T Series

Handheld Thermal Camera

User Manual V1.0.2
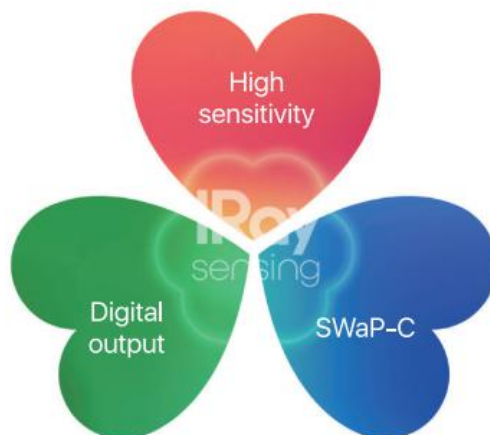

IRay Technology Co., Ltd.

www.infiray.com

Explore And
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Introduction to IRay Technology

IRay Technology Co., Ltd. concentrates on developing infrared thermal imaging technologies and manufacturing relevant products, with completely independent intellectual property rights. IRay is committed to providing global customers with professional and competitive infrared thermal imaging products and solutions. The main products include IRFPA detectors, thermal imaging modules, and terminal thermal imaging products.

With R&D personnel accounts for 48% of all employees, 662 intellectual property projects in terms of IRay have been authorized and accepted: 522 patented technologies authorized and accepted in China (including those for integrated circuit chips, MEMS sensors design and manufacture, Matrix III image algorithms and intelligent precise temperature measurement algorithms, etc.); 16 patented technologies authorized and accepted overseas; 86 software copyrights; and 38 integrated circuit layout designs.（The statistic data is up to April,2021）

IRay products have been applied in various fields, including epidemic prevention and control, industrial thermography, security and fire control, night vision observation, automatic driving, Internet of Things, AI, and machine vision.

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1.Notice to Users

1.1 Calibration

IRAY TECHNOLOGY recommends that you verify your calibration yearly in order to ensure accuracy. You can verify the calibration through IRAY TECHNOLOGY or third-party organizations.

1.2 Accuracy

For very accurate results, we recommended that you wait 5 minutes after you have started the camera before measuring a temperature.

1.3 Documentation Updates

Our manuals are updated several times per year, and we also issue product-critical notifications of changes on a regular basis. Please visit our website to access the latest manuals and notifications.

1.4 Scope of Application

This manual is applicable for all products in a range, which means that parts of the manual may not apply to a particular model.

2.Quick Start Guide

To get started according to the following procedures:

No.	Procedures
1	On/off Long press the power button⏻，the power indicator is lit, the device is started up. Long press the power button ⏻ to turn off when the device is on.
2	Target Viewing Remove the lens cover, point the camera to the target of interest, make the image clear by auto focus button ⌖ or manual focus ring adjustment
3	Parameter Settings To change the thermographic parameters (emissivity, RH, distance and ambient temperature) according to the actual situations, among which the emissivity is most important and has the biggest influence on temperature measurement accuracy. Note： 　① The emissivity is generally taken as 0.9 during patrol inspection of electric equipment. For accurate inspection, the emissivity can be taken as 0.95 for silicone rubber (incl. RTV and HTV), 0.92 for electro ceramics, 0.9 for metal wires and metal connections. Refer to the appendix for emissivity of more materials. 　② While the target is reflective metal surface (such as stainless steel), you can put a piece of insulated rubber tape (3M electrical insulating tape is recommended, black, emissivity:0.93) onto the target surface, then wait a moment, and conduct the test after the target temperature and the tape temperature becomes the same. The emissivity should be taken as 0.93(the emissivity of the tape). 　③ The default thermographic range is -20℃～150℃, so if the target temperature is above 150℃, the thermographic range should be changed to manual mode or auto medium.

4	Image Capture and Video Recording You can pull the trigger to capture images in the image preview interface, and you can also add annotations (such as words or voice) to the images. Long press the trigger and the icon ⬛ will appear on the display area, which means recording, pull the trigger again to save the video recordings into SD card.
5	Charging The battery can be disassembled, the charging base can be used to charge single battery or two batteries at the same time. The LED will turn green, which indicates full battery capacity.

3.Thermal Camera Introduction
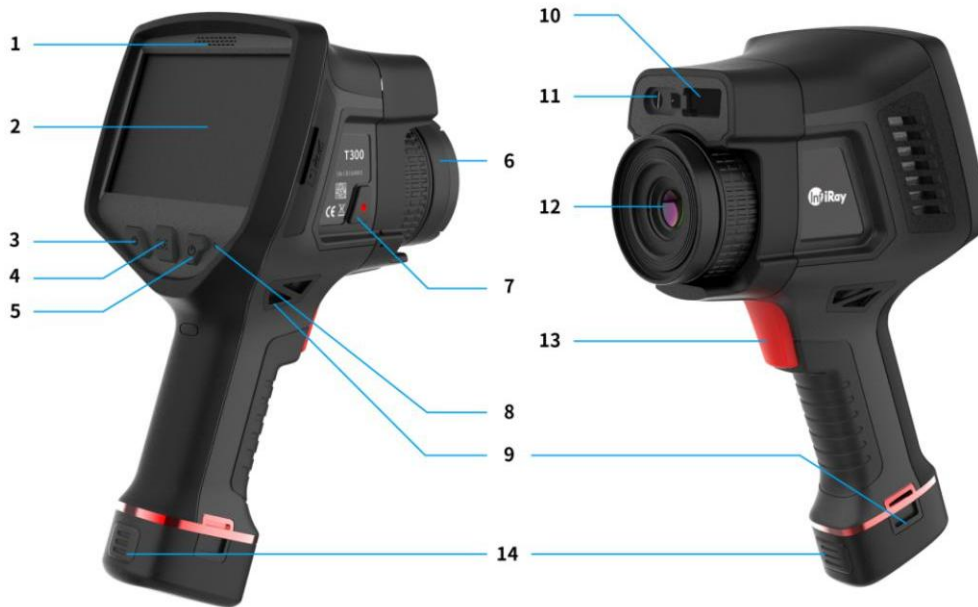
No.	Component Introduction	No.	Component Introduction
1	Microphone	8	Power indicator
2	Touch screen	9	Attachment point for the wrist strap
3	Correction button	10	Laser distance meter
4	Auto-focus button	11	Digital camera and flashlight
5	Power button	12	Infrared lens
6	Lens cover	13	Trigger
7	Lens unlock button	14	Battery unlock button

4.Operation Introductions

4.1 Power On and Power Off

No.	Operation Introductions
1	Long press power button to turn on the camera, the power indicator will be lit, the main interface will be displayed after a while.
2	Long press the power button to turn off, meanwhile the power indicator will be off.

4.2 Thermographic Correction

No.	Operation Introductions
1	Auto correction： the device has auto thermographic correction function, the system will perform auto thermographic correction once after a while. The image will be frozen for 2 minutes during auto thermographic correction and the inside of the machine makes a "ta-ta-ta" sound twice. The system thermography will be more accurate after the correction.
2	Manual correction： press the correction button to perform thermographic correction in the main interface.
Note	The device will perform auto correction frequently when the device is getting started, the frequency of auto correction will get lower after the temperature inside the device becomes stable (about 5 minutes).

4.3 Image Capturing and Video Recording

4.3.1 Image Capturing

No.	Operation Introductions
1	Pull the trigger in the main interface, the system will freeze the present image automatically, and pull the trigger again to save the image to the SD card. The image can be deleted by clicking the delete button on the screen when the image is freezing.
2	The spot, line and region can be added and analyzed as you want under image freezing mode, and color Palettes can be changed before image saving.
3	If the function of "image preview before capture" in "other settings" is disabled, the current image will be saved into the SD card then the freezing image will not appear when you pull the trigger.

4.3.2 Video Recording

Long press the trigger button, the 🔘 button will pop up, and the video recording is getting started, pull the trigger again to save the video recording into the SD card.

4.4 Focus Mode

There are three kinds of focus mode：auto-focus, electric focus and manual focus.

4.4.1 Auto-focus

Click the auto-focus button 🔲 then relieve, the device will perform focus on infrared image according to the target, a black square will show on the central focus area.

4.4.2 Electric Focus

Perform the electric focus by clicking or long pressing the 🔍 🔍 on the screen.

4.4.3 Manual Focus

Perform the manual focus by rotating the focus ring.

4.5 Main Menu Functions of the Software

Image Mode	Isotherm
Gallery	Flashlight
Thermographic Parameters	Image Style
Thermographic Analysis	Laser Distance Meter
Color Palettes	Color Scale Adjustment
Digital Zoom	Auto Level/span
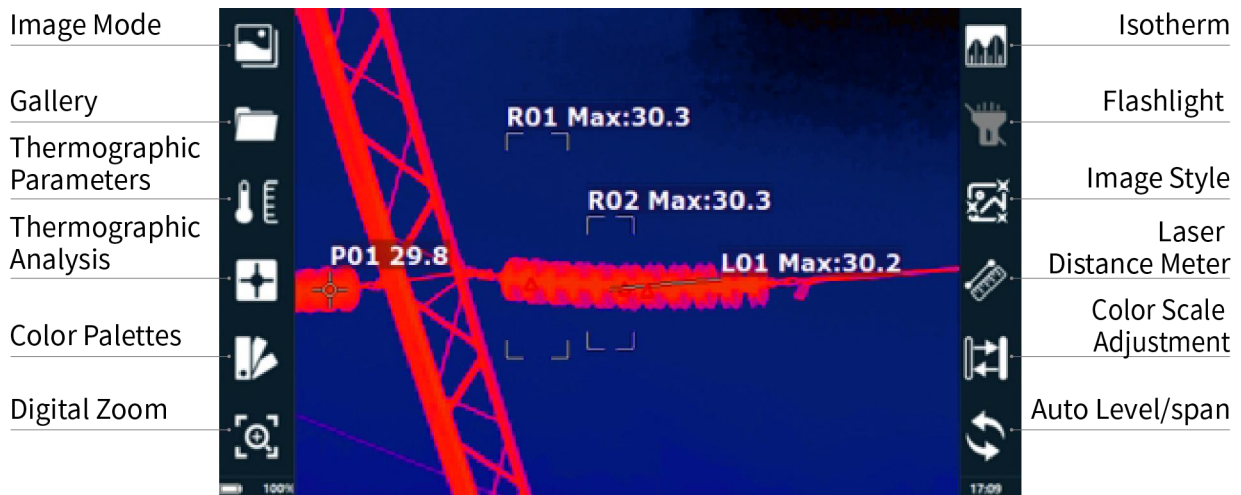
4.5.1 Image Mode

There are four image modes: thermal, PIP, thermal fusion and visible.

4.5.2 Gallery

Click the gallery button, the following window will pop up, click "image" or "video" button to view the images and videos saved in the storage card.
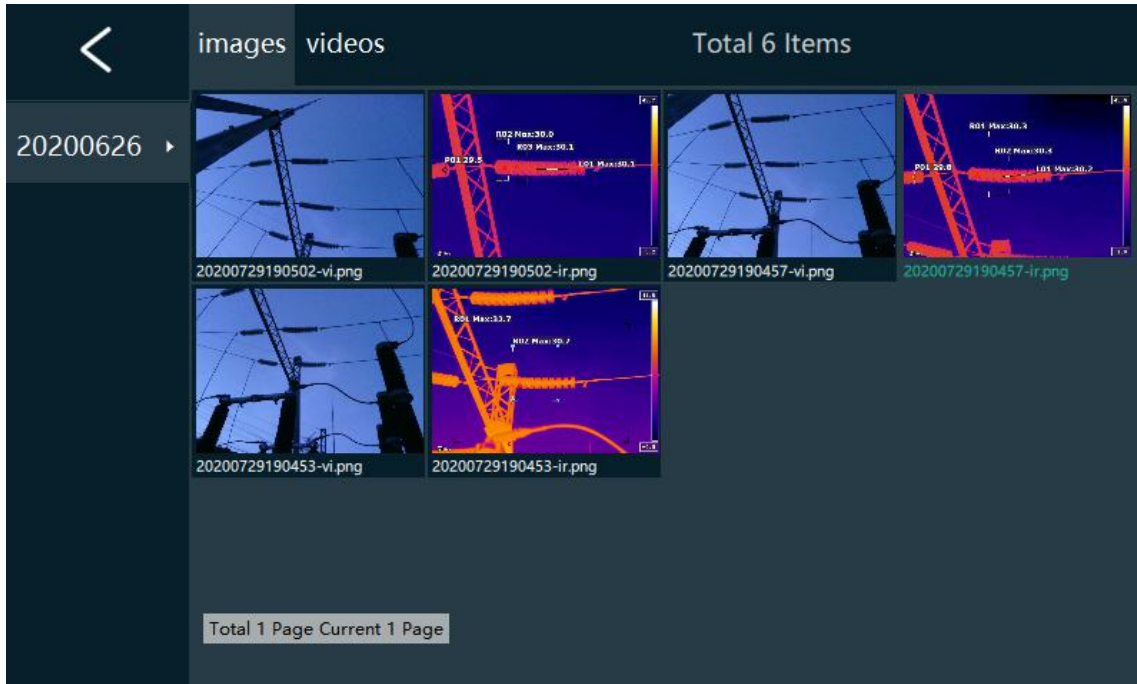
1. Image viewing and secondary analysis

While viewing the images, long press the images to pop up three options, click the icon [□] to select all the images in the current folder, click the icon [↻] to restore, click the icon [🗑] to delete all the selected images.
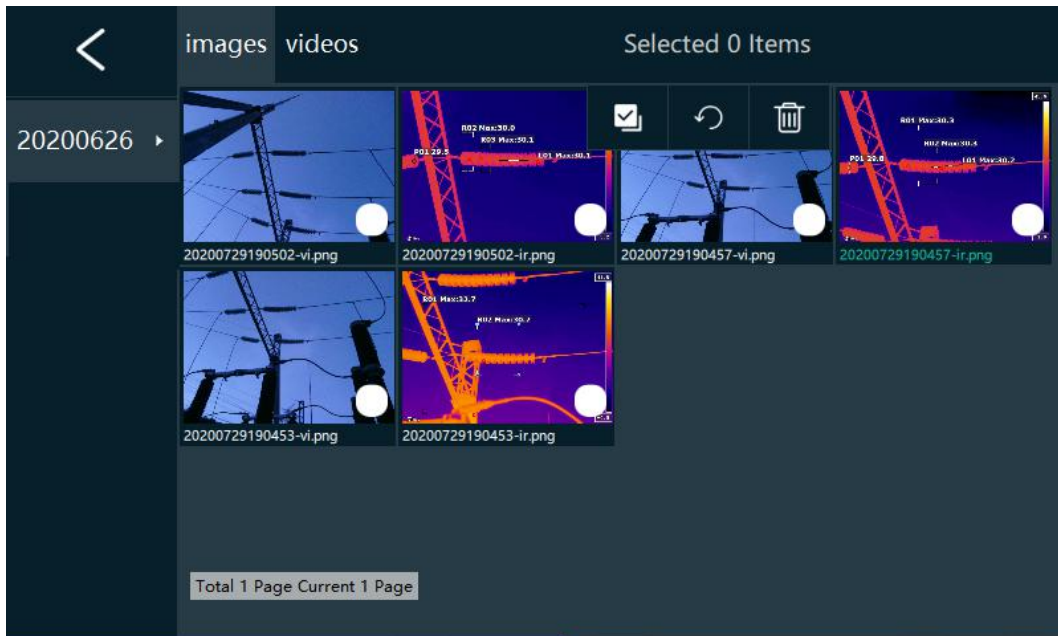
Click an image to enter the secondary analysis, view and delete interface, as the following picture.
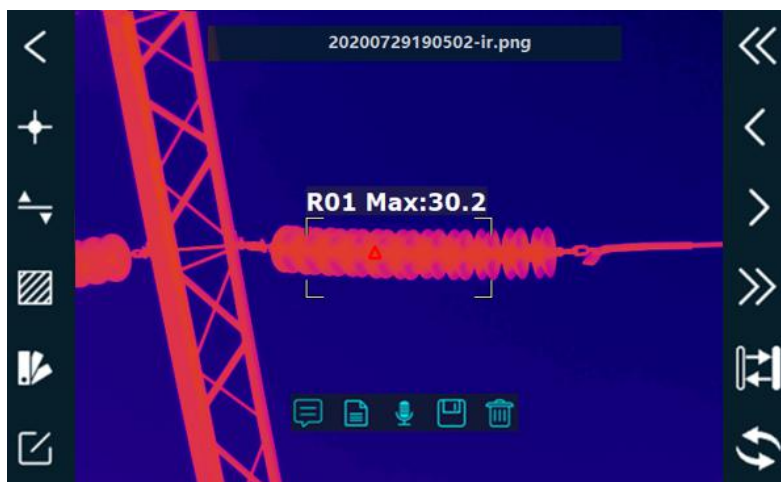
Icon	Function Introduction
[💬]	Add text notes for the images
[📄]	Add preset text notes for the images
[🎤]	Add recording notes to the images

	Save the present image analysis information
	Delete the present image

2. Video viewing and deleting

Long press the image capture button to perform video recording, the recorded video can only be viewed and played back on PC, you can only view the file name and size via the device，see the following figure.
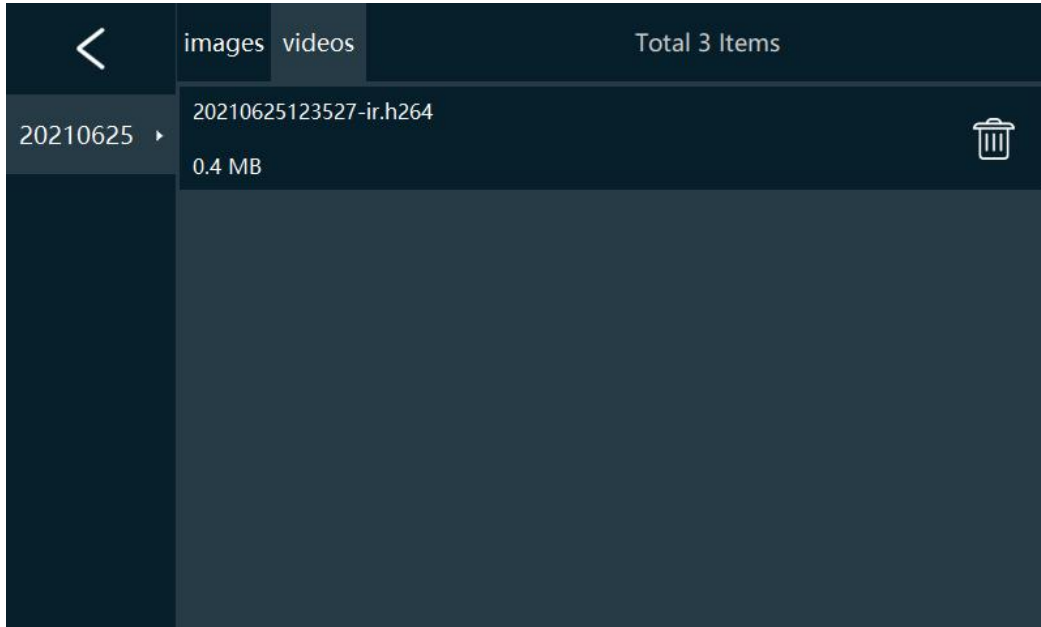
4.5.3 Thermographic Analysis

No.	Operation Introductions
1	Click the thermographic button, the button will pop up on the main interface.
2	:it indicates the temperature of the center spot, the temperature will display on the top left of the screen after clicking.
3	:the Min. temperature of the screen will display after clicking
4	:the Max. Temperature of the screen will display after clicking

5	⊹ : click to add spots on the thermal image ⇌ :click to add lines on the thermal image ▨ :click to add regions on the thermal image
6	🐍 : click to enable temperature difference analysis, to display the temperature difference between two regions.
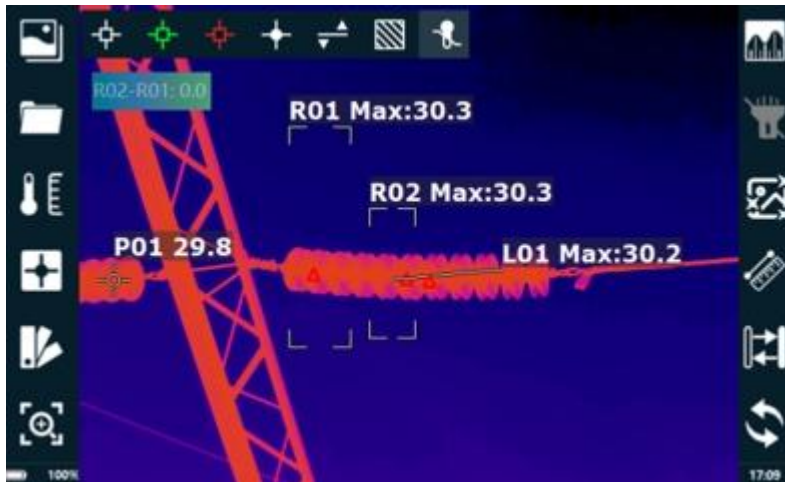
4.5.4 Color Palettes

Click the color Palette button to display different kinds of palettes, select the color palette as you want.
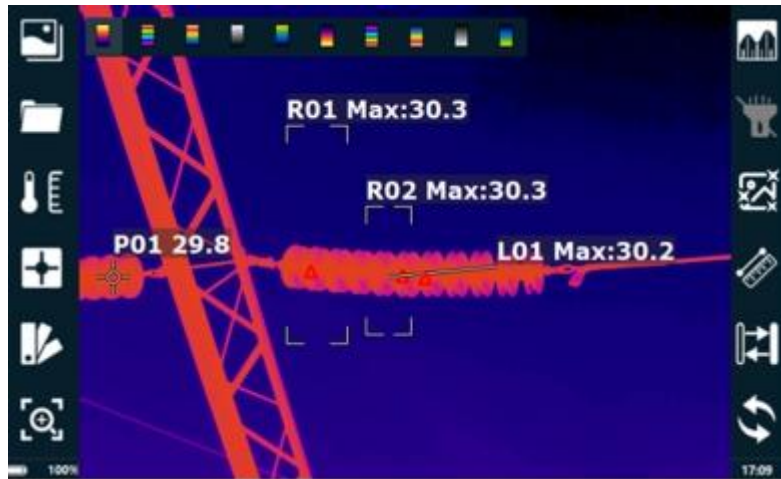
4.5.5 Digital Zoom

Click the button ![button], four options will display on the interface: ×1,×2,×4,×8. Select the amplification times to amplifying the infrared image.

4.5.6 Isotherm

Click the isotherm button ![button] to enable isotherm analysis, the images within the same temperature range will display in the same color, therefore the user will easily view the temperature distribution in the region of concern. See the following figure, the central part of the color scale bar on the left indicates the color of the isotherm, the upper limit and the lower limit of the color scale indicate the temperature range of the isotherm. The user can change the temperature range by adjusting the position of the triangle.
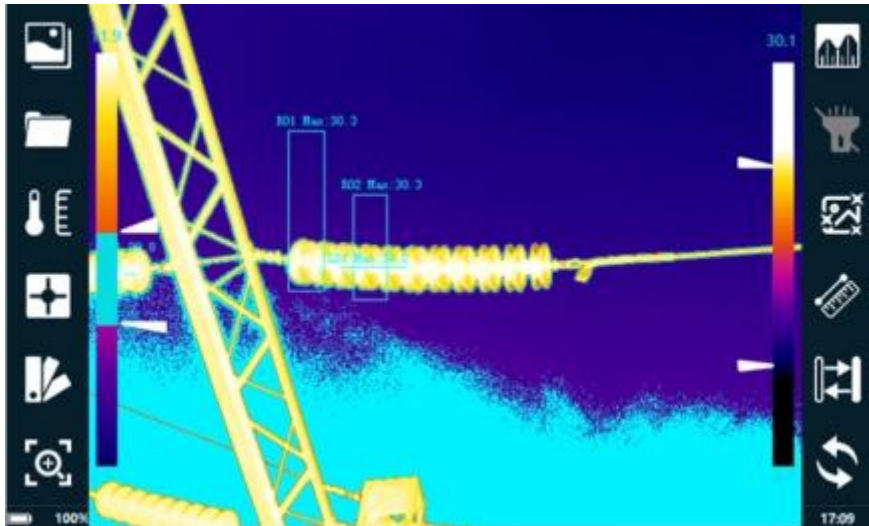
4.5.7 Flashlight

Click the sign of the flashlight ![icon] on the main interface to turn on the flashlight, then the camera can assist in illuminating the detection environment.

4.5.8 Image Style

Click the image style ![icon] on the main interface, then different image styles can be selected according to actual needs.

4.5.9 Laser Distance Meter

Click the laser distance meter button ![icon] to enable the function of laser range finder. You should point the red dot at the target to make range finding. The value on the top left of the screen indicates the distance, NA stands for abnormal range finding.

4.5.10 Color Scale Adjustment

Click the hide/display button ![icon] to hide or display the color scale. Click the auto level/span button, the system can automatically adjust the color scale according to the frame temperature. If the image after auto color scale does not meet the user need, the user can move the two triangle icons to adjust the color scale manually. See the following figure for the effect of manual color scale adjustment.

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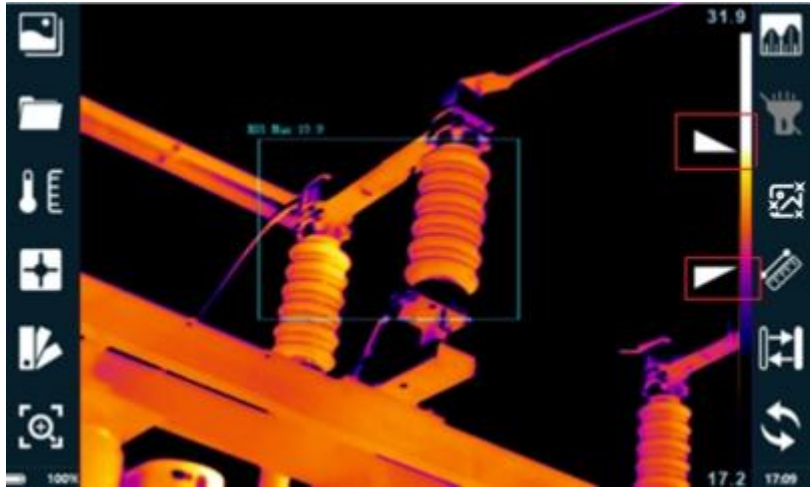
5.Settings

5.1 Thermographic Parameters

No.	Thermographic Parameters
1	Lens type: set according to the actual lens type while changing the lens.
2	Thermographic range: low temperature range and medium temperature range and high temperature range.
3	Change thermographic range: the camera will automatically change the temperature range according to the target temperature when selecting "auto". The temperature range should be changed manually if the target temperature is not within the current temperature range when selecting "manual".
4	Temperature Unit: Celsius and Kelvin.
5	Image Capturing Parameters: ①Emissivity: set according to the target emissivity, you can refer to the appendix for part of emissivity of common materials② Relative humidity: set according to the environment at the scene. ③Distance: set according to the actual distance between the camera and the target. ④ Ambient temperature: set according to the environment at the scene.

5.2 Analysis Settings

Click the "analysis settings"button on the screen, now you can make changes to the temperature type(Max. temperature, Min. temperature and AVG temperature)on the already added spot/lines/regions, and you can also choose whether to display the screen max. Temperature and min. Temperature, see the following figure for the detailed settings.

5.3 Alarm

Choose alarm on the settings interface, then you can change the alarm conditions for the already added spot/lines/regions. After the alarm function is enabled, the spot/line/region on the image will flash and make alarming sounds when the temperature of the spot/line/region reaches the set alarming conditions.
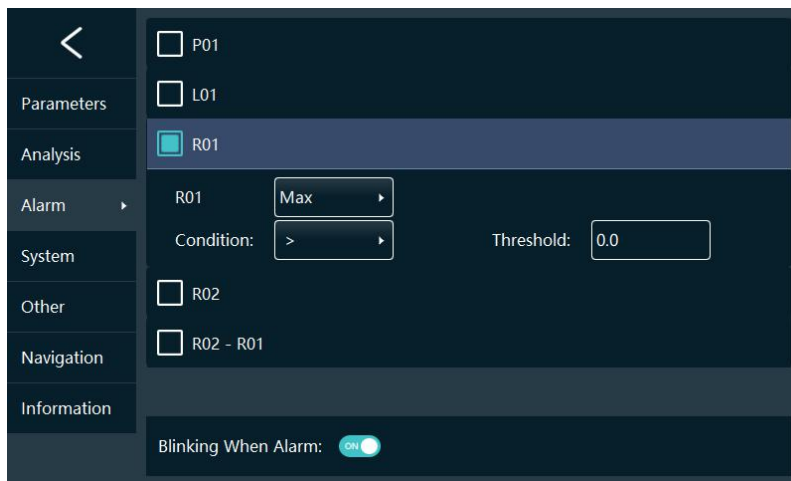
5.4 System Settings

5.4.1 General Settings

No.	General Settings
1	Save the infrared image as well as visible light images,when this function is enabled, the camera will automatically capture thermal images as well as visible light images , the visible light images will not be saved when the function is disabled.
2	Image preview during image capture, after the function is enabled, the captured image will be frozen first and then saved into the camera only if the image capture button is pressed again.
3	Scale display, after the function is enabled, the cross scale and image capture box will display on the thermal video interface to assist the user to capture images.
4	Flashlight, after this function is enabled, it will flash to complement the visible light when image is captured.
5	Soft keyboard, after this function is enabled, the temperature calibration button, image capture button, and video recording button will pop out. The soft keyboard can be used when the physical buttons can not work properly.
6	HDMI, video output settings, after this function is enabled, the real-time video can be output to PC or other display devices via HDMI interface.
7	Sleep mode, after this function is enabled, the screen brightness will be reduced automatically if the camera is not operated for a long time to extend battery life. The camera will be automatically awaken by pressing any button.

5.4.2 GPS

To enable GPS via system settings, then the real-time view of GPS information can be displayed on the images, see the following picture for real-time view effect.
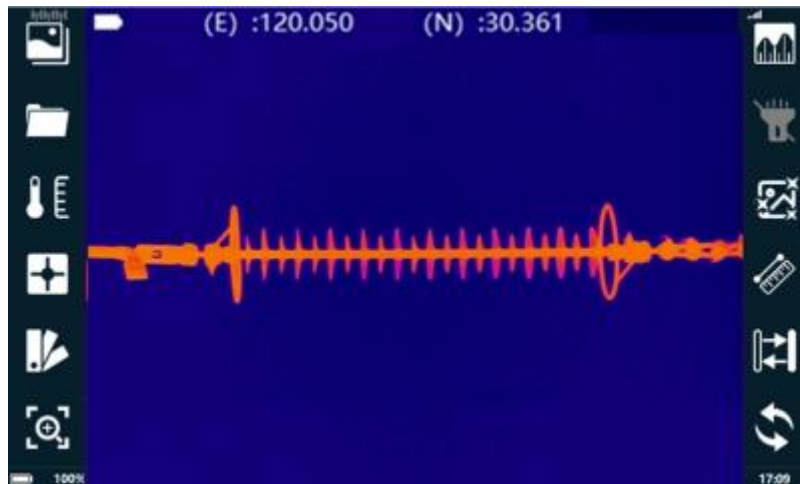
5.4.3 4G

After 4G is enabled, remote video preview can be achieved via MCP software on PC or Smart phones. You can refer to the "Simultaneous transmission address", "simultaneous transmission port", "simultaneous transmission account" and "simultaneous password" in the about interface for the related login information.
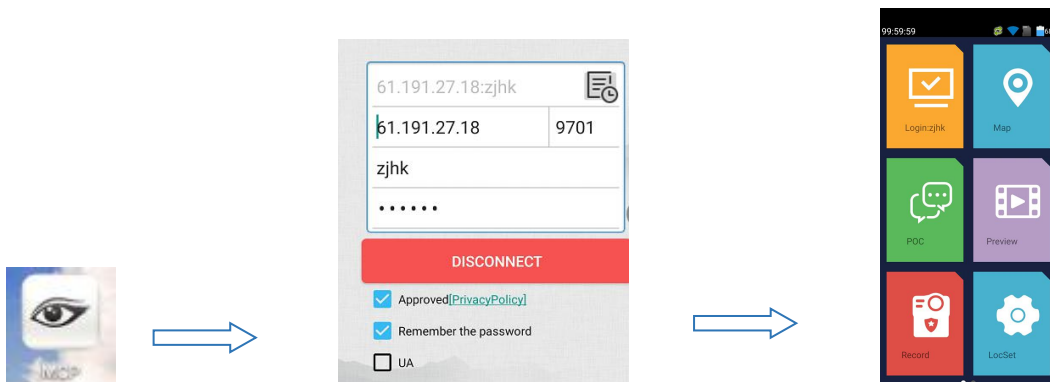
Click "video preview" button to enter into online device list, unfold device list, click "video" to view the corresponding real-time video of the power-on devices, see the following picture:
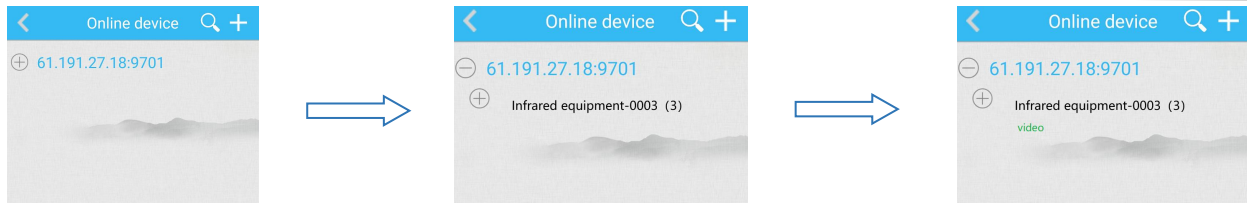
5.4.4 Wi-Fi

Connect Wi-Fi by searching for the Wi-Fi signals, then refer to 4G introduction to login the software to view videos.

5.5 Other Settings

Click "other settings" button on the screen to enter into the other settings interface, then the saved image format, system time, screen brightness and languages can be set.

- The weather, wind speed, voltage and load current can be set according to the conditions on site.
- Default text, the default text can be typed into the device according to the conditions on site, the you can add default texts to images to save time when operating on site.
- Color of isotherm: to adjust the color of isotherm.
- Image format: PNG/JPG/state grid JPG, PNG is optimized infrared image, JPG is normal infrared image, state grid standard JPG can be analyzed by state grid software.
- Video format: "H.264" recording video is available and it can be reviewed. However, the "total emission infrared video" is full pixel infrared video which can be viewed, secondary analysis can also be performed on the images, the size of the video format is relatively big.
- Image fusion: choose the appropriate distance to get the best fusion effect.

5.6 Smart Image Capture

5.6.1 Load smart image capture package

The following interface will pop up after clicking the "smart image capture" button in the settings interface.
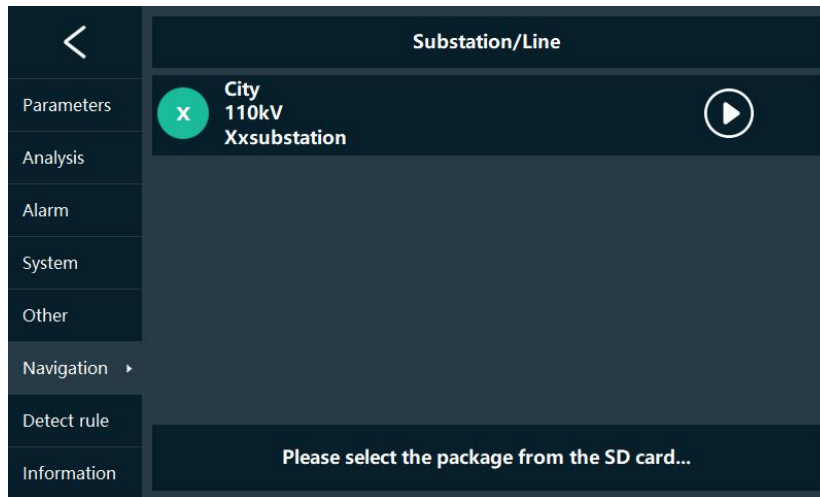
The following interface will pop up after clicking the "select the smart naming package from the SD card" button.

Select the image capture package, click "import" button to start the loading of smart package, the loading is completed when the load progress displays 100%. Then you can find the loaded image capture information of smart packages after returning to the "smart image capture" interface.

5.6.2 Use Smart Image Capture Package

Click to start smart image capture. Then the information on smart image capture will be displayed, see the below figure.

The image will be captured in order of smart image capture package in default. The user can click the device names as illustrated in the above yellow box and select the capture target in the pop-up device lists. See the below picture.

The system will name the images after the format of date + device name automatically when the image is saved.

5.6.3 Delete the Smart Image Capture Package

Click "smart image capture" button in the setting menu, long press the name of the image capture package to enter into the delete interface, select the package which needs deleted, click "delete" button to delete the image capture package.

6.The Creation Method of Smart Image Capture Package

The creation procedures of smart image capture package is as follows:

1. Unzip the original smart image capture template in SD card on PC (if there is no original template in SD card, the users can use their own templates which have been confirmed applicable), the below illustrated files can be acquired after unzipped.

20190704210600-Province-City-Operation & Maintenance Unit-110kV-XXSubstation .xls

2. Open the unzipped files, fill in the file according to the templates format.

"Device phase "should be filled in according to the specific phase, generally Phase A, Phase B, Phase C, Phase ABC and no Phase.

Version No.	Power Type	Province	City	Operation & Maintenance Unit	Substation or Line Name Voltage Level	Substation or Line Name	Interval or Tower Name Voltage Level	Interval or Tower Name	Equipment Voltage	Equipment Name	Equipment Type	Equipment Component	Equipment Phase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	#1main transformer	110kV	110kV side bushing, #1 main transformer	bushing	Main part	Aphase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	#1main transformer	110kV	110kV side bushing, #1 main transformer	bushing	Main part	Bphase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	#1main transformer	110kV	110kV side bushing, #1 main transformer	bushing	Main part	Cphase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	110kV Section II bus bar	110kV	110kV Section II bus bar insulator1	insulator	Main part	Aphase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	110kV Section II bus bar	110kV	110kV Section II bus bar insulator1	insulator	Main part	Bphase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	110kV Section II bus bar	110kV	110kV Section II bus bar insulator1	insulator	Main part	Cphase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	110kV Section II bus bar	110kV	110kV Section II bus bar insulator2	insulator	Main part	Aphase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	110kV Section II bus bar	110kV	110kV Section II bus bar insulator2	insulator	Main part	Bphase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	110kV Section II bus bar	110kV	110kV Section II bus bar insulator2	insulator	Main part	Cphase
0	0	Province	City	Operation & Maintenance Unit	110kV	Xxsubstation	110kV	110kV Section II bus bar	110kV	110kV Section II bus bar insulator3	insulator	Main part	Aphase

Notes: the content after the "device phase" does not need filled in by user.

3. Save the files after device filling in is done, and change the file information according to the actual situation.

20190704210600-Province-City-Operation & Maintenance Unit-110kV-XXSubstation .xls

Notes: the file name was changed in order to make the files easier to find, it is not necessary to change the file names because this can not have influence on the normal use of smart image capture package.

4. Compress the files into ZIP format.
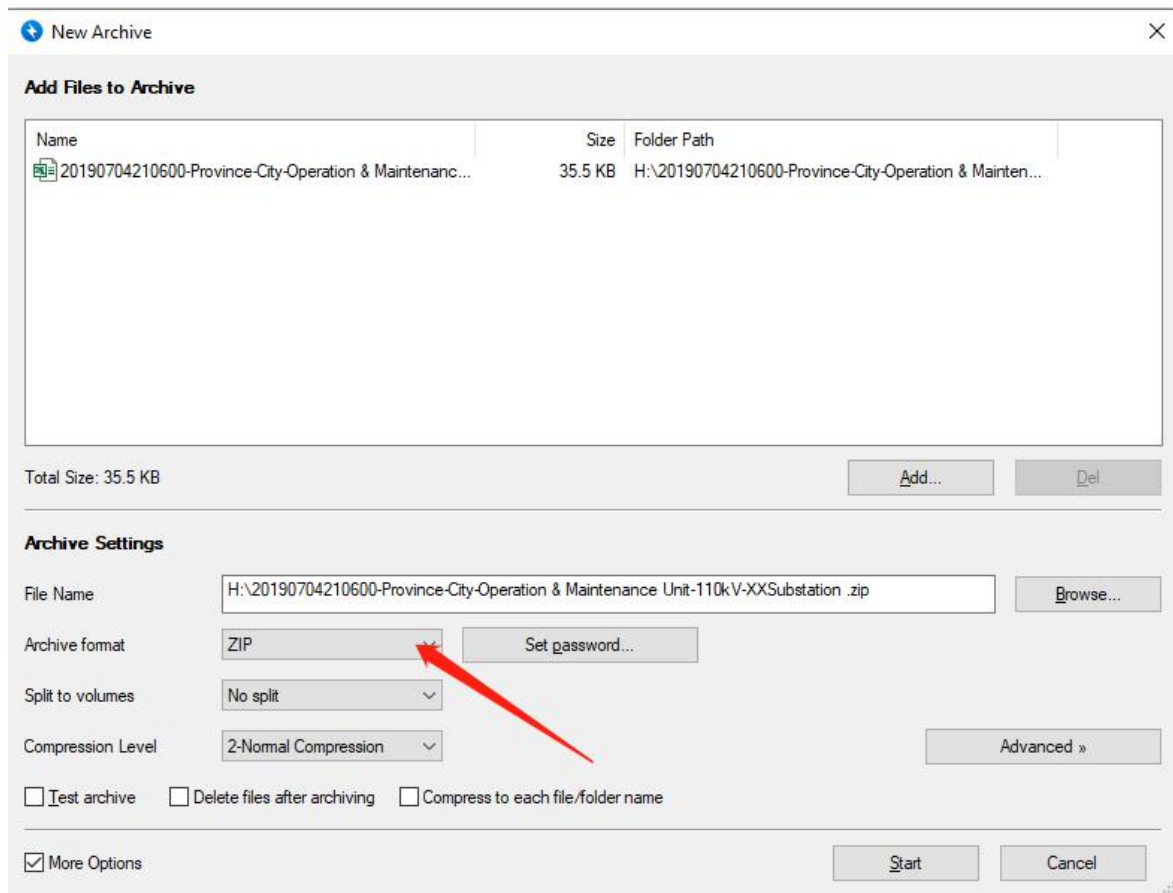
Notes: you need to zip the files instead of file folders.

5. Put the zipped files into the root directory of SD card, then you can import the image capture package into the thermal camera according to the above described method.

Notes: do not put the zipped files into the folders in the SD card.
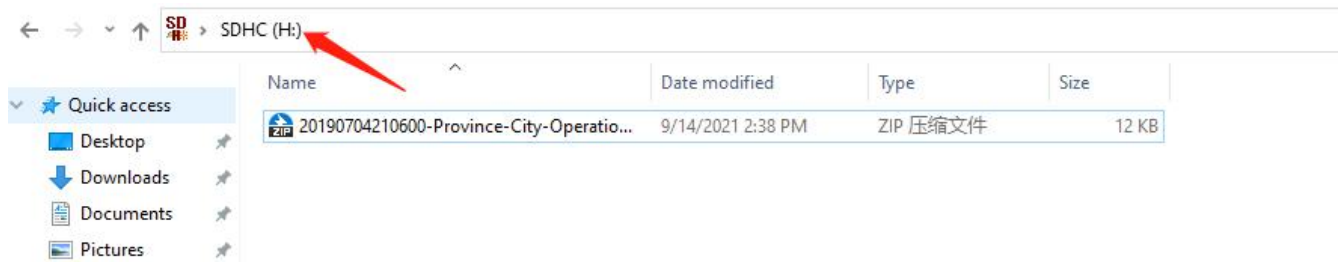
7.Precautions

To protect you and others from injury or damage to your device, please read all of the following information before using your device.

1. Do not point the lens directly to the sun or other high-intensity radiation sources.
2. Do not touch the lens with your hands or collide with other objects.
3. Do not touch the device with wet hands.
4. Do not use diluent to scrub your equipment.
5. Do not connect the attached connecting cable wrongly to avoid damaging the equipment.
6. Please pay attention to prevent static electricity.
7. Please do not disassemble the equipment. If there is any fault, please contact us, and our professional personnel will repair it.

8.Support and Services

8.1 Technical Supports

Systematic training could be provided to end-user technicians and operators.

8.2 After sales services

T series hand-held thermal camera is developed by IRay, we provide good after-sales service guarantee of our equipment maintenance and repair. If you need anything, please contact us.

9.Company Information

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Appendix A Emissivity of Common Materials

Metal

Materials	Temperature（℃）	Emissivity
Aluminum		
Polished aluminium	100	0.09
Commercial aluminum foil	100	0.09
Light aluminium oxide	25～600	0.10～0.20
Strong aluminium oxide	25～600	0.30～0.40
Brass		
Brass mirror （highly polishing）	28	0.03
Brass oxide	200～600	0.59～0.61
Chromium		
Polished chromium	40～1090	0.08～0.36
Copper		
Copper Mirror	100	0.05
Strong copper oxide	25	0.078
Red copper oxide	800～1100	0.66～0.54
Melting copper	1080～1280	0.16～0.13
Gold		
Gold mirror	230～630	0.02
Iron		
Polished cast iron	200	0.21
Processing cast iron	20	44
Totally rusted surface	20	0.69
Cast iron（oxide at 600℃）	19～600	0.64～0.78
Electrolytic iron oxide	125～520	0.78～0.82
iron oxide	500～1200	0.85～0.89
Iron plate	925～1120	0.87～0.95

Materials	Temperature（℃）	Emissivity
Cast iron, heavy iron oxide	25	0.8
Melting Surface	22	0.94
Melting cast iron	1300～1400	0.29
Melting iron	1515～1680	0.42～0.45
Steel		
Steel（oxidation at 600℃）		
Steel Oxide	100	0.74
Melting low-carbon steel	1600～1800	0.28
Melting Steel	1500～1650	0.42～0.53
Lead		
Pure lead (non-oxide)	125～225	0.06～0.08
Mildly oxidized	25～300	0.20～0.45
Magnesium		
Magnesium oxide	275～825	0.55～0.20
Mercury		
Mercury	0～100	0.09～0.12
Nickel		
Electroplate polished	25	0.05
Electroplate not polished	20	0.01
Nickel wire	185～1010	0.09～0.19
Nickel plate（oxidizing)	198～600	0.37～0.48
Nickel oxide	650～1255	0.59～0.86
Nickel alloy		
Nichrome wire（heatproof）（bright）	50～1000	0.65～0.79
Nichrome	50～1040	0.64～0.76
Nickel-chromium（heatproof）	50～500	0.95～0.98
Silver		
Polished silver	100	0.05
Stainless steel		
18/8stainless steel	25	0.16

Materials	Temperature（℃）	Emissivity
304（8Cr,18Ni）	215～490	0.44～0.36
310（25Cr,20Ni）	215～520	0.90～0.97
Tin		
Commercial tin plate	100	0.07
Zinc		
Oxidized at 400℃	400	0.01
Galvanized bright iron plate	28	0.23
Gray zinc oxide	25	0.28

Nonmetal

Material	Temperature（℃）	Emissivity
Brick	1100	0.75
Firebrick	1100	0.75
graphite（lamp black）	96～225	0.95
enamel（white）	18	0.9
Pitch	0～200	0.85
Glass（surface）	23	0.94
Heatproof glass	200～540	0.85～0.95
Calcimine	20	0.9
Oak	20	0.9
Carbon plate	-	0.85
Insulating strip	-	0.91～0.94
Sheetmetal	-	0.88～0.90
Glass tube	-	0.9
Coil form	-	0.87
Enamelware	-	0.9
Enamel pattern	-	0.83～0.95
Capacitor		
Rotation type	-	0.30～0.34
Ceramics（bottle type）	-	0.9
Film	-	0.90～0.93
Mica	-	0.94～0.95
Liquid mica	-	0.90～0.93
Glass	-	0.91～0.92
Semi-conductor		
Crystal valve（plastic package）	-	0.80～0.90
Crystal valve（metal）	-	0.30～0.40
Diode	-	0.89～0.90
Transmission coil		
Pulse transmission	-	0.91～0.92
Flat chalk	-	0.88～0.93

Material	Temperature（℃）	Emissivity
Top ring	-	0.91～0.92
Electronic material		
Epoxy glass plate	-	0.86
Epoxy phenolic plate	-	0.8
Gold-plated copper	-	0.3
Coating copper	-	0.35
Tin-plated lead wire	-	0.28
Copper wire	-	0.87～0.88

Worth comes from Service

Technical Support

Hotline：

400-883-0800

24h Hotline:

400-998-3088

Customized Services