

HIOKI

3281/82 DIGITAL CLAMP ON HITESTER INSTRUCTION MANUAL

May 2001 Revised edition 1 Printed in Japan
3281A981-01 01-06H

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

HIOKI USA CORPORATION

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

E-mail: os-com@hioki.co.jp URL: http://www.hioki.co.jp

Introduction

Thank you for purchasing this HIOKI 3281/82 DIGITAL CLAMP ON HITESTER. To get the maximum performance from the product, please read this manual first, and keep it handy for future reference.

Inspection

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

Safety

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.

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

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

Safety Symbols

	The symbol printed on the product indicates that the user should refer to a corresponding topic in the manual (marked with the symbol) before using the relevant function. In the manual, the symbol indicates particularly important information that the user should read before using the product.
	Indicates a double-insulated device.
	Indicates DC (Direct Current).
	Indicates AC (Alternating Current).
	Indicates a grounding terminal.

Overvoltage Categories

To ensure safe use of measurement, IEC 60664 establishes safety level standards for different locations, classified as CAT I through CAT IV, and called overvoltage categories. These are defined as follows.

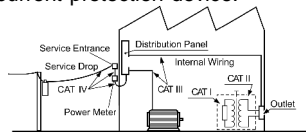
CAT I: Secondary electrical circuits that are connected to a wall outlet through a transformer or similar device.

CAT II: Primary electrical circuits in equipment connected to a wall outlet via 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 between the distribution panel and outlets.

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

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. Use of a lower category product in a higher category environment could result in a severe accident and must be carefully avoided.



Precautions

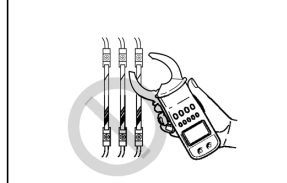
⚠ DANGER

This product is designed to conform to IEC 61010-1 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the product. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from product defects.

Do not use on the voltage lines exceeding 600 Vrms.



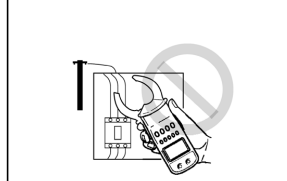
Do not use on bare conductors.



Do not input voltage in the resistance measurement, continuity checking and temperature measurement.

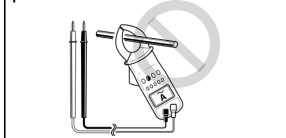


Do not use on the primary side of the breaker.

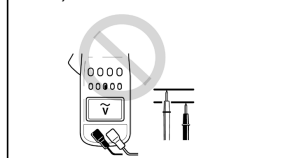


⚠ WARNING

During current measurement, do not connect the test leads or temperature probe to the product.



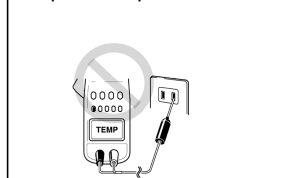
Do not input voltages exceeding 600 Vrms. (1000 V max.)



Avoid touching the exposed metallic parts of the clamp sensor while measuring voltage.



Do not input voltage to the temperature probe.



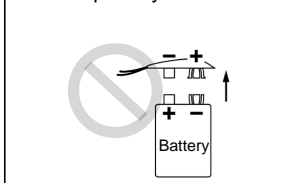
Do not use the unit with the back casing removed.



Do not use when your hands are wet.



Be sure to insert the battery with the polarity correct.



Do not short-circuit used batteries, disassemble them, or throw them in a fire.



- Handle and dispose of batteries in accordance with local regulations.
- To avoid electric shock when measuring live lines, wear appropriate protective gear, such as insulated rubber gloves, boots and a safety helmet.

⚠ CAUTION

Do not use or store the product where it is exposed to direct sunlight, high temperatures, high humidity, or condensation.



Do not use the cable or handle portion of the probe at higher than 70°C (158°F) or lower than -10°C (14°F).



Do not input subject the product to vibrations or shocks. Do not drop the product.

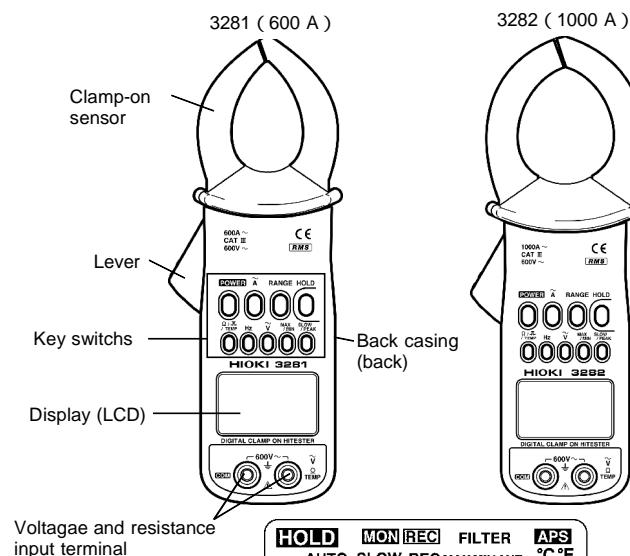


- Before using the product the first time, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.
- Before using the product, make sure that the insulation on the test leads is undamaged and that no bare conductors are improperly exposed. Using the product in such conditions could cause an electric shock. Replace the test leads and probes with the specified Hioki Model 9207.
- Do not use the unit if the battery is exhausted (when the **B** mark lights in the display area). Be sure to replace the exhausted battery with a new one.
- When replacing the battery, make sure that the metal battery snap fitting is firmly connected. If the metal fitting is loose, adjust it and recheck the connection. If it isn't connected securely, the power may not be turned on, and a power may be turned off during the use.

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.
- 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.

Names and Functions of Parts



	Alternating current		Fahrenheit
	Auto-ranging		Resistance
	Display update: approx. once per three seconds		Continuity
	Record function		Frequency
	Maximum value		Voltage
	Minimum value		Current
	Average value = (maximum value + minimum value) / 2		True RMS value
	One minute: one segment (bar graph)		Peak value
	One hour: one segment (bar graph)		Crest factor = Peak value / Effective value
	Data hold		Input over (bar graph)
	Auto power-off		Battery consumption warning
	Centigrade		

Specification

The 3281 and 3282 are different in the maximum range. (3281: 600 A, 3282: 1000 A)

1. Measurement specification

23°C +5°C (73°F +9°F), 80% RH max. () in the current ranges: 3282

Function	Mode	Range	Accuracy + (%rdg. +dgt.)	Maximum permissible input
AC current (A)	RMS (Effective value)	30.00	40 to 1 kHz: + (1.0%rdg. +0.7%fs.)	3281: 600 AAC continuous 1000 A max. 3282: 600 AAC continuous 1000 AAC (5 minutes) 1700 A max.
		300.0	45 to 66 Hz: + (1.0%+5)	
		600.0 (1000)	40 to 45, 66 to 1 kHz: + (1.5%+5)	
	PEAK (Peak value)	Auto-ranging	As per the above range	
		30.0	40 to 1 kHz: + (5%+5)	
		300	40 to 1 kHz: + (3%+5)	
AC voltage (V)	RMS	300.0/600	45 to 66 Hz: + (1.0%+3)	600 VAC continuous 1000 V max.
		Auto-ranging	40 to 45, 66 to 1 kHz: + (1.5%+5)	
	PEAK	300/600	40 to 1 kHz: + (3%+5)	
Crest factor		1.00 to 5.00	+ (10% + 5)	
Frequency (Hz)	Auto-ranging (100.0/1000)	30 to 99.9 Hz	+ (0.3%+1)	Effective in the voltage and current functions
		95 to 1000 Hz	+ (1%+1)	
Resistance (Ω)	Auto-ranging (1000/10.00k)	10 to 10.00 kΩ	+ (1.5%+5)	Open terminal voltage: 3 VDC max. Overload protection: 600 Vrms
Continuity		1000 Ω	Buzzer at approx. 30 Ω or less	
Temperature		°C	-50 to 150	+ (2% + 2) Add the accuracy of the 9462 THERMISTOR TEMPERATURE PROBE
		°F	-58 to 302	
				Overload protection: 600 Vrms

Accuracy is guaranteed for over 10% input of the range in current and voltage.

Temperature probe: 9462 (THERMISTOR TEMPERATURE PROBE)

Measurement range: -50 to 150°C -58 to 302°F
Accuracy: -50 to 50°C +3°C -58 to 62°F +6°F
50 to 100°C +4°C 62 to 182°F +8°F
100 to 150°C +5°C 182 to 302°F +10°F

2. General specifications

Diameter of measurable conductor	3281: 33 mm dia. max. (1.3"), 3282: 46 mm dia. max. (1.8")
Effect of conductor position	At any position based on the center of the core 3281: Within +4.0%, 3282: Within +1.0%
Effect of external magnetic field	In an external magnetic field of 400 AAC/m 3281: 1.5 A max., 3282: 0.2 A max.
Effect of radiated radio-frequency electromagnetic field (in 3 V/m)	Voltage measurement: 60 V max. Resistance measurement: 300 Ω max.
Function	Record (displays the maximum (MAX), minimum (MIN) and average (AVE) values in the AC current, AC voltage and frequency measurements), data hold (holds the display), auto-power off (approx. 10 minutes, the buzzer alarms just before the product is powered off, can be extended and released), buzzer (can be turned on or off)
Display	LCD, digital (3000 counts), bar graph (35 segments) Over range display: "O.L." or "▶" (bar graph input over) Battery consumption warning: "B" Data hold display: "HOLD" Auto power-off display: "APS" Units (A, V, Hz, Ω, kΩ, °C, °F) Zero suppressor: 5 counts max.
Display update rate	Digital display: approx. twice per second, SLOW: approx. once per 3 seconds, FAST: approx. 4 times per second Bar graph display: approx. 4 times per second (fixed)
Response time	Current, voltage frequency: approx. 2.2 seconds Resistance, temperature, continuity check: approx. 1.1 seconds
Range selection	Auto-ranging/manual ranging (fixed range) selectable (excluding the frequency, resistance, temperature and continuity check)
Circuit dynamic (Crest factor)	2.5 max. (600 A (3281), 1000 A (3282), 600 V range: 1.7)
Dielectric strength	5.55 kVAC/1 minute between the case and input terminals, and the case and clamp core
Location for use	Altitude up to 2000 m (6562 feet), Indoors
Standards applying	EN 61010-1: 1993+A2:1995 Safety Overvoltage Category III (anticipated transient overvoltage 6000 V) Pollution Degree 2 EN 61010-2-031:1994 EN 61010-2-032:1995 EN 60529:1991 IP40 (protected against access to hazardous parts with a wire) EMC EN 61326-1:1997+A1:1998
Operating temperature and humidity range	0 to 40°C (32 to 104°F), 80% RH max. (no condensation)

Temperature characteristics	0.05 x accuracy specifications/°C(°F) at 0 to 40°C (32 to 104°F)
Storage temperature range	-10 to 50°C (14 to 122°F) (no condensation)
Power source	Rated power voltage 9 VDC x 1 6F22 layer-built manganese battery x 1
Maximum rated power	100 mVA
Battery lifetime	Approx. 50 hours (continuous, no load)
External dimensions and mass	62 (W) x 218 (H) x 39 (D) mm, approx. 350 g (3281) 2.44" (W) x 8.58" (H) x 1.54" (D), approx. 12.3 oz. (3281) 62 (W) x 230 (H) x 39 (D) mm, approx. 400 g (3282) 2.44" (W) x 9.06" (H) x 1.54" (D), approx. 14.1 oz. (3282)

- 3. Accessories**
9207 TEST LEADS (black and red set), Instruction manual, 9399 CARRYING CASE, Hand strap, 6F22 (006P) battery

- 4. Option**
9462 THERMISTER TEMPERATURE PROBE

Measurement Procedure

Preparation

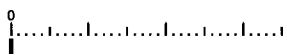
- Loosen the case back screw, and load the battery in the unit. (Refer to Battery Replacement Procedure on page 11.)
- Press the POWER key to power on the unit. Check to make sure that all display segments light.



New battery



Remaining amount of the battery: 50%



Remaining amount of the battery: 0 "B" lights. The buzzer beeps three times.

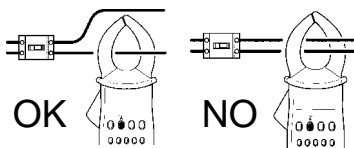
- The product is in the AC current measurement state.

Low battery voltage detection function

After the "B" mark lights and battery voltage drops below a certain level, the power goes off automatically. When this occurs, **bAtt** and **Lo** are displayed. When power goes off after display of these marks, replace the exhausted battery with a new one.

AC current (ACA) measurement A

- Press the \tilde{A} key.
- Position the conductor within the core centered. Make sure that only one conductor is in the core. The effective value (RMS) of current is displayed in the digital and bar graph. Ranging is automatic (AUTO).



NOTE

- Use data hold function when you abolish indication and want to read it.
- In some cases, the unit cannot measure the secondary side of an inverter or other devices that produce special waveforms. A frequency character is 40 Hz to 1 kHz.
- Current measurements exceeding 600 A should be of short duration. Heat builds up in the clamp core proportionate to the current value, and will reach a dangerous level over a long period of time.

Range selection

Pressing the RANGE key repeatedly cycles through the 30 A, 300 A, 600 A and AUTO ranges.

Changing the display update SLOW

When the readings fluctuate and are difficult to take, it is possible to make the display update slow (approx. once per three seconds), and the readings easy to take. The bar graph cannot be displayed at "SLOW".

Pressing the SLOW/PEAK key repeatedly changes the display as follows.



Peak value display PEAK

The peak value is displayed. The effective value is displayed in the bar graph.

NOTE

- It may not be able to be measured when rush electric current and so on is charged with big electricity in a short time.
- The input more than 1 kHz or the peak value of the pulse width shorter than 1 ms cannot be measured correctly.
- This is not a function to hold the peak value. (Refer to 1 of the record functions when you hold peak value.)

Crest factor display C.F.

The crest factor of a waveform is displayed. Crest factor = Peak value / Effective value. The crest factor of a sine waveform where no distorted, and the harmonic components are generated.

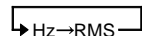
When the crest factor of current is being displayed, "A" flashes. The effective value is displayed in the bar graph.

Wave form	Sine wave	Triangular wave	Square wave
C.F.	1.41	1.73	1

Frequency display Hz

- Press the Hz key.
- Pressing the Hz key changes the display.
- The frequency of the current being measured is displayed.

When no input is applied, "----" is displayed. When measuring the current frequency, "A" flashes. The effective value is displayed in the bar graph.



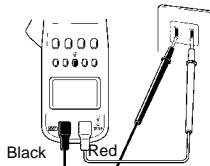
NOTE

- When the frequency is lower than 30 Hz, "----" is displayed.
- The AUTO range display indicates the current range.

AC voltage measurement V

- Press the \tilde{V} key.
- The effective value (RMS) of voltage is displayed in the digital display and bar graph. The display update changing, and the peak value, crest factor and frequency displays are possible as well as in the AC current measurement.

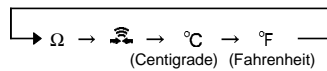
NOTE In some cases, the unit cannot measure the secondary side of an inverter or other devices that produce special waveforms. A frequency character is 40 Hz to 1 kHz.



Plug in the test leads

Resistance measurement

- Insert test lead in the product as the figure.
- Pressing the Ω /TEMP key repeatedly, and let me indicate Ω . Changes the display as follows.



(Centigrade) (Fahrenheit)

The resistance value is displayed in the digital display and bar graph. Ranging is automatic (AUTO).

NOTE

- Even if voltage is accidentally input, the alarm beeps, and the internal circuit is protected up to 600 VAC, but stop measurement at once.
- In some cases, the alarm does not beep for DC or DC weighted components.

Continuity check

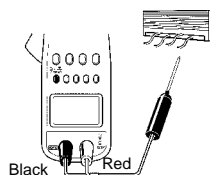
- Let me indicate "diode symbol" in the same way as the resistance measurement. The buzzer beeps at less than approximately 30 Ω , and "diode symbol" flashes.

NOTE

- The digital display indicates the measured resistance value.
- Even if voltage is accidentally input, the alarm beeps, and the internal circuit is protected up to 600 VAC, but stop measurement at once.
- In some cases, the alarm does not beep for DC or DC weighted components.

Temperature measurement TEMP (°C, °F)

- Insert 9462 TEMPERATURE PROBE (option) as the figure.
- Push Ω /TEMP key, and let me indicate °C or °F. Display °C for Centigrade display.



Plug in the 9462 TEMPERATURE PROBE

Data hold function HOLD

Data hold functions to "stop" the display at its present reading.

- Press the HOLD key. "HOLD" appears, and the digital and bar graph displays are held. This function is effective for all measurements. To release this function, press the HOLD key again.

Auto power-off function APS

When "APS" is being displayed, the auto power-off function is effective. The unit is powered off in approx. 10 minutes unless any key is pressed.

"APS" flashes and the alarm beeps for approx. 30 seconds just before the unit is powered off. Pressing a key other than the POWER key prolongs the auto power-off function for 10 minutes.

To release the auto power-off function, press the POWER key while holding down the HOLD key to power on the unit. In this case, "APS" does not appear. When using the record function, the auto power-off function is ineffective.

Battery consumption warning

Accuracy is not guaranteed because the battery is worn out, when "B" is indicated. Replace with a new battery. Refer to "Preparation" for the confirmation of the capacity of the battery.

Buzzer

To turn off the buzzer, press the POWER key while holding down the RANGE key to power on the product. The alarm and continuity buzzers cannot be turned off.

FAST mode

Make it FAST mode when you do the measurement of such as the starting current. The digital display update can be set to approx. 4 times per second.

- Press the \tilde{A} key twice to set to the FAST mode. "F" appears for an instance, and the unit enters the FAST mode.. Then "F" appears each time the A or V key is pressed.
- Press the RANGE key to fix the current range.
- It is convenient for taking readings to hold the maximum value (MAX) by using the record function.
- To release the FAST mode, press the \tilde{A} key twice again.

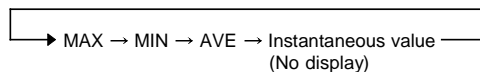
NOTE

- The stable measurement cannot be made unless the waveform lasts for more than 250 ns.
- Push a \tilde{V} key in the case of the voltage measurement as well after it is made FAST mode.
- This mode is not effective for the resistance, continuity and temperature measurements.
- If setting to the SLOW display in the FAST mode, the display update is the same as in the normal mode (approx. twice per second).

Record function REC

Use the recording function to hold the maximum and minimum measured values and maximum/minimum averages.

- Measurement indicated value. Pressing the MAX/MIN key during measurements of current, voltage, or frequency activates the recording function. REC flashes and the product saves the maximum value (MAX), minimum value (MIN), and average value (AVE) in internal memory from the instant you press the MAX/MIN key. Pressing the MAX/MIN key with the recording function activated switches the display as shown below. If MAX, MIN, or AVE is not displayed, an instantaneous value is assumed.



Data (MAX, MIN, AVE) remains displayed while the display is switched. If maximum or minimum data is updated in the meantime, however, the data values will change. With the recording function activated, the auto power-off function remains disabled. (APS off.)

The average value (AVE) displayed is calculated by: Average Value = [(Maximum value + Minimum Value)/2].

If the recording function is activated and MAX selected after you activate PEAK mode with the SLOW/PEAK key, the peak-hold function is enabled.

- Display of Elapsed Time. When you press the MAX/MIN key to activate the recording function, the bar graph segments flash and the elapsed time appears. When "min" is shown in the right-hand corner of the bar graph, each segment of the bar graph corresponds to one minute. Every time one minute elapses, one segment of the flashing bar graph goes on. When all segments on the bar graph go on, the elapsed time is 30 minutes.

When the elapsed time exceeds 30 minutes, one segment of the flashing bar graph goes off every time one minute elapses.

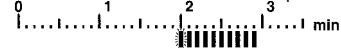
When the segments left of a flashing segment remain on: the number of "on" segments represents the elapsed time (0 ~ 29).

The illustration below shows when 20 minutes have elapsed:



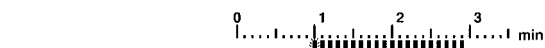
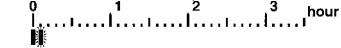
When the segments right of a flashing segment remain on: the number of "off" segments (+30) represents the elapsed time (30 ~ 59).

The illustration below shows when 50 minutes have elapsed:



When digital display switches the average value (AVE) to a instantaneous value when you press the MAX/MIN key, the right corner of the bar graph indicates hours. In this mode, each segment of the bar graph corresponds to one hour. The way to read the bar graph here is similar to reading it in minutes. When all bar graph segments remain on, the elapsed time is 29 hours.

The illustration below shows when one hour, 40 minutes have elapsed.



- Deactivation of Recording Function. Pressing the HOLD key deactivates the recording function. HOLD goes on, REC stops flashing and goes on, and the elapsed time stops incrementing. While the recording function is being deactivated, data is not updated, even if the clamp sensor is disconnected from the conductor. Pressing the HOLD key again cancels HOLD display and activates the recording function again, with REC flashing again.

- Cancellation and Resetting of Recording Function. To cancel the recording function, press the related function key (A, V or Hz) for the measurement in progress. Once the recording function is canceled, the auto power-off function becomes effective. (APS goes on.) To restart the unit after resetting the data temporarily cancel the recording function, then activate it again by pressing the MAX/MIN key.

NOTE

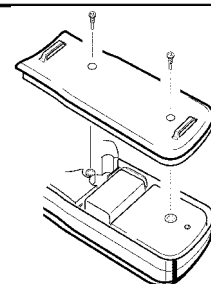
- An instantaneous power failure and a surge cannot be detected. The record function is not effective for the resistance and temperature measurements.
- The maximum recording duration depends on the remaining battery capacity.
- The lowest possible frequency that can be displayed is 30 Hz.
- If changing the range when "O.L." is being displayed in any of the displays, the held data and elapsed time are cleared.
- When you need minimum value and average value data, make sure to activate the recording function during measurement. If the function is activated when there is no input, the minimum value will remain zero. To deactivate the recording function, press the HOLD key to terminate measurement. If you disconnect the clamp or test lead from the circuit under measurement without deactivating the recording function beforehand, the minimum value will be zero.
- When the unit is turned off, accumulated data are lost.

Battery Replacement Procedure

WARNING

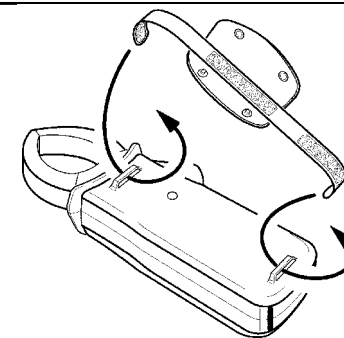
When replacing the battery, be sure to insert them with the correct polarity. Otherwise, poor performance or damage from battery leakage could result. Replace battery only with the specified type.

- Remove the two back casing screws, and take off the back casing.
- Remove the old battery without pulling the codes of the snap.
- Install a new battery in the battery snap securely.
- Attach the back casing.



How to Attach the Hand Strap

The hand strap improves the operation.



Troubleshooting

Although the product seems to be out of order in the following cases, there may be the causes of the troubles. Check it again before you send it for repair.

Symptom	Battery	Battery snap	Test leads	Temperature probe
The product cannot be powered on.			-	-
The product is powered off soon after "B" lights.		-	-	-
"B" lights.		-	-	-
The product is powered off during operation.		-	-	-
Voltage measurement does not function.	-	-	-	-
Resistance measurement does not function.	-	-	-	-
Temperature measurement does not function.	-	-	-	-
Remedy: If the trouble cannot be remedied, send the product for repair.	Replace with a new battery.	The terminals of the battery snap are poorly contact.	Check the test leads wiring.	Check the temperature probe wiring.*

An indication E.001 to E.005 appears. Send the product for repair.

*The resistance of the temperature probe is normally approx. 70 Ω to 2 k Ω .

Service

- The shortest period for possession of the repair parts is 5 years after stopping the production.
- For inquiries about service, contact your dealer or Hioki representative.
- Pack the product carefully so that it will not be damaged during shipment, and include a detailed written description of the problem. Hioki cannot be responsible for damage that occurs during shipment.

HIOKI

DECLARATION OF CONFORMITY

Manufacturer's Name:	HIOKI E.E. CORPORATION
Manufacturer's Address:	81 Koizumi, Ueda, Nagano 386-1192, Japan
Product Name:	DIGITAL CLAMP ON HITESTER
Model Number:	3281, 3282
Accessory:	9207 TEST LEADS
Option:	9462 THERMISTER TEMPERATURE PROBE

The above mentioned products conform to the following product specifications:

Safety:	EN61010-1:1993+A2:1995 EN61010-2-031:1994 EN61010-2-032:1995
---------	--

EMC:	EN61326-1:1997+A1:1998 ClassB equipment Portable test and measurement equipment
------	---

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

21 June 2001

HIOKI E.E. CORPORATION

Yuji Hioki
Yuji Hioki
President

3281A999-02