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OSXL160
Infrared Camera

OMEGA®

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OSXL160

Infrared Camera

User Manual

Please read carefully before first use

WARNING

DO NOT USE WHEN RAINING!
DO NOT OPEN OR EXCHANGE PARTS!
REPAIR ONLY CAN BE CONDUCTED BY STUFF!

NOTICE

- In order not to cause malfunction or even damage the device please do not direct the lens towards strong high-temperature radiation source (such as the sun) whether the power is on or off!
- Avoid violent shock and impact during operation or transport.
- Storage temperature is between -40℃ and 60℃. The device must be kept in original packing case during transport.
- Typical storage place is cool, dry, ventilated, and without strong electromagnetic field.
- Keep the lens surface off grease or any chemical substance which would damage the lens. Close the lid after operation.
- Please regularly backup data on PC to prevent potential data loss and format the internal FLASH memory duly to make it operate properly.

Table of Contents

1. Product Summary

This new generation OSXL160 Infrared Camera (equipped with Uncooled Focal Plan Array Micro-bolometer) produces crisp thermal image and accurate temperature reading to help increase system maintenance quality and efficiency in many industries. THE OSXL160 Infrared Camera is packed with advanced features, such as colored thermal image, voice annotation, sound and color alarm, FLASH memory storage, USB connection to PC, and analysis software. Crisp thermal image, accurate temperature reading, clear user interface, reliable product quality, and affordable cost makes OSXL160 Infrared Camera the new standard in Infrared imaging industry!

Typical Application:

- **Power Plant:** Monitor and diagnose the condition of electrical wire and equipment, detect power leak, and prevent system malfunction
- **Petrochemical Industry:** oil pipeline check, material interface detect, heat leakage, insulation structure and power equipment detect.
- **Fire Protection:** forest fire protection and latent fire source search, self-ignition prevention and detection of special material, electric fire precaution detect.
- **Medical Application:** Accurately measure human body temperature in a distance, critical under a contaminated condition
- **Building Industry:** humidity, air leakage and insulation defects detect.
- **Other Applications:** Civil engineering, university research, and railway etc.

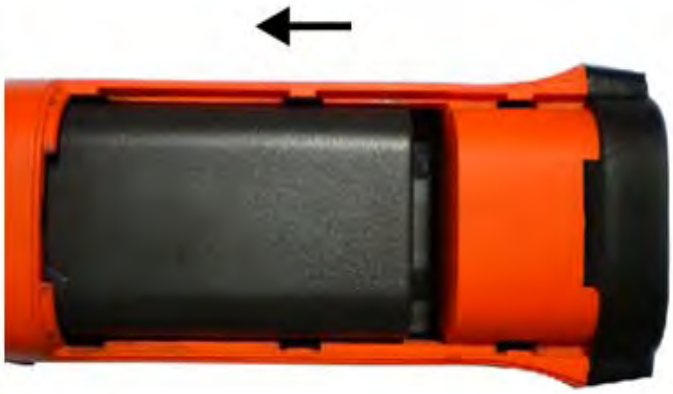
1.1 Standard Item List

OSXL160 Infrared Camera comes with the following standard items and accessories:

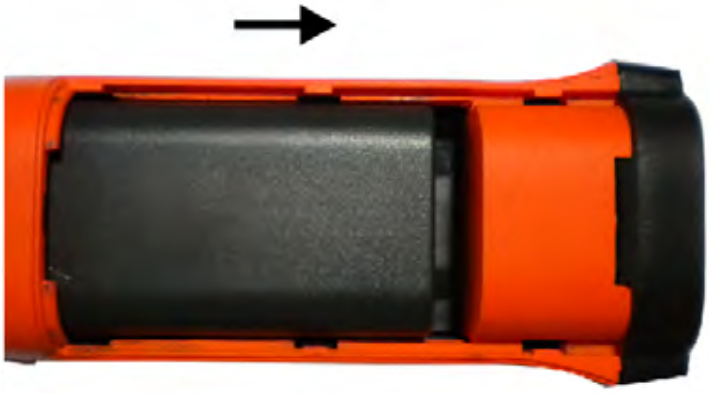
Item	Quantity
OSXL160 Infrared Camera	1
Li-Ion Battery	2
Battery Charger	1
USB Cable	1
Video Cable	1
User Manual	1
IR See Software CD	1
Suitcase	1

2. Battery and Charger

It is recommended to charge battery immediately when device indicates low power. By press and move in the indicated direction, user can easily insert and remove battery.



Battery Insertion



Battery Removal

Device comes with two sets of Li-Ion battery and one battery charger. It is strongly recommended to operate only with the included battery and charger. Use any other brand charger or Li-Ion battery may cause fire or critical damage.

2.1 Charging Battery

1) Following the direction indicated on battery charger, insert the Li-Ion battery, press firmly and push all the way in.
2) During charging, the red LED will be on, and when charging is completed, the green LED will be on instead.

📖: Normally it takes 3 hours to completely charge one battery.

2.2 Direct Charging

1) The battery can also be charged by using an adapter.

Normally it takes 5 hours to charge one battery in this mode.

2.3 Attention for Using Battery Charger

1) Battery Charging can only be conducted inside of a house.
2) Do not short-circuit the battery.
3) Do not put the battery in high temperature environment (≥60℃). Never disassemble the battery or put it into fire, which may cause explosion.
4) Do not try to modify the battery or the charger.
5) Please remove the charger from AD socket as soon as charging is completed.

3. Panel Function Summary

In this manual, “long press” means Long press button down for about 2 seconds, and “press” or “short press” means press and release.

3.1 Main Control Panel

1. Power ON/OFF Button
Long press this button to turn on or off the device.

2. Power LED Light
When device is powered on, the Power LED Light will be on.

3, 4, 5, 6. Direction Buttons
Up (▲), Down (▼), Left (◀), and Right (▶), 4 direction buttons have different usage in different mode.
In main menu, direction buttons are used for moving selected items or changing slide-bar value. In real time Infrared view mode, directions buttons provide one-click access:
Press ◀ to freeze Infrared image and press again to unfreeze

Long press ◀ to save current Infrared image
Press ▲ or ▼ to switch between normal view and 2X zoom

After press Hotkey button (refer page 8, 3.3) and in area measure mode:

- Select the measure spot; press ▲, ▼, ◀, and ▶ to move the spot in the same direction.
- Select the measure line and sampling line; press ▲, ▼, ◀, and ▶ to move the line in the same direction.
- Select area box: in **move** menu, press ▲, ▼, ◀, and ▶ moves area box, and in **size** menu, press ▲, ▼, ◀, ▶ resizes area box.
- Select Color Palette or temperature measurement limit: Press ◀, ▶ to change, and ▲, ▼ has no effects.

7. OK (Menu/Confirm) Button
This button has different functions under different conditions:

- In real time Infrared view mode, press this button opens the main menu.
- In main menu, press this button to confirm operation.
- In real time Infrared view mode, long press this button to manually rectify measurement result.
- In image viewing mode, long press this button to exit.

📖: After auto rectifying, if device has abnormal noise, long press OK button to perform manual rectifying usually solves such issues.

8. MIC
Internal MIC records audio annotation.

9. Laser Sight
Long press Hotkey button to turn on/off laser sight.

3.2 Rear Interface Panel

10. Video Output
CVBS standard video output.

11. Audio Output
Audio output playbacks recorded voice annotation.

12. USB 2.0 Interface
USB2.0 interface transfers data between device and PC.

13. External DC In
External DC requirement is 12V.

3.3 Side View

14. Hotkey Button

Press Hotkey button to switch between Color Palette, area measurement rectangle, temperature limits, and long press Hotkey button to turn on/off laser sight.

15. Sound Alarm Buzzer
Signal sound alarm when reaches temperature limit.

4. Quick Start Reference

4.1 Infrared Image

1. Insert Li-Ion battery correctly.
2. Long press Power button until LED light is on and wait until system finishes initialization.
3. Remove IR Lens lid if closed, point to target, and adjust focus to get crisp thermal image.
4. Long press OK button to rectify thermal image.

4.2 Measure Target Temperature

1. Point device to measurement target, and adjust to correct focus. On the upper-right LCD corner, -|-*=×× displays the spot measurement result. For better accuracy, long press OK button to perform manual rectify.
2. Select Area (Rect) Measurement to measure max, min, and average temperature within a rectangle box.
3. It is recommended to press ◀ button to freeze thermal image first, and then apply different and detailed analysis. Press ◀ button one more time to unfreeze.
4. Press ▲ button or ▼ button to switch between normal and 2X zoom. Upper-left LCD corner displays ×2 when in 2X zoom.
5. When measure result is outside temperature range, screen display changes to indicate either below or above temperature range.

4.3 Infrared Image and Voice Annotation

Each thermal image can save up to 40 seconds voice annotation data. Image and voice annotation can later be reviewed on PC by bundled IRSee software. To save Infrared image, first press ◀ button to freeze image, and then long press ◀ button again to open the voice recording menu. If only needs store Infrared image, select Cancel, otherwise select Record. Press OK button to confirm.
In main menu, File → Save provides the same function.
📖: Select Cancel during voice recording to exit.

4.4 Infrared Image Playback

1. Press OK button to open main menu.
2. Select File → Manage, and select folder to view stored thermal image.
3. When viewing thermal image, press ◀ button or ▶ button to switch image in the same folder.
4. The ♪ icon indicates voice annotation attached to current thermal image. Press ▲ button to playback.
5. Long press OK button to exit.

4.5 Replace Lens

1. Screw off the lens on device, replace it with another lens and screw on tightly.

Screwing off

Screwing on

2. Press ◀ or ▶ to adjust “IR Lens” in “Analysis Setup” menu.
3. Operate Image Save and Image Playback according to the steps mentioned in **4.3** and **4.4** hereinabove.

4.6 Connect to PC

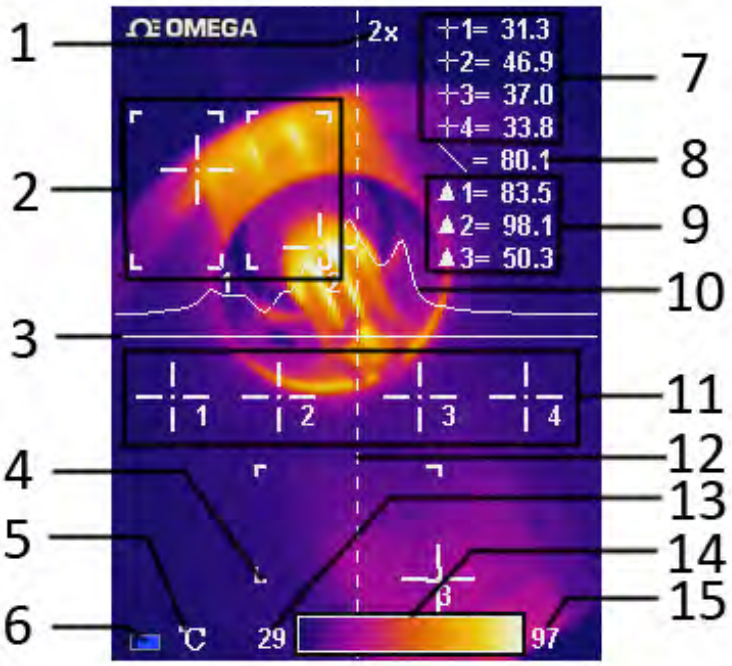
Connect device to PC using included USB cable. Refer OSXL160 software manual for additional PC operation instruction. It is recommended to format device periodically.

5. Operation Menu

5.1 Display Summary

All items can be selected by short pressing the Hotkey button (Note: Long press Hotkey button will turn on/off laser sight). The

selected item is flashing in yellow color. If no operation in 2 seconds after selection, Hotkey mode will exit automatically.



Real Time Thermal Image Interface

1 **Symbol for 2X zoom**: symbol 2X denotes enlarge twice in size; press ▲、▼ button to realize the function.

2, 4 **Area measure box**: 3 areas can be selected in area measure mode**.**

3 **Horizontal measure line:** Horizontal sampling line.

5 **Temperature unit**: there are three options: ℃、℉、K.

6 **Battery condition**: indicates current battery power condition.

7 **Point measure**: ⊣1, ⊣2, ⊣3 and ⊣4 indicates temperature value of point 1, 2, 3 and 4 respectively.

8 **Line measure**: the temperature value in the crossing of measure line and cursor line.

9 **Area measure**: measure points within the area (maximum, minimum or average temperature is optional)

10 **Temperature distribution curve**: sample temperature distribution curve of the measure line.

11 **Point measure cursor:** 4 measure points can be selected**.**

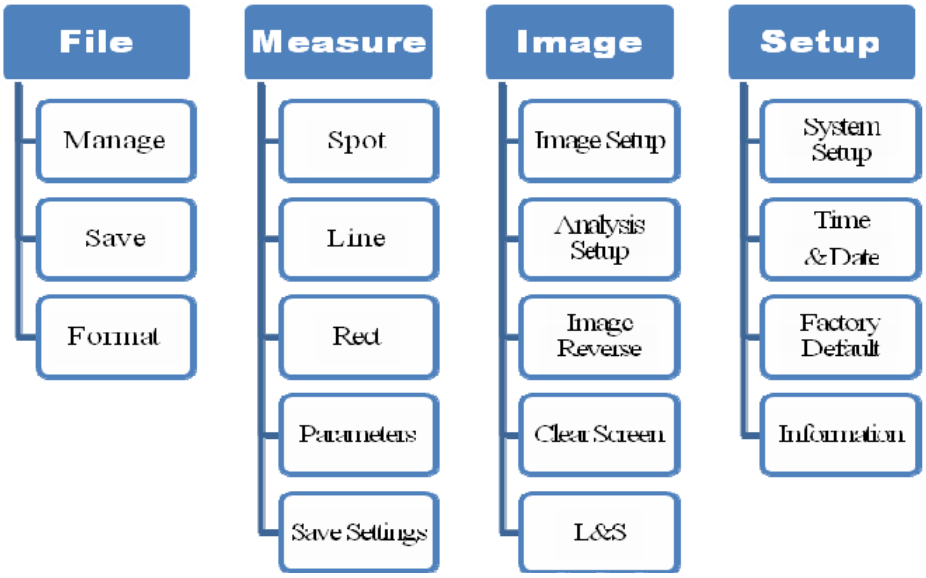
12 **Cursor line:** it appears in line measure mode.

13, 15 Lower limit temperature, upper limit temperature: the lower and upper limit temperature of the color code at the same time.

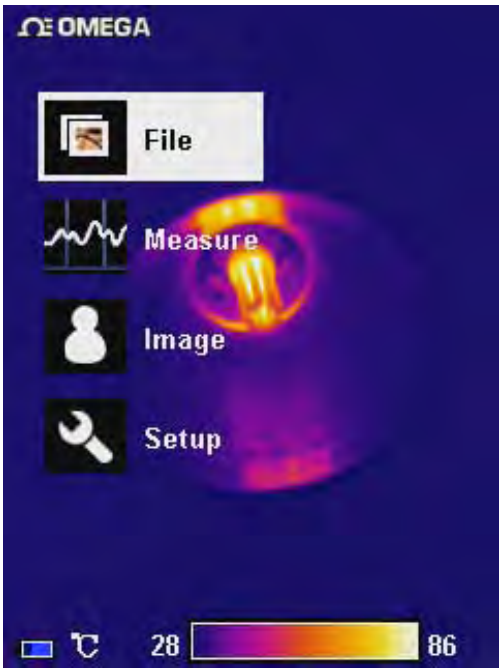
14 Color code: color palette. Any kind of color code is available in the palette.

5.2 Main Menu

Menu and sub-menu items:



Press OK button (when not in Hotkey mode) to enter main menu. Note if press OK button too long, instead of enter main menu, triggers manual rectify.

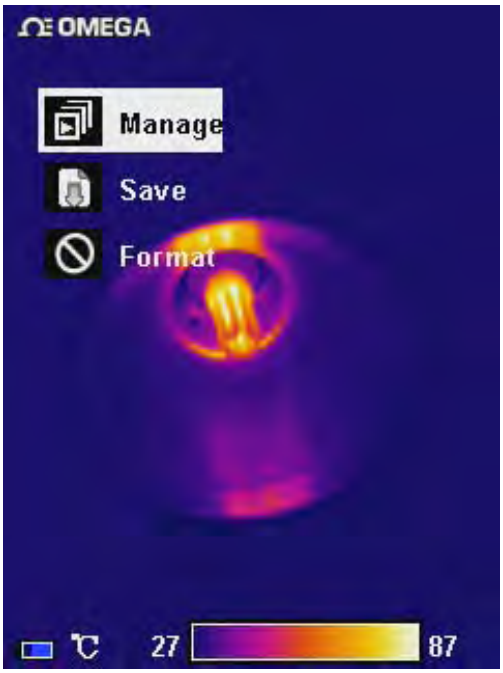


Main Menu

Using ▲ and ▼ button to select menu item, and selected item is highlighted with white background. Press OK or ► button to enter sub-menu. Press ◄ button to return to previous menu or exit.

5.2.1 File

Using File menu to save, playback, delete thermal image and voice annotation.



File Sub-menu

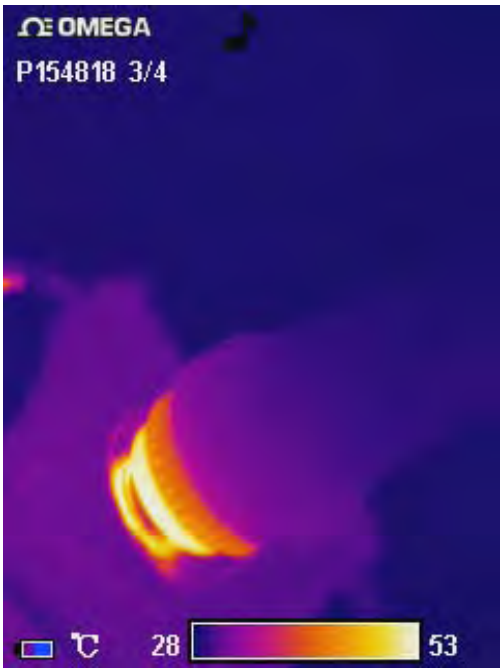
Manage

Select Manage to preview thermal image, add or edit voice annotation, or delete thermal image.

File Manage

Folder is automatically created if not exist when saving thermal image. Folder name is MYYMMDD, and YYMMDD is year, month, and date. For example, Jan 2nd, 2009 folder is M090102. All thermal images taken in this day is saved in this folder. Thermal image file name is Phhmmss, and hhmmss is hour, minute, second (according to system time). For example, P080502 in folder M090102 means the thermal image taken at 08:05:02 time in Jan 2nd, 2009.

In File Manage window, press ▲ and ▼ button to select items. Selected item is highlighted with red background. Press ◀ and ▶ button to switch folder or file when highlighted. After select thermal image, press Open to view thermal image or Delete to delete. Press Exit to exit File Manage window.

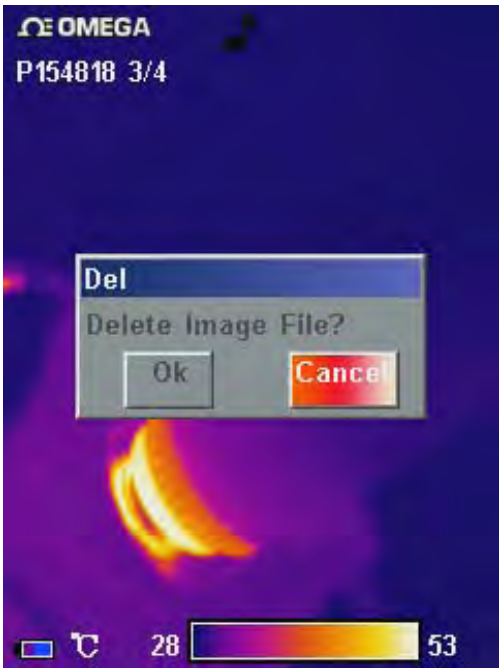


Thermal Image preview

Press ◀ or ▶ button to switch saved thermal image in the same folder. The ♪ icon indicates voice annotation data with current thermal image. Long press ▲ button to enter Voice Annotation menu. If voice annotation already exists, press Record will record new voice annotation and erase previously saved one. Press Cancel first to stop recording then press Save to save.

Voice Annotation

Long press ▼ button to delete thermal image.



Delete Saved Thermal Image

To exit thermal image playback, long press OK button.

Save

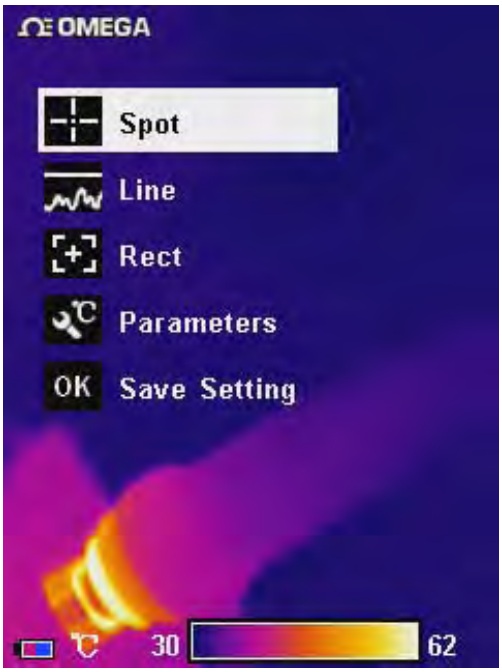
Save current thermal image. Freeze image first before saving.

Format

Format the internal FLASH memory. Press OK to confirm or cancel to exit. Format will erase all saved thermal images. It is recommended to transfer data to PC before format.

5.2.2 Measure

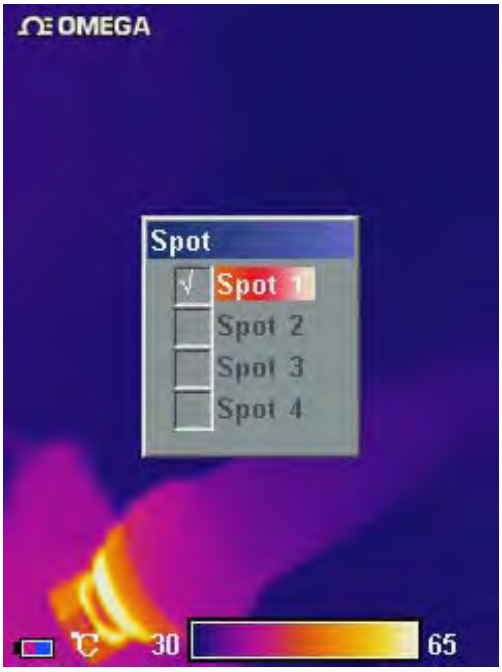
There are 5 items: Spot, Line, Area (Rect), Parameters, and Save Setting in Measure menu.



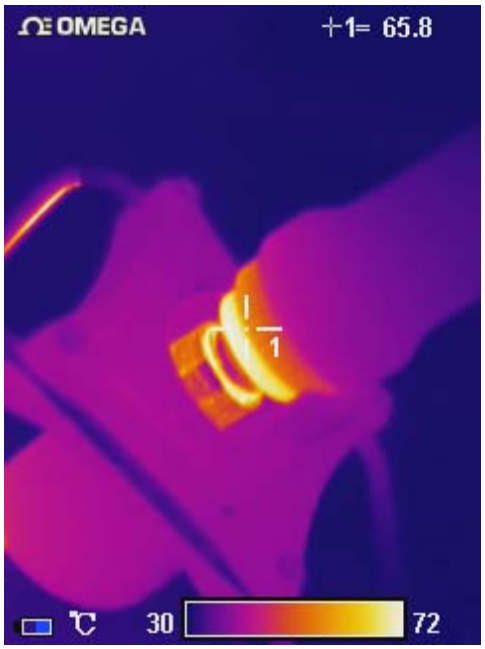
Measure Sub-menu

Spot Measure

Press ◀ or ▶ button to select or deselect. Selected spot is check marked. Up to 4 spots can be selected at the same time.



Spot Target Selection

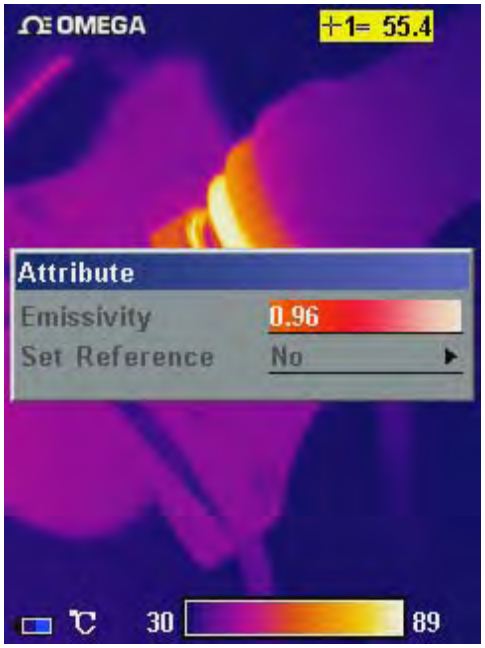


Spot Measure

Measure result on upper-right LCD corner is temperature reading at location marked with +. Up to 4 spots can be selected.

Spot Measure Attribute

Press Hotkey button until spot marker is flashing in yellow, and then use ▲, ▼, ◀, ▶ buttons to move spot location to different directions. Press OK button to enter Attribute Menu. After 2 seconds with no operation, system will exit to real time Infrared view screen.



Spot Measure Attribute

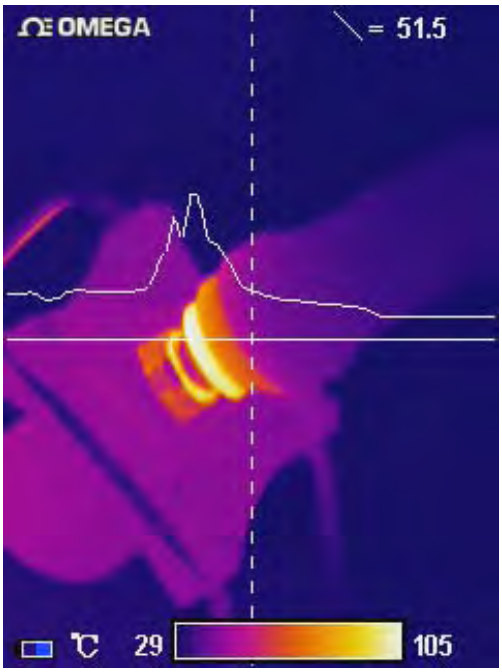
Emissivity: Refer to Appendix *Emissivity of raw materials*.

Set Reference: Set current spot as reference point. If selected, all measure result will be relative value to this spot temperature.

Line Measure

There are 2 line measure options: vertical and horizontal.

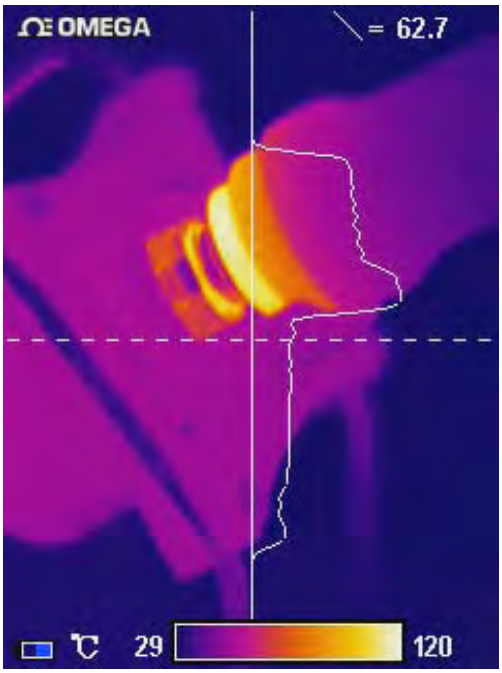
Horizontal Line Measure



Horizontal Line Measure

Horizontal line is temperature sampling line, and upper-right LCD corner displays temperature measurement reading on vertical cursor line intersection. After using Hotkey button select line measure, press ▲ and ▼ button to adjust sampling line position, and press ◀ and ▶ button to adjust cursor line position. Press OK button to enter Attribute Menu. After 2 seconds with no operation, system will exit to real time Infrared view screen.

Vertical Line Measure

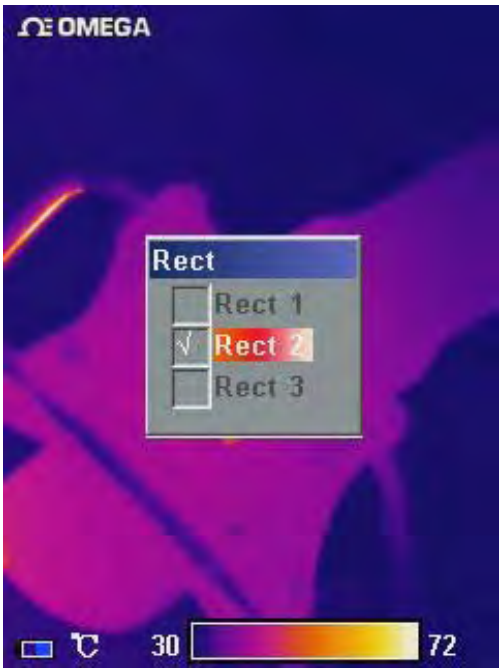


Vertical Line Measure

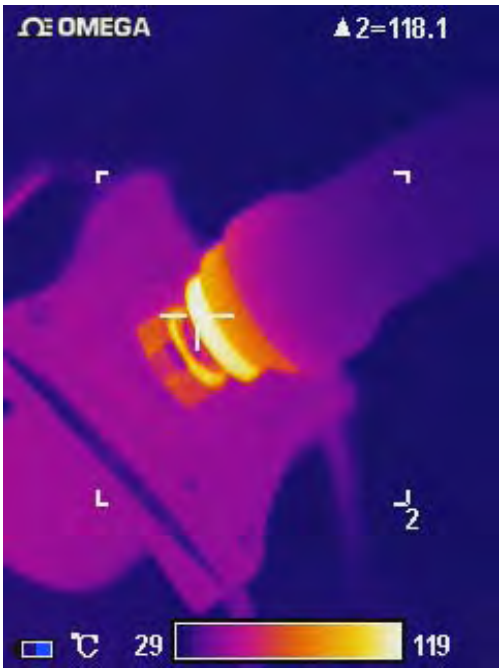
Vertical line is temperature sampling line, and upper-right LCD corner displays temperature measurement reading on horizontal cursor line intersection. After using Hotkey button select line measure, press ◀ and ▶ button to adjust sampling line position, and press ▲ and ▼ button to adjust cursor line position. Press OK button to enter Attribute Menu. After 2 seconds with no operation, system will exit to real time Infrared view screen.

Area (Rect) Measure

Press ◀ or ▶ button to select or deselect. Selected Area is check marked. Up to 3 areas can be selected.



Area (Rect) Target Selection



Area (Rect) Measure

Measure result on upper-right LCD corner is the temperature measurement result within the corresponding rectangle. There are 3 measure types: max, min, and average temperature.

Area (Rect) Measure Attribute: Press Hotkey button until area rectangle is flashing in yellow. Press OK button to enter Attribute Menu in which four parameters can be adjusted namely: emissivity, set reference, measure type, move /size.

Emissivity: Refer to Appendix: *Emissivity of raw materials*.

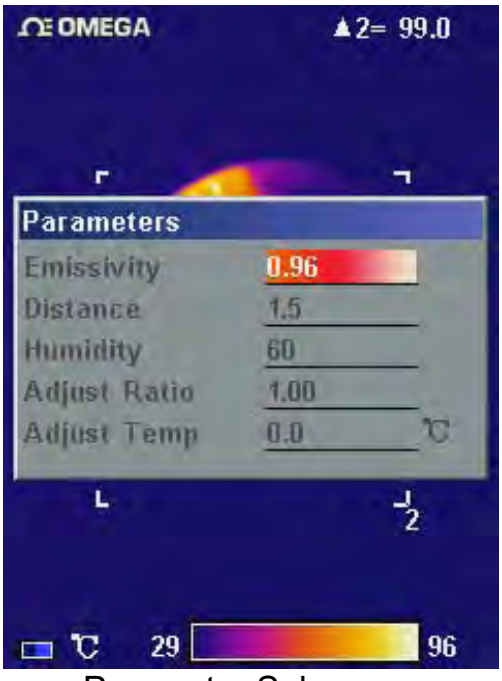
Set Reference: Set current area as reference. If selected, all measure result will be relative value to this temperature.

Measure Type: Select from max, min, and average.

Adjust: Adjust rectangle position and size.

Parameters

Change different settings to adjust temperature measurement accuracy. Press ▲ and ▼ button to select different parameters, and press ◀ and ▶ button to change value.



Parameter Sub-menu

Emissivity

Emissivity varies based on target subject material, surface temperature, surface roughness, measurement angle, and etc. Press ◀ or ▶ once to change Emissivity by 0.01. Long press ◀ or ▶ will change Emissivity in 0.1 intervals.

Distance

This value can be omitted if target subject is close to device (less than 10m). Otherwise, set Distance value accordingly to get more accurate temperature reading. Press ◀ or ▶ once to change Distance 0.1m. Long press ◀ or ▶ will change Distance in 1m interval.

Humidity

This value can be omitted if target is close to device (less than 10m). Otherwise, set Humidity value according to environmental condition. Press ◀ or ▶ once to change Humidity 1%. Long press ◀ or ▶ will change Humidity in 10% interval.

Adjust Ratio

Due to long time usage of device, the sensitivity of IR detector may decrease. In such case, it is necessary to adjust ratio value to get more accurate temperature reading. During calibration, if temperature reading is higher than actual target temperature, change ratio value lower, and vise versa. Press ◀ or ▶ once to change ratio value 0.01. Long press ◀ or ▶ will change ratio value in 0.1 intervals.

Adjust Temp

Under certain condition, it is necessary to adjust temperature reading by a pre-define value. Normally this option should be left unchanged. Press ◀ or ▶ once to change 0.1℃. Long press ◀ or ▶ will change this value in 1℃ interval.

Save Setting

All parameter changes must be saved before power off device. Otherwise, changes will not be saved for next power on.

5.2.3 Image

There are 5 items: Image Setup, Analysis Setup, Image Reverse, Clear Screen, and Auto/Manual (L&S) in Image menu.

Image Sub-menu

Image Setup

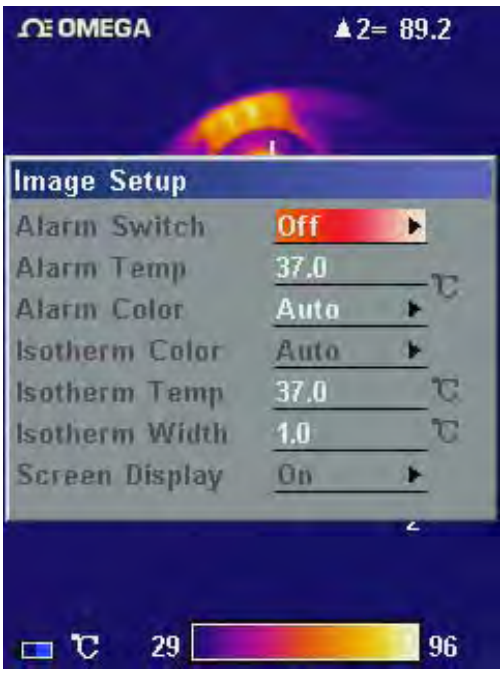


Image Setup Sub-menu

Alarm Switch

Press ◀ or ▶ turns on or off the alarm function. If the Alarm Switch is on, when target subject within area box has surface temperature exceeding Alarm Temp, device will alarm with buzzer sound and mark the high temperature location as Alarm Color if Alarm Color is set.

Alarm Temp

When Alarm Switch is off, this option is disabled. When Alarm Switch is on, Alarm Temp is the desired alarm temperature. Press ◀ or ▶ once to change Alarm Temp 0.1℃. Long press ◀ or ▶ will change Alarm Temp in 1℃ interval. Default setting is 37.0℃.

Alarm Color

Alarm Color can select from Auto, Black, White, Red, Orange, Yellow, Green, Blue, Gray, and Purple. Default setting is Auto, which is no color alarm.

Isotherm Color

When this option is Auto, there is no Isothermal display. Otherwise, target subject Infrared image will change to selected color when temperature is within the range of (Isothermal Temp ± Isothermal Width/2). Default setting is Auto.

Isotherm Temp

Press ◀ or ▶ once to change Isothermal Temp 0.1℃. Long press ◀ or ▶ will change Isothermal Temp in 1℃ interval. Default setting is 37.0℃.

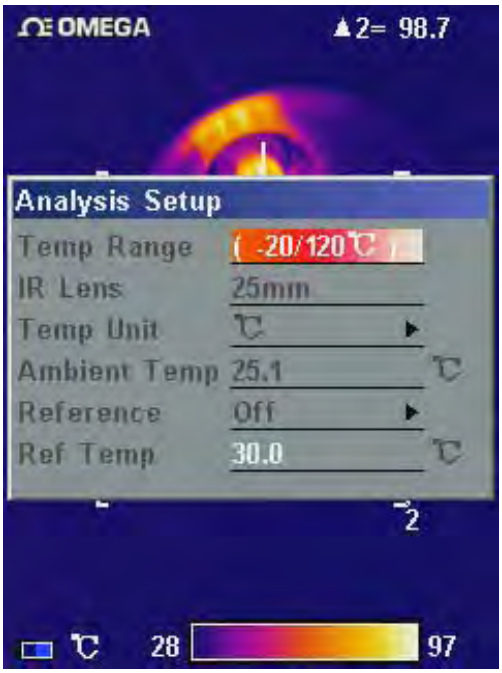
Isotherm Width

Adjust Isothermal Width to change the range of Isothermal Color display. Press ◀ or ▶ once to change Isothermal Width 0.1℃. Long press ◀ or ▶ will change Isothermal Width in 1℃ interval. Default setting is 1.0℃.

Screen Display

When this option is Off, screen display will clear battery condition, temperature unit, temperature limit, and color palette. Press ◀ or ▶ to turn on/ off this option.

Analysis Setup



Analysis Setup Sub-menu

Temp Range

Select Temperature range base on measure target temperature from 2 options: standard grade (-20/120℃) and medium grade (0/350℃). Extra grade (300/1200℃) which is customized high temperature measurement.

Temp Unit

Press ◀ or ▶ to select Temperature Unit from ℃, ℉, and K.
℉=9/5*℃+32，K=273.15+℃

Ambient Temp

For more accurate measure result, set Ambient Temp to correct environmental temperature. Press ◀ or ▶ once to change Ambient Temp 0.1℃. Long press ◀ or ▶ will change Ambient Temp in 1℃ interval.

Reference

Set reference spot or area to display measure results as relative value.

Ref Temp

Press ◀ or ▶ once to change Ref Temp 0.1℃. Long press ◀ or ▶ will change Ref Temp in 1℃ interval. This option is only active when set Ref Temp as reference.

Image Reverse

Press OK button to reverse palette for thermal image display. Press OK again to switch back.

Clear Screen

Press OK button to clear all screen items except Logo mark.

L&S (Auto/Manual Mode)

Press OK button to switch between auto and manual rectifying. In manual rectifying mode, upper-left corner of LCD display shows L&S.

5.2.4 Setup

There are 4 items in Setup menu: System Setup, Time & Date, Factory Default, and Information.

Setup Sub-menu

System Setup

System Setup includes: Language, Auto Rectify, Auto Save, Video, Transparence, Display Device, Screen Save, and Power Save. Press ▲ and ▼ button to switch selection, and press ◀ and ▶ button to adjust value. Active item is highlighted with red background.

System Setup Sub-menu

Language

There are 11 different language options: Simplified Chinese, Traditional Chinese, English, Korean, Japanese, German, French, Russian, Italian, Portuguese and Spanish.

Auto Rectify

Set the number of seconds to perform next auto-rectify. Set value between 1 and 3000 seconds. Value 0 means disabling auto-rectify feature.

Auto Save

Set the number of seconds to perform next auto-save. Set value between 5 to 3600 seconds. Value 0 means disabling auto-save feature. Press ◀ or ▶ once to change the value by 1 second. Long press ◀ or ▶ will change the value in 10 intervals.

Video

Select between PAL and NTSC.

Transparence

Set to enable or disable menu transparence feature.

Display Device

Select between LCD display and external monitor device. Only one video output device can be selected at one time, the other one will be disabled.
📖: If accidentally selected external monitor device and LCD display is disabled, power off and power on device to get LCD display back.

Screen Save

Set the number of minutes without operation to trigger disabling LCD display to save power. Select between 5min, 10min, 30min, and None.

Power Save

Set the number of minutes without operation to trigger power off completely. Select between 10min, 20min, 30min, and None.

Time & Date

Set system date and time. Press ▲ or ▼ button to select an item, press ◀ or ▶ button to change its value and press OK button to confirm. If Li-Ion battery is removed for a long time, it is necessary to reset system time and date.

Factory Default

Restore factory default and rectify some improper settings.

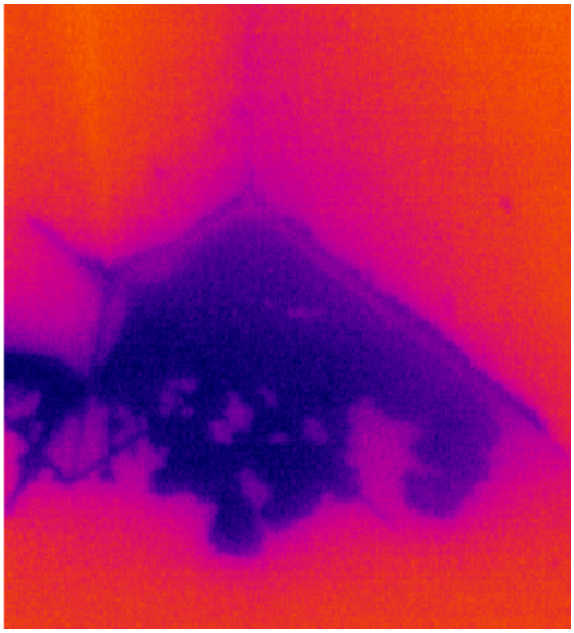
Information

Select to display system information, such as: serial number, software version, and production date etc.

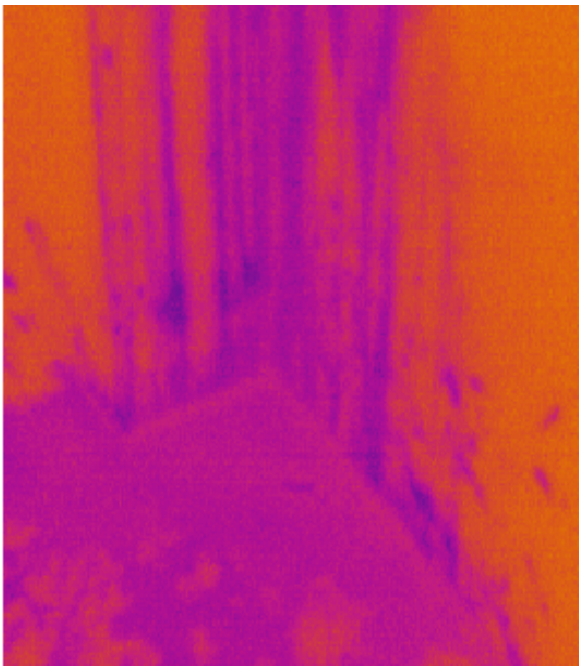
6. Building Thermal Imaging Summary

As the quality of life improves and the low-carbon life style becomes known, higher demands are being set on buildings. The features of our TI series IR camera make it possible to detect slight temperature difference and to analyze indoor humidity and leakage. Hereinafter are images in some cases.

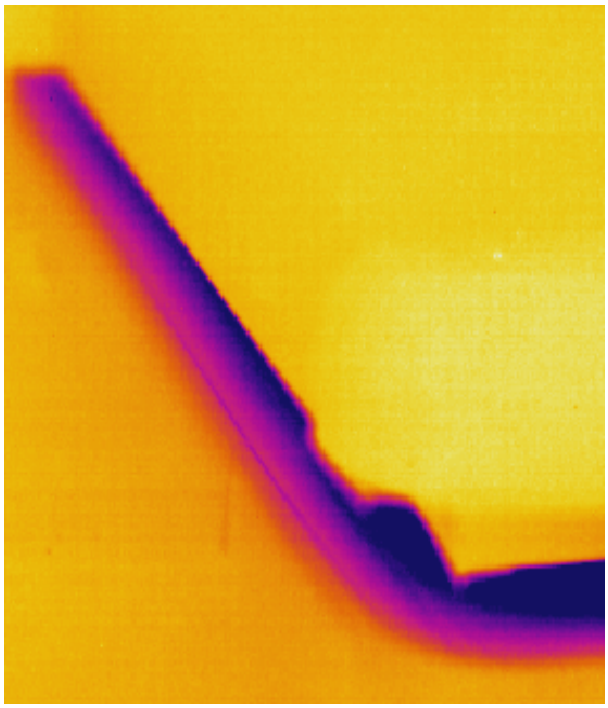
The effect drawing of building detection



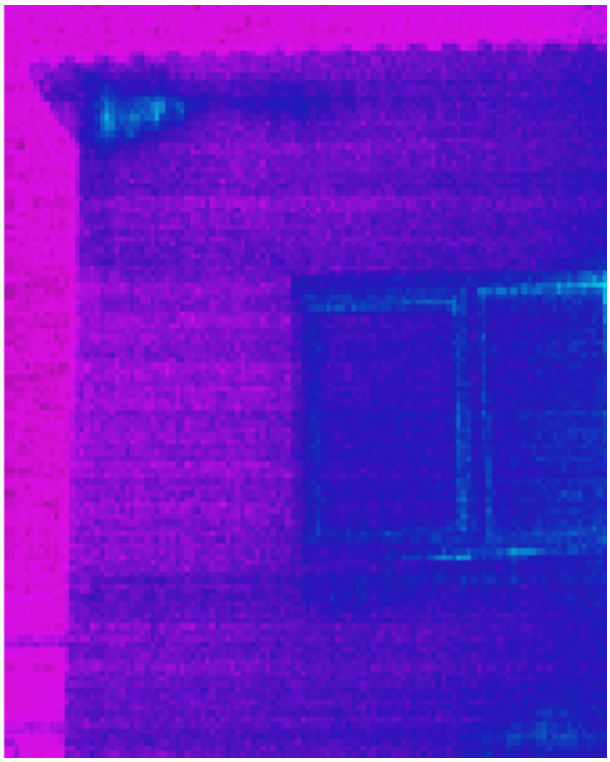
The effect drawing of indoor humidity



The effect drawing of indoor water leakage



The effect drawing of indoor corner air leakage



The effect drawing of outdoor corner air leakage

7. Technical Specification

IR Detector	Type	New UFPA micro-bolometer
	Resolution	160×120
	Pixel Spacing	25*μm*
Infrared Image Quality	Standard Lens	21°×16°/0.15*m*
	Spatial Resolution	1*mrad/f*=25*mm*
	Thermal Sensitivity	<65mk at 30℃
	Frame-frequency	50/60Hz
	Focusing	Manual
	Digital Zoom	2X
	Spectral Range	8~14*μm*
Display	LCD	3.5" Color LCD
Measure	Temperature Range	-20℃～+120℃/ 0℃～+350℃ +350℃～+1200℃（customized）
	Accuracy	±2℃ or ±2%(reading range), select the bigger value
	Measure rectification	Auto/Manual
	Measure Mode	4 spots, 3 areas available under real time mode(max, min and average temp) line measure, isothermal display, temp difference measure and temp alarm (sound/color)
	Color Palette	12 Colors selectable (including iron red, rainbow, black-white, and white-black etc.)
	Image Setup	Auto/Manual adjust contrast, brightness

	System Setup	Date, Time, Temperature Unit ℃/℉/K 10 Languages available, namely: Chinese (simplified & traditional), English, Italian, Japanese, Russian, French, German, Korean, Spanish and Portuguese.
	Emissivity Rectification	Adjustable from 0.01 to 1.0
	Ambient Temp Rectification	Auto, according to background temperature input
	Atmospheric Trans Correction	Auto, according to distance, relative humidity, ambient temperature input

Continued table: Technical Specification

Storage	Storage Media (Built-in Memory)	Up to over 1500 images
	Storage Mode	Auto/Manual single frame image storage
	File Type	JPEG, with 14 bits measure data
	Voice Annotation	40 Seconds voice recording per image (built-in microphone)
Laser	Director	Class 2, 1mW/635*nm* Red
Power Supply	Battery Type	Rechargeable Li-Ion Battery
	Battery Operating Time	3 Hours (Under normal temperature)
	Charging type	Intelligent charger
	Power Save	Included
	External Power	12V±5% DC
Operating Condition	Operation Temperature	-20℃~ +50℃
	Storage Temperature	-40℃~ +60℃
	Humidity	≤90％ (non condensing)
	Protection Grade	IP54
Physical	Weight	660g
	Size(L×W×H)	330mm×95mm×86mm

8. Technical Support

For common mistakes and issues during operation, please refer the following form. If issue cannot be resolved, please contact our technical support department.

For simple problems arising during operation, please refer to the following table. If the problem cannot be settled, please cut off the power and contact our technical department.

Problem	Cause and Solution
Camera cannot be powered on	● No battery or batteries are not installed correctly → Install battery correctly. ● Battery power is used up. → Change battery or recharge. ● Save power mode →power on after 5 seconds.
Device power off automatically	● Battery power is used up. → Change battery.
Battery power is soon used up	● Ambient temperature is too high or low. ● Battery is not fully charged. → recharge battery fully. ● Battery may already reach end of life. (300 usage cycles) → use new battery to charge.
No thermal image	● Lens lid is closed. → Remove lens lid.
Thermal image is black and white	● Black & white palette may be selected. →restore factory default.

9. Appendix: Emissivity of Raw Material

（For reference purpose only）

Material	Surface	Temp (℃)	Emissivity (ε)
Aluminum	inoxidized	100	0.20
	Oxidized	100	0.55
Brass	Brown polished	20	0.40
	Unpolished	38	0.22
	Oxidized	100	0.61
Copper	Oxidized badly	20	0.78
Iron	Oxidized	100	0.74
	Rusted	25	0.65
Cast Iron	Oxidized	200	0.64
	inoxidized	100	0.21
Wrought Iron	Rough	25	0.94
	Polished	38	0.28
Nickel	Oxidized	200	0.37
Stainless Steel	Oxidized	60	0.85
Steel	800℃ Oxidized	200	0.79
Brick	--	20	0.93
Concrete	--	20	0.92
Glass	Smooth flat	20	0.94
Lacquer	White	100	0.92
	Natural Black	100	0.97
Carbon	Smoky black	25	0.95
	Candle smoke	20	0.95
	Black-lead rough	20	0.98
Paint	16 Color average	100	0.94
Paper	White	20	0.93
Soil	--	20	0.90
Wood	Polished	30	0.90
Water	--	30	0.96
Skin	Human	32	0.98
China	Fine	21	0.90
	Rough	21	0.93

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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