# SKF TKTI 10

Instructions for use

Table of contents

## EC Declaration of conformity

We, SKF Maintenance Products, Kelvinbaan 16,
3439 MT Nieuwegein, declare that

**SKF Thermal Camera**
**TKTI 10**

Conforms to the following standards;

- EMC Directive 89/336/EEC as amended
  "Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility" as outlined in harmonized norms:

  EN61000-6-2:2005 Immunity for industrial environments
  EN61000-6-3:2007 Emission standard for residential, commercial and light-industrial environments

- Federal Communications Commission regulation CFR47:2007 sub part 15b

The laser is classified in accordance to the

21CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice No. 50 dated July 26th 2001
and complies with IEC/EN 60825-1 (2001).

The Netherlands, January 2009

Sébastien David
Manager Product Development and Quality

## Safety recommendations


### Warning

- The equipment described in this document uses a Class 2 laser. Do not look directly into the laser beam or the laser beam exit aperture, irreversible damage to the eye may occur. The laser should not be operated when there are personnel in the camera's field of view.

### Caution

- Use of controls or adjustments or performance of procedures other than those specified in this document may result in hazardous laser radiation exposure.
- To help minimize burn hazards, be aware that thermal images of highly reflective objects will show lower than actual temperature measurements.
- Do not use in a manner not specified in this instruction for use.
- Do not use in explosive atmospheres.
- Always use the lanyard provided to help minimise damage to the thermal imager and personal injury accidents.
- Only use genuine SKF spares and accessories. Other spares and accessories may damage the thermal camera.
- The thermal camera contains no user serviceable parts. Opening the imager casing voids warranty. All service work must be carried out by an authorised SKF workshop.

# 1. Description

The SKF TKTI 10 is a digital camera with advanced thermal imaging capabilities.
It is ideal for use as a Predictive Maintenance (PdM) tool. Thermography is a non-invasive technique and is well suited for mechanical and electrical inspections, energy conservation and plant safety activities. The TKTI 10 has a large backlit 3 1/2” colour screen, which gives a clear, sharp resolution using any of the eight colour palettes. Designed for easy operation, multiple temperatures can be measured and the differences between them displayed. Other advanced measurement options are also available. Images can be stored as radiometric data and digital images on the micro SD card (supplied). Powerful PC software supplied with the TKTI 10, allows the images to be further analysed and to be optimised for ease of interpretation.

# 2. Getting started

## 2.1 Contents


*Figure 1. Contents of the case*

1. SKF Thermal Camera TKTI 10
2. Power supply unit (12V) and International adaptors
3. CD - Software and instructions (MP5358)
4. USB cable (camera to PC)
5. Detachable handle

and Quick Start guide SKF Thermal Camera TKTI 10 (MP5361)

Inspect all the items. If any item is damaged or missing, please notify your dealer or local SKF office immediately.

## 2.2 Charging internal battery

- The TKTI 10's battery can be charged in the camera by connecting the supplied 12V power supply unit into the DC socket in the hatch of the thermal camera (see figure 2; connection ports).
- The battery condition indicator appears on the screen when the imager is switched on (see figure 3).
- The red led indicates that the camera is charging. The green led means that the camera is fully charged (see figure 2).
- The rechargeable battery will power the TKTI 10 for approximately 6 hours.

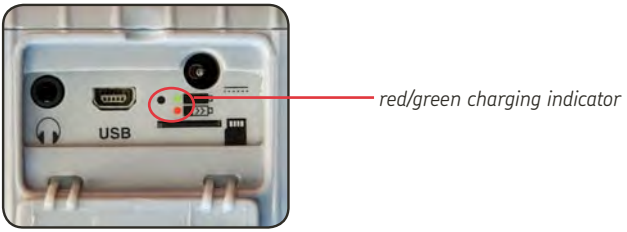



*Figure 2. Connection ports*

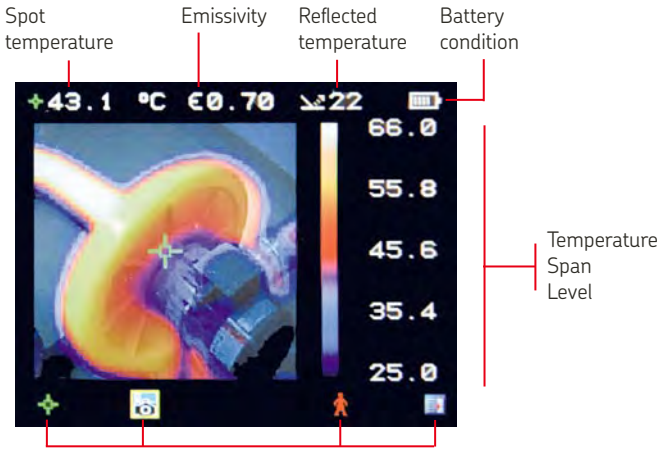



*Figure 3. Screen overview*

# 3. Basic features of the SKF Thermal Camera TKTI 10

## 3.1 Hardware

The TKTI 10 is designed for use as a handheld thermal camera. You can use the detachable handle if convenient. Thermal images are stored on a micro SD memory card (supplied size is 1GB). These images can be transferred to a PC using the USB cable provided. PC software is included for viewing and analysis of saved thermal and digital images.

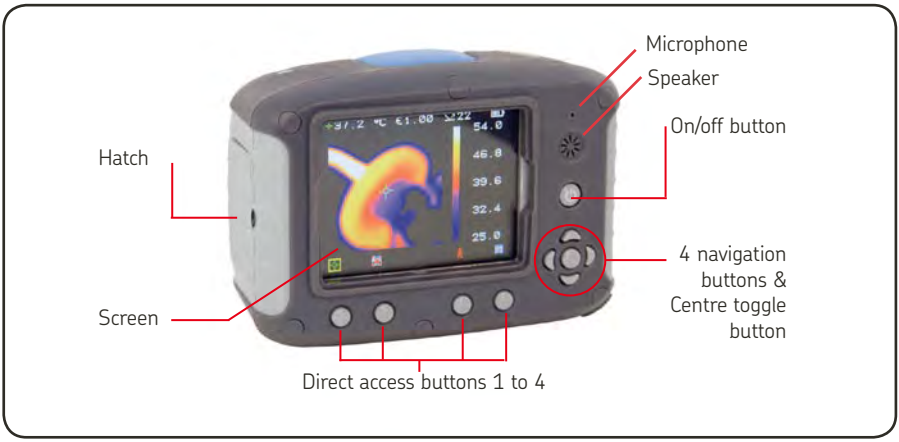



*Figure 4. Main camera controls*

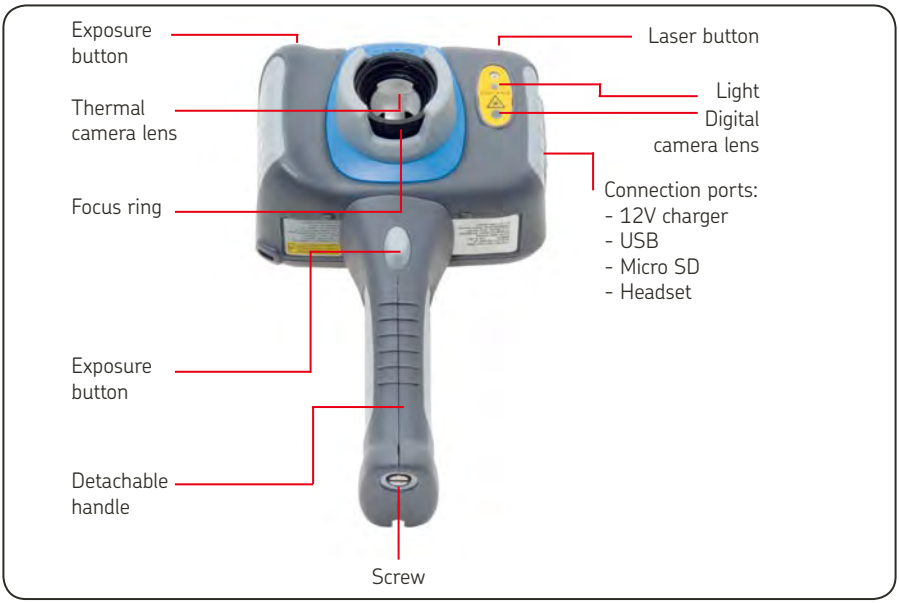



*Figure 5. Front panel*

## 3.2 Switching on the TKTI 10


- The TKTI 10 is switched on and off by pressing and holding down the power button.
- The TKTI 10 takes approximately ten seconds to become operational.

*Figure 6. Camera on/off button*

## 3.3 Focusing

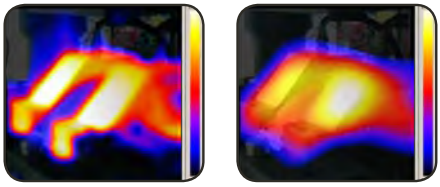
Sharpen the image by rotating the focus ring

*Figure 7. Focusing*

If the camera is not focused, the thermal image quality will be poor and temperature measurements will not be accurate. To focus make certain that the display blending is less than 100% visible (see chapter 4.2).

Rotating the focus ring in a clockwise direction (from user point of view) focuses the images at shorter distances down to a minimum of 30 cm.
Rotating the lens in the opposite direction focuses the imager at longer distances up to infinity.

Rotate the lens until the image has a sharp definition, with the sharpest contrast at object edges.



*Focused* *Not focused*

*Figure 8. Focusing*

When focusing, a focus bar appears on the screen showing the focused distance.

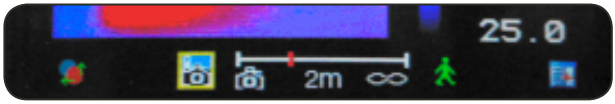



*Figure 9. Focus bar*

## 3.4 Using the laser pointer

When the TKTI 10 is switched 'ON', the laser may be activated by pressing and holding down the laser button on the front of the imager (see figure 5) or the laser pointer button on the handle.


*Figure 10. Laser pointer button*

The laser pointer is used to illuminate and identify features in the image.

**Note:** The laser centre is aligned to objects at a distance of 3 m.

### 3.5 Field of view

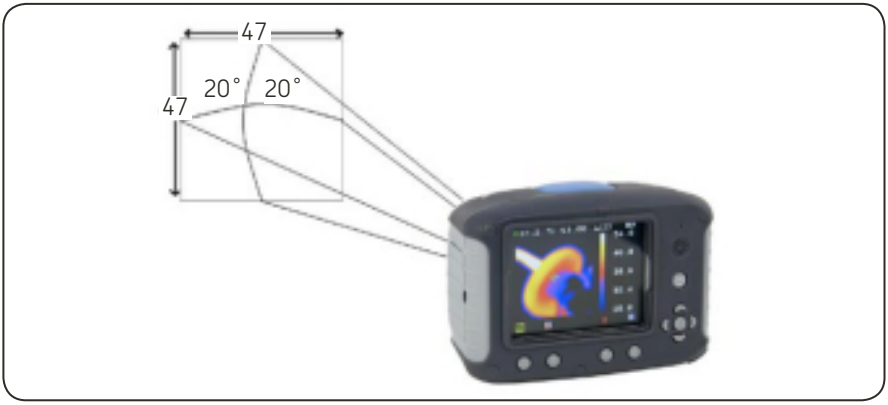



*Figure 11. Field of view*

The TKTI 10 has a 20° x 20° field of view, and a 47x47 pixel detector.
The detector resolution can be interpolated to 180x180 (see section 4.4.1; Interpolation).

## 4. Using the direct access buttons

The Direct access button positions are shown in the below figure. The icon with a yellow border show the selected function that can be adjusted (see also figure 3):


1. Direct access button 1
2. Direct access button 2
3. Direct access button 3
4. Direct access button 4
5. Centre toggle button
6. 4 Navigation buttons

*Figure 12. Direct access buttons*

## 4.1 Direct access button 1

With Direct access button 1 you can access:

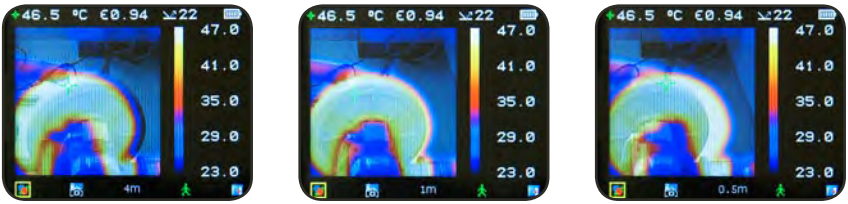
a. Alignment

b. Several measurement options, if enabled in the Measurement Option menu.

**a. Alignment** (if visible on : see Direct access button 2).

As the visible and thermal camera are not co-incident the visible and thermal image often need to be aligned. This is usually required when inspecting objects at different distances. It is possible to align the thermal and visible (digital) images only on “Live” mode. Further adjustments can be done on the saved images with the software.

| | |
|---|---|
| 1. Press Direct access button 2 to locate the camera on/off option and toggle the centre button to turn the camera option on. | |
| 2. Press Direct acces button 1 to locate the alignment option. | |
| 3. Alignment presets are accessible with centre toggle button. You can also use the navigation buttons for final adjustment. | |




*Press left navigation arrow* *fully aligned* *Press right navigation arrow*

**Note**: *Only the digital image is moving.*

*Figure 13. Examples of alignment*

**b. Measurement options**

To be displayed while navigating with Direct access button 1, these options need to be enabled in the Measurement Option menu.

To access the Measurement Option menu

press Direct access button 4

and select the correct icon:

Direct access button 1 can display the following icons:

| | | |
|---|---|---|
| Cursor one Menu>Measurement options>Cursors: 1 | Cursor two Menu>Measurement Options>Cursors: 2 | Isotherm low temp Menu>Measurement Options>Isotherms: (Low, High&Low) |
| Isotherm high temp Menu>Measurement Options>Isotherms:(High, High&Low) | Area Menu>Measurement Options> Area: On | Hot/cold tracking Menu>Measurement Options>Tracking:(High, Low, High&Low) |
| Low temp range Menu>Measurement Options>Temp. Alarm: (Low, High&Low) | High temp range Menu>Measurement Options>Temp. Alarm: (High, High&Low) | Horizontal profile Menu>Measurement Options>Temp. Profile: Horizontal |
| Vertical profile Menu>Measurement Options>Temp. Profile: Vertical | Align (If Camera On : see Direct Access Button 2) | |

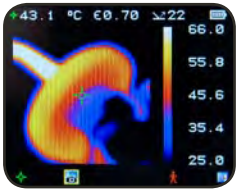
See for detailed description of the functionality of these options section 4.4.2: Measurement Options.

## 4.2 Direct access button 2

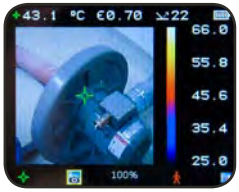
When a picture is displayed on the screen, this button gives acces to 3 different options with 2 settings for each (toggle using centre toggle button):

| | |
|---|---|
| **1. Camera on/off**<br>Enable/disable the display of a digital picture blended with thermal image. | |

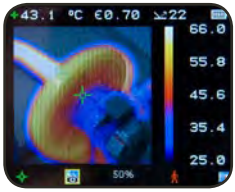
| | |
|---|---|
| How to set blending:<br>1. Press Direct access button 2 to locate the camera on/off option and toggle the centre button to turn the camera option on. | |
| 2. Blend between the digital and thermal image by pressing the up/down, left/right arrow buttons. | |
| 3. This will blend the two images on a percentage scale 0%, 25%, 50% 75% and 100%. | |




*a) 100% Thermal only*




*b) 100% Digital only*




*c) 50% Thermal/50% Digital*

| | |
|---|---|
| **2. Light on/off**<br>Enable/disable high power LED in the front panel, helpful to take pictures in a dark environment (see figure 5). | |

| | |
|---|---|
| **3. Auto/manual temperature range scale** | |
| **Auto**<br>Automatically adjusts the image to allow for the highest and lowest temperature in the scene. Useful when starting an imager and switching to different parts of a scene. | |
| **Manual**<br>The user defines the range of temperatures to be displayed.<br>Manual setting is useful when the user wants to examine various pieces of similar equipment. In a fixed temperature range, anomalies or discrepancies can be highlighted visually very easily.<br>Set the span using the right and left navigation button and the level using the up and down navigation button. | |

| | |
|---|---|
| **4. Play audio (only in picture viewing mode)**<br>Plays previously recorded voice annotation saved with the image. | |

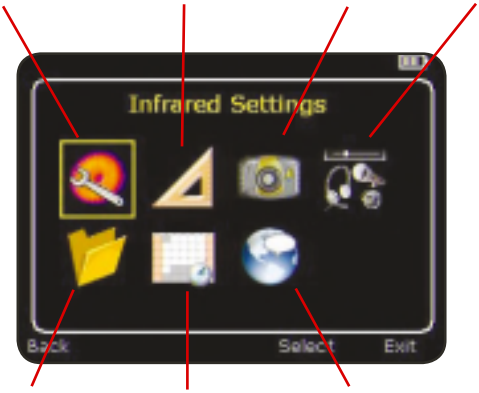
## 4.3 Direct access button 3

This button toggles between live image and a frozen image

live frozen

## 4.4 Direct access button 4

This button selects the camera menus.



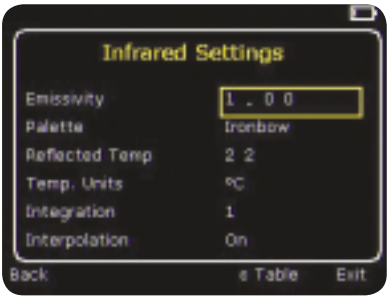

### Menu selection

| | |
|---|---|
| 1. Press Direct access button 4 to enter the menu selection screen | |
| 2. Navigate to the desired option using the navigation buttons. (The icon with the yellow border show the selected option) | |
| 3. Press Direct access button 3 or the centre toggle button to enter the selected option. | |

### Menu items

| | |
|---|---|
| 1. Arrow up and down to the desired item | |
| 2. Use the left/right arrows to change the value of this item | |
| 3. Select Direct access button 4 to exit or Direct access button 1 to go back to the main menu. | |

### 4.4.1 Menu Infrared Settings




Infrared Settings

- **Emissivity**

Different surfaces can radiate different amounts of infrared energy at the same temperature. This difference in temperature measurement can be corrected for by setting the emissivity value.

The amount of infrared radiation emitted by a surface depends on both its temperature and its emissivity. Surfaces that are good reflectors (e.g. polished metal) are poor emitters, and surfaces that are good emitters (e.g. human skin) are poor reflectors. A black body is defined as an object that absorbs all radiation falling on it; and it is a perfect emitter of radiation.

The emissivity of a surface (usually written **ε**) is the ratio of energy radiated by that surface to energy radiated by a black body at the same temperature. For accurate temperature measurements, the emissivity of the surface being measured must be entered into the camera. This is done by entering a number in the range 0.10 (for polished chromium) to 1.00 (for a black body). An emissivity lookup table is provided, which lists the emissivities of a range of common materials.

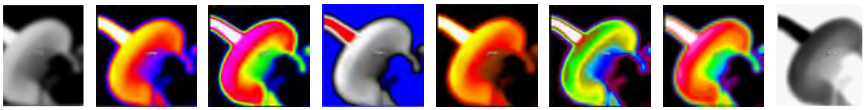
It is not recommended that temperature measurements be attempted when emissivity values lower than 0.70 are required, because large errors are likely due to reflected radiation from surrounding objects.

Set emissivity value between 0.10 and 1.00 for measuring temperature. Pressing Direct access button 3 (**ε** Table) gives a table of emissivity values of common materials from which a selection can be made.

Infrared Settings

- **Palette (8 options)**

Different colour palettes are useful in viewing objects and scenes for different requirements. As a simple rule of thumb, palettes with a lot of different colours are more helpful when looking for hot spots or cold spots, whereas palettes with fewer and gradually changing colours are more useful in viewing changes of temperatures in a scene or object.



1 2 3 4 5 6 7 8

1. White Hot Mono
2. Ironbow
3. Rainbow
4. Isotherm Style
5. Hot Metal
6. High Contrast
7. 16 step Rainbow
8. Black Hot Mono

Infrared Settings

- **Reflected Temperature**

*This is only applicable if an emissivity of less than 1 is selected.*

Some of the infrared energy seen by the camera from a surface with an emissivity of less than 1.00 is reflected background energy. If there is a hot object in the background, this can have a significant effect on the temperature measured. By entering a reflected temperature value, the camera can correct for the effect of this reflected background energy. Usually set to the ambient temperature.

Infrared Settings

- **Temperature units**

Choose between °C and °F.

Infrared Settings

- **Integration. (1 low to 9 high.)**

The camera normally operates at a frame rate of 8Hz (i.e. the image is updated 8 times per second). For viewing scenes in which there is very little temperature variation, however, the image may be improved by integrating over several frames to reduce the noise.

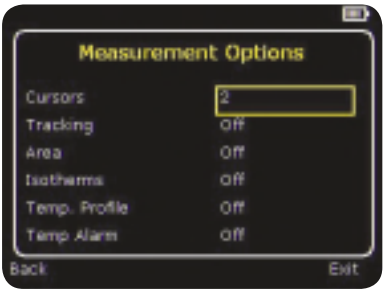
Chose an integration period from 1 (fast) to 9 (slow).
This determines the trade off between display speed and noise.

Infrared Settings

- **Interpolation. (On/Off.)**

Interpolation is on by default as it smoothes the image to provide a better visual image. Turning it off gives a more pixelated image. Some users may wish to observe the scene with the actual resolution of the detector. Actual resolution is 47x47.
By turning interpolation on the resolution is interpolated to 180 x180.

## 4.4.2 Menu Measurement Options



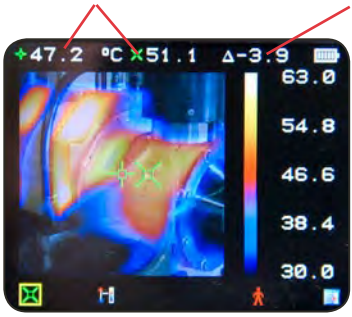

This menu enables the selection of options for temperature measurements. The symbols shown below indicate the icons shown for Direct access button 1 when the various options are selected.

Measurement Options

- **Cursors** 

One or two measurement cursors can be selected. When two cursors are chosen, the temperatures at both cursors and the temperature difference between them will be displayed. When one of the cursors is selected by Direct access button 1, it can be moved around on the display by the navigation buttons.

*cursor centre temperature* *cursor temperature difference*




*two cursors*

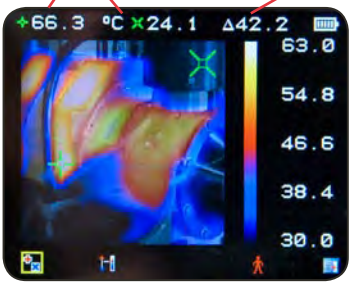
Measurement Options

- **Tracking**

Select “High”, “Low”, or “High & Low” in order to track and measure the following:

- the hottest part of the scene
- the coldest part of the scene
- or both the hottest and coldest part of the scene.

*cursor centre temperature* *cursor temperature difference*




*Tracking*

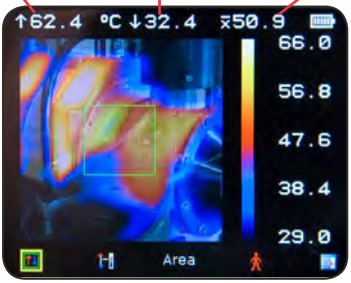
Measurement Options

- **Area**

Area analysis is useful when wanting to know the highest and lowest temperature in a part of the scene. It also works out the average temperature. There are three area boxes sizes to choose from.

- Maximal temperature in the selected area
- Minimal temperature in the selected area
- Average temperature (surface average).

*Maximal temperature* *Minimal temperature* *Average temperature*




*Area analysis*

Measurement Options

- **Isotherms** 

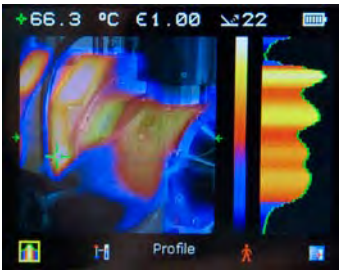
Select “High”, “Low”, or “High & Low” in order to highlight areas of the scene with temperatures within one or two temperature bands. The temperature bands are adjustable by means of Direct access button 1 and the navigation keys.
Use right/left navigation button to set the span and up and down navigation button to set the level of the isotherm.


*Isotherms high & low*

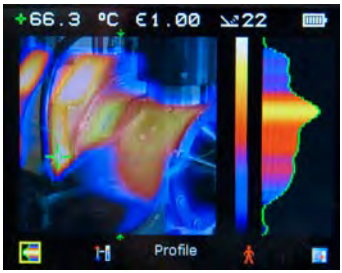
Measurement Options

- **Temperature profiles** 

Select “Horizontal” or “Vertical” to enable a histogram of temperature values along a horizontal or vertical cross section to be displayed on the right hand side of the display. The position of the cross section is indicated by small arrows at the left and right (for horizontal profile) or top and bottom (for vertical profile) of the image and can be adjusted by means of Direct access button 1 and the navigation buttons.




*Horizontal*




*Vertical*

Measurement Options

- **Temperature alarms**

Select “High”, “Low”, or “High & Low”.
Visual and audio (if enabled in Audio setting menu) alarms will be triggered if either cursor or a point within the designated area is higher or lower than a set temperature. The high and low set temperatures may be adjusted by means of Direct access button 1 and the navigation buttons.

*Alarm temperature setting*


*Temperature alarms*

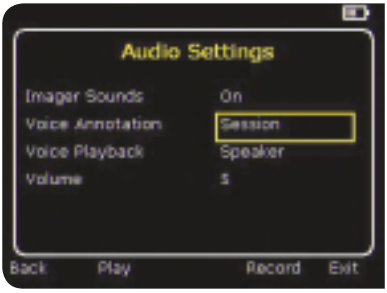
### 4.4.3 Menu Camera Settings

Camera Settings


- LCD Brightness
  Select from 1 (low) to 9 (high) to control the screen brightness to save battery power.
- Caption Mode
  Select “On” to enable the addition of a text caption when saving an image. Options will then be displayed when saving an image, to be selected by means of Hotkey 2 and Hotkey 3.
- Auto Off
  Select “5 Mins”, “10 Mins”, “20 Mins” to allow the camera to switch itself off after a defined period of inactivity in order to save power. Always on means that the Auto off function is disabled.
- Camera Reset
  Select Direct access button 3 to restore the factory settings.

### 4.4.4 Menu Audio Settings

Audio Settings




- Imager Sounds
  Select “Off” to mute all audible outputs.

- Voice Annotation
  Select “Session” to add a voice message at the start of a set of images (A session ends when the imager is switched off).
  Select “Individual” to add a voice message to each saved image.
  Select “Combined” to add a common voice message at the start of a set of images and add additional comments for each image.

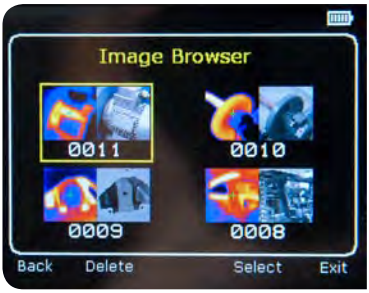
  If session or combined is selected, the voice message is recorded in the audio settings by pressing Direct access button 3. Recording is stopped by pressing Direct access button 3 again. Direct access button 2 can be used to play back the recorded message. Direct access button 3 can be used to re-record if necessary.

- Voice Playback
  Select “Speaker” or “Headset” for the desired method of audible outputs.

- Volume
  Select the volume of the audible outputs from 0 to 9.

### 4.4.5 Menu Image Brower

Image Browser



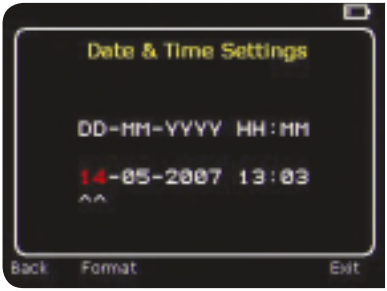

The saved images are shown on the screen with the most recently saved image first.

Select the desired image by means of the navigation keys.
To display the selected image press Direct access button 3.
To delete the selected image press Direct access button 2, to confirm deletion press Direct access button 3.

When a stored image is displayed, press DIrect access button 3 to return to live imaging.

### 4.4.6 Menu Date & Time Settings

Date & Time Settings




a) Use the left/right buttons to navigate in this menu, the item that can be changed is highlighted in red. In the picture above the day (DD) 14 is highlighted.

b) Use the up/down buttons to change the value.

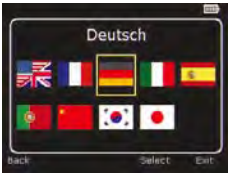
- Minute. (00 to 59.)
- Hour. (00 to 23 in 24 hour format, am or pm in 12 hour format.)
- 12 hour or 24 hour clock.
- Day. (01 to 31.)
- Month. (01 to 12.)
- Year. (2000 to 2099.)
- Format ( DD-MM-YYYY, MM-DD-YYYY, YYYY-MM-DD).

### 4.4.7 Menu Language Selection

Language Selection


In this menu you can select the language in which you want to use the camera.
The icon with a yellow border show the selected language. Press Direct access button 3 to select.


*French*



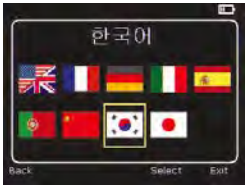

*German*


*Italian*


*Spanish*


*Portuguese*


*Chinese*




*Korean*


*Japanese*

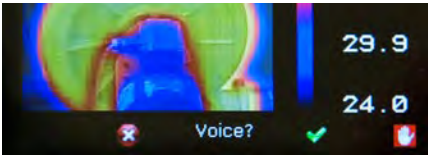
# 5. Saving and annotating pictures

## 5.1 Saving a picture

To save a picture press the exposure button (see figure 5).
After pressing you can add 'voice message' and 'caption' to the picture.
Note: micro SD card should be inserted for saving a picture (see figure 2).

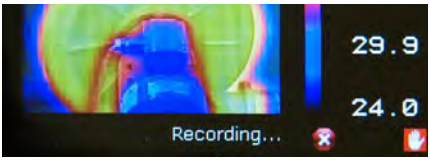
## 5.2 Adding a voice message

When saving an image with Individual Voice Annotation turned on (see 4.4.4). There you can save a voice message with each image. The voice recording can be played back when viewing the saved images in the browser (see chapter 4.4.5).

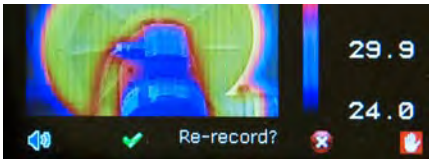



a) You can attach a voice message to this saved image
Press Direct access button 2 for no.
Press Direct access button 3 for yes .
Press Direct access button 4 to cancel and return to 'live'


b) Start voice recording?
Press Direct access button 3 for yes.
Press Direct access button 4 to cancel and return to 'live'



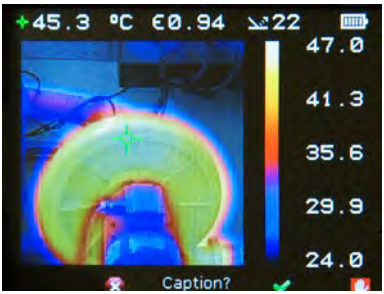

c) Stop Recording
Press Direct access button 3 to stop.
Press Direct access button 4 to cancel and return to 'live'




d) Option to Re-record the voice message
Press Direct access button 1 for replaying your voice message
Press Direct access button 2 for Yes
Press Direct access button 3 for No
Press Direct access button 4 to cancel and return to 'live'

## 5.3 Adding a Caption

When saving an image with Caption Mode turned on (see 4.4.3), you can attach a text caption to each image.




a) To attach a text caption message to this image
Press Direct access button 2 for no
Press Direct access button 3 for yes
Press Direct access button 4 to cancel and return to 'live'


1. Use the up/down arrow buttons to cycle through letters and numbers until the one required appears.
   The available symbols are:ABCD EFGHIJKLMNOPQRSTUVWXYZa bcdefghijklmnopqrstuvwxyz012 3456789

2. Use the left/right arrow buttons to move to the next space and repeat the above step until the caption is completed.


3. Press Direct access button 2 to clear the whole message.

4. Press Direct access button 4 to exit and save the image and caption

**Note:** Captions cannot be viewed with the saved images in the browser. The captions can be viewed using the PC software (for more detailed information see IFU TKTI 10 Thermal Camera Suite Software (MP5358)).

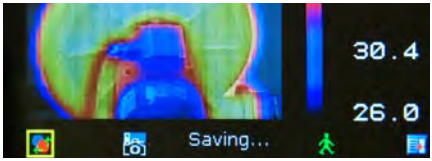



Image with voice message is being saved.

Both thermal and visible images are now saved with annotations and caption if recorded.

# 6. Technical specifications

| | |
|---|---|
| **Performance** | |
| Temperature range | -10 ºC to +350 ºC (14 ºF to +572 ºF) |
| Field of view (FOV) | 20º x 20º |
| Spectral Response | 8 to 14 µm |
| Sensitivity | ~0,3 ºC @ 30 ºC |
| Detector | 47 x 47 pixel array (interpolated to 180 x 180) |
| Frame rate | 8 Hz |
| Focal Range | 0,5 m (19 in) to infinity |
| **Image Storage** | |
| Number | Up to 1 000 images on SD card supplied |
| Medium | Micro SD Card |
| Display | 3.1/2" colour LCD with LED Backlight. 8 colour palettes.<br>Mixed thermal and visual images |
| Laser Pointer | A built in Class 2 laser is supplied to highlight the reference pixel |
| **Measurement** | |
| Temperature range | -10 ºC to 350 ºC |
| Radiometry | Two moveable temperature measure cursors. Temperature difference measurement |
| Emissivity Correction | User selectable 0.1 to 1.0 in steps of 0.01<br>Emissivity table of common surfaces built-in<br>with reflected ambient temperature compensation |
| Accuracy | The greater of ± 2 ºC or ± 2 % of reading in ºC |
| **Camera Power Supply** | |
| Battery | Lithium-ion field rechargeable |
| Operation time | Up to 6 hours continuous operation |
| AC operation | AC adaptor supplied |
| **Mechanical & Environment** | |
| Housing | Impact Resistant Plastic with over-moulded rubber |
| Dimensions | 210 x 120 x 90 mm ( 8,3 x 4,8 x 3,5 in) |
| Weight | 0.70 kg (1,5 lbs) |
| Temperature operating & storage Range | -5 °C to 45 °C (14 °F to 113 °F) Humidity: 10 % to 90 % non condensing/ -20 °C to 60 °C (-4 °F to 158 °F) |
| Ingress Protection | IP 54 |
| **Software** | SKF TKTI 10 Thermal Camera Suite: Advanced imager analysis and report writing software |
| **Computer Requirements** | PC with minimum of 300 MHz processor, MS Windows XP 128 Mb RAM 16 bit colour graphics with 1024 x 768 capability |

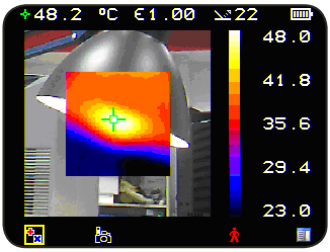
# SKF Thermal Camera TKTI 10 - Addendum

## Extra Features

All cameras with a serial number 01606 or higher are equipped with extra features.

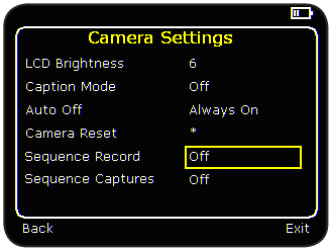
### 1. Picture in picture

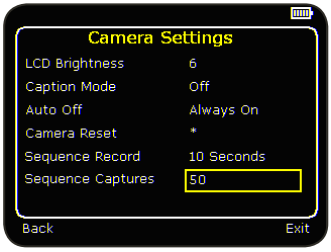
The Picture in picture option has been added to the blended thermal/visible picture options.
Refer to Instructions for Use, section 4.2



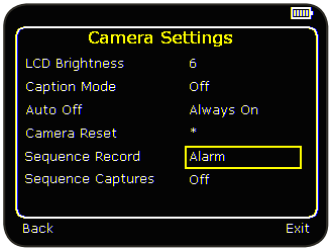

### 2. Sequence Record

Sequence Record saves a sequence of 10, 50, 100, 500 or 1000 images to the SD card. Images can be saved every 10 seconds, 20 seconds, 30 seconds, 1 minute, 2 minutes, 5 minutes, 10 minutes, 20 minutes, 30 minutes or 1 hour.
Refer to Instructions for Use, section 4.3.3




Sequence Record with Alarm selected saves an image to the SD card every time the high and/or low level temperature is exceeded.




### 3. Persistent Manual setting.

Persistent Manual allows one set of manual span and level settings to be saved. When turning the camera on, the default is always Auto. However, by selecting the Persistent Manual mode, the previously stored span and level settings are used.
Refer to Instructions for Use, section 4.2.

*Persistent Manual Icon*

SKF Maintenance Products



www.mapro.skf.com
www.skf.com/mount

MP5357E