

# Infrared Thermography for evaluation, maintenance, inspection and diagnosis of office building & Housing



*R500EX*



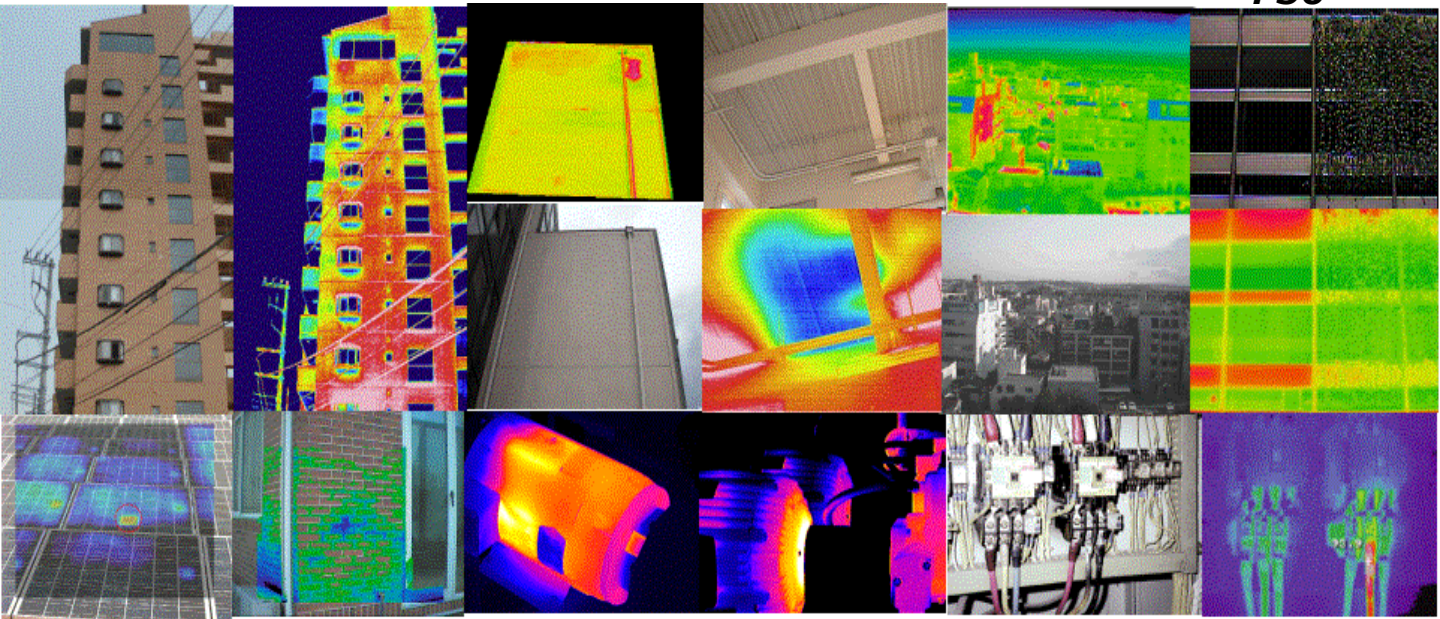
*R300SR-S*



*Thermo GEAR  
G100EX*



*Thermo Flex  
F50*



Infrared thermography is being widely used for evaluation, maintenance, inspection and diagnosis of office building and apartment buildings. Infrared thermography is an equipment which enables “visualization of temperature distribution”. By visualization of temperature, “inspection for separation/lifting of wall finishing material”, “inspection for water leakage/stagnant water”, “inspection of heat insulation material”, “inspection of air tightness” and “inspection of electric facility, piping and air conditioner” can be conducted efficiently within a short period of time. Furthermore, inspection and survey using thermography is most useful in “measurement of energy saving effect” in office buildings and apartment buildings

### **The benefits of external wall separation inspection using thermography**

There are four benefits of external wall separation inspection using thermography as follows.

#### **① Inspection period can be shortened!**

Scaffold, which is necessary in the case of percussion diagnosis, is not required. In the case of the thermography inspection, simplified diagnosis of external walls can be conducted remotely and quickly.

#### **② Diagnosis can be conducted at a reasonable cost!**

No scaffold is required. Inspection period can be shortened. Comparing to the case of percussion diagnosis, external wall diagnosis can be conducted at less than a half of the budget size.

#### **③ Diagnosis can be conducted safely!**

No scaffold is required. Inspection can be conducted safely as there is no high-place work involved.

#### **④ Easy to understand and convincing explanation can be made!**

Because visually presented report can be prepared using thermography, easy to understand and convincing explanation can be given to the clients.

### **Precaution related to the external wall separation inspection using thermography.**

In order to conduct external wall degradation diagnosis and evaluation and diagnosis of buildings and housings based on the infrared survey method using thermography, not only the knowledge on the structure/construction method of the building (housing) in general but also correct knowledge regarding infrared survey method and know-how related to the thermography photographing and image data analysis are required



※: Screen images above are inserted rather than actual.

# Survey and diagnosis items for buildings and structures

## Maintenance of electric facility

[Major observed object]

- Observation for abnormal temperature of power distribution panel

## Maintenance of facilities (roof)

[Major observed object]

- Elevated water tank
- Lifting pump
- Roof top HEATS water heater

## Diagnosis and countermeasure for energy saving

Inspection for missing or defective heat insulation material

[Major observed object]

- Ceiling, floor, wall surface

## Maintenance of communication facility

[Major observed object]

- Communication facility
- Temperature control of a server room

## Maintenance of facilities (piping)

[Major observed object]

- Water supply and hot-water supply system
- Drainage system
- Central heating system

## Survey for building deterioration

- ① Separation inspection
- ② Inspection for water leakage and stagnant water
- ③ Inspection for heat leakage
- ④ Verification of air tightness (inspection for heat leakage)

[Major observed object]

Ceiling, floor, wall surface, window, exit

## Maintenance of facilities

[Major observed object]

- Water supply and hot-water supply system
- Drainage system
- Central heating system
- Heating and cooling system (floor heating, etc.)

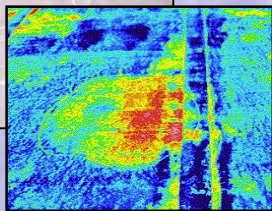
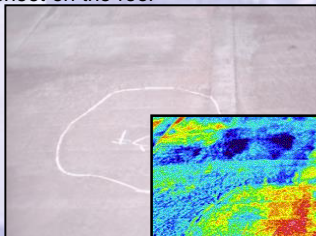
## Diagnosis and countermeasure for energy saving

Installation of heat insulation material and implementation of energy saving construction method, verification of their effect

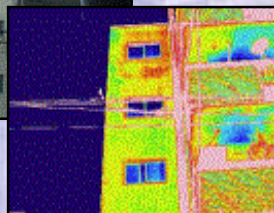
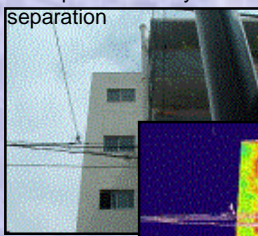
[Major observed object]

- Heat insulation effect by planting

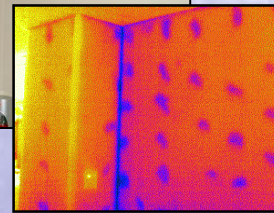
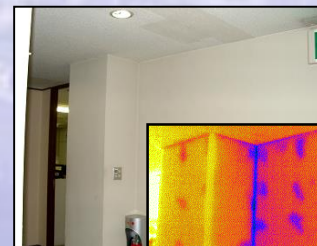
Example of defective water-proof sheet on the roof



Example of balcony wall surface separation

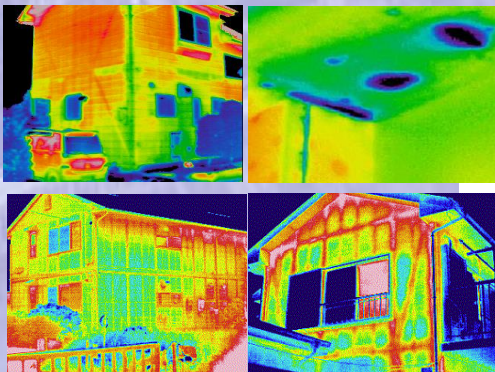


Example of plaster board installed area



Infrared diagnosis method may not be applicable to some external wall diagnosis depending on the environmental condition. Knowledge on structure and construction method of buildings and on thermography are necessary to conduct diagnosis work

# Survey/diagnosis items for homes



## Building deterioration survey

- ① Inspection for separation of tiles and mortar
- ② Inspection for water leakage and stagnant water
- ③ Inspection for heat leakage, verification of air tightness (inspection for heat leakage)
- ④ Verification of internal structure (bracing, etc.)
- ⑤ Verification of heating and cooling effect

[Major observed object]

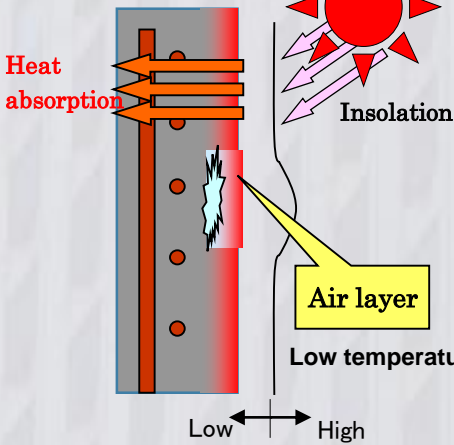
- Water related facilities (kitchen, bathroom, toilet)
- Ceiling, floor, wall surface, window, doorway

Infrared diagnosis method may not be applicable to some external wall diagnosis depending on the environmental condition. Knowledge on structure and construction method of buildings and on thermography are necessary to conduct diagnosis work.

## Inspection of external wall (tiles and mortar) separation

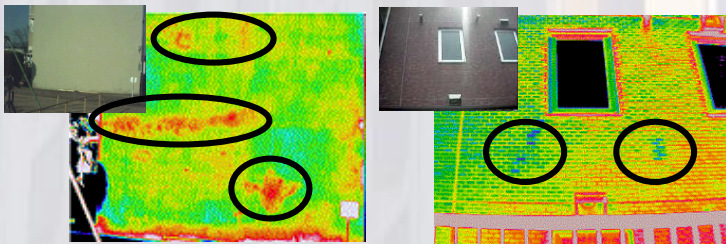
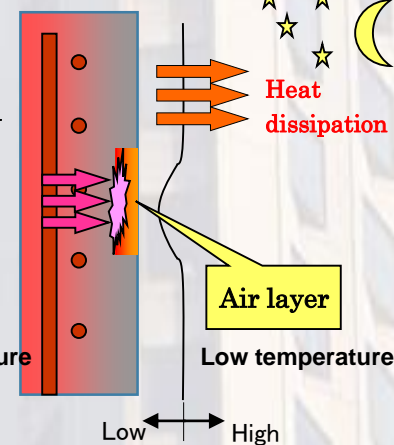
☉ During day time

Reinforced concrete



☾ At night

Reinforced concrete

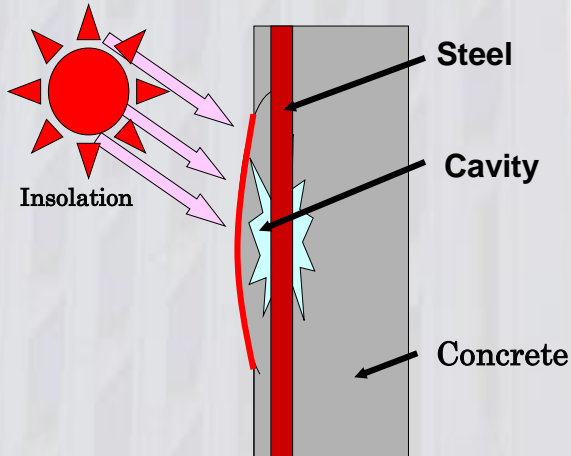


○ The area with possible lifting/separation

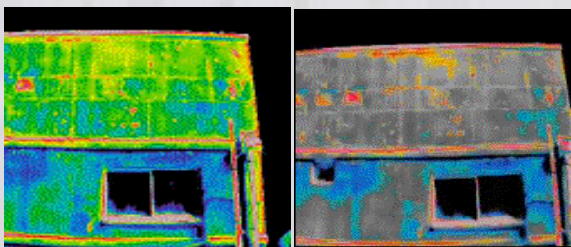
Separation of mortar or tile used as the external wall finishing may cause dropping of mortar or tile leading to accident. Identification of separation location is difficult by visual inspection only.

Percussion diagnosis requires long time and large cost due to scaffolding. Therefore, inspection of external wall separation using thermography is becoming popular. Where there is a wall separation, there is an air layer inside. As the air layer has large heat insulation characteristics, the surface temperature of the area where the finishing material is separated will largely fluctuate comparing to the normal area. When the sun shines or the temperature rises, the temperature of the separated area gets higher than the normal area, and the separated area temperature gets lower at night when there is no sunshine.

## Inspection and diagnosis for aging due to rusting of the reinforcing steel

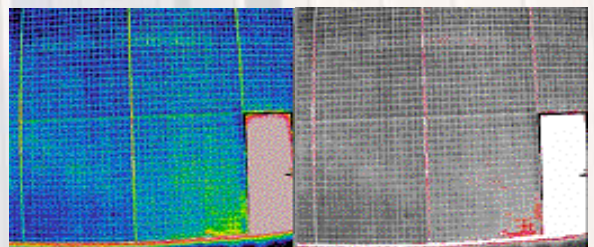


Rusting of the reinforcing steel inside the concrete wall will lead to deterioration of the strength of the building itself. Internal cavity with suspected rusting, which is normally difficult to be recognized by visual inspection, can be visualized. When the reinforcing steel inside the reinforced concrete gets rusted, that area will expand making an air layer. Similar to the case of external wall separation, the heat insulation effect of the air layer helps the temperature to be higher than the normal area during temperature rise process, and to be lower during temperature lowering process. While the cause of the cavity could be different, the temperature difference can be detected similar to the principle of lifting/separation of the wall (tile, mortar, etc.). Because judgment cannot be made whether it is a separation/lifting of the wall or rusting of the reinforcing steel, inspection using reinforcing steel rusting measurement device or verification at the time of repair will be very important.



○ Possible area for lifting/separation

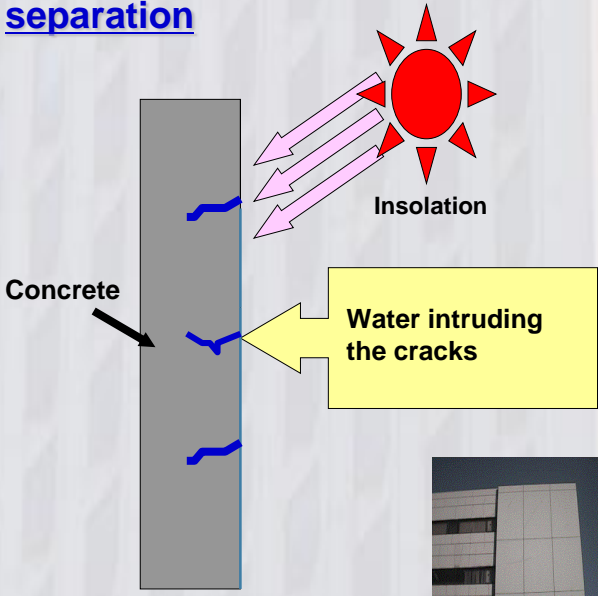
○ Possible area for water immersion



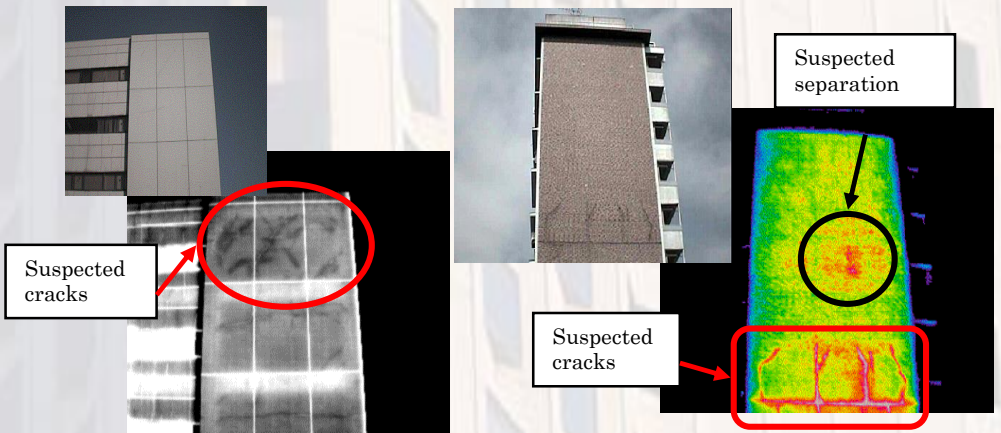
○ Possible area for lifting/separation

# Inspection of external wall (tiles and mortar)

## separation

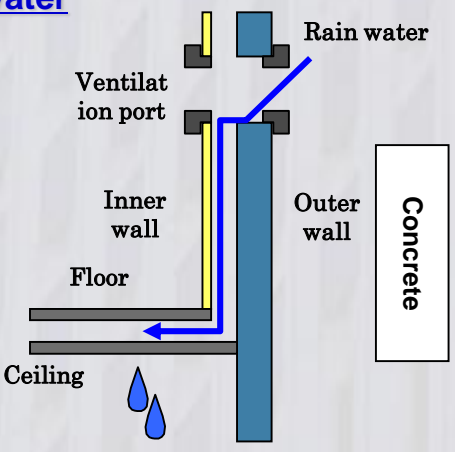


When cracks are caused on the external wall, water may intrude inside by rain. Such water intrusion will lead to the reinforcing steel rusting inside the concrete wall, which will result in deteriorated strength of the building. After the rain, if the sun shines on the wall with some cracks, the temperature rise of the cracked area will be slow due to the intruded water, and the temperature rise of the normal area will be faster. By measuring such temperature difference, location of the cracks can be identified. Similar phenomenon can be observed by intentionally making the water intrude inside the wall



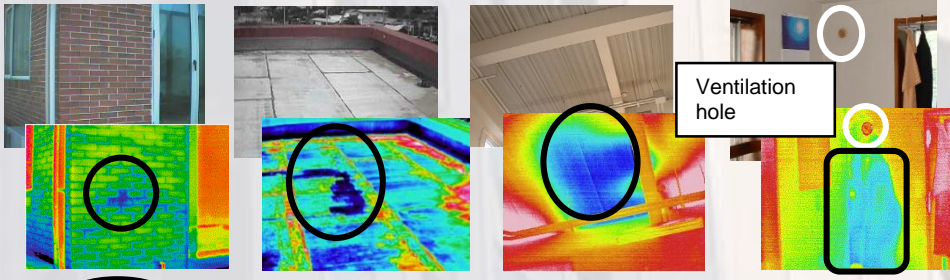
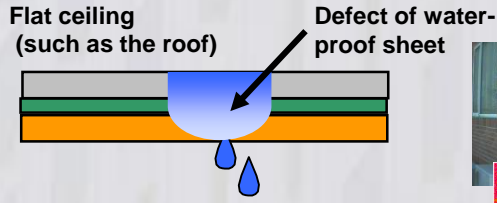
# Inspection and diagnosis of water leakage and stagnant water

## water



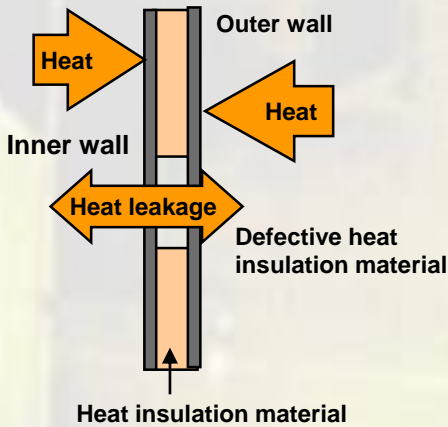
Damages of water-proof sheet on the roof of a building or in the hallway and water leakage or stagnant water due to cracks on tap water/sewerage pipe may cause various problems including "molding → sick house syndrome" or "deterioration of strength due to corrosion of walls or ceiling of a building". By surveying the building using a thermography, stagnant water area (moisturized area) can be visualized.

When defects occur to the water proof work (water-proof sheet) installed underneath the floor, in the ceiling or between the outer and the inner walls and water-proof is no longer effective, water will penetrate and stay after the rain. If sun shines under such circumstances, the temperature rise at the area of water leakage or stagnant water will be slow due to the existence of water whereas the temperature rise is faster in the normal area.

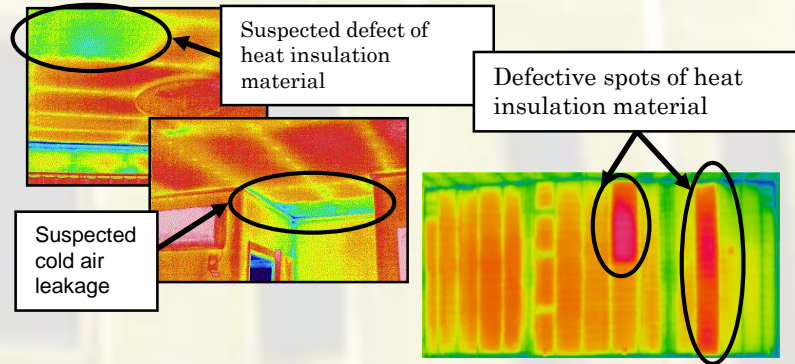
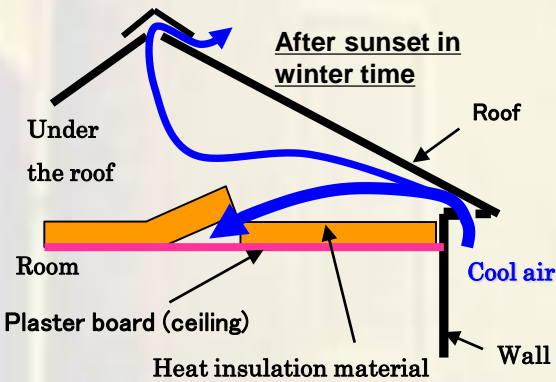


Water leakage or stagnant water suspected area.

## Inspection and diagnosis of defective heat insulation material and air tightness performance



As part of the energy saving efforts, heat insulation is installed in walls, ceiling, floor, window and door of buildings, and as a result, air tightness is improving. When there are defects in heat insulation material or deterioration in air tightness, there will be a major loss in terms of air conditioning energy. These defects cannot be recognized through visual inspection alone. The temperature difference caused between inside and outside of a room by air conditioning will gradually be balanced and eventually reach equal temperature (heat equilibrium). When there is a defect in air tightness due to defect of heat insulation material, heat leakage will be observed from the areas of defects in heat insulation or air tightness.



## Inspection and diagnosis of various facilities

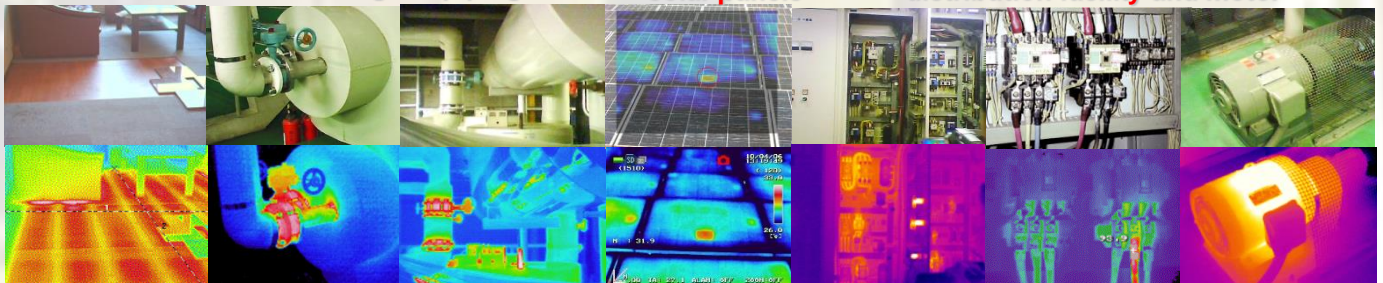
Various equipment and instruments are installed in office buildings and apartment buildings. Appropriate maintenance of these equipment and instruments is very important in terms of energy saving, preservation of living environment and disaster prevention (prevention of fire). When there is an overload to the pumps for pumping up water or for drainage or elevator motors, there will be more heat generation comparing to normal state. Heat generation due to overload will also occur to electric facilities. In the case of electric facilities, abnormal heat generation also occurs due to poor contact. The principle of heat generation is: poor contact  $\rightarrow$  increase of resistance value  $\rightarrow$  heat generation, which is the same as the case of electric heater. If such abnormal heat generation is overlooked, there is a danger of accident by electric power interruption or fire. In recent years, the scope of thermography study is expanding to cover inspection of solar panels. It can be said that visualization of heat is an extremely effective method for inspection of various facilities and equipment in office buildings and apartment buildings.

**Verification of floor heating effect**

**Inspection for heat leakage of piping**

**Inspection of solar panels**

**Thermal inspection of power distribution facility and motor**



# Avio Thermal Imaging Camera Lineup for Building Diagnosis

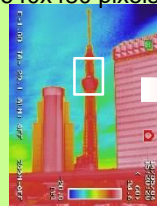
R500EX



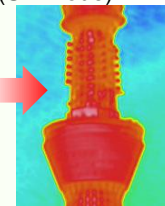
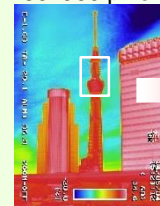
R300SR-S



R500EX  
640x480 pixels



1280x960 pixels (SR Mode)



Extremely effective in building diagnosis and structure inspection because of its high image quality and high precision at the world top level!

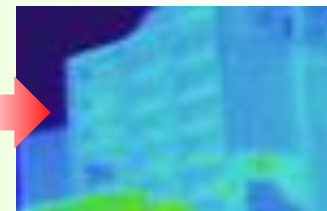
[Features]

- R500EX
- 640x480 pixels
  - 1280x960 pixels with Super Resolution function
  - FOV: 32° (H) x 24° (V)
  - Spatial Resolution: 0.87mrad (0.58mrad with SR mode)

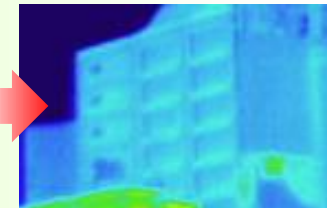
- R300SR-S
- 320x240 pixels
  - 640x480 pixels with Super Resolution function
  - FOV: 22° (H) x 17° (V)
  - Spatial Resolution: 1.2mrad (0.8mrad with SR mode)

- R500EX & R300SR-S
- High temperature resolution: 0.025°C at 30°C with S/N improvement
  - LED illumination + laser pointer function
  - Data management is supported by voice memo function
  - 270° Multi-angle display

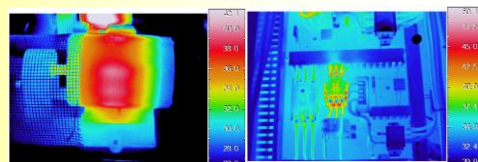
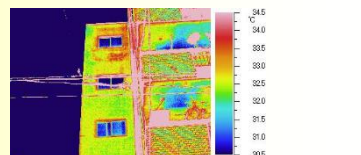
R300SR-S  
320x240 pixels



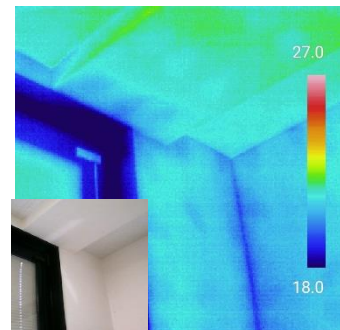
640x480 pixels (SR Mode)



Thermo GEAR  
G100EX



Thermo Flex  
F50



Versatility Thermal Imaging Camera it has enough performance for insulation diagnosis, electrical facility equipment diagnosis and lower floor building external wall diagnosis.

[Features]

- 320x240 pixels + visible camera
- FOV: 32° (H) x 24° (V)
- NETD: 0.04°C with S/N improvement
- LED illumination + laser pointer function
- Data management is supported by voice memo function
- 270° Multi-angle display



270° Multi-angle display



LED illumination and laser pointer

Removable compact size camera unit which can be inserted to narrow space, and used by completely free camera angle with high resistance to environment.

- 240x240 pixels + visible camera
- Light weight body of approximately 500g (Camera Unit 100g+Controller 400g)
- High resistance to environment  
Protection class IP64 equivalent  
Operating Temperature: Camera Unit -20 to 70°C  
Controller -20 to 50°C
- Smartphone-like simple operation
- 4 hours operation by built in battery

# Specifications of infrared thermography for building diagnostics

Model		Thermo Flex F50	Thermo GEAR G100EX/G100EX-D	R300SR-S/R300SR-SD	R500EX/R500EX-D
Basic Performance	FOV	F50A: 35° x 35° F50B: 70° x 70°	32° (H) x 24° (V)	22° (H) x 17° (V)	32° (H) x 24° (V)
	Spatial Resolution (Normal Mode)	F50A: 2.8mrad F50B: 5.3mrad	1.78mrad	1.2mrad	0.87mrad
	Spatial Resolution (SR Mode)	-	-	*0.8mrad equivalent	*0.58mrad equivalent
	Focal Distance as Standard Lens	F50A: 30cm to ∞ F50B: 10cm to ∞	10cm to ∞ For temperature accuracy: from 30cm	10cm to ∞ For temperature accuracy: from 30cm	10cm to ∞ For temperature accuracy: from 30cm
	Focus	Focus Free	Auto/Manual	Auto/Manual	Auto/Manual
	Infrared Detector	UFPA	UFPA	UFPA	UFPA
	Spectral Range	8 to 14μm	8 to 14μm	8 to 14μm	8 to 14μm
	Infrared Resolution (Normal Mode)	240 x 240 pixels	320 x 240 pixels	320 x 240 pixels	640 x 480 pixels
	Infrared Resolution (SR Mode)	-	-	*640 x 480 pixels	*1280 x 960 pixels
	Frame Time	7.5Hz	G100EX: 60Hz G100EX-D: 8.5Hz	R300SR-S: 60Hz R300SR-SD: 8.5Hz	R500EX: 30Hz R500EX-D: 7.5Hz
	Thermal Sensitivity (NETD)	0.05°C at 30°C	0.04°C at 30°C with SN improvement	0.025°C at 30°C with SN improvement	0.025°C at 30°C with SN improvement
	Temperature Measurement Range	-20 to 350°C	-40 to 1,500°C	-40 to 120°C	-40 to 500°C
Accuracy at 30°C black body	±2°C	±2°C	±2°C	**±1°C	
Measuring Function	Point Temperature	5x Movable Points 1x Max, Min each	5x Movable Points 1x Max, Min each 1x Center Point	10x Movable Points 1x Max, Min each	10x Movable Points 1x Max, Min each
	Area Temperature (Max, Min, Ave)	○ (F50-STD/ONL) 1 x BOX	5x BOX	5x BOX	- (R500EX-Pro Available)
	Line Profile	○ (F50-STD/ONL)	○	○	○
	Delta T	○ (F50-STD/ONL)	○	○	○
	Temperature Correction	○	○	○	○
	Alarm Display	○	○	○	○
Image Display	Display	4.8"HD Touch Panel	3.5"LCD Monitor	3.5"LCD Monitor	3.5"LCD Monitor
	Visible Camera	CMOS 5M Pixels	CMOS 2M Pixels	CMOS 3.1M Pixels	CMOS 5M Pixels
	Visible/Thermal Fusion	P in P Blending	P in P Blending Side-by-Side	P in P Blending Side-by-Side	P in P Blending Side-by-Side
Storage	Storage Device	micro SD card, Conforms to SDHC	SD card, Conforms to SDHC	SD card, Conforms to SDHC	SD card, Conforms to SDHC
	Data Storage	JPEG	JPEG (G120EX can record IR movie image)	Still image: JPEG Movie image: SVX	JPEG (R500EX-Pro can record IR movie image)
	Voice Recording	○	○	○	○
Others	I/F	USB2.0 Mass-Storage Thermal/Visible Image Transfer (F50-ONL)	USB2.0 Mass-Storage	USB2.0 Mass-Storage Thermal/Visible Image Transfer	USB2.0 Mass-Storage Thermal/Visible Image Transfer
	LED Light	○	○	○	○
	Laser Pointer	-	○	○	○
	Battery	Built-in Rechargeable Li-ion Operation: 4H (Typ)	Rechargeable Li-ion Operation: 4H (Typ)	Rechargeable Li-ion Operation: 2H (Typ)	Rechargeable Li-ion Operation: 2.5H (Typ)
	Dust & Splash Proof	IP64	IP54	IP54	IP54
	Weight (including Battery pack)	Camera Approx. 100g Controller: Approx. 400g	Approx. 800g	Approx. 1.3kg	Approx. 1.3kg

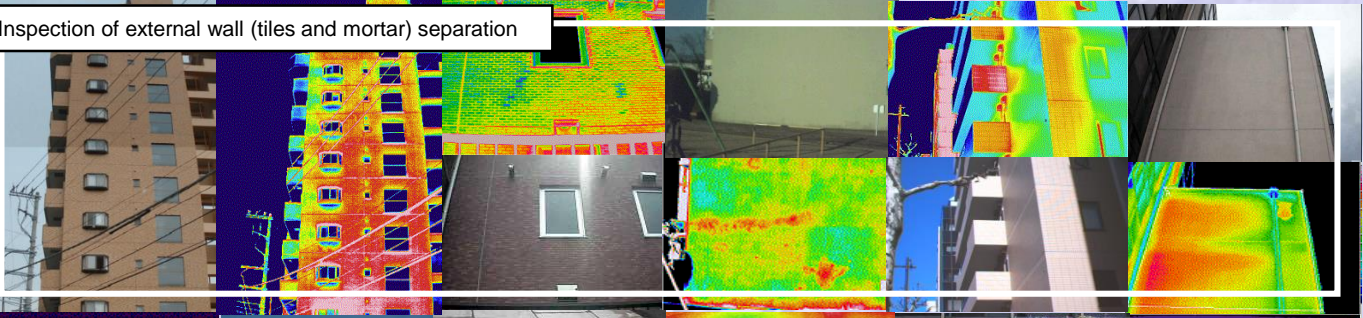
\*SR function is supporting only for recorded IR data

\*\*Only the range 1 at the environmental temperature from 20 to 30°C

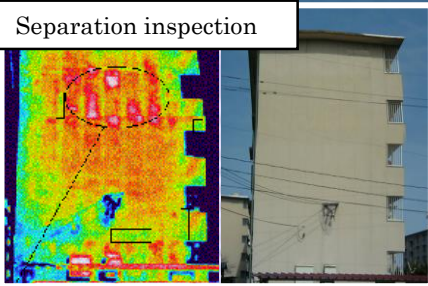


# Building maintenance , building diagnostics , energy sector Thermal Image Gallery

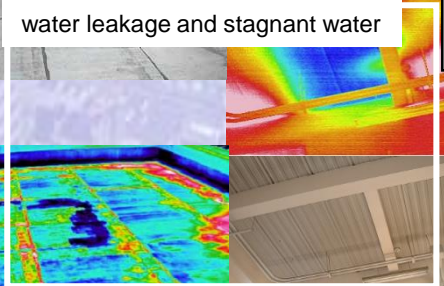
Inspection of external wall (tiles and mortar) separation



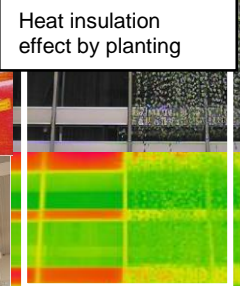
Separation inspection



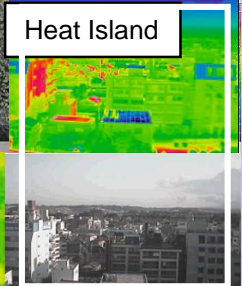
water leakage and stagnant water



Heat insulation effect by planting



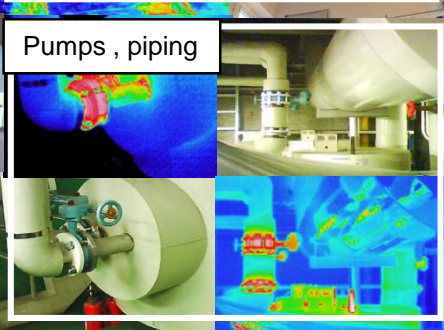
Heat Island



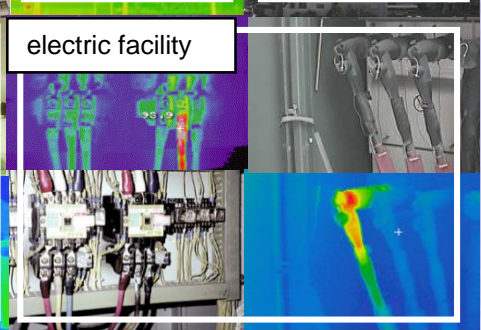
Floor heating



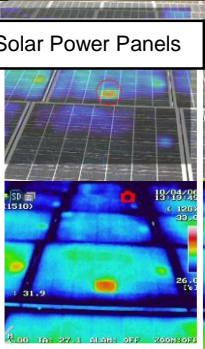
Pumps , piping



electric facility



Solar Power Panels



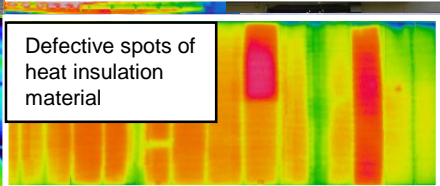
Wooden house internal structure



Water leakage or stagnant water suspected area.



Defective spots of heat insulation material



**NIPPON AVIONICS CO.,LTD.**

Thermal Imaging Department  
Industrial Electronic Products Sales Division  
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Phone : +81-3-5436-1614  
Fax : +81-3-5436-1395  
E-mail : product-irc-e@avio.co.jp



## WARNINGS & CAUTIONS

- Before using this product, please carefully read the provided Operation Manual "WARNINGS" & "CAUTIONS" section to ensure proper operation.
- Please do not place the product in high temperature, high humidity or high inert gas environments.

Distributor:

<http://www.avio.co.jp/english/>