



SKF TTKTI 21 & 31

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Original instructions

EC Declaration of conformity

We,
SKF Maintenance Products
Kelvinbaan 16
3439 MT Nieuwegein
The Netherlands

herewith declare that the following products:

SKF Thermal Camera
TKTI 21
TKTI 31

has been designed and manufactured in accordance with:
EMC DIRECTIVE 2004/108/EC as outlined in the harmonized norm for
EN61326-1:2006 Class A
EN61326-2-2:2006
IEC61000-4-2:2008
IEC61000-4-3:2006
FCC Part 15 Subpart B

The laser is classified in accordance to the
21CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice
No. 50 dated June 24th 2007 and complies with IEC/EN 60825-1.

EUROPEAN ROHS DIRECTIVE 2011/65/EU

Nieuwegein, The Netherlands,
September 2013



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 must 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 a lower temperature than their actual temperature.
- Do not use in a manner not specified in this instruction for use.
- Do not use in explosive atmospheres.
- The thermal camera contains no user serviceable parts. Opening the casing voids the warranty. All service work must be carried out by an authorized SKF workshop.
- Never point the lens directly towards a strong radiation source (eg. Sun, direct or reflected laser beam, etc), with power on or power off, as permanent damage may result to the thermal detector of the camera.
- Store the unit in its original case in a cool, dry, well-ventilated area away from strong electromagnetic fields.
- Protect the surface of the lens from being stained or damaged by foreign objects such as sludge or chemicals. Place the lens cap back on the lens after use.
- For best measurement accuracy, allow 3 to 5 minutes for the camera to stabilize after initial start up.

1. Introduction

The SKF TKTI 21 and SKF TKTI 31 are rugged handheld digital cameras with advanced thermal imaging capabilities.

They are 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 cameras have a large 3.5" colour screen, which gives a clear, sharp image using any of the eleven 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). The powerful PC software allows the images to be further analyzed and exhaustive reports to be created.

Instructions for use for the PC software can be found on the CD or on SKF.com



2. Overview

2.1 Case Content



Figure 1 Case content

1. SKF Thermal Camera TKTI 21 or TKTI 31	5. Quick Start guide SKF Thermal Camera TKTI 21 and 31 (MP5416)
2. Battery Power adapter (110V-230V) and 4 International adaptors for EU, US, UK, AUS	6. Certificate of Calibration and Conformance (MP5414 or MP5421)
3. CD – PC Software and instructions (MP5413)	7. 2 x Batteries
4. Mini USB to USB cable (camera to PC)	8. Mini Jack to Video cable

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

2.2 Camera Overview



Figure 2 Camera description

1. 3.5" Color display	7. Connectors hatch
2. Control Buttons	8. Laser
3. Status LED	9. Infrared Camera lens
4. Microphone	10. Focus Ring
5. Battery hatch	11. Digital Camera lens
6. Trigger	12. Tripod Mount



Figure 3 Connectors

1. Mini USB connector	3. Mini jack video output
2. Micro SD card port (2GB Micro SD card supplied)	4. 12V DC connector (Power adapter not provided)

3. Getting Started

3.1 Battery

3.1.1 Battery Installation and Replacement

The Battery door is located in the bottom of the handle. Open the lock on the battery door by pushing in the direction shown figure 4.



Figure 4 Battery door



Figure 5 Battery insertion

Insert one of the two batteries supplied as shown on Figure 5. Ensure the battery contacts are oriented towards the upper part of the camera. Lock the door.

3.1.2 Charging the Battery

For charging the battery, remove the battery from the camera. Place the battery in the battery charger provided. To fully charge the battery will take around 3 hours.

Two batteries are supplied in order to allow continuous operation of the camera.

When placing the battery on the battery charger, check the contact to make sure the charger light becomes red.

Note:

Before first use, it is recommended to fully charge the batteries.

Alternatively the battery can be charged by connecting a 12V DC 3A max power adapter to the 12V connector located on the side of the camera.

3.1.3 Battery safety and usage

Batteries should be stored at ambient temperature of -20 °C (-4 °F) to +20 °C (68 °F).

Lithium batteries will self-discharge during storage, so they should be fully charged before storage. Self-discharge may affect long term battery performance.

Furthermore, it is recommended that the battery should be fully charged every 3 months.



CAUTION:

The use of an incorrect battery may result in physical or electrical damage to the instrument due to incorrect voltage or physical size difference. The ambient temperature for charging should be between 0 °C (32 °F) and +40 °C (104 °F).

When using the camera under 0 °C (32 °F) ambient temperature, the battery capacity will be reduced, over +50 °C (122 °F), the battery may overheat, resulting in permanent damage.



WARNING:

- Never disassemble, incinerate or puncture battery
- Never short circuit the battery
- Keep the battery dry
- Keep out of reach of children
- Always dispose of the battery in accordance with local regulations

3.2 Switching On the Camera

The Thermal camera is switched On and Off by pressing and holding the On/Off button for at least 3 seconds, until the display switches On.

The clicking noise heard frequently when the camera is switched On is due to the calibration of the Infrared detector. This is done automatically by the camera.

Note:

After powering off, please wait ten seconds before switching On the camera again.



Figure 6 Switching on the camera

3.3 Focusing



Figure 7 Focusing

REMEMBER TO REMOVE THE LENS CAP

Focus:

- Is the most important step to obtain a good quality image.
- Influences the accuracy of the temperature reading.
- Cannot be modified when viewing the images on a PC.
- Some palettes allow you to make a better focus.
- Make sure you are in automatic span and level.

- Rotating the focus ring in a clockwise direction (from user point of view) focuses at shorter distances down to a minimum of 10 cm.
- Rotating the lens in the anti-clockwise direction focuses at longer distances up to infinity.
- Rotate the lens until the image has a sharp definition, with the sharpest contrast at object edges.

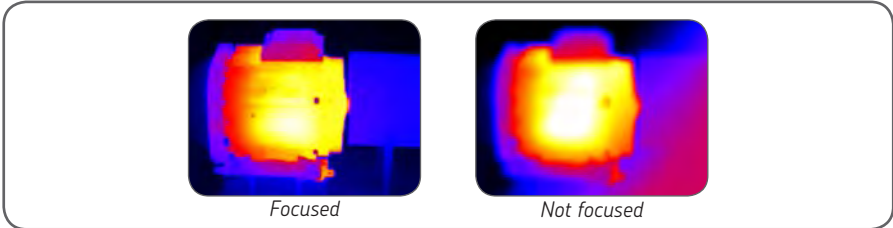


Figure 8 Focusing

3.4 Buttons

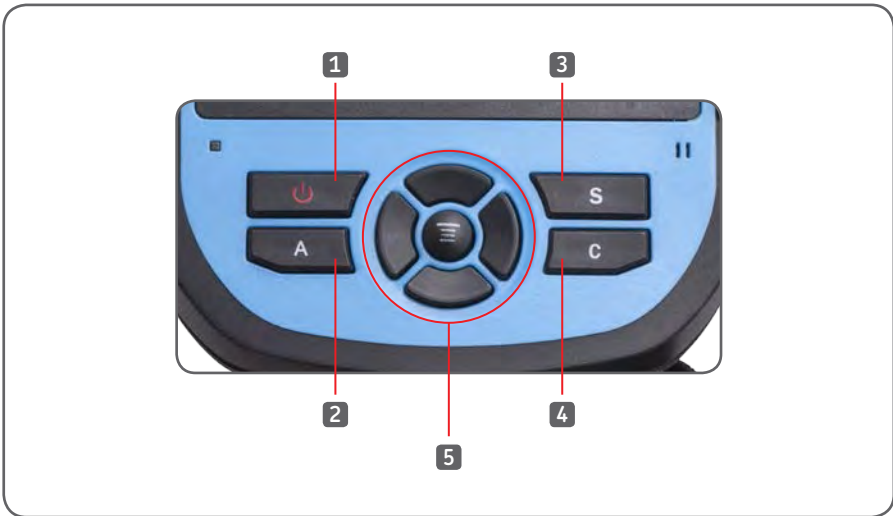


Figure 9 Front buttons

1. On/Off Button	4. C button
2. A button	5. Menu/Okay centre button and navigation pad
3. S button	

3.4.1 On/Off Button

See 3.2 Switching On the camera

3.4.2 A button

The A button has two functions.

1) The first function is the modification of selected parameters.

Press the A button successively to be able to change the parameters of the different cursors, areas, lines, colour palettes and span/level setting shown on the screen.

When an element is selected, it will be highlighted in yellow to show it is active.

It will remain active for 2 seconds.

Clicking on the A button one more time will highlight the last active element.

Measurement cursors, lines and areas

- Pressing the **Menu** button will pop up the element settings box.
- Pressing the **Okay** button will save the settings and close the settings box.
- Pressing the **C** button when the settings box is shown will close the box without saving the settings.
- Use the **navigation pad** buttons to move the cursors and lines
- In the area settings box, the user can select to adjust either the position or the size of the area.
- Use the **navigation pad** buttons to adjust the selected area.
- Use the **C** button to delete the selected elements.

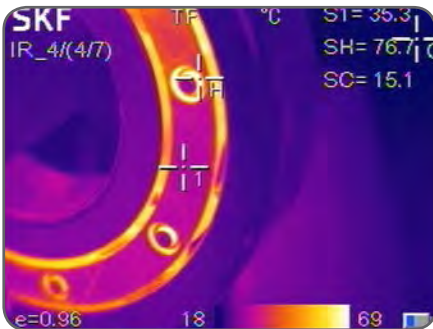


Figure 10 Measurement cursors

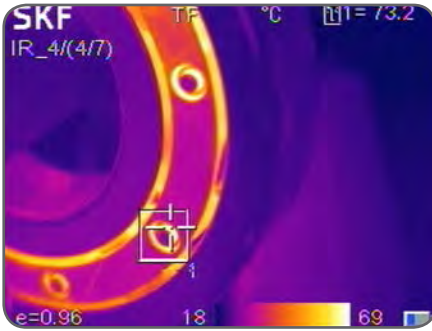


Figure 11 Areas and settings box



Colour Palette

- Pressing the left or right buttons of the **navigation pad** will scroll through the available colour palettes, displaying their name above the palette.
- The selected palette will become active after about 3 seconds and will be set as the default palette when the camera is switched on.

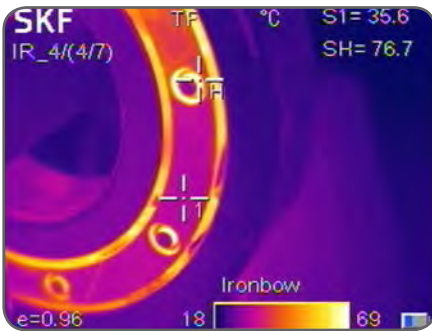


Figure 12 Changing the colour palette

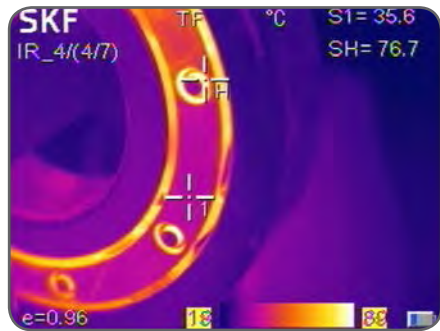


Figure 13 Level/Span

Level/Span values

- Pressing the left or right buttons of the **navigation pad** will reduce or increase the Span and pressing the up or down buttons of the **navigation pad** will reduce or increase the Level.
- If the unit is in Automatic mode, modifying any of these parameters will switch the span/level to Manual mode.

2) The second function performed by the A button is to force an internal calibration cycle.

This is performed by pressing and holding the **A** button for at least 5 seconds until the calibration clicking noise is heard. The camera will make an automatic correction to get the most accurate thermal measurement.

Note:

Use the **A** button to refresh the image when the image quality is not optimum.

3.4.3 S button

The S button will allow freezing and viewing the infrared or digital image and save these images.

- Pressing the S button once will freeze the image.
- Pressing the Okay button will save the thermal and/or visual image. If Voice recording is enabled, a voice comment dialog box will be displayed.
- Press the C button or select the box on the right to return to real-time measurement.

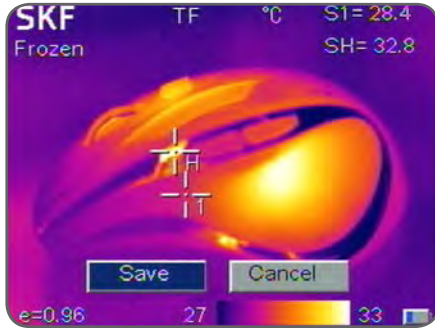


Figure 14 Saving an infrared image

3.4.4 C button

- Pressing the C button cancels the present operation when browsing in a Menu.
- Pressing the C button when an image is frozen or being viewed from the memory will return to real-time measurement.
- When not browsing in a Menu or editing a setting, pressing and releasing the C button will switch between the thermal image and the visible camera image.
- When a parameter is selected, such as a measurement cursor, line or area, pressing the C button will delete the highlighted cursor, line or area.

3.4.5 Menu/Okay button and navigation pad

The buttons include **Up**, **Down**, **Left**, **Right** and **Menu/Okay** (centre).

The functions vary with operation mode.

- In a **Menu**, it is used for menu selection. **Up** and **Down** buttons are for browsing vertically. **Left** and **Right** keys are for different levels menu operation. **Okay** button (centre) is to activate the menu and confirm the choice.
- In **Infrared Image mode**, pressing the **Up** or **Down** buttons will activate X2 digital zoom. The screen will display "X2" in the upper left corner. Press **Up** or **Down** button again to return to the original image.
- In **Spot Measurement** editing mode (activated immediately after adding a spot or by selecting via the **A** button), press the **Menu** button to pop up the attribute box. Press the navigation pad to move the spot location.
- In **line temperature** measurement editing mode (activated immediately after adding a line or by selecting via the **A** button), press the **Menu** button to pop up the attribute box.
- In **area measurement** editing mode (activated immediately after adding an area or by selecting via the **A** key), press the **Menu** button to pop up the attribute box. Select in the attribute box the parameter to be edited, either size or position.

4. Using the Camera

4.1 Screen elements

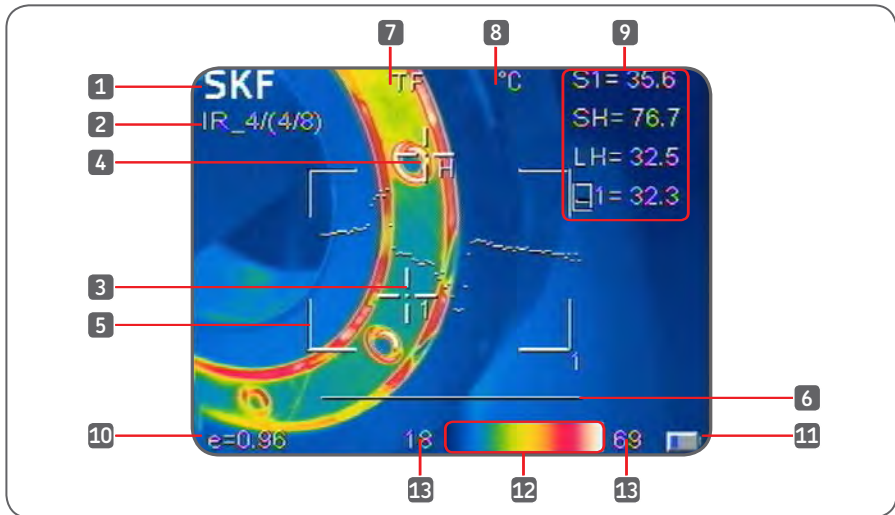


Figure 15 Screen elements

1. SKF on-screen logo	8. Temperature unit (°C, °F, K)
2. Operating status (Saved image name, calibrating, L/S)	9. Temperature readings, shows the temperature of the spots, areas and lines displayed
3. Measurement spot with spot number	10. Global emissivity
4. Hot spot (H) and cold spot (C)	11. Battery status
5. Area	12. Colour palette
6. Line	13. Span and Level temperature limits
7. Memory card symbol, shown when the Micro SD card is inserted	

4.2 Menu functions

4.2.1 Measurement cursors

The measurement menu is used for adding or deleting spots, areas and lines.

- Press Menu button to activate the main menu.
- Select Measurement and press the Okay button.

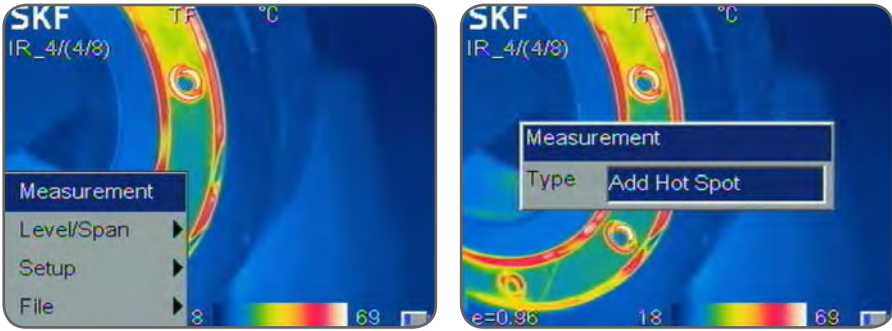


Figure 16 Measurement options

The Measurement dialog box will be displayed.

- Toggle through the options and press the **Okay** button to select the required item or the **C** button to cancel.

The available options are:

- **None** – Deletes all measurements from the screen.
- **Add Hot Spot** – adds a moving cursor that automatically displays the hottest spot in the image. Designated by SH and +H.
- **Add Cold Spot** – adds a moving cursor that automatically displays the coldest spot in the image. Designated by SL and +L.
- **Add Spot** – adds up to 2 fixed cursors, user adjustable by the cursor editing mode. Designated by S1, +1 and S2, +2.

A temperature profile is a histogram showing the temperature values through a cross-section of the scene.

The horizontal or vertical cross-section can be moved by the user.

- **Horizontal** – Adds horizontal line measurement to display profile of temperatures along the line. Designated by LH.
- **Vertical** – Adds vertical line measurement to display profile of temperature along the vertical line. Designated by LV.

Note:

Either Horizontal or Vertical can be enabled at a time.

- **Area** – adds up to 3 area boxes, with min, max or average temperature displayed for each box. Areas can be sized and moved by the user.

Note:

To delete a single object, press **A** button to select the object and then press **C** button to delete.

The emissivity will be set to the global emissivity when the cursors are added. The emissivity of each cursor can be individually adjusted.

4.2.2 Level/Span

The span is defined by the minimum and maximum temperatures on the scale on the bottom side of the screen. A wider span will give you less thermal details, whereas a narrower span will give you more thermal details but also increases the noise in the image.

You can adjust its position within the range, this is the level setting.

By adjusting the temperature and colour corresponding relation, users can observe enhanced image quality and easily find and analyze thermal fault.

There are two operational modes available **Automatic** or **Manual**.

- In **Auto** mode, the camera automatically adjusts the image to allow for the highest and lowest temperature in the scene. This is useful when starting the camera and switching to different parts of a scene.
- In **Manual** mode, the user defines the range of temperatures to be displayed. Manual setting is useful when the user wants to examine specific parts of the image. In a fixed temperature range, anomalies or discrepancies can be precisely highlighted.

Press the Menu button to enter the menu

- To switch between **Manual** and **Auto**, select **Level/Span** from the menu and validate **L/S?** for manual or **Auto?** for automatic.



Figure 17 Auto or Manual mode

In **Manual** mode press the **left** or **right** arrow will reduce or increase the Span and pressing the **up** or **down** arrow will reduce or increase the Level.

In **Manual** mode, **L/S** symbol is shown in the top left of the screen to indicate the Level and Span can be manually adjusted.

4.2.3 Setup

Access the setup menus by pressing the Menu button and select Setup.

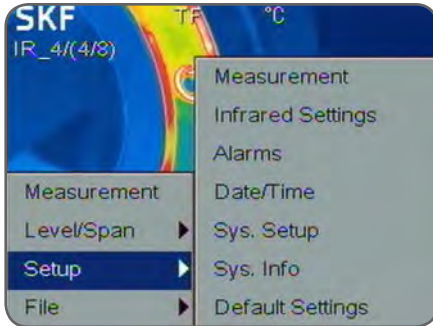


Figure 18 setup menu

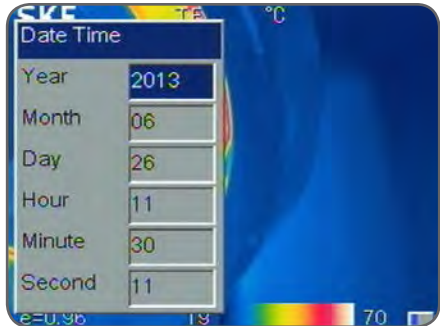


Figure 19 Date and time setup

4.2.3.1 Date/Time setup

Select Setup->Date/Time to open the Date/Time dialog box. The user can set the Year, Month, Day, Hour, Minute and Second. Press Okay to validate or C to cancel.

4.2.3.2 System setup

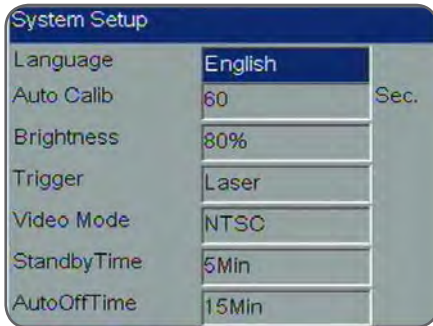


Figure 20 System Setup

Press Menu button and select Setup->Sys. Setup and press the Okay button to open the System Setup dialog box.

Use the navigation pad to modify each setting.

Press the Okay button to validate or C to cancel.

The user can modify the following parameter:

- **Language:** English, Spanish, French, German, Italian, Portuguese, Korean, Japanese, Russian, Simplified Chinese and Traditional Chinese.
- **Auto Calibration:** Select Auto Calibration and press the right button on the navigation pad, the Auto Calib dialogue box will pop up. The user can select 3 different modes: long, short or customize.

Customize allows the user to set the time interval for the automatic calibration. The range varies from 0, which means Off and 30 to 600 seconds with 1 second increments. Auto calibration is used to improve image quality and measurement accuracy during use.

Note:

Calibration can be forced manually by pressing the A button at least 5 seconds until a clicking noise is heard.

- **LCD Brightness:** The user can select the brightness of LCD display with choices being 20, 40, 60 80 and 100%.
- **Trigger:** The user can define the function given to the trigger
- **Laser (default):** The trigger operates the laser
 - **Spot Temp:** Adds and deletes the spot Measurement number 1
 - **Area Temp:** Adds and deletes the Area Measurement number 1
 - **Save key:** The trigger will be used to save images
 - **IR/CCD:** Switches between IR image and digital visual image.
- **Video Mode:** Select PAL or NTSC video output.
- **Standby Time:** Select the camera standby time from **None**, 2, 5, 10 or 15 minutes. When no button is pressed during the set period of time, the camera will turn the display off automatically, to extend the battery life. Press any key except the power key to reactivate the screen. If set to **None**, the function is disabled.
- **AutoOffTime:** Select **None**, 2, 5, 10 or 15 minutes. When no button is pressed during the set period of time, the camera will switch off automatically to extend the battery life. If set to **None**, the function is disabled. When **StandbyTime** is enabled, **AutoOffTime** will start calculating from **StandbyTime**.

4.2.3.3 System Info

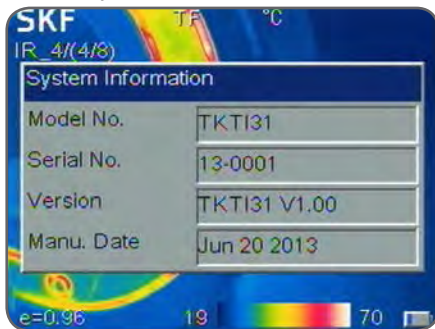


Figure 21 System info

Select **Setup->Sys. Info** to open the **System Information** dialog box. The camera model, the serial number, firmware version and Date of Manufacture are available.

4.2.3.4 Factory Default

Select Setup->Default to open the Default dialog box.
Press the Okay button to reset the settings to the factory default.
Press the C button to cancel the reset operation.

Note:

The default function will delete all parameters defined by the user.

Note:

Restoring Default settings will NOT delete the images stored on the micro SD memory card.

4.3 Measuring

4.3.1 Laser pointer

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

- Press the trigger to switch On the laser.
- Release the trigger to switch Off the laser.

The laser is aligned to objects at a 2 meters distance.

Note:

The user can choose to assign other functions to the trigger, in that case the trigger will not operate the laser.

4.3.2 Colour palettes

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. It is recommended that you find the palette which suits you best.

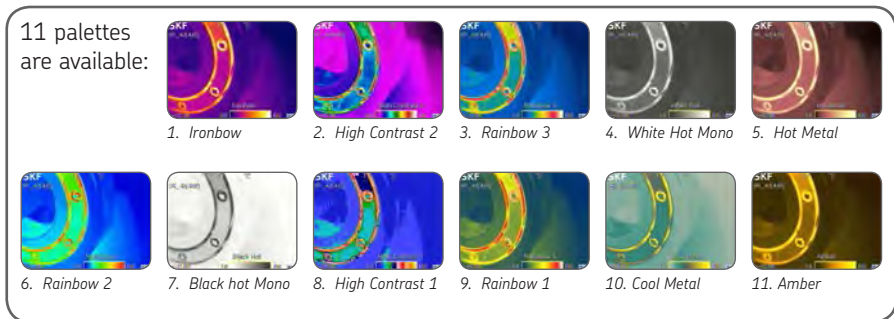


Figure 22 11 palettes

4.3.3 Emissivity

Different surfaces can radiate different amounts of infrared energy at the same temperature. This difference in temperature measurement can be corrected 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 the radiations falling on it and it is also a perfect emitter of radiation.

The emissivity of a surface (usually written ϵ) is the ratio of the energy radiated by that surface to the 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 from 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 to use the camera on surfaces with an emissivity below 0.7.

The global emissivity can be set via the Adjustment menu.

Select Setup->Adjustment to open the Adjustment dialog box.

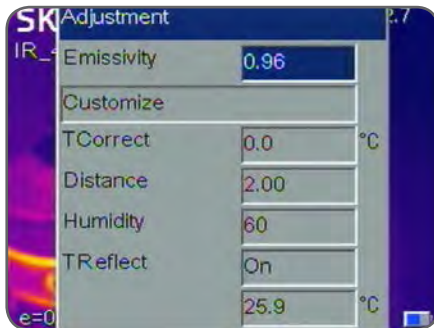


Figure 23 Emissivity adjustment

The user can set the global emissivity, temperature correct and ambient temperature.

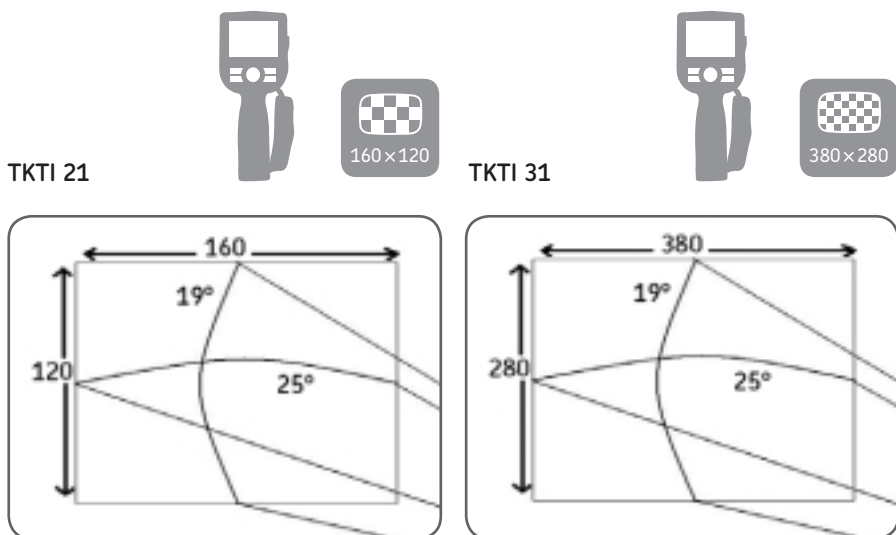
- **Emissivity:** The emissivity can be entered manually or chosen from a list of materials by clicking on **Customize**. See a list of common emissivities in chapter 6.2.
- **TCorrect:** Temperature correction setup.
- **TRect:** Some of the infrared energy seen by the camera is reflected by the background. 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.

The emissivity of each cursor, area or line can also be individually adjusted after these elements have been created (see 3.4.2 A button)

4.3.4 Field of view



Figure 24 Field of view



The following table gives an indication of the minimum dimensions of an object you can measure at a given distance.

Distance (m)	0,5	1	5	10	15
TKTI 21 (cm)	0,4	0,8	4,2	8,3	12,5
TKTI 31 (cm)	0,2	0,4	1,7	3,5	5,2

The object size is proportional to the distance.

From the above table you can deduce the TKTI 31 is better suited for farther applications.

The IFOV for the TKTI 21 is 2,77 mrad.

The IFOV for the TKTI 31 is 1,15 mrad.

4.3.5 Temperature measurement

- If no measurement cursors are on screen, add a measurement spot, area or line.
- Aim the cursor indicator onto the target object on the screen.
The temperature will be displayed in the upper right corner of the screen.
- If you want to measure the current thermal image in detail, press the S button to freeze and save the image for on-screen analysis
- To modify the measurements attributes, select the measurement parameter, and then press the Menu button. The screen will display the settings dialog box.



Figure 25 Set reference in settings dialog box

- When Set Ref is set to Yes, the user can visualize a temperature delta. The reference temperature will be shown as R, all other cursors will show the temperature difference (delta) with the R reference. Any spot or area can be set as the temperature reference.

In figure 27 below, the hot spot SH is set as the reference R, the spot 1 and spot 2 will show the temperature difference with the hot spot.

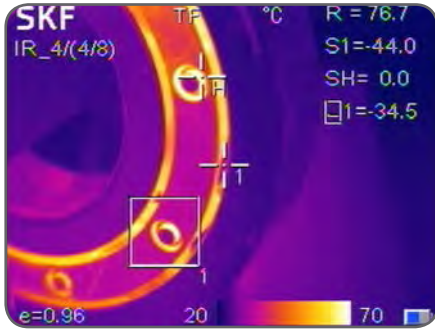


Figure 26 Reference spot example

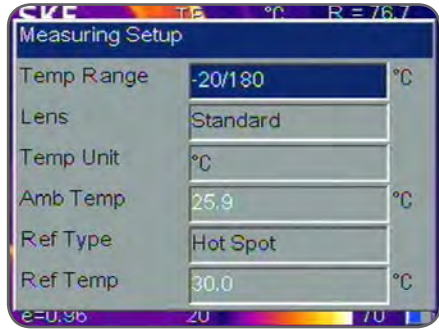


Figure 27 Measurement settings

Select **Setup->Measurement** to show the **Measuring Setup** dialog box.

- **Temp Range:** Select the temperature range best suited to the temperature of the object being measured. The ranges available are:
 - TKT1 21: -20°/350 °C (-4 °F to 662 °F)
 - TKT1 31: -20°/180 °C (-4 °F to 356 °F) Low Temp Range or 100°/600 °C (212 °F to 1112 °F) High Temp Range

Note:

After changing the temperature range, calibrate by pressing the A button until **Calibrating** is displayed on the screen

- **Lens:** The cameras are supplied with a standard lens.
- **Temperature unit:** Select between °C, °F and K units.
- **Ambient temperature:** The camera will display the internal camera temperature automatically. This is used for automatic calibration and is not editable by the user.
- **Reference type:** The user can manually set the reference temperature in **Ref Temp** or choose which cursor will be used as reference. When **Ref Type** is "On", the temperature of the measured object displayed by the cursors on the screen is the difference from the selected reference or the reference temperature set below.

4.3.6 Alarms and Isotherms

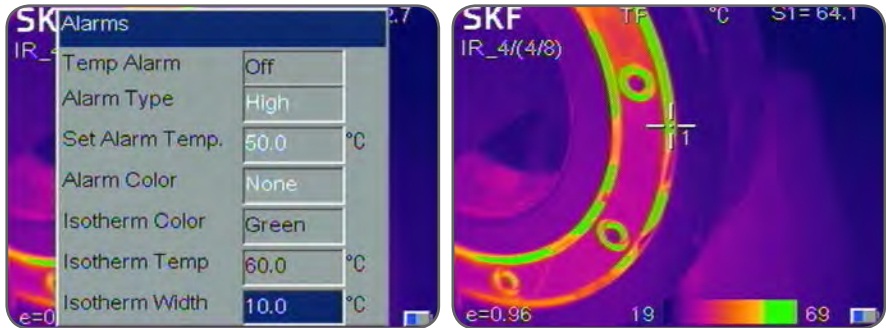


Figure 28 Alarms and Isotherms

Select **Setup**->**Alarms** to show the Alarms dialog box.

A visible and/or audible alarm is triggered when an object in the scene will have a lower or higher temperature than the one set in the alarm setting. All pixels above or below this temperature will change to the colour as set in **Alarm Colour**.

When the **Alarm Colour** is set to **None**, only the audible alarm will be heard.

When using alarms with **Area** measurements, the selected measurement mode, **Min**, **Max** or **Average** will have to meet or exceed the set temperature in order to trigger the alarm.

- **Temp Alarm:** Select **Off** to disable the alarm function and **On** to enable the alarm function.
- **Alarm Type:** Choose **High** for the Alarm to be triggered when the temperature goes over the set limit. Choose **Low** for the Alarm to be triggered when the temperature goes below the set limit.
- **Set Alarm Temp.:** Sets the alarm detection temperature
- **Alarm Colour:** Selects the colour in which the alarming pixels are displayed. If set to **None**, no changes are made to the screen's colour.
- **Isotherm Colour:** Activates the Isotherm display by showing the part of the image in the set temperature range in the chosen colour.
- **Isotherm Temp:** Sets the centre temperature of the isotherm.
- **Isotherm Width:** Sets the width of the displayed Isotherm band.
For example, if **Isotherm Temp** is set to 50 °C (122 °F) and **Isotherm Width** is set to 1 °C, the isotherm band will be from 49,5 °C (121.5 °F) to 50,5 °C (122.5 °F).

4.4 Taking pictures

4.4.1 Freeze and Save images

There are two ways to save an image:

1. Use the S button to save the current image.
2. Select File->Save

Validate **Save** to save the image or validate **Cancel** to cancel this operation.

Alternatively, the C key may be pressed to cancel.

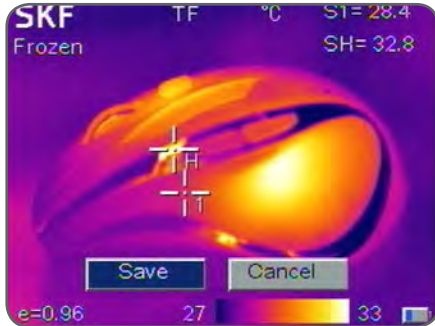


Figure 29 Save dialog box

If the memory card is not installed, the display will prompt the user to install a micro SD card.

Note:

The save function can also be assigned to the trigger, see 4.2.3.2.

4.4.2 Add a voice Comment

With **Voice Save** set to **On** in **File->Save Setting** menu, the user can record up to 60 seconds of voice comment which can be listened to using the SKF TKTi Thermal Camera Software provided.

- Speak loud and close to the microphone on the control panel.
- The recording is stopped by pressing the **Okay** or **C** button.



Figure 30 Voice comment

4.4.3 View saved images

The Saved images can be accessed via **File->Open**.

- Press the **C** button to exit the opened image and return to live measurement.
- The camera will open the last image displayed or the last image saved, whichever occurred last. Press **Left** and **Right** buttons to browse through the images.
- In Infrared image mode, the infrared images can be viewed.
In Visual image mode the visual images can be viewed.

4.4.4 Settings for saved images

The **Save setting** menu allows to choose whether the thermal image and the visual image should be saved together with or without an audio comment.

Open the menu **File->Save Setting**.

- **Link Save**
With Link Save "On", the camera will always save a thermal image and a visual image together. With Link Save "off", the camera will only save the thermal or visual image the camera is viewing at the time of the save.

Note:

Always save thermal images with thermal camera active, when Link Save is On.

Note:

By default the thermal image and the visual image will be saved together.

- **Voice Save**

With Voice Save "On", the camera will start the voice recording after the user saves the image. No recording will occur with Voice Save set to "Off".

Voice save setting is ignored with the Auto Save function.

Note:

To add a voice comment to an already existing uncommented image, enable Voice Save, open the image to be modified and select **File->Save**. The camera will prompt you to record the message and the image will receive a new number while the old image will remain unchanged.

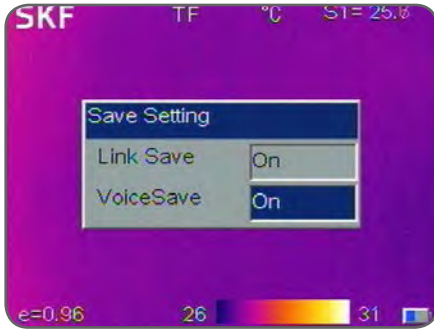


Figure 31 Save Setting

- **Auto Save**

Auto Save allows the camera to automatically save images at a user-specified time interval. Voice annotation is inactive with Auto Save.

With Auto Save set to 0 the function is disabled.

To enable, select 10 to 3 600 seconds (1 hour), in 1-second increments.

Select **File->Auto Save** to access the auto save function.

- **Delete**

When browsing through saved images, images can be deleted by selecting **File->Delete**, to delete the current opened image. If it has a voice comment, it will also be deleted. Press the C button to cancel the deletion.



CAUTION:

Before deleting, make sure the file is not required or is already backed up. Files cannot be recovered after deletion.

- **Format**

Format is used for formatting the memory card.

Select **File->Format** to pop up the below dialog box.

Press the **Okay** button to erase all images from the memory card.

Press the **C** button to cancel.

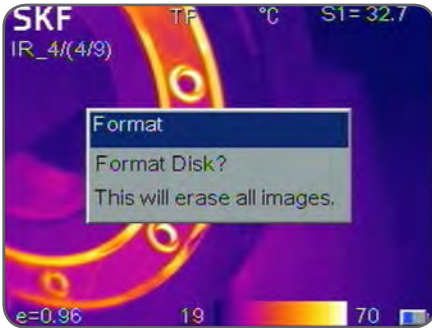


Figure 32 Formatting



CAUTION:

Before formatting, make sure all files are not required or are already backed up.

Data cannot be recovered after formatting.

When formatting the memory card on a PC, please use the FAT16 format.

5. Technical Specifications

Technical data		
Designation	TKTI 21	TKTI 31
Description	SKF Thermal Camera TKTI 21	SKF Thermal Camera TKTI 31

Performance		
Thermal detector (FPA)	160 × 120 uncooled FPA microbolometer	380 × 280 uncooled FPA microbolometer
Display	3.5" colour LCD with LED backlight 11 colour palettes Thermal or Visual Image	
Thermal Sensitivity	NETD ≤100 mK (0,10 °C) @ 23 °C ambient and 30 °C scene temperature	NETD ≤60 mK (0,06 °C) @ 23 °C ambient and 30 °C scene temperature
Field of view (FOV)	25° × 19°	
Spectral range	8 - 14 microns	
Theoretical Spatial Resolution IFOV	2,77 mrad	1,15 mrad
Measureable Spatial Resolution IFOV	8,31 mrad	3,46 mrad
Accuracy	The greater of ±2 °C or ±2% of reading in °C	
Focus	Manual, Easy Turn Ring, minimum distance 10 cm (3.9 in.)	
Visual camera	1,3 Megapixel digital camera	
Laser pointer	Built-in class 2 laser	
Frame rate and Image Frequency	9Hz	

Measurement		
Temperature range:		
- Standard Mode	-20 °C to +350 °C (-4 °F to +662 °F)	-20 °C to +180 °C (-4 °F to +356 °F)
- High Temperature Mode	N/A	100 °C to 600 °C (212 °F to 1 112 °F)
Measurement Modes	Up to 4 movable spots. Up to 3 movable areas and 2 movable lines (maximum, minimum and average temperatures). Automatic Temperature difference. Hot and Cold spots. Visual and audible alarms. Isotherms.	
Emissivity correction	User selectable 0,1 to 1,0 in steps of 0,01 with reflected and ambient temperature compensation. Emissivity can be individually adjusted on each cursor. Emissivity table of common surfaces built-in.	

Image Storage	TKTI 21	TKTI 31
Medium	2GB Micro SD card	
Number	Up to 10 000 images on Micro SD card supplied	
Voice Annotation	Input via Built-in Microphone for up to 60 seconds clip per image	

Software

Software	Included SKF TKTI Thermal Camera Software Comprehensive Image Analysis and Report Generation Software Compatible with TKTI 21 and TKTI 31, Free updates available on SKF.com
Computer requirements	PC with Windows XP, Vista, Windows 7 or above

Connections

PC Connection	Mini USB connector for image export to PC software (Cable provided)
External DC input	12V DC Input connector (DC Charger not provided)
Video Output	1 × Mini-jack Output for live image viewing (mini-jack to Video cable provided)
Mounting	Handheld and tripod mounting 1/4" BSW

Battery and Power

Battery	2 × 14,8 W 7,4 V standard camcorder lithium-ion batteries Rechargeable and field replaceable
Operation time	Up to 4 hours continuous operation with 80% brightness
Power Adapter	External 100 V-240 V 50 to 60 Hz AC Battery Compact Charger with Europe cable, USA, UK and Australian plugs
Charging Time	2h45min

Size and Weight

	Height: 245 mm (9.65 in.) Width: 105 mm (4.13 in.) Depth: 230 mm (9.06 in.) Weight: 1,1 Kg including battery (2.42 pounds)
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Operating Requirements

Operating temperature	-15 °C to +50 °C (5 °F to +122 °F)
Storage temperature	-20 °C to +70 °C (-4 °F to +158 °F)
Relative Humidity	10% to 90% non condensing
IP rating	IP54

In the Case	TKTI 21	TKTI 31
	1 × Thermal camera TKTI 21 with 2 × batteries	1 × Thermal camera TKTI 31 with 2 × batteries
	1 × AC Battery Charger	1 × AC Battery Charger
	1 × Micro SD card (2GB)	1 × Micro SD card (2GB)
	1 × Mini USB to USB connection cable	1 × Mini USB to USB connection cable
	1 × Mini-jack to Video connection cable	1 × Mini-jack to Video connection cable
	1 × Micro SD card to USB adapter	1 × Micro SD card to USB adapter
	1 × CD containing instructions for use and PC software	1 × CD containing instructions for use and PC software
	1 × Certificate of calibration and conformance	1 × Certificate of calibration and conformance
	1 × Quick start guide (English)	1 × Quick start guide (English)
	1 × Carrying case	1 × Carrying case

Warranty

2 years standard warranty

6. Appendix

6.1 Troubleshooting

Please follow the table below to diagnose and correct the problem.

Issue	Cause & Solution
The camera does not switch on	<ul style="list-style-type: none"> • Battery is not installed or installed incorrectly → Re-install the battery • Battery is out of power → Charge the battery • "Power off" protection is enabled → Wait for 5 seconds and reboot
The camera powers off automatically	<ul style="list-style-type: none"> • Battery is out of power → Charge the battery • AutoOffTime option is enabled → Set AutoOffTime to a different value
Battery level drains too fast	<ul style="list-style-type: none"> • Ambient temperature is too low • Rechargeable battery is not charged completely → Recharge the battery • Rechargeable battery is out of power completely and cannot be recharged → Change to a new battery
No thermal image on the screen	<ul style="list-style-type: none"> • Lens cover is not removed → Remove the lens cover • A saved image is being viewed → Press the C button to exit
Thermal image is white-black	<ul style="list-style-type: none"> • White-black palette is selected → Select another palette

6.2 Emissivity table

Material	Surface	Temperature °C	Emissivity (ϵ)
Aluminium	Non-oxidized	100	0,20
	Oxidized	100	0,55
Brass	Burnished to Brown	20	0,40
	Dull lustre	38	0,22
	Oxidized	100	0,61
Copper	Seriously Oxidized	20	0,78
Iron	Oxidized	100	0,74
	Rusty	25	0,65
Cast iron	Oxidized	200	0,64
	Non-Oxidized	100	0,21
Wrought iron	Quarry-faced	25	0,94
	Polished	38	0,28
Nickel	Oxidized	200	0,37
Stainless steel	Oxidized	60	0,85
Steel	Oxidized	200	0,79
Common brick	Surface	20	0,93
Concrete	Surface	20	0,92
Glass	Polished plate	20	0,94
Lacquer	White	100	0,92
	Black	100	0,97
Carbon	Smoke black	25	0,95
	Candle soot	20	0,95
	Rough lead surface	20	0,98
Oil paint	Value of 16 colours	100	0,94
Paper	White	20	0,93
Sand soil	Surface	20	0,90
Timber	Dressed	20	0,90
Water	Distilled water	20	0,96
Skin	Human	32	0,98
Ceramic	Thin	21	0,90
	Thick	21	0,93

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