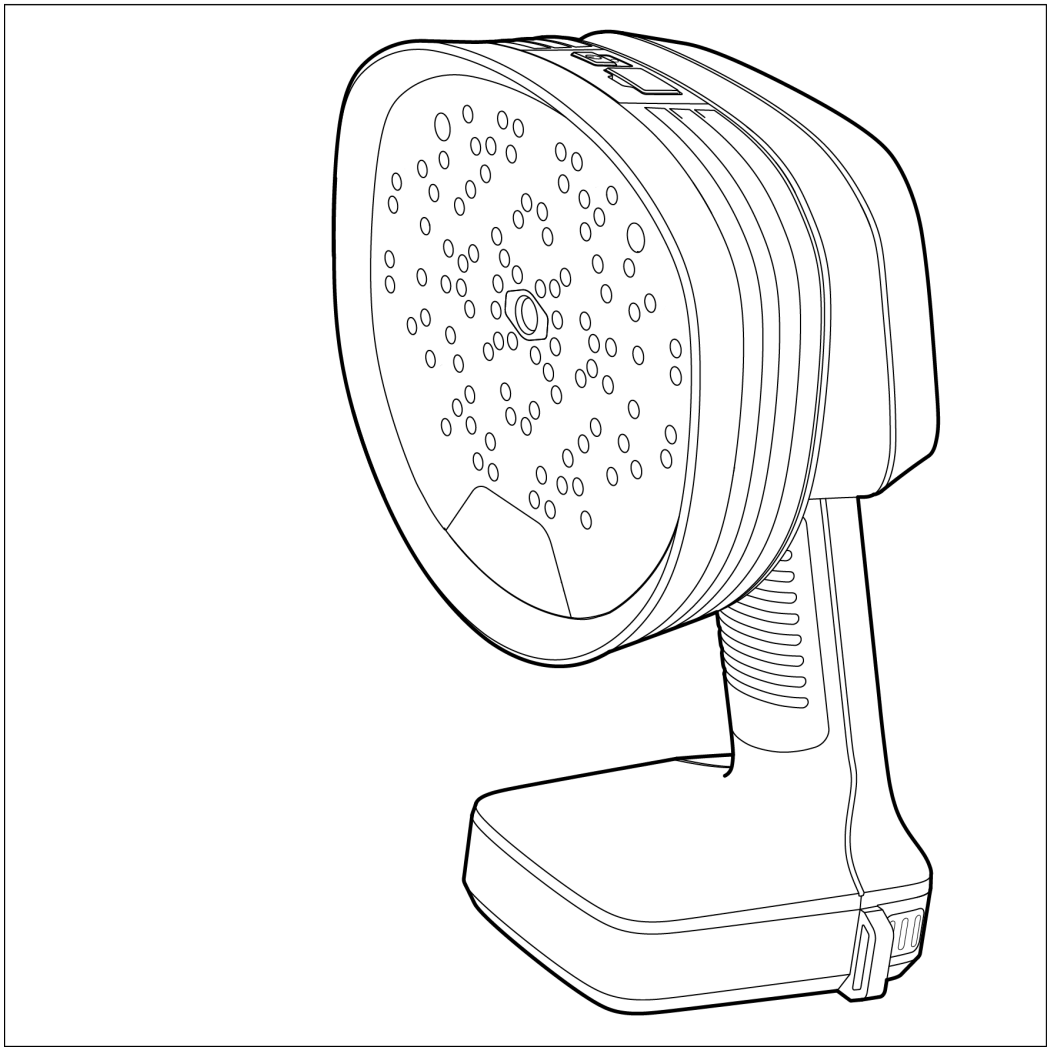
User's manual
FLIR Si1-LD



Important note
Before operating the device, you must read, understand, and follow all instructions, warnings, cautions, and legal disclaimers.

Důležitá poznámka
Před použitím zařízení si přečtěte veškeré pokyny, upozornění, varování a vyvázání se ze záruky, ujistěte se, že jim rozumíte, a řiďte se jimi.

Vigtig meddelelse
Før du betjener enheden, skal du du læse, forstå og følge alle anvisninger, advarsler, sikkerhedsforanstaltninger og ansvarsfraskrivelser.

Wichtiger Hinweis
Bevor Sie das Gerät in Betrieb nehmen, lesen, verstehen und befolgen Sie unbedingt alle Anweisungen, Warnungen, Vorsichtshinweise und Haftungsausschlüsse

Σημαντική σημείωση
Πριν από τη λειτουργία της συσκευής, πρέπει να διαβάσετε, να κατανοήσετε και να ακολουθήσετε όλες τις οδηγίες, προειδοποιήσεις, προφυλάξεις και νομικές αποποιήσεις.

Nota importante
Antes de usar el dispositivo, debe leer, comprender y seguir toda la información sobre instrucciones, advertencias, precauciones y renuncias de responsabilidad.

Tärkeä huomautus
Ennen laitteen käyttämistä on luettava ja ymmärrettävä kaikki ohjeet, vakavat varoitukset, varoitukset ja lakitiedotteet sekä noudatettava niitä.

Remarque importante
Avant d'utiliser l'appareil, vous devez lire, comprendre et suivre l'ensemble des instructions, avertissements, mises en garde et clauses légales de non-responsabilité.

Fontos megjegyzés
Az eszköz használata előtt figyelmesen olvassa el és tartsa be az összes utasítást, figyelmeztetést, óvintézkedést és jogi nyilatkozatot.

Nota importante
Prima di utilizzare il dispositivo, è importante leggere, capire e seguire tutte le istruzioni, avvertenze, precauzioni ed esclusioni di responsabilità legali.

重要な注意
デバイスをご使用になる前に、あらゆる指示、警告、注意事項、および免責条項をお読み頂き、その内容を理解して従ってください。

중요한 참고 사항
장치를 작동하기 전에 반드시 다음의 사용 설명서와 경고, 주의사항, 법적 책임제한을 읽고 이해하며 따라야 합니다.

Viktig
Før du bruker enheten, må du lese, forstå og følge instruksjoner, advarsler og informasjon om ansvarsfraskrivelse.

Belangrijke opmerking
Zorg ervoor dat u, voordat u het apparaat gaat gebruiken, alle instructies, waarschuwingen en juridische informatie hebt doorgelezen en begrepen, en dat u deze opvolgt en in acht neemt.

Ważna uwaga
Przed rozpoczęciem korzystania z urządzenia należy koniecznie zapoznać się z wszystkimi instrukcjami, ostrzeżeniami, przestrogami i uwagami prawnymi. Należy zawsze postępować zgodnie z zaleceniami tam zawartymi.

Nota importante
Antes de utilizar o dispositivo, deverá proceder à leitura e compreensão de todos os avisos, precauções, instruções e isenções de responsabilidade legal e assegurar-se do seu cumprimento.

Важное примечание
До того, как пользоваться устройством, вам необходимо прочитать и понять все предупреждения, предостережения и юридические ограничения ответственности и следовать им.

Viktig information
Innan du använder enheten måste du läsa, förstå och följa alla anvisningar, varningar, försiktighetsåtgärder och ansvarsfriskrivningar.

Önemli not
Cihazı çalıştırmadan önce tüm talimatları, uyarıları, ikazları ve yasal açıklamaları okumalı, anlamalı ve bunlara uymalısınız.

重要注意事项
在操作设备之前，您必须阅读、理解并遵循所有说明、警告、注意事项和法律免责声明。

重要注意事項
操作裝置之前，您務必閱讀、了解並遵循所有說明、警告、注意事項與法律免責聲明。

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1 Safety information

1.1 Radio

WARNING

This device complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

WARNING

This equipment contains specified radio equipment that has been certified to the Technical Regulation Conformity Certification under the Japanese Radio Law.

当該機器には電波法に基づく、技術基準適合証明等を受けた特定無線設備を装着している。

CAUTION

This portable transmitter with its antenna has shown compliance with FCC's SAR limits for general population / uncontrolled exposure. The maximum listed SAR level is 1,5 W/kg (head) and 1,5 W/kg (body) at 0 mm. The antenna used for this device must not be co-located or operating in conjunction with any other antenna or transmitter.

Note In the camera settings, there is an e-label with certification and compliance information. For more information, see section 5.4 *E-label*.

1.2 Handling and operation

WARNING

If you do not obey these Warnings, injury to persons can occur.

- Do not touch the heat sinks when the camera is powered on. The heat sinks become hot when the power is on.
- Take special care around heavy machinery when carrying the camera using the neck strap. The neck strap is rigid and does not have a separate safety release mechanism.

CAUTION

If you do not obey these Cautions, damage to the equipment can occur.

- Protect the camera and accessories from dirt, dust, impacts, and liquids.
- Protect the microphone panel from physical contact. Do not touch the microphone holes.
- Keep the USB port covered to prevent water ingress.
- Do not look directly at the LED lights placed on the microphone panel.
- Only use the accessories and spare parts that FLIR provides.
- Do not disassemble the camera.
- Do not use a damaged camera, battery, or accessories.

1.3 Battery and charging

For safety information related to the battery, refer to the battery documentation www.rrc-ps.com/manual2054.

For safety information related to the battery charger, refer to the battery charger documentation www.rrc-ps.com/manualSMB-MBC.

1.4 Declaration of conformity

The full text of the Declaration of conformity is available at the following internet address: http://support.flir.com/resources/p5h3.

2 Notice to user

2.1 Register your camera

Register your camera to receive an extended warranty and other related benefits.

To register the camera, go to http://support.flir.com/camreg.

To access the registration form, you must log in to your FLIR account or sign up for a new account.

You will also need the serial number of your camera. A label with the serial number is available at the bottom of the camera. See also section 5.5 *Serial number*.

To complete the registration, you must enter a verification code into the camera. The code is available in your FLIR account, under *My Products*.

2.2 Online documentation

Our manuals are continuously updated and published online.

To access the FLIR Si1-LD series user manual and other product documentation, go to http://support.flir.com/resources/p5h3.

To access the manuals for our other products, as well as manuals for our discontinued products, go to https://support.flir.com/resources/app.

2.3 About this manual

FLIR Systems issues generic manuals that cover several models within a camera series. This means that this manual may contain descriptions and explanations that do not apply to your particular camera model.

The authoritative version of this publication is English. In the event of divergences due to translation errors, the English text has precedence. Any late changes are first implemented in English.

2.4 Support

Contact our Technical Support Center if you experience problems or have any questions about your product: https://support.flir.com.

2.5 Training

For training resources and courses, go to https://www.flir.com/support-center/training.

3 Introduction

The FLIR Si1-LD is a powerful yet cost-effective acoustic imaging camera designed for easy and accurate compressed air leak detection. Lightweight and operable with one hand, it requires minimal training and provides instant decision support in the field. Featuring market-leading sensitivity and detection range, the FLIR Si1-LD incorporates advanced AI for superior performance and data accuracy . For enterprise-level users, it provides easy data export, fleet management tools, automatic data upload, online storage and API integration for seamless asset health data transfer to your preferred management software.

4 Getting started

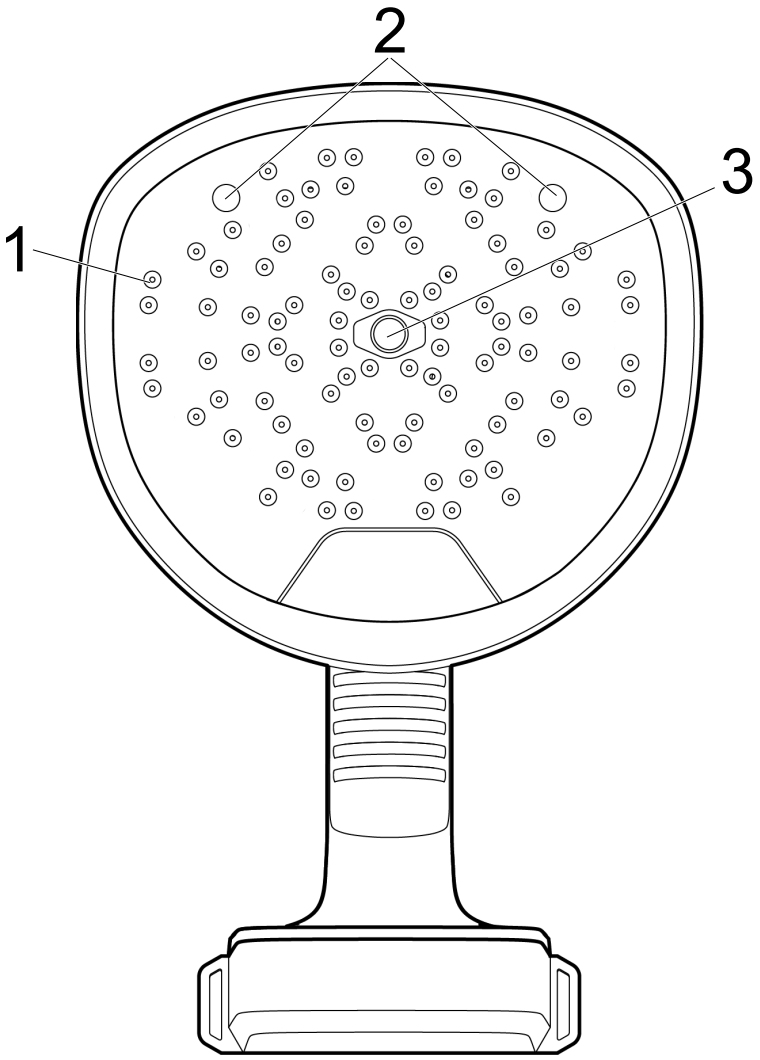
Note Before operating the camera, you must read, understand, and follow the warnings and cautions in section 1 *Safety information*.

1. Fully charge the battery.
2. Remove the battery cover.
3. Align the battery and push it into the camera battery compartment.
4. Place the battery cover onto the battery and press it gently until it clicks into place.
5. Briefly press the On/Off button to power on the camera. The green Power LED indicates that the camera is on.
6. Wait until the camera screen turns on. The camera is now ready to use.
7. Follow the instructions on the camera screen to set up the camera according to your preferences.
   Applicable to camera models with Wi-Fi: You can also set up the camera to upload snapshots and videos for storage online. To enable upload, you must connect the camera to the internet and pair the camera with the FLIR Acoustic Camera Viewer cloud service. Use a computer or other device with internet access and follow the instructions on the camera screen.

   Note You can select the settings as a part of the initial setup of the camera or later at any time via the Settings menu.
8. Aim the camera toward the object of interest.
   The camera will highlight any detected sound source on the screen.

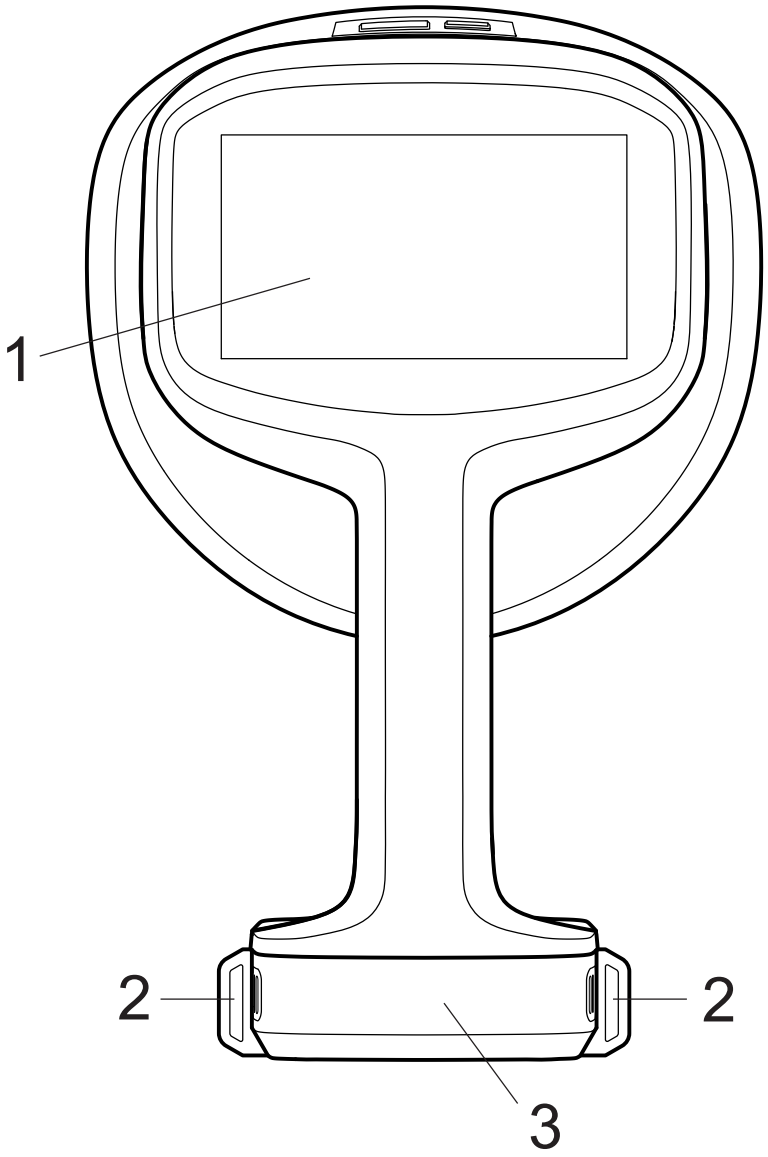
5 Camera parts

5.1 View from the front



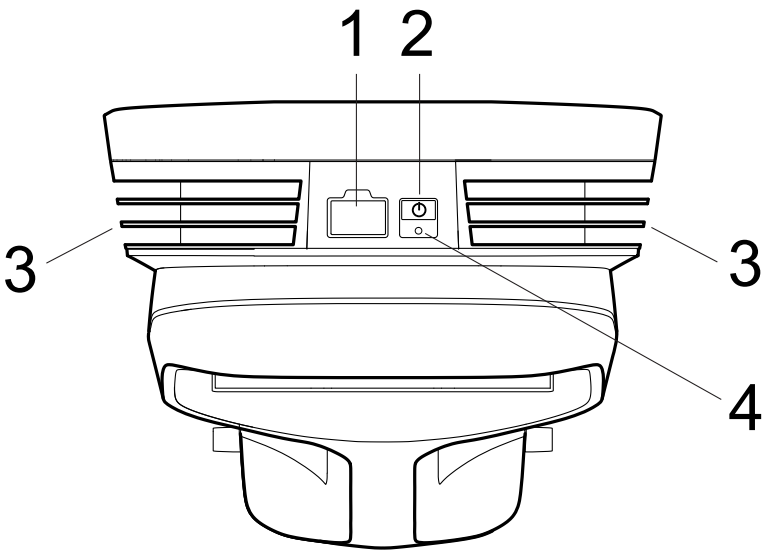
1. Microphones
2. LED lamps
3. Digital camera

5.2 View from the rear



1. LCD screen
2. Neck strap attachment points
3. Battery cover

5.3 View from the top



1. USB port
2. On/Off button
3. Heat sinks
4. Power LED

5.4 E-label

The e-label is the primary identification plate for the camera. It contains certification and compliance information and other relevant product details.

The e-label is available in the camera settings:

1. Tap the Settings button.
2. Tap the *Device info* field at the bottom of the Settings menu.
3. Swipe up/down to scroll or close the window.

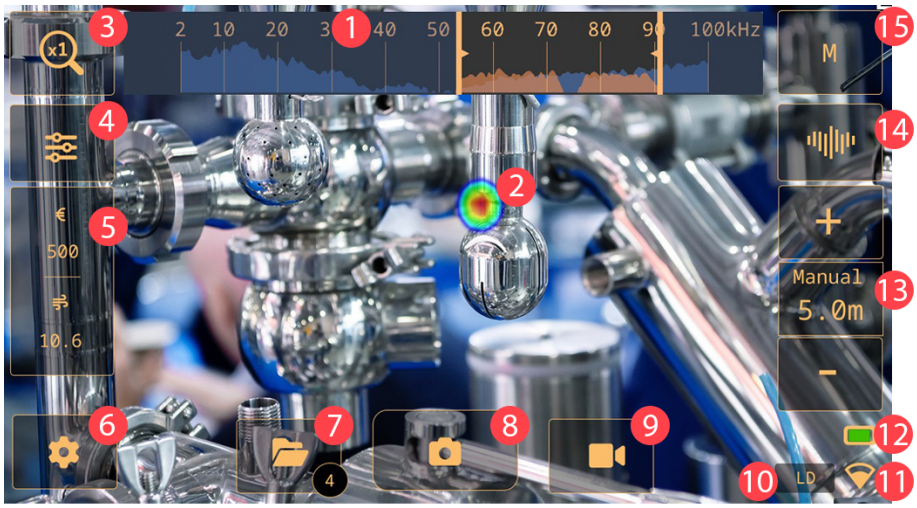
5.5 Serial number

A label with the serial number is available at the bottom of the camera.

The serial number is also available in the camera settings, at the bottom of the Settings menu and in the e-label (see section 5.4 *E-label*).

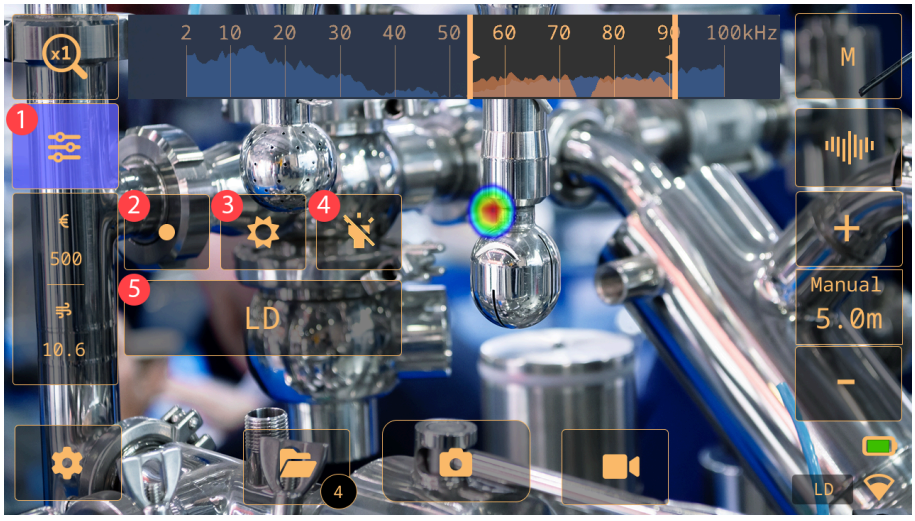
6 User interface

6.1 General



1. Frequency view
2. Acoustic image
3. Zoom button
4. Quick menu button
5. Analysis results (mode specific)
6. Settings button
7. Archive button
8. Snapshot button
9. Record button
10. Leak detection
11. Wi-Fi indicator
12. Battery indicator
13. Distance settings
14. Frequency view toggle
15. Filter button

6.2 Quick menu



1. Quick menu button: Tap to open/close the Quick menu
2. Source button: Tap to switch between the Single-source and Multi-source modes. See section 8.3 *Single-source and Multi-source modes*.
3. Brightness button: Tap to switch the brightness on and off.
4. Lamp button: Tap to switch the lamp on and off.

6.3 Archive indicators

The number of files in the archive is displayed within the circled area on the Archive button.

An animated upload progress spinner in the circled area indicates that files are being uploaded to the FLIR Acoustic Camera Viewer cloud service. Snapshots are automatically removed from the camera, after they have been uploaded to the FLIR Acoustic Camera Viewer cloud service or exported to a USB memory stick.

6.4 Wi-Fi indicator

Note Only applicable on camera models with Wi-Fi.

	Excellent Wi-Fi connection strength.
	Good Wi-Fi connection strength.
	Satisfactory Wi-Fi connection strength.
	Poor Wi-Fi connection strength.
	No Wi-Fi connection.

6.5 Acoustic image

The acoustic image shows the location of a sound source, using colors ranging from red in the center to blue in the periphery.

The camera displays one or multiple sound sources, depending on the selected mode: Single-source or Multi-source. For more information, see section 8.3 *Single-source and Multi-source modes*.

7 Basic operation

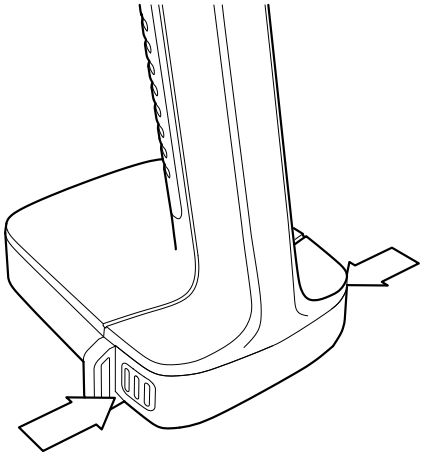
7.1 Safety information

Before operating the camera, you must read, understand, and follow the warnings and cautions in section 1 *Safety information*.

7.2 Battery

7.2.1 Battery cover

To remove the battery cover, push the ends of the cover. Then lift the cover off the camera.



7.2.2 Install the battery

1. Remove the battery cover.
2. Align the battery connectors with the battery compartment.
3. Push the battery into the battery compartment with the connectors at the front and facing upwards.

7.2.3 Remove the battery

1. Power off the camera.
2. Remove the battery cover.
3. Pull the battery out of the camera.

7.2.4 Battery indicator

To check the battery level, push the indicator button on the battery. The lights indicate the battery level.

Indicator lights	Battery level (%)
■ ■ ■ ■	100–76
■ ■ ■ □	51–75
■ ■ □ □	26–50
■ □ □ □	10–25
■ □ □ □ (flashing)	below 10

The battery indicator in the camera live view UI shows available charge, with green indicating sufficient battery level.

7.2.5 Low battery warning

The battery indicator in the camera live view UI turns red to indicate insufficient battery charge and the battery icon start to flash.

The color code in the UI displayed in the battery changes from green (full battery), orange to red (low battery).

7.3 Battery charging

⚠ CAUTION
When you connect the power supply to a mains socket, select a socket that is easy to access. Should a hazardous situation occur, you must be able to easily disconnect the power supply.

Note It is a good practice to disconnect the power supply from the mains socket when not in use.

Estimated charging time: The battery takes approximately 2 hours to fully charge.

7.3.1 Charge the battery using the battery charger

1. Put the battery in the battery charger.
2. Connect the power supply to the battery charger.
3. Connect the power supply to a mains socket.

7.3.1.1 Battery charger indicator

- When the battery is inserted, the light on the battery charger starts flashing red and green.

  Note Continuous red flashing light indicates a malfunction or exceeding temperature limits.

- During the charging, the light is steady yellow.
- When the battery is fully charged, the light is steady green.

7.4 Power on/off

7.4.1 Power on

To power on the camera, push the On/Off button.

7.4.2 Power off

To power off the camera, push and hold the On/Off button.

7.4.3 Power LED

The Power LED at the top of the camera shows the camera status:

- Green: ON
- Red: Shutting down

7.5 Take a snapshot

When you take a snapshot, the camera captures the current camera image and the acoustic image.

The camera also saves a 2 seconds recording of the strongest sound signal. Holding the camera steady will help you capture a clear sound signal.

Before saving the snapshot, you can enter additional information, such as label, and change settings. This information will be saved in the snapshot.

To take a snapshot, do the following:

1. Tap the Snapshot button.
2. A preview with editing options is displayed.
3. Tap the field to enter information or change a setting.
4. To scan a QR code, tap the icon. The camera will recognize the code and display the information. For more details, see section 7.6.1 *Scanning a QR code*.
5. To save the snapshot, tap *Save*.

7.6 Record a video

1. To start the recording, tap the Record button.
2. To stop the recording, tap the Stop button.
3. A preview with editing options is displayed.
4. Tap the field to enter information or change a setting.
5. To scan a QR code, tap the icon. The camera will recognize the code and display the information. For more details, refer to section 7.6.1 *Scanning a QR code*.
6. To save the video, tap *Save*.

7.6.1 Scanning a QR code

A QR code is a type of matrix barcode that contains information readable by the FLIR Si1-LD camera. Some companies assign QR codes to identify assets. The information in these QR codes can be stored in the camera field, such as the label.

To scan a QR code, do the following:

1. Tap the snapshot or the record button.
2. Select *Label* and open the QR code reader via the text edit settings.
3. Find and align the QR code within the camera screen.
4. The information encoded in the QR code will be displayed on the screen, with a maximum limit of 512 characters.
5. To save the snapshot, tap the checkbox.

The QR code is compatible with the Wi-Fi setup, allowing you to connect instantly by scanning the QR code, without having to manually select an SSID or enter a passkey.

7.7 Archive

To open the archive, tap the Archive button.

In the archive, you can do the following:

- At the bottom of the screen, swipe left/right to scroll through the snapshots thumbnails.
- To edit additional information, such as label and distance, tap the edit icon.
- Manually upload files to your FLIR Acoustic Camera Viewer. For more information, see section 11.6 *Manual upload*.
- To delete a snapshot, tap on the snapshot , then tap on the trash bin.
- To enable selection mode, tap on a snapshot. Checkboxes will appear in the top right corner of each thumbnail. Tap the checkbox to select snapshot. The screen will display the total number of selected snapshots.
- To exit the archive, tap the Exit button at the left of the screen.

Note

- Snapshots and videos are automatically removed from the camera, after they have been uploaded to the FLIR Acoustic Camera Viewer cloud service or exported to a USB memory stick.
- The number of files in the archive is displayed next to the Archive button.

7.8 Zoom

The camera has a digital zoom, which can be used to narrow the camera's field of view.

Tap the Zoom button to cycle through the available zoom options: 1x, 2x, and 8x.

7.9 File transfer

Snapshot and video files from the camera can be imported to the FLIR Acoustic Camera Viewer or opened in FLIR Thermal Studio for further analysis and reporting.

You can transfer snapshot and video files from the camera using one of the following methods:

- Upload the files to the FLIR Acoustic Camera Viewer cloud service, see section 11 *FLIR Acoustic Camera Viewer*.
- Export the files to a USB memory stick, see section 7.9.1 *Export files to a USB memory stick*.

Note

- Snapshots and videos are automatically removed from the camera, after they have been uploaded to the FLIR Acoustic Camera Viewer cloud service or exported to a USB memory stick.
- Upload to FLIR Acoustic Camera Viewer is only applicable on camera models with Wi-Fi.

7.9.1 Export files to a USB memory stick

Note Only use the USB memory stick supplied with the camera. Other memory sticks may lead to loss of data.

1. Power on the camera.
2. Open the USB port cover at the top of the camera.
3. Insert the USB memory stick. This displays a dialog on the camera screen.
4. Tap *Yes* to start the transfer.
5. During the transfer, a progress bar is displayed.
   To stop the transfer, tap *Stop*.

   Note Do not remove the USB memory stick while the transfer is in progress.
6. When the transfer is completed, the live view will be displayed.
7. Remove the USB Memory stick. Put the USB port cover back in place.
8. Insert the USB into a computer to access the files. The files are organized by the camera´s serial number and the timestamp of the snapshot.
9. Navigate to the DATA folder to find the camera files which are identified by the .nlz extension.

7.10 Tags

Tags are keywords you can assign to a snapshot to identify and sort the snapshot. Tags and relevant information are saved in the files and can be retrieved in the Acoustic Viewer for sorting information. They are also visible in Thermal Studio, shown as Acoustic user data.

Tags can be assigned directly in the camera. After taking a snapshot or recording a video go to the option *Tags*. Tap the + sign then tap the field to type a keyword.

To remove a tag, tap on the tag and select *Remove*.

Previously stored tags can be found by tapping the + sign.

8 Locating sound sources

The acoustic camera captures sound, forming the basis for all its detection modes and features. The FLIR Si1-LD is an innovative tool that allows users to visualize sound, including ultrasound frequencies that are inaudible to human hearing.

8.1 Basic steps to sound location

- To locate compressed air leaks, it is recommended to use the High filter. If you need to inspect a specific frequency range, switch to the M filter. See section 8.2.3 *Frequency view*.
- Use the Multi-source mode to scan a large area quickly and find several sound sources. To inspect interesting sound sources more closely, switch to Single-source mode.
- Keep in mind that the camera only analyzes and displays results for the strongest sound source.
- Make sure the displayed source is a physical sound source and not a reflection. See section 8.4 *Reflections*.
- It is easier to find the location of the sound source if you move the camera around and look at the source from different angles.
- Analyzing snapshots and videos in the FLIR Acoustic Camera Viewer or in FLIR Thermal Studio can help find the exact location of a sound source.

8.2 Filters

The camera has different filters that help locate various sound sources. These filters limit the frequency range that the camera uses to detect sound sources. The filters typically filters out the background noise, allowing the camera to display only the interesting sound sources on the screen.

8.2.1 Filter selection

For leak detection, the filter selection can help to start inspections quickly, especially in noisy environments. The Si1-LD offers a single filter, the High filter (20 to 65 kHz), which effectively filters out most background noise while maintaining a good detection distance.

8.2.2 Change the filter setting

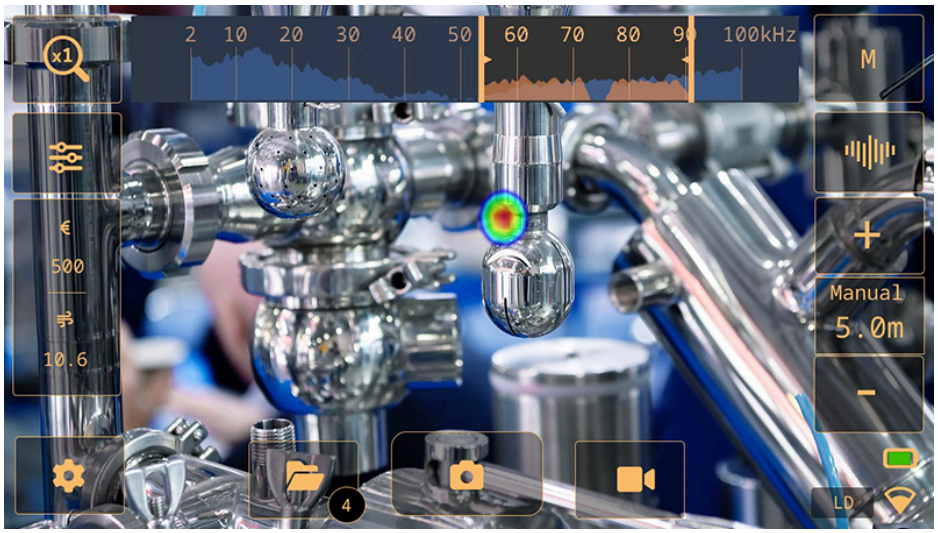
To change the filter setting, tap the Filter button and swap the user-adjustable frequency selection and the filter option.

General guidelines:

- For quick air leak identification, try the *High* filter.
- If scanning is needed within specific frequency ranges, try the manual frequency selection, *M* filter.

8.2.3 Frequency view

The Frequency view tool allows users to scan areas within specific frequency ranges to identify issues that are otherwise difficult to detect.

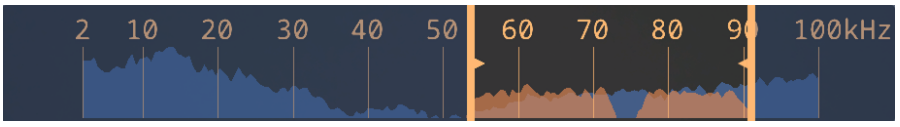


The Frequency view displays the spectrum of the sound and ultrasound in the environment as detected by the microphone array. The camera can sense frequencies from 2 kHz up to either 100 kHz. The view shows two different frequency spectrums:

- Orange spectrum. Represents the dominant sound source that the camera currently is focusing on. This sound is filtered and processed by the camera´s algorithm to separate it from e.g. background noise.
- Blue spectrum. Represents all sounds present in the environment within the selected frequency range. This can include the sound from both relevant sources and background noise outside the selected frequency range.

Enabling frequency view:

1. Enabling Frequency view. On the live screen, locate the Frequency view toggle button. When activated, the Frequency view will show up on the top of the screen.
2. Enable manual frequency selection. Using the Filter button, switch to select the “M” filter (manual filter).



3. Adjusting frequency limits.
    - Using handles. Drag the handles at the extremes to set the frequency detection limits, the frequency range is shown at the bottom as reference and represented in kHz. The selected frequency region will appear highlighted as a rectangular area.
    - Moving the region. Tap and drag the middle of the rectangular area to move it left or right to another frequency region.
    - Entering values manually. Tap the frequency spectrum to prompt a window displaying the lower and upper limits. Enter the desired values and press the check mark to confirm.

8.3 Single-source and Multi-source modes

The Single-source mode is useful when you are trying to locate a single sound source, while the Multi-source mode is more effective when you are trying to locate multiple sound sources.

In Single-source mode, the camera displays only the sound source with the highest intensity. The location of the sound source is highlighted in color. If there are multiple sound sources with the same or almost the same intensity, all of them will be displayed.

In Multi-source mode, the camera displays multiple sound sources. The sound sources are highlighted in color and the strongest source is marked with a crosshair. The camera analyzes and displays results for the strongest sound source. The camera will not display sound sources that are considerably weaker than the strongest source.

The strongest sound source (in both Single-source and Multi-source mode) depends on the currently selected filter, meaning that different sound sources may be displayed when you use different filters. See also section 8.2 *Filters*.

Keep in mind that the camera analyzes and displays results for the sound coming from the strongest sound source. To locate and examine a weaker sound source in the presence of a strong sound source, move or rotate the camera so that the strong sound source is clearly outside the camera's field of view. You can also use the Zoom button to narrow the camera's field of view.

8.3.1 Switch between the modes

To switch between the Single-source and Multi-source modes, tap the Quick menu button and then tap the Mode button.

8.4 Reflections

The camera displays physical sound sources, but also any reflections from them.

To confirm that a displayed source is a physical sound source and not a reflection, move around and observe the source from different directions. If the source location remains the same from all directions, it is a physical sound source. If the source location moves along a surface or disappears when you move around, it is likely a reflection.

Using the Multi-source mode (see section 8.3 *Single-source and Multi-source modes*), you may be able to see both the physical sound source and one or more reflections. By moving the camera around, you can identify which sources are reflections.

8.5 Position the camera

Changing the position of the camera and looking at the sound source from different angles makes it easier to find the location of the sound source.

A sound source can be directional, meaning that the sound level differs depending on the direction. Again, it is useful to move the camera around and look at the sound source from different angles.

The minimum distance between the sound source and the camera should be around 0.3 meters. If the distance is shorter than this, the location of sound sources will not be accurately displayed. Additionally, the optical camera will not focus at such short distances.

In practice, the camera can be used at distances up to 130 meters. Strong sound sources in quiet environments can be detected from larger distances. However, environmental factors such as temperature, humidity, and background noise may affect distances detection range.

8.6 Save and analyze sounds

It is often useful to take snapshots and record videos of interesting sound sources from different angles. Snapshots and videos can be further analyzed in the FLIR Acoustic Camera Viewer or in FLIR Thermal Studio.

When capturing several snapshots from different angles, use the one that displays the highest SPL levels. This will facilitate further analysis.

By adjusting the dynamic range in FLIR Acoustic Camera Viewer or FLIR Thermal Studio. Move the slide bar to increase or decrease the SPL value. This will make it possible to make the sound sources more or less prominent for reporting and representation.

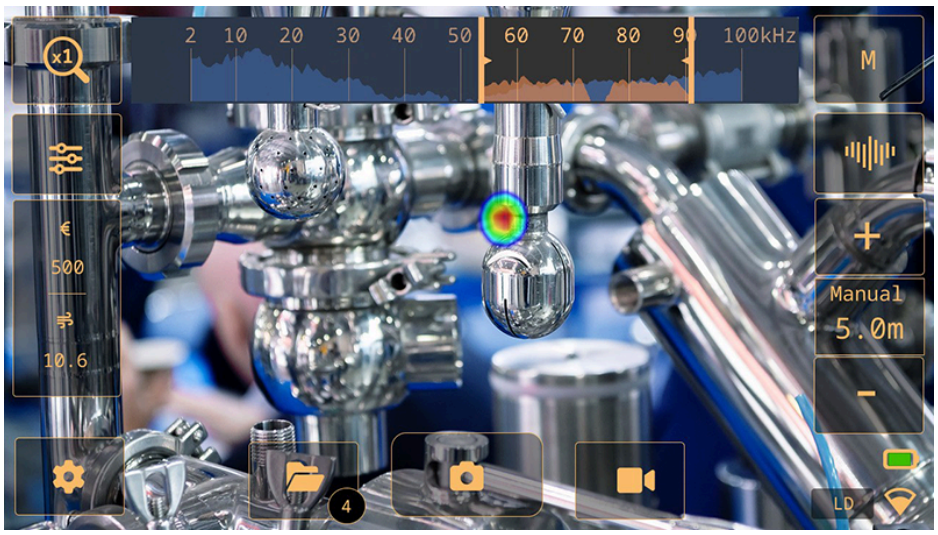
- Decrease the dynamic range to find the exact location of the sound source.
- Increase the dynamic range to identify if there are multiple sound sources.

8.6.1 Example: Large sound source

If the sound source is large, like a large vibrating surface, the highlighted sound source on the camera screen may seem smaller than the actual source. The source may also appear to move around as you move around the surface, depending on which point of the surface is closest to the camera.

By analyzing a snapshot or video recording in FLIR Acoustic Camera Viewer or FLIR Thermal Studio and increasing the dynamic range, you may be able to determine the actual size of the sound source.

9 Leak detection



The camera can detect compressed air leaks by analyzing the sound emitted by the leak.

By using the High filter on the background noise and focusing on the ultrasonic frequencies, where the sound from a leak is typically much louder, the camera can determine if the sound source is likely a leak.

When a leak is detected, the camera will estimate the size of the leak and display an estimate of the annual cost of the detected leak.

The leak size and leak cost estimates both rely on the distance setting and the leak analysis parameters entered by the operator.

9.1 Work flow

1. Start with the High filter. Later you can try if the M filter fits in your environment and current situation.
2. Use the Multi-source mode first, which enables you to scan larger areas and find several sound sources at the same time.
3. To inspect interesting sound sources more closely, switch to Single-source mode.
4. When a leak is detected, the camera displays the leak size and cost in the analysis result box.
5. You can take snapshots and videos of the detected leak for further inspection and reporting in the FLIR Acoustic Camera Viewer or FLIR Thermal Studio.

9.2 Leak analysis results

The camera displays the following analysis results in the Leak mode:

- *Max (dB)*: Measure the strength of a sound.
- *Leak est*: The estimated size of a detected leak.
- *Leak cost*: The estimated cost of a detected leak. Expressed in currency/year.
- *Leak type*: Select the type of gas from the available list in the camera.

Note

- The accuracy of the leak size and leak cost estimates depends on the correct input of the distance setting and leak analysis parameters.
- The strength of the sound from a compressed air leak depends on the direction which you observe the leak. Therefore, the size and cost estimates will also depend a bit on the measurement direction.
- The absolute SPL reading depends on the selected filter. To ensure that the results are comparable across different filters, the camera displays a normalized SPL value, that matches what the result would be with a measurement bandwidth of 20 kHz.
- To ensure accurate leak analysis and snapshot data, it is essential to set the leak type, which defines the type of gas. The leak estimation is based on energy, mass, or volume of the selected gas. For more details, see section 9.3 *Leak analysis parameters*.

9.3 Leak analysis parameters

To obtain accurate estimates of leak size and leak cost, it is important to set the leak analysis parameters correctly.

When you take a snapshot of a detected leak, the camera saves also the current leak analysis parameters settings. This means you can edit the parameters later using the FLIR Acoustic Camera Viewer or FLIR Thermal Studio.

- Leak unit
  The unit to use for the displayed leak size.
- Currency
  The currency to use for the displayed leak cost.
- Energy/Volume cost
  The cost setting depends on the selected Leak type and Leak cost calculation settings; Energy cost (price per kWh), Mass cost (price per kg) or Volume cost (price per cubic meter).

  Note If you change the Currency setting, the cost setting must be updated accordingly.
- Leak cost calculation
  The estimated leak cost can be calculated based on either the energy cost, the mass cost or the cost per volume.
- Environmental temperature
  The temperature of the air can affect how sound waves propagate through the air. To obtain accurate results, it is recommended to specify the environmental temperature.
- Relative humidity
  The propagation of sound is affected by the relative humidity of the environment. To obtain accurate results, it is recommended to specify the relative humidity.
- Leak correction factor
  The camera's ability to estimate leak size is based on a large set of leaks of different types. However, since there are many variables that can impact the leak size, the camera sometimes underestimates or overestimates the size. If the camera's estimates systematically differ from your own observations, you can set a leak correction factor to adjust the estimate. Before displaying the final leak size estimate, the camera multiplies its estimate with the correction factor.
- Specific power
  Specific power is a measure of the energy required to produce a certain amount of compressed air. This option is intended if you are unsure of the specific power of your compressed air system, it is recommended that you leave it at the default value.
- Utilization

By entering the hours, days, and/or weeks of use, you can describe how often the compressor is being used in practice. The camera will use the resultant utilization figure as a factor in leak cost calculations.

- Leak type
  FLIR Si1-LD supports leak size estimation for air leaks, considering the energy, volume, or mass cost parameters to estimate the leak cost. Select "Other" from the leak type drop-down menu in the leak mode settings to disable leak size and cost estimations.

9.3.1 Set the leak analysis parameters

1. Tap the Settings button.
2. Tap *Leak* mode settings.
3. Tap a parameter to change the setting.

9.4 Distance

When estimating the size of a leak, the camera takes into account distance information to adjust for the natural decrease in sound intensity as distance increases.

9.4.1 Auto Distance

With the Auto Distance feature, the camera automatically calculates the distance to the sound source. The distance is displayed in the Auto Distance field. Tap the center Distance button to switch between Auto Distance and manual distance settings.

Note The availability of the Auto Distance feature is only available in the High filter.

9.4.2 Set the distance manually

If Auto Distance cannot provide a reliable distance estimate, the camera displays a dash in the Auto Distance field. In this case, you must set the distance manually. Use the Distance buttons (+ and -) to select the distance to the sound source that you think is the most accurate.

10 Camera settings

To open the Settings menu, tap the Settings button. The Settings menu includes the following, depending on the camera model:

- Network settings
- Time settings
- Leak mode settings
- Advanced settings
- Device info

10.1 Network settings

Note Only applicable on camera models with Wi-Fi.

- Enable and disable Wi-Fi.
- Connect the camera to a Wi-Fi network. For more information, see section 11.3 *Connect the camera to the internet*.
- Pair the camera with the FLIR Acoustic Camera Viewer. For more information, see section 11.4 *Pairing*.
- When the camera is connected to Wi-Fi, the IP address and SSID of the network is displayed.

10.2 Time settings

The current time and date are displayed here. Select the region and time zone to be used in the camera.

10.3 Leak mode settings

Settings required for accurate analysis results in Leak detection mode. For more information, see section 9.3 *Leak analysis parameters*.

10.4 Advanced settings

- *Calibration mode*: This function is used together with the FLIR Acoustic Tester to check the accuracy of the camera. For more information see FLIR Acoustic Tester user manual.
- *Reset settings*: Resets all settings to factory defaults. There is no impact on saved snapshots and videos in the camera, and no impact on paired FLIR Acoustic Camera Viewer accounts.
- *Remove all data*: Removes all user data and resets all settings to factory defaults. All snapshots and videos will be removed from the camera. All FLIR Acoustic Camera Viewer accounts will be unpaired.
- *Language*: Select the language to be used in the camera.
- *Distance unit*: Select the distance unit to be used in the camera.
- *Update*: Select to update the camera to the latest firmware version.

10.5 Device info

The device information is displayed at the bottom of the Settings menu:

- Serial number
- Software version
- Hardware version

To display the e-label, tap the *Device info* field. For more information, see section 5.4 *E-label*.

11 FLIR Acoustic Camera Viewer

FLIR Acoustic Camera Viewer is a cloud service for acoustic snapshots and videos. Upload snapshots and videos from your camera and your data will be instantly available on your computer and mobile devices.

With the FLIR Acoustic Camera Viewer you can perform further analysis of detected leaks, partial discharges, and mechanical faults, and also generate inspection reports.

To use the cloud service, you must create a FLIR Acoustic Camera Viewer account and pair the camera with the account.

- A FLIR Acoustic Camera Viewer account can be paired with multiple cameras.
- A camera can be paired with multiple FLIR Acoustic Camera Viewer accounts.

The settings, parameters, and comments you enter in the camera will be saved in the snapshots. This information will be visible to all users who have access to the uploaded snapshots.

Note Connection to the internet is only applicable on camera models with Wi-Fi.

11.1 Setup

You can set up the camera to upload images to the FLIR Acoustic Camera Viewer.

If automatic upload is enabled, new snapshots and videos will automatically be uploaded to the FLIR Acoustic Camera Viewer account. You can also upload files manually.

To be able to upload snapshots and videos, you must connect the camera to the internet and pair the camera with a FLIR Acoustic Camera Viewer account.

11.2 Create a FLIR Acoustic Camera Viewer account

To create a FLIR Acoustic Camera Viewer account, go to http://acousticviewer.flir.com and click *Sign in*.

11.3 Connect the camera to the internet

You can connect the camera to the internet via Wi-Fi. This can be done as part of the initial setup of the camera, or at any time via the Settings menu.

To connect to Wi-Fi via the Settings menu, do the following:

1. Tap the Settings button and then tap *Network settings*.
2. Tap *Location* and select country.
3. Tap *Enable WiFi*.
4. When Wi-Fi is enabled, tap *Select WiFi*.
5. Select one of the available networks.

Note

- If the *Location* setting is incorrect, you may not be able to connect to Wi-Fi networks or the Wi-Fi connection may not work properly.
- If the network you wish to connect to is not listed among the available networks, try moving closer to the Wi-Fi access point.
- The camera only accepts secure Wi-Fi networks that require password input. Networks that require both user name and password and public Wi-Fi networks are not supported.
- If you are using an iPhone, enable the "Maximize Compatibility" option.
- When using a hotspot connection, make sure that the SSID (network name) has no spaces. For instance, instead of ‘My Hotspot’, use ‘MyHotspot’ as network name.

- Ensure the information in the Time Settings menu are set correctly: Region and Time zone.
- Connect to a network by accessing the QR Code feature. This allows you to join the network without manually entering the SSID or passkey.

11.4 Pairing

To pair the camera with the FLIR Acoustic Camera Viewer, you need the serial number of your camera and also a secret code. These details are available in the camera settings.

1. Make sure the camera is connected to the internet.
2. On the camera, tap the Settings button and then tap *Network settings* > *Device registration*. Make a note of the serial number and secret code.

   Note The secret code changes over time. Tap the *Refresh* button to make sure the current secret code is displayed.
3. Use a computer or other device with internet access and go to http://acousticviewer.flir.com. Sign in to your FLIR Acoustic Camera Viewer account.
4. On the website, enter the serial number and the secret code.

11.5 Automatic upload

You can set up the camera to automatically upload snapshots and videos to your FLIR Acoustic Camera Viewer account.

Note Snapshots and videos are automatically removed from the camera, after they have been uploaded to the FLIR Acoustic Camera Viewer cloud service.

To enable automatic upload, do the following:

1. Make sure the camera is paired with your FLIR Acoustic Camera Viewer account.
2. Tap the Archive button.
3. Tap the Upload button.
4. Tap to select *Upload to cloud* = *On*.
5. Return to the live view to resume the upload, tap the Exit button at the left of the screen.

11.6 Manual upload

You can manually upload files from the archive when the camera is connected to the internet and is paired with a FLIR Acoustic Camera Viewer account.

Note Snapshots and videos are automatically removed from the camera, after they have been uploaded to the FLIR Acoustic Camera Viewer.

To upload, do the following:

1. Make sure the camera is connected to the internet
2. Make sure the camera is paired with your FLIR Acoustic Camera Viewer account.
3. Tap the Archive button.
4. Tap the Upload button.
5. Tap *Upload to cloud now* and confirm.
6. Return to the live view to resume the upload, tap the Exit button at the left of the screen.

11.7 Access the FLIR Acoustic Camera Viewer

You can access the FLIR Acoustic Camera Viewer from a browser on your computer or mobile device.

To access the FLIR Acoustic Camera Viewer, go to http://acousticviewer.flir.com.

11.8 Import files

If you have exported snapshots and videos to a USB memory stick, you can import the files (.nlz) to the FLIR Acoustic Camera Viewer.

Note Before importing the files, ensure that the camera used for capturing the snapshots and videos is paired with your FLIR Acoustic Camera Viewer account and that the snapshots are not opened or modified in Thermal Studio.

12 FLIR Thermal Studio

FLIR Thermal Studio is a powerful, flexible, and efficient Windows desktop software for advanced image post-processing and reporting. The software supports images and videos from all modern FLIR thermography cameras, as well as snapshots and videos from the FLIR acoustic imaging cameras.

You can open files (.nlz) that you have uploaded to the FLIR Acoustic Camera Viewer or exported to a USB memory stick in FLIR Thermal Studio.

To open camera snapshots in FLIR Thermal Studio, activate the Acoustic Plug-in. The camera includes a perpetual Acoustic Plug-in license. For Thermal Studio licensing options, contact your distributor for assistance.

In FLIR Thermal Studio, you can view and analyze your snapshots and videos. The application specific analysis results are displayed and you can change the settings.

For reporting, you can use one of the predefined acoustic reporting templates or create your own custom templates.

For more information, refer to the FLIR Thermal Studio user manual.

13 Maintenance and cleaning

13.1 Clean the camera

CAUTION

If you do not obey these Cautions, damage to the equipment can occur.

- Do not use strong cleaning solutions.
- Do not expose the equipment to running or dripping water or liquid.
- Do not apply direct and/or highly compressed air to the microphones.

13.1.1 Camera chassis and screen

To clean the camera chassis and screen, do the following:

1. Power off the camera.
2. Dampen a cloth with water or mild soapy water.
3. Squeeze the cloth to remove excess water.

13.1.2 Microphone array

User cleaning of the microphone array is not recommended, as it may cause damage. Contact your distributor for assistance.

Note FLIR assumes no responsibility for any damage caused by user attempts to clean the microphone array.

If you decide to clean the microphone array yourself, use indirect and low pressure air from a distance to blow particles away from the conical holes of the microphones.

13.1.3 Battery and charger

To clean the battery and charger, use a dry cleaning cloth only.

13.2 Storage

Store the equipment in a dry location at room temperature.

Store the batteries fully charged and recharge them once every three months.

Start up the camera at least once every three months.

13.3 Calibration

The camera undergoes calibration during production. No further re-calibration is necessary.

The FLIR Acoustic Tester can be used to check the accuracy of the camera. For more information, refer to the FLIR Acoustic Tester user manual.

14 Updating the camera

To take advantage of our latest camera software, it is important that you keep your camera updated.

To access available updates, go to the "Update" option in the camera's Advanced settings or the FLIR Acoustic Camera Viewer. Log in to your account, or create one, and ensure your camera is paired. For more information, see section11 *FLIR Acoustic Camera Viewer*. When a notification appears on the landing page indicating an available update, click on the dialog. You can also access updates by clicking the "Cameras" option on the sidebar, where your paired cameras are listed. The available update will highlight the camera with the software update. Expand the view to see camera details and click on the drop-down menu. Go to the Software tab to view available updates. Choose to send via Wi-Fi or download the updates via USB from the cloud.

Users can update the camera by accessing to the FLIR Acoustic Viewer or request them from the device. Use one of the following methods:

- Wireless (Wi-Fi): Updates are sent from the cloud directly to the camera via Wi-Fi.
- USB update: Download an update package and update the camera via a USB memory stick.
- Update from the camera: The update can be requested and downloaded from the device.

Go to https://support.flir.com. For detailed information and complete instructions on applying the update, please visit the FLIR Customer Help page.

The current software version is displayed in the e-label, see section 5.4 *E-label*.

14.1 Update the camera wireless (Wi-Fi)

Note Only applicable on camera models with Wi-Fi.

1. Make sure the camera battery is fully charged.
2. Power on the camera.
3. Connect the camera to a stable Wi-Fi network. See section 11.3 *Connect the camera to the internet*.
4. Make sure the camera is paired with a FLIR Acoustic Camera Viewer account. See section 11.4 *Pairing*.
5. Open the Cameras tab in the main menu, expand the dropdown menu of the camera and select the Software tab. In the FLIR Acoustic Camera Viewer, the update is sent when clicking in the Wireless (Wi-Fi) update button, the page will confirm when it has been prepared and it will automatically transfer to your camera. The user must send the update. The camera automatically downloads the package.
6. During the download, the e-label, see section 5.4 *E-label*, displays the percentage progress of the download, the percentage is refreshed when exiting and opening the Settings page again. The percentage progress must be manually refreshed to display the latest value.
7. When the download is completed (progress is shown as 100%), restart the camera to apply the update; power off and then power on the camera.

14.2 Update the camera via USB memory stick

1. Login to your FLIR Acoustic Camera viewer Account.
2. Go to the Cameras tab in the menu.
3. Search the camera you want to update and dropdown to expand.
4. Go to the Software tab to find the available update.
5. Choose the USB update option to download the update file (nlupdate).
6. Put the update file in the root folder of a USB memory stick. It is highly recommended to use the USB thumb drive that comes with the camera. Make sure there are no other .nlupdate files in the root folder. Do not rename or alter the update file.
7. Power on the camera. Wait until the camera has started.

8. Open the USB port cover at the top of the camera.
9. Insert the USB stick.
10. Follow the instructions on the camera screen.

    Note Do not remove the USB memory stick while the update is being copied.

11. When the update has been copied, remove the USB memory stick and put the USB port cover back in place.
12. Restart the camera; power off and then power on the camera.
13. To complete the update process, restart the camera again.
14. The camera will finalize the update. When the live view is displayed, the camera is ready for normal operation.

14.3 Update the camera from Device

This option may appear when booting the camera if it is already connected to a Wi-Fi network. The update can be postponed by closing this window.

1. Make sure the camera battery is fully charged.
2. Power on the camera.
3. Make sure the camera is connected to a stable Wi-Fi network.
4. On the live view main UI, tap the *Settings* button and go to *Advanced Settings*.
5. Select *Update*.
6. The update will begin downloading and installing. This process takes approximately 20 minutes, depending on the network connection.
7. Once the update has been downloaded, the camera will prompt you to turn it back on. The update will complete during this restart.
8. A confirmation prompt will appear on the screen, indicating the new software version. Confirm this message to proceed to the main view. The camera is ready for normal operation.

15 Disposal of electronic waste

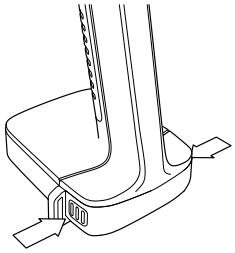
Waste of Electrical and Electronic Equipment (WEEE) poses a risk to human health and the environment when not disposed of properly. This product should not be discarded as unsorted waste but must be sent to separate collection facilities for recovery and recycling. More information is available from the relevant local authority.

15.1 Battery removal

Before disposal of the camera, remove the battery.

To remove the battery, do the following:

1. Push the ends of the battery cover. Then lift the cover off the camera.



2. Pull the battery out of the camera.

Before you discard the battery, apply insulation to the terminals with adhesive tape or equivalent materials.

16 Disclaimers

16.1 Legal disclaimer

Terms of use is available in the user interface of the product.

For warranty terms, refer to https://www.flir.com/warranty.

16.2 Export controls

Products described herein may be subject to export regulations.

This document does not contain export-controlled information.

16.3 Patents

This product is protected by patents, design patents, patents pending, or design patents pending.

16.4 Quality assurance

The Quality Management System under which these products are developed and manufactured has been certified in accordance with the ISO 9001 standard.

FLIR Systems is committed to a policy of continuous development; therefore we reserve the right to make changes and improvements on any of the products without prior notice.

16.5 Third-party licenses

Information about third-party licenses is available in the FLIR Acoustic Camera Viewer at http://acousticviewer.flir.com.

16.6 Usage statistics

FLIR Systems reserves the right to gather anonymous usage statistics to help maintain and improve the quality of our software and services.

16.7 Copyright

Website
http://www.flir.com

Customer support
http://support.flir.com

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