HIOKI

INSTRUCTION MANUAL

3460-50

2D THERMO HiTESTER

HIOKI E. E. CORPORATION

Contents

Introduction

Thank you for purchasing the HIOKI "3460-50 2D THERMO HiTESTER". To obtain maximum performance from the product, please read this manual first, and keep it handy for future reference.

Request

We have tried to bring this manual as close to perfection as we could achieve. If perchance you find any unclear portions, mistakes, omissions, or the like, we would be most obliged if you could please notify us of them via any Hioki agent, or directly.

Inspection

When you receive the product, inspect it carefully to ensure that no damage occurred during shipping. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

Before using the product the first time, verify that it operates normally to ensure that the no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.

- Accessories supplied

Check the Supplied Accessories

Strap	1
LR6 (AA) alkaline batteries	6
Compact Flash Card (16 MB)	1
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Safety Notes

⚠ CAUTION

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 claims no liability for any damage caused by this system except for damage resulting from a defect in the system itself.

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

Safety symbols

	In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the product.
	Indicates DC (Direct Current).

The following symbols in this manual indicate the relative importance of cautions and warnings.

WARNING	Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.
CAUTION	Indicates that incorrect operation presents a possibility of injury to the user or damage to the product.
NOTE	Advisory items related to performance or correct operation of the product.

Measurement categories (Overvoltage categories)

To ensure safe operation of measurementproducts, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT I to CAT IV, and called measurement categories. These are defined as follows.

CAT I: Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.

CAT II: Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)

CAT III: Primary electrical circuits of heavy

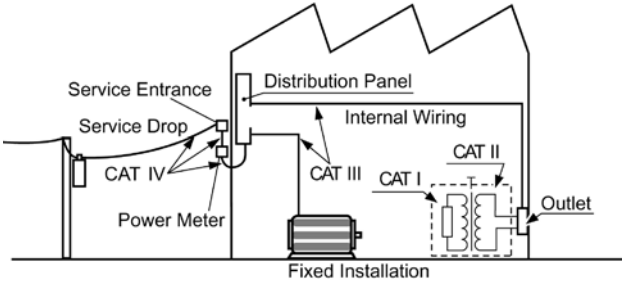
equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.

CAT IV: The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).

Higher-numbered categories correspond to electrical environments with greater momentary energy. So a measurement device designed for CAT III environments can endure greater momentary energy than a device designed for CAT II.

Using a measurement product in an environment designated with a higher-numbered category than that for which the product is rated could result in a severe accident, and must be carefully avoided. Never use a CAT I measuring product in CAT II, III, or IV environments.

The measurement categories comply with the Overvoltage Categories of the IEC60664 Standards.



Notes on Use

Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

⚠ WARNING

- **Do not use the product where it may be exposed to corrosive or combustible gases. The product may be damaged or cause an explosion.**
- **To avoid electric shock, do not allow the product to get wet, and do not use it when your hands are wet.**

⚠ CAUTION

- To avoid system damage and malfunction by making sure that the object to be measured does not touch the system.
- Do not touch the lens with a hard object, apply undue pressure to the lens, or insert a foreign substance in the unit. These actions will cause system damage or malfunction.
- 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 touch the LCD screen surface, since doing so may cause erroneous display or distortion.

⚠ CAUTION

- To avoid damage to the product, protect it from vibration or shock during transport and handling, and be especially careful to avoid dropping.
- Do not store or use the product where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the product may be damaged and insulation may deteriorate so that it no longer meets specifications.
- This product is designed for indoor use, and operates reliably from 0℃ to 40℃.
- This product is not designed to be entirely water- or dust-proof. To avoid damage, do not use it in a wet or dusty environment.
- Do not use the product near a device that generates a strong electromagnetic field or electrostatic charge, as these may cause erroneous measurements.
- If the protective functions of the product are damaged, either remove it from service or mark it clearly so that others do not use it inadvertently.
- Do not disassemble or modify the system, since doing so may prevent the system from satisfying the specifications.

NOTE

- Accurate measurement may be impossible in the presence of strong magnetic fields, such as near transformers and high-current conductors, or in the presence of strong electromagnetic fields such as near radio transmitters.
- If the set emissivity differs from the emissivity of the object, a measurement error may result.
- To avoid corrosion from battery leakage, remove the batteries from the product if it is to be stored for a long time.
- To avoid problems with battery operation, remove the batteries from the product if it is to be stored for a long time.

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 3460-50 2D THERMO HiTESTER, 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 8μm 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.

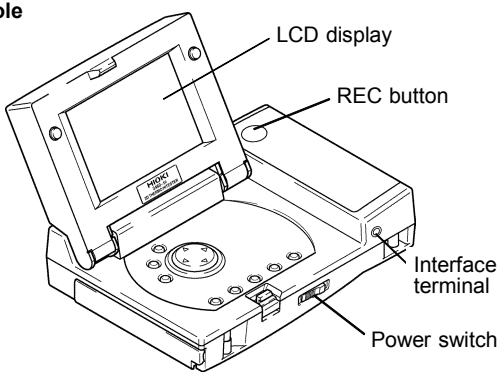
The electronic circuit calculates the object temperature while applying standard temperature compensation, thermal emissivity compensation, etc., and displays the result.

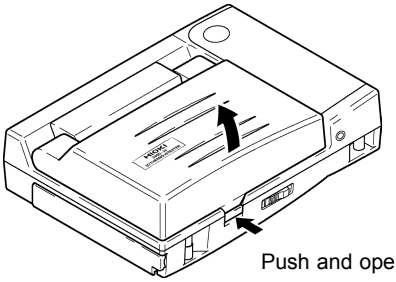
1.2 Characteristic

- Measures two-dimensional temperature using the thermopile array (8 x 8 elements)
- Equipped with a 3.8-inch color LCD
- Built-in CMOS camera enables simultaneous display of temperature image and optical image on a screen.
- Compact and lightweight
- Data stored on a compact flash card
- The temperature alarm helps detect abnormal temperatures.
- Provided with an NTSC video terminal; images can be recorded on a video recorder (video cable available as an option).
- Logging function and alarm function are available.
- Temperatures can be recorded, monitored, and alarms sent by connecting to a PC and creating a program. (Interface cable is supplied separately.)

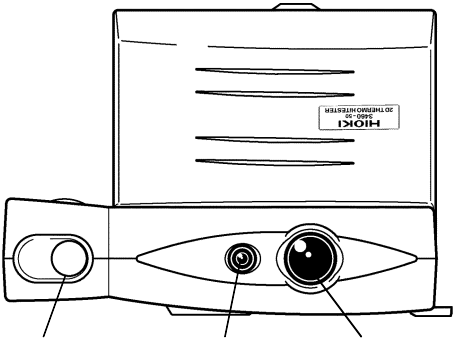
1.3 Names of Parts

Whole





Front

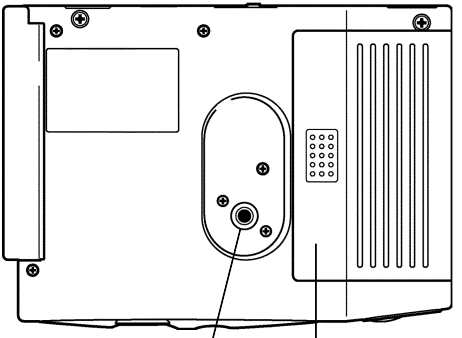


Measurement/ hold button (HOLD)

Visible camera lens

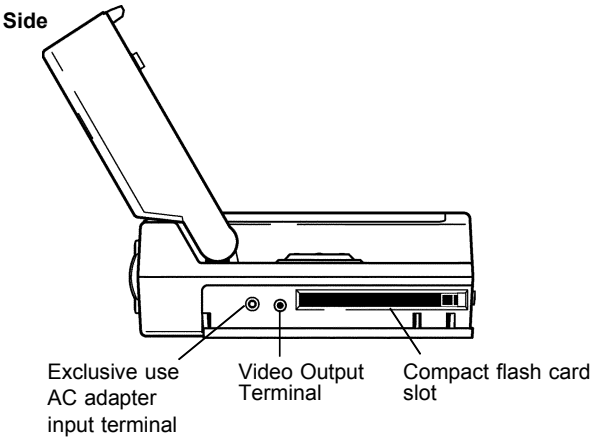
Infrared lens

Bottom



Screw hole for camera tripod

Battery cover



- **[Video Output Terminal]**

The terminal outputs the same video signals as those output to the LCD screen. To view the images on a TV, use the optional cable to connect this terminal to the TV monitor input terminal. The video image size is 1/4 of a full screen.
The cable and AC adapter are included within the 3915 OPTION PACK.
Make sure the power is turned off before connecting or disconnecting the AC adapter.

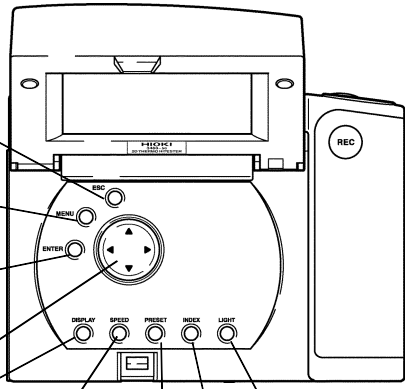
⚠ WARNING

- **To avoid damage, turn the product off before connecting the AC adapter to the product and to AC power.**
- **Use only the AC adapter supplied with Model 3915 OPTION PACK. AC adapter input voltage range is 100 to 240 VAC (with ±10% stability) at 50/60 Hz. To avoid electrical hazards and damage to the product, do not apply voltage outside of this range.**
- **Make sure the power is turned off before connecting or disconnecting the AC adapter.**

NOTE

- To ensure proper system operation, do not use the AC adapter with an unstable power supply. In particular, be careful about the mixing-in of impulse components.

LCD display, operation panel



Cancel Button (ESC)

Menu Button (MENU)

Input Button (ENTER)

Cursor Button

Display Selector Button (DISPLAY)

Measurement Condition Selector Button (PRESET)

Backlight Brightness Setting Button (LIGHT)

Measurement Speed Selector Button (SPEED)

Index Display Button (INDEX)

1.4 Switches and Controls

- Input Button (ENTER)

During Measurement/ Hold	Set distance to object. (see page 22)
During Menu Screen	Use the cursor button to enter the setting screen of the menu option.
During Index Screen	Displays full-screen the image data selected with the cursor button.

- Menu Button (MENU)

  Displays the menu for option settings.

- Cancel Button (ESC)

During Menu Screen	Returns to the measurement mode.
During Setting Screen	Returns to the menu screen with confirming the setting.
During Index Screen	Deletes the image data selected with the cursor.

- Cursor Button

During Measurement/ Hold	Use the cursor button to choose a measurement point for which numeric data must be displayed.
During Menu Screen	Use this screen to choose a setting option.
During Setting Screen	Use this screen to choose an option or edit the setting.
During Index Screen	Selects image data.

- Display Selector Button (DISPLAY)

  Chooses a display mode (see page 21).

- Measurement Speed Selector Button (SPEED)

  Chooses a temperature measurement speed.

  The resolution for high speed measurement is 1℃.

NORMAL	Display resolution is 0.1℃. You can select a function that displays a moving average for 10 data points, or approx. 2 seconds of measurements.
FAST	Display resolution is 1℃. Moving average is not available.

- Measurement Condition Selector Button (PRESET)

  Selects a set of preset measurement conditions including emissivity, scale, and alarm. The settings for each preset are edited in the PRESET setting screen. To go to the setting screen, enter the setting mode (**SETTING**) and select the measurement condition (**PRESET**) in the menu.

- Index Display Button (INDEX)

  Enters the index display mode and displays a list of recorded image data.

- Backlight Brightness Setting Button (LIGHT)

  Adjusts the brightness of the LCD backlight (4 adjustable levels from no light to maximum brightness).

  When brightness is set to maximum, if no key operation occurs for approximately 10 seconds, brightness is automatically reduced to intermediate or minimum settings (depending on the power

supply conditions).
Brightness cannot be set to the maximum setting when the battery indicator indicates "Replace."
During automatic data recording, brightness is set to the minimum setting.

- Hold Button (HOLD)
  The image is held on the LCD by pressing hold button. (See page 4)

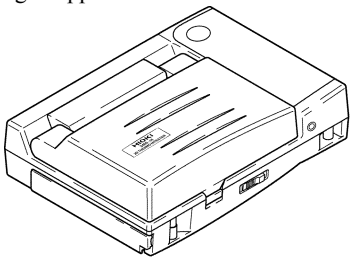
- Record Button (REC)
  Save the temperature data to the compact flash card. (See page 3 and 24)

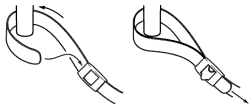
Chapter 2
Prior to Use

Prior to operating the thermometer, carry out the following:

1. Attaching the strap

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





2. Loading the battery

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

   For loading the battery, see page 14 "5. Battery replacement".

3. Setting the date and time

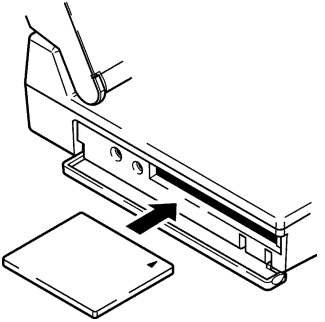
   When using the unit after replacement of the battery, set the date and time. (See page 31)

4. Installation of Compact Flash Card

⚠ CAUTION

- Inserting a compact flash card upside down, backwards or in the wrong direction may damage the product.

Open the cover on the side of the system and insert the compact flash card into the slot. Make sure that the card faces in the correct direction and is fully inserted.



- **Compact Flash Card**

The card stores image data and transfers data to a PC and PDA (personal digital assistant) without special software.
Image: JPEG format
Measurement: CSV format
The system supports an 16-1 GB compact flash cards ranging from 16 to 1 GB.

⚠ WARNING

Use only PC Cards (Compact flash cards) sold by HIOKI. Compatibility and performance are not guaranteed for PC cards (Compact flash cards) made by other manufacturers. You may be unable to read from or save data to such cards.
Hioki options PC cards (includes adapter)
9726 PC CARD 128M, 9727 PC CARD 256M
9728 PC CARD 512M, 9729 PC CARD 1G

NOTE

- An adapter is required to use a compact flash card in the PC card slot of a PC.
- To avoid data save or read errors, do not remove the card when data is being saved or read. The card can be inserted or removed at any time unless data is being saved or read.

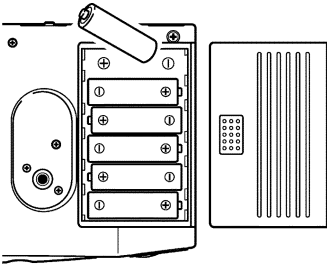
5. Battery replacement

⚠ WARNING

- **To avoid electric shock, turn off the power switch and disconnect the connection cables before replacing the batteries.**
- **Do not mix old and new batteries, or different types of batteries. Also, be careful to observe battery polarity during installation. Otherwise, poor performance or damage from battery leakage could result.**
- **Attempting to charge alkaline batteries may cause them to explode.**
- **To avoid the possibility of explosion, do not short circuit, disassemble or incinerate batteries.**
- **Handle and dispose of batteries in accordance with local regulations.**

NOTE

- The batteries are not pre-installed in the system. Install the batteries as shown in the illustration.



NOTE

- The supplied batteries are designed for a display monitor. Thus, battery life may be short.
- Do not use manganese batteries; use only alkaline batteries.
- Reset the system clock after replacing the batteries (page 31).
- To avoid corrosion from battery leakage, remove the batteries from the product if it is to be stored for a long time.

5. Battery Indicator

Remaining battery power is indicated in three levels on the LCD.

When "Replace" is displayed, replace the batteries immediately.

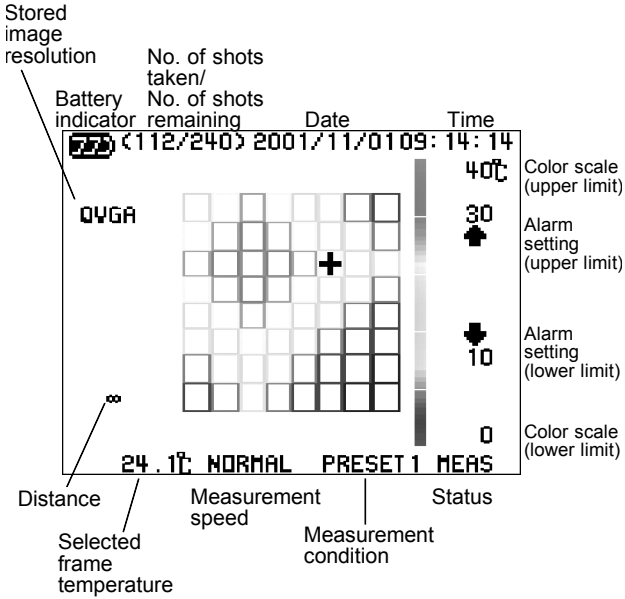
Normal Low Replace

NOTE

- When "Replace" starts flashing, power will be shut off within 5 minutes.
- When "Replace" is displayed, the backlight brightness cannot be set to maximum.
- If you continue to use the tester after "Replace" appears, either by switching to the AC adapter or reducing backlight brightness, make sure that temperature measurements are updated.

Chapter 3 Making Measurements

3.1 Measurement Screen



Example of a color frame display

- Battery Indicator

  Indicates the remaining battery power in three levels.
  When is displayed, replace the batteries immediately.

- Number of Shots Taken/Number of Shots Remaining

  Indicates the number of shots remaining according to the space remaining on the compact flash card. The number of shots remaining is an estimate. The actual number may be smaller or larger than the number shown, as the size of data varies with objects to measure. The maximum number of shots remaining is 999.

- Date/Time

  Indicates date and time using the built-in clock.

- Status

  Indicates the operating status.
  HOLD: Holding the image
  MEAS: Performing measurement
  REC: Performing the record
  AUTO: Performing the record of data Automatically
  WAIT: Waiting for start of automatic data recording

- Color Scale Upper Limit Temperature

  Indicates the upper limit temperature of the preset selected with the **PRESET** button.

- Color Scale Lower Limit Temperature

  Indicates the lower limit temperature of the preset selected with the **PRESET** button.

- Alarm Upper Limit Temperature

  Sets the upper limit on the measurement condition setting screen (**PRESET**). The upper limit is marked on the side of the scale.

- Alarm Lower Limit Temperature

  Sets the lower limit on the measurement condition setting screen (**PRESET**). This is marked on the side of the scale.

- Selected Frame Temperature

  The selected frame is marked by a white cross cursor. The cursor is moved up and down and right and left with the cursor button.

- Temperature Frame

  Indicates the average temperature in the frame with a color from the color scale.

- Measurement Speed

  Indicates the selected response speed. There are two speed modes: high-speed mode (**FAST**) and standard speed mode (**NORMAL**).

- Measurement Condition

  Indicates the measurement condition No. (1 to 3) selected with the **PRESET** button.

- Color Scale

  This is a temperature color scale used for a frame or mosaic display. There are three display patterns available. Enter the setting mode (**SETTING**), select COLOR SCALE in the menu, and choose a display pattern from the **COLOR SCALE** setting screen.

- Stored Image Resolution

  Sets the resolution of an image file. Select between **QVGA** (320 x 240) and **VGA** (640 x 480). (page 24)

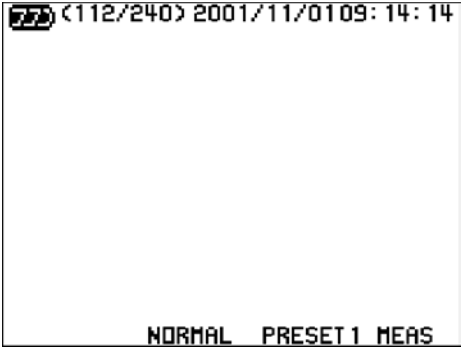
- Distance

  Sets the distance from the object to be measured. Select between 0.5 m (**0.5**), 1.0 m (**1.0**), and 2.0 m & over (∞). (page 22)

3.2 Measurement

(1) Turn on power

Open the LCD and slide the power switch to the right. Following the opening screen, the visible image, temperature data, and other information will appear on the screen.



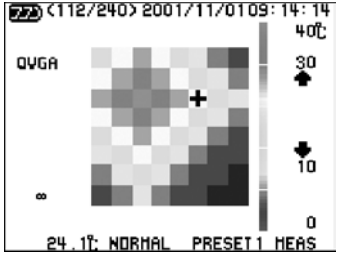
NOTE

- After the power switch is moved to the ON position, the LCD will first display a blue screen, then the opening screen.
- On any one occasion, slide the power switch to the On position only once. Do not slide it back and forth. If power does not turn on when you first slide the switch to the On position, see Chapter 7 (P50).

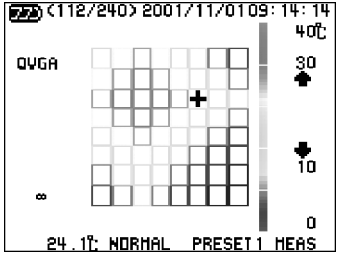
(2) Choose display mode

Choose a display mode using the Display Selector button (**DISPLAY**).

Visible image only



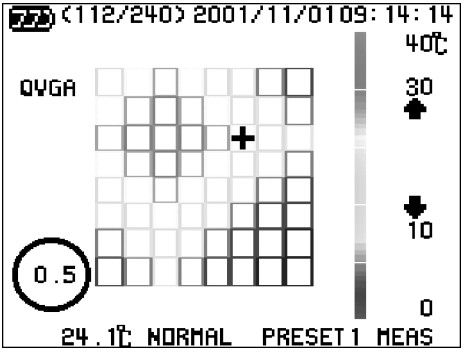
Temperature mosaic color display



Temperature frame color display

(3) Set distance to object

Press the input button (**ENTER**) and select a distance to the object to be measured. Select from 0.5 m (**0.5**), 1.0 m (**1.0**), and 2.0 m & over (∞), whichever most closely matches the actual distance.



(4) Measure temperature

(In the temperature frame color display mode or the temperature mosaic color display mode)

Point the lens at the object. A visible image of the object and the temperature measurement appear on the screen. While the system is measuring, the **MEAS** indicator is shown at the bottom right-hand portion of the screen.

Press the measurement/hold button (**HOLD**) to hold the image on the screen to the bottom right-hand portion of the screen. Press the measurement/hold button (**HOLD**) once again to release the image and to display measurement results.

The temperature of the measuring point selected with the cursor button is displayed at the bottom left-hand portion of the screen.

NOTE

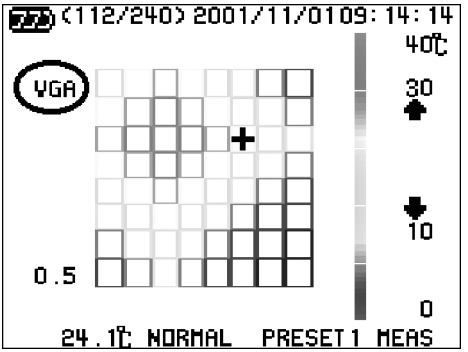
- If the emissivity is not set to the emissivity of the object, the system will not display the correct measurement results.
  (See "Emissivity Table" on page 52 and "Measurement Condition Setting" on page 30.)
- When the emissivity of the object is low, the thermal radiation from nearby heat sources may be reflected on the measured surface, causing measurement errors. Move the heat sources away or shade the object from the heat sources.
- When the distance to the object is set to 2.0 m & over (∞), the 3460-50's two optical axes are parallel, parallax (the displacement between the visual image optical axis and the optical axis of the temperature sensor unit) is independent of the distance from the measurement target, and is 26 mm in the horizontal direction and 0 mm in the vertical direction.

(5) Turn off power

Slide the power switch to the right again.
When the Auto Power Off (page 32) is enabled (ON), if the system has been idle for one minute, power will be automatically turned off.

3.3 Storage Image and Temperature Data

Simultaneously press the cancel button (**ESC**) and the input button (**ENTER**) to select between **QVGA** (320 x 240) and **VGA** (640 x 480) for window size.



3.3.1 Measurement with Record Button

The image is held on the LCD by pressing the hold button (**HOLD**). Press the record button (**REC**) for saving the temperature data to the compact flash card.

3.3.2 Logging Recording

You can set the system to perform automatic logging. Set the recording start and end times. (page 33)

3.3.3 Storage File

The file extension for the image data file is JPG. The file extension for the temperature data file is CSV. Image data is saved to the PICT folder, list of image data is saved to the IPICT folder, while temperature data is saved to the DATA folder.

Image	: PICTxxxx.JPG
	PICT0001.JPG
Each temperature data	: DATAxxxx.CSV
	DATA0001.CSV
Cumulative data	: LOGDATA.CSV
	LOGDATA.CSV

Image data files are paired with corresponding data files. A new data file is named by incrementing the number assigned for the previous data filename by 1. If no data file exists, the new data file is assigned the name DATA0001.CSV.
If the last data file is DATA9999.CSV, the new data file will be assigned the name DATA0001.CSV.
The images are recorded as shown on the screen.

The size of an image file is approximately 90 KB. This may vary slightly from image to image and from object to object. The supplied 16 MB card will hold about 100 to 200 image and data files. The data can be transferred to a PC using a commercially-available compact flash card adapter. The image data can be viewed in Internet Explorer(note1) or other browser software.

(note1) Internet Explorer is a registered trademark of Microsoft Corporation (USA).

Temperature data can be read in EXCEL(note2) or other software. You can copy or delete this data on a PC.

3.3.4 CSV File Data

The CSV files store the following data:

Each image data: CSV file
Year/month/day, hour:minute:second, CH1 measurement --- CH64 measurement
2001/10/15, 11:55:36, 1000.0, 985.5, --- 123.4

Cumulative data: CSV file
No., year/month/day, hour:minute:second, CH1 measurement --- CH64 measurement
1, 2001/10/15, 11:55:36, 1000.0, 985.5, --- 123.4
2, 2001/10/15, 12:12:55, 856.3, 732.5, --- 55.8

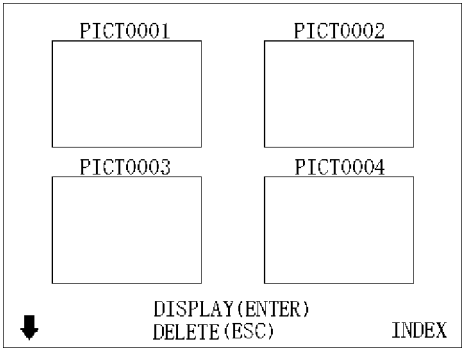
Each channel corresponds to an individual temperature display frame, as shown below.

1	2	3	. .			. .	8
9	10	11	. .			. .	16
17	18	. .				. .	24
25	26	. .				. .	32
33	34	. .				. .	40
41	42	. .				. .	48
49	50	. .				. .	56
57	58	. .				. .	64

(note2) Excel is a trademarks of Microsoft Corporation (USA).

3.4 View Saved Images

Press the **INDEX** button to view a list of saved images. Select an image in the list by using the cursor button, then press the **ENTER** button. The selected image will then be enlarged. Press the **ESC** button to return to the list.



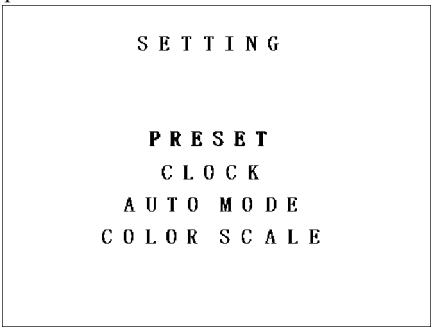
To delete an image, select an image, press the **ESC** button, then press the **ENTER** button. Press the **DISPLAY** button or **INDEX** button to return to measurement mode.

NOTE

- When many images are recorded (involving several tens of files), it may take more time to read the images.

Chapter 4
Setting

Press the **MENU** button to enter the setting mode (**SETTING**). To return to measurement screen, press the **ESC** button.



Choose a setting option using the up/down cursor button.

The following setting options are available:

- PRESET (measurement conditions)
  You can register up to 3 combinations of color scale temperature range, emissivity, and alarm upper/lower limits.
- CLOCK (time setting)
  Set the time and choose the clock display pattern.

- AUTO MODE (automatic data recording setting)
  Enter the settings for the logging recording.
- COLOR SCALE
  Choose a color scale to display.

4.1 Measurement Condition Setting (PRESET)

This is used to edit the settings of the measurement condition presets 1 to 3. Select **PRESET** in the menu and press **ENTER** to enter this screen.

SETTING (PRESET)

No	SCALE	ε	ALARM
1 :	-30～ 200℃	1.00	-15℃/ 150℃
2 :	0～ 100℃	0.98	15℃/ 80℃
3 :	-50～1000℃	0.90	-30℃/ 900℃

Set SCALE (color scale temperature range), ε (emissivity), and ALARM (alarm upper/lower limits).

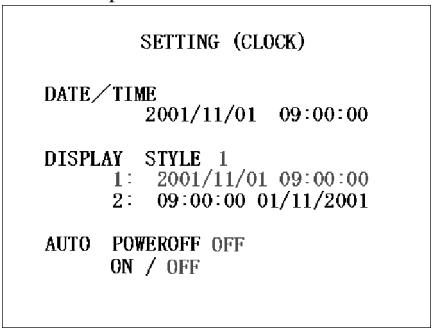
Move a cursor to the digit place you want to edit using the right/left cursor button.
Increase or decrease the number using the up/down cursor button.

The alarm upper/lower limits may be selected within the measurement temperature range. The upper limit must be greater than the lower limit.
The presets set on this screen are selected with the measurement condition selector button (**PRESET**).
Press the **ESC** button to return to the Menu screen (**SETTING**).

<Setting Range>
SCALE, ALARM : -50 to 1000℃ by every 1℃
ε : 0.10 to 1.00 by every 0.01

4.2 Clock

This sets date and time for the built-in clock and auto power off function. Select **CLOCK** from the menu and press **ENTER** to enter this screen.



Choose DATE/TIME (clock date and time), DISPLAY STYLE (display pattern), or AUTO POWER OFF.

The confirmed setting is shown in red.
Press the **ESC** button to return to the Menu screen (**SETTING**).

4.2.1 Set DATE/TIME (clock date and time)

Move the cursor to DATE/TIME using the right/left cursor button. Select the decimal place to be edited using the right/left cursor button. Increase or decrease the number by using the up/down cursor button.

4.2.2 DISPLAY STYLE (display pattern)

Move the cursor to DISPLAY STYLE using the right/left cursor button.
Choose 1 or 2 for the display pattern (DISPLAY STYLE) using the up/down cursor button.

4.2.3 Set AUTO POWER OFF

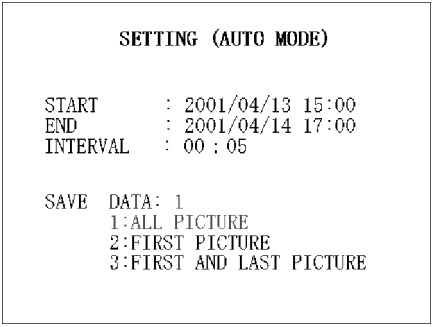
Move the cursor to AUTO POWER OFF using the right/left cursor button.
To set AUTO POWER OFF, choose between ON and OFF using the up/down cursor button.
When the Auto Power Off is enabled (ON) and the system has been idle for one minute, power will automatically be turned off. To turn power on again, slide the power switch to the right as in the regular operation procedure.

4.3 Automatic Data Recording (Logging) Measurement (AUTO MODE)

This sets the time to start measurement (**START**), the time to end measurement (**END**), and the measurement interval (**INTERVAL**) for logging measurements.

When **INTERVAL** is set to 00:00, the system does not perform logging measurement.

Select **AUTO MODE** in the menu and press **ENTER** to enter this screen.



Set the conditions for automatic data recording.

Chosen setting is shown in red.

START : Start time (year/month/day/hour/minute)

END : End time (year/month/day/hour/minute)

INTERVAL : Measurement interval (hour/minute)

Move the cursor to the field you want to edit using the right/left cursor button.

Increase or decrease the number using the up/down cursor button.

When INTERVAL is set to 00:00, the system does not perform automatic data recording.

SAVE DATA : Sets whether or not to save the image.
1:ALL PICTURE : Save the image at every recording.
2:FIRST PICTURE: Save the image at the start of recording only.
3:FIRST AND LAST PICTURE: Save the image at the start and end of recording.

Choose from 1 to 3 using the up/down cursor button.

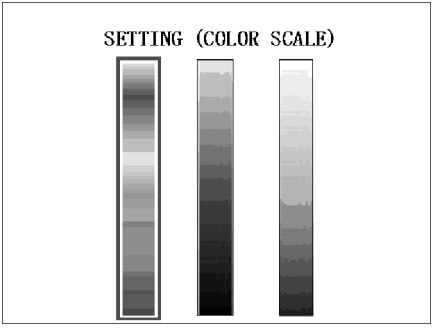
<Default Setting>
START : The start time entered in this screen.
END : The end time entered in this screen.
INTERVAL : 00:00
SAVE DATA : 1: ALL PICTURE

Press the **ESC** button to return to the Menu screen (**SETTING**).
Press the **ESC** button during automatic data recording to return to measurement screen.
Press the menu button (**MENU**) view the setting for automatic data recording on the SETTING (**AUTO MODE**) screen. When the setting is being displayed, data recording is suspended. Press the menu button (**MENU**) to return to the measurement screen and resume data recording.

4.4 Color Scale

This selects among three display patterns of the color scale used for temperature color frame or mosaic display.

Select **COLOR SCALE** in the menu and press **ENTER** to enter this screen.



Choose a pattern using the up/down cursor button. On the scale, the top is high and the bottom is low.

Press the **ESC** button to return to the Menu screen (**SETTING**).

Chapter 5
Transfer Function

Temperature measurement data is sent from the interface terminal on the main unit. Temperatures can be recorded, monitored, and alarms sent by connecting to a PC and creating a program.

NOTE

The data transfer function on the main unit is only able to transmit temperature measurement data repeatedly. The unit cannot be controlled via a PC (e.g. to change settings) and it is not possible to acquire camera image data.

5.1 Interface Specifications

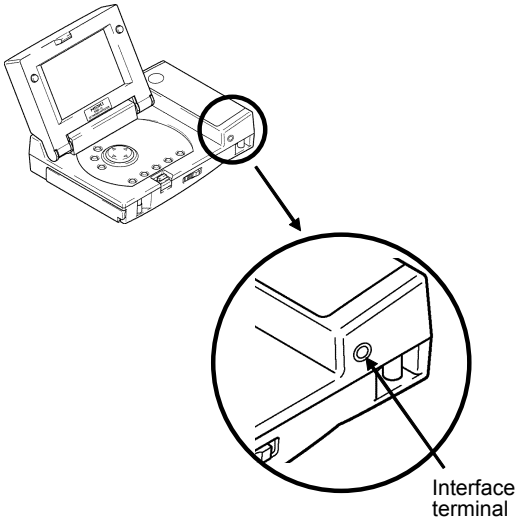
Item	Specifications	Remarks
Output data	Temperature measurement data (fixed-length binary data)	
Transmission interval	0.2 s	
Interface	RS-232C	No flow control
Signal	SD、GND	Transmission only; no reception
Transfer format	Asynchronous : 38400 bps Data bit : 8 Start bit : 1 Stop bit : 2 Parity bit : None	

5.2 Connection

⚠ WARNING

Always turn both devices OFF when connecting and disconnecting an interface connector. Otherwise, an electric shock accident may occur. To avoid damage to the product, do not short-circuit the terminal and do not input voltage or current to the terminal.

1. Insert the interface cable plug into the interface terminal on the main unit.
2. Connect the interface cable RS-232C connector to the PC COM port.



5.3 Transmission Data Format

5.3.1 Temperature Measurement Data

Temperature measurement data is transmitted repeatedly at intervals of approximately 200 ms while measurement is in progress. Data is sent each time as 133-byte fixed length binary data.

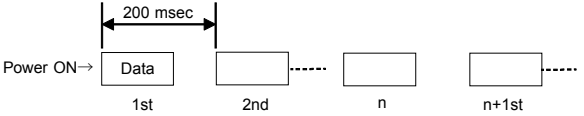
1st byte	Header	Measurement successfully completed : 20H Invalid data : 21H Not calibrated - Measurement not possible : 22H Data error - Calculation not possible : 23H
2nd byte	Emissivity setting ×100	64H for setting 1.00
3rd/4th bytes	Sensor temperature	2 bytes (first byte first)
5th-132nd bytes	Temperature measurement results	2 bytes ×64 points
133rd byte	Check sum	Last 8 bits of sum from 1st to 132nd byte

Sensor temperatures and temperature measurements are expressed as 2-byte data. Details are as shown below.

Sensor temperature, temperature measurement	Status, conversion formula
0000	Invalid temperature data (e.g. measurement results have not been saved)
0001～FFFEH	Temperature (Celsius) ×50+4096
FFFFH	Data error (error occurred during measurement or calculation)

Example: 0℃ →a Internal data 1000H
1000℃→ a Internal data D350H

5.3.2 Data Timing



Temperature measurement data (133 bytes) is transmitted automatically at 200 ms intervals. Transmission of temperature measurement data takes approximately 40 ms.

Measurement data is sent repeatedly, so the header data must first be detected before receiving the following 133 bytes to process the data. The header data cannot be detected if it is not distinct from the temperature measurement data. Processing is therefore required to cope with this situation, such as clearing the receipt buffer if no data is received within a preset time interval.

5.4 Temperature Measurement Result Sequence and Measurement Location

Each measurement data transmission contains 64 temperature measurement results. The sequence and measurement locations are as shown below.

Measurement surface

upper

	A	B	C	D	E	F	G	H
8	57	49	41	33	25	17	9	1
7	58	50	42	34	26	18	10	2
6	59	51	43	35	27	19	11	3
5	60	52	44	36	28	20	12	4
4	61	53	45	37	29	21	13	5
3	62	54	46	38	30	22	14	6
2	63	55	47	39	31	23	15	7
1	64	56	48	40	32	24	16	8

left

right

lower

The figures in the table indicate the temperature data transmission sequence.

Chapter 6
Specification

6.1 Product Specification

Temperature Measurement	
Detection element	Thermopile array
Measurement range	-50 to 1000℃
Sampling rate	Approx. 0.2 seconds
Number of elements	64 (Horizontal 8 x vertical 8)
Measurement view angle for one element	3.1square (55 mm square at 1 m)
Measurement view angle	24.8° square (440 mm square at 1 m)
Infrared wavelength	8 to 16 μm
Radiation ratio correction	0.1 to 1.00 (steps of 0.01)
Resolution	0.1℃(Note 1)
Accuracy	±10%rdg. ±2℃ (-50.0 to -0.1℃) ±2.0℃ (0.0 to 200.0℃) ±1%rdg. (200.1 to 1000.0℃) (Note 1)
Relative accuracy	1.0℃ (P-P, 23℃)

Note 1: At the standard measurement speed (**NORMAL**)

Visual Photography	
Detection element	Color CMOS
Frame Time	Approx. 0.5 seconds
Number of pixels	Approx. 300,000 pixels (640 x 480)
Image angle	Horizontal 50.0° x vertical 37.5° (Horizontal 930 mm x vertical 680 mm when the object is 1 m away)
Smallest distance	0.5 m
Display	

Display element	Transmission type color TFT liquid crystal
Size	3.8 inch
Number of pixels	Approx. 76800 pixels (320 x 240)
Display colors	65535 colors (16-bit)
Backlight	Cold cathode tube
Backlight brightness	3 adjustable levels + no light
Temperature indication (each element)	Frame color display (Display range and display pattern are selectable.)
Temperature indication (selected element)	Indicated by numerals
Parallax error	26 mm constant (Correction possibility with software)
Optical axis deviation	1.15° or less (20 mm when the object is 1 m away, excluding parallax error)

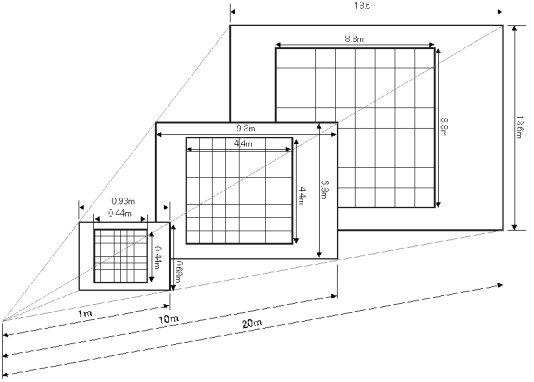
Functions	
Temperature units	℃
Logging measurement	Specified in units of minutes (hh:mm)
Interval	00:01 to 24: 00
Measurement data memory	Compact flash card (16 to 1 GB)
Storage format	JPEG file (image data, Definition 320 x 240, 640 x 480: Selection possibility) CSV file (temperature value data)
Battery remaining indicator	3-level display
Other functions	Image data deletion, audible click, alarm/buzzer, automatic power off, clock

Basic Specifications	
Data output	RS-232C (Temperature data only)
Image output	NTSC video output
Power source	LR6 (AA) alkaline batteries x 6, AC adapter (S-8392, KAGA COMPONENTS) (3915 OPTION PACK)
Rated power source voltage	1.5 V DC x 6 (LR6), 9 V DC (Exclusive use AC adapter)

Maximum rated power	13.5 VA
Continuous operating time	Approx. 70 minutes (intermediate level, about 23℃)
Dimensions	Approx. 165W x 55H x 123D mm Approx. 6.57" W x 2.17" H x 4.84" D (The main unit only with the LCD closed)
Mass	Approx. 700 g, Approx. 24.7 oz. (excluding battery)
Accessories supplied	LR6 (AA) alkaline batteries x 6, Strap, Compact flash card (16 MByte), Instruction manual
Options	3915 OPTION PACK (Portable case, Video cable, AC adapter) Serial communication cable, Black body spray, Black body tape, PC cards (compact flash and PC card adapter set) (9726 PC CARD 128M, 9727 PC CARD 256M, 9728 PC CARD 512M, 9729 PC CARD 1G) , PC card adapter (for compact flash card)
Environment condition	
Operating temperature and humidity range	0 to 40℃, 32 to 104℉ 35 to 75% RH; no condensation
Storage temperature and humidity range	-20 to 50℃, -4 to 122℉ 80% RH or less; no condensation
Temperature and humidity for guaranteed accuracy	23±5℃, 73℉±9℉ 35 to 75%RH; no condensation
Guaranteed accuracy period	1 year
Location for use	Indoor
Standards applying	
Safety	EN61010 Pollution Digree 2
EMC	EN61326 EN61000-3-2 EN61000-3-3

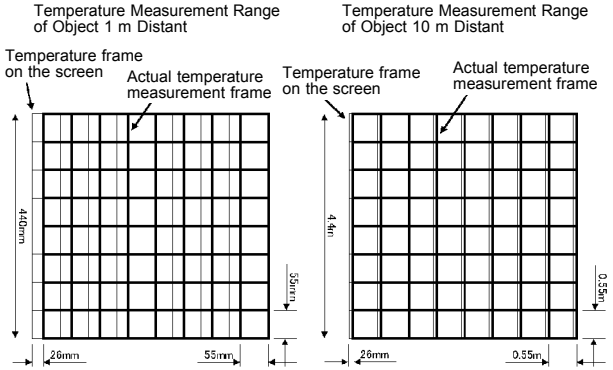
6.2 Measurement Range

- **Measurement range**



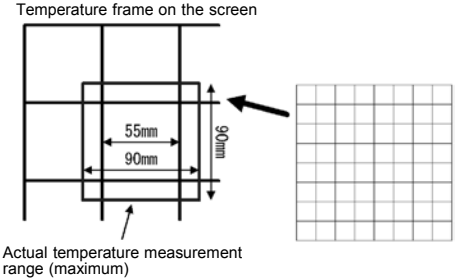
- The measurement range is proportional to the distance between the 3460-50 and the object.

• Parallax error



- The axes of the camera and the thermopile array are 26 mm apart from each other in parallel.
- Parallax error may be ignored if the distance to the object is set properly.

- **Measurement Area of Each Temperature Element (distance: 1.0 m)**



- The measurement result shows the average temperature in the measurement area.
- This range assumes that the optical efficiency is 90%.

Chapter 7 Maintenance and Service

7.1 Troubleshooting

- If damage is suspected, check the "Troubleshooting" section before contacting your dealer or Hioki representative.
- When sending the product for repair, remove the batteries and pack carefully to prevent damage in transit. Include cushioning material so the instrument cannot move within the package. Be sure to include details of the problem. Hioki cannot be responsible for damage that occurs during shipment.

Problem	Cause	Solution
No display / Power does not come on	Batteries are dead.	Replace the batteries.
	Backlight is set to no light.	Press the LIGHT button.
	The internal circuit is in a reset state due to a drop in voltage (including temporary drops).	Disconnect the AC adapter and remove the batteries. Wait at least one minute, then reconnect the adapter and reinstall the batteries.
Measured temperature value peculiar	Lens dirty and Adhesion of the drop of water	Clean the lens.
	There is a high heat source nearby.	Move the heat source away or shade the object from the thermal radiation of the heat source.
	The thermal emissivity value is not appropriate.	Set the thermal emissivity to an appropriate value.
	Remaining battery power is low.	Replace the batteries.
	The temperature of the 3460-50 is unstable.	Wait until the temperature stabilizes.

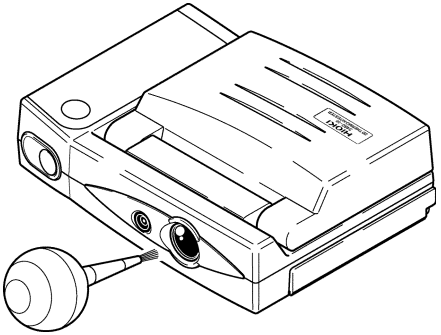
7.2 Maintenance

- Infrared lens

  The infrared lens is the most critical component for the temperature measurements. A dirty lens may cause measurement errors or shorten the life of the lens.

- If the lens is dirty

  If the lens is dirty, clean dust etc. off it using a camera lens cleaning tissue, blower or similar means. Wipe off moisture with gauze or cotton swab.
  If the lens is very dirty, clean it using a cotton bud containing a small quantity of alcohol.



- Body

  To clean the product, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.
  Wipe the LCD gently with a soft, dry cloth.

7.3 Emissivity Table

When the emissivity of the object is low, the readings may become unstable. In that case, use the blackbody spray or blackbody tape available as optional equipment.

Use the table below as a guide. Emissivity varies depending on the smoothness of the surface and the thickness of the material besides the material itself.

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		

7.4 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.

HIOKI

DECLARATION OF CONFORMITY

Manufacturer's Name: HIOKI E.E. CORPORATION

Manufacturer's Address: 81 Koizumi, Ueda, Nagano 386-1192, Japan

Product Name: 2D THERMO HiTESTER

Model Number: 3460-50

Option: 3915 OPTION PACK

The above mentioned product comforms to the following product specifications:

Safety: EN61010-1:2001

EMC: EN61326:1997+A1:1998+A2:2001+A3:2003
Class B equipment
Minimum immunity test requirement
EN61000-3-2:2006
EN61000-3-3:1995+A1:2001+A2:2005

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC.

HIOKI E.E. CORPORATION

27 December 2007

Mitsuyoshi Tanaka

Director of Quality Assurance

3460C999-02

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Instruction Manual

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Technical Support Section

All inquiries to International Sales and Marketing Department
81 Koizumi, Ueda, Nagano, 386-1192, Japan
TEL: +81-268-28-0562 / FAX: +81-268-28-0568
E-mail: os-com@hioki.co.jp
URL http://www.hioki.com/

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HIOKI

HIOKI E. E. CORPORATION

HEAD OFFICE
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 / FAX +81-268-28-0568
E-mail: os-com@hioki.co.jp
URL http://www.hioki.com/

HIOKI USA CORPORATION
6 Corporate Drive, Cranbury, NJ 08512, USA
TEL +1-609-409-9109 / FAX +1-609-409-9108

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