INSTRUCTION MANUAL

FOR

PORTABLE

DIGITAL INFRARED RADIATION THERMOMETER

IRT-300-AS
IRT-300-AT

Shinko

■ Request and notices

For the safe and correct use of the thermometer, please read this instruction manual.

◆Request to the operator of the thermometer

This instruction manual also describes the maintenance of the thermometer.

Keep this instruction manual with the thermometer.

If you have any doubts or need technical assistance, please contact SHINKO's sales agent.

───── Notices ─────

1. The contents of this instruction manual are subject to change without notice.

2. If any question arises, or if there are any errors, omissions, or other deficiencies, please inform SHINKO's sales agent.

3. SHINKO is not responsible for the results of any operation.

■ Preface

For the safe and correct use of the thermometer, please adhere to the following safety measures for the operation and storage of the thermometer.
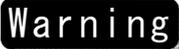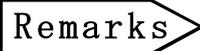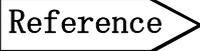
1 Working conditions and environment

● The thermometer has been designed as a handheld type. Use a tripod or a simple type universal head for long term or fixed mounting measurements.

● The working temperature range of the thermometer is 0 to 50 °C. (No dew condensation)

● Do not use the thermometer in dusty places, etc. Remove the dust after using it.
(As for cleaning the cover glass, refer to the clause of "8.3 Cleaning of cover glass".)

● Be careful that the thermometer is not subject to vibration or impact.

● For preventing the consumption of the batteries, turn the Power Supply Switch of the thermometer off when it is not used.

● As glass can not transmit the infrared ray in the measuring wavelength of the thermometer, when the thermometer measures an object through the glass, the surface temperature of the glass is measured.
(For Model IRT-300-AT only)

● When ambient temperature changes rapidly, the measured value may be influenced. When the thermometer has been brought to a place where the ambient temperature is greatly different from the former place, leave the thermometer for one hour and then start the measurement. (For Model IRT-300-AT only)

2 Storage

● Do not store the thermometer in hot and humid places. Make sure to store the thermometer with the lens cap. Storing the thermometer in room temperature with a drying agent is recommended.

● Do not leave the thermometer in places of extremely high ambient temperature such as beside a rear window or inside of the trunk of a car. This may disturb the operation of the thermometer.

● When the thermometer is not used for 2 weeks or more, remove the batteries. Otherwise, the thermometer may be damaged by liquid leakage of the batteries.

● If any problems occur, please contact SHINKO' s sales agent.

3 Symbol in this instruction manual

In this manual, the symbols shown below are used depending on degrees of importance for using the thermometer safely and avoiding unexpected situations.

Degrees of importance	Symbols	Contents
1	⚠	This symbol is attached to a title with a **Warning** sentence.
2	**Warning**	For avoiding dangerous accidents (which may cause death or serious injury) such as electrical shock, fires, or troubles/damages to the thermometer
3	Caution	For avoiding injury or physical damage to the thermometer
4	Remarks	For items that you should know as a supplement for this instruction manual
5	Reference	For items that are convenient as a supplement for this instruction manual

■ Warnings and Cautions ⚠

◆ Please use the thermometer correctly by adhering to the following items.

In addition, please read this instruction manual carefully and keep it at the place where you can access easily.

⚠	**Warning** （May cause death or serious injury）
⚠	Make sure not to view the sun through the finder of the thermometer. It may cause blindness. To protect the detecting element, never directly face the objective lens to the sun. For the measurement of high temperature objects, refer to the clause of "5.4 Cautions on measurement".
⚠	Never operate the thermometer in places where combustible or volatile gas is present. It is extremely dangerous to use the thermometer in such an environment.
⚠	Never put the batteries into fire, or never charge, short-circuit, heat or disassemble the batteries. Breaking or heating the batteries may cause fire or injury.
⚠	Never use the thermometer if it has been broken, is smoking or if there is a bad smell. Using it under these conditions may cause fire. When the thermometer is broken, smoking, or if there is a bad smell, turn the power supply switch off at once and take out the batteries, and contact to SHINKO's sales agent.

⚠	**Caution** （May cause injury or physical damage）
⚠	Do not use other batteries than the batteries specified. Load the batteries so that their polarities meet the polarity marks on the battery case. Different polarities may cause fire, injury or damage by burst or liquid leakage of the batteries.
⚠	Do not walk while looking through the finder of the thermometer. It may cause accidents.
⚠	Never take the thermometer apart or convert it. These may cause problems and be dangerous.
⚠	Adhere to the [items] and handling methods described in this instruction manual. When the thermometer is used without adhering to them, the thermometer may be damaged or not function perfectly, or may damage other equipment.
⚠	Dispose of the used batteries according to the appropriate disposal procedure in your country.

CONTENTS

> **Caution**
>
> Read the items marked with ⚠ in the title without fail.
>
> These paragraphs comprise **Warning** item.

1. Introduction

1.1 General

IRT-300 series portable infrared radiation thermometers can easily measure temperature without any contact over a wide range from -50°C to 3000°C. The thermometers can store the temperature data measured into memory up to maximum 1000 units of data.

2. Model and accessories

2.1 Model

Model	Measuring temperature range
IRT-300-AS	Medium/high temperature: 600 to 3000 ^{o}C
IRT-300-AT	Low temperature: -50 to 1000 ^{o}C

2.2 Accessories

Name	Quantity	Remarks
AA (UM3) battery	4	
Tripod mounting adapter	1	
Instruction manual	1	
Housing case	1	

■ C€ - marking

Above models conform to EMC directive. (89/336/EEC, 92/31/EEC amendment, 93/68/EEC amendment) EN61326 Emission: Class B Immunity: Table-Minimum immunity test requirement.

3. Names and functions of component parts

■Front

Collimation mark (Page11)

Internal display

External display

①

Viewfinder

Meas Set Mem ■■■ Error ▬
AH
AL

°C
°F

ON/OFF

MEASURE

MEM MODE → ↑ ENT

③

④

⑤

⑥

⑦

②

Beam attenuation filter
selector knob (for IRT-
300-AS only) (Page 12)
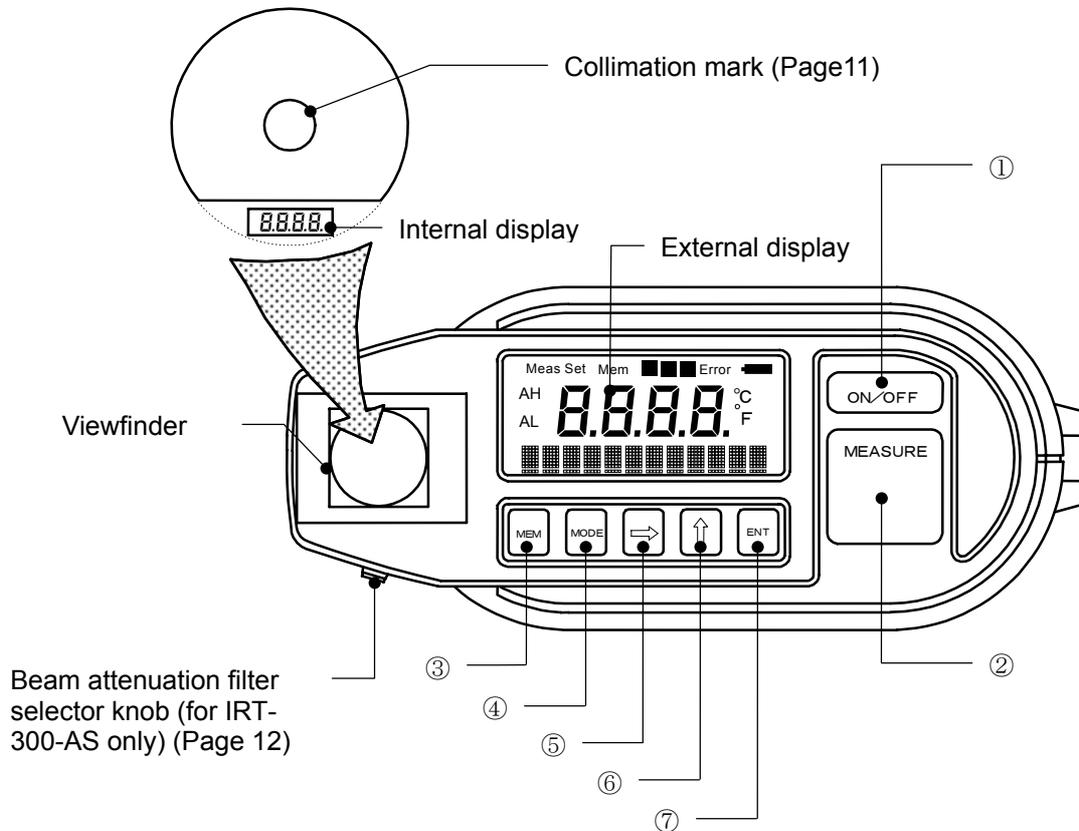
●Functions of keys

Keys		Major functions	Indications in this manual
①	Power switch	Turns the power supply on or off.	ON/OFF
②	Measure switch	Starts or stops measurement.	MEASURE
③	Memory key	Stores the measured data into memory.	MEM
④	Mode selector key	Selects the screen.	MODE
⑤	Shift key	Shifts the digit on programming parameters.	→
⑥	Change key	Changes the numeric at the selected digit on programming parameters.	↑
⑦	Entry key	Stores the parameter programmed.	ENT

■External display

⑥

⑤

④

③ ●Meas Set Mem M I F Error ▬

② ●AH

① ●AL

°C ●
°F ●

⑦

⑧

⑨

⑩

⑪

⑫

Measured value display

Parameters display
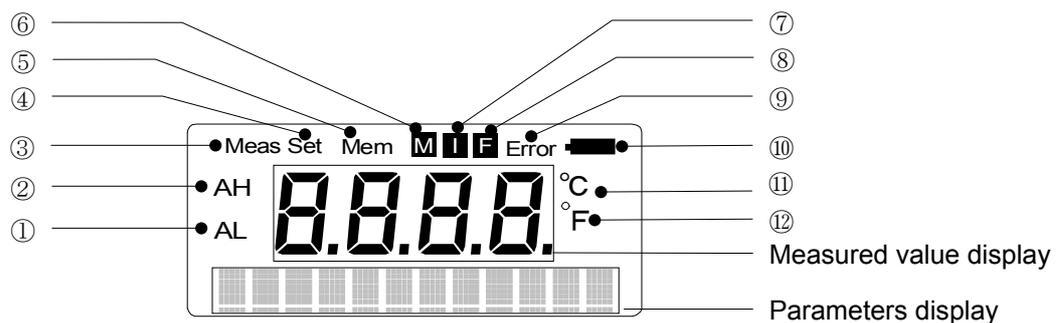
3. Names and functions of component parts

●Markers

Markers		Major functions	Indications in this manual
①	AL	Lights when the low limit alarm is on.	"AL"
②	AH	Lights when the high limit alarm is on.	"AH"
③	Meas	Lights during measurement.	"Meas"
④	Set	Lights when parameters or system is programmed.	"Set"
⑤	Mem	Lights when memory is programmed or displayed.	"Mem"
⑥	M	Lights when the memory function is effective.	M
⑦	I	Lights when the interval memory mode is programmed.	I
⑧	F	Lights when the memory for data storage has no space.	F
⑨	Error	Lights when the internal temperature of thermometer is abnormal.	"Error"
⑩	▬	Lights when batteries are low.	
⑪	°C	Lights when the temperature is displayed in °C.	"°C"
⑫	°F	Lights when the temperature is displayed in °F.	"°F"

■Left side panel

Cover ring   Distance adjusting ring

Beam attenuation filter selector knob   Diopter adjusting dial

■Right side panel

Connector cover hook   Connector cover
Adapter mounting screw

Battery cover   Hand strap
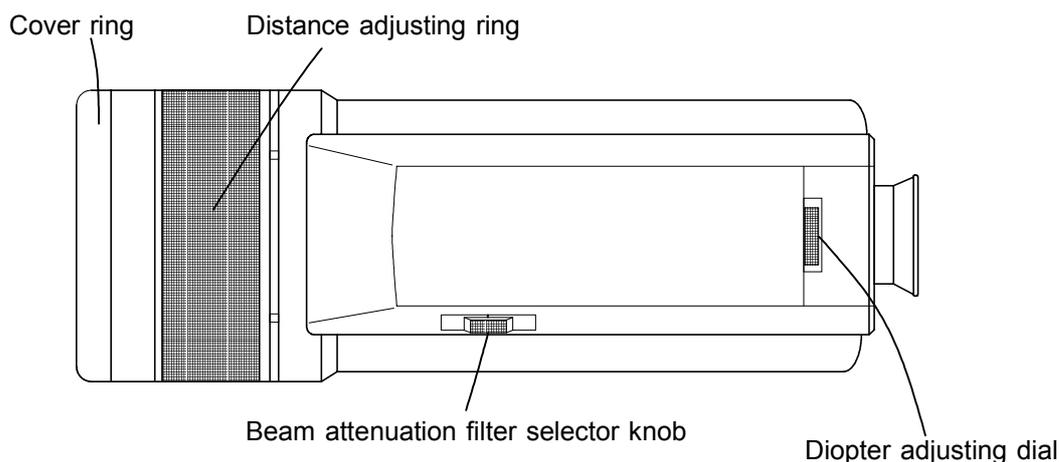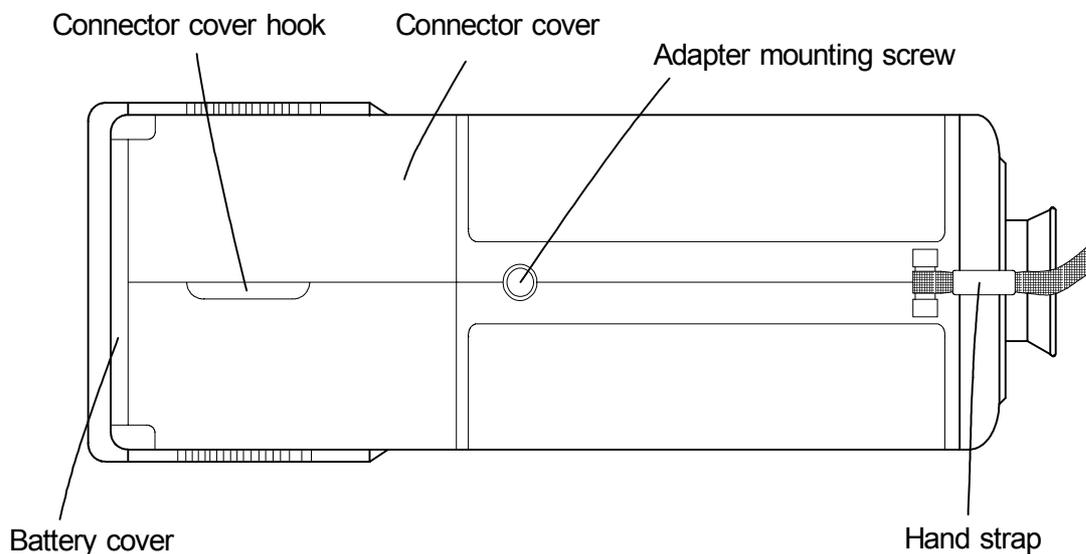
4. Preparation for measurement

4.1 Loading batteries

◇ **Removing the battery cover**
   Remove the battery cover by sliding it in the direction of the arrow while slightly pushing the asterisked (*) part.

Battery cover

※
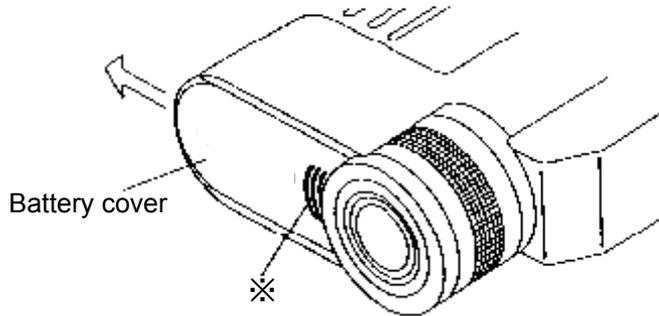
◇ **Removing the inside cover**
   Using a coin, remove the inside cover by turning the cover fixing screw in the direction indicated by the arrow.

Cover fixing
screw
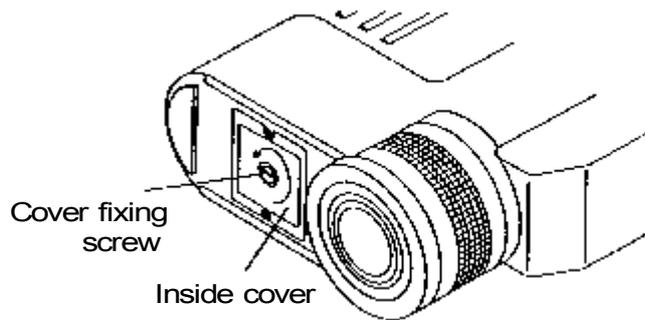
Inside cover

◇ **Loading batteries**
   Load the new batteries so that their polarities meet the polarity marks on the battery case.

Polarity mark
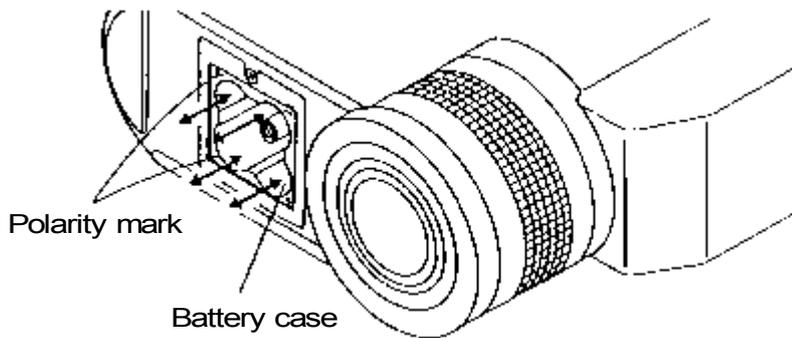
Battery case

◇ **Mounting the inside cover**
   Mount the inside cover so that A of the battery case meets B of the inside cover.

A

31

B

30

(Unit: mm)

[Battery case]   [Inside cover]
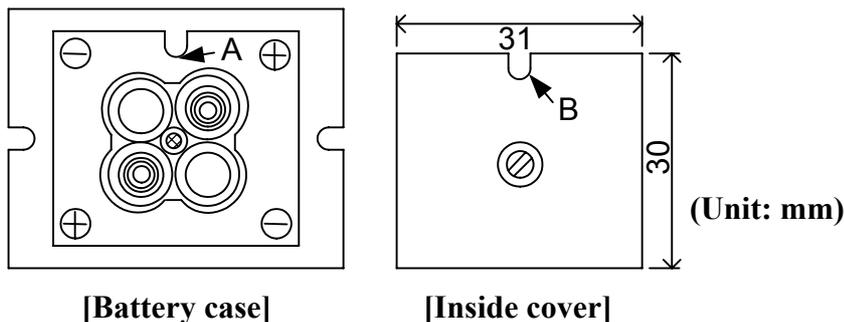
◇ **Mount the battery cover.**

9

4. Preparation for measurement

4.2 Start and stop

4.2.1 Start

Press ON/OFF key to turn the power supply on.
This thermometer checks the system immediately after the power supply has been turned on.
The message "System Check" appears on the parameter display while system is checked.

S	y	s	t	e	m		C	h	e	c	k

After the system check is finished, the measurement screen is displayed.
On the measurement screen, the signal modulation mode is displayed on the left side and the emissivity is displayed on the right side of the parameter display.

```
                          ℃



   Real      E1.00
```

4.2.2 Stop

Press ON/OFF key to turn the power supply off.

> **Caution** By pressing ON/OFF key, the shutdown process is executed to save the system information. Make sure to press ON/OFF key to turn off the power to the thermometer.

4.3 Programming temperature unit

Program the temperature unit by the procedure below.
- Press ON/OFF key while pressing MODE key to turn the power supply on.
- The temperature unit programming screen appears on the parameter display.

U	n	i	t						℃	

- **Select °C for Centigrade temperature display or °F for Fahrenheit temperature display by pressing the ↑ key.**
- **Press ENT key to store the temperature unit selected.**
- **Press ON/OFF key to turn off the power supply once.**

The temperature unit stored is displayed again when the instrument is switched on again.

> **Remarks** · The default temperature unit is °C.

5. Measuring

5.1 Measuring procedure

・Press ON/OFF key to turn the power supply on.
・Set the measuring distance roughly by the distance adjusting ring.
・Adjust the diopter adjusting dial to see the collimation mark on the internal display clearly.
・Adjust the distance adjusting ring to see the object measured clearly in the collimation mark.
・Press MEASURE key to start the measurement.

The temperature measured is displayed on the internal and external displays, and the "Meas" marker lights up on the external display.

```
 Meas
   257.6 ℃
 Real     E1.00
```

The "OFL" is displayed if the temperature measured exceeds the measuring range or the "UFL" is displayed if it is lower than the measuring range.

```
 0.F.L.          U.F.L.
```
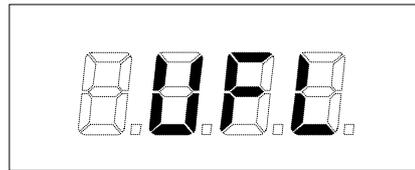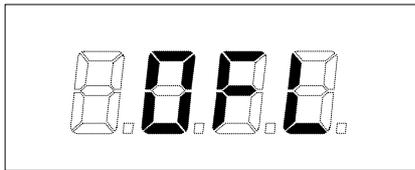
・**Release MEASURE key to stop the measurement. The temperature measured just before stop is held on the internal and external displays.**

5.2 Continuous measurement

For continuous measurement, press ON/OFF key while pressing MEASURE key to turn the power supply on. Press MEASURE key to start the measurement. The measurement is continued until MEASURE key is pressed again.

5.3 Auto power off

The back-light for internal display turns off in 10 seconds after measurement stops.

For the continuous measurement, it turns off in 10 seconds after measurement starts.

To switch on the back-light again, press ENT key. The back-light lights for 10 seconds.

To conserve the battery life, the power supply is turned off automatically if the thermometer is not operated for 5 minutes.

5. Measuring

5.4 Cautions on measurement ⚠

Warning

・Never directly face the objective lens to the sunlight to protect your eyes and the detecting element.
・Set the beam attenuation filter selector knob to the beam attenuation side in advance (in the case of Model IRT-300-AS) to protect your eyes when measuring objects exceeding 1500°C.

⇨
Beam attenuation
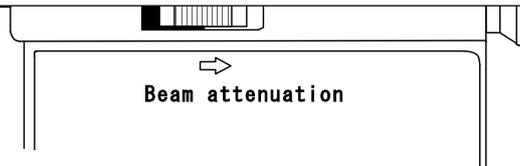
Caution

・**Light path**
Ensure that water drops, dust particles, smoke, steam, or other foreign substances are not introduced into the light path between the object measured and the objective lens of this thermometer.
・**Interference causing high indication**
Be careful not to expose the object measured and the objective lens of this thermometer to direct sunlight, light of an incandescent lamp, flame or other thermal radiation.
・**Abrupt change of ambient temperature**
Model IRT-300-AT uses a thermopile as its detecting element. If ambient temperature changes abruptly, it takes time until the indication is stabilized.
If your thermometer is Model IRT-300-AT and it has been brought into a place where the temperature difference is noticeable, leave the thermometer for about one hour before starting the measurement.

5. Measuring

5.5 Measuring

This thermometer has various measuring parameters.
The list of parameters is shown in [9. List of starting modes/screens]. By pressing MODE key when the measurement screen is displayed, the measuring parameter programming screen appears with the "Set" marker lit. Measuring parameters cannot be programmed during measurement. To program the parameters, cancel measurement.

5.5.1 Programming emissivity

If the emissivity of object measured is low, the temperature displayed becomes lower than the actual temperature and the emissivity is to be compensated.

・**Press MODE key to bring up the emissivity programming screen.**

| E | m | i | . | | | 1 | . | 0 | 0 | |

・**Press → key to shift the digit and press ↑ key to program the emissivity.**

・**Press ENT key to store the emissivity programmed.**

The programming range is 0.10 to 1.99 (0.01 step).

Remarks ・The default emissivity is 1.00.

Reference ・If you know the emissivity of object measured, program its value.
If the emissivity is unknown, measure the temperature of object by a thermocouple or other sensors and program the emissivity to display the same temperature.
The reference table of emissivity is shown in [11. Emissivity table]

5.5.2 Programming signal modulation mode

The maximum value, average value, and minimum value can be extracted continuously from the measurement signal (real signal).

・**Press MODE key to bring up the signal modulation mode programming screen.**

| M | o | d | . | | | R | e | a | l | |

・**Press ↑ key to program the mode.**

Real	The measured temperature is displayed based on the real signal without any signal modulation.
Peak※	When the measured temperature increases, it is displayed based on the real signal. When the measured temperature decreases, it is displayed based on the first-order lag signal by the time constant being programmed by the modulation time constant programming.
Delay※	The measured temperature is displayed based on the first-order lag signal.
Valley※	When the measured temperature decreases, it is displayed based on the real signal. When the measured temperature increases, it is displayed based on the first-order lag signal by the time constant being programmed by the modulation time constant programming.
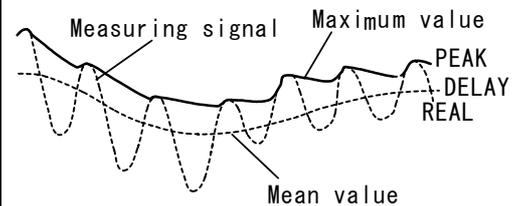
※ For the first-order lag degree in peak, delay, and valley, refer to [5.5.3 Programming modulation time constant].

・**Press [ENT] key to store the modulation mode programmed.**

Remarks ・The default mode is Real.

5. Measuring

5.5.3 Programming modulation time constant

The modulation time constant is programmed on the signal modulation modes. The first-order lag degree can be adjusted by the modulation time constant. The increase of modulation time constant makes the first-order lag degree increase and the temperature measured is displayed smoothly.

・**Press MODE key to bring up the modulation time constant programming screen.**

| T | . | C | . | | | 9 | 9 | . | 9 | s | |

・**Press → key to shift the digit and press ↑ key to program the modulation time constant.**
・**To program to Hold, increase the value by ↑ key at the most significant digit to display "Hold".**

| T | . | C | . | | H | o | l | d | | ? | |

・**Press [ENT] key to store the time constant programmed.**

The programming range of the modulation time constant is 0.0 to 99.9 seconds (0.1 seconds step) and "Hold".

Remarks >	・The default time constant is 0.0 seconds.

Reference >	・Operation when the modulation time constant is programmed to "Hold". By programming the signal modulation mode to Peak, the maximum temperature during measurement is held. By programming the signal modulation mode to Valley, the minimum temperature during measurement is held. By programming the signal modulation mode to Delay, the temperature measured is displayed on condition that the modulation time constant is 99.9 seconds

5.5.4 Programming alarms

Two kinds of alarm, high limit alarm and low limit alarm can be programmed. If an alarm is on, either the "AH" (high limit alarm) or the "AL" (low limit alarm) marker lights on the external display and the buzzer sounds.
Program to "OFF" if no alarm is required.

・**Press MODE key to bring up either the high limit alarm programming screen (left figure) or the low limit alarm programming screen (right figure).**

| A | l | m | H | | O | f | f | | | | A | l | m | L | | O | f | f | | |

・**Press → key to shift the digit and press ↑ key to program the alarm value**
・**To program to OFF, increase the value by ↑ key at the most significant digit to display "OFF".**
・**Press ENT key to store the alarm value programmed.**

Alarm programming range

Model	High limit alarm programming range	Low limit alarm programming range
IRT-300-AT	-50 to 1000 °C （1°C step）、OFF	-50 to 1000 °C （1°C step）、OFF
IRT-300-AS	600 to 3000 °C （1°C step）、OFF	600 to 3000 °C （1°C step）、OFF

Remarks >	・The default high and low limit alarms are "OFF".

6. Temperature data storage

This thermometer provides the function of storing temperature data measured up to a maximum of 1000 units of data.

Two kinds of storage modes are prepared. The manual storage mode is to store the temperature data being measured at the time pressing [MEM] key, and the storage-with-interval mode is to store the temperature data being measured at every interval time programmed.

6.1 Manual storage mode

· **Press [MODE] key for about 2 seconds on the measurement screen to bring up the storage mode programming screen.**

M	M	O	D			O	f	f	

· **Press** ⎡↑⎤ **key to program to "Man".**
· **Press ENT key to store the manual storage mode.**

The M marker lights up when the manual storage mode is stored.

Mem **M**

· **Press [MODE] key for about 2 seconds to return to the measurement screen.**
· **Press [MEASURE] key to start the measurement.**
· **During measurement, press [MEM] to store the temperature data being measured at the time into memory and the message "Data Stored" appears.**

D	a	t	a		S	t	o	r	e	d	

While measurement is not being undertaken, by pressing MEM key, the temperature data being displayed at the time is stored into memory. (Once data is stored while measurement is not being undertaken, any data after that can not be stored until the measurement is executed again.)

To make the memory function disable, program to "Off" in the storage mode programming screen. MEM key does not function and the temperature data are not stored into memory.

Remarks > · The default memory mode is "Off".

6. Temperature data storage

6.2 Storage-with-interval mode

・**Press [MODE] key for about 2 seconds on the measurement screen to bring up the storage mode programming screen.**

M	M	O	D				O	f	f	

・**Press ⬆ key for programming to "Int".**
・**Press ENT key to store the storage-with-interval mode.**

The ⬜ I marker lights when the storage-with-interval mode is stored.

```
            Mem     ▮I▮
```

・**Press MODE key once to bring up the interval time programming screen.**

I	n	t		0	:	0	1	:	0	0	

・**Press → key to shift the digit and press ⬆ key to program the interval time.**
・ **Press [ENT] key to store the interval time programmed. On this stage, the storage-with-interval function does not activate.**
・**Press MODE key for about 2 seconds to bring up the measurement screen.**
・**Press MEM key to activate the storage-with-interval function. The ▮M▮ marker lights in addition to the ▮I▮ marker when the function is activated.**

```
               ▮M▮▮I▮
```

・ **Press MEASURE key to start the measurement. The temperature data at every interval time programmed is stored into memory and the message "Data Stored" appears each time the data is stored.**

D	a	t	a		S	t	o	r	e	d	

・**To cancel the storage-with-interval function temporarily, press MEM key. The ▮M▮ marker light turns off.**

The programming range of interval time is 1 second to 2 hours (0:00:01 to 2:00:00).

Remarks > ・The default interval time is 1 minute (0:01:00).

6. Temperature data storage

6.3 Display of data stored

・Press ⬛MODE⬛ key for about 2 seconds on the measurement screen to bring up the storage mode programming screen.
・Press ⬛MODE⬛ key to display the temperature data stored. .

Index number (serial number from 1 to 1000 showing data storing numbers) is displayed on the left side and temperature data is displayed on the right side.
The temperature data stored into memory last is displayed first.

			1				1	0	0	0	℃

・Press →| key to display the temperature data stored prior to the temperature data displayed.
 Press ↑ key to display the temperature data stored after the temperature data displayed.
・Press [MODE] key for about 2 seconds to cancel the display of temperature data stored.

The message "No Data" appears if any temperature data has not been stored.

6.4 Number of temperature data stored

Maximum 1000 units of temperature data can be stored into memory. The temperature data exceeding 1000 cannot be stored and the ⬛F⬛ marker lights when 1000 units of temperature data have been stored.

Meas ⬛M⬛ ⬛F⬛

To store the new temperature data in this status, delete the previous temperature data referring to [6.5 Deletion of last storage data] and [6.6 Deletion of all storage data].

6.5 Deletion of last storage data

・The following procedure is to delete the last temperature data stored.
・Press ⬛MODE⬛ key for about 2 seconds on the measurement screen to bring up the storage mode programming screen.
・Press ⬛MODE⬛ key to bring up the last temperature data deletion screen.

L	D	D	E	L		Y	E	S		N	O

・Press →| key to shift the cursor to "Yes".
・Press ⬛ENT⬛ key.

When the data is deleted normally, the message "xxxx Erased" appears. This "xxxx" shows the index number of the temperature data deleted.

		1	0		E	r	a	s	e	d	

The message "No Data" appears if any temperature data has not been stored.
・Press ⬛MODE⬛ key for about 2 seconds to cancel the last temperature data deletion.

6. Temperature data storage

6.6 Deletion of all storage data

・**The following procedure is to delete all temperature data stored.**
・**Press MODE key for about 2 seconds on the measurement screen to bring up the storage mode programming screen.**
・**Press MODE key to bring up all temperature data deletion screen.**

A	D	D	E	L		Y	E	S		N	O

・**Press → key to shift the cursor to "Yes".**
・**Press ENT key.**

When the data are deleted normally, the message "All Erased" appears.

A	l	l		E	r	a	s	e	d	

The message "No Data" appears if no temperature data is being stored.
・**Press MODE key for about 2 seconds to cancel all temperature data deletion.**

7. User calibration

For the routine calibration of this thermometer, the user calibration function is provided to recalibrate this thermometer by using your black body furnace for calibration.
The calibration is executed on two optional temperature points.

> **Caution** Do not calibrate this thermometer if you don't have a blackbody furnace.

7.1 Calibration method

・Press ON/OFF key while pressing MODE key to turn the power supply on.
・Press MODE key twice to bring up the zero/span calibration execution screen "CMP".

C	M	P			G	O			N	O

・Press →| key to shift the cursor to "GO".

> **Remarks** ・ If calibration at the zero side is not necessary, press the MODE key in this status. This brings up the span calibration data programming screen.

・Press ENT key to bring up the zero calibration data programming screen.

At this time, the temperature data indicated by the real signal that is not converted by emissivity compensation, signal modulation, and modulation time constant is indicated on the temperature data display.

```
 Meas Set

      6 1 2  ℃

   Zero    _600c?
```

・**Measure the temperature of your black body furnace.**
・**During the measurement of the black body furnace temperature, press →| key to shift the digit and press ↑ key to change the temperature displayed to the calibrated temperature of black body furnace**

> **Caution** ・ When changing the numeric value, be sure to select the digit by the →| key first, then press ↑ key. If the ↑ key is pressed first without selecting the digit to be changed, the value at the most significant digit will be changed.

・**Press ENT key to store the calibrated data at the zero side.**
As the confirmation of calibrated data storage, the asterisk (*) appears after the character "Zero".

Z	e	r	o	*			7	0	0	℃

> **Caution** ・ After the calibration at the zero side is finished and if it takes time longer than 5 minutes until the calibration at the span side is finished, Auto-power-off function works and the power is turned off. (When there is no key operation for 5 minutes)

・**Press MODE key once to bring up the span calibration data programming screen "Span".**

S	p	a	n			3	0	0	0	℃

・**Measure the temperature of your black body furnace, and program and store the calibrated temperature of black body furnace in the same way as the programming of calibration data at the zero side. Make sure that the calibration data at the span side is greater than the calibration data at the zero side**

7. User Calibration

・**Press [MODE] key once more to bring up the calibration operation execution screen.**

| C | A | L | . | | | G | O | | | N | O | | |

・**Press** → **key to shift the cursor to "GO"..**
・**Press** ENT **key to start the calibration operation.**
・**When the calibration operation has finished correctly, the message "Completed" appears for several seconds**

| C | o | m | p | l | e | t | e | d | | | |

・**To make the calibrated data effective, restart the thermometer.**

> **Remarks** · If zero/span calibration data are not stored or if the calibrated data at the zero side is greater than the calibrated data at the span side, the message "Data Abnormal" appears and the calibration operation is not executed.

7.2 Recovery of calibration data

This function is to recover the previous data from the calibrated data after the execution of the user calibration.
The thermometer stores the previous calibrated data at the execution of the user calibration.
To recover the previous stored data from the calibrated data, follow the procedure below.
・**Press** ON/OFF **key while pressing [MODE] key to turn the power supply on.**
・**Press** MODE **key twice to bring up the zero/span calibration execution screen.**

| C | M | P | | | | G | O | | | N | O | | |

・**Press** → **key to shift the cursor to "GO".**
・**Press** ENT **key to bring up the zero calibration data programming screen.**
・**Press** MODE **key three times to bring up the calibration data recovery screen.**

| U | n | d | o | | | G | O | | | N | O | | |

・**Press [→] key to shift the cursor to "GO".**
・**Press [ENT] key.**
After the calibration data recovery has finished correctly, the message "Completed" appears.

| C | o | m | p | l | e | l | e | d | | | |

・**To make the recovered calibrated data effective, restart this thermometer.**

> **Caution** When recovering the previous calibrated data from the current calibrated data, the current calibrated data is erased and the recovering operation can not be executed again until the next user calibration is executed. To initialize the default calibration data, refer to [8.5 Initializing to default condition.].

8. Maintenance and check

8.1 Self-diagnostic function

8.1.1 Low battery

The battery warning marker lights up on the external display when the battery capacity becomes lower than a certain level. At this time, the batteries have to be replaced.

| Meas | | **Battery warning marker**. |

> **Caution** > For replacing the batteries, refer to [4.1 Loading batteries].
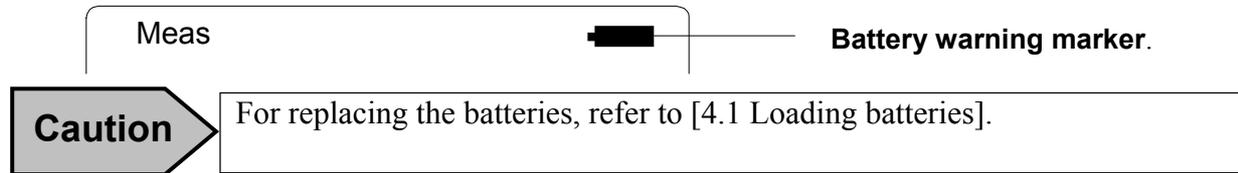
8.1.2 Abnormal internal temperature

If the temperature inside this thermometer becomes abnormal, the inside temperature error marker lights up on the external display.

| M I Error | Inside temperature error marker |

> **Caution** > The inside temperature error marker lights up when the inside temperature of the thermometer drops below 0ºC or rises higher than 55ºC.
> Measurement cannot be executed correctly under such an environment.
> Check the ambient temperature.
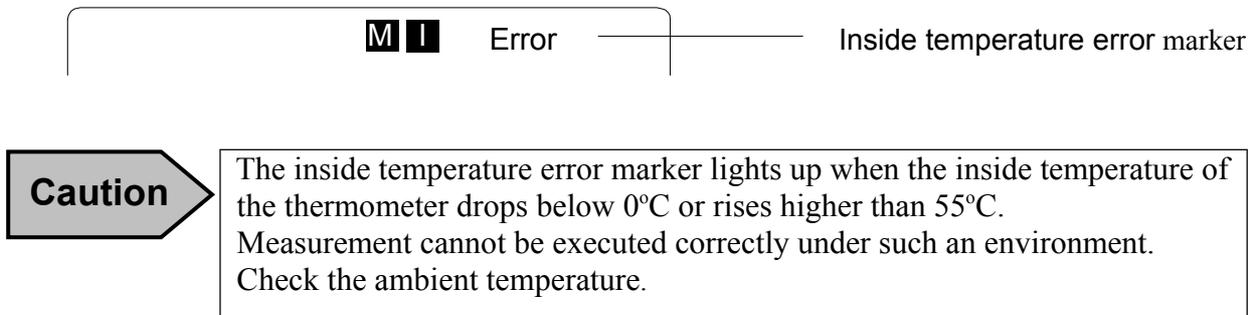
8.1.3 EEPROM error

If an error occurs in the EEPROM which stores the parameters and the temperature data, the message "EEPROM ERROR" appears at EEPROM access timing.

| E | E | P | R | O | M | | E | r | r | o | r |

> **Caution** > The parameters and the temperature data cannot be stored into memory under this condition. Contact your nearest SHINKO's sales agent.
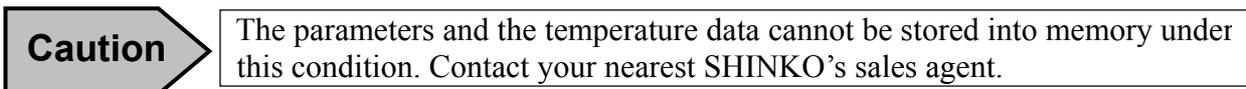
8.1.4 Status display

If → key is pressed for about 2 seconds on the measurement screen while the thermometer is stopped, the status of this thermometer is displayed on the external display. Press the MODE key to switch the screens.

The following status is displayed.
・Inside temperature
・Model
・Serial number
・Measuring temperature range
・Measuring wavelength

Press → key for about 2 seconds to return to the measurement screen.

8. Maintenance and check

8.2 Storage

Caution	・Don't store this thermometer in hot and/or wet places. ・Make sure to mount the lens cap during storage. ・Remove the batteries if this thermometer is not used for longer than 2 weeks, otherwise this thermometer may become defective due to an electrolyte leak in the batteries.

8.3 Cleaning of cover glass

Wipe the cover glass inserted into the cover ring periodically with a soft cloth.

In the case of Model IRT-300-AT, the cover glass is mounted in a deep position. Remove the ring from the thermometer to wipe the cover glass.

8.4 Cleaning of external display and eyepiece cover

Clean them periodically with a soft cloth.

8.5 Initializing to default condition

For initializing this thermometer to the default condition, press ON/OFF key while pressing ENT and ↑ keys. The message "Initialized" confirms the initialization.

I	n	i	t	i	a	l	i	z	e	d	

Caution	・By this operation, all parameters are initialized to the default condition and the temperature data stored are erased.

Remarks	・For the default parameters, refer to [9.2 Table of screens]

9. List of Starting Modes/Screens

9.1 Modes at start time
The following operation modes are available by the key combinations at the start time.

Keys	Modes	Remarks
Press ON/OFF key only	Standard measurement	
Press ON/OFF while pressing MEASURE key	Continuous measurement	
Press ON/OFF key while pressing MODE key	System programming	No measurement can be executed.
Press ON/OFF key while pressing ENT and ↑ keys together	Initialization	After initialization, the standard measurement is executed.

9.2 Table of screens
The screens displayed on the external display correspond to the 4 basic types.

Modes	How-to-display from measurement screen	Makers appeared	Return to measurement screen
Programming measuring parameters	Press MODE key.	**"Set"**	Press MODE key on the low limit alarm programming screen.
Programming and display on temperature data storage	Press MODE key for 2 seconds.	**"Mem"**	Press MODE key for 2 seconds. (Enable from any screen)
Status display	Press → key for 2 seconds.		Press → key for 2 seconds. (Enable from any screen)
System programming	Press ON/OFF key while pressing MODE key to turn the power supply on.	**"Set"**	

To change screens, press MODE key.

9.2.1. Measuring parameters programming/display items

Screen	Display	Programming range	Default
Emissivity	Emi.	0.10 to 1.99	1.00
Signal modulation mode	Mod.	Real, Peak, Valley, Delay	Real
Signal modulation time constant	T.C.	0.0 to 99.9 seconds, HOLD	0.0 seconds
High limit alarm	AlmH	-50 to 1000 $^{\circ}$C, OFF (IRT-300-AT) 600 to 3000 $^{\circ}$C, OFF (IRT-300-AS)	OFF
Low limit alarm	AlmL	-50 to 1000 $^{\circ}$C, OFF (IRT-300-AT) 600 to 3000 $^{\circ}$C, OFF (IRT-300-AS)	OFF

9.2.2. Temperature data storage programming/display items

Screen	Display	Programming range	Default
Storage mode	MMOD	OFF, Man, Int	OFF
Interval time programming	Int	00:00:01 to 02:00:00	00:01:00
Storage data display			
Last storage data deletion	LDDEL		
All storage data deletion	ADDEL		

The interval time programming screen is only displayed when the storage mode is programmed to "Int".

9. *List of Starting Modes/Screens*

9.2.3 Status display items

Screen	Display
Inside temperature	Dtemp
Model	Model
Serial number	SN
Measuring temperature range	R
Measuring wavelength	WL

9.2.4. System programming display items

Screen	Display	Programming range	Default
Temperature unit	Unit	^{o}C, ^{o}F	^{o}C
Zero/span calibration execution	CMP		
Calibration data programming at the zero side *1	Zero	-50 to 1000 ^{o}C (IRT-300-AT) 600 to 3000 ^{o}C (IRT-300-AS)	-50 ^{o}C (IRT-300-AT) 600 ^{o}C (IRT-300-AS)
Calibration data programming at the span side *1	Span	-50 to 1000 ^{o}C (IRT-300-AT) 600 to 3000 ^{o}C (IRT-300-AS)	1000 ^{o}C (IRT-300-AT) 3000 ^{o}C (IRT-300-AS)
Calibration operation execution *1	CAL		
Calibration data recovery *1	Undo		

*1: The screens for the zero side calibration data programming, the span side calibration data programming, the calibration operation execution and the calibration data recovery are only displayed when "GO" is selected on the zero/span calibration execution screen.

10. *General Specifications*

10.1 External dimensions

Unit:mm
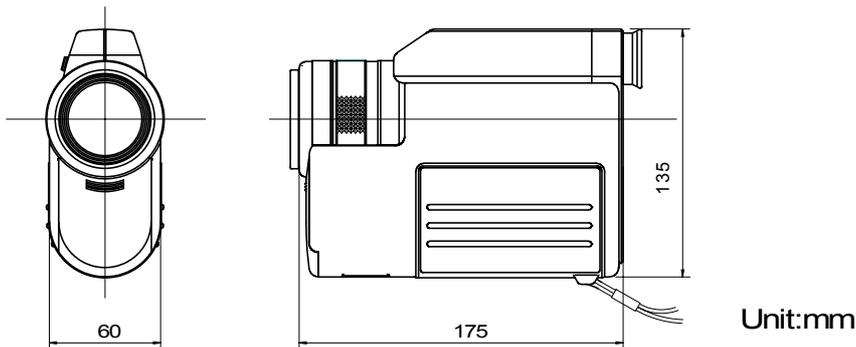
10. General Specifications

10.2 Specifications

Model	IRT-300-AS	IRT-300-AT
Measuring System	Narrow band infrared radiation thermometer	Wide band infrared radiation thermometer
Detecting Element	Si	Thermopile
Measuring Wavelength	0.96μm	8 to 13μm
Measuring Range	600 to 3000°C	-50 to 1000°C
Accuracy Ratings	Lower than 1500°C: ±0.5% of measured value ± 1digit 1500 to 2000°C: ±1% of measured value ± 1digit Higher than 2000°C: ±2% of measured value ± 1digit (ε = 1.0, Reference operating condition: 23°C ± 5°C, 35 to 75%RH)	Lower than 200°C: ±2°C ± 1digit Higher than 200°C: ±1% of measured value ± 1digit
Repeatability	1°C ± 1digit	
Stability	1) Temperature drift:0.015% of measured value / °C 2) Stability: ±5°C under EMC test environment	1) Temperature drift: Lower than 300°C: 0.15%/°C 300 to 700°C: 0.05% of measured value /°C Higher than 700°C: 0.025% of measured value /°C 2)Stability: ±15°C under EMC test environment
Resolution	1°C	1°C (higher than 50°C)
Response Time	0.5 seconds	1 second
Emissivity Compensation	ε =1.00 to 0.10 (0.01 increment)	
Signal Modulation	Modulation : Real, Peak, Delay, and Valley . Modulation ratio:0 to 99 seconds, 1-sec increment Peak hold, Valley hold, Hold with the measuring switch turned off.	
Display System	LCD digital 4 digits, Displayed in the finder and on the panel board	
Data Storage Function	Maximum 1000 units of data	
Users' Calibration Function	Calibration at the zero and span	
Output Signal	Digital transmission（RS-232C）	
Communications Function	RS-232C	
Optical System	Focusable lens type	Cassegrain focusable mirror type
Distance Factor	100(Measuring distance L / Measuring diameter D)	40 (Measuring distance L / Measuring diameter D)
Measuring Distance	L = 500mm to ∞	L = 700mm to ∞
Measuring Diameter	D = L / 100(ø, mm)	D = L / 40(ø, mm)
Collimation	Direct viewing finder	
Lens Diameter	Ø30mm	Ø40mm
Other Functions	Auto-power-off, Continuous measurement, °C / °F selection, Battery check, High / low limit alarms	
Ambient Temperature	0 to 50°C	
Power Supply	AA (UM-3) battery, 4 pieces (about 20 hours for continuous measurement)	
Casing Material and Color	ABS resin, Gray	
Outside Dimensions and Weight	W135 x H60 x D175mm, About 700g (thermometer only)	
Attachment	4 pieces of AA (UM-3) battery, Adapter for tripod, Housing case	

11. Emissivity table

The emissivity is the value determined by the material of object, profile of its surface, surface roughness, oxidization, measuring temperature, measuring wavelength and other factors.
They are represented by the thermal radiation ratio " ε " when a black body furnace at the same temperature is measured in the same wavelength band.

The emissivity " ε " is generally known by a value at the wavelength of 0.65µm when an optical pyrometer is used. The emissivity changes according to the above factors even if the same material is used. Please use the following table as a reference.

11.1 Emissivity table (λ = 0.65µm)

Metal	Emissivity		Oxide	Emissivity
	Solid	Liquid		
Zinc	0.42	—	Alumel （*）	0.87
Alumel	0.37	—	Chromel(*)	0.87
Aluminum	0.17	0.12	Constantan （*）	0.84
Antimony	0.32	—	Ceramics	0.25 to 0.5
Iridium	0.30	—	Cast iron （*）	0.70
Yttrium	0.35	0.35	55Fe. 37.5Cr. 7.5Al （*）	0.78
Uranium	0.54	0.34	70Fe. 23Cr. 5Al. 2Co （*）	0.75
Gold	0.14	0.22	80Ni. 20Cr （*）	0.90
Silver	0.07	0.07	60Ni. 24Fe. 16Cr （*）	0.83
Chromium	0.34	0.39	Stainless steel （*）	0.85
Chromel P	0.35	—	Aluminum oxide	0.22 to 0.4
Cobalt	0.36	0.37	Yttrium oxide	0.60
Constantan	0.35	—	Uranium oxide	0.30
Zirconium	0.32	0.30	Cobalt oxide	0.75
Mercury	—	0.23	Columbium oxide	0.55 to 0.71
Tin	0.18	—	Zirconium oxide	0.18 to 0.43
Carbon	0.8 to 0.9	—	Tin oxide	0.32 to 0.60
Tungsten	0.43	—	Cerium oxide	0.58 to 0.82
Tantalum	0.49	—	Titanium oxide	0.50
Cast iron	0.37	0.40	Iron oxide	0.63 to 0.98
Titanium	0.63	0.65	Copper oxide	0.60 to 0.80
Iron	0.35	0.37	Thorium oxide	0.20 to 0.57
Copper	0.10	0.15	Vanadium oxide	0.70
Thorium	0.54	0.34	Beryllium oxide	0.07 to 0.37
Nickel	0.36	0.37	Magnesium oxide	0.10 to 0.43
80Ni / 20Cr	0.35	—		
60Ni / 24Fe / 16Cr	0.36	—	(*): Oxidized surfaces	
Platinum	0.30	0.38		
90Pt / 10Rh	0.27	—		
Palladium	0.33	0.38		
Vanadium	0.35	0.35		
Bismuth	0.29	—		
Beryllium	0.61	0.61		
Manganese	0.59	0.59		
Molybdenum	0.37	0.40		
Rhodium	0.24	0.30		

11. Emissivity table

11.2 Emissivity table (λ = 0.9μm)

Metal	Emissivity
Aluminum	0.10 to 0.23
Gold	0.015 to 0.02
Chrome	0.36
Cobalt	0.28 to 0.30
Iron	0.33 to 0.36
Copper	0.03 to 0.06
Tungsten	0.38 to 0.42
Titanium	0.50 to 0.62
Nickel	0.26 to 0.35
Platinum	0.25 to 0.30
Molybdenum	0.28to 0.36

Alloy	Emissivity
Inconel X	0.40 to 0.60
Inconel 600	0.28
Inconel 617	0.29
Inconel	0.85 to 0.93
Incoloy 800	0.29
Kanthal	0.80 to 0.90
Stainless steel	0.30
Hastelloy X	0.30

Semi conductor	Emissivity
Silicon	0.69 to 0.71
Germanium	0.60
Gallium arsenic	0.68

Ceramics	Emissivity
Silicon carbide	0.80 to 0.83
Titanium carbide	0.47 to 0.50
Silicon nitride	0.89 to 0.90

Others	Emissivity
Carbon pigment	0.90 to 0.95
Graphite	0.87 to 0.92

11.3 Emissivity table (λ = 1.55μm)

Metal	Emissivity
Aluminum	0.09 to 0.40
Chrome	0.34 to 0.80
Cobalt	0.28 to 0.65
Copper	0.05 to 0.80
Gold	0.02
Steel plate	0.30 to 0.85
Lead	0.28 to 0.65
Magnesium	0.24 to 0.75
Molybdenum	0.25 to 0.80
Nickel	0.25 to 0.85
Palladium	0.23
Platinum	0.22
Rhodium	0.18
Silver	0.04 to 0.10
Tantalum	0.20 to 0.80
Tin	0.28 to 0.60
Titanium	0.50 to 0.80
Tungsten	0.30
Zinc	0.32 to 0.55

Alloy	Emissivity
Brass	0.18 to 0.70
Chromel, Alumel	0.30 to 0.80
Constantan, Manganin	0.22 to 0.60
Inconel	0.30 to 0.85
Monel	0.22 to 0.70
Nickel Chrome	0.28 to 0.85

Ceramics	Emissivity
Alumina ceramics	0.30
Red brick	0.80
White brick	0.35
Silicon brick	0.60
Sillimanite brick	0.60
Ceramics	0.50

Others	Emissivity
Asbestos	0.90
Asphalt	0.85
Carbon	0.85
Graphite	0.80
Soot	0.95
Cement, Concrete	0.70
Cloth	0.80