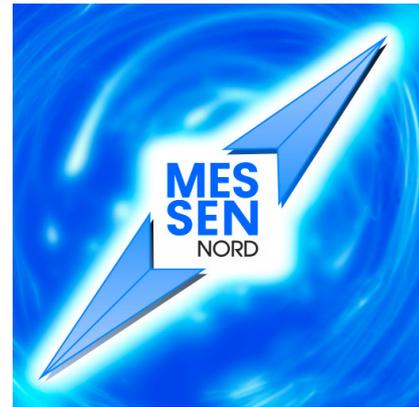


MesSen Nord GmbH
Zum Forsthof 2
18198 Stäbelow, Germany
Phone: +49 (0)38207 – 656 – 0
Fax: +49 (0)38207 – 656 – 66
www.messen-nord.de



STV-4

Wireless **FULL-HD** Manhole Zoom Camera

“Electronic sewer inspection”

Documentation/Operating instructions

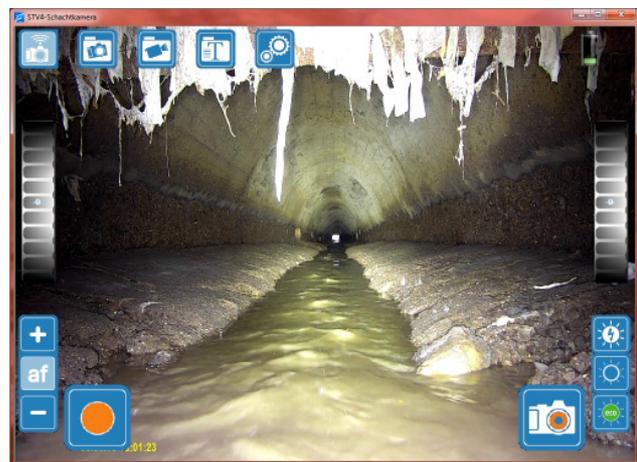


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1 Function and usage

The manhole zoom camera STV-4 offers a far-reaching look into sewer pipes, waste water pipes and water piping in normal operation from manholes and inspection openings, without the need of entering or previous cleaning. With this tool, used to inspect the operating condition, the operation, control and cleaning of the drainage systems can be organised under completely new conditions.

The zoom camera STV-4 will be fully software-controlled by WLAN with a tablet PC or notebook of the operating personnel or from a camera inspection car operator workstation. The supplied control software can be installed on any number of control PCs of the potential users.

Due to the special lighting characteristic of the 12 high efficiency LEDs and the extremely high light sensitivity of the camera module used, the STV-4 is, starting with DN 150, suitable for zoom inspection of public drainage systems in the entire dimension range, especially for large dimensions as well as shaft and special structures.

Depending on the dimensions 'range and the operating situation, the STV-4 is either:

- a) Manually adjusted in the shaft channel, by means of a telescopic rod and a support foot, which can be adjusted depending on the dimensions, so that it is approximately in the channel axis

or:

- b) The telescopic rod is clamped in the optionally supplied tripod and the camera is positioned in the channel axis

Due to the integrated motor-driven angle adjustment, the actual inspection can be fully carried out by software, if the camera is correctly aligned at a horizontal level.

2 Equipment options/Scope of delivery

Article STV-4	Description/Scope of delivery
<p>Inspection camera for sewers and tanks</p> <p>“Electronic sewer inspection”</p> <p>Camera unit incl. Carbon telescoping rod 6.6 m</p>	<p>Wireless manhole zoom camera / Full-HD / motor adjustment</p> <p>for the inspection of the operating condition of sewers, pipes, shafts and separators, without the need of entering</p> <p>Camera set with motor-driven adjustable zoom camera on telescopic pole system incl. accessories; operation takes place by means of the supplied software via WLAN from the tablet PC or notebook (from Mobile Core M5); tablet PC/Notebook are not included in the scope of delivery</p> <p><u>Technical data:</u></p> <p>Camera unit</p> <ul style="list-style-type: none"> - Full-HD Video Zoom Camera 1920x1080 pixels - Newest CCD technology, Light sensitivity 0.01 Lux - 30 x optical + 12 x digital zoom - 12 High-Efficiency-LED-Spots - +10°/-30° motor-driven, rotatable in vertical direction - Camera unit protection degree IP 67 / not explosion-proof (Observe the warning!) - Overpressure/shield gas filling with permanent monitoring - Standard lithium-ion batteries for camera/router - Carbon telescoping rod, standard 6.6m, extendible - Adjustable, spring-loaded support foot for exact positioning in the pipe centre according to DN200-DN800 - WLAN router (radio amplifier) for plugging onto the telescopic rod end included in the scope of delivery <p>Operation</p> <ul style="list-style-type: none"> - Full WLAN control of all camera functions using the supplied PC software - Intelligent lighting management for maximized battery life (luminosity adapted to the operating situation) - Access to all functions via touch and keyboard control - Picture and video recording with adjustable resolution and compression rate to adjust memory requirements <p><u>Scope of delivery:</u></p> <ul style="list-style-type: none"> - Camera unit incl. support foot - WLAN router/radio amplifier - 2 a4 cell battery packs for camera and router - Chargers for quick charging of one battery pack at a time - Transportation case for camera and accessories - Carbon telescoping rod 6.6 m



Options	Description/Scope of delivery
<p>STV4-TRIP</p> <p>Tripod with rotation support</p> 	<p>Tripod for STV-3/STV-4 with rotation support</p> <p>Rotation support with angular positioning to manually create a surface processing (panoramic image) of shaft and tanks structures.</p> <p>The camera rod system can be inserted laterally into the rotation support without disassembly and clamped at any working height.</p>
<p>STV4-RODSET</p> <p>Quicklock-connecting rod set</p> <p>Total length 8.00 m</p>	<p>Aluminium connecting rod set consisting of 4 individual rods of 2.0 m (transport length 2.1 m) with Twinloc pin locking</p>
<p>STV4-CARB10</p> <p>Extension STV4-CARB /CARBOPT to 10.0 m total length</p>	<p>Extension set for carbon telescopic rod 6.6 m to 10.0 m total length</p> <p>Two-part telescopic extension, high rigidity, weight <1 kg</p> <p>Transport length 2.02 m</p>

3 Commissioning

3.1. Insert the batteries into the router

Router/radio amplifier (is used for the extension of the WLAN signal)

Insert the battery into the router/radio amplifier as shown in the figure below. Insert the battery into the battery housing with the positive pole first (see picture). The router is operated with a single lithium-ion round cell battery. A battery charge will operate for approx. 14 hours. This ensures a safe daytime operation without the need for an exchange of batteries.



Router with battery and cover (observe battery polarity!)

Switch the router on via the non-locking push-button by keeping it pressed until it starts blinking (approx. 1 second).

To switch off press the push-button briefly. The router sends a confirmation via a quick blinking sequence of the LEDs. The camera cannot be controlled if the router is not switched on. The camera logs on to the router. Then the control PC logs on to the WLAN of the router. Now it can control the camera and connect to the video streaming.

The current battery level of the router is displayed in the upper right corner of the status bar of the control software and is also indicated by the blinking speed of its operating LEDs. A 2-second interval means a battery charge greater than 60% and a 1-second interval means a battery charge greater than 40%. Faster blinking cycles indicate an imminent battery change.

3.2. Insert the batteries into the camera

STV4 Manhole zoom camera

Insert the batteries into the camera as shown in the figure below. Insert the batteries into the battery housing with the positive pole first (see picture). The camera is operated with three lithium-ion round cell batteries. The batteries must be inserted in the order “positive pole/negative pole”, “positive pole/negative pole”, “positive pole/negative pole”. Same poles must not come into contact!



Camera battery tube with cover and battery pack in correct polarity (Minus towards the cover)

A battery charge is sufficient for daily operation in ECO mode (see chapter 4.3). A tube can be illuminated for approx. 1.5 hours with maximum lighting in the boost mode. The camera is equipped with a locking switch used for switching on and off. The camera is ready for use after approx. 100 seconds.

The current charge status of the battery is indicated by the blinking frequency of the operating LEDs as well as in the status bar of the control software. A 2-second interval means a battery charge greater than 60% and a 1-second interval means a battery charge greater than 40%. Faster blinking cycles indicate an imminent battery change. In addition, the battery status is displayed in the control software.

If a battery change could not be completed in time and the camera is turned off suddenly, the last video recording may not be stored correctly.

3.3. Preparation STV4 camera (filling pressure + support foot)

The STV-4 camera unit is not explosion proof but has the possibility of being filled with a shielding gas (e.g. nitrogen) for the purpose of leakage monitoring (please observe the operation notes/warnings at the end of the documentation!). To do so remove the protective cap located on the rear of the filling valve and fill the camera via a suitable, finely adjustable pressure reducer with an overpressure of 0.4 - 0.5 bar. Remount then the protective cover.

CAUTION! The camera can be destroyed and can lead to personal injury, if the maximum permissible filling pressure of 0.5 bar is exceeded!

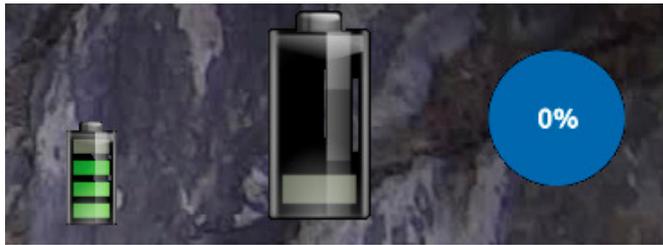


The pressure prevailing in the camera body is continually monitored by the camera electronics. If the value falls **below the pressure limit** of 0.2 bar (corr. to 2 m water column) an appropriate warning message is displayed on the user interface of the PC software. The **operation must be cancelled immediately.**

Overpressure-Filling connection

If the value exceeds the pressure limit of 0.7 bar, a warning message is also displayed. In that case, the filling pressure can be lowered by briefly opening the filling valve. At normal operating conditions, the pressure can increase due to internal overheating of the camera body. In that case, repeat the discharge of the pressure. The pressure limits are designed to ensure that the 0.7 bar cannot be reached, provided that the camera has been filled at room temperature with 0.5 bar. To prevent fogging of the pane from the inside during operation do not use moist air for filling.

The current filling pressure can be displayed via the software interface in the upper right corner of the screen. To change the display, click the big battery symbol (camera battery) in the area of the status window. By clicking the status display again, it changes to the filling pressure, then to the temperature and finally back to the battery indicator.



Status display with battery symbol in the middle. Click on the battery icon to go to the next view.



Status display with filling pressure (P) in mbar. By clicking on the pressure indicator, it changes to the next view.



Status display with temperature (T) in °C. By clicking on the temperature indicator, it switches again to the battery indicator.

If the camera unit is placed in the shaft channel (use without a tripod), the supplied spring-loaded support foot must be installed and adjusted to half the diameter value according to the nominal pipe size to be inspected.



It is recommended to adjust a height value above the water line during the inspection of partially filled channels, since the optical properties of the headlights and the camera are drastically restricted during the operation under water. Furthermore, a **radio operation under water is technically not possible.**

Adjustment of the support foot

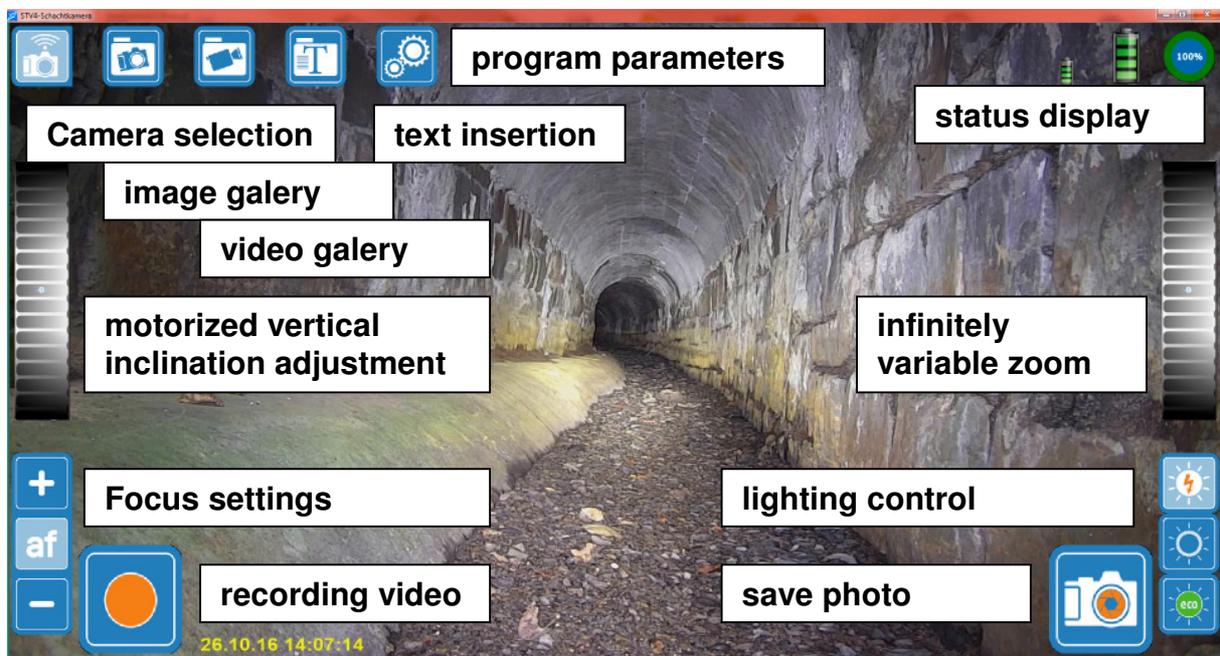
After the video image is displayed on the screen, move the camera with the telescopic rod into the shaft to be examined. The camera hangs on the tripod holder if a tripod is used; without a tripod, the camera is placed into the shaft channel by means of the previously installed support leg. The control units in the software provide a full control of all camera functions.

4 Control software “STV4”

The control software allows you exploit the entire functionality of the camera. You control the zoom, focus, horizontal orientation, lighting, screen display and the video settings. You can monitor the battery level, the temperature and the filling pressure. Moreover, photos and videos can be digitally stored, viewed and managed.

4.1 System requirements

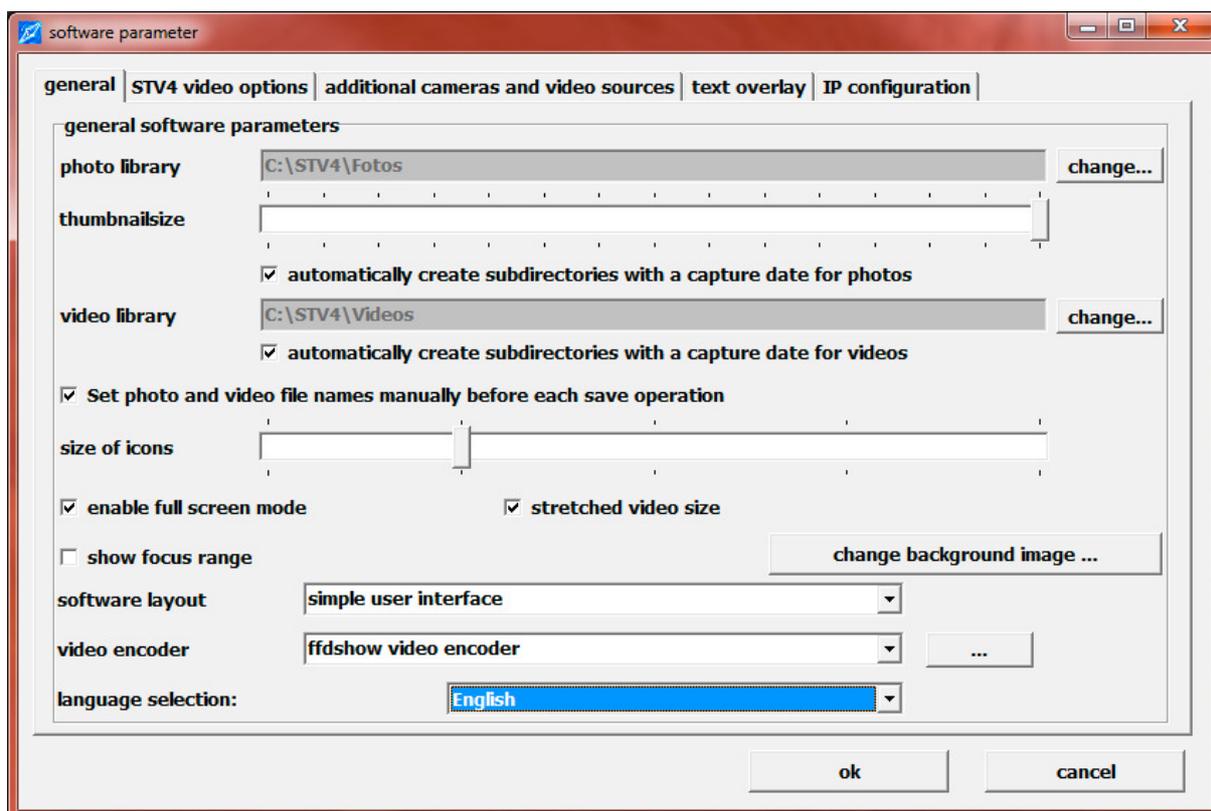
- Windows 7/8/10
- PC or Notebook with WLAN
- An anti-glare FULL-HD screen suitable for daylight conditions is recommended
- The FULL-HD video signal requires at least Intel Core i3; Intel Core i5 is recommended
- 4 GB RAM + SSD with at least 100 GB free storage capacity recommended for recording videos and photos



You can access the latest version of the software with your login data on our website www.messen-nord.de, in the “Download” section. If you do not have login data yet, you can request there your personal login data, free of charge.

4.2 Settings and program parameters

The  program parameters settings can be accessed via the button. The directories for picture and video storage can be defined in the tab-window “General”. On request, the stored data can be additionally stored in subdirectories with a date-time stamp. The files are also stored with the current date-time stamp. If a large number of files are stored in a directory, you may not be able to navigate properly during the subsequent viewing with the integrated picture gallery.



Parameters setting of -tab-window “General”

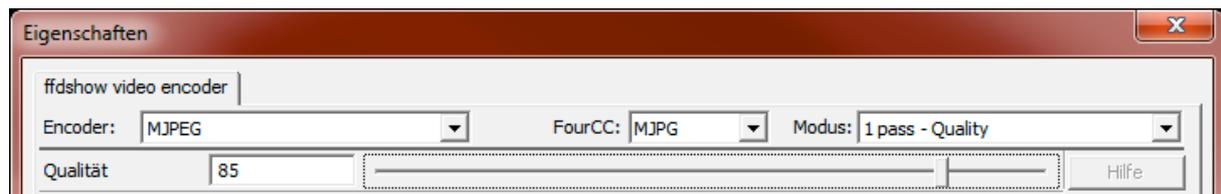
The symbol size of the control buttons can be adjusted. This may be necessary for a more comfortable use, depending on the screen resolution and screen diagonal. Furthermore, the picture preview size can be defined in the picture gallery.

The video display can be in either full screen mode or limited to the area within the control buttons. Moreover, the video image can be expanded to the maximum screen diagonal or reproduced in the original aspect ratio.

The display of the distance of the focusing range can be activated or deactivated.

The software offers switching between different layouts as a special feature. Two layouts are currently available. In the detailed surface layout, e.g., the LED segments can be controlled individually and exact zoom positions can be selected. The simple surface layout is easier to operate and pre-set after the installation.

The selection of the video encoder is very important for the size of the stored video recordings and the CPU utilisation. We recommend the “ffdshow video encoder” included in the installation package with the following settings.



“ffdshow video encoder”-Settings → MJPG with 85% JPG-quality

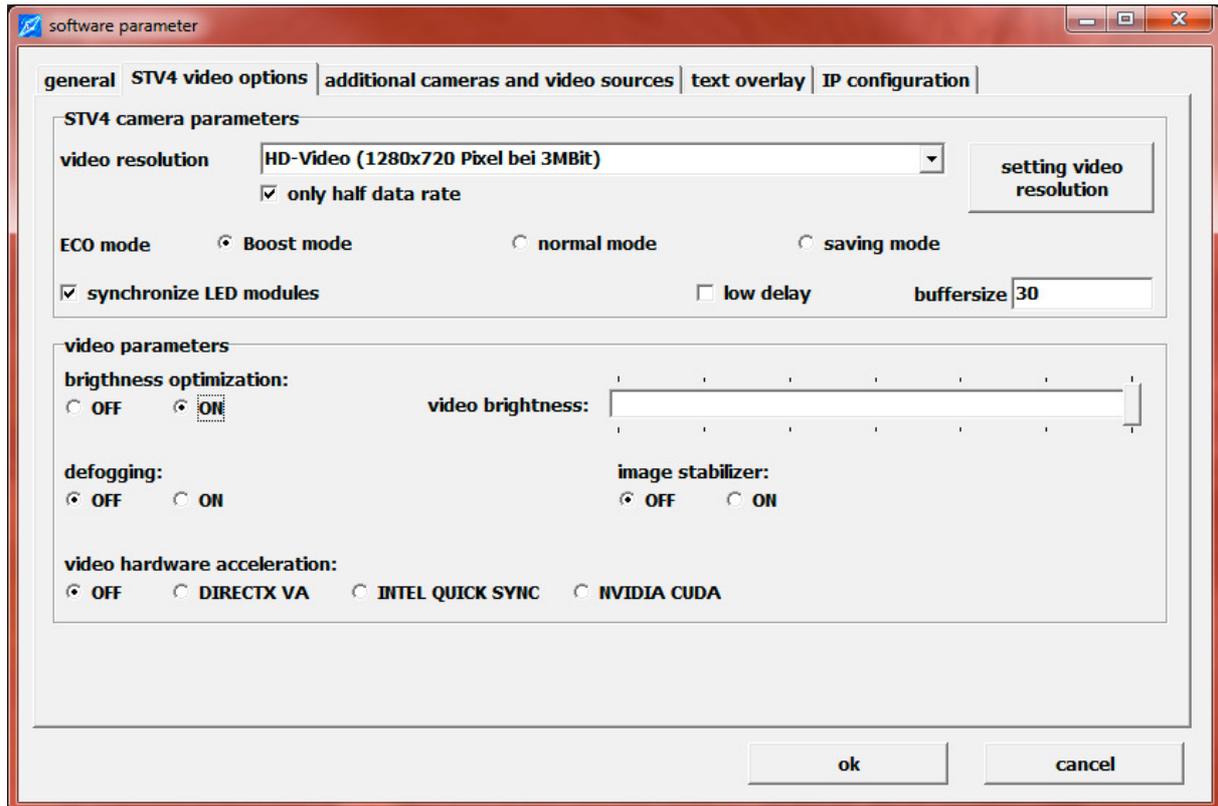
The video resolution can be changed in the tab window “Hardware”. The following modes are available: FULL-HD 1920x1080, HD 1280x720 and PAL 720x576. In addition, the data rate can be divided in half, which has an influence on the quality of the video image. If the connection speed of the WLAN connection is too slow, a reliable video playback can still be achieved by lowering the video resolution and dividing the data rate in half.

The ECO mode is a fully automatic control mode for the lightning, to maximize the battery capacity. The camera adjusts strongly illuminated areas of the image automatically by means of the aperture setting. This would consume battery capacities unnecessarily. The ECO mode has three different control modes. Compared to the normal mode, a little more light is used during the boost mode and a little less light in the economy mode.

The video signal in the camera can be adjusted via the slide control for the light intensity of the video. In this way, the lightning can be regulated or darker areas in the image can be made more visible.

The fog compensation calculates a contrast-rich video image if in the channel Mist or haze.

The video hardware acceleration may relieve the processor while rendering the video image display. If the existing hardware is not supported, the video image can not be displayed. The connection to the Video will fail. In this case, please switch off the video hardware acceleration or try another acceleration mode.



Parameters setting of-tab-window "STV video options"

Existing system cameras can be added to the camera selection in the user interface. For example, existing front and back webcams for tablets or even USB video devices. During the operation of the software, it is simple and fast to switch between the different cameras and videos and photos can be recorded for documentation, while the STV4 is located at the bottom of the shaft.

Predefined texts can be set on the tab window "Text overlay", to easily display or hide them during the video recording, at the respective fixed position. In addition, logos as well and the GPS position can be displayed in the video image.

The tab window "IP configuration" helps to analyse network problems.

4.3 Program interface and operation (Live-Video)

The connection to the STV4 is automatically established when the software is started. First, the WLAN connection and the battery level of the router and the camera are checked. The corresponding warning messages are displayed if a battery change is required. The video resolution preselected in the software is then set in the camera and the video streaming is started and displayed. Error messages are displayed if the camera has not logged in to the router or if the video streaming is not ready. In this case, check the start-up condition of the camera and the router and wait 30 seconds for the next attempt.

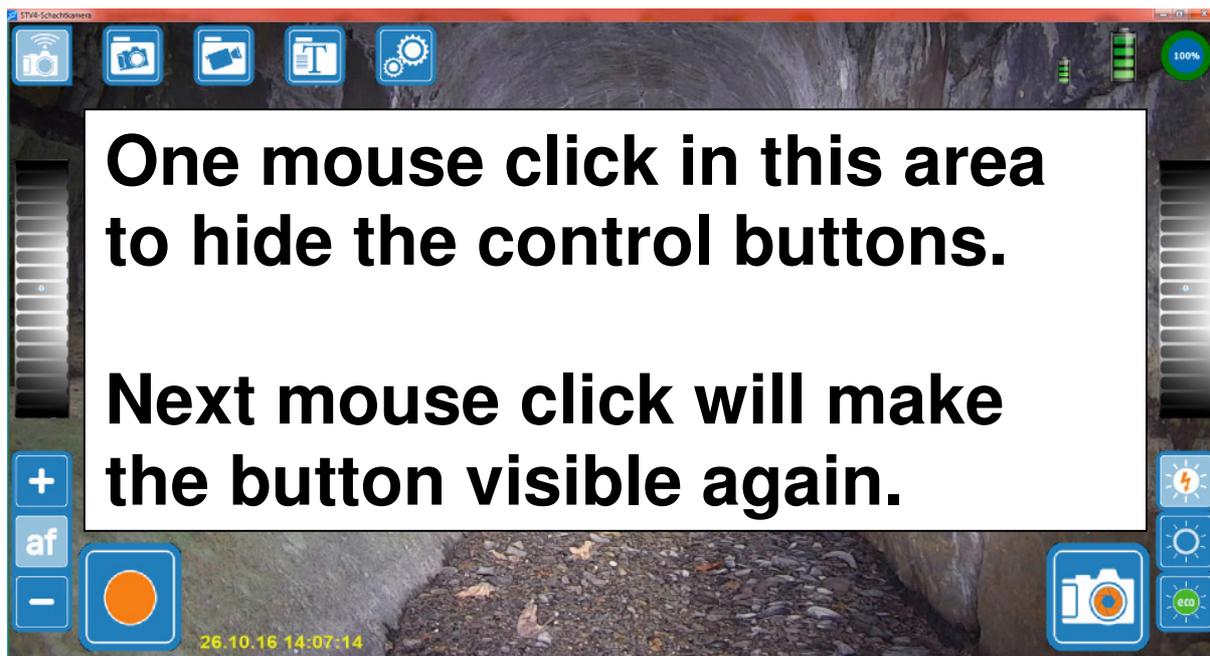
The top left button (camera symbol) is for the selection of the camera. The button displays the available system cameras. Click once on the icon to start the connection setup to STV4. Other configured system cameras can be selected by clicking on the camera symbols 1 to 3.



Buttons for camera selection (STV4 is the WLAN camera)

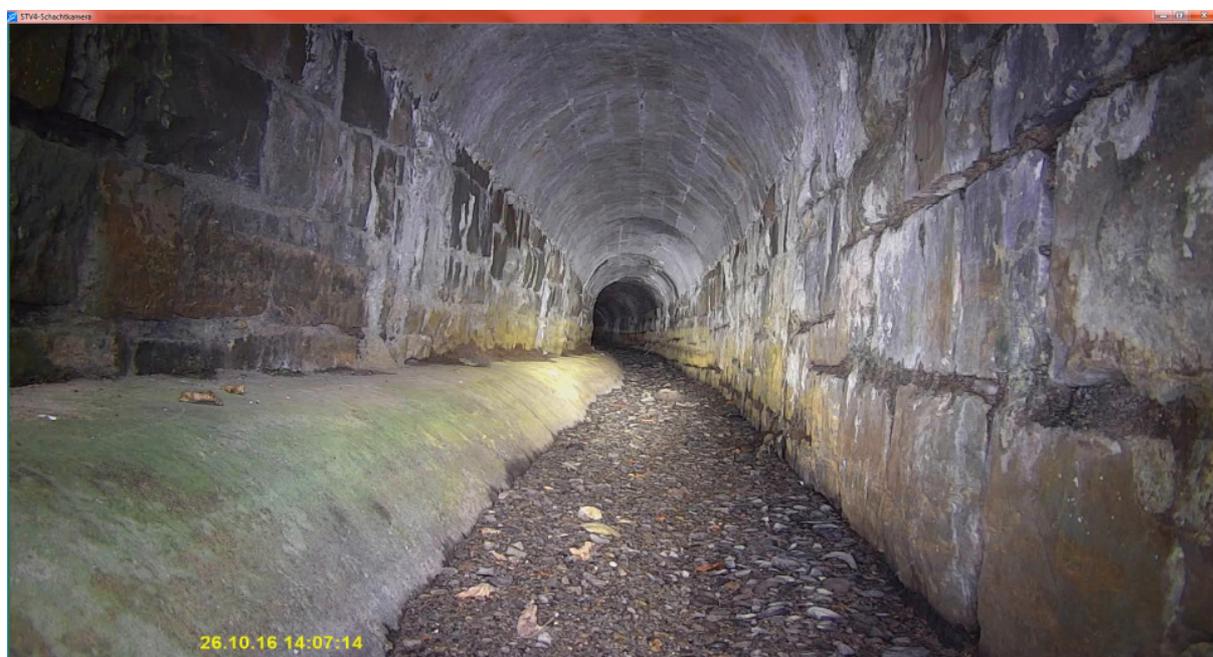
The live video and the control buttons for STV4 are displayed, if the connection has been established successfully. The control buttons can be hidden, if required. By doing this, also the peripheral areas of the video image can be viewed. In this case, the camera control is still possible via the PC keyboard. The following assignment of keys applies:

- | | |
|--|-------------------------------|
| “Arrow up” = ZOOM IN | “Arrow left” = FOCUS NEAR |
| “Arrow down” = ZOOM OUT | “Arrow right” = FOCUS FARAWAY |
| “+ Button” = INCREASE BRIGHTNESS | “Enter” = AUTOFOCUS |
| “- Button” = REDUCE BRIGHTNESS | |
| “Image high” = INCLINATION UPWARDS (MOTOR) | |
| “Image down” = INCLINATION DOWNWARDS (MOTOR) | |



Video image with control buttons

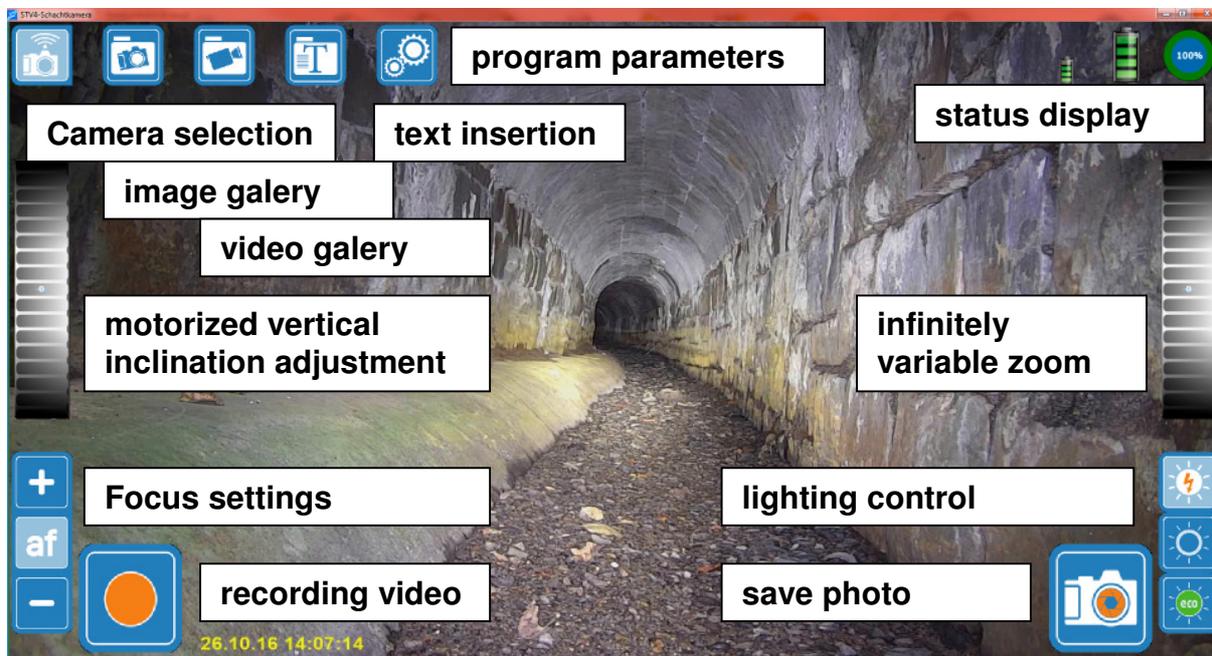
One mouse click on the video image displays the control buttons again. If the full screen mode has been deactivated, it is not necessary to display or hide the control buttons. The buttons are then permanently displayed and the video image is reduced to the area within the buttons.



Video image without control button (Click to re-display)

The status displays are in the right upper corner of the screen. The small battery symbol indicates the charge status of the router battery; the big battery symbol indicates the charge status of the batteries in the STV4. Click once on this icon to display the temperature and the filling pressure in the STV4. In the event of

overtemperature, over- or low pressure, it is signalled here instead of the battery indicator. The filling pressure should always be checked after the camera is switched on to ensure that the camera is not leaking.



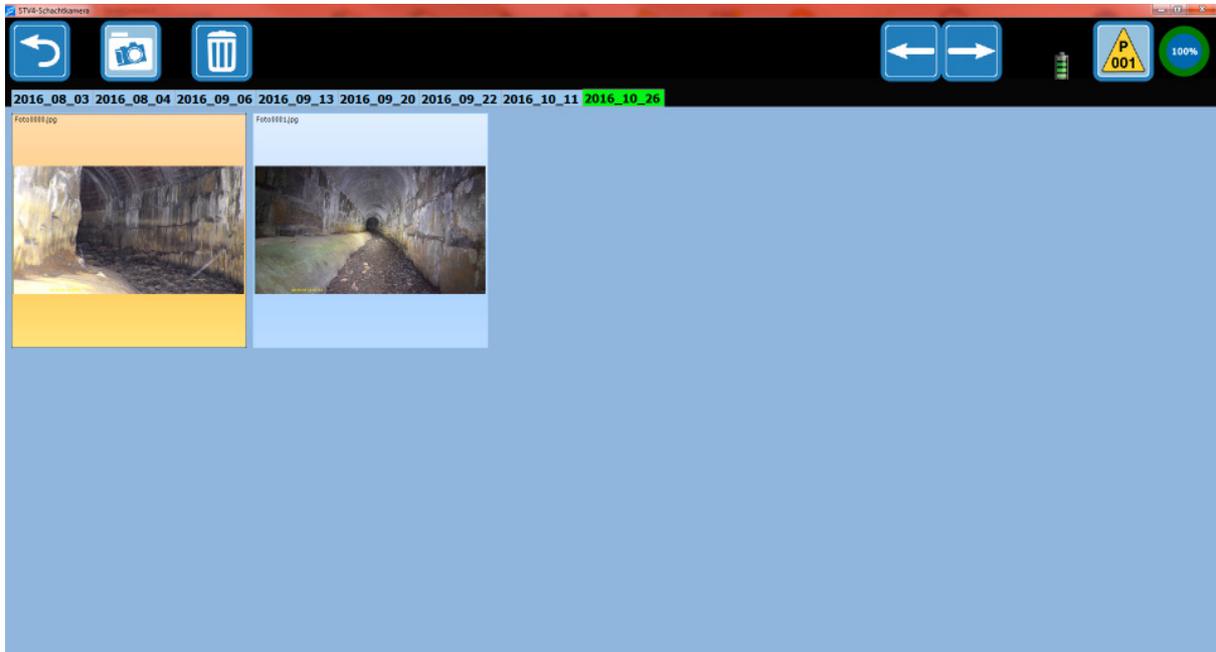
Program interface of the control software for STV4

	Camera selection menu
	Connect to STV4 and show video
	Start the video of a configured system camera or an USB video device
	Start picture gallery (see chapter 4.4)
	Start video gallery (see chapter 4.5)
	Display text insertion menu (Display/hide date/time + display/hide predefined texts)
	Program parameters settings for the system settings (see chapter 4.2)

	Move the focusing range away manually (also possible via the keyboard using the “right button”)
	Move the focusing range close manually (also possible via the keyboard using the “left right”)
	Activate the autofocus or trigger the autofocus (also possible via the keyboard using the “Enter” button)
	Switch on maximum lightning in boost mode (clicking again switches to maximum level of illumination without boost)
	Switch off the lighting (the light can be switched gradually with the “+” and “-” buttons on the keyboard of the control PC)
	Activates the ECO mode for the lightning (the brightness is automatically adjusted to maximize the battery life)
	Save video recording (video files are consecutively numbered and stored in the subdirectory of the video library)
	Save picture (photos are consecutively numbered and stored in the subdirectory of the photo library)
 Left adjusting wheel	Motor-driven angle adjustment of the camera (pull upwards to raise the camera and pull down to lower the camera). The intensity of the deflection continuously defines the movement speed (the more deflected, the faster the camera moves) Keyboard control also via “picture up” and “picture down”
 Right adjusting wheel	Zoom settings: pull upwards (zoom in) to zoom in distant objects/pull downwards (zoom out) for the wide angle setting. The intensity of the deflection defines the zoom speed. Keyboard control via “cursor up” and “cursor down”

4.4 The picture gallery

The icon opens the  picture gallery. Video playback and recordings will be stopped.



The picture gallery is for the view and management of the saved pictures.

Zoom in a picture by double-clicking on it, close the picture again by clicking on it again. The buttons have the following functions:



Closes the picture gallery and starts the last live video



Deletes the last selected picture or the empty picture directory



Switches to the previous picture directory

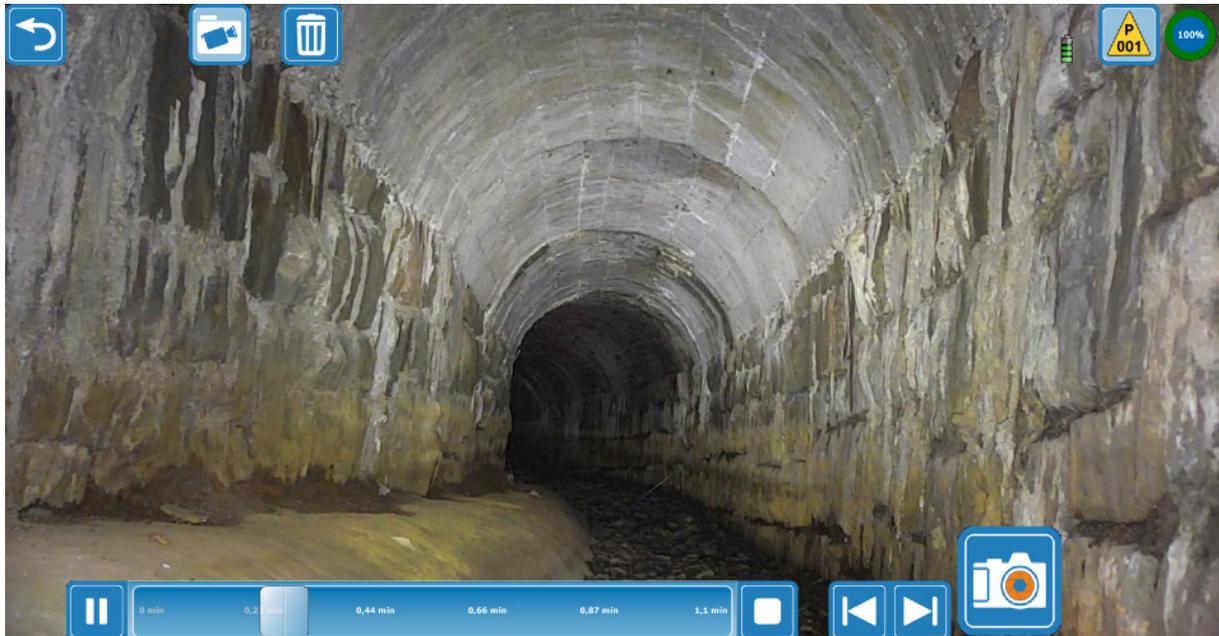


Switches to the next picture directory

After closing the picture gallery, the live video of the last selected video device will start.

4.5 The video gallery

The icon  opens the video gallery. Live video playback and current recordings will be stopped.



The video gallery is for the view and management of the saved videos.

The videos of a selected directory will be played. Direct positions in the video can be selected via the slide control and position information/times can be read and documented. During playback, pictures can be saved from the videos. The buttons have the following functions:



Closes the video gallery and starts the last live video



Select the video file to be replayed. All videos in the directory are copied to the current playlist and can be selected quickly.



Deletes the currently played video (previous request to operator)



Starts,



pauses



or stops the video playback



Switches to the previous video file in the currently selected directory



Switches to the next video file in the currently selected directory



Saves a picture in the directory for the current date

After closing the video gallery, the live video of the last selected video device will start.

5 Troubleshooting

Message: “Router/radio amplifier is not available. Please check the start-up condition/battery of the radio amplifier. The PC must be connected to the WLAN of the radio amplifier!”

- Switch on the router by pressing the power button. Keep the button pressed until the LED of the button lights. (See chapter 3.2) Make a wireless connection to the router's WLAN. Restart the connection setup via the camera selection.

Message: “The camera is not logged in to the router. Please wait the start-up condition of the camera (approx. 60 sec.).”

- Switch on the camera by pressing the power button. Observe the LED switches. Very fast flashing (2x per second) indicates low batteries. Please change the batteries to ensure correct functioning of the camera.

Message: “Camera is connected, video streaming has not yet been initialised (requires about 60 sec. after switching on).”

- The camera is still in start-up phase (Status-LED is fading). Try to start the connection setup to the camera again in about 60 seconds, using the camera selection buttons when the status LED is blinking. (See chapter 4.3)

Message: “Camera is connected, video streaming is not ready yet (requires about 30 sec. more).”

- The camera is still in start-up phase (Status-LED is fading). Try to start the connection setup to the camera again in about 30 seconds, using the camera selection buttons when the status LED is blinking. (See chapter 4.3)

“The camera displays a black image during video recording.”

- No encoder/format selected for video storage. Please select a video encoder with correct settings, according to chapter 4.2.

If necessary, you can contact us personally for support via the contact information provided therein.

6 Technical data

Weights	Camera unit with carbon telescopic rod 6.6 m:: 4.5 kg
Battery supply	3 pieces Lithium standard cells camera, 1 lithium standard cell router
Ambient temperature	-5 °C to max. 50 °C
Camera / Optics	FULL-HD 1920(H) x 1080(V), Light sensitivity 0.01 Lux 30 x optical + 10 x digital zoom, Focus
Camera unit	protection degree IP 67 / not explosion-proof Overpressure filling 0.5 bar with monitoring/warning indicator
Lightning	12 continuously dimmable LED spots
Interfaces	WLAN IEEE 802.11 b/g/n

Operation notes/Warning:

The camera unit of the STV-4 can be filled with overpressure; the internal pressure of the camera is continuously monitored. The system is not explosion proof, which means it must never be used in the hazardous area of flammable gases. Tanks and sewers, in which inflammable substances have been stored or transported or in which emergence of flammable mixture of gases cannot be excluded for certain, must be emptied, cleaned and sealed before the camera is inserted. If necessary, introduce a forced ventilation by means of an air exchange and clear the area of application with a suitable gas detection technology before using the camera.

The device complies with the valid EMC directives. The manufacturer reserves the right to make changes in the sense of a technical development. Please observe the corresponding documentation supplements. Please send any indications and suggestions to:

MesSen Nord GmbH
Zum Forsthof 2
D 18198 Stäbelow
Phone: +49 (0)38207/656-0
Fax: +49 (0)38207/656-66
Email: info@messen-nord.de
www.messen-nord.de