INSTRUCTION MANUAL

FOR

PORTABLE

DIGITAL INFRARED RADIATION THERMOMETER

IRT-200-HS

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

Make sure all keys beep when pressed.

- The thermometer has been designed as a portable 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 "8.3 Cleaning of cover glass", and as for the cleaning the external display and eyepiece cover, refer to “8.4 Cleaning the external display and eyepiece cover”.)
- Be careful that the thermometer is not subject to vibration or impact.
- For preventing the consumption of the batteries, remove batteries when the thermometer is not used.

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

CONTENTS

Read the items with the mark of ⚠ in the title without fail.
These paragraphs comprise **Warning** item.

1. Introduction

1.1 General

The IRT-200-HS is small and lightweight portable infrared radiation thermometer with a clear viewfinder. The direct viewfinder enables you to measure small objects at a distance. With the digital display in the viewfinder, you can see a measured value while viewing an object.

2. Model and accessories

2.1 Model

Names	**Measuring temperature range**
IRT-200-HS	Single color type for high temperature (600 to 2000ºC)

2.2 Accessories

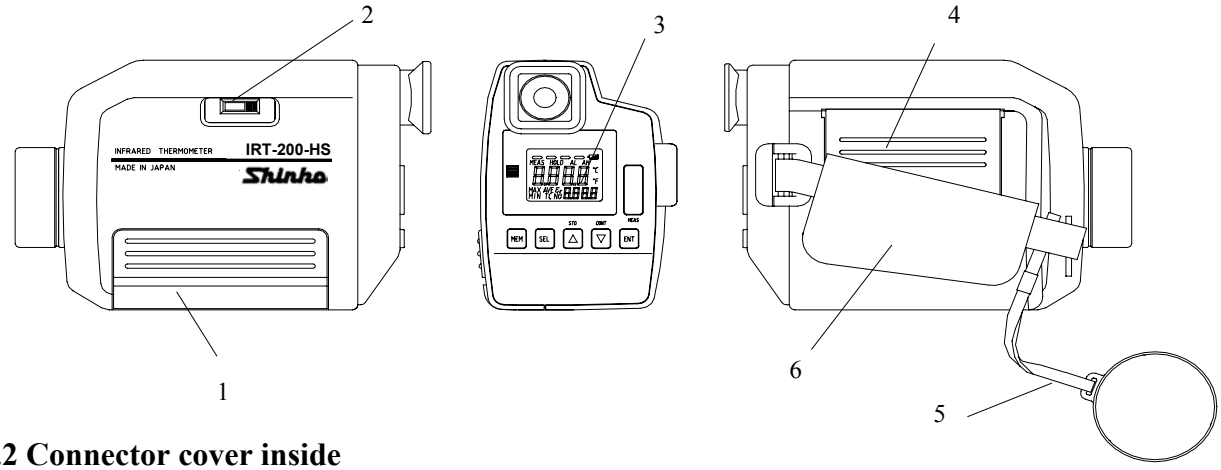
Names	**Quantity**	**Remarks**
AA (UM-3) battery	2	Alkaline
Instruction manual	1	

3. Names and functions of component parts

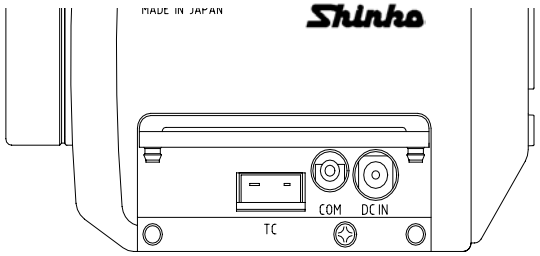
3.1 Views

3.1.1 Front and both-side panels

[Left side view] [Front side view] [Right side view]



3.1.2 Connector cover inside

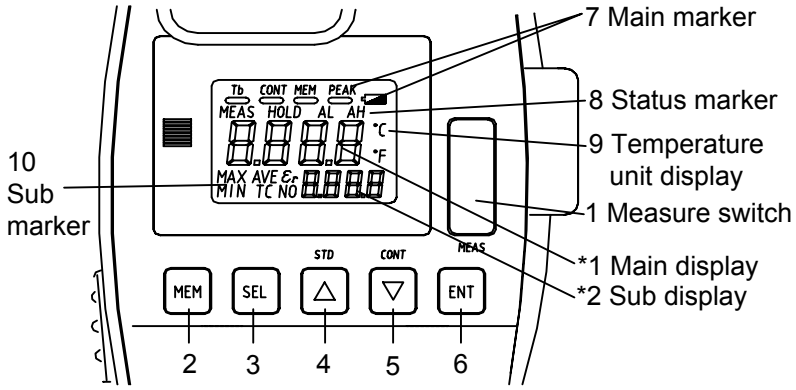


3.1.3 Functions

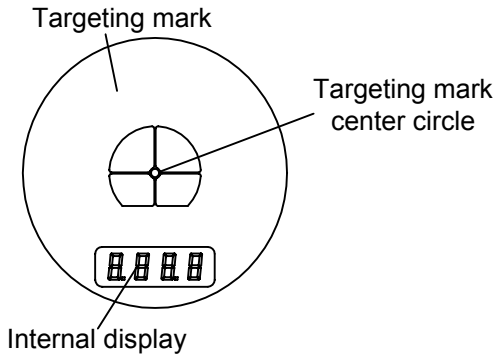
Names	Functions
1: Connector cover	Open the cover from down side for the connection to the connectors.
2: Beam attenuation filter selector knob	For setting a beam attenuation filter to ON (beam attenuation side). For protecting your eyes when an object with high temperature over 1500ºC is measured or when there is too much glare, measure the object through the beam attenuation filter by setting the beam attenuation filter selector knob to the beam attenuation side (ON). (Ref: 5.3 Cautions on measurement)
3: External display	The measured value and parameters are displayed.
4: Battery cover	Remove it by lightly pushing both sides of the triangle mark and sliding it in the direction of the arrow. (Ref: 4.1 Loading batteries)
5: Lens cap	For protecting the lens
6: Side band	For supporting the thermometer Adjustable

3. Names and functions of component parts

3.1.4 External display



3.1.5 Viewfinder



***1:Main display**: Displays the measured value in the measurement mode or a parameter in the parameter selecting/programming mode.

***2:Sub display**: Displays the data selected by the **SEL** key in the measurement mode or a parameter item in the parameter selecting/programming mode.

3.1.6 Functions of keys

Keys		Functions	Indications
1:	**Measure Switch**	Turns the power supply on and starts/stops a measurement. (The power supply will be automatically turned off if no key is pressed for 30 seconds in the hold mode.)	**MEAS**
2:	**Memory key**	Changes from the standard or continuous measurement mode to the data storage mode, or vice versa.	**MEM**
3:	**Select key**	Selects a data to be displayed on the sub display in measurement mode or a selecting/programming item in the parameter selection/programming mode.	**SEL**
4: **5:**	**Up key** **Down key**	Selects a parameter item or changes the numerical figure at a digit in the parameter selection/programming mode.	△ ▽
6:	**Entry key**	Stores the parameter selected/programmed in the parameter selection/ programming mode or the measured value in the manual data storage mode. (This key is not used in the automatic data storage mode.)	**ENT**

3.1.7 Markers

	Markers	Major functions	Indications
7:Main marker	Tb	Not used	**"Tb"**
	CONT	The "‾" mark under "**CONT**" lights up in the continuous measurement mode.	**"CONT"**
	MEM	The "‾" mark under the "**MEM**" lights up in the data storage mode.	"**MEM**"
	PEAK	When the PEAK is selected in the signal modulation mode selection, the "‾" mark under the "**PEAK**" lights up.	**"PEAK"**
	▬	Blinks for low batteries.	
8:Status marker	MEAS	Lights up in the measurement mode.	**"MEAS"**
	HOLD	Lights up in the hold mode.	**"HOLD"**
	AL	Lights up when the low limit alarm is activated.	**"AL"**
	AH	Lights up when the high limit alarm is activated.	**"AH"**
9: Unit	°C	Lights up when a temperature is displayed in Celsius.	**"°C "**
	°F	Lights up when a temperature is displayed in Fahrenheit.	**"°F "**
10:Sub mareker	MAX	Lights up when the sub display shows a maximum temperature.	**"MAX"**
	MIN	Lights up when the sub display shows a minimum temperature.	**"MIN"**
	AVE	Lights up when the sub display shows an average temperature.	**"AVE"**
	TC	Lights up when the sub display shows a temperature measured by a thermocouple.	**"TC"**
	ε	Lights up when the sub display shows an emissivity (ε).	**" ε"**
	NO	Lights up when the sub display shows a data storage number.	**"NO"**

4. Preparation for measurement

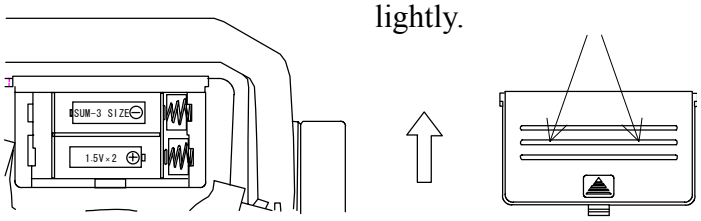
4.1 Loading batteries

• Remove the battery cover. Remove it by lightly pushing both sides of  mark and sliding it in the direction of the arrow.

Caution

• Load two batteries with proper polarities.

Remove the battery cover by sliding it upward while pushing both sides lightly.

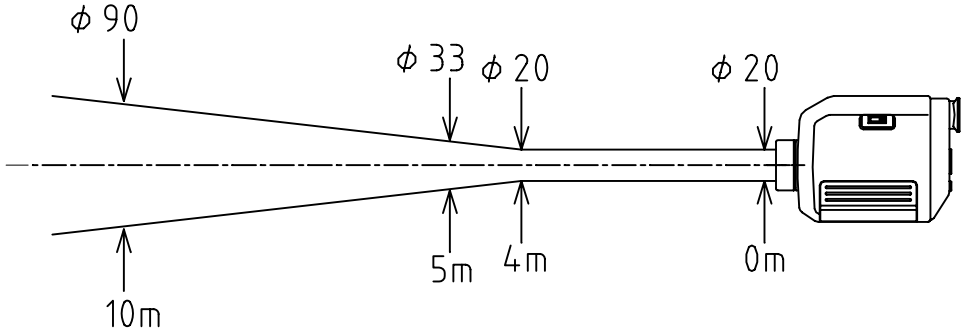


Caution

• Battery life
The battery warning maker " " will blink when the battery capacity becomes lower. Replace the batteries (Alkaline AA or UM-3 batteries).
(Ref: 3.1.7 Markers)
When the marker disappears, replace the batteries (Alkaline AA or UM-3 batteries), too.
• Take care when removing the batteries
Make sure to remove the batteries from the [no springs mounted] side.
• Battery replacement
Replace 2 batteries together.

4.2 Distance and diameter

The relation of measuring distance and measuring diameter is shown below.



Remarks

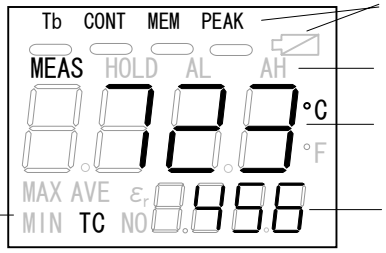
• The measuring diameter is fixed at ø20mm for measuring distances up to 4m.
• To measure distances of 3 to 10m, the measuring diameter will be almost same as the center circle of the targeting mark.
• To measure distances shorter than 3m, make sure to have the measuring diameter larger than the center circle of the targeting mark.

5. Measuring

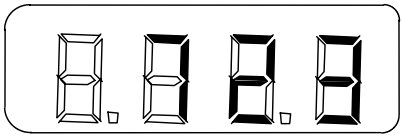
***Make sure all keys beep when pressed.**

(Common to [5.1 Standard measurement mode] and [5.2 Continuous measurement mode])

External display



Internal display



*** Data on the sub marker (Common to [5.1 Standard measurement mode] and [5.2 Continuous measurement mode])**

Sub marker	Data displayed in sub display
ε	Emissivity (ε)
TC	Temperature data measured by a thermocouple is displayed on the sub display when you select **on** (enable) in [5.6.5 Thermocouple measurement selection]. Refer to the following Remarks . "**oFF**" is displayed when you select **oFF** (disable).
MIN	Minimum temperature during measurement (while the status marker "**MEAS**" lights)
MAX	Maximum temperature during measurement (while the status marker "**MEAS**" lights)
AVE	Average temperature during measurement (while the status marker "**MEAS**" lights) (Moving average of 25 points)
NO	Stored data storage number. Lights in the data storage mode only.

5.1 Standard measurement mode

This mode is for measurement with holding the thermometer by hands.

- Look through the viewfinder and match the center circle of the targeting mark to the center of object measured.
- Press the **MEAS** key for about 1 second to turn the power supply on and start a measurement. The temperature measured will be displayed on the main and internal displays, and the status marker "**MEAS**" will light on the external display.
  (The measurement is continued while **MEAS** key is being pressed.)
- Select the marker of the data to be displayed on the sub display by pressing the **SEL** key if necessary.

Remarks

- "**oFL**" will be displayed on the main and internal displays if the temperature data measured is higher than [the measuring range + 20°C (or +36°F)] or "**uFL**" will be displayed if it is lower than [the measuring range - 20°C (or -36°F)].

Remarks

- In [5.6.5 Thermocouple measurement selection], when you select **on** (enable) and display "**TC**" on the sub marker by the **SEL** key, "**oFL**" will be displayed on the sub display if the temperature data measured by the thermocouple is higher than 1220°C (or 2228°F). If the temperature is lower than -50 °C (or -58°F), "**uFL**" will be displayed.
- On the condition mentioned above, if the thermocouple is disconnected, "**oFL**" will be displayed on the sub display.

- By releasing the **MEAS** key, the measurement will stop and the measured value will be held. The status marker "**MEAS**" will disappear and "**HOLD**" will light up.

Remarks

- The internal display will disappear in 10 seconds in the hold mode and the power supply will be automatically turned off if no key is pressed for 30 seconds in the hold mode.

5.2 Continuous measurement mode

5.2.1 Start of continuous measurement

This mode is for continuous measurement by fixing the thermometer on a tripod or a universal head.

- Look through the viewfinder and match the center circle of the targeting mark to the center of object measured
- For the continuous measurement mode, press the **MEAS** key while pressing ▽ key. As soon as all segments of the external display (Ref: 3.1.4 External display) light, release the **MEAS** key. The " — " mark under the main marker "**CONT**" and the status marker "**HOLD**" will light.

Caution

- The status marker "**MEAS**" will light depending on the release timing of the **MEAS** key. In this case, press the **MEAS** key only once again to light the status marker "**HOLD**".

- Press the **MEAS** key to start the continuous measurement. The status marker "**HOLD**" will disappear and the status marker "**MEAS**" will light up.
- Select the marker of the data to be displayed on the sub display by pressing the **SEL** key if necessary.

Remarks

- "**oFL**" will be displayed on the main and internal displays if the temperature data measured is higher than [the measuring range + 20°C (or +36°F)] or "**uFL**" will be displayed if it is lower than [the measuring range - 20°C (or -36°F)].

Remarks

- In [5.6.5 Thermocouple measurement selection], when you select **on** (enable) and display "**TC**" on the sub marker by the **SEL** key, "**oFL**" will be displayed on the sub display if the temperature data measured by the thermocouple is higher than 1220°C (or 2228°F). If the temperature is lower than -50°C (or -58°F), "**uFL**" will be displayed.
- On the condition mentioned above, if the thermocouple is disconnected, "**oFL**" will be displayed on the sub display.

Remarks

- The internal display will disappear in 10 seconds after the measurement starts.

- Press the **MEAS** key again to hold the measured value. The status marker "**HOLD**" will light up.

Remarks

- The power supply will be automatically turned off if no keys are pressed for 30 seconds in the hold mode.

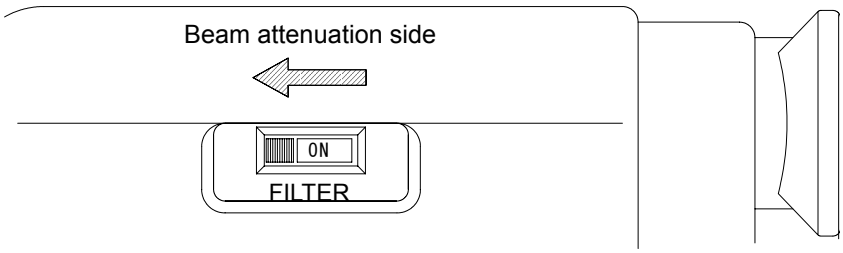
5.2.2 Cancellation of continuous measurement

- To cancel the continuous measurement mode, press the **MEAS** key for about 1 second while pressing the △ key when the power supply is off. Confirm that the " — " mark under the main marker "**CONT" is no longer displayed**.

5. Measuring

***Make sure all keys beep when pressed.**

5.3 Cautions on measurement



Warning

- To protect your eyes and the detecting element, ensure that you never point the objective lens directly at the sun.

Warning

- For measurement of objects exceeding 1500ºC, make sure to set the beam attenuation filter selector knob to "**ON**" (beam attenuation side) to protect your eyes. (Refer to the above figure.)
- However, when there is too much glare on the measurement of objects lower than 1500ºC, set the beam attenuation filter selector knob to "**ON**" (beam attenuation side). (Refer to the above figure.)

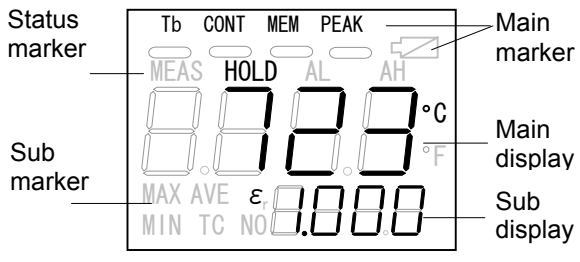
Caution

- **Light path**
  Be careful not to introduce water drops, dust particles, smoke, steam, or other foreign substances into the light path between the object measured and the objective lens of the thermometer.
- **Interference causing high indication**
  Be careful not to apply the direct sunlight, light of an incandescent lamp, flame or other thermal radiation to the object measured and the objective lens of the thermometer.

5.4 Emissivity programming

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

- Press the **MEAS** key for about 1 second to turn the power supply on and then release the **MEAS** key. The status marker "**HOLD**" will light up.
- In the hold mode, press the **SEL** key several times to enter the emissivity programming mode " ε " on the sub marker. (Ref: 3.1.7 Markers).



- By pressing either the △ or ▽ key, the least significant digit of 4-digit numeric will blink for programming.
- Program the desired figure by pressing the △ or ▽ key.
- Press the **ENT** key. The blinking will stop and the programming digit will shift to the next higher digit.
- Repeat the above procedure up to the most significant digit for programming the emissivity (4 digits).
- By pressing the **ENT** key at the most significant digit, the programming of emissivity will be completed.

Remarks

- The programming range is **0.100 to 1.900**. (0.001 increment)
- The default is "**1.000**".

Caution

- The emissivity programming is disabled in the data storage mode (when the " ▬ " mark under the main marker "**MEM**" lights). For canceling the data storage mode, press the **MEM** key. The " ▬ " mark under the main marker "**MEM**" will disappear.

Reference

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

5.5 Emissivity programming by thermocouple

The thermometer can be used as a surface thermometer by connecting a K type thermocouple. Furthermore, the emissivity of the thermometer can be automatically programmed by assuming that the surface temperature measured by the thermocouple is a true temperature

Remarks

- The default parameter of thermocouple input is **oFF** (thermocouple measurement disabled.).
- To program it to **on** (thermocouple measurement enabled), refer to [5.6 Parameters selection] and [5.6.5 Thermocouple measurement selection].

- Press the **MEAS** key for about 1 second to turn the power supply on and then release to the **MEAS** key. The status marker "**HOLD**" will light.
- In the hold mode, press the **SEL** key several times to display "**TC**" (thermocouple input mode) on the sub marker.
  (Ref: 3.1.7 Markers).
- Press the **MEAS** key to take a measurement by the thermometer and a thermocouple simultaneously.
- After the measurement, the emissivity will be automatically programmed by pressing the **ENT** key in the hold mode.

Caution

- The emissivity programming is disabled in the data storage mode (when the " ▬ " mark under the main marker "**MEM**" lights). To cancel the data storage mode, press the **MEM** key.

Reference

- In [5.6.5 Thermocouple measurement selection], when you select **on** (enable) and the thermocouple is disconnected, "**oFL**" will be displayed on the sub display.

5.6 Parameters selection (This section explains the highlighted items.)

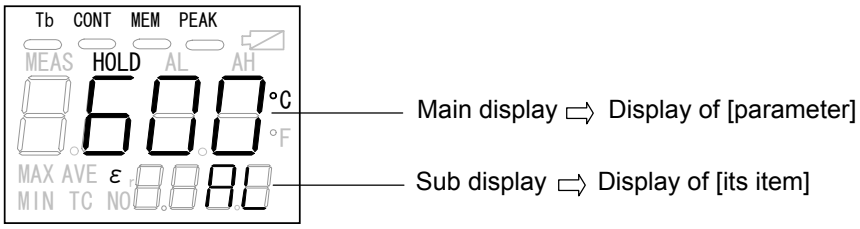
The thermometer provides parameters for measurements as shown in the list below. When selecting or programming the parameters, refer to the list.

Parameter item	Sub display	Parameter	Default	Section
Low limit temperature alarm programming	AL	oFF, 600 to 2000°C/1112 to 3632°F	oFF	5.7.1
High limit temperature alarm programming	AH	oFF, 600 to 2000°C/1112 to 3632°F	oFF	5.7.2
Signal modulation mode selection	**modu**	**dELy, PEAk**	**dELy**	**5.6.1**
Modulation ratio selection	tAu dEC	0.0, 0.2, 0.5, 1.0 (second) 0, 2, 5, 10°C (°F)/second	0.0s 0°C/s	5.7.3
Data storage mode selection	**mmod**	**mAn, int**	**mAn**	**5.6.2**
Data storage interval programming	int	1 to 7200 seconds	60s	5.7.4
All stored data erasing	AdEL	no, yES	no	6.5
Communications mode selection	**Com**	**trnS, Com**	**trnS**	**5.6.3**
Temperature unit selection	**unit**	**C, F**	**C**	**5.6.4**
Thermocouple measurement selection	**tC**	**oFF, on**	**oFF**	**5.6.5**

- Press the **MEAS** key for about 1 second to turn the power supply on and then release the **MEAS** key. The status marker "**HOLD**" will light.
- Press the **SEL** key for about 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.
- Press the **SEL** key several times to select a parameter item. (Ref: 9.4 System settings)
- To select or program procedure of the above parameters, refer from [5.6.1 Signal modulation mode selection] to [5.6.5 Thermocouple measurement selection].

Remarks

- If the **SEL** key is pressed for 2 seconds in the programming mode or if no keys are pressed for 1 minute, the thermometer will return to the measurement mode.

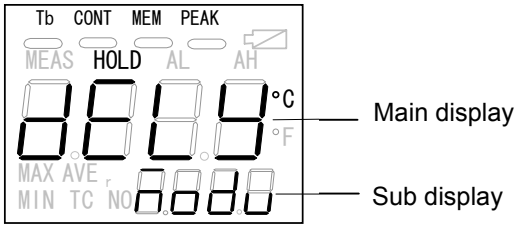


(Programming mode screen)

5.6.1 Signal modulation mode selection

Maximum value and average value can be extracted continuously from the measurement signal (real signal).

- Press the **MEAS** key for about 1 second to turn the power supply on and then release **MEAS** key. The status marker "**HOLD**" will light.
- Press the **SEL** key for about 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.
- Press the **SEL** key several times to display "**modu**" on the sub display.
- By pressing the △ or ▽ key, either "**dELy**" (average value) or "**PEAk**" (maximum value) will blink on the main display.



- Select your desired mode and press the **ENT** key.
- By storing the **dELy**, the "**dELy**" will light on the main display. By storing the **PEAk**, the "**PEAk**" will light on the main display and the "▁" mark will light under the main marker "**PEAK**".

dELy	The temperature displayed is based on the first-order lag signal selected in [5.7.3-1 Modulation time constant selection].
PEAk	When the temperature measured increases, its displayed value is based on the real signal. When the temperature measured decreases, its displayed value is based on the value selected in [5.7.3-2 Damping degree selection].

Remarks

- The default is "**dELy**".

5.6.2 Data storage mode selection

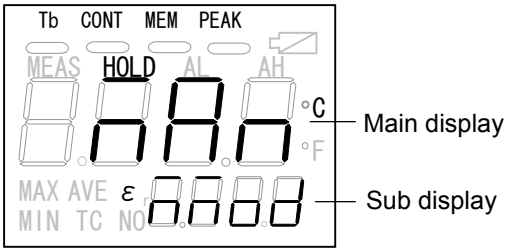
mAn	Manual data storage mode: Stores the data each time the **ENT** key is pressed.
int	Automatic data storage mode: Stores the data at the interval time programmed.

To store the measured data, select the manual data storage mode or the automatic data storage mode.

Reference

- This data storage selection is effective in the data storage mode.
  (Ref: 6.1 Manual data storage mode and 6.2 Automatic data storage mode)

- Press the **MEAS** key for about 1 second to turn the power supply on and then release the **MEAS** key. The status marker "**HOLD**" will light up.
- Press the **SEL** key for about 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.



- Press the **SEL** key several times to display "**mmod**" on the sub display.
- By pressing △ or ▽ key, either "**mAn**" (manual data storage mode) or "**int**" (automatic data storage mode) will blink on the main display.
- Select your desired mode and press **ENT** key.

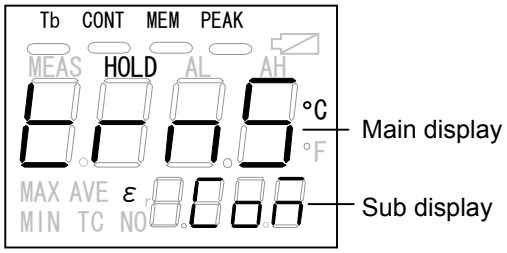
Remarks

- The default is "**mAn**" (manual data storage mode).

5.6.3 Communications mode selection

Select one-way communications to or two-way communications with a personal computer.

- Press the **MEAS** key for about 1 second to turn the power supply on and then release the **MEAS** key. The status marker "**HOLD**" will light up.



- Press the **SEL** key for 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.
- Press the **SEL** key several times to display "**Com**" on the sub display.
- By pressing △ or ▽ key, either "**trnS**" (one-way communications) or "**Com**" (two-way communications) will blink on the main display.
- Select your desired mode and press the **ENT** key.

TrnS	• This mode is used for monitoring of emissivity, temperature and thermocouple temperature as the measured data with a personal computer. • The transmission of data is one-way from the thermometer to the personal computer when the **MEAS** key is released in the standard measurement mode and at every 0.2 seconds in the continuous measurement mode.
Com	• This mode is used to see the display and settings of parameters with a personal computer in addition to the monitoring in "**trnS**" mode, • This mode uses two-way communications by sending a response from the thermometer over the communications command of a personal computer

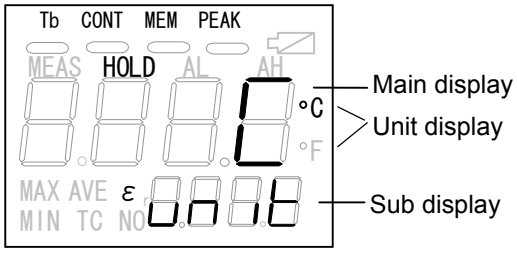
Remarks

- The default is "**trnS**" (one-way transmission from thermometer).

5.6.4 Temperature unit selection

Select ºC or ºF for measuring temperature unit.

- Press the **MEAS** key for about 1 second to turn the power supply on and then release the **MEAS** key. The status marker "**HOLD**" will light.



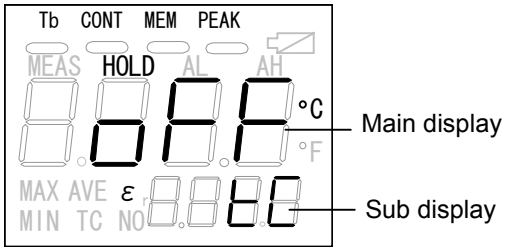
- Press the **SEL** key for about 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.
- Press the **SEL** key several times to display "**unit**" on the sub display.
- By pressing △ or ▽ key, either "**C**" (ºC) or "**F**" (ºF) will blink on the main display.
- Select your desired mode and press the **ENT** key.

Remarks

- The default is "**C**" (ºC).

5.6.5 Thermocouple measurement selection (Separate purchase of a K type T/C is required.)
Selects when measuring with a thermocouple which is sold separately.

- Press the **MEAS** key for about 1 second to turn the power supply on and then release the **MEAS** key. The status marker "**HOLD**" will light.
- Press the **SEL** key for about 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.



- Press the **SEL** key several times to display "**tC**" on the sub display.
- By pressing the △ or ▽ key, either **"oFF"** (disable) or "**on**" (enable) will blink on the main display.
- Select your desired mode and press the **ENT** key.

Remarks

- The default is "**oFF**" (disable).

5.7 Parameters programming (This section explains the highlighted items.)

The thermometer provides parameters for measurements as shown in the list below.
When programming the parameters, refer to the list.

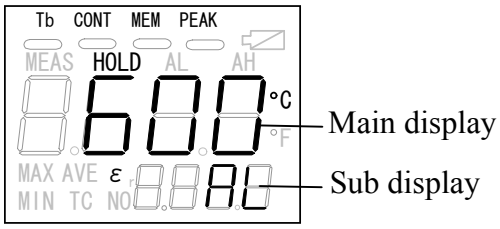
Parameter item	Sub display	Parameter	Default	Section
Low limit alarm setpoint programming	**AL**	**oFF, 600 to 2000°C/1112 to 3632°F**	**oFF**	**5.7.1**
High limit alarm setpoint programming	**AH**	**oFF, 600 to 2000°C/1112 to 3632°F**	**oFF**	**5.7.2**
Signal modulation mode selection	modu	dELy, PEAk	dELy	5.6.1
Modulation ratio selection *	**tAu** **dEC**	**0.0, 0.2, 0.5, 1.0 (second)** **0, 2, 5, 10°C (°F)/second**	**0.0s** **0°C/s**	**5.7.3**
Data storage mode selection	mmod	mAn, int	mAn	5.6.2
Data storage interval time programming	**int**	**1 to 7200 seconds**	**60s**	**5.7.4**
All stored data erasing	AdEL	no, yES	no	6.5
Communications mode selection	Com	trnS, Com	trnS	5.6.3
Temperature unit selection	unit	C, F	C	5.6.4
Thermocouple measurement selection	tC	oFF, on	oFF	5.6.5

***** The modulation ratio selection depends on the selection of the signal modulation mode.
(Ref: 5.6.1 Signal modulation mode selection)

5.7.1 Low limit alarm setpoint programming

This programming is to ascertain the low limit alarm during measurement.
When the low limit alarm is ascertained, the status marker "**AL**" will light and the buzzer will sound.
When the "**oFF**" is selected, neither the alarm can be ascertained nor will the buzzer sound.

- Press the **MEAS** key for about 1 second to turn the power supply on and then release the **MEAS** key. The status marker "**HOLD**" will light.
- Press the **SEL** key for about 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.
- Press the **SEL** key several times to display "**AL**" on the sub display.
- By pressing the △ key, the least significant digit on the main display will blink for programming.



- Program the desired figure by the △ or ▽ key and press the **ENT** key to shift the programming digit to the next higher digit.
- Repeat the above procedure up to the most significant digit.
- By pressing the **ENT** key at the most significant digit, the programming of low limit alarm setpoint will be completed.

Reference

- The programming range is "oFF" or the following.
  600 to 2000°C/1112 to 3632°F
- The default is "**oFF**".

Reference

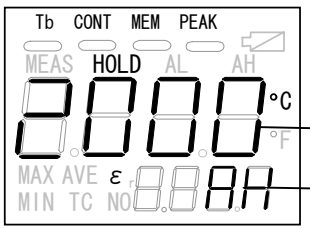
[How to reprogram the low limit alarm set-point to "oFF"]

- Press the **SEL** key for about 2 seconds to display "**AL**" on the sub display.
- By programming the set-point to be lower than the lower limit value shown in the above by △, ▽ and **ENT** keys, "**oFF**" will be displayed.
  [e.g. 599°C (1111°F)]
- Press the **ENT** key to store it.

5.7.2 High limit alarm setpoint programming

This programming is to ascertain the high limit alarm during measurement.
When the high limit alarm is ascertained, the status marker "**AH**" will light and the buzzer will sound.
When the "**oFF**" is selected, neither the alarm can be ascertained nor will the buzzer sound.

- Press the **MEAS** key for about 1 second to turn the power supply on and then release the **MEAS** key. The status marker "**HOLD**" will light.
- Press the **SEL** key for about 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.
- Press the **SEL** key several times to display "**AH**" on the sub display.
- By pressing the △ key, the least significant digit will blink for programming.



- Program the desired figure by the △ or ▽ key and press the **ENT** key to shift the programming digit to the next higher digit.
- Repeat the above procedure up to the most significant digit.
- By pressing the **ENT** key at the most significant digit, the programming of high limit alarm set-point will be completed.

Remarks

- The programming range is "oFF" or the following.
  600 to 2000°C/1112 to 3632°F
- The default is "**oFF**".

Reference

[How to reprogram the high limit alarm set-point to "oFF"]

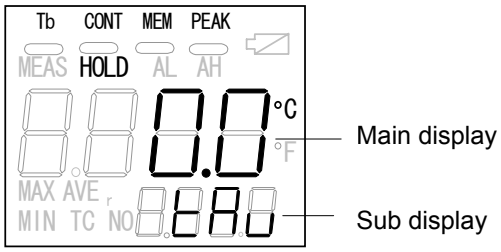
- Press the **SEL** key for about 2 seconds to display "**AH**" on the sub display.
- By programming the set-point to be higher than the high limit value shown in the above by the △, ▽ and **ENT** keys, "**oFF**" will be displayed.
  [e.g. 2001°C (3634°F)]
- Press the **ENT** key to store it.

5.7.3 Modulation ratio selection

When the "**dELy**" is selected in the signal modulation mode, the first-order lag degree can be adjusted by setting of the modulation time constant.
Furthermore, when the "**PEAk**" is selected, the damping degree of signal after tracing the peak value can be adjusted.

- Press the **MEAS** key for about 1 second to turn the power supply on and then release the **MEAS** key. The status marker "**HOLD**" will light.
- Press the **SEL** key for about 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.

5.7.3-1 Modulation time constant selection (effective when the "dELy" is selected in the signal modulation mode)



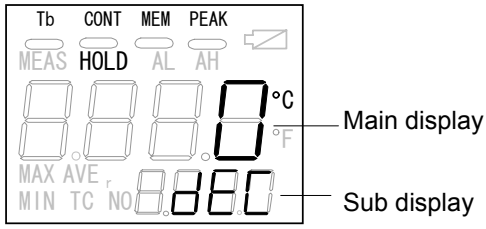
•Press the **SEL** key several times to display "**tAu**" on the sub display.

•By pressing the △ or ▽ key, the modulation time constant will blink in order of 0.0 → 0.2 → 0.5 → 1.0 (second) on the main display. Select the desired modulation time constant and press the **ENT** key.

Remarks

- The default is "**0.0**" seconds. (The displayed value is based on the real signal without any modulation.)

5.7.3-2 Damping degree selection (effective when the "PEAk" is selected in the signal modulation mode)



- Press the **SEL** key several times to display "**dEc**" on the sub display.
- By pressing the △ or ▽ key, the modulation time constant will blink in order of 0 → 2 → 5 → 10 (°C/second) on the main display. Select the desired damping degree and press the **ENT** key.

Remarks

- The default is "**0**"°C/second. (The highest temperature during measurement is held.)

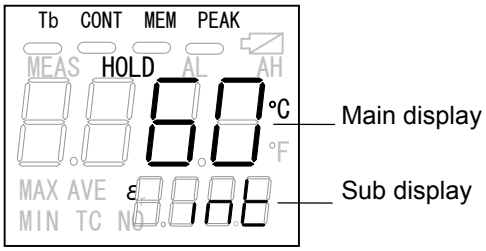
5.7.4 Data storage interval time programming

When the automatic data storage mode is selected, program the interval time for storing the measured data.

Reference

- This programming is only effective in the automatic data storage mode. (Ref: 6.2 Automatic data storage mode)

- Press the **MEAS** key for about 1 second to turn the power supply on and then release **MEAS** key. The status marker "**HOLD**" will light.
- Press the **SEL** key for about 2 seconds in the hold mode to move to the programming mode. A parameter will be displayed on the main display and its item will be displayed on the sub display.
- Press the **SEL** key several times to display "**int**" on the sub display.
- By pressing △ or ▽ key, the least significant digit will blink for programming.



- Program the desired figure by the △ or ▽ key and press the **ENT** key to shift the programming digit to the next higher digit.
- Repeat the above procedure up to the most significant digit.
- By pressing the **ENT** key at the most significant digit, the programming of interval time will be completed.

Remarks

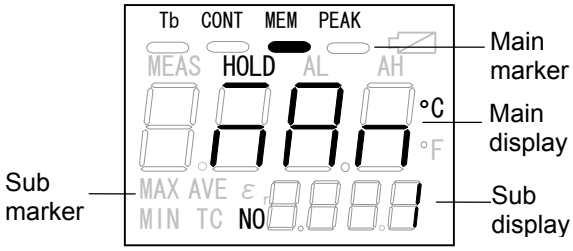
- The programming range is **1 to 7200** seconds.
- The default is "**60**" seconds.

6. Temperature data storage ***Make sure all keys beep when pressed.**

The thermometer provides a function of storing measured data (temperature measured by the thermometer, temperature measured by the thermocouple and the emissivity).
The data storage number is from 1 to 500.
There are two kinds of the data storage mode; the manual data storage mode for storing the measured data when **ENT** key is pressed and the automatic data storage mode for storing the measured data at the interval time programmed.

6.1 Manual data storage mode

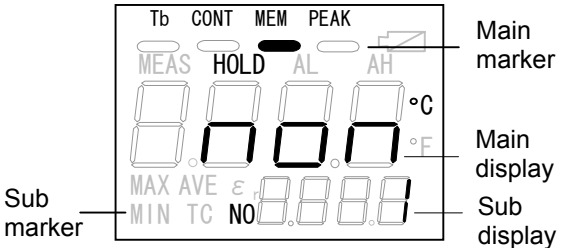
• Press **MEM** key in the hold mode in the standard measurement mode or continuous measurement mode (Ref: 5.1 Standard measurement mode, 5.2 Continuous measurement mode) to move to the data storage mode. The " — "mark under the main marker "**MEM**" will light. At the same time, if the manual data storage mode is selected in [5.6.2 Data storage mode selection], "**mAn**" will appear on the main display for an instant and "**NO**" will be displayed on the sub marker. Also, the data storage number "**1**" will be displayed on the sub display for initial data storage. When measured data has already been stored in any data storage number, the next number will be displayed.



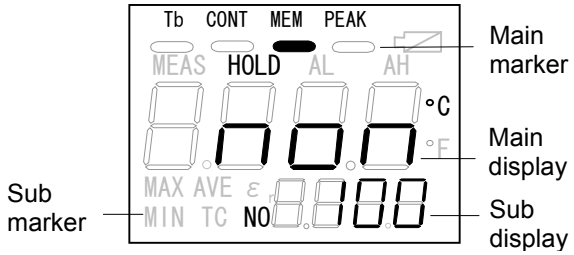
• If "**int**" (automatic data storage mode) is appeared on the main display for an instant, change the data storage mode to the manual data storage mode "**mAn**". (Ref: 5.6.2 Data storage mode selection).
(Note) "**mAn**" will appear **for an instant** when **MEM** key is pressed.

Reference

• After that, "**non**" will be displayed on the main display for the initial data storage.
• Also, "**non**" will be displayed when the next data storage number is displayed.



(Initial data storage)



(Data has been stored up to No. 99)

Reference

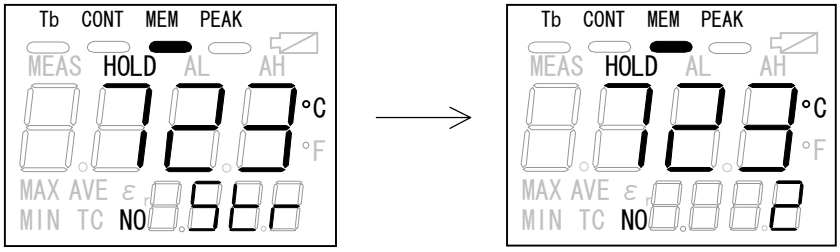
• If the measured data have been stored in the data storage mode last time, the next number to the last data storage number will be displayed on the sub display. (For the above example, the number "100" will be displayed when the measured data have been stored up to the number 99.)

• Press **MEAS** key for about 1 second to measure.
The measurement depends on the measurement mode (Ref: 5.1 Standard measurement mode, 5.2 Continuous measurement mode).

6. Temperature data storage ***Make sure all keys beep when pressed.**

Reference

- Data storage in the standard measurement mode: In the measurement by keeping **MEAS** key pressed (with the status marker "**MEAS**" lit) or in the temporary measurement stop (with the status marker "**HOLD**" lit), by pressing **ENT** key, the measured data (thermometer temperature, thermocouple temperature and emissivity) will be stored. The sub display will display "**Str**" for an instant when the measured data is stored, and then will display the next data storage number.
- Data storage in the continuous measurement mode: In the measurement by keeping **MEAS** key pressed (on the condition that the " —" mark under the main marker "**CONT**" and the status marker "**MEAS**" light together), by pressing **ENT** key, the measured data (thermometer temperature, thermocouple temperature and emissivity) will be stored. The sub display will display "**Str**" for an instant when the measured data is stored, and then will display the next data storage number.



Reference 1

- On this condition, by pressing **SEL** key, "**TC**" will be displayed on the sub marker and the thermocouple temperature will be displayed on the sub display. Furthermore, by pressing **SEL** key, " ε" will be displayed on the sub marker and the emissivity will be displayed on the sub display.
- The emissivity displayed is the emissivity programmed in [5.4 Emissivity programming] or 1.000 (default) if not programmed.

Remarks

- To return to the standard measurement mode or the automatic measurement mode from the data storage mode;
  For the standard measurement mode, release **MEAS** key to move to the "hold" mode
  For the continuous measurement mode, press **MEAS** key again to move to the "hold" mode.

  In the hold mode, press **MEM** key. Confirm that the " —' mark under the main marker "**MEM**" disappears.

Remarks

- To change the emissivity at the above **Reference 1**
  For the standard measurement mode, release **MEAS** key to move to the "hold" mode
  For the continuous measurement mode, press **MEAS** key again to move to the "hold" mode.

  Referring to [5.4 Emissivity programming], program a new emissivity by pressing △ , ▽ and **ENT** keys in the "hold" mode.
- The new emissivity programmed will be effective from the next data storage number.
  When you change the emissivity at the specific data storage number, follow this procedure.

6. Temperature data storage ***Make sure all keys beep when pressed.**

Reference

(1) Initial data storage number: The initial data storage number starts from "**1**".
(2) Specific data storage number programming: The specific data storage number for the next data storage is programmable by pressing △ , ▽ and **ENT** keys in the hold mode. (Ref: 6.3.1 Data storage number programming in manual data storage mode)

Reference

- The measured data stored in the specific data storage number can be recalled by [(2) Specific data storage number programming]. (Ref: 6.3.3 Recalling of stored data in manual data storage mode)

Caution

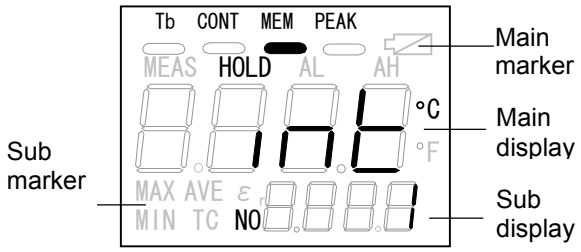
- On the condition that the measured data stored in the specific data storage number is being displayed on the main display, if you press **MEAS** key to measure and then press **ENT** key, be careful that the measured data already stored will be overwritten by a new measured data..
- If you do not want to overwrite, follow the procedures shown in [6.3.1 Data storage number programming in manual data storage mode].

Caution

- Measured data can be stored in the data storage number from No. 1 to No. 500, but when measured data is stored in the data storage No. 500, the memory is used up and new measured data can not be stored even if **ENT** key is pressed after that. (Ref: 6.4 Memory full)

6.2 Automatic data storage mode

- Press **MEM** key in the "hold" mode in the standard measurement mode or continuous measurement mode (Ref: 5.1 Standard measurement mode, 5.2 Continuous measurement mode) to move to the data storage mode. The " ▬ " mark under the main marker "**MEM**" will light.
  At the same time, if the automatic data storage mode is selected in [5.6.2 Data storage mode selection], "**int**" will appear on the main display for an instant and "**NO**" will be displayed on the sub marker. Also, the data storage number "**1**" will be displayed on the sub display for the initial data storage. When measured data have been already stored in any data storage number, the "**next number**" to the last data storage number will be displayed.



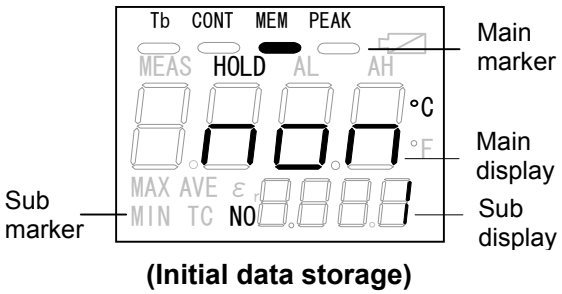
- If "**mAn**" (manual data storage mode) is appeared on the main display for an instant, change the data storage mode to the automatic data storage mode "**int**". (Ref: 5.6.2 Data storage mode selection).
  (Note) "**int**" will appear **for an instant** when **MEM** key is pressed.

Reference

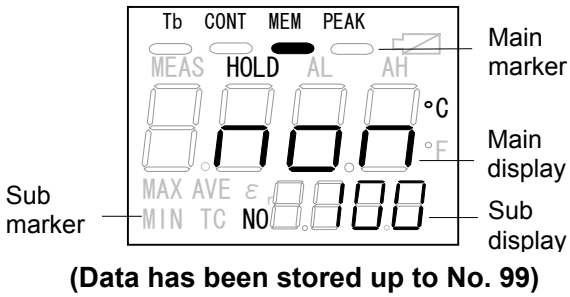
- After that, "**non**" will be displayed on the main display for the initial data storage.
- Also, "**non**" will be displayed when the next data storage number is displayed.

6. Temperature data storage

***Make sure all keys beep when pressed.**



(Initial data storage)



(Data has been stored up to No. 99)

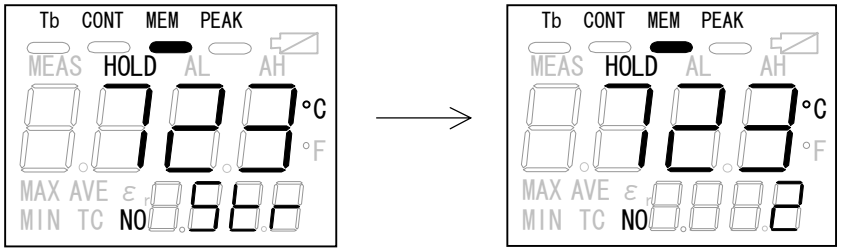
Reference

- If the measured data have been stored in the data storage mode last time, the next number to the last data storage number will be displayed on the sub display. (For the above example, the number "100" will be displayed when the measured data has been stored up to the number 99.)

- Press **MEAS** key for about 1 second to measure. The measurement depends on the measurement mode (Ref: 5.1 Standard measurement mode, 5.2 Continuous measurement mode).

Reference

- Data storage in the standard measurement mode: In the measurement by keeping **MEAS** key pressed (with the status marker "**MEAS**" lit), the measured data (thermometer temperature, thermocouple temperature and emissivity) will be stored at the interval time programmed (Ref: 5.7.4 Data storage interval time programming). The sub display will display "**Str" for an instant** when the data is stored, and then will display the next data storage number.
- Data storage in the continuous measurement mode : In the continuous measurement by pressing **MEAS** key (on the condition that the " " mark under the main marker "**CONT**" and the status marker "**MEAS**" light together), the measured data (thermometer temperature, thermocouple temperature and emissivity) will be stored at the interval time programmed (Ref: 5.7.4 Data storage interval time programming). The sub display will display "**Str" for an instant** when the data is stored, and then will display the next data storage number.



Reference 1

- On this condition, by pressing **SEL** key, "**TC**" will be displayed on the sub marker and the thermocouple temperature will be displayed on the sub display. Furthermore, by pressing **SEL** key, " ε" will be displayed on the sub marker and the emissivity will be displayed on the sub display.
- The emissivity displayed is the emissivity programmed in [5.4 Emissivity programming] or 1.000 (default) if not programmed.

6. Temperature data storage ***Make sure all keys beep when pressed.**

Remarks

- To return to the standard measurement mode or the automatic measurement mode from the data storage mode;
  For the standard measurement mode, release **MEAS** key to move to the "hold" mode
  For the continuous measurement mode, press **MEAS** key again to move to the "hold" mode.

  In the hold mode, press **MEM** key. Confirm that the " ▬ " mark under the main marker "**MEM**" disappears.

Remarks

- To change the emissivity at the Reference 1 on the previous page (page25)
  For the standard measurement mode, release **MEAS** key to move to the "hold" mode
  For the continuous measurement mode, press **MEAS** key again to move to the "hold" mode.

  Referring to [5.4 Emissivity programming], program a new emissivity by pressing △, ▽ and **ENT** keys in the hold mode.
- The new emissivity programmed will be effective from the next data storage number.
  When you change the emissivity at the specific data storage number, follow this procedure.

Reference

(1) Initial data storage number: The initial data storage number starts from "**1**".
(2) Specific data storage number programming: The specific data storage number for the next data storage is programmable by pressing △, ▽ and **ENT** keys in the hold mode. (Ref: 6.3.2 Data storage number programming in automatic data storage mode)

Reference

- The measured data stored in the specific data storage number can be recalled by [(2) Specific data storage number programming]. (Ref: 6.3.4 Recalling of stored data in automatic data storage mode)

Caution

- On the condition that the measured data stored in the specific data storage number is being displayed on the main display, if you press **MEAS** key to measure and then press **ENT** key, be careful that the measured data already stored will be overwritten by a new measured data.
- If you do not want to overwrite, follow the procedures shown in [6.3.2 Data storage number programming in automatic data storage mode].

Caution

- Measured data can be stored in the data storage number from No. 1 to No. 500, but when a measured data is stored in the data storage No. 500, the memory is used up and new measured data can not be stored even if **ENT** key is pressed after that. (Ref: 6.4 Memory full)

6. Temperature data storage ***Make sure all keys beep when pressed.**

6.3 Data storage number programming and recalling of stored data

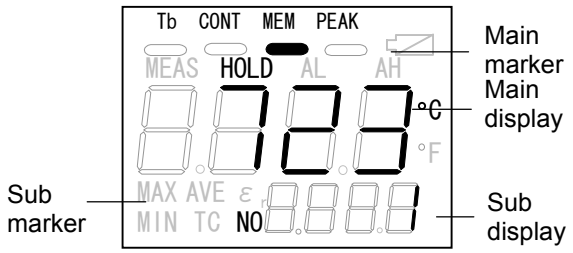
6.3.1 Data storage number programming in manual data storage mode (Select "mAn" in [5.6.2 Data storage mode selection].)

To program a data storage number for the next data storage, follow the following procedure.

- Press **MEM** key in the "hold" mode in the standard measurement mode or continuous measurement mode to move to the data storage mode. The " — " mark under the main marker "**MEM**" will light. At the same time, if the manual data storage mode is selected in [5.6.2 Data storage mode selection], "**mAn**" will appear on the main display for an instant and "**NO**" will be displayed on the sub marker. Also, the data storage number "**1**" will be displayed on the sub display for the initial data storage. When measured data has been already stored in any data storage number, the "**next number**" to the last data storage number will be displayed.

Reference

- After that, "**non**" will be displayed on the main display for the initial data storage.
- When measured data has been already stored in any data storage number, the "temperature data" stored at the data storage number will be displayed.



- By pressing △ or ▽ key in the hold mode, the least significant digit will blink for programming.
- Program the desired figure by △ or ▽ key and press **ENT** key to shift the programming digit to the next higher digit.
- Repeat the above procedure up to the most significant digit.
- By pressing **ENT** key at the most significant digit, the programming of the data storage number will be completed.

Reference

- When no measured data has been stored in the data storage number programmed, "**non**" will be displayed on the main display.

Reference

- When a measured data has been stored in the data storage number programmed, its temperature data will be displayed on the main display.

Caution

- On condition that a data storage number has been programmed by the above procedure, when you press **MEAS** key to start a measurement and then press **ENT** key, the measured data already stored in its data storage number will be overwritten by new measured data.
- If you do not want to overwrite the measured data already stored in its data storage number, follow the above procedure again to select a data storage number that any measured data has not been stored in.

6. Temperature data storage ***Make sure all keys beep when pressed.**

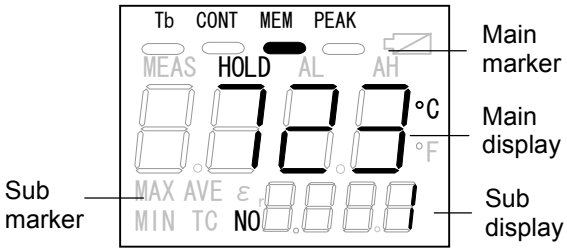
6.3.2 Data storage number programming in automatic data storage mode (Select "int" in [5.6.2 Data storage mode selection].)

To program a data storage number for the next data storage, follow the following procedure.

- Press **MEM** key in the hold mode in the standard measurement mode or continuous measurement mode to move to the data storage mode. The "—" mark under the main marker "**MEM**" will light. At the same time, if the automatic data storage mode is selected in [5.6.2 Data storage mode selection], "**int**" will appear on the main display for an instant and "**NO**" will be displayed on the sub marker. Also, the data storage number "**1**" will be displayed on the sub display for the initial data storage. When measured data has been already stored in any data storage number, the "**next number**" to the last data storage number will be displayed.

Reference

- After that, "**non**" will be displayed on the main display for the initial data storage.
- When measured data has been already stored in any data storage number, the "temperature data" stored at the data storage number will be displayed.



- By pressing △ or ▽ key in the hold mode, the least significant digit will blink for programming.
- Program the desired figure by △ or ▽ key and press **ENT** key to shift the programming digit to the next higher digit.
- Repeat the above procedure up to the most significant digit.
- By pressing **ENT** key at the most significant digit, the programming of data storage number will be completed.

Reference

- When any measured data has not been stored in the data storage number programmed, "**non**" will be displayed on the main display.

Reference

- When a measured data has been stored in the data storage number programmed, its temperature data will be displayed on the main display.

Caution

- On condition that a data storage number has been programmed by the above procedure, when you press **MEAS** key to start a measurement, measured data already stored in its data storage number will be overwritten by new measured data.
- If you do not want to overwrite measured data already stored in its data storage number, follow the above procedure again to select the data storage numbers that no measured data has been stored in.

6. Temperature data storage ***Make sure all keys beep when pressed.**

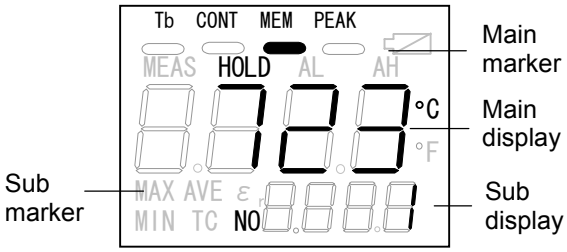
6.3.3 Recalling of stored data in manual data storage mode (Select "mAn" in [5.6.2 Data storage mode selection].)

To recall the data stored in the data storage number, follow the following procedure.

- Press **MEM** key in the hold mode in the standard measurement mode or continuous measurement mode to move to the data storage mode. The " — " mark under the main marker "**MEM**" will light. At the same time, if the manual data storage mode is selected in [5.6.2 Data storage mode selection], "**mAn**" will appear on the main display for an instant and "**NO**" will be displayed on the sub marker. Also, the data storage number "**1**" will be displayed on the sub display for the initial data storage. When measured data has been already stored in any data storage number, the "**next number**" to the last data storage number will be displayed.

Reference

- After that, "**non**" will be displayed on the main display for the initial data storage.
- When measured data has been already stored in any data storage number, the "temperature data" stored at the data storage number will be displayed.



- By pressing △ or ▽ key in the hold mode, the least significant digit will blink for programming.
- Program the desired figure by △ or ▽ key and press **ENT** key to shift the programming digit to the next higher digit.
- Repeat the above procedure up to the most significant digit.
- By pressing **ENT** key at the most significant digit, the programming of data storage number to recall will be completed.

Reference

- The temperature data stored in the data storage number recalled will be displayed on the main display.

Remarks

- On this condition, by pressing **SEL** key, "**TC**" will displayed on the sub marker and the thermocouple temperature, that has been stored together with the temperature data on the main display, will be displayed on the sub display.
- Futhermore, press **SEL** key to display " ε" on the sub marker. The emissivity, which has been stored together with the temperature data on the main display, will be displayed on the sub display.

Reference

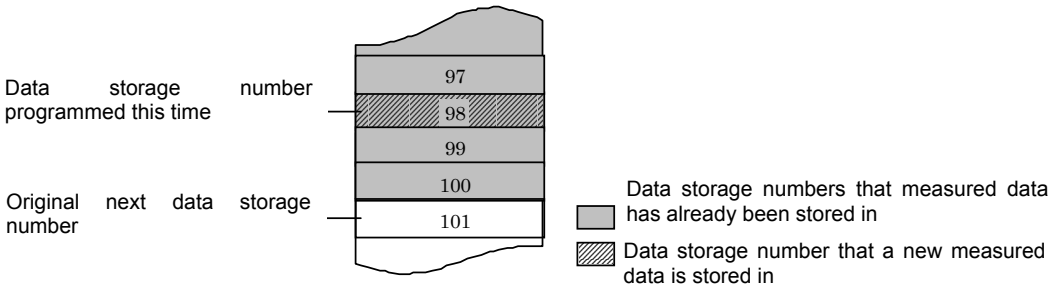
- When no measured data has been stored in the data storage number recalled, "**non**" will be displayed on the main display.

6. Temperature data storage ***Make sure all keys beep when pressed.**

Caution

When you recall stored data, be careful of the following points.
(Example)

1) If the measured data has been stored in the data storage number up to No. 100, "101", that is the next number to the last data storage number, will be displayed on the sub display.
2) At this time, if you want to display the measured data stored in the data storage No. 98, recall the number "98" by △, ▽ and **ENT** keys following the procedure on the previous page, to display the measured data stored.
3) On this condition, if **MEAS** key is pressed again to measure and then **ENT** key is pressed, a new measured data will be stored in the data storage No. 98 and then the data storage number becomes No. 99. It means that the measured data already stored in No.98 will be overwritten by a new measured data.



If you do not want to overwrite the measured data already stored, re-program the data storage number to be the next number that a new measured data is to be stored originally. (Refer to [6.3.1 Data storage number programming in manual data storage mode] for re-programming.)

Reference

- To cancel the display of the data stored, press **MEAS** key to disappear the " ▬ " mark under the main marker "**MEM**".
- To start measurement again, refer to [5.1 Standard measurement mode] and [5.2 Continuous measurement mode].

6. Temperature data storage ***Make sure all keys beep when pressed.**

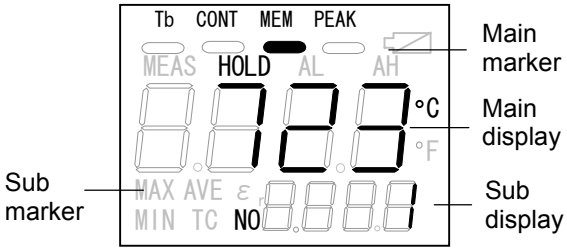
6.3.4 Recalling of stored data in automatic data storage mode
(Select "int" in [5.6.2 Data storage mode selection].)

To recall the data stored in the data storage number, follow the following procedure.

- Press **MEM** key in the hold mode in the standard measurement mode or continuous measurement mode to move to the data storage mode. The " — " mark under the main marker "**MEM**" will light. At the same time, if the automatic data storage mode is selected in [5.6.2 Data storage mode selection], "**int**" will appear on the main display for an instant and "**NO**" will be displayed on the sub marker. Also, the data storage number "**1**" will be displayed on the sub display for the initial data storage. When measured data have been already stored in any data storage number, the "**next number**" to the last data storage number will be displayed.

Reference

- After that, "**non**" will be displayed on the main display for the initial data storage.
- When measured data has been already stored in any data storage number, the "temperature data" stored at the data storage number will be displayed.



- By pressing △ or ▽ key in the hold mode, the least significant digit will blink for programming.
- Program the desired figure by △ or ▽ key and press **ENT** key to shift the programming digit to the next higher digit.
- Repeat the above procedure up to the most significant digit.
- By pressing **ENT** key at the most significant digit, the programming of data storage number to recall will be completed.

Reference

- The temperature data stored in the data storage number recalled will be displayed on the main display.

Remarks

- On this condition, by pressing **SEL** key, "**TC**" will displayed on the sub marker and the thermocouple temperature, that has been stored together with the temperature data on the main display, will be displayed on the sub display.
- Futhermore, press **SEL** key to display " ε" on the sub marker.
  The emissivity , which has been stored together with the temperature data on the main display, will be displayed on the sub display.

Reference

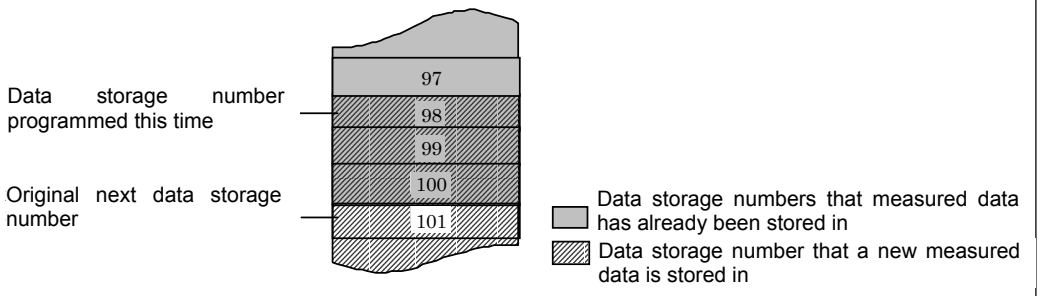
- When any measured data has not been stored in the data storage number recalled, "**non**" will be displayed on the main display.

6. Temperature data storage ***Make sure all keys beep when pressed.**

Caution

When you recall stored data, be careful of the following points.
(Example)

1) If the measured data have been stored in the data storage number up to No. 100, "101", that is the next number to the last data storage number, will be displayed on the sub display.
2) At this time, if you want to display the measured data stored in the data storage No. 98, recall the number "98" by △, ▽ and **ENT** keys following the above procedure, to display the measured data stored.
3) In this status, if **MEAS** key is pressed again to measure, new measured data will be stored from the data storage No. 98. It means that the measured data already stored from No.98 will be overwritten by new measured data.



If you do not want to overwrite the measured data already stored, re-program the data storage number to be the next number that a new measured data is to be stored originally. (Refer to [6.3.1 Data storage number programming in automatic data storage mode] for re-programming.)

Reference

- To cancel the display of the data stored, press **MEAS** key to disappear the " ▁ " mark under the main marker "**MEM**".
- To start measurement again, refer to [5.1 Standard measurement mode] and [5.2 Continuous measurement mode].

6. Temperature data storage ***Make sure all keys beep when pressed.**

6.4 Memory full

The data storage number is up to No. 500. When a measured data is stored in the data storage No. 500, the memory becomes full and new measured data can not be stored after that.

Remarks

• On the memory full condition, the " — " mark under the main marker "**MEM**" will blink.

If the measured data is stored in the data storage No. 500,

<Memory full in the manual data storage mode>

- In the measurement mode or the hold mode, by pressing **ENT** key, the measured data (thermometer temperature, thermocouple temperature and emissivity) will be stored in the data storage No. 500.
- The sub display will display "**Str**" **for an instant** when the measured data is stored, and the memory becomes full.
- The sub display will display No. **500** and the main marker "**HOLD**" lights continuously. Furthermore the " — " mark under the main marker "**MEM**" will blink continuously. After that, measured data can not be stored.

  On this condition, if **ENT** key is pressed for storing a new measured data, the sub display will display "**FULL**" for an instant and then display No. **500**.

< Memory full in the automatic data storage mode>

- In the measurement mode (with the status marker "**MEAS**" lit), the measured data (thermometer temperature, thermocouple temperature and emissivity) will be stored at the interval time programmed.
- The sub display will display "**Str**" **for an instant** every time when the measured data is stored. After the measured data is stored in the data storage No. 500, the memory becomes full. Furthermore the " — " mark under the main marker "**MEM**" will blink continuously. After that, measured data can not be stored.

  On this condition, if **ENT** key is pressed for storing a new measured data, the sub display will display "**FULL**" for an instant and then display No. **500**.

Reference

• To store new measured data on the above condition,

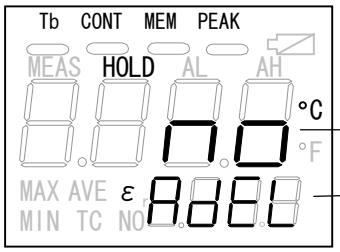
1) Store the new measured data in the data storage number that have not stored any measured data, by referring to [6.3.1 Data storage number programming in manual data storage mode], [6.3.2 Data storage number programming in automatic data storage mode], or
2) Store the new measured data in the data storage number that can be overwritten, by referring to [6.3.1 Data storage number programming in manual data storage mode], [6.3.2 Data storage number programming on automatic data storage mode], or
3) Store the new measured data by erasing the measured data stored, by referring to [6.5 Erasing all stored data].

6. Temperature data storage ***Make sure all keys beep when pressed.**

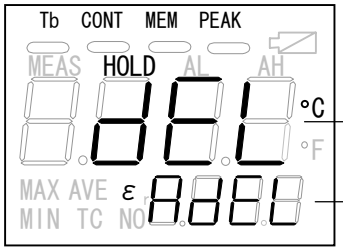
6.5 Erasing all stored data

When all data being stored are not necessary or the memory becomes full (Ref: 6.4 Memory full), follow the following procedure to erase all stored data.

- Press **MEM** key in the hold mode in the standard or continuous measurement mode to move to the data storage mode. The " — " mark under the main marker "**MEM**" will light. (The " — " mark will blink when memory is full.
- By pressing **SEL** key for about 2 seconds in the hold mode, a parameter will be displayed on the main display and its item will be displayed on the sub display.
- Press **SEL** key several times to display "**AdEL**" on the sub display.



- At the first time, "**no**" (deletion disable) will be displayed on the main display.
- By pressing △ or ▽ key, either "**no**" (deletion disable) or "**yES**" (deletion enable) will blink on the main display.



- For the deletion of all data stored, select "**yES**" (deletion enable) and then press **ENT** key. "**dEL**" will be displayed for an instant and then "**no**" will light on the main display.
  If no data have been stored, "**non**" will be displayed for an instant and then "**no**" will light on the main display.
- If you do not want to delete all data stored, select "**no**" (deletion disable) and then press **ENT** key. The blinking of "**no**" will stop and "**no**" will light.

- To quit this mode, press **SEL** key for about 2 seconds.

Remarks

- The default is "**no**" (deletion disable).

7. User calibration

***Make sure all keys beep when pressed.**

For the routine calibration of the thermometer, the user calibration function is provided to recalibrate the thermometer by using your black body furnace for calibration.

7.1 User calibration procedure

By referring to the table [**Calibration point table**], prepare a blackbody furnace covering the zero point temperature and the span point temperature of the Range to be calibrated.

Caution Do not calibrate the IRT-200-HS if you don't have a blackbody furnace.

[Calibration point table]

Calibration Point		**Sub-display**	**Blackbody Furnace Temperature**
Range 1	Zero point	AJ 1	610°C / 1130°F
	Span point	AJ 2	870°C / 1568°F
Range 2	Zero point	AJ 3	870°C / 1568°F
	Span point	AJ 4	1300°C / 2372°F
Range 3	Zero point	AJ 5	1300°C / 2372°F
	Span point	AJ 6	1990°C / 3614°F

Caution By using a reference radiation thermometer, measure and adjust the furnace temperature to be within ±10°C (°F) of the value (furnace temperature) listed in the **[Calibration point table]**.
Make sure to record the temperature measured by the reference radiation thermometer for your calibration procedure.

Reference

In the case of the calibration at a specified temperature, you can calibrate by 2 points of temperature including its temperature.

(Ex) For the calibration at 700ºC:

Prepare a blackbody covering 610ºC at the zero point and 870ºC at the span point.

By using a reference radiation thermometer, measure the zero and span points.

Then adjust the furnace temperature

to be between 600 and 620ºC for the zero point

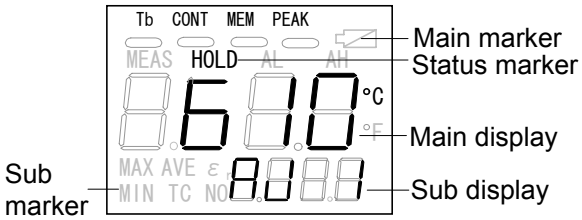
to be between 860 and 880ºC for the span point.

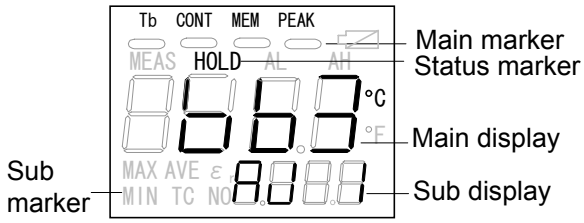
7. User calibration

***Make sure all keys beep when pressed.**

Focus the center circle of the targeting mark in the viewfinder to the center of the blackbody furnace.

1) To turn the power supply on, press ▽, **ENT** and **MEAS** keys simultaneously and release these keys **quickly before the beep**.
The status marker "**HOLD**" will light with the displays of "**AJ 1**" on the sub display and the furnace temperature at the zero point of Range 1 "610ºC" will be displayed on the main display.



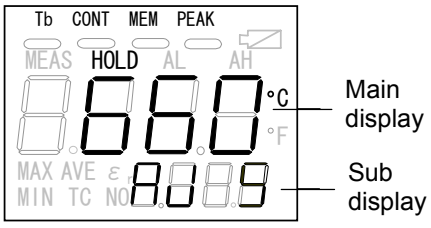


* Display when the release timing of ▽, **ENT** and **MEAS** keys is late :
(The status marker "**MEAS**" will light for an instant and then the status marker "**HOLD**" will light. In the hold mode, the "measured temperature", not the furnace temperature of "**AJ 1**", will be displayed on the main display.
Repeat the following procedure of Caution.

Caution

- When the release timing of ▽ , **ENT** and **MEAS** keys is late and the measured temperature is displayed on the main and internal displays, the user calibration can not be executed.
In this case, turn off the power supply once and repeat the above 1) to display "**AJ 1**" on the sub display and the furnace temperature of "**AJ 1**" on the main display. (Refer to the above left figure.)

2) Press **SEL** key several times to display "**AJ** " for the zero point of the Range to be calibrated on the sub display. The furnace temperature of "**AJ** " shown in the calibration point table will be displayed on the main display.
3) If the furnace temperature displayed on the main display equals the temperature measured by the reference radiation thermometer, go to step 4).
If the temperatures are different, set the furnace temperature on the main display to the temperature measured by the reference thermometer by the following procedure.



- By pressing △ key, the least significant digit will blink for programming.
- Program the desired figure by △ or ▽ key and press **ENT** key to shift the programming digit to the next higher digit.
- Repeat the above procedure up to the most significant digit.
- By pressing **ENT** key at the most significant digit, the calibration data will be stored.

Remarks

- The programming range is within ±10ºC (ºF) of the furnace temperature shown in the **[Calibration point table]**.
- The defaults are the furnace temperatures shown in the **[Calibration point table]**.

7. User calibration

***Make sure all keys beep when pressed.**

4) Press **MEAS** key to measure the temperature of the furnace. (Make sure that the status marker "**HOLD**" does not light and the status marker "**MEAS**" lights.)
   Release **MEAS** key after the measurement.
   Press **ENT** key on the condition that the status marker "**MEAS**" does not light and the status marker "**HOLD**" lights.
   At this point, the calibration at the zero point is finished.
5) Press **SEL** key to display "**AJ** " for the span point of the Range to be calibrated on the sub display. The furnace temperature of "**AJ** " shown in the **[Calibration point table]** will be displayed on the main display.
6) If the furnace temperature displayed on the main display equals the temperature measured by the reference radiation thermometer, go to step 7).
   If the temperatures are different, set the main display to the temperature measured by the reference thermometer by the procedure shown in step 3).
7) As per 4), press **MEAS** key and then press **ENT** key after the measurement.
   At this point, the calibration at the span point is finished.
8) When you want to calibrate the next range continuously, press **SEL** key to display "**AJ** " for the zero point of the Range to be calibrated on the sub display.
   The furnace temperature of "**AJ** " shown in the calibration point table will be displayed on the main display or, if the furnace temperature has been already set at the span point of the preceding range, its temperature will be displayed.
9) If the furnace temperature displayed on the main display equals the temperature measured by the reference radiation thermometer or if the furnace temperature has been already set at the span point of the preceding range, go to step 10).
   If the temperatures are different, set the main display to the temperature measured by the reference thermometer by the procedure shown in 3).
10) As per 4), press **MEAS** key and then press **ENT** key after the measurement.
    At this point, the calibration at the zero point is finished.
11) Calibrate the span point by the procedure 5) to 7).

Reference

* For the continuous calibration from Range 1 through Range 3, if the furnace temperature at the span point has been set, the setting at the zero point of the next range is not necessary.

- For the calibration at the same furnace temperature like as "AJ 2" and "AJ 3", if the furnace temperature is set at the zero point (or the span point), the setting at the span (or the zero point) is not necessary.
  Note: When the power supply is turned off during the calibration, the furnace temperature displayed on the main display will return to the default (the furnace temperature shown in the calibration point table).
- For re-calibration, press **SEL** key to display the screen to be re-calibrated and execute the re-calibration of the specific temperature.
- The power supply will be automatically turned off if no key is pressed for 30 seconds in the hold mode.

Caution

- When the temperature other than the furnace is measured by pressing **MEAS** key and then **ENT** key is pressed, **the thermometer is calibrated by its measured temperature**. Be sure to take notice of this.

8. Maintenance and check

8.1 Self-diagnostic function

The thermometer provides the self-diagnostic function.
The following are the displays on abnormal conditions.

	Display (Main display)	Contents	Alarm	Countermeasure
Main display (Thermometer)	oFL	High limit over range (The object temperature exceeds the measuring range of the thermometer + 20°C.)	The status marker "**AH**" lights and the buzzer sounds. *1	Is the emissivity programmed too low? Program the correct emissivity by referring to [5.4 Emissivity programming] and [11 Emissivity table].
	uFL	Low limit over range (The object temperature is lower than the measuring range of the thermometer - 20°C.)	The status marker "**AL**" lights and the buzzer sounds. *1	Is the emissivity programmed too high? Program the correct emissivity by referring to [5.4 Emissivity programming] and [11 Emissivity table].
	Er1	Abnormal ambient temperature (The thermometer is placed in the environment under 0°C or over 50°C	Er1 display only	Use the thermometer in the environment from 0 to 50°C.
	Er4 *2	EEPROM data broken (Stored data, temperature data and calibration data have been initialized by the data ROM broken.)	Er4 display only	Re-adjustment is necessary. Return the thermometer to us. (Stored data and calibration data are initialized.)

	Display (Sub display)	Contents	Alarm	Countermeasure
Sub display (T/C temperature)	oFL	High limit over range [The thermocouple is disconnected (broken) or the (object) temperature measured by the thermocouple exceeds 1220°C (2228°F)].	oFL display only	• If "**oFL**" is displayed in room temperature, the thermocouple has been broken. Replace it. • If "**oFL**" is displayed in the measurement, the object temperature exceeds 1220°C (2228°F) and the thermocouple may be broken. Stop the measurement by the thermocouple.
	uFL	Low limit over range [The (object) temperature measured by the thermocouple is lower than -50°C (-58°F)].	uFL display only	The object temperature exceeds the low limit measuring range of the thermocouple. The thermocouple may be deteriorated. Stop the measurement by the thermocouple.

*1 When the alarm setpoint is "**oFF**", no buzzer sounds.
*2 When the power supply is turned on or when the stored data is displayed, this error cord is displayed.

8.2 Storage

Caution

- Do not store the thermometer at a hot and/or wet place.
- Make sure to mount the lens cap for storage.
- Remove the batteries if the thermometer is not used for longer than 2 weeks, otherwise the thermometer may become defective due to an electrolyte leak failure of the batteries.

8.3 Cleaning of objective lens

Wipe the objective lens periodically with a soft cloth.

8.4 Cleaning of external display and eyepiece cover

Clean them periodically with a soft cloth.

9. List of Starting Up Modes

9.1 Modes at start up

The following operation modes are available by the key combinations at the start up.

Keys	Modes	Remarks
Press **MEAS** key only (about 1 second)	Standard measurement or continuous measurement	Measurement with the same measurement mode as at the previous start up
Press **MEAS** while pressing △ key	Standard measurement	
Press **MEAS** key while pressing ▽ key	Continuous measurement	The " — " mark will light under the main marker "**CONT**".
Press **MEAS** key while pressing **ENT** and ▽ keys together	User calibration	For the next start up with **MEAS** key only, the measurement will become the standard measurement mode.

9.2 Table of screens

The screens displayed in the external display correspond to the 3 basic types.

Modes	Outline
Measurement mode	Measurement by **MEAS** key In the hold mode in the standard or continuous measurement mode, the programming and automatic calculation of emissivity are possible.
Data storage mode	Data storage number programming, stored data display and storing measured data into memory are possible. By pressing **MEM** key in the standard or continuous measurement mode, the mode will become the data storage mode and the " — " mark will light under the main marker "**MEM**". To return to the standard or continuous measurement mode, press **MEM** key again.
Parameter programming mode	Display and programming of measuring parameters. By pressing **SEL** key for about 2 seconds in the standard measurement mode, continuous measurement mode or data storage mode, the mode will become the parameter programming mode. In the parameter programming mode, by pressing **SEL** key for about 2 seconds or no key is pressed for 1 minute, the mode will return to the measurement mode or the data storage mode.

9. List of Starting Up Modes

9.3 Measuring parameter programming/display

9.3.1 Emissivity programming/display

Parameter item	Display	Parameter	Default	Section
Emissivity (ratio)	ε	0.100 to 1.900	1.000	5.4

***** The emissivity can not be programmed in the data storage mode.

9.3.2 Data storage number programming/display

Parameter item	Display	Parameter	Default	Section
Data storage number	NO	1 to 500	1	6.3

***** The data storage number is only displayed in the data storage mode.

9.4 System settings

Parameter item	Sub display	Parameter	Default	Section
Low limit temperature alarm programming	AL	oFF, 600 to 2000°C/1112 to 3632°F	oFF	5.7.1
High limit temperature alarm programming	AH	oFF, 600 to 2000°C/1112 to 3632°F	oFF	5.7.2
Signal modulation mode selection	modu	DELy, PEAk	dELy	5.6.1
Modulation ratio selection *1	tAu dEC	0.0, 0.2, 0.5, 1.0 (second) 0, 2, 5, 10°C (°F)/second	0.0s 0°C/s	5.7.3
Data storage mode selection	mmod	mAn, int	mAn	5.6.2
Data storage interval time programming	int	1 to 7200 seconds	60s	5.7.4
All stored data erasing	AdEL	no, yES	no	6.5
Communications mode selection	Com	trnS, Com	trnS	5.6.3
Temperature unit selection	unit	C, F	C	5.6.4
Thermocouple measurement selection	tC	oFF, on	oFF	5.6.5

*1: The parameters of modulation ratio selection depends on the signal modulation mode.
(Ref: 5.6.1 Signal modulation mod selection)

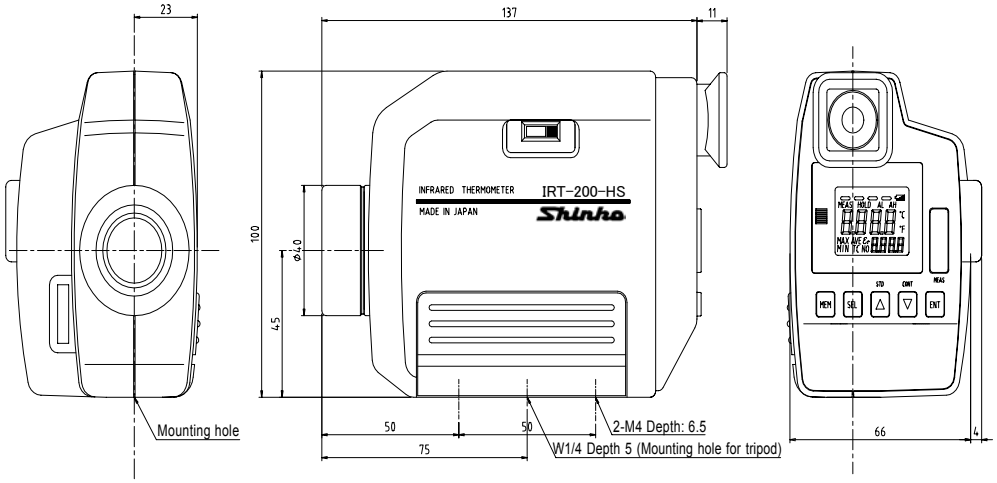
10. General Specifications

10.1 Specifications

Type		**Single color type for high temperature**
Model		**IRT-200-HS**
Measuring System		Narrow band infrared radiation thermometer
Detecting Element		Si
Measuring Wavelength		0.9μm
Measuring Range		600 to 2000°C
Accuracy Ratings *		Lower than 1000°C: ±6°C 1000 to 1500°C: ±0.6% of reading Higher than 1500°C: ±1.2% of reading
Repeatability		±1°C
Stability	**Temperature drift**	Lower than 1000°C: 0.2°C/°C Higher than 1000°C: 0.02%/°C of reading
	In the test environment required by EMC directives	±3°C
Resolution		1°C
Response Time		0.2 seconds
Emissivity (ratio) Compensation		0.100 to 1.900
Mathematics		Maximum value, minimum value, average value
Signal Modulation		Peak, delay
Display System		LCD digital 4 digits, Displayed in the viewfinder and on the external display
Data Memory Function		Maximum 500 pieces of data
Communications Function		RS-232C
Optical System		Fixed focus type
Distance/diameter		ø20/4000mm (Ref: 4.2 Distance and diameter)
Targeting		Direct viewing finder
Lens Diameter		ø20mm
T/C stability	**Input/accuracy**	K type thermocouple: -50 to 800°C Accuracy: Within ±2°C (at 23°C ± 5°C)
	In the test environment required by EMC directives	±10°C
Other Functions		Auto-power-off, Automatic back-lit display, Continuous measurement, °C/°F selection, Battery check, High /Low limit alarms
Ambient Temperature		0 to 50°C
Power Supply		2 AA (UM-3) alkaline batteries (about 50 hours for continuous measurement)
Casing Material and Color		ABS resin, Gray
Weight		About 350g (thermometer only)
Attachment		2 pieces of AA (UM-3) battery

* At ε =1.0. reference operating conditions: 23°C ± 5°C, relative humidity: 35 to 75%RH

10.2 Outside dimensions



11. Emissivity table

The emissivity are values 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

11.1.1 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 / 024Fe / 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

11.1.2 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	0.28 to 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

11.1.3 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

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