

C.A 1954

DiaCAM 2



■ THERMAL CAMERA

Measure up



ATTENTION

An infrared camera is a sensitive optical measuring device. Pay special attention to the following points:

Never aim the camera towards the sun or other source of intense thermal radiation (e.g. welding, cutting, and similar operations).

If parts of the camera are damaged or present problems following failure to heed the warnings listed above, neither the manufacturer nor the distributor shall be held liable, and all costs incurred shall be borne solely by the operator.

INTRODUCTION

Infrared thermography detection technology has been in existence for many years in industrialized countries, where it has become an indispensable means ensuring safety in industrial production. It is used in sectors of industry as diverse as metallurgy and steel-making, electric power, petroleum, automation, the exploitation of natural gas, and transportation, and in other committed professions such as fire-fighting and border surveillance. In all of these activities, characterized by just-in-time operating procedures, high-voltage production equipment, powerful electric currents, and/or high operating speeds, infrared thermal imaging provides a real-time non-contact inspection method.

This detection method does not require you to cut off the power, shut down the machines or interrupt production. It can diagnose latent malfunctions in advance, and so forestall their occurrence and prevent production incidents. Thermal imaging is an innovative non-contact evaluation technique that is safe, reliable, and rapid.

Compared to the contact-based detection instruments still widely used, this new technology is revolutionary. Infrared thermal imaging detection technology has major applications in the following fields:

- surveillance of electrical equipment and high-voltage transformers
- locating leaks from thermal equipment and heat exchangers; analysis of heat losses
- identification of thermal failures in rail transport
- in the micro-electronics industry, rationalization of circuits by detection of systematic hot spots
- fire-fighting, locating latent fire sources
- at a fire, aid to victims and tactical command
- security professionals, night time surveillance

This is why infrared thermal imaging detection technology is currently regarded by all concerned as the cutting edge in industrial surveillance.

Thank you for purchasing a **C.A 1954** thermal camera.

For best results with your device:

- Read these operating instructions carefully,
- Comply with the precautions for use.

Meanings of the symbols used on the device:

	The CE marking indicates compliance with the European "Low Voltage" and "Electromagnetic Compatibility" directives (2014/35/UE).
	In the European Union, this product is subject to selective collection and recycling at end-of-life as waste electrical and electronic equipment under directive 2002/96/EC (WEEE): this equipment must not be treated as ordinary household waste. The spent batteries must not be treated as household waste. Take them to the appropriate collection point for recycling.
	This product is designed to allow recovery and recycling of most of its constituents.
	WARNING ! Class 2 laser radiation. If the flap is open, do not look at the beam.

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1. GETTING STARTED

1.1. Elementary precautions

1.1.1. Never aim the camera towards the sun or other source of intense thermal radiation

Direct exposure to sunlight or other strong thermal radiation can impair the operation of the camera and make the infrared sensor partially or totally inoperative for as long as several months.

We therefore recommend closing the lens flap when the camera is not in use, to avoid any accidental exposure.

1.1.2. Avoid exposing to dust with the lens flap open

Even though it is rated IP54 (dust and splash protected), it is best not to use the camera in a dusty environment: dust deposited on the lens can not only perturb the measurements (absorption of part of the thermal flux and spurious diffusion) but also impair the sharpness of the images.

To clean your lens, refer to § 9.2. [Cleaning the infrared optics](#).

1.1.3. Do not touch the lens with your fingers.

Finger marks must be carefully avoided, because acids from the skin attack the coatings and the glass of the lens; they can leave indelible traces. Refer to § 9.2. [Cleaning the infrared optics](#).

1.1.4. Avoid jolting or dropping the camera.

The camera is rugged, but even so it is a delicate precision instrument which should not be jolted or dropped.

1.1.5. Do not point the laser pointer at a person's eyes

The camera has a laser pointer.*



Warning! *Do not aim the laser beam towards a person's eyes, which could cause burns.*

1.2. Powering the camera



- The camera accepts AA batteries of two types:
 - either alkaline batteries
 - or Ni-MH rechargeable batteries.
- The latter must be recharged with an external charger.
- When the batteries are withdrawn, the internal clock has enough power for 15 hours.
- The batteries are inserted through the end of the handle.
- Open the cover using a coin while pressing down on the locking tab:



1.3. Inserting the micro SD memory card



The files created by the camera (image, audio, and setup files) are stored only on the micro SD memory card located on the left side of the head.

If this card is missing, an error message appears as soon as access to it becomes necessary.

The memory card must be formatted:

- either in FAT16 format,
- or in FAT32,

or it cannot be read.

To insert the card, open the rubber flap and push the card into its slot. Refer to the diagram opposite.

Take care to insert it in the right direction.

If the card cannot be inserted:

- either it is in the wrong direction and must be turned around;
- or there is already a card in the slot.

1.4. Organization of the display

In principle, the camera starts up:

- in its main display,
- in continuous acquisition mode,
- with the setup loaded when it was last switched off.

However, after the batteries have been withdrawn, when the camera is started up, a "[Battery Management](#)" menu is displayed.

It can be displayed on demand, by keeping the **F2** key pressed when the camera is started up.

Information messages may be superimposed on this screen (*example: messages for reconnection of the Bluetooth peripherals if they had been used, or error/information messages, as the case may be*).

The system date and time entry menu is displayed if the power supply to the internal clock has been interrupted. It is recommended in this case to update this information, which is used in the names of the image files.

1.4.1. Battery management

To inform the operator of the state of the batteries during operation, the camera has a battery indicator in the status bar of the main screen (see § 1.4.2.1. [Status bar](#)). The battery manager can be controlled in two ways:

1. default mode

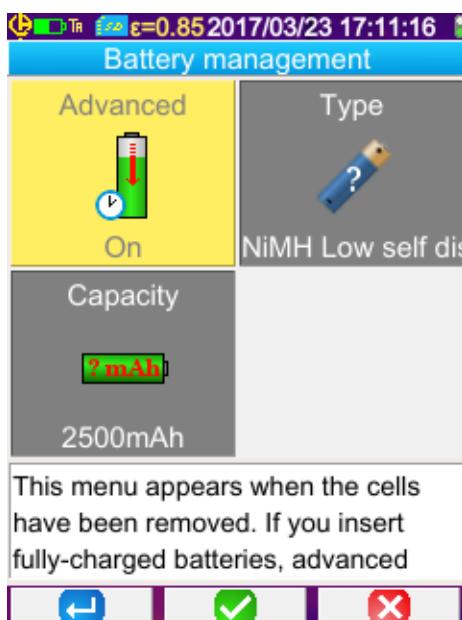
the operator is not required to enter any information, but is informed when the charge level of the batteries is low:
- no display before this low level is detected,
- display of  approximately 30 minutes before automatic shutdown of the instrument.

2. advanced mode

This allows precise tracking of consumption, provided that the necessary data are correctly entered, namely:
- the type of batteries used,
- their theoretical capacity.

This battery manager assumes that the batteries inserted before the data are entered are fully charged.

The "Battery Management" menu selects the operating mode:



F1  confirms the information entered, closes the window and initializes the battery manager with these settings.

F2  edits and confirms entry of the selected item.

F3  cancels an entry or closes the window without resetting the battery manager.

The "Advanced" item determines whether the advanced mode is active or not:

- Pressing F2  edits the value of the item.
- The Up/Down arrows select a value and F2  confirms entry.

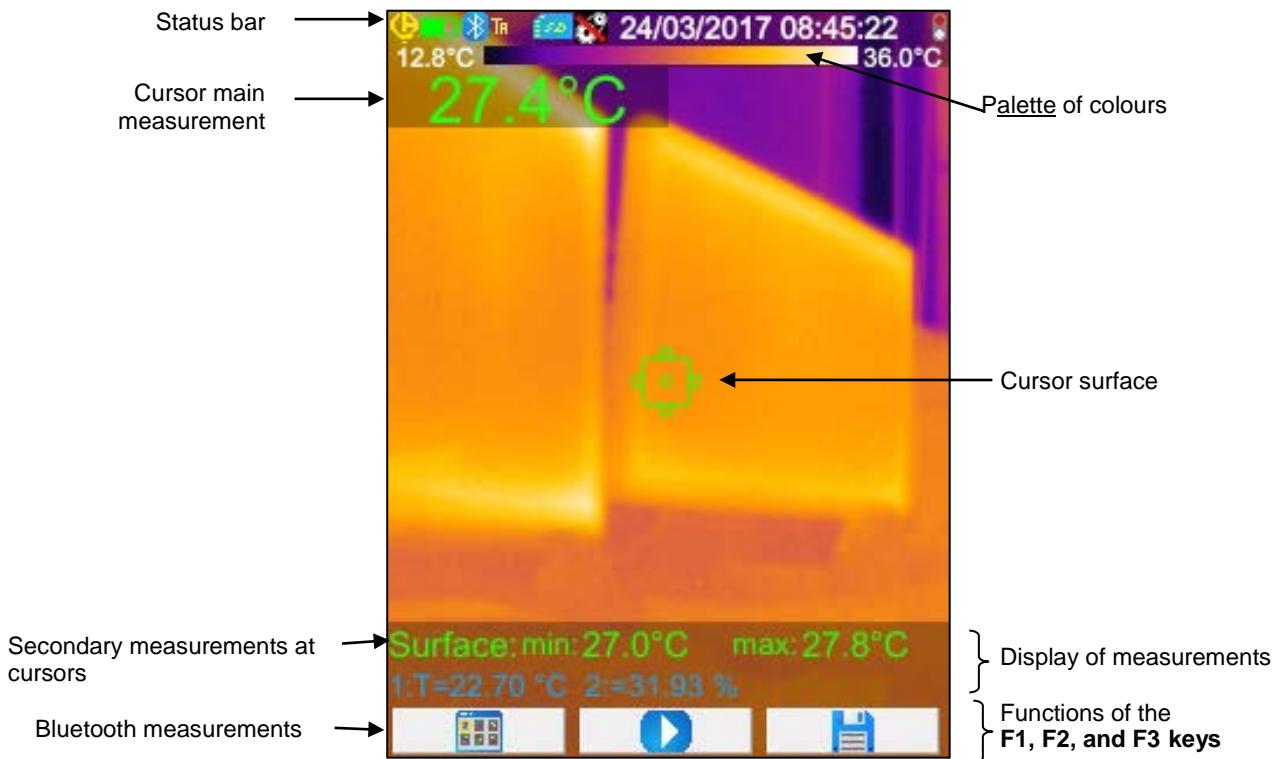
Type of batteries: The camera is delivered with low-self-discharge Ni-MH rechargeable batteries with a capacity of approx. 2500 mAh. These are the default parameters.



If the user always uses the same set of rechargeable batteries, it may be useful to operate until the camera automatically switches off because the batteries are low. In this case, the theoretical capacity of the batteries entered at the outset is automatically adjusted in light of the actual discharge. This new capacity is proposed by default the next time the menu is displayed.

1.4.2. Main screen

The screen is divided into 4 zones:



An image covers the entire surface of the screen; the following items are superimposed on it:

- status bar
- palette of colours
- the display of the main and secondary measurements (in IR)
- the display of the Bluetooth measurements (on request)
- the functions of function keys F1, F2, and F3

1.4.2.1. Status bar

This bar tells the operator the current operating mode of the camera.

In normal operation, it contains the following information → 

	Batteries OK Batteries discharged	Default management
	Batteries OK Batteries low Batteries discharged	
 no display	Bluetooth function activated Bluetooth not activated	
TA	Function of the trigger → Aim (Aim + Laser)	
TF	Function of the trigger → Freeze	
Ts	Function of the trigger → Save	
TL	Function of the trigger → Laser ('Laser')	
 	Presence of micro SD detected Absence of micro SD detected	
 	E=0.85 Value of the emissivity, user correction for influencing factors activated Default correction for influencing factors	
2017/03/23 14:42:56	Date and time of acquisition of the current image	
 	Continuous acquisition Acquisition stopped → Image frozen	

When an image is recalled, the information becomes → 

	Batteries OK Batteries discharged	Default management
	Batteries OK Batteries low Batteries discharged	
 no display	Bluetooth function activated during creation of the file Bluetooth not activated during creation of the file	
TA	Function of the trigger → Aim , forced when an image is recalled	
 	Recall of infrared image in progress Recall of visible image in progress	
 	The correction of user influence factors is activated The correction of default influence factors is activated	
20170323_141012_IR.png	Recalled file name	

1.4.2.2. Palette of colours

The colour palette is used to identify the temperatures of the various colours used on the thermogram. By default, this temperature/colour assignment is done automatically as a function of the minimum and maximum temperatures read in each image. But the operator can also fix this relation by forcing the min. and max. temperatures: imposing a "frozen" palette (see § 2.7. [Freezing the colours representing the temperatures](#)).

In the automatic mode, the palette is represented as follows:



When the palette is frozen, the min. and max. temperatures are shown in red and a padlock appears in the centre:



1.4.2.3. Display of the measurements

This space is used to display the measurements of the various cursors, along with the Bluetooth measurements when a peripheral measurement device is connected and when the measurement is selected for display.

 → Measurement of the surface cursor
 → Bluetooth measurements (only one has been validated for display)

See § 2. [Measurement campaign](#) and § 6.3.10. [Display of Bluetooth measurements on the main screen](#)

1.4.2.4. Functions of the F1, F2, and F3 keys



The **F1**, **F2**, and **F3** (*) keys have different functions depending on the display and camera operation context.

These functions are identified by the icons displayed in this space above the keys in question:

	Opens the menu or re-opens the last menu opened
	Closes all open menus
	Validates an item, an entry, closes a message, adds the selected character...
	Closes a menu, cancels an entry, a record
	Freezes the image
	Restarts continuous acquisition
	Saves the current image
	Validates the entry in the text editor or the selection in the working directory
	Deletes the file or folder selected in the file manager
	Opens the file or folder selected in the file manager
	Exits from image recall
	Information concerning the recalled file
	Freezes the colour palette
	Edits the min or max value of the palette or restores automatic mode
	Displays the infrared image
	Displays the visible camera image
	Plays back the vocal message
	Records a new vocal message
	Stops playing or recording the vocal message
	Searches for new Bluetooth peripherals
	Connects all Bluetooth peripherals in the current list
	Lights the laser pointer.

(*) If none of these keys is pressed for about 20s, the display area shrinks in favour of display of the image.
 Pressing a key restores the display of the functions.

1.4.3. Displaying the menus

The menus are accessed by pressing the **F1** key with the function . When a menu is displayed, new functions are assigned to the **F1**, **F2** and **F3** keys.



Select an item in the menu using the arrow keys. The selected items appear in yellow.

The **F2** key is used:

-either to open the corresponding sub-menu

-or, in some cases, to modify the parameter represented.

The menus form a tree structure which is recalled in the title of the window.

The **F1** key closes all open menus, without action, and is used to return to the main screen.

The **F3** key closes the current window, without action (return to the previous menu, if any, or to the main screen).

When a parameter is being modified, it appears on a blue

background with the symbol to the left; the possible values can be scrolled using the Up/Down keys.

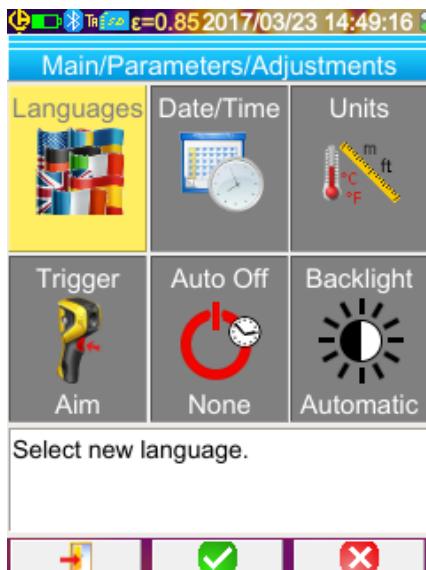
F2 pressed again → the value is accepted.

An item that is displayed shaded cannot be modified.

1.5. Configuring the camera

When the camera is first started up, all parameters are initialized to "default" values; the operator can modify these settings to meet his/her needs.

Once these adjustments have been made, they are stored in permanent memory each time the device is switched off and recovered when it is switched back on.



Most of these settings are accessible from the "Main/Parameters/Adjustments" menu.

1.5.1. Changing the language of the camera



The menus are translated into languages which can be selected from the Main/Parameters/Adjustments menu by validating the item.

1.5.2. Changing the camera's date and time

The camera's clock is reset from the Main/Parameters/Adjustments menu by validating the item .

This menu opens automatically at start-up if the power supply of the internal clock has been interrupted. It is essential to update the date and time, in order to identify the records, because the thermogram file names depend directly on this information (see § 4.1. [How are the image files named?](#)). The information entered and validated is applied by **F2** .

1.5.3. Changing the units of temperature and of distance



From the Main/Parameters/Adjustments menu, validate the item opposite to select the unit in which temperatures or distances are displayed:

- the temperature is displayed in degrees Fahrenheit (°F) or Celsius (°C),
- the distance in feet (ft) or metres (m).

1.5.4. Changing the function associated with the trigger of the camera



4 functions are associated with the trigger. They are selected from the Main/Parameters/Adjustments menu by validating the items described below:

1. Aim 	This function is used to toggle the display from the infrared image to the visible camera image, to make it easier to aim at a target. The laser lights when the trigger is pressed. When this function is selected, the "TA" icon is displayed in the status bar at the top of the screen. When an image is recalled, the trigger is automatically assigned to this function. Upon exit from the recall, the function programmed by the operator is restored.
2. Freeze 	This function is used to stop on an image: in this case, both images, infrared and visible, are frozen; you can toggle between them by pressing F3 or .
	When this function is selected, the "TF" icon is displayed in the status bar at the top of the screen. Pressing again restarts continuous acquisition.
3. Save 	This function starts by freezing the infrared and visible images, then records them on the micro SD card (if one is present). When this function is selected, the "TS" icon is displayed in the status bar at the top of the screen. Each press entails another save, creating derivative files if acquisition is not restarted in the meantime. To restart continuous acquisition, simply press F2 .
4. Laser 	This function switches the laser pointer on and off. When this function is selected, the "TL" icon is displayed in the status bar.

1.5.5. Setting the time before automatic shutdown of the camera

To extend its battery life, the camera switches itself off automatically (no operator action: key press, etc.) after a time that can be set to between 15 and 60 minutes (15min being the default value).



This function is accessible from the Main/Parameters/Adjustments menu, by validating the item opposite.

It is possible to deactivate this function (choose "None"), in which case the camera will switch itself off (if the operator does nothing) when the batteries are too low to supply it.

1.5.6. Adjusting the brightness of the screen

For greater convenience of use, it is possible to adjust the screen lighting level. For example, the lighting can be lowered when it is dark to avoid being dazzled, or turned up for use outdoors on a sunny day.

By default, the camera is configured in automatic mode: a luminosity sensor adjusts the lighting level at all times.

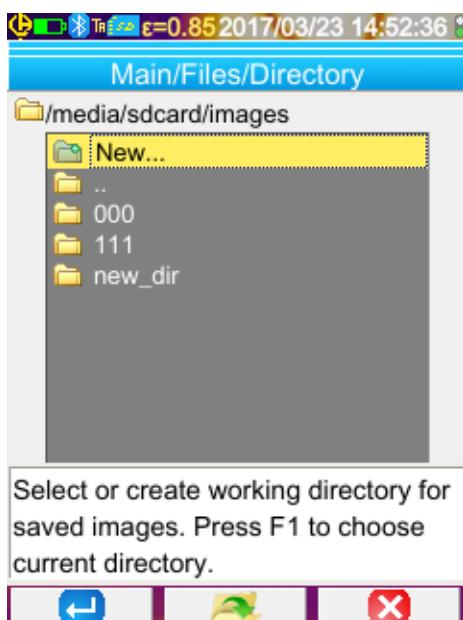


This adjustment, which directly affects the battery life, can be accessed from the Main/Parameters/Adjustments menu by validating the item opposite.

1.5.7. Changing the image backup location



The images are saved to a working directory which can be selected by the operator in the Main/Files menu, by validating the item opposite.



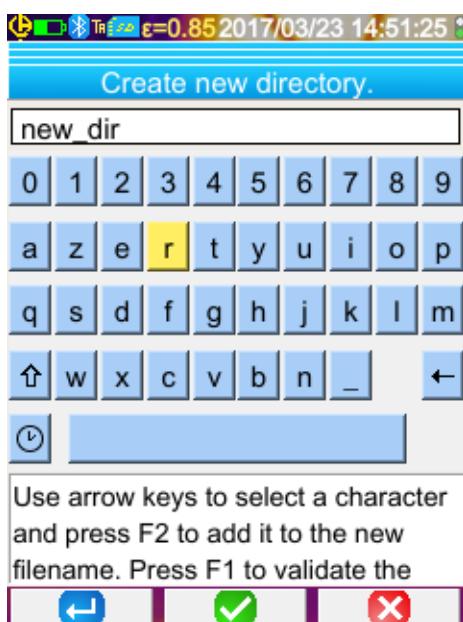
The working directory must be located on the micro SD card, which must be present in the device.

A default directory, « /media/sdcard/images », is defined.

Since the time it takes to access the micro SD card is rather long, it is best to organize the records into several directories and to limit the number of files in each of them; this will make the time needed to display the content of each directory shorter.

The current directory is chosen as working directory after **F1** is pressed to close the window.

Pressing **F2** opens the selected item of the list. Thus, to move back up the tree to the previous level, open the " ..." item of the list, and to create a new directory, open the " New..." item.



The Create menu is used to enter the directory name; the number of characters is limited to 20:

Select the letter to be insert using the arrows, add it with **F2** , and confirm the entry with **F1** .

Note: The button can be used to insert the current date and time.

Attention!

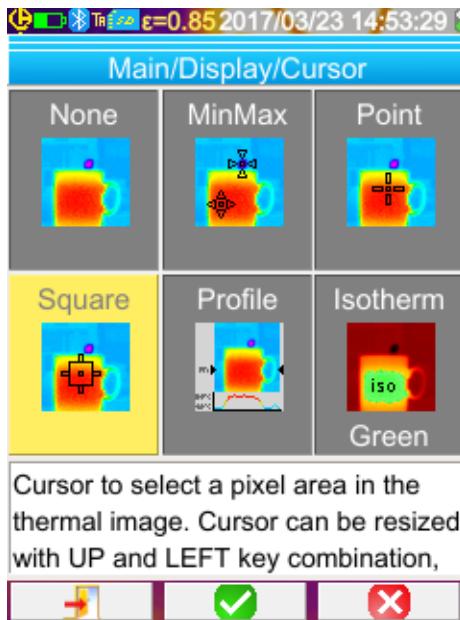
We recommend creating a directory in the root of the SD card to store the images: in the case of FAT16 formatting, if long names are used, only 256 entries are available in the root (any combination of 256 files and directories); the card will very quickly be considered full, even though its full capacity has not been reached.

1.5.8. Changing the colours used in the images



The camera has several palettes of colours, one of which can be selected by validating the item of the Main/Display menu.

2. MEASUREMENT CAMPAIGN



By default, no measurement cursor is selected (selection of the item in the Main/Display/Cursor menu), and the camera produces only infrared images.

2.1. Estimating the temperature of an object without a cursor

It is possible to evaluate a temperature from the information of the colour palette. The distribution of the colours between the minimum and maximum temperatures displayed at the ends of the palette is linear, so simply interpolating based on the position of the colour in the palette gives the temperature sought.

*Example: if the colour of the zone of which the temperature is to be determined lies at the centre of the palette, the temperature corresponding to this colour will be approximately $T_{min} + (T_{max} - T_{min}) * \frac{1}{2} = (T_{min} + T_{max}) / 2$, in other words the mean of the min. and max. temperatures of the palette; if the colour lies in the 1st quartile, $T_{min} + (T_{max} - T_{min}) * \frac{1}{4}$ etc.*

2.2. Locating the cold and hot spots in the image



In the Main/Display/Cursor menu, choose the **Min/Max** cursors → they represent the minimum and maximum temperatures in the image and display their values.

2.3. Measuring the temperature of a point in the image



In the Main/Display/Cursor menu, choose the **Point** cursor → it gives the temperature of a point. It can be moved on the image using the arrow keys.

Place the cursor in the centre of the screen and aim so as to shift the point to the centre.

2.4. Determining the characteristics of a zone on the screen



In the Main/Display/Cursor menu, choose the **Surface** cursor → it indicates the mean, minimum, and maximum temperatures of a square or rectangular area (the rectangular area has the same aspect ratio as the screen), identified by the cursor.

Place the area in the centre of the screen, then aim so as to shift the target zone into this area.

Move this area using the arrow keys or adjust its size using the following combinations of keys: Up + Left to reduce it and Down + Right to enlarge it.

2.5. Displaying the temperature profile of a line in the image



In the Main/Display/Cursor menu, choose the **Profile** cursor → it highlights a horizontal line in the image (Up/Down keys) and shows its profile. This cursor also identifies a point on this line (Left/Right keys) and indicates its temperature.

2.6. Displaying points at the same temperature in the image



In the Main/Display/Cursor menu, choose the **Isothermal** cursor → it marks with another palette of colours the points at the same temperature to within a given tolerance. Selection of this mode requires two validations of the menu item with the **F2** key: one to activate selection of the colour representing the temperature (Up/Down keys to scroll through the colours) and one to validate the choice and start the function.



Up/Down keys → adjust the temperature

Left/Right keys → adjust the tolerance

If a Bluetooth device provides a Dew Point temperature that has been selected for influence, the reference temperature is this measurement (a logo precedes the value). The up / down keys (see above) have no action and the isotherm collects all the points whose temperature is lower than the reference. Tolerance only increases this value.

2.7. Freezing the colours representing the temperatures

By default, assignment of the colours is automatic and is recalculated for each image as a function of the temperatures of the hot and cold spots in the image.

In consequence, a given colour does not necessarily represent the same temperature from one image to another, if the hot and/or cold spots change.

If you want the colours always to represent the same temperatures, the palette must be frozen (the min. and max. temperatures of the palette remain constant, whatever the hot and cold spot temperatures in the image).

- **There are two ways to freeze the palette:**

- either using the **F2** or **F3** key, when its function is

- or from the Main/Parameters menu, by validating the item with the **F2** key to change its value to "Manual" (Up/Down keys).

When the palette is frozen, a red padlock appears on the palette; the min and max values are also red.

When the mode is entered, the minimum changes to edit mode for a few seconds (on a blue ground with the symbol) so that its value can be changed (Up/Down keys).

To modify the max., a simple press on Right (when min. is in edit mode) edits the value. If there is no action on the keypad for a few seconds, the edit mode disappears.

To re-edit a value, another press on the **F2** or **F3** key with the function , or another validation of the item in the Main/Parameters menu, returns the min. value to edit mode.

- **To exit from the frozen palette mode, the following steps are necessary:**

- if not in edit mode → two successive presses on **F2** or **F3** having the function

- if in edit mode → a single press from the edit mode or, from the Main/Parameters menu, by editing the item of the Main/Parameters menu to restore the value "Automatic".

3. MORE PRECISE MEASUREMENT CAMPAIGN

3.1. Good practices

- Make the measurement in the central zone of the screen.
- Aim head on, not at an angle.
- Measure scenes that are large enough. Avoid point-like scenes.
- Following a variation of ambient temperature, wait for the camera to stabilize.
- If the storage batteries have warmed up during charging, wait before putting them back in the camera.

3.2. Use influencing parameters consistent with the conditions of measurement

The flux received by the camera depends:

- on the **emissivity** of the object observed,
- on the **temperature** of the environment,
- on the **distance** to the target,
- on the relative **humidity** of the air.

The emissivity is the most crucial of the adjustments, whatever the measurement context.

The higher the relative humidity and the greater the distance, the larger the influence of the relative humidity.

The relative humidity, the ambient temperature, and the distance are likely to vary more significantly outdoors.

The measurement context may not match the default settings, leading to measurement errors that may be large. For this reason, manual or "user" compensation is proposed to allow adjustment of these parameters.

Attention! *Incorrect settings of the various parameters can lead to an aberrant result, possibly worse than that obtained with the default parameters.*

3.2.1. Using the default compensation for the influencing factors



The default compensation for the influencing factors matches the context of calibration of the camera
(example: the emissivity is set to 1.00, the distance to 0.5m, the relative humidity to 50%, and the ambient temperature to 25°C).

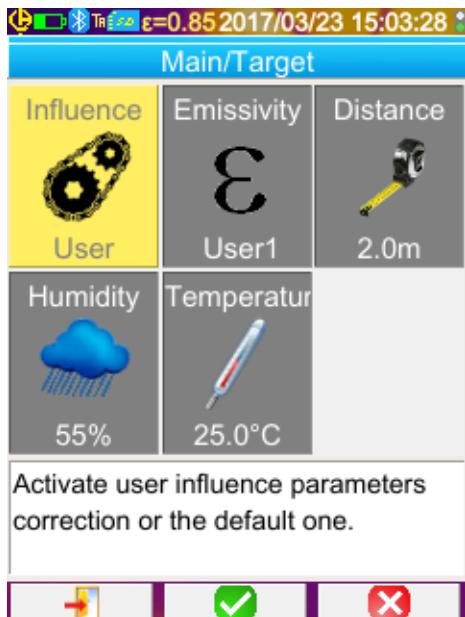
In this case, the parameters cannot be customized and are displayed shaded in the Main/Target menu.
The value of the emissivity in the status bar is replaced by the symbol

If the emissivity of the object observed is close to this, and so are the environment parameters, this calculation mode can be used.

This is also the case if the operator does not need very precise measurements (search for thermal bridge or temperature difference).

3.2.2. Using the user compensation for the influencing factors

This calculation mode is necessary when the measurement conditions are significantly different from the calibration conditions (emissivity, relative humidity) and the operator wants accuracy.



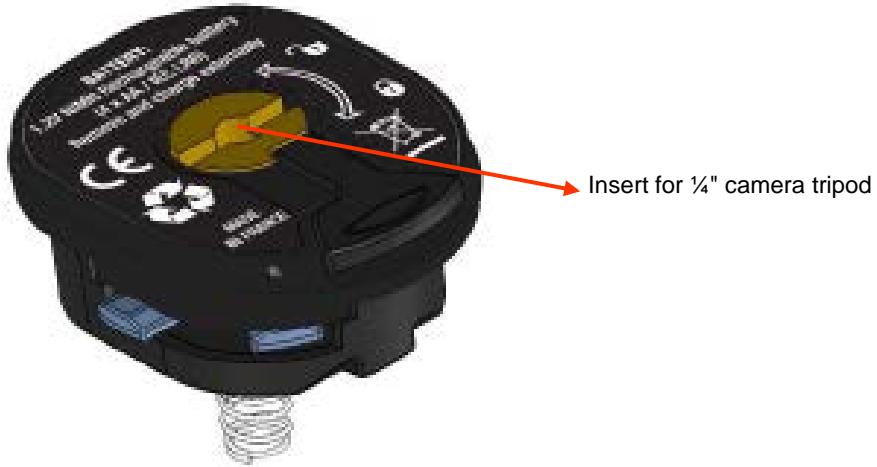
When user compensation is selected, the various parameters can be adjusted:

- **emissivity**: it is necessary to choose from a list of materials or enter a value. There are 3 user values that can be modified (press the Right key to enter the value, the Up/Down keys to change it, and F2 to validate the entry). Once it is validated the menu closes and the value of the emissivity appears in the status bar.
→ it is adjustable from 1.00 to 0.05
- **distance**: the default is 2m,
→ it is adjustable from 0.5m to 999.9m
- **relative humidity**: the default is 55%,
→ it is adjustable from 0 to 100%
- **ambient temperature**: the default is 25°C,
→ it is adjustable from 0°C to +55°C

3.3. Using a tripod

To improve the sharpness of the images and therefore the accuracy of the measurements, it is possible to use a support that prevents extraneous movements.

The camera can be attached to the tripods used in photography using the 1/4-inch-diameter insert on the underside of the handle, on the battery compartment cover.



4. SAVING AND RECALLING IMAGES

If there is a micro SD memory card in the drive, it is possible to **store**, then **recall** the current image and measurements displayed.

4.1. How are the image files named?

The camera has two objectives, one for infrared images, the other for entering a photograph in the visible domain. In consequence, when an image is recorded, two files are created, one for the infrared image, named "yyyymmdd_hhmmss_IR.PNG", the other for the visible image, having the same name but without the IR extension ("yyyymmdd_hhmmss.PNG"), where yyyymmdd_hhmmss is the date and time of acquisition of the image (the operator must take care to reset the system date and time in advance, see § 1.5.2. [Changing the camera's date and time](#)).

A third file may be added to the other two if a Bluetooth headset is connected to the camera and the operator accepts the proposal to create a vocal message (see § 4.4. [Adding a vocal remark](#)). This file will be given the same name as the associated IR image, with the extension .WAV instead of .PNG (e.g. yyyymmdd_hhmmss_IR.WAV).

When the image is frozen, it is possible to make several backups of the same image (addition of cursors, change of palette, etc.). These are referred to as "derived" images: to differentiate these infrared images, which have the same date of acquisition, an index from "a" to "z" is added after the date (e.g. 20141020_131254a_IR.PNG). When all indexes from "a" to "z" have been used, the index "z" is re-used and the file that already bears this name is overwritten by the new one.

As for the visible image, it does not change and so is not duplicated. A single visible image can therefore be associated with several infrared images (when erasing visible images other than via the camera's file manager, take care not to create orphan IR images). Here again it is possible to add a vocal message, which will have the same name as the IR image (e.g. 20141020_131254a_IR.WAV).

4.2. Saving an image

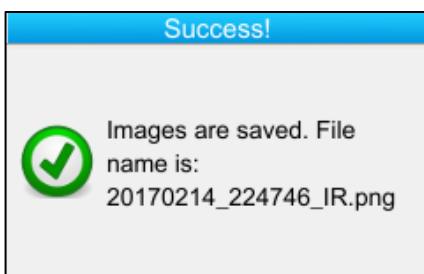
It is possible to save an image when there is a micro SD memory card in the drive.

In normal operation → if the function associated with the trigger is Aim or Freeze (see § 1.5.4. [Changing the function associated with the camera's trigger](#)), it is first necessary to stop acquisition (if this has not already been done, press F2  II) to freeze the image.

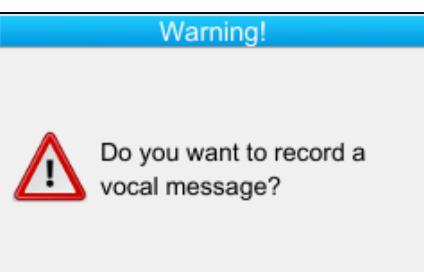
Either the F2 or the F3 key then takes on the function , allowing backup of the current image in the working directory. If the trigger is assigned to the Save function, each press freezes the image (if it is not already frozen) and records the frozen image in memory.

If acquisition is stopped, each further press creates a new "derived" image (same date of acquisition), differentiated by the addition to its name of an index (see § 4.1. [How are the image files named?](#))

If an image is recalled → it is possible to create a new image (derived, because from the same acquisition) by selecting the item  in the Recall menu; a new index (see § 4.1. [How are the image files named?](#)) will be used, since the date of acquisition is unchanged.



When the backup is terminated, a message reports the name of the file that has just been created.



If a Bluetooth headset is connected (see § 6.2.2. [How to connect a headset](#)) a second message proposes adding a vocal remark to this file.

As the case may be, 1, 2, or 3 files are saved:

1 file	for a derived image (same date of acquisition) with no headset connected (the visible image already exists, only the IR file is created)
2 files	for the creation of an image from a new acquisition (new date of acquisition) with no headset connected (the IR and visible image files are created)
3 files	for the creation of an image from a new acquisition with a vocal file

4.3. Where are the images saved?

The images are saved in the working directory selected by the operator in the Main/Files/Directory menu (see § [1.5.7. Changing the image backup location](#)). The working directory must be located on the micro SD card present in the device; if it is missing, an error message informs the operator.

4.4. Adding a vocal remark

The vocal functions are performed by means of a Bluetooth headset, which must be connected to the camera (see § [6.2.2. How to connect a headset](#)).

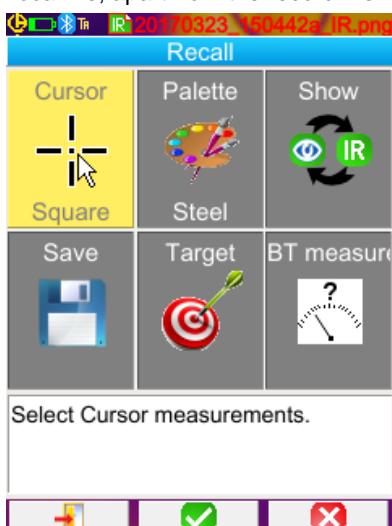
The vocal message can be added only at the end of a backup of an image, after the display of the message indicating the name of the file created. If the headset is connected, another message proposes recording a vocal message (see above). The duration of a vocal message is limited to 30 seconds.



- The vocal message recording window uses the **F1**, **F2** and **F3** keys, which receive the following functions:
- : to start recording (or adding another message)
- : to stop recording or playback
- : to play back the message
- : to close the window (without creating a file if the press was before the start of recording or during recording).

4.5. Changing the vocal remark on an existing image

The only way to change a vocal file, apart from the record menu, is to create a new file and delete the old one.



First of all, the image concerned must be recalled (see § [4.6. How to recall an image?](#)), then saved by selecting the item in the Recall menu.

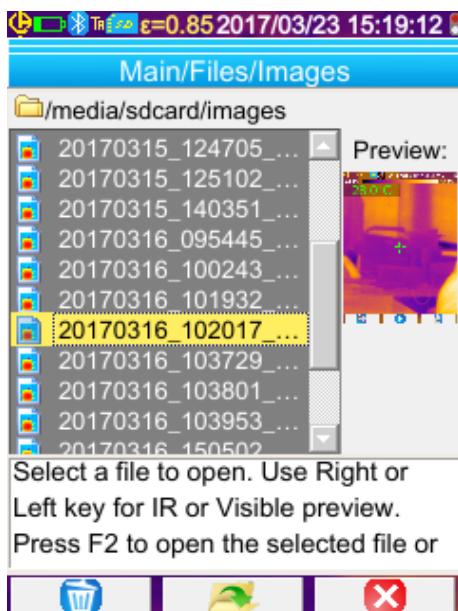
A new derived image (with a new index, "a" to "z") is then created.

If the headset is connected, a message proposes creating an associated vocal record.

All that remains is to create the new message (see above) and erase the old image (see § [4.8. How to delete an image?](#)).

4.6. Recalling an image

An image is recalled from the Main/Files/Images menu, provided that the micro SD card is in its slot.



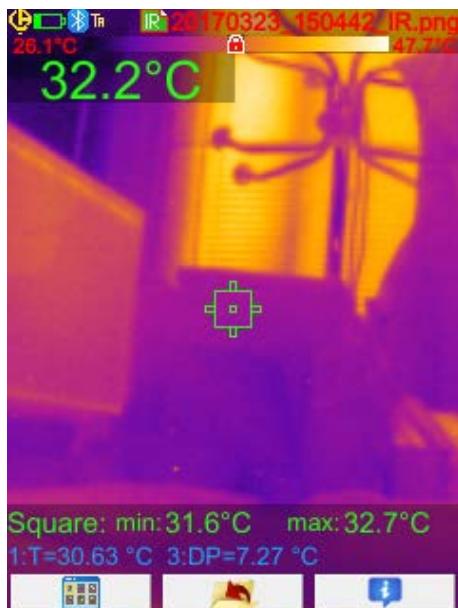
The file manager lists only infrared images generated by the camera bearing a name in the form yyyyymmdd_hhmmssX_IR.PNG, along with the folders, to allow browsing in the tree of the SD card.

A preview of the image is provided, and the Right/Left keys can be used to go from the infrared display to the associated visible image.

Images that have an associated vocal message are identified in the file manager by the icon , while the other images are identified by the icon .

The F1, F2, and F3 keys associated with the file manager are:

	deletes the selected file or directory (only empty directories can be deleted)
	opens the selected directory or file (opening a file recalls it)
	closes the file manager.



Opening an image closes the menus and the display of the image on the main screen.
The status bar changes (see § 1.4.1.1. [Status bar](#)) and the file name is displayed in red.

The F1, F2, and F3 keys associated with the main image recall screen are:

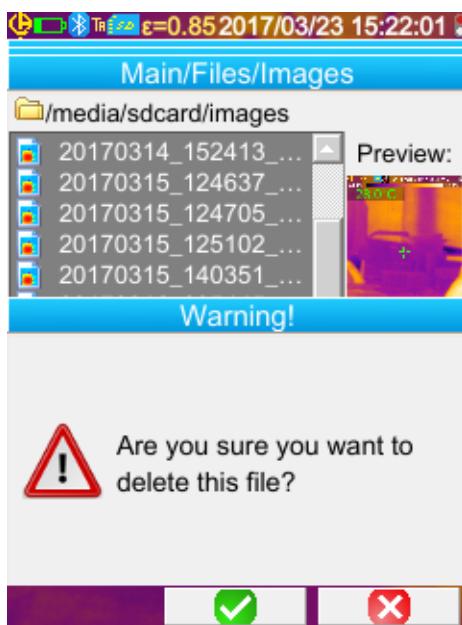
	opens the recall menu, which allows the operator to modify the palette, the cursors, to toggle from the IR to the visible image, to save the current image, to change the influencing parameters, or display the Bluetooth measurements (if there were any when the recalled image was saved).
	exits from image recall and returns to the file manager.
	displays the complementary information concerning the file and gives access to playback of the associated audio file as the case may be.

During a file recall, the trigger is used to toggle from the infrared image to the photograph of the target in the visible domain.

4.7. Playing back a vocal remark



4.8. Deleting an image



4.9. Transferring an image to a PC

The images are always saved to the micro SD memory card.

Attention!	An image that is modified and/or renamed on the PC is no longer usable on the camera:
	<ul style="list-style-type: none">- Part of the information contained in the image may disappear- The file manager screens the names.

4.9.1. With the micro SD memory card

The micro SD memory card is removable; simply withdraw it from its slot and insert it in a card reader on the PC. The image files can thus be transferred just like any other files, by being cut or copied and pasted from one folder to another.

4.9.2. Via the USB cable

- The camera, in normal operation, has a USB port of the type used for mass storage: when the camera is connected to the PC by the USB cord, the content of the micro SD memory card can be accessed directly by the PC; the image is transferred by cut or copy and paste from one folder to another.
- If the camera's file manager is open and the PC modifies the content of the SD card, the file manager must be reopened or the camera rebooted for the camera to apply the changes.
- Conversely, any modification from the camera requires disconnection/reconnection of the USB cable to force an update of the file manager of the PC.

4.10 Creating an operating report including images from the camera

The instrument is delivered with an application **CamReport** allowing post-processing of the images taken with the camera and automatic generation of reports.

To use an image, simply transfer the image files from the SD card (infrared image, visible image, and audio file) to the PC and open it with the application (see the documentation of the software).

5. BACKUP AND RECALL OF USER CONFIGURATIONS

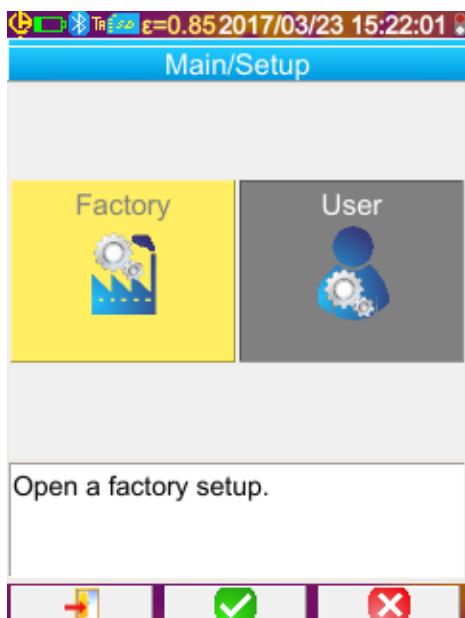
The setup files contain a complete backup of the current parameters of the camera, enabling the operator to return to an operating mode defined earlier (user setup) or to a predefined setup (factory setup). The setup stores the list of Bluetooth peripherals connected and their statuses, to allow their re-use.

5.1. Where are the configurations saved?

Like the images, the setup files are saved in the micro SD card. The files are stored in a single directory named « /media/sdcard/config/ » placed in the root of the memory card.

Their names are entered by the operator at the time of the backup and have the extension ".CFG".

5.2. Saving the current setup of the camera



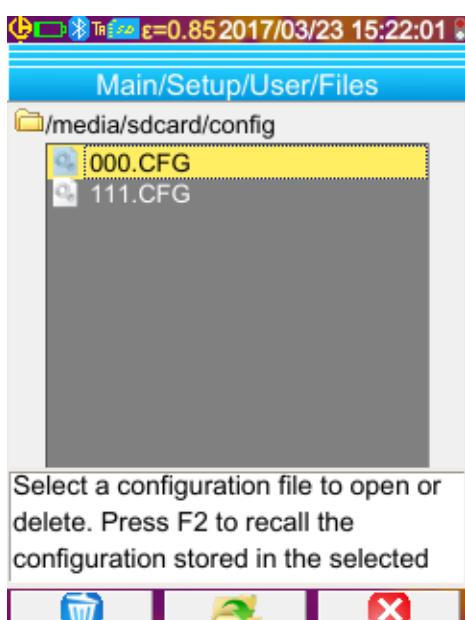
The backup is started by validation by F2 of the item in the Main/Setup/User menu.

A new menu then opens for entry of the name of the file to be created (up to 20 characters without extension).

The character to be inserted is selected using the arrow keys and added using the F2 key.

The name entered is confirmed by the F1 key, while F3 cancels the entry and the request for backup of the setup.

5.3. Recalling a saved setup



A setup file is recalled from the Main/Setup/User/Files menu, by means of the file manager, which lists all of the configuration files (extension .CFG) found in directory « /media/sdcard/config/ ».

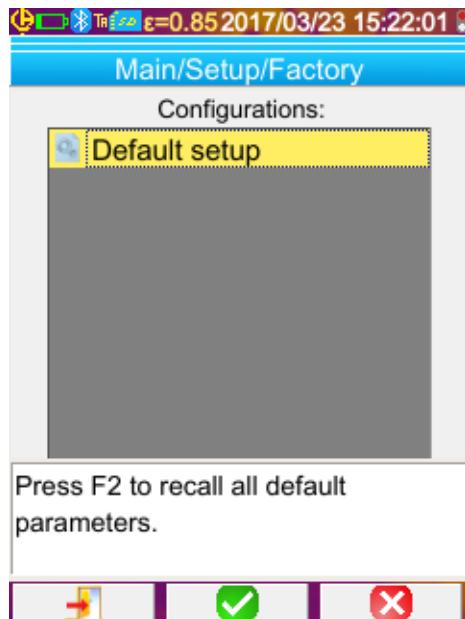
When the file has been selected (Up/Down keys), a press on F2 opens the file and updates all of the camera's parameters with the values stored in the file.

5.4. Deleting a saved setup

A configuration file is deleted from the Main/Setup/User/Files menu, by means of the file manager, which lists all of the configuration files (extension .CFG) found in directory « /media/sdcard/config/ ».

When the file has been selected (Up/Down keys), a press on **F1**  activates the deletion. A message requesting confirmation appears and must be accepted for definitive deletion of the file to take place.

5.5. Returning to the default setup of the camera



The default setup is one of the predefined configurations proposed in the Main/Setup/Factory menu.

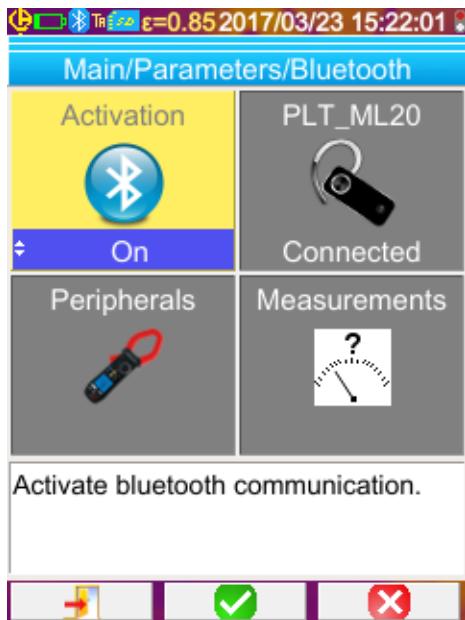
To restore the programming as defined upon leaving the factory, simply open the default setup with **F2** .

6. BLUETOOTH FUNCTION

6.1. Activating/Deactivating the Bluetooth function

6.1.1. Activating Bluetooth

To prolong battery life, the Bluetooth function can be deactivated (in fact it is the default). In this case, it is not powered and so consumes no energy.



To use this function, you must first activate it from the Main/Parameters/Bluetooth menu by setting the Activation item to "On" (validate the item with F2 , to allow entry, use Up/Down to change the value, and F2 to validate the entry).

A pictogram then appears in the status bar at the top of the screen (see § 1.4.1.1. [Status bar](#)).

If peripherals or a headset have already been identified during a previous activation, they attempt to reconnect during the activation. This automatic reconnection sometimes fails; it is then necessary to restart it manually from the Bluetooth peripherals manager (Main/Parameters/Bluetooth/Peripherals menu) by pressing F2 .

6.1.2. Deactivating Bluetooth

Deactivation is performed in the same way, this time by setting the Activation item to "Off".

All of the communicating peripherals are then disconnected, but their identifications are stored in memory, and upon the next activation the camera will attempt to reconnect them.

6.2. Using the headset

The headset can be used to create or/and play back vocal messages associated with the saved images.

6.2.1. How many headsets can be connected at a time?

The camera allows the connection of only one headset at a time.

6.2.2. Connecting a headset

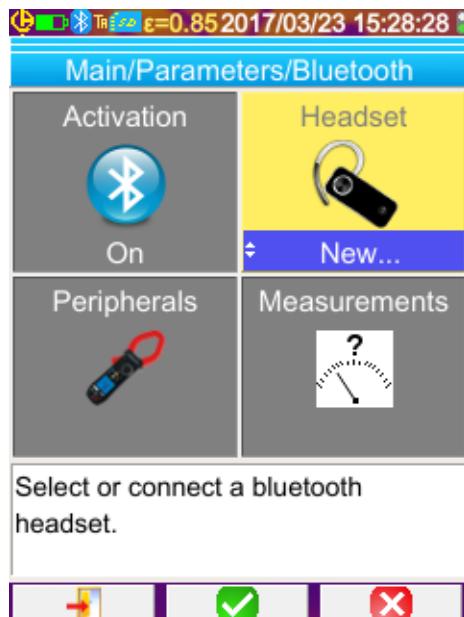
For it to be possible to connect a headset, the Bluetooth function must be activated (see above).

The connection of a Bluetooth headset to a system differs according to whether the peripheral is known (has already been connected) or not.

6.2.2.1. Case of first connection of a headset

Because the headset is not yet known, it must give the camera all of the information necessary for its connection.

To do this, the headset must be started in the coupling or pairing mode (see the headset data sheet for information on how to select this mode).



When the item has been selected in the Main/Parameters/Bluetooth menu, validation by F2 makes it possible to choose the "New..." value (Up/Down arrows) and another validation by F2 applies it.

The pairing starts; after a few seconds, the connection is made.

The menu item changes: the name of the headset is displayed and its value becomes "Connected".

6.2.2.2. When the headset is already known

If the headset is known, there is no need for pairing → simply power up.

Connection is requested by selecting the value "Connect" for the item (validation by F2 , Up/Down arrows, and another validation to apply). The headset should connect after a few seconds (the value of the item becomes "Connected").

If connection fails, switch the headset off and back on and repeat the operation.

If the name of the headset does not appear in the title of the item , pairing has failed and you must try again.

6.2.3. Disconnecting a headset

There are several possibilities:

If ...	Then ...
measurement peripherals are connected to your camera and you want to leave them connected	the simplest solution is to switch off the headset or disconnect it from the Main/Parameters/Bluetooth menu by forcing the value of the item to "Disconnect" (validation by F2 , Up/Down arrows, and another validation to apply).
no other peripheral is connected to your camera	we recommend deactivating the Bluetooth function as explained in § 6.1. How to activate/deactivate the Bluetooth function and thereby deactivate your headset. This eliminates the power drain associated with this function.

6.2.4. Changing headsets

To change headsets, you must first switch off the headset currently connected, then proceed as indicated in § 6.2.2. [Connecting a headset](#) with the new headset, which is assumed to be unknown to the camera.

6.3. Using Bluetooth measurement peripherals

6.3.1. How many peripherals can be connected?

The camera allows the simultaneous connection of 3 measurement peripherals and one headset (classic Bluetooth or low-energy).

6.3.2. How many measurements can be recovered from a peripheral?

Three measurements for the clamps and one measurement for the ASYC IV multimeter can be read on each of the measurement peripherals, for a maximum of 9 measurements if 3 clamps are connected.

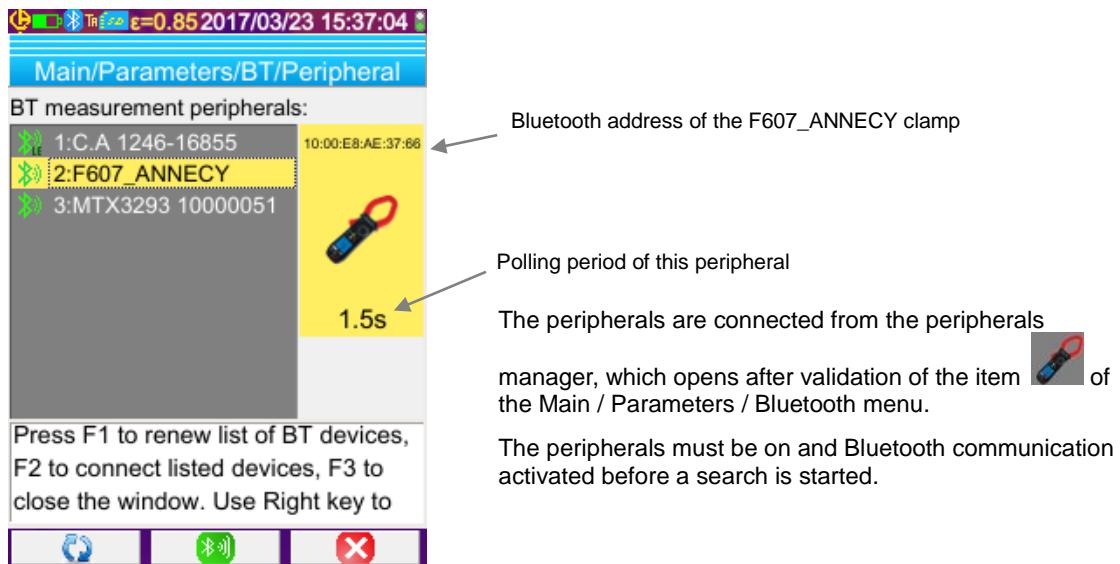
6.3.3. What peripherals does the camera recognize?

In the current version, the camera recognizes the following instruments:

- ASYC IV multimeters: MTX 3292/3BT (1 measurement read)
- current clamps: F607 (3 measurements read)
- current clamps: F407 (3 measurements read)
- Chauvin Arnoux BLE instruments: C.A 1246, C.A 1821 ...

6.3.4. Connecting a Bluetooth measurement peripheral

For a measurement peripheral to be connected, the Bluetooth function must be activated (see § 6.1. [How to activate/deactivate the Bluetooth function](#)).



This manager lists the Bluetooth peripherals previously or currently connected:

	Peripherals connected
	Peripherals not connected
	"Low-energy" peripherals connected
	"Low-energy" peripherals not connected

The F1, F2, and F3 keys associated with this menu have the following functions:

	starts a search for Bluetooth peripherals; the peripherals already connected are kept. Those having the highest receive levels are added and connected until the 3 peripherals allowed are reached.
	starts an attempt to reconnect all of the peripherals in the list.
	closes the Bluetooth peripherals manager.

The Up/Down keys are used to select a peripheral in the list and display its Bluetooth address and the reading period of the peripheral.

6.3.5. How are the Bluetooth peripherals chosen?

A first search identifies, among the devices detected, those that are recognized by the camera (see § 6.3.3. [What peripherals does the camera recognize?](#)). The camera then favours the peripherals with the highest transmit levels.

If peripherals are already connected to the camera when the search is started, they will be kept. The list will be completed up to the 3 peripherals allowed, using those found previously.

6.3.6. Replacing one peripheral with another

1. Disconnect the peripheral to be removed by switching it off.
2. Wait until the disconnection takes effect on the camera (appearance of a message).
3. Switch on the new peripheral to be connected.
4. Start a new search (**F1** key) from the peripherals manager (Main/Parameters/Bluetooth/Peripherals menu), which will overwrite the current list (the peripherals which are connected are kept) and lead to addition of the new instrument.

6.3.7. Changing the frequency of reading of a Bluetooth peripheral

From the peripherals manager (above), it is possible to change the reading period of the selected peripheral:

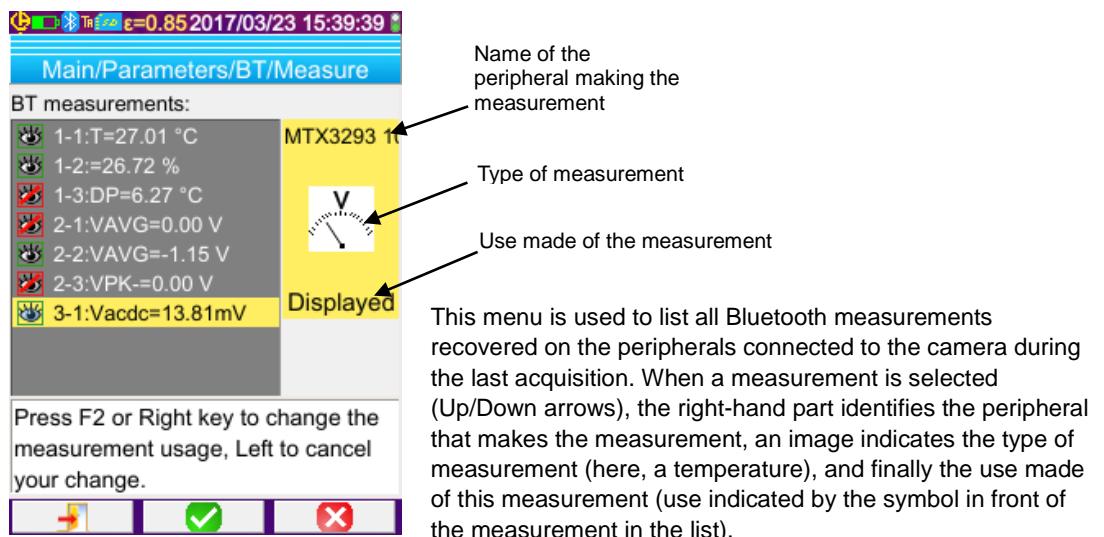
the Right arrow is used to start the entry of a new reading period. The period is displayed on a blue ground with the symbol  indicating that the Up/Down arrows can now be used to change its value. The F2  key is then used to validate the entry, while the F3  key or the Left arrow cancels it. The reading period can be set to 50 minutes.

6.3.8. Displaying the measurements of the various Bluetooth peripherals



Once the peripherals are connected to the camera, it is possible to view all measurements read from the Main/Parameters/Bluetooth menu, by validating the item opposite.

Attention! *To maintain consistency between the Bluetooth measurements and the image displayed, the measurements are refreshed in the measurements manager at each new acquisition. If acquisition is stopped (the image is frozen), there is no update of the measurements manager. Watch out in particular when you connect peripherals while the image is frozen: the measurements from these peripherals will not appear in the measurements manager until the next acquisition.*



The possible types of measurement are		temperature measurement in °C or °F
		current measurement in Amperes
		power measurement in Watts
		voltage measurement in Volts
		frequency measurement in Hertz
		impedance measurement in Ohms
		capacitance measurement in Farads
		relative humidity measurement in %
		target distance measurement in feet or in metres
		other measurement

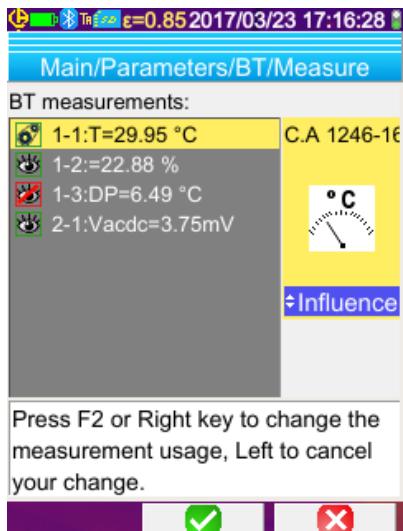
Several uses are possible	hidden	The measurement does not appear among the Bluetooth measurements displayed at the bottom of the main screen.
	displayed	The measurement is added to the list of Bluetooth measurements displayed at the bottom of the main screen (unless the Profile cursor is selected)
	influence	The measurement is added to the list of measurements displayed at the bottom of the main screen and can be used in the correction for the influencing factors or isotherm cursor (see § 6.3.9. Using a Bluetooth measurement as an influencing parameter).

6.3.9. Using a Bluetooth measurement as an influencing parameter

The three influencing quantities taken into account in the correction of the thermograms are the ambient **temperature**, the **distance** from the target, and the ambient relative **humidity**.

If you have a Bluetooth sensor compatible with the camera and capable of making one of these measurements, the value read can be used in the calculation of the correction for the influencing parameters.

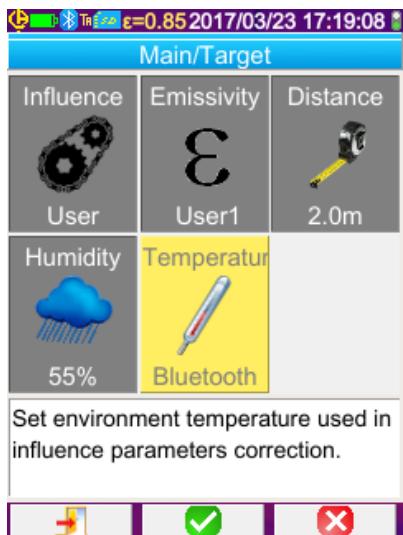
The Dew Point temperature can also be used as an influence, but only for the isothermal slider. This temperature then serves as a reference for the isotherm which will materialize all the points whose temperature is lower than this one.



For the measurement to be used as an **influence**, the use "influence" must be assigned to it in the Bluetooth measurements viewing window (Main/Parameters/Bluetooth/Measurements menu):

- select the measurement concerned (Up/Down arrows) for the use of the measurement to be displayed, allowing modification with the Right arrow (the use is displayed on a blue ground with the symbol
 - select the use "influence" (Up/Down arrows) and validate the entry by **F2**
- Reminder: this use is proposed only for measurements of the following types:*
- temperature (in °C or °F)
 - distance (in metres)
 - relative humidity [in % (from 0 to 100)]
 - Dew point temperature (in °C or °F)

Only one measurement per type can be used for the influence: if a measurement of the same type is already used as influence, its use is changed to "Displayed" and the new measurement becomes "Influence".



In case of Influence parameters, the measurements replace the user data entered in the Main/Target menu, provided that user influence is selected (see § 3.2.2. [Using the user compensation for the influencing factors](#)).

If a Bluetooth measurement is used as an influence, the corresponding influence value in the Main/Target menu takes the value "Bluetooth", indicating that it is in fact the measurement which is used in the correction.

The value actually applied is displayed on the main screen, in the list of Bluetooth measurements (index "i" after the measurement number).

In the case of the isotherm, a logo appears in front of the reference temperature of the secondary slider measurements. The reference temperature is that of the dew point given by the Bluetooth device.

Note: the operator must make sure that the measurements chosen are consistent with the uses that are made of them.

6.3.10. Displaying the Bluetooth measurements on the main screen

As described above, it is possible to assign a use to measurements.

If a measurement is "Displayed" or "Influence", it will appear in blue on the last line of the measurement zone of the screen (unless the profile cursor is activated, because of lack of space). If the number of measurements is too large, they are not all visible in continuous acquisition. However, if the image is frozen, all Bluetooth measurements corresponding to the acquisition scroll along the line.

For each measurement, the measurement number is displayed as it appears in the Bluetooth measurements window, possibly followed by an "i" if the measurement is used as an influence, followed by the separator ":", the name of the measurement, and its value. Measurements are separated by 2 spaces.

If the setup of the Bluetooth peripheral is modified (change to another measurement function), then the use of all measurements from this peripheral are forced to "hidden" on the camera and they disappear from the main screen. The operator must return to the Main/Parameters/Bluetooth/Measurements menu to request display once again.

6.3.11. Can the Bluetooth measurements be saved at the same time as an image?

Yes, the Bluetooth measurements are recorded when an image is saved.

They can be viewed when the file is recalled (see § 4.6. [Recalling an image](#)) by validating the item  in the Recall menu.

7. UPDATING THE FIRMWARE OF THE CAMERA

7.1. Where can the firmware version of the camera be read?



The current version of the camera's firmware is available from the "Main" menu by validating with **F2** → the item . The version number appears on the "Soft version:" line of this menu.

7.2. How update the firmware?

- Software update is available on our website <http://www.chauvin-arnoux.com>, under the heading **C.A 1954** support.
- If an update is available on the website, please download and install it.

Step	Action
1.	The update archive must be copied to the root directory of the µSD card before it is inserted in the camera.
2.	When the device is next switched on, the application detects the update and asks the user if he/she wants to install it. If the answer is "yes", the update is applied.
Warning!	<ul style="list-style-type: none">An update is a critical operation.Make quite sure that the batteries are adequately charged.We strongly recommend recharging the batteries before updating.Never interrupt an update in progress.

8. ARE YOU HAVING DIFFICULTIES?

8.1. The IR image I obtain is solid-colour

8.1.1. The palette of colours is frozen

Make sure that the low and high temperature limits of your palette are consistent with the temperature range of your scene. To check this, unlock the palette (see § 2.7. [Freezing the colours representing the temperatures](#)).

8.1.2. Inconsistent "user" influencing parameters

The entry of an incorrect emissivity value can lead to measurement errors of this type. Check your influencing parameters in the "Main/Target" menu. If there is any doubt, restore the "default" influencing parameters.

8.2. The contrast of my IR image is wrong

- Make sure that isothermal measurement is not activated.
- If the palette is frozen, make sure that the low and high temperature limits of your palette are consistent with the temperature range of your scene.
If there is any doubt, unlock the palette (see § 2.7. [Freezing the colours representing the temperatures](#)).
- The temperature range of the image is very large (hot and cold points very far apart), so the linear distribution of the colours between the minimum and maximum temperatures is in larger steps, impairing the contrast of the image.
Several solutions are possible:
 - either freeze the palette and set the limits according to the range of temperatures that interest you,
 - or arrange to keep the hot or cold point which does not interest you outside the field of view of the camera, so as to reduce the temperature range of the image.

8.3. I am unable to save the current image

- Make sure that the micro SD card is correctly inserted in its slot and displayed as being present in the status bar of the main screen (see § 1.4.1.1. [Status bar](#)).
- Make sure that your micro SD card is not full (with FAT16 formatting, watch out for the number of entries in the root; see § 1.5.7. [Changing the image backup location](#)).
- Make sure that your micro SD card is not corrupted and that you can read/modify its content on a PC via the USB cable or a card reader.

8.4. The file manager takes a very long time to respond

The access time to the SD is relatively long. To make it shorter, favour the creation of new directories to store your images and limit the number of files per directory. We suggest regularly uploading your images to a host PC via the USB cable or a card reader.

8.5. I cannot connect my headset

- Make sure that your headset is correctly powered and that it is not automatically connected to another instrument with which you have already paired it.
- Switch off your headset and repeat the operation as described in § 6.2.2. [Connecting a headset](#).
- If the problem persists, deactivate the Bluetooth function on the camera (see § 6.1. [Activating/deactivating the Bluetooth function](#)), re-activate it and then make another attempt to connect.

8.6. I cannot connect my Bluetooth peripheral

- Make sure that your peripheral is correctly powered, configured in Bluetooth mode, and not already used by another instrument.
- Switch off your peripheral and repeat the operation described in § 6.3.4. [Connecting a Bluetooth measurement peripheral](#).
- If the problem persists, deactivate the Bluetooth function on the camera (see § 6.1. [Activating/deactivating the Bluetooth function](#)), re-activate it, then make another attempt to connect.

8.7. My Bluetooth measurements are not displayed or are not refreshed in the measurements manager

- Make sure that acquisition has not been stopped. To preserve consistency between the image displayed and the Bluetooth measurements read on the peripherals at the time of acquisition, the measurements are refreshed only when there is a new acquisition. If a peripheral is connected, but acquisition has been stopped, its measurements will not be displayed until there has been another acquisition.
- Following an incorrect reading, the measurement read and the measurement expected may not be consistent. This can prevent refreshing. To eliminate the ambiguity, change the measurement function on the peripheral (rotary switch on clamps) and return to the initial position.
- If the problem persists:
 1. Switch off the Bluetooth peripheral.
 2. Wait until this disconnection is detected on the camera.
 3. Switch your peripheral back on (Bluetooth mode activated).
 4. Press **F2**  to try again to connect the instrument from the Bluetooth peripherals manager (Main/Parameters/Bluetooth/Peripherals menu).

If continuous acquisition is activated, your measurements must appear in the Bluetooth measurements manager (Main/Parameters/Bluetooth/Measurements menu).

9. SERVICING AND MAINTENANCE

9.1 Cleaning the housing and screen of the camera

- Cleaning the housing: to avoid any spattering on the lens, you must close the camera's lens protection flap. Use a cloth moistened with soapy water or with alcohol.
- Cleaning the screen: to avoid scratching, use a soft, lint-free cloth.

WARNING! The camera is not immersion-proof.

9.2 Cleaning the infrared optics



The infrared lens has a very fragile coating.

For this reason, great care must be taken to avoid leaving fingerprints. Insofar as possible, any rubbing of the lens will be avoided. If there is a dust deposit on the lens, favour non-contact methods, such as compressed dry nitrogen, an air bulb, etc., so as not to damage the lens coating.

If you must wipe the lens, always start by blowing away any dust as explained above, to avoid scratching by dust wiped across the surface, then use a special soft, absorbent, lint-free optical lens cleaning paper (such as KIMWIPE).

9.3 Metrological checking

Like all measuring or testing devices, the instrument must be checked regularly. This instrument should be checked at least once a year.

For checking and calibration, contact one of our accredited metrology laboratories (information and contact details available on request), at our Chauvin Arnoux subsidiary or the branch in your country.

9.4 Unpacking, re-packing

The mechanical and electrical condition of all of the equipment was checked before dispatching.

When you receive it, carry out a quick check for damage that may have occurred in transit. Should there be any, contact our sales department immediately and declare your reservations to the carrier.

For reshipping, it is best to use the original packaging.

9.5 Repair

The device can be repaired only by the manufacturer, which reserves the right either to repair the device or to replace it or part of it. If the equipment is returned to the manufacturer, carriage is paid by the customer.

For all repairs before or after expiry of warranty, please return the device to your distributor.

10. WARRANTY

Our warranty applies, except as otherwise stated, for **two years** after the date of availability of the equipment.

Extract from our General Terms of Sale, communicated on request.

The warranty does not apply in the following cases:

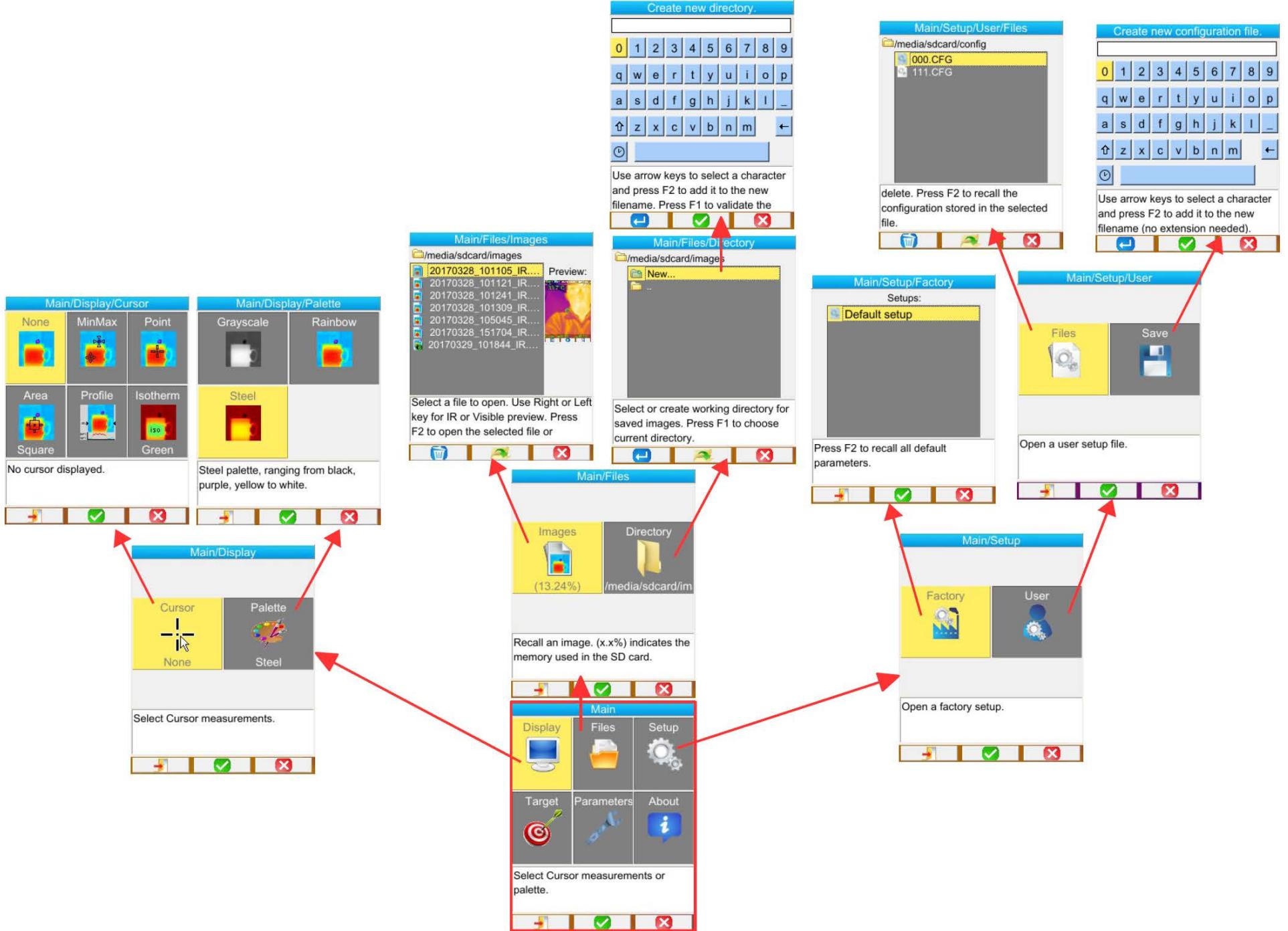
- Inappropriate use of the equipment or use with incompatible equipment
- Modifications made to the equipment without the explicit permission of the manufacturer's technical staff
- Work done on the device by a person not approved by the manufacturer
- Adaptation for a particular application not anticipated in the definition of the equipment or not indicated in the user's manual
- Damage caused by shocks, falls, or floods.

11. DELIVERY CONDITION

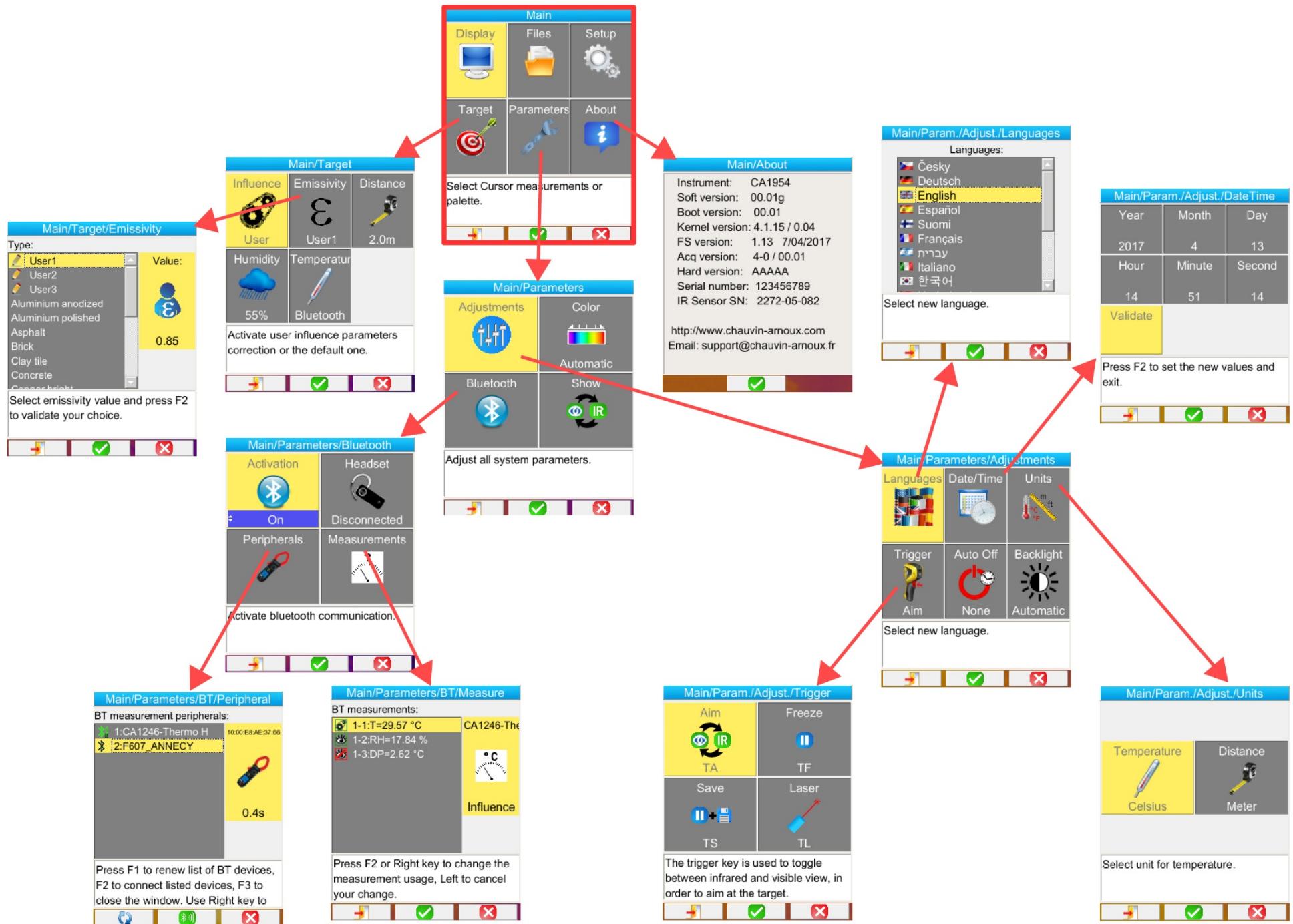
The **C.A 1954** thermal camera is delivered in a carrying case with:

- Battery charger
- 4 Ni-MH batteries - 1.2 V, 2500 mA h
- Bluetooth headset
- USB cable
- µSD memory card
- Getting started guide in 13 languages (printed)
- CD including software and complete manuals (product & software)

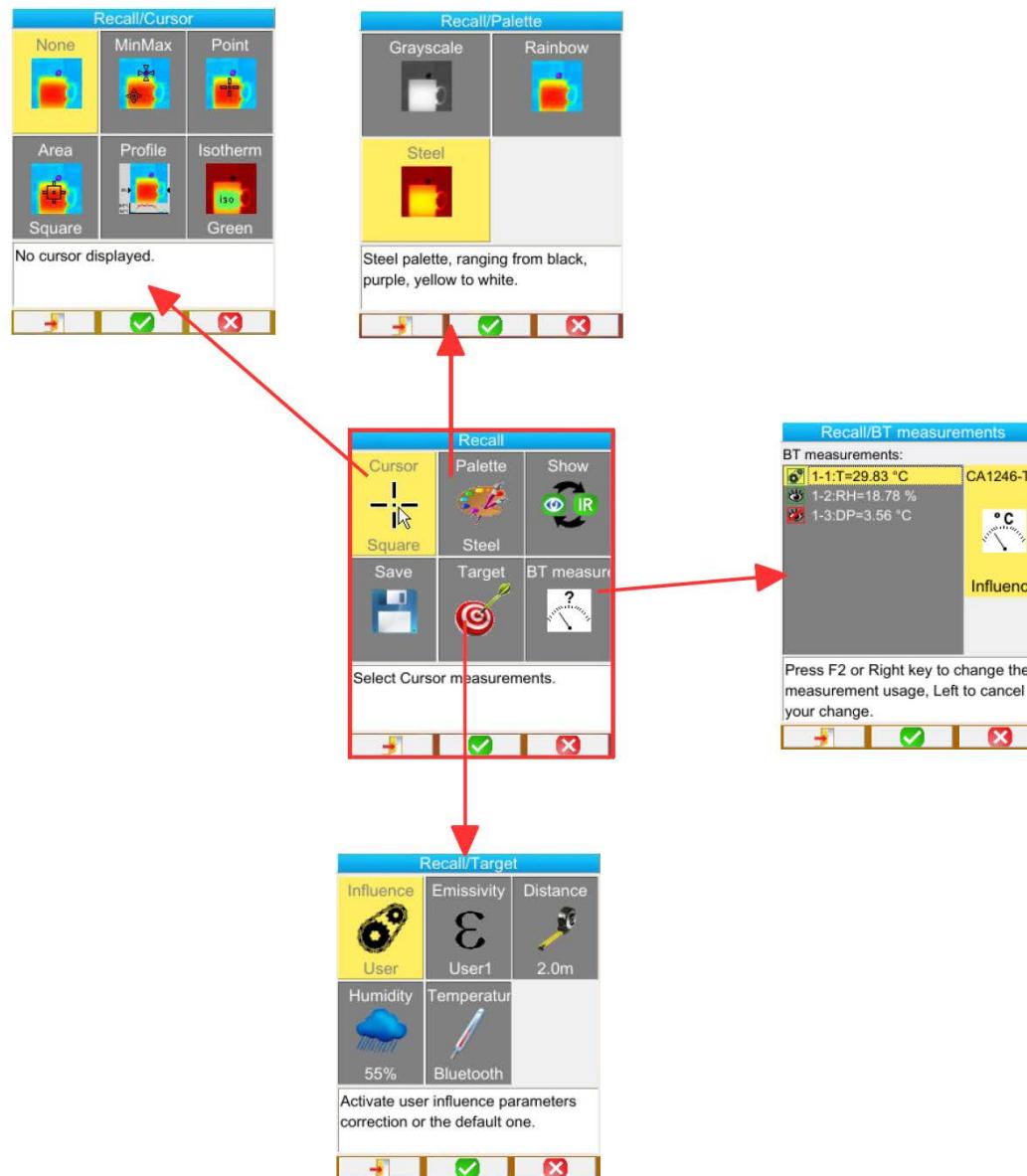
APPENDIX I – Menu tree (1/3)



APPENDIX I - Menu tree (2/3)



APPENDIX I - Menu tree (3/3)



APPENDIX II – Emissivity table

Material	Specification	Temp. °C	Spectrum	Emissivity	Ref.
Stainless steel	18-8	25		0.16	
Stainless steel	304(8Cr, 18Ni)	215~490		0.44~0.36	
Stainless steel	310(25Cr, 20Ni)	215~520		0.90~0.97	
Nickel alloys	Nickel-chromium alloy wire (shiny) (refractory)	50~1000		0.65~0.79	
Nickel alloys	Nickel-chromium alloy	50~1040		0.64~0.76	
Nickel alloys	Refractory nickel-chromium	50~500		0.95~0.98	
Nickel alloys	Nickel-silver alloy	100		0.14	
Aluminium	Polished aluminium	100		0.09	
Aluminium	Commercial aluminium sheet	100		0.09	
Aluminium	Oxidized anodized aluminium-chromium	25~600		0.55	
Aluminium	Slightly oxidized aluminium	25~600		0.10~0.20	
Aluminium	Highly oxidized aluminium	25~600		0.30~0.40	
Aluminium	Anodized, light grey, matte	70	LW: 8 - 14 µm	0.97	9
Road asphalt		4	LLW: 6,5 - 20 µm	0.96	8
Concrete		20	T: total spectrum	0.92	2
Wood	planed oak	20	T: total spectrum	0.90	2
Brick	Red	20	T: total spectrum	0.93	2
Brick	Refractory brick	1100		0.75	
Calcimine		20		0.9	
Rubber	hard	20	T: total spectrum	0.95	1
Chromium	Polished chromium	40~1090		0.08~0.36	
Copper	Shiny copper	100		0.05	
Copper	Highly oxidized copper	25		0.78	
Copper	Liquid copper	1080~1280		0.16~0.13	
Copper	Oxidized	50	T: total spectrum	0.6 - 0.7	1
Water				0.96	
Enamel (white)		18		0.9	
Tin	Commercial tinplate	100		0.07	
Tin	High oxidation	0~200		0.6	
Iron and steel	highly oxidized	50	T: total spectrum	0.88	1
Graphite (carbon black)		96~225		0.95	
Brass	Shiny brass (extreme polishing)	28		0.03	
Brass	Brass oxide	200~600		0.61~0.59	
Magnesium	Magnesia	275~825		0.55~0.20	
Magnesium	Magnesia	900~1670		0.2	
Magnesium	Mercury	0~100		0.09~0.12	
Nickel	Polished by anodizing	25		0.05	
Nickel	Electrolyzed	20		0.01	
Nickel	Nickel wire	185~1,010		0.09~0.19	
Nickel	Nickel foil (oxidized)	198~600		0.37~0.48	
Nickel	Nickel oxide	650~1,255		0.59~0.86	
Gold	Shiny gold	230~630		0.02	
Paint	8 different colours and grades	70	LW: 8 - 14 µm	0.92 – 0.94	9
Plastic	PVC, plastic flooring, matte, structured	70	LW: 8 - 14 µm	0.93	9
Plaster	unfinished covering	20	T: total spectrum	0.91	2
Plaster	plaster tile			0.87	10
Lead	Pure lead (without oxidation)	125~225		0.06~0.08	
Lead	Slightly oxidized	25~300		0.20~0.45	
Terra cotta tile				0.88	10
Glass (surface)		23		0.94	
Refractory glass		200~540		0.85~0.95	
Zinc	Oxidation at 400°C	400		0.01	
Zinc	Shiny plate of galvanized iron	28		0.23	
Zinc	Oxidized zinc powder	25		0.28	

APPENDIX III - Technical specifications

Description	Characteristics	C.A 1954
IR detector	Type	UFPA microbolometer
	Spectral range	8~14µm
	Resolution	120 x 160
IR imaging performance	NETD	< 80 mK at 30°C
	Frequency	9 Hz
	Objective	28° x 38 (typical)°
	IFOV (spatial resolution)	4.1 mrad
	Min. focal distance	0.3 m
Focusing	Adjustment	Fixed focus
Visible image	Built-in digital video	480 x 640
	Illuminator	no
	Min. focal distance	0.05 m
Presentation of the images	Images displayed	Infrared image, visible image
	Video output	no
	LCD screen	2.8 " 240 x 320
	Display of the images	Pseudo-colours, multiple palettes
Functions	Freezing of image	Moving or frozen image
	Storage of files	Micro SD and SD HC card
Measurement	Temperature range	-20 °C to 250 °C
	Accuracy	± 2 °C or ± 2 %
Analysis functions	Analysis tools	<ul style="list-style-type: none"> - point cursor - surface cursor - temperature profile - min max cursor - isotherm
	Temperature alarm	no
	Adjustment	Automatic or manual adjustment of the min. max. palette
	Correction	Emissivity, Distance, Ambient temperature, Relative humidity
	Display of isotherms	Display in colour of a temperature range adjustable by the user
Software	Vocal remarks	Yes, Bluetooth headset provided
	Analysis software	Report writing software
Laser pointer	Type	CLASS 2 Wavelength : 645-655 nm Power : < 1 mW
Battery system	Type	Ni-MH, low self-discharge - 1.2 V, 2500 mA h
	Life	09.00h typical 07.00h min.
Conformity	Electromagnetic compatibility	IEC 61326-1
	Safety	IEC 60825-1 : 2014 – IEC 61010-1-Ed. 02
Environmental specification	Temperature range, operation	-15°C to 50°C (-4°F to 122°F)
	Temperature range, storage	-40°C to 70°C (-40°F to 158°F)
	Humidity	10 % to 95 %
	Drop resistance	2 m on all sides
	Impact resistance	25G
	Vibration resistance	2G
	Protection	IP54
	Altitude	< 2000 m and 10000 m in storage
	Pollution degree	2
	For use indoors and outdoors.	
Physical characteristics	Mass	700 g with batteries
	Dimensions	225 x 125 x 83 mm

FRANCE

Chauvin Arnoux Group
190, rue Championnet
75876 PARIS Cedex 18
Tél : +33 1 44 85 44 85
Fax : +33 1 46 27 73 89
info@chauvin-arnoux.com
www.chauvin-arnoux.com

INTERNATIONAL

Chauvin Arnoux Group
Tél : +33 1 44 85 44 38
Fax : +33 1 46 27 95 69

Our international contacts
www.chauvin-arnoux.com/contacts

