



WORKSWELL MEDICAS

USER MANUAL

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1 Legal Disclaimer

All products (software, hardware or firmware) manufactured by Workswell s.r.o. are warranted against defective materials and workmanship for a period of twelve (12) months, provided such products have been under normal storage and use in accordance with herein instructions.

The warranty extends only to the original purchaser and is not transferable. It is not applicable to any product which has been subjected to misuse, neglect, accident or abnormal conditions of operation.

In the case of a defect in a product covered by this warranty the product must not be further used in order to prevent additional damage. The purchaser shall promptly report any defect to Workswell s.r.o. or its authorized distributor or this warranty will not apply.

Workswell s.r.o. will, at its option, repair or replace any such defective product free of charge if, upon inspection, it proves to be defective in material or workmanship and provided that it is returned to Workswell within the said twelve-month period.

Nobody but Workswell s.r.o. is allowed to open or modify such product.

Workswell s.r.o. has no other obligation or liability for defects than those set forth above. No other warranty is expressed or implied. Workswell s.r.o. shall not be liable for any direct, indirect, special, incidental or consequential loss or damage, whether based on contract, tort or any other legal theory.

1.1 Copyright

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Names and marks appearing on the products herein are either registered trademarks or trademarks of Workswell s.r.o. All other trademarks, trade names or company names referenced herein are used for identification only and are the property of their respective owners.

2 Warning and Cautions

2.1 Warnings

Before using the product, please read the whole User Manual. Before power-up the camera, please check that there is no visible damage or malfunction, cables are connected properly and verify the polarity is correct.

If there are any visible signs of damage or other defect on the device, or you are not sure with the connection, then on no account should it be installed or put into operation.

Any interference and non-certified service operations into the product leads to an automatic loss of warranty.

2.2 Notifications

Do not use or store the device in conflict with the storage and operating conditions laid down in this manual (only for hardware).

- Do not point the infrared camera (with or without the lens cover) at strong energy sources, for example, devices that cause laser radiation, or the sun. This can have an unwanted effect on the accuracy of the camera. It can also cause damage to the detector in the camera.
- Use original accessories only.
- Do not use the Workswell Medicas system in temperatures higher than +35°C (+95°F). High temperatures can cause damage to the camera.
- Do not use the Workswell Medicas system in temperatures lower than +10°C (+50°F). Low temperatures can cause damage to the camera.
- Do not use the Workswell Medicas in environmental conditions that make condensation possible (make sure the air is non-condensing)
- Do not apply solvents or equivalent liquids to the cameras, the cables, or other items. Damage to the items can occur. For cleaning refer to chapter 21.
- Be careful when you clean the infrared lens. The lens has an anti-reflective coating which is easily damaged. Do not use too much force to clean the infrared lens. This can cause damage to the anti-reflective coating.
- The encapsulation rating is only applicable when all the openings on the all components of the system are sealed with their correct covers, hatches, or caps.

3 Help and FAQ

3.1 General Instructions

While looking for a solution of any technical problem we recommend following these steps:

- try to find an answer by searching this User Manual
- contact your dealer
- send an email to support@workswell.eu

4 User Information

4.1 Typographic Conventions

Following typographic conventions are used in this User Manual:

- UPPER CASE is used for the names of keys, buttons and menu items
- COURIER is used for filenames and paths
- *Italic* is used for important information and document names
- **bold** is used for the links to other sections, for function names or Internet sites

4.2 Help and Support

For technical questions that were not answered in this User Manual feel free to contact your dealer or visit the product website at <https://workswell-thermal-camera.com/thermal-imaging-camera-airport-flue-virus-screening/>, or send an email on support@workswell.eu.

4.3 Updates

The primary aim of Workswell s.r.o. company is to supply their products in a way that meets the current needs of its users and at the same time to remove all the weaknesses that were found in their use as quickly possible. For this reason, Workswell s.r.o. regularly releases updates for all their products.

Visit <https://www.workswell-thermal-camera.com/firmware-update/> to download the latest firmware release. The update process itself is described in a later section.

4.4 Firmware

Firmware is the „internal“ control program of the device. From the user’s point of view, only the official firmware released by Workswell s.r.o. company can be used for update of the device.

5 Revision History

0.1.0

- Initial draft

0.1.1

- Added screenshots

1.0.0

- Initial release

1.1.0

- Added mounting sections and measurement scheme

1.1.1

- Corrected focusing mark explanation

1.2.0

- Described new features added in the 1.1 FW update

1.2.1

- Grammar and correction in the User submenu

1.2.1

- Described new features added in the 1.2 FW update

6 Introduction

The thermal camera MEDICAS allows to measure the temperature of the human skin and is therefore effective in detecting the body temperature increases for instance due to a virus infection.

MEDICAS has accuracy of the measurement ± 0.3 °C, according to reference blackbody. This accuracy is always guaranteed only when measuring the temperature near the black body, i.e. in similar distance from the camera as the distance between black body and the MEDICAS.

The camera is designed to continuously calibrate the measured temperatures by measuring the temperature of the black body shipped with the camera. This black body needs to be placed in the view of the camera in specific distance based on the camera lens focus distance. The position of the Blackbody then needs to be set in the thermal image by setting BLACK BODY ROI (region of interest) from the Functions menu.

The system offers a digital video output. Both visible and thermal spectrum images are displayed on the screen at the same time.

While measuring the human body with the MEDICAS thermal camera and correctly evaluate the results of the measurement, it is necessary to follow instructions written in this manual. You also need to understand the theory behind evaluating normal human body temperature.

6.1 Correct measurement of the human body temperature

Normal human core body temperature (normothermia, eutheria) is the typical temperature range found in humans. The normal human body temperature range is typically stated as 36.5–37.5 °C (97.7–99.5 °F).

Human body temperature varies. It depends on sex, age, time of day, exertion level, health status (such as illness and menstruation), what part of the body the measurement is taken at, state of consciousness (waking, sleeping, sedated), and emotions. Body temperature is kept in normal range by thermoregulation, in which adjustment of temperature is triggered by the central nervous system.

6.2 Methods of measurement

Taking a person's temperature is an initial part of a full clinical examination. There are various types of medical thermometers, as well as sites used for measurement, including:

- In the rectum (rectal temperature)
- In the mouth (oral temperature)
- Under the arm (axillary temperature)
- In the ear (tympanic temperature)
- On the skin of the forehead over the temporal artery

6. INTRODUCTION



6.3 Core body temperature

Core body temperature, also called core body temperature, is the operating temperature of an organism, specifically in deep structures of the body such as the liver, in comparison to temperatures of peripheral tissues. Core temperature is normally maintained within a narrow range so that essential enzymatic reactions can occur. Significant core temperature elevation (hyperthermia) or depression (hypothermia) over more than a brief period of time is incompatible with human life.

6.4 Skin surface temperature

Skin surface temperature is the temperature of the outermost surface of the body. Normal human skin temperature on the trunk of the body varies between 33.5 and 36.9 °C (92.3 and 98.4 °F), though the skin's temperature is lower over protruding parts, like the nose, and higher over muscles and active organs.[1] Recording skin temperature presents extensive difficulties. Although it is not a clear indicator of internal body temperature, skin temperature is significant in assessing the healthy function of skin.

6.4.1 Factors influencing skin temperature

Skin is the largest of the human body's organs, making up approximately 15-16% of total adult body weight. The surface of the organ exhibits significant regional temperature variation and often survives thermal extremities that would prove damaging to internal organs.

Surface skin temperature in humans varies alongside ambient temperature, internal temperature and conditions affecting both the skin and underlying structures. Consequently, a uniform temperature is not typically maintained by skin as a whole, as demonstrated by inconsistencies between different regions of the body even in spite of measurements taken under various external conditions. Lower temperatures are characteristically observed in proximity to superficial veins, relative to superficial arteries, and over protruding body parts including the toes, fingers, ears and nose. Meanwhile, skin surface temperature has been observed to be higher over active organs rather than those at rest, as well as over muscles rather than tendons or bones.

Other notable influences on skin surface temperature include instances of heat stress (in which significant portions of cardiac output are directed to the skin), lowered skinfold thickness (contributes to significantly greater surface temperature variation during exercise) and local thermal control of cutaneous blood vessels (local heating may prompt vasodilation whilst local cooling decreases blood flow to the skin).

6.5 Normal Core Body Temperature Ranges

Normal body temperature in a healthy person is a range that fluctuates throughout the day. Body temperature can vary as much as 1.0° to 2.0°F (0.5°C to 1.0°C) and is lowest in the morning (2-4 AM) while resting and is warmest in the afternoon (4-6 PM) while active. Up to 5% of the population has a body temperature that falls outside of the normal range. Body temperature variation is the result of an individual's metabolic rate. Slower equals cooler and faster means higher normal body temperature. Metabolic rate is determined by factors such as genetic makeup, lifestyle, age, and environment.

Body temperature is regulated by the hypothalamus that continuously adjusts temperature to stay within a set range of normal in the absence of illness. Fever is defined as a temperature above an individual’s normal range.

Fever occurs from an infection or inflammation or can also be caused by noninfectious illnesses such as stroke, blood clots, or gout attacks. Different sites equal different temperatures:

- Rectal temperature is typically higher than Core
- Core is typically higher than Oral
- Oral is typically higher than Axillary

°C	0 - 2 years	3 - 10 years	11 - 65 years	> 65 years
Oral	—	35.5 37.5	36.4 37.6	35.8 36.9
Rectal	36.6 38	36.6 38	37 38.1	36.2 37.3
Axillary	34.7 37.2	35.9 36.7	35.2 36.9	35.6 36.3
Ear	36.4 38	36.1 37.8	35.9 37.6	35.8 37.5
Core	36.4 37.8	36.4 37.8	36.8 37.9	35.9 37.1

°F	0 - 2 years	3 - 10 years	11 - 65 years	> 65 years
Oral	—	95.9 99.5	97.6 99.6	96.4 98.5
Rectal	97.9 100.4	97.9 100.4	98.6 100.6	97.1 99.2
Axillary	94.5 99.1	96.6 98.0	95.3 98.4	96.0 97.4
Ear	97.5 100.4	97.0 100.0	96.6 99.7	96.4 99.5
Core	97.5 100.0	97.5 100.0	98.2 100.2	96.6 98.8

Figure 6.1 – Normal body temperature is a range. This table shows that normal temperatures vary by site. Therefore, readings from different sites, even if taken at the same time, should not be directly compared.

6.6 CBT vs SST measurement mode of the MEDICAS

MEDICAS Thermal camera contains two modes, SST and CBT measuring mode.

SST or Skin Surface Temperature is the temperature measured on the surface of the human body.

CBT or Core Body Temperature is a mode of the camera that estimates the core temperature of the measured human body. The camera computes internally the CBT based on the non-linear estimation that originated from the statistical average of multiple measurements.

6. INTRODUCTION



6.7 Hypothermia

DEFINITION OF HYPOTHERMIA Hypothermia refers to the cooling of the body beyond the normal temperature range. In practice, a limit of 36°C is normally accepted. Below this value, organ function begins to deteriorate.

Temperatures between 36°C to around 33°C are considered mildly hypothermic. The body reacts with thermoregulatory mechanisms such as shivering and vasoconstriction. In addition, symptoms such as increased heart rate (tachycardia), increased respiratory rate (tachypnoea), coordination disturbances (ataxia), apathy, and a reduction in circulating blood volume (hypovolaemia) appear. Moderate hypothermia, or temperatures between 32 and 28°C, cause respiratory depression (hypoventilation) slow pulse (bradycardia), decreased blood pressure (hypotension), reflex suppression (hyporeflexia), enlarged pupils and an ever-increasing loss of consciousness. Shivering ceases. At even lower temperatures (severe hypothermia) the human organism reacts with circulatory and respiratory collapse.

6.8 Fever or hyperthermia

The terms fever and hyperthermia both describe a state in which core body temperature is increased above normal limits. While fever is considered to be a regulated physiological reaction, hyperthermia occurs when the body's thermoregulatory mechanisms are pushed beyond their limits. Depending on the definition, temperatures higher than 37.5°C are considered to be higher than normal.

Fever is a reaction of the human organism to both infectious and non-infectious challenges. In intensive care patients, infections are the most common cause of fever. These are usually in the form of pneumonia and sepsis. Aside from infections, non-infectious, inflammatory reactions can also lead to fever. These can be brought about by myocardial infarction, pulmonary embolism and tumours. It is rare that non-infectious reactions are sufficient to increase temperatures above 38.9°C. Exceptions include patients with fever reactions to pharmaceuticals of blood transfusions. Cerebral damage can cause fever of up to 40°C. Structured differential diagnostics are necessary in order to avoid inappropriate pharmaceutical therapy.

6.8.1 The consequences of fever

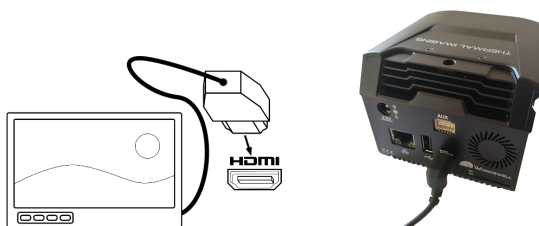
Fever is a core function within the unspecific immune response. An increase in temperature activates T-lymphocytes, neutrophils and macrophages and stimulates the production of antibodies and cytokines, thereby modulating the immune system. Simultaneously, the growth of many microbial pathogens which thrive at normal temperatures is inhibited. Very high temperatures, above 41°C, can lead to the derangement of the coagulation system and disturb enzyme function. Hallucinations and confusion can also occur. In addition, hyperthermia causes an increase in cardiac output, increasing oxygen consumption and fluid losses.

7 System Installation

7.1 General Installation Requirements and Procedure

Follow these steps to prepare the system:

1) Connect the system to a HDMI display using HDMI micro cable (included).



2) Connect USB keyboard receiver to the system.



3) Connect the power supply to the camera using power supply adapter 24 VDC, 1 A (included).



4) Connect the power supply to the black body using power supply adapter 24 VDC, 1 A (included). Make sure the black body is always set to 40°C.



7. SYSTEM INSTALLATION



5) Follow the schema bellow for the best measurement results. Make sure the black body and the camera are in a stable environment with surrounding room temperatures between 15°C to 35°C. There can be no air circulation in the near vicinity of the black body to ensure the homogeneity of the black body heated surface.

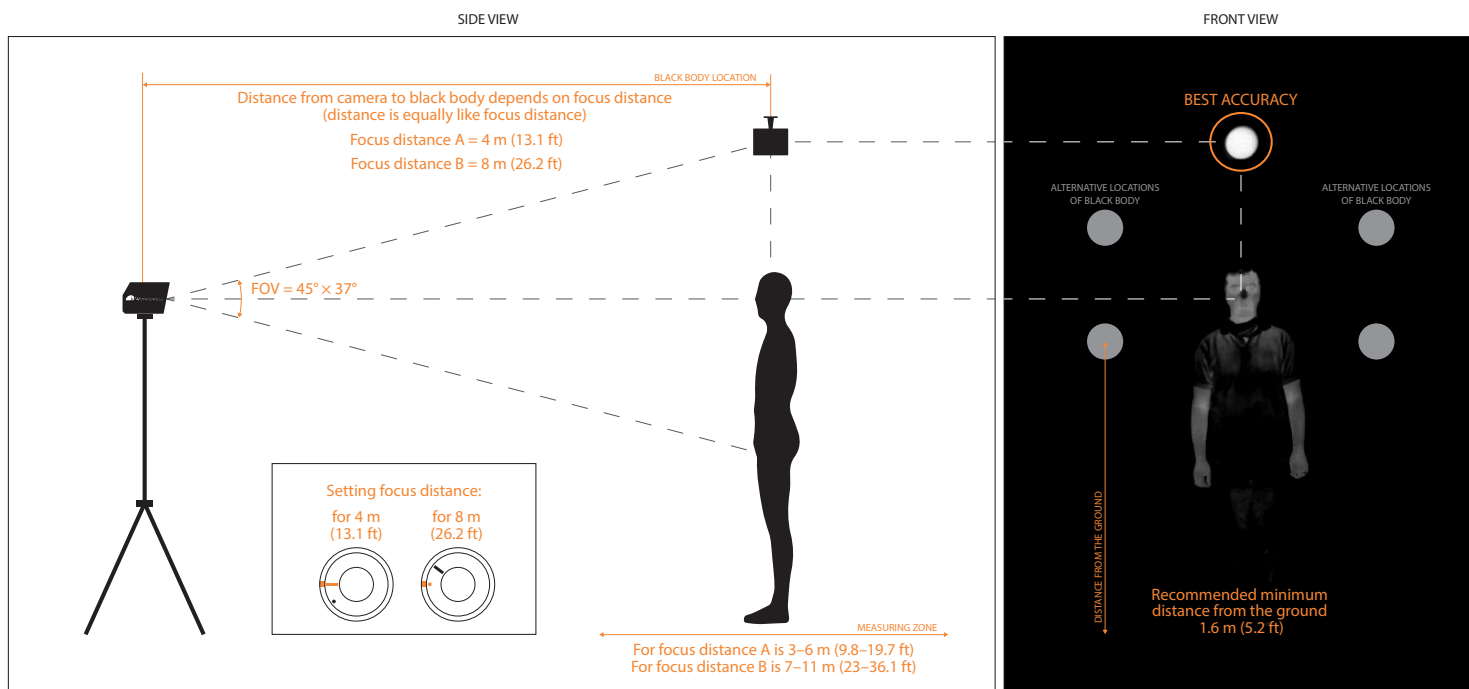


Figure 7.3 – Workswell MEDICAS measurement scheme.

7.2 Power Supply

The Workswell MEDICAS system can be powered through a +9 to +36 VDC connector on the back panel. The back panel DC connector is compatible with a 5.5 mm/OD (outer diameter) and 2.5 mm/ID (inner diameter) plug, where the inner contact is +9 to +36 VDC and the shell is GND.

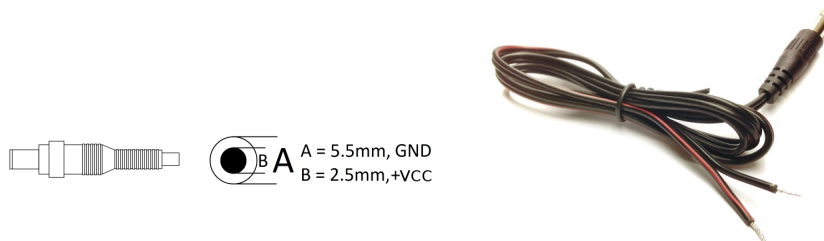


Figure 7.4 – Inner power pinout, form of the common cable.

The standard package contains appropriate adapter to power up the MEDICAS (24 VDC, 1 A).

Warning: Failure to follow these instructions could damage the system

7.3 Turning the System OFF

To turn the system off, simply unplug the power supply.

7. SYSTEM INSTALLATION



7.4 Mounting the MEDICAS

The Workswell MEDICAS system can be mounted on a tripod.

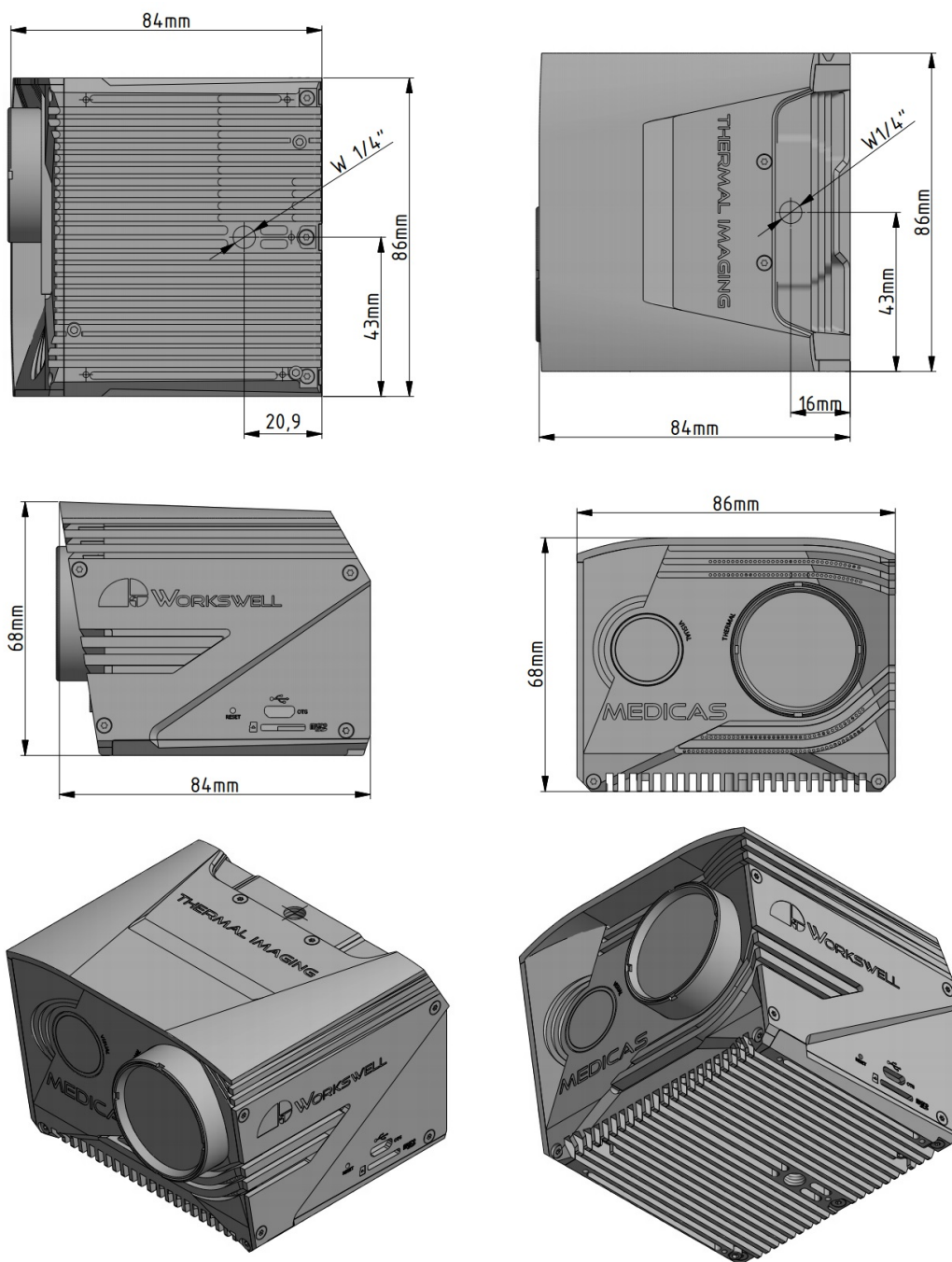


Figure 7.5 – Scheme of the MEDICAS.

8 Focusing the Infrared Camera

The infrared camera has adjustable focus. The focus can be set using the focus tool (included).

Warning: The MEDICAS camera is focused to 4 m (13.1 ft) during manufacturing. This means you should place the black body to the same distance (4 m or 13.1 ft) and measure the temperature at the range 3-6 m (9.8-19.7 ft). You can also refocus the camera to 8 m (26.2 ft) using the focusing tool (included). There is a 4 m (13.1 ft) focusing mark "COMMA" and a 8 m (26.2 ft) focusing mark "DOT" painted on the side of the objective. When you focus the camera to the 8 m (26.2 ft) mark, you should also place the Black Body to this distance (8 m or 26.2 ft). Best measurement results are then achieved at distance range 7-11 m (23-36.1 ft) from the camera. Considering the delicate nature of the optics **it is better to not change the focus of the camera too often. Be very careful while removing the protective glass and adjusting the focus of the lens.**

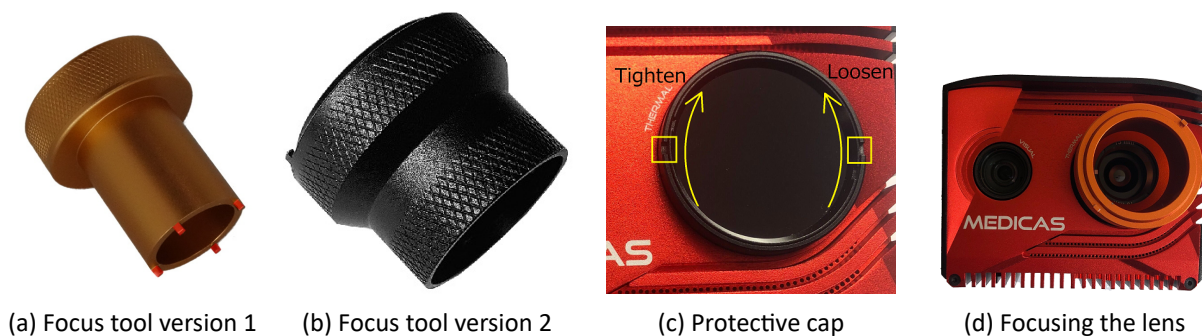


Figure 8.1 – Remove the protective cap with focus tool (wider side). Focus the lens with the focus tool (narrower side) to short distance by rotating the lens counter-clockwise. To focus to the long distance, rotate the lens clockwise

When focused to the 8 m (26.2 ft) distance marked by the DOT, in order to focus to the 4 m (13.1 ft) distance gently rotate the lens counter-clockwise until you reach the COMMA mark. Only very short movement is needed.

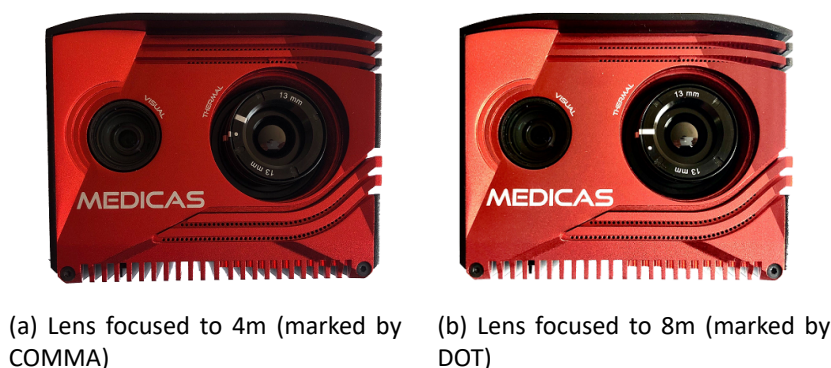


Figure 8.2 – Detail of the camera focused to different distances and markings on the side of the lens.

8. FOCUSING THE INFRARED CAMERA



During counterclockwise movement, the lens extends from the camera body.

Warning: Trying to rotate the lens too much counterclockwise may cause the lens to fall out.

When focused to the 4 m (13.1 ft) distance marked by the COMMA, in order to focus to the 8 m (26.2 ft) distance gently rotate the lens clockwise, until you reach the mark DOT. Only very short movement is needed. During this movement, the lens retracts to the camera body. Rotating the lens too far in this direction can adjust beyond the intended focus range.

9 External Black Body

In order to measure the temperatures correctly, the camera needs to perform temperature calibration every few seconds. To do so, it needs to have a black body of a known temperature (included) in its field of view in the correct distance and have correctly set the BLACK BODY ROI (region of interest).

The distance the blackbody needs to be placed is corresponding to the focused distance of the camera lens - either 4m from the camera if focused to the 4m mark or 8m from the camera if focused to the 8m mark. The black body needs to be facing the camera directly and it is suggested to place the black body to a place, where it won't be covered by environment or passing people in any time during the measurement. The recommended position of the black body is in the upper left or right corner of the thermal image.

After you power up the black body, you will see red LED light blinking. This is an indication that the black body is heating up to the calibrated temperature 40C. Once the calibrated temperature is achieved, the LED turns to the constant green color. When the black body is cooling down, the LED is blinking blue.

After the black body is sufficiently heated up and the LED is colored green, you need to set the ROI (region of interest) of the black body. To set the ROI of the black body, turn on the camera and go to the MENU -> FUNCTIONS -> SET BLACK BODY ROI. After you select this option with ENTER key, the menu will close. You can then use arrow controls (UP, DOWN, LEFT, RIGHT) or number controls (8, 2, 4, 6) to move the position of the Black Body. The Black Body ROI should be positioned in the center of the Black Body as seen in the Thermal view. After you are done placing the ROI press ENTER key to save the position or BACKSPACE key to cancel the position placing.

The camera assumes, that the black body remains on the set position, and remembers this position after reboot. If the position of the black body changes, you need to initialize the black body ROI again. If the measured temperature in the ROI changes quickly by a higher step than ACCEPTANCE SPAN, the camera detects it as passing object and refuses new value. This is indicated by showing either "Black body warning" or "Black body error" in the INFORMATIONAL PANEL.

9.1 Camera Calibration

The Workswell MEDICAS is shipped with calibrational black body. It should always be used only with correctly calibrated black body. The MEDICAS performs offset calibration of measured temperatures based on the measured temperature value of the black body. This calibration is performed automatically every 2 seconds. If the difference between measured and expected temperature of the black body is greater than the set threshold (ACCEPTION SPAN), the camera assumes that the view of the black body is blocked and does not calibrate. When this happens, Black body warning is displayed in INFORMATION PANEL. If the assumed view is not restored in 5seconds, Black body error is displayed. If the user is sure that the black body works properly and is visible for the camera and still the Black body error is displayed, or if the measurement have obviously some offset, FORCE CALIBRATION is required. That can be achieved by pressing MENU -> FUNCTIONS -> FORCE CALIBRATION.

In order for calibration to work properly, it is necessary to set the position of Black Body ROI.

Note: The ACCEPTION SPAN can be set between 1°C and 2.9°C or OFF. Recommended set value is 2°C.

9. EXTERNAL BLACK BODY



Note: If calibration is rejected, the camera will warn user by displaying BLACK BODY WARNING and try to calculate new calibration every second. If even after ten seconds the calibration value is still not acceptable, the camera will display BLACK BODY ERROR. This means that the accuracy of measurement can not be guaranteed in any way. When sure that the black body is visible and working properly use FORCE CALIBRATION to recalibrate the camera manually.

Note: For maximal accuracy to be maintained, it's recommended for the device to be sent to the manufacturer for a calibration once a year, otherwise the stated accuracy cannot be guaranteed.

Warning: as with all measurement devices, the volatility of the device's storage environment in terms of temperature swings, light radiation, electromagnetic interference and vibrations can have detrimental effects on quality of the device's calibration and its longevity. Attempt to store the device with as few disturbances of any sort as possible for maintaining maximal accuracy.

Make sure the black body and the camera are in a stable environment with surrounding room temperatures between 15°C to 35°C. There can be no air circulation in the near vicinity of the black body to ensure the homogeneity of the black body heated surface.

9.2 Mounting the Black Body

The Black Body can also be mounted on tripod. Please follow the figure below for more instructions.

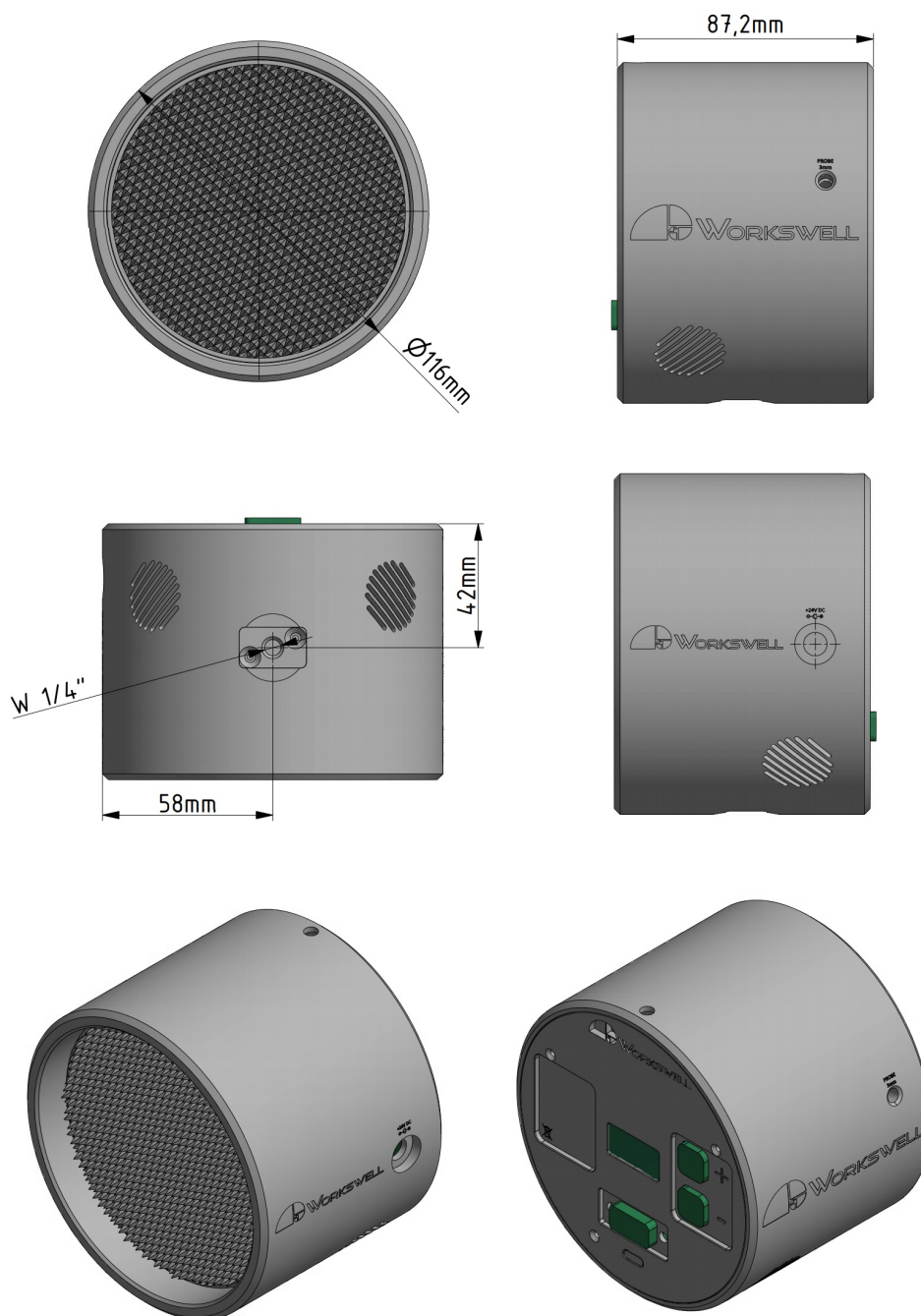


Figure 9.1 – Scheme of the Black Body.

10 System Interface

10.1 HDMI Micro Video Output

The Workswell MEDICAS is equipped with a standard HDMI micro video output. It can be connected to any display with HDMI input that supports MEDICAS resolution.

The default MEDICAS resolution is 1280x720 (also called HD or 720p). It is required to use a display with 16:9 aspect ratio.

10.2 USB Keyboard

The Workswell MEDICAS can be controlled via USB numeric keyboard. You can connect the keyboard receiver either directly to the full sized USB port on the rear of the camera or to a USB Hub connected to this USB port. Once the keyboard is connected, it can be used for navigation in system menu, changing camera configuration or setting numerical values.



Figure 10.1 – Connection of the USB keyboard.

Warning: Do NOT connect MEDICAS to any other powered device (such as PC) through the full size USB port on the rear of the camera. As the rear USB port is powered, connection to another powered USB port can lead to permanent damage to either device. Only unpowered devices (USB Keyboards and USB Flash Storage drives) are to be connected into the rear USB A port of MEDICAS.

The following table shows the behavior of connected keyboard

Key	Function
Up / 8	Up
Down / 2	Down
Left / 4	Left
Right / 6	Right
Enter	OK/Menu
Backspace	Cancel

10.3 USB On-The-Go

The Workswell MEDICAS internal SSD memory can be accessed directly using an USB On-The-Go connection between any system capable of correctly accessing the standard USB mass storage such as a PC with MS Windows or GNU/Linux.

To connect to the internal memory, use a standard USB Micro B connector cable and plug it into the connector in the side of MEDICAS.

If communication is successfully established, most modern operating systems will automatically report presence of a mass storage device and allow access to the data.



Figure 10.2 – Connecting WIRIS Pro using USB On-The-Go

Warning: Do NOT connect MEDICAS to any other powered device (such as PC) through the full size USB port on the rear of the camera - only the side Micro USB port can be used for mass storage access. As the rear USB port is powered, connection to another powered USB port can lead to permanent damage to either device.

10.4 SD Card

The Workswell MEDICAS can be optionally fitted with a MicroSD memory card as a storage medium. Most generic MicroSD cards should be compatible. Video recordings cannot be saved directly to the MicroSD card and have to be recorded only to internal storage (but can be moved over to the MicroSD off-line within the device itself).

10. SYSTEM INTERFACE



To install the MicroSD card simply insert it into the MicroSD slot on left side of the device. Be mindful of the SDCard orientation; contacts should be facing upwards.



Figure 10.3 – MicroSD memory card insertion.

The MicroSD card should be recognized by the device even if inserted with the system already running. The MicroSD card should only be removed with the device either unpowered, or after the SD card is manually unmounted in the Memory menu.

11 First start

The Workswell MEDICAS system will automatically start within seconds of the power supply being provided. Once the system loads for the first time, the following screen appears.

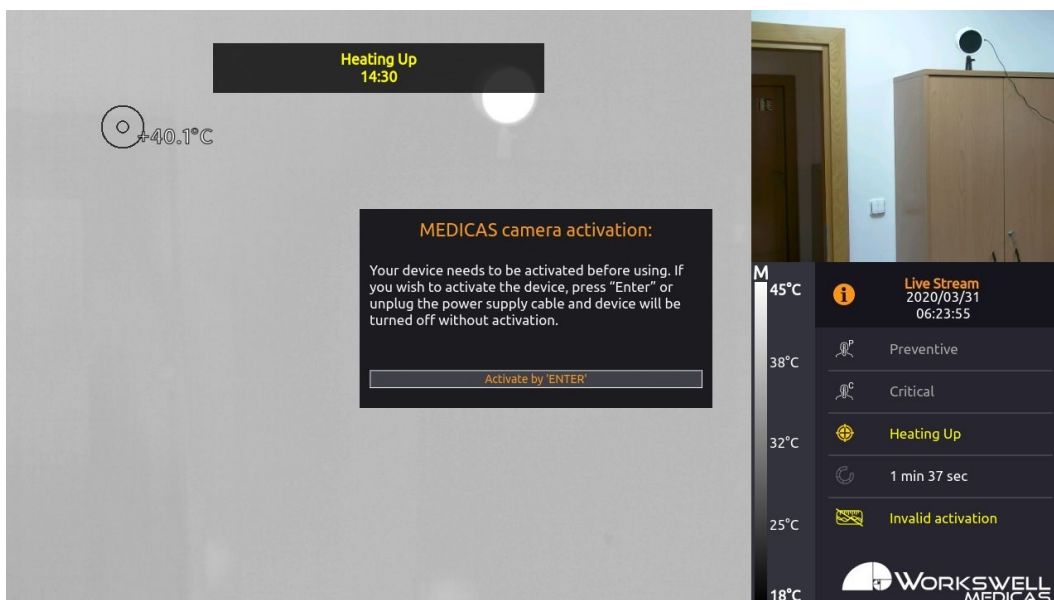


Figure 11.1 – Camera activation screen.

After the first start and before being able to operate the camera, the camera needs to be activated. To activate the camera, simply follow the steps on the screen after the first start. This screen will not show up again after activation, even after factory default.

The warranty of the camera is calculated from the date of the activation of the camera. This means that the camera can be safely stored and not used before activation without losing warranty due to warranty expiration.

12 System Appearance

The Workswell MEDICAS system will automatically start within seconds of the power supply being provided. Once the system loads the following screen appears.



Figure 12.1 – Main screen.

This screen consists of the following parts

- PRIMARY CAMERA SCREEN - live stream from the camera currently selected as primary
- SECONDARY CAMERA SCREEN - live stream from the other camera
- PALETTE PANEL - show how current thermal color palette translates to temperatures
- ALARM PANEL - show the alarm status and black body status



Figure 12.2 – Primary camera screen.

PRIMARY CAMERA SCREEN shows live stream from the selected camera (infrared or visible spectrum). It is possible to switch between infrared and visible spectrum camera and set either one as primary camera.



Figure 12.3 – Secondary camera screen.

SECONDARY CAMERA SCREEN is additional live stream camera screen. It shows live stream from the camera that is not set as the primary (shown in PRIMARY CAMERA SCREEN). The max and center crosses are not shown in SECONDARY CAMERA SCREEN either.

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Figure 12.4 – Alarm panel

ALARM PANEL shows the status of alarms - if alarm is off, grey text is displayed. If the alarm is on but not triggered white text and the temperature threshold is shown. If the alarm is triggered, the text will be flashing with the color of the alarm. It also show the status of Black Body - OK/WARNING/ERROR. Warning is shown when the camera refuses calibration based on ACCEPTION SPAN (see chapter 14.6) for short time. If calibration is refused for longer period of time, error is shown. This might be caused for example by something covering the black body in the environment.



Figure 12.5 – Palette panel

PALETTE PANEL shows how thermal temperatures are displayed color-wise on the thermal stream. The alarms are painted on the color palette starting at the preset temperature threshold. If the alarm is triggered, pixels in

the thermal stream that reach this alarm temperature will be painted by this color. There are 2 possible alarm types, preventive and critical, thus setting up 2 different colors is possible to display the alarms.

13 Users and logging in

Workswell MEDICAS contains user accounts with different rights and permissions to control the camera. After every start of the camera the "Default User" is automatically logged in. The Default User does not have any permission to access submenu settings and different user needs to log in.

13.1 Types of user accounts

There are 2 different user account types in the MEDICAS camera.

- Admin - has full permission to the camera and can access every setting of the camera. Admin can also give permission to other users and set their passwords. Please see chapter 14.7.1 for more information about user settings.
- User - needs to have permission to access different submenus of the camera.

13.2 Logging in

To log in the camera, navigate to the Menu -> Advanced -> User -> Login. A new window will appear in the middle of the screen with user selection. Using arrow keys on the keyboard, navigate to the desired user and confirm the selection with enter key. You will be then prompted to enter the password for selected user. Finally after entering the correct password, you will be logged in as the previously selected user. Admin can change password to each user, but the Admin password can not be changed. You should receive the Admin password on a special card with your camera. If you forgot you password and lost your Admin password card, please contact the Workswell support to receive the password again. You will be required to to send the serial number of your camera.

13.3 Logging out

To log out of the currently logged in user account, please navigate to the Menu -> Advanced -> User -> Logout and confirm the selection with the Enter key.

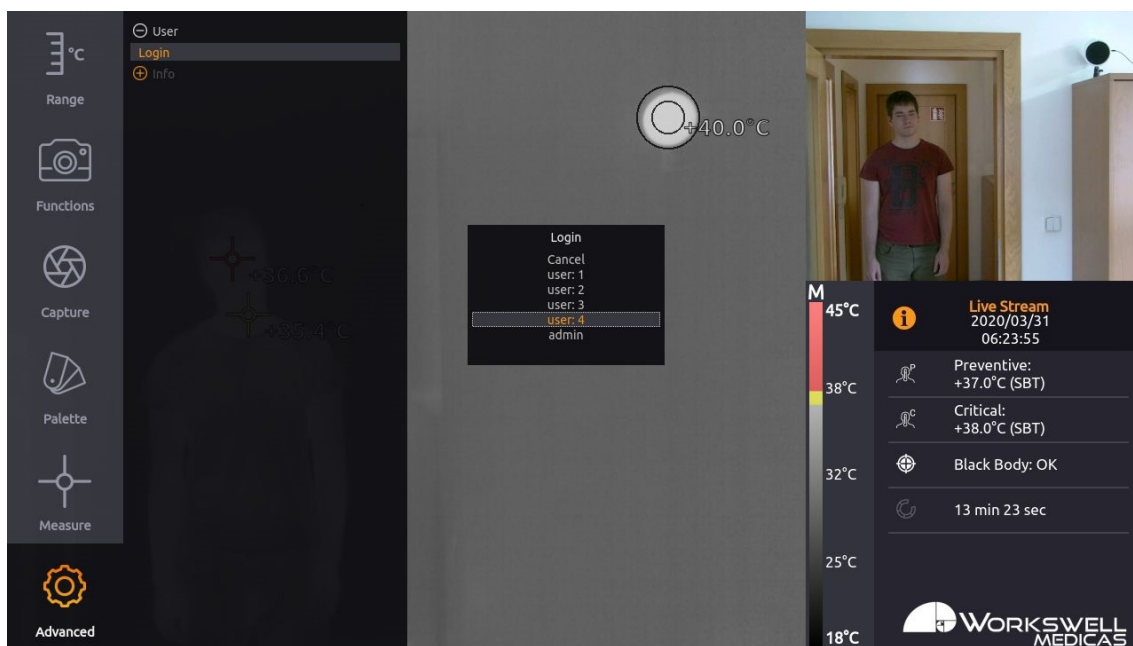


Figure 13.1 – Logging in - Selection of the user.

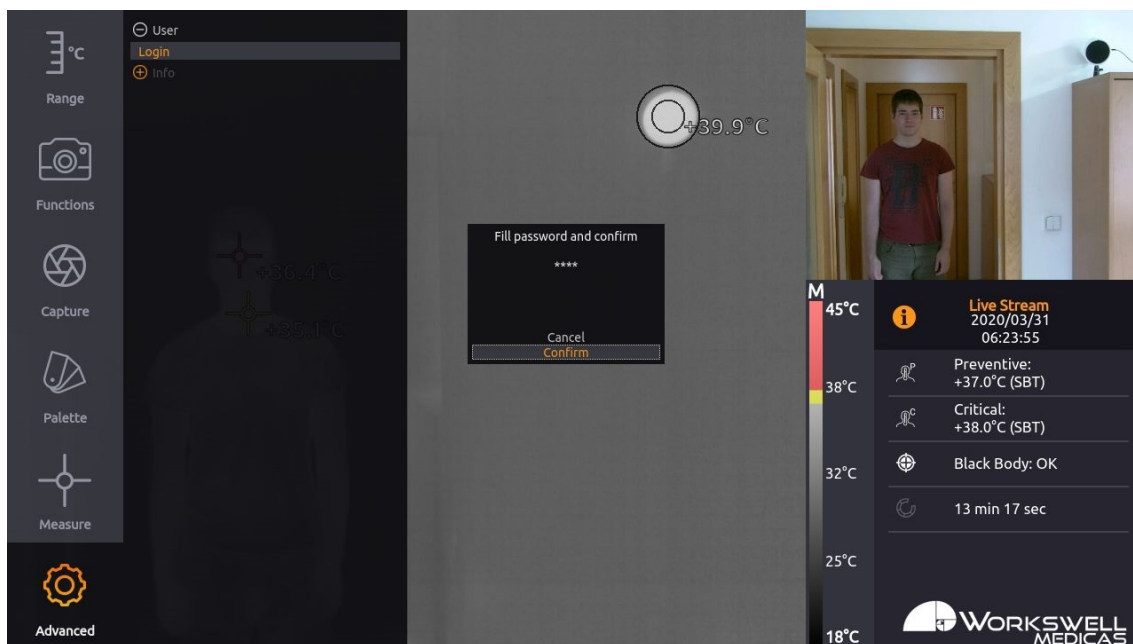


Figure 13.2 – Logging in - Password window for selected user.

14 Main Menu (Settings)

14.1 General Description

The Workswell MEDICAS system offers many customization options. All the configuration can be done using the MAIN MENU. It can be opened by pressing ENTER button or RIGHT ARROW button. The MAIN MENU will appear on the left side of the PRIMARY CAMERA SCREEN.



Figure 14.1 – Main menu.

The MAIN MENU is divided into 6 categories:

- RANGE - Settings for the temperature range.
- FUNCTIONS - Primary camera screen selection and black body settings.
- PALETTE - Choice from different color palette options.
- CAPTURE - Immediate capture or recording of the picture.
- MEASURE - Option to toggle the temperature extreme marking crosses on and off and to activate the temperature threshold based alarm display.
- ADVANCED - Visible stream camera settings, Image saving settings, Alarm settings, Memory settings, System settings and Info

Each submenu can be accessed only with the correct user rights given to each user by the Admin. For more information, please read the chapter 13

14.2 Range

RANGE submenu allows user to set the upper and lower temperature limit for the infrared camera. The colors of the selected color palette are distributed lineary between MAX and MIN values. Any area with measured temperatures out of these limits will be displayd with the max (or min) color of current palette, or with the color of alarm if the alarm is set and the area met the conditions.

RANGE menu consist of following items:

- MAX - Manual temperature range maximum. Has to be at least 10°C above MIN. Maximal value of MAX can be 50°C.
- MIN - Manual temperature range minimum. Has to be at least 10°C below MAX. Minimal value of MIN can be 0°C.



Figure 14.2 – Range settings

Changes are previewed in real time and can be confirmed to be kept by pressing ENTER key or canceled by pressing BACKSPACE key, in which case the last value set is maintained.

14.3 Functions

FUNCTIONS submenu allows you to manually set which camera is the primary and adjust settings for the black body calibration.

- MAIN CAMERA - toggle which camera (thermal or visible) is displayed as the primary (main) screen and which is in the secondary (preview) screen.
- FORCE CALIBRATION - recalibrate the measured temperature. The calibration is based on the temperature measured inside of the BLACK BODY ROI. The position of the BLACK BODY ROI must be set correctly in the thermal picture.

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- BLACK BODY DETECTION - Medicas is designed to automatically compensate small inaccuracies in the measured temperature by re-calibrating periodically against the BLACKBODY. When the Black Body temperature changes rapidly, the temperature is refused and the Black Body is considered obscured. The BLACK BODY DETECTION configures, how sensitive is the refusal of the rapidly changed Black Body temperature. There are 3 options: STANDARD, SENSITIVE and OFF. When the option OFF is selected, the camera will not check for the rapid changes of the Black Body temperature and will always re-calibrate against the Black Body.
- SET BLACK BODY ROI - closes the menu and allows moving and setting the Black Body ROI using arrow keys (UP, DOWN, LEFT, RIGHT) or numeric keys (8, 2, 4, 6) on the numeric keyboard. The position of the BLACK BODY ROI should be within the black body on the scene. To confirm the position, press ENTER key. To cancel the position setting, press BACKSPACE key. After the position setting is complete, the menu will automatically reappear.
- SET BLACK BODY RADIUS - sets the radius of the black body ROI on the picture. There are 4 size options (3px, 5px, 8px, 13px). It is necessary, that the black body ROI is within the black body on the scene. The temperature of the black body is measured within this ROI.
- SET BLACK BODY MASK SIZE - sets the size of the black body mask on the picture. The mask is always around the black body ROI. The temperature of the black body is measured only inside of the black body ROI and not measured in the mask area. The mask should cover the area around the black body in the scene.

Warning: To ensure proper function of the MEDICAS, the black body ROI must be placed over the black body radiation source in the thermal image. To do so, select SET BLACK BODY ROI and then use keyboard arrows or numeric control to set the ROI square over the black body. Confirm new position by pressing Enter, or return to previously set position by pressing BACKSPACE. Make sure to set correct black body size and the mask size.

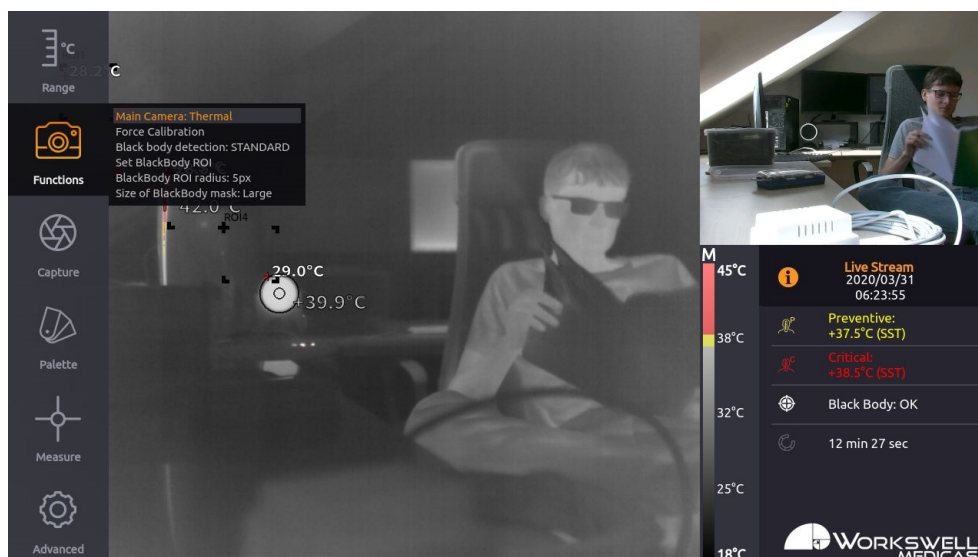


Figure 14.3 – Functions settings

14.4 Capture

CAPTURE submenu allows user to manually capture images, record video.

CAPTURE menu consists of following items:

- CAPTURE - Captures single image.
- RECORD - Starts and stops recording of encoded video.



Figure 14.4 – Capture options.

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14.5 Palette

PALETTE category includes set of different color palettes that can be applied on the infrared image. For the reason of increasing the visibility of the alarm in the picture, it is not recommended to mix color palettes with similar alarm colors.



Figure 14.5 – Palette settings.

14.6 Measure

MEASURE submenu allows user to toggle the highlighting crosses (CENTER and MAX), and toggle visualization of the black body ROI (region of interest). Additionally, the MEASURE submenu allows turning on the ALARM visualisation, as well as setting of two alarm thresholds (preventive and critical).

MEASURE menu consists of following items:

- ALARM - changes the alarm evaluation in the scene. There are 3 options:
 - GLOBAL - the alarms will be evaluated in the whole scene
 - ONLY IN ROIS - the alarms will be evaluated only inside of the shown ROIS in the scene
 - OFF - the alarm evaluation is turned off
- PREVENTIVE ALARM - sets the lower temperature threshold considered in the PREVENTIVE ALARM visualization
- CRITICAL ALARM - sets the higher temperature threshold considered in the CRITICAL ALARM visualization
- SHOW CROSS MAX - toggles appearance of the highlight cross which always positions itself on the maximal temperature measured within the view
- SHOW BLACK BODY ROI - toggles appearance of the Black Body ROI, that is positioned based on SET BLACK BODY ROI option.
- SHOW USER CROSS - toggles appearance of the USER CROSS, that is positioned based on SET USER CROSS option in the Advanced -> ROI -> Set user cross position. This cross allows the user to monitor desired point in the scene.
- SHOW ROI 1-4 - Set the appearance of the ROI 1-4 in the scene. ROI is an area in the scene, that can be set by the user. If the The position of these ROIs can be set through Advanced -> ROI -> Set user ROI position. Each ROI can be also named through Advanced -> ROI -> Set ROI names. There are 3 possible options of the ROI appearance in the scene:
 - ALL - all outlines of the ROI are visible
 - CORNERS - only the corners of the ROI shape are visible
 - NOTHING - the ROI is not visible. If the option NOTHING is selected, the alarms are not evaluated in this ROI.
- MEASUREMENT MODE - Changes the measurement mode. There are 4 possible measurement modes:
 - Skin Surface Temperature (SST) - measures the temperature measured on the surface of the human body. The camera needs to be focused to 3-6m mark when performing the SST measurement.
 - Core Body Temperature (CBT) - a mode of the camera that estimates the core temperature of the measured human body. The camera computes internally the CBT based on the non-linear estimation that originated from the statistical average of multiple measurements. Please read the chapter 6.3 and 6.4 for better understanding CBT and SST. The camera needs to be focused to 3-6m mark when performing the CBT measurement.
 - Axillary Temperature (AXI) - a mode of the camera that estimates the axillary temperature of the measured human body. The camera computes internally the AXI based on the non-linear estimation that originated from the statistical average of multiple measurements. The camera needs to be

14. MAIN MENU (SETTINGS)



focused to 3-6m mark when performing the AXI measurement.

- Eye Surface Temperature (EST) - a mode of the camera that estimates the eye surface temperature of the measured human eye. The camera computes internally the EST based on the non-linear estimation that originated from the statistical average of multiple measurements. The camera needs to be focused to 0.8m mark when performing the EST measurement.

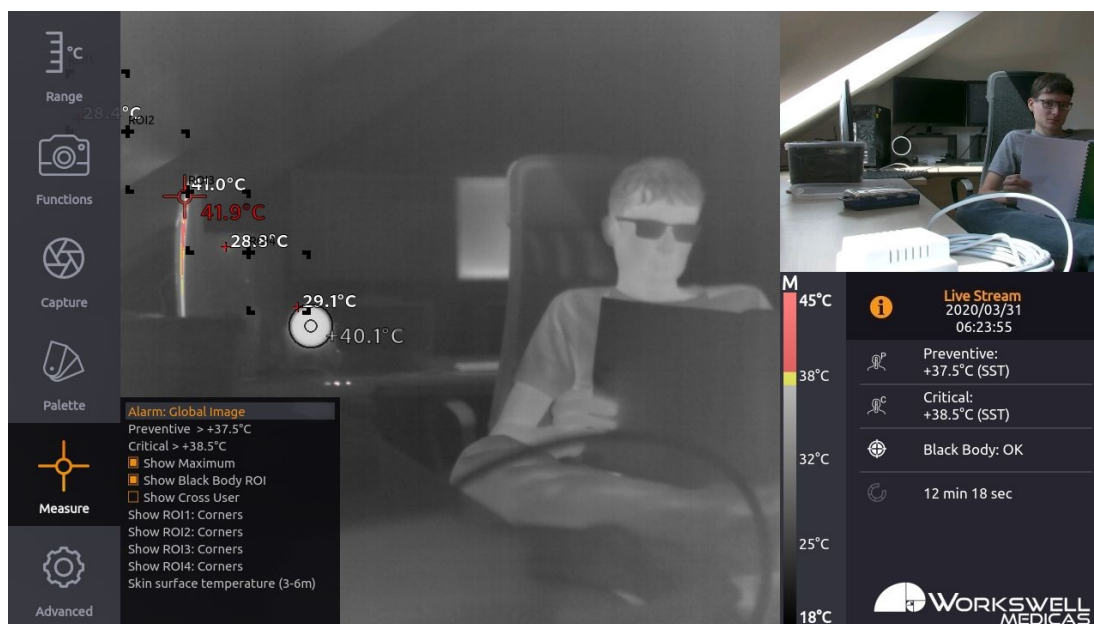


Figure 14.6 – Measure options.

14.7 Advanced

ADVANCED category allows user to set advanced behavior of the device. It is divided into six more categories – VISIBLE CAMERA, IMAGES & VIDEO, ALARMS, MEMORY, SYSTEM and INFO.

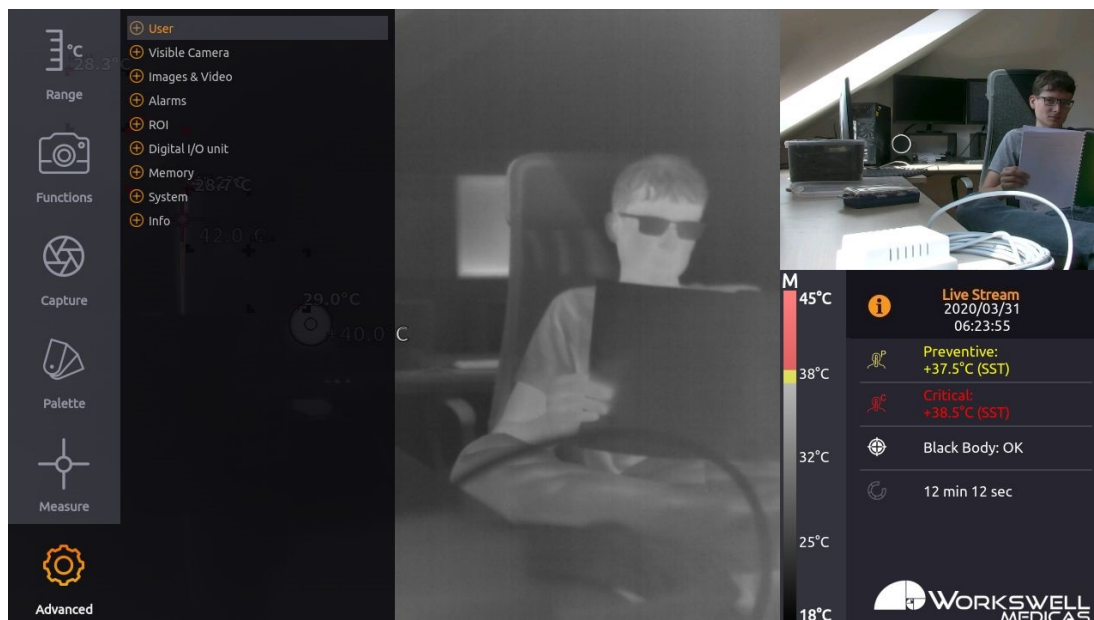


Figure 14.7 – Advanced settings.

ADVANCED MENU consists of the following categories:

- USER - Login, Logout, set user password, set user rights
- VISIBLE CAMERA - Gamma, White Balance, Wide dynamic range mode, Backlight Compensation, Noise Reduction (2D), Noise Reduction (3D), Color Gain, Exposure Mode, Shutter, Iris, Gain, Exposure Compensation and reset to Default settings
- IMAGES & VIDEO - Toggles for capture file types, Image Save to, Video IR encoded, Video Visible
- ALARMS - Critical alarm color, Preventive alarm color, Alarm Opacity
- MEMORY - Set SSD, Set SD Card, Set Flash Drive, Copy Logs
- SYSTEM - Current Time, Current Date, Units, Update, Language, Reboot System, Set Default Settings
- INFO - Product name, Firmware version, Serial Number, Article Number, Workswell address, CPU and IR Core Temperatures

Note: The Advanced menu cannot be accessed while Video or Image Series capture is underway. The user will be notified of this and prompted to stop the capture or recording before accessing the Advanced menu.

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14.7.1 User

USER submenu allows the user to Log in or Log out. It also allows the admin user to give rights and permissions for other users to access other parts of the menu. Admin user can also change password of other users.

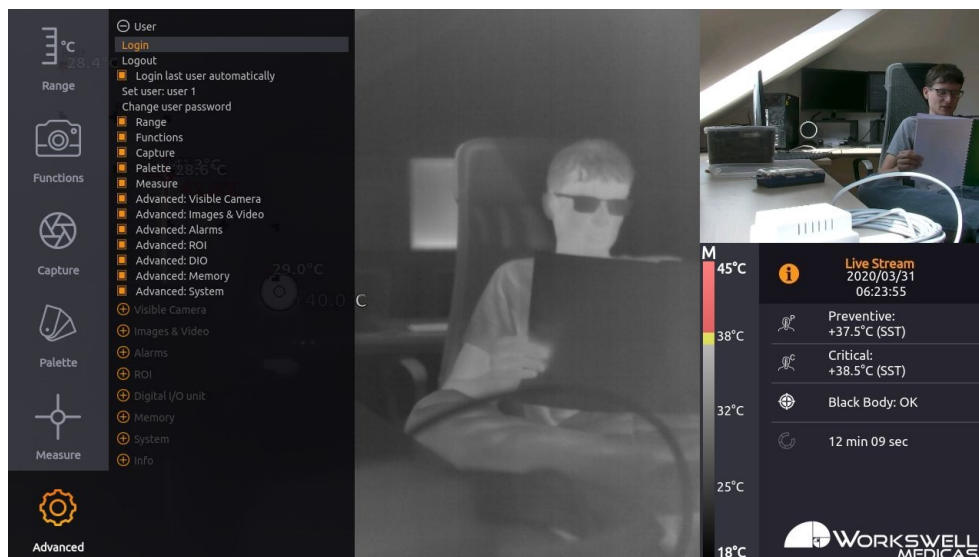


Figure 14.8 – User submenu.

USER submenu consists of the following items:

- LOGIN - Lets the user to log in. After clicking the login option, new window with user selection appears. After selecting the user using arrow keys, confirm the selection with the enter key and type the correct password for the user.
- LOGOUT - Logs out currently logged user.
- LOGIN LAST USER AUTOMATICALLY - Toggle the option to log in the previously logged user after the camera is rebooted. If this option is toggled OFF, the Default user is logged after the camera reboots.
- SET USER - Selects the user (User 1, User 2, User 3 or User 4) to configure permissions for that user.
- CHANGE USER PASSWORD - Change the password for the currently selected user.
- PERMISSION SETTINGS - set of check boxes that configure permission of the currently selected user to access toggled submenus. The individual check boxes are named same as the menu sections of the camera:
 - Range
 - Functions
 - Capture
 - Palette
 - Measure
 - Advanced - Visible camera
 - Advanced - Images & Video

- Advanced - Alarms
- Advanced - ROI
- Advanced - Digital I/O unit
- Advanced - Memory
- Advanced - System

14.7.2 Visible Camera

Visible Camera submenu allows user to set the parameters common to many regular digital video cameras. It also allows these parameters to be reset to their default values.



Figure 14.9 – Visible Camera submenu.

VISIBLE CAMERA submenu consists of following items:

- **GAMMA** - cycles between STANDARD, STRAIGHT, NARROW and WIDE. This changes the gamma curve used for mapping and compression of the values observed by the camera.
- **WHITE BALANCE** - cycles between WIDE, NARROW, INDOOR, OUTDOOR. WIDE and NARROW are automatic modes which cover color temperature range from about 10000K to 2200K and about 7000K to 2500K respectively. INDOOR and OUTDOOR are fixed color temperature balance modes for about 3200K and 5800K respectively.
- **WIDE DYNAMIC RANGE MODE** - toggles ON and OFF. Wide dynamic range cleverly maps the observed brightness levels through the image to bring more contrast out of areas that're in shadow or uneven light, providing a clearer, more informative image in high contrast scenes.
- **BACKLIGHT COMPENSATION** - toggles ON and OFF. Backlight compensation attempts to ignore small, very bright areas of the scene when determining the correct exposure settings which may allow intensely backlit objects still remain well visible in the resulting image.

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- NOISE REDUCTION 2D - sets one of 5 available levels of spatial noise reduction or turns it off. Spatial noise reduction looks at each frame individually and attempts to decrease noise by comparing values of neighboring pixels. Higher 2D noise reduction settings might lead to loss of detail in the image.
- NOISE REDUCTION 3D - sets one of 5 available levels of temporal noise reduction or turns it off. Temporal noise reduction looks at series of frames and attempts to decrease noise by comparing current pixel value with the past ones. Higher 3D noise reduction settings might introduce afterimage or "ghosting" phenomena in the image.
- COLOR GAIN - sets the level of color gain from 60% to 200%. Color gain can decrease or increase the level of color saturation of the image.
- EXPOSURE MODE - cycles between the modes AUTO, SHUTTER PRIORITY, IRIS PRIORITY, MANUAL. AUTO mode controls all of the parameters of SHUTTER, IRIS and GAIN automatically and attempts to provide the best possible image on basis of heuristics. SHUTTER PRIORITY and IRIS PRIORITY modes allow user to set one of these parameters manually and allow the other two to be determined automatically. MANUAL mode allows the user to set all three parameters manually.
- SHUTTER - sets the shutter duration between 1 second and 1/10000th of a second. High shutter durations increase the amount of available light, helping to decrease the amount of noise, at the cost of blurring objects captured in motion. Set the shutter duration to 1/100 or 1/120 to eliminate flicker from artificial lighting in countries with 50Hz and 60Hz power grid frequencies respectively.
- IRIS - sets the iris (aperture) value between F2.4 and F22. Allows the user to set the physical iris size manually. The iris setting changes the camera's depth of field; small aperture (High F/ value) means higher depth of field - broader envelope within which observed scenery remains relatively sharp. Level of the iris setting also influences the total amount of light available in the camera, which can be detrimental to amount of noise in the image.
- GAIN - sets the gain correction value between 0dB and 34dB. High values of gain can increase brightness of image at cost of amplifying digital noise.
- EXPOSURE COMPENSATION - sets the brightness adjustment within any of the automatic or semi automatic exposure modes with level from -6 to +6 or turns it off. Exposure compensation allows the user to choose the desired brightness level which the automatic or semiautomatic EXPOSURE MODE settings will adjust the image to.
- DEFAULT - option to reset all the items above to their default values.

These settings items operate similarly to any other common visual spectrum camera and the intricate nuances of their inner functioning is beyond scope of this manual. Users who do not have the insight into the proper functioning of these parameters will be in most cases best served by leaving them to their default values.

14.7.3 Images & Video

IMAGES & VIDEO submenu allows the user to choose which still capture image file types should be saved, and which medium should be used for their storage. It also allows toggling if encoded IR and visible video streams should be recorded.

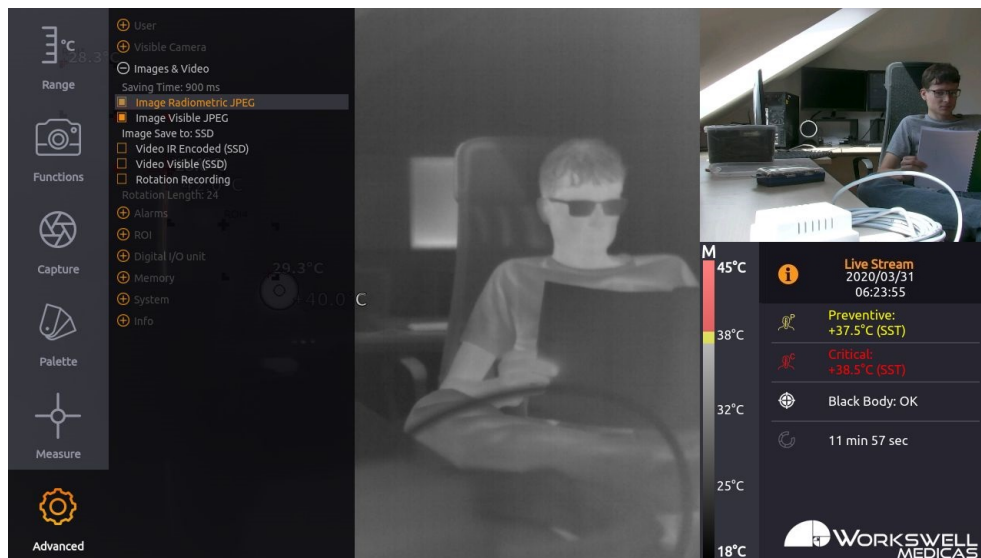


Figure 14.10 – Images & Video submenu.

IMAGES & VIDEO submenu menu consists of the following items:

- SAVING TIME - Displays a rough estimation of the time required to save all the selected capture formats.
- IMAGE RADIOMETRIC JPEG - Toggles saving of radiometric (exact thermal data including) images in the JPEG file format
- IMAGE SCREENSHOT JPEG - Toggles saving of simple screen capture images in the JPEG file format
- IMAGE VISIBLE JPEG - Toggles saving of visible camera image in JPEG file format
- IMAGE SAVE TO - Cycles the storage media (SSD, SD Card, Flash Drive) still image captures will be stored to
- VIDEO ENCODED IR - Toggles saving of thermal encoded video sequence capture
- VIDEO VISIBLE - Toggles saving of visible video sequence capture
- ROTATION RECORDING - Toggles DVR function of the video recording. The camera will record for the set amount of time in video sequences until it reaches set rotation length.
- ROTATION LENGTH - Length of the maximal video recording in hours. After the set amount of hours of the recording is reached, the camera deletes the oldest sequence to make room for the newest one and keeps recording in "circle".

Note: Aside of the storage capacity cost of each file type, requesting simultaneous capture and recording of many concurrent file types will significantly load the device and performance issues might be encountered. It is strongly advised user chooses only the capture formats they do need in the given situation even if storage capacity isn't of a concern.

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Note: While files of still image capture can be recorded directly to the optional storage media (SD Card, Flash Disk), video sequence files can be only recorded to the internal SSD. User can move the finished video sequence files to the optional storage media later through the MEMORY submenu within the ADVANCED menu.

14.7.4 Alarms

ALARMS submenu allows the user to further specify appearance of the ALARMS display as defined and invoked within the MEASURE menu.

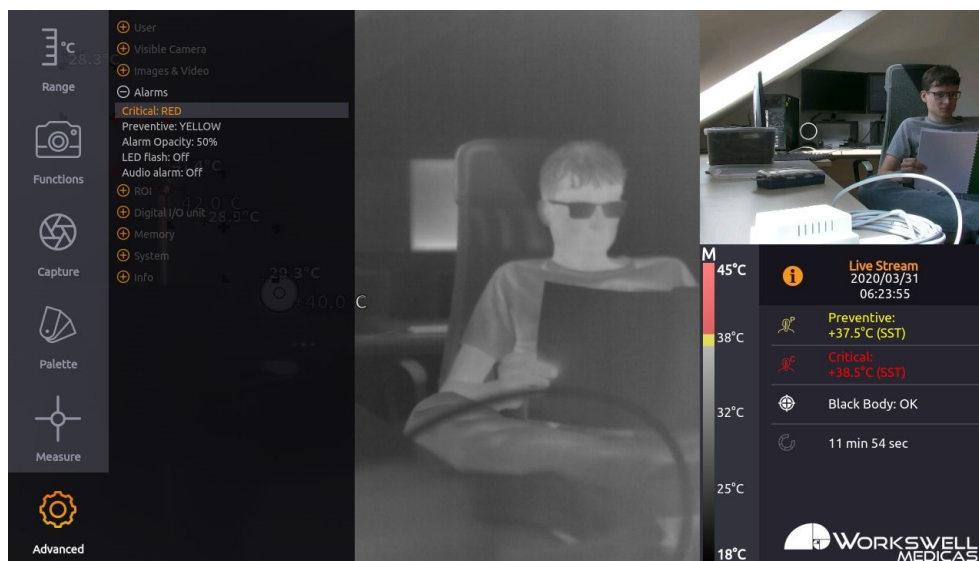


Figure 14.11 – Alarms submenu.

ALARMS submenu consists of the following items:

- CRITICAL - Cycles through the 13 color options which will be used to mark areas with temperature above the upper threshold
- PREVENTIVE - Cycles through the 13 color options which will be used to mark areas with temperature below the lower threshold
- ALARM OPACITY - Sets the degree of opacity of the ALARM display; lower opacity values will allow for more of the basic palette colors to show. Lowest possible setting is 50%.
- LED FLASH - The LED FLASH ALARM is only available for custom MEDICAS models and is not present in the default MEDICAS model. This setting changes the LED flash alarm configuration. There are 3 possible options:
 - OFF - The LED alarm is turned off
 - PREVENTIVE - The LED will blink when a preventive or critical alarm temperature is measured in the scene

- CRITICAL - The LED will blink only when a critical alarm temperature is measured in the scene
- AUDIO ALARM - The AUDIO ALARM is only available for custom MEDICAS models and is not present in the default MEDICAS model. This setting changes the audio alarm configuration. There are 3 possible options:
 - OFF - The audio alarm is turned off
 - PREVENTIVE - The audio alarm will signal sound when a preventive or critical alarm temperature is measured in the scene
 - CRITICAL - The audio alarm will signal sound only when a critical alarm temperature is measured in the scene

Cycles through the 13 color options which will be used to mark areas with temperature below the lower threshold

14.7.5 ROI

ROI submenu allows the user to position up to 4 different regions of interest (ROI) on the measured scene. Each ROI can be named individually. For more information about the ROI measurement, please see the chapter 14.6.

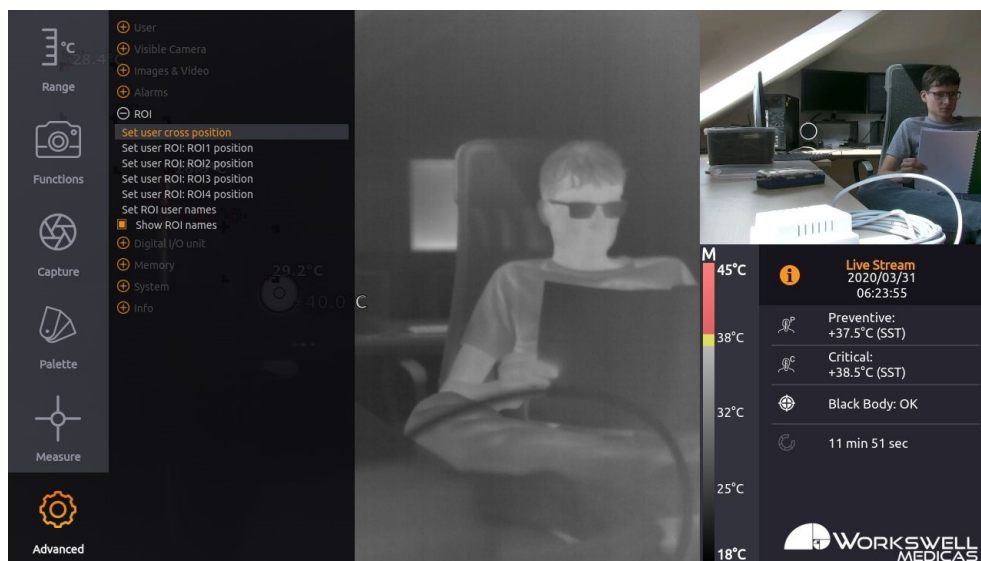


Figure 14.12 – ROI submenu.

ROI submenu consists of the following items:

- SET USER CROSS POSITION - closes the menu and allows moving and setting the USER CROSS using arrow keys (UP, DOWN, LEFT, RIGHT) or numeric keys (8, 2, 4, 6) on the numeric keyboard. The position of the USER CROSS within the scene is up to the user. To confirm the position, press ENTER key. To cancel the position setting, press BACKSPACE key. After the position setting is complete, the menu will automatically reappear.
- SET USER ROI (ROI 1-4 by default) - closes the menu and allows moving and setting the selected USER ROI using arrow keys (UP, DOWN, LEFT, RIGHT) or numeric keys (8, 2, 4, 6) on the numeric keyboard. The ROI is

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always rectangular shape and is positioned in 2 steps. First you need to position the top left corner of the ROI and then the bottom right corner. You can confirm each position by pressing the ENTER key. You can cancel the positioning by pressing the BACKSPACE key. After the position setting is complete, the menu will reappear.

- SET USER ROI NAMES - Shows the ROI naming dialog. Here you can select specific ROI name by navigating to it using arrow keys (UP, DOWN) or numeric control keys (8, 2) and confirming the selection with ENTER key. You can then write a desired name for the selected ROI and confirm it by pressing the ENTER key again.
- SHOW ROI NAMES - Toggles the visibility of the ROI names on top of the ROIs in the scene (ON / OFF).

14.7.6 Digital I/O unit

Digital I/O unit submenu allows the user to configure the DIO unit. The DIO unit is not part of the default MEDICAS package content and needs to be ordered separately. To configure the DIO unit, the unit needs to be connected to the camera. Please read the DIO unit quick start guide for more information.

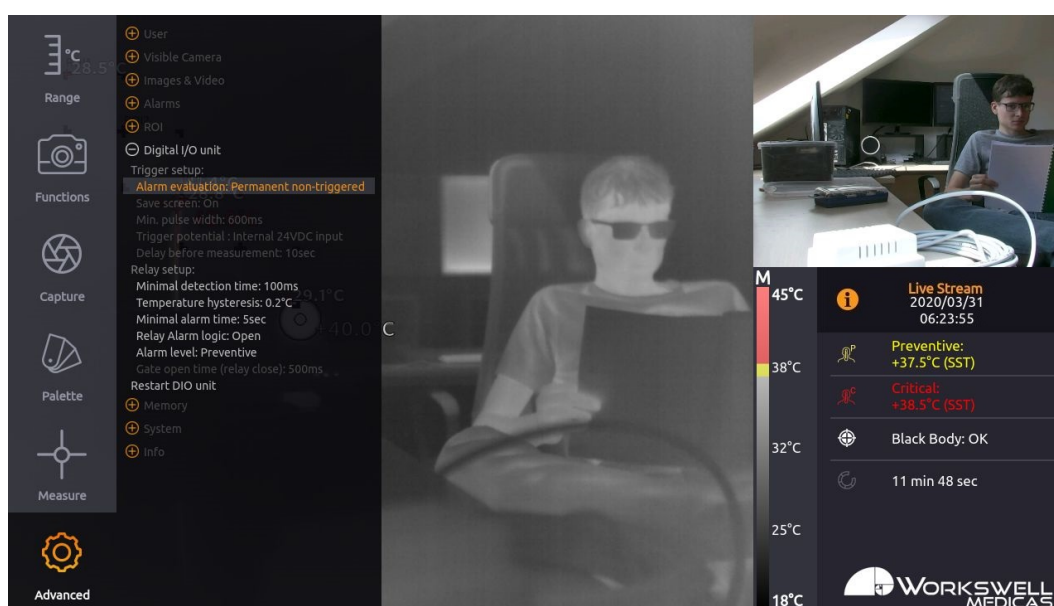


Figure 14.13 – Digital I/O unit submenu - Permanent Non-triggered mode.

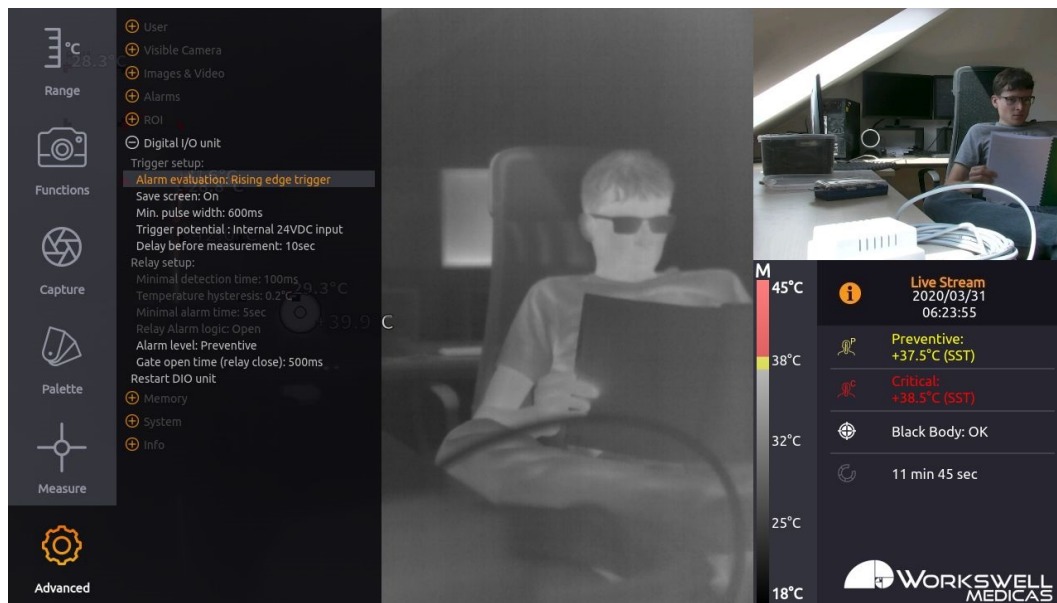


Figure 14.14 – Digital I/O unit submenu - Rising Edge Trigger mode.

Digital I/O unit submenu consists of the following items:

- Trigger setup:

- Alarm evaluation - there are 2 types of the alarm evaluation configuration:
 - Permanent Non-triggered - the trigger pins are not connected and the measurement of the scene is evaluated continually. The logical DIO unit output value changes after the camera detects and evaluates an alarm in the scene.
 - Rising Edge Trigger - the MEDICAS camera is waiting for a trigger sent from the DIO unit before it starts an alarm measurement and evaluation. There are 3 possible states that the camera is in during this measurement: The camera is waiting for a trigger and ton measuring alarm, the camera received a trigger and evaluated the measurement with preventive or critical alarm, or the camera received a trigger and evaluated the measurement without any alarms. The logical output on the DIO board changes only after the camera receives a trigger and evaluates the measurement without any alarms in the scene. This setting is meant to be used for example as a entrance gate check, with automatic gate opening.
- Save Screen - Toggle if the camera should save the screen-shot of the scene after the trigger is sent by the DIO unit. If the option is toggled ON, the camera will take screen-shot in every situation (alarm in the scene, no alarm in the scene, black-body error). This option is available only with the Rising Edge Trigger alarm evaluation.
- Min. Pulse width - sets the minimal pulse width sent to the DIO unit, that is evaluated as a trigger and sent to the MEDICAS camera. Short pulses are discarded as a prevention against input oscillation. This option is available only with the Rising Edge Trigger alarm evaluation.
- Trigger potential: Toggle the potential on the trigger pins. If the option is set to Internal 24VDC, you only need to short the circuit between corresponding TRIG and POT pins on the DIO unit to produce the corresponding trigger (shorting the TRIG 1 and POT 1 pins produces trigger 1). If the option is set

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to Externat 24VDC input, you need to use your own power supply of 24VDC and bring it to the TRIG pin to activate the corresponding trigger. You need to use the same potential ground for the power supply for the trigger and the DIO unit. This option is available only with the Rising Edge Trigger alarm evaluation.

- Delay before measurement - sets how long should the measurement and alarm evaluation be delayed after the trigger from the DIO unit is received. If the option is set for example to 5 sec and the trigger from the DIO unit is received by the MEDICAS camera, the measurement, screenshot capture and alarm evaluation will be delayed 5 seconds from the time the trigger input was detected by the camera. This option is available only with the Rising Edge Trigger alarm evaluation.
- Relay setup:
 - Minimal detection time - Minimal time that the alarm needs to be active in the scene, before the camera sends alarm output to the DIO unit. This option is available only with the Permanent Non-triggered alarm evaluation.
 - Temperature hysteresis - After the alarm is detected in the scene and the temperature drops below the set alarm level value by a temperature lower than the set temperature hysteresis value, the temperature is still evaluated as a alarm. Here is an example: The alarm level is set as preventive, the temperature hysteresis is set to 0.3°C the preventive alarm value is 37°C and the critical temperature value is 38°C. The temperature in the scene rises to 39°C and a critical alarm is produced. After the temperature in the scene drops to 37.5°C, only preventive alarm is produced. If the temperature drops to 36.8°C, the preventive alarm is still produced. If the temperature drops to 36.6°C the alarm is not produced any more. This option is available only with the Permanent Non-triggered alarm evaluation.
 - Minimal alarm time - Minimal time that the alarm will be sent to the DIO unit after it is detected in the scene. For example if there is alarm in the scene that lasts only 3 seconds but this configuration is set to minimal alarm time of 5 seconds, the alarm signal will be sent to the DIO unit for the whole 5 seconds. If the alarm will be detected for 10 seconds, the alarm signal will be sent to the DIO unit only for 10 seconds, because the minimal alarm time configuration is set to lower time value as the actual time of detected alarm. This option is available only with the Permanent Non-triggered alarm evaluation.
 - Relay alarm logic - sets if the relay should be OPEN or CLOSED when the alarm signal is sent by the MEDICAS camera and detected by the DIO unit. This option is available only with the Permanent Non-triggered alarm evaluation.
 - Alarm level - sets if the DIO unit should react to PREVENTIVE or CRITICAL alarm. If the option is set to CRITICAL and only preventive alarm signal is produced by the camera, the logic on the DIO unit output will not change. If the black body error is detected in the scene, the camera is sending alarm signal to the DIO unit.
 - Gate open time (relay close) - Sets the pulse length that is send to the DIO unit, after the camera receives a trigger and evaluates the scene as with no alarm (healthy person in the scene). An example is: Camera receives a trigger from the DIO unit, the camera waits for the set Delay Before Measurement time, then evaluates the scene. If the camera does not detect any alarm, it produces a pulse to the DIO unit with the length of set Gate Open Time (Relay close) value. This option is available only with the Rising Edge Trigger alarm evaluation.

- Initialize connection / Restart DIO unit - if the DIO unit is not initialized and the unit is correctly connected to the camera and running, press initialize connection to start the communication. You can also Restart DIO unit to reinitialize the communication.

14.7.7 Memory

MEMORY submenu allows user to format storage devices and to move stored files between them or erase them altogether. It also allows the user to copy system logs to external storage devices.

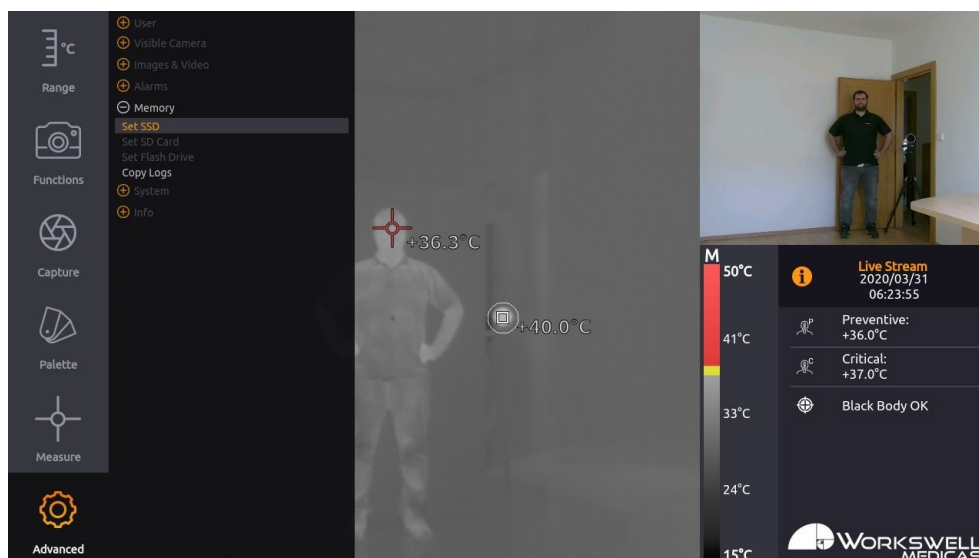


Figure 14.15 – Memory menu.

MEMORY menu consists of the following items:

- SET SSD - Access further options for work with the internal SSD storage.
- SET SD CARD - Access further options for work with the SD Card storage.
- SET FLASH DRIVE - Access further options for work with Flash Drive storage.
- COPY LOGS - Copies internal system logs to all the storage devices, making the files accessible to the user.

Note: The SET SD CARD and SET FLASH DRIVE options are only accessible if the respective storage device is present and recognized by the system.

More about transferring data in chapter 16.

14. MAIN MENU (SETTINGS)



14.7.8 System

SYSTEM category allows user to set the current time and date, set the temperature unit, trigger a search for an update file, set the system language, reboot the system and to revert to default settings.

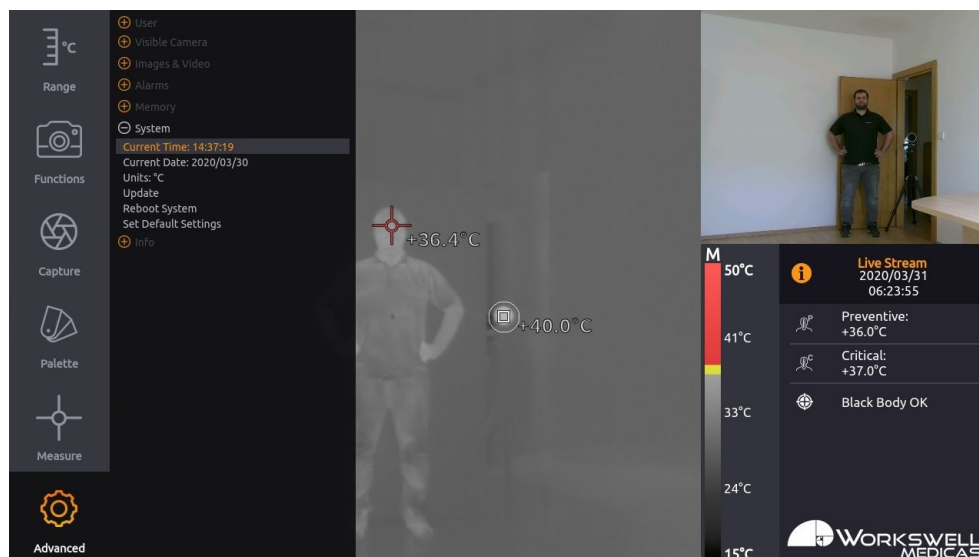


Figure 14.16 – System menu.

SYSTEM menu consists of the following items:

- CURRENT TIME - Current system time
- CURRENT DATE - Current system date
- UNITS - Cycles through the available temperature units (degrees Celsius, Fahrenheit)
- UPDATE - Initiate a search for an update file on all of the device storage devices.
- LANGUAGE - Cycles through the available system language options
- REBOOT SYSTEM - Restarts the device
- SET DEFAULT SETTINGS - Sets the system to factory default settings

Note: Correctly set system time and date are important for correct tagging of date and time in the captured images and recorded videos.

Note: Rebooting the system may help refresh the device.

14.7.9 Info

INFO category displays information about system such as firmware version, serial number (needed for communication with Workswell), article number, DIO unit information, device temperature and information about the Workswell s.r.o. company.

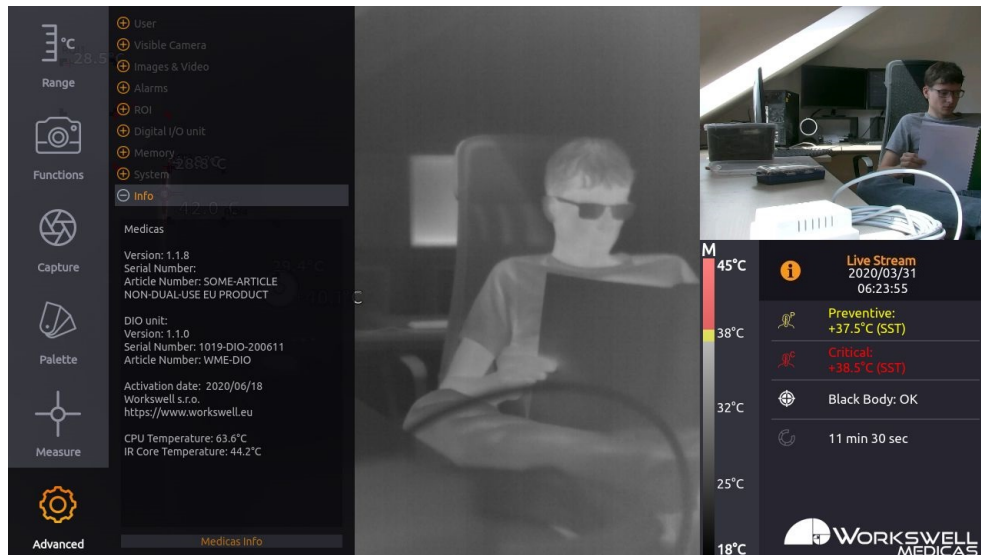


Figure 14.17 – Info menu.

15 Images and Video

WORKSWELL MEDICAS allows the user to capture and record several image and video formats. The user is advised to save only the desired formats, since each image or video format have performance and memory requirements that adds up.

Each image is tagged with Exif metadata including source, date and time.

Following formats are supported:

- Images
 - Radiometric JPEG
 - Screenshot JPEG
 - Visible JPEG
- video
 - Encoded IR
 - Visible

Images can be saved directly to connected memory (Flash Drive or SD Card). Video can be recorded only to the internal SSD memory due to high memory speed requirements.

15.1 Images

All the images can be opened in standard image viewer applications. Images named as radiometric contain additional temperature information and can be further edited in ThermoLab software.

15.1.1 Radiometric JPEG

Plain JPEG image from thermal camera without any overlays, containing additional temperature informations.

15.1.2 Screenshot JPEG

Screenshot of current display in JPEG format. User can save the current display state, including overlays and menu.

15.1.3 Visible JPEG

Plain JPEG from visible camera in full HD (1920x1080) resolution.

15.2 Video

15.2.1 Encoded IR

Compressed video stream from thermal camera. Can be played with any video player supporting *H.264* video in *MP4* container.

15.2.2 Visible

Compressed video stream from visible camera in HD (1280x720) resolution. Can be played with any video player supporting *H.264* video in *MP4* container.

16 Data Transfer and Memory Manipulation

Workswell MEDICAS system is equipped with internal SSD storage for captured images and recorded video. This storage can be further extended and copied from using an optional SD Card and a Flash Drive.

There's two ways of extracting recorded data from the device. Either through a direct connection to another device acting as an USB Host is made, which makes the internal SSD accessible as a generic Mass Storage device, or by using the removable SD Card or Flash Drive to transfer the files. Files can be either captured directly to these removable devices, or moved to them manually from the internal SSD storage.

Warning: Do NOT connect MEDICAS to any other powered device (such as PC) through the full size USB port on the rear of the camera. As the rear USB port is powered, connection to another powered USB port can lead to permanent damage to either device. Only unpowered devices (USB Keyboards and USB Flash Storage drives) are to be connected into the rear USB A port of MEDICAS.

16.1 Application Menu

Note: Only still image capture can be done directly to the SD Card and Flash Drive external devices, video recordings are always saved to the internal SSD storage and have to be either recovered via USB transfer or copied to the external storage media manually.

All of the three storage media (SSD, SD Card, Flash Disk) can be managed within the menu through the options ADVANCED > MEMORY > SET [SSD/SD Card/Flash Drive].

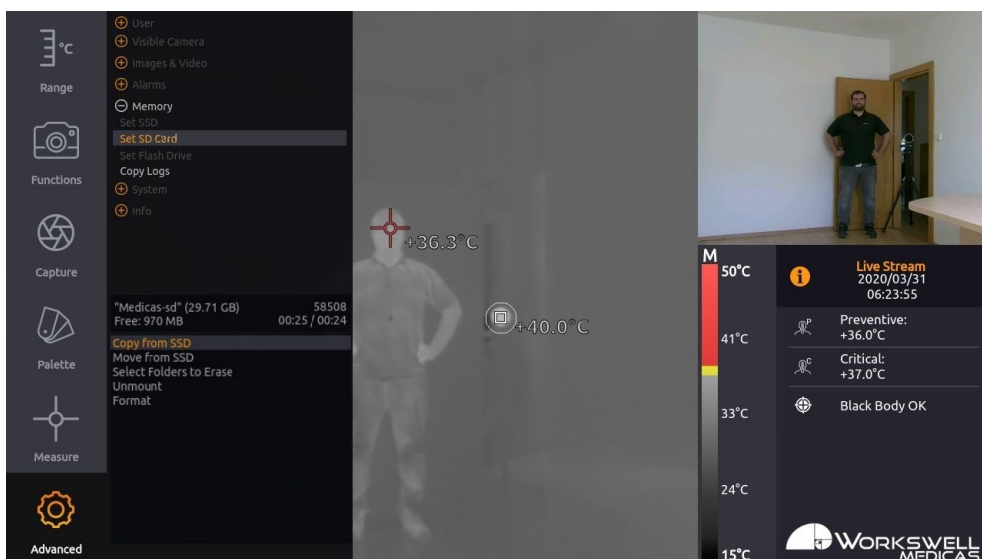


Figure 16.1 – Storage manipulation submenu.

The memory management menu for the SD CARD and FLASH DRIVE have the following options:

- COPY FROM SSD - After scanning the SSD storage for available data, allows selective copy of folders containing the captured images and sequences to the chosen external medium. Copied files are NOT removed from the internal SSD storage.
- MOVE FROM SSD - After scanning the SSD storage for available data, allows selective move of folders containing the captured images and sequences to the chosen external medium. Copied files ARE removed from the internal SSD storage.
- SELECT FOLDERS TO ERASE - After scanning the selected storage medium for available data, allows selective deletion of folders containing the captured images and sequences. If these files haven't been copied previously, they will be lost.
- UNMOUNT - Safely unmounts the chosen external medium so it can be physically removed without risk of data loss. External media are automatically mounted again, after being reinserted into the device.
- FORMAT - Performs a format of the storage device. **Beware**, this will delete all the data stored on the given storage medium, including data unrelated to operation of the device.

Note: The memory management menu for the internal SSD storage has only the SELECT FOLDERS TO ERASE and FORMAT options, which function as outlined above. Data cannot be copied or moved from external storage media to the SSD. The SSD cannot be unmounted.

Note: The respective media menu options only become accessible if the given storage medium (SD Card, Flash Disk) are physically connected to the device and successfully mounted

Once the COPY, MOVE or TO ERASE option is selected, memory of the medium is scanned for data (this may take a while). User is prompted to choose which folders should be copied, moved, or erased. New data folders are always created automatically based on the current date and time.

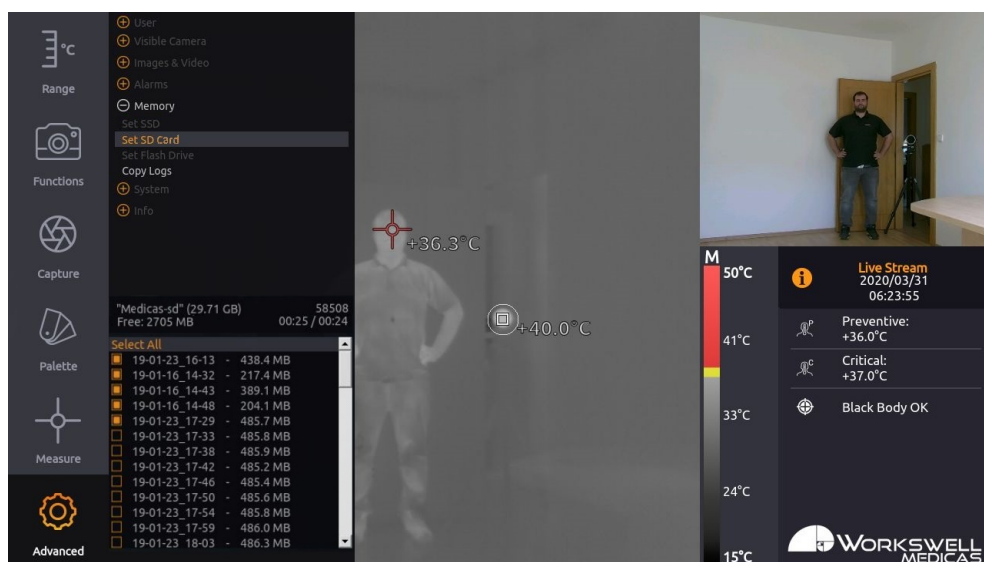


Figure 16.2 – Selection of folders to be acted upon.

16. DATA TRANSFER AND MEMORY MANIPULATION

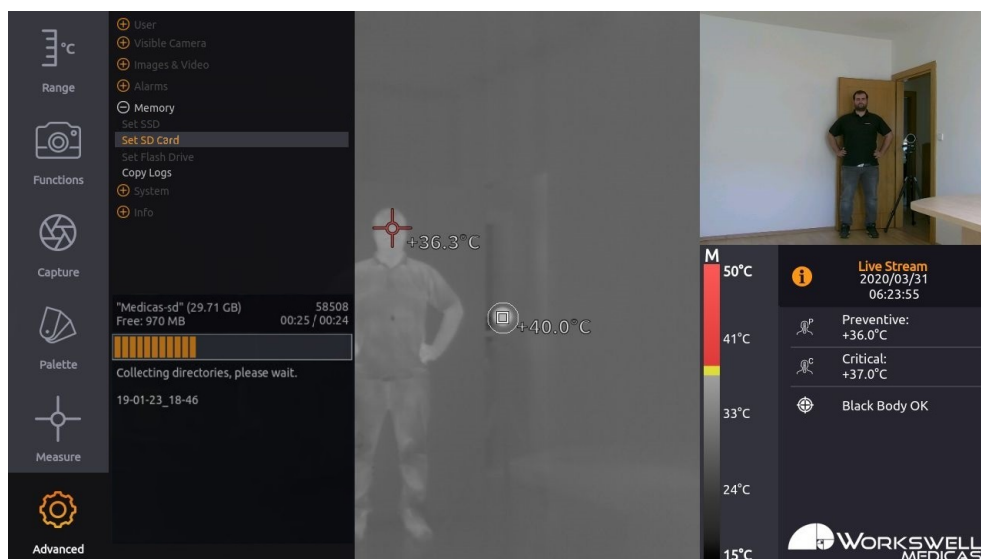


Figure 16.3 – Longer actions display a progress bar.

The copy/move process starts when the user chooses COPY/MOVE SELECTED.

Warning: Do not unplug power supply or USB flash drive during copy/move process. Data loss may occur.

Warning: Either always manually unmount external storage media before physically removing it from the device, or only remove it while the device is powered off altogether, otherwise data loss may occur.

16.1.1 Formatting Memory

We highly recommend using the supplied USB flash drive and SD Card that is already formatted. It might be necessary to format any new Flash Drive or SD Card.

This can be done directly from the ADVANCED > MEMORY > SET FLASH DRIVE menu. The formatted file system is FAT32 with one partition.

Warning: Do not use other file system formats than default FAT32. Do not make more than one partition in the memory.

16.2 Mass Storage (USB OTG)

Workswell MEDICAS can be connected directly to PC or Mac with Micro USB cable and act as a Mass Storage. Thus the data from connected memory can be accessed, copied, moved or deleted.

The MEDICAS must be started and running the whole time. When connected, the warning window on the MEDICAS display informing about the connection should appear.

After disconnecting the MEDICAS will reboot itself.

Warning: Only connect external host devices (PC/Mac) to USB Type Micro B slot on side of the device; the rear USB Type A slot is only intended to be used with peripheral devices like the keyboard and Flash Drives. Connecting powered devices to the rear full sized USB slot could lead to permanent damage to either device.

17 Firmware Update

Workswell MEDICAS system is supplied with the latest firmware. As time goes on, newer firmware could appear in order to bring the user new functions, improve the old ones or fixing bugs. For this purpose, the system allows the user update the firmware.

To update Medicas, follow these steps:

1. Download the update file from <https://workswell-thermal-camera.com/firmware-update/medicas/>.
2. Copy the update file `update-medicas.tar` to USB flash drive, SD Card or internal SSD (make sure the filename is correct).
3. Connect the memory with update to MEDICAS.
4. Select **ADVANCED > SYSTEM > UPDATE**.
5. Confirm the update installation.

17.1 Firmware Update Process

After the **ADVANCED > SYSTEM > UPDATE** choice is selected, the device will search all three storage devices for valid update files. If an update file is found, the user will be prompted one last time to confirm or cancel the update. Once the update is initiated the camera will reboot. This may take several minutes.

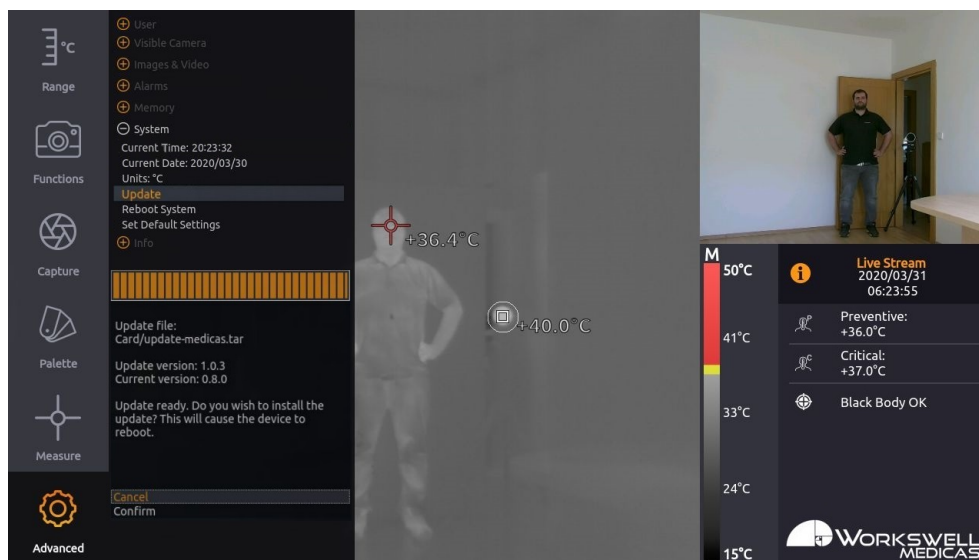


Figure 17.1 – Update menu – firmware update available.

Warning: Do not turn off the system and do not unplug the power supply during the firmware update process! Damage to the system may occur!

18 Workswell ThermoLab

18.1 General Description

The Workswell MEDICAS system can capture radiometric images compatible with Workswell ThermoLab (supplied with Workswell MEDICAS system). Workswell ThermoLab offers the user many functions for editing and processing radiometric images.

Workswell ThermoLab is available for Windows at <https://software.workswell.eu/thermolab/Windows/> and for MAC at <https://software.workswell.eu/subdom/software/thermolab/Mac/>

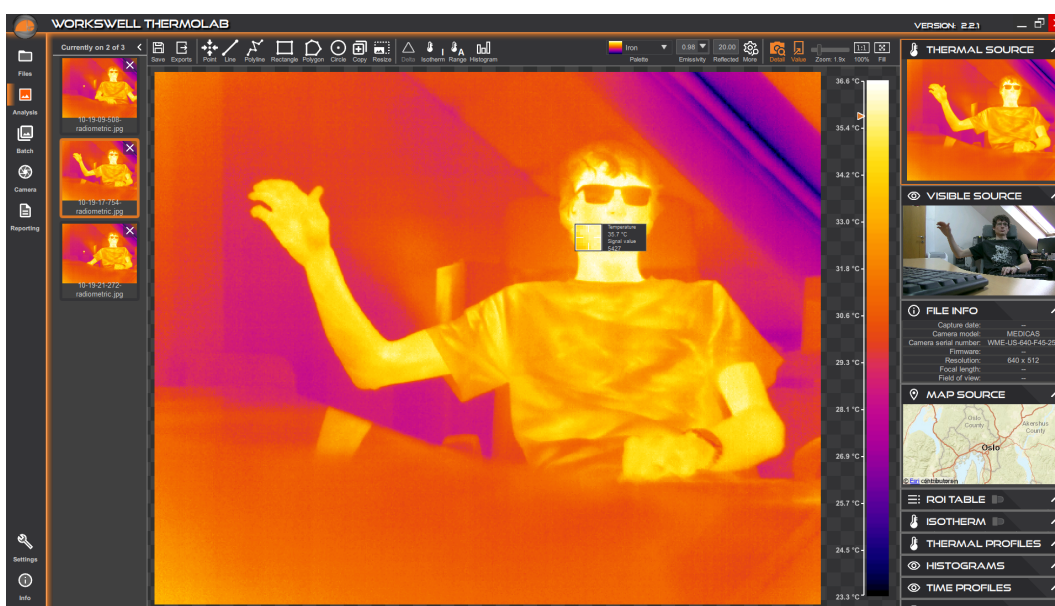


Figure 18.1 – Workswell ThermoLab.

Workswell ThermoLab allows the user to

- Change temperature range, colour palette
- Use multiple isotherms
- Use measurement functions in multiple ROIs (region of interest)
- Export images and much more...

To learn more, please refer to Workswell ThermoLab manual.

19 Environmental Conditions

19.1 Environmental Conditions

You should follow these storage and operating conditions for proper function of the Workswell MEDICAS system:

Operation temperature range	from +15°C to +35°C
Storage temperature range	from -30°C to +60°C
Humidity	5-95%, noncondensing
Maximum irradiance	100W/cm ²

Storage or use of the device outside of these specified values can lead to permanent damage to the device.

20 Infrared Camera Behavior

20.1 Infrared Camera Warm-Up

Modern infrared cameras based a microbolometer array need to internally warm up to their working temperature before the measured values stabilize. The sensor begins to automatically warm up after user turns the camera on. The infrared camera is usually up to ideal internal temperature in about 15 - 30 minutes. There is a timer indicating the Heating Up period of the camera after every start. During this period, the alarms are turned off. It is recommended to let the camera warm up another 15 minutes to ensure best measured results. If you want to skip the waiting period (not recommended) go into MENU > MEASURE and follow the warning instructions.

During the warm-up process the accuracy of the measured temperature data is lower and various defects can appear in the thermal image. Therefore, we recommend to let the infrared camera warm up before measuring critical data.

20.2 Non-Uniformity Correction (NUC)

Infrared cameras needs to be periodically calibrated in order to get reasonable measurement accuracy. This process is called Non-uniformity correction (NUC) or shutter calibration. MEDICAS is equipped with an internal, automated shutter which is triggered automatically in a set interval.

Note: Even after NUC is performed, temperature non-uniformity can, depending on the environmental circumstances, still reach up to 4°C. It recommended to send the camera to Workswell s.r.o. after 12 months of usage for SFFC calibration and camera optic system maintenance.

21 Maintenance

21.1 Cleaning the MEDICAS Head and Cables

Liquids: Use one of these liquids:

- Warm water
- A weak detergent solution

Equipment:

- A soft cloth

Procedure:

1. Soak the cloth in the liquid.
2. Twist the cloth to remove excess liquid.
3. Clean the part with the cloth.

21.2 Cleaning the Infrared Lens

Liquids: Use one of these liquids:

- A commercial lens cleaning liquid with more than 30% isopropyl alcohol.
- 96% ethyl alcohol (C₂H₅OH)
- DEE (= "ether" = diethylether, C₄H₁₀O)
- 50% acetone (= dimethylketone, (CH₃)₂CO) + 50% ethyl alcohol (by volume). This liquid prevents drying marks on the lens.

Equipment:

- Cotton wool

Procedure:

1. Soak the cotton wool in the liquid.
2. Twist the cotton wool to remove excess liquid.
3. Clean the lens one time only and discard the cotton wool.

Warning: Make sure that you read all applicable MSDS (Material Safety Data Sheets) and warning labels on containers before you use a liquid: the liquids can be dangerous.

Caution:

- Be careful when you clean the infrared lens. The lens has a delicate anti-reflective coating.
- Do not clean the infrared lens too vigorously. This can damage anti-reflective coating. Re-applying anti-

reflective coating is not possible and is required to change the lens.

22 Troubleshooting

22.1 Turning ON

When the power cable is plugged in, the LED should begin flashing. If nothing happens, please check you power supply. A stable power supply is essential for correct functioning of the device. The device should boot and produce picture through the HDMI within seconds of powering up.

22.2 Reset button

On side of the MEDICAS device, a reset button is present. This button has two functions.

- If the reset button is held down during device startup, the device should go directly into the Safe Mode as described in the next section.
- Holding the reset button for 15 seconds while the camera is already running (but even if no image is produced) should reset the device to factory default state.

To actuate the reset button, use a fine pointed object such as a toothpick or an unfolded paperclip.



Figure 22.1 – Reset button.

22.3 Safe Mode

In the case the device detects issues with the main firmware even after repeated reboot attempts, it will launch the Safe Mode application instead.

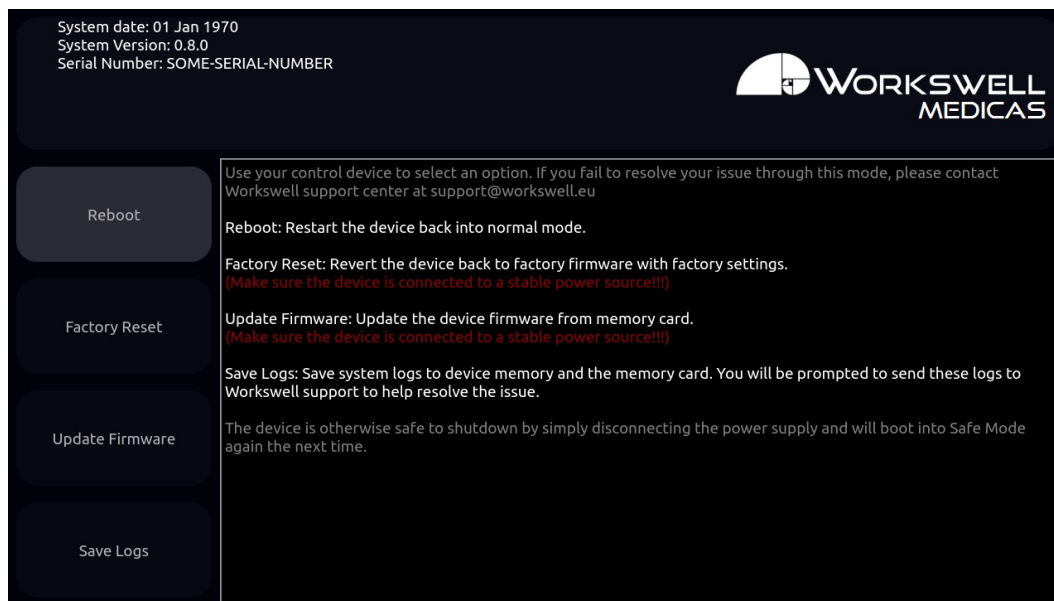


Figure 22.2 – Safe mode.

The Safemode application offers the following options:

- REBOOT and continue with standard application
 - Choose this option when first observing the safe mode.
- FACTORY RESET
 - Choose this option to restore the system to its Factory defaults. All of the applied updates will be removed.
 - A stable power supply has to be maintained during the Factory Default!
- UPDATE FIRMWARE
 - This allows you to manually update firmware on the device when the main firmware application doesn't function.
- SAVE LOGS to connected external devices
 - Choose this option to copy log files for faster solving of the issue.
 - Log files will be copied to all of the externally accessible SSD, the SD Card and the Flash Drive, if they are present
 - Please, send these log files to Workswell support center with information about the issue.

In the case none of the first three options help resolve the issue, please contact the Workswell support center support@workswell.eu and report the problem, supplying the system logs saved through the fourth option.

22. TROUBLESHOOTING



22.4 Reset to Factory Default

You can reset the MEDICAS to its factory default state with the pin button. Press the pin button for more than 5 seconds. The LED should start blink rapidly. Do not unplug the MEDICAS from power source during this process!

Factory default can help in some situations. Typically if some settings or update caused the MEDICAS to stop displaying the image or other minor things like going back to previous working firmware version.

Factory default will not work if the LED is not emitting light.

22.5 System Update

Make sure that your MEDICAS version is up to date. You can find information about the current version on <https://workswell-thermal-camera.com/firmware-update/medicas/>



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