HIOKI

ST9210

Instruction Manual

PD SENSOR

The latest edition of the instruction manual

Read carefully before use.
Keep for future reference.

EN

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ST9210A961-00

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Contents

Introduction

Thank you for choosing the Hioki ST9210 PD Sensor. Preserve this manual carefully and keep it handy to make full use of this instrument for a long time.
Read the following Operating Precautions carefully before using the instrument.
Refer to the instruction manuals below as relevant to your purpose.

Type	Contents	Format
ST9210 Instruction Manual (this document)	This guide contains information on how to safely use the instrument, basic operating instructions, and specifications (excerpt).	Print
ST4200 Instruction Manual	This manual contains an ST4200 product overview, operating instructions, function descriptions, and specifications. https://manual.hioki.com/en/ST4200/manual	HTML
Operating Precautions	This provides information on the instrument for safe operation.	Print

Product registration Register your product in order to receive important product information. https://www.hioki.com/global/support/myhioki/registration/	

Target audience

This manual has been written for use by individuals who use the product in question or who teach others to do so. It is assumed that the reader possesses basic electrical knowledge (equivalent to that of someone who graduated from an electrical program at a technical high school).

Confirming Package Contents

When the instrument arrives, inspect it carefully to ensure that everything is in good condition and there is no damage. If the instrument seems to have been damaged or does not work as specified, contact your authorized Hioki distributor or reseller.

Confirm that the package contents are correct.

Instrument

☐ ST9210 PD Sensor

Included accessories

☐ Operating Precautions (0990A907)
☐ Instruction Manual

Options (Sold Separately)

The following options are available for the instrument. To buy, contact your authorized Hioki distributor or reseller. The options are subject to change without prior notice. Visit our website (https://www.hioki.com) for updated information.

Product Name	Maximum rated terminal-to-ground voltage	Maximum rated voltage	Maximum rated current	Cable length
L2265 Unterminated Lead Cable 	AC/DC 5000 V rms 8 kV peak	–	AC/DC 150 mA rms	3000 mm (118.1 in)
L2266 Unterminated Lead Cable 	AC/DC 5000 V rms 8 kV peak	–	AC/DC 150 mA rms	3000 mm (118.1 in)
L2270 Connection Cable 	AC/DC 5000 V rms	–	AC/DC 150 mA	1500 mm (59.1 in.)
L2271 Connection Cable 	–	–	AC/DC 150 mA	1500 mm (59.1 in.)
L9218 Connection Cable 	AC 30 V rms	AC 30 V rms	0.2 A	1500 mm (59.1 in.)

Notations

Safety notations

In this document, risk levels are classified as follows.

⚠ DANGER	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury or potential risks of damage to the supported product (or to other property).
IMPORTANT	Indicates information or content particularly important from the standpoint of operating or maintaining the product.
	Indicates a high-voltage hazard. Failure to verify safety or improper handling of the product could lead to an electric shock, a burn, an injury, or a death.
	Indicates a prohibited action.
	Indicates a mandatory action.

Symbols affixed to the instrument

	Indicates the presence of a potential hazard. See the “Operation Precautions” (p. 10) and safety notes listed at the beginning of operating instructions in the instruction manual(s), and the accompanying document entitled “Operating Precautions”.
	Indicates that dangerous voltage can be present at this terminal.
	Indicates a protective conductor terminal.
	Indicates a ground terminal connected to the chassis of the instrument.

Symbols for Standards

CE	Indicates that the product complies with standards imposed by EU directives.

Notation of terms for partial discharge

PD	Abbreviation for “partial discharge”.
AC PD	Indicates partial discharge occurring when applying AC high voltage to the object under measurement.

Other notations

OUTPUT (bold-faced)	Indicates text printed on the instrument.

Safety Information

The instrument is designed in accordance with the IEC 61010 international standard and their safety was confirmed during pre-shipment inspections.
However, using the instrument in a way not described in this manual may diminish their safety.
Read the following safety notes carefully before using the instrument.

⚠ DANGER

Mishandling the instrument could result in bodily injury or even death, as well as damage to the instrument. Familiarize yourself with the instructions and precautions in this manual before using the instrument.

⚠ WARNING

- **Electricity can cause potentially serious events such as an electric shock, heat generation, fire, and an arc flash due to a short-circuit. If you have not used electrical measuring instruments before, you should be supervised by a technician who has experience in electrical measurement.**
- **PD measurements is performed using a live line. To prevent an electric shock, use appropriate protective insulation and adhere to applicable laws and regulations.**

Operation Precautions

Follow these precautions to ensure safe operation of the instrument and to obtain the full benefits of its various functions.
Ensure that your use of the instrument falls within the specifications not only of the instrument itself, but also of any included accessories and options being used.

Installing the instrument

⚠ WARNING

Installing the instrument in inappropriate locations could cause a malfunction of the instrument or an accident. Avoid locations that are:

- **Exposed to direct sunlight or high temperatures**
- **Exposed to corrosive or combustible gases**
- **Exposed to strong electromagnetic fields or electrostatic charges**
- **Near induction heating systems (such as high-frequency induction heating systems and IH cooking equipment)**
- **Susceptible to vibration**
- **Exposed to water, oil, chemicals, or solvents**
- **Exposed to high humidity or condensation**
- **Exposed to high quantities of dust particles**
- **On top of unstable platforms or inclined surfaces**

- Do not stack multiple instruments.
- Place the instrument with the bottom side downwards.

Precautions during shipment

Store the packaging materials after unpacking. Use the packaging materials that came with instrument when transporting it.

⚠ CAUTION

To avoid damage to the instrument, protect it from physical shock when transporting and handling. Be especially careful to avoid physical shock due to dropping it.

- Do not use packaging or cushioning if torn or deformed. If not using packaging and cushioning when shipping the product, contact your authorized Hioki distributor or reseller. Hioki will send specialized packaging and cushioning.
- When packaging the instrument, be sure to remove connection cables from the instrument.

Before connecting cables

⚠ DANGER

Do not use any cables whose metal conductor is exposed. Doing so could result in an electric shock, burn, or other hazards.

Before performing a measurement, check that connection cables are securely locked or screwed in at all connection terminals. The user may experience an electrical shock if connection cables are not connected.

⚠ WARNING

Do not step on cables or pinch them between other objects. Do not bend or pull on cords at their base, or repeatedly bend them. The cable may disconnect or short-circuit.

- **To prevent an electric shock, confirm that the insulation layer inside the cable is not exposed. If a color inside the cable is exposed, do not use the cable.**
- **Use only the connection cables specified by Hioki when using the instrument. Using a nonspecified cable may result in unsafe measurements. Using a non-specified cable may also result in incorrect measurements due to poor connection or other reasons.**

⚠ CAUTION

The cable is hardened in freezing temperatures. Do not bend or pull it to avoid tearing its shield or cutting the cable.

Before connecting the instrument to external equipment

⚠ CAUTION

- Connect the ground terminal of the instrument and the ground terminal of connected equipment to a single grounding point with sufficiently low impedance. Using different ground circuits will result in a ground potential difference between the instrument and the connected equipment. If a cable is connected while such a potential difference between grounds exists, it may result in equipment malfunction or failure.
- Before connecting or disconnecting any cable, always turn off your device to be connected. Failure to do so could result in an equipment malfunction or damage to the equipment.
- To prevent damage to the equipment, ensure that the wires have sufficient withstand voltage and current capacity.

Precautions during measurement

⚠ DANGER

Do not use the instrument to measure circuits that exceed those ratings or specifications. Damage to the instrument or overheating can cause bodily injury.

1 Overview

1.1 Product Overview

This sensor detects partial discharge events during production processes and shipping inspections for motors and similar products. It is used in combination with an AC high-voltage source such as withstand voltage tester and the ST4200 Partial Discharge Detector. Internal components include a blocking coil, AC voltage division capacitor, and detection impedance.

1.2 Features

Flexible interoperation with existing testers

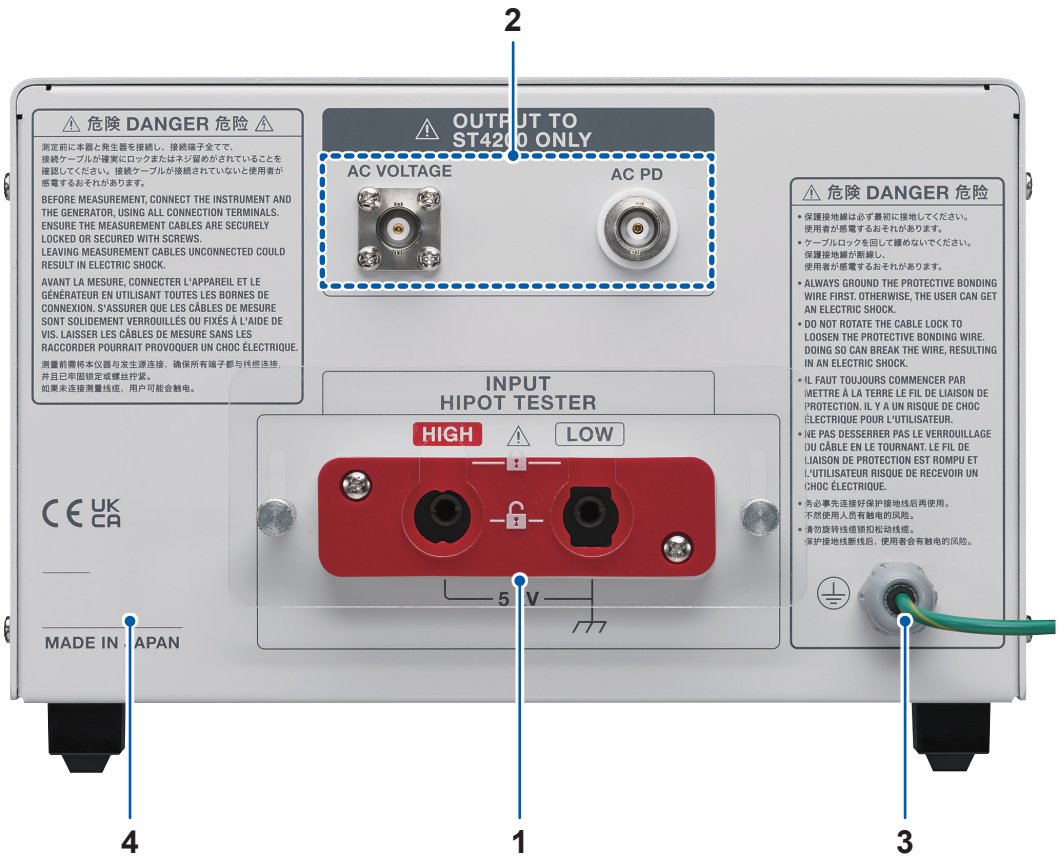
If you’re planning to combine the sensor with an AC withstand voltage tester you’re already using so that you can perform partial discharge testing of motor coils or similar components, it can be used along with the ST4200 Partial Discharge Detector to easily build a partial discharge detection system.

1.3 Name and Function of Each Part

Front

No.	Name	Function
1	**Output channels**	Connect the optional L2265 Unterminated Lead Cable (HIGH side) and L2266 Unterminated Lead Cable (LOW side).

Rear



No.	Name	Function
1	HIPOT TESTER terminal	Connect the L2270 Connection Cable (HIGH side) and L2271 Connection Cable (LOW side) to 3153 Automatic Insulation/Withstanding HiTester.
2	ST4200 output terminals	Connect to the ST4200 Partial Discharge Detector using L9218 Connection Cable.
3	Protective ground line	Used to provide a protective ground connection.
4	Serial number	The serial number consists of nine digits. The first two digits from the left indicate the year of manufacture (last two digits of the year), and the next digits two indicate the month of manufacture. This label is needed for administrative purposes. Do not remove this label. Inform your authorized Hioki distributor or reseller of this number if required.

2 Preparing for Measurement

2.1 Inspection Before Measurement

⚠ DANGER

If the connection cords or the instrument is damaged, there is a risk of an electric shock. Perform the following inspection before using the instrument:

- **Check that the insulation of the connection cords is neither ripped nor torn and that no metal parts are exposed. Replace the connection cords with those specified by Hioki.**
- **Check if there is any damage to the instrument occurred during storage or shipping and verify that it operates normally before using the instrument. If you find any damage, contact your authorized Hioki distributor or reseller.**

Checking the instrument and peripheral devices

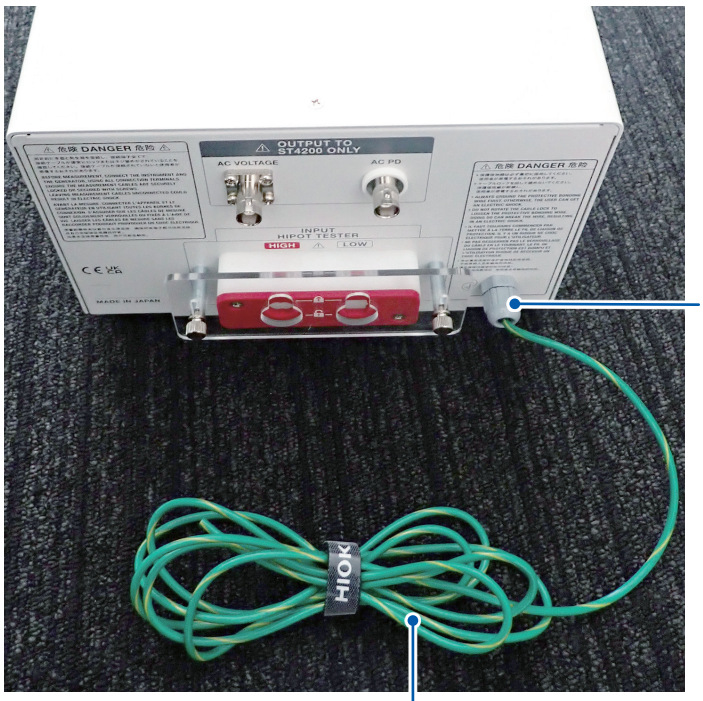
Inspection item	Solution
The insulation of measurement cables or connection cables is not damaged and no metal parts are exposed.	If damaged, do not use it because it may cause an electric shock.
The instrument is not damaged.	If the instrument is damaged, request repairs. Contact your authorized Hioki distributor or reseller.

2.2 Connecting the Protective Ground Line

This section describes how to use the sensor's protective ground line to establish a protective ground connection.

⚠ DANGER

- **Always ground the protective bonding wire first. otherwise, the user can get an electric shock.**
- **Do not rotate the cable lock to loosen the protective bonding wire.doing so can break the wire, resulting in an electric shock.**



1 Terminate the line to accommodate your measurement environment so that you can connect it to the protective ground terminal.

The protective ground line specifications are listed below. If using a crimp terminal, choose a part that suits the wire specifications.

- Conductor size: AWG 16
- Insulation standard outside diameter: 3.15 mm

2 Connect the protective ground line to the protective ground terminal.

2.3 Connecting Measurement Cables

Connect the instrument to the object under measurement with a measurement cable.

Cable used

- L2265 Unterminated Lead Cable (optional, 3 m length)
- L2266 Unterminated Lead Cable (optional, 3 m length)

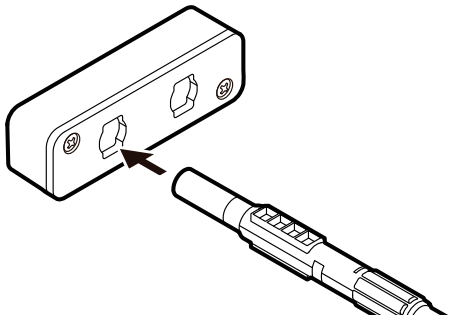
IMPORTANT

In factory default state, the “object under measurement” side of the unterminated lead cable is disconnected. You must modify the tip of the cable to suit the object under measurement.

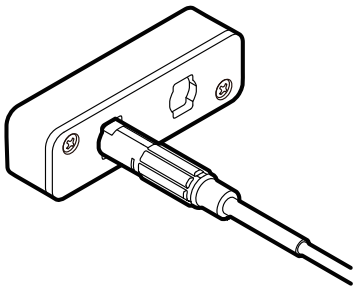
Connection procedure

1 **Connect the unterminated lead cable connector to the instrument.**

Align the terminal holes with the unterminated lead cable connector.

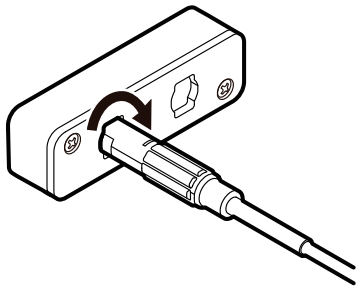


2 **Insert the unterminated lead cable connector all the way inside.**



3 **Turn the unterminated lead cable connector 90 degrees and lock it.**

This connector rotates 90 degrees or more in both directions.
However, turning it 180 degrees is dangerous as it will deactivate the lock.



4 **Check to ensure that the unterminated lead cable connector cannot be removed.**

5 **Connect the unterminated lead cable to the object under measurement.**

2.4 Connecting Connection Cables

Connect the instrument to the measurement instrument with a connection cable.

IMPORTANT

See the instruction manual for each measuring instrument for how to connect the instrument with connection cables.

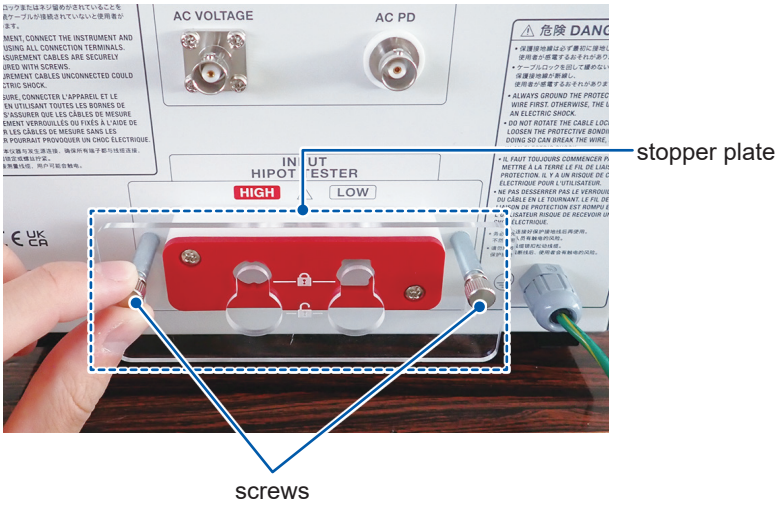
Select the connectors on the instrument side and the connection cables depending on the instrument being connected.

Measuring instrument	Model example	Instrument connector	Connection Cables
Automatic Insulation/ Withstanding HiTester	3153	**HIPOT TESTER** terminal	L2270 (H side) L2271 (L side)
ST4200 output terminals	ST4200	**AC VOLTAGE**, **AC PD** terminals	L9218

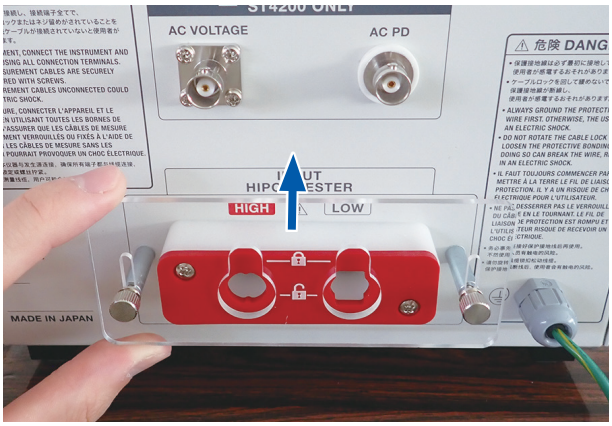
HIPOT TESTER terminal

Carefully read “Before connecting cables” (p. 11) in advance.

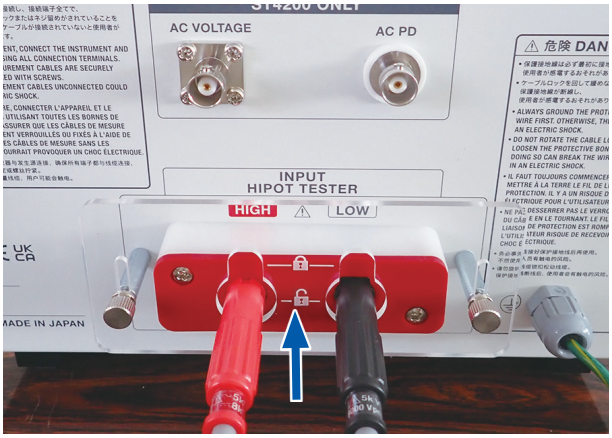
1 Loosen the stopper plate screws.



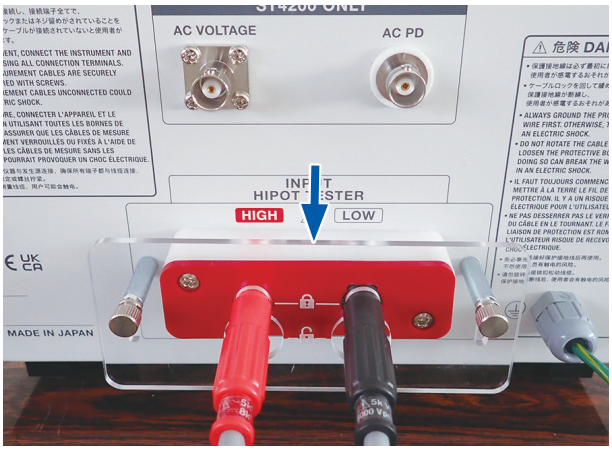
2 Slide the stopper plate upward.



3 Align the terminals with the connection cable connectors, and fully insert them.



4 **Slide the stopper plate downward until it comes in contact with the screws and locks the connectors in place.**



5 **Tighten the stopper plate.**

6 **Check to ensure that the connection cable connectors cannot be removed.**

How to remove connection cables

Remove the cables in the reverse order of the above procedure.

ST4200 output terminals

⚠ DANGER

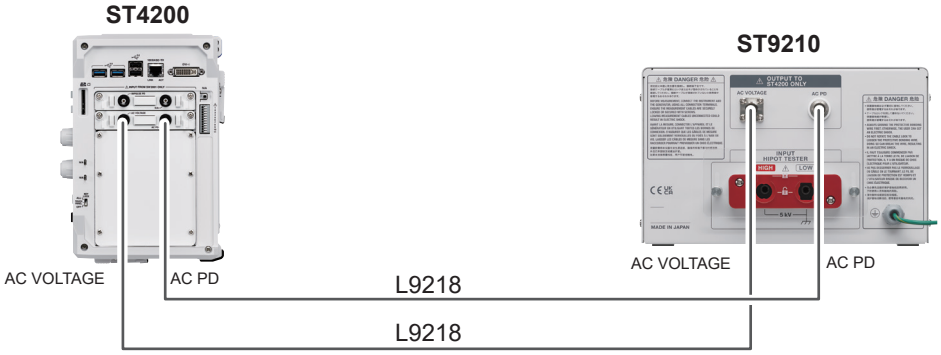
Verify that the connected insulation withstand voltage tester is not generating output before connecting the cable. Failure to do so may cause the user to experience an electrical shock.

⚠ CAUTION

- Connect the plastic connector (black) or L9218 Connection Cable to the input terminal (green BNC connector) of the ST4200.
  Connecting a metal connector to an insulated BNC connector may cause the insulated BNC connector to be damaged.
- When removing the cable, remove the lock and hold the head (not the cable) of the BNC connector before pulling it out.
  This may damage the BNC connector.

Measuring AC PD

Connect the instrument's **AC PD** terminal to the **AC PD** terminal on the right side of the ST4200 using L9218 Connection Cable.
Connect the instrument's **AC VOLTAGE** terminal to the **AC VOLTAGE** terminal on the right side of the ST4200 using L9218 Connection Cable.
Connect the metal connectors to the ST9210 and the plastic connectors (black) to the ST4200.



3 Maintenance and Service

⚠WARNING

Touching any of the high-voltage points inside the instrument is very dangerous. Do not attempt to modify, disassemble, or repair the instrument. Doing so may cause a fire, electric shock, or injury.

3.1 Cleaning the Instrument

⚠CAUTION

To clean the instrument, wipe it gently with a soft cloth moistened with water or mild detergent. Do not use solvents such as benzene, alcohol, acetone, ether, ketone, thinners or gasoline. Doing so could deform and discolor the instrument.

3.2 Troubleshooting

Contact your authorized Hioki distributor or reseller.

4 Specifications

4.1 General Specifications

Operating environment	Indoor use, pollution degree 2, altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity range	0°C to 40°C (32°F to 104°F), 80% RH or less (non-condensing)
Storage temperature and humidity range	-10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
Conforming standards	Safety EN 61010
Dimensions	Enclosure: Approx. 215W × 132H × 360D mm (8.46W × 5.20H × 14.17D in.) (excluding protrusions) Protective ground line: Approx. 2000 mm (78.74 in.)
Weight	Approx. 3.57 kg (7.9 lbs)
Product warranty period	3 years
Included accessories	p.6
Options	p.7

4.2 Basic Specifications

Number of measurement channels	1
Maximum input voltage	No measurement category 5 kV rms AC, 5 kV DC, 7.07 kV peak
Maximum rated line-to-ground voltage	No measurement category Anticipated transient overvoltage 0 V 5 kV rms AC, 5 kV DC, 7.07 kV peak
Input channels (For connecting the Insulation/ Withstand HiTester)	Banana terminals (special shape)(Labeled as “INPUT HIPOT TESTER”)
Output channels (For connecting an object under measurement)	Banana terminals (special shape)(Labeled as “OUTPUT”)
AC partial discharge sensor output	BNC terminal ×2 (Labeled as “AC PD, AC VOLTAGE”)
Blocking coil inductance	14 mH ±20%
Coupling capacitor capacitance	1.33 nF ±10%
Measurable test specimen capacitance range	10 nF or less

4.3 Options

L2265 Unterminated Lead Cable

Operating environment	Indoor use, pollution degree 2, altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity range	0°C to 40°C (32°F to 104°F), 80% RH or less (noncondensing)
Storage temperature and humidity range	-10°C to 50°C (14°F to 122°F), 80% RH or less (noncondensing)
Dimensions	Total length: Approx. 3000 mm (118.1 in.)
Weight	Approx. 73 g (2.6 oz.)
Maximum rated current	150 mA AC/DC rms
Maximum rated line-to-ground voltage	5000 V AC/DC rms, 8 kV peak, no measurement category Anticipated transient overvoltage: 0 V

L2266 Unterminated Lead Cable

Operating environment	Indoor use, pollution degree 2, altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity range	0°C to 40°C (32°F to 104°F), 80% RH or less (noncondensing)
Storage temperature and humidity range	-10°C to 50°C (14°F to 122°F), 80% RH or less (noncondensing)
Dimensions	Total length: Approx. 3000 mm (118.1 in.)
Weight	Approx. 73 g (2.6 oz.)
Maximum rated current	150 mA AC/DC rms
Maximum rated line-to-ground voltage	5000 V AC/DC rms, 8 kV peak, no measurement category Anticipated transient overvoltage: 0 V

L2270 Connection Cable

Operating environment	Indoor use, pollution degree 2, altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity range	0°C to 40°C (32°F to 104°F), 80% RH or less (noncondensing)
Storage temperature and humidity range	-10°C to 50°C (14°F to 122°F), 80% RH or less (noncondensing)
Dimensions	Total length: Approx. 1500 mm (59.1 in.)
Weight	Approx. 49 g (1.7 oz.)
Maximum rated current	150 mA AC/DC
Maximum rated line-to-ground voltage	5000 V AC/DC rms, no measurement category Anticipated transient overvoltage: 0 V

L2271 Connection Cable

Operating environment	Indoor use, pollution degree 2, altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity range	0°C to 40°C (32°F to 104°F), 80% RH or less (noncondensing)
Storage temperature and humidity range	-10°C to 50°C (14°F to 122°F), 80% RH or less (noncondensing)
Dimensions	Total length: Approx. 1500 mm (59.1 in.)
Weight	Approx. 43 g (1.5 oz.)
Maximum rated current	150 mA AC/DC

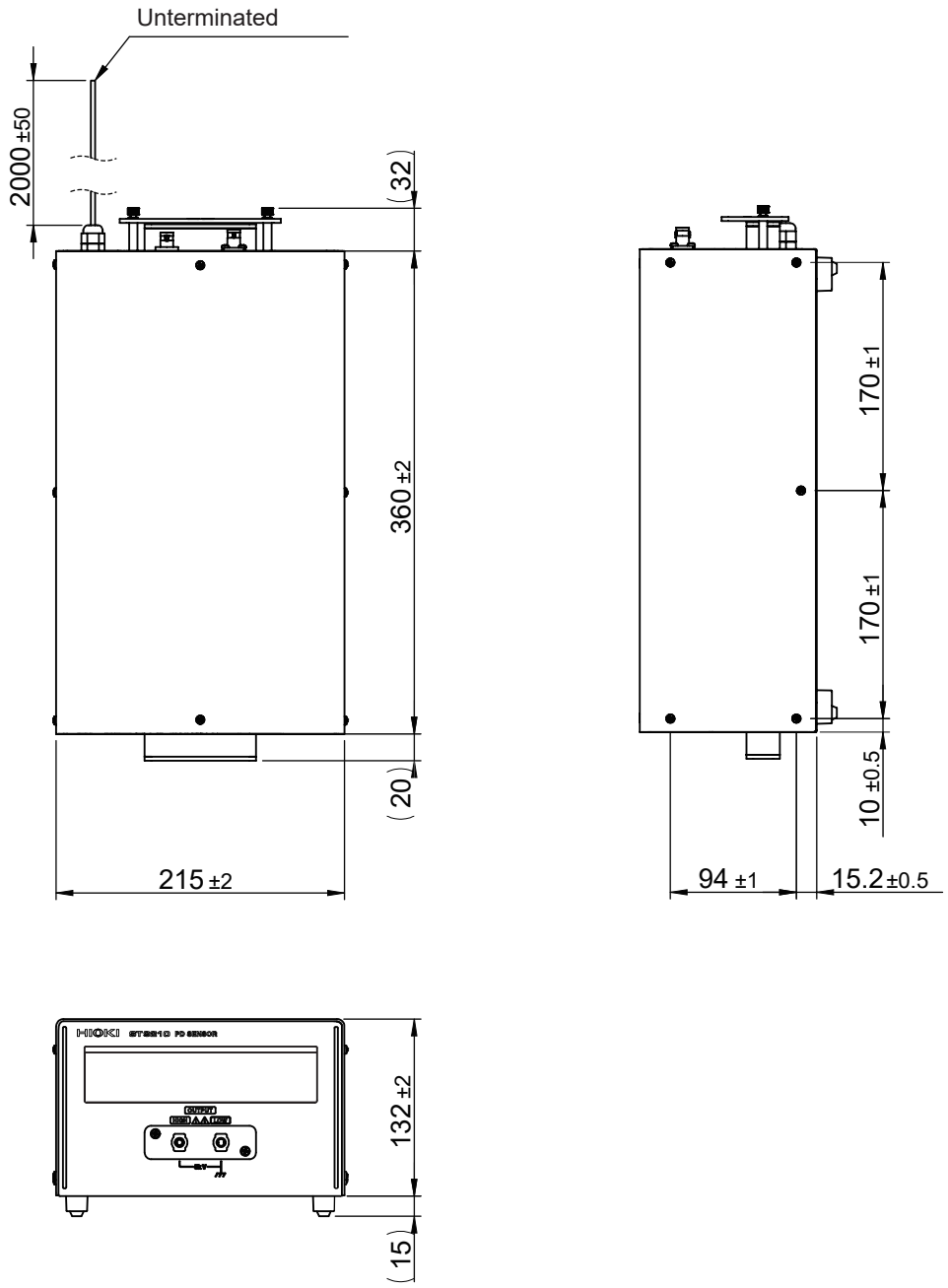
L9218 Connection Cable

Operating environment	Indoor use, pollution degree 2, altitude: up to 2000 m (6562 ft.)
Operating temperature and humidity range	0°C to 40°C (32°F to 104°F), 80% RH or less (noncondensing)
Storage temperature and humidity range	-10°C to 50°C (14°F to 122°F), 80% RH or less (noncondensing)
Dimensions	Total length: Approx. 1500 mm (59.1 in.)
Weight	Approx. 78 g (2.8 oz.)
Maximum rated current	0.2 A
Maximum rated voltage between lines	30 V AC rms
Maximum rated line-to-ground voltage	30 V AC rms

5 Appendix

5.1 Dimensions

Unit: mm



5.2 Rack Mount

A rack mount bracket can be attached if screws are removed from the side of the device.

⚠WARNING

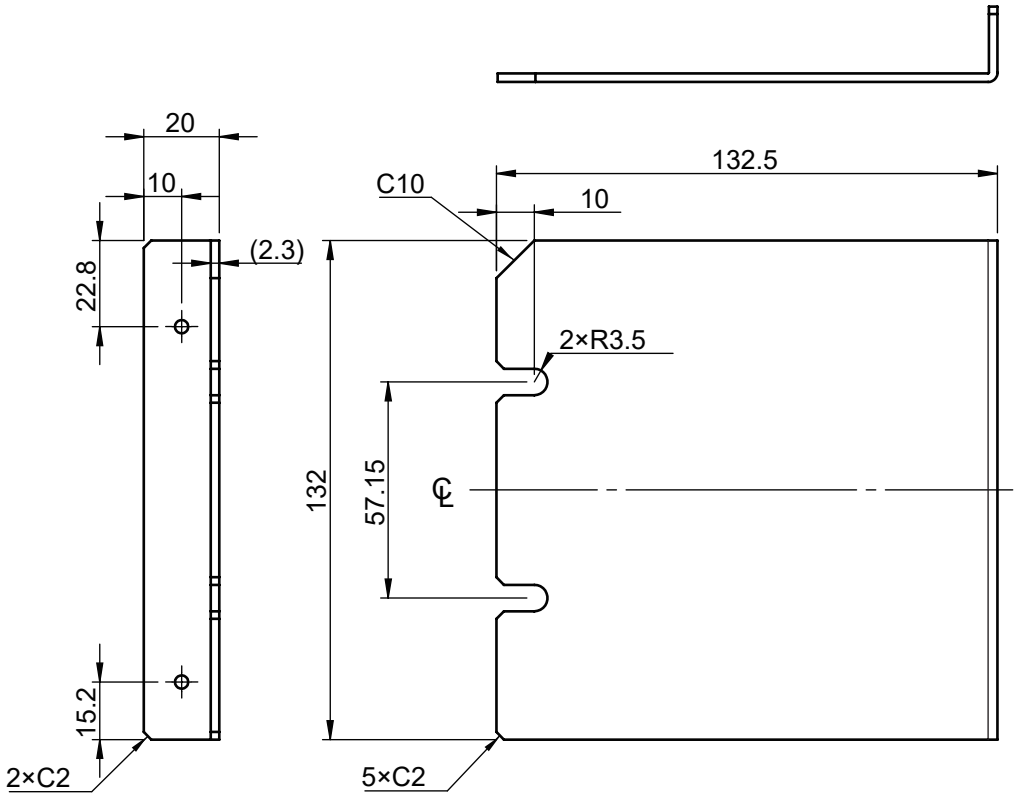
To prevent device damage or an electric shock, use only the screws that are originally installed. (Side: M3 × 6 mm, when the rack mount bracket is attached: M3 × 8 mm)
If you have lost a screw or find that a screw is damaged, please contact your authorized Hioki distributor or reseller.

Rack mount bracket

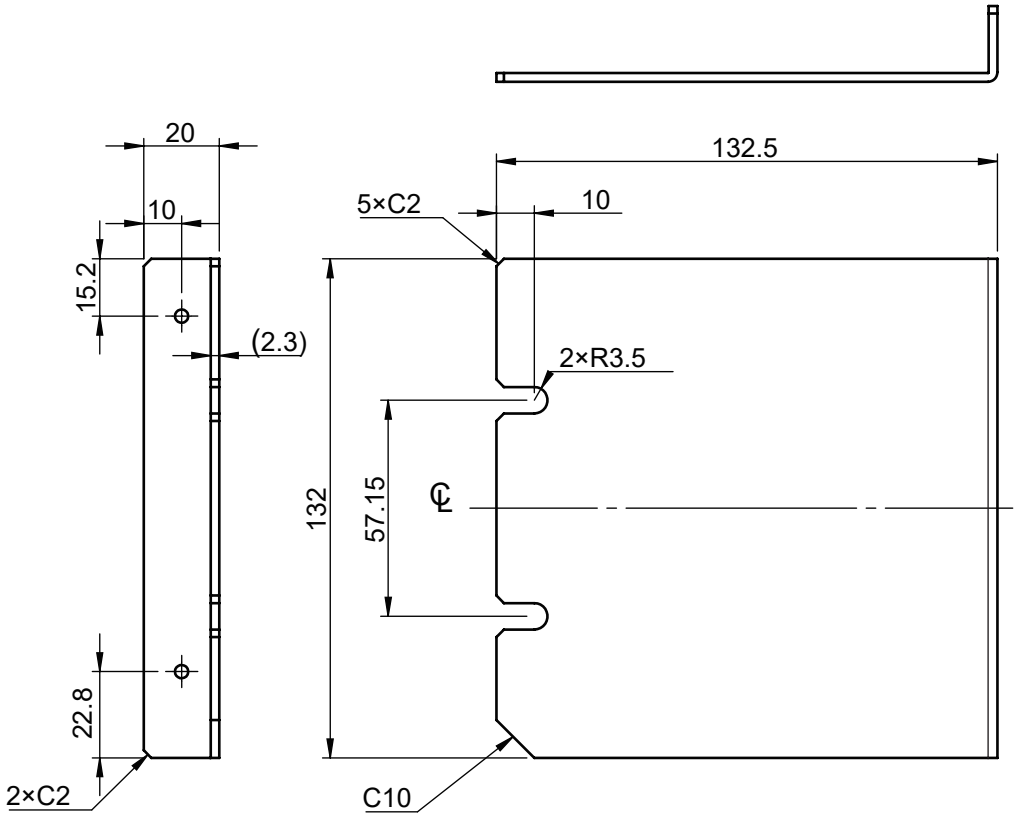
IMPORTANT
Two parts are required as the EIA mount bracket consists of different parts on the left and right sides.

EIA (for right side)

Unit: mm, Material: SECC (electro-galvanized steel sheet), Thickness: 2.3

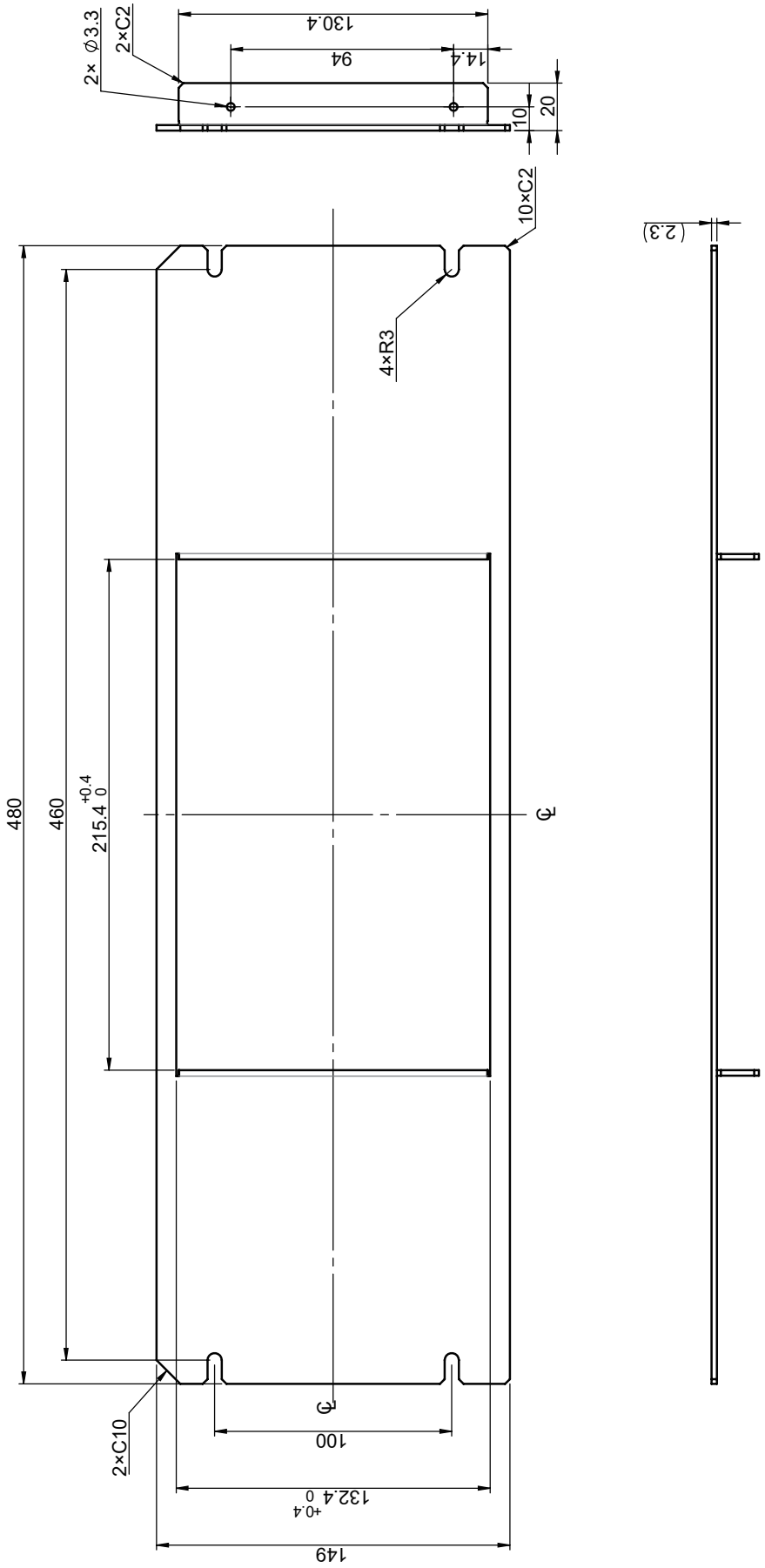


EIA (for left side)

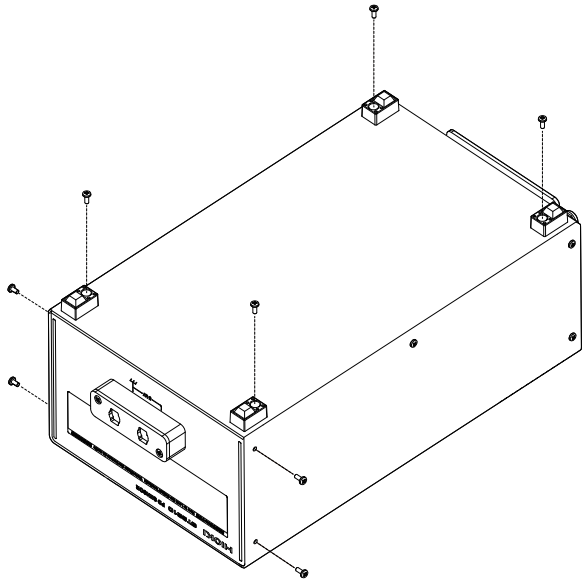


JIS

Unit: mm, Material: SECC (electro-galvanized steel sheet), Thickness: 2.3

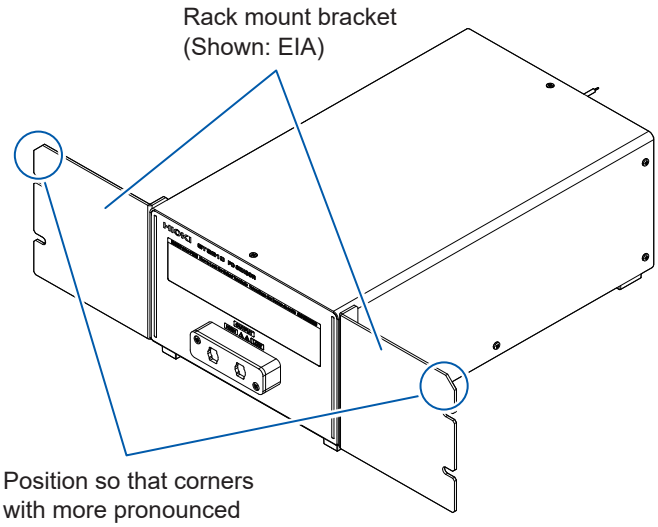


Attachment procedure



1 **Remove the four screws shown in the figure and remove the rubber feet from the bottom.**

2 **Remove the screws on the left and right sides shown in the figure (two screws each toward the front).**



3 **Attach the rack mount bracket.**

Use M3 × 8 screws on the left and right side at the front of the device.

When mounting the device on a rack, use a commercially available base for reinforcement.

Warranty Certificate

HIOKI

Model	Serial number	Warranty period Three (3) years from date of purchase (___ / ___)

Customer name: _____

Customer address: _____

Important

- Please retain this warranty certificate. Duplicates cannot be reissued.
- Complete the certificate with the model number, serial number, and date of purchase, along with your name and address. The personal information you provide on this form will only be used to provide repair service and information about Hioki products and services.

This document certifies that the product has been inspected and verified to conform to Hioki's standards.
Please contact the place of purchase in the event of a malfunction and provide this document, in which case Hioki will repair or replace the product subject to the warranty terms described below.

Warranty terms

1. The product is guaranteed to operate properly during the warranty period (three [3] years from the date of purchase). If the date of purchase is unknown, the warranty period is defined as three (3) years from the date (month and year) of manufacture (as indicated by the first four digits of the serial number in YYMM format).
2. If the product came with an AC adapter, the adapter is warrantied for one (1) year from the date of purchase.
3. The accuracy of measured values and other data generated by the product is guaranteed as described in the product specifications.
4. In the event that the product or AC adapter malfunctions during its respective warranty period due to a defect of workmanship or materials, Hioki will repair or replace the product or AC adapter free of charge.
5. The following malfunctions and issues are not covered by the warranty and as such are not subject to free repair or replacement:
   -1. Malfunctions or damage of consumables, parts with a defined service life, etc.
   -2. Malfunctions or damage of connectors, cables, etc.
   -3. Malfunctions or damage caused by shipment, dropping, relocation, etc., after purchase of the product
   -4. Malfunctions or damage caused by inappropriate handling that violates information found in the instruction manual or on precautionary labeling on the product itself
   -5. Malfunctions or damage caused by a failure to perform maintenance or inspections as required by law or recommended in the instruction manual
   -6. Malfunctions or damage caused by fire, storms or flooding, earthquakes, lightning, power anomalies (involving voltage, frequency, etc.), war or unrest, contamination with radiation, or other acts of God
   -7. Damage that is limited to the product's appearance (cosmetic blemishes, deformation of enclosure shape, fading of color, etc.)
   -8. Other malfunctions or damage for which Hioki is not responsible
6. The warranty will be considered invalidated in the following circumstances, in which case Hioki will be unable to perform service such as repair or calibration:
   -1. If the product has been repaired or modified by a company, entity, or individual other than Hioki
   -2. If the product has been embedded in another piece of equipment for use in a special application (aerospace, nuclear power, medical use, vehicle control, etc.) without Hioki's having received prior notice
7. If you experience a loss caused by use of the product and Hioki determines that it is responsible for the underlying issue, Hioki will provide compensation in an amount not to exceed the purchase price, with the following exceptions:
   -1. Secondary damage arising from damage to a measured device or component that was caused by use of the product
   -2. Damage arising from measurement results provided by the product
   -3. Damage to a device other than the product that was sustained when connecting the device to the product (including via network connections)
8. Hioki reserves the right to decline to perform repair, calibration, or other service for products for which a certain amount of time has passed since their manufacture, products whose parts have been discontinued, and products that cannot be repaired due to unforeseen circumstances.

HIOKI E.E. CORPORATION
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HIOKI

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