Leuze electronic

LCAM 408*i*

Industrial Ethernet Camera

User Manual

Revision 1.0

Revision	Changes	Date | Name
1.0	**First Edition**	**20.05.2016 | esh**

DISCLAIMER

Copyright

Federal communications commission statement

This device complies with FCC Rules Part 15. Operation is subject to the following two conditions:

This device may not cause harmful interference, and

This device must accept any interference received including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with manufacturer's instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

The use of shielded cables for connection of the monitor to the graphics card is required to assure compliance with FCC regulations. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Canadian department of communications statement

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

This class B digital apparatus complies with Canadian ICES-003.

SAFETY INFORMATION

Electrical safety

To prevent electrical shock hazard, disconnect the power cable from the electrical outlet before reloading the system.

When adding or removing devices to or from the system, ensure that the power cables for the devices are unplugged before the signal cables are connected. If possible, disconnect all power cables from the existing system before you add device.

Before connecting or removing signals cables from motherboard, ensure that all power cables are unplugged.

Make sure that your power supply is set to the correct voltage in your area. If you are not sure about the voltage of the electrical outlet you are using, contact your local power company.

If the power supply is broken, do not try to fix it by yourself. Contact a qualified service technician or your retailer.

Operation safety

Before installing the motherboard and adding devices on it, carefully read the manuals that came with the package.

Before using the product, make sure all cables are correctly connected and the power cables are not damaged. If you detect any damage, contact your dealer immediately.

To avoid short circuits, keep paper clips, screws, and staples away from connectors, slots sockets and circuitry.

Avoid dust, humidity, and temperature extremes. Do not place the product in any area where it may become wet.

Place the product on a stable surface.

If you encounter technical problems with the product, contact a qualified service technician or your retailer.

RECYCLING

Please recycle packaging environmentally friendly:

Packaging materials are recyclable. Please do not dispose packaging into domestic waste butrecycle it.

Please recycle old or redundant devices environmentally friendly:

Old devices contain valuable recyclable materials that should be reutilized. Therefore please dispose old devices at collection points which are suitable.

CONTENTS

1 Hardware

This manual covers the industrial LCAM 408i with MJPEG streaming capabilities and its software. The LCAM 408i has outer dimensions of approx. 75 mm (L), 55 mm (W), 113 mm (H).

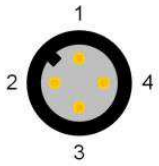
1.1 M12 connectors

The M12 connectors on the bottom side are used for Ethernet connection (named with SERVICE) and the other for Power Supply (named with PWR). It is an X-coded M12 with 8 pins (female) and a A-Coded M12 with 4 Pins. Be sure to use only matching cables.

1.2 Pin definition Ethernet connector

M12 X-Coded female	Pin	Signal Name
	1	D1+
	2	D1-
	3	D2+
	4	D2-
	5	D4+
	6	D4-
	7	D3-
	8	D3+

1.3 Pin definition Power connector

M12 A-Coded male	Pin	Signal Name	Description
	1	+VIN	Supply Voltage, positive terminal
	2		not connected
	3	-VIN	Supply Voltage, negative terminal
	4		not connected

The camera needs 3,6 W for operation. The device can be powered in the range from 18 to 30 Volt DC.

1.4 Switching off

The unit may be switched off anytime, since an overlay file system is used to store persistent data.

1.5 Optics

The lens (M12) is mounted behind a protective front glass (no optical requirements) that cannot be changed be the user.

The setup the lens focus is done in the production, and cannot be changed by the user.

The field of view is

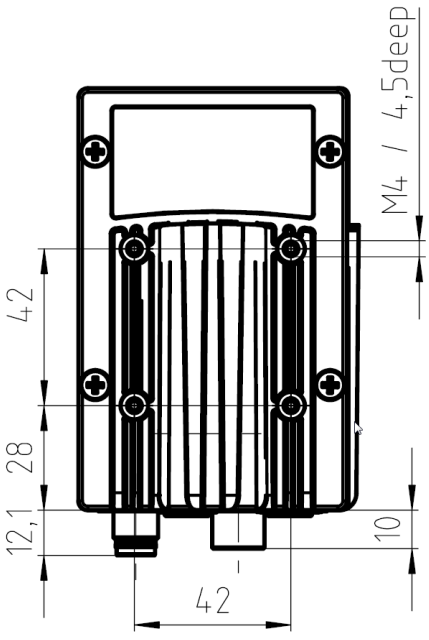
1,80 x 1,40 m	@ 1 Meter distance
2,50 x 1,90 m	@ 1,5 Meter distance
3,40 x 2,60 m	@ 2 Meter distance

1.6 Mounting the camera

There are different options to mount the LCAM 408i

1.6.1 With screws

The camera can by mounted to a flat surface with four M4 * 4 screws. There is no preferred mounting direction.



1.6.2 At a Rod (14-20mm)

with the BT 56-1 or BT 300-1

1.6.3 With a mounting angle

The camera can mount to the BT 300W and adjust in different directions

2 First Steps

2.1 What's needed

Before you start, you will need:

- The LCAM 408i
- Ethernet cable with connectors M12 X-coded – RJ-45, CAT6
- Switch (1000BaseT) or direct PC connected with Gigabit Ethernet interface
- Streaming video viewer Leuze viewer, VLC or equivalent.

2.2 What to do

After unpacking the camera, the following steps for a first use are:

- Connect an M12 – RJ45 Ethernet cable between the LCam and a Ethernetport (PC or switch)
- Connect a Cable for Power supply to the other M12 connector
- Power up the cable, wait for approx. 1 minute for LCam to boot. If you hear a faint noise, do not worry.
- Detect the Lcam's address
- Either: Run the program hipca detect.exe' and identify the LCam you want to talk with
- Or: Use default fixed address (see below). You may have to change the PC's IP to an address like 192.168.60.101, so it is in the same sub-net
- Open Internet browser on the computer
- In the browser's address line type in the IP address of the LCAM 408 in the form "192.168.60.101"
- Watch for the camera's web server surface to show up, should appear as in "Menu general appearance"
- Proceed with setting password and video parameters. For that you need a password (see below for default)
- Start streaming video
- When finished, start the streaming client as shown below.

This document gives an introduction into the use of the LCAM 408i with MJPEG streaming. The Software API is available on request.

3 Web Interface

3.1 Changing Camera IPs

Under *Network settings* you can choose between static address assignment and DHCP mode.

For static IP, fill out the fields as needed. And press "Save data". To use the new settings, pressing "Restart network" is needed.

3.2 Default network settings

The default factory settings for network are:

DHCP	off	
IP	**192.168.60.101**	**This is in one of the private IP spaces**
IP Mask	**255.255.0.0**	
Gateway		**Not needed for test, change for large nets**
DNS server		**Not needed for test, change for large nets**
Order number	**xxx**	**Camera-individual**

3.3 Default login data

Web interface

User: admin

Password: leuze

SSH

User: root

Password: rootLogin

3.4 Camera Settings

Camera settings can only be changed by the web interface. It is possible to change the exposure time, the gain of the different color channels, image flipping and Bayer mode. Gain values for the color components can be used for color correction.

Exposure	**sets the exposure time of the sensor.**
Gain	**global gain for all color channels**
Red gain	**gain for all red pixels**
Blue gain	**gain for all blue pixels**
Green gain 1 and 2	**gain for green pixels in even and in odd lines, values should be identical**
horizontal and vertical flip	**can be used to correct the image orientation according to mounting position of the camera. Changes Bayer mode, which is fixed yet. See below.**
Bayer mode	**because the flipping will change the starting pixels the Bayer mode the mode has to be adjusted if flipping is done. In streaming mode this setting has no effect.**
Sleep between snaps	**only used in webcam mode, not in streaming mode**
Automatic gain correction	**enables the automatic exposure control**
Flicker-free exposure	**if 0 no flicker-free exposure is used. Gain is fixed to a medium value and exposure is controlled by changing the exposure time For values > 0 exposure time is limited to multiples of the value. Exposure values in between are realized by changing the gain. For 50Hz lighting flicker-free exposure is realized with a value of 820. For 60Hz the value should be set to 683.**
Average grey value	**The average gray value of the whole image, the exposure control tries to reach.**
Color saturation	**color saturation of the result image in percent. 0 is black and white, 100 neutral. The maximum lies at 200.**
Button: “White balance once”	**if pressed the software calculates RGB parameters that set the current scene to neutral white. This will take several seconds.**

3.5 Still image

A JPEG file of the video stream, which is updated once a second can be accessed under the URL http://*Your_IP_here*/camera/current.jpg

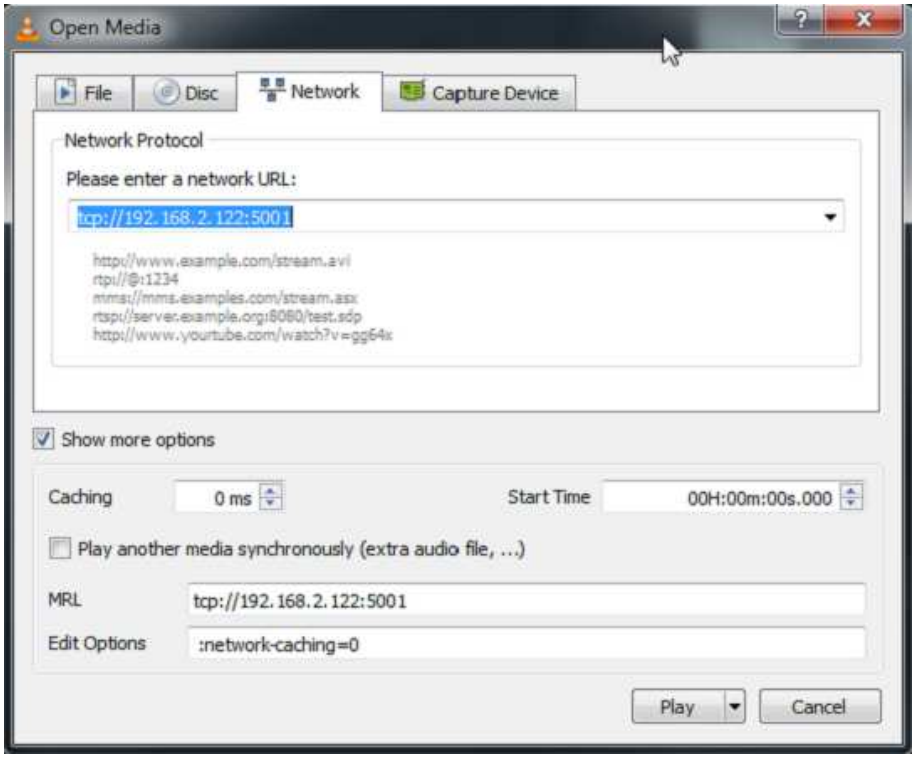
3.6 Streaming

To watch the streamed image with the VideoLANClient VLC on a 64-Bit Windows system use the line:

"C:\Program Files (x86)\VideoLAN\VLC\vlc.exe" tcp://*IPaddress*:5001 --network-caching=0

Fill in the IP address of the camera and adjust the path to vlc.exe as needed.

The typical setting in VLC looks like this:



Be sure to set caching and IP address if not done so on the command line.

3.6.1 Stream data structure

To access the video data in your own software, open a socket to port 5001 of the camera and scan the incoming data for the separator string ---jworudfg83h23lsow2z04. The following line contains the content type and the next the length of the image data.

The typical structure of the stream data is:

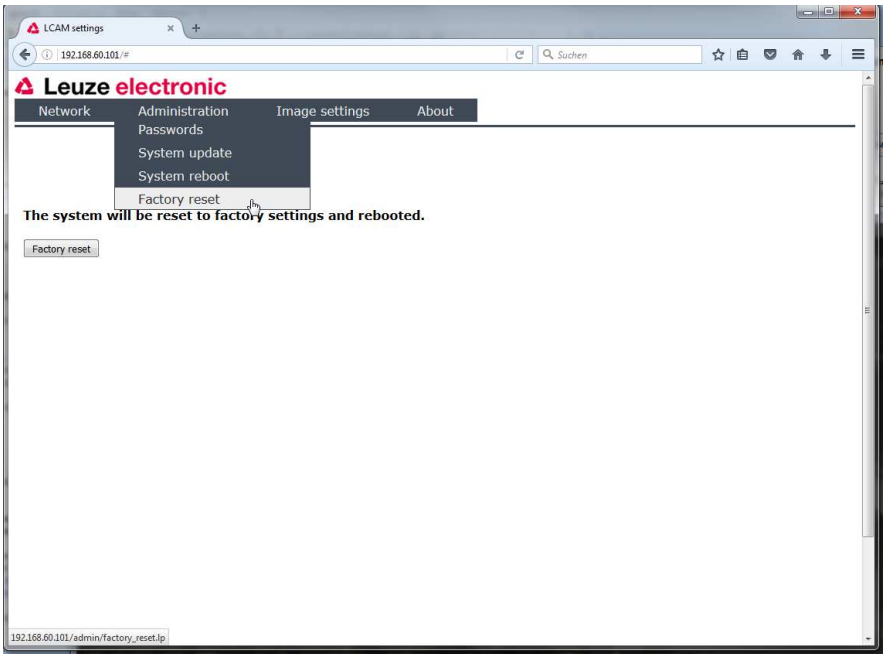
```
---jworudfg83h23lsow2z04
Content-Type: image/jpeg
Content-Length: 200976
|
|
jpeg
data
here
|
|
---jworudfg83h23lsow2z04
Content-Type: image/jpeg
Content-Length: 200437
|
|
```

4 Menus

The LCAM 408i has an internal web server that has the following menus.

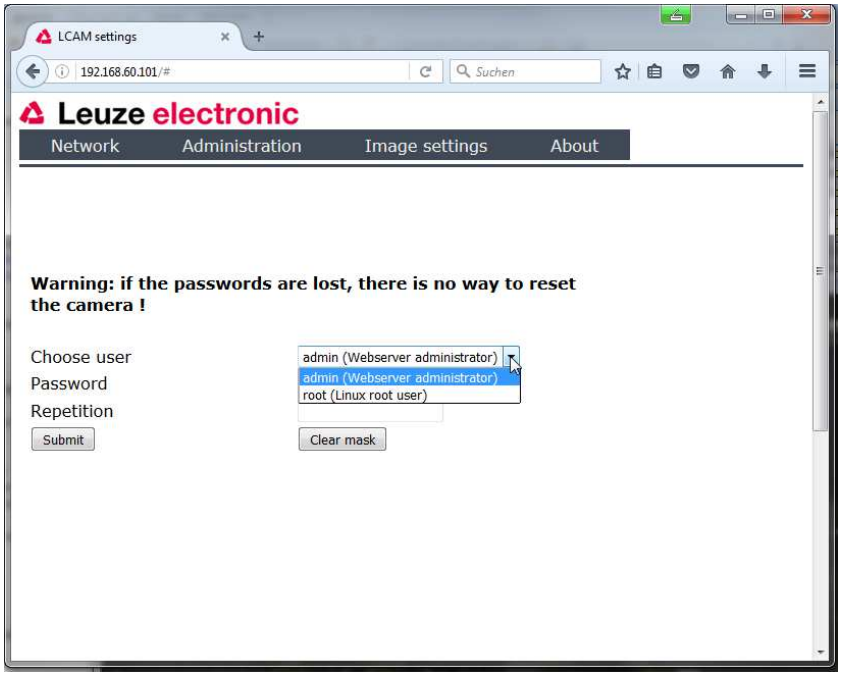
4.1 Administration

4.1.1 Factory reset



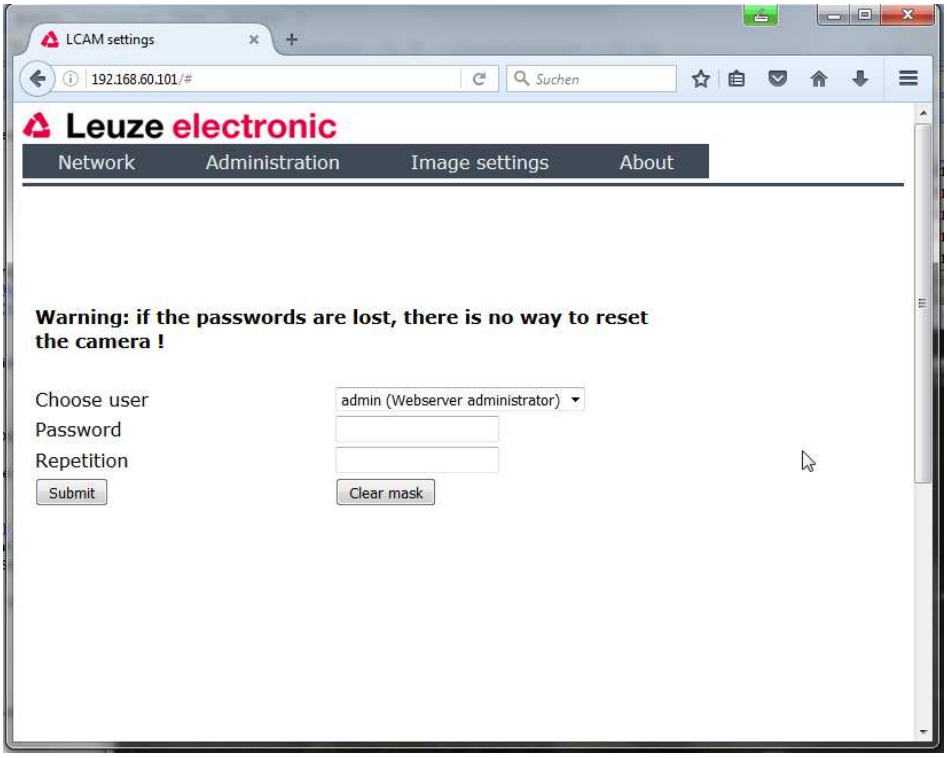
4.1.2 Password selection

Here one of the two possible passwords can be selected to be changed or set.



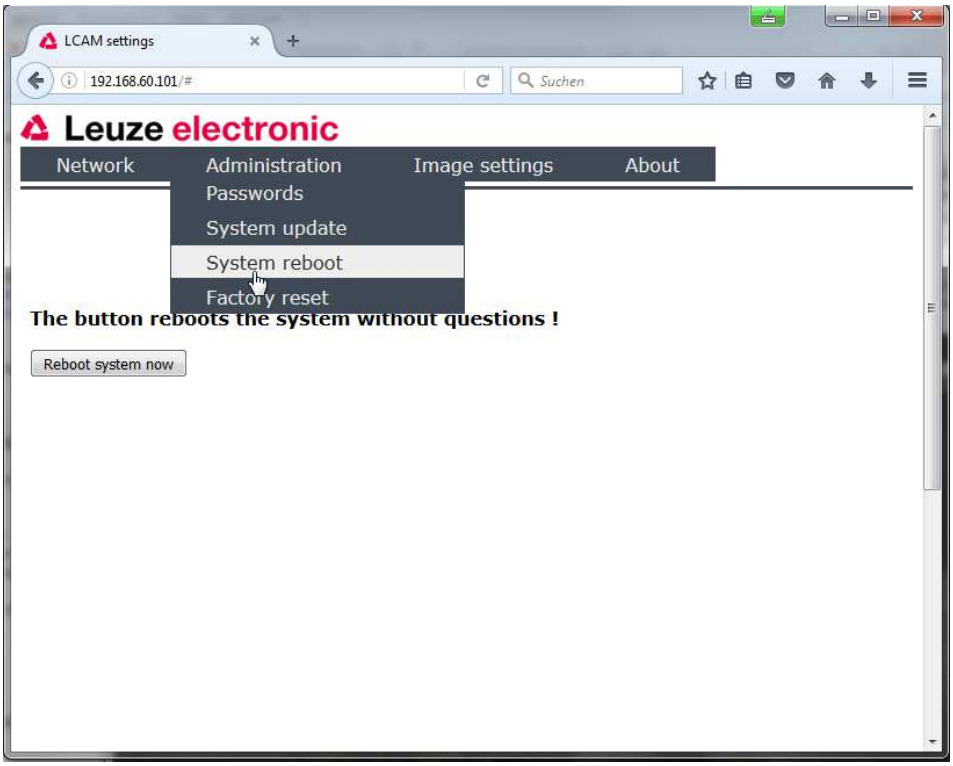
4.1.3 Password setting

Here passwords are changed and set.



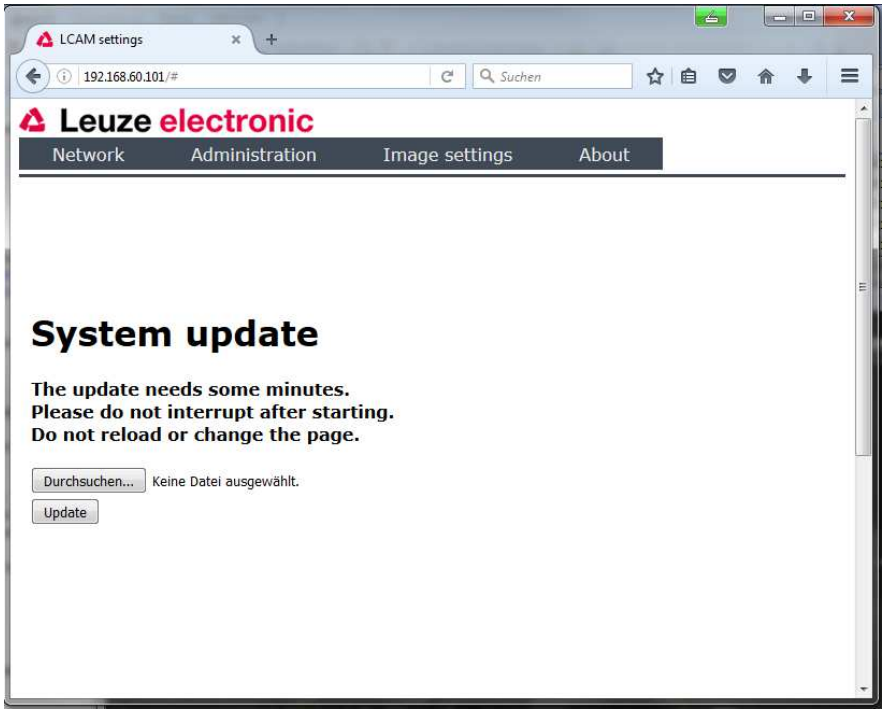
4.1.4 Reboot

System reboot is done without further data and should be finished after a minute.



4.1.5 Update

The update process needs a path to a firmware file.



4.2 Image settings

4.2.1 Automatic Exposure

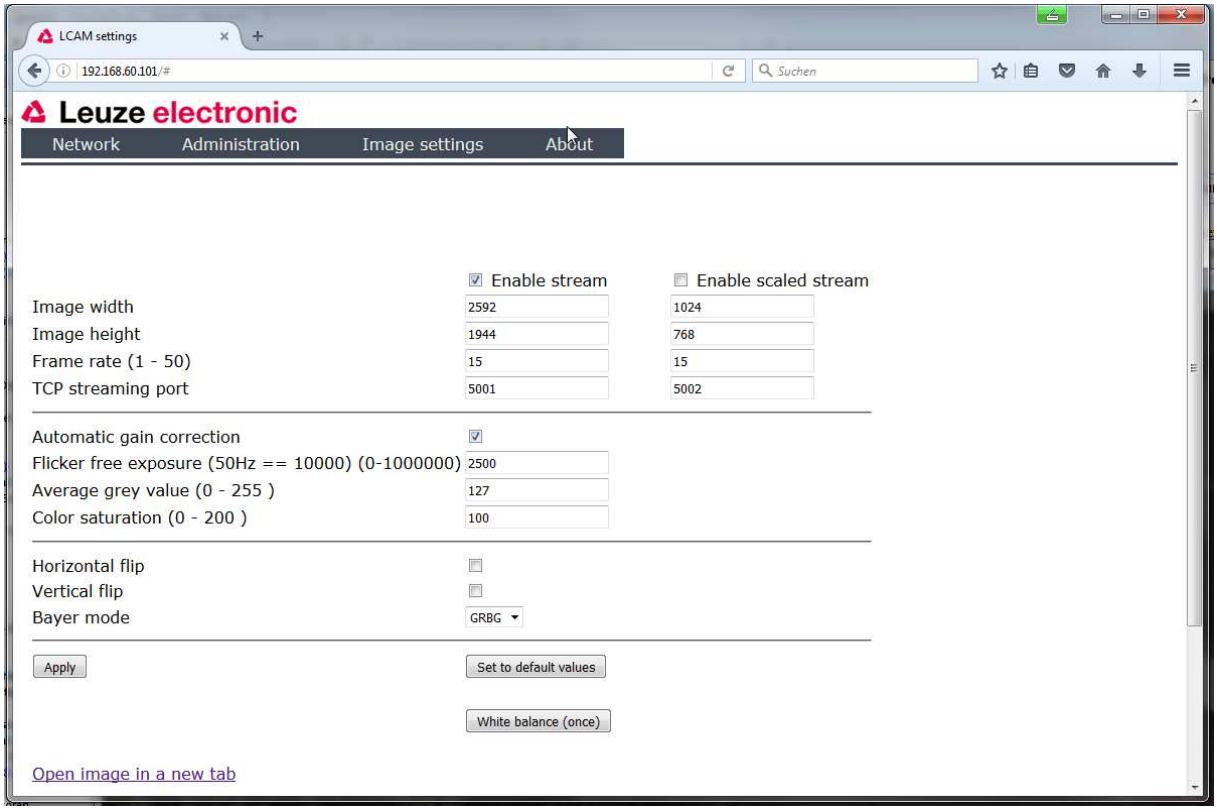
Here, image sizes and frame rates can be selected. Image size is limited by sensor parameters, however, smaller images can be selected.

The LCam supports two independent streams with the same content on different ports, one full-size and one scaled-down.

When the image size is set to values smaller than half the linear sensor pixel number (see data sheet below) binning is enabled, first ½, later ¼. Binning is very useful in low-light situations, since the effective pixel size is increased by 4 resp. 16.

Be sure to set the frame rate if slow refresh is observed.

Note: by clicking on Open image… at the bottom a live image is displayed, so adjustments can be judged.



Bayer mode	**because the flipping will change the starting pixels the Bayer mode the mode has to be adjusted if flipping is done. In streaming mode this setting has no effect**
Sleep between snaps	**only used in webcam mode, not in streaming mode**
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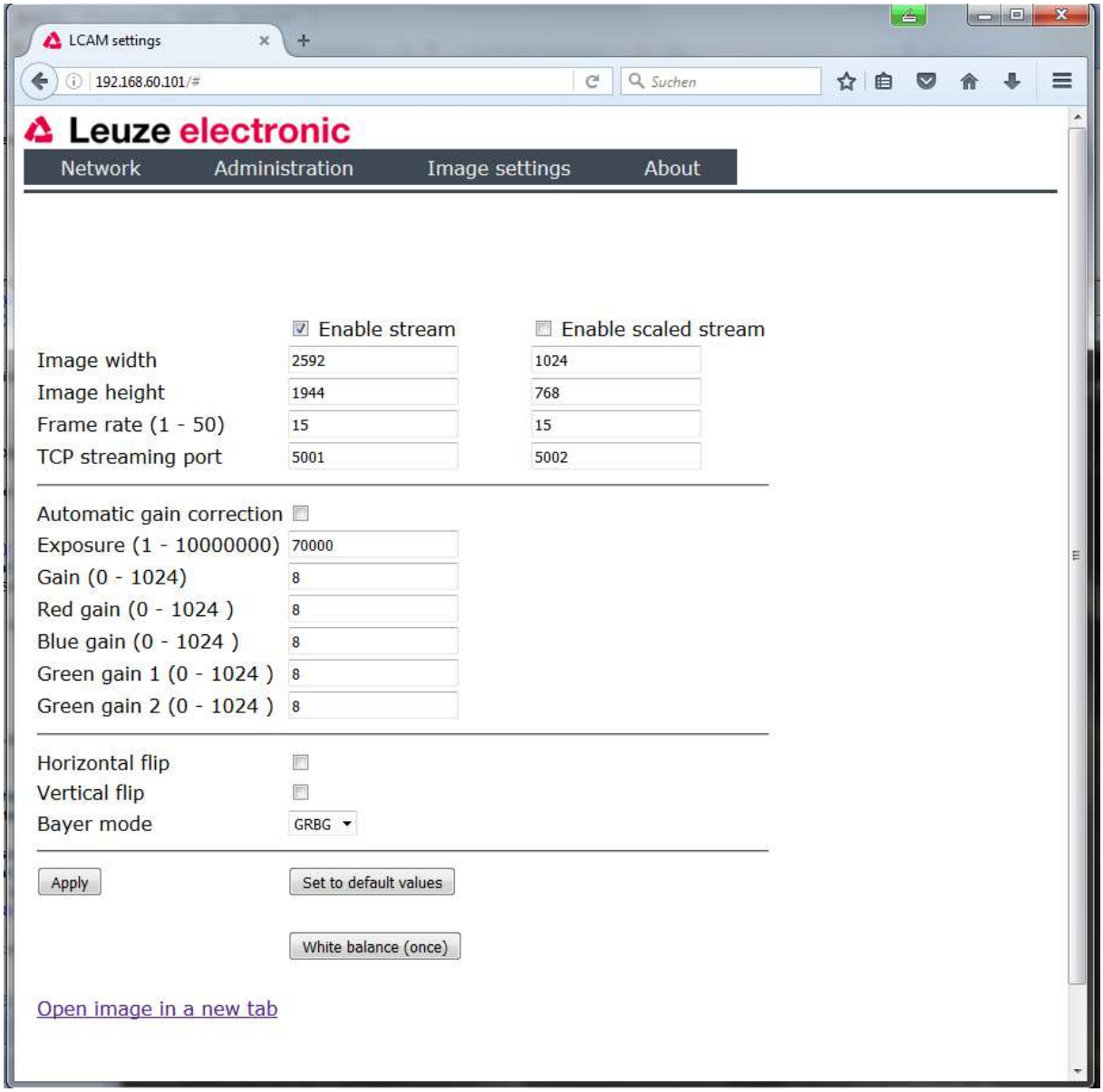
Average grey value	**The average gray value of the whole image, the exposure control tries to reach**
Color saturation	**color saturation of the result image in percent. 0 is black and white, 100 neutral. The maximum lies at 200**
Button: "White balance once"	**if pressed the software calculates RGB parameters that set the current scene to neutral white. This will take several seconds**

4.2.2 Manual Exposure

In manual exposure mode, gain and exposure parameters can be set.



At the moment camera settings can only be changed by the web interface. It is possible to change the exposure time, the gain of the different color channels, image flipping and Bayer mode. Gain values for the color components can be used for color correction.

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Red gain	**gain for all red pixels**
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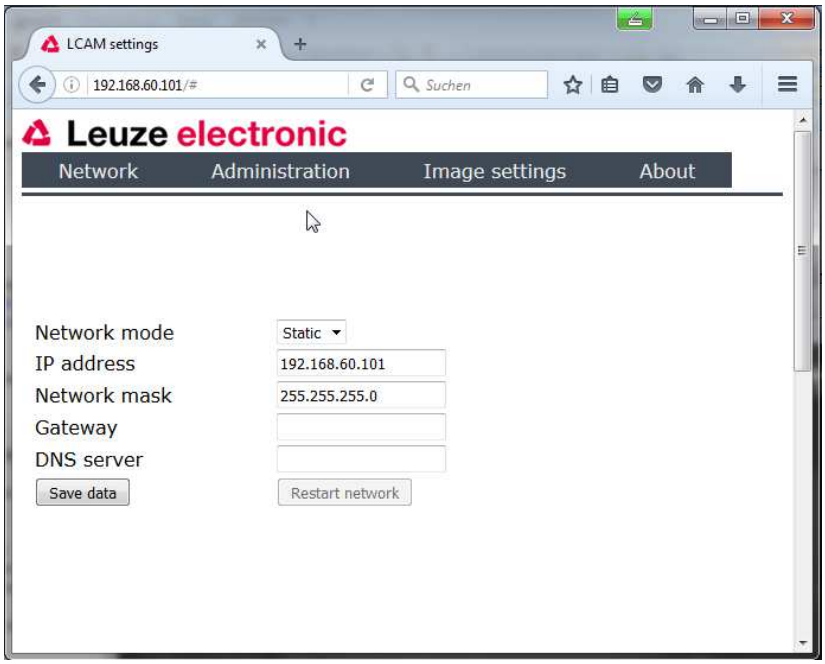
Automatic gain correction	**enables the automatic exposure control**
Button: “White balance once”	**if pressed the software calculates RGB parameters that set the current scene to neutral white. This will take several seconds.**

4.3 Network

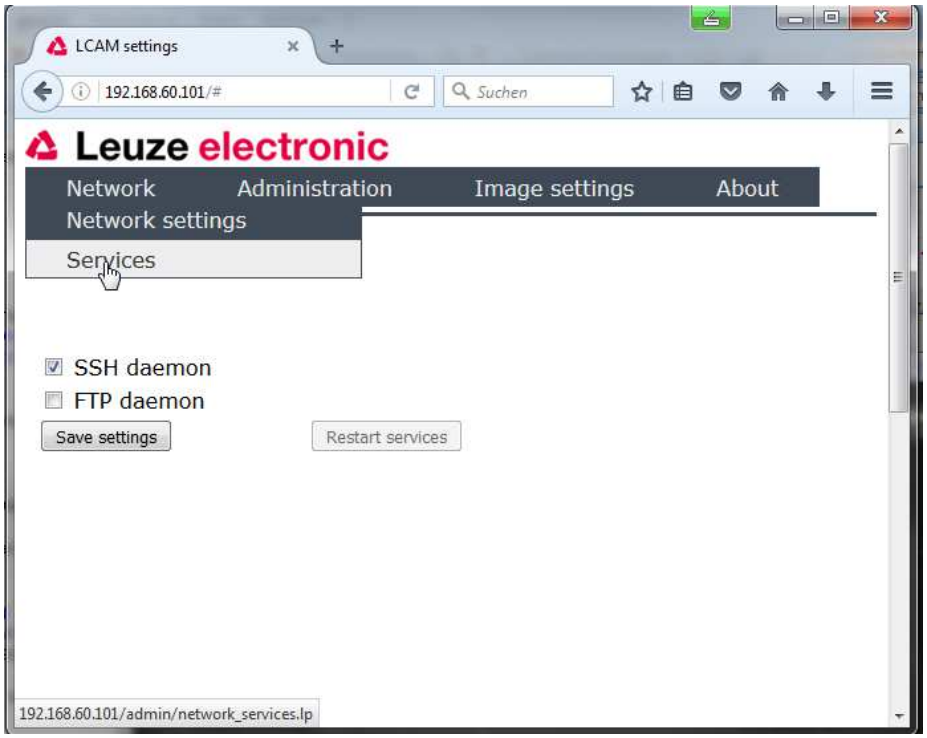


Here you can choose between static address assignment and DHCP mode.

For static IP, fill out the fields as needed. And press "Save data". To use the new settings, pressing "Restart network" is needed. For DHCP mode, no addresses are needed, they are obtained from the DHCP server.

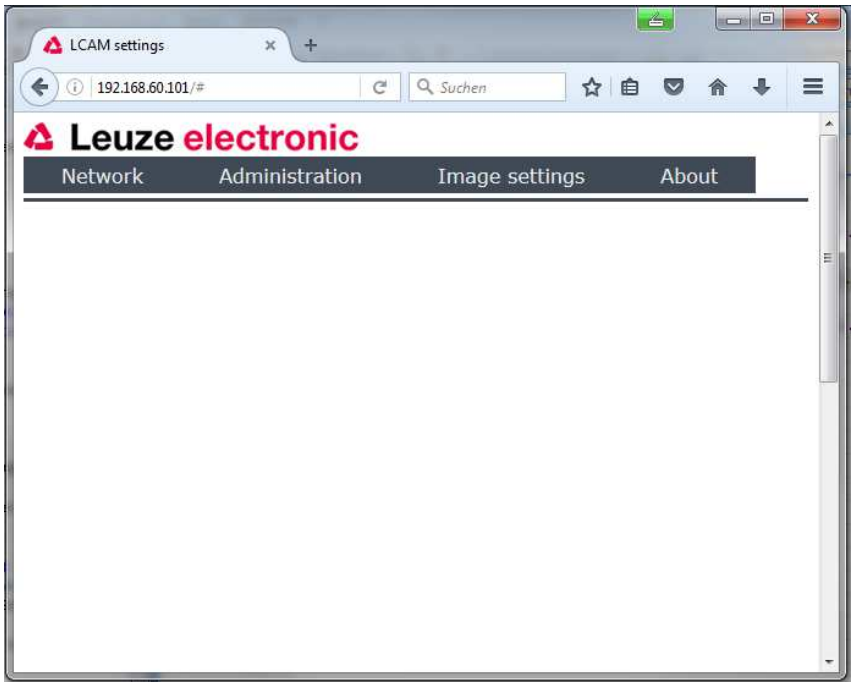
4.3.1 Services – SSH and FTP

Here SSH and FTP can be selected.



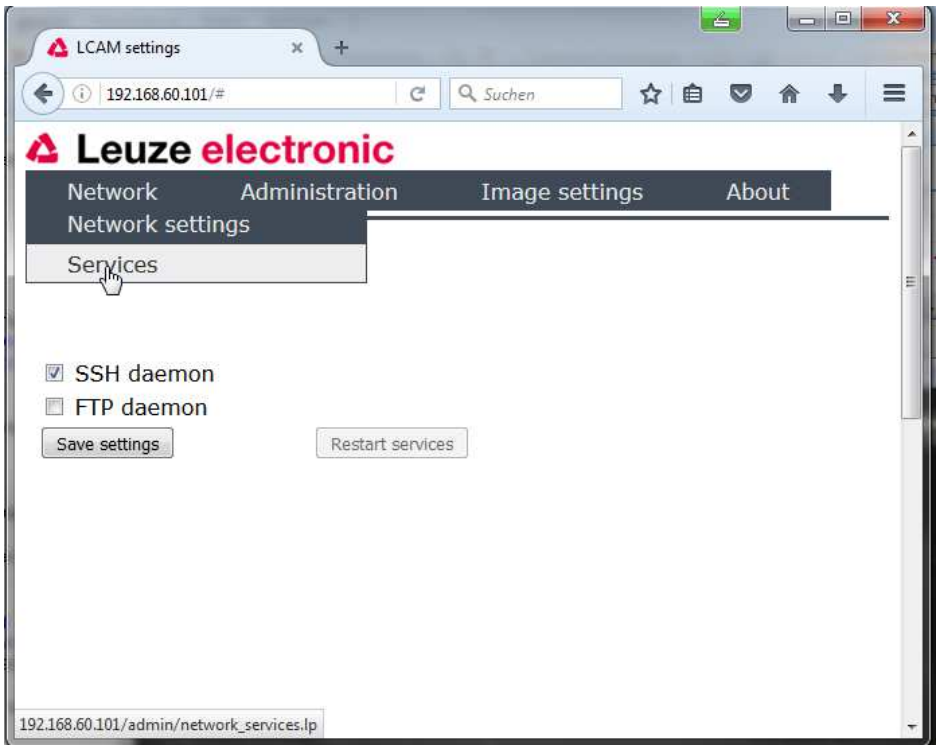
4.4 Menu general appearance

This image shows the general menu structure.



4.5 About Menu

The “About” screen shows data needed for service enquiries or for searching a camera in the network.



5 Appendix

Data sheet key data

Below you find the key data for the sensor.

CMOS Sensor

Optical format	½.5-inch (4:3)
Active image size	5.70 mm (H) x 4.28 (V), 7.13 mm diagonal
Active pixels	2592 H x 1944 V
Pixel size	2.2 x 2.2 µm
Frame rate	Up to 14 fps at full resolution
	Up to 53 fps at VGA (640 x 480)
Binning factors	1, 2, 4 linear i.e. 1, 4, 16 area
ADC resolution	12-bit
Responsivity	1.4 V/lux-sec (550 nm)
Pixel dynamic range	70.1 dB
SNR_{MAX}	38.1 dB