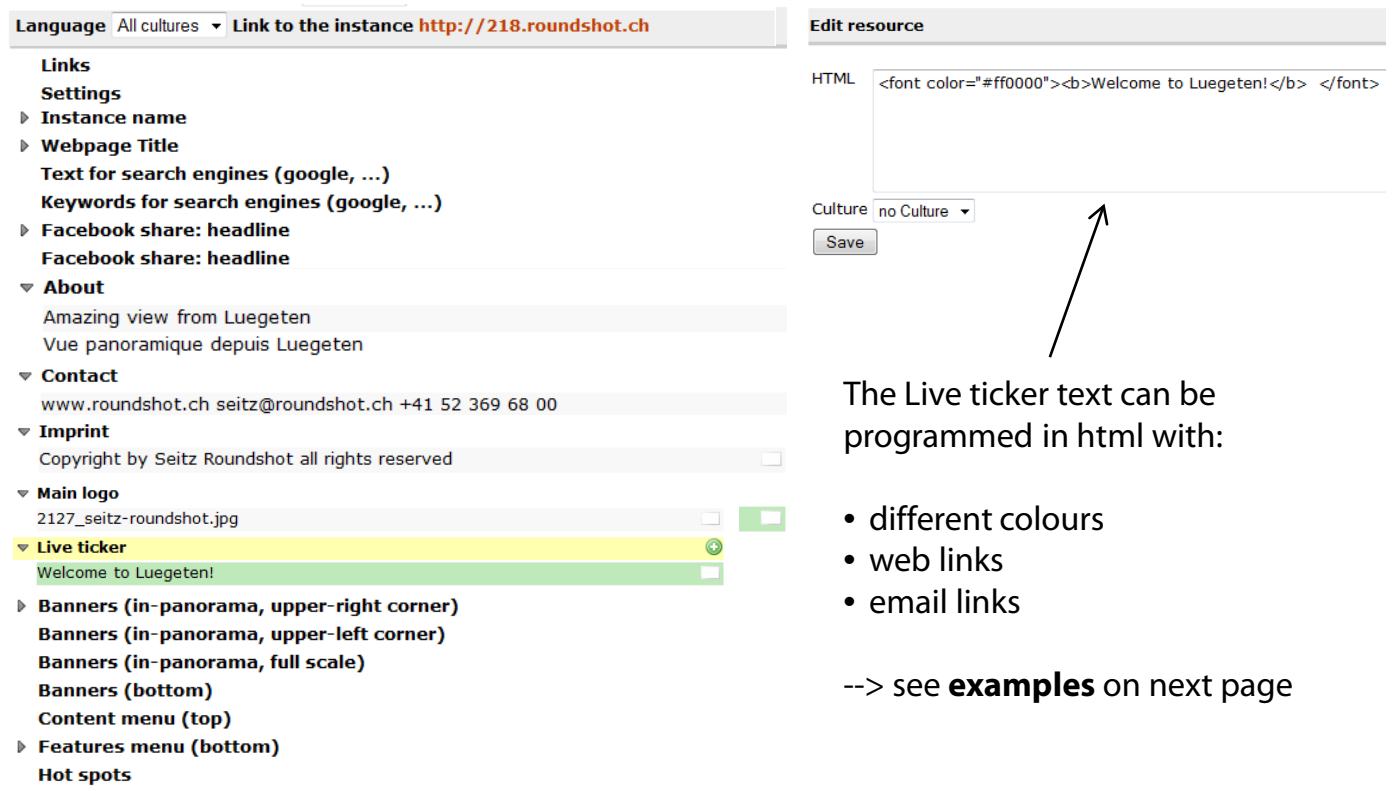


It is also possible to upload logos with **transparent background** (**.png**). The web software will automatically detect whether the logo has a solid background or not.

3.1 Frontend configuration (continued)

Step 10: Live ticker

Click on the **green plus sign** next to **"Live ticker"** to add a message in the bottom section of the window. In this example instead of adding a simple text we entered an HTML text to have the text in Red. Any other HTML code (also with hyperlinks or email links) can be added here.



The Live ticker text can be programmed in html with:

- different colours
- web links
- email links

--> see **examples** on next page

3.1 Frontend configuration (continued)

Step 10: Live ticker - examples

Text with different font colour

```
<font color="#ff9900">Welcome at Luegeten... </font>
<font color="#ff0000">fantastic view on the Lake of Zurich!</font>
```

Email link

```
<a onmouseover="status='info@luegeten.ch';return true;" title="info@luegeten.ch" href="mailto:info@luegeten.ch" target="_top"><font color="#ffff00">info@luegeten.ch</font></a>
```

Web link

```
<a title=„Luegeten." href="http://www.luegeten.ch" target="_blank"><font color="#ffffff">www.luegeten.ch</font></a>
```

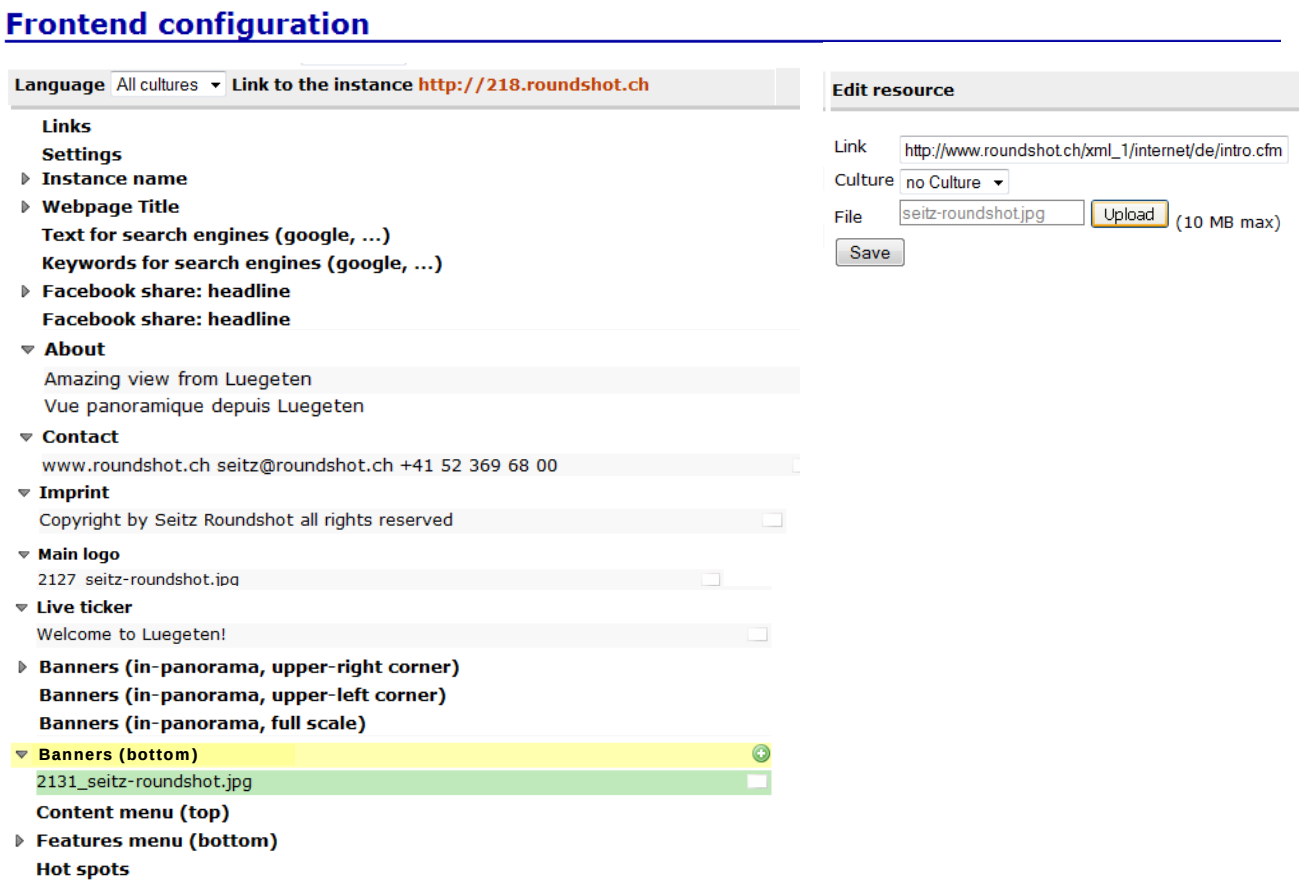
3.1 Frontend configuration (continued)

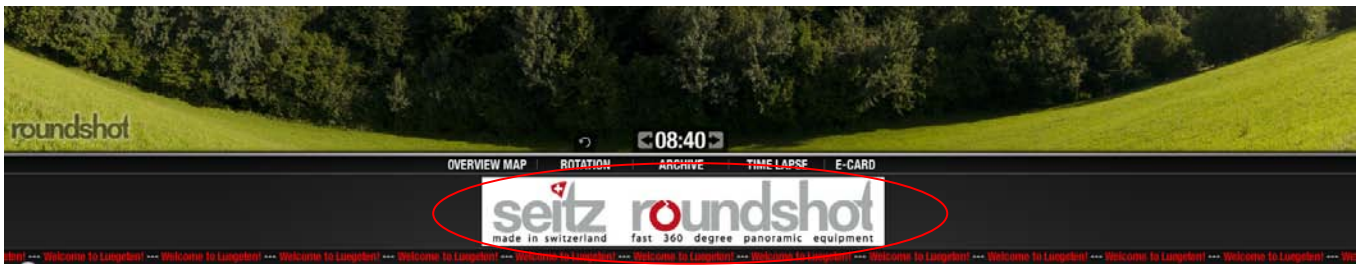
Step 11: Banners (bottom)

Click on the **green plus sign** next to **"Banners (bottom)**" to add a sponsor logo in the bottom area of the window.

Select the type "File upload" to be able to select a file on your computer.

Then enter the web link where the logo should point to and select the file path by clicking on upload. Finally click on "Save". If several sponsors logos should be added repeat the procedure by clicking a second time on the green plus sign.



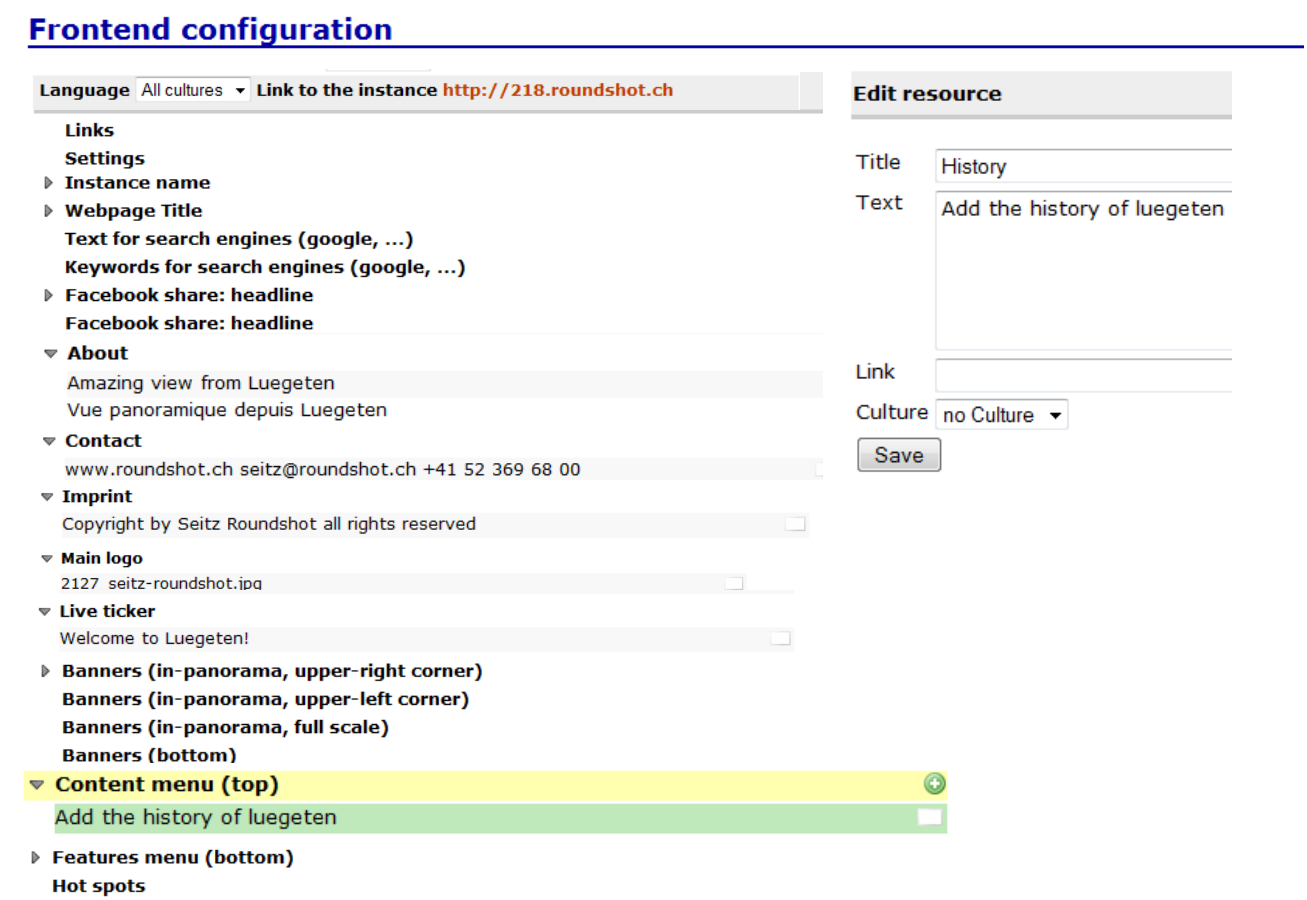


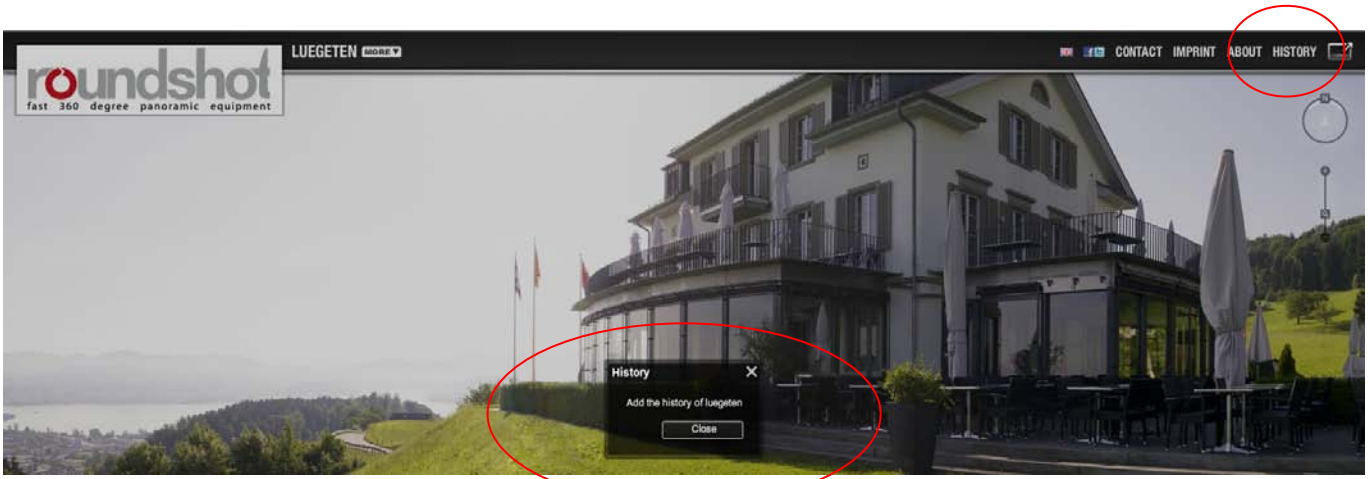
3.1 Frontend configuration (continued)

Step 12: Content menu (top)

Add more menus in the top area of the window by clicking on the **green plus sign** next to **"Content menu (top)".**

Give a name to the menu and select between adding a text or a link. In this example we create a menu "History" with a text displayed in a popup window as shown below:



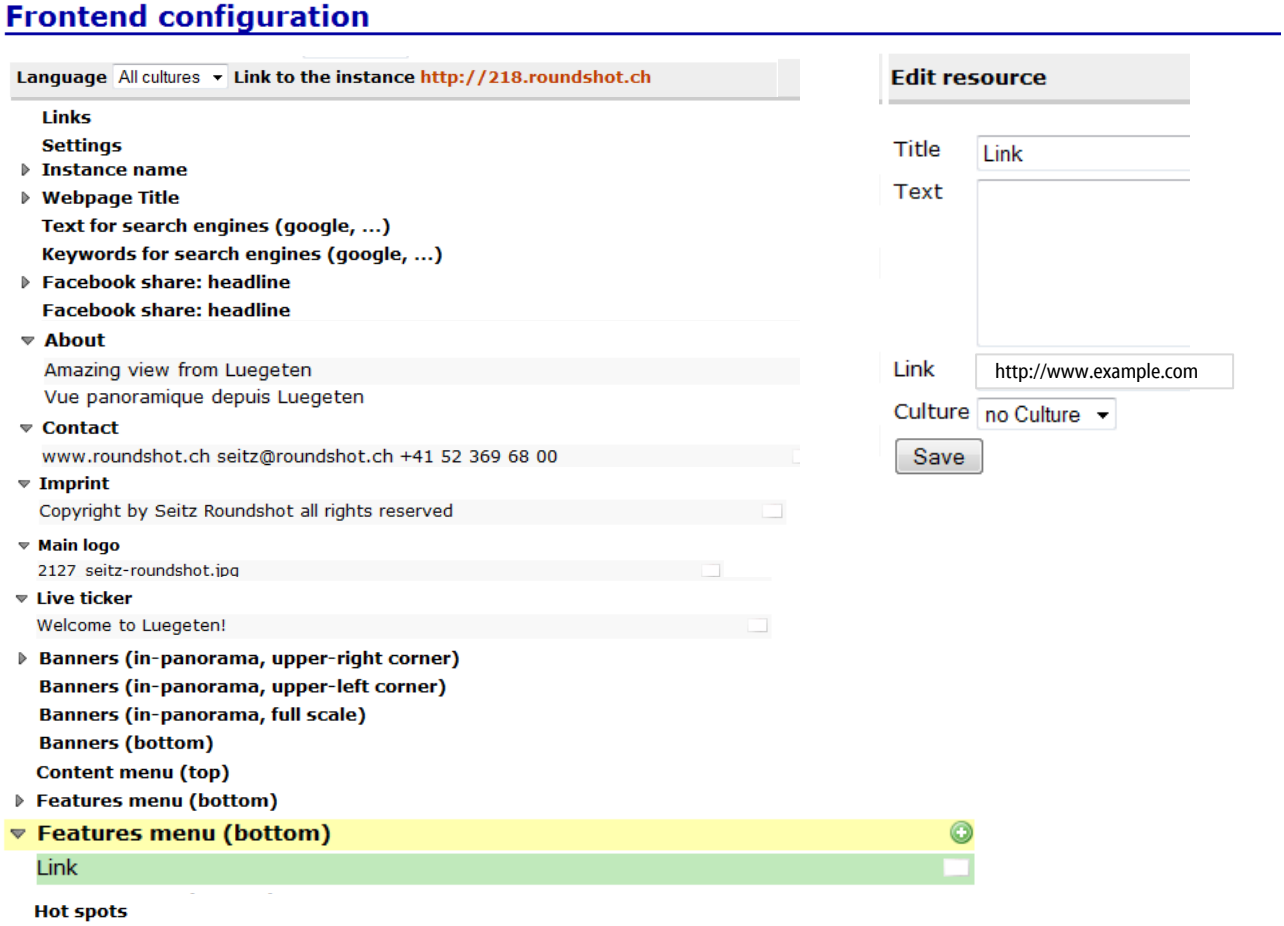


3.1 Frontend configuration (continued)

Step 13: Feature menu (bottom)

Add more menus in the bottom area of the window by clicking on the **green plus sign** next to **"Feature menu (Bottom)".**

Give a name to the menu and select between adding a text to be displayed or a link. In this example we create a menu "Link" forwarding the user to the website "www.example .com" .

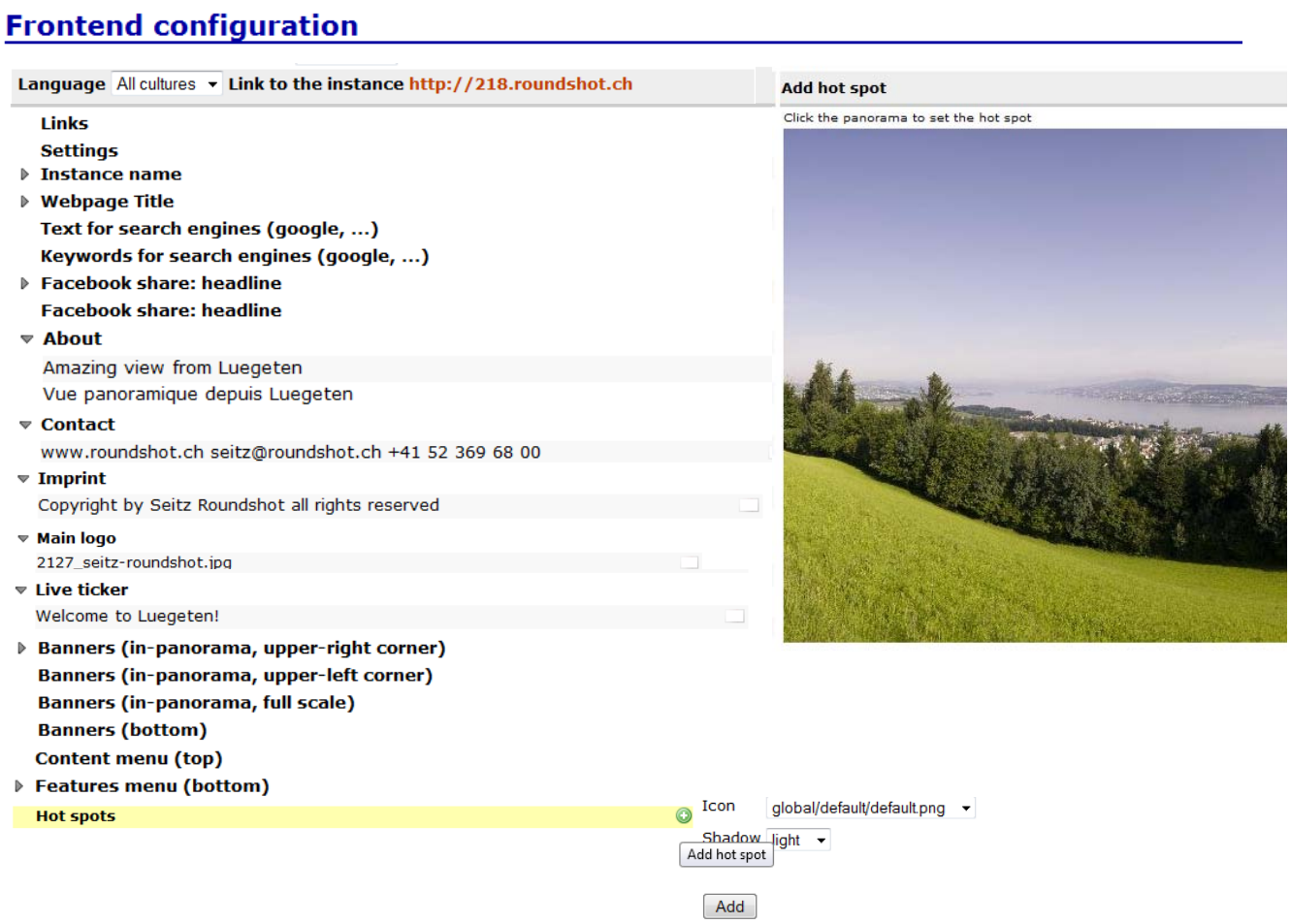


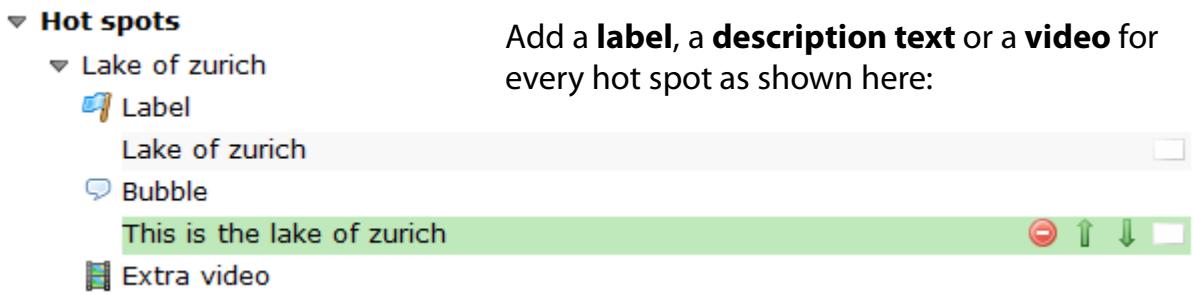
3.1 Frontend configuration (continued)

Step 14: Hot spots

Add hot spots on the image by clicking on the **green plus sign** next to **"Hot spots".**

Select the Hotspots parameters (Icon and shadow) then click on the correct location on the image preview displayed as shown below:





Add a **label**, a **description text** or a **video** for every hot spot as shown here:

3.1 Frontend configuration (continued)

Step 15: check the results

Congratulations !

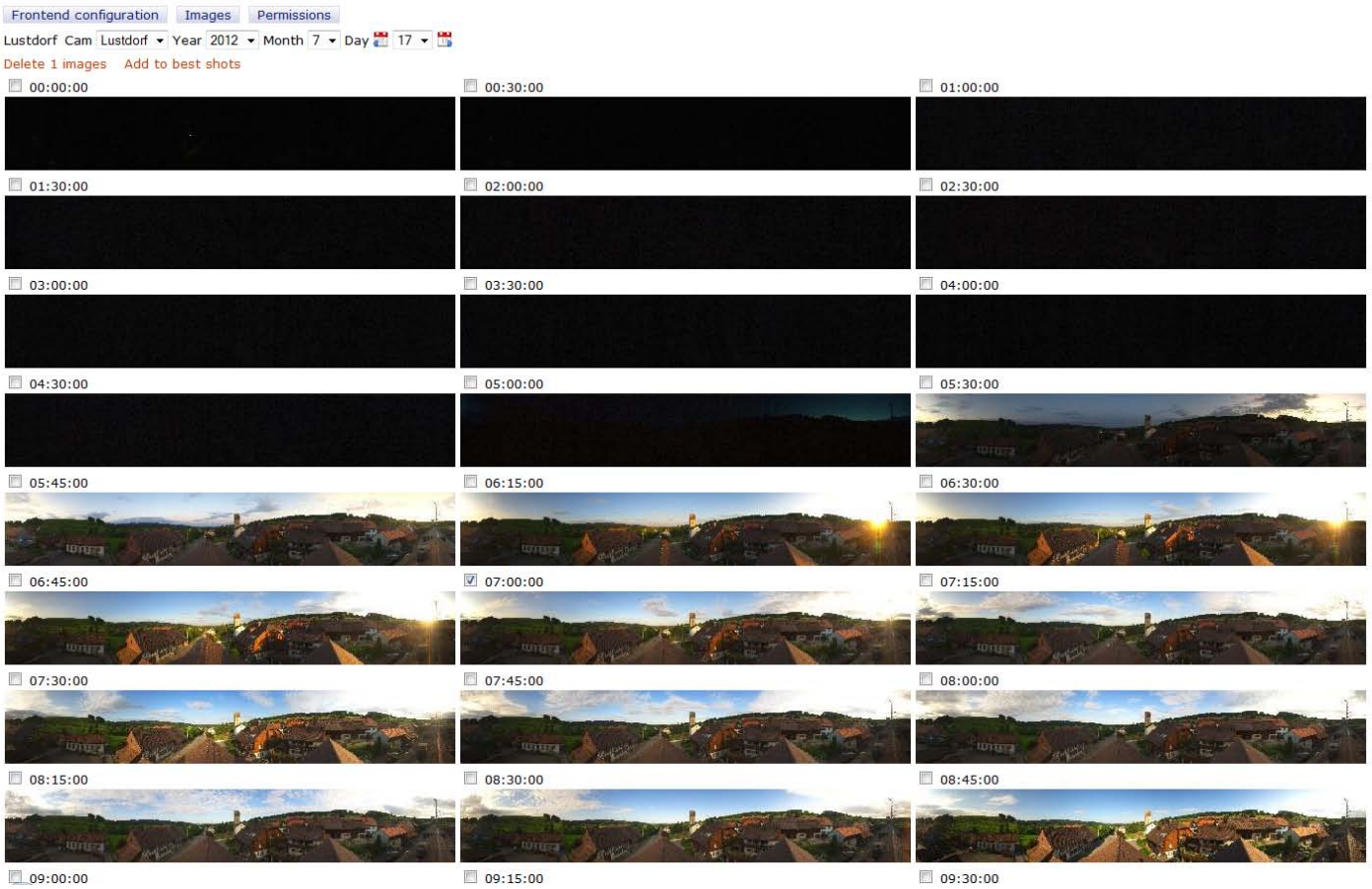
Your website is now fully customised and is ready to display beautiful Livecam panoramas.

3.2 Image database + “best shots”

In the “Images” menu you can access the image database of the livecam.
Once one or several images are selected, 2 functions are available:

- **delete one or more images** from the history
- **mark one or several images as “best shots”**

The **“best shots” menu** is automatically created and is accessible by all website visitors.



3.3 Permissions

In the "Permissions" menu it is possible to add or remove users accessing administration tool of your Livecam.

This allows, for example, to **grant access** for various users to **different instances** of the same Livecam. Every instance can then be customised independently by its owner.

4. Maintenance

4.1 Camera handling & maintenance

The Roundshot Livecam D2 HD contains high-tech electronic components. Therefore it is important to handle the camera with care, in particular:

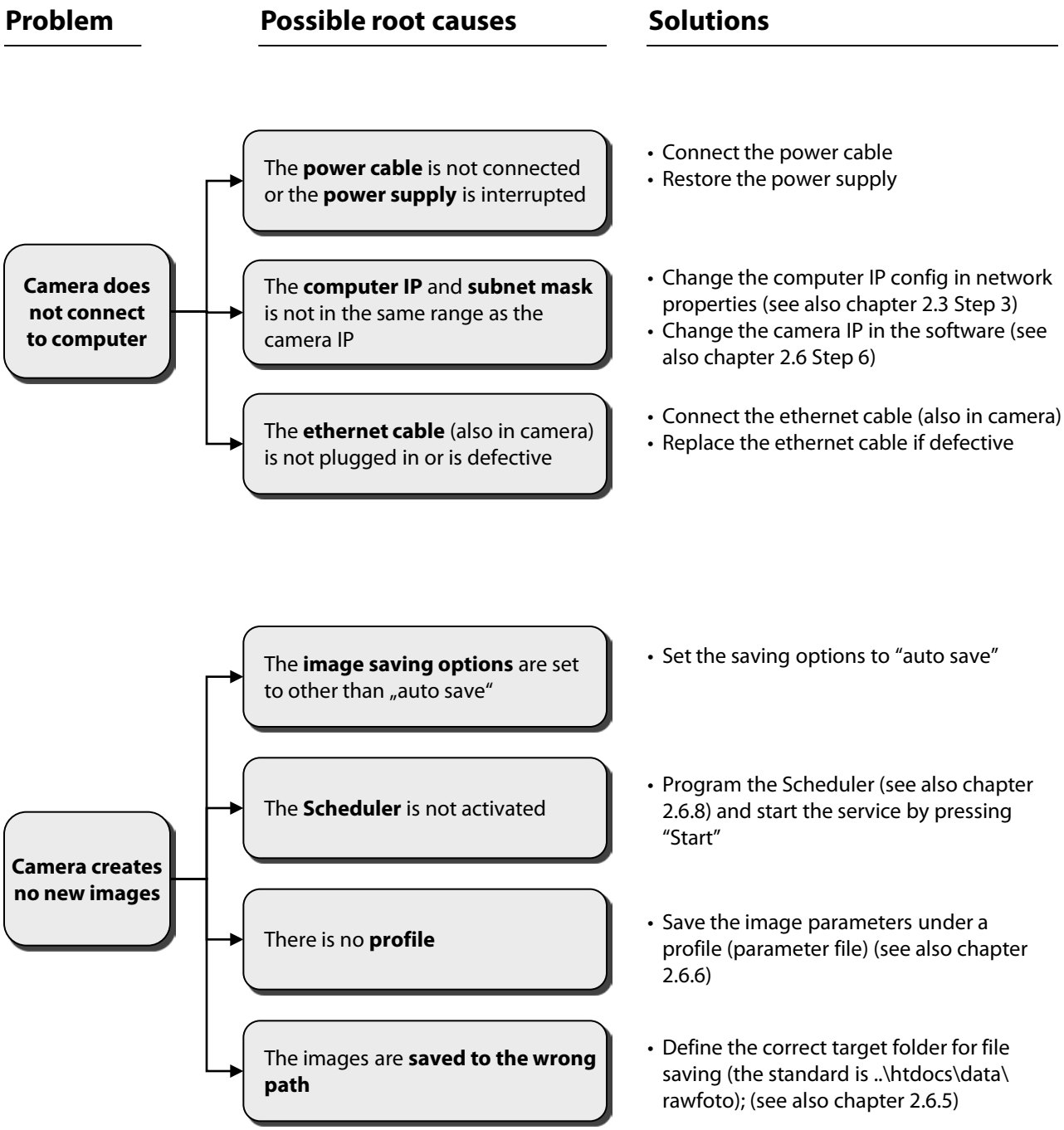
- Check whether all **levers and screws** (for example the tilt lever, the f-stop lever) are fastened
- Add a **silica gel pack** inside the waterproof cover (next to camera) to help absorbing any potential humidity
- Never use the camera without completely **closing and sealing** the waterproof cover except for installation or maintenance
- Make sure that the three cover screws are completely tightened and that that the **waterproof cover is sealed** with **waterproof tape or with silicone gel**
- Verify that the **waterproof plugs** (ethernet + power) are inserted firmly into the camera and fastened tightly
- If the camera is not installed, **keep the camera in a cool and dry place for storage** (ideally in the original case supplied with the camera)
- **Prevent exposure to dust**, as an accumulation of dust particles on the digital sensor may impair image quality
- Make sure **not to drop** the equipment
- When unplugging cables **pull at the plug not at the cable**

From time to time and depending on the climatic environment your camera needs some maintenance:

- **Clean the front glass** (outside) with window cleaner
- Replace the **silica gel pack** inside the waterproof cover every 2 years
- Make sure that **no objects** obstruct the operation of the camera

4.2 Camera problem shooting

It is possible that there is a problem with operating the Livecam. Before contacting Seitz Roundshot or a Seitz Roundshot representative please refer to the check list in chapter 2.6.6. If the problem persists check the following points:



4.2 Camera problem shooting (continued)

Problem	Possible root causes	Solutions
The images are not correctly framed	The **zoom position** on the lens was modified	• Check whether the focal length in the software corresponds to the marking on the lens; go back to chapter 2.6.1 to frame the image
	The **camera's orientation** in the mast was changed	• Make sure that the camera position in the mast is correct and adjust if necessary
	The **camera start angle** was modified	• Check the setting for "Start angle" in Format/Degrees/Options
	The **digital crop function** was activated	• Check if the "Digital crop" function in Format/Degrees/Options is set at the correct value

4.2 Camera problem shooting (continued)

Problem	Possible root causes	Solutions
Camera creates low quality images	The image is **unsharp**	• Stop down the lens (for example to f=11 or f=16) • Check the focusing on the lens and optimise sharpness; see also chapter 2.6.2
	The image is **blurred**	• Check if the image has been accidentally blurred. Display any blurring rectangles by clicking on the "blurring" icon. Deactivate them with a right-mouse-click; see also chapter 2.6.4
	The image is **overexposed**	• Check if the exposure is set to a manual exposure speed by error (instead of "Automatic (prescan)" or "Automatic (variation)" • Check if the "Exposure correction" is set to a value other than 0.0x
	The image is **underexposed**	
	There are **vibrations** in the image	• Check if the Livecam mast is solid or if there are any vibrations caused by wind or by nearby installations
	There are **horizontal stripes** in the image	• The motor blocks because it does not receive enough power -> Set the environment settings to "Cold condition" (menu "Manage) -> Check if the mains adaptor delivers sufficient power (voltage)
	There are **vertical stripes** in the image	• Vertical stripes can be caused by fluorescent (indoor) light; use the "Light frequency correction" to eliminate the vertical stripes in the image
	The image is **black**	• The electronic shutter does not work correctly; contact Seitz Roundshot
	The image has **strange colours**	• Set White Balance to "Automatic, Gamma to 2.2 and S-Curve to "Weak" • The electronic shutter does not work correctly; contact Seitz Roundshot
	The image is **noisy**	• Reduce the ISO/ASA setting

4.3 „Club Livecam“

4.3.1 International warranty & product registration

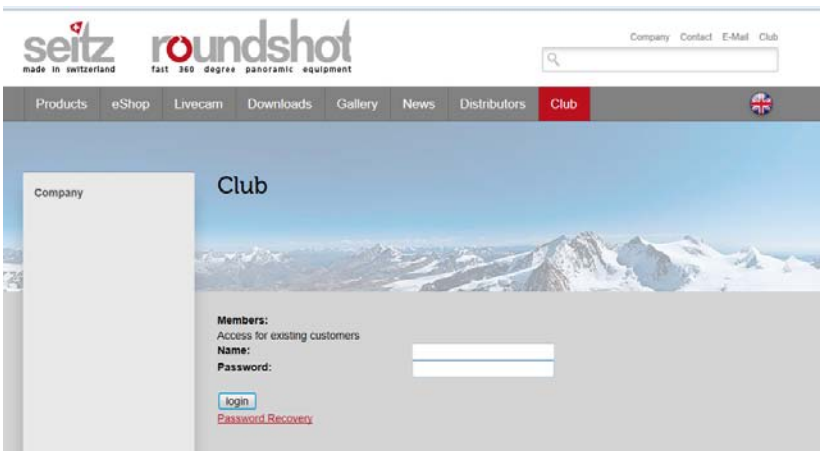
Your Roundshot Livecam D2 HD is covered by the international 2-year Seitz warranty. The warranty is linked to the serial number of the camera directly and is stored in our database.

If there is any malfunction or defect of the equipment we will repair the camera at no cost. The warranty extends to technical defaults that are not caused by negligent use, damage by transportation or other defaults not related to the manufacturing of the camera.

The warranty is void if the camera has not been handled with care (has been dropped). Delivered components for which separate warranty agreements are issued (for example for computers) bear the warranty of the manufacturer.

We invite you to register your product with us. Registering your product has several advantages:

- Free access to the latest software downloads and instruction manuals
- Email software update alerts + release notes
- Direct technical assistance in case of a problem



Registering your product is a simple 2-step process:

1. Send us an email to seitz@roundshot.ch indicating the serial numbers of your camera as well as where you bought the equipment.

2. We will activate your membership and confirm your registration by email.

Then go to the „Club Livecam“ section at www.roundshot.ch, log in with your member ID and password and download new software or instruction manuals.

4.3 „Club Livecam " (continued)

4.3.2 Software & firmware updates

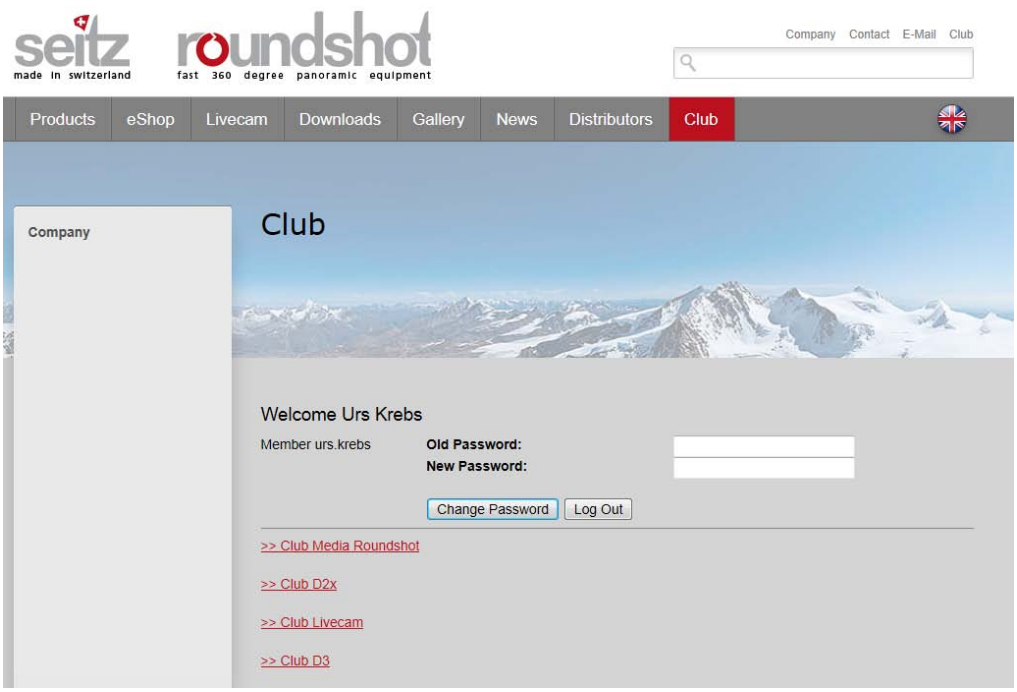
Sometimes copying programs or flash files on USB sticks can damage them. Therefore we recommend downloading the software directly to your computer from our website.

The software runs on Windows PCs (XP, VISTA, 7) as well as on Mac computers (OS 10.5 and 10.6) with 32-bit or 64-bit Intel processors.

To update the software proceed as follows:

- Set the LAN connection properties to: detect IP and DNS server address automatically
- Connect to the www.roundshot.ch website and enter „Club"
- Download the latest software directly to your computer
- Make sure that the active account has Administrator rights (otherwise restart the computer and log on)
- Unzip the new installation exe file to your desktop, launch the installation file
- Choose your favorite language and follow the instructions
- Set the LAN connection properties again to: 10.0.0.20, 255.0.0.0 (or your personal settings)
- Connect to the camera

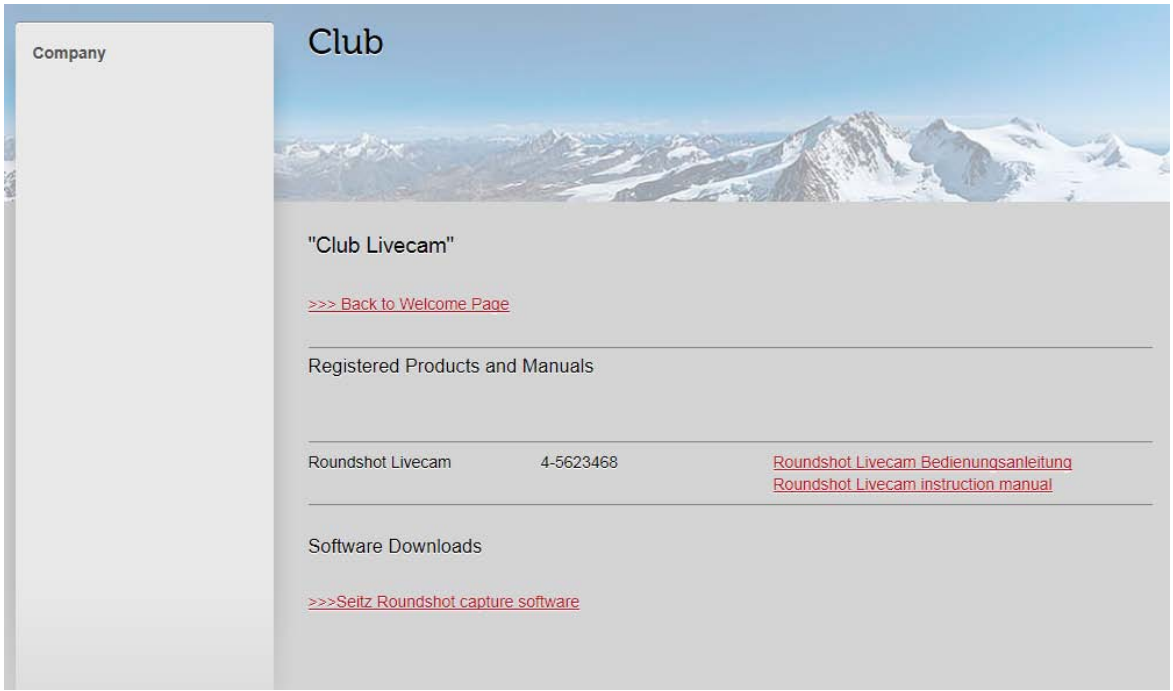
Connect to the "Club" website at www.roundshot.ch
Please change your password on your first visit.



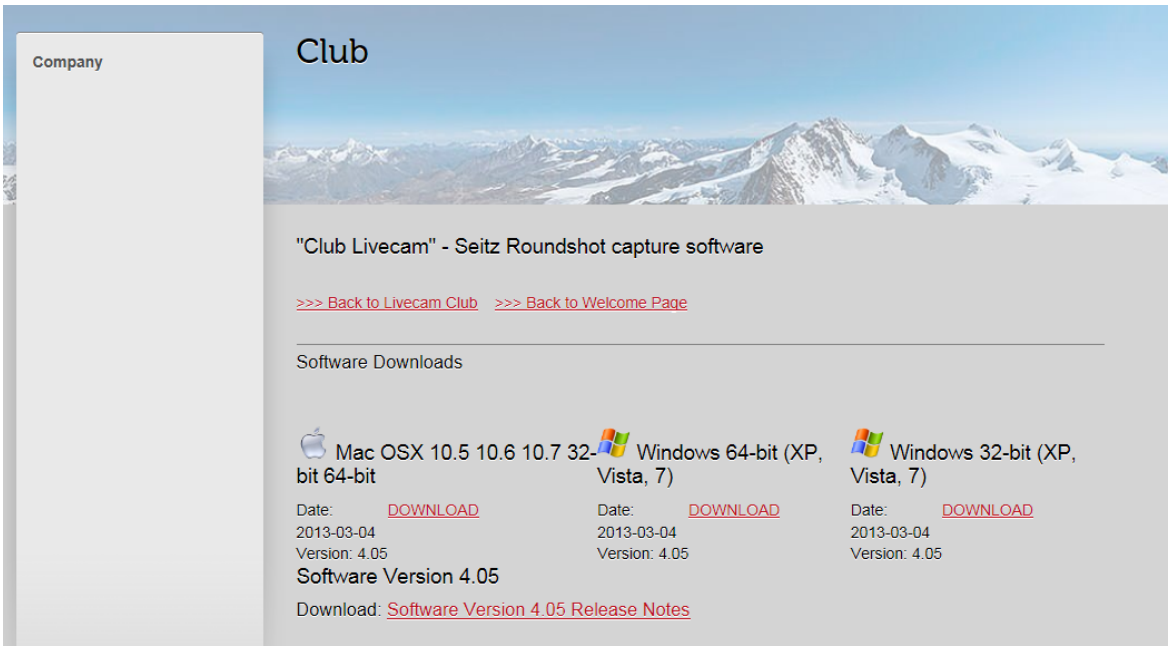
4.3 „Club Livecam“ (continued)

4.3.2 Software & firmware updates (continued)

In the **“Club Livecam”** your registered products are displayed and the latest **instruction manuals** are available for download.



In **“Software Downloads”** the most up-to-date version of the **Roundshot Livecam capture software** is available for download.



4.4 Return of equipment / recycling

Your Roundshot product and the accessories are produced from highest quality materials and parts and will provide you continued pleasure. Should you nevertheless want to dispose of your Roundshot equipment one day, it should not be placed in normal waste. The correct disposal of your old equipment is a contribution to preventing possible negative causes for the environment.

For optimum recycling we kindly ask you to return us your camera (with accessories) to the following address:

Seitz Phototechnik AG
Environment & Recycling Department
Hauptstr. 14
8512 Lustdorf / Switzerland

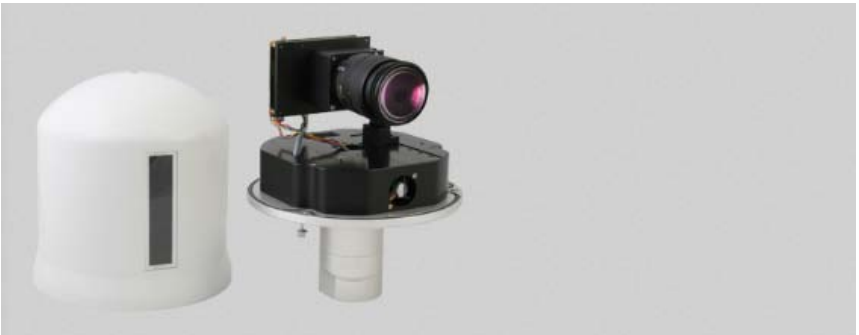
swico Recycling-Garantie
Garantie de recyclage

This return shipment to the manufacturer is **free of charge**. The service is available **worldwide**.

Please contact us to arrange the return shipment and prepare the materials for the delivery. Your camera and accessories will be picked up by our courier service and will be recycled in our factory.

We wish you continued success and fun with your Roundshot Livecam D2 HD!

5. Technical Data



Roundshot Livecam D2

Sensor type	3-linear RGB sensor
Vertical resolution	2,048 pixels
Dynamic range	9 f-stops
Lens brand	Nikkor
Focal length	from 18mm to 72mm - longer focals on request
Horizontal resolution	for example with 72mm lens: 32,313 pixels
Total resolution	2,048 x 32,313 pixels = 66 million pixels
File type	jpg
Min. time for a 360° scan	with 24mm lens: 6 seconds
Exposure times	from 1/333 sec. to 10 seconds (per pixel)
Exposure options	automatic with prescan, automatic with variation, prescan with variation, manual
Sensitivity control	ISO/ASA 100, 200, 300, 400, 600, 800
Image format	adjustable vertically and horizontally
Image angle	from 1° to 360° in 1° steps
Housing*	dimensions: height: 40cm, diameter: 26cm weight: 7.9 kg
Camera control	with Windows computer
Requirements for capture computer	64-bit operating system at least 100 GB hard disk at least 2 GB RAM
Image transfer	ethernet (speed upgrade to gigabit ethernet available)
External power supply	110-220V, 24V mains adaptor
Hardware	high resolution 360° camera in weatherproof case, connection cable ethernet (any length) and power (max. 30m), mains adaptor (power), professional Nikkor zoom lens 18-55mm, computer (eeeBox) available as accessory, Livecam hat (accessory)
Software	Roundshot Livecam capture software, image Uploader, use of web interface with webhosting, iphone/ipad + android apps, screensaver application, software to display images on large screens, tv broadcast software (accessory), panodrive (accessory)
Additional accessories	See price list

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Impressum

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Seitz Phototechnik AG
Hauptstr. 14
8512 Lustdorf / Switzerland

ph: +41 52 369 68 00
email: seitz@roundshot.ch

www.roundshot.ch

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May 2013