INSTRUCTION MANUAL

MTi3

THERMAL IMAGER

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1. INTRODUCTION OVERVIEW

The Thermal Imager is handheld imaging camera used for predictive maintenance, equipment troubleshooting, and verification. Focus the lens to the object, Then the thermal images are displayed on the LCD and can be saved to a Micro SD Memory card. Transferring images to a PC is accomplished by removing the SD memory card and connecting it to a PC through the included card reader, or transfer the images and video stream to the smart device with "Thermal-X" app installed. In addition to the features mentioned above, the Thermal Imager provide video recording and play back.

2. SAFETY INFORMATION

To prevent eye damage and personal injury, do not look into the laser. Do not point laser directly at people or animals or indirectly off reflective surfaces.
Do not disassemble or do a modification to the Thermal Imager.
Do not point the Thermal Imager (with or without the lens cover) at intensive energy sources, for example devices that emit laser radiation, or the sun.
This can have an unwanted effect on the accuracy of the camera. It will also cause damage to the detector in the Thermal Imager.
Do not use the Thermal Imager in a temperature higher than +50°C (+122°F), lower than -20°C (-4°F). High temperature or low temperature can cause damage to the Thermal Imager.
Only use the correct equipment to discharge the battery. If you do not use the correct equipment, you can decrease the performance or the life cycle of the battery. If you do not use the correct equipment, an incorrect flow of current to the battery can occur. This can cause the battery to become hot, or cause an explosion and injury to persons.
Do not remove the battery when the thermal imager is working. If you remove the battery when the thermal imager is working, it may cause the thermal imager work incorrectly.
Do not disassemble or do a modification to the battery. The battery contains safety and protection devices which, if they become damaged, can cause the battery to become hot, or cause an explosion or an ignition. If there is a leak from the battery and the fluid gets into your eyes, do not rub your eyes. Flush well with water and immediately get medical care. Do not make holes in the battery with objects. Do not hit the battery with a hammer. Do not step on the battery, or apply strong impacts or shocks to it. Do not put the battery in or near a fire, or in direct sunlight, or other high-temperature locations. Do not solder directly onto the battery.
Always charge the battery in the special temperature range.
The temperature range through which you can charge the battery is 0°C to

+50°C (+32°F to +122°F). If you charge the battery at temperatures out of this range, it can cause the battery to become hot or break. It can also decrease the performance or the life cycle of the battery.
Do not get water or salt water on the battery, or permit the battery to get wet.
Clean the case with a damp cloth and a weak soap solution. Do not use abrasives, isopropyl alcohol, or solvents to clean the case or lens/screen. Be careful when you clean the infrared lens. Do not clean the infrared lens too vigorously. This can damage the anti-reflective coating.

Avoid condensation
Taking the Thermal Imager from a cold to hot temperature will cause condensation in thermal Imager. To protect the Thermal Imager, you should power off the Thermal Imager, and wait until the Thermal Imager has become warm enough for the condensation to evaporate.

Storage
If you do not use the Thermal Imager, put the Thermal Imager in cool and dry environment, if you store Thermal Imager equipped with the battery, the power of the battery will be exhausted.

3. BEFORE YOU START

3.1. How to Charge the Battery

- Before you use the Thermal Imager for the first time, charge the battery for three to three and a half hours.
- The battery status shows on the six-segment charge indicator.
- To charge the battery, use the following steps:

1. Connect the ac power adapter into an ac wall outlet and connect the dc output to the Thermal Imager's ac power socket, the charge light is on, the battery indicator becomes "→→→→→", while the battery charges with the ac power adapter.
2. Charge until the charge indicator becomes "" and does not change.
3. Disconnect ac power adapter when the battery is fully charged.

Note: Make sure that the Thermal Imager is near room temperature before you connect it to the charger. Do not charge in hot or cold areas. When you charge in extreme temperatures, the battery capacity may be decreased.

3.2. Power ON

To turn the Thermal Imager on, push the **Power** ⏻ Button.

After powering on the device, The thermal Imager needs sufficient warm-up time for the most accurate temperature measurements and best image quality. So the visible image will first appear, and the thermal sensor will calibrate internally for several seconds. After that the thermal image will be displayed on the screen.

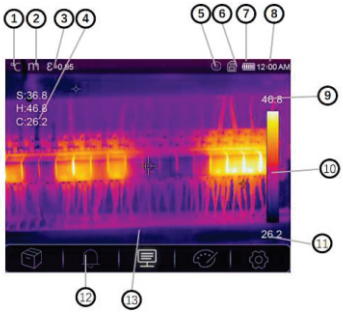
3.3. Power OFF

- When the Thermal Imagers power is on, push and hold the **Power** ⏻ Button for two seconds, then open the power off menu, press "**OK**" to power off the device.
- Push and hold the **Power** ⏻ Button for twelve seconds, the device will power off.

3.4. Desktop

The desktop is as follows:

1 - Temperature unit
2 - Distance unit
3 - Emissivity
4 - Centre/Max/Min point temperature readings
5 - Flashlight ON status
6 - SD card
7 - Battery capacity status
8 - Time
9 - Max temperature of current scene
10 - Colour bar
11 - Min temperature of current scene
12 - Main menu
13 - Image display area



3.5. Shutter

The thermal image of the Thermal Imager can become blurry when the Thermal Imager is not correcting or the Thermal Imager changes target. To get a fine thermal image, the Thermal Imager needs to correct. Short push the Power ⏻ Button and the inner shutter will action once to un blur the image.

3.6. LED Light

In device "setting" menu, press "Left/Right" button to highlight the flash light button, the LED light will be on or off. Press the OK Button to switch on or off. Push the Power ⏻ Button to return.

3.7. Temperature Measurement

All objects radiate infrared energy. The quantity of energy radiated is based on the actual surface temperature and the surface emissivity of the object. The Thermal Imager senses the infrared energy from the surface of the object and uses this data to calculate an estimated temperature value. Many common objects and materials such as painted metal, wood, water, skin, and cloth are very good at radiating energy and it is easy to get relatively accurate measurements. For surfaces that are good at radiating energy (high emissivity), the emissivity factor is >=0.90. This simplification does not work on shiny surfaces or unpainted metals as they have an emissivity of <0.6. These materials are not good at radiating energy and are classified as low emissivity. To more accurately measure materials with a low emissivity, an emissivity correction is necessary. Adjustment to the emissivity setting will usually allow the Thermal Imager to calculate a more accurate estimate of the actual temperatures. More information please see Emissivity Adjustment to get the most accurate temperature measurements.

3.8. Emissivity Adjustment

The correct emissivity value is important to make the most accurate temperature measurement. Emissivity of a surface can have a large effect on the apparent temperatures that the Thermal Imager observes. Understanding the emissivity of the surface allows you to obtain more accurate temperature measurements.

Note: Surfaces with an emissivity of <0.60 make reliable and consistent determination of actual temperature problematic. The lower the emissivity, the more potential errors are associated with the Imager's temperature measurement calculations. This is also true even when adjustments to the emissivity and reflected background adjustments are performed properly. Emissivity is set directly as a value or from a list of emissivity values for some common materials. The global emissivity displays in LCD Screen as **E=x.xx**.

The following table gives typical emissivity of important materials:

Material	Emissivity	Material	Emissivity
Water	0.96	Tape	0.96
Stainless Steel	0.14	Brass Plate	0.06
Aluminum Plate	0.09	Human Skin	0.98
Asphalt	0.96	PVC Plastic	0.93
Concrete	0.97	Polycarbonate	0.80
Cast Iron	0.81	Oxidized Copper	0.78
Rubber	0.95	Rust	0.80
Wood	0.85	Paint	0.90
Brick	0.75	Soil	0.93

3.9. Reflected Temperature

Using the offset factor, the reflection is calculated out due to the low emissivity and the accuracy of the temperature measurement with infrared instruments is improved. In most cases, the reflected temperature is identical to the ambient air temperature. Only when objects with strong emissions with much higher temperature are in the proximity of the object being measured should be determined and used. The reflected temperature has only a little effect on objects with high emissivity. The reflected temperature can be set individually. Follow these steps to get the right value for the reflected temperature.

1. Set the emissivity to 1.0
2. Adjust the optical lens to near focus
3. Looking in the opposite direction away from the object, take a measurement and freeze the image
4. Determine the average value of the image and use that value for your input of reflected temperature.

3.10. Thermal Imager Reporter Software

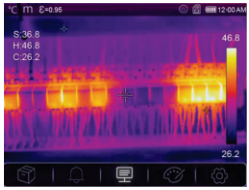
Thermal Imager Reporter software is supplied with the Thermal Imager. This Software is intended for Thermal Imager and contains feature to analyze images, organize data and information, and make professional reports. Thermal Imager Reporter software allows audio annotations and commentary to be reviewed on a PC.

4. MENUS

The menus, are access for image, measurement, Emiss, Palette, temperature measurement range, take photo and video, review, and settings.

4.1. Main Menu

Press the "**OK|ESC**" button, the main menu will be opened up. Hold down the "**OK|ESC**" button, the main menu will be hidden. Main Menu is the main interface of the Thermal Imager's menus. It contains six items such as Image Browser, Alarm Setting, Measure parameters, Image mode Palette, system Settings.



- **Image Browser:** Enter into the image view
- **Alarm setting:** Settings for high/low temperature alarm
- **Parameters:** Parameters set for the calculation temperature.
- **Image mode:** Set image source for the display on the Thermal Imager's LCD. It contains three items such as infrared image, visual image and fusion.
- **Palette:** Set the type of colour bar.
- **Settings:** Set for the user preferences such as language, unit of temperature measurement, date, time. restore factory setting and display product information.

4.2. Image Mode

In main menu, press "Left/Right" button, highlight "Image mode" icon, highlight "Image mode", press the "**OK|ESC**" button to popup the Image submenu which contains three image modes. Hold down the "**OK|ESC**" button to exit the Palette Image mode menu.

Thermal Imager has 3 kinds of image modes for display. IR, Camera and AUF mode.

- **IR:** displays only infrared image
- **Camera:** displays only visible image
- **UF:** Auto Fusion mode, compare the centre area temperature with full screen, the machine will calculate the mix ratio of infrared and visible images automatically.

4.3. Image Palette

The Image Palette lets you change the false-colour presentation of the infrared images on display or captured. A variety of palettes are available for

specific applications. The standard palettes offer an equal, linear presentation of colours that allow for best presentation of detail.

4.4. Standard Palette

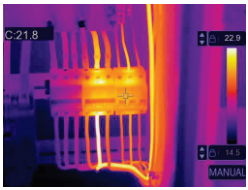
In main menu, press "Left/Right" button, highlight "Palette". Press the "**OK|ESC**" button, the Palette menu will pop up, Palette submenu which contains 8 kinds of color palettes. Hold down the "**OK|ESC**" button to exit the Palette setting menu.

4.5. Image Adjustment

There are three kinds of modes for image adjustments, histogram and Auto & Manual.

4.6. Lock Operation

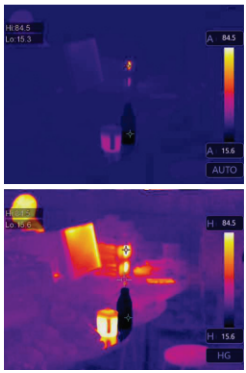
Press power key button to switch to Manual mode, lock the current scene temperature range. 🔒 means Manual**.**



4.7. Histogram Mode and Auto Mode

Auto mode: level and span are decided by the thermal image of minimum temperature and maximum temperature. The relationship between temperature and colour is linear.

Histogram mode: the thermal image is enhanced by histogram algorithm, The relationship between temperature and colour is not linear. Some parts of the image are enhanced.



4.8. Parameter Menu

In main menu, press "**Left/Right**" button, highlight "Parameter". Press the "**OK|ESC**" button, the Parameter submenu will pop up. Hold down the "**OK|ESC**" button to exit the Parameter setting menu.

4.9. Ambient Temperature Compensation

Ambient temperature will affect the measurement of the thermal imager, it can be compensated from 0 degrees to 50 degrees.

4.10. Reflective Temperature

The reflective temperature is important for radiometric temperature measurement. The Thermal Imager has temperature compensation for reflective temperature. To get more accurate temperature measurements, accurately set the reflective temperature. In most cases, the reflected temperature is identical to the ambient temperature. Only when objects with strong emissions with much higher temperature are in the proximity of the object being measured, the reflected temperature must be set.

4.11. Atmospheric Humidity

Water droplets in the air can absorb infrared rays. The wet air can affect the measurement of the temperature's accuracy, the compensation humidity can be set from 10%~100%.

4.12. Delta Temperature Compensation

In delta temperature, the value of the delta temperature will affect the measurement directly.

4.13. Distance

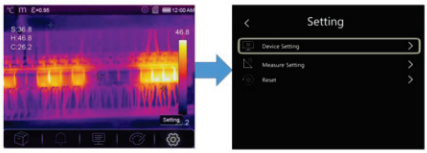
There are many substances in the air that can absorb infrared rays. So the infrared ray of the object will decay as the distance increases. The distance can be set from 2 meters to 1000 meters.

4.14. Emissivity

"Emiss" sets object emissivity, the value range is 0.01～1.00.

4.15. Settings Menu

In main menu, press "Left/Right" button, highlight "Settings". Press the "**OK|ESC**" button, the Settings submenu will pop up. Hold down the "**OK|ESC**" button to exit the setting menu.

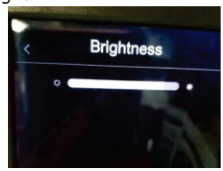


4.16. Device Settings
There are multiple pages in Device setting, press "**Left/Right**" button to go to next page, or go to previous page.

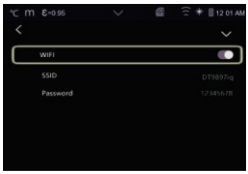
4.17. USB Mode
PC connection: Set the device as Mass storage mode, if connecting the device to the PC with USB cable, there will be a Mass storage device on the PC.
PC Camera: Set the device as UVC camera mode, if connecting the device to the PC with USB cable, there will be a UVC camera device on the PC.

4.18. Flashlight
Press "**Left/Right**" button to turn on the flashlight.

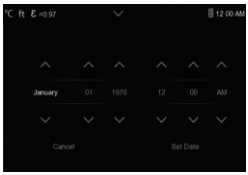
4.19. Brightness
Press "**Left/Right**" button to adjust the LCD brightness.



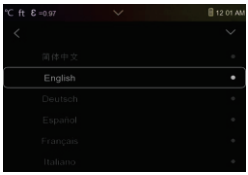
4.20. WIFI:
- Press "" → "" to turn on the wifi, the wifi model worked on access mode, set the SSID and Password to allow other device connect to it.
- The default SSID is "MTi5", the default password is "12345678".



4.21. Time Date
Press "**Left/Right**" button to change time/date, then press "Set Date" to save the change, or press "Cancel" to quit.

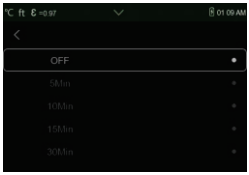


4.22. Language
Press "**Left/Right**" button to select the language you want.



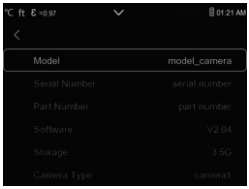
4.23. Auto Power Off

There are four options in auto power off menu, as follows: "OFF", "5Min", "10Min", "15Min", "30Min". When pressing any one of the buttons, the timer of Auto Power Off will be cleared and re-timed.



4.24. Info

The info menu contains all of the product information, such as: software version, serial number, etc.



4.25. Measure Setting

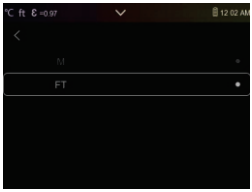
There are four options in Measure setting menu, as shown in the image.

4.25.1. Max/Min Enable

Press "**Left/Right**" button to highlight options on the Max/Min submenu, press "**OK|Exit**" to enable Max/Min point measurement.

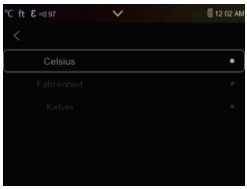
4.25.2. Distance Unit

Change the distance unit between "m" and "ft", "m" means meter, ft means Foot.1(ft)=0.3048(m);1(m)=3.2808399(ft)



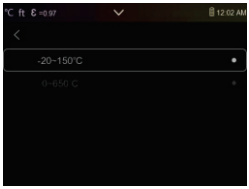
4.25.3. Temperature Unit

Temperature Unit have three types to choose: °C, °F and K. Conversion relationship: °F=1.8*°C+32, K=273.15+°C.



4.25.4. Temperature Range

The temperature measurement ranges have "-20°C~150°C" and "0°C~550°C" to choose. The overlap temperature of the two ranges is more accurate to choose "-20°C~150°C".

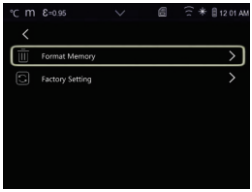


Emissivity:

Quick set the emissivity from the table below:

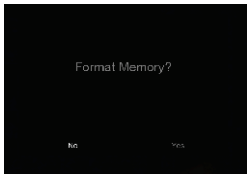
Material	Emissivity	Material	Emissivity
Water	0.96	Tape	0.96
Stainless Steel	0.14	Brass Plate	0.06
Aluminum Plate	0.09	Human Skin	0.98
Asphalt	0.96	PVC Plastic	0.93
Concrete	0.97	Polycarbonate	0.80
Cast Iron	0.81	Oxidized Copper	0.78
Rubber	0.95	Rust	0.80
Wood	0.85	Paint	0.90
Brick	0.75	Soil	0.93

4.25. Reset



4.26. Format Memory

Format Memory operation will format all the Pictures in the Gallery, the device setting is not affected.



5. FACTORY SETTINGS

Factory Settings of the Thermal Imager are as follows:

Item	Parameter	Value
Measurement	Center Spot Measurement	off
	Hot Spot Measurement	off
	Cold Spot Measurement	off
Measurement Parameters	Emissivity	0.95
	Reflective temperature	25°C
Image	Mode	Infrared
	Palette	Iron
	Adjustment	Auto
System Setting	Language	English
	HDMI Output	off
	Laser	off
	Lamp	off

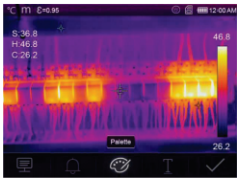
6. CAMERA MENU

Thermal Imager has photo and video functions. In photo function, the Imager can save thousands of images. Every image resolution is 1280x960. The format is ".jpg", and stores infrared data and visible data in an image. In video function, the Imager has .mp4 video capture for hours, and save infrared data in ".mp4" format.

Note: Images and video files are stored in the SD Memory Card. Images can easily be read and analysed within Thermal Imager PC software.

6.1. Save Image

1. In desktop, press photo button, freeze an image. The save menu will display.
2. Press "**Left/Right**" button to select "√" button save image, and the image will flash for a second, after the image is saved, the image will be unfrozen.



6.2. Change Measure Parameters
Press "**Left/Right**" button to highlight "**Parameters**", it will change the image's measure parameters: emissivity, ambient temperature, humidity, reflect temperature, infrared compensation and distance.

6.3. Add Analysis Tools
Press "**Left/Right**" button to highlight "**Measurement**", it can add or change the analysis tools in the image: point analysis, area analysis & line analysis.

6.4. Change Image Mode
Press "**Left/Right**" button to highlight "**image mode**", it can change the image mode: thermal, visible, picture in picture, Auto fusion, zoom.

6.5. Change Colour
Press "**Left/Right"** button to highlight "**Pallete**", it can change the image colour.

7. VIDEO MENU
The Thermal Imager has .mp4 video capture.
1. In desktop, press photo button and hold for about 2 seconds, start video capture with voice.
2. To stop video capture, press photo button again. The video will be saved in the video file.

7.1. Files Browser
In desktop, press "**Left/Right**" button to highlight , this will open the files Browser, which displays images and videos saved onto the SD Card.

7.2. Play a video
When current file type is video, press "**Left/Right**" button to highlight ▷ to play video.

Play Video

Stop Play Video

7.3. Delete A File

Press "**Left/Right**" button to highlight 🗑 to delete the current file.

7.4. Fault Diagnosis and Exclusion

If you encounter any problems while using the thermal imager, refer to the following table. If the problem persists, disconnect the power and contact the Company's technical support department.

Phenomenon of the fault	Cause of the fault	Solution
Thermal imager cannot start	No battery	Insert the battery
	No power	Replace the battery or charge it
Thermal imager shut down	No power	Replace the battery or charge it
No Thermal image	The lens cap cover	Opened the lens cap

8. ANDROID/IOS APP THERMAL-X SOFTWARE

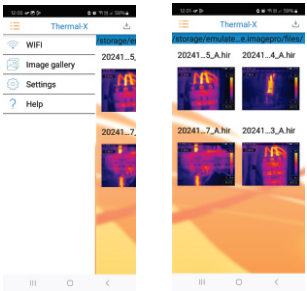
Android mobile phone: Android 4.0 above, with USB OTG Support
iOS: iPhone4 above

8.1. Thermal-X App Install

Search "Thermal-X" on Google Play
and the Apple Store or Scan the QR Code

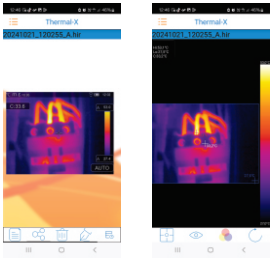
8.2. Thermal-X Function Import Pictures

1. Use the USB OTG cable to download the IR pictures from the thermal imager directly.
2. Copy the IR pictures from PC or SD card.



8.3. Analyse

Select a IR Picture and click " " icon to analyse it.



1.Image mode

Click " " icon to select image mode, there are four modes for you to select

(1) IR mode: only infrared picture displayed

(2) Visible mode: only visible picture displayed

(3) IR fusion mode: The infrared picture is fusioned with a visible picture

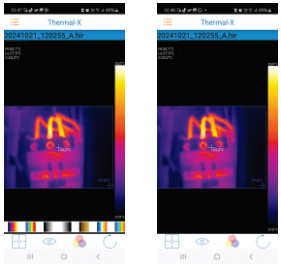
(4) Visible fusion mode: full screen fusion, the visible picture is fusioned with infrared picture.

2.Colour bar select.

Click " " icon to select colour bar. There are eight colour bar for you to choose.

3.Analyse

Click " " icon to analyse the IR pictures. There are three analysis tools:



(1) Point analyse: Add a point to the picture, it will display the temperature of the point.

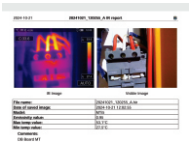
(2) Line analyse: Add a line to the picture, it will display the highest, lowest and average temperature of the line.

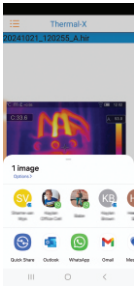
(3) Area analyse: Add a rectangle to the picture, it will display the highest, lowest and average temperature of the rectangle.

4.Save and exit.
Click "↻" to save and return to the main page of the APP.

8.4. Report and Share

1.Report
Click "📄" icon to report as a .pdf file.
2.Share
Click "⋔" icon to share the Infrared picture with Email, Whatsapp, etc.





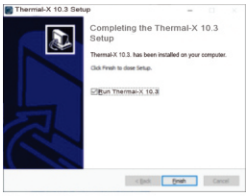
8.5. PC software

8.5.1. Software install and uninstall System required

Works on Windows 10 or a higher version of Windows system. ".Net Framework 4.6" is required when you install Thermal-X software. If not, please find and install our Microsoft. NET_Framework_v4.6.exe that is provided to you. Open the net framework 4.6, and follow all tips to install Net Framework 4.6 until it finishes. If your system already has installed Net Framework 4.6, then there is no need to install it again.

8.5.2. Thermal-X install

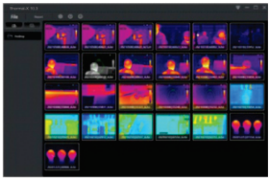
Insert your installation USB to install the software directly if you have one, or you can run "setup.exe" to install it as follows:



Click "Next" to install, until finished installation.
Once the installation is successful, click "Finish" as above.

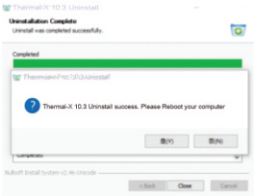
8.5.3. Running

After ensuring Thermal-X software has been installed, click shortcuts on the desktop to run the software.



8.5.4. Uninstall

Uninstall Thermal-X in the Installation directory as follow .run "uninst.exe" and then click "YES" to start to uninstall, and finally choose whether or not to reboot the computer.



9. SPECIFICATIONS

9.1. Imaging and Optical Data

Function	Range
Field of View (FOV) / Minimum Focus Distance	43° x 23° / 0.5m
Thermal Sensitivity / NETD	<0.05°C @ 30°C (86°F) / 50mK
Image Frequency	25Hz
Focus Mode	Focus Free
Focal Plane Array (FPA)/ Spectral Range	Uncooled microbolometer / 8-14μm
IR Resolution	160x120 Pixels

9.2. Image Presentation

Function	Range
Display	2.8" LCD, 320x240 pixels
Image Modes	IR Image, Visual Image, Picture in Picture, Auto Fusion
Colour Palettes	IRON, Rainbow, Grey, Grey Inverted, Brown, Blue-Red, Hot-Cold, Feather

9.3. Measurement

Function	Range
Object Temperature Range	-20°C to 150°C (-4°F to 302°F) 0°C to 550°C (32°F to 1022°F)
Accuracy	±2°C (3.6°F) or ±2% of reading (Environment temperature 10-35°C Object temperature >0°C)

9.4. Measurement Analysis

Function	Range
Spot	Centre Spot, three manual spots
Automatic Hot/Cold Detection	Auto Hot or Cold Markers
Area	Three areas analyse
Measurement Corrections	Emissivity, Reflected Temperature, Ambient Temperature, Atmospheric Humidity, Infrared Compensation, Distance Compensation

9.5. Storage of Videos

Function	Range
Storage Media	8GB Micro SD Card and 3.4GB Internal EMMC
Video Storage Format	Standard MPEG-4 Encode, 640x480 at 30fps, on memory card >60 minutes
Video Storage Mode	IR/Visual Images; simultaneous storage of IR and visual images

9.6. Storage of Images

Function	Range
Image Storage Format	Standard JPEG or HIR files including measurement data on memory card, >6000 pictures
Image Storage Mode	IR/Visual Images; simultaneous storage of IR and visual images
Image Analysis	Internal Image Analysis tools, complete function

9.7. Set-Up

Function	Range
Set-Up Commands	Local adaptation of units, language, date & time and info of camera
Languages	Multinational

9.8. Digital Camera

Function	Range
Built-in Digital Camera	2 Megapixels
Built-in Digital Lens Data	FOV 59°

9.9. Data Communication Interfaces

Function	Range
Interfaces	USB-C
USB	Data transfer between Camera & PC
WiFi	802.11, transfer images and realtime video stream

9.10. Power System

Function	Range
Battery	Li-ion,
Operating Time	4 Hours
Input Voltage	DC 5V
Charging System	In Camera (AC Adaptor)
Power Management	Automatic Shutdown

Battery Longevity: Li-ion batteries naturally degrade over time, which can shorten usage duration between charges, even with minimal use. Keep the battery's age in mind for optimal performance.

9.11. Environmental Data

Function	Range
Operating Temperature	-15°C to 50°C (5°F to 122°F)
Storage Temperature	-40°C to 70°C (-40°F to 158°F)
Humidity (Operating & Storage)	10% to 90%
Drop Test	2m
Bump	25g (IEC60068-2-29)
Vibration	2g (IEC60068-2-6)

9.12. Physical Data

Function	Range
Weight	180g (Including Battery)
Dimensions (LxWxH)	90 x 85 x 25mm

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