

User's manual

FLIR Thermal Studio

Version 2.0 and later

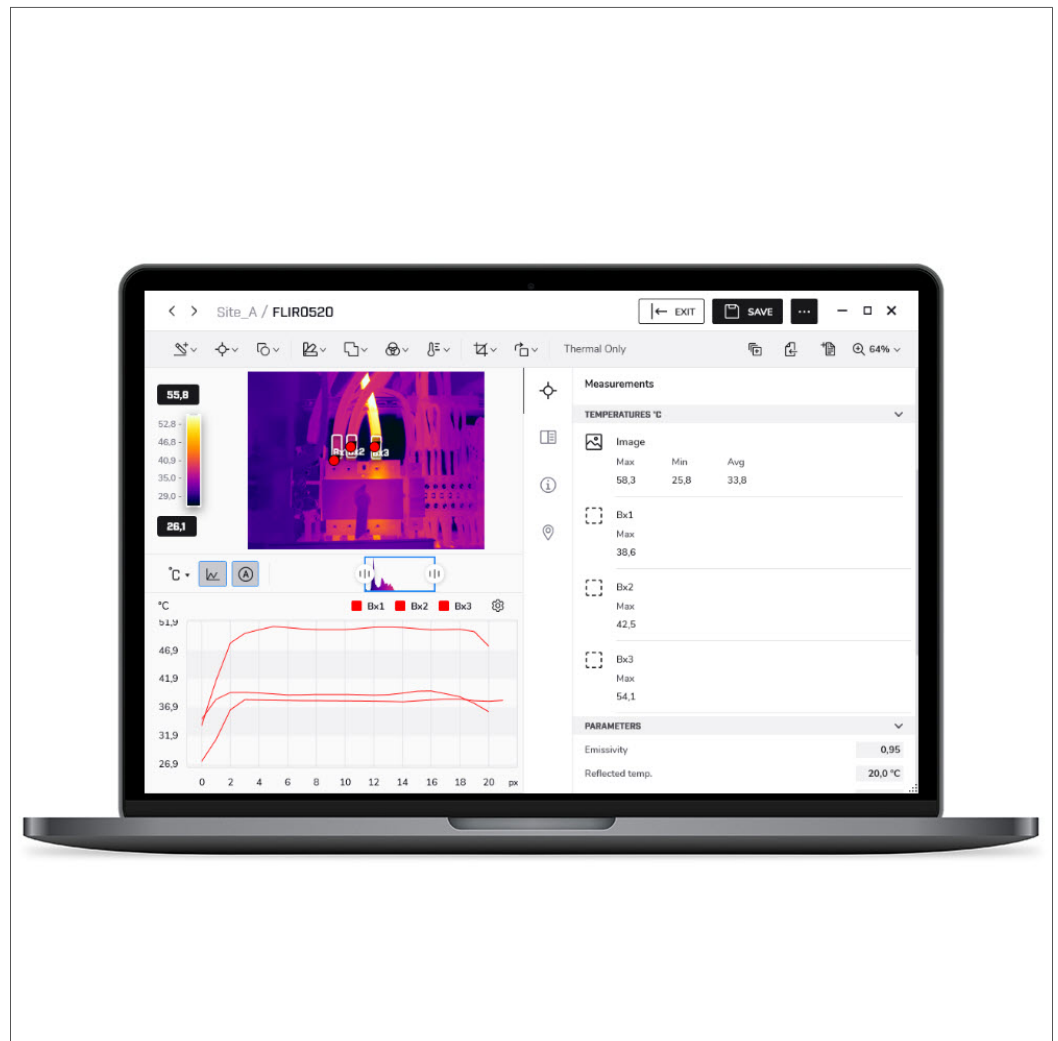


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1.1 Online documentation

Our manuals are continuously updated and published online.

To access the FLIR Thermal Studio series user manual and other product documentation, go to <https://support.flir.com/resources/5sfn/>.

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

1.2 About this manual

This manual covers the FLIR Thermal Studio application from version 2.0.

FLIR Systems issues generic manuals that cover several software variants within a software suite. This means that this manual may contain descriptions and explanations that do not apply to your software variant.

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.

1.3 Support

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

1.4 Training

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

FLIR Thermal Studio is a powerful, flexible, and efficient Windows desktop software for creating thermal inspection reports and automation of editing tasks with large amounts of thermal images. The software supports images and videos in standard FLIR format from all modern FLIR thermography cameras. With the Acoustic plug-in you can also create reports based on images and videos from the acoustic camera FLIR Si124.

FLIR Thermal Studio provides features where the user can:

- **Use report templates**
Instead of manually creating an inspection report, design your own template and include the information you need for this particular report. Working with templates makes the work easier especially when you handle a large number of images.
- **Customize overlay and palettes**
Select what information you want to see in the image, for example measurements, emissivity, compass (when applicable), and date/time. Import palettes and apply colorization from other thermographers.
- **Correct thermal fusion alignment**
Respond to any alignment issues caused by thermal cameras.
- **Use batch processing**
Automate the tasks that need to be repeated for each thermal image such as normalization, modifying measurements, changing palettes, and customizing image overlay.
- **Automate data collection and reporting**
Create inspection routes you can download to an enabled FLIR camera. Import the inspection images and data and create a report.

2.1 FLIR Thermal Studio versions

The FLIR Thermal Studio desktop suite includes several versions and plug-ins.

For detailed specifications, go to https://flir.custhelp.com/app/answers/detail/a_id/4590.

This chapter describes how to install and activate the FLIR Thermal Studio application.

3.1 System requirements

For system requirements, go to https://flir.custhelp.com/app/answers/detail/a_id/4590.

3.2 Install application

1. Go to <https://support.flir.com/thermalstudio> and download the FLIR Thermal Studio installer package.
2. To start the installation, double-click the executable installer file.
3. Read and accept the license terms and conditions.
4. Click *Install*.
5. Click *Finish*.
6. Run the application from the Start menu or by double-clicking the desktop icon.
7. The *FLIR Thermal Studio* dialog box appears where you can activate your FLIR Thermal Studio Pro license key.

Note To complete the installation, the computer may need to be restarted. Follow the instructions on the screen.

3.3 License activation

The first time you start FLIR Thermal Studio you will be prompted to activate your license key. Do this either as an *Online activation* (internet access) or as an *Offline activation* (no internet access).

3.3.1 Online activation

1. Run the application from the Start menu or by double-clicking the desktop icon. The FLIR Thermal Studio dialog box appears.
2. Click *Online activation*.
3. In the *Software license key* text box, type the license key obtained at the time of purchase.
4. Type your contact details in the *Customer name* and *Customer e-mail* text boxes.
5. Click *Validate*.
6. The activation is completed and FLIR Thermal Studio is started.

3.3.2 Offline activation

1. Run the application from the Start menu or by double-clicking the desktop icon. The FLIR Thermal Studio dialog box appears.
2. Click *Offline activation - no internet access*.
3. Copy the information in the *Machine identifier* text box.
4. Go to the FLIR Thermal Studio product page, <https://support.flir.com/thermalstudio>, and then click the link *Offline activation*, FLIR Thermal Studio.
5. Click the link of your preferred language.
6. Type your contact details in the *Name* and *E-mail* text boxes.
7. In the *Serial number* text box, type the license key obtained at the time of purchase.
8. In the *Machine code* text box, paste the *Machine identifier* that you copied in an earlier step (step 3 above).
9. Click *Request activation code*.
10. Copy the generated activation code that appears at the top of the page.
11. Return to the FLIR Thermal Studio dialog box, and then paste the copied activation code into the *Activation code* text box.
12. Click *Validate*.
13. The activation is completed and FLIR Thermal Studio is started.

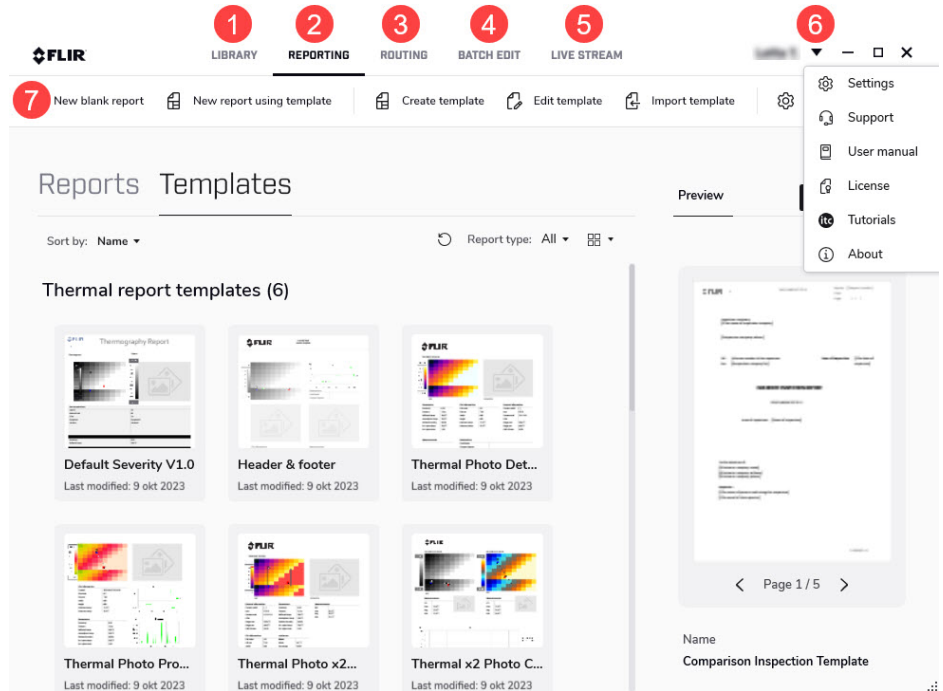
3.4 Plug-in activation

Plug-ins are supported by FLIR Thermal Studio Pro.

1. Run the application from the Start menu or by double-clicking the desktop icon.
2. Open the *Settings* window.
3. Select the *Plugins* tab.
4. To activate a plug-in, click *License*.
5. Enter your plug-in license key and click *Validate*.

This chapter provides an overview of the FLIR Thermal Studio user interface.

4.1 General



1. *Library* tab

This tab shows the File Explorer of the computer you are working on. Here you can navigate to any folder where you have saved your thermal images, both locally on your computer and on any connected network shares.

When you click a folder, the images in that folder are presented in the center pane. When you click an image in the center pane, information about that image is shown in the pane to the right.

2. *Reporting* tab

This tab is used to create reports. You can create reports from scratch or by using templates.

3. *Routing* tab

This tab is used to create routes and inspection reports.

4. *Batch edit* tab

This tab is used to create and run jobs in batches. Use the batch processing feature for automation of repetitive tasks when editing and normalizing thermal images.

5. *Live stream* tab

This tab is used to live stream and control USB connected cameras.

6. Drop-down menu

Click the arrow to display the drop-down menu.

7. Toolbar

The toolbar includes functions that are relevant for the selected tab. The toolbar adapts to the window size, meaning that some functions may be available in a group when the window is minimized.

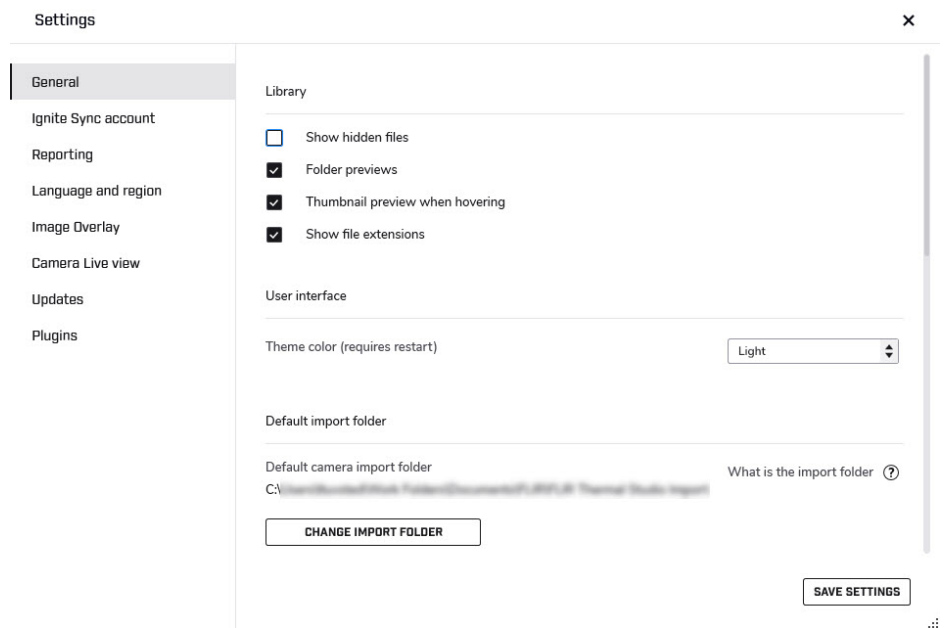
4.2 Settings

The application settings are configured on the *Settings* window.

To open the *Settings* window, do one of the following:

- Click the arrow at the upper right corner and then click *Settings*.
- On the top toolbar, click the *Settings* icon.

Note Some settings require a restart of the FLIR Thermal Studio application before a change goes into effect.



4.2.1 General

Library

- Change the file and preview options for the File Explorer.

User interface

- Change the theme of the user interface.

Default import folder

- Change the file path to the folder for imported files from camera.

Palettes

- *Palettes folder*: Change the file path to the folder where your custom palettes are located.

Output

- When the *Open output folder when done* check box is selected, the folder with the result files will open when the task is completed.
- *Output folder*: Change the file path to the folder where you want to store the result files.

Other

- Select the *Enable analytics* check box to collect data on how the FLIR Thermal Studio application is used. This data can be sent to FLIR for analysis and troubleshooting.

4.2.2 Ignite Sync account

FLIR Ignite is a cloud storage service for thermal images. FLIR Ignite Sync is a PC-based (Windows 10) application that allows you to sync your image library with your computer, for easy access when creating reports.

To install FLIR Ignite Sync, click *Install Ignite Sync*.

Ignite Sync path displays the path to the sync folder as set up in the FLIR Ignite Sync application.

4.2.3 Reporting

Select the *Reporting* options and the *Default fonts* to be used in your reports.

4.2.4 Language and region

Select the language and units to be used in the user interface.

4.2.5 Image Overlay

Select if and how you want to use an image overlay when editing images manually in File Explorer and when running batch processing. When you select or deselect a check box in the list of settings, the result is immediately presented in the example image. Note that the *Overlay enabled* check box must be selected before the settings can be changed.

4.2.6 Camera Live view

Select options for camera captures and recordings.

4.2.7 Updates

Select how you want to manage updates of the FLIR Thermal Studio application.

- *Automatically check for updates*
With this option enabled, a check for updates will automatically be performed every time the application is started.
- *Prompt to install updates*
With this option enabled, the user will be asked to install any available updates if the *Automatically check for updates* option is enabled.
- *Check if updates are available*
Click to manually check if any updates are available for download.
- *Proxy settings*
If updates need to be downloaded via a proxy service, configuration is needed. In the *Proxy settings* dialog box, select the *Use proxy* check box, and then enter the requested information. Click *OK* to save.

4.2.8 Plugins

Plug-ins are supported by FLIR Thermal Studio Pro.

Click *License* to activate a plug-in. For more information, see 3.4 *Plug-in activation*.

After activation, you can change the settings for the plug-in here.

Note The Routing functionality is included in FLIR Thermal Studio Pro, without license activation.

This chapter describes how to use the image editor.

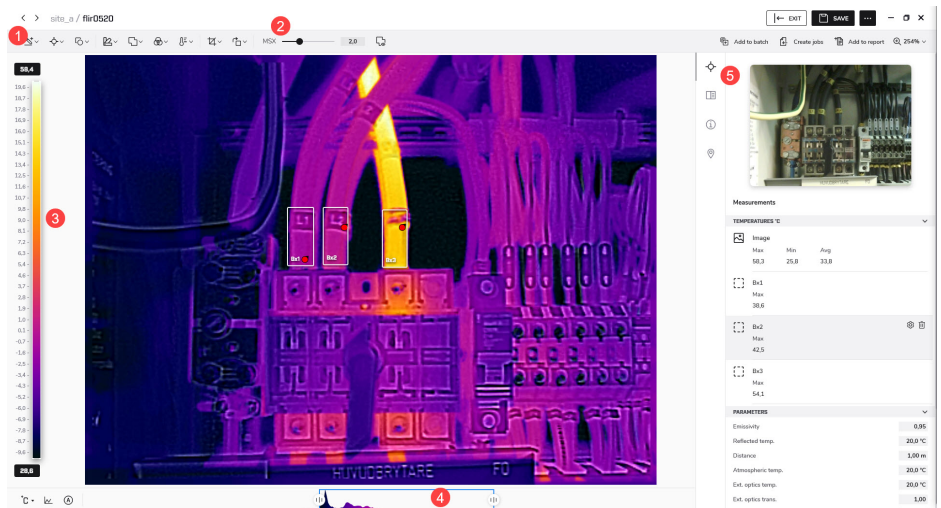
5.1 General

The FLIR Thermal Studio application includes an embedded image editor where you can edit thermal images and sequences (videos).

To open the image editor, do one of the following:

- Double-click the image.
- Right-click the image and then click *Edit*.
- In the *Library* tab, click *Edit image* in the right pane.

5.2 Navigation



1. **Toolbar**
The toolbar includes options such as adding measurements, changing palettes, and controlling isotherms and the color distribution.
2. **Current fusion mode**
Displays the currently selected fusion mode and any additional mode settings.
3. **Temperature scale**
4. **Temperature span and level control**
Use the controls to adjust the temperature scale.
5. **Properties pane**
Use the vertical pane toolbar to select display of measurements, notes, camera details, and geolocation.

5.3 Temperature span and levels

At the bottom of the infrared image you have two sliders. By dragging these sliders to the left or to the right, you can change the top and bottom levels of the temperature span. If you change the span to temperatures closer to the temperature of the object you are analyzing, it will be easier to analyze any temperature anomalies.

- To move the temperature span, click and hold the temperature span and then move it into position.

- To change the bottom and top levels of the temperature span, click and drag the left (bottom level) and the right (top level) sliders into position.
- To auto-adjust, double-click the span and level control. See also section 5.3.1 *Auto-adjust control*.
- To use the full camera range, right-click the span and level control.

5.3.1 Auto-adjust control

When you auto-adjust a thermal image, you adjust it for the best image brightness and contrast. This means that the color information is distributed over the existing temperatures of the image.

In some situations the image may contain very hot or very cold areas outside your area of interest. In such cases you might want to exclude those areas and use the color information only for the temperatures in your area of interest. You can do so by defining an auto-adjust region.

To auto-adjust an image, do one of the following:

1. Double-click the temperature span and level control at the bottom of the window.
2. At the lower left corner, click the *Enable scale auto adjust* button.

To define an auto-adjust region, follow this procedure:

1. On the top left toolbar, click *Add measurement*, and then click *Rectangle*.
2. Click the image to place the start point. Drag the pointer to the desired size, and then click to place the end point.
3. Right-click the rectangle, and then click *Auto level and span from rectangle*.
4. Move and change the size of the rectangle to suit your area of interest. Note how the image changes as you make your changes.

5.4 Sketch

You can add an image, e.g. a logo, on top of the image.

1. On the top left toolbar, click *Sketch*, and then click *Replace sketch*.
2. Browse for the image to display on top of the currently edited image.
3. Use the *Enable sketch* check box to show/hide the sketch image.

5.5 Measurement tool

You can add one or more measurement tools to the image, such as *Spotmeter*, *Rectangle*, and *Polygon*.

Each measurement tool has its own settings, which are available in the *Measurements* section of the properties pane.

5.5.1 Add a measurement tool

1. On the top left toolbar, click *Add measurement*, and then click the preferred tool.
2. Click the image to place the start point. Drag the pointer to the desired size, and then click to place the end point. For the *Polygon* and *Polyline* shapes, click to place the start point, and then drag the pointer to the next point. Continue until you have the desired shape. Finish by right-clicking.
3. The properties for the tool are shown in the *Measurements* section of the properties pane.

5.5.2 Edit a measurement tool

- To move the tool, click and hold the tool, and then move it into position.
- To change the size, click and hold the outline of the tool, and then drag it to the desired size and shape.

5.5.3 Change settings of a measurement tool

The tool settings are available in the *Measurements* section of the properties pane.

To display the tool settings, do one of the following:

- Right-click the tool, and then click *Measurement settings*.
- In the *Measurements* section of the properties pane, point at the tool and then click the settings button that appears.

5.5.4 Delete a measurement tool

To display the tool settings, do one of the following:

- Right-click the tool, and then click *Delete*.
- In the *Measurements* section of the properties pane, point at the tool and then click the trash bin button that appears.

5.5.5 Use the *Delta* tool

The *Delta* tool gives the difference (delta) between two measurement results, or between a measurement result and a reference temperature.

1. On the top left toolbar, click *Add measurement*, and then click *Delta*.
2. In the *Measurements* section of the properties pane, point at the delta tool and then click the settings button that appears.
3. In the properties pane, select the measurement tools or reference temperature you want to use as sources.
4. When completed, click *Done* at the bottom of the properties pane.

5.5.6 Use the *Magic wand*

Use the Magic wand to capture an area in the image based on pixel temperature. This is similar to the Polygon measurement tool but more advanced and easier to use when you want to capture and measure more complex shapes.

1. On the top left toolbar, click *Add measurement*, and then click *Magic wand*.
2. Click to place the tool in the image. An area that has the same temperature as the selected point appears in the image.
3. In the *Measurements* section of the properties pane, move the *Tolerance* slider to adjust the area and include pixels that are close in temperature to the selected point.

5.5.7 Export to a csv file

Use the *Export to csv* functionality to export detailed temperature information. The export will include the temperature values of every pixel within the selected measurement tool.

1. Right-click the tool, and then click *Export to csv*.
2. In the settings dialog, select the preferred export options, and then click *Ok*.
3. In the *Save as* dialog, browse to the folder where you want to store the exported file, and then click *Save*.

5.5.8 Use coverage

Use the *Coverage* functionality to see, as a percentage, the number of pixels in an area that are above or below a certain temperature. The area is defined by the outline of a measurement tool, such as a rectangle or ellipse.

The coverage percentage is displayed in the *Measurements* section of the properties pane. It is also possible to apply a contrasting color to all pixels in the area that meet the temperature setting.

1. In the *Measurements* section of the properties pane, point at the tool and then click the settings button that appears.
2. Select the *Use coverage* check box.
3. Select the *Above* and/or *Below* boxes and set the temperature limit.

4. Use the *Isotherm* check box to apply a contrasting color to the pixels that meet the temperature setting.

5.6 Shape

You can add shapes to the images, such as arrows, comments, and alerts.

5.6.1 Add a shape

1. On the top left toolbar, click *Add new shape*, and then click the preferred shape.
2. To move the shape, click and hold the shape, and then move it into position.
3. To change the size, click and hold the outline of the shape, and then move it to the desired size and shape.
4. To change the shape settings, right-click the shape and then click *Shape settings*.

5.7 Palette

You can change the palette that is used to display the temperatures within an image. A different palette can make it easier to analyze the image. The FLIR Thermal Studio application comes with a set of predefined palettes, but custom palettes can also be used.

To change the palette, follow this procedure:

1. On the top left toolbar, click *Select palette*.
2. Select one of the predefined palettes, or click *From file* to select a custom palette.

To export a palette, follow this procedure:

1. On the top left toolbar, click *Select palette*.
2. Right-click the palette, and then click *Export palette*.
3. In the *Save as* dialog, browse to the folder where you want to store the exported palette, and then click *Save*.

5.8 Fusion mode

Use the *Fusion mode* feature to mix a visual image with its corresponding thermal image. The following fusion modes are available:

- *MSX (Multi Spectral Dynamic Imaging)*
Displays a thermal image where the edges of the objects are enhanced. The thermal-visual balance can be adjusted.
- *Thermal only*
Displays a fully thermal image.
- *Thermal fusion*
Displays a visual image with some parts displayed as a thermal image, depending on the temperature limits.
- *Blending*
Displays a blended image that uses a mix of thermal image pixels and visual image pixels. The thermal-visual balance can be adjusted.
- *Picture in picture*
Displays a thermal image frame on top of a visual image.
- *Visual only*
Displays a fully visual image.

To set the fusion mode, follow this procedure:

1. On the top left toolbar, click *Fusion mode*.

2. Select the preferred fusion mode.

Note that some of the modes have additional settings:

MSX

- Move the *MSX* slider to show more or fewer contours in the image.
- If necessary, click the *Adjust fusion alignment* button to manually align the images.

Thermal fusion

- Move the sliders to change the temperature limits.
- If necessary, click the *Adjust fusion alignment* button to manually align the images.
- Select the *Black and white* check box for a black and white visual image.

Blending

- Move the *Blending* slider to change the proportions of the thermal image and the visual image.
- If necessary, click the *Adjust fusion alignment* button to manually align the images.
- Select the *Black and white* check box for a black and white visual image.

Picture in picture

- Select the *Picture in picture* check box, and then move the slider to change the proportions of the thermal image and the visual image.
- If necessary, click the *Adjust fusion alignment* button to manually align the images.
- Click the *Adjust picture-in-picture rectangle* button to move the rectangle or change its size.
- Select the *Black and white* check box for a black and white visual image.

Visual only

- Select the *Black and white* check box for a black and white visual image.

5.9 Color distribution

Use the *Color distribution* option to change the distribution of colors in the image. A different color distribution can make it easier to analyze the image more thoroughly. The following distributions are available:

- *Histogram equalization*
The color information is distributed over the existing temperatures of the image. This method of distributing the information is especially successful when the image contains few peaks at very high temperature values.
- *Signal linear*
The color information in the image is distributed linearly with respect to the signal values of the pixels.
- *Temperature linear*
The color information in the image is distributed linearly with respect to the temperature values of the pixels.
- *Digital Detail Enhancement (DDE)*
The high-frequency content in the image, such as edges and corners, are enhanced to increase the visibility of details.

To change the color distribution, follow this procedure:

1. On the top left toolbar, click *Color distribution*.
2. Click one of the available color distributions.

5.10 Isotherms control

Using isotherms is a good method to easily discover anomalies in a thermal image. The isotherm functionality applies a contrasting color to all pixels with a temperature above,

below, or within a certain temperature interval. You can also create your own isotherm formulas.

For building inspection, there are specific alarms for detection of humidity, insulation, and condensation issues.

To add an isotherm or alarm, follow this procedure:

1. On the top left toolbar, click *Isotherms control*.
2. Select an isotherm or alarm.
3. In the *Measurements* section of the properties pane, define the settings for the isotherm or alarm.

5.11 Crop an image

Use the *Crop image* option to trim the image. Provided that the cropped image has not been saved, it is possible to revert to the original image size.

To crop an image, follow this procedure:

1. On the top left toolbar, click *Crop image*.
2. Select the *Show crop rectangle* check box. A dotted rectangle is added to the center of the image.
3. To move the rectangle, click and hold the rectangle, and then move it into position.
4. To change the size, click and hold the outline of the rectangle, and then move it to the desired size and shape.
5. To exit, click one of the icons in the bottom right corner of the rectangle:
 - To confirm the change, click the check mark.
 - To cancel the change, click the cross.

To revert to the uncropped image, follow this procedure:

1. On the top left toolbar, click *Crop image*.
2. Click *Reset image*.

5.12 Image rotation

To rotate an image, follow this procedure:

1. On the top left toolbar, click *Image rotation*.
2. Click one of the rotation options.

As an alternative, type the desired angle in the *Angle* text box.

5.13 Filter

Filters for enhanced gas visualization are available for video files (.seq and .csq).

Using the high sensitivity mode and pixel binding filters can make it easier to identify gas leaks.

5.14 Show a profile plot

The plot shows the temperature profile along a line or rectangle in the image.

1. At the bottom left corner, click the *Show profile plot* button.
2. On the top left toolbar, click *Add measurement*, and then click *Line*.
3. In the image, draw a measurement line of interest. The plot now shows the temperature profile along the drawn measurement line.
4. To change the plot settings, click the *Settings* button to the right of the plot.

5.15 Show a time-temperature plot

This plot is available for video files (.seq and .csq). The plot shows the temperature fluctuations over time for the image statistics (max, min, average) and for selected measurement tools.

1. At the lower left corner, click *Show profile plot*.
2. At the lower left corner, click *Sequence*. The plots for the image statistics (max, min, average) are displayed. Each plot shows how the temperature changes with time.
3. To change the plot settings, click the *Settings* button to the right of the plot.
4. To add a new plot, do one of the following:
 - On the *Settings* pane, click *Add plot*, and then select a measurement and a type of value.
 - Right-click a measurement tool in the image, click *Sequence plot*, and then select the type of value.

5.16 Video controls

When you open a video file in the image editor, video controls such as play/pause, auto repeat, and save a snapshot are available at the bottom of the window.

To save a part of the video as a separate file, follow this procedure:

1. At the lower left corner, click *Add marker*.
2. On the time line, click and drag the markers into position.
3. At the lower left corner, click *Save selection*.
4. In the dialog, browse to the folder where you want to store the exported file, and then click *OK*.

5.17 Save changes

To save the changes in the original file, do one of the following:

- At the top right corner, click *Save*.
- At the top right corner, click *Exit*. In the *Unsaved changes* dialog, click *Yes*.

To save the image with the changes in a new file, click the button with three dots at the top right corner and then click *Save as*.

This chapter describes the *Reporting* tab and how you create reports and reporting templates, in general. For details on how to add elements such as images, tables, plots, fields, thermal fields, and formulas to the report, refer to chapter 7 *Edit reports*.

6.1 General

You can create a report from scratch or by using a template—either select one of the available templates or create a new one.

Reports are saved in the .atr (advanced thermal report) file format and report templates are saved in the .att (advanced thermal template) file format. Both formats can be exported to Adobe PDF or Microsoft XPS.

Note When images are added to a report, copies of the images are made. This means, when changes are made to an image that has been added to a report, the original image stays unchanged.

6.2 Generate a report using a template

1. Select the *Reporting* tab, and then select the *Templates* view.
2. To open the report workspace screen, do one of the following:
 - Right-click the template you want to use, and then click *Select*.
 - Click a template, and then click *New report using template* on the top left toolbar.
3. On the top left toolbar, click *Add image*. This displays the library in the left pane.
4. To add images to the report, drag an image or folder from the left pane and drop it into the page pane.
5. To save the report, click the button with three dots at the top right corner, and then select one of the options.

6.3 Generate a report using Rapid Report

With the Rapid Report functionality, you can create a shortcut to a FLIR Thermal Studio report on your computer desktop, and then drop images or a folder of images on the shortcut to create a report. You can create one or multiple Rapid Report shortcuts on your desktop.

To create a report shortcut, follow this procedure:

1. Select the *Reporting* tab, and then select the *Templates* view.
2. Right-click the template you want to create a shortcut to, and then click *Create RapidReport shortcut*.

To generate a report using Rapid Report, follow this procedure:

1. Open File Explorer on your computer and navigate to the images (or to the folder of images) that you want to create a report on.
2. Drag the images (or the folder of images) and drop them on the report shortcut on the desktop.
3. The report is created and then opened in FLIR Thermal Studio.

6.4 Create a blank report

When you create a new blank report, you must first add elements, such as thermogram, parameters, and measurements, before you can add images.

1. Select the *Reporting* tab, and then select the *Reports* view.

-
2. On the top left toolbar, click *New blank report*. This opens the report workspace screen.
 3. On the top left toolbar, click *Add field*. This displays the available elements in the left pane.
 4. In the page pane, click the report page where you want to add elements.
 5. In the left pane, click the elements you want to add to the selected page.
 6. To add a page, click the *Add page* button at the bottom of the page pane.
 7. On the top left toolbar, click *Add image*. This displays the library in the left pane.
 8. To add an image to the report, drag the image from the left pane to a thermogram in the center pane.
 9. To save the report, click the button with three dots at the top right corner, and then select one of the options.

6.5 Create a reporting template

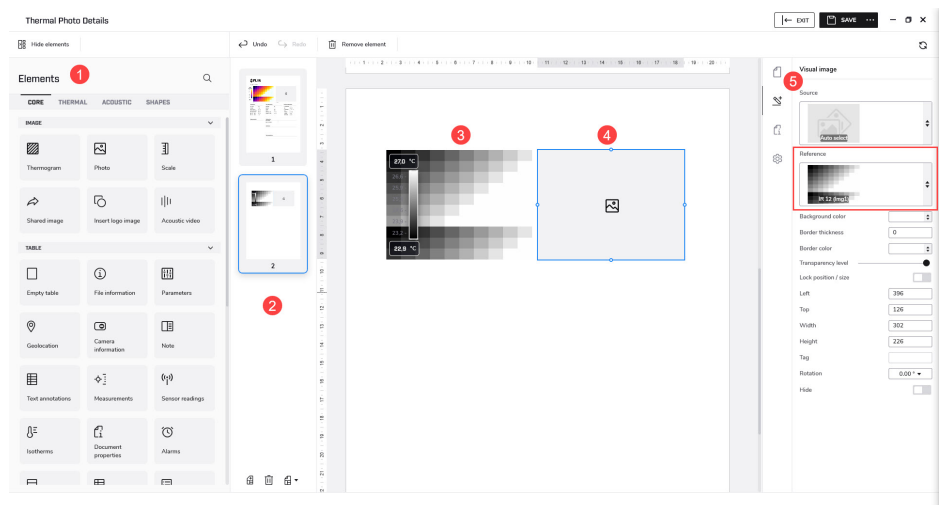
If the predefined reporting templates do not meet your requirements, you can create your own custom templates. You can create a new template from scratch or edit an existing template.

1. Select the *Reporting* tab, and then select the *Templates* view.
2. To open the template workspace screen, do one of the following:
 - To create a new template, click *Create template* on the top left toolbar.
 - To edit a template, right-click the template and then click *Edit*.
3. On the top left toolbar, click *Add page element*. This displays the available elements in the left pane.
4. In the page pane, click the report page where you want to add elements.
5. In the left pane, click the elements you want to add to the selected page.
6. To add a page, click the *Add page* button at the bottom of the page pane.
7. To save the report, click the button with three dots at the top right corner, and then select one of the options.

This chapter describes how to add elements such as images, tables, plots, and fields to the report. Note that these elements and the thermal images they refer to must be on the same page in the report. The exception is the *Summary table*, which is normally placed at the end of the report.

7.1 Navigation

This image shows what the user interface looks like when you have started to edit a report and added a few pages and elements.



1. Elements pane
2. Page pane
Use the buttons at the bottom to add and remove pages.
3. Thermogram element
Placeholder for a thermal image.
4. Photo element
Placeholder for a visual image.
5. Properties pane
Use the vertical pane toolbar to select display of page details, element details, document properties, and general settings.

The element details shows, for example, which thermal image the element is referring to.

7.2 Start editing

To start editing a report or reporting template, follow this procedure:

1. Select the *Reporting* tab.
2. Open a report or reporting template.
3. To display the available report elements in the left pane, do the following:
 - When editing a report, click *Add field* on the top left toolbar.
 - When editing a reporting template, click *Add page element* on the top left toolbar.

7.3 Images

Several types of images are available like *Thermogram* (thermal image), *Photo* (visual image), *Scale* (temperature), and *Acoustic video*.

7.3.1 Add a thermal image

1. Click the report page where the image is to be added.
2. In the elements pane, click *Thermogram*. A placeholder for a thermal image is added to the report page.
3. Click *Photo*. A placeholder for a visual image is added next to the placeholder for the thermal image.
4. To verify that the visual image is referencing the correct thermal image, click the visual image. Its *Reference* is then shown in the properties pane.

7.3.2 Add a temperature scale

By default, a temperature scale is visible in the thermal image. To add a scale and place it anywhere on the report page, follow this procedure:

1. In the report, click the thermal image for which a temperature scale is to be added.
2. In the elements pane, click *Scale*. A scale is added to the report page.
3. Click and hold the scale, and then move it into position.
4. To verify that the scale is referencing the correct thermal image, click the scale. Its *Reference* is then shown in the properties pane.

7.3.3 Remove or hide a temperature scale

To show/hide the temperature scale in the thermal image, follow this procedure:

1. In the report, click the thermal image with the scale to be hidden.
2. In the properties pane, use the *Show scale* switch to show/hide the temperature scale.

To remove an added temperature scale, follow this procedure:

1. In the report, click the scale to be removed.
2. Right-click the scale, and then click *Remove*.

7.3.4 Add an acoustic video or image

You can add an acoustic video or image to the report.

1. Click the report page where the video/image is to be added.
2. In the elements pane, click *Acoustic video*. A placeholder is added to the report page.

7.4 Tables

A table can show any type of information such as measurements, parameters, and camera information. Add a table and reference it to one of the images on the report page. Modify the table by adding or removing table rows and columns, or by changing row and column order.

7.4.1 Add a table

1. In the report, click the image for which a table is to be added.
2. In the elements pane, click the preferred type of table. The table is added to the report page.
3. Click and hold the table, and then move it into position.
4. To verify that the table is referencing the correct image, point at the table and then click the arrow icon that appears. Its *Reference* is then shown in the properties pane.

7.4.2 Remove a table

1. In the report, click the table.

2. Point at the table and right-click the arrow icon that appears, and then click *Remove*.

7.4.3 Add a table row

1. In the report, right-click anywhere in the table.
2. Click *Add row*, and then select which information to add.
The new row is added at the bottom of the table.

7.4.4 Move a table row (change the row order)

1. In the report, click the table.
2. Right-click the row to be moved, and then click *Move up* or *Move down*.

7.4.5 Remove a table row

1. In the report, click the table.
2. Right-click the row to be removed, and then click *Remove row*.

7.4.6 Add a table column

Note Not available for all types of tables.

1. In the report, click the table.
2. In the table, right-click the column to the left of where you want to add the new column.
3. Click *Add column*, and then select which information to add.

7.4.7 Move a table column (change the column order)

Note Not available for all types of tables.

1. In the report, click the table.
2. Right-click the column to be moved, and then click *Move left* or *Move right*.

7.4.8 Remove a table column

Note Not available for all types of tables.

1. In the report, click the table.
2. Right-click the column to be removed, and then click *Remove column*.

7.5 Plots

Add a plot and reference it to one or more images. Several types of plots are available.

7.5.1 Add a plot (single thermal or acoustic image)

1. In the report, click the image for which a plot is to be added.
2. In the elements pane, click the preferred type of plot. The plot is added to the report page.
3. Click and hold the plot, and then move it into position.
4. To verify that the plot is referencing the correct image, click the plot. Its *Reference* is then shown in the properties pane.

7.5.2 Add a plot (several thermal images)

1. In the report, click one of the thermal images for which a plot is to be added.
2. In the elements pane, click the preferred type of plot. The plot is added to the report page.
3. Click and hold the plot, and then move it into position.
4. Click the plot. Settings for the plot are shown in the properties pane.
5. In the *Reference* list, click the check boxes of all images that you want the plot to reference.

7.5.3 Remove a plot

1. In the report, click the plot to be removed.
2. Right-click the plot, and then click *Remove*.

7.6 Fields

A field is a single object that can be placed anywhere in the report. Several types of fields are available.

7.6.1 Add a field

1. In the elements pane, click the preferred type of field. The field is added to the report page.
2. Click and hold the field, and then move it into position.
3. Click the field. Settings for the field are shown in the properties pane.

7.6.2 Remove a field

1. In the report, click the field to be removed.
2. Right-click the field, and then click *Remove*.

7.7 Thermal fields

Several types of thermal fields are available. Add a thermal field and reference it to one of the thermal images on the report page.

7.7.1 Add a thermal field

1. In the report, click the thermal image for which a thermal field is to be added.
2. In the elements pane, select the *Thermal* tab, and then click the preferred type of thermal field. The field is added to the report page.
3. Click and hold the thermal field, and then move it into position.
4. To verify that the field is referencing the correct thermal image, click the thermal field. Its *Reference* is then shown in the properties pane.
5. The field settings are available in the properties pane. You can, for example, use the *Treat as title* switch to show the name of the field at the top of the field.

7.7.2 Remove a thermal field

1. In the report, click the thermal field to be removed.
2. Right-click the field, and then click *Remove*.

7.8 Acoustic fields

Several types of acoustic fields are available like *Acoustic discharge type*, *Estimated leak size*, *Estimated leak cost*, *Acoustic severity*, and *Acoustic recommendation*. Add an acoustic field and reference it to one of the acoustic videos/images on the report page.

7.8.1 Add an acoustic field

1. In the report, click the acoustic video/image for which an acoustic field is to be added.
2. In the elements pane, select the *Acoustic* tab, and then click the preferred type of acoustic field. The field is added to the report page.
3. Click and hold the acoustic field, and then move it into position.
4. To verify that the field is referencing the correct acoustic video/image, click the acoustic field. Its *Reference* is then shown in the properties pane.
5. The field settings are available in the properties pane.

7.8.2 Remove an acoustic field

1. In the report, click the acoustic field to be removed.
2. Right-click the field, and then click *Remove*.

This chapter describes how to create, import, and export formulas in the *Formula editor* of the FLIR Thermal Studio application. For more information, see the appendix *Working with formulas in FLIR Thermal Studio* (available online, see section 1.1 *Online documentation*).

8.1 General

By using formulas, the user can carry out advanced calculations in the reports based on information from the thermal images. A formula can include all mathematical operators and functions, and it is possible to export formulas from one report and then import them into another report.

The FLIR Thermal Studio application comes with a set of predefined formulas. If these formulas do not meet your requirements, you can create your own. Create them from scratch or use one of the predefined formula as a basis.

The formulas are created, edited, imported, and exported in the *Formula editor*.

8.2 Open the formula editor

1. Select the *Reporting* tab.
2. Open a report or reporting template.
3. To display the elements pane, do the following:
 - When editing a report, click *Add field* on the top left toolbar.
 - When editing a reporting template, click *Add page element* on the top left toolbar.
4. In the elements pane, select the *Thermal* tab, and then click the *Formula* field. The field is added to the report page and its settings are available in the properties pane.
5. In the properties pane, click the button with three dots to the right of *Expression*. This opens the formula editor in a separate window.

8.3 Create a formula

1. Open the formula editor, see section 8.2 *Open the formula editor*.
2. In the formula editor window, click *Create*. A formula named *Formula [X]* is created and listed in the *Stored formulas* list.
3. Click the new formula. The *Editor* section appears at the bottom of the window.
4. In the *Title* text box, type the name of the formula.
5. In the *Expression* text box, define the expression of the formula.
6. In the *Precision* text box, type the number of decimal places to be used for accuracy.
7. To save the formula, click *Save*.

8.4 Import a formula

1. Open the formula editor, see section 8.2 *Open the formula editor*.
2. In the formula editor window, click *Import*.
3. In the *Open* window, browse to the formula file (.json) that you want to import, and then click *Open*.
4. The imported formulas are listed in the *Stored formulas* list.

8.5 Export all formulas

1. Open the formula editor, see section 8.2 *Open the formula editor*.
2. In the formula editor window, click *Export*.

3. In the *Save as* window, browse to the folder where you want to store the exported formula file (.json), and then click *Save*.

8.6 Delete a formula

1. Open the formula editor, see section 8.2 *Open the formula editor*.
2. In the *Stored formulas* list, point to the formula to be deleted, and then click the trash bin that appears on the row. The formula is removed from the *Stored formulas* list.

8.7 Use predefined formulas

The following predefined formulas are available:

- **Difference in temperature from first image**
The difference between the maximum temperature and the minimum temperature of the first thermal image on the current report page. The calculated temperature is shown in blue text.
- **Difference in temperature from second image**
The difference between the maximum temperature and the minimum temperature of the second thermal image (Img2) on the current report page.
- **Difference in temperature between two spotmeters**
The difference in temperature between spotmeter 1 (Sp1) and spotmeter 2 (Sp2) of the first thermal image (Img1) on the current report page.
- **Difference in average temperature between boxes from two thermal images**
The difference in average temperature between box 1 (Bx1) of the first thermal image (Img1) and box 1 (Bx1) of the second thermal image (Img2) on the current report page.
- **Default rating formula**
The formula compares the maximum temperature of box 1 (Bx1.Max) and the temperature of spotmeter 1 (Sp1). By using the temperature differences defined in the formula, one of the texts **Normal** (lime green text), **Investigate** (orange text), **Repair next time** (orange text), or **Repair immediately** (red text) will appear on the report page.

8.8 Reset the predefined formulas

The predefined formulas are editable. If you change (e.g., by mistake) and need to reset them, follow this procedure.

Note Any custom formulas need to be removed. Make sure that you have exported them so that you can reimport them afterwards.

1. Open the formula editor, see section 8.2 *Open the formula editor*.
2. In the formula editor window, click *Restore*.

This chapter describes the FLIR Inspection Route solution in general and how to create routes and inspection reports on the *Routing* tab.

Note The inspection route functionality is available in FLIR Thermal Studio Pro.

9.1 FLIR Inspection Route

FLIR Inspection Route is a solution that streamlines thermal inspections and simplifies data collection and reporting. The solution includes FLIR software and camera support for preparation, inspection, and post-processing.

With the Inspection Route function, the camera guides the operator along a predefined route of inspection points, where images and data are collected in a structured manner. FLIR Inspection Route speeds up post-processing and reporting by ensuring that nothing is missed and that all inspection results are organized right from the start.

The inspection work flow is defined by a Route file, with a high degree of flexibility. It is possible to configure an automated work flow, where the camera automatically sets the status and steps to the next inspection point when an image is saved. The operator can also manually select the status, add comments, and add more images.

The Route file is used as template when starting an inspection in the camera. It is possible to have multiple Route files in camera and the operator can run multiple inspections based on any of the Route files in the camera.

Reference images provide aiming support, increase quality in decision making in the field, and speeds up data collection by defining a baseline for the user based on a set of predefined parameters.

9.1.1 Work flow

The work flow typically involves the following steps:

1. Prepare one or more Route files.
2. Add the Route file(s) to the camera memory card.
3. Perform one or more inspections based on the Route files available on the memory card.
4. Transfer the inspection results to a computer, using one of the following methods:
 - Upload the results to cloud storage and then automatically sync the files with the computer.
 - Upload the results to cloud storage and then manually download the files to the computer.
 - Transfer and save the results manually using the USB cable or the memory card.
5. Create an inspection report.

9.1.2 FLIR Inspection Route Solution user manual

The FLIR Inspection Route Solution user manual describes how to configure Route files, perform inspections, transfer inspection results, and create inspection reports using a camera with FLIR Inspection Route enabled, the FLIR Thermal Studio application, and the FLIR Ignite cloud service.

To access the FLIR Inspection Route Solution user manual, go to <http://support.flir.com/resources/route>.

9.1.3 First generation FLIR Inspection Route

The first generation of the Inspection Route functionality in the camera was based on an inspection route file in .xml format. The new Inspection Route functionality is based on a Route file in .routex format.

The camera still supports the xml based functionality. However, it is not possible to use a mix of .xml and .routex files on the camera memory card.

FLIR Thermal Studio supports both file formats.

9.1.3.1 User manual

For a description of the xml based FLIR Inspection Route functionality, refer to the user manual for the FLIR Inspection Route Solution, First generation.

To access the user manual, go to <http://support.flir.com/resources/route>.

9.2 Create Route file

You can create a Route file in FLIR Thermal Studio.

9.2.1 General

The Route file specifies the route structure, consisting of multiple levels of locations, assets, and inspection points. The Route file also specifies the statuses that can be set for an inspection point during the inspection and the configuration of the camera behavior.

You can build the route structure manually in FLIR Thermal Studio.

It is also possible to import a structure from an asset management system. The file to import must be an Excel file (.xlsx) or a Comma Separated Values file (.csv). After the import, you can make additional changes to the structure and configure the Route file manually.

9.2.2 Create a Route file

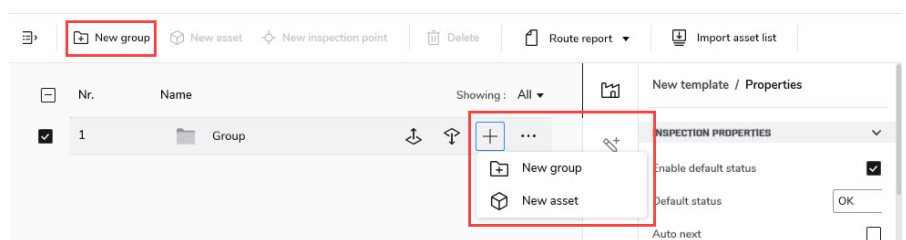
1. Select the *Routing* tab, and then select the *Routes* view.

2. Groups:

To add a group at Level 1, click *New group* on the top toolbar.

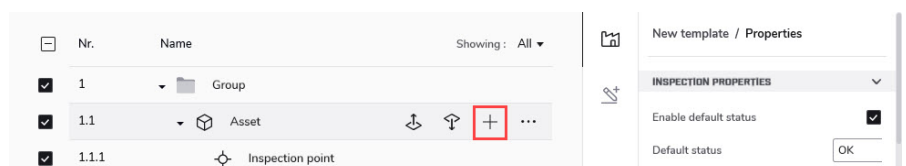
Point at the group and then click the + button that appears. This displays a menu.

- Click *New group* to add a group at a level below this group.
- Click *New asset* to add an asset below this group.



3. Assets:

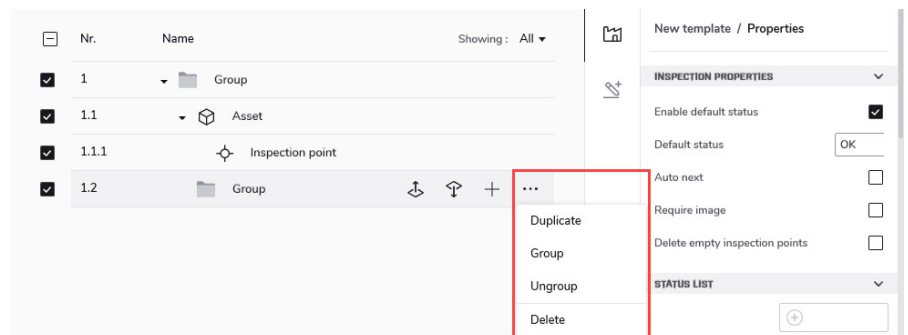
Point at the asset and then click the + button that appears. This adds an inspection point to the asset.



4. Groups, assets, and inspection points:

Point at the item and then click the buttons that appear.

- Click the *Move up* or *Move down* button to move the item.
- Click the three dots button. This displays a menu.
 - Click *Duplicate* to duplicate this item and its dependents.
 - Click *Group* to add a group at a level above this item.
 - Click *Ungroup* to delete this group and move its dependents to the group above.
 - Click *Delete* to delete the item and all of its dependents.



5. Enter the asset properties that will be displayed in the camera user interface as guidance to the operator:

In the center pane, click the item. This displays the item properties in the right pane.

- For all locations, assets, and inspection points, enter a *Name* in the properties pane.
- For the inspection points, you may want to add a *Description*, for example instructions or reminders.

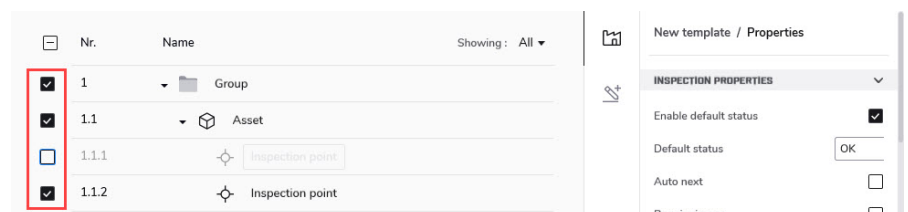
6. Add reference image to an inspection point:

- 6.1. In the center pane, click the inspection point.
- 6.2. On the top left toolbar, click *Show file explorer*. This displays the library in the left pane.
- 6.3. Drag an image from the left pane and drop it on the *Add image* button in the right pane.

For more information, see section 9.4 *Reference images*.

7. *Include asset* check box:

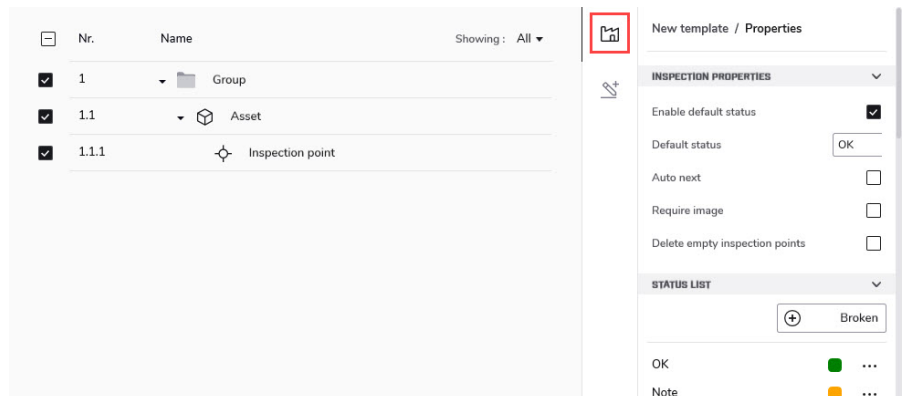
Only clear the *Include asset* check box if you want to exclude the item when you export the route. You may, for example, want to create a Route file for only a part of the structure and then you clear the check box for the items you want to exclude.



8. Configure the settings that control the behavior of the camera during the inspection:

On the right pane toolbar, click the route properties button. This displays the route properties in the right pane.

- To change the default status, first select the *Enable default status* check box. Then click the *Default status* field and select a status from the menu that appears.
- *Auto next*: This setting defines if the camera after saving an image automatically will set the default status and step to the next inspection point. If most inspection points will have the default status, you will save inspection time by selecting the check box. If you often want to set the status or add comments to the inspection points, it may be more convenient to deselect the check box.
- *Require image*: This setting defines if the operator must save an image before it is possible to set the status of an inspection point.
- *Delete empty assets*: This setting defines if all empty inspection points (no image and no status) will be removed from the Inspection file when the inspection is finished.
- *Status list*: This setting defines the text and colors of the statuses. To add a status, first enter the name in the field, and then click the + button.



9. To save the Route file, click *Save* at the top right corner and save as a **.routex** file.

10. The Route file (.routex) is now ready to be used as template for inspections in the camera.

9.2.3 Import structure

1. Select the *Routing* tab, and then select the *Routes* view.
2. On the top left toolbar, click *New route*. This opens the route workspace screen.
3. On the top toolbar, click *Import asset list*.
4. In the *Open* window, open the file (.xlsx or .csv) from your asset management system.
5. In the *Column mapping* window, select how to map the columns in your file to fields in FLIR Thermal Studio.
6. When you have completed the mapping, click *Import*. This displays your structure in the route workspace.
7. To make additional changes to the route structure and configure the Route file, see section 9.2.2 *Create a Route file*.
8. To save the Route file, click *Save* at the top right corner and save as a **.routex** file.

9.3 Create inspection report

When you have completed an inspection in the camera, you can create an inspection report on the *Routing* tab in FLIR Thermal Studio.

9.3.1 Prepare inspection results

The inspection results, including all inspection data and images, are stored in the Inspection file (.route).

Make sure you have the Inspection file (.route) available on your computer.

9.3.1.1 Uploaded results

When uploading the inspection results to FLIR Ignite, the camera uploads the Inspection file (.route) to your FLIR Ignite account.

If FLIR Ignite Sync is set up for automatic sync, the Inspection file (.route) should be in your sync folder on the computer.

To manually transfer the Inspection file (.route) from FLIR Ignite to your computer, do the following:

1. Sign in to your FLIR Ignite account.
2. Find the .route file.
3. Select the .route file by clicking the row.
4. Click the *DOWNLOAD* button.

9.3.1.2 Results on memory card

To transfer the Inspection file (.route) from the camera memory card to your computer, do the following:

1. Connect the camera to the computer with a USB cable or insert the memory card into the computer.
2. Go to the folder named *Inspections* located at the root of the memory card.
3. Save the Inspection file (.route) to the computer.

Note In FLIR Thermal Studio, you can also open the Inspection file (.route) directly from the *Inspections* folder on the camera memory card.

9.3.2 Open inspection results

1. Start FLIR Thermal Studio.
2. Select the *Routing* tab, and then select the *Inspections* view.
3. On the top left toolbar, click *Open inspection file*.
4. In the *Open* window, find the location for the Inspection file (.route) and open the .route file.
5. To review the inspection results, click the inspection points one by one, or use the arrow buttons at the top of the right pane. The inspection image(s), reference image (if there is one), status, and any comments are available in the right pane. You can edit the inspection images, change statuses, and add more information to the inspection points. To open the image editor, double-click the image.
6. Save changes:
 - To save the changes in the original inspection file, click *Save* at the top right corner.
 - To save the changes in a new file, click the button with three dots at the top right corner and then click *Save as*.

9.3.3 Create an inspection report

1. Open the inspection results, see section 9.3.2 *Open inspection results*.
2. On the top left toolbar, click *Generate inspection report*. This opens the *Available templates* window.
3. In the *Available templates* window, click a template and then click *Select*.
 - *Inspection default template*: Template for inspection reports (with this template, the reference images will not be included in the report).
 - *Inspection default ref image*: Template for inspection reports with reference images. See also section 9.4.3 *Report with reference images*.

-
4. The report workspace screen opens. You can make additional changes to the report using the normal reporting functions.
 5. You can save the report as an .atr file. This will allow you to continue working with the report later. At the top right corner, click the button with three dots and then click *Save as report*.
 6. You can export the report to, for example, a PDF file. At the top right corner, click the button with three dots and then click *Export to PDF*.

9.4 Reference images

Reference images enable guidance support, increase quality in decision making in the field, and speeds up data collection by defining a baseline for the user based on a set of predefined parameters.

With FLIR Thermal Studio, it is possible to convert the images from an inspection to reference images. You can also add reference images manually when you create a Route file.

The camera can be configured to use the same measurement tools, measurement parameters, temperature scale values, and color palette as in the reference images.

9.4.1 Create Route file with reference images from inspection

You can export an inspection to a Route file (.routex) and use the inspection images as reference images in the new Route file.

1. Create a Route file, see section 9.2.2 *Create a Route file* or section 9.2.3 *Import structure*.

Note Do not add any reference images at this point. It is only possible to have one reference image for each inspection point. If there already is a reference image in the Route file, it will not be possible to replace it with an inspection image.

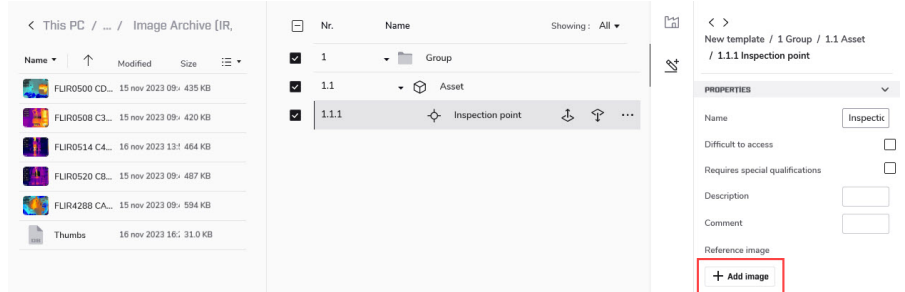
2. Perform an inspection with the camera and take reference images for all inspection points.
3. Make sure you have the inspection results available on your computer, see section 9.3.1 *Prepare inspection results*.
4. Start FLIR Thermal Studio.
5. Select the *Routing* tab, and then select the *Inspections* view.
6. On the top left toolbar, click *Open inspection file* and open the Inspection file (.route).
7. On the top left toolbar, click *Export to new route*.
8. When asked, click *Yes* to save the inspection images as reference images.
9. For inspection points with more than one image, select the image you want to use as reference image. Then click *Export*.

9.4.2 Add reference images manually

You can manually add reference images to a Route file in FLIR Thermal Studio.

1. Select the *Routing* tab. Do one of the following:
 - Import an existing Route file: On the top toolbar, click *Import route* and open a Route file (.routex).
 - Start to create a new Route file, see section 9.2.2 *Create a Route file*.
2. In the center pane, click the inspection point.
3. On the top left toolbar, click *Show file explorer*. This displays the library in the left pane.

4. Drag an image from the left pane and drop it on the *Add image* button in the right pane.



5. To delete the reference image, click the *Clear reference image* button in the right pane.
To edit the reference image, double-click the image. This opens the image editor.

9.4.3 Report with reference images

With the *Inspection default ref image* template, the reference images will be included in the report.

You can also add reference images to your own report templates. For details on how to add elements, see chapter 7 *Edit reports*.

To add reference images to a report template, do the following:

1. Select the *Reporting* tab, and then select the *Templates* view.
2. Right-click the template you want to use, and then click *Edit*.
3. In the page pane, click the report page where you want to add the reference image.
4. On the top left toolbar, click *Add page element*. This displays the available elements in the left pane.
5. In the elements pane, click *Thermogram*. A placeholder for a thermal image is added to the report page.
6. In the right pane, scroll down to the *Tag* field and enter **reference_image**.
You may also want to add a *Text box* with information that this is a Reference image.



This chapter describes the *Batch edit* tab and how you create and run batches of jobs.

10.1 General

Use the batch processing feature for automation of repetitive tasks when editing and normalizing thermal images. Operations that can be automated are, for example:

- Set parameters.
- Change settings.
- Modify measurements.
- Apply isotherms.
- Change the palette.
- Add a logo.

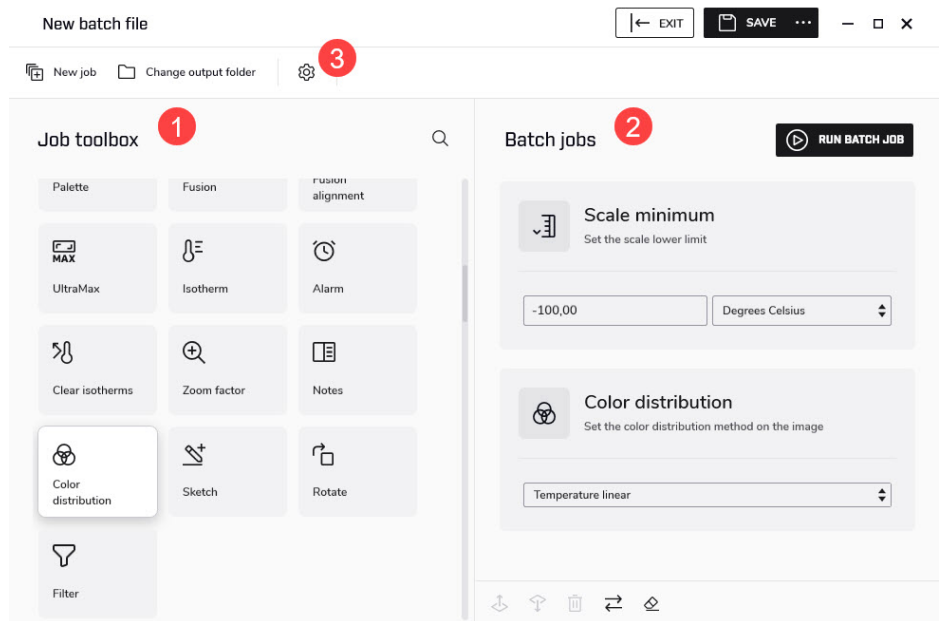
When processing batches of jobs, the following outputs are available:

- Radiometric images (.jpeg) for further processing.
- Plain overlay images for sharing online or with customers.
- Transcoder from a radiometric sequence to an AVI video file.
- Radiometric data exported to CSV files.

Batch jobs are saved in the .atb (advanced thermal batch) file format.

10.2 Navigation

This image shows what the user interface looks like when working with a batch.



1. Job toolbox pane

The toolbox lists all the jobs that can be run in a batch. The jobs are grouped into categories, such as the *Output targets*, *Image*, and *Parameters* categories.

2. *Batch jobs* pane

This is the workspace where you create the batch by adding jobs and setting values. As more jobs are added, a batch execution list is created.

A new job is normally added at the end of list. Use the icons at the bottom of the pane to move the jobs up or down the list, to reverse the execution order of the jobs, to remove jobs from the list, or to clear the list of all jobs.

3. Click the icon to open the *Settings* window.

General tab: If the *Open output folder when done* check box is selected, File Explorer will open when the batch job is completed and show the output files in the defined output folder.

Image Overlay tab: Configure if and how you want to use an image overlay for batch processing. For more information, see section 4.2.5 *Image Overlay*.

10.3 Start a new batch

1. Select the *Batch edit* tab.

2. On the top toolbar, click *New job*. This opens the batch workspace screen.

3. In the *Job toolbox* pane, click the jobs you want to add to the batch. Point to a job to see a short description. The jobs are added to the *Batch jobs* pane.

4. Note that some jobs have additional settings. In the *Batch jobs* pane, make any changes to the job settings.

5. Use the icons at the bottom of the pane to:

- Move a selected job up or down the list.
- Remove a selected job from the list.
- Reverse the order of the selected jobs.
- Remove all jobs and clear the list.

6. Verify that you have added an *Output target* job as the last job in the batch.

Note At least one *Output target* job must be run in the batch. If no output target has been selected, the job *Radiometric JPEG* will be added automatically and run as the last job in the batch.

7. To run the batch job, click *Run batch job* at the top of the right pane. This opens the image workspace screen.

8. In the left pane, select images and/or folders and drag-and-drop them into the right pane.

9. Use the icons at the bottom of the right pane to:

- Move a selected file up or down the list.
- Remove a selected file from the list.
- Sort the files by name, or by date and time.
- Reverse the order of the selected files.
- Remove all files and clear the list.

10. To change the output folder, click *Change output folder* at the top toolbar.

11. To start the processing, click *Run batch job* at the top toolbar.

12. When the processing is completed, click *Go to output* at the top toolbar. This opens the output folder in the left pane.

13. To take a closer look at a result file and edit it if necessary, double-click the file in the left pane. This opens the image in the image editor. For more information, see 5 *Image editor*.

10.4 Save a batch as a template

1. Select the *Batch edit* tab.

2. On the top toolbar, click *New job*. This opens the batch workspace screen.

3. Select which jobs to run, set values where applicable, and place the jobs in the correct order. See also section 10.3 *Start a new batch*.

4. To save the batch as a template, click *Save* at the top right corner.

10.5 Start a predefined or saved batch

1. Select the *Batch edit* tab.
2. In the left pane, click the batch you want to run.
3. In the right pane, click *Run job*. This opens the image workspace screen.
4. Select the images to be processed and place them in the correct order. See also section 10.3 *Start a new batch*.
5. To start the processing, click *Run batch job* at the top toolbar.

10.6 Create a panoramic image

Use the *Panorama* functionality to stitch a sequence of thermal images together into one single panoramic image.

Note

- The sequence of image files used as input must come from the same recording.
- The order of the image files in the sequence is not important.
- Only one panoramic image can be created at a time. If you select image files from multiple sequences as input, only the images of the first selected sequence will be processed.

To create a panoramic image, follow this procedure:

1. Select the *Batch edit* tab.
2. In the left pane, click *Panorama*.
3. In the right pane, click *Run job*. This opens the image workspace screen.
4. In the left pane, select a folder or individual images and drag-and-drop them into the right pane.
5. To start the processing, click *Run batch job* at the top toolbar.
6. When the processing is completed, click *Go to output* at the top toolbar. This opens the output folder in the left pane.
7. Optionally: Double-click the panoramic image in the left pane. This opens the image editor where you can change zoom, change palette, crop, or rotate the panoramic image.

This chapter describes how to live stream, record radiometric video, and control USB connected cameras.

11.1 Connect camera

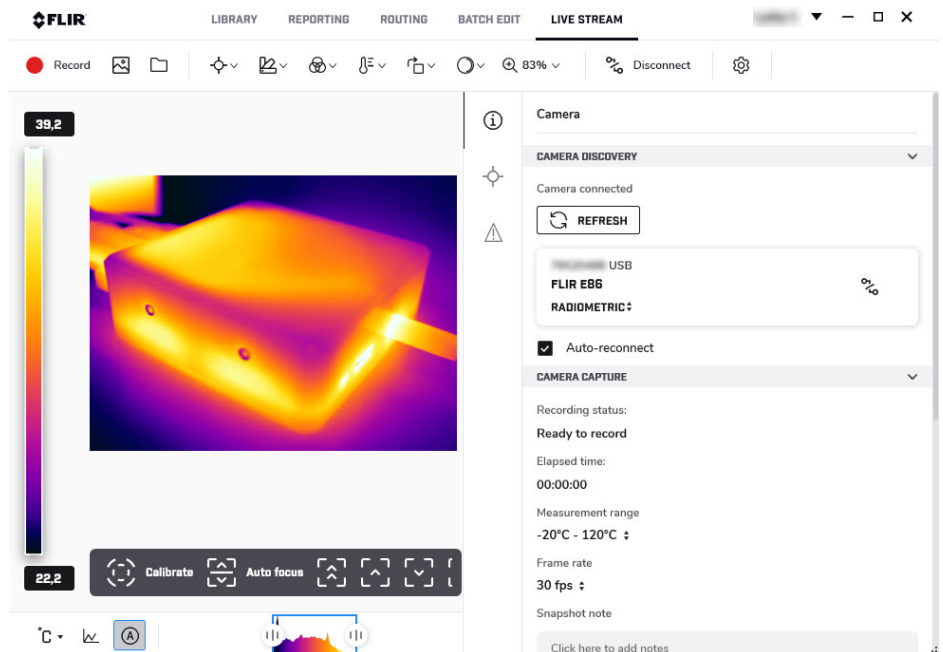
1. On the computer, start FLIR Thermal Studio and select the *Live stream* tab.
2. Turn on the camera.
3. Connect the camera to the computer with a USB cable. This displays the *Device connected* dialog.
4. In the *Device connected* dialog, you can select to import all files, download all inspections, or view all files.
5. On the *Live stream* tab, select the camera and then click *Connect*. This displays the live image stream from the camera.

Note

- Click *Refresh* to update the camera list.
- If you select the *Auto-reconnect* check box, the camera will connect automatically next time.

11.2 Control camera

When the camera is connected, you can record radiometric video, save snapshots, calibrate the camera, and adjust the camera focus. There are also functions similar to the ones in the image editor, such as measurement tools, isotherm controls, and temperature scale adjustment.



This chapter describes how to view, edit, and create reports based on acoustic videos and images from the FLIR Si124 camera.

Note The acoustic functionality is available as a plug-in for FLIR Thermal Studio Pro. For information on how to activate the Acoustic plug-in, see 3.4 *Plug-in activation*.

12.1 FLIR Si124

FLIR Si124 is an acoustic camera that uses 124 microphones to form an acoustic image on top of a digital camera picture. The FLIR Si124 can be used for localization and classification of high-voltage partial discharges and for localization of pressurized air leaks.

The acoustic video and image files from the FLIR Si124 camera have the extension .nlz. For more information, refer to the FLIR Si124 user manual.

12.2 View and edit videos and images

You can open the acoustic video and image files (.nlz) using FLIR Thermal Studio.

On the *Library* tab, you can view your acoustic videos and images. When you click an acoustic file in the center pane, the analysis results and other information are shown in the pane to the right. For videos, the displayed results and information relate to the last frame in the video recording.

To edit a video or image, double-click the file or click *Edit image* in the right pane. This opens the image editor. This image shows what the image editor looks like when you have selected an acoustic video.

The screenshot shows the FLIR Thermal Studio software interface. At the top, there is a breadcrumb path: < > DATA / ACROFLEX_000001_070416_1408_0000. The main window is divided into several sections:

- Top Right:** Window controls (EXIT, SAVE, etc.) and a zoom level of 47%.
- Center:** A video frame showing an industrial scene with a green spot indicating a leak location. Below the video is a waveform plot labeled 'Signal' with a red waveform. The waveform plot has a volume control slider set to 12.1 dB, with a range from -12.3 dB to 16.5 dB.
- Right Pane:** A 'Measurements' section with a dropdown menu for 'PARAMETERS' (value: 4) and 'LEAK ANALYSIS' (value: 3). The 'LEAK ANALYSIS' section displays the following data:

Estimated leak size	5,15 L/min
Estimated leak cost	63,32 €
Utilization weeks	52
Utilization days	7
Utilization hours	24,0
- Bottom:** Video playback controls including a play button (highlighted with a red circle '1'), a progress bar, and a timestamp of 104 / 173 · 00:00:06:907 / 00:00:11:534.

1. Video controls.

Use the controls to play/pause/stop the video recording and to select a specific frame in the video recording. Note that the analysis results in the right pane relate to the currently displayed frame.

2. Dynamic range.

By changing the dynamic range, you can analyze the snapshot in more detail – you can decrease the range to get the precise location of the strongest sound source, and increase it to see if there are multiple sound sources. To change the dynamic range, use the slider under the image or enter the level in the *Dynamic range* field in the pane to the right.

3. Analysis results.

Depending on the mode selected in the camera when taking the picture, leak analysis results or partial discharge analysis results will be shown. For more information, see sections 12.2.1 *Leak analysis* and 12.2.2 *Partial discharge analysis*.

4. Parameters.

The analysis results depend on the *Parameters* settings. The leak analysis results also depend on the leak analysis settings, see section 12.2.1.1 *Leak analysis settings*.

5. Audio analysis tools.

The sound signal from the dominant source in the image can be visualized in different ways:

- *Signal* is a waveform representation of the audio signal as a function of time.
- *FFT* shows the magnitude spectrum of the signal.
- *Autocorrelation* is the correlation of the signal with itself.
- *Spectrogram* is a frequency spectrum of the signal in the function of time.
- *Cepstrum* can be used for analyzing the periodicity of the spectrum.

12.2.1 Leak analysis

For a compressed air leak, the *Estimated leak size* and *Estimated annual cost* are displayed, as well as utilization data.

The leak analysis results depend on the distance and leak analysis settings.

- The *Distance* setting is available under *Parameters* in the right pane.
- The *Leak analysis* settings are available on the *Settings* page, see section 12.2.1.1 *Leak analysis settings*.

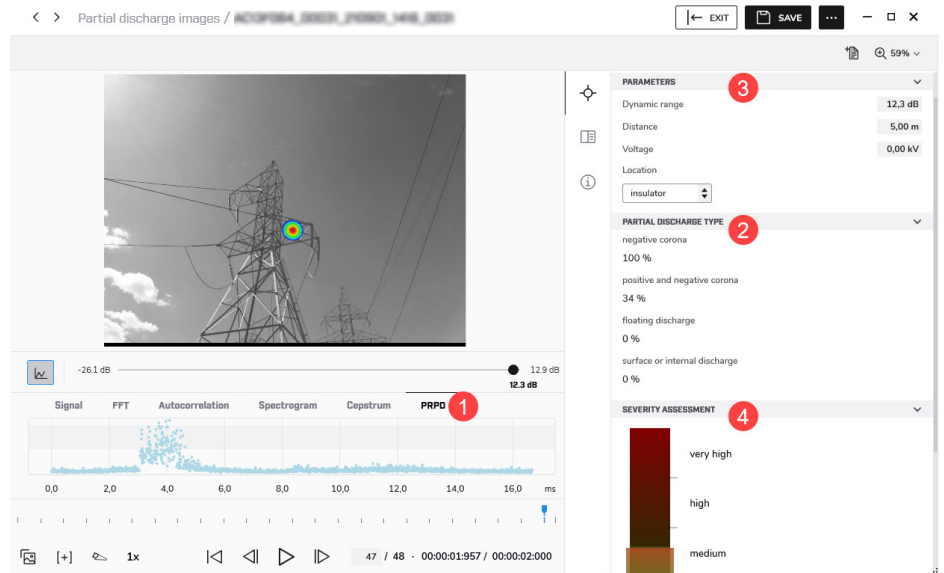
12.2.1.1 Leak analysis settings

Settings related to leak analysis are available on the *Plugins* tab on the *Settings* window, see section 4.2 *Settings*.

- **Currency**
The currency in which to display the leak cost estimate.
- **Leak unit**
The unit used to display the leak size estimate. Available options are: l/min (liters per minute) and Cf/min (cubic feet per minute).
- **Energy cost**
To estimate the cost of compressed air leaks, the energy cost must be known. Typically this means the local price (per kWh) of electricity. Note that if the currency is changed, the energy cost must be updated accordingly.
- **Leak size correction factor**
The leak size estimation in the FLIR Si124 has been developed based on a large set of different measured leaks. It might, however, in some cases underestimate the leak size, or in other cases overestimate the leak size, since the leak size depends on a large amount of different variables. If the leak size estimate systematically differs from your own observations, you can adjust it by setting the leak size correction factor. A leak correction less than 1.0 will produce smaller estimates, while a leak correction larger than 1.0 will produce larger estimates.

12.2.2 Partial discharge analysis

This image shows what the image editor looks like when an image is recognized as a possible partial discharge.



1. PRPD.

The PRPD (Phase Resolved Partial Discharge) pattern is used for analyzing the PD type – different PD types typically have a distinct pattern.

2. Partial discharge type.

There are four categories:

- Negative corona
- Positive and negative corona
- Floating discharge
- Surface or internal discharge

The percentage indicates how certain the system is that the detected PD is of a specific type. Several categories may have approximately the same percentage, which means that the system is uncertain as to which type it is.

3. Parameters.

The sound attenuates over distance, which needs to be considered. A very precise *Distance* is not a requirement for the severity assessment but may produce more accurate results.

The *Voltage* and *Location* affect the severity assessment and recommended actions.

4. Severity assessment.

The colored bar, ranging from green, yellow, and orange to red, shows the severity assessment. The highlighted region indicates the estimated severity range of the detected partial discharge.

The more the parameters (distance, voltage, and location) are specified, the more precise the severity assessment will typically be.

There is a description of the type of partial discharge and a recommendation for the actions to be taken.

Note The severity assessment only provides general guidelines based on the likely type of PD and the data available. Always consult an expert to decide on the actions that need to or need not be taken when PD has been detected.

12.3 Reporting

12.3.1 Acoustic report templates

The Acoustic plug-in comes with several predefined acoustic reporting templates, e.g., Automatic acoustic, Discharge Analysis, and Leakage Analysis.

If these templates do not meet your requirements, you can create your own custom templates. For more information, see section 6.5 *Create a reporting template*.

12.3.2 Rapid report

You can easily create acoustic reports using shortcuts on your computer desktop. For more information, see section 6.3 *Generate a report using Rapid Report*.

12.3.3 Acoustic objects

You can add acoustic objects such as images, tables, plots, and fields to a report. For more information, see chapter 7 *Edit reports*.

13.1 Legal disclaimer

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

13.2 Export controls

Products described herein may be subject to export regulations.

This document does not contain export-controlled information.

13.3 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.

13.4 Third-party licenses

Information about third-party licenses is available in the user interface of the product.

13.5 Usage statistics

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

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