IRBIS® 3

Infrared Thermographic Software

User Manual

State: 2008

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Dear User,

Congratulations on the purchase of the thermographic software IRBIS® 3.

This User Manual describes the installation and functionality of the control and evaluation software IRBIS® 3. This software serves to process images taken by the hardware series VARIOSCAN, VarioTHERM™, VarioCAM®, VarioCAM® high resolution, ImageIR®.

All instructions in this User Manual describe the complete functionality of the software IRBIS® 3 professional/full version. Those functions that are not available in all versions are respectively marked * within this Manual.

The respective scope of functionality and delivery is principally determined by its description in the relevant shipping documents (confirmation of order/delivery note).

Subject to further development with view of technological progress.

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Subject to error and alteration.

2 System Requirements

System requirements for the IRBIS® 3 software partly differ according to the range of functions of the user's IRBIS® 3 version. While minimum system requirements are sufficient for an offline version of IRBIS® 3, recommended system requirements are favoured for an online version of the software with camera connection.

Minimum system requirement:

Processor: CPU 1 GHz or higher
Main memory: 512 MB RAM
Hard disc: 80 MB free disc storage
Operating system: from Windows 2000
Display resolution: 1,024x768, 16 Bit (High-Colour)

Recommended system requirement:

Processor: Dual Core CPU 1,6 GHz or higher
Main memory: 1 GB RAM or more
Hard disc: 120 MB free disc storage (complete installation)
Operating system: Windows XP, Windows Vista
Display resolution: 1,280x1024 or higher, 24 Bit resp. 32 Bit (TrueColour)

3   Installation of the Software

Depending on the IRBIS® 3 version purchased, several software modules can be installed. The software installation is started by executing the included installation file. The Setup Wizard will guide you through the entire installation:
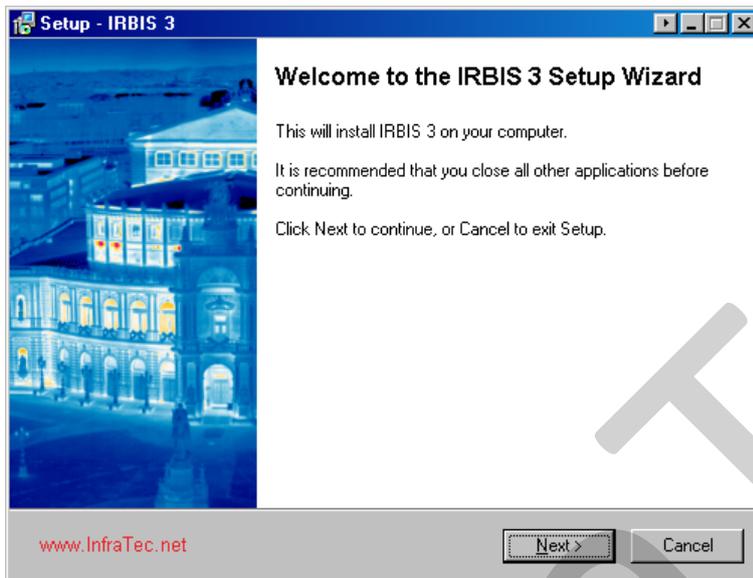
Fig. 1   Screen of IRBIS® 3 when starting the installation

The installation is started by clicking on **"Next >"**.

Fig. 2   License agreement

In the dialogue for the license agreement, **"I accept the agreement"** must be selected. Pressing **„Next >"** will continue the installation.
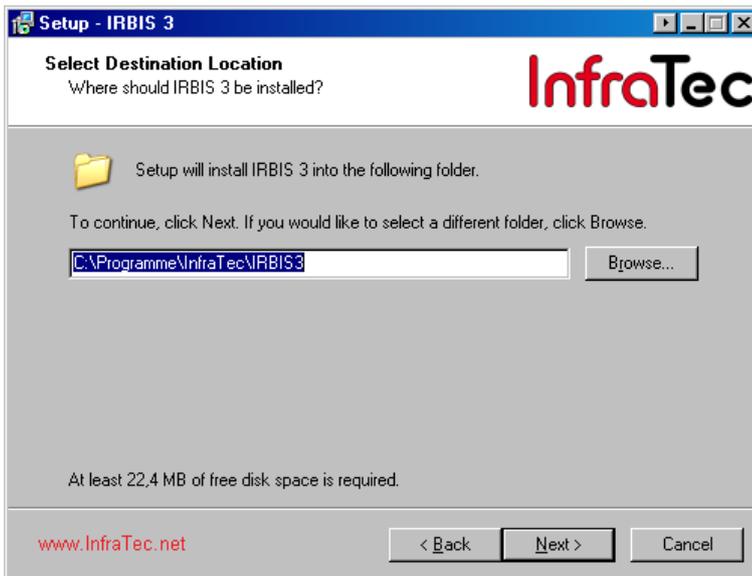
Fig. 3   Select target folder

Enter directly the desired target folder or select it via the function **"Browse…"**. To continue with the installation, click **"Next >"**.
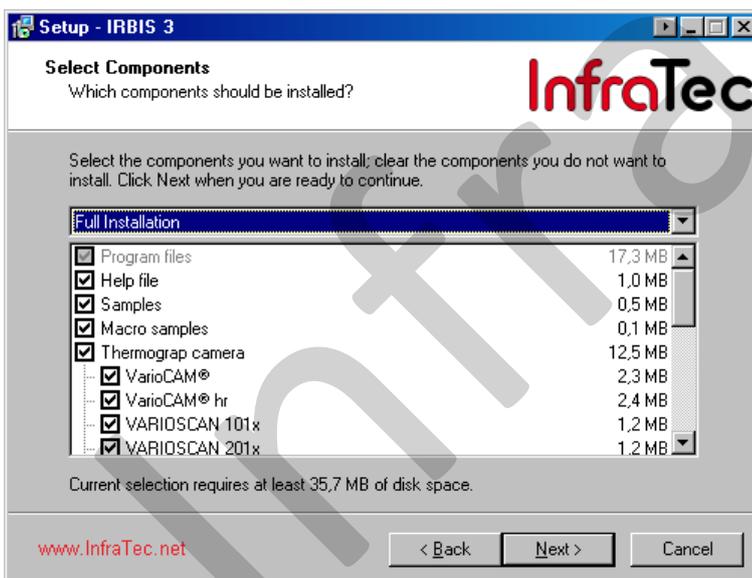
Fig. 4   Select components

Determine which components are to be installed. Here you may select the camera which will be controlled by the software. To continue with the installation, click **"Next >"**.
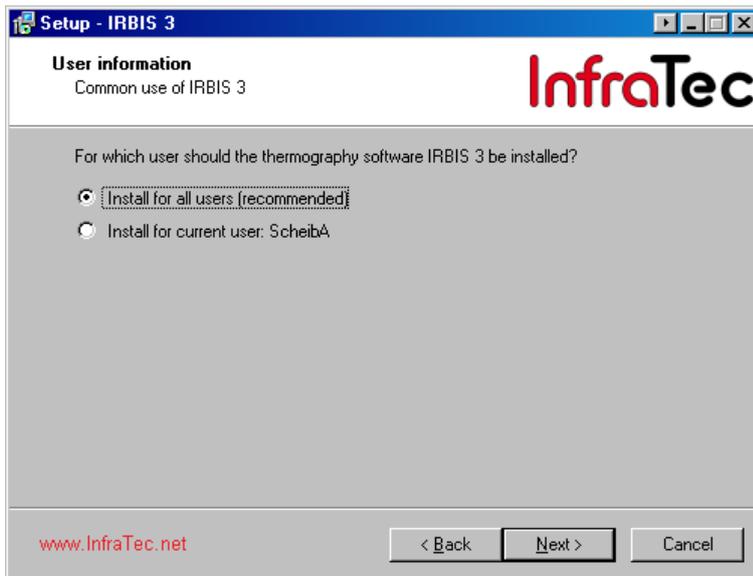
Fig. 5   User information

Option **"Install for all users"** is recommended. To continue with the installation, click **"Next >"**.
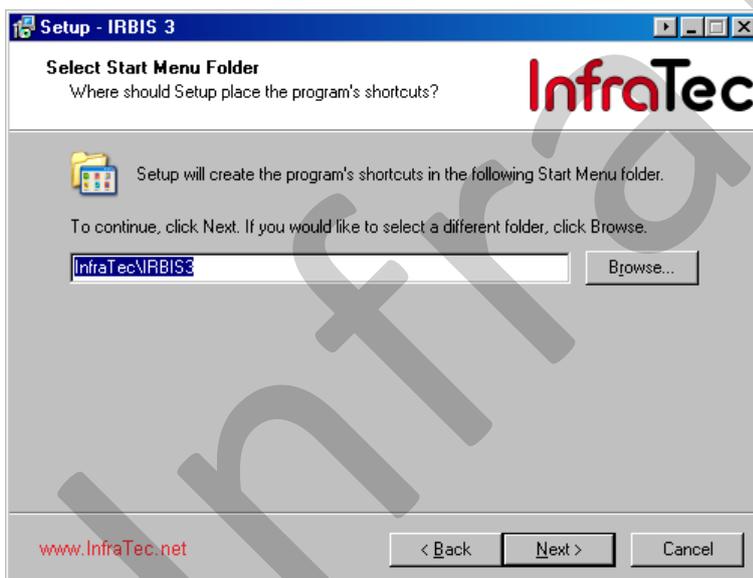
Fig. 6   Selection of the shortcut for the Start Menu Entry

Select the shortcut via which you want to access the software in the Start Menu. To continue with the installation, click **"Next >"**.
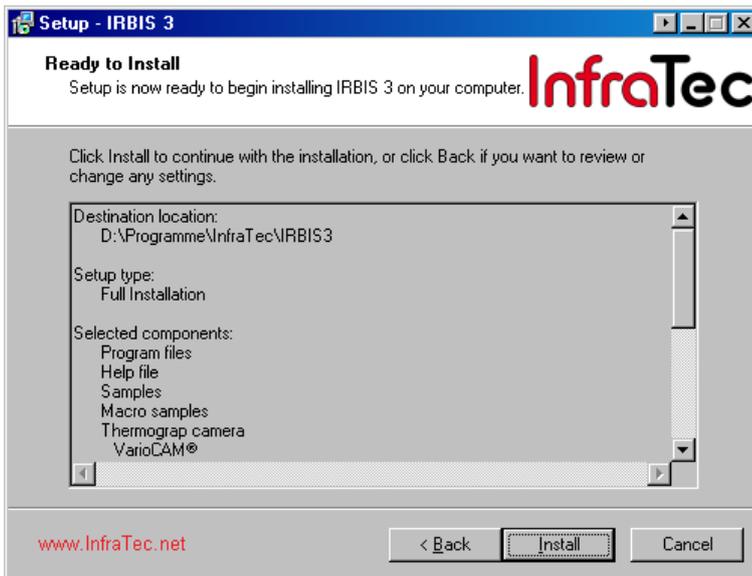
Fig. 7   Overview of the defaulted installation parameters

All selected settings can be reviewed at this point or changed again by clicking **"< Back"**. To start the installation process, click **"Install"**.

Fig. 8   Dialogue for completing the installation

After all files have been copied the installation can be finished by clicking **"Finish"**.

4   Activating the Software

After its installation, the software can be used as a demo version for 30 days to its full extent. Subsequently, the software cannot be used anymore. As long as the software has not been registered yet, the blue headline of the software will display the information **"Unregistered demo version"** at the top left. In order to use the software, its registration is required.

Fig. 9   Dialogue for registering the software   Fig. 10   Dialogue "Order registration"
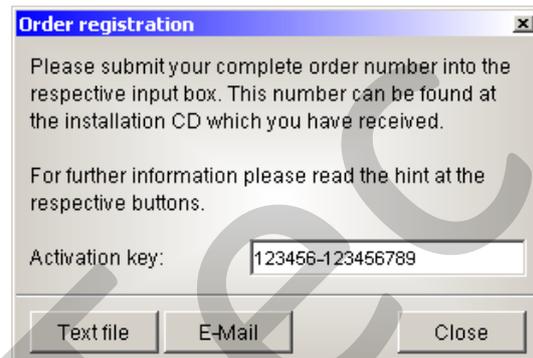
After running the non-licensed software, the dialogue **"Registration"** will appear. Now, users may receive their specific access data via the button **"Order registration"**. The activation key which has to be entered into the input field of the dialogue **"Order registration"** is to be found on the CD-ROM included in the delivery. As soon as the activation key is fully entered, both buttons **"Text file"** and **"E-Mail"** will be activated.

- **Text file**   Saves the required information into a text file (*.txt). Copy the content the text file, paste it into an e-mail and send this e-mail to license@InfraTec.de. The sending of e-mails can be carried out on every computer with access to the internet. You can also send the text-file via fax to InfraTec. Afterwards, users will receive their specific access data via e-mail or fax from InfraTec.

- **E-Mail**   Opens a new e-mail (to license@InfraTec.de) containing the necessary information for licensing. After forwarding this e-mail, your specific access key will be delivered by InfraTec via email.

Please do not send the text file as an attachment of the e-mail.

The following information is required for licensing:

- software product <<PR-IRBIS 3>>
- activation key <<AK-xxxxxx-xxxxxxxxxx>>
- computer code <<CC-xxxxxxxxxxx>>

Enter your specific access data completely into the input field of the dialogue **"Registration"** while replacing the entry "InfraTec GmbH Dresden".

Fig. 11   Dialogue for registering the software with inserted customer data

Please note that it will take some time to process fax messages.

In Order to continue using the software as demo version, close the dialogue **"Registration"** by clicking **"OK"**. Following, the dialogue **"Information"** will appear either displaying the remaining duration of the demo version or indicating the demo version's expiration. In both cases, the software's registration is still possible. Confirm the respective dialogue via the **"OK"** button and go back to the **"Registration"**.
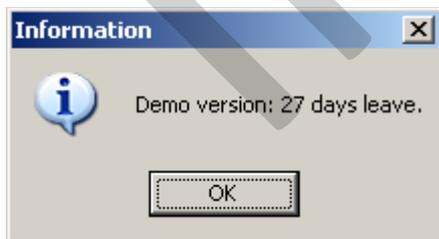
*Fig. 12   Information of the Demo version
(demo is valid)*

*Fig. 13   Information of the Demo version
(demo is expired)*

Please note that the function **"Demo version"** is only available for a limited period of time.

5 List of Abbreviations

*.irb-File	Current image format for thermal images, which were taken with a thermal camera by InfraTec. Output format of the software IRBIS® 3.	
*.iri-File	Image format for thermal images, which were taken with a thermal camera mobileIR M3/M4/M8.	
*.sid-File	Image format for thermal images, which were taken with a thermal camera mobileIR M3/M4/M8 VARIOSCAN 101x, VARIOSCAN 201x and VARIOSCAN 301x.	
ASCII-Format	*.asc	ASCII
	*.csv	CSV
	*.txt	Text
	*.xls	Microsoft Excel-Page
Image Format	*.bmp	Windows-Bitmap
	*.gif	CompuServe-Bitmap
	*.pcx	PaintBrush
	*.jpg; *.jpeg	JPEG-Bitmap
	*.png	Portable network graphic
	*.tif; *.tiff	TIFF Bitmap
FOV	**F**ield **o**f **V**iew, View field of an optical device	
GPS	**G**lobal **P**ositioning **S**ystem, satellite-supported system for worldwide position regulation	
HD	**H**ard **d**isk, Hard disk of a computer for data storage	
HFOV	**H**orizontal **F**ield **o**f **Vi**ew, horizontal view field of an optical device	
IEEE1394	serial bus interface, also known as **FireWire**	
IR-Radiation	**I**nfra**r**ed Radiation	
PAL/NTSC	**P**hase-**A**lternation-**L**ine/**N**ational **T**elevision **S**ystems **C**ommittee	
RAM	**R**andom-**A**ccess **M**emory, working memory of the computer	
RLE	**R**un **L**ength **E**ncoding	
RGB	RGB colour model, includes the three additive primary colours, red, green, and blue.	
ROI	**R**egion **o**f **I**nterest, general name for measuring definitions	
Thermal Image	Image that was made with a thermal camera and which includes all data of the measurements.	
VFOV	**V**ertical **F**ield **o**f **Vi**ew, vertical view field of an optical device	
VGA	**V**ideo **G**raphics **A**rray, Standard for graphic boards	
VIS Image	**Vis**ual Image VIS images are images that have been made with the help of a digital camera or of the visual camera of the thermographic camera (regardless of the equipment of the thermographic system).	

6   Thermal image file in the Explorer

After successfully completed installation of the software IRBIS® 3, thermal images, such as irb; .sid; .iri can be displayed in the Explorer without starting the software. Under Windows 2000 / XP you can change the view in the Explorer to **Thumbnails** and under Windows Vista to **Tile** or **Symbols**
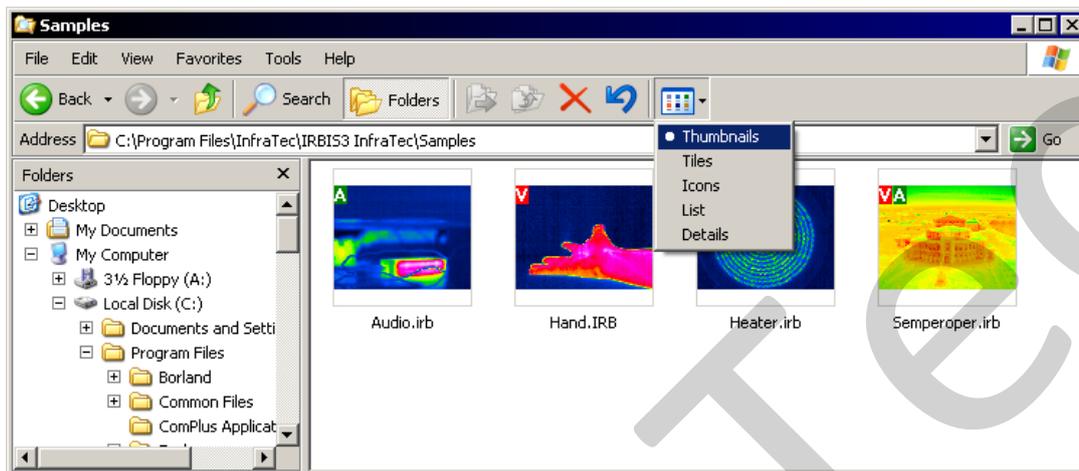
Fig. 14   Explorer with thermal image data

If further data is available for a thermal image, a capital letter (**V** = VIS image available, **S** = sequence, **A** = audio file available) is displayed in the preview image in the upper left corner.
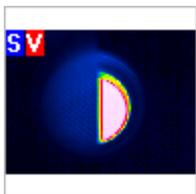
Fig. 15   Preview image of a sequence with VIS image

After the IRBIS® 3 installation, a link to thermal image files (*.irb; *.sid und *.iri) localised in the Explorer is provided by the software. A double click on the selected thermal image files in the Explorer opens them in the IRBIS® 3 software, and loads the respective files into the favourite file list. If this list is already open, each reselected thermal image file in the Explorer will be added into the favourite file list, and displayed in the main window.

A thermographic file can be dragged directly from the Explorer into the IRBIS® 3 per Drag & Drop. Following, these thermographic files appear also in the **"Favourite file list"**, see chapter 7.4 Favourite File – page 18.

7   Main Window of IRBIS® 3

The IRBIS® 3 main window consists of a **work area** framed at the top by a **menu and icon bar** as well as a **toolbar** and at the bottom by a **status bar**. According to your IRBIS® 3 version, users may evaluate up to four thermal images at the same time and in full functional circumference.

The **Menu bar** is divided into several editing and operation subjects, and allows a fast activation of the desired features. Tools and functions of the menu are presented in the icon bar. The work area contains the to-be-edited thermal image at any time. Further elements, such as the profile diagram, the VIS image and the measurement table can be individually arranged, respectively displayed or hidden. After a restart of the software, last settings will be restored.
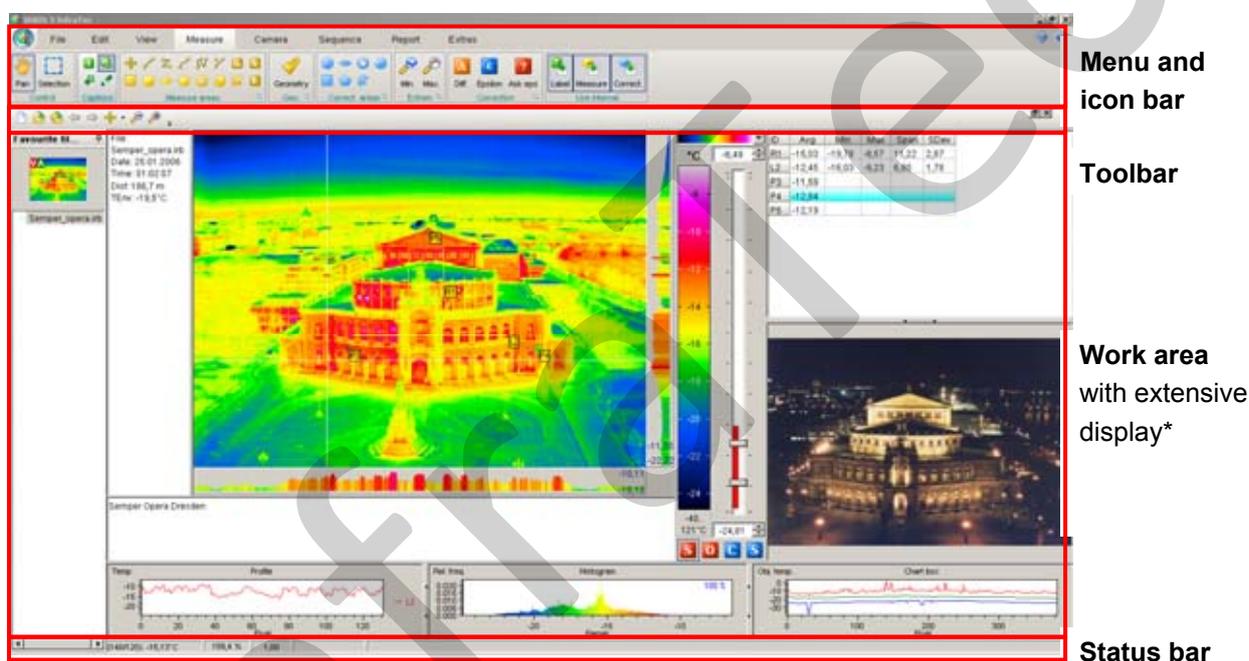
Fig. 16   Main window of IRBIS® 3

IRBIS® 3 is a graphic-controlled software. Its operation is already possible from a VGA graphic resolution of (1024 x 768) pixels at a colour depths of 16 bits (high colour). For optimum display, however, a resolution of at least (1024 x 768) pixels or higher as well as the TrueColour mode (24 bits or 32 bits, respectively) are recommended.

> **VIS images** are images that have been recorded with the help of a digital camera or of the visual camera of the thermographic camera (regardless of the equipment of the thermographic system).

> In order to ease the handling of the software, it should be mentioned at this point that many of its functions can be called up by clicking on the **right mouse button.**

The positions of the elements (VIS Image, Measure Table, Profile Chart, Time Chart/Column Value Chart and Histogram) can be exchanged with each other, see chapter 10.2.1 Settings "Elements – page 42. This can be realised by clicking on the respective element with the left mouse button, and dragging it, while holding the mouse button, to the desired position.
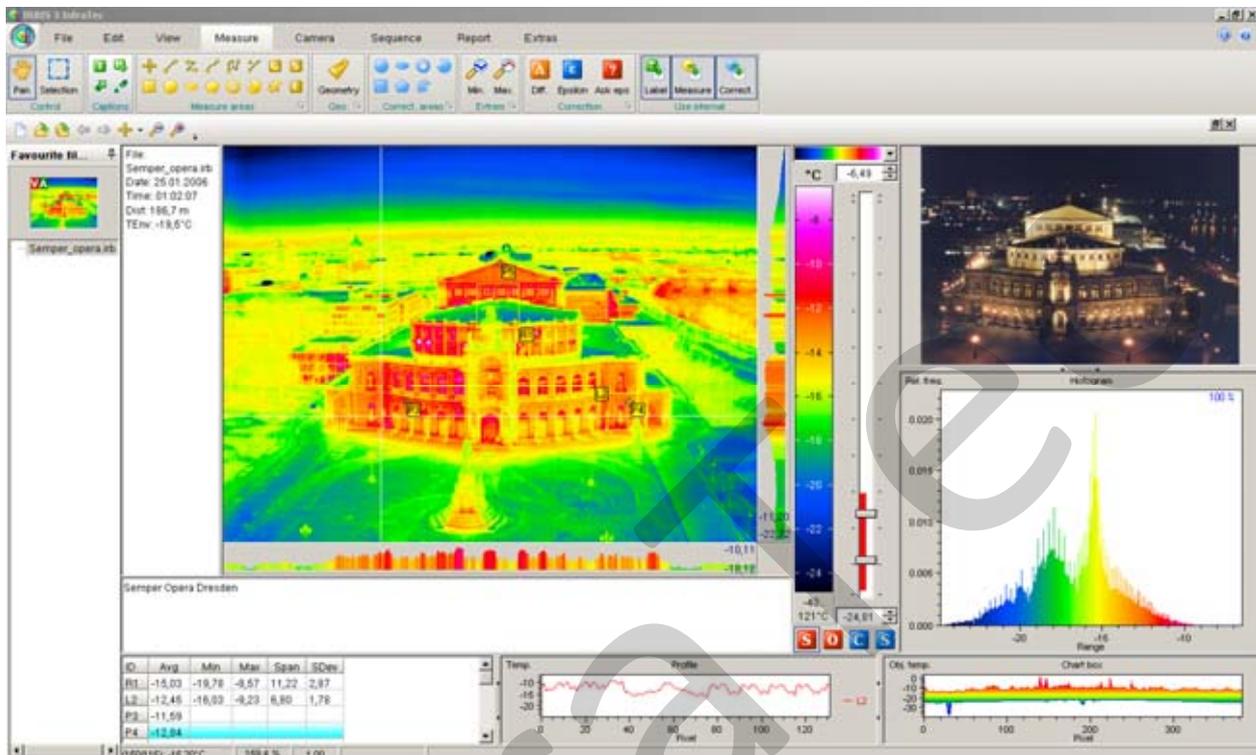
Fig. 17   IRBIS® 3 Main window − adjusted arrangement of elements

7.1   Menu and Icon Bar (Multi-functional Bar)

The IRBIS® 3 software can be operated via a menu and icon bar. The menu bar is arranged above the icon bar, and subdivided into several editing and operation subjects. The icon bar contains the respective features of each menu item - the IRBIS® 3 software tools. This subject-specified arrangement allows an effective and intuitive approach with single images and thermal image series.
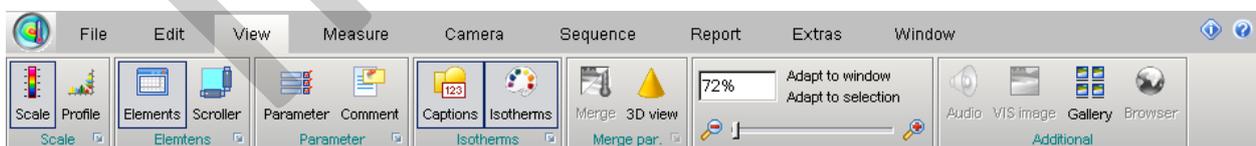
Fig. 18   Menu and icon bar of IRBIS® 3

Menu bar

The various software menus are called up via the menu bar. The menu bar contains the following menu items:

| | File | Edit | View | Measure | Camera | Sequence | Report | Extras | Window | |

Fig. 19   Menu bar of IRBIS® 3

- **File**   Open/Save/Print files/Information on files, programme settings
- **Edit**   Modification of thermal image
- **View**   Selection and Adjustment of the elements of the software interface IRBIS® 3
- **Measure**   Functions for temperature measurement and temperature correction
- **Camera***   Online-Communication with the thermographic camera
- **Sequence***   For editing sequences
- **Report***   Report in Microsoft Word
- **Extras***   For calling up editors
- **Window***   Functions for window adjustment (this menu item is available if several windows are opened)

IRBIS® Icon

In the upper left area of the menu bar, there is the IRBIS® icon. With the help of this icon, several important functions (e.g. Open file, Save and Print) can be called up directly, whereas the item "Options" helps to make basic settings (see Chapter 8.5.1 Dialogue "Options" – page 31).

Info

By clicking on the info icon in the menu bar, information about the current software version will be displayed.

Help

A click on the symbol **"IRBIS® 3 Help"** in the menu bar or the key **F1** will open the online help function for IRBIS® 3. Moreover, contextual help texts about the menu items and dialogues can be opened by clicking on this symbol if it is displayed.

Icon bar

The buttons in the icon bar activate or deactivate the functions of the software. Furthermore, different settings for some functions can be configured.
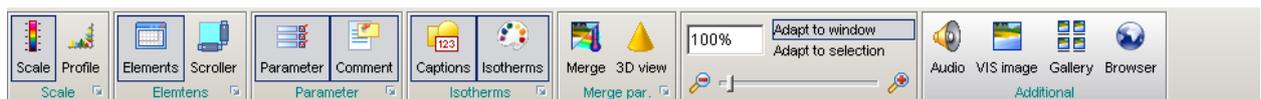
Fig. 20   Icon bar exemplifying the menu "View"

All activated functions are displayed with a frame in the icon bar:

Function is activated: [Profile], function is deactivated: [Profile]

7.2   Opening Settings Menus

For some buttons or their functions, software function settings can be configured and displayed. By clicking on the symbol ▣ in the menu items, the corresponding dialogue is opened.

Fig. 21   Opening additional settings

The changes that have been made in the setting menus are saved upon closing the application and are automatically loaded when restarting the programme.

> If several users working on the computer with IRBIS® 3, a separate user profile is deposited for each of them.
>
> Path: C:\Documents and Settings**user**\Application Data\\InfraTec\IRBIS3*.ini

In the upper right corner of the dialogue windows, there are three symbols each:

- 🔵 **Question mark**   call help function
- ✅ **Green tick**   the changes that have been made in the settings menus are saved and the dialogue window is closed
- ❌ **Red cross**   dialogue is closed and the changes are not saved

Fig. 22   Headline of the dialogue window for the parameter settings

7.3   Icon Bar for Fast Access (Toolbar)

The toolbar allows starting frequently used functions directly from each menu. Some functions are included in the toolbar by default. The toolbar can be adjusted individually by the user at any time. Functions can be added or deleted and their order can be changed.

The function of a button will be displayed when you hold the cursor over it.:

Fig. 23   Example: toolbar of IRBIS® 3

Place toolbar under the multifunction bar…

When launching the software for the first time, the toolbar is located in the IRBIS® 3 main window above the **menu bar**. With the help of the symbol ⬇ and the function **"Place toolbar under the multifunction bar..."**, the toolbar can be placed below the multifunction bar.
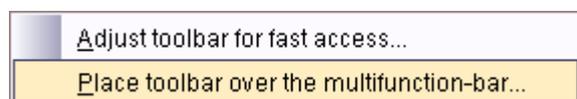
Fig. 24   Placing the toolbar

Adjust toolbar for fast access…

Using the symbol ⬇ the dialogue **"Adjust toolbar for fast access... "** can be started as well (see Fig. 25 – Dialogue for the adjustment of the). On the left hand side, this dialogue shows the functions and their corresponding buttons, which can be added to the toolbar. On the right hand side, you can see the buttons which are already displayed in the toolbar. New functions can be added in this dialogue by selecting them on the left hand side and dragging them with the **arrow to the right**.
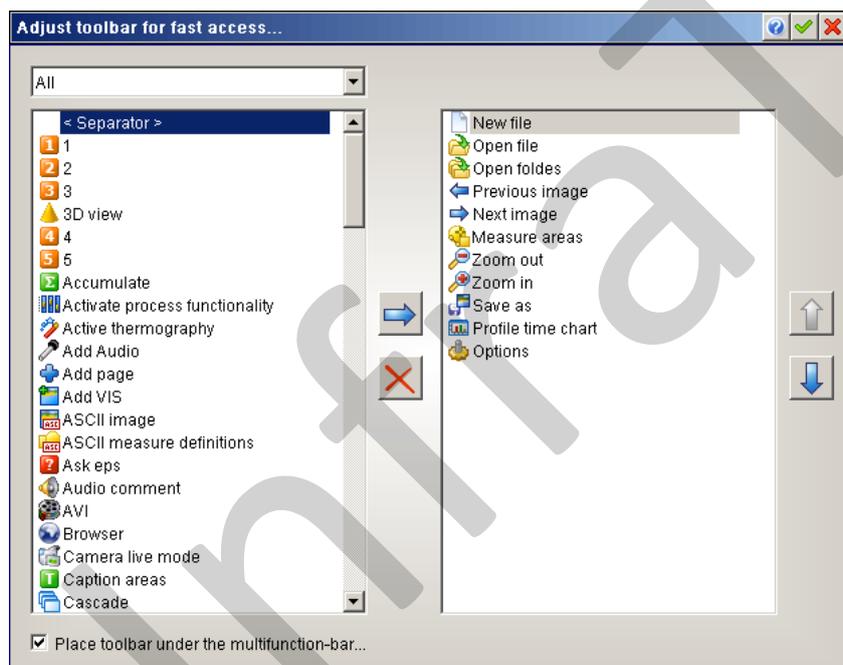
Fig. 25   Dialogue for the adjustment of the toolbar

In order to separate the functions visually, **separators** ⎢ can be placed between the buttons. Moreover, the order in which the functions are displayed can be adjusted individually on the right of the dialogue (**arrow keys up or down**). A button can be removed from the toolbar by selecting it and pressing the red cross button in the centre of the dialogue window.

Several buttons are merged in groups, for instance the **arrow keys** ⬅ ➡, the operations **zoom in** and **zoom out** 🔍 🔍 as well as the **minimum** and **maximum temperature** 🔍 🔍 are always displayed in connection with each other. If one of the these buttons is moved to the right area, the respective button appears automatically. In contrast to the toolbar, the buttons **"Measure Definition"** 🟡 and **"Correction"** 🔵 are represented by different symbols in this dialogue.

Please note that for certain groups of buttons (e.g. button for different measuring spots:), only one button each can be placed in the toolbar. The required function can be called up by pressing the corresponding button .

Each software function can be added directly to the toolbar by clicking on the right mouse button: **"Add to toolbar for fast access"**.
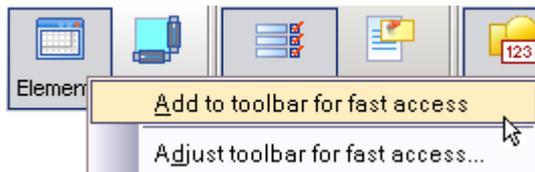
Fig. 26   Adding a function to the toolbar

7.4   Favourite File List

The **favourite file list**, which is on the left of the software window, displays all thermal images and sequences which have been recently opened. Therefore, the thermal data has to be saved on the hard disk as *.irb-, *.iri- or *.sid-file. In order to load new thermal images or sequences, use the functions **"New file", "Open file"** or **"Folders".**
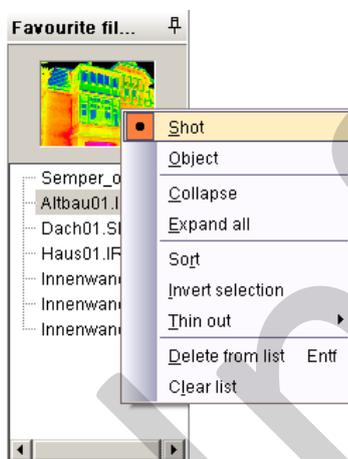
Fig. 27   View and context menu of the favourite file list

In order to display the favourite file list, hold the mouse pointer over the position of the favourite file list (to the left of the thermal image). The favourite file list is displayed as long as the cursor is held in this area. In order to permanently display the list, click on the **pin symbol** ( ). The pin will then point to the bottom ( ) and the favourite file list will not disappear when the cursor is moved to another position. In this case, you can navigate within the displayed list using the **arrow keys** .

If the favourite file list is hidden, you can navigate within the current source directory of the thermal image, even if not all data in this directory has been loaded into the favourite file list.

If thermographic data is being saved to the RAM while the camera is connected, users will only have access to the temporary data within the menu "Sequence" (see chapter 12 Menu "Camera"* - page 79).

The preview window in the upper area of the favourite file list displays the thermal images as **"Shot"** (scaled like the recorded image) or as **"Object"** (scaled like the measuring object), depending on the current setting. If further data is available for a thermal image, a capital letter (**V** = VIS image available, **S** = sequence, **A** = audio file available) is displayed in the preview image in the upper left corner.

The context menu of the favourite file list is opened by a right mouse click on the favourite file list.
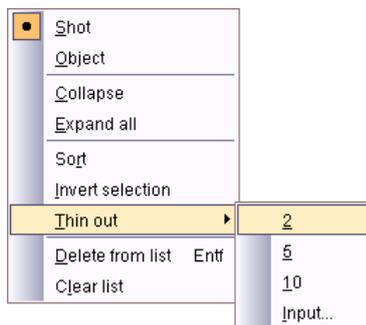
Fig. 28   Context menu of the favourite file list

If sequences are displayed in the favourite file list, they can be reduced or expanded through the functions **"Collapse"** and **"Expand all"**. The function **"Sort"** lists all displayed images in alphabetic order. If a sequence with a great number of images has been loaded, it may be useful to delete some of the images from the favourite file list using the function **"Thin out"**. With this function, the number of images to be deleted can be determined as well. The function only deletes images from the currently selected image downwards. In order to thin out the entire favourite file list, the first image must therefore be selected. When thinning out the list, only the selection of files is reduced; the files as such are not deleted (see also chapter 13.1 Menu Item "Buffer" – page 95). It is also possible to delete selected images only (**"Delete from list")** or to clear the entire list (**"Clear list"**).

Select all data of the favourite file list with the shortcut **Ctrl + A.**

7.5   Thermal Images

The main focus of IRBIS® 3 is on the thermal image. It is possible to set and move measuring areas, correction areas and captions in the thermal image. The current temperature and data, like avg-temperature for a measure area, are shown at the mouse.
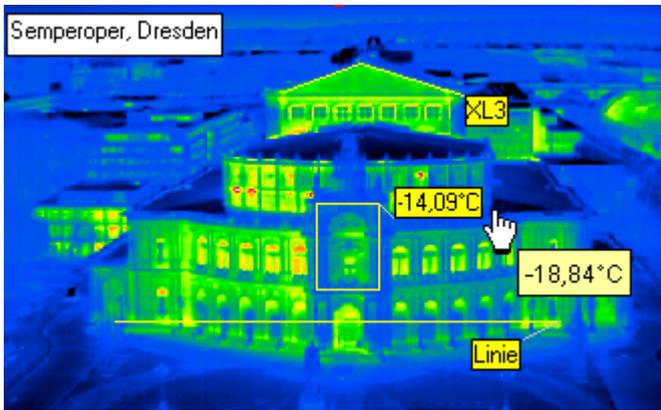
Fig. 29   Thermal image with measurement areas and captions

Abb. 30   Selected measurement areas P1 and L2 (R3 is not selected)

Definitions can be selected by drawing a frame with the mouse or by pressing the key "Ctrl" + mouse click. Marked definitions can be moved, copied and deleted jointly. Additionally, definitions can be marked from the measuring or correction definition table, see chapter 10.2.1.2 Measurement and Correction Table – page 44.

By pressing the right mouse button, an item or definition (e.g. measuring area), and further submenu functions can be called up:

■	**Properties**	Displays the **properties dialogues** of the respective element or definition, see chapter 10.2.1.2 Measurement and Correction Table – page 44.
■	**Copy definition***	An element or definition is copied. For captions only the text box can be copied.
■	**Copy to corr. definition**	A measuring area can be copied to a correction area with this function. The new compiled correction area is located just above the copied measuring area.
■	**Order**	A measuring area or correction area can be displayed in the foreground or background compared to other areas.
■	**Delete**	Deletes the currently selected elements and definitions in the thermal image. This function is directly available with the **Delete** button
■	**Delete all meas. definitions**	Deletes all measuring areas which are shown in the thermal image.
■	**Delete all corr. definitions**	Deletes all correction areas which are shown in the thermal image.
■	**Selection**	The selection can be copied or exported.
■	**Report**	This function is shown if a Microsoft-Word-Report is open. The thermal image can than be copied into the report .
■	**Settings...**	Opens a dialogue for the measuring areas and correction areas, see 11.3.4 Measuring Area Settings – page 66.

7.6   Elements of the Work Area

In the work area, several elements can be displayed beside the thermal image. The user can select the elements to be displayed by activating the corresponding functions and adjusting the respective settings. This elements will be described in this chapter briefly. A detailed description of the functions you will find in the respective menu point of the software, see chapter 10.2.1 Settings "Elements" – page 42.

Temperature Scale

With the help of the **temperature scale**, which is displayed to the right of the thermal image, the temperatures of the scene can be matched with colours or grey scale values. Selection and scale of the colour palette can be changed with the corresponding tools, see chapter 7.8 Temperature Scale – page 23.

Profiles

The two output buttons below and right of the thermal image serve to display the profiles. These buttons are activated or deactivated with the help of the function **"Profiles"** in the menu **"View"** (see chapter 10 Menu "View" – page 41.

Parameter Field

The parameter field is on the left of the thermal image. In this field, parameters selected in the menu **"View"** and **"Parameter settings"** are displayed, see chapter 10.3.1 Parameter settings – page 50.

Comment Field

The **comment field** can be placed under the thermal image. In this field, the content of the comment field of the current IRB file is displayed, see chapter 10.3.1 Parameter settings – page 50.

Measurement and Correction Table

In the **measurement table**, values of all active temperature measuring spots and areas as well as the correction definitions used for calculating the temperatures are displayed. The measured values are displayed at the top, the **correction definitions** at the bottom of the measurement table, see chapter 11.5 Menu Item "Correction Areas" – page 70.

VIS Image

The VIS image is displayed if a digital image is contained in the currently loaded .irb file or if an external graphics file (*.bmp; *.jpg, etc.) with the same name as the loaded .irb file is located in the same source directory. The VIS image is also displayed as soon as a graphics is added via the menu **"Edit"** – **"VIS"** or displayed via the thermographic camera, see chapter 9.4 Menu Item "Add to File" – page 39.

Profile chart

In the **profile chart**, the profile of the temperature along a line or along the outline of other measuring areas of the thermal image is displayed. As soon as a line is defined in the thermal image, it will be displayed in the profile chart. In order to show the temperature profiles of outlines, they must be selected in the dialogue **"Settings"**, which can be opened by a right mouse click into the profile chart, see chapter 10.2.1.3 Profile Chart – page 46.

Histogram*

The **histogram** shows the frequency distribution of temperature values for the entire thermal image or ROI charted in it, see chapter 10.2.1.6 Histogram* – page 49.

Column Value Chart/Time Chart

Below the thermal image, the two several charts **column value chart** or the **time chart** can be displayed. The change between the two diagrams effects via the right mouse button, see chapter 10.2.1.5 Time Chart/ – page 48.

7.7 Status Bar

The status bar at the bottom of the **IRBIS® 3 main window** shows information about the currently loaded **thermal image**.

| (78/4): 6,66°C | 56,3 % | 1,00 | Display: 31 Hz | Acquisition ok |
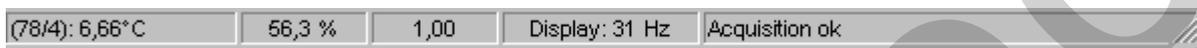
Fig. 31   Status bar of IRBIS® 3

The fields of the status bar (from left to right) display the following information:

- Cursor position and temperature at the cursor position
- Zoom factor
- Current emissivity
- Display frame rate in the Real-Time Mode with thermographic systems connected
- Status report

The displayed frame rate does not necessarily correspond to the current frame rate of the thermographic camera. Depending on one's system performance, a maximum displayed frame rate of 24 Hertz can be achieved.

If the field for the cursor position is red coloured, the storage for thermograms with corrected temperature values is activated, see chapter 8.5.1 Dialogue "Options" – page 31.

| (193/4): -58,73°C | 56,6 % | 0,70 | | | |

Fig. 32   Status bar – storage for corrected temperature values is active

If the field for emissivity is yellow coloured, the global correction is activated, see chapter 11.7 Menu Item "Correction" – page 78.

| (138/0): -42,10°C | 56,6 % | 0,80 | Display: 9 Hz | |

Fig. 33   Status bar – emissivity correction is activated

If the field for emissivity is red coloured, a thermogram with corrected temperature values has been loaded! A renewed correcting of the thermal image would entail incorrect temperature values in this case.

| (4/157): 4,73°C | 56,6 % | 0,40 | | | |

Fig. 34   Status bar – thermogram with corrected temperature value

If the field for status report is yellow coloured, it can occur that the forthcoming recording of data is incomplete because of missing hard disk or RAM storage! In this case, loss of data could be the consequence.

| (124/4): 4,66°C | 67,9 % | 1,00 | Display: 4 Hz | Not enough RAM reserved | |

Fig. 35   Status bar – Information: Not enough RAM reserved

7.8   Temperature Scale

If the function **"Scale"** is activated, the **colour and temperature scale** will be displayed to the right of the thermal image. With the help of this scale, it is possible to match the temperature values and the colour or grey scale values of the thermal image. The single functions of the temperature scale are described on the following sides.

Temperature ranges which are outside the calibration range of the thermographic system and which can therefore not be fully assessed with respect to their radiometric accuracy are highlighted by a light blue stripe in the temperature scale and in the scaling tool.

Select colour palette

Unit

Temperature scale
choose isotherms

Calibration range

Buttons for
display options

Upper temperature limit
of shown range

Calibration ranges
(light blue bar)

Scroll bar for upper
and lower limits

Object range (red bar)
Shot range (black lines)

Lower temperature limit
of shown range
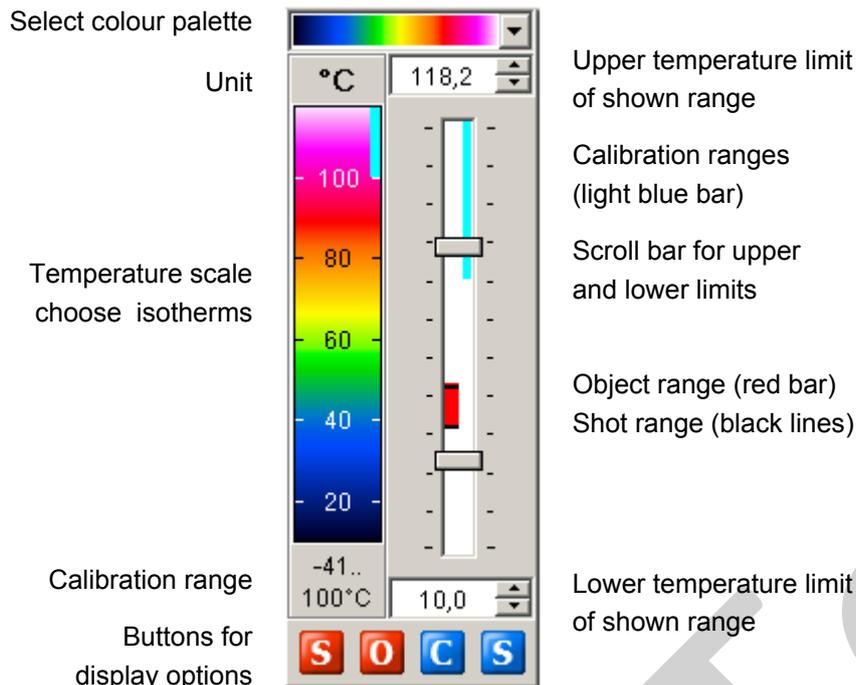
Fig. 36   Temperature scale

Scale Unit

By a left or right mouse click on the currently displayed **unit** (°C), you can decide in which temperature unit the thermal image is to be displayed. Alternatively, the scene can be displayed as spectral power or the pixel-wise emissivity can be shown. Further information can be displayed, depending on the thermographic system in use and the data recording.

- **°Celsius**   Linear temperature display in **degrees Celsius**
- **°Fahrenheit**   Linear temperature display in **degrees Fahrenheit**
- **Kelvin**   Linear temperature display in **Kelvin**
- **Spectral Radiation***   Linear radiation display in Watts per square metre
- **Epsilon***   Display of the valid local **degrees of emission**
                                         (quantity between 0 and 1, without unit)
- **Digital Values***   Display of the digitalisation value of the **detector signal**
- **Millikelvin [mK]***   Linear temperature display in **milliKelvin**
- **Phase [°]***   Phase display (for Lock-In Thermography)

Just below the temperature scale is the calibration range of the currently loaded thermal image. If a thermographic camera is connected to the system, it displays the current calibration range of the camera.

Adjust Level/Span

IRBIS® 3 allows the display of a thermal image within a temperature range that can be selected independently of the range used in the camera when the thermal image was taken. However, please note that the footroom and the headroom depend on the digitalisation depth (8 or 16 bits) of the thermographic camera and the calibration range chosen for the acquisition.

Determine Temperature Span

By selecting an upper and a lower temperature limit, the **temperature span** within which the thermal image is displayed is determined. The span can be changed by clicking into the respective field and pressing the key buttons (up/down) or by entering a concrete number.

By changing the **span limits** with the left mouse button, the upper and lower temperature limits of the thermal image can be changed as well. The scroll bars can be moved up or down separately in order to adapt the span and the level. If you want to change the level without changing the span, you must scroll both bars at the same time by clicking into the area between the bars and moving the mouse up or down while holding the mouse button pressed. IRBIS® 3 will show the current level and the (consistent) span.
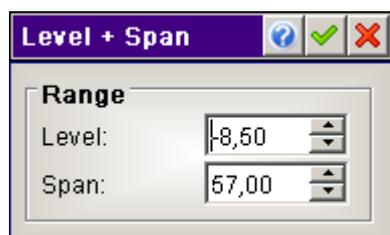
Fig. 37   Dialogue level/span

By holding the mouse pointer between the scroll bars on the temperature scale and pressing the right mouse button, the dialogue **"Level + Span"** can be opened directly (see fig. 34). The values for **level** and **span** can be changed by clicking on the arrow buttons (up/down) or entering concrete values via the keyboard.

Add Isotherms via the Scale

The display and the settings of isotherms can either be called up directly via the **temperature scale** (by a right mouse click into the temperature scale) or via the menu **"View"**, menu item **"Isotherms"**. If the isotherms are added via the temperature scale, they can be added as an interval as well as at the upper limit (Above) or lower limit (Below) of the temperature scale. Additional functions are available by starting the isotherm editor.

Fig. 38   Add isotherm via the temperature scale

If isotherms were added to the thermal image, they are also displayed in the temperature scale. The limits of the isotherms can be changed using the mouse directly in the temperature scale. For intervals, it is also possible to change the position (see chapter 10.4 Menu Item "Isotherms" – page 51).

It is recommended that you use coloured isotherms for black/white images and grey isotherms for coloured images, respectively.

Display Options

With the help of the following settings, the assignment of the temperature ranges of the thermal image and the limits of the colour scale can be determined. These buttons are below the colour palette or the scaling tool.

	Shot	Sets the temperature range (of the thermal image) to be displayed equal to the values set for the temperature span and level with which the thermal image was acquired by the thermographic system. This function can be accessed directly by pressing the key **F5**.
	Object	Sets the temperature range to be displayed in such a way that the entire temperature range of the image content is displayed by the colour scale. This function can be accessed directly by pressing **F6**. (maximum of the scene = upper limit / minimum of the scene = lower limit of the range to be displayed)
	Calibration	Sets the temperature range to be displayed equal to the values of the calibration range of the thermal image set on acquisition of the image. This function can be accessed directly by pressing **F7**. (upper limit of the calibration range = upper limit of the range to be displayed / lower limit of the calibration range = lower limit of the range to be displayed)
	Selection	Sets the upper and lower temperature limits equal to the value range with the help of which the entire temperature range of a selected image detail can be displayed by the colour scale. Image areas outside the selected image detail can be displayed as over-controlled or under-controlled, i.e. they can be displayed in such a way that the temperatures and the colour or grey scale values cannot be assigned. For this purpose, the button **Selection** in the icon bar must be used (see chapter 11.1 Menu Item "Control" – page 60). This function can be accessed directly by pressing **F8**.

8   Menu "File"

The menu **"File"** contains all functions needed for handling **thermal images** and functions for **exporting** into different file formats as well as **printing functions, settings** and **image information**.
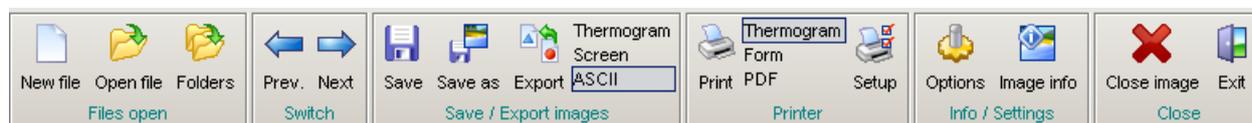
Fig. 39   "File" menu of IRBIS® 3

8.1   Menu Item "Files open"

The function **"New file"** creates a new thermal image window with the start image of IRBIS® 3. Depending on the installed software, up to four windows can be opened. In that way, several separate images or thermal image sequences can be processed at the same time (see chapter 16 Menu "Window" – page 111).

In order to open a thermal image file in the current window, use the function **"Open File"**. The thermal image is displayed according to the currently valid parameters (colour palette, temperature range, etc.). Several thermal images can be opened at the same time. All thermal images are added to the favourite file list. When selecting the thermal images, additional information is displayed in the image preview of the Explorer or in the thumbnail view in the upper left corner of the thermal images, if such information is available for a thermal image (**V** – a VIS image is available for the thermal image, **S** – the image is part of a sequence, **A** – an audio file is available).

> **VIS images** are images which have been recorded with a digital camera or the visual camera of the thermographic camera.

Loading a large number of thermal images at the same time a dialogue appears, see chapter 8.2 Dialogue "Files selected" – page 28.

With the help of the function **"Folders"**, thermal image files or several directories can be opened. This allows opening several sequences of thermal images and editing them. All thermal images are added to the favourite file list. However, only the thermal images in the respective folders are opened, thermal images in subdirectories are not opened.

> If there are only single files loaded into the favourite file list and the option **"Regard as single files"** is activated, the loading time is very low. A checkup of the existing data on the feature "package" is omitted.

8.2 Dialogue "Files selected"

With this dialogue you can define a first selection for the files you want to open. see chapter 8.1 Menu Item "Files open" – page 27.

With the function **"Thin out"** only **every n-th file** will be opened or shown in the **Favourite file list**, see chapter 7.4 Favourite File – page 18. Via the option **"Regard as single files"**, only the first image of the available sequence files is used, and therefore opened in a much faster way. Here, sequence data will be displayed as single files in the **favourite file list**.

Fig. 40   Preselection of data

The dialogue appears if you want to open more files than are specified in the **Dialogue "Options"**, tab **"Common"**, category **"Preselection at open"**, see chapter 8.5.1 Dialogue "Options" – page 31.

8.3 Menu Item "Switch"

A click on the **arrow pointing to the left** opens the file with the previous number in the current source directory of the thermal image. A click on the **arrow pointing to the right** opens the file with the next number in the current source directory of the thermal image. The **"previous/next"** functions can only be used if there are several thermal images or sequences in the favourite file list.

8.4 Menu Item "Save / Export Images"

When you click on **"Save"**, the currently loaded thermal image file (with the same name), including the possibly changed correction parameters and the modified image content, is saved under the same file name. It will be saved in .irb format. When you use **"Save as"**, the current thermal image will be saved under a new file name.

A thermogram can be saved in two different ways:
- Blackbody values (standard)
- Corrected temperature values*

This function can be changed in **"Options"**, tab **"Common"**, category **"Save thermogram"**, see chapter 8.5.1 Dialogue "Options" – page 31.
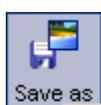
Fig. 41   Selection of the option "Blackbody values"

⚠️ **If a thermogram with corrected temperature values was loaded, the danger of a repeated correction exists! Incorrect values are the result! In such a thermogram the field of the emissivity in the status bar is red coloured.**

8.4.1   Advantage of Saving Corrected Temperature Values

Particulary with regard to emissivity corrections with low emissivity, huge differences between object and ambient temperature, or temperatures close to the range limit, a recalculation of temperature values into digital values (due to the limited dynamic and digitalisation) is restrictedly possible. In this case, instead of moving on a implemented interpolated characteristic line in the correction model, users move on an extrapolated characteristic line which can differentiate from the original calibration range leading to error-prone digital values.

On saving corrected temperature values, it is possible to evaluate and save changes of different areas of the thermogram permanently via several available correction models and definitions. Please pay attention to the fact that temperature corrections cannot be withdrawn.

ℹ️ The storing of blackbody values is recommended.

The currently displayed window can be exported in the following formats:

- Windows bitmap (*.bmp)
- JPEG bitmaps (*.jpg; *.jpeg)
- Portable Network Graphics (*.png)
- PaintBrush (*.pcx)
- CompuServe bitmap (*.gif)
- TIFF bitmap (*.tif; *.tiff)
- ASCII format
    - ASCII (*.asc)
    - Text (*.txt)
    - CSV (separator separated) (*.csv)
    - Microsoft Excel document (*.xls)

The option **"Thermogram"** saves the current thermal image, including the marked measuring and correction areas. The option **"Screen"** saves the current IRBIS® 3 work area (including measure table, charts, comment field, parameter field, VIS images). The function **"ASCII"** saves a file including all temperatures of the thermal image. This file can be saved in *.txt, *.asc, *.xls or *.csv formats. To start **"export"**, you must first select one of the options **"Thermogram"**, **"Screen"** or **"ASCII"**. After that, the function **"Export"** will be activated.

ℹ️ On activating **"Option"** (Menu "Measure", Menu item "Control") and function **"Adapt to selection"** (Menu "View", Menu item "Zoom"), only the selected area of the image will be exported. To disable this function, it is required to selected the option "**In original size**" in the dialogue **"Options"**, tab **"additional"**, see chapter 8.5.1 Dialogue "Options" – page 31.

8.4.2   Menu Item "Printer"

The content of the IRBIS® 3 window can be printed via the currently selected printer. You can print as **"Thermogram"** (thermal image will be printed) or **"Screen"** (work area will be printed). In order to create a **PDF file**, the option **"PDF"** should be selected beside the options **"Thermogram"** or **"Screen"**. If available, a PDF writer can then be selected as printer.

8.4.3   Dialogue "Print"

The function **"Print"** opens the dialogue for the printing settings. The adjustments that can be made under **"Margins"**, **"Position"**, **"Image size"** and **"Alignment"** are instantaneously visible in the preview. A click on the green tick or the **"Print"** button starts the print.
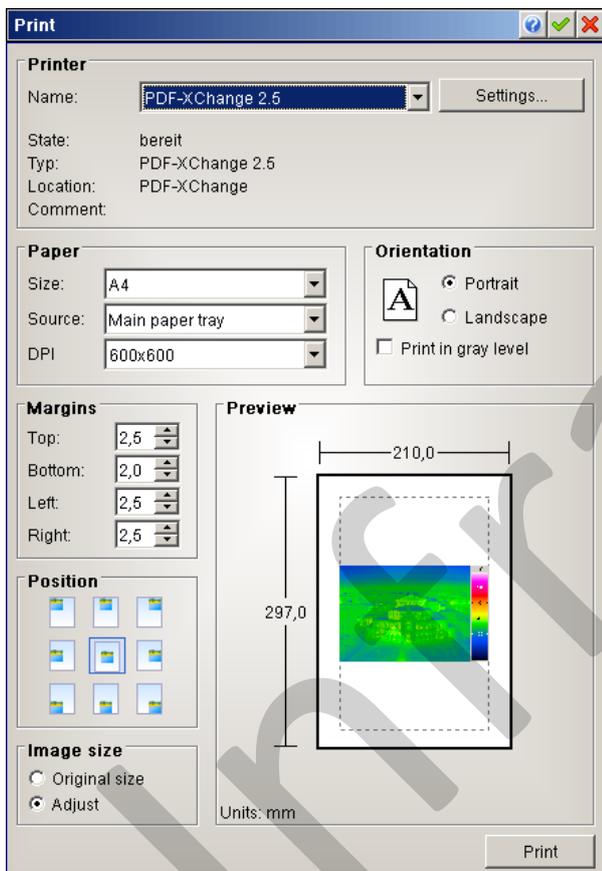

Fig. 42   Dialogue "Print"

8.4.4 Dialogue "Setup"

General printer settings can be configured with the help of the function **"Settings"**. A dialogue will open where all settings for the printer can be made.

> For optimal colour representations of thermographic images, an individual adjustment of the print options of the respective manufacturer could be necessary.

8.5 Menu Item "Info/Settings"

Via the dialogue **"Options"**, the software design and the functions of software elements can be changed individually.

8.5.1 Dialogue "Options"

Via the dialogue **"Options**, the software design and the functions of software elements can be changed individually. These settings will be saved and loaded on restarting the software. With the control field at the top, the different tabs can be called up. Via the button **"Standard"**, functions for each tab can be reset to factory settings.

Tab "Common"
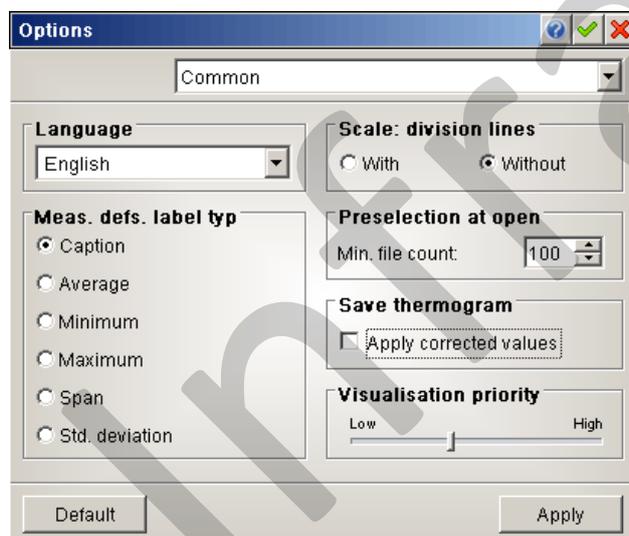
Fig. 43   Dialogue "Options" – Tab "Common"

IRBIS® 3 offers different languages after the installation. The language can changed directly, without a restart of the programme. The changing of **"Language"** can take some moments. New languages can be added without another installation of the software.

Under the category **"Meas. defs. label type"**, users may specify the label type for measuring areas displayed in the thermogram. Additionally, labels of each measuring area can be changed.

Under the category **"Scale: division lines"**, the temperature scale (see chapter 7.8 Temperature Scale – page 23) can be represented in two different modes (see chapter Fig. 45 and Fig. 44)

Fig. 44   Temperature scale with division lines

Fig. 45   Temperature scale without division lines

If more files should be opened than displayed in category **"Preselection at open"**, then a preselection dialogue appears after the selection of opening files, see **Dialogue "Files selected"**.

The category **"Save thermogram"** has an influence on the file format of the thermal image file which can be saved. If the function **"Apply corrected values"** is activated, the thermogram will be saved with corrected temperature values. If the function is not activated, the thermogram will be saved with uncorrected black body values, see chapter 8.4 Menu Item "Save / Export Images" – page 28. The activated status is shown in the status bar in the field of the cursor position in red colour.

⚠️ **If a thermogram with corrected temperature values was loaded, the danger of a repeated correction exists! Incorrect values are the result! In this case the field of the emissivity in the status bar is red coloured.**

With the **"Visualisation priority"** can be specified, how high the priority of updating of the individual elements like **Profile**, **Histogram**, **Column value chart** or **Time chart** should be.

ℹ️ If the visualisation priority is lower, the picture is shown faster in the live picture mode.

Tab "Additional"

In the category **"Parameter"** can be determined with the function **"Rec. time with milliseconds"** whether the recording time of a thermal image in the **Parameter field** is displayed, including milliseconds, see chapter 10.3.1 Parameter settings – page 50. GPS data included in the currently loaded thermogram can be additionally displayed to the already existing parameters with the function **"Show GPS data"** in the **Parameter field**.

The category **"Sequence speed"** displays, in which intervals (milliseconds) the images in **Menu "Sequence"**, menu item **"Play"** are to be shown - whether in normal or fast playback. An input at normal (slow) speed of (200 … 9,000) ms and with fast playing time of (1 … 5,000) ms can be specified.

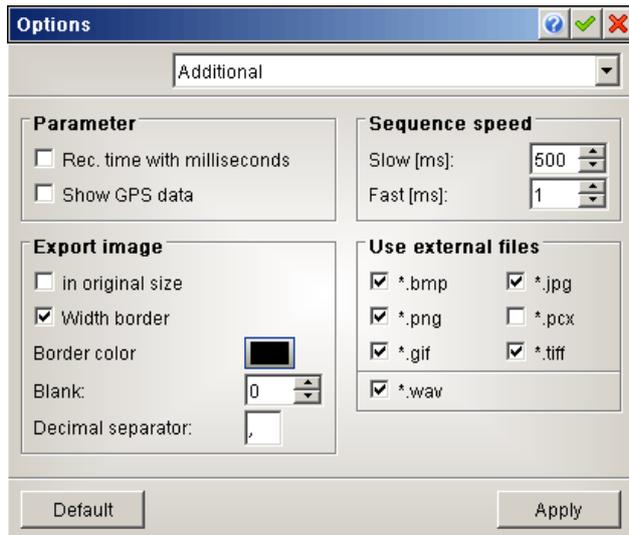ℹ️ The display speed depends on the computer performance.

Fig. 46   Dialogue "Options" – Tab "Additional"

In the category **"Export image"**, all settings are transacted, that are important for a created image in IRBIS® 3. The function **"In original size"** is of importance, if a thermogram should be exported in its original size in **Menu "File"**, button **"Export"** in the correlation of the button **"Thermogram"**. The advantage is that very large thermograms, for example (1,280 x 960) pixels, can be exported to 100% with indicated temperature scale and profiles. When you hold the cursor over the button **"Export"** a hint with the current status of original or displayed size is indicated.

Exporting only parts of thermograms requires a deactivation of this option, see 10.6 Menu Item "Zoom" – page 56.

If the function **"With border"** is activated, every image in IRBIS® 3 will create with a one pixel wide border in **"Border color"**. The functions **"With border"** and **"Border color"** refer to all pictures which are created in IRBIS® 3, e.g. over copying, printing or exporting.

With the function **"Blank"**, the exported form image can be contain gaps. The gaps are as large as indicated (in pixels) in the field.

The **"Decimal separator"** is used by export of ASCII files. Please insert valid decimal separators in this field, such as comma or point. This decimal separator refers to all exported values from the IRBIS® 3.

In the category **"Use external files"**, it is determined whether graphic or audio files can be loaded. These graphic and audio files must be in the same directory as the loaded thermographic file is, (for example Semperoper.irb + Semperoper.bmp).

Tabs "Measure area design" / "Correcture area design" / "Label area design"
Settings for the design of the measurement and correction definitions or of the caption areas, such as **Caption**, **Line**, **Font** and **Label**.
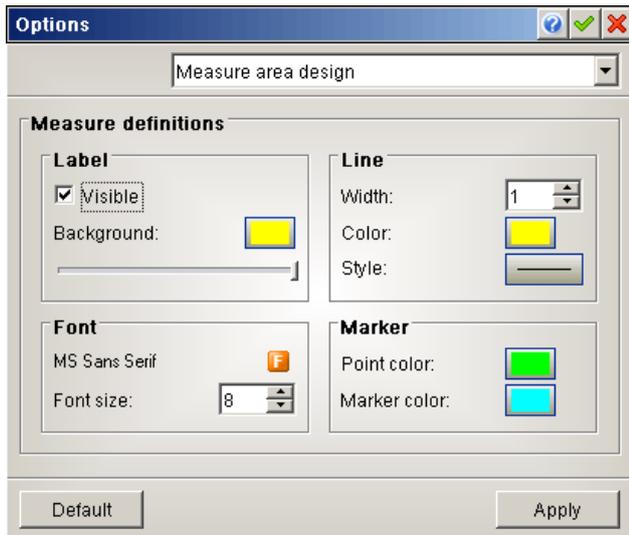
Fig. 47 Dialogue "Options" – Tab "Measure area design"

The here performed settings are set by adding the definitions in the thermal image. If there are definition already in the thermal image before change of these settings, the definitions are not affected. Later, the appearance of a definition can be changed in the **Properties dialogue**, see chapter 11.3.3 Measure areas, Corrections areas, Captions – page 65.

Tab "Other design / Charts"

Via the option **"Other Design/Charts",** the representation of the list box in the menu **"Measure"** and the charts in the thermographic form are set.
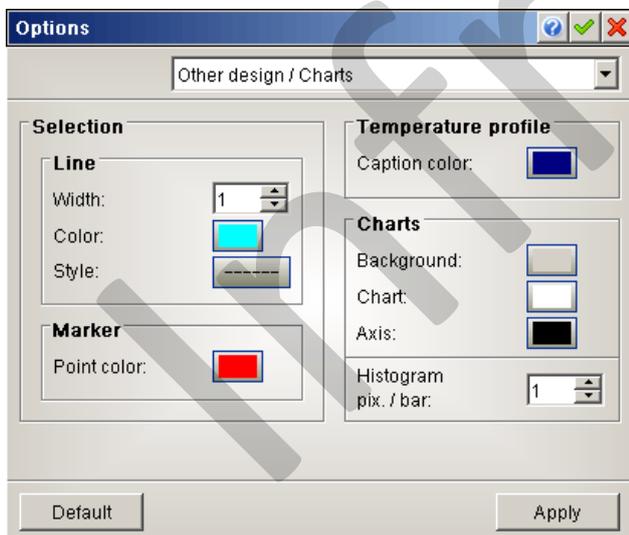
Fig. 48 Dialogue "Options" – Tab "Other design / Charts"

The colour of the min/max values on the profiles are set in the category **"Profile".**
In the category **"Temperature profile"**, the colour for min/max values on the temperature profiles can be specified. In the category **"Charts"**, the background chart colour and axis colour for all charts like **Profile chart**, **Histogram**, **Column value chart** and **Time chart** can be specified. Additionally, the number of the pixels per column can still be displayed for the **Histogram**.

8.5.2   Dialogue "Image information"
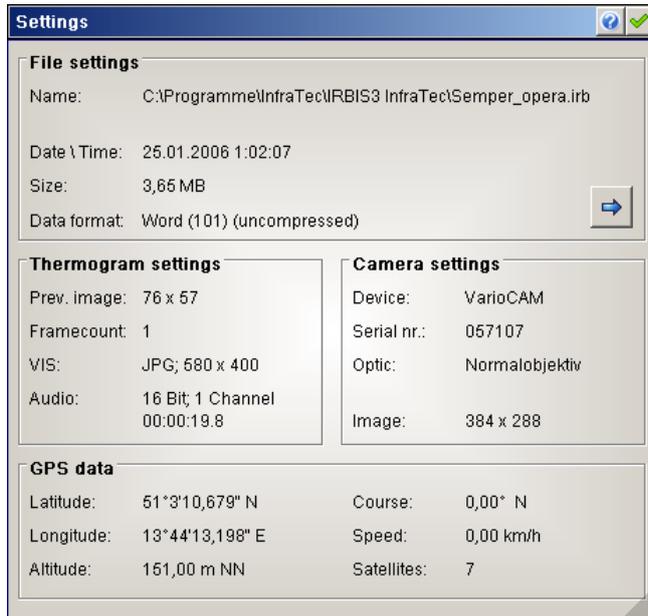
Fig. 49   Dialogue "Settings"

The function **"Image info"** displays the properties of the currently loaded file (sequence or thermal image). GPS data included in thermal images will also be displayed in the category **"GPS data".**

The dialogue will be updated after loading a new thermal image.

8.6   Menu Item "Close"

The current thermogram can be closed with a click on **"Close image"**.

The function **"Exit"** closes IRBIS® 3. Number and position of the set measuring areas, the temperature scale, etc. are not saved. On restarting the software, the most recently selected colour palette will be opened.

9 Menu "Edit"

The menu **"Edit"** menu contains image editing functions and, if required, additional functions such as adding VIS images and audio comments. Furthermore, parts of displayed window contents can be copied into the clipboard or exported into a Word document* or PDF file*.
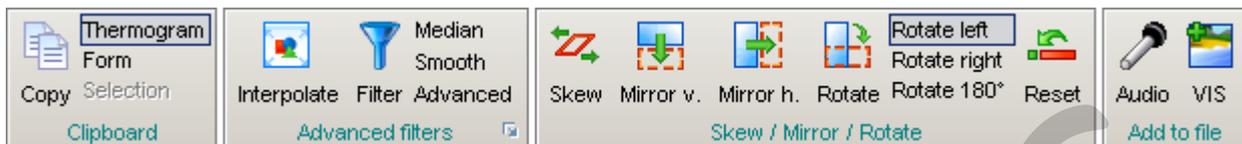
Fig. 50   "Edit" menu of IRBIS® 3

9.1 Menu Item "Clipboard"
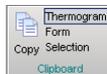
On using the function **"Copy"**, the loaded thermal image is either copied into the clipboard as a **thermogram** (thermal image including colour palette and temperature profiles) or as a **"form"** (thermal image with all displayed list boxes). The data can then be pasted from the clipboard into other programmes (e.g. MS Word, MS Excel, MS PowerPoint).

> Thermograms and thermographic forms can be inserted as an image file from the clipboard into other programmes.

9.2 Menu Item "Advanced Filters"

The function **"Interpolate"** doubles the number of rows and columns (resolution) of the thermal image. Since the size of the thermal image is not changed, the zoom factor will be automatically reduced by 50 %. The value of the interpolated pixels is calculated from the average value of the neighbouring pixels.

The temperature values of the thermal image are subject to the image editing methods every time the function **"Filter"** is used. In order to use a "filter", the required filter must be selected before the function **"Filter"** has been started. The selected filter is activated as long as the function "Filter" is.

You can select from the following filters:

- **Median**   Median filter extending over three neighbouring pixels
- **Smooth**   Soft-focus filter (surface is "smoothed")
- **Advanced**   Filter for image improvement (optimising the image content)

> Using the filters may change the temperature information.

9.2.1   Settings "Filter"*

Additional filters are available on activating **"Filter Settings".** Filters can be added to one's usage by selecting them in the left area, and moving them by clicking on the **arrow to the right direction** into the right area. The order of the utilised filters corresponds with their order in the filter list.
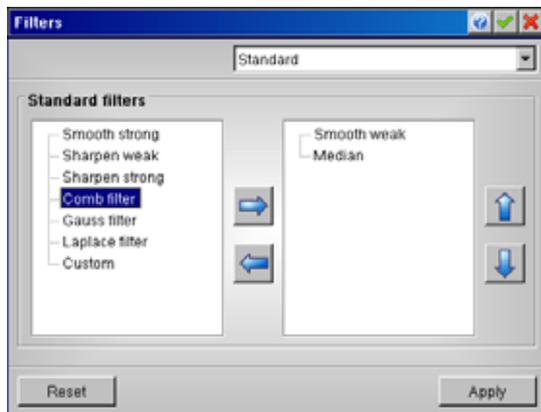

Fig. 51   Dialogue "Filters"

The use of additionally available filters corresponds to the currently loaded thermogram.

- **Median**
A median filter is non-linear and utilised in image processing. It belongs to the type of rank filters. In image processing, pixel values are arranged according to their size within a defined area around a central pixel, whereas the value of the replaced pixel is included in the calculation. The mean value of the assorted list returns and replaces the value of the central pixel.

- **Comb Filter**
A comb filter adds a delayed version of a signal to itself, causing constructive and destructive interference. The frequency response of a comb filter consists of a series of regularly-spaced spikes, giving the appearance of a comb. In contrast to high-pass and low-pass filters, comb filters are characterised by possessing more filter frequencies in the same frequency separation.

- **Gauss Filter**
Gaussian filters are filters whose impulse response is a Gaussian function. They are designed to give no overshoot to a step function input while minimising the rise and fall time. This behaviour is closely connected to the fact that Gaussian filters have a minimum possible group delay. Mathematically, a Gaussian filter modifies the input signal by convolution with a Gaussian function; this transformation is also known as the "Weierstrass transform".

- **Laplace Filter**
The Discrete Laplace Operator is an analogue of the continuous Laplace Operator, defined so that it has meaning on a graph or a discrete grid. For the case of a finite-dimensional graph (having a finite number of edges and vertices), the discrete Laplace Operator is more commonly called the Laplacian Matrix.

- **Custom**
Utilises the filter set under tab **"User".**

Via calling up the tabs **"Custom"** and **"Advanced"**, detailed filter settings may be carried out by the user.
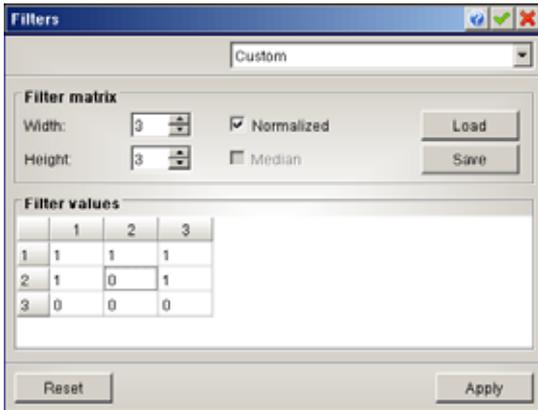
Fig. 52   Setting of an user-defined Filter Matrix
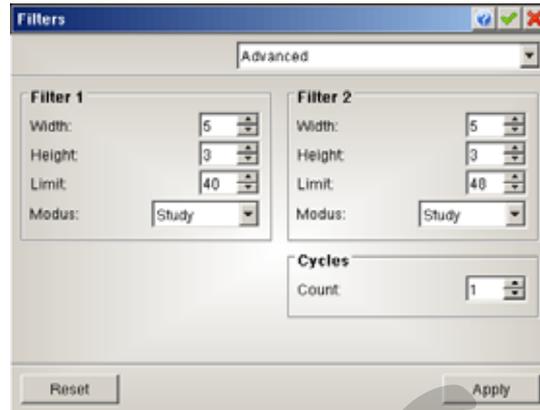
Fig. 53   Settings for Advanced Filters

9.3   Menu Item "Skew / Mirror / Rotate"

Via this menu, thermograms can be mirrored or rotated, and users may correct perspective distortions of thermograms.

9.3.1   Dialogue "Skew"*

With the help of the function **"Skew"***, perspective distortions of the thermal images can be corrected without disabling the possibility of radiometric measurements/corrections in the image. Regardless of that, it is recommended that the best position possible for the acquisition of images is selected in order to avoid image contortions.
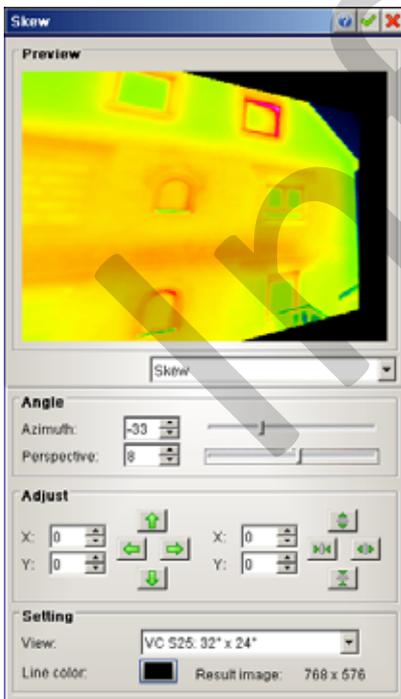
Fig. 54   Dialogue "Skew" – Skew
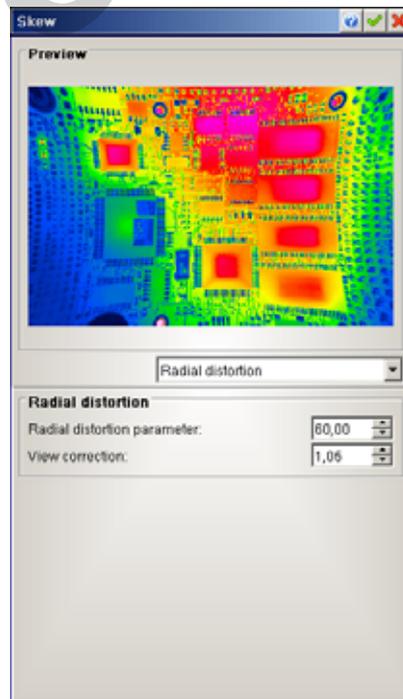
Fig. 55   Dialogue "Skew" – Radial Distortion

A click on the button **"Skew"*** opens the dialogue in which parameter settings for skewing thermal images with the functions **"Angle"**, **"Adjust"** and other **"Settings"** can be made. Changes that have

been made here can be checked in the preview image. The selected line colour displays the outline of the skewed thermal image in the thermal image window.

Via the option **"Angle",** thermograms can be skewed to the horizontal or vertical direction of the image plane. The position of the distortion mask on the thermogram is defined under point **"Adjust"** in the left area. In the opposite direction, on the right, the distortion area can be compressed or stretched to the x-axis and y-axis.

By selecting the option **"Radial skew"**, barrel-shaped distortions can be corrected with the help of a wide-angle lens. The **"Radial distortion"** must be entered for this.

9.3.2 "Mirror" and "Rotate" Thermograms

The functions **"Mirror vertically"*** and **"Mirror horizontally"*** reflect the pixels of the thermal image along a vertical or horizontal axis.

- **Vertical** reflects the thermal image along a horizontal axis at the bottom part of the image
- **Horizontal** reflects the thermal image along a vertical axis at the bottom part of the image

When the function **"Rotate"** is used, the thermal image is rotated around the image centre by the angle that has been entered in the settings. This option must therefore be selected before the function **"Rotate"** is activated.

- **Rotate left** rotates by 90° anti-clockwise
- **Rotate right** rotates by 90° clockwise
- **Rotate 180°** rotates the thermal image by 180°

If the buttons are activated when loading another thermal image, the new thermal image will be skewed, mirrored or rotated in the same way. **"Reset"** undoes all **"Mirror"** and **"Rotate"** edits.

A skewed, mirrored or rotated image can be saved as an *IRB file.

9.4 Menu Item "Add to File"

Via the functions **"Audio"** and **"VIS"**, audio files (.wav) or an image shot with an external digital camera can be added to the thermal image. If such data has already been added to the thermal image, these functions are not available (the buttons are greyed out in this case).

The function **"Audio"** opens an audio recorder with the help of which an audio comment can be recorded, loaded, edited and saved.

With the function **"VIS"**, a VIS image can be added to the current thermal image and saved.

After adding an audio and/or VIS file, the thermal image must be saved to ensure the data's availability for further editing.

9.5   Menu Item "List"*

The function **"Undo"** reverts the most recent edit. The function **"Redo"** repeats the edit that was most recently reverted. A click on the menu item **"list"** deletes all taken actions. These functions are only applicable for operations in the menu item **"edit"**.

10   Menu "View"

The menu **"View"** contains all functions with the help of which the design of the current window can be changed.

10.1   Menu Item "Scale"

If the function **"Scale"** is activated, the **colour and temperature scale** will be displayed on the right of the thermal image. With the help of this scale, it is possible to match the temperature values and the colour or grey scale values of the thermal image.

10.1.1 Profiles

Via the button **"Profiles"** in the menu **"View"**, a horizontal or vertical temperature profile can be created for any spot of the thermal image. As soon as the button **"Profiles"** is activated, a reticle appears in the thermal image. With the help of the reticle, any position in the image can be selected and confirmed by a click on the left mouse button. If you wish to correct this position, you can repeat the process by pressing the profile button once again. The scaling process of the temperature in the profile depends on the temperature scale of the thermal image.
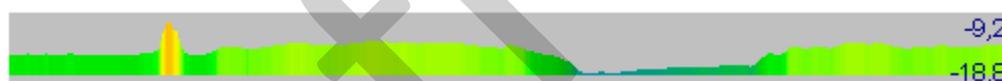
Fig. 57   Horizontal Temperature Profile

The colour of the displayed min/max values can be set via dialogue **"Options",** tab **"Other design/ charts"**, see chapter 8.5.1 Dialogue "Options" – page 31.

10.1.2 Settings "Scale"

In the temperature scale settings, the **"Color range"** and the **"Number of colors"** can be selected and the **"Linearity"** settings can be configured. **"Color count"** determines the number of colour or grey scale values (16, 64, 256, 1000 or a numeric **"input"**) in which the thermal images are displayed (e.g. according to the selected colour palette, the value 16 corresponds to 16 grey scale values or 16 different colours). High resolutions will only be displayed correctly if the graphics card of the PC supports such resolutions (we would therefore recommend at least High Colour = 16 bits).

Through the function **"Linearity"***, the temperature scale can be changed exponentially (positive factor) or logarithmically (negative factor), depending on the dynamics of the thermographic scene. In that way, areas with minor temperature differences in scenes with wide dynamic ranges can be distinguished in a better way.
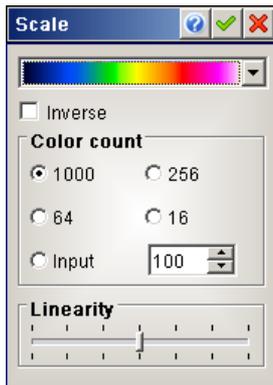
Fig. 58   Dialogue "Temperature scale"

You can choose from the following colour palettes:
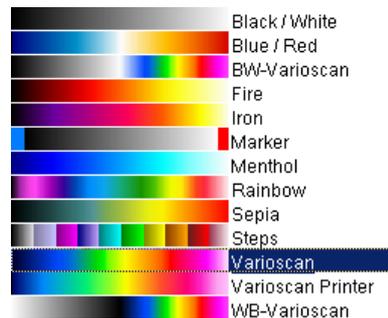
Fig. 59   Colour palettes of IRBIS® 3

10.2   Menu Item "Elements"

When the function **"Elements"** is activated, a **VIS image**, a **measure table** and up to three charts can be displayed beside the current thermal image.

The function **"Scroller"** enables a scroll bar to the right and below the thermal image so that details can be displayed when the zoom is used. A preview window (**Preview**) shows which image detail of the thermal image is currently1 displayed. The zoomed area can be moved by changing the position of the detail area within the preview windows.
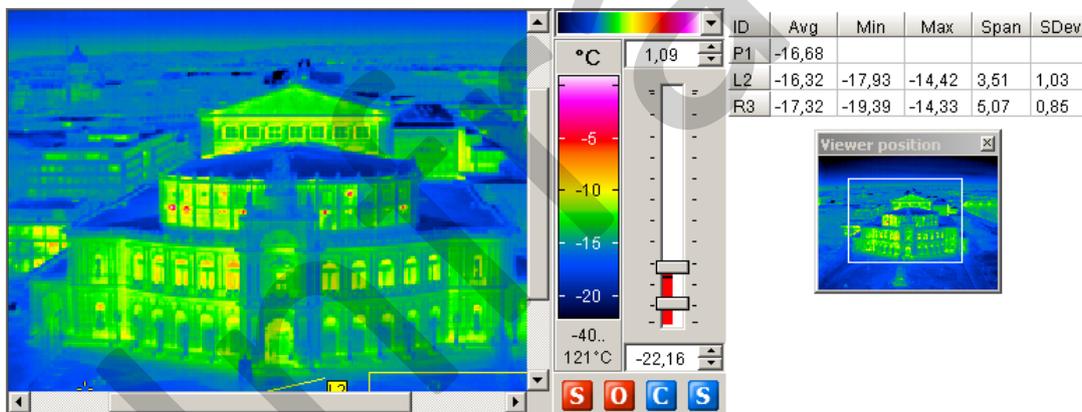
Fig. 60   Enlarged image section with scrollbar and preview

10.2.1 Settings "Elements"

With the help of the **"Settings Elements"**, the information to be displayed on activating the function **"Elements"** can be determined. The information to be displayed is activated. Here, the number of decimal places to be displayed for each measured value is determined, too.

While this dialogue is open, modifying settings has an effect on the elements of the thermogram form.
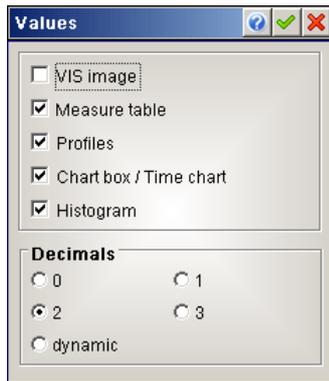
Fig. 61   Dialogue "Values"

The set decimals relate to the **measure table**, the **Level+Span,** in the min-/max values in the **Profiles,** the **description of the measuring areas** and the **ASCII-Export**.

10.2.1.1   VIS Image

The VIS image will be shown if a digital image in the loaded thermal image or an external graphic file (*.bmp; *.jpg etc.) with the same name as the thermal image is located in the same source directory. If the currently loaded thermal image file contains a VIS image, the function "VIS image" in the Menu "Edit" is available in the menu bar.
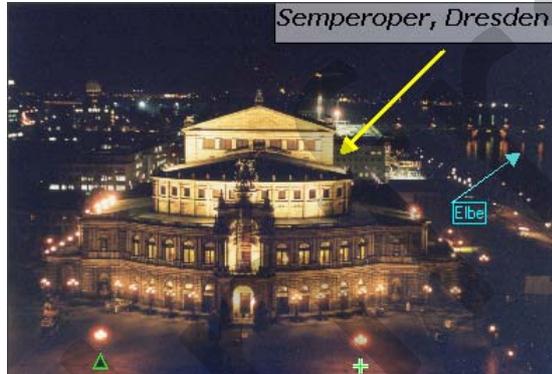
Fig. 62   VIS image with captions

Additional information, in the form of captions, can be added into the VIS image pointing out details of the thermal image or VIS image.

"Captions" can be added to the VIS image when it is displayed on the software's surface. On opening the VIS image for editing, **"Captions"** cannot be added. See chapter 10.7.2 Dialogue "VIS" – page 57.

Further information will be found in the menu **"Measure"**, see chapter 11.2 Menu Item "Caption" – page 60.

A click on the right mouse button calls up further functions for the VIS image:

- **Copy**   Copies the histogram into the Windows clipboard. It can then be pasted into other programmes (e.g. MS Word)..
- **Export**   The VIS image can be saved in different image formats.
- **Element**   With this function, the VIS image can be hidden.
- **Edit...**   The VIS image can be edited in the Dialogue "VIS", see chapter 10.7.2 Dialogue "VIS" – page 57.
- **Report**   This function is displayed, when an IRBIS® 3 report was opened. It is possible to add the VIS image into the report.

10.2.1.2   Measurement and Correction Table

IRBIS® 3 allows the use of various measuring definitions (**measuring spots, measuring lines** and **measuring areas**) within the thermal image (see also Chapter 11.3 Menu Item "Measure Areas" – page 61). To display measured values, a measurement table can be shown in the work area by applying the menu **"View"**, menu item **"Elements"**. At the same time, correction areas of the thermogram are listed together with the selected parameters, while correction definitions are displayed on the bottom of the table.

ID	Avg	Min	Max	Span	SDev	Eps	L[m]
R1	-15,80	-20,91	-12,06	8,85	0,95	1,00	64,13
L2	-14,84	-18,51	1,10	19,61	3,94	1,00	25,97
P3	-15,97					1,00	
P4	-11,99					1,00	

ID	MOD	Eps	Te	Tau	Tp	RH
R1	O	0,80	-19,50			
T2	O	0,80	-19,50			

Fig. 63   Measurement and Correction Table

Individual columns of measured values and correction definitions can be deleted by a double click on the column. Via double click on the first column header (ID), all available columns will be displayed. Selecting a line in the measure table marks the corresponding definition in the thermogram. Multiple lines can be selected by holding key **Ctrl** or **Shift**. Selected lines will be displayed in blue colour.

Further settings and functions can be called up by a **right mouse click** on a column, row or the headline of the table.
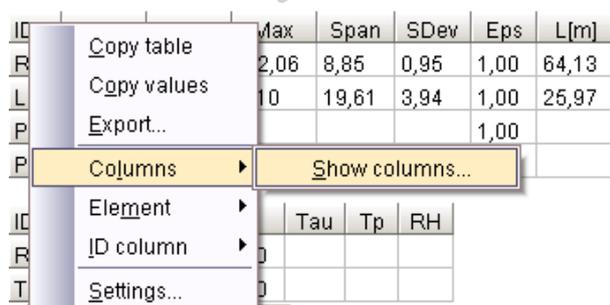

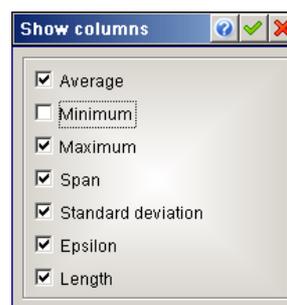*Fig. 64   Showing and hiding columns of the measurement table*

Fig. 65   Dialogue "Show columns"

ID	Av			Dev	Eps	L[m]
R1	-15,			95	1,00	64,13
L2	-14,			94	1,00	25,97
P3	-15,				1,00	
P4	-11,				1,00	

ID	Avg	Max	Span	SDev
R1_Rectangle	-15,80	-12,06	8,85	0,95
L2	-14,84	1,10	19,61	3,94
P3	-15,97			
P4	-11,99			

ID	MO
R1	O
T2	O

Fig. 66   Settings of display the ID column   *Fig. 67   Display of ID column with the option long name*

- ■ **Copy table**   The Measurement table is copied into the clipboard, and can be added into other programmes, for instance Microsoft Word.
- ■ **Copy values**   Measured values are copied into the clipboard, and can be added into other programmes, for instance Microsoft Excel.
- ■ **Export**   The measure table will be exported as image file (*.bmp, *.jpg etc.)
- ■ **Columns**   This calls up the dialogue responsible for the columns which are to be displayed.
- ■ **Element**   Via this function, the element measurement table can be made hidden.
- ■ **Settings**   Opens the dialogue for setting measure and correction areas, see chapter 11.3.4 Measuring Area Settings – page 66.
- ■ **ID-Column**   The ID-Column can be displayed as short and long name. When displaying **Short name (ID)** signifies the measure area (e.g. R1). If an additional description is added to the measure area, it will be displayed in/on the **Long name (Label)**, e.g. R1_Rectangle and in the maximised dialogue.

By pressing the right mouse button when the mouse pointer is on a **line** within the table, further submenu options can be called up.

Fig. 68   Functions of the measurement and correction table

- **Properties**   Displays the properties dialogue of the respective elements or definition. See chapter 11.3.3 Measure areas, Corrections areas, Captions – page 65.

- **Copy definition**   An element or definition is copied. Amongst all captions, only the text box can be copied.

- **Copy to correction definition**   Via this function, measuring areas can be copied to a correction area. The newly created correction area is located just above the copied measuring area.

- **Order**   In contrast to other areas, measuring and correction areas can be moved into the foreground and background.

- **Delete**   Deletes the currently selected elements and definitions of the thermogram. This function is to be carried out through the delete key (**Del**).

- **Delete all measure definitions**   Deletes all measuring areas existing in the thermogram.
- **Delete all correction definitions** Deletes all correction areas existing in the thermogram.
- **Settings**   Opens the dialogue for measuring and correction areas, see chapter 11.3.4 Measuring Area Settings – page 66.

10.2.1.3   Profile Chart*

In the **profile chart**, the profile of the temperature along a line or along the outline of other measuring areas of the thermal image is displayed. As soon as a line is defined in the thermal image, it will be displayed in the profile chart. In order to show the temperature profiles of outlines, they must be selected in the dialogue **"Settings"**, which can be opened in the profile chart by a right mouse click.

The vertical line in the profile chart corresponds to the red spot on the thermogram. Additionally, the temperature is displayed on this spot.
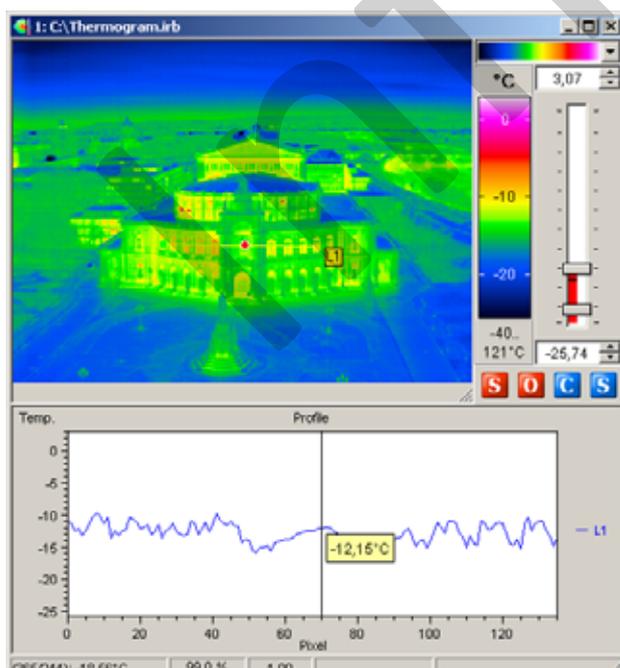

Fig. 69   Thermogram with profile chart

A number of other functions for the profile chart can be called up by a click on the right mouse button:

- **Copy** Copies the profile chart into the Windows clipboard. It can then be pasted into other programmes (e.g. MS Word).
- **Export** The profile can be saved in different image formats.
- **Show legend** Shows or hides the legend next to the profile chart.
- **Element** With this function, the profile chart can be hidden.
- **Maximize*** Maximizes the profile chart. A dialog will open where further settings for the maximized profile can be configured.
- **Report** This function is indicated if a MS-Word report is opened. Then profile chart can be added in the report.
- **Settings** Determines which of the measuring lines and measuring areas in the image are shown or hidden.

10.2.1.4 Dialogue "Profile chart"*

The dialogue **"Profile chart"** contains an enlarged profile chart of the thermographic form and enhanced configurations.

Via the **"File"** menu, users may **"Copy", "Export"** and **"Print"** charts. Additionally, adjusted **"configuration"** can be saved and loaded.

An update of the profile can be realised through menu **"Edit"** and function key F5. This might be helpful, if a measuring point was added or moved within the thermogram.

Showing and hiding properties (on the right) and the comment field (on the bottom) are possible via the **"View"** menu. With the help of menu item **"Default values"**, components, such as charts, legend and axes can be restored to factory settings.
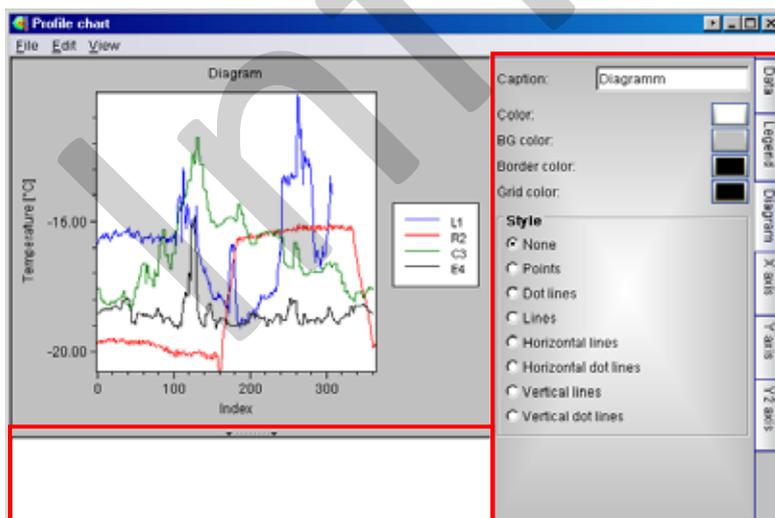

Fig. 70 Profile chart with several measuring definitions

Profile chart tabs correspond with the time chart and profile over time chart to a large extent. See chapter 13.3 Menu Item "Charts" – page 96.

Properties − Tab Selection

10.2.1.5   Time Chart/Chart box*

Alternatively, a time chart or a column value chart can be displayed. You can switch between both charts by a right mouse click. For both charts, further settings can be made through the functions of the right mouse button.

The **time chart*** displays the chronological sequence of the average, minimum and maximum values of an ROI. The values will be shown if a real-time image is displayed via the thermographic camera. A time chart can also be created for the assessment of an image sequence. In order to display a curve, measuring spots must be defined in the image whose values serve as a basis for the display.
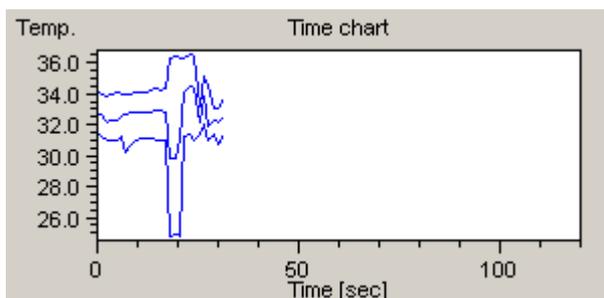

Fig 71   Time chart

With the right mouse button, the following operations for the time chart can be called up:

- ■ **Copy**   Copies the time chart into the Windows clipboard, which afterwards can be added to other programme (e.g. Microsoft Word).
- ■ **Export**   The time chart can be saved as different image formats.
- ■ **Chart box**   Displays the chart box instead of the time chart.
- ■ **Show legend**   Option for showing or hiding legend right to the time chart.
- ■ **Element**   Via this function, the chart box, respectively the time chart can be hidden.
- ■ **Maximize***   Maximises the time chart, and opens a dialogue in which further settings for the maximised time chart can be configured. See chapter 13.3.1 Time Chart – page 96.
- ■ **Report**   This function will be displayed, if an IRBIS® 3 report is open. The time chart, then, can be added to the report.
- ■ **Settings**   Via this option, users determine which ROI-values are displayed in the time chart. See chapter 11.3.4 Measuring Area Settings – page 66.

The **chart box** displays the minimum, maximum and average values for each column (x-profile) of a thermal image. The chart can either be displayed as **"3-line chart"** or as **"colour chart"**, the display of which can be switched by a click on the right mouse button. The colours used in the colour chart depend on the selected colour palette. The scale is determined before the thermal image is scaled.
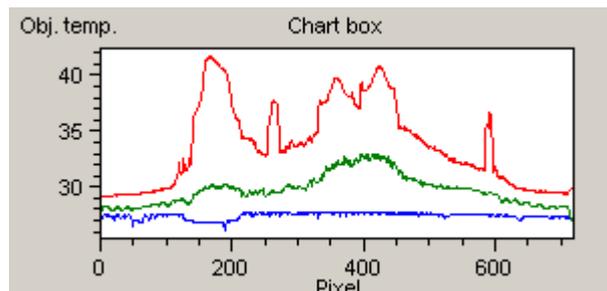
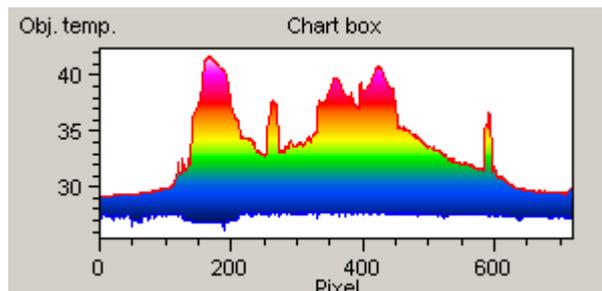*Fig. 72   Chart box – displayed as a colour chart*

Fig. 73   Chart box – displayed as 3-line chart

With the right mouse button, the following operations for the time chart can be called up:

- **Copy**   Copies the column value chart into the Windows clipboard, which, afterwards can be added to other programmes (e.g. Microsoft Word).
- **Export**   The chart box can be saved as different image formats.
- **3 lines**   With this function the chart box is displayed as 3 lines chart.
- **Colored**   With this function the chart box is displayed as colour chart.
- **Time chart** Displays the time chart instead of the chart box.
- **Element**   Via this function, the chart box, respectively the time chart can be hidden.
- **Report**   This function will be displayed, if an IRBIS® 3 Report is open. The column value chart, then, can be added to the report.

10.2.1.6   Histogram*

The **histogram** shows the frequency distribution of temperature values for the entire thermal image or ROI charted in it. If one or several ROI are charted in the thermal image, the frequency distribution of these ROI can be displayed by a right mouse click and selecting the function **"Settings".** The scaling of the histogram's x-axis and the colours in which it is displayed correspond to the scaling and selection of colour palettes. The number in the upper right corner delivers information on the percentage of the displayed area.

In case of a percentage lower than 100%, a modification of the temperature scale/ scaling is recommended.
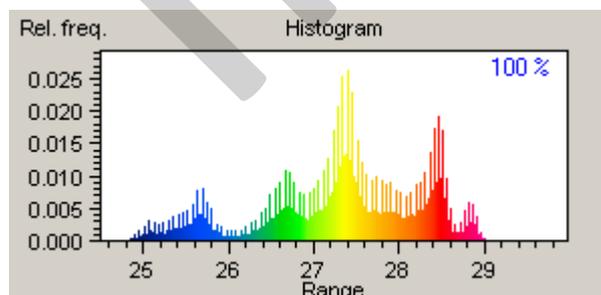

Fig. 74   Histogram with one pixel per column
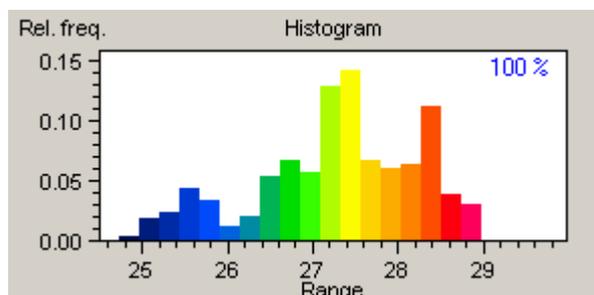

Fig. 75   Histogram with ten pixels per column

Via dialogue **"Options",** tab **"Other design/ Charts"**, the number of pixels per column can be inserted into the histogram. See chapter 8.5.1 Dialogue "Options" – page 31.

A click on the right mouse button calls up further profile chart functions:

- **Copy**   Copies the histogram into the Windows clipboard. It can then be pasted into other programmes (e.g. MS Word).
- **Export**   The histogram can be saved in different image formats.
- **Element**   With this function, the histogram can be hidden.
- **Report**   This function is indicated if a MS-Word report is opened. Then the histogram can be added to the report.
- **Settings**   Determines for which of the charted ROI the frequency distribution is displayed.

10.3   Menu Item "Parameter"

If the function **"Parameter"** is selected in the menu **"View"**, an additional column is shown on the left of the thermal image. This column contains additional information, such as the acquisition date, filename, etc. which can be selected via the function **"Parameter settings"**.
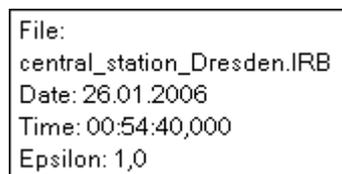
File:
central_station_Dresden.IRB
Date: 26.01.2006
Time: 00:54:40,000
Epsilon: 1,0

Fig. 76   Detail from the parameter field

Additional GPS data can be displayed in the parameter field by selecting **"GPS-Data"** in the dialogue **"Options"**. See chapter 8.5.1 Dialogue "Options" – page 31. Further information can be found under the **"View"** menu, see chapter 10 Menu "View" – page 41.

The format of the thermal image files contains a comment which can be added, depending on the camera model, by entering it into the thermographic camera when the image is taken. This comment is displayed in the comment field if the latter has been activated through the menu item **"Comment"** in the menu **"View"**. In the comment field, further comments can be added to a comment that has been saved. After changing or adding a new comment, the thermal image must be saved in order apply changes.

VarioCAM high resolution, central station Dresden
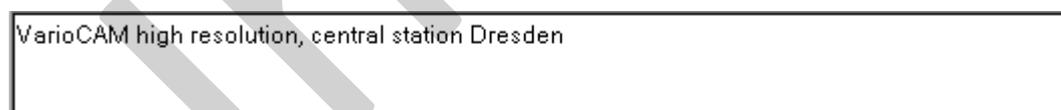
Fig. 77   Comment field

Any font, as well as numbering and enumeration is selectable in the comment field. Further information is available under the **"View"** menu.

10.3.1 Parameter settings

In the parameter field, those parameters are displayed which have been activated via the function **"Parameter settings"**. The selection can be made in the dialogue "Parameters", which shows the functions and their corresponding buttons on the left. These functions and buttons can then be added to the parameters to be displayed. The buttons on the right have already been selected.

New functions can be added by selecting them on the left and moving them to the right using the **arrow pointing to the right**. In the bottom part of the dialogue, a project name (**Job**) can be entered.

If the option **"Use as comment"** is activated, the comment which has been entered there is displayed in the comment field, even if a comment of the thermographic camera already exists. If the function is deactivated, the comment field displays only the comment made by the thermographic camera.
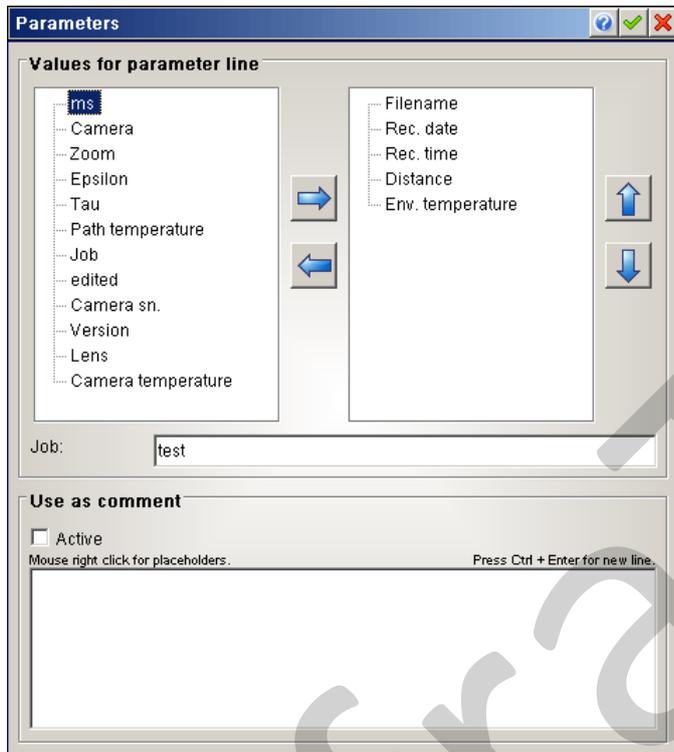
Fig**.** 78 Dialogue "Parameters"

10.4   Menu Item "Isotherms"

By pressing the button **"Captions"**, the name of measuring and correction areas (e.g. L2) can be shown or hidden. If several measuring and correction areas are used, the display of caption areas is recommended in order to guarantee an unambiguous attribution to the measuring or correction definitions in the measure table.

Isotherms that have been defined before can be shown or hidden through the function **"Isotherms"**. If a new isotherm is added, this function is automatically activated.

10.4.1 Dialogue "Isotherm Settings"

In order to define isotherms, the dialogue **"Isotherm settings"** (isotherm editor) must be started.
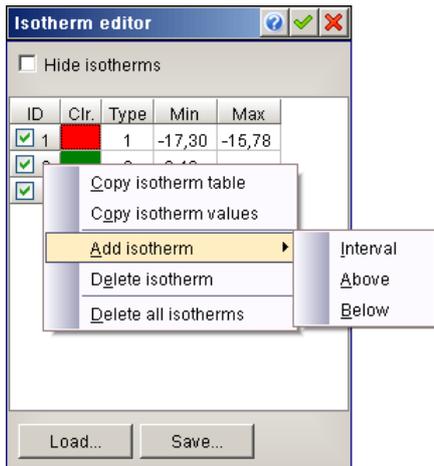
Fig. 79   Dialogue "Isotherm Editor"   Fig. 80   Display of isotherms on the temperature scale

With the help of isotherms, all areas of a thermal image whose temperatures are within a determined temperature interval can be highlighted through colour or grey value scales. The settings of the isotherm editor are equal to the menu that can be called up by a right mouse click on the temperature scale (see chapter 10.1 Menu Item "Scale" – page 41.

Isotherms characterise a temperature range which is defined by a lower (**"Min"**) and an upper limit (**"Max"**). The limits can be overwritten or entered in the currently selected unit (°C, °F or K). Please note that the value on the left (**"Min"**) must be less than the value of the upper limit (**"Max"**).
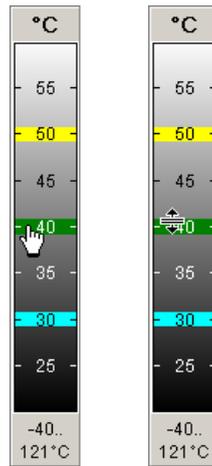
In order to activate the isotherms with the defined parameters, the box in the column **"ID"** must be ticked. The colour (**"Clr."**) of each isotherm can be changed by a left mouse click on one of the colours. A dialogue will open which shows all selectable colours. Isotherms are **added** or **deleted** by a right mouse click into the column **"Type"**. A short dialogue will open.

- **Interval**   A new isotherm is created in the centre of the display area. If an interval is created which is above an already existing isotherm, an isotherm with the property "lower limit greater than upper limit of existing isotherm" will be activated. If an interval is created below an already existing isotherm, an isotherm with the property "upper limit less than lower limit of existing isotherm" will be activated. If intervals are added by using the right mouse button, their position depends on the position of the mouse pointer within the temperature scale.
- **Above**   Isotherms whose upper limit (Max) is equal to the upper limit of the display area.
- **Below**   Isotherms whose lower limit (Min) is equal to the lower limit of the display area.

Via the operations **"Copy Isotherm Table"** as well as **"Copy Isotherm Values",** data of the defined Isotherms can be either copied as **Isotherm Table** or **Isotherm Value** into the clipboard, and afterwards added into other programmes, such as Microsoft Word. Thus, isotherms can be easily saved for documentation purposes and further traceability.

As long as the isotherms' display is activated, they are visible on the temperature scale. Isotherms can be moved up and down within the temperature scale, respectively zoomed in and zoomed out (see Fig. 80).

10.5   Menu Item "Merge parameter"

The function **"Merge par."** can only be selected if a VIS image is available beside the presently loaded thermal image. As soon as the function **"Merge par."** is activated, the IR image and the VIS image will be merged, see chapter 10.5.2 "Merging" – page 55.

Fig. 81   Merged images

10.5.1 Dialogue "3D View"*

By activating the function **"3D view"**, the present thermal image will be displayed three-dimensionally in a visualisation window. This 3D view can be modified by using the list box **"Select view"** on the right and selecting the options **"Position/Dimension"**, **"Design"** or **"Color scheme"**. It is also possible to switch between the **"Standard 3D"** and **"OpenGL"** 3D views. **"OpenGL"** has fewer functions than **"Standard 3D"** but it displays the thermal image using the current colour palette at a much higher speed.
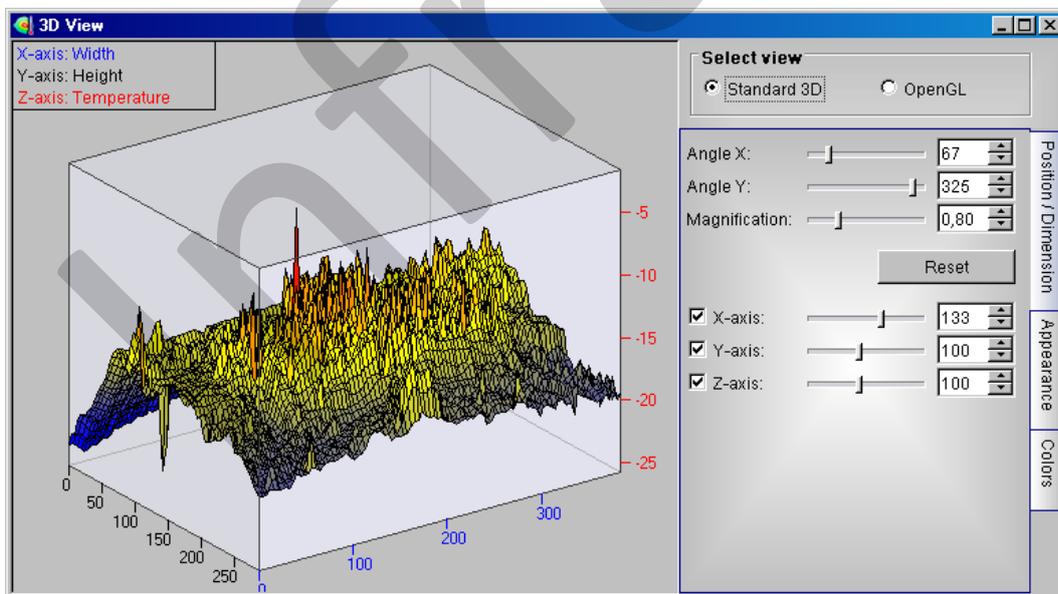
Fig. 82   3D view of a thermal image

In comparison to **"Standard 3D"**, **"OpenGL"** provides less functions, even though it displays thermograms in the current colour palette at a higher speed. The 3D View can be displayed without any problems while the thermographic camera is connected in "Real-time mode" with **"OpenGL"**. In the menu **"Position/Dimension"**, the position of the 3D image can be changed. The 3D model can be rotated by using the left mouse button.

Changing the colour palette or level and span in the thermal image has an direct effect on the **"OpenGL"** 3D image.
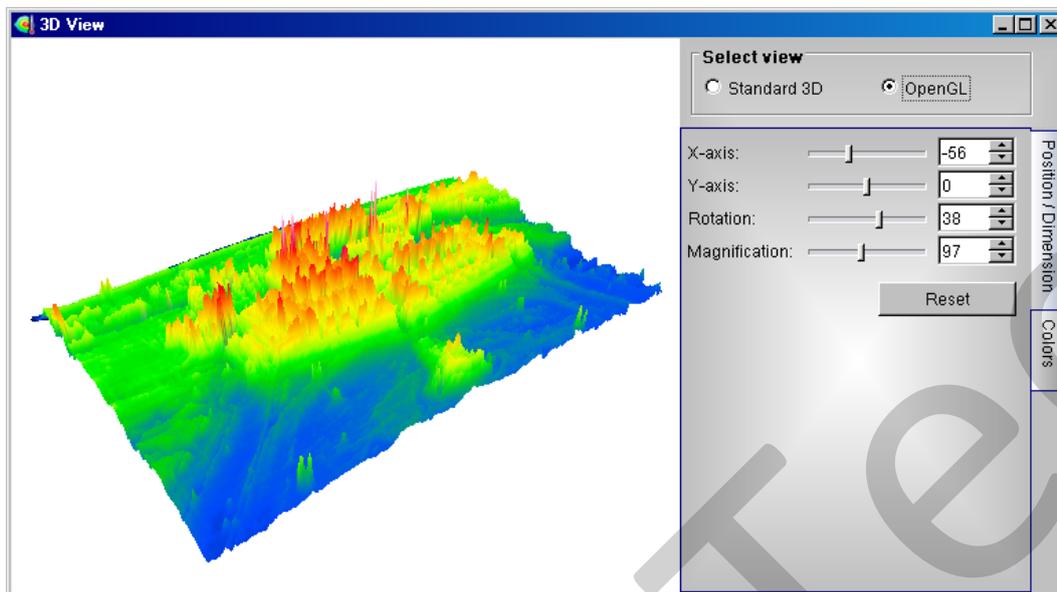

Fig. 83   3D view of a thermal image – display as OpenGL

Tabs of the modes **"Standard 3D"** and **"OpenGL"** slightly differ from each other. The following explains the functions of the **"Standard 3D"** View.

- **Angle X**   Rotates the 3D image around the horizontal axis (angle X = 0 corresponds to a two-dimensional image / angle X = 90 corresponds to the horizontal profile of all image rows.
- **Angle Y**   Rotates the 3D image around the image centre.
- **Zoom**   Size of the 3D image can be modified.
- **X/Y/Z axes**   Changes the scaling of the selected dimension.

Tab "Design"

In the menu **"Design"**, the appearance of the 3D model can be modified. The smaller the **"Resolution"** value, the more detailed the 3D model will be. If the option **"Reticle"** is activated, the X/Y position of the mouse pointer will be highlighted in colour in the 3D model.

Tab "Colors"

In the menu **"Color scheme"**, the colouring of the 3D image can be changed. You can choose from the colour palettes **"VarioSCAN", "Black/White", "Iron"** and **"Blue/Red"**. By activating the option **"Selectable"**, the function **"3-colour scheme"** is displayed where you can select either two or three colours which will then be used for the colouring of the 3D image.

Please note that the colours of the "Standard 3D" view are not the same like those of the colour palette selected for the thermal image. The colours can be selected independently of each other.

If the cursor is over the 3D chart, a submenu can be opened by a click on the right mouse button. In this submenu, the following functions can be called up directly:

- **Copy**   The chart in 3D View is copied into the clipboard, and afterwards, it can be added to other programmes, such as Microsoft Words.
- **Export**   Charts in 3D View can be saved as different image formats.
- **Print**   The 3D chart is added to the print preview.
- **Rotate**   Via this function, 3D charts can be rotated by using the left mouse button.
- **Move**   3D charts can be moved by using the left mouse button.
- **Zoom**   3D charts can be zoomed in and zoomed out by using the left mouse button.
- **Rotate X-Axis** 3D charts can be rotated on the X-Axis by using the left mouse button.
- **Rotate Y-Axis** 3D charts can be rotated on the Y-Axis by using the left mouse button.

10.5.2 "Merging" Settings

In the dialogue **"Merging"**, the parameters for merging an IR image and a VIS image can be configured.

In the category **"Image"**, VIS images can be adjusted to the IR image's size via **"Scale width"**, respectively **"Scale height"**. Additionally, it is possible to display the VIS image in **"Gray scale"** mode. In contrast to thermograms, VIS images can also be moved on the x-axis and y-axis in the category **"Offset"**.

Under option **"Range"**, users may determine which temperatures are to be highlighted as cross-fade with false colour in the VIS image via the functions **"Level"** and **"Span"**. The VIS image will only be displayed outside the area defined via **"Range"** option. **"Color"** and **"Blend"**, respectively the false colour cross-fade's transparency can be set instantaneously.
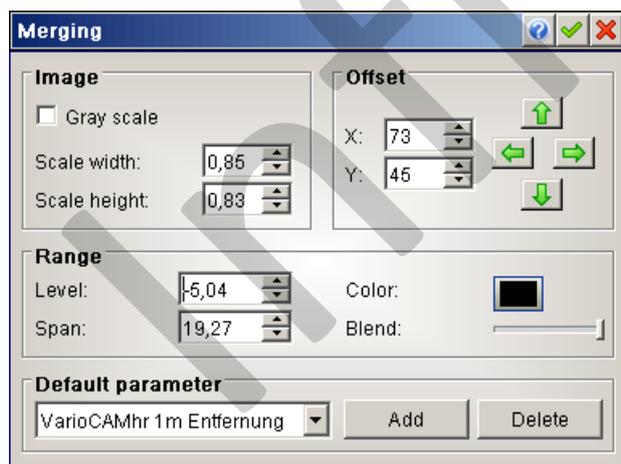

Fig. 84   Dialogue "Merging"

If **black** and **white** is selected in the colour setting, the current palette will be applied for the cross-fade of the thermal image data.

The default setting for the scaling parameters depends on the thermographic systems' focusing. A correction may be of use with regard to objects differing in distances. In the category **"Default**

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parameters" several options are available. Via the functions **"Add"** and **"Delete"**, the list can be individually adjusted.

10.6   Menu Item "Zoom"

In this menu, the display size of the thermal image can be set on the preset standard values by pressing the mouse button. For the automatic adjustment of the display area, it is recommended to activate the function **"Adapt to window"** with the help of which thermal images will always be displayed in the same window size, even if they have different formats. Using the function **"Adapt to selection"**, users can zoom into the image detail that has been selected via the function **"Selection".** The selected image detail will then be magnified. Alternatively, the zoom factor can simply be selected by using the magnifying glass function (**Zoom in** or **Zoom out**) in the icon bar.

The function **"Adapt to selection"** should be deactivated during the acquisition process. In the live-mode, the zoomed version needs additional computing power, which could lead to loss of data. The maximum zoom level is limited up to 300% in the live mode.

If necessary, the display area of the thermal image can also be zoomed in by pressing the keyboard shortcut `Ctrl + F`. In this case, the menu and icon bars are hidden. The toolbar is still displayed.

10.7   Menu Item "Additional"

If the currently loaded thermal image file contains an audio file, the function **"Audio"** is available in the menu bar. The audio comment of a thermal image can be started by pressing the button **"Audio"**. In order to edit the audio file, you must click with the right mouse button on the audio symbol (see also Chapter 9.4 Menu Item "Add to File" – page 39).

10.7.1 Dialogue "Audio"

The function **"Audio"** is available on the menu bar as soon as the currently loaded thermogram contains an audio file. Saved audio comments can be played by activating **"Audio"**.

Only the audio comment will be played by clicking on **"Audio"** with the left mouse button. A click on **"Audio"** with the right mouse button will display the dialogue **"Audio"**.

The tone curve of the audio comment is displayed in the dialogue **"Audio"**, in which the audio comment of the thermogram can be added into or edited.
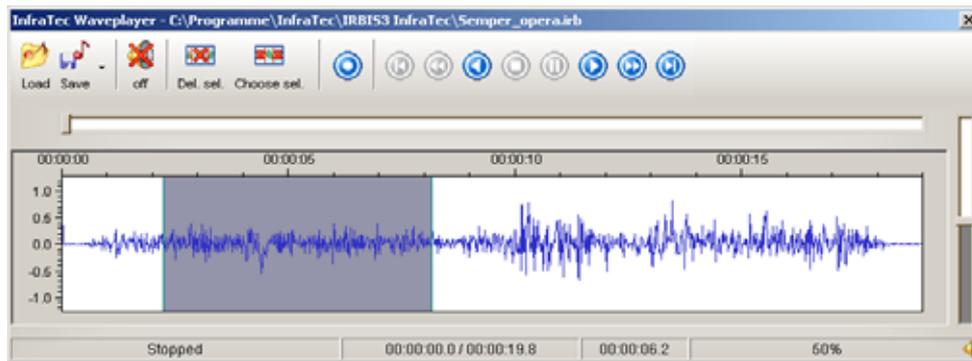
Fig. 85   "Audio" dialogue – dubbing thermographic files

Via the **"Load"** button, an external audio comment in wave-format (*.wav), or one of another thermographic file can be loaded. By clicking on **"Save"**, edited audio comments can be saved in wave-format, or exported into another IRBIS-file (*.irb-Datei).

Certain parts of the audio comments' tone curve can be selected by holding the left mouse button, and moving the selected part with the mouse pointer (see fig. 82). The function **"Delete selection"** deletes the selected part whereas **"Choose selection"** retains it.

Additionally, a **"Record"** button as well as buttons for playing audio comments are located on the icon bar. The recording is limited up to a duration of one minute. If there is already an audio comment, users may decide on replacing the existing audio comment with the currently recorded one, or placing it before, respectively after their recording.

The volume is adjustable through the slide control on the right of the window. The currently set volume in this dialogue has an effect on the volume of the Windows setting.

The output fields of the status bar contain the following (from the left to the right):

- Current status
- Total time
- Selected time (selected part of the tone curve, see fig. 82)
- Current volume

10.7.2 Dialogue "VIS"

If the currently loaded thermal image file contains a VIS image, the function **"VIS image"** is available in the menu bar. On activating this function, the VIS image is zoomed in. In order to edit the VIS image, you must click with the right mouse button on the VIS symbol.

The icon bar is available in the dialogue by clicking on **"VIS"** in the **"View"** menu, or selecting menu item **"Edit"** on the thermographic form in the submenu of the VIS image.
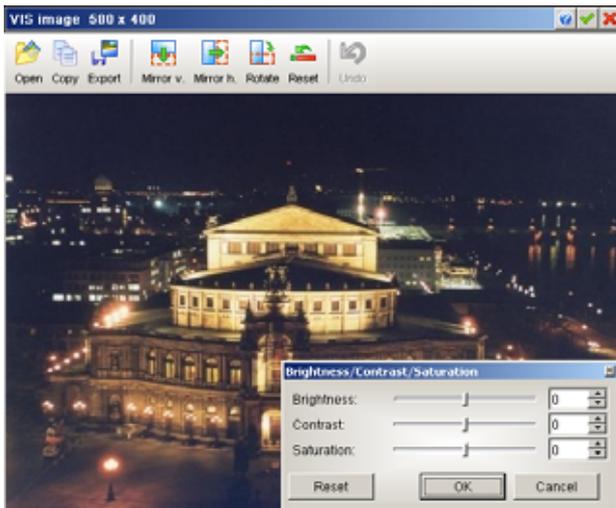
Fig. 86   Editing VIS image

Confirmation by clicking the button (✔) will add the modified VIS image (Fig. 86) into the thermographic form. Only after saving data, it will be added to the thermographic file.

Via the **"Open"** button, other VIS images can be loaded or added to the thermogram. Furthermore, it is possible to copy, export, mirror and rotate VIS images. A click on the button **"Undo"** cancels the last taken action.

When the mouse pointer is on the VIS image, a submenu can be opened by clicking on the right mouse button. Now, users may call up the following functions:

- **Balance**   A white and grey colour balance will be carried out for the selected parts on the whole image.
- **Effects**   Images can be enhanced through different filters.
- **Brightness-Contrast-Saturation**   Change level of brightness, contrast and saturation.
- **Colour balance**   Change colour hue of the VIS image
- **Cancel**   Delete last taken action

10.7.3 Dialogue "Gallery"

If several thermal images have been added to the favourite file list, they can be displayed as thumbnails in the **"Gallery"**. There, various adaptation tools are shown via the preview images of the files.
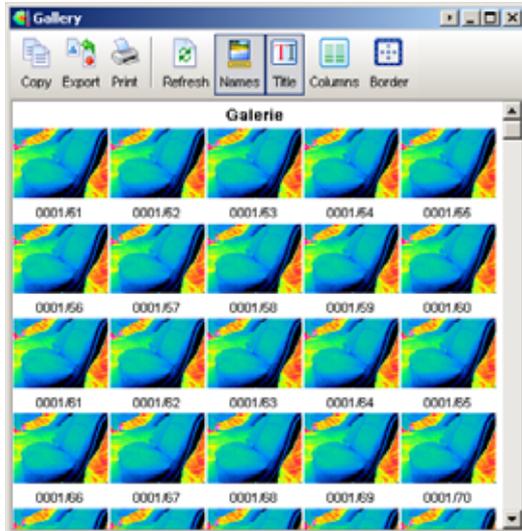

Fig. 87 Gallery mode

By a click on the left mouse button, thermograms displayed in the gallery mode can be added to the work area of IRBIS® 3 for further editing. The current **temperature scale** settings, such as **"Palette"** or **"Level/Range"**, are applied to the thermograms' display. The display in gallery mode can be copied into the clipboard, exported or printed out. Via the **"Refresh"** button, the current content of the gallery will be displayed. Users may enter a title for the whole gallery with the help of the **"Title"** button. If the function **"Name"** is activated, the file name of each thermogram will be displayed below. The number of columns can be determined through the **"Columns"** button, and the space between thermograms through the button **"Border"**.

> A maximum of 200 images can be displayed in the gallery mode.

You can **copy, export** or **print** the gallery. If the function **"Names"** is activated, the file names of the images are displayed. With the help of the function **"Title"**, a title for the gallery can be entered. The function **"Columns"** determines the number of columns in which the images are sorted.

10.7.4 Browser

The function **"Browser"*** allows geographical coordinates to be displayed in Google™ Maps if GPS data are available for the thermal image. An internet connection is needed for this procedure.

11 Menu "Measure"

The menu **"Measure"** contains all functions with the help of which different measurements are performed in the thermal image and corrections required for calculating the temperatures are made.
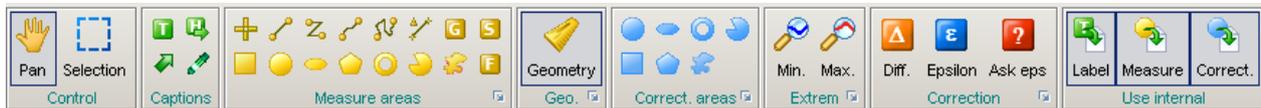

Fig. 88   Menu "Measure" of IRBIS® 3

11.1 Menu Item "Control"

If the function **"Pan"** is activated, one or more ROI and captions displayed in the thermal image can be moved. If this function is deactivated, the measuring, correction or caption definitions cannot be moved.

Measuring definitions are generally referred to as ROI (**R**egion **o**f **I**nterest).

After activating the button **"Selection"**, the mouse pointer's form changes as soon as the cursor is over the thermal image: ![cursor]. By pressing and holding the left mouse button, the upper left corner of a quadrilateral is selected. The quadrilateral can be enlarged by moving the mouse while the mouse button is held. The lower right corner is selected by releasing the mouse button. On activating the function **"Selection"**, the scaling and the display scale of the false-colour view are set on **"Selection"** or **F8.** Consequently, the upper limit of the displayed area corresponds to the maximum, and the lower limit to the minimum of all temperatures within the area defined by the selection. This function allows fast adaptation of the temperature scaling to an area of interest without the limits of the area to be displayed having to be adapted by entering numbers or using certain tools.

11.2 Menu Item "Caption"

In order to bring out details in the thermal image more clearly, additional information can be added to the thermal image in the form of **"Captions"**.
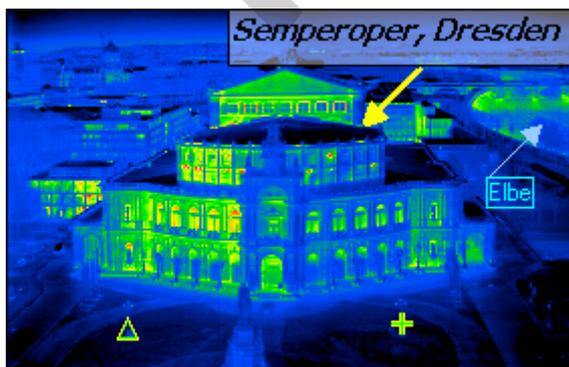

Fig. 89   Thermogram with captions

Fig. 90   VIS image with captions

Captions can be added by selecting the respective symbol (see below) placing it to the thermogram or VIS image. The following **"Captions"** can be added into thermograms:

[T]	Text box	[H]	Hint*
[↗]	Arrow	[✎]	Label*

Only captions displayed in the menu **"View",** menu item **"Elements"** can be added into VIS images, see chapter 10.2 Menu Item "Elements" – page 42.

After a caption has been placed to the thermal image, it can be adapted individually. By a click on the right mouse button, and selecting the option **"Properties"**, a dialogue window with the following options is opened:

- **General**   A name can be given to the textbox or a text can be entered.
- **Coordinates**   The position of the captions (designation) can be chosen and captions for hints and arrows can be entered. Coordinates can be selected for the text box and the label.
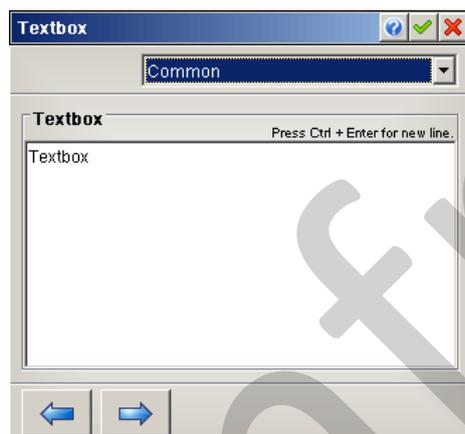- **View**   Settings for caption, font, line and label.

Fig. 91   Dialogue setting "Textbox", tab "Common"

11.3   Menu Item "Measure Areas"

For the measurement of temperatures, measuring spots and **ROI** (points, lines and areas) can be defined in the thermal image. After activating the respective button, the mouse pointer will look like the selected measuring area when held over the thermal image.

According to the kind of measuring area you have chosen, the measuring spots and ROI are placed as follows:

|	**Point**	Press the left mouse button when the cursor is in the position where you wish to place the point. You can place further points without having to activate this function once again.
	Line	Press the left mouse button to start drawing a line, release the button to end.
	Bezier line*	Press the left mouse button to start and release the button to end. Place two additional control points outside the straight line.
	Polyline	Line with several control points. Press the left mouse button to start and release it at the second control point. You can then place further control points by clicking the mouse button until the line is complete. To finish, place the connections between the points by a right mouse click.
	Freehand line*	Press the left mouse button to start and release it after you have drawn the line moving the mouse freehand.
	Dou point*	Press the left mouse button to define the reference point and click again at the measuring point. The difference between both points will be displayed.
	Rectangle	Press the left mouse button to define the corner of a rectangle and release it at the diagonally opposed corner.
	Circle	Press the left mouse button to define the centre of a circle and release it at radius distance.
	Ellipse	Press the left mouse button to define the centroid of an ellipse.
	Polygon	Press the left mouse button to define one of the corners, then define all the other corners by left clicks. Place the sides by pressing the right mouse button.
	Ring*	Press the left mouse button to define the centre of the circle or ellipse, and release it at radius distance of the inner circle/ellipse. Then, create the outer circle/ellipse and place it by a left mouse click.
	Segment*	See circle. Additionally, draw a line within the circle and place it with the mouse. Another left click completes the segment.
	Freehand area*	See freehand line. Initial and end point are automatically connected with each other, thus defining the enclosed area.
	Whole IR-image*	On activating this symbol, the entire thermal image serves as measuring definition.
	Special*	Display of system parameters and other process parameters, depending on the hardware.
	Freeform*	There are three different varieties of freeform, see chapter 11.3.2 Dialogue "Define free RLE"* − page 64.
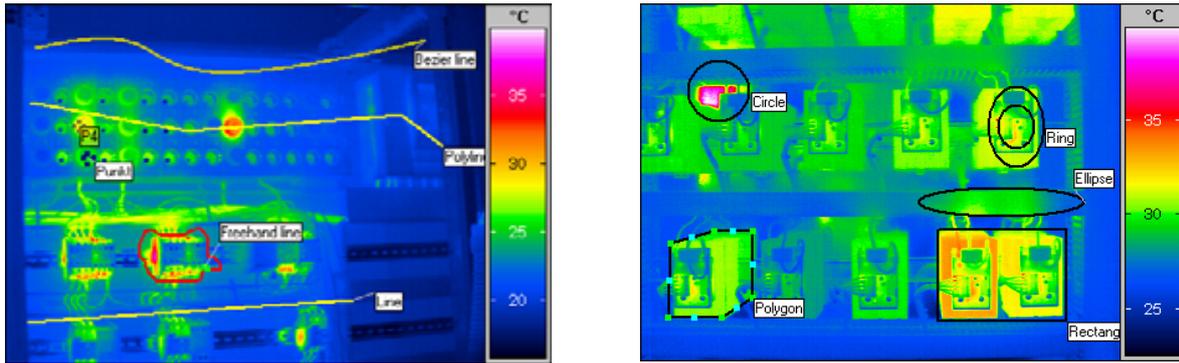
Fig. 92   Thermal images with measuring areas

> Please note that the forms as well as the number of available ROI depend on the software version.

The function **"Measure area settings"** opens the **Dialogue "Measure definitions"** where the measure table and other features of the software can be adapted, see chapter 11.3.4 Measuring Area Settings – page 66.

The appearance of each measuring area can be changed via the properties dialogue individually, see chapter 11.3.1 Dialogue "Additional measuring"* – page 63.

11.3.1 Dialogue "Additional measuring"*

Values of hardware dependent system and process parameters are displayed in the **measure table** of the dialogue **"Additional Measuring"**. Furthermore, apart from camera parameters, analogue and digital input values are visible to users. All values are updated on live images. During the offline mode, camera parameters are taken from the currently loaded thermogram.

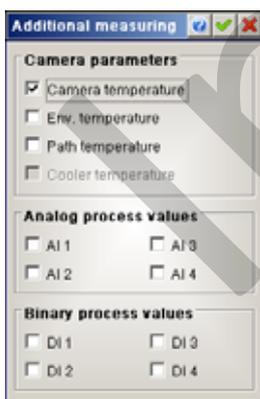
Fig. 93   Dialogue "Additional Measuring"

> The output of temperature measurement dependent analogue voltage values and digital alarms can only be carried out through the usage of an additional analogue card, respectively digital I/O-cards.

11.3.2 Dialogue "Define free RLE"*

The dialogue **"Define free RLE"** is used to realise further forms of measuring definitions. By selecting **"Isotherm"**, a measurement area can be defined on the basis of all areas in a thermogram falling within a temperature range set in the dialogue (according to the definition of a common isotherm).
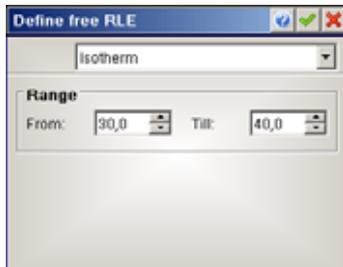

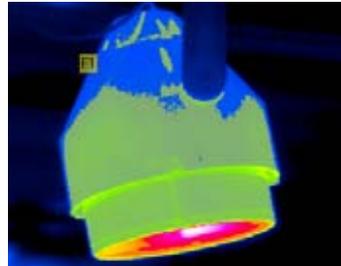*Fig. 94   Dialogue "Define Free RLE", tab "Isotherm"*

Fig. 95   Isotherm measure definition

The operation **"Grid"** defines free forms in "Net-Position-Form" for a specific area in the thermogram. Via the category **"Start position"**, the starting position located in the upper left corner of the thermogram has to be indicated. Definitions of the axial distance (x-axis and y-axis) between the positions of the net can be realised through **"Step X"** and **"Step Y"** in the category **"Grid properties"**. With the help of the options **"Count X"** and **"Count Y"**, the number of positions in the net are determined in XY-direction.

Fig. 96   Dialogue "Define Free RLE", tab "Grid"
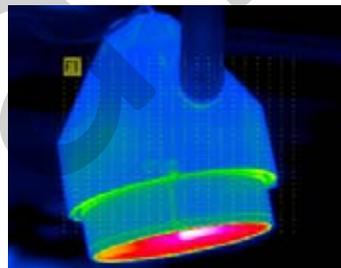

Fig. 97   Grid measure definition (Net-Position-Form)

In order to determine the free form **"Graphic"**, an image file, such as one with a silhouette, can be loaded A colour covering the newly defined measurement surface in the thermogram can be selected under **"Mask color"**.
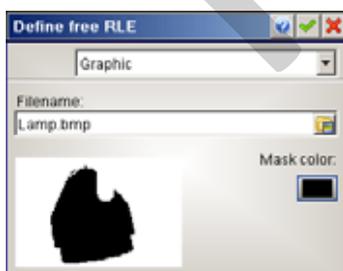

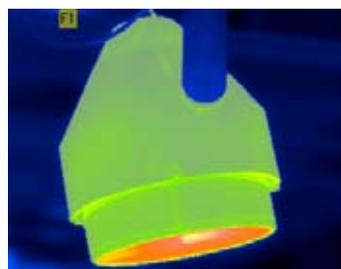*Fig. 98   Dialogue "Define Free RLE", tab "Graphic"*

Fig. 99   Graphic measure definition

How to create a silhouette image file?

- **1. Step**

  Create a free form **"Isotherm"** with the desired temperature range.

- **2. Step**

  With the help of the **temperature scale/temperature regulation** and the changing of **level/span**, thermograms can get slightly understeered or oversteered. Following, the entire thermogram is covered by a different colour compared to the one of the defined measurement surface (in the first step).

- **3. Step**

  Properties of the defined measurement surface can be displayed by clicking on the defined measurement surface with the right mouse button. See chapter 11.3.3 Measure areas, Corrections areas, Captions – page 63. In the properties dialogue under tab **"View"**, users may for instance change the colour of the measurement surface to black, and transparency to "0" (non-transparent).

- **4. Step**

  To obtain an image which equals the thermogram in size, it is necessary to set the enlargement option in the menu **"View"** on 100%. The function **"With border"** can be deactivated in the dialogue **"Options"**, tab **"Additional",** suboption **"Export image"**. Following, the temperature scale under the menu **"View"** will fade out. Via the **"Copy"** button and the setting **"Thermogram"**, users may copy thermograms first into the clipboard, and later into Microsoft paint saving it as bitmap (*.bmp). However, it is also possible to save the thermogram into the **"File"** menu via the function **"Export"**.

11.3.3 Measure areas, Corrections areas, Captions

With the properties dialogues, users may adjust the appearance of the measure areas, correction areas and captions. To open the dialogue, you have to click the right mouse button of a definition in the **Thermal image** and select the submenu option **"Properties"**.

Changing between the areas and definitions of the **thermogram** has a direct effect on the dialogue. Additionally, users may call up previous or next areas and definitions in the thermogram via the buttons on the bottom left.
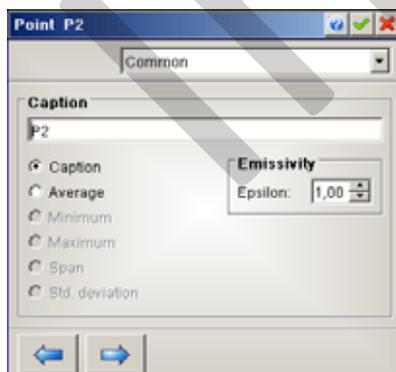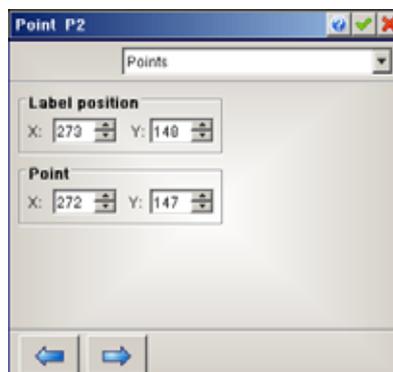

Fig. 100   Tab "Common"   *Fig. 101   Tab "Points"*   *Fig. 102   Tab "Style"*

Tab "Common"

With the help of the **"Common"** tab, it is possible to change the captions of the definitions: e.g. select the current average value or other temperature information at the caption. After changing the label of a measuring point, it will be adapted into the measurement table if the option **"ID Long name"** in the ID-column is activated. See chapter 10.2.1.2 Measurement and Correction Table) – page 44. The name for the label is limited up to 60 characters.

For a measure point, the Epsilon value can be changed directly. For correction areas, Epsilon is changed in the **Dialogue "Correction"**, see chapter 11.5.1 "Correction Area" Settings − page 71.

Tab "Points"

It is possible to change the position of the respective definition and the appropriate caption.

Tab "Style"

Via the tab **"Style"**, the complete appearance of the respective definitions can be changed. The appearance of an added definition refers to the properties in the **Dialogue "Options"**, tabs **"Measure area design"**, **"Correction area design"** and **"Label area design",** see chapter 8.5.1 Dialogue "Options" – page 31.

11.3.4 Measuring Area Settings

This dialogue navigates all measure definitions which are shown in the thermal image. To change, add or delete an measure definition in the opened dialogue has direct consequences. With the help of the functions **"Load"** and **"Save",** the measure definitions can be loaded or saved as *.mdf-file.

Tab "Definitions"

All ROI, charted in the thermal image, are listed in a table. The parameters (**Designation, Position** and **Properties**) can be modified by the input boxes. The coordinates in the column **Position** refer to the designation (example: R2) attributed to each ROI.
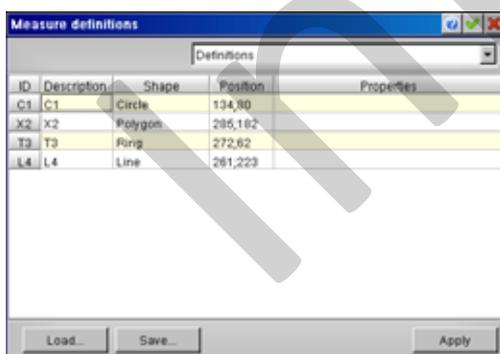
Fig. 103   Dialogue "Measure definitions" – Tab "Definitions"

Tab "Show in Measure Table"
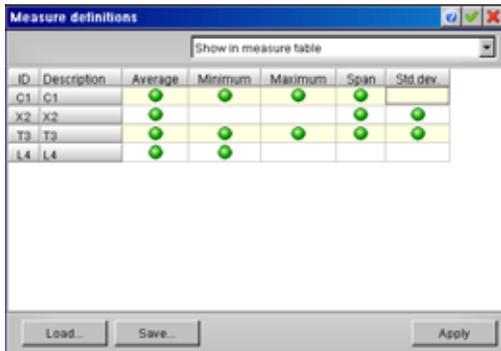
Fig. 104   Dialogue "Measure definitions" – Tab "Show in Measure Table"

In this table, data to be displayed in the measure table can be determined. A click on the left mouse button activates or deactivates the green button. If the green button is activated, data is displayed in the measure table. For points, only the **"average value"** can be selected.

Tab "Time chart"
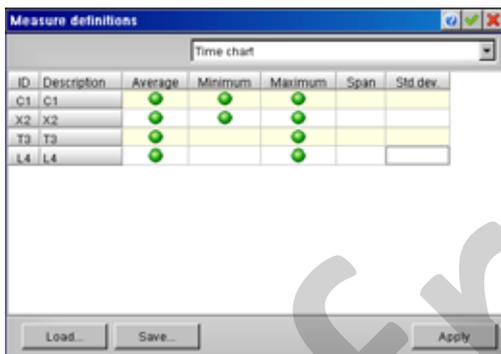
Fig. 105   Dialogue "Measure definitions" – Tab " Time chart "

Via this tab, users may determine which ROI values are to be displayed in the time chart. The green button can be activated or deactivated by clicking the left mouse button (green = data is displayed). A time chart can only be displayed when a sequence of images is measured.

Tab "Histogram"

Fig. 106   Dialogue "Measure definitions" – Tab "Histogram"

Via this tab, users may determine which ROI values a histogram is to be calculated for. The selection can be made with the help of a graphic editor in which the non-selected measuring areas are shown on the left and the selected areas on the right hand side. Those measuring areas which are to be involved in calculating the histogram can be selected with the mouse and moved to the right through the **arrow pointing to the right**.
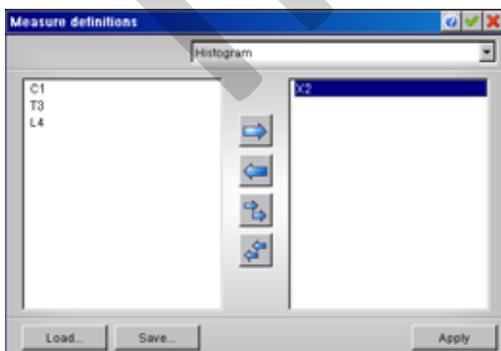
If no ROI is displayed or selected in the thermal image, the histogram is calculated on the basis of the entire thermal image.

Tab "Profiles"
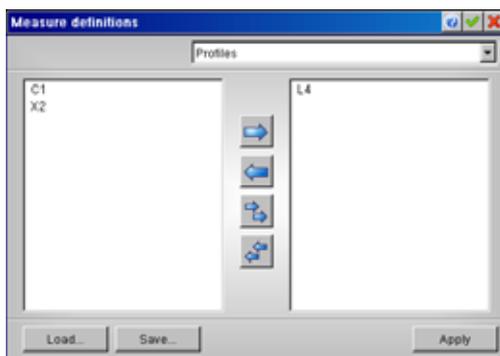
Fig. 107   Dialogue "Measure definitions" – Tab "Profiles"

Determines for which of the ROI data is to be displayed in the profile chart. The selection can be made with the help of a graphic editor in which the non-selected measuring areas are shown on the left, and the selected areas on the right hand side. Those measuring areas which are to be added to the profile chart can be selected with the mouse and moved to the right through the **arrow pointing to the right**. It is possible to display profiles along lines as well as profiles of the outlines of areas.

Tab "Captions / Min/Max"
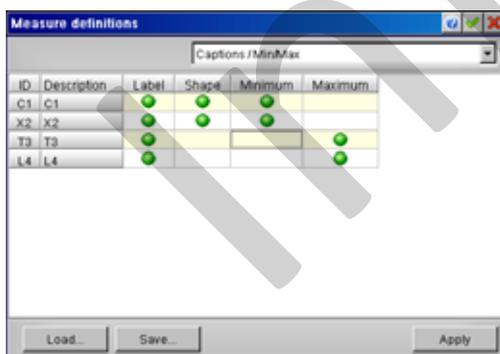
Fig. 108   Dialogue "Measure definitions" – Tab "Captions / Min/Max"

For each ROI (except of points) in the thermal image, local **minimum** and/or **maximum values** can be shown or hidden. The designations (**captions**) of the ROI can also be shown or hidden individually. If the green button is activated in the selection menu, the respective information is displayed.

Tab "Geometry"*

Fig. 109   Dialogue "Measure definitions" – Tab "Geometry"

Via this tab, users may configure parameters for each geometric measurement in the thermal image. The **geometry** settings contain functions for defining the image geometry as a basis for a simple calculation of the length of lines in the thermal image. If the distance between two points in the image is measured, it is assumed that these points are in a plane parallel to the imaging plane of the camera.

> The distances calculated in "Geometry" are only used for profiles displayed in maximised view.
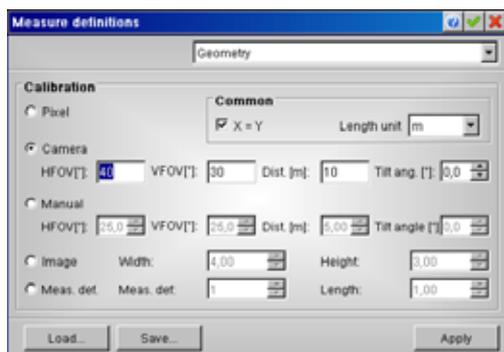
In the category **"Calibration"**, the following options for calculating length specification are available:

- **General**   The distance can be given in pixels or meters (m, cm, mm ...). For calculating the lengths, users may select the following variants in **"Calibration"**:
- **Pixels**   The distances are calculated on the basis of the number of pixels.
- **Camera**   The line segments are calculated on the basis of the camera data saved in the thermal image (depending on the used objective lens): **HFOV** (**H**orizontal **F**ield **o**f **V**iew), **VFOV** (**V**ertical **F**ield **o**f **V**iew) and the **distance [m]** to the measuring object. If the view of the measuring object is not vertical, the **angle of view [°]** can also be involved in the geometric measurement.
- **Manual**   The line segments are calculated as in **"Camera"**. However, the values **HFOV, VFOV** and **distance** can be set independently for available camera data.
- **Image**   The line segments are calculated on the basis of the (image) **width [m]** and (image) **height [m].**
- **Line**   In this case, a line (measuring definition) must be placed in the thermal image. The length of this line serves as reference for performing the geometric measurement

11.4   Menu Item "Geometry"*

The function "Geometry" allows the geometric measurement of line segments in the thermal image. If the menu item **"Geometry"** is activated, the length of each measuring area is displayed in the column **"L"** of the **measure table**.

11.4.1 Settings "Geometry"*

This Menu item opens the tab "Geometry" of the measure definitions, see Tab "Geometry" – page 69.

11.5   Menu Item "Correction Areas"

For thermographic temperature measurements, the current material properties of the measuring object (emission/reflection and, if necessary, transmission) and the temperature distribution in the direction of reflection or behind the measuring object has to be taken into consideration. Transmission losses in the optical channel between the thermographic system and the measuring object, e.g. when measuring through windows permeable for infrared radiation, must be considered as well.

A correction can be made either globally, i.e. for the entire thermal image, or for areas with equal properties and equal ambient temperatures. Independently of the measuring areas, different correction areas can be defined in the thermal image for this purpose: after pressing the respective button, the cursor takes the form of the selected correction area when the mouse pointer is held over the thermal image. Depending on the selected type, at this point, the correction area can be defined. As soon as a correction area has been defined in the thermal image, correction parameters are displayed at the bottom part of the measure table.

For the correction areas, various correction schemes can be selected. The temperatures of all points within the correction areas are then calculated on the basis of the parameters set for the selected correction scheme. In the menu **"Correction area settings"**, correction schemes can be selected and parameters can be configured.

Users may select the following correction areas which can be placed as follows:

	Circle	Press the left mouse button to define the centre of a circle and release at radius distance.
	Ellipse	Press the left mouse button to define the centre of a quadrilateral which encloses the ellipse.
	Ring*	Press the left mouse button to define the centre of a circle or ellipse and release at radius distance of the inner circle/ellipse. Then, create the outer circle/ellipsis and place it by a left mouse click.
	Segment*	See "circle". Additionally, draw a line within the circle and place it with the mouse. Another left click completes the segment.
	Rectangle	Press the left mouse button to define the corner of a rectangle and release it at the diagonally opposed corner.

	Polygon	Press the left mouse button to define one of the corners, then define all the other corners by left clicks. Place the sides by pressing the right mouse button.
	Freehand*	Press the left mouse button to start and release it when you have enclosed the area you want to select. Initial and end point are automatically connected with each other, thus defining the enclosed area.

Each correction area can be individually changed via the properties dialogue, see chapter 11.3.1 Dialogue "Additional measuring"* – page 63.

11.5.1 "Correction Area" Settings

The function **"Correction area settings"** opens the dialogue window **"Correction"** for the selection of **"Areas"**. Via these settings, correction schemes for specified areas can be selected and the corresponding correction parameters can be determined.

Tab "Global"

The function **"Global"** contains all functions required for applying correction algorithms related to radiation physics (emission, reflection, transmission) to the entire thermal image (Global) or to correction definitions (Sections). Thereby, the temperature-relevant parameters, which were saved during the acquisition of the thermal image and contained in the original data set of the IRB file, are displayed and can be modified.
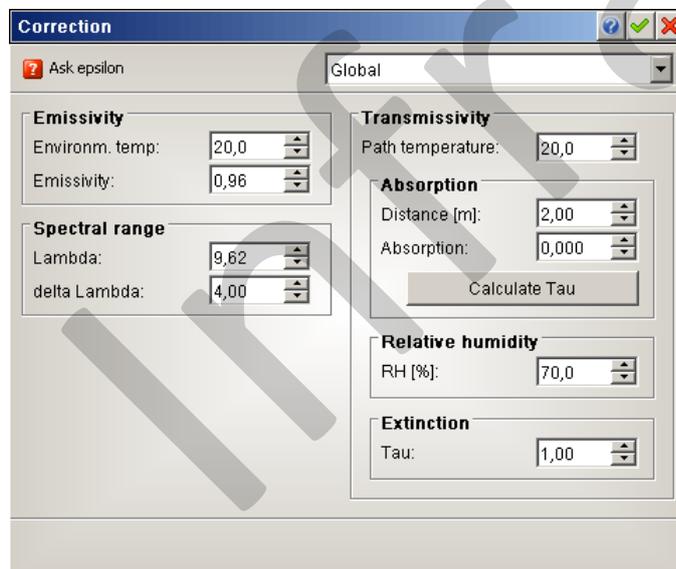
Fig. 110   Dialogue "Correction" – Tab "Global"

Global correction values can only be saved in *.irb-files. To retain the original file, the existing thermogram (*.irb) should be named differently via the function **"Save as"** in the menu **"File".**

Under **"Emissivity"**, the ambient temperature **("Environm. temp.")** and the **"Emissivity"** can be entered for the entire image. The **"Emissivity"** must be valid for the entire thermal image (equal material

surface in the entire thermal image). The (constant) ambient temperature (temperature level of the scene in direction of reflection) can deviate considerably from the (air) temperature around the camera.

Via the list box **"Global"**, the temperature-relevant parameters, which were saved during the acquisition of the thermal image and which are contained in the original data set of the IRB file, are displayed and can be modified. **"Lambda"** is the spectral centroid, which is needed for calculations related to radiation physics. **"Delta Lambda"** describes the width of the spectral range of the used thermographic system. **"Lambda"** and **"Delta Lambda"** should not be changed.

Under **"Transmission"**, the **"Path temperature"** as well as the **"Absorption"** and the **"Distance"** can be taken into consideration by **"Transmission Tau"**, and entered. Transmission losses in the optical transmission channel can be described via the **"Relative humidity"** and the **"Extinction coefficient"**.

Tab "Areas"

In the drop-down menu **"Areas"**, parameters for previously defined correction areas can be set individually. These areas are temporarily listed in a table in the top part of the dialogue window. At the bottom part, parameters can be selected for each correction area. The values preset for parameters are determined by the global correction parameters.

Fig. 111   Dialogue "Correction" – Tab "Areas"

In the drop-down menu **"Areas"**, parameters for previously defined correction areas can be set individually. Depending on the software version, a different number of correction areas can be defined independently of each other. These areas are temporarily listed in a table at the top part of the dialogue window. At the bottom part, parameters can be selected for each correction area. The values preset for the parameters are determined by the global correction parameters.
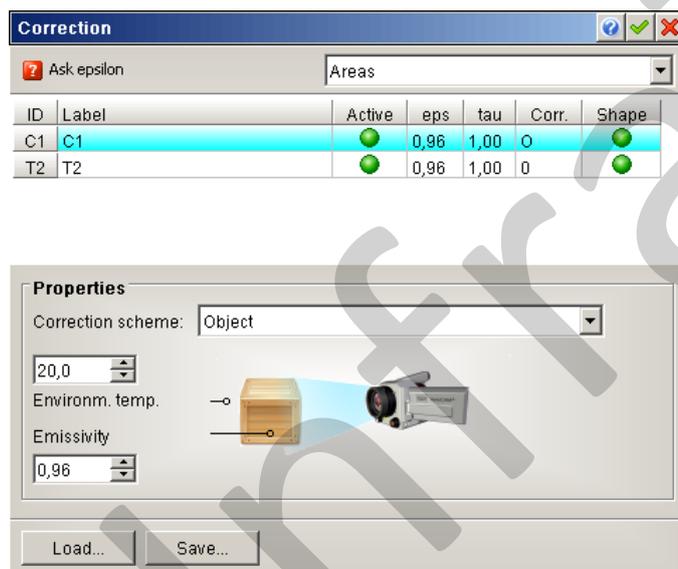
For the correction, users may select the following correction schemes, which are displayed as graphic schemes by selecting them (list box **"Correction scheme"**):

- Object
- Object with transmission distance
- Object with window
- Transparent object with transmission distance
- Transparent object with window
- Relative humidity
- Offset enhancement
- Pixel correction (directly)
- Pixel correction (indirectly)
- Pixel correction (directly 2 ref. images)
- Pixel correction (indirectly 2 ref. images)
- eps = f(T)

The number of available correction schemes depends on your IRBIS® 3 version.

11.5.2 Correction Scheme – Object

For the correction scheme "object", the temperature in an image section is calculated assuming that all pixels of the area have the same emissivity eps and that the ambient temperature T is identical for all pixels.

The following measuring situations are possible:

- **eps = 1**   Result of the measurement depends on the ambient temperature
                        (ideal black body, no reflection)
- **eps < 1**   **a)** Temperature of the measuring object (To) < ambient temperature (Te)
                        → correction reduces the displayed value
                        b) Temperature of the measuring object (To) > ambient temperature (Te)
                        → correction increases the displayed value

Example:

In order to measure the temperature of a window correctly, eps = 0,75 is entered for the emissivity of correction area R01. For the ambient temperature, the temperature T = -68 °C measured for the clear night sky in the direction of reflection must be entered. As a result, the point temperatures P1 (not corrected) = -11.8 °C and P2 (corrected) = 0.6 °C vary tremendously from each other!
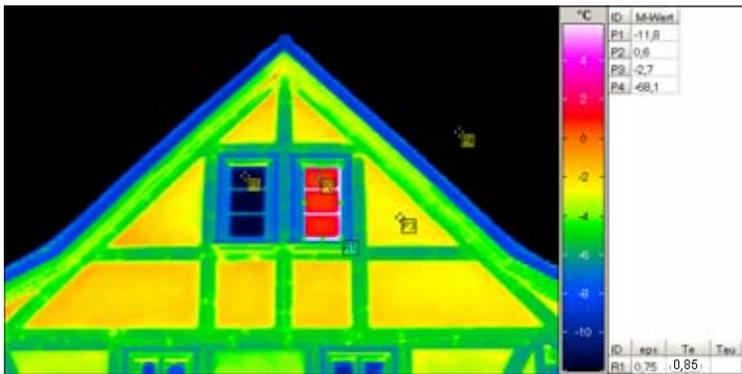
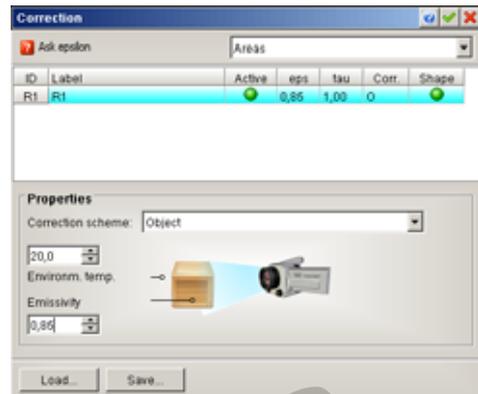*Fig. 112   Thermogram with correction area and measuring points*

Fig. 113   Parameters for the correction scheme "object" (correction area)

11.5.3 Correction Scheme – Object with Transmission Distance*

Beside emissivity and ambient temperature, the correction scheme **"Object with transmission distance"** takes the absorption of infrared radiation between the thermographic system and the measuring object into consideration. The parameters **extinction coefficient** and **path temperature** are authoritative here.

11.5.4 Correction Scheme – Object with Window*

The correction scheme **"Object with window"** is used for windows which are permeable to infrared radiation and whose transmission losses must therefore be taken into account. Since the transmission of the window is reduced due to reflection, the **tau** parameters and the **temperature in front of the window** must be taken into consideration. If the emissivity has to be considered as well, this scheme is equal to the correction scheme **"object"**.

11.5.5 Correction Scheme – Transparent Object with Transmission Distance*

For the correction scheme **"Transparent object with Transmission Distance"**, surface temperatures are calculated involving the partial permeability of the measuring object for infrared radiation and the temperature behind the measuring object. Thus, the emissivity is not reduced due to reflection but because of the permeability of the material. This means that the thermographic system does not "look" via a reflection into the environment, as is the case with reflection on a surface, but it "looks" through the measuring object into the background. Additionally, the absorption of infrared radiation between the thermographic system and the measuring object can be taken into consideration.

11.5.6 Correction Scheme – Transparent Object with Window*

For the correction scheme **"Transparent object with window"**, surface temperatures are calculated involving the partial permeability of the measuring object for infrared radiation and the temperature behind the measuring object. Additionally, the transmission of the window (tau) and the temperature in front of the window are taken into account.

11.5.7 Correction Scheme – Relative Humidity*

Beside emissivity and ambient temperature, the correction scheme **"Relative humidity"** takes the atmospheric attenuation of the infrared radiation in form of the parameters "Relative humidity" and "Distance" into consideration (analogue to the correction scheme "Object").

11.5.8 Correction Scheme – Offset Enhancement*

The correction scheme **"Offset enhancement"** allows calculating temperatures by means of a linear correction curve according to T´ = (T - A) x B + C. The calculation algorithm corresponds to the global correction scheme "Offset mode" (see Chapter 11.7 Menu Item "Correction" – page 78).

11.5.9 Correction Scheme – Pixel Correction Directly*

The correction scheme **"Pixel correction directly"** can be used if, due to a very inhomogeneous distribution of emissivity, it is impossible or too time-consuming to define sections for areas of equal emissivity as correction areas in the thermal image. The correction scheme requires a reference acquisition in which the entire measuring object (or at least the section to be tested) is **uniformly** heated to a temperature which must be different from the ambient temperature (object temperature during the reference acquisition ≠ ambient temperature). For this purpose, the measuring object, e.g. a conductor board, consisting of various materials with different levels of emissivity is heated in a room with a consistent temperature (heating cabinet). During the reference acquisition, the ambient temperature must be identical for all pixels of the area of interest with the same temperature, i.e. all pixels "reflect", depending on the individual degree of reflection/emissivity, to a homogeneous ambient scene (outside the heating cabinet). Consequently, the different pixel "temperatures", which the thermographic system displays in this moment, is actually a reflection of the different emissivity of the surface elements. On the basis of the reference acquisition, the emissivity is calculated for each pixel.

Reference images for the correction models "Pixel Correction" must be recorded with the global emissivity setting ε = 1.

With the help of the calculated emissivity, it is possible to measure the real temperature distribution during the current measurement (e.g. a conductor board in operation), provided that the position of the measuring object relative to the thermographic system is not changed after the reference acquisition. Even minor changes of the position will cause grave measuring errors which will be displayed as "shadow images" in the corrected thermal image.

The calculated emissivity distribution can be displayed as false color display by changing the display unit (right above the color palette) from **°C** to **emission ratio***, see chapter 7.8 Temperature Scale – page 23.

When correcting emissivity pixel-wise, the position of the thermographic system and the measuring object must not be changed during the entire measuring process!
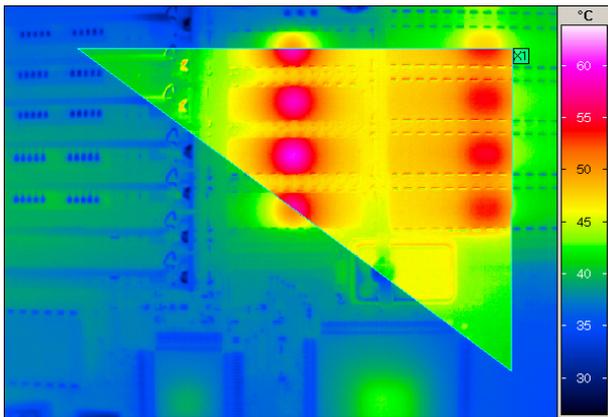
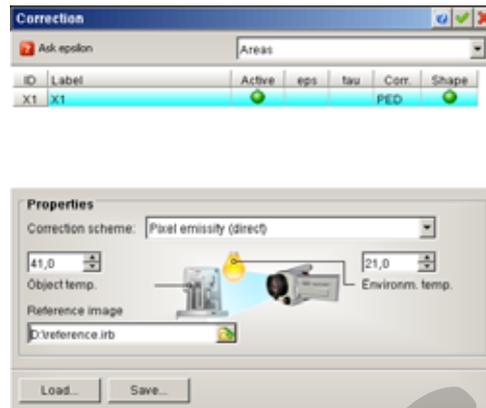*Fig. 114   Example for pixel correction (directly)*   *Fig. 115   Pixel correction (directly)*

11.5.10   Correction Scheme – Pixel Correction Indirectly*

The correction scheme **"Pixel correction indirectly"** can be used if it is impossible to heat the measuring object itself to a reference temperature which is above the ambient temperature. In this case, the ambiance reflected to the measuring object can be heated by using large-scale radiators. Nevertheless, it is required that all pixels in the area of interest have the same temperature. After the reference acquisition for finding out if emissivity for each pixel has been made as described, the position of the thermographic system relative to the measuring object must not be changed.

11.5.11   Correction Scheme – Pixel Correction Directly 2 Reference Images*

Conditions for calculating emissivity with *two* reference images
To calculate the emissivity using **two** reference images, it is only necessary to meet **one** the following two requirements:

■ The object is homogeneously heated, the temperature is known **or**
■ The environment is homogenously heated to a know temperature, which is differs from the object temperature

The correction scheme **"Pixel correction directly 2 reference images"** can be used in case the temperature of the ambient scene is not the same for all pixels, e.g. when something is reflected into the objective lens of the thermographic system (narcissism) during the utilisation of microscope optics for the thermographic measurement on reflecting surfaces. An uneven temperature distribution can be compensated by an additional reference acquisition.

Now, two reference images are necessary to calculate the emissivity for every pixel. On both images, the object has to be heated or cooled down to a temperature which differs from the environment. The object temperatures on both images cannot be the same. The measurement setups of the reference- and object measurements have to be completely identical, which means that the position of the camera (including the focus setting) and of the object must not be altered.

Reference images for the correction models "Pixel Correction" must be recorded with the global emissivity setting ε = 1.

Previously saved reference images have to be loaded and object temperatures have to be put in before the actual temperature measurement begins.
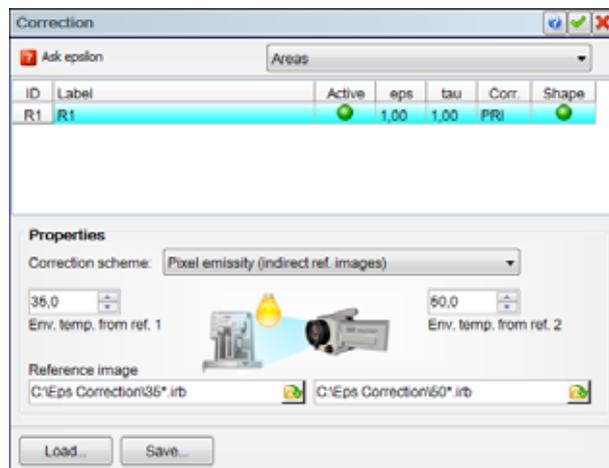

Fig. 116   Pixel correction (directly) using 2 reference images

During the measurement, the calculation of the temperature is done using the eps-values of every pixel and the environmental temperature, which has been **calculated separately for every single pixel**. The global environmental temperature does not affect the results for the subarea.

11.5.12   Pixel Correction Indirectly 2 Reference Images*

The correction scheme **"Pixel correction indirectly 2 reference images"** can be used if the temperature of the measuring object is not the same for all pixels, e.g. when "homogenising" the temperature of the measuring object is impossible during a medical application. An uneven temperature distribution can be compensated by an additional reference acquisition.

11.5.13   Correction Scheme – eps (T)*

When temperatures are measured within a great dynamic range, the fact that the material identification value "emissivity" is dependent on the material temperature can affect the result of the measurement. With the help of the correction scheme **"eps (T)"**, temperature dependence of emissivity can be taken into consideration. IRBIS® 3 already contains data for a number of materials, which can be loaded in the dialogue field of the correction schemes eps (T). Thanks to the simple data structure of the *.edf file, users may enter own correction data for specific materials.

11.6   Menu Item "Extreme Values"

If the functions **"Min"** or **"Max"** are activated, the values for the minimum and maximum temperatures of the entire thermal image are displayed automatically. If measuring areas have already been defined, the values for these measuring lines and areas are displayed.

For each measuring area in the thermal image, the caption and the minimum and/or maximum values can be shown or hidden, see chapter 11.3.4 Measuring Area Settings – page 66.

11.7   Menu Item "Correction"

With the help of the function **"Difference image"** *, the temperature values of two thermal images can be subtracted for each pixel position. If the emissivity is to be taken into account, this must be done via a global/regional correction **before** activating the function "Difference image". Difference images cannot be corrected any more.

The function **"Epsilon"** activates or deactivates the calculation of corrections and the display of the results for correction areas that have been previously defined in the thermal image.

11.7.1 Dialogue "Ask for Epsilon"

Through the function **"Ask eps"**, emissivity can be found out for each pixel of the thermal image if the object and ambient temperatures are known.
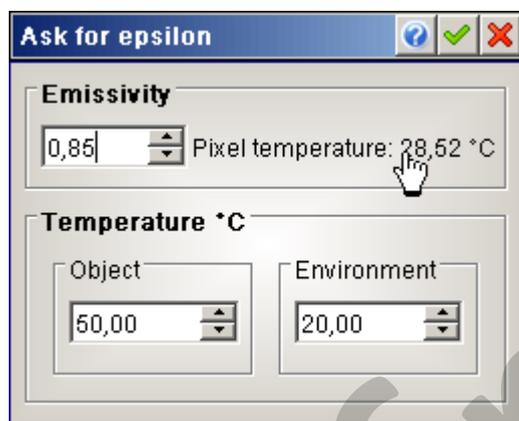

Fig. 117   Dialogue "Ask for epsilon" – cancel fixation

Activating the menu item **"Ask eps"**, automatically opens the dialogue **"Determine epsilon"**. In order to determine the emissivity, first, the present **"Object and ambient temperatures"** must be entered. If the mouse is then moved over the thermal image, the values for **"Epsilon"** and the **"Pixel temperature"** will be shown for each pixel of the image.

> By clicking on a position in the thermogram, the temperature of the respective pixel will be fixed and displayed next to **"Pixel temperature"**. This process can be repeated by clicking on **"Pixel temperature"**.

11.8   Menu Item "From File"*

If measuring or correction definitions have already been saved during the acquisition of the thermal image, this data can be applied to the current thermal image by pressing the buttons **"Measuring definitions"** and **"Correction definitions"**.

12 Menu "Camera"*

By using the menu **"Camera"**, a connection to the camera can be activated (depending on the hardware and the software version) so that the camera can be controlled, sequences and single images can be taken and the live image can be activated.

Fig. 118   Menu „Camera" of IRBIS® 3

12.1 Menu Item "Camera"*

The software is connected to a thermographic camera connected to the computer through the function **"Connect"**. The camera (or Simulator) must be selected in the dialogue **"Camera"**. If the **"Simulator"** has been selected, already saved data can be selected and displayed (as an infinite loop) instead of the connected camera's data.

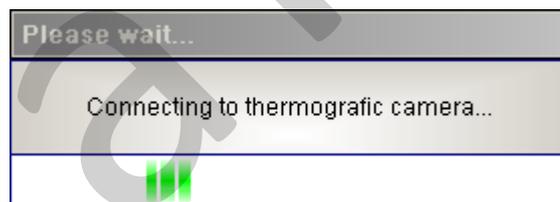
Fig. 119   Dialogue "Select camera"   *Fig. 120   Dialogue after a camera or sequence was selected for the simulator*

If the connection to the selected camera type is not possible, an error message occurs, see Fig. 121. A failed connection can be caused by:
1. missing connection to the device driver
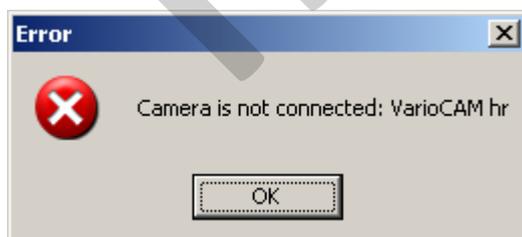2. no physical connection between camera system and controlling computer

Fig. 121   Error dialogue "Camera is not connected"

More advice on the connection of the different camera systems and their device drivers is available in the respective camera manual.

The function **"Remote"** can only be selected after the software has been connected to the camera. With this function, the remote control for the camera can be activated. The availability of the remote control functions depends on the camera, and is described exemplifying the system VarioCAM® high resolution. Immediately after the software has been connected to the camera, the camera image being up-to-date at the time of connection is displayed in the activated thermal image window. The live image of the camera can then be displayed by activating the function **"Live"**. Independently of the display scale of the scale, the view of the live image in the thermal image window can be changed.

12.1.1 Connection to the Simulator*

Instead of displaying camera images, saved thermographic data can be displayed as an infinite loop via the function **"Connect simulator"**. .

The control line for the simulator has the following functions:

- **Open**   Opens a new series of thermal images
- **Add**   Adds another series of thermal images to the current image series
- **Info**   Displays the current file settings
- **Manual**   Calls up single images of the loaded sequence. With the help of the buttons, users may select each single image of the sequence or call a specific one up directly. In this case, the display window will be extended.
- **Frequence**   Adjustment of the frame rate in Hertz (0 = as fast as possible)
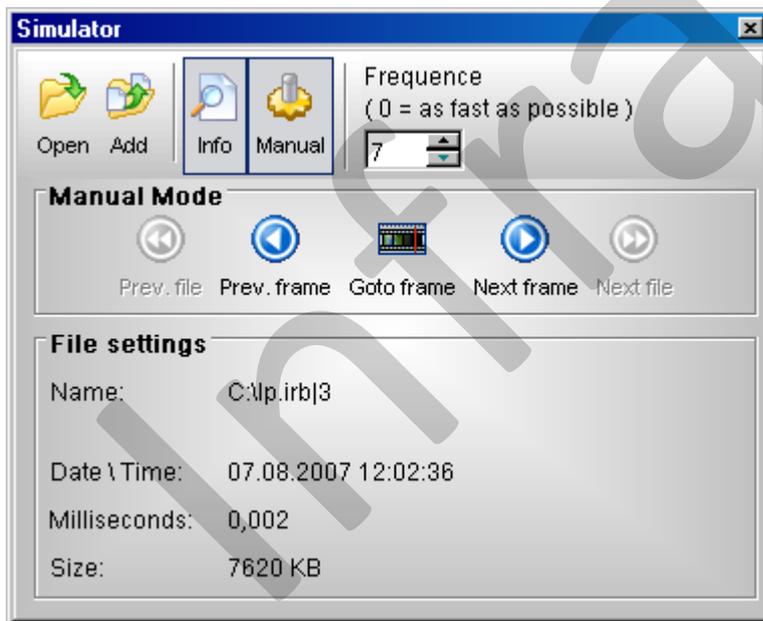

Fig. 122   Remote control for the simulator

12.2   Connection with VarioCAM® high resolution*

With the connection to the VarioCAM® high resolution the current camera image will be displayed in the thermal image window.
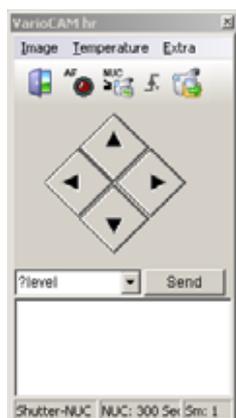
Fig. 123   Control window for VarioCAM® high resolution

In the menu item **"Image"** of the camera remote control, the following functions are available:

- **Smooth/Image filter**   Users may select four camera-internal filter options: **"Off"**, **"Weak"**, **"Medium"** and **"Strong"**. A filter will reduce image noise; this will improve the image quality considerably, particularly scenes with low thermal gradients. For moving objects or for the documentation of fast temperature changes, the filter options **"Off"** or **"Weak"** should be used.

- **Zoom**   Determines the camera-internal zoom setting, which will only affect the thermal image displayed by the camera but not the raw data. Therefore, the size of the image displayed with IRBIS® 3 will not change.

- **Adjust**   Adapts the display scale of the image displayed by the camera to the current temperature scene (AutoImage).

- **Frame rate**   Change the refresh rate setting between PAL (50 Hz) and NTSC (60 Hz). The settings are carried out on the camera.

In the menu item **"Temperature"** of the camera remote control, the following parameters can be determined for the present scene:

- **Emissivity**   Emissivity can be displayed/entered
- **Environment**   Ambient (environment) temperature can be displayed/entered
- **Transmissivity**   Transmission can be displayed/entered
- **Path temperature**   Path temperature can be displayed/entered
- **Distance**   Distance to the object can be displayed/entered
- **Calibration**   Calibration range can be displayed/entered
  40...120 °C / 0...300 °C / 100...600 °C / 400...1200 °C

- **NUC**   Performs a camera-internal calibration (**N**on-**U**niformity **C**orrection):
  - Shutter   - camera-internal reference
  - Object   - external reference (reference current scene)
  - Interval   - Time interval for internal calibration
- **Camera temp**   Displays the internal temperature of the camera

Buttons

Closes the camera remote control window.

Starts the function **"Autofocus"**

The **NUC** (**NUC** = **N**on-**U**niformity **C**orrection) triggers the internal camera shutter, which will homogenise the thermal image.

Adapts the temperature level and span (display scale of the thermal image in the camera) to the current scene in the most optimal way.

Arrow buttons

Using the arrow buttons, users may change zoom and focus settings for the camera:

- **Arrow up** ▲ Changes the focus in the direction "close"
- **Arrow down** ▼ Changes the focus in the direction "far"

⚠️ **Fine adjustment for the focus (close and far) is also possible step-by-step by holding the SHIFT key.**

- **Arrow left** ◄ Reduces the zoom. This function depends on the respective camera system.
- **Arrow right** ► Enhances the zoom. This function depends on the respective camera system.

ℹ️ Changing the zoom only affects the thermal image displayed by the camera but not the data transferred to the PC and displayed or saved by IRBIS® 3.
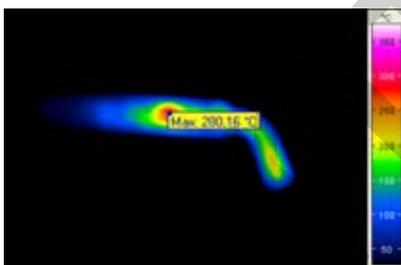
Effect of insufficient focus on the temperature values

| Fig. 124: | *Soldering iron, bad focused (maximum temperature: 280 °C)* | Fig. 125: | *Soldering iron, focused better (maximum temperature: 338 °C)* | Fig. 126: | *Soldering iron, in focus (maximum temperature: 428 °C)* |

Command Line

Via the command line, special commands can be sent directly to the camera. A command is executed by pressing **"Send"**: `?level ▼` `Senden` .

File Transfer

The function **"File Transfer"** serves to transmit the data contained in the infrared camera and saved on the SD card.

- ■ **CF Status**   Total and free capacity of the SD card contained in the camera VarioCAM® hr are displayed. The displayed data and the file list can be refreshed by pressing the button ![icon] .

- ■ **Copy...**   All files selected from the file table can be copied to the hard disk. After clicking on **"Copy"**, a dialogue will open in which the target directory must be selected. Copying files will be displayed in a status window. Additionally, the time of the so far taken copy process, and the time left are shown. The file transfer can be stopped by clicking **"Cancel"**. File being copied at this moment will be completely transferred.

- ■ **Delete**   This function allows the deletion of single files.

- ■ **Format**   **Here,** the SD card in VarioCAM® hr can be formatted.

⚠ **If you format the SD card, all files on it will be deleted!**

ℹ All functions available in the dialogue ″File transfer″ will directly affect the SD card in VarioCAM® hr. The files are transmitted directly via the IEEE 1394 FireWire interface.

12.3 Menu Item "Acquisition Parameters"*

On activating the function **"Snap"** ![icon] the content of the thermal image window is updated. This option will not be available, if the "live image" is activated. The currently loaded thermogram can be saved by the **"Auto save"** option (triangle downwards on the right of the button). Possible save options are single image storing (standard), premium snap (premium), and RE* (Resolution Enhancement).
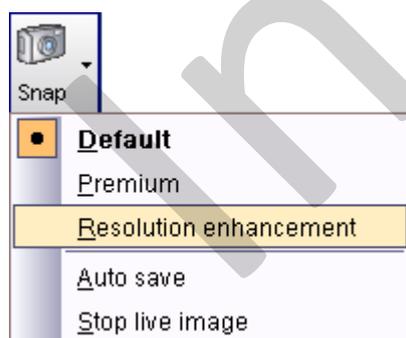

Fig. 127   Dialogue "Acquisition" – "Snap"; Parameter Settings for Real Time Recording

If the function **"VIS image"** is activated, on every IR-image storing the VIS image will be updated and saved as *.irb file (* the availability of this function is hardware dependent).

ℹ The image recording is carried out with a frequency of 1 Hz. Saved *.irb-files are stored in the format YY:MM:DD_hh:mm:ss.

The storing position can be determined via the "Acquisition parameter settings" (see Chapter 12.3.1 Settings for "Acquisition Parameters" – page 84). It is also possible to save thermograms by pressing **F2** on the keyboard.

After the software has connected to the camera, the live image can be activated by clicking on the function **"Live"**. IRBIS® 3 will then permanently display the current image of the thermographic camera. If the simulator is activated, the currently loaded sequence will be displayed as an infinite loop. The current refresh rate which the live image and every element on the form is updated with, is displayed on the status bar.

The frame rate does not necessarily correspond to the current frame rate of the thermographic camera. Depending on the system performance, a maximum display frame rate of 24 Hz can be achieved.

Through the function **"Record"** , images of the measuring object are taken one after another as a series. If the system is recording, the blue icon **"Record"** will be displayed in orange. The number of images to be taken can be determined in the settings for the **"Acquisition parameters"**. The function HD / RAM determines whether data has to be saved on the hard disk or in the RAM buffer. The desired option can be selected by clicking on the function.

Saving data into RAM requires the camera to be connected to the control computer.

For additional Information about the **"Acquisition parameters"**, see chapter 12.3 Menu Item "Acquisition Parameters"* - page 83.

12.3.1 Settings for "Acquisition Parameters"*

Through the various menu items in the acquisition settings (acquisition parameters), the recording process of sequences can be adjusted.
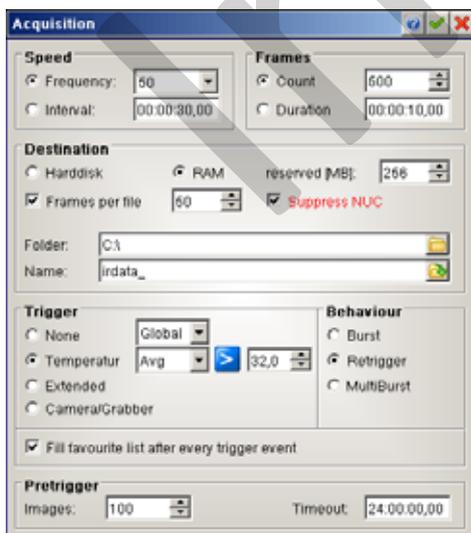

Fig. 128   Settings for the live image acquisition parameters

Category "Speed"

In the category **"Speed"**, it is possible to configure the image saving frequency in Hz through **"Frequency"**. Additionally, it is possible to configure the image saving frequency via the time interval between the images in <hh:mm:ss> in the **"Interval".**

> The selectable frequency depends on the current frame rate (50 or 60 Hz) of the camera system.

Category "Frames"

With the help of the function **"Count"**, sequences are limited up to a fixed number of image acquisitions. Via **"Duration"** the sequence is limited up to a fixed time period

> The input fields in the categories **"Speed"** und **"Frames"** depend on the input fields of the respective other category.

> **The recording is currently limited to max. 100,000 files.**

Category "Destination"

The options **"Hard disk"** and **"RAM"** determine whether data is to be saved directly on hard disk or first in the main memory (RAM). The hard disk or rather RAM can be limited to a certain size with **"Reserved [MB]".** Upon closing the dialogue **"Acquisition"**, the available memory (RAM/HD) is compared with the calculated memory. Too little available memory opens an information window (see Fig. 129) and a yellow marked information will be displayed in the status bar (see Fig. 130)

Fig. 129   Information for too little memory

Fig. 130   Display of status bar

> A later selection of the storage medium is possible via the buttons [HD] / [RAM] in the menu **"Acquisition parameters"**. During the recording this selection cannot be varied.

- ■ **Folder**   Determines the directory in which the sequence will be saved.
- ■ **Name**   With this function, the root for the sequence file names is determined. The current file names are created by adding a 5-digit number to the root.

To decrease the number of single files, it is recommended to collect several records as package files (for large data volume and recording frequencies higher than 5 Hz). With the function **"frames per file"** and the input field next to it, the amount of thermograms in a package can be determined. The operating system is not designed for generating 50 or 60 file names per second for a longer period. Setting the parameter **"Frames per file = 1"** leads to a buffer overflow resulting in loss of data.

During the tempering process of the thermographic camera and longer recording sequences (after switching on the camera), temperature drifts can take place leading to high temperature variation. In this case, a re-activation of the shutter interval is recommended to counteract this thermally conditioned effect. Via the function **"Suppress NUC"**, the NUC, respectively the shuttering of the thermographic camera can be switched on or switched off.

Activating **"Suppress NUC"** on real time acquisition can lead to temperature drift and high temperature variation. On the one hand, the advantage might be that no loss of information through interruption of image import takes place during shuttering. On the other hand, the disadvantage is the possible appearance of temperature drifts within the recorded thermograms (in case of a modification of the camera's inside temperature). It is important to note that a decrease of measuring accuracy on longer sequences can take place with a switched off NUC shuttering.

The **"NUC"** can be activated and de-activated during data acquisition. See **"Acquisition state"** - page 88.

The path in which the output files are to be saved is specified in the input field **"Folder"**. Recording sequences can be named in the field **"Name"**. On starting the recording, a subdirectory with the format "YY:MM:DD_hh:mm:ss" will be created stating the current date and time of the users personal computer. Recording sequences are saved in this subdirectory at all times.

If the title of repeated recording is not changed, several identically named files will be chronically arranged in subdirectories of the selected target directory.

Category "Trigger"

Users may select between different trigger sources for a trigger-controlled acquisition:

- **None**   Data acquisition without trigger
- **Temperature**   The trigger condition depends on the temperature.

    Condition: greater or less – can be switched by clicking on the symbol. For the temperature condition, the measuring object 1 or, if not available, the global temperature (entire image) is authoritative.
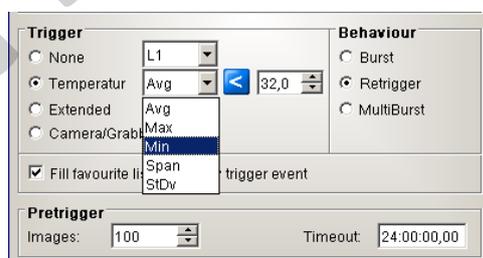

Fig. 131   Setting of the parameter for live mode

The following options can be used as conditions:

- **Avg**   Average value
- **Max**   Maximum value
- **Min**   Minimum value
- **Span**   Span
- **StDV**   Standard deviation

Due to the fact that measured areas have to be analysed, there will be a time delay depending on the computer performance. If the threshold value is 50 °C, the temperature limit (concerning fast thermal processes) should be set on < 50 °C. The limit can be left on 50 °C (1 Kelvin per second) when a slow heating-up process takes place.

- **Extended**   With the option **"Extended"**, up to three conditions can be logically connected and configured as trigger condition, see chapter 12.6.1 Dialogue "External Trigger Parameter"* − page 90:

  - **RLE**   Temperature trigger of a measuring object (analogue to "Temperature")
  - **Global**   Temperature trigger ROI = entire thermal image
  - **DI**   Digital inputs DI 1 ... DI 8
  - **AI**   Analogue inputs AI 1 … AI 8

  The use of digital and analogue inputs requires the additional installation of hardware in the control PC. By default, the 0->1 change is recognised as digital trigger condition. For the analogue trigger condition, a voltage [V] can be selected as switching threshold. In any case, please pay attention to the maximum input signal voltages of the hardware.

- **Camera/Grabber**   Depending on the applied camera, further trigger options are available, e.g. a hardware trigger input in the camera itself or trigger channels in the frame grabber. In order to use the VarioCAM® hr hardware trigger, the breakout box must be installed (see manual VarioCAM® hr).

Category "Behaviour"

Users may preset different reactions of the system to face specific trigger events:

- **Burst**   On appearance of a trigger event, the preset sequence under **"Speed"** and **"Frame"** is captured in the selected directory.
- **Retrigger**   On appearance of a trigger event, an image will be captured in the selected directory (one image per trigger event), e.g. one image per incoming trigger pulse until the maximum number of the images, which have to be captured, is reached.
- **Multi-Burst** In this setting the systems reacts equally to "Burst". Additionally, the number of sequences, which have not been captured, can be preset. For instance, by selecting "5",the preset sequence will be captured five times on the appearance of a trigger event. Sequences are consecutively numbered, and will be saved in a common directory. Images of each sequence are consecutively numbered from 1– n.

On applying the temperature trigger in the **"Retrigger"** mode, it is important to note that the maximum acquisition rate depends on the computer configuration, which is below 5 Hz.

Pretrigger

- **Images**   If the thermal image display is running, it is possible to save images also that were taken before the trigger event, provided that the number of advanced images (max. 1,000) is, depending on the acquisition rate, determined "in time". The number of advanced images that can really be used depends also on the image size and the available RAM capacity.

- **Timeout**   The **"Timeout [hh:mm:ss]"** determines the time condition for stopping the expected data acquisition if there is no trigger event.

Acquisition state

After the acquisition parameters are set, and the recording is activated, the dialogue **"Acquisition state"** displays status and trigger options of the current record. An already started recording can be cancelled via the red cross ✖ at any time.
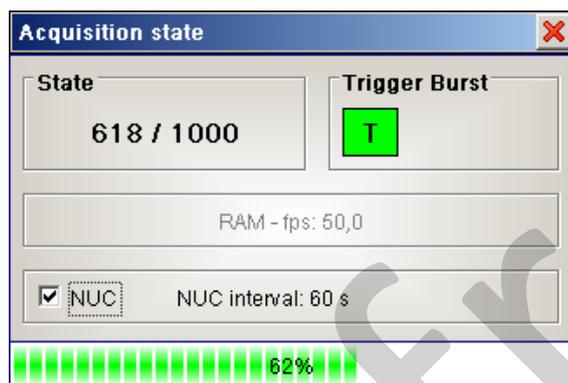
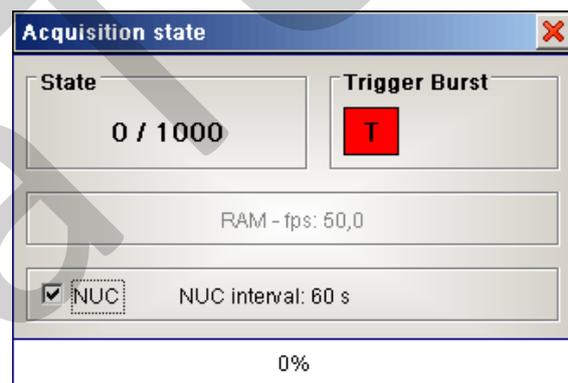|	
Fig. 132 Temperature Trigger with NUC	*Fig. 133 Camera Trigger with NUC – waiting for an event*

The activated trigger is presented through the respective symbol and colour:

C (green)	Green = Recording has started, all requirements are met (Burst)
C (yellow)	Yellow = Recording has started and is waiting for further requirements (Retrigger/Multiburst)
C (red)	Red = Waiting for requirements to start the recording (Burst/Retrigger/Multiburst)
T	Temperature Trigger
C	Camera Trigger
EX	External Trigger

12.4   Menu Item "VIS"*

Depending on the applied camera type, a VIS image (taken internally on the camera) can be displayed by IRBIS® 3 beside the infrared image. Activating the button the displayed VIS image will be updated.

12.5   Menu Item "ASCII Live"*

Via the function **"ASCII live"**, users may activate a continuous saving of the entire content of the thermal image or of the values of the ROI.

- ■ **IR image**   Saves the entire thermal image
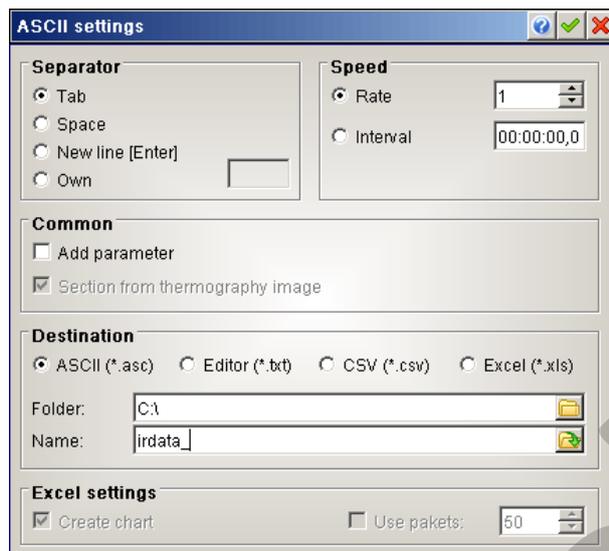- ■ **Meas. defs.**   Saves the measured values of the ROI

Fig. 134   Dialogue "ASCII Settings"

In the settings for **"ASCII live"** ,the separators between the values for the file formats ASCII, TXT, CSV and Excel as well as the acquisition interval/frequency, the target directory and the filename can be determined. However, it is recommended that users save series as IRB files first, which can be edited fast and efficiently with the help of IRBIS® 3. The IRB files can then be converted into any other format.

Separators between two ASCII values are displayed under the category **"Separators"**. In the input field **"Own"**, users may define a separator with a maximum of five characters.

In the category **"Speed"**, under **"Rate"** is indicated per how many images an ASCII storing should be carried out. It is also possible to set the frequency of the frame buffer between the images in the format <hh:mm:ss> via **"Interval"**.

Whether the current displayed parameters of the parameter field are adapted on exporting can be determined via **"Add Parameter"**, under category **"Common"**. The option **"Selection from thermography image"** will be activated, if a selection is on the thermographic image. Under menu **"Measure"**, size and position of the ASCII export can be determined through the selected areas which are set.

The file format for the ASCII real time storing is specified in the category **"File"**. The path in which the output files are to be saved is indicated in the input field **"Directory"**. Files can be named via the input field **"Name"**.

In the category **"Excel settings"**, users may decide whether a chart shall be additionally created into Excel when exporting measurement positions. The chart will be recorded in real time.

12.6 Menu Item "Trigger"*

With the functions of the menu **"Trigger"**, data can, for test purposes, be acquired without a trigger event. The buttons have the following functions:

- **One shot**   Single impulse/single event
- **Gate**   Pulse sequence/trigger condition always fulfilled
- **Pretrigger**   Activates the pretrigger function

The function of the menu item depends on the selected trigger option in the dialogue **"Acquisition"**. See chapter 12.3.1 Settings for "Acquisition Parameters"* - page 84.

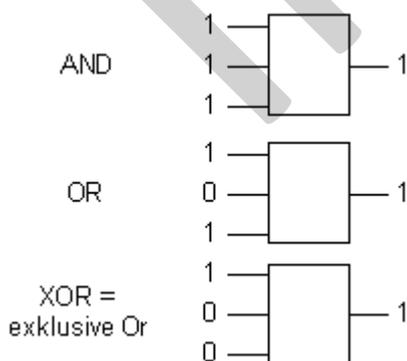### 12.6.1 Dialogue "External Trigger Parameter"*

Settings for the extended trigger can be defined In the dialogue **"External Trigger Parameter"**. Measured values of the thermogram, and in the presence of an I/O-card digital and/or analogue input signals can be utilised as trigger sources. These signals can be linked with each other through functions AND, OR, XOR (see fig. 135).

Fig. 135   Dialogue "External Trigger Parameter"
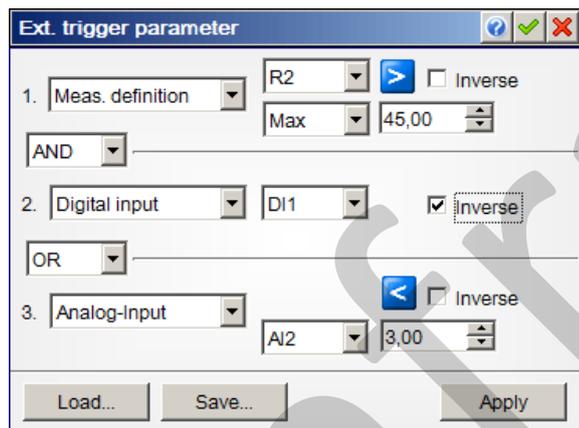
Example:

In the displayed dialogue, the maximum value of the measurement definition R2 is tested for exceeding a threshold of **45 °C**. The result of the test can be linked with the negated input signal at the **digital input 1** via **UND**. Additionally, the **analogue input** will be checked on a lower deviation of **3 volt**, and the result is logically linked with the previous state via **ODER**. The recording starts when the maximum temperature in the measurement area is greater than 45 °C, and at the digital input DI1 Low Level "0", or the voltage at the analogue input AI2 falls below 3 V.

If all requirements are met.

If a requirement is not met.

If an uneven number of requirements is met (either/or).

Fig. 136   Schematic diagram of the functions AND, OR, XOR

12.7   Menu item "Process"*

In this category, users may define whether analogue output and digital alarms are displayed in the **measurement table**. Further details are available in the dialogue **"Process Properties".**

Only in combination with the activated function **"Process"** the function **"Remote"** operational. In contrast to a singular triggering of a saving operation, a continuous repetition of it can be achieved through a simultaneously activated remote. An acquisition restriction defined in the dialogue **"Acquisition",** category **"Frames"** is offset.

12.8   "Process" Settings*

External Limit settings for analogue outputs and digital alarms are preset in the dialogue **"Process"**. The **"Information"** tab displays information on the currently connected and activated IO-cards via a listing of the available input and output channels.
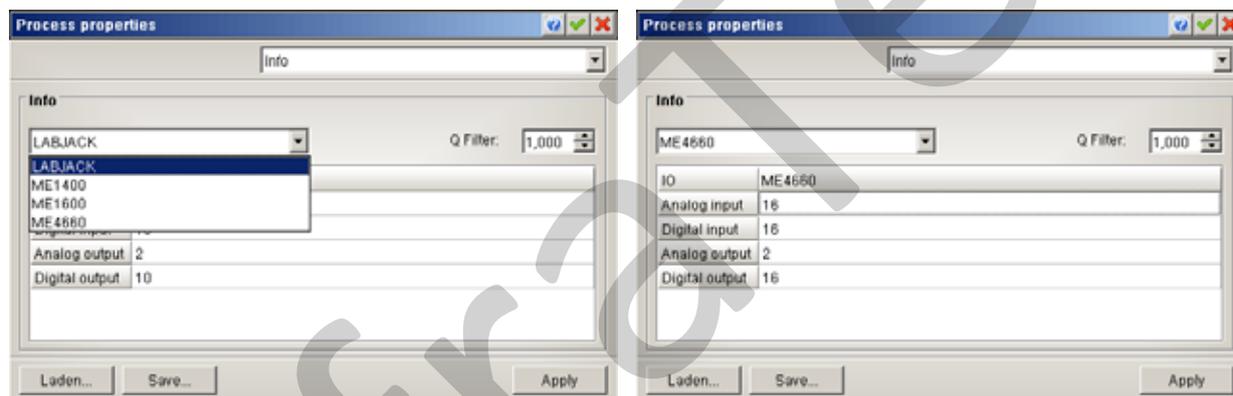

Fig. 137   Dialogue "Process Settings", IO-card Selection

Fig. 138   Dialogue "Process Settings", Displaying the IO-card's properties

Installed IO-cards can be selected via the check box. The interface to the IO-card is defined by the *.iox-file.

IRBIS® 3 supports the following IO-cards of the company Meilhaus Electronic GmbH:

- ME-1600
- ME-1400
- ME4660
- LabJack
- RedLab

Operating elements of the dialogue "Process Settings"

![plus]	Adds a definition/line
![minus]	Deletes a definition/line out of the list
![copy]	Copies the selected definition/line
![A]	Switch Activation
![load wav]	Loads a *.wav file and activates the acoustic alarm signal
![delete wav]	Deletes a *.wav file and deactivates the acoustic alarm signal
![less]	Measurement definitions lower than the specified value
![greater]	Measurement definitions higher than the specified value
![I]	Interval
☑ Active	Activates/deactivates the tagged measurement definition

The configuration of the analogue alarms for the measurement areas can be saved (**"Save"** button), as well as loaded (**"Load"** button).

> ![info icon] Every setting and every alteration of the tab pages has to be confirmed by pressing "apply".

Tab "Analogue Output"

The tab **"Analogue Output"** is utilised for configuring values of the analogue output. This procedure is carried out in the following way:

Via the button ![plus], users may specify a new definition for a channel, and set its configuration with the help of the control elements on the right. Determinations have to be created for the measurement definition (e.g. L1) and its parameter (Avg/Min/Max) which has to be evaluated, and for the range (0 ... 100) °C which has to be transferred into the output area of the I/O-card as well as the channel number of the analogue output of the I/O-card.

By switching the activity flag ![A], you can also activate and deactivate all measurement conditions. Which changes will be made by pressing the button depends on the current state of the tagged measurement definition:

- **Measurement definition active** ![A] deactivates the tagged measurement definition along with all other definitions
- **Measurement definition inactive** ![A] activates the tagged measurement definition along with all other definitions
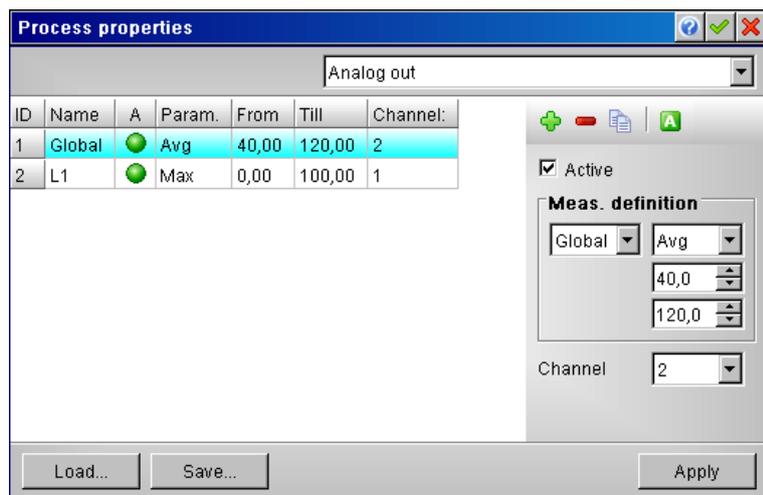
Fig. 139   Dialogue "Process Settings" – Tab "Analog Output"

Example:

The maximum value of measurement definition L1 (with the range (0 ... 100) °C) is converted to the output voltage (0 ... 10) V and put out on channel 1 of the I/O card. This also depends on the settings and the type of I/O card. For example a temperature of 35 °C will lead to an output voltage of 3,5 V on the analogue output channel 1 of the I/O card, if its dynamic range is 1 ... 100.

Tab "Digital Output"

The tab **"Digital Output"** is utilised as configuration for threshold value monitoring of measurement areas with the help of a digital I/O card. This procedure is carried out in the following way:

Via the button ➕ users may specify a new definition for a channel, and set its configuration with the help of the control elements on the right. Definitions have to be created for the to-be-evaluated measurement definition (e.g. L1), the to-be-monitored parameter (Avg/Min/Max), the kind of monitoring (limit 1, limit 2, interval), the threshold values and the I/O card's digital output channel which has an effect on the result of the evaluation.
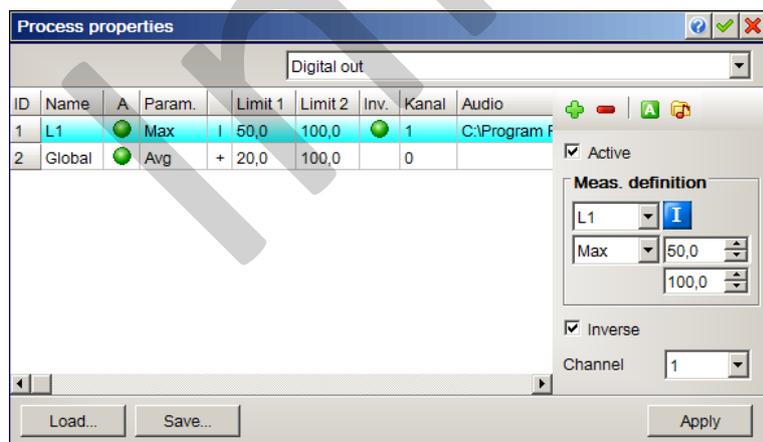

Fig. 140   Dialogue "Process Settings" – Tab "Digital Output"

Example:

On leaving **(inverse)** the area L1 within (50 ... 100) °C, the average value of the measurement definition **L1** will be checked. The result of the checkup is put out on the digital output channel **(Channel 1)** of the I/O card.

Acoustic Alarm

Additionally, you can chose an audio file (*.wav) for every condition, which will be played if the condition is fulfilled ("if the alarm is released"). This option can be found on the tab page **"Digital Output".** Clicking **"Audio file"** will open a Windows dialogue which will allow you to chose a *.wav file of any desired length. To activate this feature, you have to "apply" the changes. As soon as a condition has been appointed an audio file, its symbol will change: If a condition is linked to an audio file, you can delete the file by clicking **"Delete audio file"** and thereby deactivate the acoustic alarm by clicking **"Apply"**.

Different *.wav files can be active for different conditions at the same time.

> It is recommended to choose short audio files (*.wav), since the software will play the entire file.

Tab "Remote-controlled Acquisition"

The function **"Remote –controlled Acquisition"** can be configured via the same-titled tab. The source of the control signal is defined in the selection area on the left. Via the **"Invert"** button, the logic can be inverted.
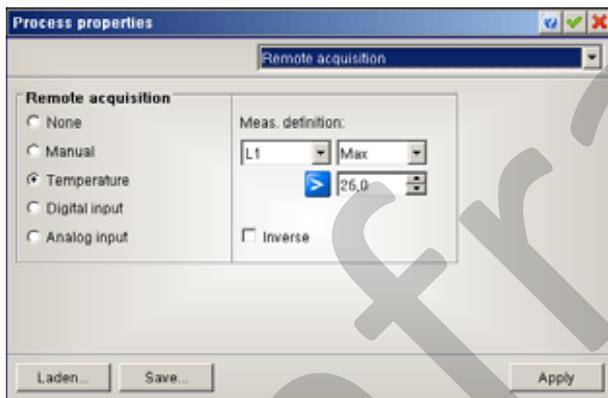

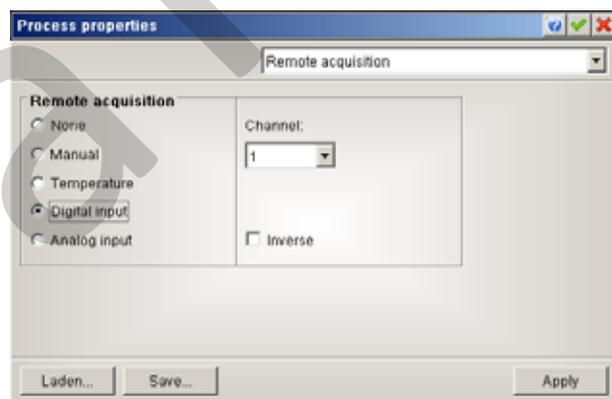*Fig. 141   Dialogue "Process Settings" – Tab "Remote-controlled Acquisition" – Temperature*

Fig. 142   Dialogue "Process Settings" – Tab "Remote-controlled Acquisition" – Digital Input

> On selecting "Manuel", the trigger options Trigger Oneshot and Trigger Gate can be applied.

13 Menu "Sequence"*

The menu **"Sequence"** contains all functions required for editing acquired image sequences. A sequence is a cycle of thermal images.

Fig. 143   Menu "Sequence" of IRBIS® 3

13.1 Menu Item "Buffer"*

By clicking on the button **"Clean up"**, the data contained in the RAM buffer are deleted. Created sequences can be saved via the function **"Save"**. In order to delete images from a sequence, one has to select the function **"Thin out"** by clicking the left mouse button. Users may determine the factor by which sequences are to be thinned out (in this case, every second image is deleted from the sequence). After thinning out, only every nth image is part of the sequence.

Processed data in the **"Sequence"** menu could originate from the RAM (camera connection required) or the hard disk (data from the favourite file list). The reference to the current data source is provided by the symbols ⬤ HD and ⬤ RAM which are to be found on the right of the menu item **"Buffer"**. By clicking on the respective symbol, users may switch data sources.

13.2 Menu Item "Play"*

The images of the sequences are displayed one after another. The display of the sequence can be controlled via the following functions:

	Fast rewind of the sequence
	Play backward
	Pause
	Play
	Fast forward
	Currently displayed image of the sequence
	Playbar

In order to go directly **to the beginning of the thermal image series** or **to the end of the image series** of a sequence, users may apply the following function. The playback speed (normal/fast) can be set in the dialogue **"Options"**, tab **"Additional"**, see chapter 8.5.1 Dialogue "Options" – page 31.

13.3   Menu Item "Charts"*

The functions of the menu item **"Charts"** can only be applied to loaded image sequences.

13.3.1 Time Chart*

By activating the function **"Time chart"** (T. diag.), a serial measurement is started for the previously selected sequence. In order to create a time diagram, the ROI must first be defined in the thermal image. The **time chart** will then visualise the change of the measured values over time. A diagram will be created if:

- a sequence or a series of images has been loaded into the favourite file list,
- the currently displayed thermogram is a sequence file or
- a sequence stored into the RAM via a camera system.

The **"File"** menu contains the operations **"Copy"**, **"Export"** and **"Print"**. Additionally, the set **"configuration"** can be saved and loaded. Via the **"Edit"** menu or function key **F5**, time diagrams can be updated. This might be helpful, if a measuring point was added to or moved within the thermogram.

The **"View"** menu allows users to show and hide properties (on the right) and the comment field (below). Via the menu item **"Default values"**, each element, such as diagram, key and axes can be reset to the default settings.
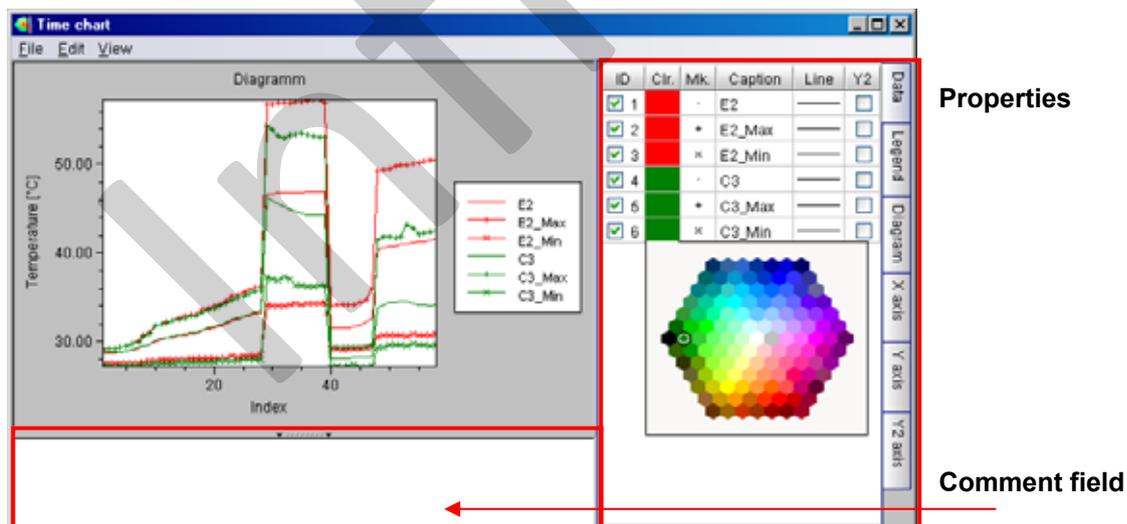

Fig. 144   Time diagram with two measuring lines, displaying average value, minimum and maximum

When the mouse pointer is on the diagram, the following operations can be called up directly by pressing the right mouse button:

- **Goto image**   The thermogram, which the mouse pointer in the diagram is on, will be loaded into IRBIS® 3. Additionally, this can be directly achieved by holding the **middle mouse button** and controlling the mouse pointer on the diagram.
- **Pan**   Via this function, diagrams can be moved by holding the left mouse button.
- **Zoom**   With the help of this function, diagrams can be zoomed in/out vertically by holding the left mouse button.
- **Reset**   Via this function, the operations **"Pan"** und **"Zoom"** can be cancelled.

Tab "Data"

Measuring points displayed in the time diagram can be listed in the tab **"Data sets"**. The column **"ID"** determines which lines (average, minimum, maximum value) of the measuring area are to be displayed.

By clicking the right mouse button when the mouse pointer is within the table, a dialogue opens in which users may determine the to-be-displayed lines (average value, minimum, maximum) on the time diagram. This selection is applicable on each displayed measured area.

All values of a measuring area are shown in the same colour. The field contents in the columns **"Clr."** (colour), **"Mk."** (marker), **"Caption"** and **"Line"** can be changed by clicking into the fields. Through the function **"Y2"**, the y-axis can be shown twice.

Tab "Legend"

The key for the time diagram can be shown/hidden via function **"Visible".** With the help of the function **"Data labels",** the indicated name in tab **"Data",** column **"Caption",** can be displayed in the diagram on the respective measuring point. The way in which the name should be displayed follows the selected form in the ID column. See chapter 10.2.1.2 Measurement and Correction Table – page 44. Additionally, the key's **"Font Color"** and **"Background Color"** can be changed, and its position be adjusted via **"Position".**

The key's position and size can be freely chosen within the diagram by selecting **"Free"**.

Tab "Diagram"

In this menu, a name can be given to the diagram. The display colours and the **"Table style"** of the diagram can be adjusted as well.

Tab "X axis"

In the menu item **"X axis"**, the design of the X axis (scale division, decimal places, colour), its position (top, bottom) and the **range** to be displayed can be changed. Moreover, the unit to be displayed by the X axis can be selected. If you select "time", users may select between second, minute and hour.

Tab "Y axis", "Y2 axis",

In the menu items **"Y axis"** and **"Y2 axis"**, mainly the same setting options can be applied as in the menu item **"X axis"** (see above). As soon as the **"Y2 axis"** is displayed, positions for the Y axis (left) and the Y2 axis (on the right of the diagram) are fixed.

Profile over Time*

ℹ Apart from the X-position, tabs of the time diagram and the profile time diagram correspond to each other.

In the chart **"Profile over time"**, profiles of measured values over time are displayed. In the course of this measuring areas, displayed in the profile diagram, are also loaded into the **"Profile over time"**, see chapter 10.2.1.3 Profile Chart – page 46.

ℹ Measured areas will only be displayed in the **"Profile time chart"**, if they are available in the dialogue **"Measurement definitions"**, tab **"Profile over time"** on the right. See chapter 11.3.4 Measuring Area Settings – page 66.

The **"Profile over time"** can be created under the same conditions as the **time chart**. On activating this function, the **"Profile over time"** diagram will be created in a new dialogue. If more than 100 records are selected into the **"Profile over time"**, the request to reduce the number of these records will appear in a dialogue.

ℹ The number of the to-be-displayed records in the Profile over time diagram is limited up to 100. If more than 100 thermograms are loaded into the favourite file list or into the RAM, they will be automatically thinned out for displaying purposes by the programme. The thin out process has no effect on the ASCII export of the profile over time.
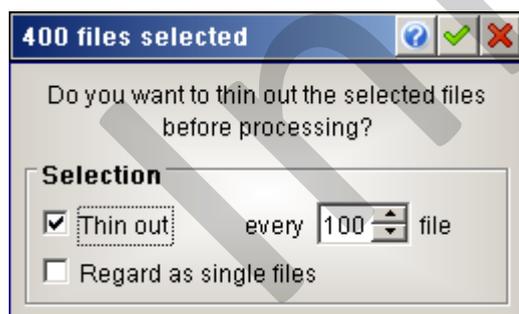

Fig. 145   Please note: large data volumes are about to be loaded

The **"File"** menu of the profile over time chart contains the functions **"Copy", "Export"** and **"Print"** which can be applied to the diagram. Additionally, the set **"Configuration"** can be saved and loaded.
The profile over time chart can be updated via the **"Edit"** menu or operation key **F5**. This might be useful if a measuring point was added into or moved within a thermogram.

The **"View"** menu allows users to show and hide properties (on the right) and the comment field (below). With the help of the menu item **"Default values"**, elements, such as diagrams, legend and axes can be reset to default settings.

Different display options as well as a range of functions for the profile over time diagram are provided via the menu **"Chart"**. In the following , these display options and functions will be explained:

2D
The 2D-diagram displays the profile over the time in a chart..
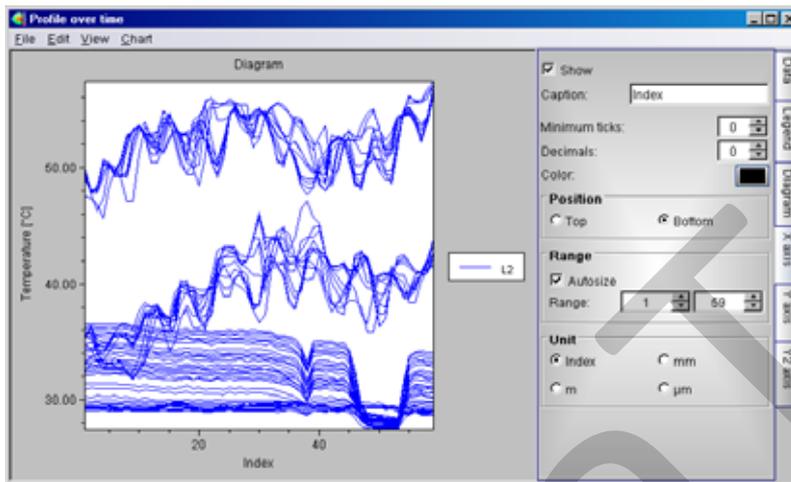
Fig. 146   2D View of the profile over time diagram with measuring line

Image Chain
Via this function, the profile over time diagram can be displayed as **"Image chain"**.. To call up this operation requires the former activation of the 2D profile.
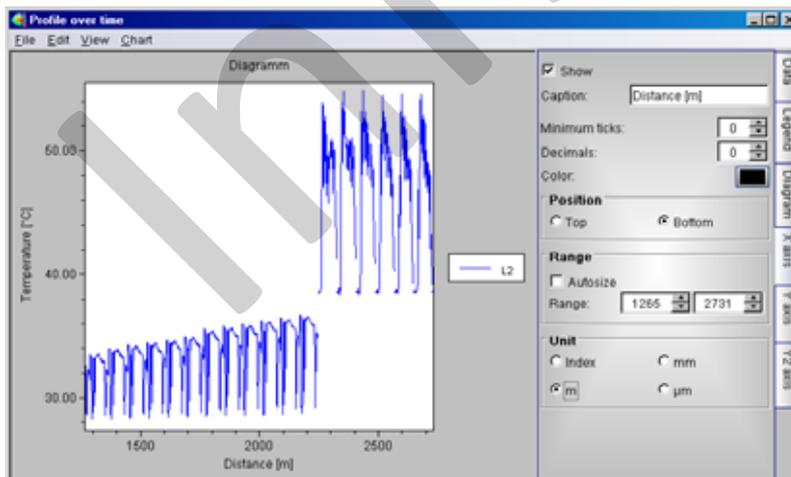
Fig. 147   Displaying the Profile over time diagram as image chain

3D

The 3D diagram displays the profile over time three-dimensionally. Measured areas set in the thermogram can be displayed in 3D view via **"Select"**.
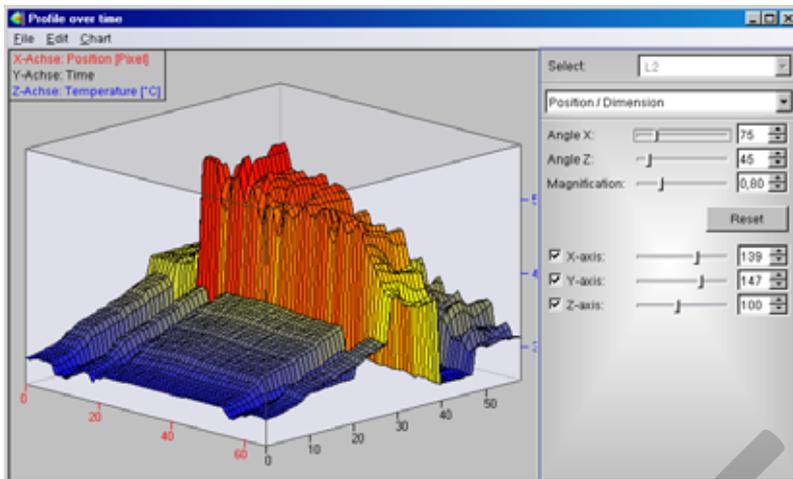

Fig. 148   3D View of the Profile over time with measuring line

The functionality of the **3D View** is described in detail in the dialogue **"3D View"**, see chapter 10.5.1 Dialogue "3D View"* − page 53.

Walls

Via the option **"Walls"**, measured values can be displayed as pseudo 3D relief. It is possible to display the 3D relief backwards via **"Reverse"**, only its **"Outline"**, or a gradual build-up of it via the function **"Build incremental"**. Under option **"Select"**, measured areas set in the thermogram can be displayed as 3D relief.
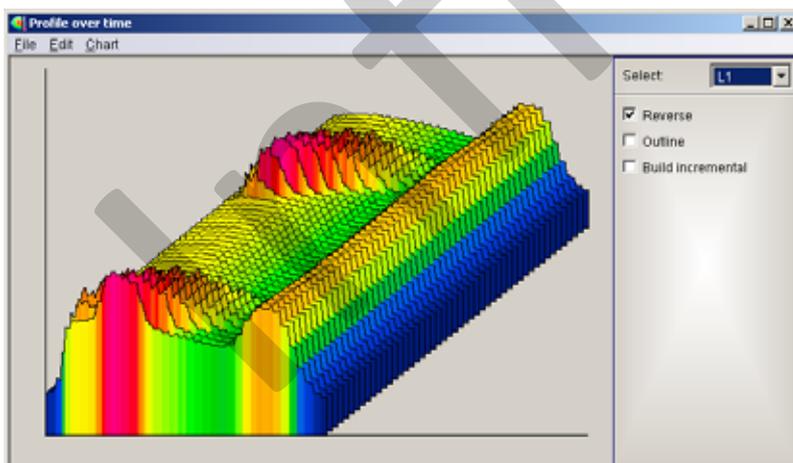
Fig. 149   Profile Over Time in "Walls" view with measuring line

13.4   Menu Item "Sequence"*

If the function **"Accumulate"** (Accu) is activated, an average value is calculated for each pixel of the thermal images of the entire sequence. Now, users may select among the functions average value, maximum, minimum, std deviation, scene-based NUC and super resolution. On selecting **"Super Resolution"**, the number of the image's pixels is doubled.
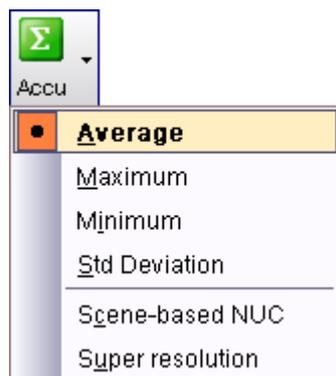
Fig. 150   Selecting Accumulation

The created image accumulation improves the signal-to-noise ratio, thus optimising the resulting image quality. The accumulated thermogram can be edited or saved afterwards.

Make sure that the thermal images applied for accumulation have been acquired with the same geometric measurement setup.

13.5   Menu Item "Conversion"*

The **"Export"** function allows users to export thermograms available in the favourite file list. It is possible to save data as **"Thermogram", "Form"** or **"ASCII files".** The target directory is selectable in the dialogue **"Choose directory"**, and the storage format in the dialogue **"Export"**.

The following graphic formats are supported by IRBIS® 3:
- Windows-Bitmap (*.bmp)
- JPEG-Bitmaps (*.jpg, *.jpeg)
- Portable Network Graphics (*.png)
- PaintBrush (*pcx)
- CompuServe-Bitmap (*.gif)
- TIFF Bitmap (*,tif, *.tiff)

When selecting the **"Export"** function, graphic overlays and variations in temperature are taken into account by correction areas in the output format.

Via the operation **"Convert"**, a sequence file (package file) can be saved as a corresponding number of single files.

- **IRB Sequence**   Converting single files of the favourite file list into a sequence file
- **IRB Single File**   Converting a sequence file into several single files
- **ASCII**   Raw data will be saved unchanged as *.asc-files. Available correction values will not be taken into ASCII files. For further settings, see Fig. 153.
- **Image files**   On exporting data as an image file, the raw image is saved without the temperature scale and measurement and correction areas. A 16 -bit thermogram can be displayed via a black and white colour palette, and converted into BMP-format which is provided for the user as 8-bit information for further data processing.
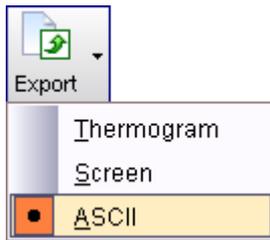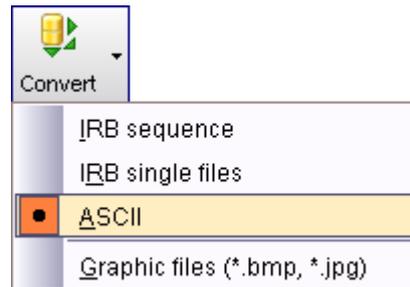
Fig. 151   Selecting Export

Fig. 152   Selecting Convert

"Convert" Settings*

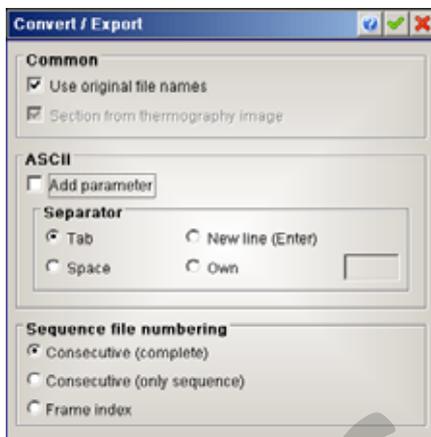Settings for exporting or converting data are saved in the dialogue **"Convert / Export"**.

Fig. 153   Dialogue Convert/Export

On exporting data, users may determine in the category **"Common"** whether the original filenames should be retained or not. The option **"Section from thermography image"** is activated when a selection is on the thermogram. Size and position of the to-be-exported image can be defined through the selected area set in the menu **"Measure"**.

Settings for the ASCII conversion or export can be changed in the category **"ASCII"**. Via the option **"Add parameter"**, currently displayed parameters of the **parameter field** can be saved on exporting or converting data.

The numbering of files is definable via the category **"Sequence file numbering"**. The option **"Consecutive (complete)"** will number all exported files consecutively. Numbering all exported files for single sequence files consecutively can be realised through **"Consecutive (only sequence)"** which also starts a new numbering for another sequence file. Via **"Frame index"**, users take the frame index of the thermography as numbering.

When a **"Selection"** is set in the thermogram (see chapter 11.1 Menu Item "Control" – page 60), the ASCII export can only be restricted to the temperature information below the selected area via the option **"Selection from thermography image"**. Therefore, a notable data reduction might be achieved. The application is recommended when utilising Excel 2000 due to its restriction to 256 columns.

14   Menu "Report"

In the menu **"Report"**, thermal image evaluations can be documented comfortably with the help of **MS Word**. The versions **Microsoft Word 2000, Microsoft Word 2003** und **Microsoft Word 2007** are supported.

Fig. 154   Menu "Report"

Calling up the menu **"Report"** activates the two functions **"New"** and **"Open"** as well as the **"MS Word – Report Generator"**. As soon as one report has been opened or regenerated, all the other functions will also be activated.

This software differentiates between Word templates *.dot (Office 2000) and report (*.ini) templates.

14.1   Generate a New Report

The function **"New"** (new Word document) opens a report template in a new Word document. This Word template corresponds with a previously created *.dot-file. It can be adjusted by any user. That very report template opens which was previously selected under **"MS Word Settings – Report Generator"**. The opened thermographic report always consists of a start page and the selected report template. Further pages may be added to the report by the functions **"Add"** and **"Insert"**. Single pages can be deleted from the Word document without any problems.

When installing the software, some report templates are already filed in the installation directory (e.g.: C:\Programme\InfraTec\IRBIS3\Report), see chapter 14.6 Report templates IRBIS® 3 – page 105.

Open a saved report

Via the function **"Open"** (Open Word document) an already saved report can be selected and opened. It may subsequently be processed further.

14.2   Add Pages to the Report Template

Has a report already been opened, the function **"Template"** is activated. On applying this function, a dialogue opens displaying the available report templates. After selecting a template, it will be inserted into the Word-document on the current page.

The previous template is thereby overwritten. This applies also to pages in which placeholders are already filled out with data.

A new page is added to the end of the currently opened report by applying the function **"Add"** ✚. The report is supplemented by the template that has been selected at the latest. On utilising the function **"Insert"** ⬆, a new page is inserted into the report right before the currently selected page. Utilising the function **"Template"** will select the required report template.

After a new page has been added to or inserted into the report, the required template can be selected via **"Template"**. This template will be activated on the previously selected page in the report.

> ℹ A template can only be selected if a new page has been previously added to or inserted into the report.

14.3   Save Report Template 🖫

Report templates can be individually adjusted in Microsoft Word documents, meaning all placeholders are movable on a page, changeable in their size, and deletable. Via the **"Save"** button, report templates of the current page can be saved into the *.ini file. The creation of own report templates can be carried out with the help of the supplied template **rep_universal.ini** including all placeholders supported by IRBIS® 3. See chapter 14.6 Report templates IRBIS® 3 – page 105.

14.4   Fill Report Templates with Data 🖼

In order to fill a report template with data, it is possible to fill the placeholders either one by one or a page by one click.

On selecting the function **"Fill"**, all available data is inserted on those pages that have been selected by means of the function in the symbol bar or by placing the cursor in the Word-document. Placeholders, for which there is no relevant data, remain blank.

> ℹ All actions performed relate to the currently marked page in the Word-document. The current page is displayed in the symbol bar at the top left, and can also be selected by this function:

Fig. 155:   Dialogue for selection of a page in the report

The placeholders in the report template can as well be individually filled with data. For this purpose, relevant data (thermogram, VIS image, diagrams) are selected by using a right mouse click in the software IRBIS® 3, so that, via the context menu, the option **"Report"** can be selected. Then, the placeholder is chosen into which the element is to be inserted.
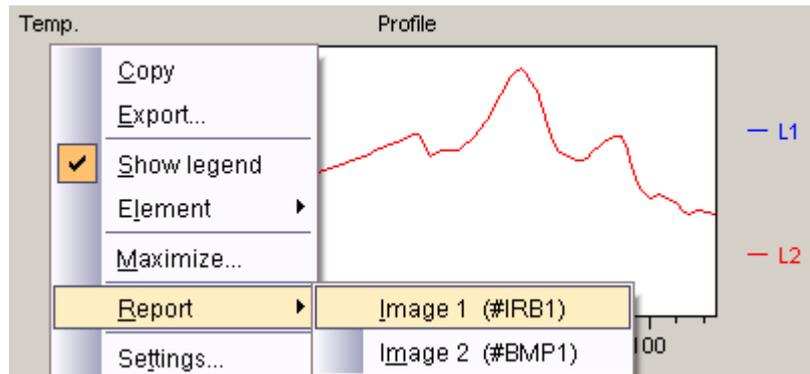
Fig. 156:   Dialogue for "Filling" the report template

The function **"Delete"** ✖ will remove one page from the report template. The page to be deleted can be selected by using the arrow keys **"Previous page"** or **"Next page"**.

14.5   Word Template 📄

The file **Thermography_report.dot** is included in the IRBIS® 3 software's delivery. This file can be individually adjusted by any user. To change templates, they have to be opened via the function **"Open"**. After saving the *.dot/*.dotx-file, changes are activated for new reports.

14.6   Report templates IRBIS® 3

The individual placeholders in the report template can be shifted, copied, edited and deleted.

The following report templates are included in the package:

- **rep_1irb.ini**   placeholder for an IRB image, the image title, the parameter box and the comment box
- **rep_1irb_1profile.ini**   placeholder for an IRB image, the image title, a profile and the measurement table
- **rep_1irb_1vis.ini**   placeholder for an IRB image, a VIS image, the image title, the parameter box and the measurement table
- **rep_1irb_1vis_1profile.ini** placeholder for an IRB image, a VIS image, the image title, the profile,
- ■   an input box and the measurement table
- **rep_2irb_2profile.ini**   placeholder for two IRB images, VIS images each and image titles
- **rep_3irb.ini**   placeholder for three IRB images with a comment image
- **rep_6irb.ini**   placeholder for six IRB images

> ℹ The report template **rep_universal.ini** allows users to create individual templates. The template contains four placeholders of each type which can be deleted, moved and changed in their size. It provides sufficient opportunities for creating own report templates in Microsoft Word which can be saved under a new filename via the **"Save"** button. See chapter 14.3 Save Report Template – page 104.

14.7 "Report" Settings

The **"Word template"** (*.dot/*.dotx) in which reports can be opened have to be selected in the dialogue **"Report"**. Additionally, the newly created report template is displayed. The option **"Report with cover sheet"** opens a new report with a previously defined cover sheet. Via the function **"Edit fields with border"**, users may determine whether each field in the form of "#Edit" should be displayed with or without a border after the Word file has been filled out. It is also possible to display the headline **(Parameter:)** in the parameter field by selecting **"Show parameter title"**.
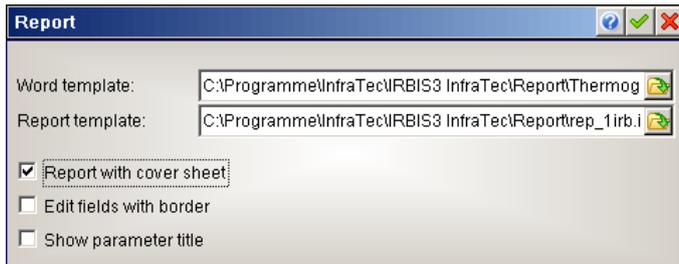
Fig. 157   Dialogue "Report"

15 Menu "Extras"

In the menu **"Extras"**, various editors can be started and controlled.

Fig. 158   Menu "Extras"

15.1 Menu Item "Editors"

Open the **"Palette editor"*** and the **"Sequence editor"**.

15.1.1 Dialogue "Palette editor"*

With the help of the **"Palette editor"**, new colour palettes can be created by mixing the colours red, green and blue.
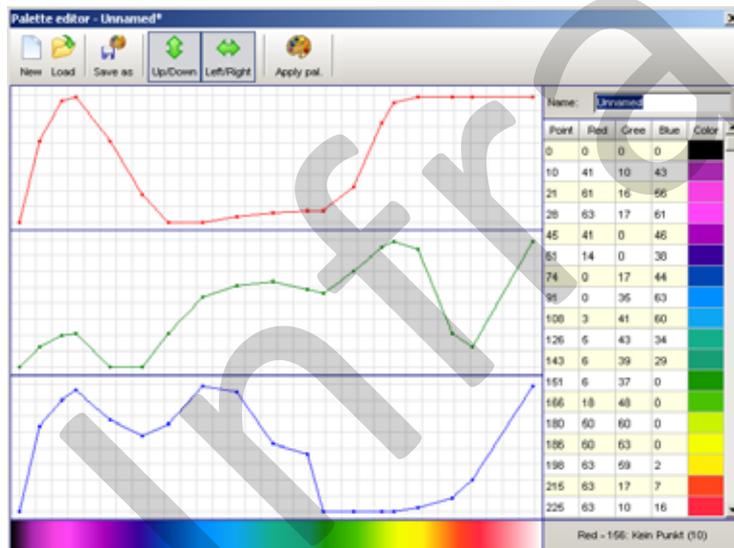
Fig. 159   Palette editor

The normalised, linear colour lines of a new colour palette (button **"New"**) will first create a black and white palette. The lines can be modified by adding new points. New points are placed on the lines by clicking on the line. If the function **"Up/Down"** is activated, points placed on a colour line can be moved up or down. If the function **"Left/Right"** is activated, points placed on a colour line can be moved to the left or to the right also. If a function is disabled, the points can only be moved into the other direction. The points that have been placed are displayed in the table to the right of the colour lines. Placed points can be deleted by a right mouse click (**"Delete"** or **"Delete all points"**). For each point, a colour can also be directly selected by a right mouse click into the colour field. Accordingly, the mixing ratio of **"Red"**, **"Green"** and **"Blue"** will then be changed.

A newly created or edited colour palette must be saved under a new filename.

The colour palette can be applied to the thermal image loaded in the IRBIS® 3 main window by clickingon the button **"Apply pal. "**. Alternatively, an already saved palette can be loaded via the menu **"Thermal image"** – **"Palette"** – **"Open…"**.

By a right mouse click on a placed point, users may select the following functions:

- **Delete**   If **"Delete"** is selected in the context menu, the point for which the menu has been opened will be deleted.
- **Interpolate**   If **"Interpolate"** is selected, the point between two neighbouring points will be smoothed (i.e. the points will be placed on a diagonal).
- **Split**   If the function **"Split"** is activated, new points can be added between two neighbouring points. An input dialogue will open in which the number of points to be added can be determined. The function **"Split"** is only activated in the context menu by clicking on one of the colour lines. In this case, all other menu options will be deactivated.

When starting IRBIS® 3, all palette files (*.col) are loaded from a default directory which was created on installation. It is recommended to save *.col files in this directory.

Palette files (*.col) are located in the following directory:
- Windows 2000/Windows XP
  C:\Documents and Settings**user**\Application Data\InfraTec\IRBIS3\Col
- Windows Vista
  C:\Users**user**\AppData\Roaming\Infratec\IRBIS3\Col

15.1.2 Sequence Editor*

In the **"Sequence editor"**, a large number of editing and assessment options is available for sequences and series of images. Separate documentations for the sequence editor can be obtained from InfraTec.

15.2   Menu Item "AVI"*

On activating the function **"AVI"**, all files available in the favourite file list will be merged into one *.avi file. The directory and Codec for the to-be-saved file has to be set under **"AVI settings"**.

15.2.1 "AVI" Settings*

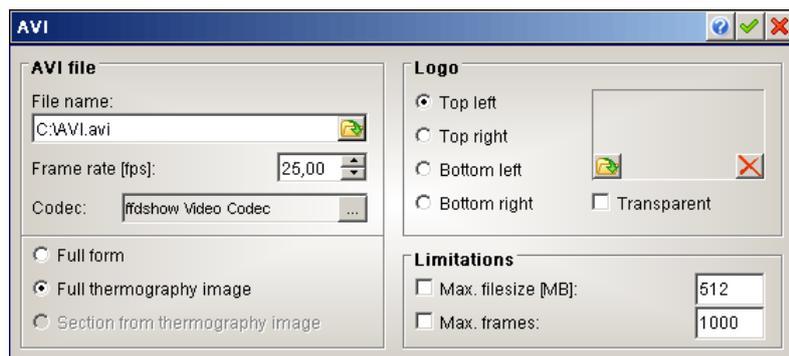Via the dialogue **"AVI Export ... "**, details for the export of AVI files can be determined.

Fig. 160   AVI export

Under **"File name"**, the directory and the filename for the AVI export are determined. The **"Frame rate [fps]"** indicates how many thermal images can be displayed per second. The function **"Codec"** serves to determine the type of compression. The range of available codecs depends on the already installed video codecs on the user's computer. Parameters for the respective codec can be set via the check box [...]

No codecs will be installed on the user's computer during the IRBIS® 3 installation.

On selecting **"Full form"**, the thermal image form including the currently displayed elements, such as the measurement table and the histogram, will be recorded. The option **"Full thermography image"** contains the thermogram and (if available) the **temperature scale** as well as the **temperature profile**. The check box **"Section from thermography image"** is activated when a selection is on the thermogram. Size and position of the AVI file can be determined through the selected area set in the menu **"Measure"**.

In the category **"Logo"**, an image can be displayed on the to-be-selected position in the created AVI file (*.avi). On activating the function **"Transparent"**, the colour (located on position x = 0; y = 0) of the image will be fully transparent. Additionally, users may determine the **"Maximum file size"** and the **"Maximum number of frames"** (Max. frames) for the AVI export in order to avoid too large files.

It is recommended to set the **"Frame rate [fps]"** not higher than 25 due to codecs (e.g. DivX) which cannot process high image frame rates. In this case, the AVI file can be deleted after the recording by the codec itself.

15.3   Menu Item "Macro"*

With the help of the **"Macro editor"**, editing steps that are frequently repeated can be merged into a macro programme which will execute the steps automatically, see chapter 15.3.1 Dialogue "Macro Editor"* - page 110. Up to five freely defined macro script files can be saved by clicking on the respective button. These script files are selectable in the dialogue **"Macro Settings"**, see chapter 15.3.2 "Macro" Settings – page 110.

15.3.1 Dialogue "Macro Editor"* 🟧M

With the help of the **"Macro editor"**, editing steps that are frequently repeated can be merged into a macro programme which will execute the steps automatically.

15.3.2 "Macro" Settings*

In the dialogue **"Macro settings"**, users may freely define up to five macro scripts which can be called up from IRBIS® 3 via the buttons 1-5. Each category corresponds to the respective button, e.g. **"Definition Macro 1" –** button **"1"**.

Macro script files previously created with the **Macro editor** are selectable under **"Script file"** (See chapter 15.3.1 Dialogue "Macro Editor"* – page 110). Additionally, a **"Hint"** can be entered which will be displayed when holding the mouse pointer on the respective button. If an existent script file is selected, the respective button in the IRBIS® 3 will be activated.
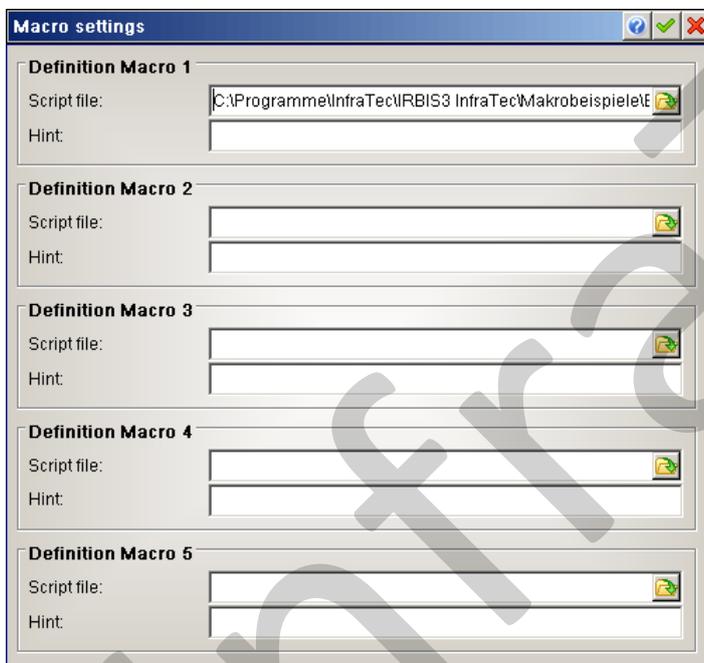
Fig. 161   Dialogue "Macro Settings"

16   Menu "Window"*

The menu item **"Window"** is only visible if several windows have been opened. A new window can be opened via the function **"New"** in the menu **"File"**. Up to four windows can be opened at the same time.
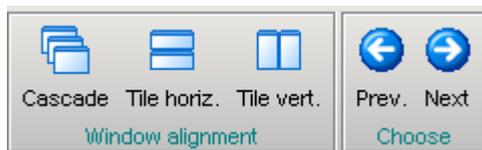
Fig. 162   Menu „Window"

16.1   Menu Item "Window Alignment"

Users may select the following options for the alignment of windows:

- **Cascade**   The open windows are overlapped (aligned as a cascade).
- **Tile horiz.**   The open windows are aligned on top of each other (horizontally).
- **Tile vert.**   The open windows are aligned side by side (vertically).

16.2   Menu Item "Choose"

With the help of the functions **"Previous"** and **"Next"**, users may switch between the open windows.

17   Hot keys at a glance

In order to ensure good working conditions, IRBIS® 3 contains certain shortcut keys making the work much easier.

- **F1** - Help
- **F2** - Fast saving at the Live-image of a thermal camera
- **F3** - Percentile (minimum- and maximum filter for the display of the thermal image)
- **F5** - Shot
- **F6** - Object
- **F7** - Calibration
- **F8** - Selection

- **Ctrl + O** - Open file
- **Shift + Ctrl + O** - Open files from folder
- **Ctrl + N** - New thermal image
- **Ctrl + S** - Save thermal image
- **Ctrl + E** - Export thermogram
- **Ctrl + P** - Print
- **Ctrl + F** – Full screen / Normal screen
- **Ctrl + Y** - Undo (last step)
- **Ctrl + Z** - Redo (repeats the edit that was most recently reverted)

- **Ctrl + left** - Select previous file
- **Ctrl + right** - Select next file

- **[Num-block]** - Enlarge to the next zoom
- **[Num-block]** - Scaling down to the next zoom

At thermal image / VIS image:
- **Ctrl + C** - Copy areas or definitions, e.g. textbox
- **Del** - Marked or selected definitions will be deleted

At favourite file list:
- **Del** - Marked or selected definitions will be deleted out of the favourite file list

At all dialogues:
- **F1** - Help
- **Return** - Quits the dialogue and adopts the settings
- **Esc** - Quits the dialogue and abolishes the settings

At Diagram- and 3D-Dialogues:
- **F1** - Help
- **Ctrl + C** - Copy image
- **Ctrl + E** - Export image
- **Ctrl + P** - Print image

18   Index