CS INSTRUMENTS

Translation of the original operating instructions

LeakCam 600

| LEAKAGE |

The completeness and accuracy of this documentation have been carefully checked. We reserve the right to make technical changes at any time. This may result in deviations from the information provided in this documentation.

The original document was published in the manufacturer's national language (German). All translations are copies of the original document and are only valid in conjunction with the original document.

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1 General information

For the sake of simplicity, the product "LeakCam 600" is referred to as the **product** in this documentation.

1.1 Documentation

This documentation describes important warnings, precautions and instructions for the safe and proper operation of the product.

▷ Before operating the product, read this documentation and ensure that you have understood its contents.

▷ Always keep this documentation to hand for reference purposes.

1.2 Symbols and labels used

The following markings and symbols are used in this documentation:

Labeling/symbol	Usage
Text	Important text passages are highlighted
text	Control elements LeakCam 600
Text	Software user interface
Text > Text > Text	User interface Click path
⬒ 2 Security	Cross-reference to text passage, figure or chapter
•	Enumeration, list element
▷	Call to action as part of an instruction. Can also be numbered.
✓	Final or intermediate result of an action instruction
✗	Final or intermediate result of an instruction that has not been achieved
ⓘ	Note on an intermediate result

Table 1: Symbols and labels used

1.3 Safety instructions and notes

	DANGER Indicates an imminent danger. Death or very serious injuries are the result.
	WARNING Indicates a potentially dangerous situation. Death or serious injury may result.
	CAUTION Indicates a potentially dangerous situation. Slight or minor injuries may result.
	NOTICE Indicates a potentially dangerous situation. Material or environmental damage may result.
	NOTE Indicates important information, application tips and useful information for proper working.

2 Security

The product is designed, manufactured and functionally tested in accordance with the applicable safety regulations and the state of the art.

To ensure operational safety, please observe the following:
- Chapter "Intended use"
- Chapter "Organizational measures to be taken by the operator"
- Chapter "Residual hazards"

Irrespective of the instructions given in this manual, the current country-specific regulations on occupational health and safety apply.

2.1 Intended use

The operational safety of the product supplied is only guaranteed if it is used as intended.

The product is designed exclusively for detecting compressed air leaks and leaks in compressed gases. It detects leaks based on the ultrasonic waves generated, which are evaluated taking into account the distance and line pressure.

Reliable leak detection is generally possible if application-dependent threshold values such as a relative overpressure > 250 mbar **and** a leak flow > 0.03 l/min are reached at a test distance of 3 m. It must be taken into account that measurement uncertainties and ambient noise (e.g. due to external noise or pressure fluctuations) can influence the detection behavior.

Any use beyond or deviating from this is considered improper use. The manufacturer accepts no liability for any resulting damage.

Intended use also includes
- Observance of the documentation supplied
- Compliance with all inspection and maintenance requirements specified by the manufacturer

Reasonably foreseeable misuse or improper handling are:
- Leak testing and leak detection of flammable and toxic gases
- Measurements on or near live parts
- Operation outside the technical specifications
- Tampering with the product in any way that does not comply with the intended and described procedures
- Continuous operation outdoors in wet conditions or direct exposure to the weather
- Use in potentially explosive areas (e.g. ATEX zones)

2.2 Organizational measures of the operator

The product may only be used if it is in perfect technical condition. It may no longer be used if it has been technically modified or damaged.

Instructions

The information on commissioning, operation and maintenance described in these instructions must be observed. These instructions must always be kept to hand with the product.

Personnel

Persons working on the product must have read these instructions, particularly the chapter entitled " 2 Security", before starting work. This also applies to persons who only work occasionally.

2.3   Handling class 2 lasers

> **CAUTION**
>
> **Laser radiation (class 2 laser)**
>
> Direct irradiation of the eyes can lead to injuries. The natural eyelid closure reflex usually provides sufficient protection in the event of unintentional short-term exposure.
>
> ▷ Do not look into the direct or reflected laser beam.
>
> ▷ Never point the laser beam at people or animals.
>
> ▷ Do not use any optical aids (e.g. magnifying glasses, binoculars) to view the beam.
>
> ▷ Mark or secure the laser work area accordingly.
>
> ▷ Observe the warning and safety instructions on the product.

This product contains a class 2 laser. Lasers in this class have a maximum output power of 1 mW. In the case of short-term exposure (less than 0.25 s), the eyelid closure reflex usually provides sufficient protection. Proper handling is nevertheless essential to avoid unintentional exposure and hazards.

▷ Observe the relevant accident prevention regulations.

▷ Switch off the product immediately if uncontrolled radiation is suspected.

▷ Mark defective products clearly and take them out of service.

▷ Have maintenance and repairs carried out by authorized specialist personnel only.
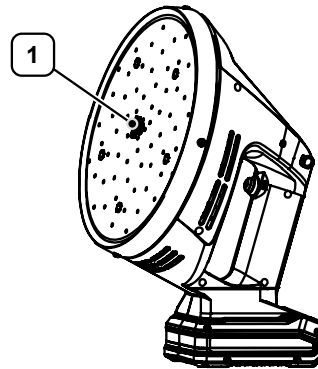
Figure 1: Laser exit point

1   Laser exit point

> **⚠ CAUTION**
> **Laser 2**
>
> Acccording IEC 60825-1:2014
> Max. output power: <1mW @ 630-660nm
>
> Complies with 21 CFR 1040.10 and 1040.11except for conformance with IEC 60825-1 Ed.3., as described in Laser Notice No. 56, dated May 8,2019
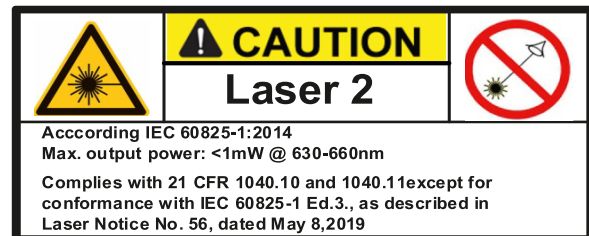
Figure 2: Product labeling "Class 2 laser"

2.4   Residual risks

> **CAUTION**
>
> **General safety instructions**
>
> The product is intended exclusively for the described application.
>
> ▷ Maintain sufficient safety distance during leak detection on electrical systems to avoid dangerous electric shocks.
>
> ▷ Do not use the product in the vicinity of explosive gases, vapors or in damp environments.
>
> ▷ Only use the product for its intended purpose and within the parameters specified in the technical data.
>
> ▷ Avoid any direct contact with hot and/or rotating parts.
>
> ▷ Observe the prescribed storage and operating temperatures.
>
> ▷ Tampering with the product in any way that does not comply with the intended and described procedures will invalidate the warranty and exclude liability.

> **CAUTION**
>
> **Lithium-ion battery**
>
> Lithium-ion batteries may only be used, charged and stored in accordance with the manufacturer's instructions. Improper handling can lead to overheating, fire or explosion.
>
> ▷ Observe the safety instructions of the battery manufacturer.
>
> ▷ Do not expose the battery to heat, direct sunlight or naked flames.
>
> ▷ Avoid mechanical damage, e.g. by dropping, crushing or piercing.
>
> ▷ Replace batteries immediately if they have fallen from a height of more than one meter or have been subjected to strong impacts - even if the housing appears undamaged. The inner cells could be seriously damaged.
>
> ▷ Do not short-circuit the battery terminals or take the battery apart.
>
> ▷ Only use the charger supplied or chargers approved by the manufacturer. Always observe the charging parameters recommended by the manufacturer to avoid damage to the product or safety risks.
>
> ▷ Do not use the supplied charger to charge other devices.
>
> ▷ Dispose of damaged, leaking or inflated batteries immediately.
>
> ▷ In the event of contact with chemicals, clean the contact points with water and seek medical assistance.
>
> ▷ Dispose of lithium-ion batteries in accordance with local regulations at suitable collection points.
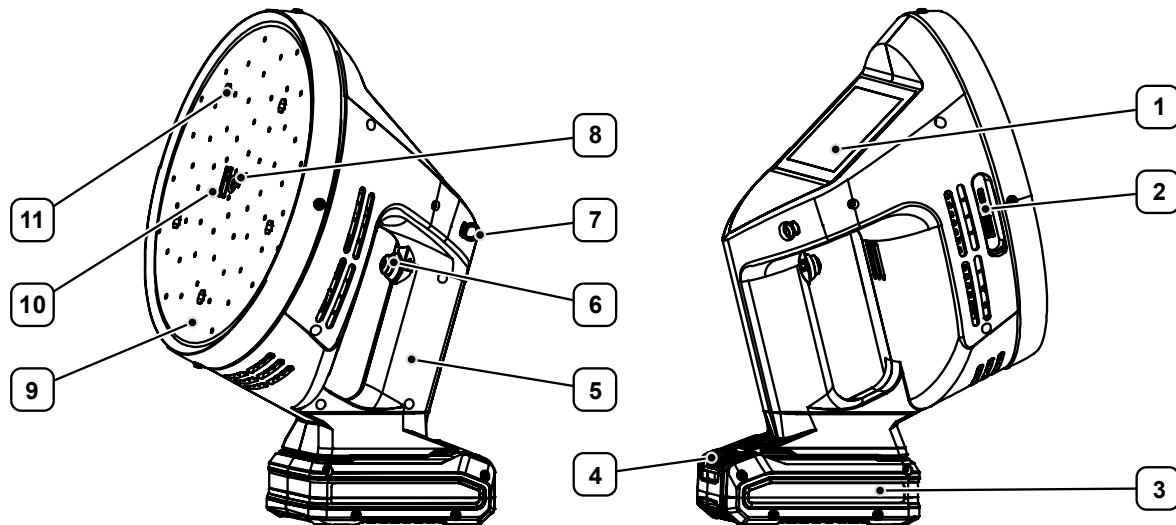
3 LeakCam 600

3.1 Product overview

Figure 3: LeakCam 600 (example)

1	Touch screen		**7**	Attachment eyelet Carrying strap (2x)
2	USB interface		**8**	Camera
3	Battery		**9**	Ultrasonic MEMS microphone (64x)
4	Battery capacity indicator		**10**	Laser distance module
5	Handle		**11**	LED light source (5x)
6	On/off switch / camera shutter release			

3.2 Product description

> **NOTE**
> Further information on terminology in connection with the topic of "leakage" can be found in the chapter "⤷ 12.5 Glossary".

LeakCam 600

The product detects, localizes and evaluates compressed air leaks in real time. In addition to compressed air leaks, the product detects leaks of nitrogen, argon, methane and CO_2. The possible detection distance depends on the transmission power of the leakage source and the respective ambient conditions. Under favorable conditions, even greater distances can be achieved.

The integrated ultrasonic MEMS microphones record a detailed sound level spectrum. The recorded data is used to calculate a frequency-dependent ultrasonic map within the set frequency window. Noise outside this range is effectively suppressed. This enables precise leak detection even in noisy or complex acoustic environments. For quick localization of leaks, the acoustic sound image and visual image are superimposed on the touchscreen.

The integrated laser distance module enables the distance to the leak to be determined automatically. The measured data flows directly into the evaluation and increases the precision of the leak detection.

Multi-directional ultrasonic transmitter (optional)

A multi-directional ultrasonic transmitter can be used to detect leaks in unpressurized systems. The ultrasonic signal penetrates the smallest openings, which can then be detected with the leakage camera.

Further information can be found in chapter "⤷ 8.6 Multi-directional ultrasonic transmitter (optional)".
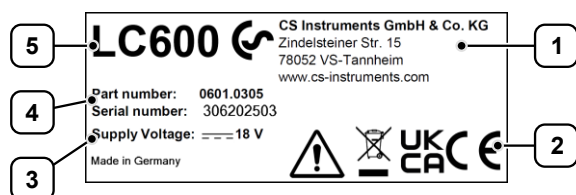
3.3 Type plate

Figure 4: Type plate (example)

1   Manufacturer information   **4**   Material/serial number

2   Conformity/certification marking   **5**   Product designation

3   Electrical connection data

3.4 Scope of delivery

The scope of delivery includes the following components:

- LeakCam 600
- Battery charger
- 18 V 2 Ah lithium-ion battery (incl. suitable battery holder)
- 18 V 4 Ah lithium-ion battery (incl. matching battery holder)
- Adjustable carrying strap
- Carrying case
- Leak tags
- Calibration certificate
- USB storage medium
- USB-C to USB-A cable
- Multi-directional ultrasonic transmitter (optional)

3.5 Applicable documents

This Translation of the original operating instructions contains information about the operation of the product "**LeakCam 600**". This essentially includes information such as

- Installation and commissioning
- Leakage detection
- Data record management
- Maintenance and servicing

> **NOTE**
>
> Data management and the creation of leakage reports with the **"Leak Reporter"** reporting software are not part of this document.
>
> Further information on this can be found in the "Operating instructions - Leak Reporter".

4   Transportation and storage

CAUTION

Danger due to improper transportation of the batteries

There is a risk of short circuit, mechanical damage or thermal reaction if the batteries supplied are transported incorrectly. Heat development, fire or explosion may occur.

▷ Only transport rechargeable batteries in designated transport containers with short-circuit protection.

▷ Cover the battery contacts and avoid mechanical stress (e.g. crushing, impacts).

▷ Observe the battery manufacturer's instructions and the legal regulations for the transportation of lithium-ion batteries.

NOTE

Improper transportation, storage and commissioning are accident-prone and can cause damage or malfunctions to the delivered product, for which the manufacturer (CS INSTRUMENTS GmbH & Co. KG) does not grant any liability or warranty.

4.1   Delivery

Transport damage

▷ Check the delivered components for visible transportation damage.

▷ Report any transport damage to the following parties immediately:

• the carrier

• the manufacturer's customer service (CS INSTRUMENTS GmbH & Co. KG)

▷ Ensure that the product is handled properly during transportation.

Packaging

▷ Keep the original packaging for future transportation or storage.

4.2   Storage

CAUTION

Damage to the battery cells due to incorrect storage

Incorrect storage can damage the battery cells in the rechargeable batteries.

▷ Observe the safety instructions of the battery manufacturer.

▷ Only store batteries in a charged state (at least 40% charged).

▷ Store the batteries in a cool and dry place.

▷ Protect the battery from humidity and direct sunlight.

▷ Prevent the battery from freezing.

▷ Dispose of batteries that have been stored below 0°C for more than 60 minutes.

To avoid damage due to environmental influences, the product must be stored properly when not in use.

▷ If possible, store the product in its original packaging.

▷ Only store the product in dry, dust-free rooms.

▷ Avoid direct sunlight and proximity to heat sources or aggressive chemical substances.

5 Installation and commissioning

> ⚠️ **CAUTION**
>
> **Danger from commissioning a damaged product**
>
> If a damaged product is installed or put into operation, this can lead to functional failures, electrical hazards or mechanical risks.
>
> ▷ Check the product, accessories and all supply lines for visible damage, loose parts or missing components before each start-up.
>
> ▷ Take a defective product out of operation immediately.

5.1 Fitting accessories (optional)

Fitting the battery holder

The battery holder improves the stability of the product and, in combination with the carrying strap, also serves as an ergonomic support for the operator's body, especially when used at stomach height.

▷ Slide the battery into the battery holder.

 ⓘ The battery can be charged in the battery holder when inserted.
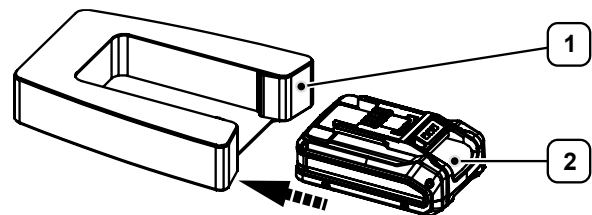
Figure 5: Fitting the battery holder (example)

1 Battery holder   **2** Battery pack

Fitting the carrying strap

A carrying strap can be fitted to the device for ergonomic use.

▷ Attach the carrying strap to the two fastening eyelets.

▷ Adjust the carrying strap to the desired length.
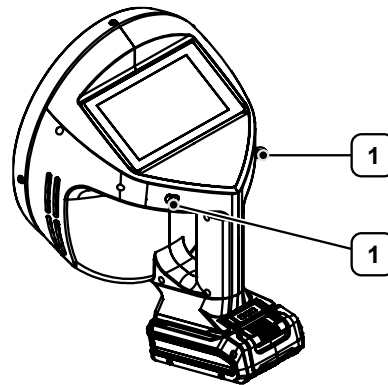
Figure 6: Fitting the carrying strap (example)

1 Fastening eyelet Carrying strap

5.2 Initial commissioning

> ℹ️ **NOTE**
>
> The batteries are only charged to around 30% on delivery and must be fully charged before first use.
>
> Further information can be found in chapter "🗎 10.3 Removing and charging the battery".

Putting the product into operation

The product and battery are supplied separately for transportation.

▷ Push the battery into the handle of the product until you hear it click into place.

 ✓ The product is ready for use.

Starting the installation wizard

When the product is switched on for the first time, the installation wizard for basic device configuration starts automatically.

▷ Follow the instructions on the screen.

▷ Select the desired settings.

    ⓘ All configurations can be edited via the system settings after commissioning.

5.3 Switching on and off

Switching on

▷ Press the on/off switch.

    ✓ The device will start up.

    ⓘ This may take a moment.

Switching off

▷ Press and hold the on/off switch for approx. 3 seconds.

▷ Confirm the message.

    ✓ The device switches off.
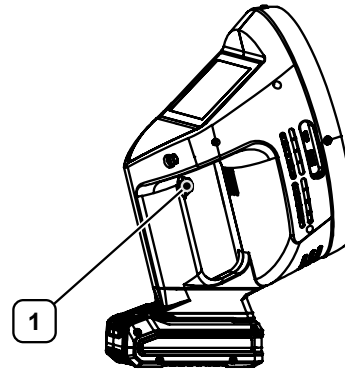
Figure 7: Switching the product on and off (example)

1   On/off switch

⚠ **WARNING**

Danger from removing the battery during operation

Removing the battery during operation can lead to data loss or electrical malfunctions. There is a risk of damage to the device and injury due to electrical discharge or uncontrolled system reactions.

▷ Ensure that the product is switched off properly before removing the battery.

6 Operation

6.1 Control elements
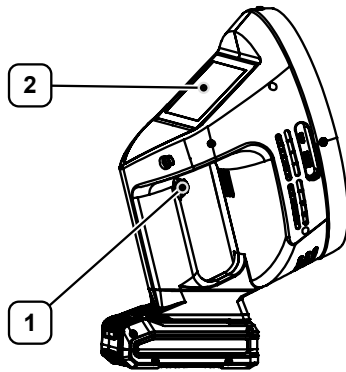
Figure 8: Operating elements (example)

| **1** | Camera shutter release | **2** | Touch screen |

Camera trigger

A measurement can be saved using the camera trigger on the handle.

▷ Press the camera trigger to save a measurement.

    ① Alternatively, a measurement can also be saved using the Camera button on the user interface.

Touch screen

The user interface is operated via the touch screen.

▷ Select menu items by tapping them with your finger or a soft, round stylus.

| ⚠ | **CAUTION**
Damage to the touchscreen
▷ Do not use pens or other sharp-edged objects to operate the touchscreen. |

6.2 User interface

The following user interface is displayed each time the product is started.

Figure 9: User interface | Camera mode view (example)

1   Status bar

2   Adjust threshold value

3   Configuration menu

4   Zoom

5   Measurement parameters

6   Camera trigger

7   Target area (for leakage documentation)

8   Laser distance measurement

9   LED light source

Various information on the current measurement is displayed in the status bar:

- Signal level [dB] (determined$_{value\ max.}$ target area)
- Leakage rate estimation
- Cost estimation
- Frequency window (default setting: 40-55 kHz)
- Focus
- Distance to leakage
- Signal level [dB] (determined$_{value\ max}$ opening angle camera)
- Threshold value [dB]

The user interface is equipped with clearly structured buttons. This allows central functions such as threshold value adjustment, calibration, recording and navigation between views to be operated directly and intuitively.

Further information can be found in chapter " 8 Leak detection".

7 Configuration

Opening the Configuration view

To switch from the Camera mode view to the Configuration view:

▷ Tap the Back button.
  ✓ The Configuration view opens.
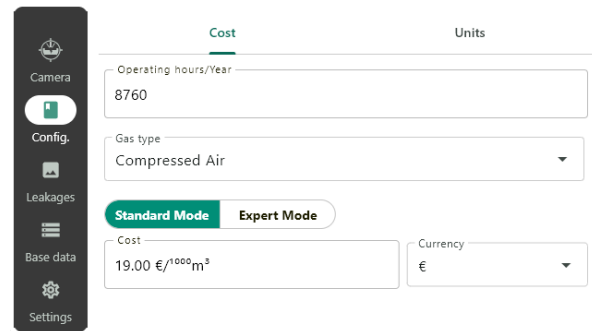
Figure 10: Configuration view (example)

7.1 Set up device settings

The following can be configured in the Settings menu item:

- Camera color setting
- Operating hand
- Display brightness
- Standby mode
- Date and time
- Language setting
- Resetting the product to factory settings

▷ Tap on the Settings button.
▷ Select the Basic settings tab.
▷ Select the desired settings.
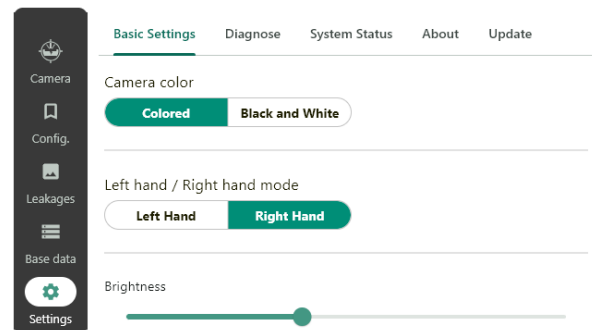
Figure 11: Adjusting the basic settings (example)

> **NOTE**
>
> A reduced screen brightness value and a short screen switch-off time help to minimize energy consumption and increase the effective operating time of the product.

7.2 Adjust configuration settings

Open configuration settings

▷ Tap on the Config. button.

Store parameters for cost calculation

All parameters relevant to the cost calculation can be stored directly for optimum quantification of the leakage.

▷ Select the Costs tab.

▷ Select the desired settings.

▷ Tap the Save button.

    ✓ The product is now configured to calculate the annual leakage costs.

Figure 12: Storing parameters (example)

**NOTICE**

Expert mode

In Expert mode, both the specific system output and the electricity price can be stored individually for the media types "Compressed air" and "Vacuum".

There are three preset values to choose from for the specific output - alternatively, you can enter your own value manually.

The estimation of the Total costs [100%] (life cycle costs) is broken down into 70 % energy costs, 20 % installation costs and 10 % maintenance costs.

▷ Tap on the Expert mode button.

▷ Select the desired settings.

Customize units

The system of units and measured variables can be adapted to country-specific specifications or individual requirements.

▷ Select the Units tab.

▷ Select the desired settings.

    ✓ The display units are adopted according to the selection and displayed correctly in all relevant areas.

Figure 13: Customize units (example)

8 Leak detection

8.1 Checklist: Settings before starting leak detection

Before you start leak detection, make sure that all relevant settings have been made. The following checklists will help you with structured preparation and the recording of individual leaks.

Checklist: Preparation for leak detection

- Reset or continue leak tag
- Define company name
- Define building (with subdivision by floor or area if necessary)
- Clarify and record compressed air costs
- Set operating hours per area (required for the economic evaluation of leaks)
- Record the operating pressures of the areas (essential for calculating the leakage volume flow)
- Check other settings (e.g. language, units, time format, etc.)

The following information should also be documented separately for each identified leak:

Checklist: Details per leakage

- Specify the operating time of the leak
- Specify the operating pressure at the leakage point
- Check measurement parameters and adjust if necessary

8.2 Adjust measurement parameters

Various measurement parameters can be adjusted for optimum detection and analysis of leaks. These include measuring distance, focus range, threshold value and frequency window. The correct parameterization enables better signal separation, minimizes environmental influences and improves the reproducibility of the measurement - especially under varying environmental conditions.

Predefined values are stored in the system, which represent a reliable starting point in most typical application scenarios.

Parameters	Factory setting
Distance	3,0 m
Focus distance	Focus far
Threshold value	20 dB
Frequency window	40-55 kHz

If the acoustic conditions change during the measurement or the location changes, it makes sense to adjust the measurement parameters.

> **NOTE**
> When restarting, all user-defined settings are deleted and replaced by the factory settings.

8.2.1 Select focus area

> ⚠️ **CAUTION**
>
> **Laser radiation (class 2 laser)**
>
> Direct irradiation of the eyes can lead to injuries. The natural eyelid closure reflex usually provides sufficient protection in the event of unintentional short-term exposure.
>
> ▷ Do not look into the direct or reflected laser beam.
>
> ▷ Never point the laser beam at people or animals.
>
> ▷ Do not use any optical aids (e.g. magnifying glasses, binoculars) to view the beam.
>
> ▷ Mark or secure the laser work area accordingly.
>
> ▷ Observe the warning and safety instructions on the product.

The focus determines the delay times for the internal calculation of the ultrasound map. For optimum image sharpness, the measuring distance and focus range should match as closely as possible.

> 🛈 **NOTICE**
>
> **Inaccurate focusing at a short distance from the leakage**
>
> The distance to the leak should be **at least 0.3 m** to ensure reliable detection. Incorrect focusing can affect the detection results.
>
> ▷ If the distance to the leak is short, pay particular attention to determining the distance as precisely as possible.

Using autofocus

Autofocusing uses the distance to the leak measured by the laser distance module as the basis for calculating the focus.

▷ Tap on the Laser button.

   🛈 Tapping again will deactivate the function.

▷ Aim the laser at a light-reflecting surface.

   🛈 Do not use glass or deep black objects as target objects.

   ✓ The focus range is automatically selected based on the distance determined.

   🛈 The focus ranges **0.3 m**, **0.6 m** and **1.0 m** are available. At distances of 3 m or more, the system automatically switches to remote focus.

   ✓ Both the determined distance and the automatically assigned focus range are displayed in the status bar.

> 🛈 **NOTICE**
>
> ▷ Reduce or increase the distance to the leak in order to measure optimally within the set focus range.

✗ If no stable measured value can be recorded via the laser distance module - e.g. due to strong movements of the leakage camera during the measurement - a warning symbol appears in the status bar. In this case, enter the distance manually.

Adjusting the focus manually

If distance measurement via the laser distance module is not possible, the distance to the leakage must be entered manually.

▷ Tap the Measurement parameters button.

   ⓘ Tapping again will deactivate the function.

▷ Tap the Distance button.

▷ Select the desired settings.

   ⓘ If the distance is entered manually, the laser distance module is automatically deactivated.
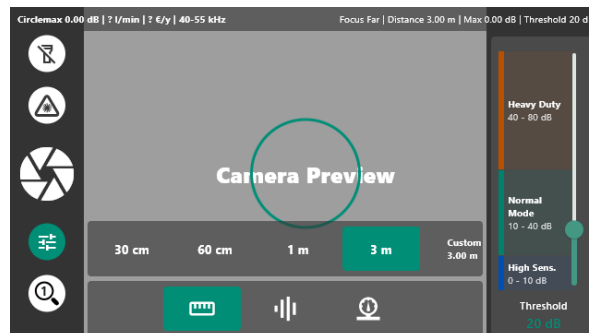

Figure 14: Adjusting the focus manually (example)

8.2.2 Adjust threshold value

The threshold value defines the signal intensity at which an acoustic event (e.g. a leak) is recognized as relevant. A correct setting is crucial in order to suppress background noise and at the same time reliably detect weak leakage signals. Ideally, the adjustment is made depending on the ambient noise and the selected frequency window.

> **ⓘ NOTE**
>
> The threshold value determines the volume at which a pixel on the ultrasonic map is colored. **The higher the threshold value, the lower the sensitivity.** This means that only loud noises are visible - quiet sound sources can be suppressed.

The current sound intensity is recorded frequency-selectively and displayed in the ultrasound map based on color (blue= lowest volume; white: highest volume).

Adjusting the threshold value

The Adjust threshold value buttons can be used to adjust the sensitivity of the measurement to the ambient conditions.

▷ Tap the Adjust threshold buttons on the right-hand side of the screen to perform the following actions:

Button	Button Description
👁	Autocalibration: Automatic adjustment to the ambient conditions
	The button is displayed in **yellow** if the set threshold value exceeds the maximum sound pressure in the current frequency window. In this case, the threshold value should be adjusted. (Special case: Certain interference should be specifically suppressed).
⊕	+1 dB: Reduce sensitivity (quieter sounds are suppressed)
⊖	-1 dB: Increase sensitivity (quiet noises are also visible)
🚫👁	Set maximum level: Suppress unwanted noise
	Example: Ultrasound source is located just outside the camera's aperture angle

Table 2: Adjust threshold value buttons

Threshold value	Environment type
40 - 80 dB	Heavy duty (noisy environments, lots of background noise)
10 - 40 dB	Medium (normal environments)
0 - 10 dB	High (quiet environments, e.g. in the laboratory)

Table 3: Threshold ranges for different types of environments

8.2.3 Select frequency window (expert knowledge)

The FFT-based evaluation (Fast Fourier Transform) makes the frequency components present in the measurement environment visible and enables their targeted analysis. By setting the lower and upper limits, a so-called frequency window can be defined in which relevant signals are analyzed.

The frequency window can be adjusted for the targeted analysis of leakage noises. The selection of suitable cut-off frequencies improves the selectivity against ambient noise - especially in the case of industrial noise.

The difference between frequency window and threshold value in leakage detection lies in their function within the detection process:

• Frequency window determines **where** to look (which frequencies).

• The threshold value determines **when** the definition is made: "There is a leak here."

Criterion	Frequency window	Threshold value
Function	Defines the frequency range to be analyzed	Defines the minimum signal level for detecting a leakage
Target	Fade out irrelevant or interfering frequency components	Avoidance of false alarms / detection of significant signals
Influencing factor	Ambient conditions, typical leakage frequencies	Background level, sensitivity of the system
Example of	Analysis of 25-40 kHz or 40-55 kHz	Leakage is detected if the level is > 70 dB in the selected frequency range
Setting option	Freely selectable via slider or via presets (max. 20 kHz)	Via Adjust threshold value buttons
Typical application benefits	Increases signal quality by focusing on relevant frequencies	Decides whether the measured signal represents a leakage

Table 4: Function and role of frequency window and threshold value

Select frequency window

In acoustically polluted environments - such as industrial halls with high levels of machine noise - the frequency window can be adjusted so that only high-frequency signals are detected. Low-frequency ambient noise outside the window is systematically suppressed.

▷ Tap on the Measurement parameters button.

    ⓘ Tapping again will deactivate the function.

▷ Tap on the Frequency window button.

▷ Set the frequency window so that prominent signals or spectral peaks are fully recorded.

▷ Select the appropriate frequency window using the two predefined values (25-40 kHz / 40-55 kHz).

▷ **Or** adjust the frequency window manually using the slider.

    ⓘ If the frequency window is selected manually, neither the "Leakage rate estimation" nor the "Cost estimation" can be carried out to quantify the leakage.
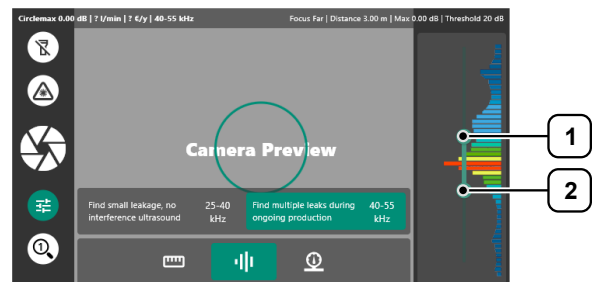

Figure 15: Select frequency window (example)

1   Upper frequency limit   **2**   Lower cut-off frequency

Characteristic	25-40 kHz	40-55 kHz	60-80 kHz
Attenuation over distance	Low	Medium	High
Sensitivity ultrasonic microphone	High	Medium	Low
Selectivity / multiple leakage detection	Medium	High	Very high
Interference sensitivity (audible range)	Medium	Low	Very low

Characteristic	25-40 kHz	40-55 kHz	60-80 kHz
Typical application	Quiet environment, small leaks from a large distance (e.g. leak tests)	Small to medium leaks from a greater distance in a production environment (ideal for compressed air)	Medium to large leaks in highly automated areas at a distance of < 6 m

Table 5: Comparison of the ultrasonic frequency ranges

8.2.4 Set operating pressure

The operating pressure of the system can be stored for optimum quantification of the leakage.

▷ Tap on the Measurement parameters button.

    ① Tapping again will deactivate the function.

▷ Tap on the Pressure button.

▷ Select the desired settings.

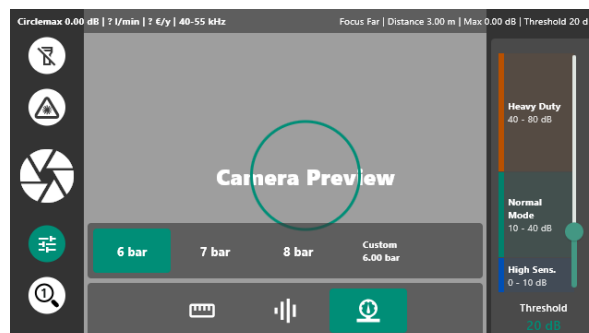   ✓ The stored operating pressure is taken into account when calculating the annual leakage costs.

Figure 16: Setting the operating pressure (example)

8.3 Carry out leak detection

DANGER

Injuries or death from touching live parts

Touching live parts can lead to death.

▷ Work on electrical systems or equipment may only be carried out by qualified electricians or by instructed persons under the direction and supervision of a qualified electrician in accordance with electrical engineering regulations.

▷ When locating leaks in electrical systems, maintain a sufficient safety distance to avoid dangerous electric shocks.

Prerequisite

• The system is in operating mode or is pressurized (depending on the measurement method used).

• All safety requirements are known and complied with.

Materials

• LeakCam 600

• Leak tags (for physically marking detected leaks)

• Personal protective equipment

NOTE

For effective planning and repair, leak data should be recorded and stored directly on site.

Preparation steps

▷ Check that there is safe and unobstructed access to the measurement area.

▷ Pressurize all relevant system parts if this can be done safely.

▷ Take the product in the desired operating hand and stabilize it with the other hand.

    ① For ergonomic working: Put on the carrying strap and slide the battery into the battery holder.

Opening the Camera mode view

To switch from the Configuration view to the Camera mode view

▷ Tap the Camera trigger button.

    ✓ The Camera mode view opens.

▷ Walk systematically along compressed air lines, connections, valves and other typical leakage points.

▷ Position the product near the area to be tested.

▷ Observe the visual indicators on the user interface.

8.4 Estimate leakage

The estimated leakage volume flow (liters/minute) results from the parameters pressure, distance and ultrasonic level (dB). The distance in particular has a significant effect on the result and should be specified as precisely as possible, as the signal intensity decreases with increasing distance and the source therefore appears quieter.

Measurement accuracy can be affected by ambient ultrasound in the target frequency range - for example, ultrasound from neighboring leaks or reflections. A sealed leakage point and an unfavorable measuring angle relative to the air flow of the leakage can also influence the result.

Therefore, it cannot be guaranteed that the measures taken during the evaluation period fully reflect the current leakage rate. The estimated leakage volume flow serves as a guide for prioritizing compressed air leaks - especially taking into account the potential costs for spare parts and repair work.

Estimate leakage

If the leakage is precisely in the target area and the maximum value measured there is above the defined threshold value, the leakage is considered a detected sound source - the target marking then changes from red to green.

▷ If there is no color change, adjust the measurement parameters accordingly.

　ⓘ Further information can be found in chapter "⤴ 8.2 Adjust measurement parameters".

Figure 17: Leakage optimally detected (example)

1 Target area (for leakage documentation)

⊘ **NOTICE**

Analyze each leak individually

For correct quantification, each leakage should be analyzed individually.

▷ If possible, only record **one** leak in the target area to enable an exact calculation.

▷ If necessary, swivel the leakage camera or zoom in closer to the area to be examined to improve the positioning of the leakage in the target area.

⊘ **NOTICE**

Distinguishing between original and reflected sources

To determine whether a displayed sound source is the original signal or a reflection, the source should be viewed from several angles.

▷ Genuine sound sources: remain clearly visible

▷ Reflections: change their position or disappear completely

⊘ **NOTICE**

Adjusting the threshold value

If the "Threshold" value is displayed in **yellow** in the status bar, the signal detection should be optimized by adjusting the threshold value.

▷ Threshold value too high: quiet leaks may remain undetected

▷ Threshold value too low: sources of interference outside the field of view can dominate and distort the analysis

> ⚠ **NOTICE**
>
> **Minimize background noise**
>
> To minimize environmental influences, leak detection over medium to high frequency windows is recommended.
>
> ▷ In addition, select a frequency window that is as small as possible to suppress neighboring interference signals.
>
> ▷ In noisy environments, select a higher frequency window to better distinguish leakage noises from interference signals.

8.5 Document leakage

For optimum analysis, the leakage should be positioned in the center of the target area (circle) and the target area should change from red to green.

▷ Place the leak in the center of the target area (circle).

▷ Tap the Camera trigger button or press the button on the handle.

   ✓ The leakage documentation menu opens.

▷ If necessary, tap the Add photo button to add another image of the leak.

▷ Fill in the form fields accordingly.

   ⓘ All entries are saved in an internal database and can therefore be used again at any time. Some predefined suggestions are already included when the product is delivered.

Figure 18: Document leakage (example)

The following fields are available to describe a leak:

• Leak Tag
• Company, building and measuring point
• Measure and leak element
• Spare part and manufacturer
• Reporting person
• Estimated repair time and repair status (leak repaired on site, repair possible under pressure?)

> ℹ **NOTE**
>
> Before finally saving the measurement to the internal SD card, a summary can be created and the correctness can be checked again to be sure.

▷ Tap the Preview button to call up an overview of the entered data.

▷ Tap the Edit leak button to correct values if necessary.

▷ Tap the Save leak button to save the data on the internal SD card.

   ⓘ The leak tag number automatically increases by one after each saved measurement.

   ✓ All entries are saved in an internal database and are permanently available for evaluations, reports and follow-up processes.

▷ Or tap the Discard leak button to delete the leak without saving it.

▷ Attach a leak tag to the leakage point for physical identification.

   ✓ The leak has been systematically identified, localized and fully documented.

8.6   Multi-directional ultrasonic transmitter (optional)

Leak detection in unpressurized systems

A multi-directional ultrasonic transmitter can be used to locate leaks in unpressurized pipe systems. The device is powered by a rechargeable battery.

Prerequisite

• The multi-directional ultrasonic transmitter is available as an accessory.

Commissioning and use

▷ Push the rechargeable battery into the bottom of the transmitter until you hear it click into place.

▷ Switch the ultrasonic transmitter on using the on/off button.

  ✓ The LED lights up green.

▷ Align the transmitter so that the ultrasonic signal is optimally coupled into the pipe system.

  ✓ The emitted ultrasonic signal penetrates even the smallest openings in the system. These leaks can then be detected with the leakage camera.
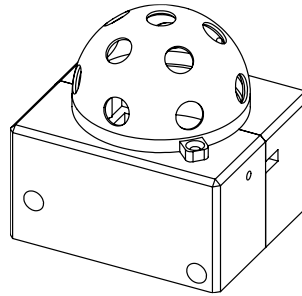
▷ Carry out the leak detection as usual.

Figure 19: Multi-directional ultrasonic transmitter (example)

9 Data record management

9.1 Manage leakage data

In data record management, all recorded leaks can be systematically displayed, exported, deleted and restored if required. This area serves as a central administration point for the structured documentation of leaks and the associated measures and repair information.

Open data record management

▷ Tap on the Leakages button.

   ✓ The leakage data overview opens.

   ⚠ Use the filter function to narrow down the data records (e.g. by company, building or status).
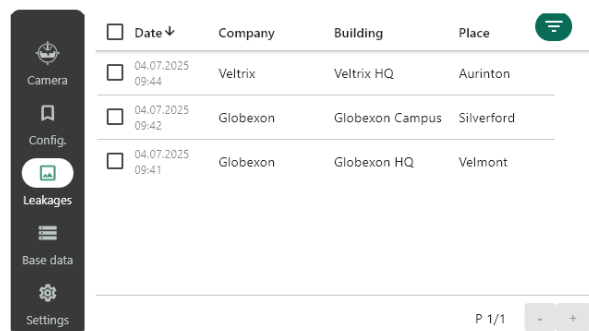

Figure 20: Data record management (example)

Show leakage (detailed view)

The details of a data record are displayed in the preview depending on the context.

▷ Tap and hold the desired data record.

   ✓ All associated information (e.g. leak tag, measuring point, measure, repair status) is displayed in the preview.

▷ Tap the Next button to switch to the next leakage.

   ⚠ Individual leaks can be selected by ticking them in order to keep them ready for subsequent actions (export, delete) in the temporary selection.
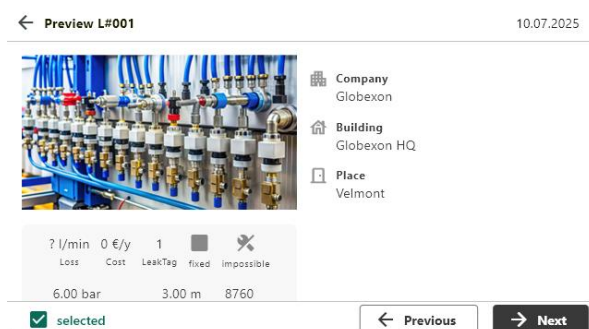

Figure 21: Leakage preview (example)

Delete leakage (soft delete)

When data records are deleted, they are moved to the recycle bin (soft delete) and removed from the standard view, but can still be restored.

▷ Select one or more data records.

   ✓ Selected data records are marked with a tick.

▷ Tap the ove x to recycle bin button.

▷ Confirm with Yes.

   ✓ The selected data records are moved to the recycle bin.

Restore leakage

Deleted data records can be completely restored from the recycle bin.

▷ Tap on the Filter button.

▷ Select Only deleted leaks.

▷ Tap on the Apply button.

▷ Select one or more data records

   ✓ Selected data records are marked with a tick.

▷ Tap on the Restore x leaks button.

   ✓ The selected data records are restored.

Permanently delete leaks

Data records that are no longer required can be permanently removed from the internal memory.

▷ Tap on the Filter button.

▷ Select Only deleted leaks.

▷ Tap the Apply button.

▷ Select one or more data records

   ✓ Selected data records are marked with a tick.

▷ Tap the Delete selected leaks button.

   ✓ The selected data records are **irrevocably** deleted.

Export leakage

Further information can be found in chapter " 9.3 Transfer data".

9.2 Manage master data

Many input fields use suggestion lists that can be customized, exported and imported.

▷ Select the Base data command.

Edit default values

▷ Select the corresponding tab to edit existing entries or add new ones:

   • Measuring point: Company, building, location

   • Repair: Leak element, measure, spare part, manufacturer

   • People

▷ Tap on the desired entry to edit or delete it.

> **NOTICE**
> **Deleting entries**
> Entries can only be deleted if they have not yet been used. This is to avoid inconsistent data.

Exporting and importing default values

The master data lists can be exported and re-imported for archiving, editing or forwarding.

Further information can be found in chapter " 9.3 Transfer data".

9.3 Transfer data

9.3.1 Establish connection

Data can be transferred in two ways: via a connection to a computer or via a USB storage medium.

Removing the USB protective cover

▷ Remove the USB protective cover.

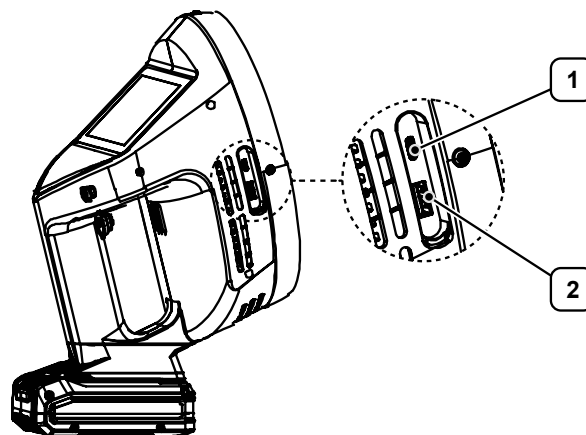▷ Select the desired USB interface for data transfer.

Figure 22: USB interfaces (example)

1 USB-C interface   **2** USB-A interface

> ⚠️ **WARNING**
>
> **Malfunctions or damage to the device**
>
> After data transfer, the USB protective cover must be completely replaced. This prevents dust, moisture or foreign objects from entering the device.
>
> ▷ Replace the USB protective cover after the data transfer.

Connection to a computer (via USB-C to USB-A cable)

▷ Insert the USB-C plug of the USB-C to USB-A cable into the USB-C port on the product.

    ✓ The system automatically recognizes the product and mounts it as two drives.

    ⓘ **Export drive** ("LD-export"): Read only (read-only -> for data export)

    ⓘ **Import drive** ("LD-import"): Read and write possible (read-write -> for software update)

> 〉 ▭ LD-export (F:)
>
> 〉 ▭ LD-import (D:)

Figure 23: Export and import drive (example)

> ⓘ **NOTICE**
>
> **Avoidance of inconsistent data**
>
> The product is locked during an active connection with the computer. This prevents changes to the product and protects against inconsistent or incomplete data transfers.
>
> ▷ Do not disconnect manually during data transfer.

Connection with a USB storage medium

▷ Insert the USB storage medium into the product via the USB-A port.

    ✓ The product automatically recognizes the storage medium.

    ⓘ When exporting data, a directory with the name "**DEV0007**" is automatically created on the USB storage medium. The exported files are stored in this directory.

> ⌄ 📁 DEV0007
>
> 〉 📁 Database
>
> 〉 📁 Journal

Figure 24: "DEV0007" directory (example)

> ⚠ **NOTICE**
>
> **Updating the data to be exported**
>
> Changes to data on the internal memory are not automatically transferred to the USB storage medium as long as it is connected.
>
> ▷ Disconnect the storage medium briefly and reconnect it to export the current data.

9.3.2 Start transfer

> ⚠ **NOTICE**
>
> **Special feature for data transfer via USB-C to USB-A cable**
>
> Changes to data on the internal memory are not automatically transferred to the export drive as long as the product is connected to the computer.
>
> ▷ First export the desired data to the internal SD card.
>
> ▷ Then connect the product to the computer using the USB-C to USB-A cable.
>
> ▷ Copy the data from the "**LD-export**" export drive.

> ℹ **NOTE**
>
> Data management and the creation of leakage reports with the **"Leak Reporter"** reporting software are not part of this document.
>
> Further information on this can be found in the "Operating instructions - Leak Reporter".

Export leakage

Data records can be exported for documentation, archiving or forwarding.

▷ Tap on the Leakags button.

   ✓ The leakage data overview opens.

▷ Select one or more data records.

   ✓ Selected data records are marked with a tick.

▷ Tap on the Export x button.

▷ Select the desired storage medium.

   ⓘ When transferring data via USB-C to USB-A cable, the desired data must first be exported to the internal SD card.

▷ Tap on the Next button.

▷ Tap on the Export button.

   ✓ The selected data records are exported to the desired storage medium.
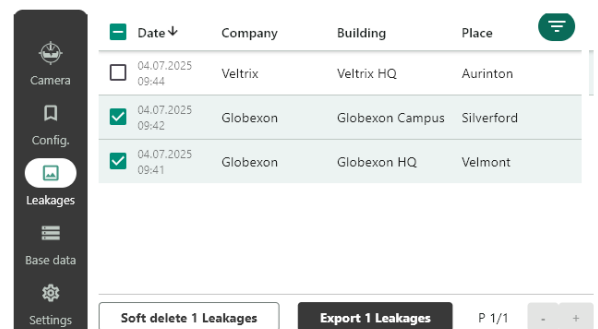

Figure 25: Export leakage (example)

Exporting and importing default values

The base data lists can be exported and re-imported for archiving, editing or forwarding.

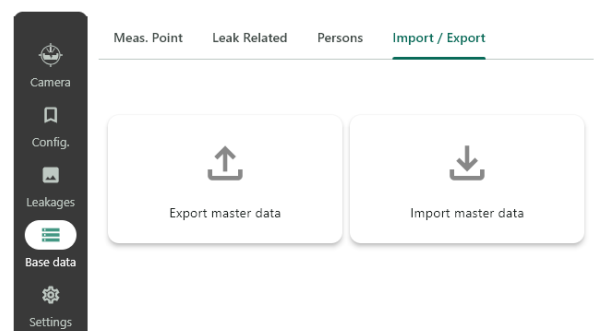▷ Select the Base data command.

▷ Select the Import / Export tab.

Figure 26: Transferring master data (example)

To export the master data:

▷ Tap on the Export master data button.

▷ Select the desired storage medium.

   ⓘ When transferring data via USB-C to USB-A cable, the desired data must first be exported to the internal SD card.

▷ Select the desired entries.

▷ Tap on the Export button.

   ✓ The data is exported in XML format.

▷ Tap on the Finish button.

To import the master data:

▷ Create an XML file in the required format.

   ⓘ Only valid XML files in the intended format can be imported.

   ⓘ When transferring data via USB-C to USB-A cable, the required data must first be copied to the "**LD-import**" import drive.

▷ Tap the Import master data button.

▷ Select the desired storage medium.

▷ Select the entries to be imported.

▷ Tap on the Import button.

   ✓ The internal database is expanded with the new entries.

10 Maintenance and servicing

10.1 Maintenance intervals

These maintenance intervals are the manufacturer's recommendations. The operator must check the intervals depending on the operating conditions and shorten them if necessary.

Interval	Description
Daily (every 10 operating hours)	see chapter " 10.2 Clean product"
Annually (every 3000 operating hours)	see chapter " 10.4 Perform microphone diagnostics"
As required	see chapter " 10.3 Removing and charging the battery"
	see chapter " 10.5 Update software"

10.2 Clean product

Prerequisite

- The product is switched off.

Cleaning the housing

If the housing is dirty, clean it with solvent-free cleaning agents.

▷ Remove the battery before cleaning.

▷ Use a slightly damp, lint-free cloth to clean the housing regularly.

Cleaning ultrasonic MEMS microphones

> **WARNING**
>
> **Risk of damage to the ultrasonic MEMS microphones**
>
> The microphones are sensitive and must not be handled improperly.
>
> ▷ Never insert objects into the microphone openings.
>
> ▷ Do not use compressed air to clean the microphone openings.
>
> ▷ Do not apply water or cleaning agents directly to the microphones.
>
> ▷ Do not use damp or wet cloths.

▷ Keep the microphone inputs clean.

▷ Vacuum the microphones carefully using a vacuum cleaner with a brush attachment fitted.

10.3 Removing and charging the battery

> **WARNING**
>
> **Danger from removing the battery during operation**
>
> Removing the battery during operation can lead to data loss or electrical malfunctions. There is a risk of damage to the device and injury due to electrical discharge or uncontrolled system reactions.
>
> ▷ Ensure that the product is switched off properly before removing the battery.

> **CAUTION**
>
> **Lithium-ion battery**
>
> Lithium-ion batteries may only be used, charged and stored in accordance with the manufacturer's instructions. Improper handling can lead to overheating, fire or explosion.
>
> ▷ Observe the safety instructions of the battery manufacturer.
>
> ▷ Do not expose the battery to heat, direct sunlight or naked flames.
>
> ▷ Avoid mechanical damage, e.g. by dropping, crushing or piercing.
>
> ▷ Replace batteries immediately if they have fallen from a height of more than one meter or have been subjected to strong impacts - even if the housing appears undamaged. The inner cells could be seriously damaged.
>
> ▷ Do not short-circuit the battery terminals or take the battery apart.
>
> ▷ Only use the charger supplied or chargers approved by the manufacturer. Always observe the charging parameters recommended by the manufacturer to avoid damage to the product or safety risks.
>
> ▷ Do not use the supplied charger to charge other devices.
>
> ▷ Dispose of damaged, leaking or inflated batteries immediately.
>
> ▷ In the event of contact with chemicals, clean the contact points with water and seek medical assistance.
>
> ▷ Dispose of lithium-ion batteries in accordance with local regulations at suitable collection points.

> **CAUTION**
>
> **Damage to the battery cells due to deep discharge**
>
> The most common cause of deep discharge of battery packs is long storage or non-use of partially discharged batteries.
>
> ▷ Do not use or charge batteries that were last charged more than 12 months ago.
>
> ▷ Only store batteries in a charged state (at least 40% charged).
>
> ▷ Charge the battery in good time.

> **CAUTION**
>
> **Safety risk due to aged lithium-ion batteries**
>
> Lithium-ion batteries are subject to a natural ageing process. Over time, the cells lose performance. Aged or weakened batteries can no longer meet the necessary performance requirements and pose a safety risk.
>
> ▷ Replace batteries whose capacity is less than 80 % of the original rated capacity.
>
> ▷ Dispose of damaged or defective batteries in accordance with the applicable regulations and environmental standards.

Display battery capacity

The battery capacity indicator provides information on the battery charge status using a 3-stage LED display.

▷ Press the battery capacity indicator button.

   ✓ The charge status is displayed via the status LEDs.

▷ Recharge the battery at regular intervals, even when not in use.

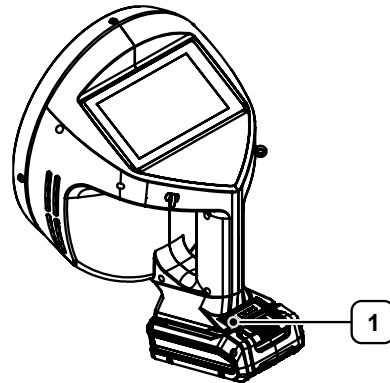   ① This extends the service life of the battery and ensures that it is ready for use.

Figure 27: Display battery capacity (example)

1   Battery capacity display

Battery status	Description
All 3 LEDs light up	Battery is fully charged
1 or 2 LEDs light up	Sufficient remaining charge available
1 LED flashes	Battery is empty and must be charged
All LEDs flash	Battery temperature is below the permissible range. • Remove battery and store at room temperature for at least 24 hours. • If the error occurs again, the battery is deeply discharged and defective. • Defective batteries must not be reused and must be disposed of properly.

NOTE

To protect the lithium-ion battery, the product issues a warning message at a supply voltage ≤ 15.5 V and shuts down automatically.

Removing and charging the battery

Prerequisite

• The product is switched off.

For optimum battery performance, avoid deep discharge cycles and charge the battery in good time.

▷ Ensure that the product has been switched off properly before removing the battery.

▷ Press the release switch downwards.

▷ Pull the battery out of the handle of the product.

    ⚠ The battery can be charged in the battery holder when inserted.

▷ Check whether the mains voltage specified on the charger matches the local mains voltage.

▷ Connect the mains plug of the charger to the power supply.

    ✓ The green LED starts to flash.

    ✓ The charger is ready for use.

▷ Push the battery onto the charger until you hear it click into place.

    ✓ The red LED lights up continuously. The charging process is active.

    ⚠ A fully discharged battery is fully charged in a maximum of 12 hours.

▷ Remove the fully charged battery from the charger.

▷ Push the battery into the handle of the product until you hear it click into place.
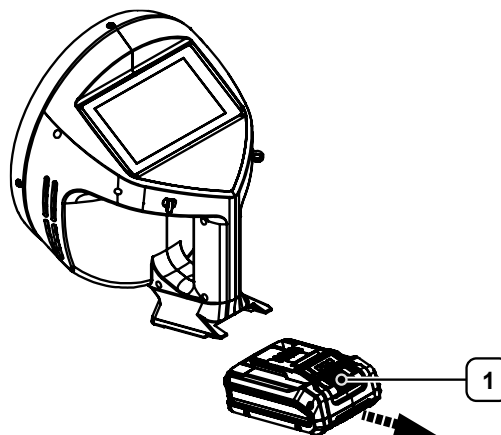
    ✓ The product is ready for use.

Figure 28: Changing the battery (example)

1 Release switch

10.4 Perform microphone diagnostics

The function of the ultrasonic MEMS microphones can be checked using the integrated diagnostic tool. A defective microphone can affect the performance and accuracy of the product.

▷ Select the Settings > Diagnostics command.

▷ Tap the Start diagnostics button.

    ✓ The microphone test is performed automatically.

    ⚠ The process can take up to three minutes.

▷ Clean the microphone inputs if necessary.

    ⚠ Further information can be found in chapter " 10.2 Clean product".

▷ Carry out the microphone test again.

▷ Contact customer service if necessary.
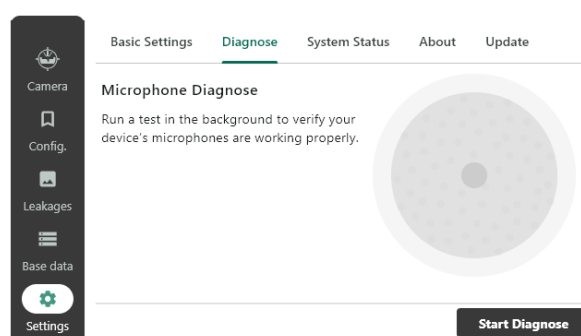
Figure 29: Performing microphone diagnostics (example)

10.5 Update software

10.5.1 Download software package

▷ Go to the manufacturer's homepage (CS INSTRUMENTS GmbH & Co. KG).

▷ Download the appropriate software package.

    ⚠ The current hardware and software version as well as the serial number are displayed in the About tab.

▷ Save the software package in the desired target directory or on the desired USB storage medium.

10.5.2 Establish connection

Removing the USB protective cover

▷ Remove the USB protective cover.

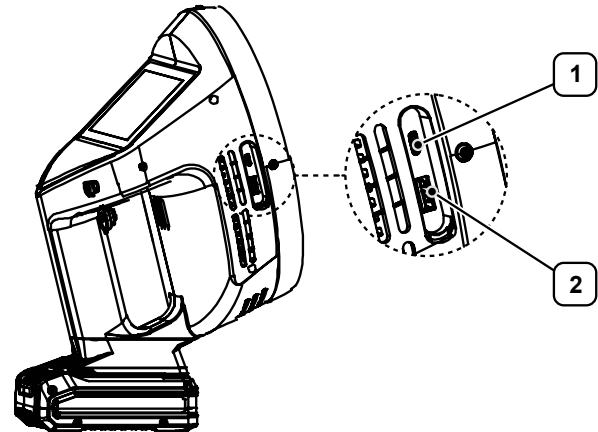▷ Select the desired USB interface for data transfer.

Figure 30: USB interfaces (example)

1 USB-C interface   **2** USB-A interface

⚠️ **WARNING**

Malfunctions or damage to the device

After data transfer, the USB protective cover must be completely replaced. This prevents dust, moisture or foreign objects from entering the device.

▷ Replace the USB protective cover after the data transfer.

Connection to a computer (via USB-C to USB-A cable)

▷ Insert the USB-C plug of the USB-C to USB-A cable into the USB-C port on the product.

   ✓ The system automatically recognizes the product and mounts it as two drives.

   ⓘ **Export drive** ("LD-export"): Read only (read-only -> for data export)

   ⓘ **Import drive** ("LD-import"): Read and write possible (read-write -> for software update)

Figure 31: Export and import drive (example)

ⓘ **NOTICE**

Avoidance of inconsistent data

The product is locked during an active connection with the computer. This prevents changes to the product and protects against inconsistent or incomplete data transfers.

▷ Do not disconnect manually during data transfer.

Connection with a USB storage medium

▷ Insert the USB storage medium into the product via the USB-A port.

   ✓ The product automatically recognizes the storage medium.

   ⓘ When exporting data, a directory with the name "**DEV0007**" is automatically created on the USB storage medium. The exported files are stored in this directory.
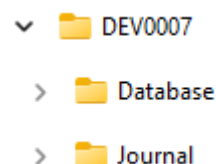

Figure 32: "DEV0007" directory (example)

10.5.3 Performing a software update

⚠️ **CAUTION**
Data loss or malfunction due to interrupted update
The update may take several minutes.
▷ Fully charge the battery before starting the update.
▷ Do not interrupt the process.
▷ Do not switch off the product.
▷ Do not remove the battery.

Prepare data transfer

Option 1: Via USB storage medium
▷ Insert the USB storage medium into the product via the USB-A port.
✓ The software update can now be carried out.

Option 2: Via computer
▷ Copy the software package to the "**LD-import**" import drive.
✓ The software update can now be carried out.

Installing the software update
▷ Select the Settings > Update command.
▷ Tap the Update button.
✓ The system compares the versions of the available and the currently installed software package.
✓ If a newer software package is available, the installation button is activated.
▷ Tap the Install update button.
✓ The installation of the software package is started.
ⓘ The installation can take up to five minutes.
✓ The product restarts automatically once it is complete.

10.6 Error states

10.6.1 Correct error states

⚠️ **CAUTION**
Data loss
Unsaved data may be lost during a forced restart.

If the device no longer responds (e.g. in the event of a system crash or frozen screen), a restart can be carried out as follows:

Option 1: Restarting the device using the on/off switch
▷ Press and hold the on/off switch for at least 10 seconds until the device restarts.

Option 2: Remove the battery
▷ Remove the battery.
▷ Wait a moment and reinsert the battery.
▷ Then start the device as usual.

10.6.2 Restore factory settings

⚠️ **CAUTION**
Data loss
All saved data and user-defined settings will be deleted when you reset the device.
▷ Back up all important data before continuing with the process.

If necessary, the product can be reset to the factory settings to restore the delivery status.

▷ Tap on the Settings button.

▷ Select the Basic settings tab.

▷ Tap on the Factory settings button.

  ✓ The device resets all settings and restarts.

10.7 Customer service

For rapid processing by customer service

Prerequisite

- Material number (product rating plate)
- Serial number (product rating plate)

▷ Describe the problem as precisely as possible.

▷ Make a note of any error messages displayed.

▷ Inform customer service about:

  • When does the problem occur?

  • How often does it occur?

  • What changes were last made to the product, the configuration or the environment?

11 Decommissioning and disposal

> **CAUTION**
>
> **Improper disposal of the lithium-ion battery**
>
> This product contains a lithium-ion battery that must not be disposed of with normal household waste.
>
> ▷ Dispose of defective batteries in an environmentally friendly manner in accordance with local regulations or via a specialist disposal company.

Decommissioning

Decommissioning is defined as a longer period of non-use of the components. The components must then be protected from external influences.

▷ If necessary, disconnect the components from the power supply.

▷ Pack the components properly if they are not to be used for a longer period of time.

▷ Store the components in such a way that they are not exposed to large temperature fluctuations. The resulting condensation moisture can cause corrosion.

Disposal

Parts and components that have reached the end of their service life, e.g. due to wear, corrosion and mechanical stress, must be disposed of properly after disassembly in accordance with national regulations.

The product and packaging contain recyclable materials that must not be disposed of with residual waste.

▷ Separate the components after recycling.

    ⓘ Disposal code according to the European Waste Catalog (EWC) 16 02 14, electrical and electronic devices and their components.

▷ Dispose of the components in an environmentally friendly manner in accordance with local regulations or via a specialist disposal company.

> **NOTE**
>
> Information on environmentally friendly disposal can be obtained from local authorities or specialized disposal companies.

▷ Alternatively, you can return the product to the manufacturer (CS INSTRUMENTS GmbH & Co. KG) at the end of its service life.

12 Appendix

12.1 Technical data

LeakCam 600

Parameters	Specification	Unit
weight	1,13	kg
Power supply	18	V DC
Frequency range	2-80	kHz
Measuring range	Operating pressure: > 250 mbar Detection range: 0.3-120 m (depending on ambient conditions + sound source power) Sensitivity: 0.03 l/min (at 3 m distance)	
Laser class	2 (wavelength 630-660 nm, output power < 1 mW)	
Camera	Resolution: 13 MP Field of view (FOV): 77.3° diagonal 8x digital zoom Autofocus High Dynamic Range (HDR) Illumination: 5 LEDs	
Touch screen	Size: 5″ Resolution: 1280 x 720 pixels Touch screen: capacitive (multi-touch)	
USB interface	A + C	
SD memory card capacity	128	GB
Area of use	Indoor use	
Degree of soiling	2	
Operating temperature	-5...+45	°C
Storage temperature	-20...+60	°C
Air humidity	10 to 90% relative humidity, non-condensing	
Altitude clearance	up to 4000 m above sea level	
Protection class	IP 20	

Battery charger

Parameters	Specification	Unit
Battery weight	0,30	kg
Input voltage	200-250 (EU) / 100-120 (US)	V AC
Output voltage	20	V DC
Output current	3	A
Operating temperature	0...+40	°C
Storage temperature	0...+40	°C
Air humidity	5 to 85% relative humidity	

Rechargeable battery | 18 V 2 Ah

Parameters	Specification	Unit
Battery weight	0,41	kg
Battery capacity	2	Ah
Voltage	18	V DC
Charging time	~2,5	h
Operating temperature	-5...+45	°C

Parameters	Specification	Unit
Storage temperature	0...+30 (recommendation: +20...+30)	°C
Air humidity	5 to 85% relative humidity	

Rechargeable battery | 18 V 4 Ah

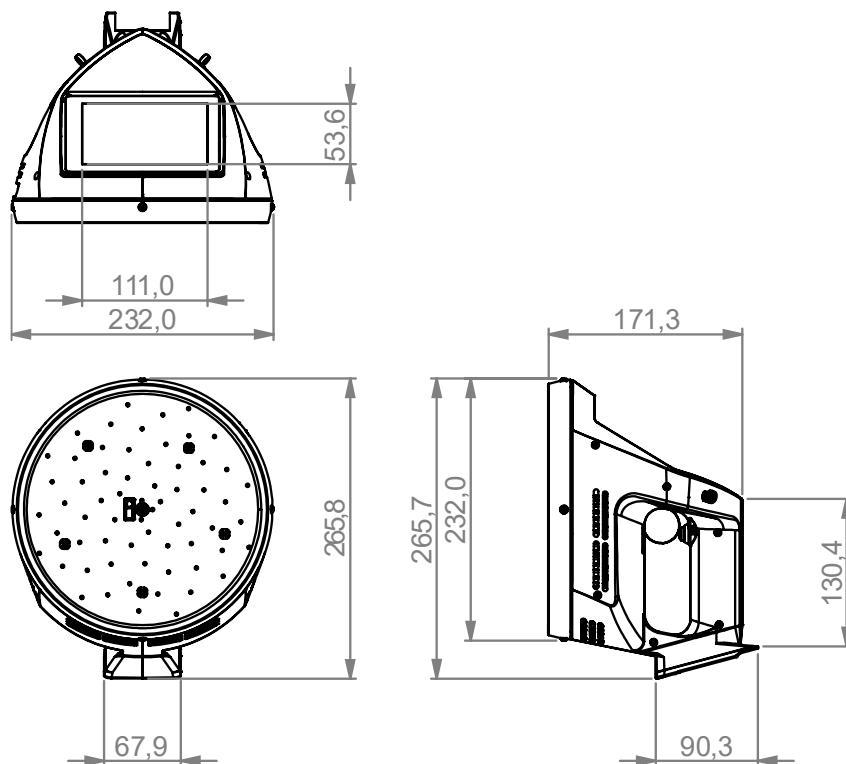| Parameters	Specification	Unit
Battery weight	0,58	kg
Battery capacity	4	Ah
Voltage	18	V DC
Charging time	~5,0	h
Operating temperature	-5...+45	°C
Storage temperature	0...+30 (recommendation: +20...+30)	°C
Air humidity	5 to 85% relative humidity	

12.2 Dimensions

Figure 33: Dimensions LeakCam 600

12.3 Declaration of conformity

CS INSTRUMENTS GmbH & Co. KG

KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY

Wir   CS Instruments GmbH & Co.KG
We   Zindelsteiner Straße 15, D-78052 VS-Tannheim

Erklären in alleiniger Verantwortung, dass das Produkt
Declare under our sole responsibility that the product

       Leckage-Suchgerät LeakCam 600 (LC 600)
       Leak meter LeakCam 600 (LC600)

den Anforderungen folgender Richtlinien entsprechen:
We hereby declare that above mentioned components comply with requirements of the following EU directives:

Elektromagnetische Verträglichkeit	2014/30/EU
Electromagntic compatibility	2014/30/EC
RoHS (Restriction of certain Hazardous Substances)	2011/65/EC

Angewandte harmonisierte Normen:
Harmonised standards applied:

EMV-Anforderungen	EN 55011: A2:2016 +A1:2017+A11:2020 + A2:2021
EMC requirements	EN IEC 61326-1: 2021
RoHS	EN IEC 63000: 2018
RoHS	

Anbringungsjahr der CE Kennzeichnung: 25
Year of first marking with CE Label: 25

Das Produkt ist mit dem abgebildeten Zeichen gekennzeichnet.
The product is labelled with the indicated mark.

$C\,E$

Tannheim, den 23.06.2025

Wolfgang Blessing Geschäftsführer

12.4 Practical examples: Effects of incorrect parameterization

Error	Graphical effect	Solution
Focusing not possible Deviation between set and actual distance		Correct the set distance **Note:** Use laser distance module for correct distance detection
Visualization not possible Selected setting is outside the valid frequency window - Leakage frequency is above or below the set range		Correct upper and lower limit frequency
Incorrect threshold value Threshold value too high: quiet leaks may remain undetected Threshold value too low: sources of interference outside the field of view can dominate and distort the analysis		Correct threshold value **Note:** Analyze each leak individually for correct quantification

12.5 Glossary

Term	Description
Distance adjustment	Manual or automatic focusing of the measuring device on the area to be examined. Important if there is no laser support.
Echo reflection	A signal generated by sound reflection that bounces back from solid surfaces (e.g. walls, machines). Can appear incorrectly as a real leakage source during localization.
Frequency window	Defined range within the audible or ultrasound-based frequency spectrum that is used for the targeted analysis of sound signals - e.g. to differentiate between leakage noise and ambient noise. Medium to high frequency windows (ultrasound) are particularly suitable for reducing background noise.
Background noise	Noise level from the environment that is not caused by a leak (e.g. machines, air movements, voices). In general, background noise increases at lower frequencies. In noisy environments, a higher frequency window should be selected to better distinguish leakage noise from interference signals.
Leakage	An unintended escape of compressed air, gases or vacuum that typically generates a high-frequency ultrasonic noise. Leads to energy loss, increased consumption and additional costs.
Detection distance	The detection distance depends on the intensity of the leak and the ambient conditions. Longer distances are possible under favorable conditions. Typically up to 20 m for medium leakages.
Reflection	Reflected sound that is visible or invisible depending on the viewing angle. Can be identified by movement or change of perspective.
Sound pressure level [dB]	Measure of the strength of a sound signal, given in decibels [dB]. When visualizing ultrasonic leaks, the sound pressure level serves as a measured variable for the leakage intensity - in the audible or ultrasonic range - and can be used for colour representation in the image (e.g. via an adjustable threshold value).
Sound source	Signal origin in the ultrasonic range, e.g. a leakage, a valve or a machine. Real sound sources remain visible when the position changes.

Term	Description
Fast Fourier transformation (FFT)	Efficient algorithm for breaking down a signal into its frequency components. An ultrasonic signal is broken down into individual frequency components using the FFT to identify leakage sources.
Threshold value	Defines the signal level above which the image is displayed in color. • Too high: Quiet leaks go unnoticed. • Too low: Sources of interference can overlay the analysis.
Ultrasound	Sound with frequencies above the human hearing range (> 20 kHz). A range between 20 kHz and 80 kHz is typically used in leak detection. Ultrasound is generated by compressed air leaks, electrical discharges or mechanical friction, among other things, and can be used specifically to locate such sources of interference. The high frequency enables pinpoint localization, but is also more sensitive to attenuation by air and obstacles.
Ultrasonic map	Combination of acoustic sound image (signal distribution in the ultrasonic frequency spectrum) and optical visual image (visual representation of the signal source). Used for precise localization of leaks.
Ultrasonic level [dB]	Measured value for the intensity of ultrasonic signals. Serves as the basis for evaluating the signal strength of a possible leak.
Target area	The defined area in which leaks are searched for. The quality of the detection depends on positioning and focusing in the target area.