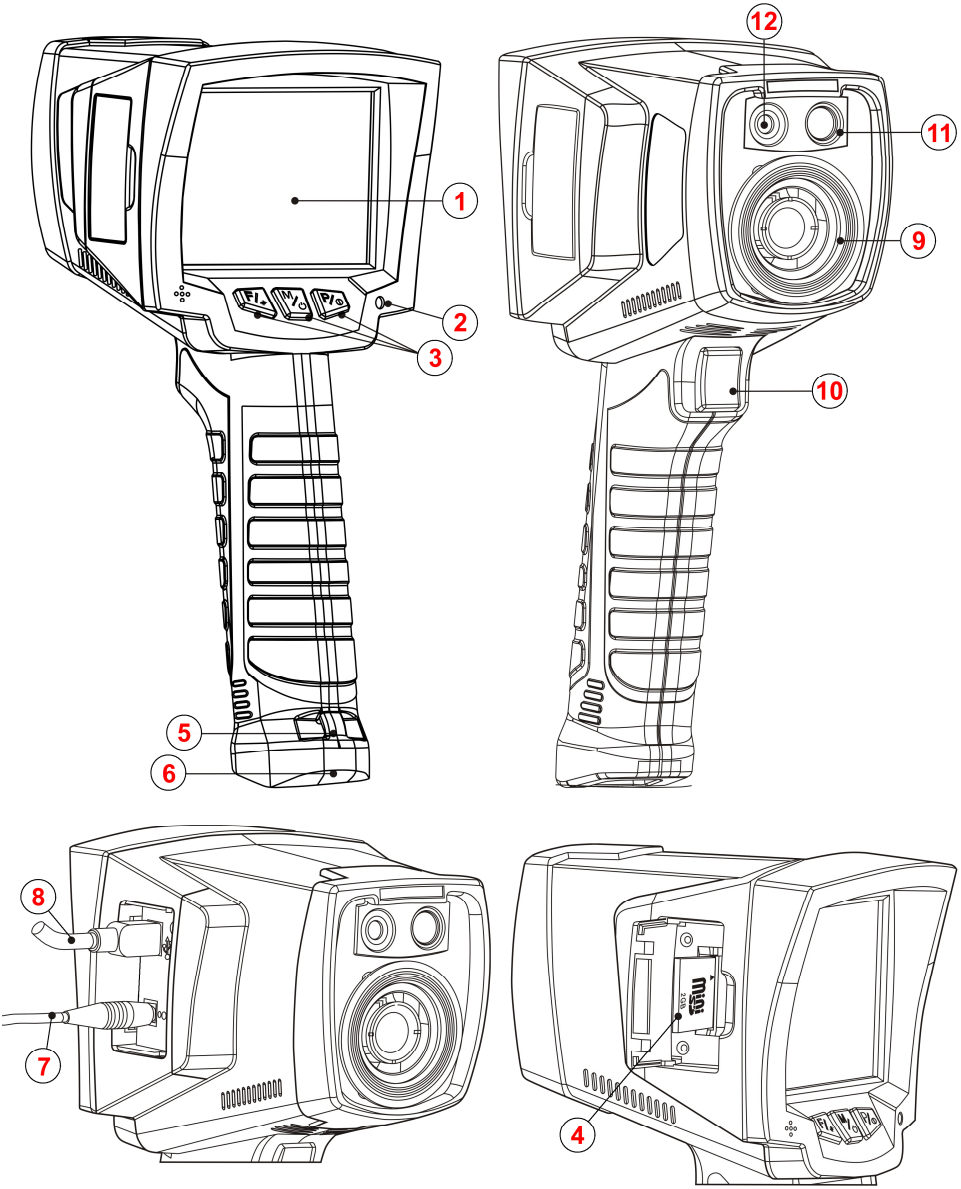
INSTRUCTION MANUAL

THERMAL IMAGER
KT-150



1. LCD display
2. LED charging indicator
3. Function buttons
4. SD memory card
5. Strap holder
6. Battery guard
7. Power supply/charging socket
8. USB socket
9. Infrared lens
10. Release button
11. Real image camera
12. Laser

INSTRUCTION MANUAL

THERMAL IMAGER
KT-150

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KT-150 thermal imager complies with the requirements of valid European Directives concerning electromagnetic compatibility and safety.

Thank you for purchasing our thermal imager, a modern, high-quality measuring instrument which is easy and safe to use. Reading this instruction manual will help you to avoid measuring errors and prevent problems while operating the camera.

Engineering, production and servicing of Sonel S.A. products are governed by ISO 9001:2008 quality control system.

Taking into consideration constant developments of our products we reserve the right to improve and modify the thermal imager and software described in this instructions manual without prior notice.

CONTENTS

1 Safety Aspects

It is necessary to carefully read this instruction manual and comply with safety regulations and the producer's recommendations before operating the thermal imager.

- Using the imager in a different way than described in the instruction manual may cause damage of the instrument and result in serious danger for the user.
- The imager may not be used in rooms with special conditions, e.g. with atmospheres which may result in explosion or fire.
- It is unacceptable to use a damaged imager, which is partially or totally out of order.
- When planning not to use the device for a longer time it is necessary to remove the batteries. Leaving uncharged batteries in the device may result in their spillage and damage of the imager.
- Do not use the imager with an open or only partially closed battery cover, do not use a power unit different than the one provided with he imager.
- Repairs can only be conducted by an authorised service company.

KT-150 thermal imager is designed to execute IR measurements and record IR images. The imager has been constructed in a way which guarantees the user maximum efficiency and work safety, however, it is necessary to observe the following conditions and recommendations in addition to complying with all the safety precautions valid for a given working post and in a given working area:

- While working, the imager must be kept in a stable position.
- Do not use the thermal imager in temperatures exceeding the working and storage temperature range.
- **Do not point the thermal imager towards very intensive thermal radiation sources, such as the sun, lasers, welding arc, etc.**
- Do not expose the thermal image to contact with dust or humidity. While using the device near water, make sure that is is suitably protected from splashing.
- While not using the thermal imager or preparing it for transportation, make sure that the device and accessories are kept in the protective carrying case.
- Do not obstruct the openings in the imager body.
- Do not switch the imager on within 15 seconds from switching it off.
- Do not throw, hit or intensively shake the imager or its accessories, as it may cause damage to the devices.
- Do not try to open the imager, as this will invalidate the guarantee.
- Use an SD memory card only with the imager.
- When there is a need to move the imager, while operating it, from a warm place to a cold one or the other way round, e.g. from inside a room to the outside or from the outside inside, you must switch the power supply off and leave the imager in the new work post for 20 minutes. After that time you can switch it on and start normal operation with exact temperature measurement. Sudden and quick temperature changes may cause a temperature measurement error or even damage to the IR sensor.

- Focal Plane Array Detector Calibration : To guarantee exact temperature measurement the focal plane array has been calibrated in different temperatures: 7°, 17°, 27°, 37°. For example, if the imager is switched on in temperature 0° after some time the temperature of the device (detector) will gradually increase; when its internal temperature reaches 7°, the automatic calibration of FPA detector will occur, which lasts for about 30 seconds. **During the calibration process the imager will not react to the user's actions**. The procedure will repeat when the imager temperature exceeds 17°, etc.
  Additionally, from time to time, during work, the imager carries out a 5-second auto calibration, which is signalled by C in the top left corner of the display.

NOTE!
Use only standard and additional accessories listed in chapter "Equipment". Using other accessories does not guarantee correct operation of the imager and may cause its damage.

NOTE!
Because of constant development of the device, the appearance of the display for some functions may be a little different than shown in this instruction manual.

NOTE!
KT-150 thermal imager is not equipped with any parts which could be repaired by the user.
Never try to dismantle or modify the imager.

Opening the device invalidates the guarantee.

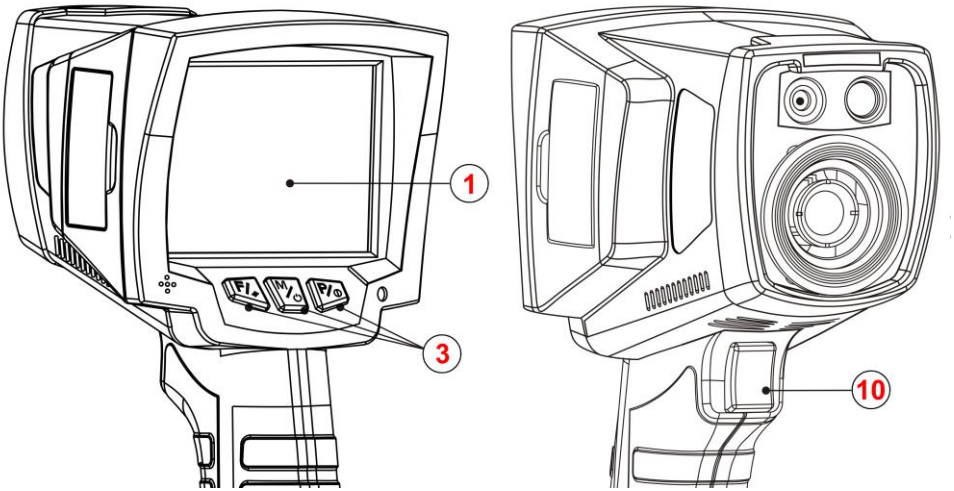
NOTE!
The laser indicator used in the imager may cause loss of vision in case of direct contact!
DO NOT POINT THE LASER BEAM AT PEOPLE OR ANIMALS!
Remember that laser beam may reflect on shiny surfaces.

NOTE!
To maintain required parameters of rechargeable batteries, unused rechargeable batteries should be charged every 3 months. If the device is not used for a longer period of time, the batteries must be removed from it and stored separately.

2 Function Buttons and Menu

2.1 Buttons Layout

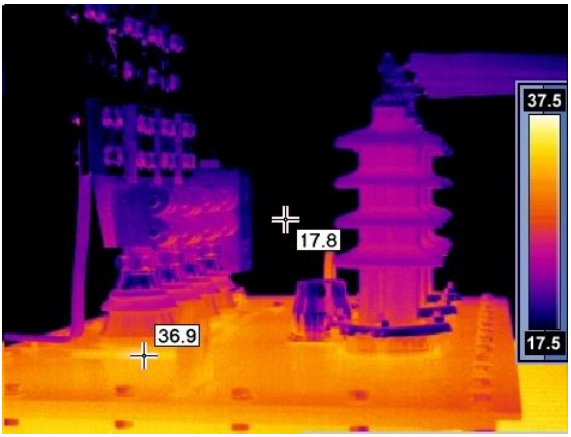
Imager functions can be accessed by means of buttons (3) placed under the LCD display (1) and by means of the release button (10):



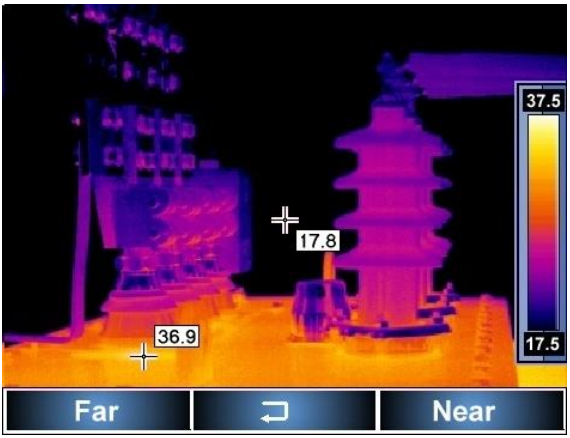
Function buttons (3) are arranged in the following way:

2.2 Screen

When the imager works, the IR image is visible on the screen (1) in real time (screen refresh rate 50 times/sec). The temperature range and corresponding screen colours bar is displayed on the right side of the screen. In the middle point of the screen the temperature value is always displayed and - depending on the chosen temperature alarm mode (min or max - see 3.9.5) - the point with the highest or the lowest temperature in the observed area:



After initiating any function or executing a measurement, a menu appears in the bottom part of the screen where each of the available functions can be initiated by means of the corresponding buttons:



In the above example, the left button marked "F" corresponds to the "Zoom out" command, the button marked "P" corresponds to the "Zoom in" command, and pushing the middle button marked "M" causes return to the previous menu or exiting the command mode.

3 Thermal Imager Operation and Adjustment

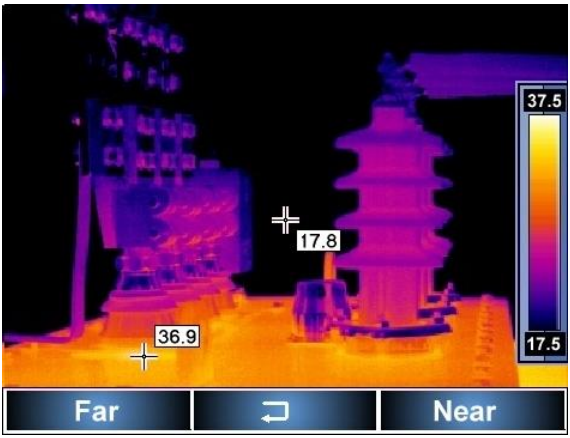
3.1 Switching the Imager On/Off

To switch the imager on press and hold the M button for more than 2 seconds.
A welcome logo will appear on the screen, then the auto-tests of the device will be carried out (results of consecutive tests are displayed on the screen). After finishing the tests the imager is ready to work and it switches into the mode of displaying real time IR image.

To switch the imager off, press and hold the M button until the screen goes out.

3.2 Focus Adjustment

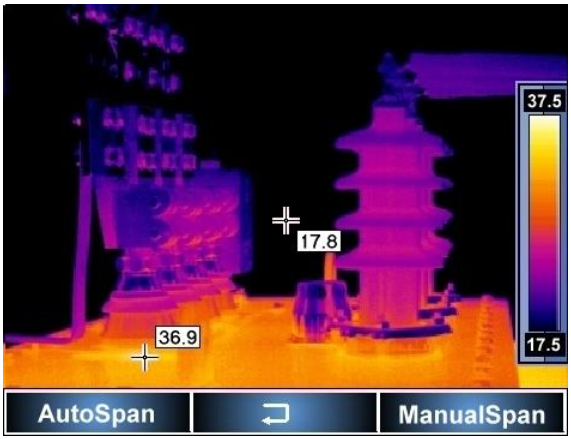
Focus is adjusted by means of buttons (3). To switch into the focus adjustment mode, press shortly the F button (when no menu is displayed on the screen). The following menu will appear on the screen, where the function buttons are assigned functions according to the bar displayed in the bottom of the screen:



After pointing the imager lens at the target, focus can be changed manually by pressing the F and P buttons: pressing the F button will cause zooming out - the focus will be set for distant objects, pressing the P button will cause zooming in - the focus will be set for closer objects. Pressing the M button or the imager release button causes recording the setting and exiting the function.

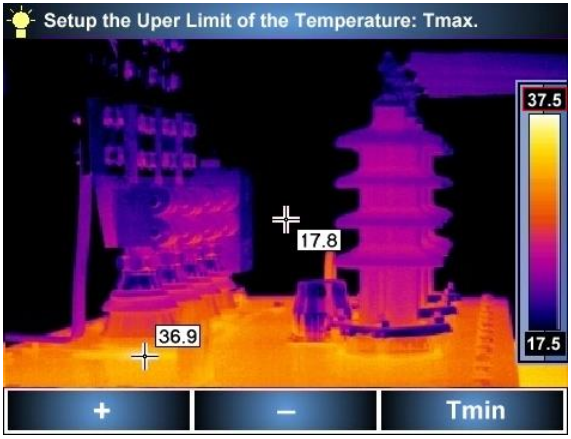
3.3 Temperature Range

Press and hold for about 2 seconds the P button, when no menu is displayed on the screen.



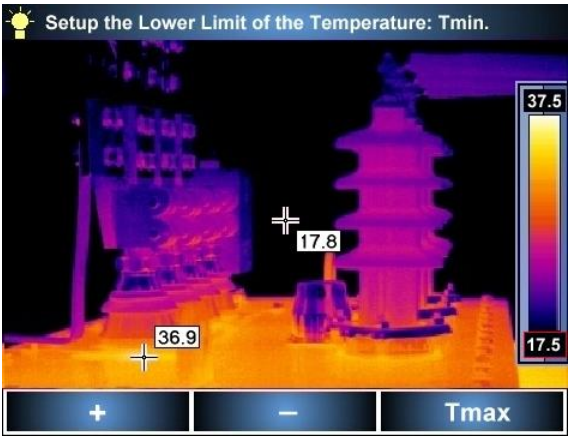
Pressing the F button sets the automatic selection of displayed temperature range - the minimum and maximum temperatures will be automatically selected by the device while executing measurements, depending on the temperature range detected in the observed area.

Pressing the P button switches the device into the manual temperature range selection mode. Choosing this option will transfer the user to the mode of setting the upper temperature limit Tmax:



By pressing the F or M buttons you may increase/decrease the upper temperature limit shown on the thermogram (the changing value is additionally marked with a red rim).

Pressing the P button transfers the user into the mode of changing the bottom temperature limit, which may be adjusted in the same way as the upper limit, by means of the F and M buttons, and:



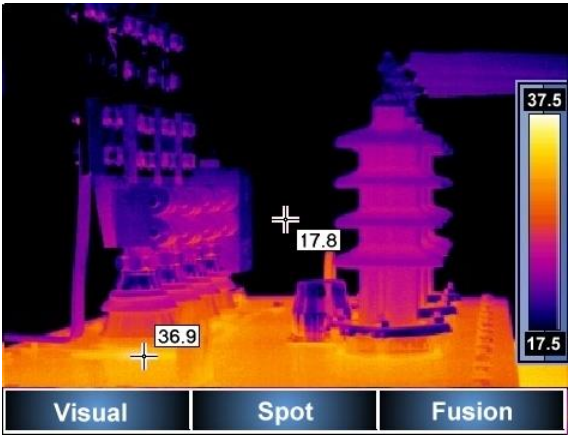
Pressing the P button transfers the user back to the mode of changing the upper temperature limit.

The manually set temperature range is confirmed by pushing the imager release button (10).

After selecting the automatic or manual temperature range, information about that is displayed in the top left corner of the screen (text on green background) for 2 seconds. Additionally, if the manual temperature range mode is chosen, the values of the range bar are displayed in brown (in the automatic mode - in white).

3.4 Image Modes

Press shortly the P button when no menu is displayed on the screen. This opens the screen where you can choose one of three image modes:

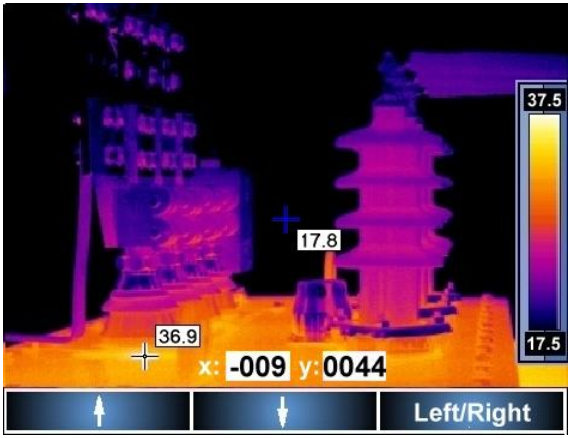


1. After selecting the "Visible" mode (the F button) the imager will only show visible

elements on the screen. By pressing the release button (10) you return to the IR image mode.

2. The "Point" function allows to change the position of permanent temperature reading point (by default it is placed in the central point of the screen). After selecting this function (the M button) the screen looks in the following way:

Pressing the F button will move the measurement point to the left, pressing the M button will move the point to the right (the new coordinates relative to the screen centre are displayed, the point is marked by blue lines); pressing the P button will switch into the "Top/Bottom" mode:

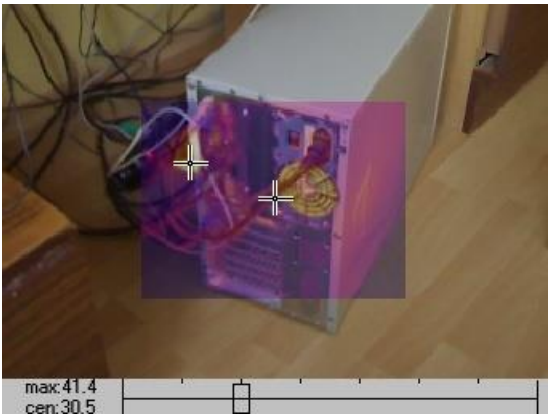


where the F/M buttons change the vertical position of the point and the P button transfers to the "Left/Right" mode. Regardless of the change of the default point posi-

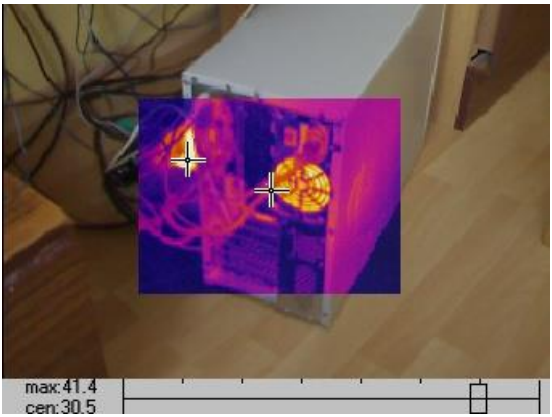
tion, the mark of the maximum (or minimum, depending on the settings - see 3.9.5) temperature is always displayed on the screen as well.
By pressing the release button (10) you exit the "Point" mode and the temperature measurement point returns to the centre of the screen.

3. The „Fusion” mode.

After selecting the "Fusion" mode (the P button) the visible image will be combined with the thermal image on the screen in such a way that the thermal image will be placed in the central part of the screen:



A scrollbar is displayed in the bottom of the screen which illustrates the proportion of image combination - moving it to the left (the F button) you will decrease the intensity of the thermal image, moving it to the right (the P button) - you will increase it:



The place with the highest (or the lowest - depending on the selected temperature alarm mode - see chapter 3.9.5) temperature and the central point of the observed area are still marked; values of corresponding temperatures are given in the bottom left corner: "max" - maximum temperature (or "min" - minimal temperature) and "cen" - temperature in the central point.

On pressing the M button or the release button (10) the screen will return to displaying the real time IR image.

NOTE:

- It is recommended to use the FUSION mode for distances bigger than 1.5 m; with smaller distances the offset of image in the vertical direction will occur (the parallax phenomenon).

3.5 Manual Calibration

While working, the imager runs an automatic calibration procedure from time to time (this is signalled by a "C" symbol appearing in the top left corner of the screen).

Calibration may also be initiated manually at any time. Press simultaneously (shortly) the F button and the release button (10), when no menu is displayed on the screen. The imager will then be calibrated, which will be signalled similarly as the automatic calibration.

3.6 Laser Indicator

The laser indicator may be switched on (when no menu is displayed on the screen) by pressing and holding the F button (it is switched on after about 1.5 second); it is switched off after releasing the button or after pressing the release button.

NOTE!

In case of direct contact the laser beam may damage vision, therefore YOU MUST NOT DIRECT YOUR LOOK TOWARDS THE LASER BEAM or direct the laser beam toward people or animals! Be particularly careful as the laser beam may reflect on shiny surfaces.

For safety reasons this function is available if the laser has been activated in the parameter setting menu (see chapter 3.8.6 - "Function settings).

3.7 Capturing and Recording Images

The imager displays the image in a constant way, refreshing it 50 times per second. To capture the image in a given moment, press the release button (10). This will cause halt-

ing the image and displaying a menu on the screen:

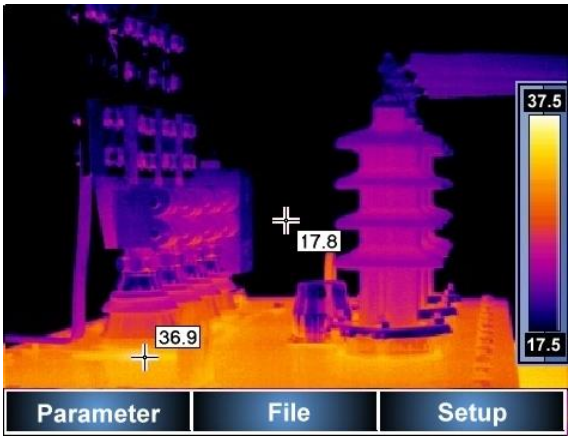
- On pressing "Save" (the F button) the halted image will be saved and the screen will return to displaying the real time image.

- Pressing "Visible" (the P button) switches the imager screen in the visible image mode (the captured visible image is displayed which corresponds to the IR image); after pressing the P button again or the release button (10) displays the captured IR image again.

- On pressing the M button or the release button (10) the screen will return to displaying the real time IR image without saving the halted image.

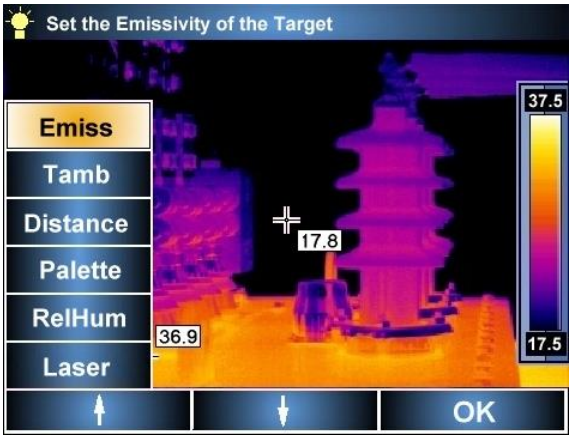
3.8 Function Setting

Pressing the M button when no menu is displayed on the screen, displays the following options selection:



You can exit the function setting menu at any time by pressing the release button (10).

After choosing "Parameter" (the F button) a submenu opens, which enables you to set the parameters of the imager:



Choose the required parameter using the "up/down" arrows (the F/M buttons); after choosing a parameter its full name will appear on the bar on the top of the screen. After confirming the choice ("OK", the P button), a submenu to adjust a given parameter opens:

3.8.1 Object Emissivity Setting

Choosing the "Emis" option and confirming it with "OK" opens a submenu "Object emissivity setting". You can decrease/increase the emissivity factor in the range of 0.01-1.00 by pressing "+" or "-" (F/✳/M/⏻). Confirm the new value by pressing "OK" (P/◑).
0.98 is the default value.
Examples of emissivity factor for different materials are given in chapter 7.

3.8.2 Ambient Temperature Setting

Choosing the "Tamb" option and confirming it with "OK" opens a submenu called "Ambient temperature setting". By pressing "set" (P/◑) you switch the imager in the manual mode. In this mode you can decrease/increase the ambient temperature value in the range -40.0 - +85.0℃ by pressing "+" or "-" (F/✳/M/⏻ buttons). Confirm the new value by pressing "OK" (P/◑).
This function allows to set the proper relation between the ambient temperature and the observed objects temperature; it is useful while executing measurements from a distance, e.g. standing in a room with different temperature than the measured object environment temperature, or conducting measurements outside in winter (the imager heats up during work, which causes distortion of the automatically measured ambient temperature). Next initiating of this function and exiting it switches the imager ambient temperature into automatic mode.

3.8.3 Selecting Distance from Object

Choosing the "Distance" option and confirming it with "OK" opens a submenu entitled "Setting distance from object". You can set the imager distance from the observed object in the range of 0.1-30 meters by pressing "+" or "-" (the F/✳/M/⏻ buttons). Confirm

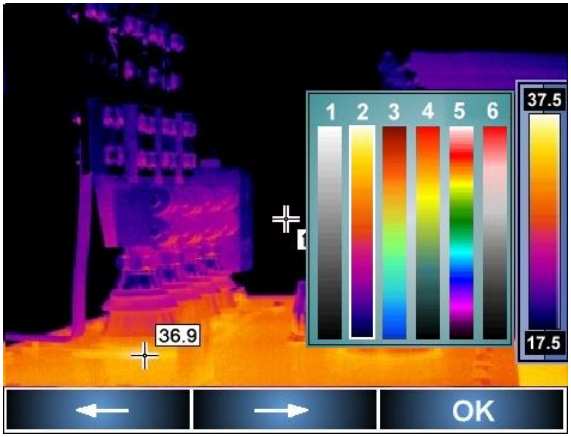
changes with "OK' button (P/◑).
Setting the distance allows to correct the influence of the medium (polluted air, fog, smoke, gas) in which the thermal radiation propagates on the accuracy of the measurement.
1.8 m is the default value.

3.8.4 Relative Humidity Setting

Choosing the "Rel. Hum." option and confirming it with "OK" opens a submenu entitled "Relative humidity setting". By pressing "+" or "-" (the F/✳/M/⏻ buttons) you can set the relative humidity value depending on the environment conditions in the range of 0-100% . Confirm changes with "OK' button (P/◑).
70% is the default value.

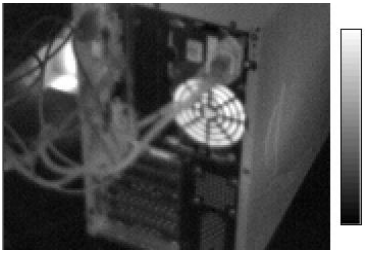
3.8.5 Colour Palette Choice

Choosing the "Palette" option and confirming it with "OK" opens a submenu entitled "Choosing one of six palettes". By pressing "<-" or "->" (the F/✳/M/⏻ buttons) you can choose one of the palettes to reproduce temperatures in the required way. Confirm changes with "OK' button (P/◑):



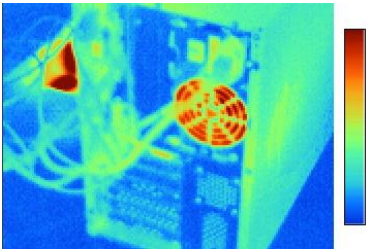
Available colour palettes:

1

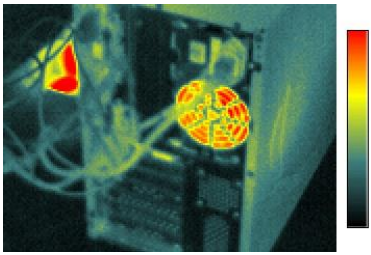


2

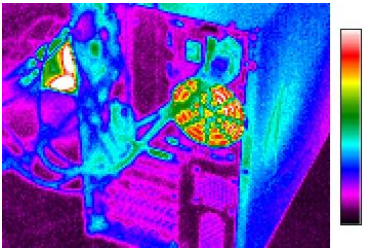
3



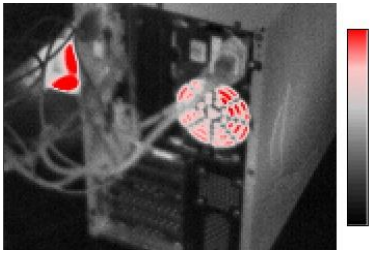
4



5



6



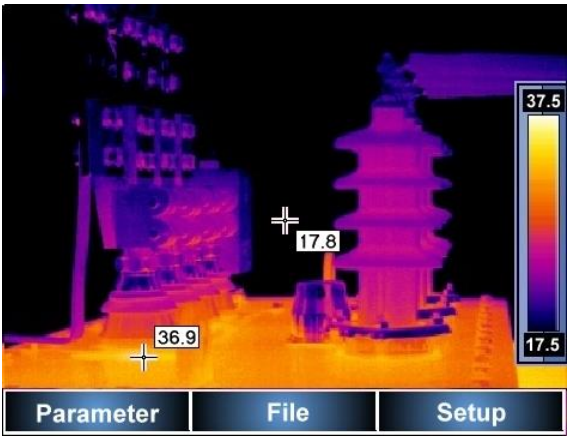
Palette no. 2 is set by default.

3.8.6 Laser Indicator Activation

The "Laser" option allows the user to disable and enable the possibility of switching the laser indicator-pointer on. After opening the "Switching the laser pointer on/off" submenu, choose the required option by means of the F/✳ / P/◑ buttons. In this way you will enable or disable the laser indicator function (the current pointer state is displayed above the menu bar). After making the selection a message about the current state of laser activity is displayed in the top left corner for 2 seconds.
By default the laser is switched off.

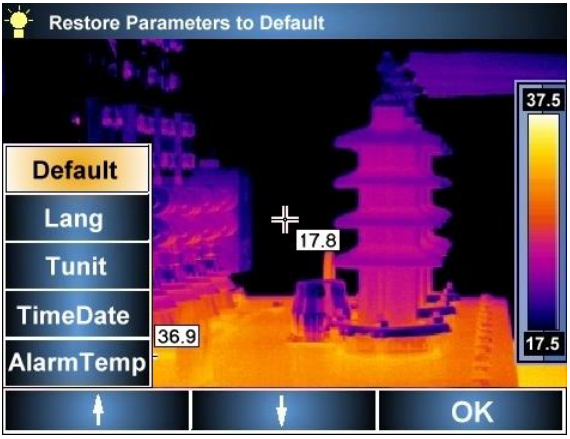
3.9 Imager Settings

Pressing the M button when no menu is displayed on the screen, displays the following options selection: "Parameter - File - Set".



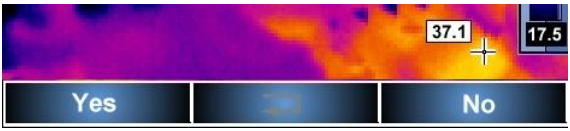
You can exit the function setting menu at any time by pressing the release button (10).

After choosing "Set" (the P button) a submenu opens which allows you to set your own parameters for the imager (language, temperature units, time/date, lens type, temperature alarm thresholds) or to choose the default settings. An option is chosen by means of "up/down" arrows (the F/M buttons):



3.9.1 Restoring Default Settings

Choosing the "Default" option and confirming it with "OK" opens a submenu entitled "Restoring default settings".



By pressing "Yes" (the F button) you confirm default settings, by pressing "No" (the P button) or the release button (10) you exit the menu without making any changes. After choosing the default settings the following parameters are changed:
- the emissivity factor: 0.98;
- the ambient temperature: measured automatically;
- the distance to object: 1.8 m
- the colour palette: 2;
- relative humidity: 70%;
- laser indicator: switched off;
- alarm temperature value: 100°C (212°F), alarm for high temperature,
- the highest temperature point is marked on the screen.

3.9.2 Choosing the User Interface Language

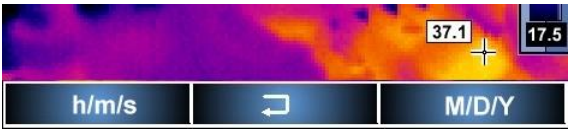
Choosing the "Language" option and confirming it with "OK" opens a submenu entitled "Choosing the user interface language". The user may choose from the following: Polish, English, Spanish, or Russian. The choice made by means of arrows (the F/M button) has to be confirmed by "OK" (the P button).

3.9.3 Choosing Temperature Units

Choosing the "C/F" option and confirming it with "OK" opens a submenu entitled "Choosing temperature units", where the user may choose "C" (the F button) for Celsius degrees or "F" (the M button) for Fahrenheit degrees. The units are changed immediately after making the choice; exit this function by pressing the M button or the release button (10).

3.9.4 Time and Date Setting

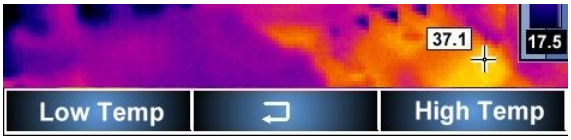
Choosing the "Time-Date" option and confirming it with "OK" opens a submenu entitled "Time and date setting" which allows you to set the imager's internal clock and calendar. Files will be saved with time and date set in the imager.



After choosing the "h/m/s" option (the F button) the time adjustment menu opens: set the hour by pressing "+" and "-" (the F and M buttons), the "Minut" option (the P button) opens the minutes setting submenu, where the minutes can be adjusted in a similar way and from where you can open the seconds setting submenu. After setting the clock (it is displayed over the menu bar all the time while setting) you can save it by pressing "OK" or exit the menu by pressing the imager release button (10).
By analogy, after opening the date setting submenu you can set („+" or „-") the year or open the month setting submenu, then set („+" or „-") the month or open the day setting submenu; at the end you can save the changes or exit the menu without saving by pressing the release button (10).
NOTE: The date is displayed in month/day/year format.

3.9.5 Setting the alarm threshold and choosing the temperature mark type.

After choosing the "Temp. Alarm" option in the "Set" menu it is possible to select the sound alarm for high temperature (after exceeding the upper temperature limit) or low temperature (after exceeding the lower temperature limit):

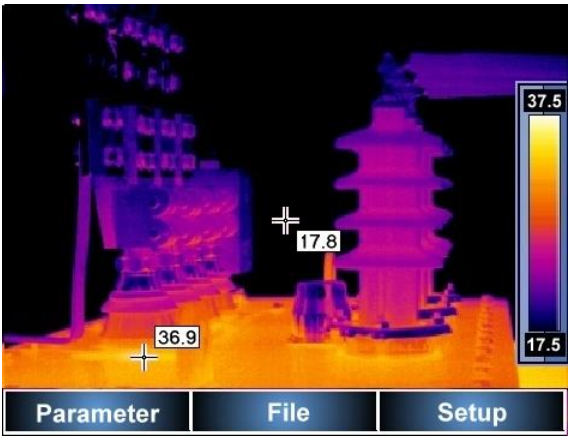


After choosing the "Low Temp." or "High Temp." option by means of "+" or "-" buttons, you can set the required value and confirm it with "OK".

NOTES:
- Depending on the selected alarm type the movable cursor on the screen will mark the highest or the lowest temperature point (see 2.2).
- By default the high temperature alarm is set to 100°C and the movable cursor shows the highest temperature point.
- Temperature values can be chosen from the range of -20-250°C.

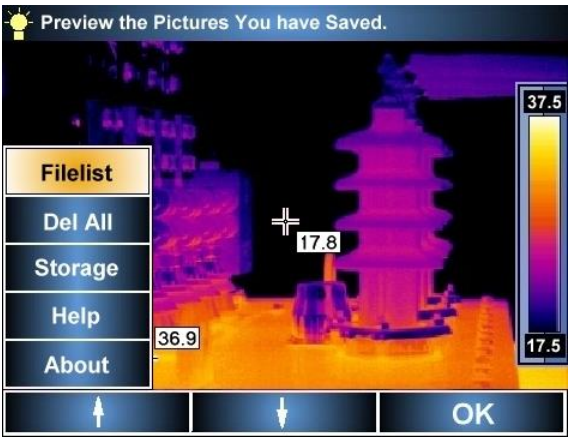
3.10 Settings and Viewing Files, Information

Pressing the M button when no menu is displayed on the screen, displays the following options selection:



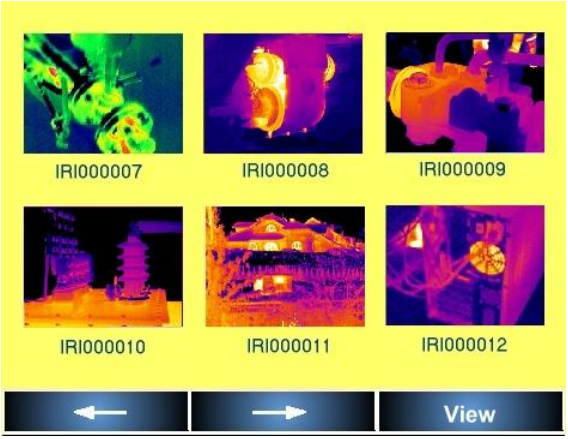
You can exit the function setting menu at any time by pressing the release button (10).

After choosing the "File" option (the button) a submenu opens which contains options related to the saved images, and information:



3.10.1 Preview of Saved Files and Removing Single Files from Memory

After choosing the "Files" option and conforming it with "OK" a submenu "Saved images preview" will be opened, where the images recorded in the default memory (a given folder in the SD card or internal memory, see chapter 3.10.3) are shown in the preview mode:



Select a file by means of arrows „←" (F/✳) and „→" (M/⏻). After selecting an image and pressing "View" (the P button) you can display a full screen image; then you can choose from 3 more options. Choosing "Erase" allows to remove the image file (after confirming the choice with "Yes"; selecting "No" you cancel the command and return to the image view); additionally, a visible image saved together with the thermogram may be previewed ("Visible"). By pressing the release button (10) you return to the preview and saved images choice mode.

3.10.2 Erasing All Saved Images

After selecting the "Erase all" option a bar will appear in the top of the screen with the question: "Are you sure you want to erase all images?" Selecting "Yes" confirms the choice and removes all images saved in the internal memory or in the SD card (depending on the memory chosen, see chapter 3.10.3). After choosing "No" you return to the "File" menu.

3.10.3 Selecting the Memory Carrier

The "Memory" option allows to choose whether the images will be saved in the internal Uflash memory or on the replaceable SD card.
After choosing the "Memory" command the current state will be displayed above the menu bar: "Uflash" or "SD card".

By means of the F/✳ and P buttons you can choose "Uflash" or "SD card". When the "SD card" option is selected and there is no SD card in the imager slot (14), "No SD

card" message will be displayed. Changing the memory selection is saved immediately; after pressing the M/⏻ or the release button (10) you return to the real time mode.

NOTES:

- When you place the SD card in the slot (14), the memory is automatically switched to SD card.
- The capacity of the built-in Uflash memory - up to 150 MB (120 images).
- The SD card must be in FAT32 format.
- Files are saved in "PICTURE0” folder.

3.10.4 Help

After choosing the "Help" option a short guide containing all information related to the imager operation will be displayed on the screen.

3.10.5 Information about the Device Version and Software

After choosing the "Info" option information about the equipment and software version installed in the imager will be displayed in the top part of the screen.

3.11 Power Supply, Charging Batteries

The power is supplied from 6 AA alkaline batteries or AA rechargeable batteries. The power can also be supplied by means of mains power unit.

Rechargeable batteries in KT cameras are charged without removing them from the camera - just plug in the AC adapter to the camera when it is switched off. **The batteries are not charged while the camera is working.** The rechargeable batteries should be recharged in an external charger, which charges every cell separately, when they are completely discharged (e.g. after a long period of inactivity) and every 5 charges (due to the serial arrangement in the camera - in order to extend their operational).

New rechargeable batteries should be completely discharged 3 times and charged in an external charger to set their capacity - it also extends their operational life (after that, recharging process may be performed at any time).

If the camera is to be inactive for a long time, it is recommended to recharge the rechargeable batteries every few weeks. When the camera is not used, the rechargeable batteries should be stored separately.

If necessary, replace the entire set of the rechargeable batteries to keep their uniform condition.

3.11.1 Using the Power Unit

Connecting the power unit is signalled by the indicator market with (2). If the imager is switched off, the indicator signals the level of battery charging. After switching the imager on (by pushing and holding the M/⏻ button for 2 seconds) the indicator blinks alternately with green and red light 3 times per second for some time; then (during the auto-tests stage) it lights with continuous red light.

After switching the imager off, if the power unit has not been disconnected, the indicator signals the battery charging.

NOTE!
Connecting the power unit to the imager when there are unrechargeable batteries inside the device
may result in the batteries explosion and in the damage of the imager.

3.11.2 Supplying Power from Batteries/Rechargeable Batteries

When the imager supplied from batteries/rechargeable batteries is switched on the indicator blinks alternately with green/red light for a few seconds. When the imager works the indicator is turned off.
NOTE: Low level of batteries charging is signalled by the "Battery low" message appearing in the top right corner of the screen.

3.11.3 Charging Batteries

When the imager is switched off and the batteries are placed in the battery compartment, connecting the power unit and the beginning of charging is signalled by slower (about 1 per second) indicator (2) blinking. When the batteries are fully charged the indicator emits uninterrupted green light.
Quick indicator blinking during charging signals anomalies (e.g. reverse placement of batteries in the compartment or batteries damage). In such a situation the charging must be absolutely stopped and the reason for the anomalies found.
If the signalled anomaly is only high temperature of the batteries, the charging must be stopped until the batteries cool down.
Nickel metal hydride batteries do not require full charging/discharging during operation, however, it is recommended to charge them fully three times at the beginning of operation.
All the batteries have to be exchanged simultaneously, new batteries must not be used with old ones, different types of batteries must not be used, either.

NOTE!
- Use only the power unit provided with the imager.
- Pay attention to the batteries polarization while inserting them into the imager.
- Batteries must be charged in temperatures 0-40°C.
- Batteries must not be removed from the imager during charging.
- To maintain required parameters of rechargeable batteries, unused rechargeable batteries should be charged every 3 months.

3.11.4 General Rules for Using Nickel Metal Hydride Batteries

If the device is not used for a longer period of time, the batteries must be removed from it and stored separately.

Batteries must be stored in a dry, cool and well ventilated place, they must be protected against direct sun exposure. Ambient temperature during long storage must be kept below 30°C. If the batteries are stored in high temperature for a long time the occurring chemical processes may shorten their life-cycle.

NiMH batteries usually withstand 500-1000 charging cycles. The batteries reach maximum efficiency only after forming (2-3 charging and discharging cycles). The most important factor influencing the battery life-cycle is the depth of the discharging. The deeper the discharging the shorter the life-cycle of the battery.

The memory effect occurs in NiMH batteries to a limited extent. These batteries can be charged up without significant consequences. It is recommended, however, to fully discharge them every few cycles.

During storage of NiMH batteries intrinsic discharging occurs, about 30% per month. The speed of the process may be doubled if the batteries are stored in high temperatures. **To prevent excessive battery discharging, which will create the need for forming, the batteries must be charged up from time to time (also when not used)**.

Modern, quick chargers detect both too low and too high battery temperature and react to these situations appropriately. Too low temperature should make it impossible to start the charging process, because it could irreversibly damage the battery. An increase in the battery temperature is a signal to stop the charging and it is a typical phenomenon. However, charging the battery in high ambient temperature results - apart from shortening the life-cycle - in quicker battery temperature increase, which will cause its incomplete charging.

It is worth remembering that during quick charging the batteries are charged to about 80% volume; better results may be achieved by continuing the charging: then the charger switches into the mode of charging-up with small current - after the next few hours the batteries will be fully charged.

Do not charge or use batteries in extreme temperatures. Extreme temperatures shorten the batteries life-cycle. Placing devices battery power supply in very warm places must be avoided. The rated working temperature must absolutely be observed.

4 Accurate Temperature Measurement

The accuracy of temperature measurement depends on many factors, e.g. the emissivity factor, the ambient temperature, the distance from the object, humidity. During measurements the imager makes corrections based on signals read from the sensors. For some situations and materials manual regulation of parameters may be necessary.

Emissivity. Measurements in IR consist in receiving infrared radiation emitted by objects. Radiation energy depends on two basic factors: the object surface temperature and its surface emissivity. The default emissivity is 0.98 and it applies to most surfaces.
Emissivity factor values for some materials are given in the emissivity table (chapter 8).
Improperly selected emissivity factor value may cause significant errors in temperature measurements, therefore KT-150 imager makes it possible to choose the emissivity factor value in the range of 0.01-1.00 (see chapter 3.8.1).

The measurement accuracy also depends on **the ambient temperature**. By default the temperature measured by the imager is assumed to be ambient; the value can be changed manually to compare and to set proper relation between the measured object temperature and the temperature of some environment types (e.g. the sky, the snow). In situations when the measurement is executed from a room with different temperature than the environment of the object or after a change in the ambient temperature, as well as in winter, manual setting of the ambient temperature is recommended.
The setting procedure is described in chapter 3.8.2.

The influence of **the distance** from the observed object on the measurement accuracy may be significant, depending on the environment of the object (the air, fog, smoke, etc.) and its influence on thermal radiation damping. The default value (1.8 m) may be corrected in the range of 0.1-30 m. The procedure of distance adjustment is described in chapter 3.8.3.

Relative humidity may also influence the measurement accuracy. It is possible to change the default value (70%) to any value in the range of 0-100% (this function is described in chapter 3.8.4).

Additionally, to achieve an accurate temperature measurement it is necessary to hold the imager steady and set the focus properly (see chapter 3.2).

5 Data Transmission and Analysis

To transfer the thermal images saved in the imager to the computer, the driver and (when using the imager internal memory) Sonel ThermoAnalyze software must be installed on the computer.

5.1 *Imager Driver Installation*

5.1.1 Hardware Requirements

Operating system: Microsoft® Windows 2000 or higher (IE5.0 or higher), 32- or 64-bit.
Processor: Pentium 4 2.4 GHz or higher
RAM: at least 512 M

5.1.2 Installation

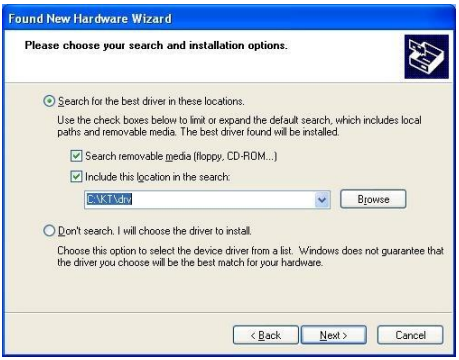
It is recommended to install the driver before connecting the imager to the computer.
After inserting the disc containing the software (provided with the imager) in the computer drive, the installation programme should launch automatically. If it doesn't, it is necessary to launch manually the "autorun.exe" file in the disc main folder.
After selecting the interface language a window opens, where you must choose "Thermal imagers":

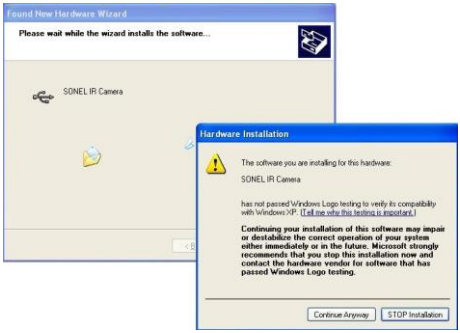
next "Install the driver", and the driver type depending on the operating system (32- or 64-bit):

If the imager has been connected to the computer before installing the drivers or when the user does not have the original installation disc, the installation process can be carried out manually on the basis of drivers saved on the computer (e.g. downloaded from

www.sonel.pl). After connecting the imager to the computer USB socket the New Hardware Installation Wizard will launch. Choose "Not this time" to answer the question about Internet search for the driver and click "Next". Let the computer automatically search for the driver - the programme will look for the driver in the data carriers. It the driver is not found automatically, choose the "Install from the list or from specified location (advanced)" command:

Then select the folder (drive) where the driver files are saved and click the "Next" button to continue. If a message appears about a driver not being digitally signed choose: "Continue anyway":





When a message appears that the installation is complete, click "Finish":

5.2 "Sonel ThermoAnalyze®" Software Installation

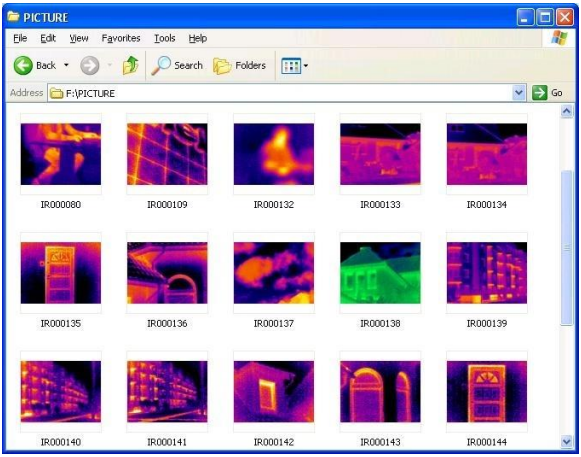
Close all other programs before beginning the installation.
After inserting the disc containing the software (provided with the imager) in the computer drive, the installation programme should launch automatically. If it doesn't, it is necessary to launch manually the "autorun.exe" file in the disc main folder.
After selecting the interface language a window opens, where you choose "Thermal imagers" and then "Install Thermo Analyze":

The installation programme will launch; proceed in accordance with the commands appearing on the screen.
NOTE: If you do not choose another folder, the programme will be installed in C:\Program Files\Sonel ThermoAnalyze. During installation shortcuts to the programme will be created on the Desktop and in the Start Menu.

NOTE.
A detailed description of all "Sonel ThermoAnalyze" functions can be found in the provided software user manual.

5.3 Reading the External Memory (SD Card)

When an SD card is placed in the slot marked (14) and SD card memory has been chosen in the imager menu (see 3.10.3), then after the imager is connected to the computer the contents of the SD card are treated as another drive installed on the computer. Files containing thermograms are saved in folder "PICTURE0":



NOTES:

- **You can transmit the data in the above mentioned way when "Sonel ThermoAnalyze" programme is not open**.
- When the imager is connected to the computer and the SD card memory has been chosen you cannot work with the imager.
- The SD card may also be read by means of the external card reader provided with the camera.

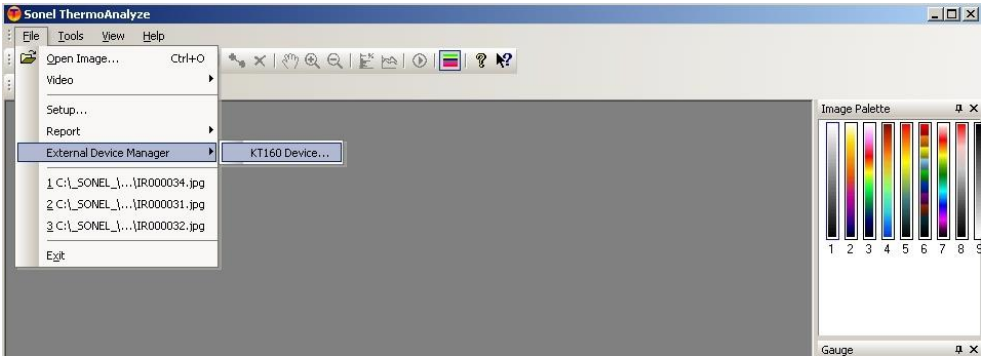
5.4 Using Uflash Internal Memory

Reading data from the internal memory (Uflash) is only possible with Sonel ThermoAnalyze software.

NOTE: reading data from the internal memory is only possible if there is no SD card in the slot marked (4) or if Uflash memory has been chosen as the default memory (see 3.10.3).

To read (copy) the saved thermal images initiate the software and connect the imager (the imager must be switched on and without any menu open).

Next, choose the appropriate imager model from the top menu ("File"):



A window will open, which allows to download (all or some) files saved in the Uflash memory to the selected folder.

NOTES:

- This function also makes it possible to remove all files saved in the memory. To remove only some files proceed according to 3.10.1.
- Disconnect the imager from the computer only after closing the file transfer manager window.

5.5 Data Analysis

The provided "Sonel ThermoAnalyze" programme makes it possible to conduct detailed analysis of saved thermal images. A report is created as a result of the analysis. A detailed description can be found in the software user manual.

6 Technical Specification

Imaging characteristics	
THERMAL	
Detector type	Non-cooled microbolometric matrix (160×120 pixel, 25 µm)
Spectral range	8-14 µm
Thermal sensitivity	≤0.1°C at 30°C
Field of view / / focal distance	20.6° X 15.5° / 11 mm
Focus	Manual (with buttons)
Screen refresh rate	50Hz
VISUAL	
Real image recording	CMOS sensor, 1600x1200 pixel, "true colour" mode (24-bit)
Image display	
LCD display	LCD TFT 3,6", resolution 640*480.
Technology InfraFusion	Combination of real and IR image
Measurement	
Temperature Range	from -20°C to 250°C
Minimum distance	10 cm from the observed object, in the Intra Fusion mode - minimum of 1.5 m recommended.
Accuracy	±2°C or ±2% of reading
Emissivity correction	Adjustable from 0.01 to 1.00 (in 0.01 increments)
Measurement properties	Automatic correction for distance, relative humidity, atmospheric transmission and outside optical conditions
Optical transmission correction	Automatic, based on signals from sensors
Laser localizer	
Classification	A1 GalnP semiconductor, diode laser

Image storage	
Media type	Replaceable SD memory card and 150 MB built-in memory
File format	JPG with thermograph image and real view image
Power supply	
Battery type	AA rechargeable batteries, possibility to use AA alkaline batteries
Charging	Built-in charger
Battery operating time	More than 3 hours of continuous operation
External power supply	AC power unit 110-240 V AC, 50/60 Hz
Environment specification	
Working temperature	-10°C to 50°C
Temperature	-20°C to 60°C
Humidity	Operating and storage: 10% to 95%, non-condensing
Casing	IP54 IEC 60529
Shocks	Working: 25 G, IEC 60068-2-29
Vibration	Working: 25 G, IEC 60068-2-6
Communication	
USB 2.0	Transfer of files from Uflash memory. Transfer of files from the SD Card
Physical properties	
Weight	0.73 kg (with batteries)
Dimensions	111 mm x 124 mm x 240 mm

7 Examples of Emissivity Factor Values

aluminium	*0.05*
coarse aluminium	*0.07*
oxidized aluminium	*0.25*
oxidated aluminium	*0.30*
asphalt	*0.90*
asbestos (sheets, slate stone)	*0.96*
asbestos (fibre)	*0.78*
bakelite	*0.93*
matt, matted bronze	*0.22*
polished bronze	*0.10*
porous, coarse bronze	*0.55*
common, glass, coarse brick	*0.85*
fireproof coarse brick	*0.94*
cement	*0.54*
cement (concrete)	*0.90*
chrome	*0.15*
polished chrome	*0.10*
tin	*0.09*
zinc	*0.05*
red brick	*0.93*
oil paint	*0.94*
burned clay	*0.91*
alumina	*0.40*
graphite	*0.85*
frozen soil	*0.93*
rubber	*0.93*
cobalt	*0.18*
quartz	*0.93*
white lacquer	*0.87*
black shiny lacquer	*0.87*
black matt lacquer	*0.97*
silvered lacquer	*0.31*
ice	*0.97*
magnesium	*0.12*
oxidized copper	*0.65*
black oxidized copper	*0.88*
polished copper	*0.07*
polished annealed copper	*0.01-0.02*
brass	*0.10*
oxidated brass	*0.61*
polished nickel	*0.05*
shiny lead	*0.08*
grey lead	*0.28*
oxidated lead	*0.63*
white paper	*0.90*
black shiny paper	*0.90*
black matt paper	*0.94*
tarred paper	*0.92*
black plastic	*0.95*
platinum	*0.10*
glazed porcelain	*0.92*
mercury	*0.10*
soot	*0.95*
lamp soot	*0.96*
silver	*0.03*
galvanised steel	*0.28*
oxidized steel	*0.88*
freshly rolled steel	*0.24*
rolled steel	*0.56*
coarse steel	*0.96*
rusty-red steel	*0.69*
nickel plated steel	*0.11*
glaze	*0.90*
glass	*0.92*
frosted glass	*0.96*
snow	*0.80*
insulation tape	*0.95*
fabrics	*0.85*
titanium	*0.30*
coal	*0.90*
powdered charcoal	*0.96*
tungsten	*0.13*
oxidated tungsten	*0.11*
gold	*0.02*
shiny iron	*0.16*
hot-rolled iron	*0.77*
oxidized iron	*0.74*
polished iron	*0.23*
oxidated iron and steel	*0.85*
cast iron, rough casting	*0.81*
polished cast iron	*0.21*

Presented values may vary depending on the conditions.

8 Usage of Additional Accessories

There is a possibility to use additional accessories while executing measurements. To purchase them you need to contact the producer or distributor of Sonel S.A. equipment.
A list of standard and additional accessories can be found in chapter 12.

8.1 Using a Support Stand

It can be tiring to hold the imager for a long time; all vibrations result in unclear images. The additional holder (**WAADASTATYW1**) allows to mount the imager on a support stand.

8.2 Work in Intensive Light

During work in intensely lit places (strong sunshine, strong lighting in rooms) the image on the screen becomes very faint. The additional sun visor (**WAPOZOSL2**) mounted on the imager over the screen makes work in such unfavourable conditions easier.

9 Cleaning and Maintenance

NOTE!
Use only the below mentioned maintenance methods.

The imager housing - all surfaces which do not belong to the optical elements of the device - can be cleaned with a soft, dump cloth with common mild detergents. Do not use any solvents or cleaning agents which might scratch the surface (powders, pastes, etc.). The imager must be switched off while cleaning.
The lenses of the thermal imager, because of the anti-reflection coating, are the most sensitive and at the same time the most expensive elements of the device (the lens is of key importance for the radiometric capacity of the infrared system). Therefore, it is necessary to replace the lens cover after using the imager. Optical surfaces must be cleaned **only** when they are visibly dirty. Do not touch the uncovered surfaces of the lens with fingers, because dirt left by fingerprints may be harmful for the coating and the glass of the lens.
Do not use any chemical agents to clean the vision panel and the imager optics. Use a clean, dry and soft cloth to clean the vision panel body and **only the provided cloth** to clean the lenses.

10 Calibration

To guarantee accuracy and reliability of the thermal imager it is recommended to have the device calibrated every 12 months.
You can receive detailed information about laboratory services by phone (74 85 83 879) or by e-mail: serwis@sonel.pl
NOTE:
KT-150 thermal imager is not equipped with any parts which could be repaired by the user. Never try to dismantle or modify the imager on your own. Opening the device invalidates the guarantee.

11 Storage

Follow the following recommendations while storing the device:

- ensure that the imager and its accessories are dry,
- for longer storage remove the batteries,
- only temperatures given in the technical specifications are appropriate for storage,
- to avoid total discharging of batteries during long storage, it is necessary to charge them up from time to time.

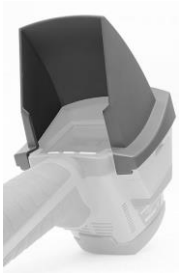
12 Equipment

The standard kit delivered by the producer contains:

- KT-150 imager (**WMPLKT150**) containing the built-in IR lens with 11 mm focal distance with a protective cover.
- Front part guard (**WAPOZOSL1**).
- SD card.
- 12 AA rechargeable batteries (2 sets).
- Universal power unit 110-240 V (**WAZASZ8**).
- USB cable (**WAPRZUSBMNIB5**).
- DVD containing Sonel ThermoAnalyze® and a driver.
- The imager instruction manual.
- Sonel ThermoAnalyze user manual.
- Hand strap (**WAPOZPAS1**).
- Casing (**WAFUTM6**).
- Transport case (**WAWALL3**).
- External memory card reader with a USB cable (**WAADAUSBMEM**).
- Gloves, a cloth.

Optional additional accessories:

- Holder to mount the imager on a support stand (**WAADASTATYW1**)



- Sun visor (**WAPOZOSL2**)

13 Dismantling and Disposal

Old electrical and electronic devices must be segregated and must not be disposed of with other types of waste.
Old electronic equipment must be delivered to a collection point, in accordance with the Used Electric and Electronic Equipment Act.
Do not dismantle any elements of this device before delivering it to the collection point.

NOTE:
Observe the local regulations concerning the disposal of packaging and used batteries.

14 Manufacturer

The manufacturer of the instrument who provides guarantee and after-guarantee maintenance services is:

SONEL S.A.
ul. Wokulskiego 11
58-100 Świdnica
Poland
tel. +48 74 858 38 60
fax +48 74 858 38 09
E-mail: export@sonel.pl
Web page: www.sonel.pl

NOTE:
The manufacturer only is authorised to conduct repairs.

Made in PRC.

Laboratory services

Research and Calibration Laboratory of SONEL SA offers calibration of the following instruments used for electrical/non-electrical measurements:

- meters for electrical protective measurements: insulation resistance, impedance and resistance of short-circuit loops, earthing resistances and earth resistivity, RCD parameters and multi-functional meters that perform the above functions,
- electrical safety meters,
- multimeters,
- power quality analysers,
- meters for measuring low resistance values,
- infra-red cameras,
- pyrometers,
- luxmeters.

In addition, the Laboratory performs voltage, current and resistance calibration.

A calibration certificate is a document confirming compliance of parameters declared by the manufacturer of tested device with national standards, specifying the measurement uncertainty.

Pursuant to standard **EN ISO 10012:2003** "Measurement management systems — Requirements for measurement processes and measuring equipment", SONEL S.A. recommends for its instruments to be periodically tested, observing the interval of **13 months**.

For new devices with calibration certificates, the next metrological inspection (calibration) is recommended within **13 months** from the date of purchase, but not later than **19 months** from the date of manufacture.

Note:
In case of instruments used for tests related to the protection against electric shock, the person performing measurements should have complete confidence in the efficiency of operated apparatus. Measurements carried out with malfunctioning meter may cause wrong assessment of tested equipment in terms of its protection features

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