Thermal Camera

SATIR

i-Series

User's manual

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Version 1.3

About this IR Camera User Guide

Symbols Used

	**This mark denotes issues that may affect the IR camera's operation.**
	**This mark denotes additional topics that complement the basic operation procedures.**

Thumb Index

Introduction of camera components.

Preparing the IR Camera

Describes basic functions, learning how to turn on/off the IR camera and work with the control panel and LCD monitor.

Basic function

Describes working with the camera, from each analysis settings to using the camera's various analysis tools.

Shooting

Explains how to review recorded images, erase images and playback voice memos.

Playback and erase

Explains how to transfer images or video to a computer.

Connection and download

You must read this section before connecting your camera to a computer.

Table of Contents

Read This First

Please Read

Test Shots

Before you try to shoot important subjects, we highly recommend that you shoot several trial images to confirm that the IR camera is operating and being operated correctly.

Please note that SATIR, its subsidiaries and affiliates, and its distributors are not liable for any consequential damages arising from any malfunction of an IR camera or accessory that results in the failure of an image to be recorded or to be recorded in a format that is machine readable.

Warning Against Copyright Infringement

Safety Precautions

Before using the camera, please ensure that you read and understand the safety precautions described below. Always ensure that the IR camera is operated correctly.

The safety precautions noted on the following pages are intended to instruct you in the safe and correct operation of the IR camera and its accessories to prevent injuries or damage to yourself, other persons and equipment.

Warnings

Read on to learn about using IR camera properly.

Avoid damaging eyesight

> ***Warning:*** Do not trigger the laser pointer in human or animal eyes. Exposure to the laser produced by the laser pointer may damage eyesight.

Do not disassemble

Do not attempt to disassemble or alter any part of the equipment that is not expressly described this guide.

Stop operating immediately if it emits smoke or noxious fumes

Failure to do so may result in fire or electrical shock. Immediately turn the IR camera's power off, Unplug the power cord from the power outlet. Confirm that smoke and fume emissions have ceased.

Stop operating immediately if it is dropped or the casing is damaged

Failure to do so may result in fire or electrical shock. Immediately turn the IR camera's power off, Unplug the power cord from the power outlet.

Do not use substances containing alcohol, benzene, thinners or other flammable substances to clean or maintain the IR camera

The use of these substances may lead to fire.

Remove the power cord on a regular periodic basis and wipe away the dust and dirt that collects on the plug, the exterior of the power outlet and the surrounding area

In dust, humid or greasy environments, the dust that collects around the plug over long periods of time may become saturated with humidity and short-circuit, leading to fire.

Do not handle the power cord if your hands are wet

Handling it with wet hands may lead to electrical shock. When unplugging the cord, ensure that you hold the solid portion of the plug. Pulling on the flexible portion of the cord may damage or expose the wire and insulation, creating the potential for fires and electrical shocks.

Do not cut, alter or place heavy items on the power adapter cord

Any of these actions may cause an electrical short circuit, which may lead to fire or electrical shock.

Use only the recommended power accessories

Use of power sources not expressly recommended for this IR camera may lead to overheating, distortion of the IR camera, fire, electrical shock or other hazards.

Use only recommended accessories

Disconnect the compact power adapter from both the IR camera and power outlet after recharging and when the IR camera is not in use to avoid fires and other hazards

Continuous use over a long period of time may cause the unit to overheat and distort, resulting in fire.

Exercise due caution when screwing on the separately sold tele-lens, close-up lens

If the lens is loosened and fallen off, the glass shards may cause an injury.

If your camera is used for prolong periods, the IR camera body may become warm

Please take care when operating the IR camera for an extended period as your hands may experience a burning sensation.

Once the equipment reach end of live

2012/19/EU (WEEE directive): Products marked with this symbol cannot be disposed of as unsorted municipal waste in the European Union. For proper recycling, return this product to your local supplier upon the purchase of equivalent new equipment, or dispose of it at designated collection points. For more information see: www.recyclethis.info

Prevent Malfunction

Read on to learn about preventing malfunction of IR camera.

Avoid damaging the detector of the IR camera

> ***Warning:*** Do not aim the IR camera directly into the sun or at other intense heat source which could damage the detector of the IR camera.

Avoid Condensation Related Problems

Moving the IR camera rapidly between hot and cold temperatures may cause condensation (water droplets) on its external and internal surfaces.

You can avoid this by placing the IR camera in the plastic case (bundle) and letting it adjust to temperature changes slowly before removing it from the case.

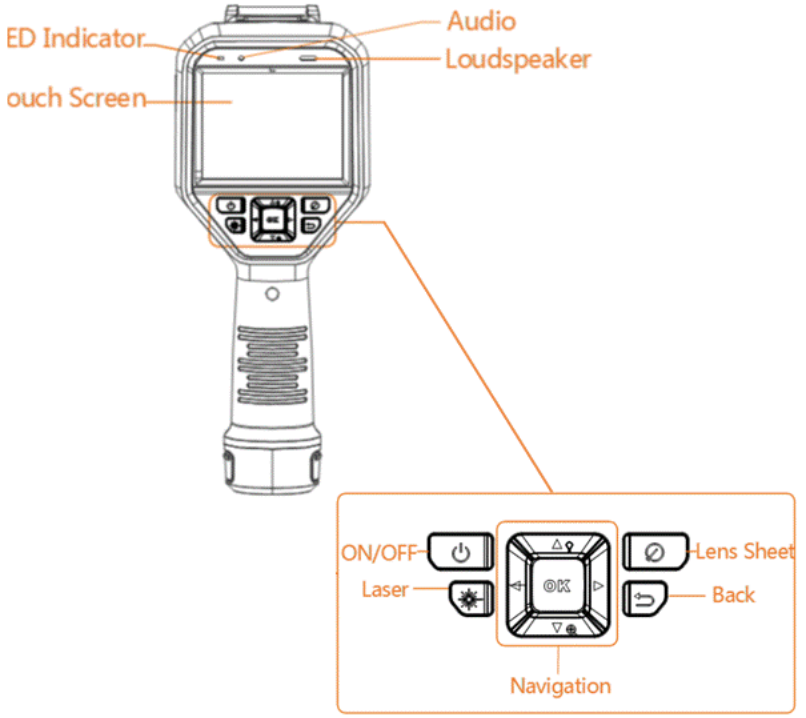
If Condensation Forms Inside the IR Camera

Stop using the camera immediately if you detect condensation. Continue to use may damage the IR camera. Remove the PC card, and a household power source, from the IR camera and wait until moisture evaporates completely before resuming use.

Right Reserved

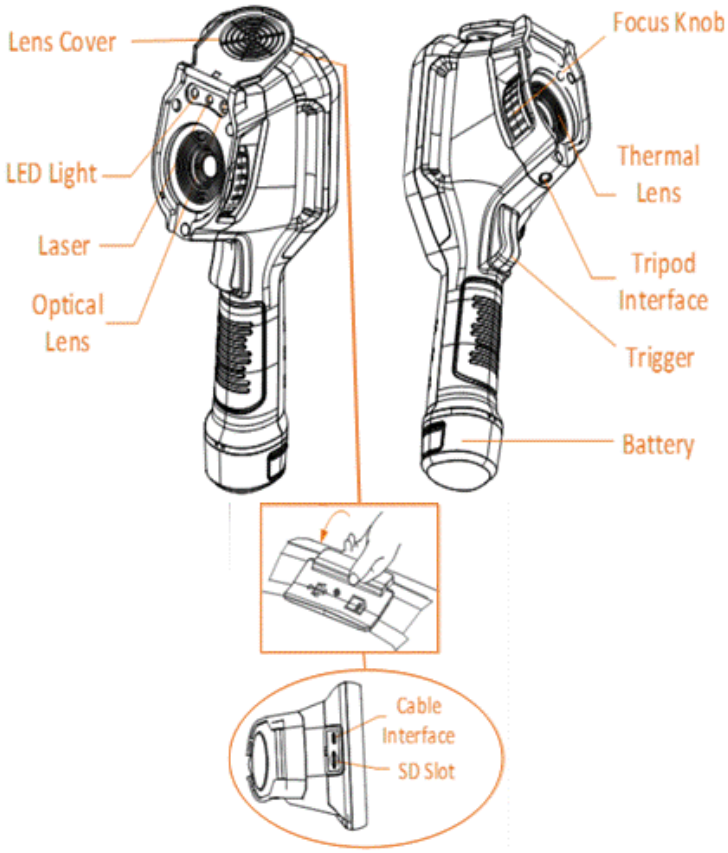
Component Guide

Front View



Component Guide

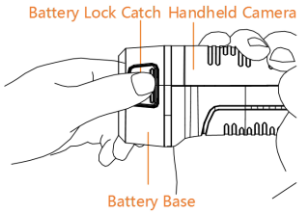
Side / Top View



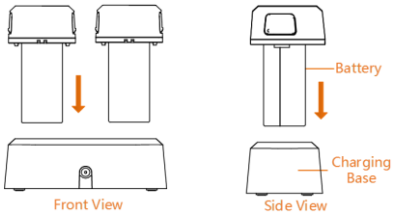
Preparing the IR Camera

Charging the device

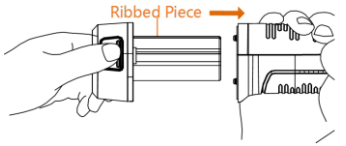
- Please only use the approved batteries and power adaptor supplied with the camera



- Hold the device and press both sides of the battery lock catch as illustrated above.
- Keep hold of the battery and withdraw it from the housing.
- Insert the battery into the charging housing. The status of the battery is shown via the charging status lamps on the base.



- When the battery is fully charged, remove the battery from the charging base.
- Align the ribbed piece on the battery with the notch of the device, and insert battery into the camera housing.



Preparing the IR Camera

Charging the Device via Cable Interface

Before You Start

Please make sure the battery is installed before charging.

Steps

1. Open the top cover of the device.
2. Connect the interface and the power adaptor with Type-C or USB cable.

Preparing the IR Camera

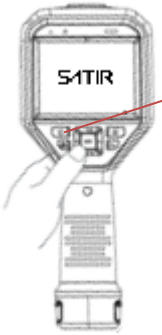
Turning the Power On / Off

The power indicator is lit while the power of the camera is on.

1

Holding the camera correctly with your left hand, put your thumb above the key pad and put your forefinger in front of the definable trigger.

2



Power switch

Press and hold the power switch for 3 seconds.

It may take the camera 30 seconds to be fully operational.

3

After a while, a startup image will appear on the screen.

4 **Turn off the camera.**

Hold the power switch for 3 seconds.

- The power indicator goes off.

Auto Power off Duration

Set Auto Power-off Duration
Go to **Local Settings** → **Device Settings** → **Auto Power-off Duration Settings** to set the automatic shutdown time for device as required

Basic Functions

Menu Operation

The device supports both touch-screen control and button control.

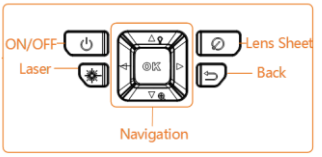
Touch-screen control

Tap on the screen to set parameters and configurations.

Figure 2-4 Touch-screen Control

Button control

Press the navigation buttons to set parameters and configurations.



- Press △,▷,▽,◁ and to move the cursor up/down/left/right.
- Press OK to confirm.

Description Component	Function
Laser Button	Hold the button to turn on laser, and release the button to turn off laser.
Navigation Button	Menu Mode: ● Press △, ▽ , ▷ ,and ◁ to select parameters. ● Press to OK confirm.
	Non-Menu Mode: ● Press △ to turn on/off the LED light supplement. ● Press ▽ to start digital zoom.
Lens Sheet Button	Cover the lens to perform the correction. [NUC]
Back Button	Exit the menu or return to previous menu.
Focus Knob	Adjust lens focal length. See ***Focus Lens***.
Trigger	Pull the trigger to capture. Hold the trigger to record videos.
Cable Interface	Connect the device to your PC via cable to export files.

Basic Functions

Menu Description

In the observation interface, tap the screen or press to show the menu bar.

Set Date and Time

Steps

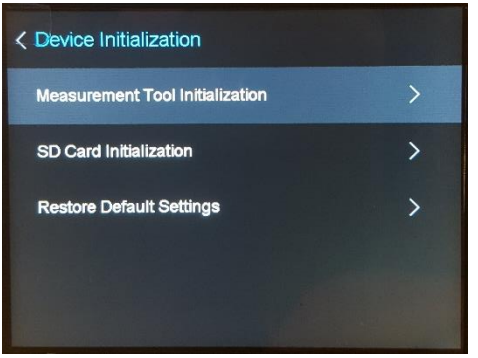
1. Go to **Local Settings → Device Settings → Time and Date**.
2. Set the date and time.
3. Press to save and exit.

Note

Go to **Local Settings → Image Settings → Display Settings** to enable or disable time and date display.

Setting to Default

Go to **Local Settings → Device Settings → Device Initialization** to initialize the device and restore default settings.



Shooting

IR camera Adjustment

Focus Lens

Adjust the lens focal length properly before you set any other configurations, or it may affect the image display and temperature accuracy.

Steps

1. Power on the device.
2. Aim the device lens to the appropriate scene.
3. Adjust the focus knob clockwise or anticlockwise, see figure below.

Note

DO NOT touch the lens to avoid affecting the display effect.

Screen Brightness

Go to **Local Settings** → **Device Settings** → **Display Brightness** to set the screen brightness. It can be set as **Low**, **Medium**, or **High**.

Display Mode

You can set the thermal/optical view of the device. **Thermal**, **Fusion**, **PIP**, and **Optical** are selectable.

Steps

1. Select  from the main menu.
2. Tap on the icon to select the display mode .

 In thermal mode, the device displays the thermal view.

 In fusion mode, the device displays the combined view of thermal channel and optical channel.

Note

You can press ◁ and ▷to set the fusion distance. Or go to **Local Settings** → **Image Settings** → **Parallax Correction** to select the fusion distance.

 In PiP (Picture in Picture) mode, the device displays thermal view inside the optical view.

Note

You can press ◁ and ▷to set the PiP proportion. Or go to **Local Settings** → **Image Settings** → **PiP Proportion** to set the value.

 In optical mode, the device displays the optical view.

3. Press  to exit.

Palettes Setting

The palettes allow you to select the desired colours.

Steps

1. Select  from the main menu.

2. Tap on the icons to select a palette type.

White Hot

The hot part is light-coloured in view.

Black Hot

The hot part is black coloured in view.

Rainbow

The target displays multiple colours, it is suitable for scene without obvious temperature difference.

Ironbow

The target is coloured as heated iron.

Red Hot

The hot part is red coloured in view.

Fusion

The hot part is yellow-coloured, and the cold part is purple-coloured in view.

Rain

The hot part in the image are coloured, and the else is blue.

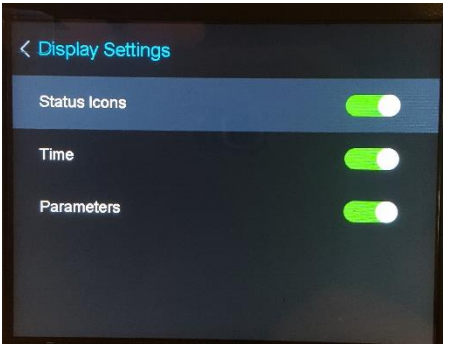
3. Press to exit the setting interface.

Digital Zoom Adjustment

In the live view interface, press ▽ to adjust the digital zoom to 1×, 2×, or 4× Then you can view the target or scene in larger size.

Local Display Settings

Go to **Local Settings** → **Image Settings** → **Display Settings** to enable the corresponding icons. Then you can view the device status, time, and target emissivity in live view interface.



Temperature Measurement

The thermography (temperature measurement) function provides the real-time temperature of the scene and display it on the left of your screen. The thermography function is turned on by default.

Set Thermography Parameters

You can set thermography parameters to improve the accuracy of temperature measurement.

Steps

1. Go to **Local Settings** → **Thermography Settings**.
2. Set the **Thermography Range**, and **Emissivity**, etc.

Thermography Range

Select the temperature measurement range. The device can detect the temperature and switch thermography range automatically in **Auto Switch** mode.

Emissivity

Refer to ***Common Material Emissivity Reference*** to set the emissivity of your target.

Reflection Temperature

If any object (not the target) of high temperature is in the scene, and the target emissivity is low, set the reflection temperature as the high temperature to correct the thermography effect.

Distance

The distance between the target and the device. You can customize the target distance or select the target distance as **Near**, **Middle**, or **Far**.

Environment Temperature

The average temperature of the environment.

Humidity

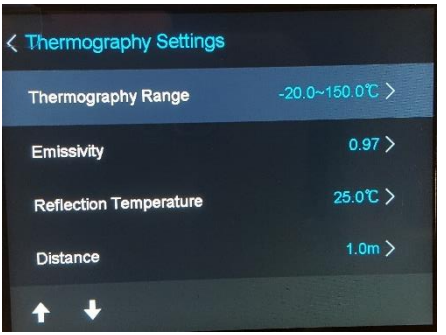
Set the relative humidity of current environment.

Note

Go to **Local Settings** → **Image Settings** → **Display Settings** to enable/disable the emissivity display.

Note.

You can go to **Local Settings → Device Settings → Device Initialization → Measurement Tool Initialization** to initialize the temperature measurement parameters.



Set Unit

Go to **Local Settings → Device Settings → Unit** to set the temperature unit and distance unit.

Note

You can go to **Local Settings → Image Settings → Display Settings** to enable/disable the temperature display.

Temperature Range

Set a temperature section and the palette only works for targets within the temperature section. You can adjust the temperature range.

Steps

1. Select  from the main menu
2. Select auto adjustment  or manual adjustment 

Auto adjustment

Select  and press OK the device adjust temperature range parameters automatically

Manual Adjustment

- Select  and press OK
- **Level and Span** adjustment. Press ◁ or ▷ to select the max , min temperature or both. You can also tap on the screen to select the max or min temperature.
- Press △ or ▽ adjust the temperature value. You can also tap on the arrow on the right side of the screen to adjust the temperature value.
- Press  to exit .

LED Setting

LED Light

Go to **Local Settings** → **Device Settings** → **Light Supplement**.

Tap  to enable LED light, or press △ in the live view to enable/disable the LED light.

Laser

In the live view interface, hold  to enable/disable the laser light.

Caution

The laser radiation emitted from the device can cause eye injuries, burning of skin or inflammable substances. Before enabling the Light Supplement function, make sure no human or inflammable substances are in front of the laser lens.

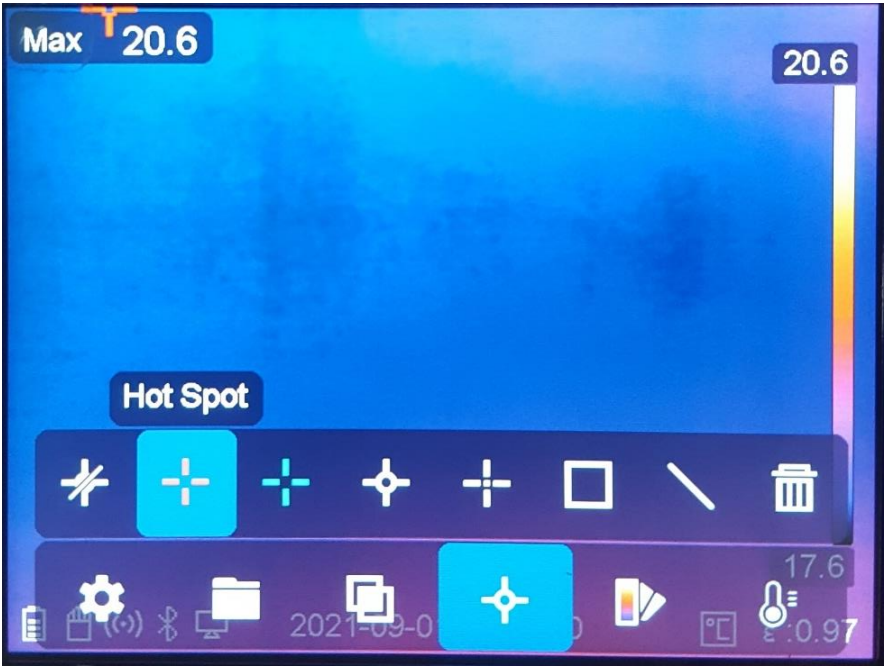
Fulfill the Analysis Function

Set Thermography Rules

You can set thermography parameters to improve the accuracy of temperature measurement.

Steps

1. Select  from the main menu.
2. Set the analysis parameters , point, line , as shown below.



Setting Analysis tools

Point Rule

You can set four types of point thermography rules.

Icon	Description
	Centre Point Thermography
	High-temperature Point Thermography
	Low-temperature Point Thermography
	Custom Point Thermography

The setting method of centre point, high-temperature, and low-temperature point thermography are all the same. Here is the example of setting high-temperature point thermography.

Example

Tap  on the interface, the device locates the point of the highest temperature, and displays Max: XX.

Custom Point Thermography

The device can detect the temperature of a custom point.

Steps

1. Select. 
2. Press. OK
3. Move the point with the navigation buttons or tap on the touchscreen to select a point.
4. Press. OK the temperature of custom point (e.g., P1) displays P1: XX.
5. Repeat step 1 to 3 to set other custom points.

Note

At most ten custom points supported.

Set Line Rule

Steps

1. Select. 

2. Press OK to generate a default line.

3. Press ▽, △, ◁, and ▷ to move the line up/down/left/right.

4. Drag points of the line on the touchscreen to extend or shorten the line.

5. Press. OK

Note

Only one line is supported.

The max. temperature, low temperature, and average temperature of line (e.g. L1) displays L1 Max: XX Min: XX Avg: XX. The real-time temperature trend chart will display.

Set Frame Rule

Steps

1. Select. 

2. Press OK to generate a default frame.

3. Press ▽, △, ◁ and ▷ to move the frame up/down/left/right.

4. Press  to enlarge the frame and press  to contract the frame. Or you can drag the corner of the frame on touchscreen to enlarge or contract the frame.

5. Press. OK

The max. temperature, low temperature, and average temperature of frame (e.g., S1) displays S1 Max: XX Min: XX Avg: XX.

6. Repeat step 1 to 5 to set other frames.

Note

At most three frames are supported.

DELETE RULES

Tap  and press OK to clear all temperature rules. Or tap  and choose the single rule you want to delete.

Set Temperature Alarm

Set the alarm rules and the device will alarm when the temperature triggers the rule.

Before You Start

Set the palette.

Steps

1. Go to **Palettes** from the main menu.
2. Tap the icons to select an alarm rule type.
3. Optional: Press △ and ▽ to select between upper limit and lower limit.
4. Press ◁ and ▷ to adjust the rule temperature.
5. Press ⮌ to exit

icon	Alarm Mode	Description
	Above Alarm	Set the alarm temperature, and the device alarms when target temperature is higher than rule temperature.
	Below Alarm	Set the alarm temperature, and the device alarms when target temperature is lower than rule temperature.
	Interval Alarm	Set the alarm temperature section (e.g., 90 °C to 150 °C), when target temperature is within the section (e.g., 100 °C), the device alarms.
	Insulation Alarm	Set the alarm temperature section (e.g., 90 °C to 120 °C), when target temperature is without the section (e.g., 70 °C or 125 °C), the device alarms.

Set Alarm/Alert Thermography Rules

Alarm actions, such as: audible warning and sending notification to the client software, are triggered when the tested temperature exceeds the set alarm or alert value.

Steps

1. Go to **Settings** → **Thermography Settings** → **Alarm Settings**.
2. Enable the function and set the alarm threshold, alert threshold, and audible warning.

Alarm Threshold

When the tested temperature exceeds the threshold, the device sends alarm notification to the client software. It beeps if the audible warning is enabled. The frame flashes red if the frame rule is configured.

Alert Threshold

When the tested temperature exceeds the threshold, the device sends alert notification to the SATIR i-Series App.

Audible Warning

The device beeps when target temperature exceeds the alarm threshold.

Fulfill the Analysis Function

Picture and Video

Insert memory card into the device, then you can record videos, capture snapshots, and mark and save important data.

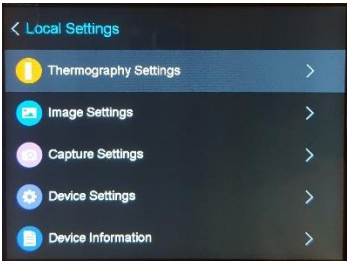
Note

● Device does not support capturing or recording when the menu is shown.

● When the device is connected to your PC, it does not support capturing or recording.

● Go to **Local Settings** → **Device Settings** → **Filename Header**, you can set the filename header for capturing or recording to distinguish the files recorded in a specify scene.

Go to **Local Settings** → **Device Settings** → **Device Initialization** to initialize the memory card is needed.



Fulfill the Analysis Function

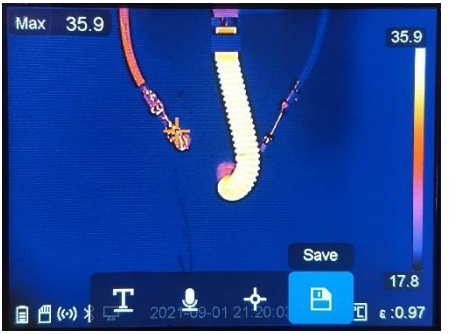
Snapshot and Edit the Image

Capture Picture

Steps

1. Go to **Local settings** **Capture Settings**
2. Select Capture Mode to set the capture mode
    a. Single capture
        i. Capture one picture for one time
    b. Continuous Capture
        i. Capture multiple pictures for one time. you can set the amount of pictures
    c. Time capture
        i. Device captures one picture after the specified time interval. You can set time interval as required.
3. Select picture type
    a. Offline picture
        i. Select this type when analysing the picture with the client's software. you can add remakes on the picture.
    b. Thermal Graphic
        i. Select this type for custom software development. remark on the picture is not allowed.
4. Optional - you can enable flashlight to get a clear visual picture in a dark environment.
5. Optional – set the optional resolution as needed.
6. Press ⮌ to exit.
7. In the live view interface, pull the trigger to capture snapshoot

8. Offline Picture Mode
    a. In this mode when the users click the trigger button the live image will freeze, and the display has a editing interface



    b. Tap  to add text remarks. Tap the screen to show the keypad interface, enter the comments and confirm.
    c. Tap  to add voice remarks. Hold OK to start recording and release the button to stop recording
    d. Tap  to add thermography analysis.
    e. Tap  of pull the trigger to save the snapshot
9. Refer to export files to export the save snapshot

Note

The image editing interface is not available in the Thermal Graphic Mode.

Fulfill the Analysis Function

Record / Replay the Video

Steps

1. In the live view interface, pull the trigger to start recording. The recording icon and count down number display in the interface

2. When you finish, pull the trigger again to stop recording. The recording video will be saved automatically and exit.

Fulfill the Analysis Function

Playback and Erase

Opening images

Steps

1. Select  from the main menu.

2. Press, ▽,△,◁ and ▷to select the video or snapshot.

3. Press OK to view the file.

Note

● When you are viewing the videos or capture snapshots, you can switch the file by tapping  or  .

● When you are viewing the snapshots, you can tap  to play the sound. Refer to ***Connect Bluetooth*** to set the Bluetooth.

● For more information contained in capture snapshots or videos, you can install the thermography client to analyse them. You can get the thermography client software from the disk packed in box.

Fulfill the Analysis Function

File Manager

Connect the device to your PC with supplied cable, you can export the recorded videos and captured snapshot.

Steps

1. Open the cover of cable interface.
2. Connect the device to your PC with cable and open the detected disk.
3. Select and copy the videos or snapshots to PC to view the files.
4. Disconnect the device from your PC.

Note

For the first time connection, the driver will be installed automatically.

Light Settings

Set LED Light

Go to **Local Settings** → **Device Settings** → **Light Supplement**  and tap to enable LED light.

You can also press ▲ in live view to enable the LED light.

Set Laser Pointer

When in live view press and hold  to enable the laser pointer, release  to turn it back off.

Connection and Download

Connect Bluetooth

You can record and hear the sound contained in the videos or images via Bluetooth headsets after pairing the device with Bluetooth headsets successfully.

Steps

1. Select  from the main menu.
2. Go to **Local Settings** → **Device Settings** → **Bluetooth**.
3. Tap on  to enable the Bluetooth.

Note

You can also press  or OK to quit pairing.

The device will search the nearby enabled Bluetooth headsets and pair them automatically.

Result

After pairing you can record and hear the sound via the headsets while recording and playing the video or image

Connection and Download

Connect to Thermal APP

The device supports both Wi-Fi connection and WLAN hot spot. Connect the device to SATIR-Thermal software, and you can control the device via mobile client.

NOTE: Please try all of the below options as some may not work with certain Android phones.

Connection and Download

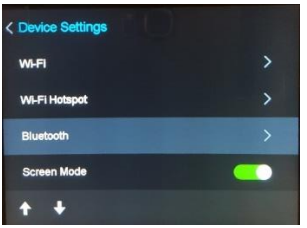
Connect Via Wi-Fi

Before You Start

Download and install client software on your phone.

Steps

1. Go to **Local Settings** → **Device Settings** → **Wi-Fi**.
2. Tap  to enable Wi-Fi, and the searched Wi-Fi will be listed as below.



3. Select Wi-Fi and enter password to show the keypad interface.

Note

DO NOT tap **enter** or **space**, or the password may be incorrect.

4. Tap **Close** to hide the keypad.
5. Tap OK.
6. Search the USB stick for the App, download and install the app. Alternatively download i-Series app from https://satir.com/software
7. Launch the App and follow the start-up wizard to create, and register an account.
8. Add the device to online devices.

Result

You can view the live view, capture snapshots, and record videos via the client.

Connection and Download

Connect Via Hot Spot

Before You Start

Download and install client software on your phone.

Steps

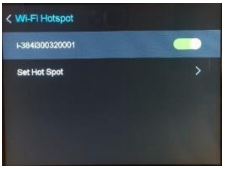
1. Go to **Local Settings** → **Device Settings** → **Wi-Fi Hotspot Settings**.

2. Tap  to enable WLAN hot spot function.

3. Tap **Set Hot Spot** to set the WLAN hot spot. The hot spot name and password display automatically.

4.Edit the hot spot name and password, show the keypad interface.

DO NOT tap **enter** or **space**, and at least 8 characters, or the password may be incorrect.



5. Tap **Close** to hide the keypad.

6. Connect your phone to the WLAN Hot Spot of the device.

7. Search the USB stick for the App, download and install the app. Alternatively download i-Series app from https://satir.com/software

8.Launch the app and follow the start-up wizard to create and register an account.

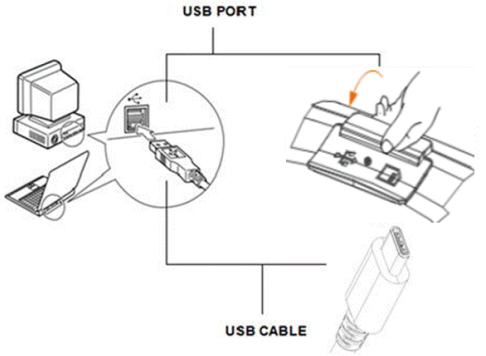
9. Select Wi-Fi configuration in the software, enter the serial number of devices to add the device. Refer to the manual of client software for details.

Connection and Download

Connect to a Computer

Connection

Connect the USB cable to the computer's USB port and the multi-functional dock's terminal.



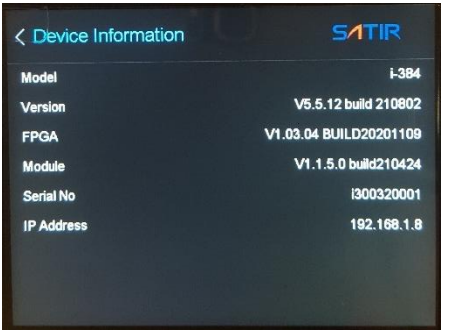
- **You do not need to turn off the computer or camera when making this connection.**
- **Please refer to your computer manual for information regarding the location of the USB port**

Maintenance

Upgrade Device

View Device Information

Go to **Local Settings** → **Device Information** to view the device information.



Upgrade Device

Steps

1. Connect the device to your PC with cable and open the detected disk.
2. Copy the upgrade file and paste it to the root directory of the device.
3. Disconnect the device from your PC.
4. Reboot the device and then it will upgrade automatically. The upgrading process will be displayed in the main interface.

Note

After upgrading, the device reboots automatically. You can view the current version in **Local Settings** → **Device Information**.

Troubles Shooting

Default Setting

Problem	Cause	Solution
Camera will not operate	Power is not turned on	• Turn on the camera. See *Turning the Power On / Off*
	Insufficient battery voltage	• Fully charge the battery.
Camera will not record	Internal memory is full	• If required, download the images to a computer and erase them to make some space.
Battery pack consumed quickly	Battery pack capacity reduced because of disuse for one year or more after being fully charged.	• Replace the battery pack with a new one.
	Battery life exceeded.	• Replace the battery pack with a new one

Appendix

Camera Care and Maintenance

Use the following procedures to clean the camera body, lens, LCD monitor and other parts.

Camera Body	**Wipe the body clean with soft cloth or eyeglass lens wiper.**
Lens	**First use a lens blower to remove dust and dirt, then remove any remaining dirt by wiping the lens lightly with soft cloth.** • Never use synthetic cleaners on the camera body or lens.
LCD monitor	**Use a lens blower brush to remove dust and dirt. If necessary, gently wipe the LCD monitor with soft cloth or an eyeglass lens wiper to remove stubborn dirt.** • Never rub or press forcefully on the LCD monitor. These actions may damage it or lead to other problems.

Never use thinners, benzene, synthetic cleaners or water to clean the camera. These substances may distort or damage the equipment.

Appendix

Emissivity table

Material	Temperature (°C)	Emissivity approximation
Metal		
Aluminum		
Polished aluminum	100	0.09
Commercial aluminum foil	100	0.09
Electrolytic chromeplate alumina	25 ~ 600	0.55
Mild alumina	25 ~ 600	0.10 ~ 0.20
Strong alumina	25 ~ 600	0.30 ~ 0.40
Brass		
Brass mirror (highly polished)	28	0.03
Brass oxide	200 ~ 600	0.61 ~ 0.59
Chrome		
Polished chrome	40 ~ 1090	0.08 ~ 0.36
Copper		
Copper mirror	100	0.05
Strong copper oxide	25	0.078
Cuprous oxide	800 ~ 1100	0.66 ~ 0.54
Liquid copper	1080 ~ 1280	0.16 ~ 0.13
Gold		
Gold mirror	230 ~ 630	0.02

Appendix

Emissivity table (continue)

Material	Temperature (°C)	Emissivity approximation
Polished cast iron	200	0.21
Processed cast iron	20	0.44
Polished tempered Iron	40 ~ 250	0.28
Polished steel ingot	770 ~ 1040	0.52 ~ 0.56
Raw welded steel	945 ~ 1100	0.52 ~ 0.61
Surface ferric oxide	20	0.69
Completely rusty surface	22	0.66
Rolled iron plate	100	0.74
Oxidized steel	198 ~ 600	0.64 ~ 0.78
Cast iron (Oxidizing at 600°C)	198 ~ 600	0.79
Steel (Oxidizing at 600°C)	125 ~ 520	0.78 ~ 0.82
Electrolytic ferric oxide	500 ~1200	0.85 ~ 0.89
Iron plate	925 ~ 1120	0.87 ~ 0.95
Cast iron, heavy ferric oxide	25	0.80
Tempered iron, ferric oxide	40 ~ 250	0.95
Melting surface	22	0.94
Melting cast iron	1300 ~ 1400	0.29
Melting mild steel	1600 ~ 1800	0.28
Liquid steel	1500 ~ 1650	0.42 ~ 0.53
Pure liquid iron	1515 ~ 1680	0.42 ~ 0.45

Appendix

Emissivity table (continue)

Material	Temperature (°C)	Emissivity approximation
Lead		
Pure lead (Non-oxidization)	125 ~ 225	0.06 ~ 0.08
Mildly oxidized	25 ~300	0.20 ~ 0.45
Magnesium		
Magnesia	275 ~ 825	0.55 ~ 0.20
Magnesia	900 ~ 1670	0.20
Hg	0 ~ 100	0.90 ~ 0.12
Nickel		
Electroplate polishing	25	0.05
Electroplate	20	0.01
non-polishing		
Nickel wire	185 ~ 1010	0.09 ~ 0.19
Nickel plate	198 ~ 600	0.37 ~ 0.48
Nickel oxide	650 ~ 1255	0.59 ~ 0.86
Nickel alloy		
Nickel-chrome (heat-resistance) alloy wire (shining)	50 ~ 1000	0.65 ~ 0.79
Nickel-chrome alloy	50 ~ 1040	0.64 ~ 0.76
Nickel-chrome (heat resistance)	50 ~ 500	0.95 ~ 0.98
Nickel-silver alloy	100	0.14
Silver		
Polished silver	100	0.05

Appendix

Emissivity table (continue)

Material	Temperature (°C)	Emissivity approximation
Stainless steel		
18-8	25	0.16
304(8Cr,18Ni)	215 ~ 490	0.44 ~ 0.36
310(25Cr,20Ni)	215 ~ 520	0.99 ~ 0.97
Tin		
Commercial tin plate	100	0.07
Strong oxidization	0 ~ 200	0.60
Zinc		
Oxidizing at 400°C	400	0.01
galvanized shining iron plate	28	0.23
Ash zinc oxide	25	0.28
Non-metal materials		
Brick	1100	0.75
Fire brick	1100	0.75
Graphite(lamp black)	96 ~ 225	0.95
Porcelain enamel (white)	18	0.90
Asphaltum	0 ~ 200	0.85
Glass (surface)	23	0.94
Heat-resistance glass	200 ~ 540	0.85 ~ 0.95
Calcimine	20	0.90
Oak	20	0.90

Appendix

Emissivity table (continue)

Material	Temperature (°C)	Emissivity approximation
Carbon piece		0.85
Isolation piece		0.91 ~ 0.94
Sheet metal		0.88 ~ 0.90
Glass pipe		0.90
Loop type		0.87
Porcelain enamel products		0.90
Porcelain enamel designs		0.83 ~ 0.95
Solid materials		0.80 ~ 0.93
Ceramics (vase type)		0.90
Film		0.90 ~ 0.93
Mica		0.94 ~ 0.95
Flume mica		0.90 ~ 0.93
Glass		0.91 ~ 0.92
Semiconductor		0.80 ~ 0.90
Transistor (plastics sealed)		0.30 ~ 0.40
Transistor (metal) Diode		0.89 ~ 0.90
Transmitting loop		
Pulse transmission		0.91 ~ 0.92
Level chalkiness layer		0.88 ~ 0.93
Top loop		0.91 ~ 0.92

Appendix

Emissivity table (continue)

Material	Temperature (°C)	Emissivity approximation
Electric materials		
Epoxy glass plate		0.86
Epoxy hydroxybenzene plate		0.80
Gilded sheet copper		0.30
Solder-coated copper		0.35
Tin-coated lead wire		0.28
Brass wires		0.87 ~ 0.88
Block talcum terminal		0.87

Specification

All data is based on SATIR's testing standard. Subject to change without notice.

Type	i 160	i 384
Image performance		
FOV/Min.focus distance	25° x19°/0.07m	37.5° x28.5°/0.10m
Spatial resolution	1.7 mrad	1.7 mrad
Thermal sensitivity	≤0.05°C@25°C	
Detector type	Vox	
Resolution	160x120 (17μm)	384 x288 (17μm)
Spectral range	8-14μm	
Focus	Manual	
Image presentation		
Image mode	IR / CCD / Fusion / PIP	
LCD Display	3.5" touch screen 640x480 Resolution	
Visible pixels	Configurable ,2,5,8 million pixels	
Video output	NTSC (60Hz) or PAL (50Hz) composite video	
Digital zoom	1x,2x,4x	
Temperature measurement		
Measurement range	-20℃ ~ +550℃, (-4°F ~ +1022°F),	
Accuracy	±2° or ±2% of readings	

Measurement mode	10 movable spots, auto hot/cold spot, profile, 3 area boxes, isotherm, line
Correction	Emissivity, ambient temperature, distance, relative humidity, reflected temperature
Alarm	Yes
Image storage	
Type	16GB / 64GB Removable Micro SD card
File format	.JPG(thermal/Visual)
Annotation	Voice, note annotation
Wi-Fi	802.11a/ac/b/g/n/ (2.4and 5Ghz)
Bluetooth	Bluetooth 4.2
Power system	
Battery type	Built-in rechargeable lithium-ion battery
Charge interface	Type-C
Battery operating time	4 hours
Power manage	Auto shut off / Sleep mode
Environment specification	
Operating temperature range	-20°C to +50°C
Storage temperature range	-40°C to +70°C
Humidity	10% to 95%, non-condensing
Encapsulation	IP54
Shock	25G
Vibration	2G
Drop resistance	2 meter
Physical characteristic	

Size	244x100x104mm
Weight	Less than 660g
Tripod mounting	1/4"_20
Additional features	
Illuminator	Yes
Laser pointer	Yes
Video record	Yes
Text comment	Yes
Voice comment	Yes
Ports	USB port , Analog video output

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