HIOKI

INSTRUCTION MANUAL

3443-01

TEMPERATURE HiTESTER

HIOKI E. E. CORPORATION

Contents

Introduction

Thank you for purchasing this HIOKI "3443-01 TEMPERATURE HiTESTER." To get the maximum performance from the unit, please read this manual first, and keep this at hand.

Safety Notes

⚠ WARNING

Incorrect measurement procedures could result in injury or death, as well as damage to the equipment. Please read this manual carefully and be sure that you understand its contents before using the equipment. The manufacturer disclaims all responsibility for any accident or injury except that resulting due to defect in its product.

This manual contains information and warnings essential for safe operation of the product and for maintaining it in safe operating condition. Before using it, be sure to carefully read the following safety precautions.

Safety symbols

	In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the product.
	Indicates warnings relating to the laser.

The following symbols are used in this Instruction Manual to indicate the relative importance of cautions and warnings.

⚠DANGER	Indicates that incorrect operation presents extreme danger of accident resulting in death or serious injury to the user.
⚠WARNING	Indicates that incorrect operation presents significant danger of accident resulting in death or serious injury to the user.
⚠CAUTION	Indicates that incorrect operation presents possibility of injury to the user or damage to the equipment.
NOTE	Denotes items of advice related to performance of the equipment or to its correct operation.

- Accuracy
  rdg. (displayed or indicated value)
  This signifies the value actually being measured, i.e., the value that is currently indicated or displayed by the measuring instrument.

- Check before use

  Before using the unit, inspect it and check the operation to make sure that the unit was not damaged due to poor storage or transport conditions. If damage is found, contact your dealer or HIOKI representative.

Inspection

When you receive this product, before use, please check that no abnormality or damage has occurred during delivery. In particular, be sure to check the accessories, the liquid crystal display, the control keys, and the lens.
In the unlikely event of damage, or if the unit does not function according to specification, you should immediately contact the dealer from whom you bought the unit, or the nearest HIOKI service facility.

Notes on Use

In order to ensure safe operation and to obtain maximum performance from the unit, observe the cautions listed below.

⚠ DANGER

- **Operation of this unit according to any procedure not specified in this manual may cause explosion due to dangerous laser radiation.**
- **The 3443-01 (field type unit) uses as a light source a semiconducting laser which emits visible light, and which conforms to JIS standard class 2 (JIS C6802). (Wavelength 670nm, maximum power output 1 mW) Since there is considerable danger of this laser light causing damage to the eyes, be very careful not to direct this laser light into your eyes or those of another person.**
- **Do not look directly into the laser light from the optical system.**
- **When measuring the temperature of an object which has a mirror finish, be careful not to allow the laser light beam to be reflected off the surface into your eyes or those of another person.**
- **Do not allow the laser light beam to impinge upon any gas which can explode.**

⚠ WARNING

- **To prevent electric shock, do not allow the unit to become wet and do not use the unit when your hands are wet.**
- **Ensure that protective functions are fail-safe: that is to say, that if they fail they either prevent the unit from operating or give an indication to prevent unwitting operation.**

⚠ CAUTION

- Do not use the unit near any device which generates strong electromagnetic radiation or near a static electrical charge, as these may cause errors.
- The unit should always be operated indoors in a range from 32°F to 104°F (0°C to 40°C) and 35% to 85% RH or less. Do not use the unit in direct sunlight, dusty conditions, or in the presence of corrosive gases.
- Do not store or use the unit where it will be exposed to direct sunlight, high temperatures, high humidity, or condensation. If exposed to such conditions, the unit may be damaged, the insulation may deteriorate, and the unit may no longer satisfy its specifications.

⚠ CAUTION

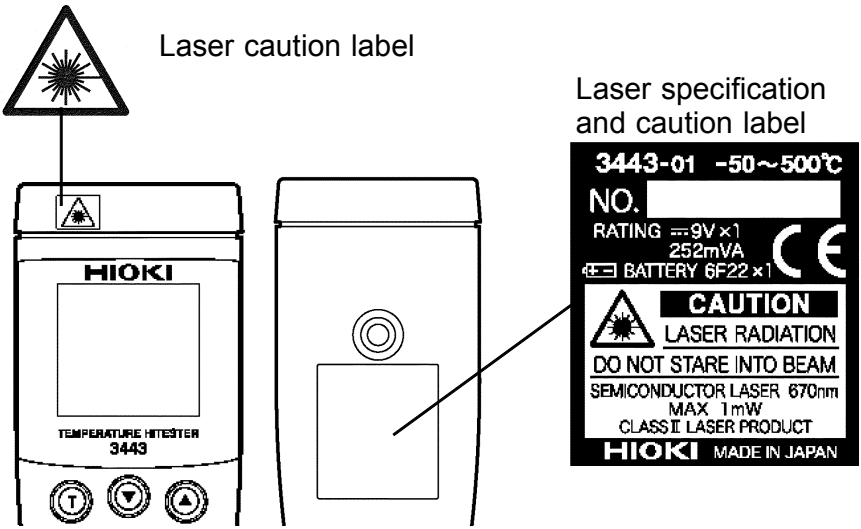
- This unit has been constructed with some degree of water resistance, but if it is subjected to direct contact with water for a long period of time, water may get into the unit. Further, water drops left on the lens will cause measurement errors. Wipe off any water drops promptly.
- Do not use the unit where it may be exposed to corrosive or explosive gases. The unit may be damaged, or explosion may occur.
- To avoid damage to the unit, do not subject the equipment to vibrations or shocks during transport or handling. Be especially careful to avoid dropping the equipment.
- Do not point the lens at the sun or at any other source of strong light. If you do, the sensor may be damaged.
- Do not contact the lens against the object whose temperature is to be measured, or get it dirty, allow it to be scratched, or allow any foreign material to adhere to it. Doing so may cause errors.

NOTE

- Before use, verify that no damage has occurred due to careless storage or transport, and check the appearance and operation of the unit.
- When the mark on the display is flashing, the battery are low. Fit new battery.

Warning Labels

Location of labels used in the HIOKI "3443-01 TEMPERATURE HiTESTER" are as follows.



Chapter 1 Summary

1.1 Product Summary

1. Theory of Measurement
   Every object emits infrared energy in accordance with its temperature. By measuring the amount of this radiant energy, it is possible to determine the temperature of the emitting object.

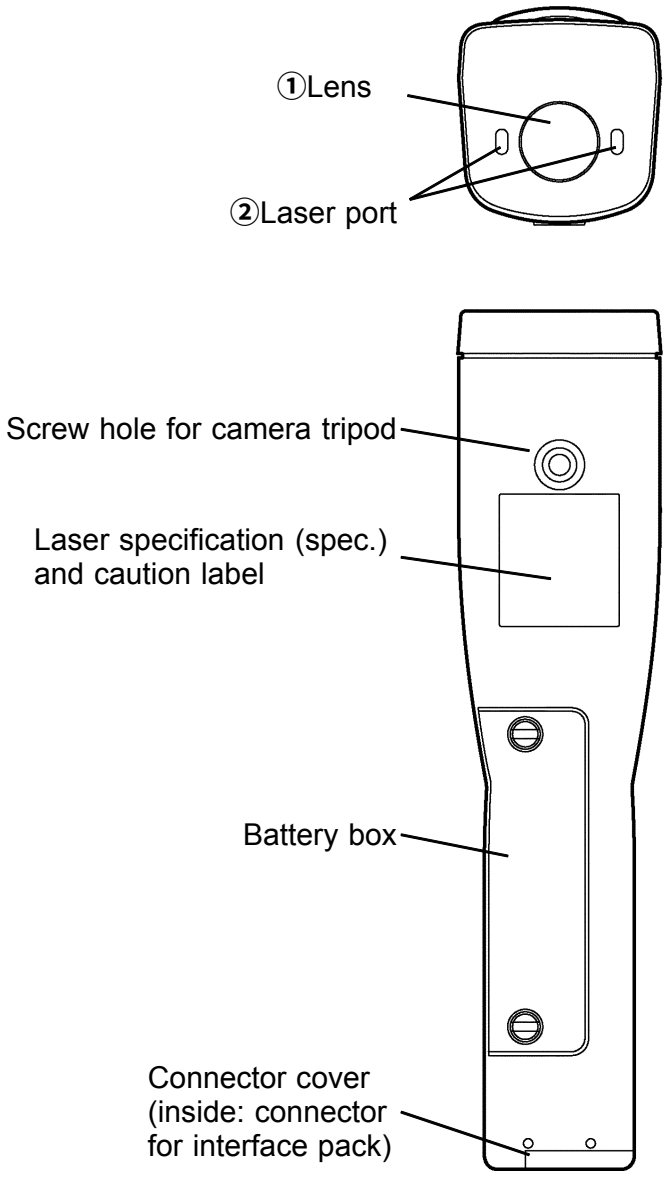
2. About infrared
   Infrared radiation is a form of light (electromagnetic radiation), and has the property that it passes easily through air, while it is easily absorbed by solid matter.
   With an emission thermometer which operates by detecting infrared radiation, accurate measurement is possible, irrespective of the air temperature or the measurement distance.

3. Emission Thermometer Structure
   Infrared radiation which has been emitted from the object is focused upon an infrared radiation sensor, via an optical system which includes a lens which is transparent to infrared radiation, an 8 μm cuton filter, etc..

The output signal from the infrared radiation sensor is input to an electronic circuit along with the output signal from a standard temperature sensor. The electronic circuit calculates the object temperature while applying standard temperature compensation, thermal emissivity compensation, etc., and displays the result.

1.2 Names and Functions of Parts

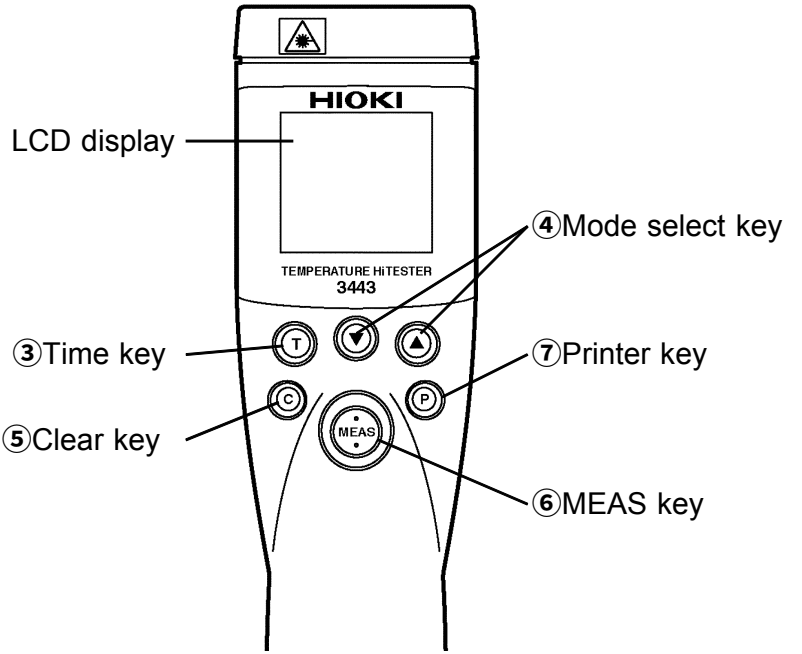
3443-01 field type unit



NOTE

- Connect the cable provided with the optional 3909 INTERFACE PACK to the expansion box connector. For details, please refer to the user instructions provided with the 3909 INTERFACE PACK.

Operating section



① Lens

Infrared rays from the object whose temperature is to be measured are received here.

② Laser marker beam emission openings

The laser marker beams are emitted from here.

③ Time key

Used to set the time and to check the time of stored data.

④ Parameter adjust keys

Used to change the date, time, and emissivity, and to increase/lower the memory data No.

- ▼ key: Decreases
- ▲ key: Increases

If either of these Parameter adjust keys is held down, the numerical value changes rapidly in the appropriate direction.

⑤ Clear key

Used to set the date and to clear displayed memory data.

⑥ **MEAS** key

Performs measurement while **MEAS** is being pressed.

Measured value is held when the key is released.

There is no power switch.

Pressing the **MEAS** key turns ON the power. Power is cut OFF in about 15 sec. if the key is not pressed, except output to printer (automatic power OFF).

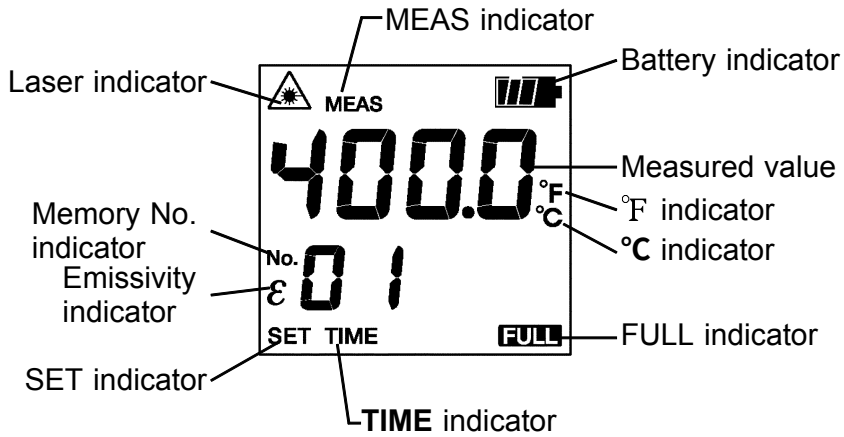
⑦ Printer key

Pressing the P key outputs the stored data to an external printer.

NOTE

- To use the printer output function, an optional 3909 INTERFACE PACK is required. The printer must be provided by the user.
  Printer with RS-232C interface.
  Standard printers such as the EPSON PM series and the CANON BJ series for personal computers cannot be used.

LCD display



LCD display

- **MEAS** indicator **:** Displayed when measurement is being carried out.
- Laser indicator : Displayed when laser is not emitted.
  Blinks when laser is being emitted.
- **No.** indicator : Displayed together with address of data memory.

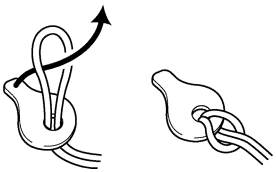
- **ε** indicator : Appears when the thermal emissivity is being set.
- **SET** indicator : Blinks when date, time, and emissivity are being set.
- **TIME** indicator : Displayed when time is set and the time of data memory is displayed.
  Blinks: during time operation.
- **FULL** indicator : Blinks when data memory is full. (max. 130)
- °F indicator : Unit of Fahrenheit.
- **°C** indicator : Unit of Celsius.
-  indicator : Blinks when battery needs to be replaced.
- Measured value : The entire display blinks when the measurement value falls outside the measurement range (-58.0 to 932.0°F, -50.0 to 500.0°C).

Chapter 2
Prior to Use

Prior to operating the thermometer, carry out the following:

1. Attaching the accessory screwdriver

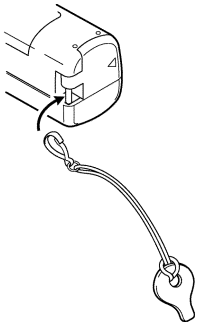
   Attach the accessory screwdriver to the hand strap so that it will not get lost. This screwdriver is used to remove the battery cover screws.



   Attaching the screwdriver

2. Attaching the hand strap

   Attach the hand strap to the instrument to help prevent its being dropped.



3. Loading the battery

   Place the battery correctly in the battery box at the back of main body.

   For loading the battery, refer to "2.1 Battery loading and replacement".

4. Setting the date and time

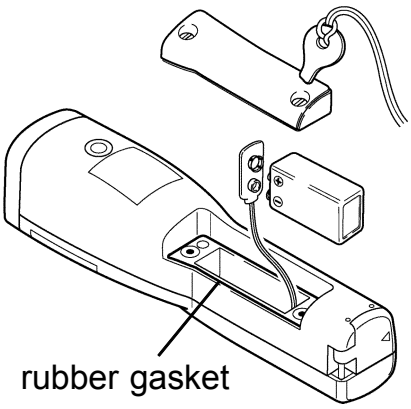
   For how to set the date and time, refer to "2.2 Setting the date and time ".

2.1 Battery Loading and Replacement

- The thermometer does not come with the battery loaded. Load the battery according to the procedure described below.
- If the battery indicator starts to blink, promptly replace the battery.
- If the main body is wet, be sure to wipe off the water, set the battery box facing downward so that any water in the joint will not enter the case, and then remove the battery cover.

Dry battery used : Manganese battery 6F22 or alkali battery 6LR61

1. Remove the battery cover.
   Loosen the screws of the battery cover at the back of the main body with the accessory screwdriver and remove the battery cover.



2. Replace the battery.
   Remove the old battery.
   Check the polarity (+ or -) of the new battery, and load it correctly.
3. Close the battery cover.
   After the battery is loaded, close the battery cover, and tighten the screws evenly and firmly.

⚠ DANGER

When changing the battery, be careful not to press the MEAS key by mistake.
It is very dangerous to allow the laser beam to shine into your eyes or those of another person.
Also, after changing the battery, be sure to close the cover before using the unit.

⚠ WARNING

- **When changing the battery, be sure to fit the battery the proper way around (i.e. with the correct polarity).**
- **Do not short circuit the old exhausted battery or throw them into a fire; they might explode.**
- **Dispose of the old exhausted battery in an approved waste disposal facility.**

⚠ CAUTION

- Take care not to get the wire caught in the battery cover.
- Do not close the battery cover if the rubber gasket is dirty or twisted. Otherwise, the water-resistance of the instruments main body will not be maintained.

NOTE

- All settings are lost when the battery is replaced. After replacing the battery, please re-set the emissivity, date and time. For details, see 2.2, Setting the Date and Time* and 3.3, Setting Emissivity (ε) .
- When not in use for a long time, to prevent possible corrosion caused by battery leakage, remove the battery before storage.
- The battery included with 3443-01 have a short time.

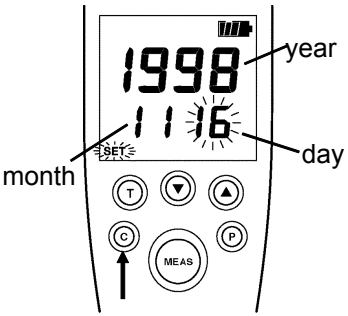
2.2 Setting the Date and Time

When using the unit first time or after replacement of the battery, set the date and time.

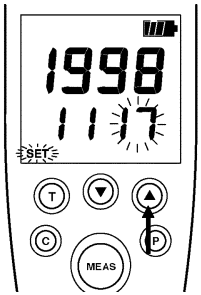
Date

Operating procedure

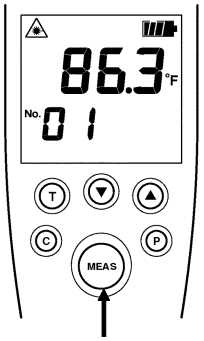
1. Display the date.
   Press the C key when the power is OFF. The date can then be set (the word **SET** will blink).
   Every time C key is pressed, the setting item changes in the order of day → month → year.



2. Change the date.
   Blinking figures can be changed with the ▼ ▲ keys.



3. Completing the date setting.
   Pressing the **T** key moves to the time setting mode. Pressing the **MEAS** key completes the date setting.



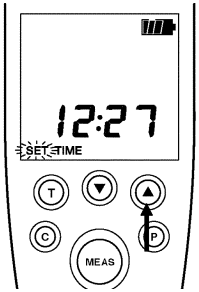
NOTE
- Setting is also possible for a date that does not actually exist (for example, November 31, February 31, etc.), so confirm the date after setting it.

Time

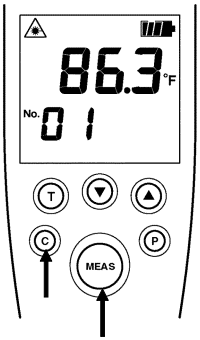
Operating procedure

1. Display the time.
   Press the **T** key when the power is OFF. The time is displayed, and the word **TIME** will blink. Press the **T** key again. The time can be set (the word **SET** will blink).

2. Change the time.
   Using the ▼ ▲ keys, set the present time.
   Time is displayed in 24-hour format.



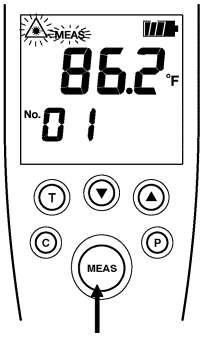
3. Completing the time setting.
   Pressing **C** key moves to the date setting mode.
   Pressing the **MEAS** key completes the setting.



Chapter 3 Making Measurements

3.1 Start and Complete Measurement

1. When the power is off, pressing the **MEAS** key turns on the power.
   The values and settings on the LCD display return to the state before the power was last turned off.



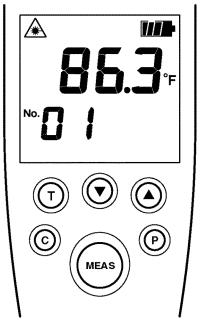
NOTE
- If, from the power off condition, the **MEAS** key is held down for more than one second, measurement starts.

2. Point the lens at the object whose temperature is to be measured.
3. Press the **MEAS** key.
   Measurement is performed as long as the **MEAS** key is kept pressed.

⚠ DANGER

With the 3443-01, whenever the indication ⚠ is flashing, the laser marker beam (class 2) is being emitted. Exercise extreme care not to allow the laser marker beam to enter your eyes (because of this laser light causing damage to the eyes) or those of another person.

4. Aim the laser beam at the object whose temperature is to be measured.
5. Read the display.
6. End measurement.
   Measurement ends when you release the **MEAS** key. The laser marker beam goes off and the current measured value is stored under the memory number indicated by No.
   The power then goes off after 15 seconds.

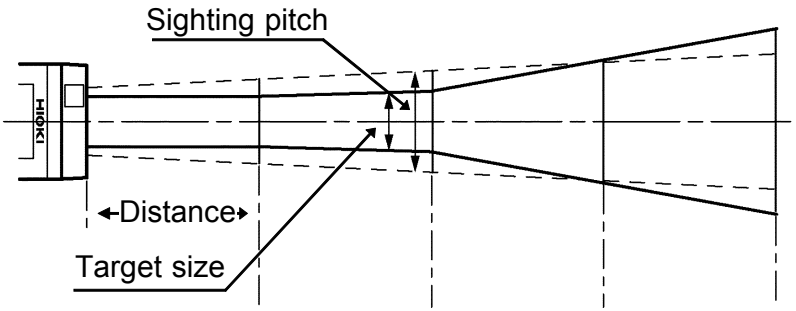


NOTE • When the measurement value is out of the measurement temperature range (-58.0 to 932.0°F, -50.0 to 500.0°C), the display will flash.

3.2 Target Size and Sighting

NOTE

- Although the field of measurement and the sighting almost coincide, actually the field of measurement corresponds to the diameter for 90% optical response. The object whose temperature is to be measured needs to be larger than the measurement diameter by an adequate margin - at least 1.5 to 2 times larger.
- The sighting beam must encompass the area to be measured up to the max. measurement distance of 4-ft. 12-in. (1.5 meters).
- Even if the measurement distance is greater than 6-ft. 7-in. (2 meters), temperature is displayed as a mean value of the target size if there is no substance to absorb or interrupt the infrared ray from the object being measured.



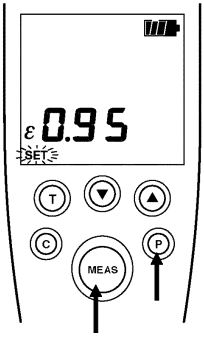
distance	1'8" 0.5 m	3'3" 1 m	4'12" 1.5 m	6'7" 2 m
Target size	0.79" φ20 mm	0.95" φ24 mm	1.89" φ48mm	3.15" φ80 mm
Sighting pitch	1.34" 34 mm	1.61" 41 mm	1.89" 48 mm	2.17" 55 mm

3.3 Setting Emissivity (ε)

Each substance has particular emissivity. Precise measurement requires appropriate setting.

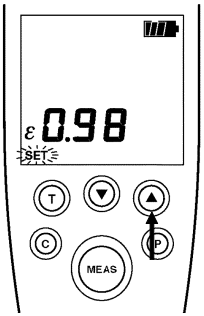
1. Displaying emissivity (ε)

   With the power off, display the emissivity setting by pressing the **MEAS** while pressing and holding the **P** key. **SET** begins flashing.



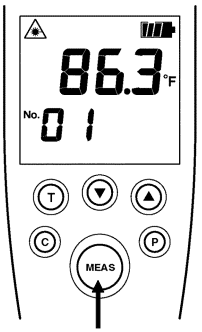
2. Setting emissivity (ε)

   Numerals can be changed with the ▼ ▲ key.



3. Completing setting of emissivity (ε)

   Press the **MEAS** key to complete the setting. Measurement can be started immediately.

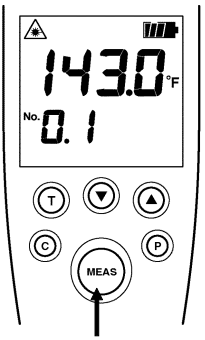


Substance	Thermal emissivity	Substance	Thermal emissivity
Asphalt	0.90 to 0.98	Charcoal (powder)	0.96
Concrete	0.94	Lacquer	0.80 to 0.95
Cement	0.96	Lacquer (matt)	0.97
Sand	0.90	Rubber (black)	0.94
Earth	0.92 to 0.96	Plastic	0.85
Water	0.92 to 0.96	Timber	0.90
Ice	0.96 to 0.98	Paper	0.70 to 0.94
Snow	0.83	Aluminium oxides	0.76
Glass	0.90 to 0.95	Chromium oxides	0.81
Ceramic	0.90 to 0.94	Copper oxides	0.78
Marble	0.94	Iron oxides	0.78 to 0.82
Fluorite	0.30 to 0.40	Nickel oxides	0.90
Plaster	0.80 to 0.90	Titanium oxides	0.40 to 0.60
Mortar	0.89 to 0.91	Zinc oxides	0.11 to 0.28
Brick (red)	0.93 to 0.96	Brass oxides	0.56 to 0.64
Textiles	0.90	Uneven bronze surfaces	0.55
Cloth (black)	0.98	Rolled stainless steel	0.45
Human skin	0.98	Heavily rusted iron	0.69
Leather	0.75 to 0.80		

NOTE

- Variations in the surface condition and color of the object whose temperature is to be measured may cause the thermal emissivity ε to be somewhat different from the values in the above table. If an accurate temperature measurement is desired for an object whose thermal emissivity is not known, black body tape or black body spray (sold separately) should be used. In this case the setting for thermal emissivity (ε) should be the value indicated on black body tape or black body spray.

3.4 Storing the Data



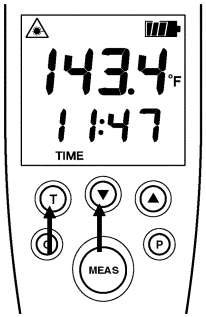
Releasing the **MEAS** key completes the measurement and stores the measured value in the address indicated by memory "No." Data can be stored in any address (1 to 84) by changing the No. using the ▼ ▲ keys. Further, multiple data can be stored in the same address.

NOTE

- The maximum number of measurements that can be stored is 130. A maximum of 130 measurements can be stored in memories No. 1 to No. 64.
- It is recommended to clear all memory data before storing new data.
- When the battery is runs out, all memory data is lost.

Displaying data memory

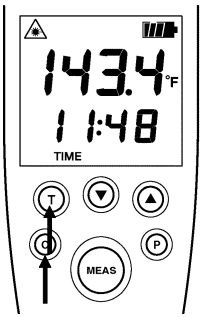
The data of the last memory No. in the stored data can be displayed using the ▼ ▲ keys. Data in the same No. can be displayed using the ▼ ▲ keys while pressing the T key. The time of data memory is displayed.



Clearing the data memory

Pressing the C key clears the displayed data.

Display the past data in the same memory No. by pressing the ▼ ▲ keys with the T key held down. Then, press the C key. The displayed data will be cleared.



NOTE

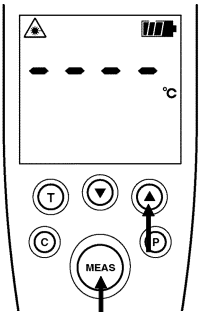
- Press the C key with the P key held down when the power is OFF. The date can be confirmed after the data memory has been completely cleared.

3.5 Switching between Fahrenheit and Celsius, and Erasing All Data from Memory

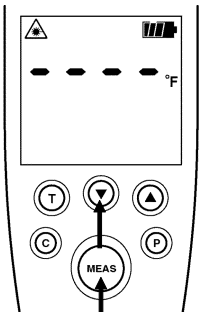
To switch between Fahrenheit and Celsius displays, perform the following operation when turning on the electrical power:

On shipment from the factory, the HiTESTER is set to display temperature in degrees Fahrenheit.

1. If, with the power off, the **MEAS** key is pressed to turn the power on while the ▲ key is being held down, the temperature display will be set to show the temperature in degrees Celsius (°C).



2. However if, with the power off, the **MEAS** key is pressed to turn the power on while the ▼ key is being held down, the temperature display will be set to show the temperature in degrees Fahrenheit (°F).



Changing the temperature display unit erases all data from memory.

This operation can thus also be used as a memory erase function.

3.6 Turning the Power Off

The unit has an auto power off function. The power goes off after 15 seconds if no control action is performed.

If you need to check the measured temperature value again, just press the **MEAS** key once.

NOTE

- During measurement, the auto power off function does not operate.

3.7 Using the Temperature HiTESTER with a Personal Computer

Using the optional 3909 INTERFACE PACK, you can transfer measurements stored in the 3443-01 memory to a personal computer for processing.
The 3909 INTERFACE PACK consists of a modular cable, an expansion box, and the TEMP software utility for loading data into the PC and saving it to floppy disk.

1. Using the 3909 modular cable, expansion box, and an RS-232C null-modem cable (not included), connect the 3443-01 to the serial port on your personal computer.
2. Start up the 3909 TEMP utility (data import software).
   The TEMP utility makes it easy to transfer data and manage it on your personal computer.
   Data can also be imported into for processing Excel.
   Excel is a registered trademark of Microsoft Corporation.

Chapter 4
Specification

Product type	3443-01 Temperature HiTester (Field Type)
Detector / optical lens	thermopile / silicon
Measurement wavelength	8 to 16 μm
Measurement temperature range	-58.0 to 932°F -50.0 to 500.0°C
Display resolution	0.1°F, 0.1°C
Guaranteed accuracy period	1 year
Accuracy of measurement -58.0 to 31.9°F 32.0 to 392.0°F 392.1 to 932.0°F 200.1 to 500.0°C 0.0 to 200.0°C -50.0 to -0.1°C	 ±10%rdg. -6.8 ±3.6°F ±1%rdg. -0.32 ε=1.0, temperature of case 64.4 to 82.4°F, ambient humidity 55 %RH ±1%rdg. ±2°C ±10%rdg. ±2°C ε=1.0, temperature of case 23±5°C, ambient humidity 55 %RH
Repeatability	±1.8°F (-58.0 to 31.9°F) ±0.9°F (32.0 to 932.0°F) ±0.5°C (0.0 to 500.0°C) ±1°C (-50.0 to -0.1°C)
Response time	Max. 1.6 s (95% response)
Target size	24±3 mm/m (90% energy limit)
Sighting	2-beam laser marker (class 2)
Data memory	1 to 64 (multiple data can be stored in the same No.)

Number of memory	130 (total of No. 1 to No. 64)
Displayable memory content	No. + measured value + time
Thermal emissivity compensation	Normally fixed at 0.95 (can be changed in 0.10 to 1.00 with the keys)
Auto power off	approx. 15 sec. (HOLD and SET mode)
Sampling rate	0.8 s
Other functions	Date setting, time setting, memory clear, memory full display, printer output, RS-232C interface : *1
Power source	Rated supply voltage 9 VDC×1 6F22 manganese battery×1 6LR61 alkaline battery×1
Maximum rated power	252mVA (max.)
Battery life	Approx.20 hours under continuous operation at sighted lighting (alkali battery)
Ambient temperature and humidity for use	32 to 104℉, 0 to 40℃, 35 to 85% RH; no condensation
Storage temperature	-4 to 131℉, -20 to 55℃; no condensation
Location for use	Indoor, altitude up to 6562 feet, 2000 mm
Dimensions	1.85"W×7.87"H×1.89"D approx. 47W×200H×48D mm approx.
Mass	9.88 oz. approx. (excluding battery) 280 g approx. (excluding battery)
Dustproof, waterproof	IP54 : *2
Applicable standards	EMC: EN61326:1997+A1:1998+A2:2001+A3:2003
Accessories supplied	instruction manual, Carrying case, Hand Strap, 6F22 manganese battery, screwdriver (for remove the battery cover)

Options	3909 INTERFACE PACK, Black body tape, Black body spray, AC Adapter (AC-10), 9442 PRINTER, 9443-03 AC ADAPTER (for printer), 9444 CONNECTION CABLE (for printer)

*1 : To use the printer output function and RS-232C interface, an optional expansion kit is required.

*2 : IP54:No harmful influence when splashed from any direction(based on IEC529 (1989))

Chapter 5
Maintenance and Service

- **Do not attempt to adjust or repair the unit with the case open. Such adjustments or repairs should only be made by a technician who fully understands the dangers involved.**
- **If the protective functions of the unit are damaged, either remove the unit from service or post warnings to prevent others from using the unit inadvertently.**

⚠ CAUTION

- Gently wipe dirt from the surface of the unit with a soft cloth moistened with a small amount of water or mild detergent. Do not try to clean the unit using cleaners containing organic solvents such as benzine, alcohol, acetone, ether, ketones, thinners, or gasoline. They may cause discoloration or damage.
- When not in use for a long time, to prevent possible corrosion caused by battery leakage, remove the battery before storage.
- If the unit is not functioning properly, check the battery, the probe. If a problem is found, contact your dealer or HIOKI representative. Pack the unit carefully so that it will not be damaged during transport, and write a detailed description of the problem. HIOKI cannot bear any responsibility for damage that occurs during shipment.
- If the lens is dirty, clean dust etc. off it using a camera lens cleaning tissue, blower or similar means.
- If the lens is very dirty, clean it using a cotton bud containing a small quantity of alcohol.

5.1 Troubleshooting

Problem	Cause	Solution
No display	• Batteries exhausted, poorly contacting, or wrongly inserted.	• Change the battery, or insert them correctly.
Measured temperature value peculiar	• Lens dirty	• Clean the lens.
	• A heat source such as a high temperature body is present close by.	• Intercept radiation from the heat source by using an insulation plate etc.
	• The thermal emissivity value is not appropriate.	• Set the thermal emissivity to an appropriate value.
℃ blinks	• Operating temperature range (32 to 104℉, 0 to 40℃) exceeded.	• Use in operating temperature range.
The display shows "Err"	• The unit is faulty.	• Contact a service facility.

- **Service**

  If the above shown solutions fail to solve the problem, it is possible that your unit is malfunctioning. Please contact your sales agent or the manufacturer to arrange for repair.

5.2 Questions and Answers about Measurement

Q: Why can't I measure the temperature on the other side of a glass pane?

A: Normal glass absorbs infrared radiation of the wavelength (8 to 16 μm) which this device uses for temperature measurement. Therefore this device cannot measure the temperature of an object on the other side of a glass sheet, but instead measures the temperature of the glass sheet itself.

Q: Light is shining on an object. Why can't I measure its temperature accurately?

A: Since fluorescent light includes almost no infrared radiation, it has almost no effect upon normal temperature measurement. However sunlight and incandescent lights emit radiation which includes substantial amounts of the infrared radiation used by this device for temperature measurement, and accordingly may produce significant measurement discrepancies.

Q: Why can't I measure the temperature of a gas, vapor, or flame?

A: Since gases, vapors, and flames are transparent to infrared radiation, their temperatures cannot be measured in this way.

Q: Why can't I measure temperature through rain or fog?

A: Since rain and fog reflect and absorb infrared radiation, accurate measurement through them is impossible.

Q: Doesn't the measurement distance affect the resulting measured value for temperature?

A: Air hardly absorbs at all infrared radiation of the wavelengths (8 to 16 μm) used by this device for temperature measurement. Therefore accurate temperature measurement is possible, irrespective of the measurement distance.