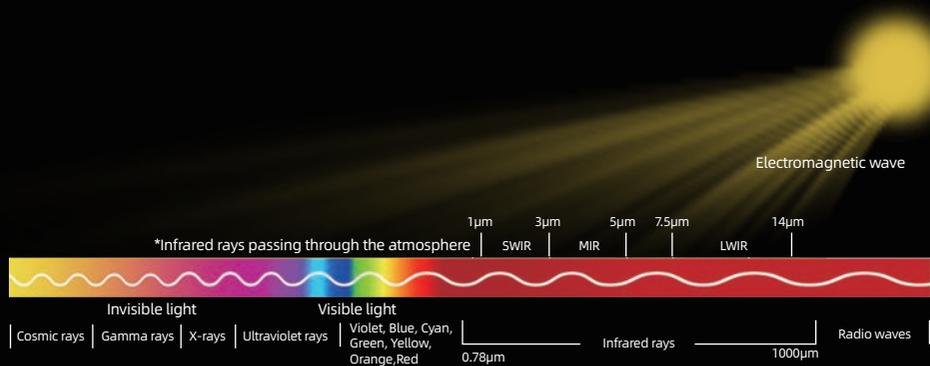




### 1.1 1.1 What is Infrared (IR)?

All objects above absolute zero (-273.5°C) emit infrared energy, which is one part of the electromagnetic radiation spectrum where wavelengths range from about 0.78  $\mu\text{m}$  to 1,000  $\mu\text{m}$ . It is longer than those of visible light, but shorter than those of radio waves.



### 1.2 What is thermal imaging?

Thermal imaging is simply the process of converting infrared radiation into visible images that depict the spatial distribution of temperature differences in a scene. It is a passive, non-contact detection and identification technology with two primary functions, temperature measurement and night vision.



Infrared image



Visual image



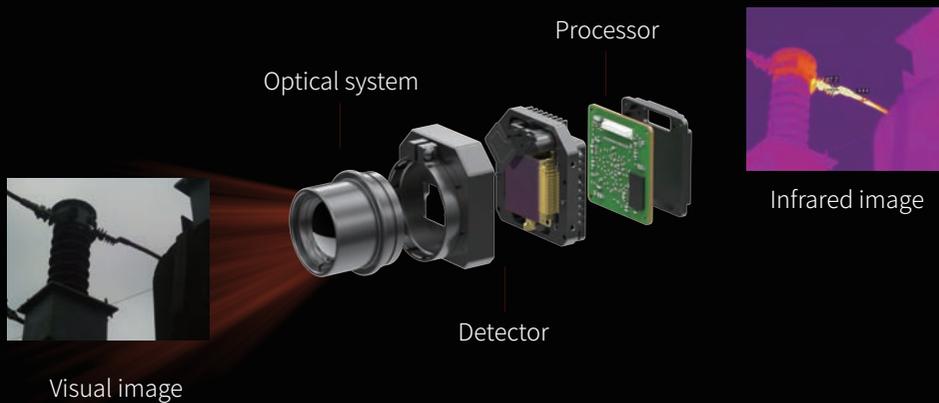
Infrared image



Visual image

1.3 How an infrared camera works

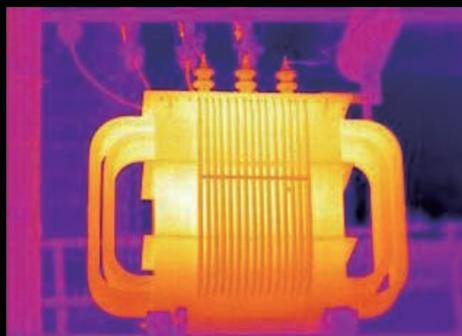
An infrared camera uses its integrated optical system to focus infrared energy onto a special detector chip (sensor array) and produce electronic signals. The camera processor takes the signal and applies a mathematical calculation to it to create a color map of the apparent temperature of the object on its display.



Why use an infrared camera?

2.1 Advantages for industrial inspections

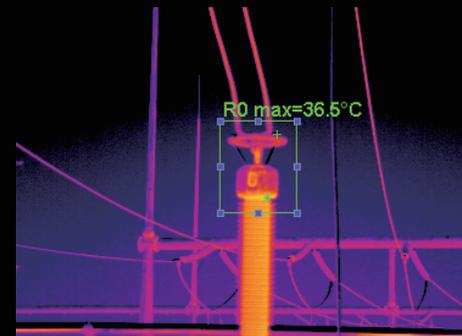
- Simple & intuitive:** Accurately reveal hot/cold spots and hidden faults;
- Efficient & time saving:** Temperature distribution profile based on a large-scale inspection;
- Safe & accurate:** A passive, non-contact inspection tool from long distances for safe and accurate temperature measurement;
- All-weather:** Operated in darkness and harsh weather conditions



Infrared image



Visual image



Infrared image



Visual image

## 2.2 Infrared thermometer VS infrared camera

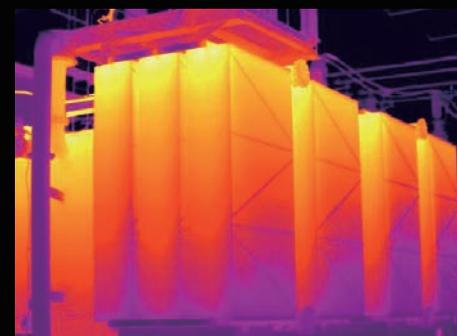
	Infrared thermometer	Infrared camera
<b>Infrared image</b>	N/A	Fast large-area scanning and accurate spot/small area measurement
<b>Visual image</b>	N/A	Locate the defects and add other information
<b>Spot measurement</b>	Measure the average temperature	Measure the temperature of every spot according to the pixel arrangement
<b>Distance-to-spot ratio</b>	10:1 to 20:1	Above 300:1
<b>Laser indicator</b>	Only for indicating the targets	Most with a laser indicator and LED for identification
<b>Measurement accuracy</b>	Measure accurately at short distance	Measure accurately at short and long distances
<b>Data analysis</b>	N/A	Provide thermal analysis and reporting
<b>Data recording</b>	N/A	Record, store, transmit and copy temperature data

## Using infrared cameras for industrial inspections

### 3.1 Electric power

Infrared cameras are commonly used for inspections of electric systems and components. They reveal a wide variety of thermal defects and pinpoint the source of the problems fast for early repair and maintenance.

- ▶ Inspection: Power lines, transmission towers, substations, etc.
- ▶ Maintenance: Bushes, slip rings, stator cores, cabinets, transformers, etc.



Transformer body



Bushing



Voltage transformer



Power line

### 3.2 Metallurgy

Infrared cameras that support auto-switching of temperature ranges and has the required lens for high temperature (up to 2000°C) meet the measurement demands of industrial applications adequately, which offer you:

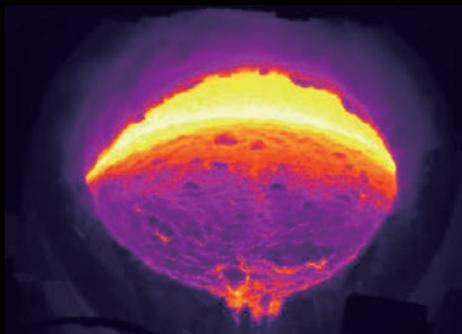
- Analyzing and tracking the history of ladles
- Monitoring slabs during steel rolling
- Measuring the temperature around furnace and boiler equipment



Kiln



Blast Furnace



Ladle opening



Converter

### 3.3 Petro Chemical

Inspection of heat transfer equipment, pipes and tanks can be carried out for safe and efficient production, which includes:

- Tank-level detection (empty, leak and overflow) and analysis of energy losses
- Inspection of pipes and thermal monitoring for storehouses
- Temperature monitoring during the production of petrochemicals



Furnace



Crude oil tank



Heat exchanger

### 3.4 Railway

Infrared cameras give valuable information about the condition of electrical equipment for the safety on the railway. Applications include:

- ▶ Insulator inspection in case of flashover
- ▶ Battery inspection during the charge and discharge process



Pantograph and insulator



Rechargeable battery



DC control cabinet

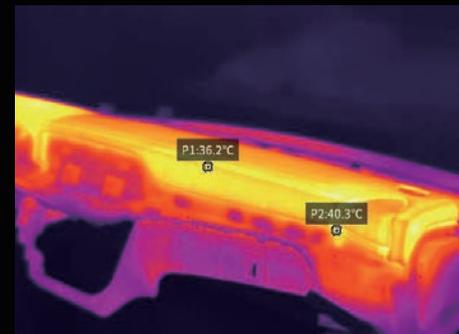


DC control cabinet

### 3.5 Industrial automation

Thermal imaging provides more information to production specialists and decision makers for delivery of higher quality products and improved productivity. Applications include:

- ▶ Quality inspection of castings and molds;
- ▶ Production monitoring of PCB and LCD;
- ▶ Production and storage monitoring of Batteries;
- ▶ Quality monitoring of the package sealing (inaccurately or inadequately applied glue);
- ▶ Production monitoring of parts and components for the automotive;
- ▶ Inspections of object thickness and uniformity;
- ▶ Inspections of glass flatness and surface uniformity of glass containers.



Mold inspection



Glue monitoring

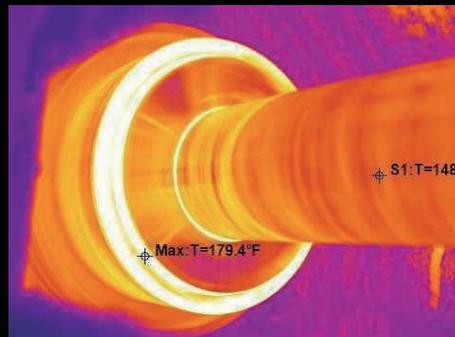
### 3.6 Others

For some sectors like IC manufacturing, infrared cameras provide high-performance thermal inspections. For example, find hot spots fast and assist in circuit design analysis. Other applications include:

- Regular inspections of PCB
- Predictive maintenance on mechanical equipment



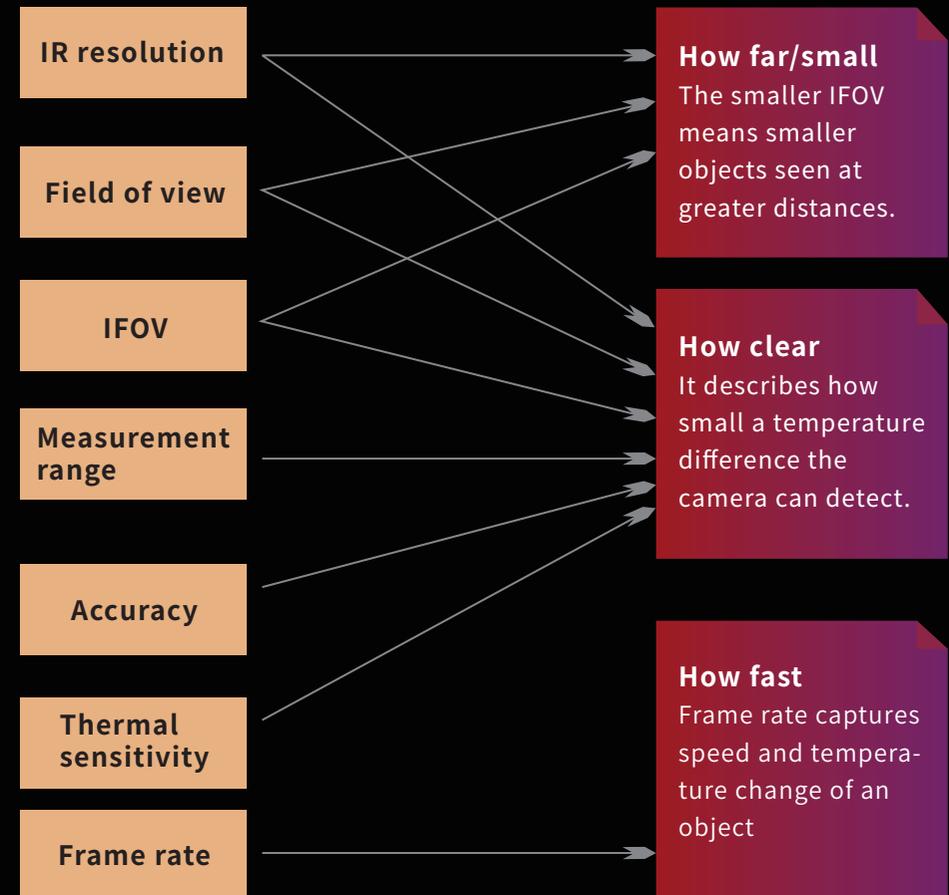
PCB



Drive shaft

## Choosing the right infrared camera

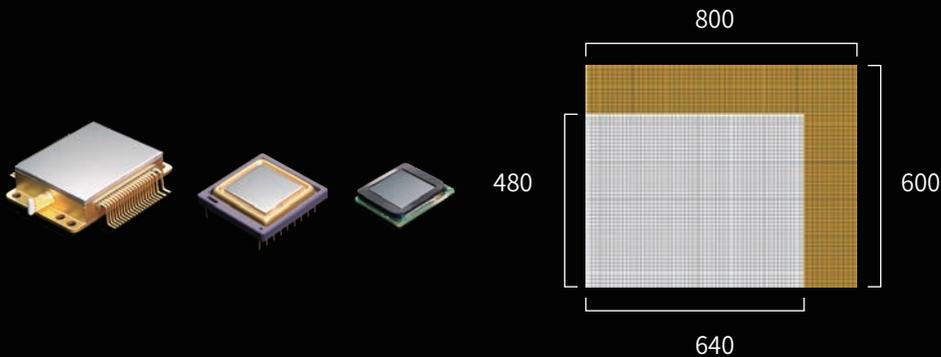
### 4.1 Key parameters



## ➤ IR resolution

The infrared camera usually has an IR resolution of 160 x 120, 400x 300, 640 x 480 or 1024 x 768 pixels. The IR resolution is how many pixels the camera has on the scene. Higher resolution means:

More temperature measurement points;  
Measurement of smaller targets from further away;  
More detailed and clearer presentation of the measured objects.

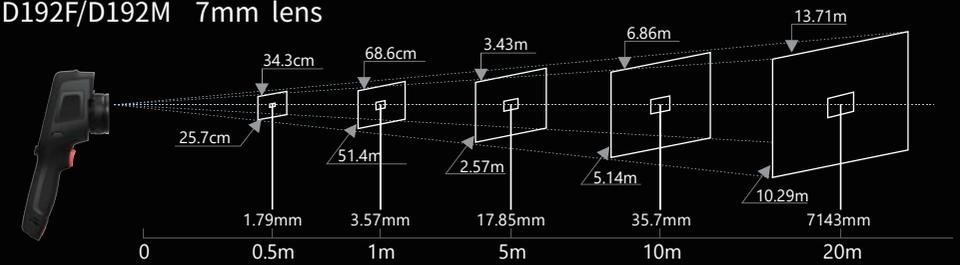


## ➤ Focal length/FOV/IFOV

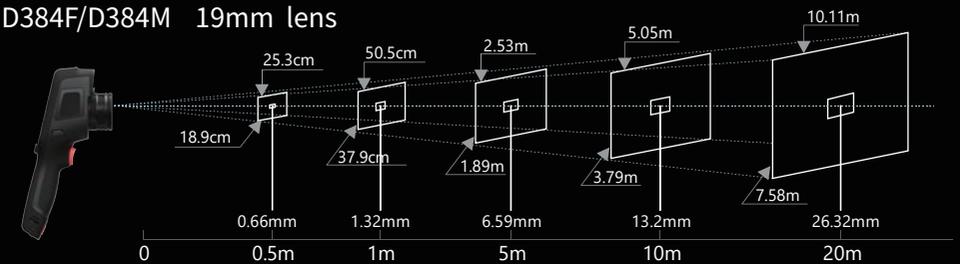
Choose a lens according to the object size, observation distance, range and details to get the IFOV you need.

For example: D Series intelligent thermal camera

### D192F/D192M 7mm lens



### D384F/D384M 19mm lens



### ➤ Thermal sensitivity

Thermal sensitivity, or Noise-Equivalent Temperature Difference (NETD), measures the smallest temperature difference that an infrared camera can detect. The lower the NETD value, the better the sensor can register small temperature differences.

Infrared cameras with a low NETD will:

- Have an improved ability of identifying the object background;
- Captures more clear and detailed objects;
- Have more options of f-number, such as F/1.0, F/1.2 or F/1.4;
- Have a small size;

### ➤ Frame rate

Frame rate is the speed at which an infrared camera updates its output information to be displayed on a screen. Faster frame rates are particularly important in applications where objects may be moving at higher speeds or when the objects have a large temperature change. Infrared cameras from Guide Sensmart has a frame rate of 50 Hz or higher.

### ➤ Measurement range/accuracy

Users can select the measurement range and accuracy based on the object temperature range. The accuracy is expressed both in percentages and degrees Celsius, which is the margin of error within which the infrared camera will operate. The current industry standard for accuracy is  $\pm 2\%$  /  $\pm 2^\circ\text{C}$  (whichever is bigger).

## 4.2 Adjustable parameters for an infrared camera

### ➤ Emissivity

Emissivity is a value measuring how efficiently a surface is able to emit infrared thermal radiation. The emissivity value varies with the material type, surface finish condition, etc. There are some techniques to get the actual emissivity for the object to be thermally imaged.

- 1)Emissivity setting: Set the emissivity value of the measured object according to the emissivity list.
- 2)Emissivity adjustment: For objects have a low emissivity due to its material such as metal or its surface finish condition like high reflection, cover the surface with black electrical tape, paint or ink.

### ► Background Temperature Compensation

Thermal radiation reflected from the surrounding will require that you make an additional correction when the reflected radiation is strong compared to the natural radiation of the object.

### ► Transmission correction

When conducting infrared inspections through infrared-transparent windows (IR Windows / Sightglasses), or the air containing moisture or smoke, or from a long distance, not all of the infrared energy emitted from the objects of interest are efficiently transmitted. You can adjust the transmission correction.

### ► Focus

Focus is essential to both image quality and temperature accuracy. You can choose from two general types of focus systems, manual or auto focus.

### ► Functions

Infrared cameras can be adjusted to meet different requirement for temperature analysis, image storage, mode adjustment or data transmission.

Parameter	T Series 	D Series 
Analysis	Measurement of a center point and 3 areas, temperature alarm	Measurement of 5 spots, 2 lines and 5 areas, temperature analysis, isotherm and alarm
Measurement parameters	Emissivity, ambient temperature, target distance	Emissivity, ambient temperature, target distance, relative humidity
Image storage	Yes	JPG format, editable
Video storage	No	H. 264 with temperature information
Storage capacity	16G TF card (maximum 32G)	12G memory, 16G TF card (maximum 32G)
Color palettes	6	8
Display	2.4-inch LCD display	4-inch high-brightness LCD touchscreen

### ► Extensibility

Guide Thermal Cameras can be operated on platforms like Android, and have extensibility and real-time sharing via WiFi.



### 5.1 Who we are

Guide Sensmart, a wholly owned subsidiary of Guide Infrared, specializes in the design, manufacture, and marketing of infrared cameras for commercial applications on the mission of Infrared Technology Benefits the Public. We bring the temperature visualization and intelligent sensing into the products and solutions for our customers.

### 5.2 What we have

- Full independent intellectual property rights: more than 200 models of self-developed products applied in different areas.
- Year-over-year increases in R&D expenditures, over 100 patents and many prestigious product design awards.
- More than 10 production lines and an annual output of 500,000 units
- Approved management system for quality assurance and certification in many countries.

### 5.3 How we serve our customers

#### ➤ Customer-built service

OEM/ODM: Advanced R & D and production meet the demands of OEM/ODM suppliers.

Solutions: Professional, efficient and convenient solutions are provided for customers from various industries.

#### ➤ Pre-sales support

Consulting services: Product demo and technical Q&A

#### ➤ Sales support:

Solution design: Translate the high-level requirements derived from the customers into practical solutions.

Technical support: Manage the implementation of solutions with guidance.

#### ➤ After-sales support

Warranty: Two-year for an infrared camera and six-month for its accessories.

Free training: Free calibration and application guidance.

Demonstration device: A demonstration device provided for warranty repairs.

After-sales service centers: Subsidiaries in Germany and Belgium.

## 5.4 Guide Infrared

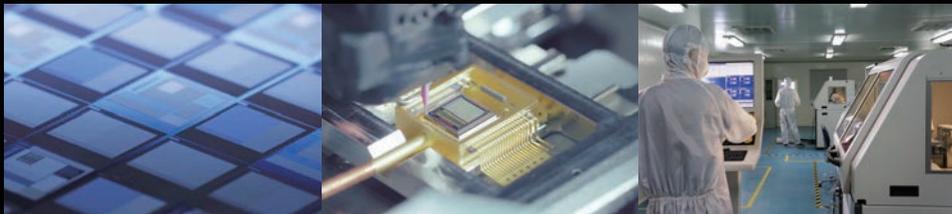
Guide Infrared takes the lead in R&D, production and sales of infrared thermal imaging system and large-scale optoelectronic system.

▶ Listed on Shenzhen Stock Exchange with market value of RMB 60 billion

▶ The globally leading R&D and production base



▶ The biggest thermal imaging industry park in Asia



▶ Self-developed infrared detectors and independent intellectual property rights from the bottom to the system

▶ Over 20 years' experience in R&D and customer-focused improvement of product performance and experience

