HIOKI

Instruction Manual

8205-10

MICRO HiCORDER

HIOKI E. E. CORPORATION

July 2013 Revised edition 10 8205B981-10 13-07H

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Contents

Introduction

Thank you for purchasing the Hioki 8205-10 MICRO HiCORDER. To obtain maximum performance from the instrument, please read this manual first, and keep it handy for future reference.

Inspection

When you receive the instrument, 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.

Accessories

9344 CARRYING CASE	1
L9257 CONNECTION CORD	1
9235 RECORDING PAPER (15 m)	1
Roll Paper Spools	2
AC Power Cord	1
Instruction Manual	1

Options

9235 RECORDING PAPER (15 m, 10 rolls)	1
9236-01 RECORDING PAPER (15 m, Climate-resistant; 10 rolls)	1
9650 CLAMP ON SENSOR	1
9651 CLAMP ON SENSOR	1
9667 FLEXIBLE CLAMP ON SENSOR*	1
9668 CLAMP ON SENSOR	1

*: A separate conversion adapter is also necessary. Contact your dealer or Hioki representative.

Safety Notes

This instrument is designed to conform to IEC 61010 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 instrument. 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.

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

Safety Symbols

- The ⚠ symbol printed on the instrument 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 instrument.


Indicates a grounding terminal.


Indicates DC (Direct Current).


Indicates AC (Alternating Current).


Indicates both DC (Direct Current) and AC (Alternating Current).

Indicates the ON side of the power switch.


Indicates the OFF side of the power switch.

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

DANGER	Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.
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 instrument.
NOTE	Advisory items related to performance or correct operation of the instrument.

Accuracy

We define measurement tolerances in terms of f.s. (full scale) values, with the following meanings:

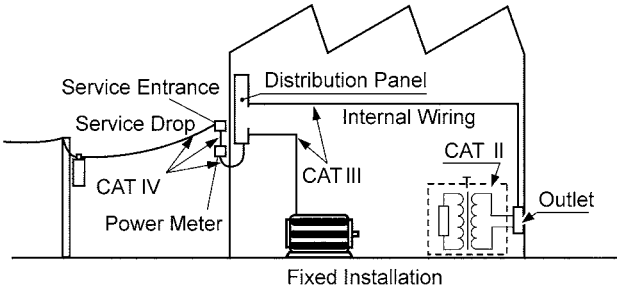
f.s.	(maximum display or scale value, or length of scale) Signifies the maximum display (scale) value or the length of the scale (in cases where the scale consists of unequal increments or where the maximum value cannot be defined). In general, this is the range value (the value written on the range selector or equivalent) currently in use.

Measurement categories

This instrument complies with CAT III safety requirements. To ensure safe operation of measurement instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT II to CAT IV, and called measurement categories. These are defined as follows.

CATII	Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.) CAT II covers directly measuring electrical outlet receptacles.
CATIII	Primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.
CATIV	The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).

Using a measurement instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.
Use of a measurement instrument that is not CAT-rated in CAT II to CAT IV measurement applications could result in a severe accident, and must be carefully avoided.



Notes on Use

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

DANGER

- **The maximum input voltage is 500 V DC/AC. Attempting to measure voltage in excess of the maximum input voltage could destroy the instrument and result in personal injure or death.**
- **The maximum rated voltage between input terminals and ground is 500 V DC/500 VrmsAC. Attempting to measure voltages exceeding 500 V with respect to ground could damage the instrument and result in personal injury.**
- **Connection cords or clamp-on sensor should be made only at the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**
- **To avoid short circuits and potentially life-threatening hazards, never attach the clamp to a circuit that operates at more than the maximum rated voltage, or over bare conductors.**

WARNING

- **To avoid electric shock, do not allow the instrument to get wet, and do not use it when your hands are wet.**
- **To avoid electric accidents and to maintain the safety specifications of this instrument, connect the power cord provided only to a 3-contact (two-conductor + ground) outlet.**
- **To avoid electric shock when measuring live lines, wear appropriate protective gear, such as insulated rubber gloves, boots and a safety helmet.**
- **Do not use the product where it may be exposed to corrosive or combustible gases. The product may be damaged or cause an explosion.**

⚠CAUTION

- This instrument is designed for indoor use, and operates reliably from 5 to 40°C.
- Do not store or use the instrument where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the instrument may be damaged and insulation may deteriorate so that it no longer meets specifications.
- This instrument is not designed to be entirely water- or dust-proof. To avoid damage, do not use it in a wet or dusty environment.
- To operate from DC power, pay careful attention to polarity when making power connections, and set the power source switch to the DC position (⎓) before use. Also, before changing the power source, unplug the (∿) power cord from the outlet to prevent hazards, and remove the connection cord from any object under test.
- Avoid stepping on or pinching the cable, which could damage the cable insulation.
- Keep the cables well away from heat sources, as bare conductors could be exposed if the insulation melts.
- To prevent an electric shock accident, confirm that the white or red portion (insulation layer) inside the cable is not exposed. If a color inside the cable is exposed, do not use the cable.
- Be careful to avoid dropping the clamps or otherwise subjecting them to mechanical shock, which could damage the mating surfaces of the core and adversely affect measurement.
- Keep the clamp jaws and core slits free from foreign objects, which could interfere with clamping action.
- For shipping or long-term storage, be certain that the recording head is in the raised position. Otherwise the rollers could be deformed and cause uneven printing.

NOTE

- Use only recording paper specified by Hioki. Non-specified recording paper may result in poor-quality or blank printouts.
- Avoid using the printer in hot, humid environments, as this can greatly reduce printer life.
- 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.
- This instrument may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Before Use

Before using the instrument 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.

WARNING

Before using the instrument, make sure that the insulation on the connection cords is undamaged and that no bare conductors are improperly exposed. Using the instrument in such conditions could cause an electric shock, so contact your dealer or Hioki representative for repair.

Chapter Summary

This manual consists of the following chapters. "Introduction", "Safety Notes", "Notes on Use" describe precautions on use, overview, and features of this unit. Be sure to read them all. Next, check Chapter 1 to 5 and the unit to confirm your understanding of the function.

Chapter 1 Product Overview

Outlines the product and explains the names and functions of its parts.

Chapter 2 Measurement Procedures

Explains procedures for measurement using the product.

Chapter 3 Changing the Recording Paper

Explains how to replace the recording paper.

Chapter 4 Specifications

Sets forth specifications of the product.

Chapter 5 Maintenance and Service

Provides information maintenance and service information for the product.

Chapter 1
Product Overview

1.1 Product Overview

The multi-functional recording Model 8205-10 MICRO HiCORDER is almost as easy to use as a simple DMM. A broad range of applications, from small-signal electronic circuitry to commercial power circuits, are supported by wide AC and DC voltage measurement ranges covering 0.1 to 500 volts, a graduated analog-style amplitude display and current measurement functions when used with an optional clamp-on sensor.

1.2 Features

(1) Easy operation

The large single-function controls allow operation without requiring repeated reference to the manual.

(2) Graduated analog-style amplitude display

The high-resolution graduated display and data display matching the selected range allow input signal levels to be viewed like an analog meter.

(3) Recording paper printout

Setup conditions for recorded data and elapsed time are printed out with recorded measurements, eliminating the need for complex multiple printouts for record storage and reporting.

(4) Wide measurement ranges

The 0.1 to 500-V AC and DC ranges support a wide variety of applications, and optional clamp-on sensors are available to measure current.

(5) True rms display

The true effective-value conversion circuitry provides accurate measurements, even of distorted waveforms.

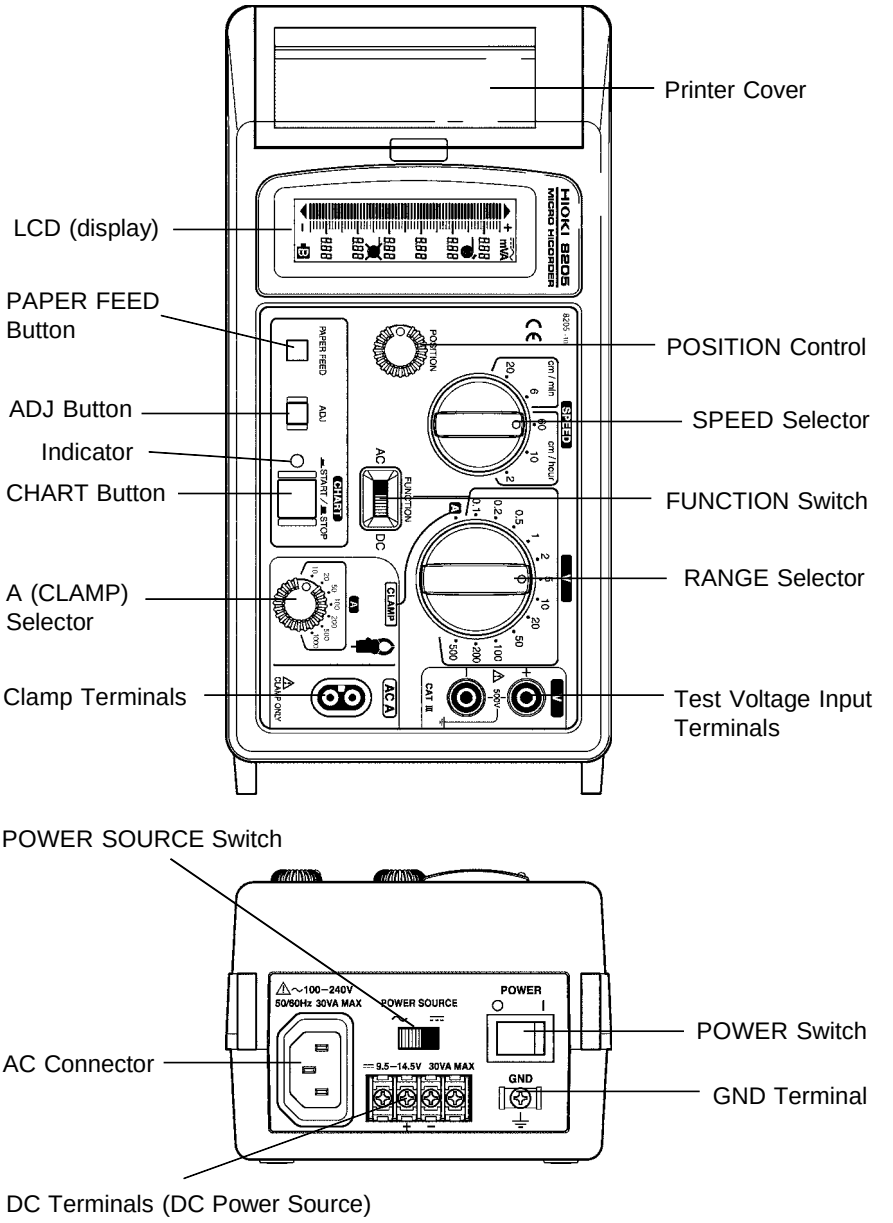
(6) Dual power supply system

Power can be supplied from either the AC mains or a 12-V DC source. AC mains supply voltages between 100 to 240 V AC are automatically selected.

(7) Handy carrying case

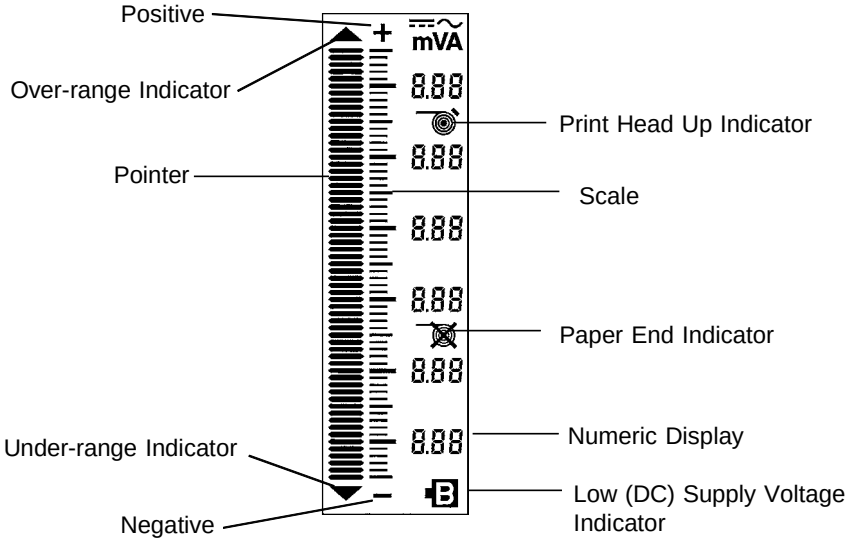
The supplied carrying case includes storage for the power cord and recording paper.

1.3 Front Panel



LCD (display)	Displays the signal level and device status, including selected mode and range, numeric scale values, and indicators. States such as print head up, out of paper and low supply voltage are also displayed.
PAPER FEED Button	Manually advances the recording paper Pressing this button momentarily advances the paper about 30 mm. Holding this button advances the paper continuously.
ADJ Button	Adjusts the zero-reference point for measurements
Indicator	This indicator lights when the **CHART** button is in the START state, and blinks when the print head is up and at paper end (in the START state).
CHART Button	Starts and stops recording
A (CLAMP) Selector	Selects input sensitivity to match a connected clamp-on sensor (when used), and applies that sensitivity internally so that the range setting prints appropriately on the recording paper
Clamp Terminals	Connect a clamp-on sensor to these terminals to measure current
Test Voltage Input Terminals	Apply the test voltage across these terminals for measurement
RANGE Selector	Selects the measurement signal type and amplitude range. **Daisabled for A ranges.**
FUNCTION Switch	Selects AC or DC measurement
SPEED Selector	Sets the transport speed of the recording paper
POSITION Control	Sets the relative display position of the numeric scale marks for measuring input signals, and the DC offset (for DC measurements). **Daisabled for A and ACV ranges.**
Printer Cover	Covers the printer mechanism and recording paper storage
POWER SOURCE Switch	Selects whether the recorder is to be powered from AC mains, or DC
AC Connector	Connect the AC cord here to operate the recorder from commercial power (100 to 240 V AC)
DC Terminals (DC Power Source)	Connect a 12-V (nominal) DC supply to these terminals to operate the recorder from DC power
GND Terminal	This is a signal reference ground to establish a reference for eliminating stray effects such as noise from measurements
POWER Switch	Turns the recorder on an off

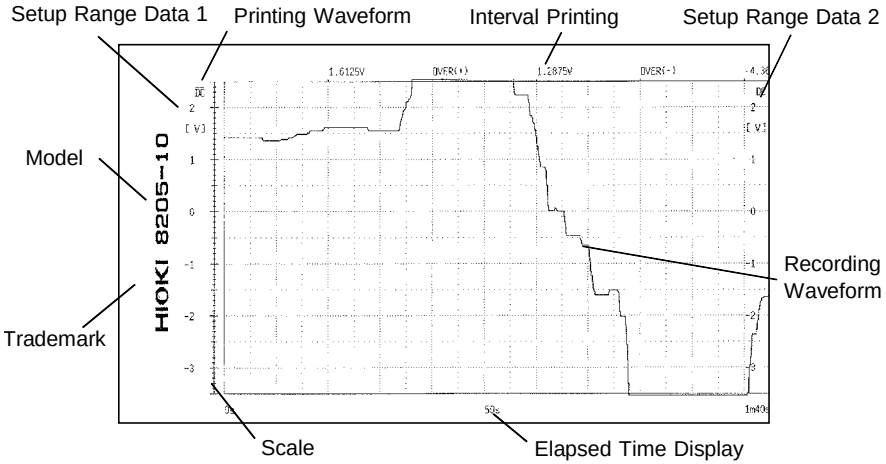
1.4 LCD (Display)



Over-range Indicator	This arrow lights when the input signal exceeds the upper limit of the selected range (the highest level segment lights at the same time).
Pointer	The input signal level is indicated by the lit segment (pointer) in the graduated bar-type scale
Under-range Indicator	This arrow lights when the input is below the lower limit of the selected range (the lowest level segment lights at the same time).
Low (DC) Supply Voltage Indicator	Lights when the DC supply voltage is low.
Numeric Display	These numeric values are the amplitude values of the gradations on the meter scale, according to the selected range (six 3-digit, 7-segment numerals plus decimal point)
Paper End Indicator	Lights when no recording paper is present.
Scale	This graduated scale contains the pointer (lit segment) that indicates the input signal level.
Print Head Up Indicator	Lights when the print head is raised.

1.5 Printout Information

Example of DC-5 V range case



Setup Range Data 1	The print setup signal type, numeric value of the range and display units are printed once when the **CHART** button is pushed (ON).
Model	Prints when the **CHART** button is pushed (ON)
Trademark	Prints when the **CHART** button is pushed (ON)
Scale	Prints when the **CHART** button is pushed (ON)
Elapsed Time Display	Prints at 5-division intervals
Setup Range Data 2	Prints at 10-division intervals, and when the range setting or position control is changed.
Interval Printing (numeric amplitude)	The input signal amplitude is printed numerically at specific intervals. If the measurable range is widely over range, the following indications will appear. **DC mode** OVER(+): Indicates the amplitude is over range (positive side). OVER(-): Indicates the amplitude is over range (negative side). **AC, Current mode** OVER(+): Indicates the amplitude is over range.
Printing Waveform	Prints when the average mode is selected. Unaverage mode: DC, Average mode: $\overline{DC}$
ADJ Data	See Section 2.7, Item 9 regarding ADJ button

NOTE When the printing speed is set to 20 cm/min (maximum), the recording waveform prints lightly.

Chapter 2
Measurement Procedures

2.1 Preparations

WARNING

- **To avoid electric accidents and to maintain the safety specifications of this instrument, connect the power cord provided only to a 3-contact (two-conductor + ground) outlet.**
- **To avoid electrical accidents, turn the power switch off and unplug the power cords from the outlet after use.**

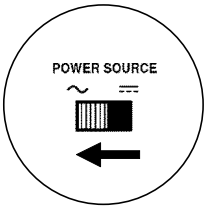
(1) Check the paper

Check the installation condition and amount of paper remaining before starting a measurement. Refer to Chapter 3 for the paper installation procedure, if necessary.

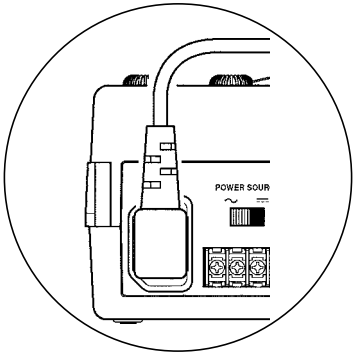
(2) Connect the power

This product can be operated from either AC mains or 12 V DC.

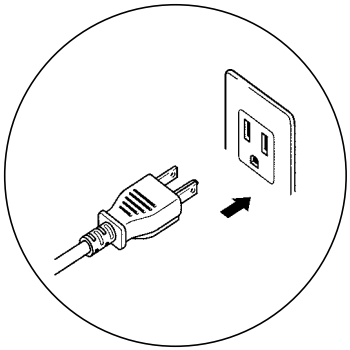
❑ AC Operation



1. Set the **POWER SOURCE** switch to the ∼ (AC) position.



2. Connect the supplied power cord to the socket on the recorder.

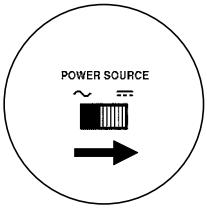


3. Plug in the power cord. Insert the plug directly into the outlet.

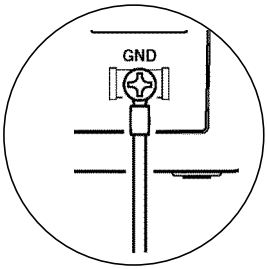
NOTE

- Although the product can operate from 100 to 240 V AC, the power cord should be selected to conform to the requirements of the mains voltage used.
- To avoid electrical accidents, unplug the power cord from the outlet after use, and turn the power switch off.

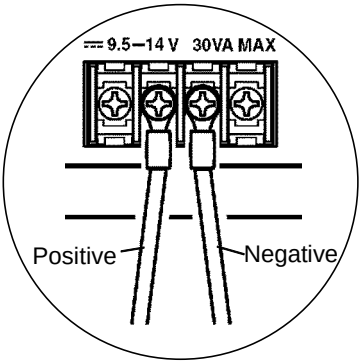
❑ DC Operation



1. Set the **POWER SOURCE** switch to the ⎓ (DC) position.



2. Connect the GND terminal to earth ground.



From 9.5 to 14-V DC power source

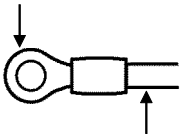
3. Connect a source of 9.5 to 14-V DC to the terminals.

NOTE

- A proper ground connection is important for safety and to ensure stable operation.
- The power wiring should be of sufficient current capability to handle the power consumption (30 VA maximum) of the product, with a margin for safety.

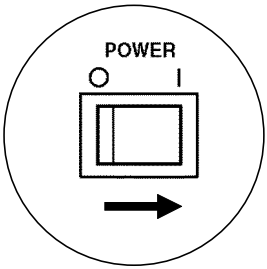
NOTE We recommend the following wiring for power connections.

PVC-insulated ring-type crimp-on terminals
(3.2-mm ID, less than 6-mm OD)



Vinyl-insulated wire, at least 1.25 mm^2 (#14 AWG)

(3) Powering on



1. Slide the **POWER** switch to the on position (O→ I).

2. The LCD should light. Confirm that no error indicators appear.

(4) Make the appropriate settings for the intended type of measurement:

To measure DC voltage, see Section 2.2, DC Voltage Measurement.
To measure AC voltage, see Section 2.3, AC Voltage Measurement.
To measure AC current, see Section 2.4, AC Current Measurement 1.
To measure AC current (using the 9667 FLEXIBLE CLAMP ON SENSOR), see Section 2.5, AC Current Measurement 2.
To measure AC current (using a voltage output clamp-on probe), see Section 2.6, AC Current Measurement 3.

2.2 DC Voltage Measurement

DANGER

To avoid electric shock, short circuits and damage to the instrument, observe the following precautions:

- **The maximum input voltage is 500 V DC/500 VrmsAC. Attempting to measure voltage in excess of the maximum input voltage could destroy the instrument and result in personal injure or death.**
- **The maximum rated voltage between input terminals and ground is 500 V DC/500 VrmsAC. Attempting to measure voltages exceeding 500 V with respect to ground could damage the instrument and result in personal injury.**
- **When connecting clip-type connection cords to live terminals, be very careful to avoid accidentally shorting conductors together and causing a serious accident.**
- **Connection cords should be made only at the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**
- **If the input signal level is unknown, begin measuring with the highest range to determine the approximate signal level, then select the appropriate range for actual measurement.**
- **Disconnect the connection cords from the measurement object before switching ranges.**

WARNING

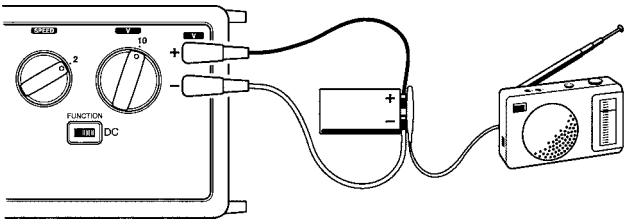
To avoid electrical shock, be careful to avoid shorting live lines with the connection cords.

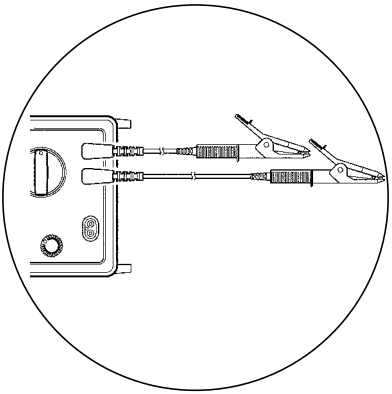
⚠CAUTION

For safety reasons, use only the supplied connection cords to connect the instrument input terminals to the circuit to be tested.

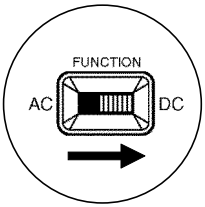
Example 1

Measuring the continuous operation of a device.
Battery used for test: 6F22 (9V)
Estimated recording period: 90 hours
Measure continuously until the battery replacement warning is displayed.

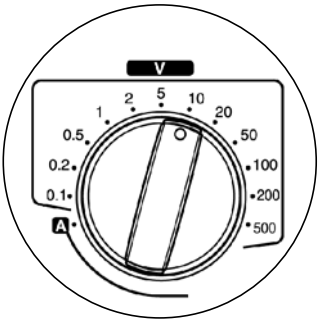




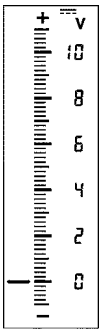
1. The supplied connection cords connect to the Test voltage input terminals.

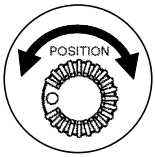


2. Set the **FUNCTION** switch to **DC**.

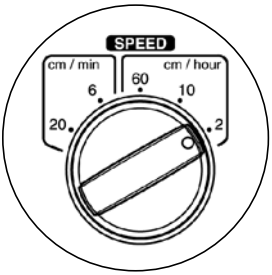


3. Set the Range selector to **10 V**, corresponding to the input signal level.

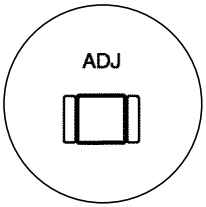




4. Adjust the **POSITION** control to display 0 to 10V (see Section 2.7, Item 3 regarding POSITION control adjustment).

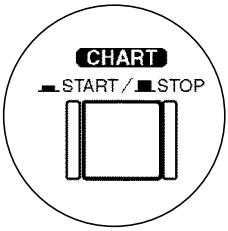


5. Set the **SPEED** selector to **2 cm/hour** (according to particular application).



6. Press the **ADJ** button to reset the zero position. (see Section 2.7, Item 9 regarding ADJ button).

7. Connect the connection cords in parallel with the device under test.



8. Press the **CHART** button to begin measuring.

9. Recording proceeds for the estimated test period (until the battery replacement warning is displayed).

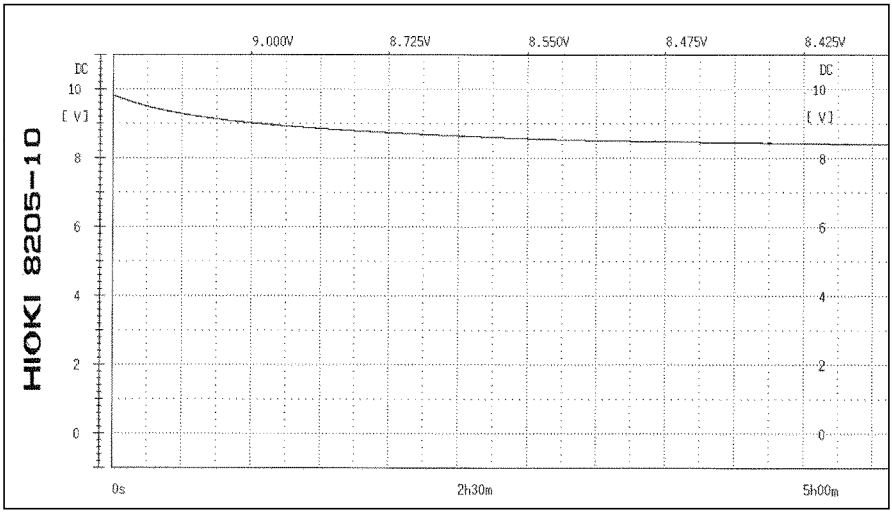
10. Press the **CHART** button again to stop recording.

11. Disconnect the connection cords from the circuit under test.

12. Press the **PAPER FEED** button to feed out the recording paper, and cut it off.

13. Turn the **POWER** switch off (◯→ |).

14. Inspect the results. In this example, the elapsed time until the battery voltage decreases to the warning level can be read from the printout and the scale.



2.3 AC Voltage Measurement

DANGER

To avoid electric shock, short circuits and damage to the instrument, observe the following precautions:

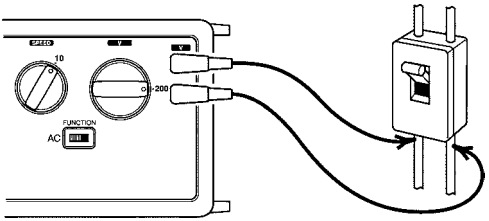
- **The maximum input voltage is 500 V DC/500 VrmsAC. Attempting to measure voltage in excess of the maximum input voltage could destroy the instrument and result in personal injure or death.**
- **The maximum rated voltage between input terminals and ground is 500 V DC/500 VrmsAC. Attempting to measure voltages exceeding 500 V with respect to ground could damage the instrument and result in personal injury.**
- **When connecting clip-type connection cords to live terminals, be very careful to avoid accidentally shorting conductors together and causing a serious accident.**
- **Connection cords should be made only at the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**
- **If the input signal level is unknown, begin measuring with the highest range to determine the approximate signal level, then select the appropriate range for actual measurement.**
- **Disconnect the connection cords from the measurement object before switching ranges.**
- **To avoid electric shock and short-circuit accidents, use only the supplied connection cords to connect the instrument input terminals to the circuit to be tested.**

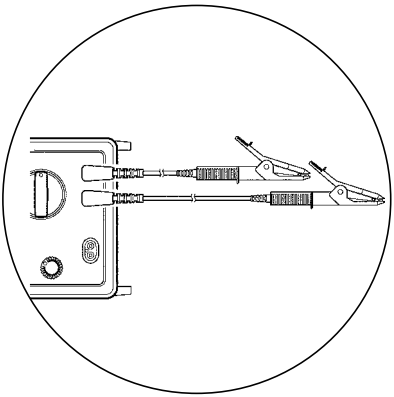
WARNING

To avoid electrical shock, be careful to avoid shorting live lines with the connection cords.

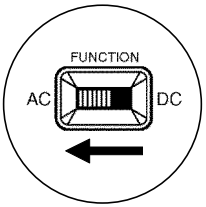
Example 2

Recording voltage changes at a breaker.
Estimated test voltage: 200 V AC
Recording period: 24 hours

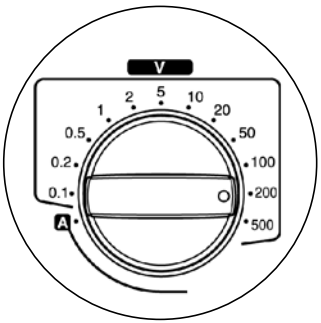




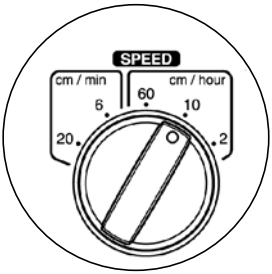
1. The supplied connection cords connect to the Test voltage input terminals.



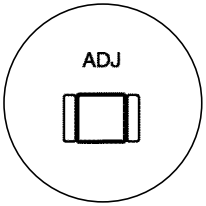
2. Set the **FUNCTION** switch to **AC**.



3. Set the Range selector to **200 V**, corresponding to the input signal level.

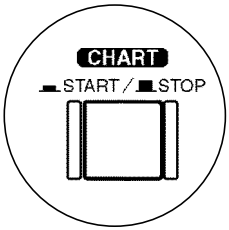


4. Set the **SPEED** selector to **10 cm/hour** (according to particular application).



5. Press the **ADJ** button to reset the zero position. (see Section 2.7, Item 9 regarding ADJ button).

6. Connect the connection cords in parallel with the device under test.



7. Press the **CHART** button to begin measuring.

8. Record for 24 hours.

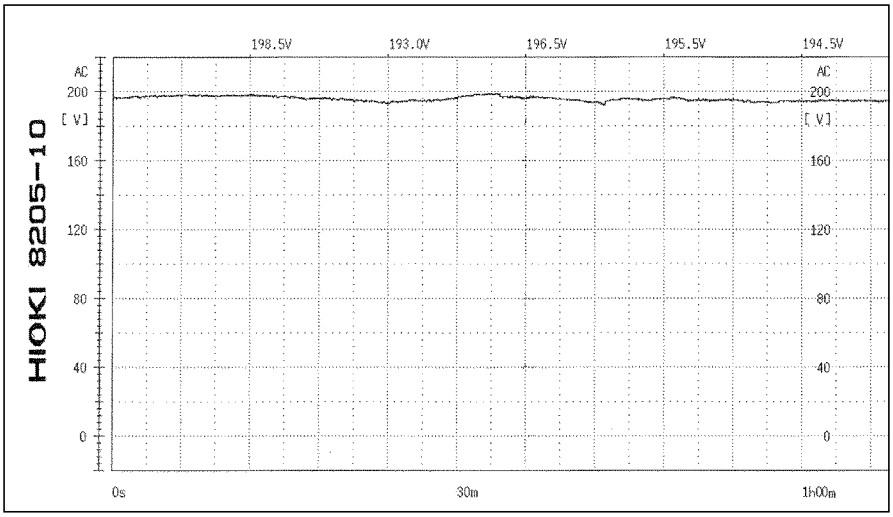
9. Press the **CHART** button again to stop recording.

10. Disconnect the connection cords from the circuit under test.

11. Press the **PAPER FEED** button to feed out the recording paper, and cut it off.

12. Turn the **POWER** switch off (○→ |).

13. Inspect the results. In this example, the voltage changes at the breaker over 24 hours can be read from the printout and the scale.



2.4 AC Current Measurement 1

DANGER

To avoid electric shock, short circuits and damage to the instrument, observe the following precautions:

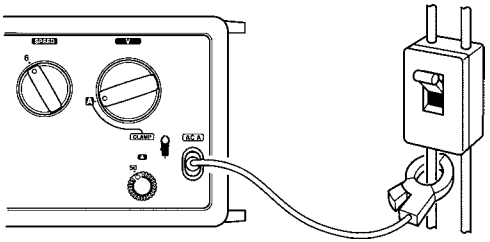
- **Clamp-on sensor should be made only at the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**
- **To avoid short circuits and potentially life-threatening hazards, never attach the clamp to a circuit that operates at more than the maximum rated voltage or over bare conductors.**
- **If the input signal level is unknown, begin measuring with the highest range to determine the approximate signal level, then select the appropriate range for actual measurement.**
- **Disconnect the clamp-on sensor from the measurement object before switching ranges.**

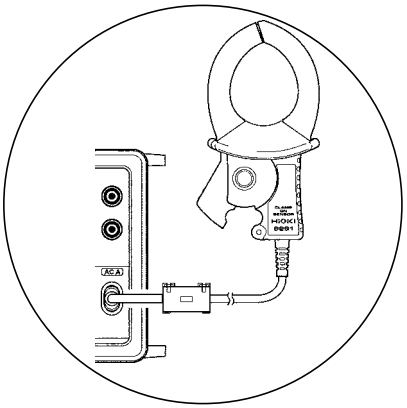
⚠CAUTION

- Note that the clamp-on sensor may be damaged if current exceeding the selected measurement range is applied for a long time.
- To prevent damage to the clamp-on sensor, never connect or disconnect a sensor while the power is on.

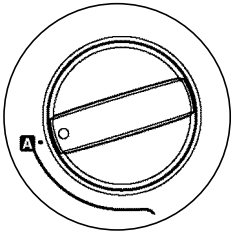
Example 3

Recording current flow through a breaker.
Estimated test current: 30 A
Recording period: 10 minutes

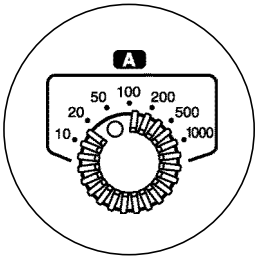




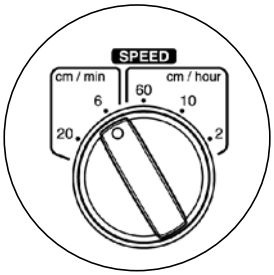
1. Connect the optional clamp-on sensor to the Clamp terminals.



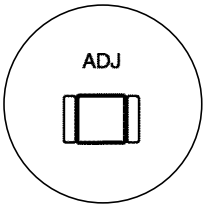
2. Set the Range selector to the **A** position.



3. Set the **A** (CLAMP) selector to **50 A** sensitivity.

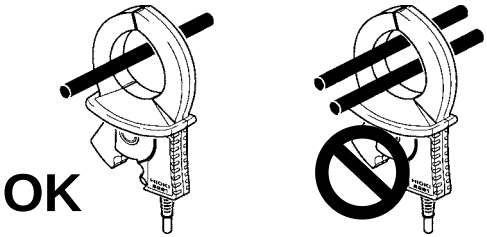


4. Set the **SPEED** selector to **6 cm/min** (according to particular application).



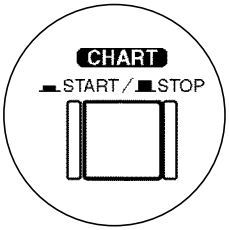
5. Press the **ADJ** button to reset the zero position. (see Section 2.7, Item 9 regarding ADJ button).

6. Clip the clamp on sensor.



NOTE

- Attach the clamp around only one conductor. Single-phase (2-wire) or three-phase (3-wire) cables clamped together will not produce any reading.
- Position the conductor so that it is as nearly centered in the clamp core as possible.
- Non-sinusoidal waveforms such as the secondary side of inverters may not be measurable.
- Depending on the size and frequency of the measured current, the core of the clamp may hum as a result of resonance. This does not affect measurement performance.
- Do not attempt to measure current levels that are likely to exceed the specified maximum rating of the clamp-on sensor.



7. Press the **CHART** button to begin measuring.

8. Record for 10 minutes.

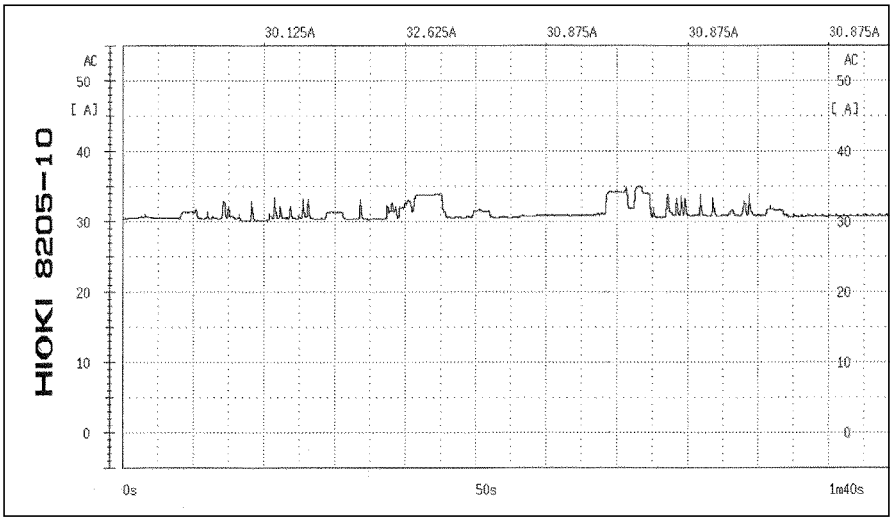
9. Press the **CHART** button again to stop recording.

10. Remove the clamp from the conductor being measured.

11. Press the **PAPER FEED** button to feed out the recording paper, and cut it off.

12. Turn the **POWER** switch off (○→ |).

13. Inspect the results. In this example, the current flow through the breaker over ten minutes can be read from the printout and the scale.



2.5 AC Current Measurement 2

Use the optional 9667 FLEXIBLE CLAMP ON SENSOR.

DANGER

To avoid electric shock, short circuits and damage to the instrument, observe the following precautions:

- **The clamp-on sensor should be made only at the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**
- **To avoid short circuits and potentially life-threatening hazards, never attach the clamp-on sensor to a circuit that operates at more than the maximum rated voltage or over bare conductors.**
- **If the input signal level is unknown, begin measuring with the highest range to determine the approximate signal level, then select the appropriate range for actual measurement.**
- **Disconnect the clamp-on sensor from the measurement object before switching ranges.**

⚠CAUTION

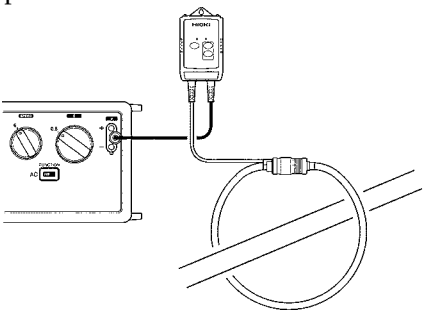
- Note that the clamp-on sensor may be damaged if current exceeding the selected measurement range is applied for a long time.
- When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.
- To prevent damage to the clamp-on sensor, never connect or disconnect a sensor while the power is on.

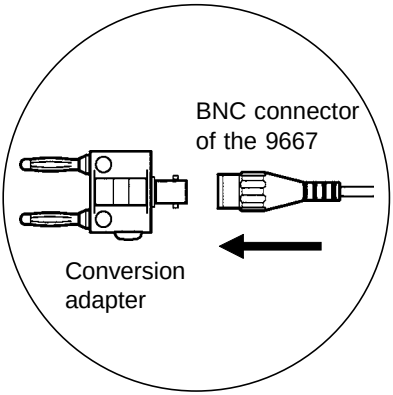
NOTE

When using the 9667 to measure current, results must be scaled according to the range of the 9667. For details, see step **16**. A separate conversion adapter is also necessary.

Example 4

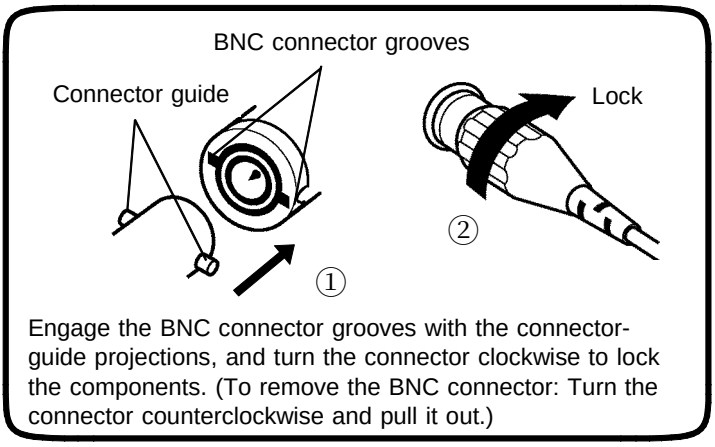
Recording current with the 9667 FLEXIBLE CLAMP ON SENSOR.
Estimated test current: 2500 A
Recording period: 10 minutes



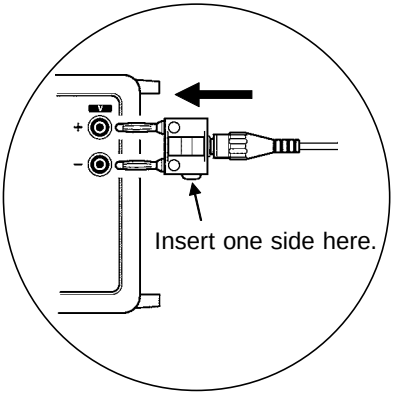


1. Connect the BNC connector* of the 9667 to the conversion adapter.

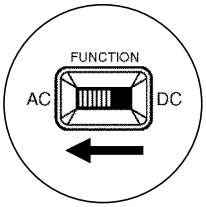
*Contact your dealer or Hioki representative.



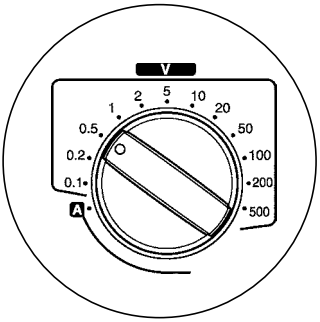
Engage the BNC connector grooves with the connector-guide projections, and turn the connector clockwise to lock the components. (To remove the BNC connector: Turn the connector counterclockwise and pull it out.)



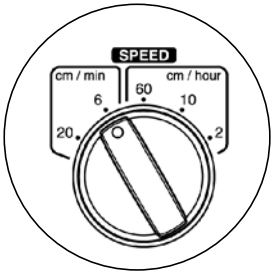
2. Connect the conversion adapter to the test voltage input terminals. When measuring high voltage and high frequency signals, see 2.5.1 "When Measuring High Voltage and High Frequency Signals."



3. Set the **FUNCTION** switch to **AC**.



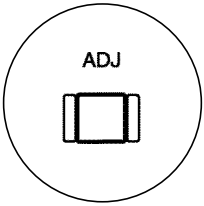
4. Set the Range selector to **0.5 V**, corresponding to the input signal level.



5. Set the **SPEED** selector to **6 cm/min** (according to particular application).

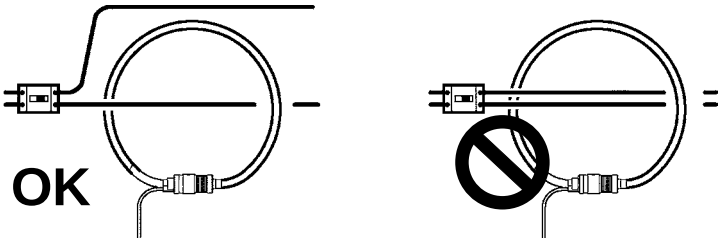
6. Confirm that the 9667 is not clamped on a power line, and that the contacts of the 9667 are locked in place.

7. Turn on the 9667, and set the **RANGE** button of the 9667 to appropriate range for actual measurement.



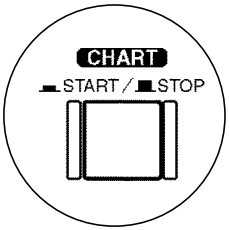
8. Press the **ADJ** button to reset the zero position. (see Section 2.7, Item 9 regarding ADJ button).

9. Clamp the conductor.



NOTE

- Attach the clamp-on sensor around only one conductor. Single-phase (2-wire) or three-phase (3-wire) cables clamped together will not produce any reading.
- Position the conductor so that it is as nearly centered in the clamp core as possible.
- Non-sinusoidal waveforms such as the secondary side of inverters may not be measurable.
- Do not attempt to measure current levels that are likely to exceed the specified maximum rating of the clamp-on sensor.
- Measurement results may vary slightly when ambient temperature fluctuates greatly. (Thermal drift)



10. Press the **CHART** button to begin measuring.

11. Record for 10 minutes.

12. Press the **CHART** button again to stop recording.

13. Turn off the 9667, and remove from the conductor being measured.

14. Press the **PAPER FEED** button to feed out the recording paper, and cut it off.

15. Turn the **POWER** switch off (○→ |).

16. Inspect the results. In this example, the current flow through the breaker over ten minutes can be read from the printout and the scale.

To read values, scale results using the following table according to the range of the 9667.

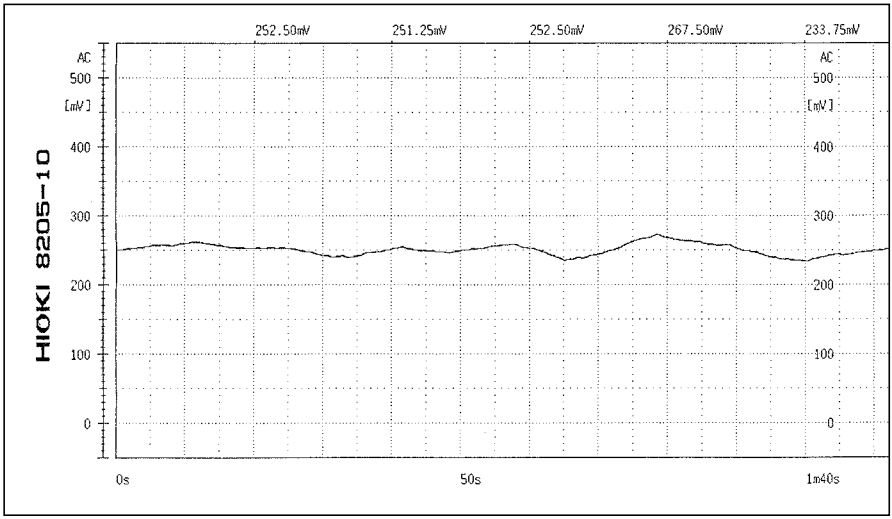
Range of the 9667	Scaling value
500 A	1 A/mV
5000 A	10 A/mV

Example

Range: 5000 A, reading value: 250 mV

Reading value X Scaling value = Measurement value

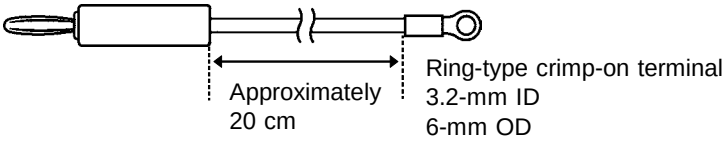
250 [mV] X 10 [A/mV] = 2500 [A]



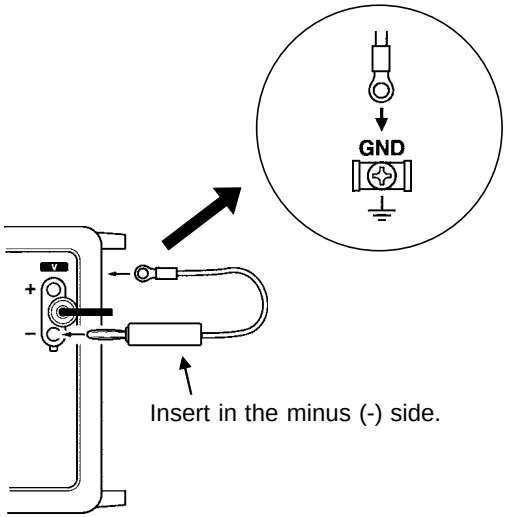
2.5.1 When Measuring High Voltage and High Frequency Signals

When measuring high voltage and high frequency signals using the 9667, the leak current increases due to the stray capacitance inside the unit. To measure high voltage and high frequency signals, use the following procedure.

Prepare a lead wire that is fitted with a banana plug.



Connect the round pressure terminal on the lead wire to the unit's GND terminal.



Insert the banana plug into the conversion adapter.

2.6 AC Current Measurement 3

Measure current by using a voltage output clamp-on probe (9010, 9010-02, 9018, or 9018-01) that is not one of the dedicated optional sensors.

DANGER

To avoid electric shock, short circuits and damage to the instrument, observe the following precautions:

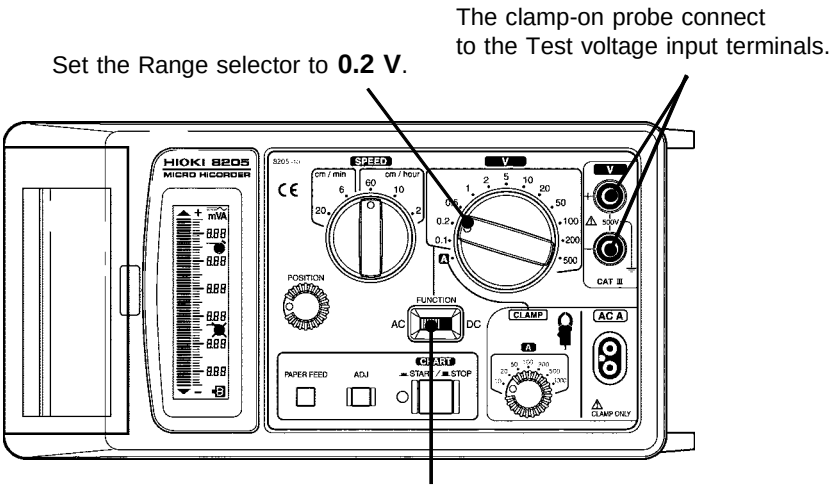
- **Clamp-on probe should be made only at the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.**
- **To avoid short circuits and potentially life-threatening hazards, never attach the clamp to a circuit that operates at more than the maximum rated voltage or over bare conductors.**
- **If the input signal level is unknown, begin measuring with the highest range to determine the approximate signal level, then select the appropriate range for actual measurement.**
- **Disconnect the clamp-on probe from the measurement object before switching ranges.**

CAUTION

- Note that the clamp-on probe may be damaged if current exceeding the selected measurement range is applied for a long time.
- To prevent damage to the clamp-on probe, never connect or disconnect a sensor while the power is on.

NOTE

- Make the sensitivity setting in the clamp-on probe.
- Because the data that is printed on the recording paper is for 0.2V AC, scaling is necessary.



Scaling method

The measurement value is calculated according to the following formula.

Reading value X Scaling value = Measurement value

The following table lists the scaling values for each clamp-on probe.

Range of the clamp-on probe	Scaling value
10 A	0.05 A/mV
20 A	0.1 A/mV
50 A	0.25 A/mV
100 A	0.5 A/mV
200 A	1 A/mV
500 A	2.5 A/mV

2.7 Common Measurement Operations

(1) Starting and ending recording

Pressing the **CHART** button down starts recording, and pressing it again (to return it to the undepressed STOP position) ends recording.

NOTE

- The **PAPER FEED** button and **ADJ** button are disabled while the **CHART** button is depressed (ON).
- Changing the range during recording, the new scale is printed.

(2) Paper transport speed

Use the **SPEED** selector to set the paper transport speed.

NOTE

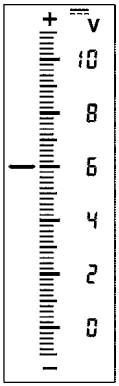
Settings can be changed during recording, but the setting information cannot be printed. Check the elapsed time printed on the paper.

(3) POSITION control

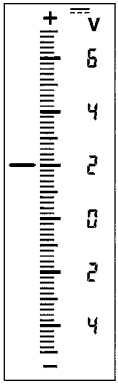
When measuring DC voltage, the displayed zero position can be offset by up to 20% of the maximum range limit. This feature is useful when the input signal contains both polarities.

Display Example of 10-V DC Range Case

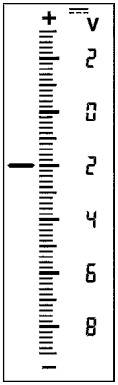
Normal State



Centered POSITION State



Maximum Offset State



(4) PAPER FEED button

Use this button for manual paper recording.
Pressing this button momentarily advances the paper about 30 mm. Holding this button advances the paper continuously.

NOTE The button is disabled during automatic recording.

(5) FUNCTION switch

Set to DC or AC to measure direct or alternating current, respectively.

(6) Range selector

Set according to the expected maximum amplitude of the measured signal.

(7) AC current measurement

To measure AC current using an optional clamp-on sensor, connect the clamp-on sensor to the clamp terminals and set the range selector to A. Also, set the A (CLAMP) selector to match the input sensitivity of the clamp with the expected maximum current to be measured.

NOTE
- The **FUNCTION** switch setting is ignored when measuring with the clamp-on sensor.
- For details on how to use the 9667 FLEXIBLE CLAMP ON SENSOR to measure AC current, refer to section 2.5, "AC Current Measurement 2."

(8) Printing waveforms

Either average or peak values can be selected for waveform printing. The selection is made when turning the power on (when the power is off, the standard condition is selected).

❑ Unaveraged mode (standard setting)

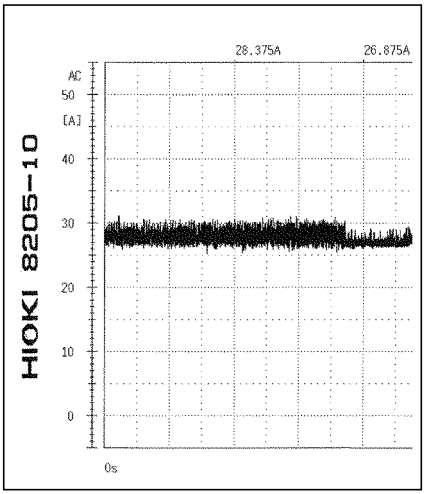
The printed waveform consists of the minima and maxima points of the data sampled between printing intervals. This mode is useful for recording rapid changes in input signals, such as instantaneous electrical faults.

❑ Average mode

The printed waveform consists of the average of the data points between printing intervals.
The printing waveform mode is displayed as $\overline{AC}$ or $\overline{DC}$.

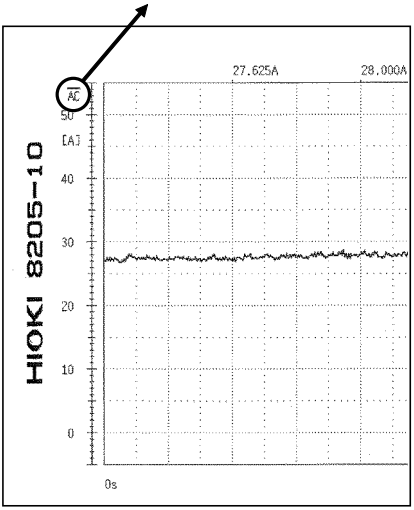
The following shows the relation between the paper transport speeds and intervals.

Papertransport speed	Intervals
20 cm/min	37.5 ms
6 cm/min	125 ms
60 cm/hour	750 ms
10 cm/hour	4.5 s
2 cm/hour	22.5 s



Standard Condition

Average mode

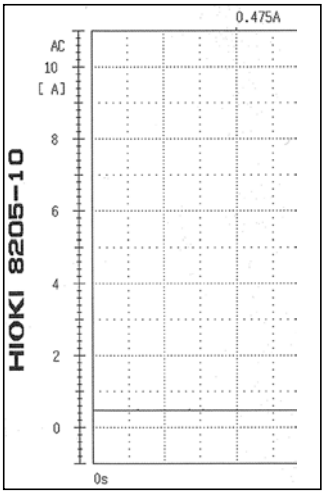


Hold the **PAPER FEED** button while turning the **POWER** switch on.

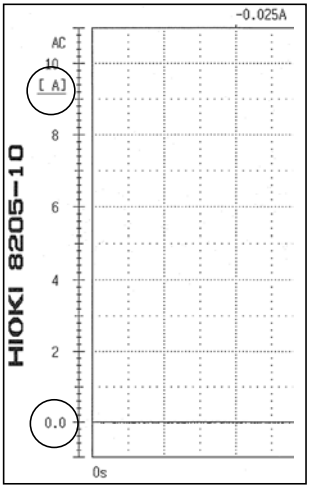
NOTE Continuing to hold the switch causes the paper to feed.

(9) ADJ button

Press this button to adjust the fine offset of the zero position during measurement. While shorting the connection cords together, press this button to reset the zero position. After adjusting the zero position, the "0" in the numeric display of the LCD changes to "0.0", the "0" in the range setting information for the recording paper changes to "0.0", and "_" appears under the unit display.



Before adjusting



After adjusting

NOTE

- This button is intended only for fine adjustment of the zero position. It cannot compensate for a large offset. The range for zero position adjustment is ± 25%f.s.(Voltage measurement)/± 2%f.s.(Current measurement).
- The zero adjustment is lost when power is turned off or range selector setting is changed, so reset the zero position again if necessary when power is turned on.
- The button is disabled during automatic recording.
- After verifying that input is 0, press the **ADJ** button. To ensure zero input, either short the tips of the connection cords or short the test voltage input terminals. Measurement error will be larger in any input is present when the **ADJ** button is pressed.
- For accurate measurements, press the **ADJ** button only when the conductor is not clamped and the core junction is closed (when the input value is 0).
- After changing the range, press the **ADJ** button to reset the zero position

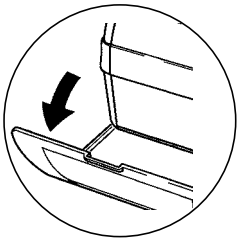
Chapter 3
Changing the Recording Paper

3.1 Opening and Closing the Printer Cover

⚠CAUTION	Avoid forcing the printer cover, as the hinge could break.

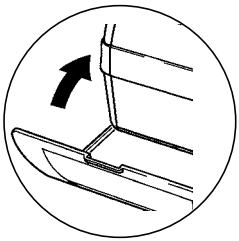
❑ Opening the Printer Cover

1. Hook your fingertip under the projecting part of the printer cover, and pull it up slightly to disengage the catch.



2. Open the cover when the catch is disengaged.

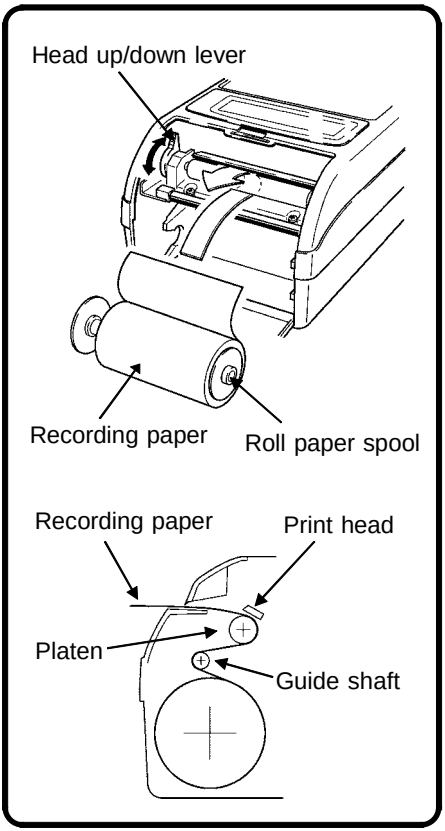
❑ Closing the Printer Cover



1. Confirm that some paper is sticking out before closing the printer cover.

2. Align the hook in the cover with the catch on the unit, and press the cover lightly until the catch engages.

3.2 Installing Recording Paper



1. Raise the print head. Move the head up/down lever up to raise the print head.

2. Insert the spool into the recording paper roll.

3. Install the spool and paper roll into the holder.

4. Feed the paper over the guide shaft.

5. Feed the paper over the platen and out through the printer frame.

6. Confirm that the paper is centered on the platen, and move the lever down to lower the print head.

NOTE

- Printing is not possible if the recording paper is loaded wrong-side up.
- The paper may jam if it is not aligned with the roller.

Chapter 4
Specifications

4.1 General Specifications

Recording system	Thermal recording paper
Input channels	2 (simultaneous recording not supported)
Sampling period	10 ms
Valid recording width	Waveform recording width: 60 mm
Paper transport speeds	2, 10 or 60 cm/hour, and 6 or 20* cm/minute
Recording axis precision	Within ± 0.5%
Operating temp./humidity	5 to 40°C (41 to 104°F), 35 to 80% RH (non-condensating)
Storage temp./humidity	-10 to 50°C (14 to 122°F), 80% RH or less (non-condensating)
Operating temperature and humidity for guaranteed accuracy	23 ± 5°C (73 ± 41°F), 35 to 80% RH (non-condensating)
Period of guaranteed accuracy	1 year
Guaranteed accuracy signal frequency	45 to 66 Hz (AC range)
Operating environment	Indoors, below 2000 m (6562 feet) altitude
Withstand voltage	4.29 kVrms (50/60 Hz, 1 min) between GND and input terminals
Power requirements	AC: 100 to 240 V, 50/60 Hz, 30 VA DC: 9.5 to 14 V, 30 VA (Voltage fluctions of 10% from the rated supply voltage are taken into account.)

*: When the printing speed is set to 20 cm/min (maximum), the recording waveform prints lightly.

External dimensions and mass	Approx. 250W × 122H × 93.5D mm (9.84"W × 4.8"H × 3.68"D) Approx. 1200 g (42.3 oz.)	
Accessories	9344 CARRYING CASE	1
	L9257 CONNECTION CORD	1
	9235 RECORDING PAPER (15 m)	1
	Roll Paper Spools	2
	AC Power Cord	1
	Instruction Manual	1
Options	9235 RECORDING PAPER (15 m, 10 rolls)	1
	9236-01 RECORDING PAPER (15 m, Climate-resistant; 10 rolls)	1
	9650 CLAMP ON SENSOR	1
	9651 CLAMP ON SENSOR	1
	9667 FLEXIBLE CLAMP ON SENSOR	1
	9668 CLAMP ON SENSOR	1
Applicable Standards	Safety: EN61010 Pollution Degree 2, Measurement category III (6000 V expected transient Overvoltage)	
	EMC: EN61326 Class A EN61000-3-2 EN61000-3-3	

4.2 Voltage Measurement Input Specifications

Measurement ranges (max. ratings)	0 to 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 V AC/DC
Maximum input voltage	500 Vrms Display range is 0 to +110% of rated value (AC)
Maximum rated voltage between input terminals and ground	500 Vrms
Input Impedance	1 MΩ ±5% (10-V range and below) 1.18 MΩ ±5% (20-V range and above)
Accuracy	Within ±2% of fixed value
Rectification system	Effective value rectification
Common mode rejection ratio	Better than 50 dB (50/60 Hz, less than 100Ω unbalance)
Frequency characteristics	Within +3, -3 dB for the range between 20 Hz to 30 kHz, using 50/60 Hz as the standard reference point.
Effect of electromagnetic interference	Within ±20%f.s. at 3 V/m
Effect of conducted radio-frequency disturbances	Within ±8%f.s. at 3 V

When using the 9667, the full-scale accuracy of the ranges of the product is as follows.

Range Model	0.1 V	0.2 V	0.5 V
9667	±3.5%	±2.75%	±2.3%

Overall accuracy is the cumulative accuracy of the recorder and the probe, as indicated in the following examples.

(Examples)

For the 0.5-V range, combining the accuracy of the recorder and the 9667 yields an overall accuracy of ±4.3% f.s., and for the 0.2-V range, ±4.75% f.s.

4.3 Current Measurement Input Specifications

Measurement ranges (max. ratings)	10, 20, 50, 100, 200, 500, 1000 AAC (depending on clamp-on sensor used). Maximum display range is 110% of measurement range.
Input sensitivity	10, 20, 50, 100, 200, 500, 1000 mA f.s. (f.s. = max. rating)
Input impedance	1 Ω ±10%
Accuracy	Within ±2% of max. rating (10, 20, 50, 100, 200, 500 A range) Within ±3% of max. rating (1000 A range)
Rectification system	Effective value rectification
Frequency characteristics	Within +3, -3 dB for the range between 20 Hz to 20 kHz, using 50/60 Hz as the standard reference point (independent of clamp-on sensor characteristics).
Range information	Sensitivity and display range are determined by the Clamp Range input selector setting.
Effect of electromagnetic interference	Within +5, -0.5%f.s. at 3 V/m
Effect of conducted radio-frequency disturbances	Within ±8%f.s. at 3 V

The full-scale accuracy of the ranges of each clamp-on sensor is as follows.

Range Model	10 A	20 A	50 A	100 A	200 A	500 A	1000 A
9650	±1.8%	±1.65%	±1.56%	±1.53%			
9651	±3.0%	±2.25%	±1.8%	±1.65%	±1.58%	±1.53%	
9668	±6.0%	±4.5%	±3.6%	±3.3%	±3.15%	±3.06%	±3.03%

Overall accuracy is the cumulative accuracy of the recorder and the probe, as indicated in the following examples.

(Examples)

1. For the 100-A range, combining the accuracy of the recorder and the 9650 yields an overall accuracy of ±3.53% f.s., and for the 50-A range, ±3.56% f.s.
2. For the 500-A range, combining the accuracy of the recorder and the 9651 yields an overall accuracy of ±3.53% f.s., and for the 100-A range, ±3.65% f.s.
3. For the 1000-A range, combining the accuracy of the recorder and the 9668 yields an overall accuracy of ±6.03% f.s., and for the 100-A range, ±5.3% f.s.

NOTE When using the 9668 CLAMP ON SENSOR in conjunction with the 8205-10 to measure current, we do not recommend taking measurements at high sensitivities. We do recommend using a clamp that is suited to the current to be measured.

4.4 Display Specifications

Display method	Signal level and setting data displayed by LCD bar
Display contents	Signal input level (AC): Zero to 110% of selected range rating, Minimum resolution = 2% of range rating Signal input level (DC): -10 to +110%, -30 to +90%, -50 to +70%, -70 to +50%, -90 to +30% (POSITION control selects the display range) Minimum resolution = 2% of range rating Low Supply Voltage (when operating on DC) Print Head Up Paper End Type of Signal Measurement Measured signal units and subunits

4.5 Recorded Information

Waveform data	Voltage or current amplitude. Waveform data may be either average or unaveraged values (set at power on)
Settings	Range, mode, etc. print at start and stop, and at each 10 DIV (format differs when printed at intervals)
Elapsed time	Elapsed time from starting to record are printed at each 5 DIV
Interval printing	Measured values print along grid at each 2 DIV The average values of the waveform data are printed on the grid of printing point.
Printing when setting change	Changes in various settings during recording are printed after the changes are made

4.6 Recording Time

The following table shows the recording capacity of one roll of recording paper.

Papertransport speed	Recording time
2 cm/hour	31.25 days
10 cm/hour	6.25 days
60 cm/hour	25 hours
6 cm/min	250 minutes
20 cm/min	75 minutes

Chapter 5
Maintenance and Service

5.1 Storage Precautions

(1) Recorder

Avoid storing the product in conditions of high temperature and humidity, as damage may result from condensation and corrosion.
During long-term storage and during transportation, the print head should be in the raised position. Leaving the print head in the lowered position for an extended period can dent the platen (rubber roller) that transports the paper, resulting in uneven printing.

(2) Storing recording paper

Store rolls of thermal paper at no more than 40°C.
The paper will change color if exposed to light over a long period, so do not unwrap a roll of paper until you are ready to use it.

(3) Storing data recordings

As the recording paper is thermally sensitive, be aware of the following points:
To avoid paper discoloration, do not expose it to direct sunlight, and store at no more than 40°C and 90% RH.
For permanent storage of important recorded data, photocopy the recording paper.
If the thermal paper is exposed to an organic solvent such as alcohol or ketone, it may no longer develop properly, and recorded data may fade.
Also, the thermal recording paper is ruined by contact with wet Daizo copy paper.

5.2 Cleaning

To clean the instrument, 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.

5.3 Cleaning the Printer Head

To maintain print quality, use the following method to clean the print head whenever recording paper is replaced.

❑ Method 1

1. Turn on the printer's power while holding down the **ADJ** button.
2. Print solid black for about 50 cm, and the printer should turn on as usual. (Press the PAPER FEED button to stop at any time.)
3. Print solid black several times to confirm whether printing has improved. If it does not improve, perform Method 2.

❑ Method 2

1. Apply a solvent such as a non-water alcohol or normal hexane, to the recording paper and insert it into the printer. The recording paper may change color depending on the solvent you use, so use the reverse side.
2. Move the head up/down lever to the down position.
3. Move the recording paper back and forth with your hand to clean the head.

NOTE

- Do not use organic solvents such as thinner or benzene, which could discolor or deform the printer.
- After applying a solvent, be certain that the printer is completely dry before use to avoid discoloring or deforming the printer.
- After prolonged use, white paper dust may build up on the surface of the paper roller. Small amounts of paper dust will not affect printer operation. However, you may remove it using a blower brush, such as those used for cameras.
- Cut the recording paper with the cutter attached to the printer's cover. If you cut the recording paper against the side of the printer head, large amounts of paper dust will stick to the paper rolle.

5.4 Service

If damage is suspected, check the "Troubleshooting" section before contacting your dealer or Hioki representative. Pack the instrument 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.

Troubleshooting

Symptom	Cause	Remedy
Does not turn on	**POWER SOURCE** switch may be set incorrectly	Set to match power source.
	Power cord may be broken	Check and replace cord.
Does not print	Paper may be installed upside down	Reinstall the paper
Measured values unstable	Ground not connected	Connect the GND terminal to earth ground
Input signals do not display	A connection cord may be open	Check and replace connection cord

- For regional contact information, please go to our website at http://www.hioki.com.
- The Declaration of Conformity for instruments that comply to CE mark requirements may be downloaded from the Hioki website.
- All reasonable care has been taken in the production of this manual, but if you find any points which are unclear or in error, please contact your supplier or the International Sales and Marketing Department at Hioki headquarters.
- In the interests of product development, the contents of this manual are subject to revision without prior notice.
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