



# USER MANUAL

# THERMAL IMAGER KT-400F





# **USER MANUAL**

## **THERMAL IMAGER KT-400F**

**SONEL S.A.  
Wokulskiego 11  
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**KT** series thermal Imagers comply with current EU directives related to electromagnetic compatibility and safety.

This device complies with part 15 of the FCC Rules. 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.

Equipment changes or modifications not expressly approved by the party responsible for FCC compliance, could void the user's authority to operate the equipment.

*Thank you for purchasing our thermal imager, which is modern, high-quality, easy and safe to use measuring device. Reading this manual will allow to avoid measuring errors and will prevent possible problems related to operation of the imager.*

All products of Sonel S.A. are manufactured in accordance with Quality Management System which is approved to ISO 9001:2008 for the design, manufacturing and servicing.

Due the continuous development of our products, we reserve the right to introduce changes and improvements in the thermal imaging camera and in the software described in this manual without prior notice.

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# TABLE OF CONTENTS

<b>1</b>	<b>Safety</b>	<b>6</b>
<b>2</b>	<b>Description of the camera</b>	<b>9</b>
<b>3</b>	<b>Function buttons and menu</b>	<b>10</b>
3.1	Camera body description	10
3.2	Overview of the camera's functional areas	12
3.3	Manual Calibration	15
<b>4</b>	<b>Observation</b>	<b>15</b>
4.1	Image mode switch	15
4.2	Temperature measurement	16
4.3	Digital Zoom	17
<b>5</b>	<b>Images</b>	<b>17</b>
5.1	Capturing images	17
5.2	Creating a panorama	18
5.3	Capturing high-resolution images	18
5.4	Adding notes	19
5.4.1	Adding picture notes	19
5.4.2	Adding text notes	21
5.5	Adding voice notes	21
5.6	Adding sketch note	22
5.7	Video recording	23
<b>6</b>	<b>Image analysis</b>	<b>24</b>
6.1	Real-time analysis	24
6.1.1	Adding/removing the analysis object	24
6.1.2	Resizing the analysis objects	25
6.1.3	Analysis function of a moving object	25
6.1.4	Selecting a color palette	27
6.1.5	Manual brightness/contrast control	27
6.1.6	Temperature difference analysis	28
6.2	File browsing	29
6.3	Image analysis	30
6.3.1	Image editing	30
6.3.2	Zooming in and out	31
6.4	Creating a PDF file	32
6.5	PDF file printing	33
6.6	Video playback	33
6.7	Isotherm	34
6.7.1	High isotherm	34
6.7.2	Low isotherm	35
6.7.3	Out of range isotherm	35
6.8	Adjusting temperature range and span	36
6.8.1	Adjusting temperature range	37
6.8.2	Adjusting temperature scale span	37
6.8.3	Semi-automatic adjustment	37
6.9	Edit menu	38

6.9.1	Emissivity .....	38
6.9.2	Reflected temperature .....	38
6.9.3	Target distance .....	38
6.9.4	Humidity .....	38
<b>7</b>	<b>System settings .....</b>	<b>39</b>
7.1	Central Temperature Cursor .....	39
7.2	Temperature measurement range .....	39
7.3	Temperature unit selection .....	40
7.4	Distance unit selection .....	40
7.5	Alarm setting .....	40
7.5.1	High temperature alarm .....	41
7.5.2	Low temperature alarm .....	41
7.6	Brightness .....	41
7.7	Auto off time settings (Timing Shutdown) .....	42
7.8	Sleep mode time settings (Timing Sleep) .....	42
7.9	Volume .....	42
7.10	Vibrate feedback .....	43
7.11	Automatic lens recognition .....	43
7.11.1	Disabling the automatic lens recognition .....	43
7.12	Indication of the maximum and the minimum temperature on screen (Full Image Temperature Marking) .....	44
7.13	Isotherm Color .....	44
7.14	Image taking mode settings (Photo Setting) .....	45
7.15	Visible light camera resolution .....	45
7.16	Video format .....	45
<b>8</b>	<b>Local settings .....</b>	<b>46</b>
8.1	Report Settings .....	46
8.2	Stamp settings .....	46
8.3	Date/Time .....	47
8.4	System Language Settings .....	47
<b>9</b>	<b>Connection settings .....</b>	<b>48</b>
9.1	Wi-Fi settings .....	48
9.2	Wi-Fi Hotspot Configuration .....	49
<b>10</b>	<b>Other settings (Info) .....</b>	<b>50</b>
10.1	Firmware update .....	50
10.2	Storage .....	50
10.3	Formatting microSD card .....	51
10.4	Restoring the default settings .....	51
<b>11</b>	<b>Connection with External Devices .....</b>	<b>52</b>
11.1	Port Connection .....	52
11.2	Micro HDMI Interface .....	52
11.3	USB Interface .....	52
11.4	USB cable connection .....	53
11.5	Installing memory card and lens .....	55
11.5.1	Installing memory card .....	55
11.5.2	Removing memory card .....	56
11.6	Installing optional lens .....	56

11.7 Installing high temperature filter lens .....	57
11.8 Wireless Access Point (AP) settings.....	57
<b>12 Troubleshooting.....</b>	<b>58</b>
<b>13 Cleaning and maintenance .....</b>	<b>59</b>
<b>14 Storing .....</b>	<b>59</b>
<b>15 Dismantling and disposal .....</b>	<b>59</b>
<b>16 Specifications.....</b>	<b>60</b>
<b>17 Accessories.....</b>	<b>61</b>
17.1 Standard accessories .....	61
<b>18 Manufacturer .....</b>	<b>62</b>
<b>19 Exemplary emissivity coefficient values .....</b>	<b>63</b>
<b>20 Laboratory services.....</b>	<b>64</b>

# 1 Safety



This is a general safety guide, covering **many models** of thermal imaging cameras from a common product line, so some functions and descriptions in this chapter **may not apply** to specific models.

Before you proceed to operate the camera, acquaint yourself thoroughly with the present manual and observe the safety regulations and specifications defined by the manufacturer.

- Any application that differs from those specified in the present manual may result in a damage to the device and constitute a source of danger for the user.
- The camera must not be used in rooms where special conditions are present e.g. fire and explosion risk.
- It is forbidden to use damaged or malfunctioning camera and is partially or fully out of order,
- In case the camera is not used for a long time, its battery should be removed. Leaving the battery inside the device may cause the battery to leak and damage the camera.
- It is not allowed to use the camera with half-closed or opened battery cover and do not use any other power adapter than the one supplied with the camera.
- Repairs may be carried out only by an authorized service point.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur with a particular installation. If the device causes harmful interference to radio or television reception, which can be determined by turning the device off and on, the user should try to correct the interference by using one of the following means:

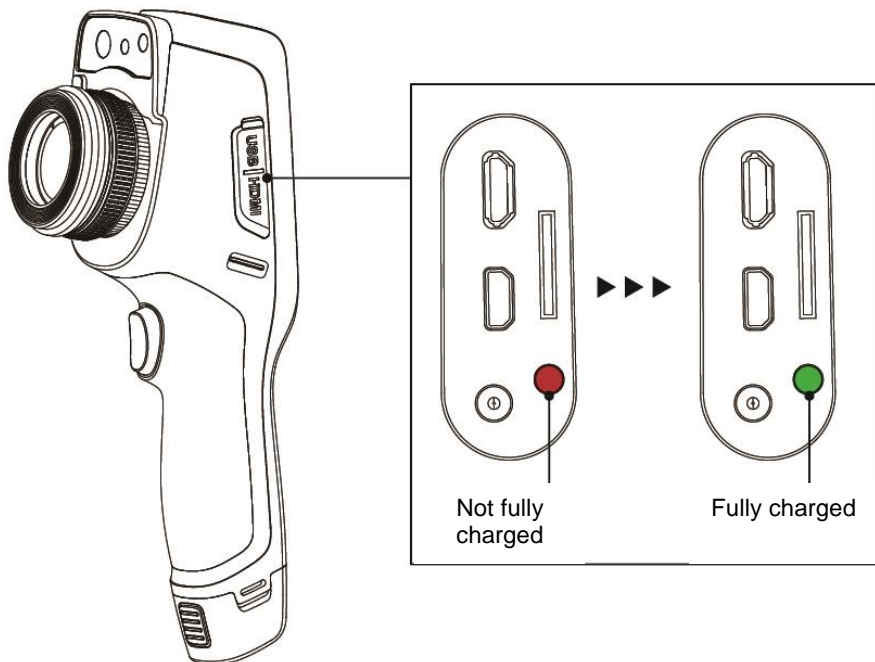
- Changing the direction or position of the receiving antenna.
- Increase the separation between the device and the receiver.
- Connect the equipment to a socket on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.
- The device has been assessed as meeting the general requirements for immunity to exposure to radio-frequency (RF) radiation.

The following precautions must be adhered to at all times:

- Keep the camera steady during operation, to prevent rapid shocks.
- Do not use the camera in ambient temperatures exceeding its operation and storage temperature ranges.
- Do not direct the camera toward very high intensity radiation sources such as the sun, lasers or welding arcs etc.
- Do not expose the camera to dust and moisture. When operating the device near water, ensure that it is adequately guarded against splashes. Cover the lens when the device is not used.
- When the camera is not in use or is to be transported, ensure that the unit and its accessories are stored in the protective carry case.
- Do not obstruct the speaker holes in the camera's body.



- Do not throw, knock or shake intensely the camera and its components in order to avoid the damage.
- Do not attempt to open the imager's body, as this action will void the warranty.
- Keep the SD memory card for the exclusive use of the camera.
- Do not use the unit in an environment where its working temperature is exceeded to avoid possible damage.
- Do not use solvents or similar types of liquids on the unit and cables to avoid possible damage.
- The camera is powered by Lithium-ion battery, therefore users must strictly adhere to the following guidelines to ensure safe use:
  - Never attempt to open or disassemble the battery,
  - Do not place the battery in a hot temperature environment or near hot objects,
  - do not short-circuit the battery terminals,
  - Do not place the battery in a damp environment or in water,
  - In case of leakage of liquid from the battery that makes direct contact with eyes, immediately rinse your eyes with clean water and seek appropriate medical attention,
  - charge the battery according to the instructions and abide the charging stages and precautions; Incorrect charging may overheat or damage the battery and may cause injury,
  - remove the battery if the device will not be used for a long time.
- Clean the device as described below:
  - non-optical surfaces: use soft and moist cloth to clean non-optical surfaces of the thermal imager;
  - optical surfaces: Avoid staining the optical lens surface while using the thermal imager, especially avoid touching the lens with your hands, as sweat may leave marks on the lens and corrode optical coatings on the lens surface. When the optical surface of the lens is fouled, wipe it with a special lens cleaning paper;
- The battery can be recharged many times. However, the battery is a delicate part. If the operating time of the device is reduced significantly, please replace the battery with a new, original one provided by the manufacturer.
- During imager operation its housing temperature increases and it's a normal phenomenon. When it's hot, stop charging the battery and move the device into a cool place. Avoid touching hot surfaces for prolonged period of time.
- For charging the device, it is recommended to use original batteries and charging cables provided by the manufacturer.
- Battery charge time depends on the temperature and the discharge level.
- Low battery level is indicated by the camera.
- When the battery level is too low, the thermal imager will turn off automatically.
- If the device does not respond to the power button pressing, the battery is exhausted and the device can only be started after charging with the original charger for more than 10 minutes.
- When the battery is charging, the charging indicator light on the side of the camera lights up red.
- When the battery is fully charged, the charging indicator light changes from red to green, indicating that no further charging is required.



Charging indicator lights



#### WARNING

- Laser locator installed in the camera may be dangerous to eyes, in case of direct contact!
- DO NOT DIRECTED THE LASER BEAM TOWARDS OTHER PERSONS OR ANIMALS!
- Please note that the laser beam may reflect off shiny surfaces.



#### NOTE!

- KT series thermal imagers have no parts that could be repaired or modified by its user. Never attempt to dismantle or modify the device. **Opening up the unit invalidates the warranty.**
- Use only standard and additional accessories, listed in "Equipment" section. Using other accessories does not ensure proper operation of the camera and **may cause its damage.**



- Due to the continuous development of the device, the design of the display and its certain features may be slightly different than presented in this manual..
- For proper battery performance, charge unused batteries every 3 months. If you do not use the unit for a long time, remove the batteries and store them separately.

## 2 Description of the camera

Thank you for purchasing our thermal imager.

KT series imagers are modern, high-quality, easy and safe to use measuring devices. They allow to capture high-quality, fully radiometric thermal images. This product combines high-quality measurement parameters with an innovative and intuitive interface, based on a new operating system, to create an intelligent solution in the field of thermal imaging.

The camera operation, with a large, touch screen is very easy. In addition to standard modes like IR (infrared), visual and PIP (picture in picture), the camera has a new mode for mixing images, overlapping and blending outlines of the visual image on the infrared image. User can take and store static images or record and save video clips. The available range of software tools allows an image analysis on the go, also in the live mode. Each infrared image can have a text note, voice annotation and/or sketch attached to it. On site reports are possible with the embedded PDF report editor. The camera provides a number of ways to connect to external devices, both wired (USB, HDMI) and wirelessly (Wi-Fi).

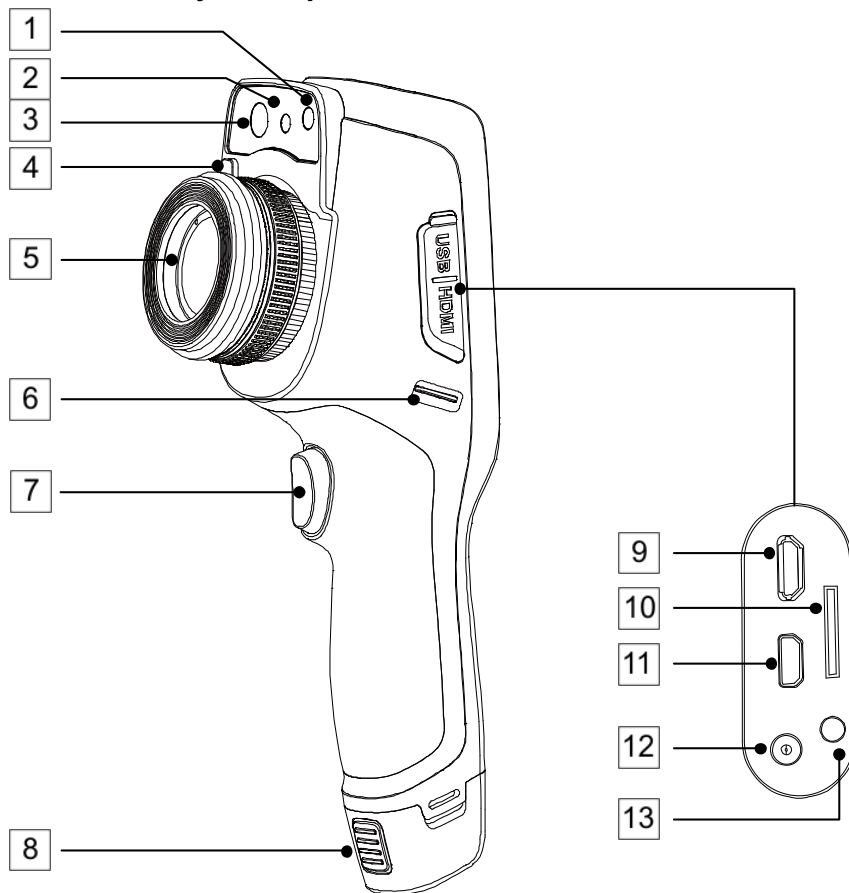
Please acquaint yourself with this manual to improve your daily work with the device, and to avoid measuring errors and prevent possible problems related to operation of the imager.



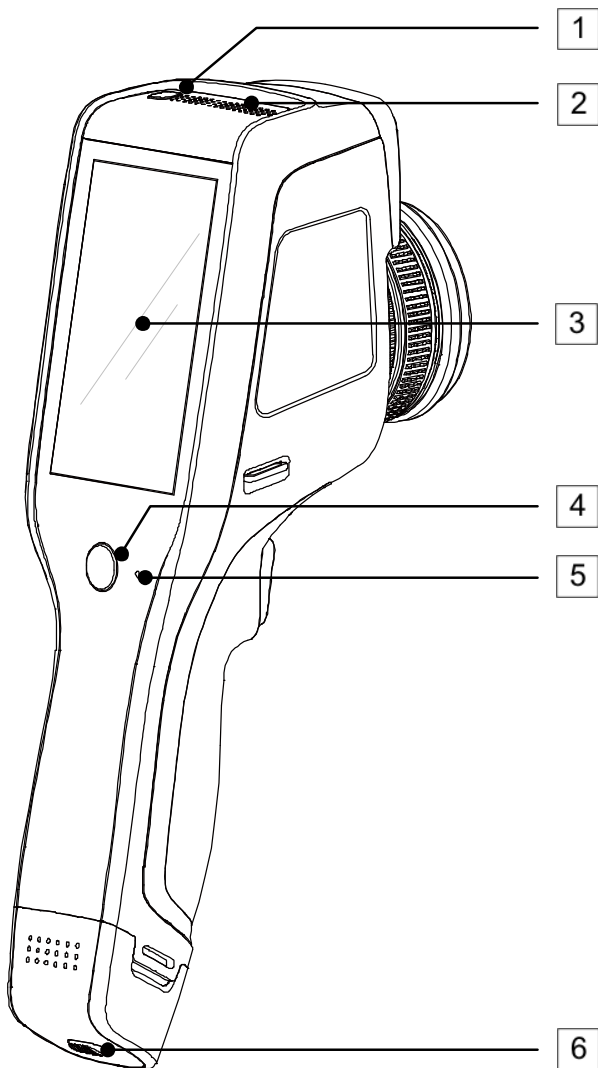
The camera operation and available options may vary, depending on the camera model. This manual describes the operation based on **the highest specs model available**.

### 3 Function buttons and menu

#### 3.1 Camera body description



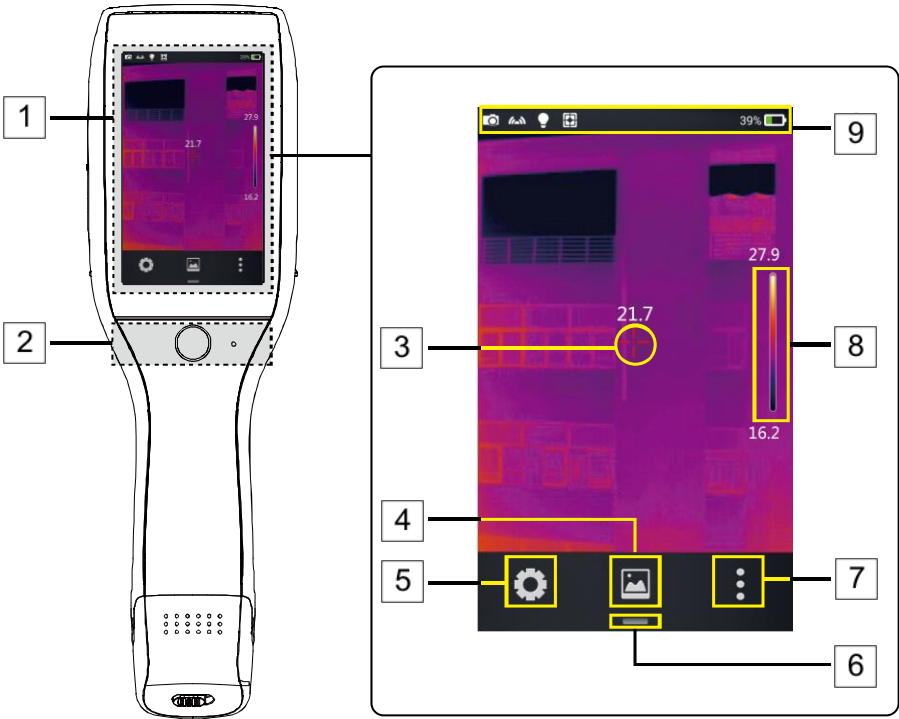
- |   |                     |    |                        |
|---|---------------------|----|------------------------|
| 1 | Flashlight          | 8  | Battery release button |
| 2 | Laser pointer       | 9  | micro USB connector    |
| 3 | Visual image camera | 10 | micro SD card slot     |
| 4 | Lens release button | 11 | micro HDMI connector   |
| 5 | Lens                | 12 | Power supply connector |
| 6 | Wrist strap holder  | 13 | Charging indicator     |
| 7 | Trigger button      |    |                        |



- |   |                     |   |               |
|---|---------------------|---|---------------|
| 1 | Power On/Off button | 4 | Return button |
| 2 | Speaker             | 5 | Microphone    |
| 3 | LCD display         | 6 | Battery lock  |

## 3.2 Overview of the camera's functional areas

### A. Functional areas



1 Display area

2 Control area

3 Central point cursor

4 Gallery

5 System settings

6 Shortcut menu button

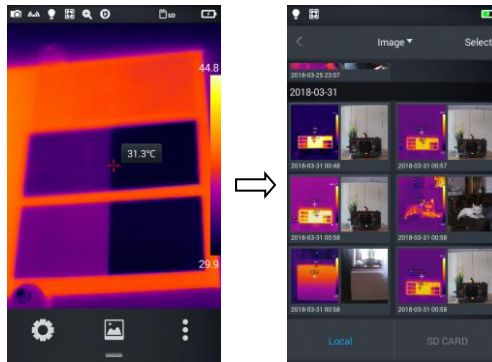
7 Real-time editing mode

8 Palette

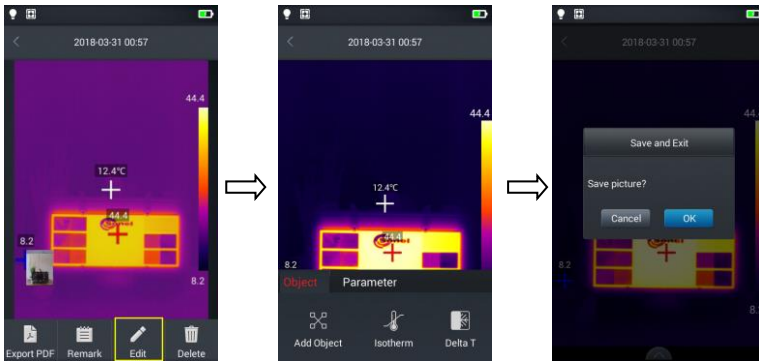
9 Status identification area

## B. Gallery

1. Click the gallery button in the main menu. This will display the image overview mode. Click the image you want to view and analyze, and the image editing screen will appear.



2. Tap the **Edit** button at the bottom to enter the analysis object editing areas. When the image is modified, the system will prompt a dialog box asking to save the changes: **Save Picture?** press **OK** to save modifications, or **Cancel** to keep the image unchanged.

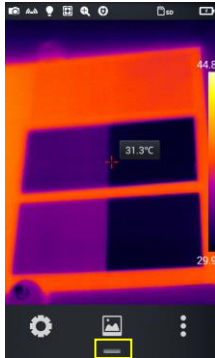


### C. Shortcut menu

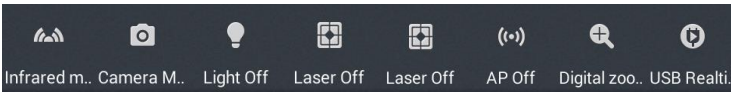
The interface displays shortcuts for some of the operations that can be performed in real-time, mainly including: changing the picture mode, flashlight on/off button, laser on/off button, wireless access point switch, etc.

How to enter the shortcut menu:

1. In real-time image mode, press the shortcut icon [—] at the bottom of the screen.



2. The shortcut menu includes the following content:



**IR Mode (image):** switches between modes: infrared, visible, fusion and PIP.

**Camera Mode:** camera operation mode: switching between image taking mode and video recording mode.

**Light:** turns the flashlight on/off.

**Laser:** turns the laser pointer on/off.

**AP:** turns the wireless access point on/off.

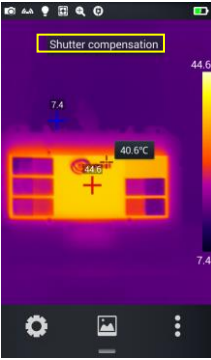
**Digital zoom:** sets the digital magnification from x1 to x4.



**USB Realtime Video:** enables/disables the USB video connection in real time mode.



### 3.3 Manual Calibration



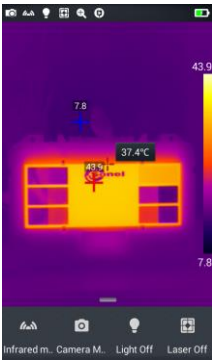
During operation the camera performs auto calibration procedure every once in a while (signaled by the sound of a camera shutter). During the calibration, for about 1 second, **the device does not respond to user's activity**, during this time the sound of a shutter clicking twice is heard. The calibration can be triggered manually at any time. To do that tap the screen twice at any place while the camera is in real time mode. The camera will carry out the calibration procedure followed by a message displayed on the screen.

## 4 Observation

### 4.1 Image mode switch

Enter the real-time image mode and tap the IR mode button on the shortcut menu multiple times to perform multiple mode switching operations for the current image.

The screen can be switched between the following four modes:



A. Infrared



B. Visible



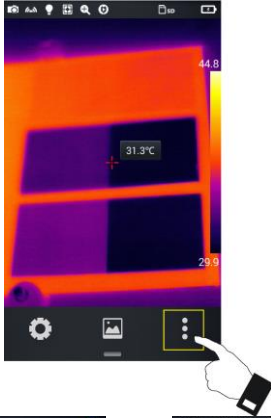
C. Fusion



D. PIP

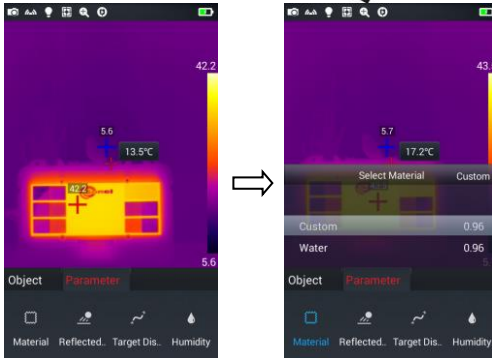
## 4.2 Temperature measurement

1.



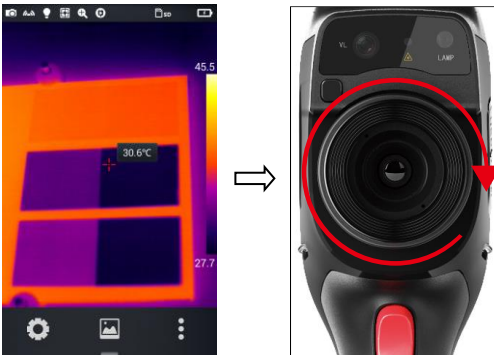
In real-time image mode tap the shortcut menu button [ ⋮ ] in the lower right corner of the screen.

2.



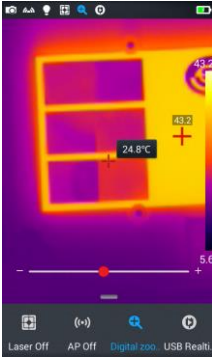
- Tap the material settings button in the **Parameter** menu, go to **Material** and select the emissivity of the measured object by:
  - ⇒ swiping the list of materials up and down, or
  - ⇒ by selecting **Custom** option and set the emissivity value with the slider.
- Then tap **Back** button twice or press the IR image on the screen to save the changes and return to the real time mode.

3.



- Align the central point cursor with the measured object for temperature measurement. Rotate the outer lens clockwise or counter clockwise to adjust the focus point.

## 4.3 Digital Zoom



In the real time image mode, press the [ ] button at the bottom to open the shortcut menu and then slide the shortcut bar to the left to the Digital Zoom option [ ], to allow up to 4 times real time image magnification, by sliding the status bar left to right.

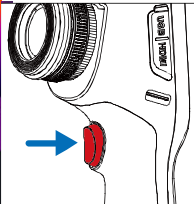
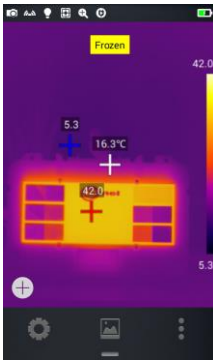
## 5 Images

### 5.1 Capturing images

Set the trigger button function in the system settings (sec. 7.14).

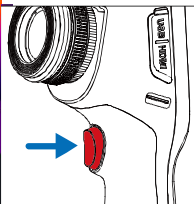
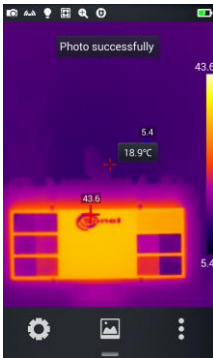
For **freeze/photo** mode:

1.



Press trigger button to freeze an image.

2.





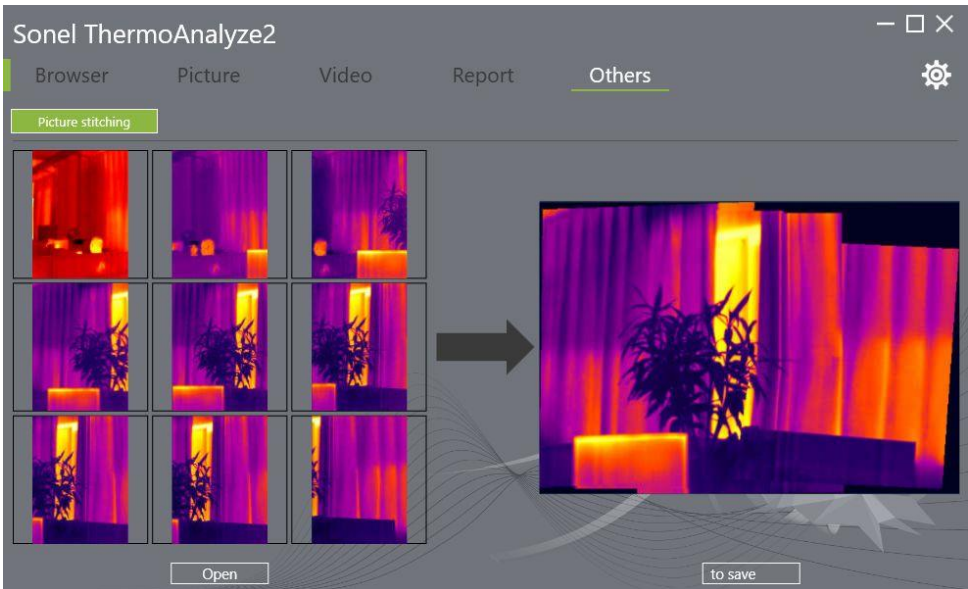
With the image frozen, press the trigger button again to save the image.





This function works only in the infrared mode.

## 5.2 Creating a panorama



1. Go to **Settings**  ► **Photo setting** and set **Panorama** (see **sec. 7.14**).
2. Using  go back to the live view.
3. Take a series of 9 images as indicated on the grid at the top left of the display. Keep in mind the instructions at the bottom of the display. If you want to quit before the end, select (X) and confirm your decision.
4. Start **Sonel ThermoAnalyze**, go to the **Others** tab, click **Open** and load 9 component photos of the panorama - the program will stitch them together.
5. Press **Save** or **Ctrl + S** to save the panorama.

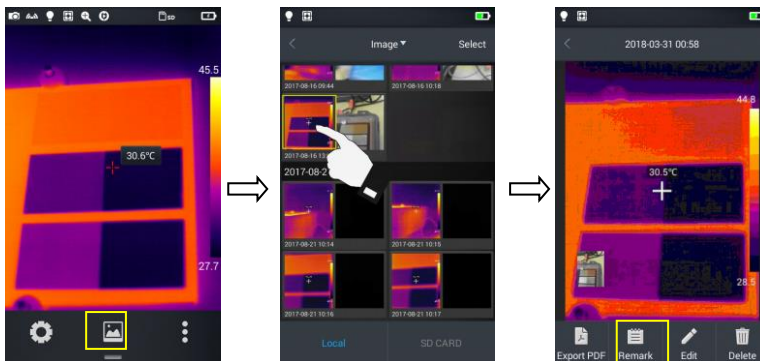


## 5.3 Capturing high-resolution images


1. Go to **Settings**  ► **Photo setting** and set **Super Resolution** (see **sec. 7.14**).
2. Using  go back to the live view.
3. From now on, photos will be taken at a resolution of 768 x 576 pixels.

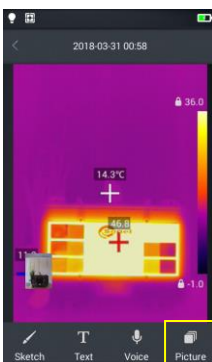
## 5.4 Adding notes

1. Tap the **Gallery**  icon in the middle of the bottom menu to enter the file browsing directory.
2. Select the image to which a note is to be added, by tapping it on the touch screen. The image preview will be displayed.
3. Tap the **Remark**  icon, to enter the notes adding menu.

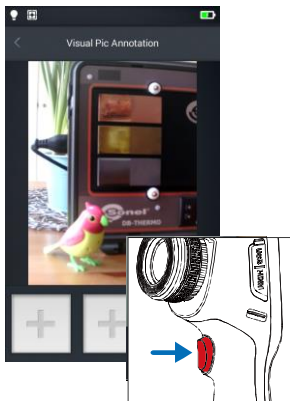


### 5.4.1 Adding picture notes

1. Tap the **Picture** note  icon in the toolbar below to enter the main interface for the picture notes.

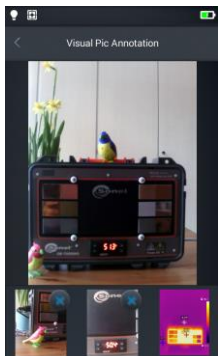


2.



Press the trigger button to take up to two photos in a visible light mode as shown in the figure below.

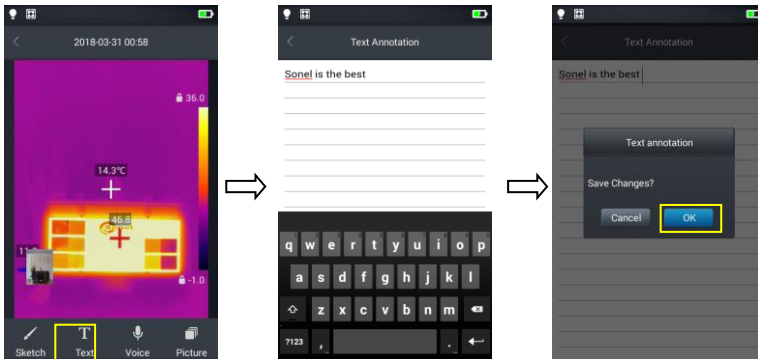
3.



If the picture is not taken correctly, it can be **deleted** by pressing the delete button (**X**) in the upper right corner of the photo and then a new one can be taken.

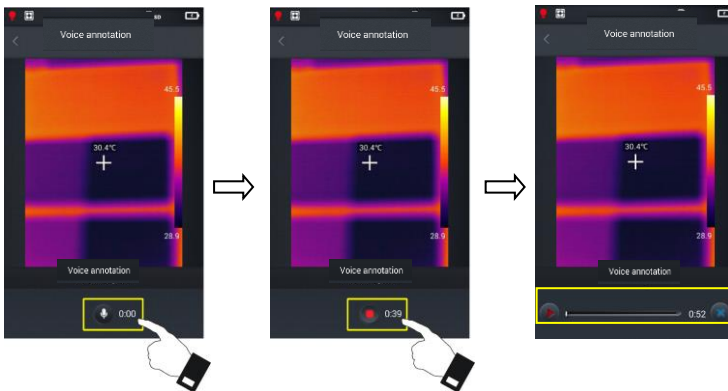
## 5.4.2 Adding text notes

1. Tap **Text** [T] button to add a text note;
2. Access the note input field and enter the text note content;
3. Press the **Return** hardware button or the onscreen [↵] symbol twice;
4. Press **Ok**, to save the text note or **Cancel** to exit without saving.



## 5.5 Adding voice notes

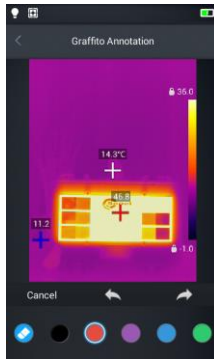
1. Tap **Voice** [🎤] button to add a voice note;
2. Tap [🎤] to start recording;
3. Tap **Stop** to stop recording and save the recorded file. The recording time for a single voice note is limited to 60 s by default, as shown in the figure below.



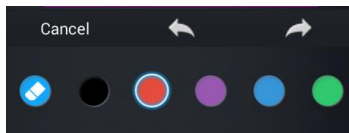
4. Play the recorded voice note by tapping **PLAY** [▶] button or delete by pressing [✕].
5. Press the **Return** hardware button or the onscreen [↵] symbol.
6. Press **Ok**, to save the voice note or **Cancel** to exit without saving.

## 5.6 Adding sketch note

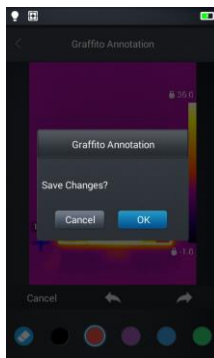
1. Tap **Sketch** [✍️] button to add a sketch note;
2. The buttons at the bottom are eraser (to delete previously drawn sketch) and color (brush) selection. User can select any button and draw a sketch in the image field.



3. Additional functional buttons are (from left to right): **Cancel** - wipes all the drawings off the screen, **Back** – removes the last sketch bit, **Restore** – brings the most recently deleted element back on screen.



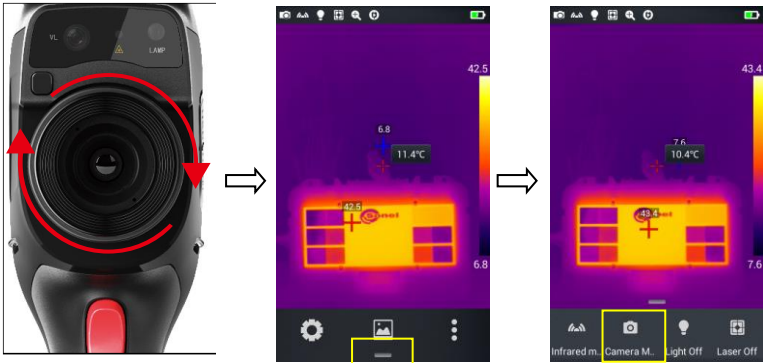
4. Once the sketch note is complete, the **Return** hardware button or the onscreen [<] symbol;
6. Press **Ok** to save the sketch note or **Cancel** to exit without saving.



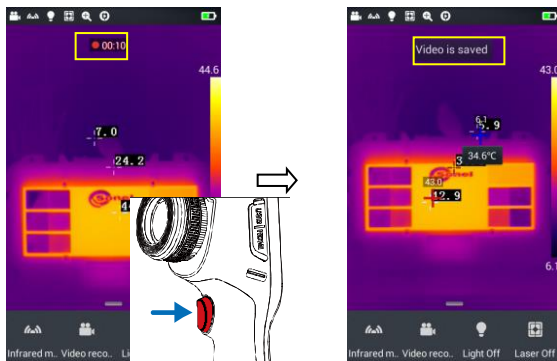


## 5.7 Video recording

1. Switch to the real time mode and point the camera at the object (it is recommended to adjust the focus before starting recording a video);
2. Tap the shortcut menu button at the bottom and then the **Camera** button to enter the video recording mode;



3. Press the trigger button to start recording. Recording time information will be displayed at the top of the screen.
4. Press the trigger button again to stop recording and the video data will be saved. It can later be checked and played in the gallery.

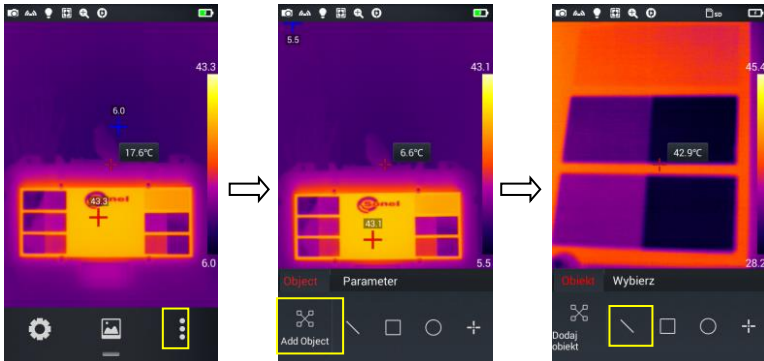


## 6 Image analysis

### 6.1 Real-time analysis

#### 6.1.1 Adding/removing the analysis object

1. Tap the shortcut menu button [⋮] on the right in real-time mode and enter the mode of adding analysis objects, as shown in the figure.



2. Temperature measurement of various analysis objects such as lines, rectangles, circles and points are available. Additionally, a maximum, minimum and average temperatures, as well as the central point temperature, can be displayed on screen.

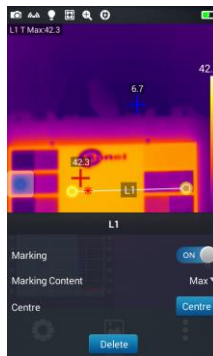
Press and hold any of the analysis objects on the touch screen for a few seconds, to display an object menu with the following functions:

**Marking:** displays the symbolic name of the object when switched on (ON).


**Marking Content:** displays the maximum (red star), minimum (blue star) or average (two stars) temperatures of the object. The selected temperature is displayed in the upper left corner of the screen.

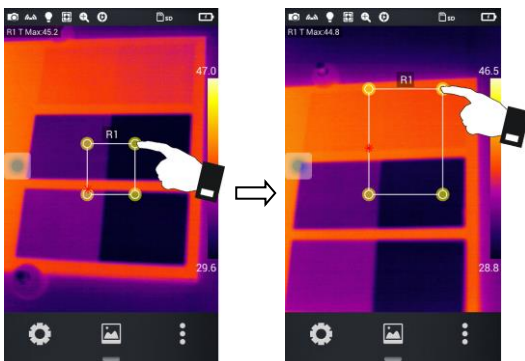
**Centre:** press to reposition the selected analysis object to the centre of the screen.

**Delete:** deletes selected analysis object.




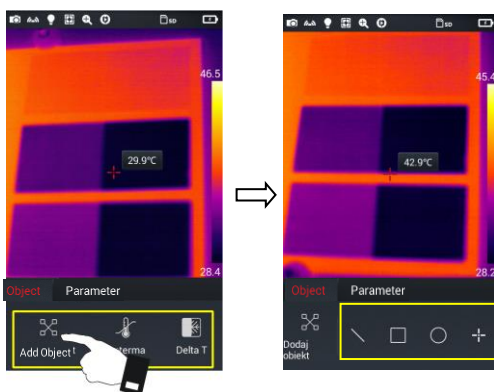
## 6.1.2 Resizing the analysis objects

1. Select an analysis object - its nodes will be selected and displayed as yellow markers [  ];
2. Move any node – the analysis object area will be changed.

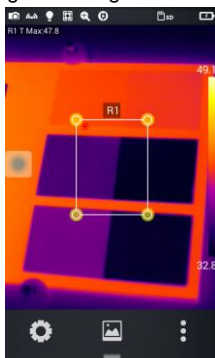


## 6.1.3 Analysis function of a moving object

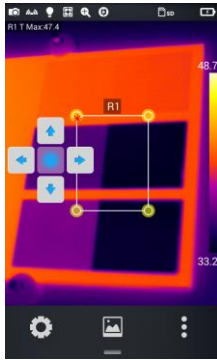
1. Tap the [  ] button to display a submenu for adding the analysis object.



2. Select the desired analysis objects, eg. a rectangle



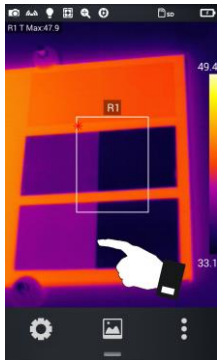
3.



Depending on the camera version:

- use the joystick or
- click the virtual round button to view the virtual cursors. The analysis objects can be moved up/down and right/left with them.

4.

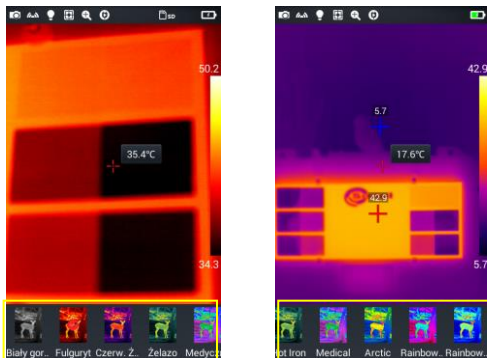


Tap any place on the screen outside the analysis objects to hide the virtual cursors (tap the analysis objects again to bring back the cursors).

5. Select one of the many analysis objects, and the selected object will be able to be moved using virtual cursors.

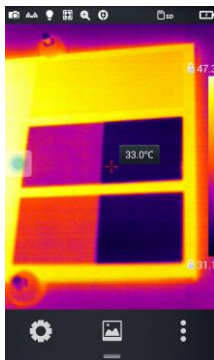
### 6.1.4 Selecting a color palette

1. Go to the main menu, tap the palette area on the right side of the screen - the palette types will appear, including **White Hot, Fulgurite, Iron Red, Hot Iron, Medical, Arctic, Rainbow 1, Rainbow 2**.
2. The user can switch between palette types as desired, as shown in the figure.

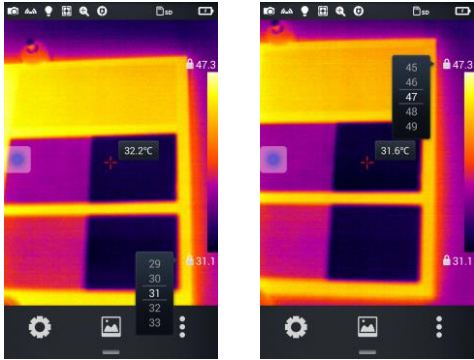


### 6.1.5 Manual brightness/contrast control

1. In the real-time image mode, press the maximum temperature value or the minimum temperature value of the colour bar on the right side of the screen.
2. A maximum or a minimum value of the colour bar temperature in the real-time image mode will be locked.

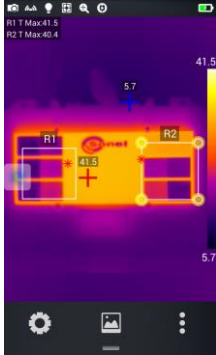
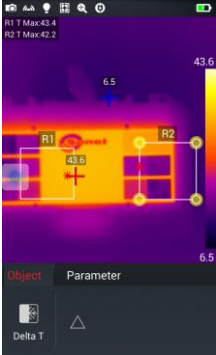


3. Press the maximum or the minimum temperature - the imager will display the corresponding value menu;



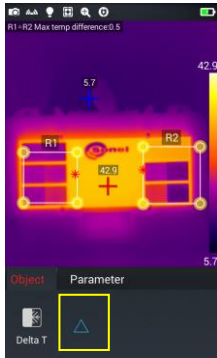
4. After selecting the appropriate high or low temperature value, press any part of the IR image to close the selection window and the value will be saved.

### 6.1.6 Temperature difference analysis

1.   Select at least 2 analysis objects, press the shortcut menu button [⋮] and then the **Delta T** temperature difference button;

2.   Tap the [△] button, to activate the temperature difference mode and select two objects for analysis


3.

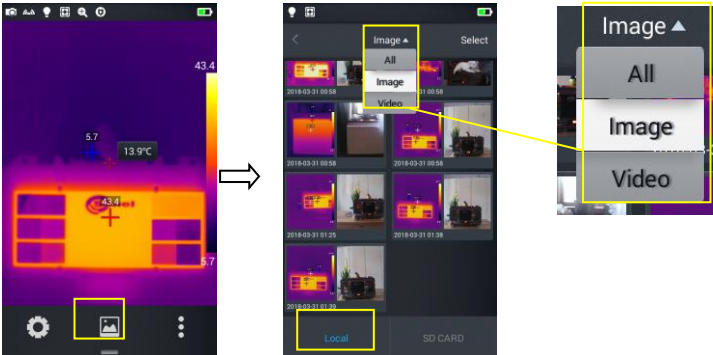


To exit the temperature difference analysis mode, press the [ $\Delta$ ] button again.

Exiting the temperature difference analysis mode

## 6.2 File browsing

1. **Local pictures and videos:** in real-time image mode tap gallery button [, to enter the file browsing main menu, select **Image** → **All** – and the system will automatically display all local files.



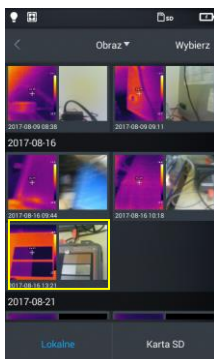
2. **Files and videos on a microSD card:** In the real-time image mode, tap the gallery button to enter the file browsing main menu, then press **SD CARD** - the system will display all the files on the microSD card.



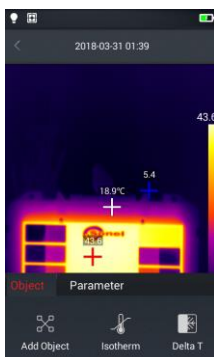
## 6.3 Image analysis

### 6.3.1 Image editing

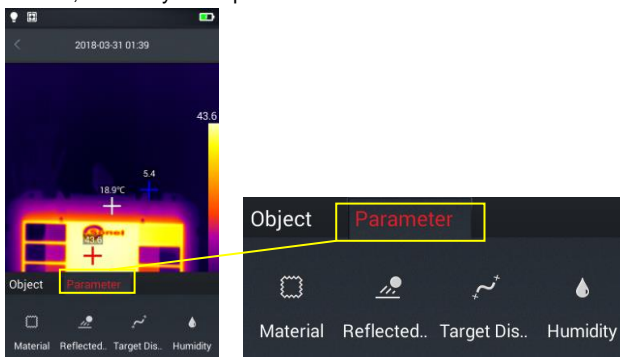
1. In file browsing mode, press any photo to enter the image editing mode;



2. Tap [✎] button - the system will enter the edit mode. In this mode, following elements can be added or modified: analysis object, isotherm and temperature difference (Delta T) between two points for the selected picture.

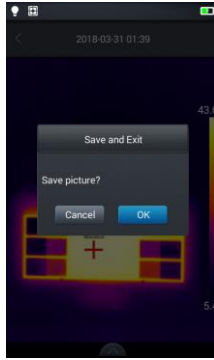


3. Tap **Parameter** button, to modify other parameters.





4. Press **OK** to exit this mode and to save the settings, as shown in the figure below.

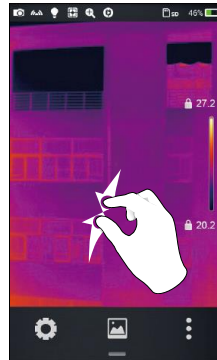


### 6.3.2 Zooming in and out

1. In edit mode, place two fingers on the screen and spread them apart. Doing this the photo can be enlarged up to 10 times.
2. Place two fingers on the screen and pinch them close to downsize an image.

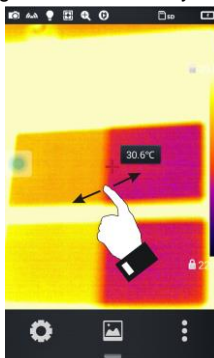


Zooming in




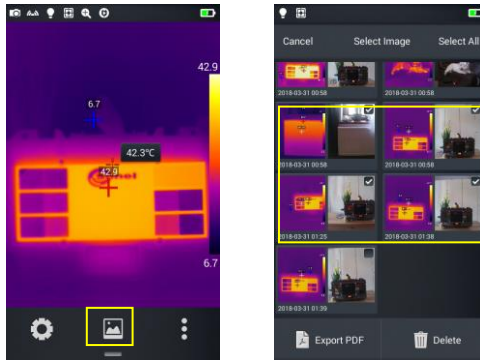
Zooming out

3. To slide an enlarged image within the screen, place one finger on the screen and move it in the desired direction. The enlarged image can be moved by swiping a finger across the screen.

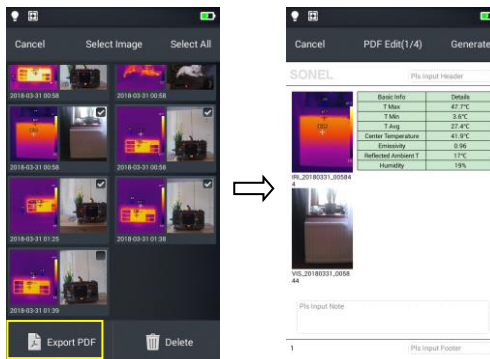


## 6.4 Creating a PDF file

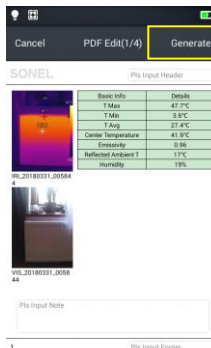
1. In real-time image mode tap gallery button ;
2. Tap **Select** button, and choose up to 5 images as shown in the figure below;



3. Press **Export PDF** button in the lower left corner to create a PDF file preview.

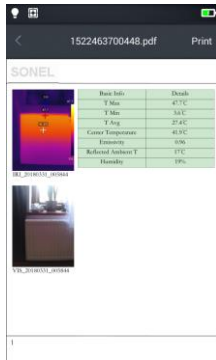


4. Press the **Generate** button to create the file.



## 6.5 PDF file printing

1. In **Connecting** settings connect to a wireless Wi-Fi network (wireless printing).
2. Select a picture in the gallery and generate a PDF (see section 6.4 for detailed information).
3. Press the **Print** button at the top right side of the PDF preview interface.
4. In Print Ready mode, press **Print** to print wirelessly.



Printing PDF



Wireless printing preview

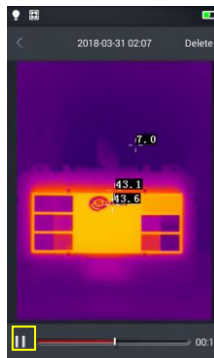
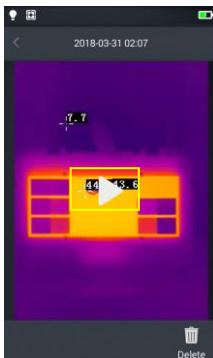
## 6.6 Video playback

- 1.



In gallery select **Image** → **Local Video** and select a video file to play;

- 2.



Play the video:

Follow these steps:

- ⇒ Tap 'Play' button at the center of the screen to play the video;
- ⇒ Tap 'Pause' button at the bottom of the screen to suspend video playback

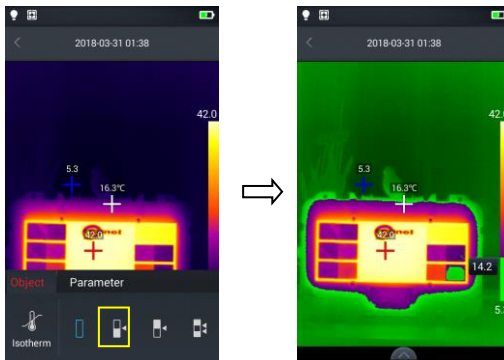
## 6.7 Isotherm

1. In real-time image mode tap gallery button [🖼️], to enter the file browsing menu;
2. Select and edit an infrared image;
3. Enter the edit menu at the bottom and select **Object** → **Isotherm**.



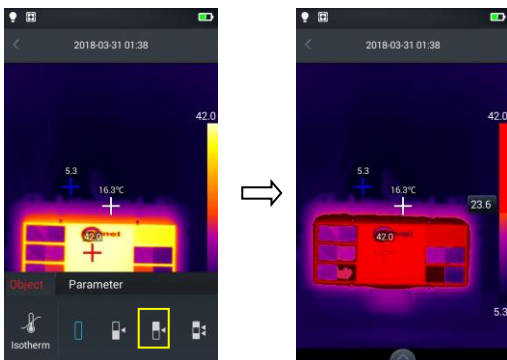
### 6.7.1 High isotherm

1. Enter the edit mode and select **Object** → **Isotherm**.
2. Tap [🎯] icon on the isotherm bar – the camera will display a target view for the high isotherm picture mode.



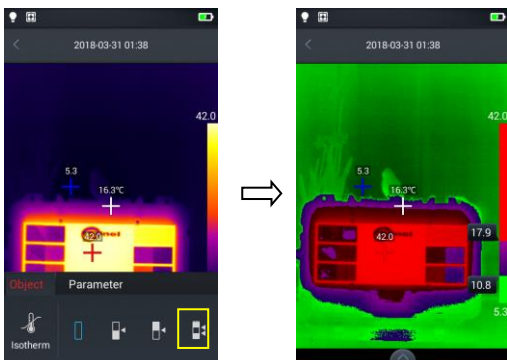
## 6.7.2 Low isotherm

1. Enter the edit mode and select **Object** → **Isotherm**.
2. Tap [📷] icon on the isotherm bar – the camera will display a target view for the low isotherm picture mode.



## 6.7.3 Out of range isotherm

1. Enter the edit mode and select **Object** → **Isotherm**.
2. Tap [📷] icon on the isotherm bar – the camera will display a target view for the out of range isotherm picture mode.



## 6.8 Adjusting temperature range and span

1. Enter the real-time image mode and press the maximum or minimum temperature value on the color bar on the right side of the screen (see Figure 1 below). The lock symbol will appear next to the temperature value and the round virtual button will be displayed on the screen (see Figure 2 below). The mode for a manual contrast adjustment will be initiated.

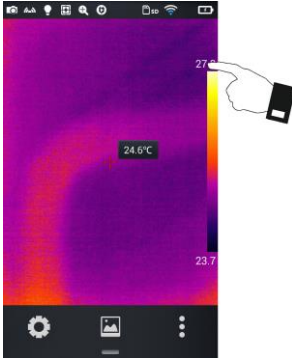


Figure 1

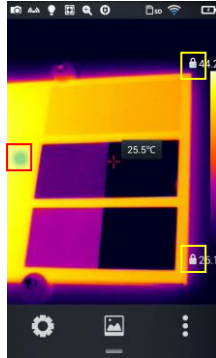


Figure 2

2. Depending on the camera version:

- tap the virtual round button to view the virtual cursors on screen (see Figure 3 below),
- use the joystick.

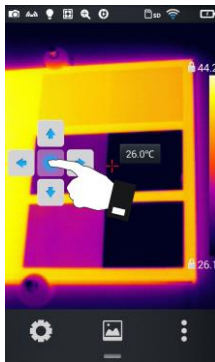


Figure 3

Double-tap one of the locks to return to autoranging mode.

### 6.8.1 Adjusting temperature range

Temperature range adjustment is done by pressing the virtual buttons up/down.

Press the up button to increase the Tmax and Tmin values. Press the down button to decrease the Tmax and Tmin values. This adjustment will apply a corresponding contrasting color that will be reflected in the real-time image mode.

You can also do this by using the joystick.

### 6.8.2 Adjusting temperature scale span

**Adjusting the temperature scale span by pressing the 'left' virtual button.**

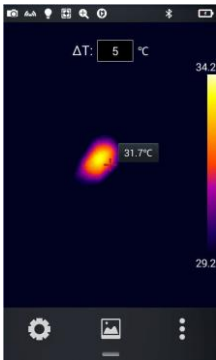
Press the **left** button to decrease the Tmax value and increase the Tmin value. This adjustment will apply a corresponding contrasting color that will be reflected in the real-time image mode.

**Adjusting the temperature scale span by pressing the 'right' virtual button.**

Press the **right** button to increase the Tmax value and decrease the Tmin value. This adjustment will apply a corresponding contrasting color that will be reflected in the real-time image mode.

You can also do this by using the joystick.

### 6.8.3 Semi-automatic adjustment



**In this mode, the  $\Delta T$  parameter can be set: a fixed span of the temperature scale (fixed interval Tmin...Tmax).** The temperature of the central point is always in the middle of this interval, so that the values Tmin and Tmax will change simultaneously as the temperature reading changes. For example:

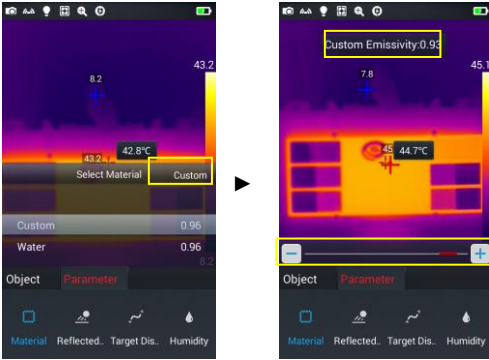
- if the central point has a temperature of 25°C and  $\Delta T$  is 20°C, the temperature scale will turn to 15°C (Tmin)...35°C (Tmax),
- if the central point increases the temperature by 2°C, Tmin and Tmax will increase by the same amount,
- increasing  $\Delta T$  by 2°C will cause Tmin to fall by 1°C and Tmax to rise by 1°C.

**Adjusting the  $\Delta T$  span is done by:**

- selecting the desired value using the joystick - up/down movements,
- touching the  $\Delta T$  field and selecting the desired value

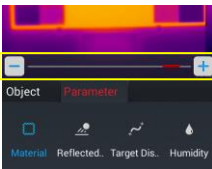
## 6.9 Edit menu

### 6.9.1 Emissivity



- Go to **Select Parameter** → **Material** in the edit menu. There are many materials available to select from. To set user defined emissivity, press **Custom** button..
- Modify the parameters as required by sliding the numerical value from 0.01 to 1.00, as shown in the figure.

### 6.9.2 Reflected temperature



Reflected temperature, also known as ambient temperature. Customizable by slider in the range of: -20°C to 150°C, 150°C to 650°C or 650°C to 1500°C (depending on the camera model and lens type used).

### 6.9.3 Target distance

A distance of the camera from the tested object. Customizable in the range: 1 m to 50 m.



To customize the reflected temperature set the **Auto** option to **OFF**.


### 6.9.4 Humidity

Relative humidity at the measurement site: customizable from 0% to 100%.



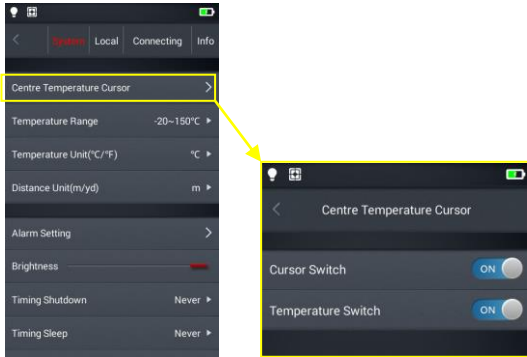
## 7 System settings



In the real-time mode tap the settings button  at the bottom of the screen to enter the global settings mode. In this mode the main parameters of the camera can be changed, including temperature units, distance units, brightness, network connection, date and language.

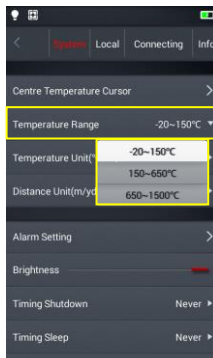
### 7.1 Central Temperature Cursor

This option enables/disables the central point temperature cursor on the screen in real-time image mode and turns on/off the display of the central point temperature value on screen.



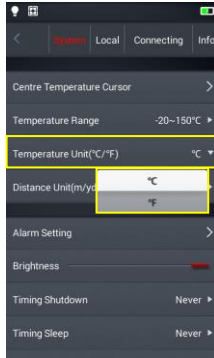
### 7.2 Temperature measurement range

Allows to set the range of the measurable temperature of the measured object.



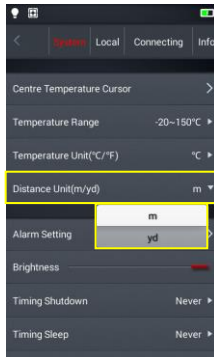
### 7.3 Temperature unit selection

The temperature can be displayed in °C or °F. Default temperature unit: °C.



### 7.4 Distance unit selection

The distance unit can be switched between meter and feet. Default distance unit is meter.

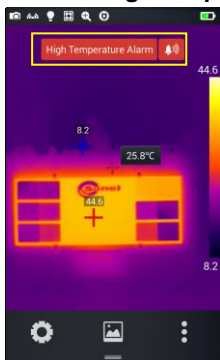


### 7.5 Alarm setting



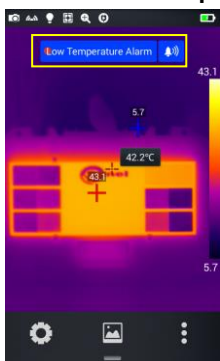
The alarm can be set to go off when exceeding a defined minimum or maximum temperature. By default the temperature alarm is off. The alarm temperature should be set within the selected temperature range, eg. if the temperature range is set as -20°C to 150°C, then the temperature alarm value should be defined within this range.

### 7.5.1 High temperature alarm



1. Activate the temperature alarm, set the alarm type to Tmax and set the temperature value that triggers the alarm when it's exceeded.
2. When in the real-time temperature measurement mode, once the temperature above the alarm threshold is detected, the device will immediately trigger an audible alarm and will display a corresponding message on screen.
3. Tap [🔕] icon, to turn off the high temperature sound alarm.

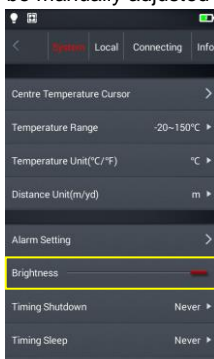
### 7.5.2 Low temperature alarm



1. Activate the temperature alarm, set the alarm type to Tmin and set the temperature value that triggers the alarm when the detected temperature drops below this value.
2. When in the real-time temperature measurement mode, once the temperature below the alarm threshold is detected, the device will immediately trigger an audible alarm and will display a corresponding message on screen.
3. Tap [🔕] icon, to turn off the high temperature sound alarm.

## 7.6 Brightness

The brightness of the touch screen can be manually adjusted by the user.



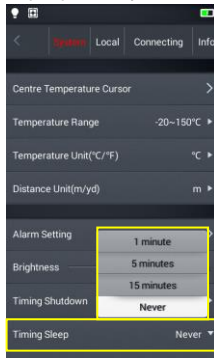
## 7.7 Auto off time settings (Timing Shutdown)

The camera can automatically shut down when not used for a while. User can define shut down times as 5, 10, 30 or 60 minutes, or choose 'Never Shutdown' option. By default the camera is in 'Never Shutdown' mode.



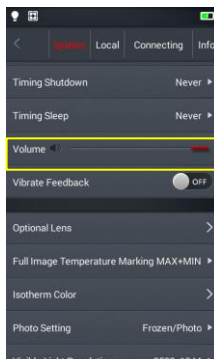
## 7.8 Sleep mode time settings (Timing Sleep)

The camera can be set to go into sleep mode after 1, 5 or 15 minutes of not being used. Sleep mode can also be deactivated by choosing 'Never Sleep' option. By default the camera is in 'Never Sleep' mode.



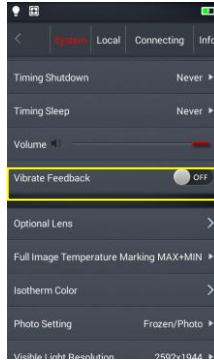
## 7.9 Volume

Adjust the volume of the camera or mute it.



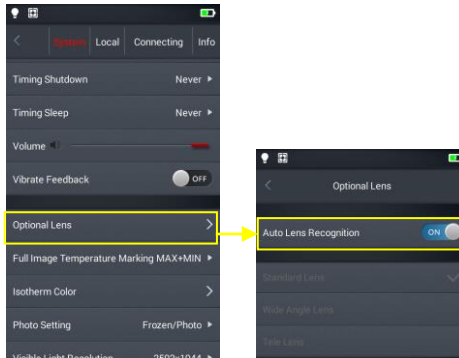
## 7.10 Vibrate feedback

Activate or deactivate the vibration feedback.



## 7.11 Automatic lens recognition

Automatic lens recognition is enabled by default, the camera automatically sets the settings for the lens used. Manual selection of the lens is possible.



### 7.11.1 Disabling the automatic lens recognition



When automatic lens recognition is turned off, users can manually select a standard, wide-angle or telephoto lens, according to the characteristics of the lens of their choice.

Standard is for lens:  $28.4^{\circ} \times 21.5^{\circ}/19 \text{ mm}$

## 7.12 Indication of the maximum and the minimum temperature on screen (Full Image Temperature Marking)



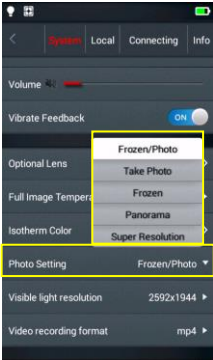
In real-time image mode the camera can be set to display the maximum, the minimum or both the temperatures on screen. By default the min/max temperature indicator is off.

## 7.13 Isotherm Color



The colors of high/low temperature isotherms are customizable.

## 7.14 Image taking mode settings (Photo Setting)



The following modes can be selected in this settings menu:

**Frozen/Photo:** freeze and save: Press the trigger button once to freeze an image. Press the trigger again to save it.

**Take Photo:** freeze and save with a single click: Press the trigger button to freeze and save the image, all at once.

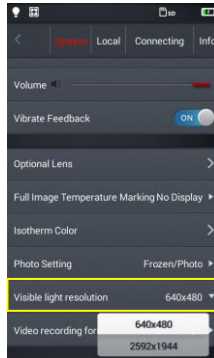
**Frozen:** freeze only: Press the trigger button to freeze an image. Press the trigger button again to unfreeze the image. In this mode, an image can't be saved.

**KT-400 Panorama:** taking a series of images to be stitched together into a single larger image in the Sonel ThermoAnalyze software.

**KT-400 Super Resolution:** like Frozen/Photo. The image has an increased resolution.

## 7.15 Visible light camera resolution

Changing resolution of the visible light camera.



## 7.16 Video format

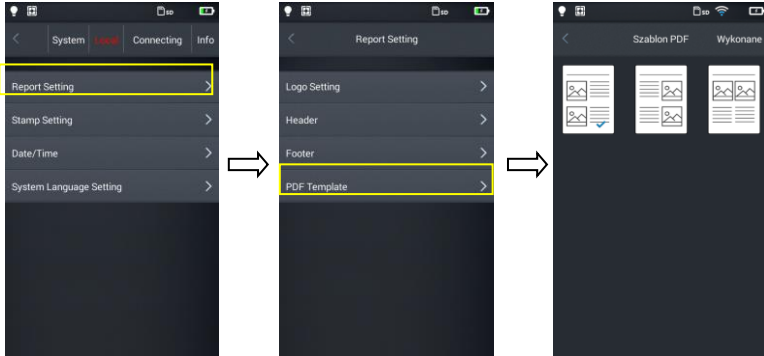
Changing video format.



## 8 Local settings

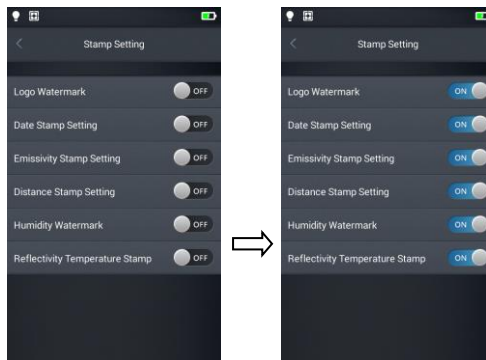
### 8.1 Report Settings

The following parameters can be modified for a PDF report: logo, header, footer and a PDF template selection (3 preset templates available).



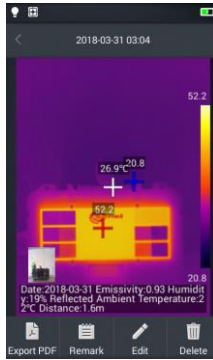
### 8.2 Stamp settings

1. In stamp settings the following options are available: logo watermark, date stamp, emissivity stamp, distance stamp, humidity watermark, reflectivity temperature stamp.



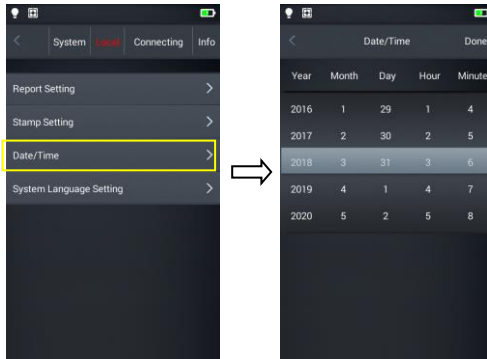
2. Once the settings are done, go to real-time mode screen and take a sample picture.
3. Tap the gallery shortcut button, enter the image viewing mode and select the preview of the captured image.
4. All selected watermarks are displayed at the bottom of the preview.





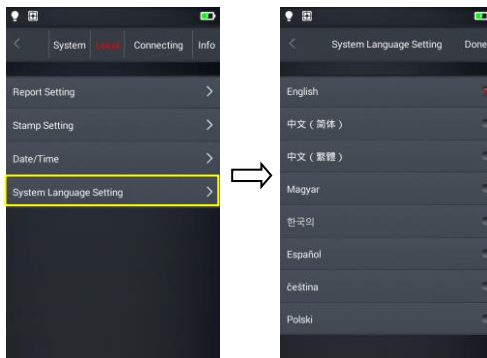
### 8.3 Date/Time

Set the date and time in the system manually by scrolling their components up/down.



### 8.4 System Language Settings

Select a language from the list of available languages.

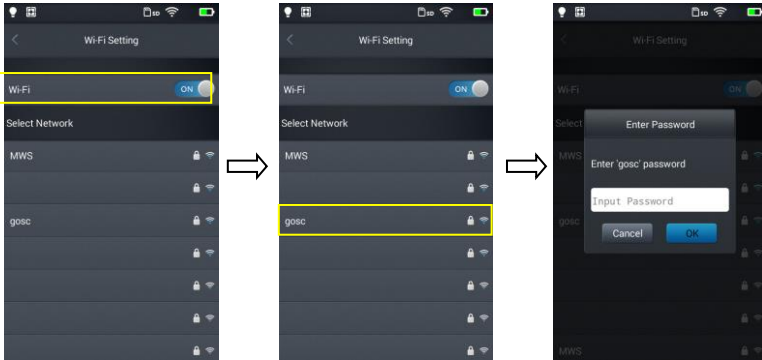


## 9 Connection settings

### 9.1 Wi-Fi settings

1. Enter Wi-Fi Setting menu.

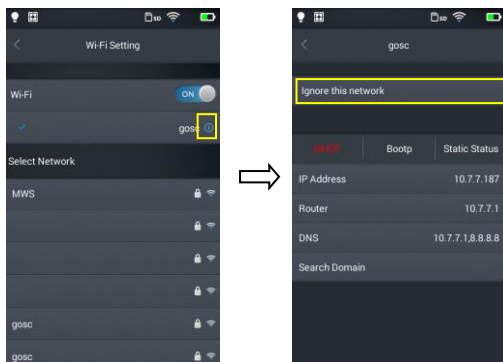
2. To select a network: tap one of the networks shown in the list and enter the password if required.



3. Type in correct password and press **OK**.



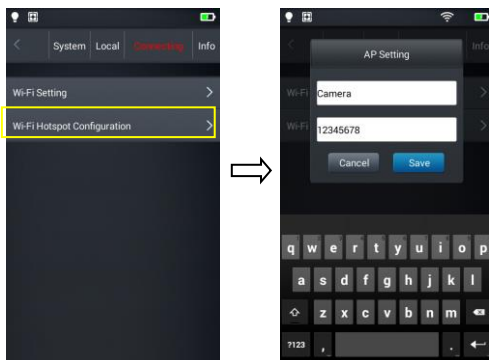
4. The Wi-Fi address setting interface menu can be entered by tapping the More Info Button [ⓘ]. Ignoring the network: Press the [ⓘ] button next to the network name you entered previously and press **Ignore this network**.



If [📶] icon appears at the top of the main screen, you are connected to the wireless LAN network

## 9.2 Wi-Fi Hotspot Configuration

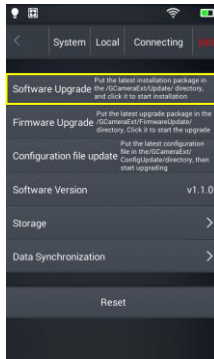
1. Enter the Wi-Fi hotspot configuration menu.
2. In the configuration interface (AP Setting), enter the name of the hotspot, which is set as default as: "Camera" and the default password is "12345678", then tap the Save button to save the settings.
3. The custom SSID settings and the hotspot access point password are saved successfully.



## 10 Other settings (Info)

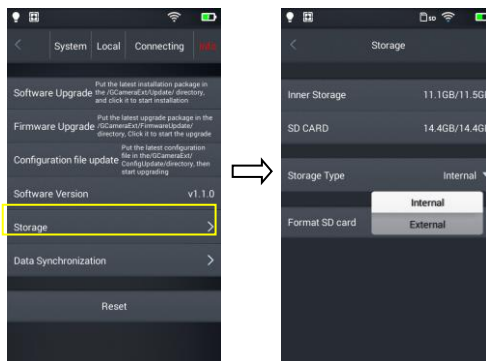
### 10.1 Firmware update

The camera allows to update both the firmware (that runs and governs the operation of the device) and the Software (user interface). To proceed with the update copy the update file to the appropriate folder on the SD card as indicated in the camera menu. If an external SD card reader was used, insert the SD card into the camera. Press the upgrade button to initiate the upgrade procedure, and then follow the on-screen instructions. After the update is complete restart the device.



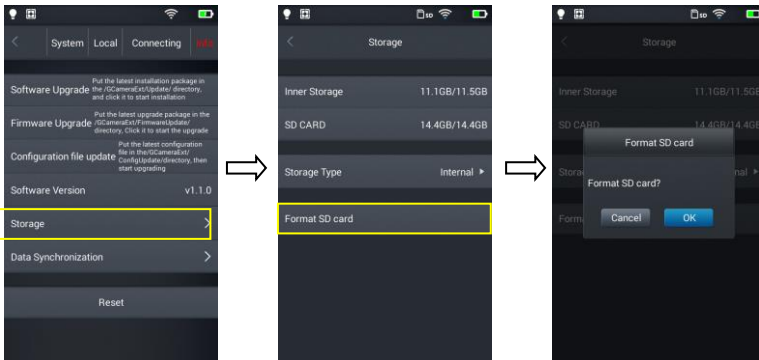
### 10.2 Storage

This option mainly shows basic information about the remaining internal and external memory space. It also allows to select the storage location for files: built-in internal memory or external memory - micro SD card.



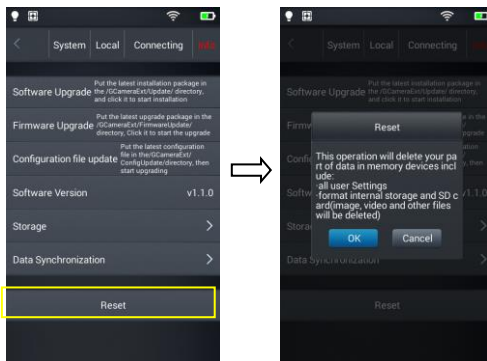
### 10.3 Formatting microSD card

To start formatting select **Storage** → **format SD card**, and then press **OK**. Note that formatting permanently deletes all photos and other data on the memory card. Before formatting, make a backup of your files if necessary.



### 10.4 Restoring the default settings

1. Tap **Reset** and then **Ok**.
2. Enabling this function will reset the device to its factory settings. Use it carefully.



# 11 Connection with External Devices

## 11.1 Port Connection

The camera can be connected to external devices via HDMI and USB cable.

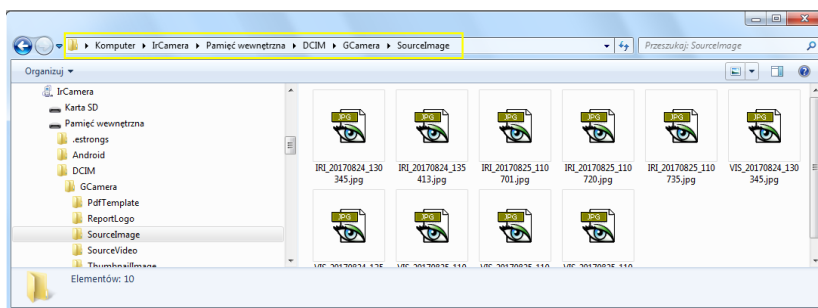
## 11.2 Micro HDMI Interface

The micro HDMI interface is mainly used to connect an external display, i.e. a monitor, a TV set or a projector. Please ensure that the target display is equipped with an HDMI interface.

1. Connect the HDMI cable to the thermal imager.
2. Insert the Micro HDMI connector with the <HDMI> symbol towards the front of the device.
3. Connect the HDMI cable to the HDMI IN jack of the external display.
4. Turn on the external display and switch the video input to the selected port.

## 11.3 USB Interface

1. Viewing files stored in the internal memory: connect the USB cable to a computer, then open My Computer to view the internal memory icon. Click it to enter the memory and find the folder containing the source image. The access path is ...\\IrCamera\\InternalMemory\\DCIM\\GCamera\\SourceImage.

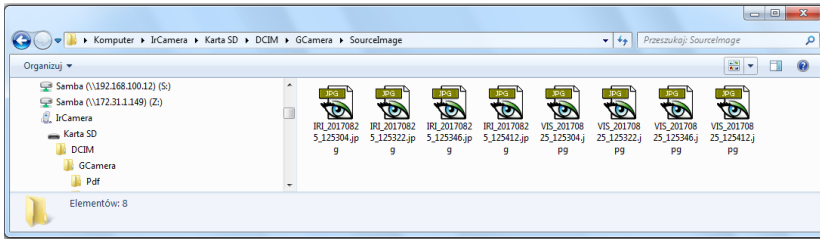


File names starting with IRI are infrared images and files names starting with VIS are visible light images.

2. Browsing files on the microSD card.

In order to save files on the microSD card go to settings – **Info** → **Storage** → and select **SD CARD**, and now the pictures will be saved on the microSD card.

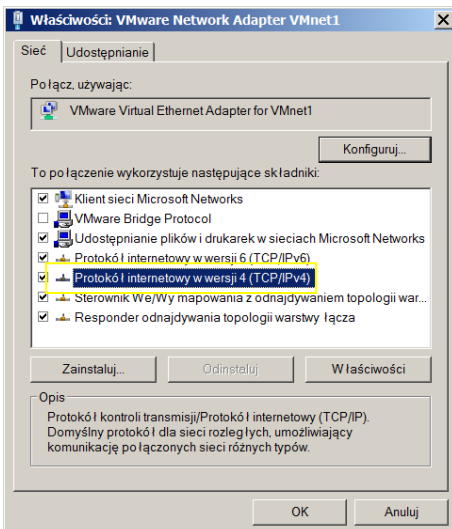
Use the USB cable to connect to the computer, and then open My Computer to view the internal memory icon. Click it to enter the memory and the path is ...\\IrCamera\\SDCard\\DCIM\\GCamera\\SourceImage.



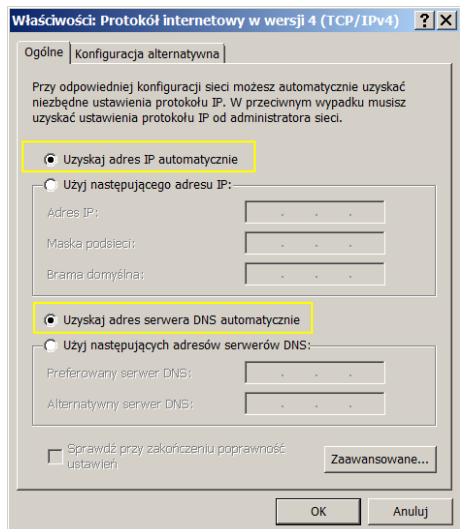
File names starting with IRI are infrared images and files names starting with VIS are visible light images.

## 11.4 USB cable connection

1. Connect the camera to PC using USB cable.
2. A new network connection should appear. If the connection has not been set up automatically, go to "TCP/IP v4" in the network settings menu, configure "Internet protocol version 4 (TCP/IPv4)" as "obtain an IP address automatically and "obtain DNS server address automatically" (see images below):

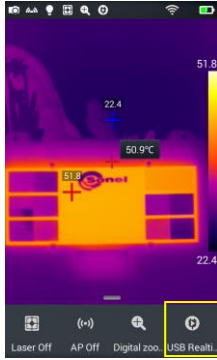


First step

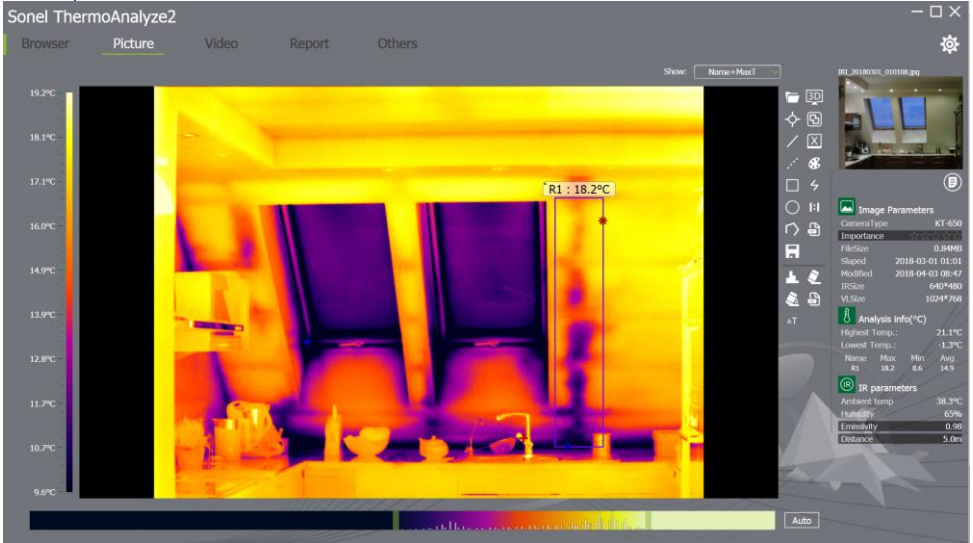


Second Step

3. Start the real-time video mode,



4. After the camera has been identified by the computer, open the analysis software (see image below).



5. Click the "video" button and select the "On-line" option and then the camera. Then follow the instructions provided with the PC software.



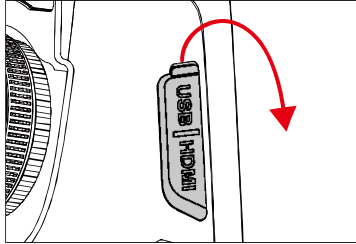
## 11.5 Installing memory card and lens

The camera supports microSD cards. All photos and videos can be stored on either local or on microSD card. The maximum supported microSD card capacity is 32 GB.

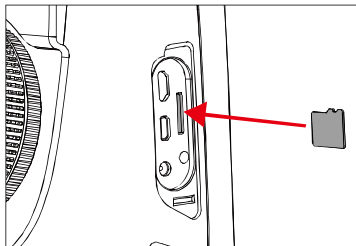
Make sure that the write-protect switch on the memory card, at the top of it, is set to open to allow to write or erase data.

### 11.5.1 Installing memory card

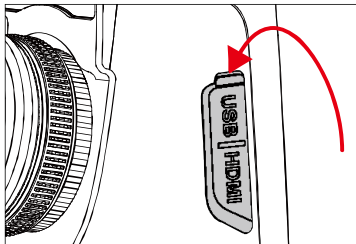
1. Turn off the camera. Slide the slot cover in the direction pointed by the arrow below.



2. Insert the memory card into the SD card slot until a clicking sound is heard.



3. Close the slot cover by sliding it in the direction of the arrow.



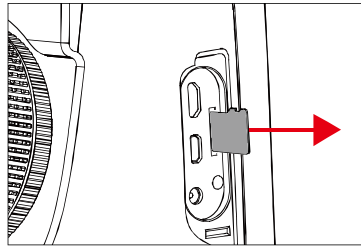
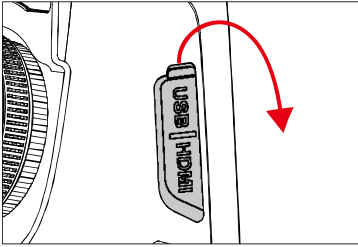
4. Turn on the camera.



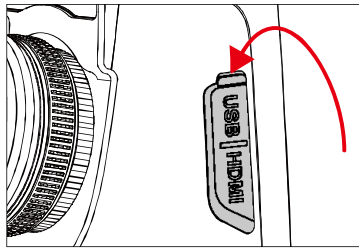
The number of images that can be stored on a card depends on the size of the data carrier used.

### 11.5.2 Removing memory card

1. Turn on the camera and open the slot cover.
2. Gently press the memory card, and then release the pressure.

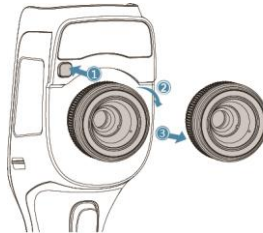


3. Pull out the card and close the slot cover.

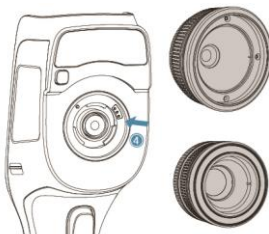


### 11.6 Installing optional lens

1. Mounting the lens: Press the **Split (lens release)** button to align the red dot on the back of the lens with the red dot on the device.



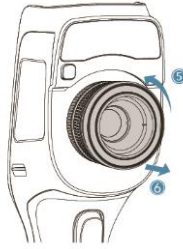
2. Select an appropriate lens, and then rotate it clockwise to mount it.



(the wide angle lens)

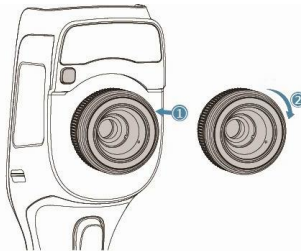
(the tele lens)

3. Unmounting the lens: Press the lens release button and align the red dot on the back of the lens with that on the unit. Then gently remove the lens.

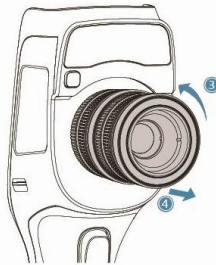


## 11.7 Installing high temperature filter lens

1. Filter installation: insert a high temperature lens into the threaded standard lens hole, then rotate the lens clockwise:

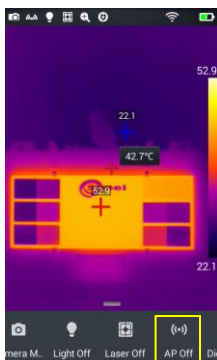


2. Removing the lens: rotate the high-temperature lens counter-clockwise to remove it:



## 11.8 Wireless Access Point (AP) settings

1. Bring up the shortcut menu on the main screen, press the **AP Off** button to enable the AP function, the button status will change to **AP On** (access point on).
2. The status bar will automatically display that the AP function has started and a wireless network initiated by the network card embedded in the camera is available (factory default SSID: GCamera); SSID is the name of the network (changeable in the camera menu).
3. To turn off this function tap the **AP** button again.



The camera with the access point enabled is ready to work with a PC software and mobile devices applications via the WiFi network.

**Refer to the manufacturer's website to find information about the applications.**

## 12 Troubleshooting

Problems	Causes	What to do
The camera doesn't turn on	Insufficient battery power	Recharge the battery and try to use it again
	Poor battery contact	Remove the battery, insert it correctly back into the battery chamber
	The external battery charger plug is not inserted correctly	Pull out the plug and re-insert it
Deviation between the battery consumption indicator and actual energy consumption	discharged battery	Replace the battery with a fully charged one
	the battery has exceeded its expiration date	Insert new battery
IR image is blurry	Focus adjustment has not been made correctly	Manual focus adjustment needs tweaking to make the image sharp
	steamed up or polluted lens	Clean the lens with a specialized lens cleaning kit
Visible light image is blurry	The surroundings are too dark	Improve lighting
	The front part of the device is steamed up or polluted	Clean the front part with a specialized cleaning kit
The temperature measurement is not accurate.	Focus adjustment is not correct	Manually adjust the focus to make the image clear and then read the temperature
	Temperature measurement parameters are not set properly	Change the parameter setting or restore the default parameters
	The auto calibration procedure has not been performed for a prolonged period of time	Perform the auto calibration procedure
	Temperature measurement starts immediately upon start-up	To ensure the best accuracy of the temperature measurement, we recommend to start the temperature measurement 5-10 minutes after start-up
	Long time since the last factory calibration	To ensure accurate temperature measurements, we recommend to periodically send back the thermal imager for calibration (once a year)

## 13 Cleaning and maintenance



### NOTE!

- Use the below specified methods of maintenance only.
- The KT series thermal imaging cameras do not comprise any parts serviceable by the user. Do not attempt to dismantle or modify the camera on your own. **Opening the instrument voids the warranty.**

Camera enclosure - all surfaces, except for optical elements of the camera, can be cleaned with a soft and moist cloth with generally available mild detergents. Do not use any solvents or cleaning agents that could scratch the enclosure (powder, paste, etc.). During cleaning, the camera must be turned off.

Due to the applied anti-reflective coating, optical lens are the most sensitive and at the same time the most expensive part of the camera (the lens is of key importance to radio-metric capabilities of the infrared system). Therefore it is important to close the protective lens cover after each use of the camera. Optical surfaces **should be cleaned only, when** they are visibly fouled. Do not touch exposed surfaces of optical lens with fingers, because fouling left with fingerprints can be harmful to coatings and glass of the lens.

Chemical agents must not be used for cleaning the optical viewfinder, and particularly op-tics and accessories of the camera. Use a clean, dry and soft cloth for cleaning the body of the viewfinder; for cleaning the lens, use only the supplied lens cleaning cloth.

## 14 Storing

When storing the instrument, observe the following guidelines:

- make sure the camera and its accessories are dry,
- when storing the camera for a prolonged time, remove the batteries,
- allowed are storage temperatures specified in technical specifications,
- in order to avoid complete discharging of rechargeable batteries during prolonged storage, charge them once in a while.

## 15 Dismantling and disposal

Used-up electrical or electronic equipment must be collected selectively, i.e. must not be mixed with waste of other types.

Used-up electronic equipment must be delivered to an appropriate collection centre in accordance with regulations related to used-up electrical or electronic equipment.

Before delivering the equipment to the collection centre do not attempt to dismantle any of its parts.



### NOTE!

Follow local regulations related to disposing of packaging, used-up batteries and rechargeable batteries.

## 16 Specifications

<b>Camera</b>	
Detector resolution	384 x 288 / 25 $\mu\text{m VOx}$
Spectral range	7.5–14 $\mu\text{m}$
Framerate	25 Hz
Thermal sensitivity	45 mK
Focus	Auto
IFOV (standard lens)	1.29 mrad
min. focus distance (standard lens)	50 cm
Lens (field of view/focal length)	28.4° x 21.5°/19 mm
<b>Image</b>	
Display	4", 480 x 800 px, high brightness, touch screen LCD
Image modes	IR / Visual / Infrarufree MIF / PiP
Digital Zoom	1.1...4
<b>Temperature measurement</b>	
Temperature range	Filter 1: -20°C...+150°C Filter 2: +150°C...+650°C
Accuracy	$\pm 2^\circ\text{C}$ or 2% of reading (for ambient temperature from 10°C to 35°C and object temp. 0°C)
<b>Functions</b>	
Image analysis modes	5 points, 2 lines, 5 areas. Temperature indication: min, max, average. Isotherm. Temperature difference. Temperature alarm. Dew point.
Palettes	8
Emissivity coefficient	Selectable from 0.01 to 1.00 or from the list of materials.
Measurement adjustment	Adjustable distance, relative humidity, ambient temperature (reflected)
File format	JPG
IR image annotations	Voice (60 s), text, sketch, photo.
Reports module	PDF reports, report printing through Wi-Fi
Video file format	AVI, IRV (including temperature information)
Built-in features	Visual camera 5 MPix, LED flashlight, laser pointer, microphone, speaker.
Wireless communication	Wi-Fi
Interface	microSD card slot, microHDMI, microUSB 2.0
Power Supply	Li-ion battery (over 4 h continuous operation), built-in charger, AC adapter 110-230 V, (50/60 Hz) / 12 V
<b>Environmental conditions</b>	
Operating Temperature	-10°C...+50°C
Storage Temperature	-40°C...+70°C
Humidity	10% ... 95%
Shock/Vibration	30 g 11 ms (IEC 60068-2-27 / 10 Hz ~ 150 Hz ~ 10 Hz 0.15 mm (IEC 60068-2-6)
Encapsulation	IP54
Weight	approx. 0.84 kg (with battery)
Dimensions (including standard lens and battery)	274 mm x 110 mm x 78 mm

## 17 Accessories

The current list of accessories can be found on the manufacturer's website.

### 17.1 *Standard accessories*

Standard bundle supplied by the manufacturer includes:

- 2 x Li-Ion 7.2 V 3.2 Ah rechargeable battery for thermal imagers KT- 400 – **WAAKU24**
- MicroUSB cable for data transmission – **WAPRZUSBMICRO**
- Hand strip – **WAPOZPAS4**
- MicroHDMI cable – **WAPRZMIKROHDMI**
- Protective gloves (for operating the touchscreen) – **WAREK1**
- MicroSD card 16 GB – **WAPOZMSD16**
- Power supply adaptor Z13 – **WAZASZ13**
- L-6 hard carrying case – **WAWALL6**
- User manual
- Factory calibration certificate

## 18 Manufacturer

The manufacturer and provider of warranty and post-warranty services for this instrument is:

**SONEL S.A.**  
Wokulskiego 11  
58-100 Świdnica  
Poland  
tel. +48 74 858 38 60  
fax +48 74 858 38 09  
e-mail: [bok@sonel.pl](mailto:bok@sonel.pl)  
web page: [www.sonel.pl](http://www.sonel.pl)



**NOTE!**

Only the manufacturer is authorized to perform service repairs.



## 19 Exemplary emissivity coefficient values

aluminum.....	0.05	lead: polished .....	0.08
aluminum Rough.....	0.07	lead: grey.....	0.28
Aluminum oxidized.....	0.25	lead: oxidized.....	0.63
asphalt.....	0.90	paper white.....	0.90
asbestos board .....	0.96	paper black glossy.....	0.90
asbestos (fiber).....	0.78	paper black dull .....	0.94
akelite.....	0.93	paper: tarred.....	0.92
bronze: dull .....	0.22	plastic: black.....	0.95
bronze: polished .....	0.10	platinum.....	0.10
bronze: rough .....	0.55	porcelain: glazed.....	0.92
brick: glass.. rough .....	0.85	mercury .....	0.10
brick: fireproof. rough.....	0.94	lampblack .....	0.96
cement.....	0.54	silver.....	0.03
cement (concrete.....	0.90	steel: galvanized.....	0.28
chrome .....	0.15	steel: oxidized.....	0.88
chrome polished .....	0.10	steel: rolled freshly.....	0.24
tin .....	0.09	steel: rolled.....	0.56
zinc.....	0.05	steel: rough.....	0.96
brick red.....	0.93	steel: rusty red.....	0.69
paint: oil.....	0.94	steel nickeled.....	0.11
clay: fired.....	0.91	glaze.....	0.90
clay.....	0.40	glass.....	0.92
graphite .....	0.85	glass dull .....	0.96
ground: frozen.....	0.93	snow.....	0.80
rubber.....	0.93	tape insulation .....	0.95
cobalt.....	0.18	fabric .....	0.85
quartz .....	0.93	titanium.....	0.30
lacquer white .....	0.87	carbon .....	0.90
lacquer polished black .....	0.87	charcoal powder .....	0.96
lacquer dull black.....	0.97	tungsten.....	0.13
lacquer silver .....	0.31	tungsten: oxidized.....	0.11
ice.....	0.97	gold .....	0.02
magnesium.....	0.12	iron: glossy .....	0.16
copper: oxidized.....	0.65	iron: heat rolled.....	0.77
copper: oxidized black .....	0.88	iron: oxidized .....	0.74
copper: polished .....	0.07	iron: polished.....	0.23
copper: polished annealed.....	0.01... 0.02	iron and steel: oxidized .....	0.85
brass .....	0.10	cast: raw casting.....	0.81
brass: oxidized.....	0.61	cast: polished .....	0.21
nickel : polished.....	0.05		

The given values may vary depending on the conditions.

## 20 Laboratory services

SONEL Testing and Calibration Laboratory has been accredited by the Polish Center for Accreditation (PCA) - certificate no. AP 173.

Laboratory offers calibration for the following instruments that are used for measuring electrical and non-electrical parameters.



AP 173

### ● METERS FOR MEASUREMENTS OF ELECTRICAL PARAMETERS

- voltage meters,
- current meters (including clamp meters),
- resistance meters,
- insulation resistance meters,
- earth resistance and resistivity meters,
- RCD meters,
- short-circuit loop impedance meters,
- power quality analyzers,
- portable appliance testers (PAT),
- power meters,
- multimeters,
- multifunction meters covering the functions of the above-mentioned instruments,

### ● ELECTRICAL STANDARDS

- calibrators,
- resistance standards,

### ● METERS FOR MEASUREMENTS OF NON-ELECTRICAL PARAMETERS

- pyrometers,
- thermal imagers,
- luxmeters.

The Calibration Certificate is a document that presents a relation between the calibration standard of known accuracy and meter indications with associated measurement uncertainties. The calibration standards are normally traceable to the national standard held by the National Metrological Institute.

According to ILAC-G24 „Guidelines for determination of calibration intervals of measuring instruments”, SONEL S.A. recommends periodical metrological inspection of the instruments it manufactures no less frequently than once every 12 months.

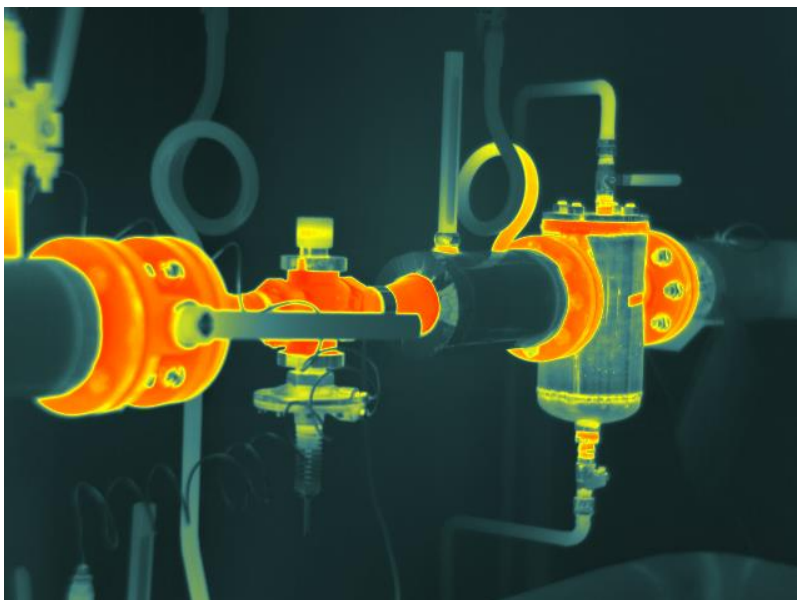
For new instruments provided with the Calibration Certificate or Validation Certificate at the factory, re-calibration should be performed within 12 months from the date of purchase, however, no later than 24 months from the date of purchase.



### ATTENTION!

The person performing the measurements should be absolutely sure about the efficiency of the device being used. Measurements made with an inefficient meter can contribute to an incorrect assessment of the effectiveness of health protection and even human life.





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[www.sonel.pl](http://www.sonel.pl)