ST4200
PARTIAL DISCHARGE DETECTOR
SW2001

HIOKI

Startup Guide

SW2001-04
SW2001-08
SW2001-16
SW2001-24

HIGH VOLTAGE MULTIPLEXER

The latest edition of the instruction manual

Read carefully before use.
Keep for future reference.

When using the instrument for the first time

Troubleshooting

EN

Aug. 2024 Revised edition 1
ST4200A961-01

600644821

Contents

Introduction

Thank you for choosing Hioki's ST4200 Partial Discharge Detector and SW2001 High Voltage Multiplexer. Preserve this manual carefully and keep it handy to make full use of this instrument for a long time.
Before using the ST4200 and SW2001, read the attached “Operating Precautions” carefully.
Refer to the instruction manuals below as relevant to your purpose.

Type	Contents	Format
ST4200, SW2001 Startup Guide (this document)	This guide contains information on how to safely use the ST4200 and SW2001, basic operating instructions, and specifications (excerpt).	Printed
ST4200 Instruction Manual (Online manual)	This manual contains an ST4200 product overview, operating instructions, function descriptions, and specifications. https://manual.hioki.com/en/ST4200/manual	HTML
SW2001 Instruction Manual (Online manual)	This manual contains an SW2001 product overview, operating instructions, function descriptions, and specifications. https://manual.hioki.com/en/SW2001/manual	HTML
Operating Precautions	Information on how to safely use the measuring instruments.	Printed
ST9210 PD Sensor Instruction Manual	This manual contains an ST9210 product overview, operating instructions, function descriptions, and specifications. Download the PDF from the Hioki’s website. https://www.hioki.com/global/support/download	PDF

Product user registration Register these products 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).

Trademarks

- Windows is a trademark of the Microsoft group of companies.
- SD, SDHC Logos are trademarks of SD-3C LLC.

Confirming Package Contents

When the measurement instruments arrive, inspect them 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.
Store the packaging materials even after unpacking because you will need them when you transport the measuring instrument.

Confirm that the package contents are correct.

ST4200 Partial Discharge Detector

☐ ST4200 Partial Discharge Detector

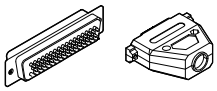
☐ Power cord
☐ Operating Precautions (0990A905)
☐ Startup Guide (this document)

SW2001 High Voltage Multiplexer

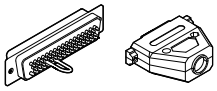
☐ SW2001 High Voltage Multiplexer

☐ Power cord
☐ Operating Precautions (0990A903)
☐ Startup Guide (this document)
☐ Feet (for installation) ×4

☐ EXT. I/O connector (with cover)



☐ EXT. I/O interlock release connector (with cover)



Carefully store interlock release connectors. When this connector is connected to the EXT.I/O terminal of the SW2001, the interlock function will be disabled. Connect to this connector when using the SW2001 without using the interlock function.

Options (Sold Separately)

The following options are available for the ST4200 and SW2001. To buy, contact your authorized Hioki distributor or reseller. The options are subject to change without prior notice. Visit our website for updated information.

ST4200 Partial Discharge Detector

High Voltage Multiplexer with PD Sensor (specified at time of order)

Specify one of two types of PD sensors when ordering.

- SW2001-04 High Voltage Multiplexer (4 channels)
- SW2001-08 High Voltage Multiplexer (8 channels)
- SW2001-16 High Voltage Multiplexer (16 channels)
- SW2001-24 High Voltage Multiplexer (24 channels)

External storage device (specify at time of order)

- U8332 SSD Unit

External storage device

- Z4001 SD Memory Card (2 GB)
- Z4003 SD Memory Card (8 GB)
- Z4006 USB Drive (16 GB)

Communication cables

- L9637 RS-232C Cable
- L1002 USB Cable (A-B)

Partial discharge sensor

- ST9210 PD Sensor
  This sensor is used for AC partial discharge in combination with the ST4200.
  For instructions on how to use the ST9210 in combination with the ST4200, please refer to the instruction manuals for both the ST4200 and the ST9210.

SW2001 High Voltage Multiplexer

Module (specify at time of order)

The SW2001 can come with two types of PD sensors installed. Specify when ordering.

- ST9200 PD Sensor (for AC Partial Discharge)
- ST9201 PD Sensor (for Impulse Partial Discharge)

Connection Cable

Product Name	Maximum rated terminal-to-ground voltage	Maximum rated voltage	Maximum rated current	Cable length
L2005 Connection Cable 	30 V DC or less	30 V peak	2.5 A peak	1500 mm (59.1 in.)
L2111 Connection Cable 	60 V DC or less 30 V AC rms or less 42.4 V AC peak or less	60 V DC or less 30 V AC rms or less 42.4 V AC peak or less	3 A AC/DC continuous	1500 mm (59.1 in.)
L2255 Connection Cable 	4200 V peak	–	–	1500 mm (59.1 in.)
L2265 Unterminated Lead Cable 	5000 V AC/DC rms 8 kV peak	–	150 mA AC/DC rms	3000 mm (118.1 in)
L2270 Connection Cable 	5000 V AC/DC rms	–	150 mA AC/DC	1500 mm (59.1 in.)
L2271 Connection Cable 	–	–	150 mA AC/DC	1500 mm (59.1 in.)
L9218 Connection Cable 	30 V AC rms	30 V AC rms	0.2 A	1500 mm (59.1 in.)
L1002 USB Cable (A-B) 	–	–	–	1000 mm (39.4 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 indeath or serious injury.
WARNING	Indicates a potentially hazardous situation that, if not avoided, could resultin 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 potential hazards. See the “Operation Precautions” (p. 12) and safety notes listed at the beginning of operating instructions in the instruction manual(s),and the accompanying document entitled Operating Precautions.
	Indicates a hazardous terminal due to high voltage.
	Indicates the push-button switch that can turn the product on and off.
	Indicates the on side of the power switch.
	Indicates the off side of the power switch.
	Indicates an earthing terminal.
	Indicates a chassis terminal, connected to the enclosure of the product.

Symbols for Standards

	Indicates that the product is subject to the Directive on Waste Electrical and Electronic Equipment (WEEE) in EU member nations. Dispose of the product in accordance with local regulations.
	Indicates that the product complies with standards imposed by EU directives.

Other notations

PD	Abbreviation for “partial discharge.”
AC PD	Indicates the partial discharge generated when high voltage is applied to the object under measurement.
Impulse PD	Indicates the partial discharge generated when impulse voltage is applied to the object under measurement.
*	Indicates that additional information is described below.
(p.)	Indicates the page number to reference.
[ ]	On-screen user interface names are displayed in brackets **[ ]**.
START (Bold-faced)	Indicates on-screen names and keys.

Safety Information

The ST4200 and SW2001 were designed in accordance with the IEC 61010 international standard and their safety was confirmed during pre-shipment inspections. However, using the instruments in a way not described in this manual may diminish their safety.
Read the following safety notes carefully before using the instruments as well as the instruction manual for connected measuring instruments.

⚠ DANGER

■ **Use the ST4200 and SW2001 only with a thorough understanding of the content of the instruction manual.**

Misuse may result in serious bodily injury or damage to the measuring instrument.

⚠ WARNING

■ **When first using an electrical measuring instrument, do so under the supervision of an experienced user.**

Failure to do so may cause the user to experience an electrical shock.
It may also result heat generation, fire, or an arc flash due to a short-circuit.

Protective Gear

⚠ WARNING

■ **Wear protective insulation.**

The SW2001 performs measurements on a live line. The user may experience an electrical shock if protective gear is not worn. Users are required by law to wear protective insulation.

Measurement categories

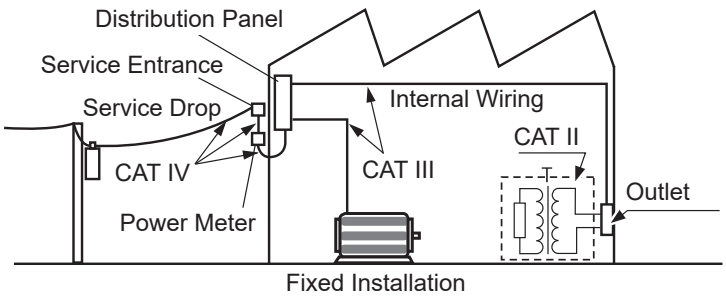
To enable the safe usage of the ST4200 and SW2001, the measurement categories established in IEC 61010 are used. Tested and measured circuits aimed at connecting to a main power supply circuit are categorized into three categories based on the type of main power supply circuit.

⚠ DANGER

- **Do not use measuring instruments to perform measurements on main power supply circuits that exceed the rated measurement category for that measuring instrument**
- **Do not use a measuring instrument that is not in the rated measurement category for measurement of the main power supply circuit**

This may result in serious bodily injury or damage the measuring instrument.

Measurement category II (CAT II)	Applies to test and measurement circuits that connect directly to points of use (outlets and similar locations) for low-voltage main power supply systems. Example: Measuring only on the user side of outlets for fixed equipment and main power supply circuits for electronic appliances, portal instruments, and similar devices
Measurement category III (CAT III)	Applies to test and measurement circuits that connect to power distribution points for low-voltage main power supply systems in buildings. Example: Measurement at fixed-equipment switchboards (including secondary-side meters), photovoltaic panels, circuit breakers, wiring, incidental cabling, bus bars, junction boxes, switches, and outlets, as well as measurements at industrial devices permanently connected to fixed equipment, installed motors, and similar equipment
Measurement category IV (CAT IV)	Applies to tests and measurement circuits that connect to power supplies for low-voltage main power supply systems in buildings. Example: Measurement at devices equipped in front of circuit breakers to main power supply fuses in buildings and equipment



Operation Precautions

Follow the precautions below to ensure safe operation of the ST4200 and SW2001 and to obtain the full benefits of their various functions.
Ensure that your use of the measuring instrument falls within the specifications not only of the instrument itself, but also of any accessories, options and other equipment being used.

Measuring instrument installation

⚠ WARNING

■ **When installing measuring instruments, 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**

Installing in such locations may cause the measuring instrument to be damaged or malfunction and cause bodily injury.

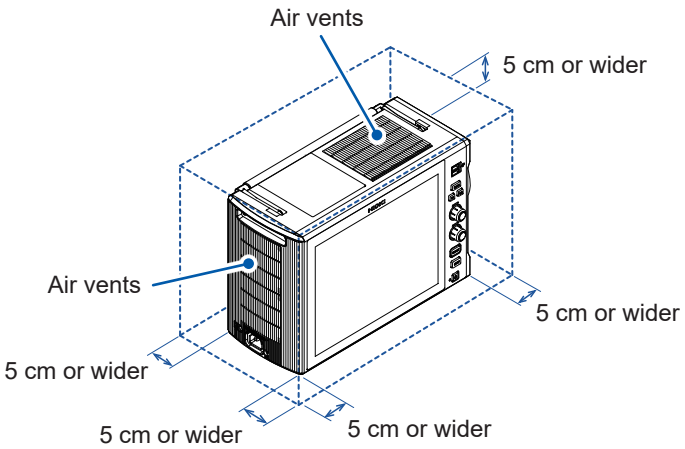
■ **Ensure there is sufficient space around the measuring instrument when it is used.**

Unplugging the power cord kills power to the measuring instrument. Be sure to provide enough unobstructed space to unplug the power cord immediately in an emergency.

⚠ CAUTION

■ **To ensure air vents are not obstructed, install the ST4200 no closer than the specified distance around such vents.**

This will cause the temperature inside the ST4200 to increase and may result in fire or device failure.



Checks before use

⚠ DANGER

■ **Inspect before use to ensure that the ST4200 and SW2001 will function correctly.**

Using a measuring instrument while it is damaged may cause serious bodily harm.
If you find any damage, contact your authorized Hioki distributor or reseller.

Handling measuring instruments

⚠ CAUTION

■ **Do not subject the measuring instrument to extreme shock or vibration when moving or handling it.**

■ **Do not drop the measuring instrument on the ground.**

The measuring instrument may be damaged.

The ST4200 and SW2001 are EN 61326 Class A products.
When using in a home environment such as a residential area, it may interfere with the reception of radio and television broadcasts.
In such cases, workers should implement appropriate measures.

Precautions during measurement

⚠ DANGER

■ **Do not use the ST4200 or SW2001 outside of their ratings or specification ranges.**

The measuring instrument may be damaged or generate heat, resulting in serious bodily injury.

⚠ WARNING

■ **Do not connect any equipment other than the SW2001 or ST9210 to the measurement signal input terminal.**

The input terminals on this instrument are used only for signal inputs from the SW2001 High Voltage Multiplexer or the ST9210 PD Sensor. Do not use inputs from devices or sensors otherthan the SW2001 and the ST9210. Damage to the instrument or overheating can cause bodilyinjury.

Handling cables

⚠ DANGER

- **Do not use cables with damaged insulation or exposed metal parts.**

  This may result in serious bodily injury.

- **Before performing a measurement, connect the instrument with the generator (AC power or impulse power) and 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.

- **Do not cause a short-circuit between two cable ends that have applied voltages.**

  Short-circuiting may cause serious bodily injury.

⚠ WARNING

- **If using the SW2001 with optional connection cables attached, do not use for measurements that exceed the ratings displayed for each.**

  Using for a measurement that exceeds one of the ratings may cause the user to experience an electrical shock.

- **Do not bend or pull cables at the base of cables or repeatedly bend them.**

  The cable may disconnect or short-circuit.

- **Check whether the insulation layer inside the cable has been exposed.**

  If the ST4200 or SW2001 are used with a cable's interior coloring exposed, the user may experience an electrical shock.

- **When using the ST4200 and SW2001, use Hioki-specified connection cables.**

  Using a connection cable other than specified type may cause bodily injury or a short-circuit incident.

⚠ CAUTION

- **Do not step on cables or place them between other objects.**
- **Do not bend or pull on cables in sub-zero temperatures.**

  The cable will be stiff in such conditions. The cable may disconnect or insulation may be damaged, causing the user to experience an electrical shock.

Precautions during transport

⚠ CAUTION

- **Have two or more people hold by the handles on the front and back.**

  Weights: SW2001-04: Approx. 20.5 kg, SW2001-08: Approx. 22.5 kg,
  SW2001-16: Approx. 27.0 kg, SW2001-24: Approx. 31.5 kg

- **Adhere to worker's safety rules. (e.g., wearing non-slip gloves and safety boots)**

  Failure to do so may result in bodily injury.

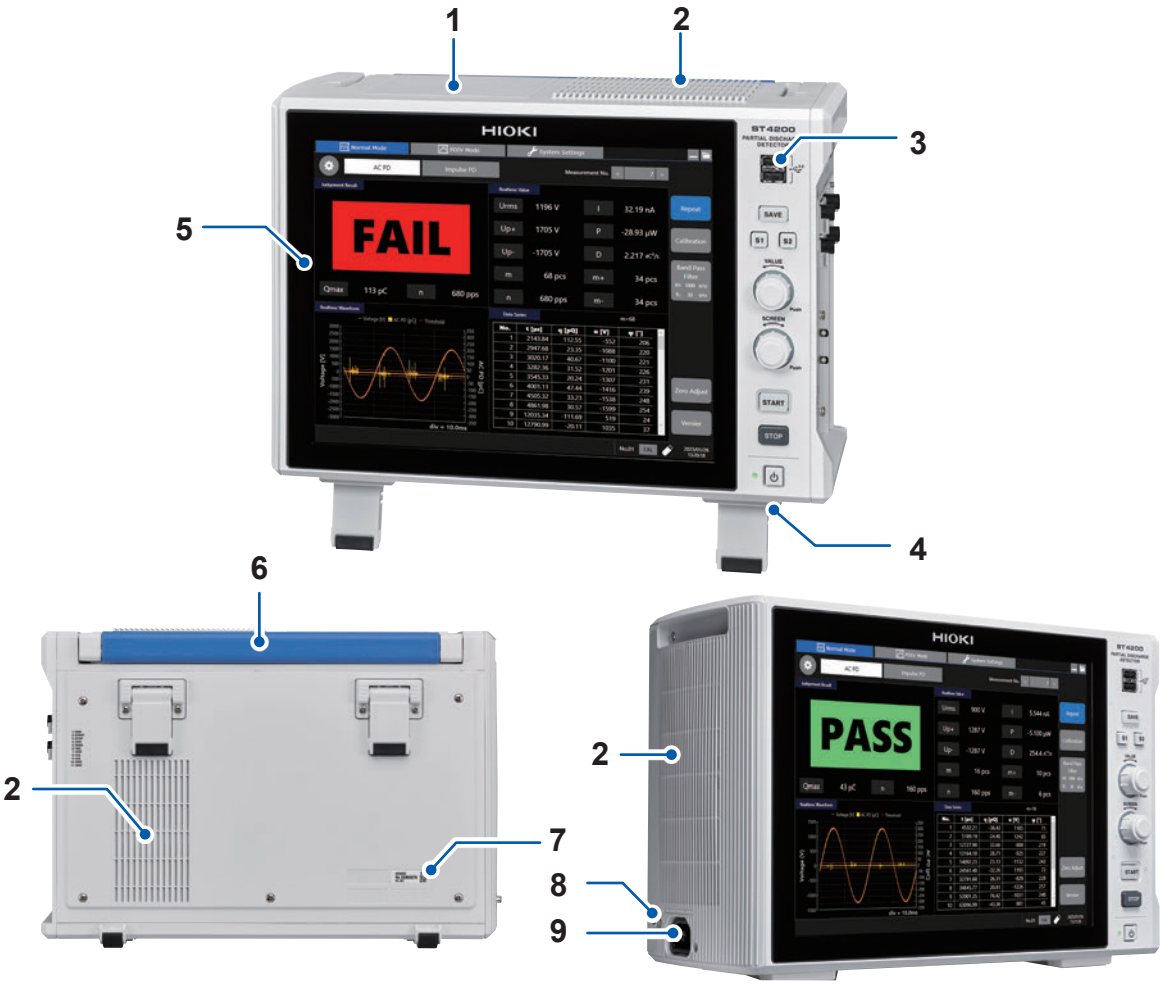
1 Overview

1.1 Product Overview

ST4200 Partial Discharge Detector is equipped with the functionality to perform both AC PD measurements in conformance with IEC 60270 (2015) and IEC 60034-27-1 (2017), as well as impulse PD measurements in conformance with IEC 61934 (2011) and IEC 60034-27-5 (2021). SW2001 High Voltage Multiplexer is a dedicated unit that integrates all motor stator tests into one unit. It can switch between U, V, W, the ground, and other measurement points, as well as automate measurements for a maximum of 24 channels with PC or PLC control. By safely changing between high-voltage and low-voltage measurement, damage to the ST4200, SW2001, and object under measurement can be prevented.

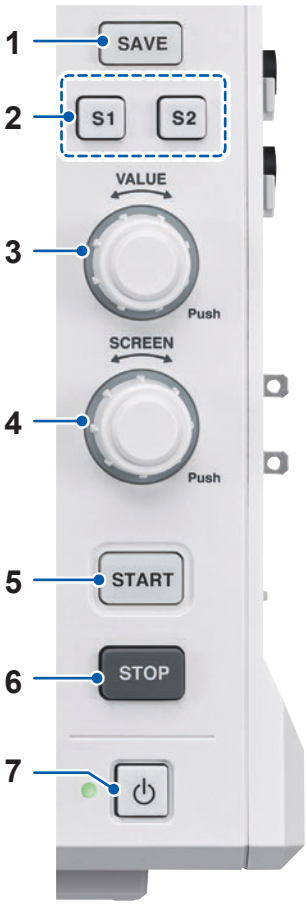
1.2 Name and Function of Each Part

ST4200 Partial Discharge Detector



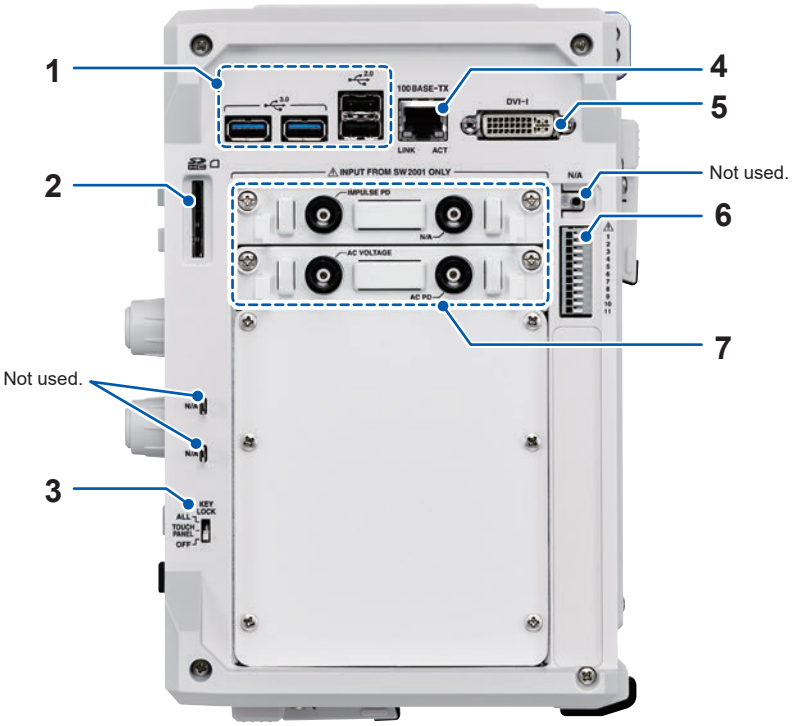
No.	Name	Function
1	**Media box**	Holds the SSD unit. One port is available for USB 3.0 connector (dedicated to USB flash drives). Always use the instrument with the cover closed.
2	**Air vents**	These holes provide ventilation to prevent the internal temperature of the ST4200 from increasing to a high temperature.
3	**USB connector**	Connect a USB flash drive, USB mouse, or USB keyboard.
4	**Feet**	These feet are used to incline the ST4200 for better visibility of the screen. These feet are used for easier operation of the touch panel.
5	**Display**	A 12.1-inch TFT color LCD equipped with a capacitive touch panel. With capacitive touch panel.
6	**Handle**	The handle used to carry the ST4200.
7	**Serial number**	The serial number consists of nine digits. The first two digits from the left indicate the year of manufacture, and the next digits two indicate the month of manufacture. Required for product control. Do not remove this label. Inform your authorized Hioki distributor or reseller of this number if required.
8	**GND terminal (Functional earth terminal)**	Ground this terminal.
9	**Power inlet**	Connects the power cord provided.

Operation Keys



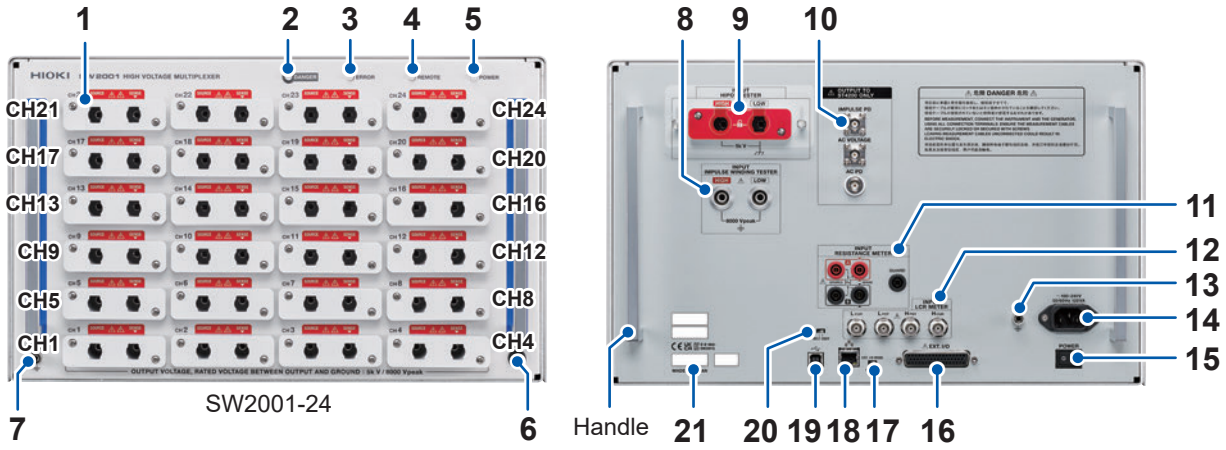
No.	Name	Function
1	**SAVE key**	Opens the manual saving dialog box. Lights up in blue while accessing the storage device.
2	**Shortcut keys**	Frequently used settings can be registered on the keys.
3	**Rotary knob VALUE**	While the slider bar setting screen is displayed, rotate the VALUE rotary knob to change by increments of **[100]**. Press the rotary knob to change by increments of **[10]**. Press the knob again to return the increment to **[100]**. When configuring using the slider bar, the LED rotary knob will light up in green and become enabled for operation.
4	**Rotary knob SCREEN**	Use this to change the value of **[Measurement No.]**. Pressing this sets the Measurement No. to 1 for AC PD and Up1 for impulse PD. When configuring AC PD repeat measurements or Impulse PD PDIV measurements, the LED rotary knob screen will light up in red and become enabled for operation.
5	**START key**	Starts a measurement. Lights up in green during a measurement.
6	**STOP key**	Stops the measurement.
7	**Power key**	Used to turn the instrument on and off.

Right side



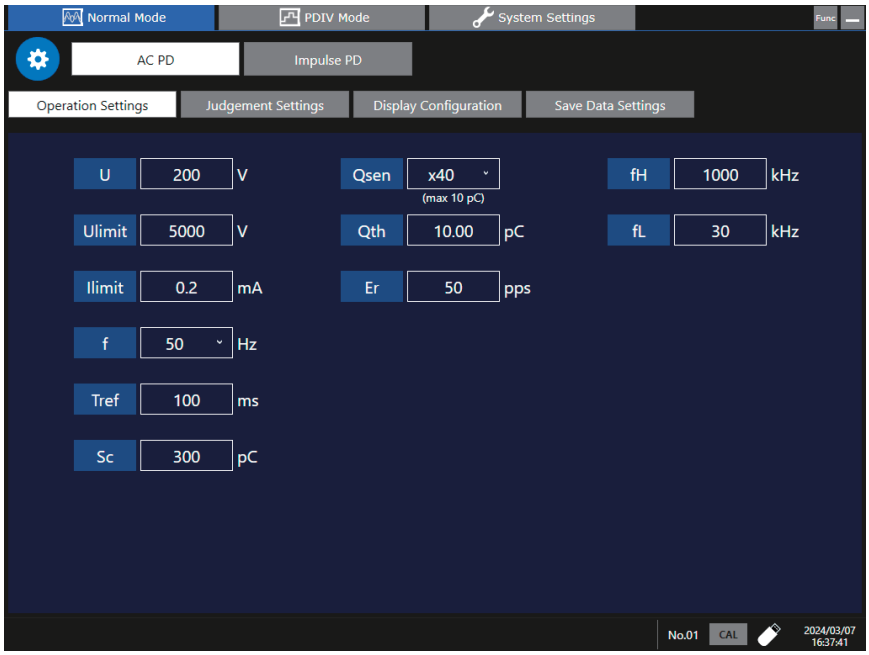
No.	Name	Function
1	**USB connector**	Connect a USB flash drive, USB mouse, or USB keyboard.
2	**SD flash drive slot**	Insert an SD flash drive.
3	**KEY LOCK**	**ALL**: Disables touch panel and key operation. **TOUCH PANEL**: Only touch panel operation is disabled. **OFF**: The key lock is disengaged.
4	**LAN connector (100BASE-TX)**	Plug a LAN cable to connect the instrument to your network.
5	**DVI-I terminal**	Outputs the screen display signals.
6	**External control terminals**	Enables control of the ST4200 by inputting external signals, and the outputting of signals externally.
7	**Measurement signal input terminal**	Terminal used to input measurement signals from the SW2001 or the ST9210.

SW2001 High Voltage Multiplexer



No.	Name	Function
1	**Output channels (CH1 to CH24)**	Connect the optional L2265 Unterminated Lead Cable.
2	**DANGER LED (Red)**	Turns on when the input channel HIPOT or IMPULSE relay is ON.
3	**ERROR LED (Orange)**	Turns on during the self-test at startup or when there is an error during communication.
4	**REMOTE LED (Green)**	Turns on when LAN communication is established or when a command is received via USB communication. Turns off when the `:LOCal` command is received.
5	**POWER LED (Green)**	Turns on when the power is activated.
6	**GUARD terminal**	Used to avoid the effects of noise when measuring resistance.
7	**GND terminal (functional earth terminal)**	Ground this terminal.
8	**IMPULSE WINDING TESTER terminal**	Connect the ST4030A Impulse Winding Tester via L2255 Connection Cable.
9	**HIPOT TESTER terminal**	Connect the L2270 (high) and L2271 (low) to the 3153 Automatic Insulation/ Withstanding HiTester.
10	**ST4200 output terminals**	Connect to the ST4200 using L9218 Connection Cable.
11	**RESISTANCE METER terminal**	Connect to RM3545 Resistance Meter using L2111 Connection Cable.
12	**LCR METER terminal**	Connect to IM3533 LCR Meter using L2005 Connection Cable.
13	**GND terminal**	Ground this terminal.
14	**Power inlet**	Connects the power cord provided.
15	**POWER switch**	Used to turn the instrument on and off.
16	**EXT. I/O connector**	Enables to control the SW2001 by inputting external signals, or output signals externally. Connect the EXT.I/O interlock release jig.
17	**EXT. I/O MODE switch (NPN/PNP)**	Switch the type of PLC (programmable logic controller) connected to EXT.I/O.
18	**LAN connector**	Connect the LAN cable.
19	**USB connector**	Connect the USB cable.
20	**Communication setting mode switch**	Change the communication setting mode to **DFLT** (fixed settings) or **USER** (user settings).
21	**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.

1.3 ST4200 Screen Configuration



[Normal Mode]	**[AC PD]**	This mode applies constant voltage to measure the magnitude of a partial discharge.
	[Impulse PD]	
[PDIV Mode]	**[AC PD]**	This mode performs measurement while adjusting measurement voltage up and down to measure partial discharge inception voltage (PDIV) and partial discharge extinction voltage (PDEV).
	[Impulse PD]	
[System Settings]	**[Table]**	The ST4200 records calibration values, measurement settings, display settings, and other information, and is equipped with a table function that can be called for use. Using the table function makes it possible to switch to different measurement conditions for multiple objects being measured.
	[System]	Configure system protection, beep sounds, languages, shortcut keys, region, and date and time. Return to factory default settings (system reset).
	[Equipment Connection]	Configure communications with measuring instruments controlled by the ST4200 and devices that control the ST4200.
	[Information]	Displays ST4200 system information. It is also possible to upgrade the firmware version.

Settings screen

[Operation Settings]	Configure ST4200 measurement and control instruments.
[Judgment Settings]	Configure judgment criteria and threshold values.
[Display Configuration]	Configure the configuration of what is displayed on the screen.
[Save Data Settings]	Configure settings for saving measurement data.

2 Preparing for Measurement

Read “Operation Precautions” (p. 12) carefully before preparing to perform a measurement.
This document will explain how to prepare for three-phase stator AC PD and impulse PD measurements. For four-terminal measurements, such as those using an LCR meter or resistance meter, read the SW2001 Instruction Manual.

2.1 Connecting Communication Cables

Connect the ST4200 and control devices using the appropriate communication cables for each device.
Configure communication settings for both the ST4200 and control devices so that the settings match.
Configure on the ST4200’s **[System Settings]** > **[Equipment Connection]** screens.
Ensure that the communications settings of the control device match those shown on the **[Equipment Connection]** screen.

⚠ WARNING

■ **Power off each device before attaching or detaching interface connectors.**

Failure to do so may cause the user to experience an electrical shock.

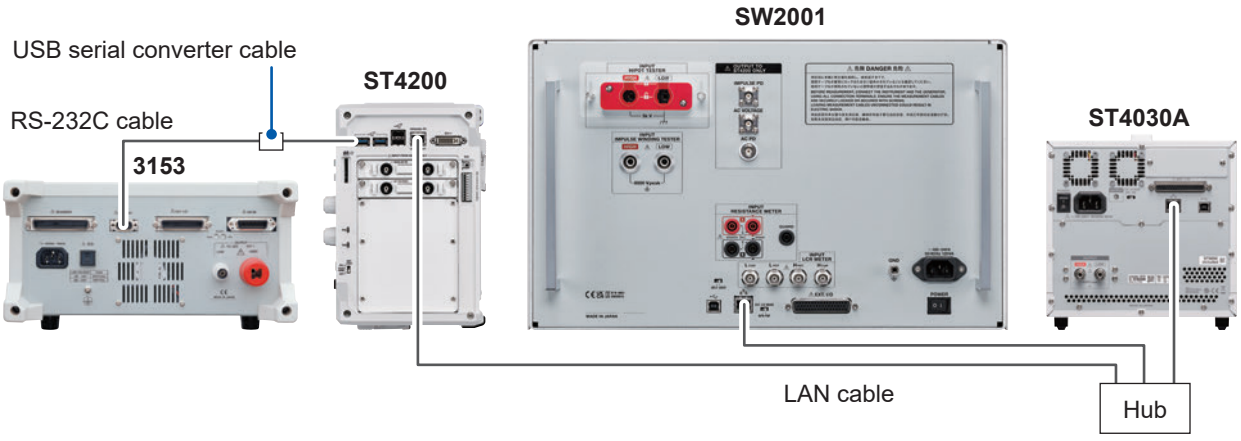
If using LAN cables

Required items

LAN cables × 3, hub ×1, USB serial converter cable (commercial) × 1, RS-232C cable L9637 (9 pin–9 pin) × 1

It may be necessary to install a USB driver on the ST4200 in order to use some USB serial converter cables. Install Windows 10 64-bit drivers.

Connection examples



1 **Connect each measuring instrument to the network via the hub.**

For the 3153 Automatic Insulation/Withstanding HiTester, use a USB serial converter cable and crossover cable to connect to the ST4200.

2 **Connect power cords to the ST4200, each measuring instrument, and the hub, and turn on their power.**

3 **Set the IP address or COM number for each measuring instrument via the ST4200's [System Settings] > [Equipment Connection] screens.**

4 **Configure communications settings for each measuring instrument based on the settings shown on the ST4200's [Equipment Connection] screen.**

For information on communications settings, refer to the instruction manual for each measuring instrument.

If using USB cables

Required items

USB cable (A-B type) × 1

1 **Use a USB cable to connect the rear USB connector of the SW2001 with the side USB connector of the ST4200.**

2 **Connect power cords to the ST4200 and SW2001, and turn on their power.**

3 **Set the COM number for SW2001 via the ST4200's [System Settings] > [Equipment Connection] screens.**

2.2 SW2001 and AC power (Insulation/Withstand Voltage Tester) Connections

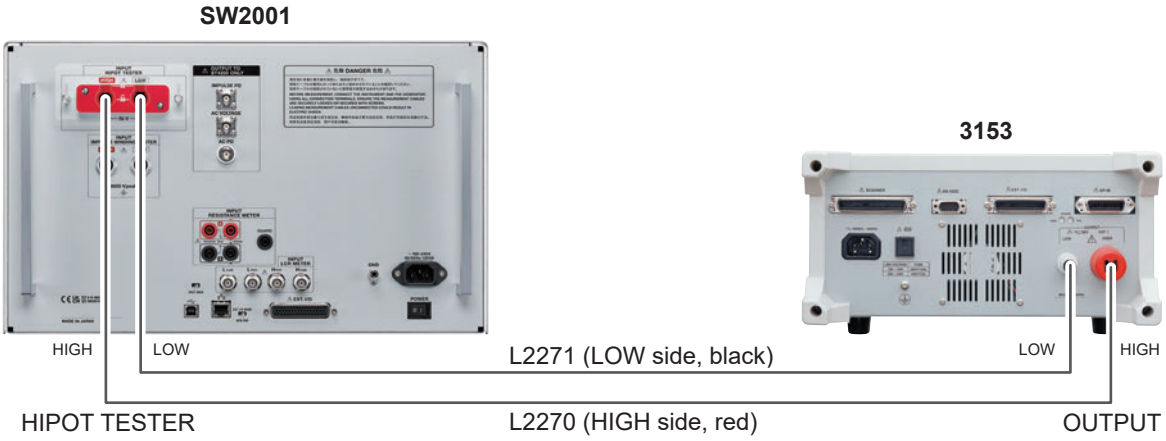
Use connection cables to connect the SW2001 and AC power (insulation/withstand voltage tester).

Required items

L2270 Connection Cable (HIGH side, red) ×1

L2271 Connection Cable (LOW side, black) ×1

Connected device: 3153 Automatic Insulation/Withstanding HiTester



IMPORTANT

If using another company's AC power supply, modify cables to suit the shape of the terminals.

1 **Turn off power to the SW2001 and withstand voltage tester.**

2 **Attach the (black) plug of L2271 Connection Cable to the low-voltage output terminal in the back of the withstand voltage tester, and insert the plug (red) of L2270 Connection Cable into the high-voltage output terminal.**

3 **Loosen the screws on the cable dropout prevention plate for the HIPOT TESTER terminal on the back of the SW2001.**

4 **Slide up the cable dropout prevention plate.**

5 **Align the connection cable connectors with the terminal holes and insert them all the way inside.**

6 **Slide down the cable dropout prevention plate until it comes in contact with the screws and locks the connectors in place.**

7 **Tighten the screws on the cable dropout prevention plate.**

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

9 **Power on the withstand voltage tester.**

2.3 Connecting the ST4200 and the SW2001

⚠ DANGER

■ **Check that the SW2001's DANGER light is off before connecting cables.**

Failure to do so may cause the user to experience an electrical shock.

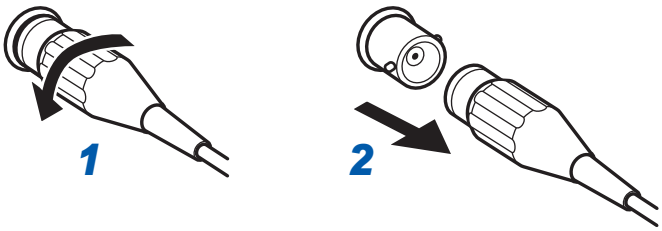
⚠ CAUTION

■ **Connect the plastic connector (black) of L9218 Connection Cable to the ST4200 input terminal (insulated BNC connector).**

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.



AC PD measurement

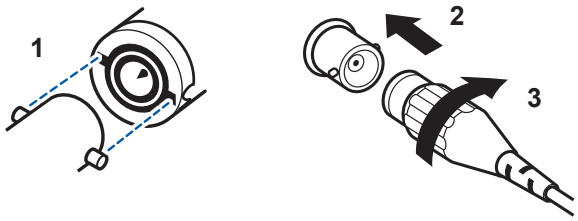
For AC PD measurements, connect the ST4200 and SW2001 with L9218 Connection Cable.

Required items

L9218 Connection Cable × 2

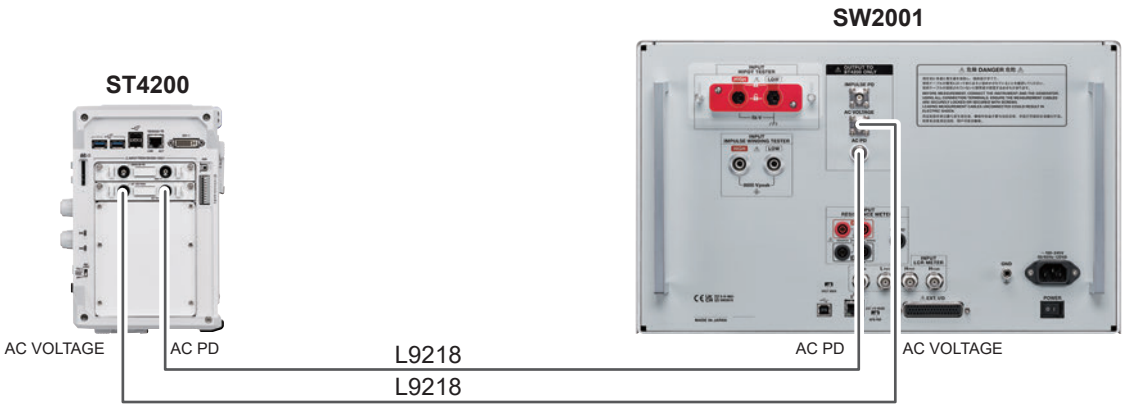
1 Connect the ST4200 AC PD terminal and the SW2001 AC PD terminal using connection cable L9218.

Connect the plastic connector (black) to the ST4200 and the metal connector to the SW2001.



2 Connect the ST4200 AC VOLTAGE terminal and the SW2001 AC VOLTAGE terminal using the connection cable.

Connect the plastic connector (black) to the ST4200 and the metal connector to the SW2001.



3 Connect the SW2001 and the withstand voltage tester.

See:“2.2 SW2001 and AC power (Insulation/Withstand Voltage Tester) Connections” (p.23)

4 Connect the SW2001 and the object under measurement.

See:“2.4 Connecting the SW2001 and the Object Under Measurement” (p.28)

Impulse PD measurement

For impulse PD measurements, connect the SW2001 and ST4030A Impulse Winding Tester with L2255 Connection Cable. Additionally, connect the SW2001 and the ST4200 using L9218 Connection Cable.

Required items

L2255 Connection Cable ×1

L9218 Connection Cable ×1

1 **Connect the SW2001's IMPULSE WINDING TESTER terminal and the impulse power supply (impulse winding tester) voltage output terminal using L2255 Connection Cable, connecting HIGHs and LOWs.**

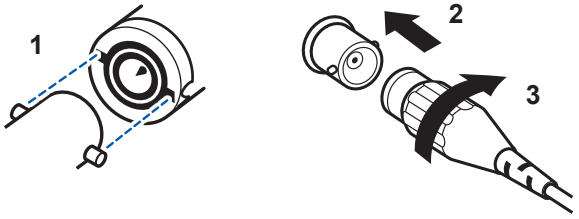
Insert the connection cable connector all the way into the SW2001 connector and confirm that the lock mechanism has locked the connection. If the lock mechanism works correctly, you will hear a click.

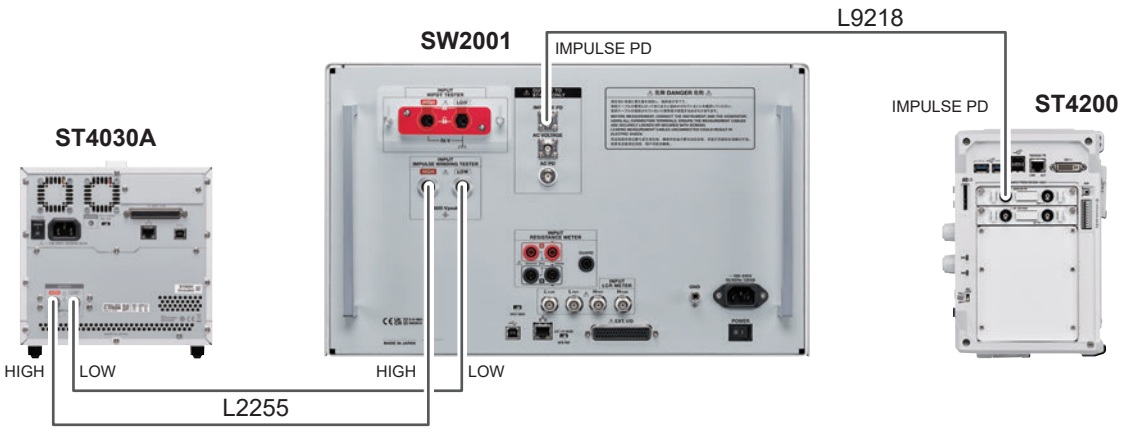
IMPORTANT

If using another company's AC power supply, modify cables to suit the shape of the terminals.

2 **Connect the ST4200 IMPULSE PD terminal and the SW2001 IMPULSE PD terminal using L9218 Connection Cable.**

Connect the plastic connector (black) to the ST4200 and the metal connector to the SW2001.





3 **Connect the SW2001 and the object under measurement.**

See:"2.4 Connecting the SW2001 and the Object Under Measurement" (p.28)

2.4 Connecting the SW2001 and the Object Under Measurement

Connect the SW2001 and the object under measurement using L2265 Unterminated Lead Cable. 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.

Required items

L2265 Unterminated Lead Cable × 4

⚠ WARNING

■ **When connecting L2265 Unterminated Lead Cable to the SW2001, disconnect the connection cable from the object under measurement.**

The object under measurement may short-circuit, depending on the relay switching circuit.

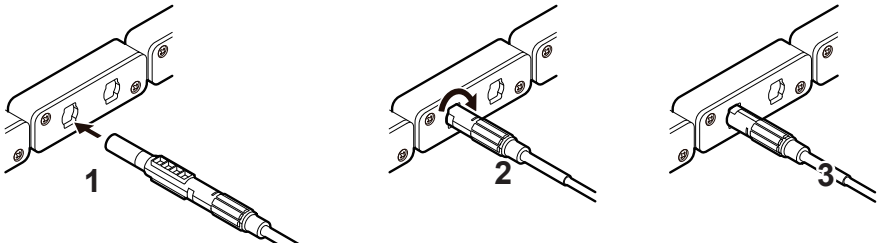
1 **Turn off power to the SW2001.**

2 **Connect the four unterminated lead cables to the SOURCE terminals for each SW2001 channel.**

Align the unterminated lead cable connectors with the terminal holes and insert them all the way inside.

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

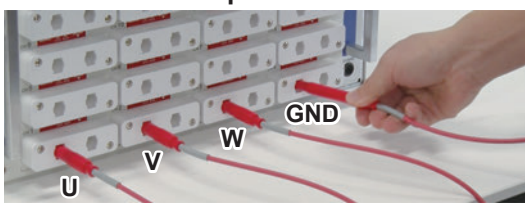
This connector can be rotated over 90 degrees either left or right. However, turning it 180 degrees is dangerous as it will deactivate the lock.

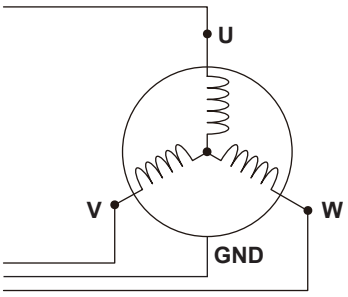


4 **Check to ensure that the unterminated lead cable connector cannot be removed.**

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

Connection examples





Object under measurement is a neutral point-connected three-phase stator

2.5 Connecting External Control Terminals

This section describes the procedure and external control terminal function for controlling the ST4200 externally. Connecting the external control terminals with external devices allows the ST4200 to start and stop a measurement. Signals inputted into the external control terminals operate the instrument even when the key lock function is enabled.
The term “external control terminals” is used to see all of these terminals collectively.

⚠ DANGER

■ **Do not input voltage/current exceeding the maximum input voltage/ current to the external control terminals.**

The ST4200 may be damaged and this may result in serious bodily injury.

I/O terminals	Maximum input voltage
START	10 V DC
STOP	10 V DC
PASS	50 V DC, 50 mA, 200 mW
FAIL	50 V DC, 50 mA, 200 mW

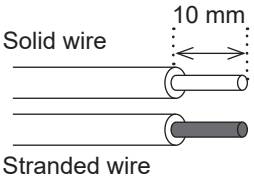
⚠ WARNING

■ **Following the steps below before wiring the external control terminals.**

1. Turn off the power to the ST4200 and any devices to be connected.
2. Remove any static electricity from your body.
3. Confirm that the signal does not exceed the rating for external input/output.
4. Properly insulate the devices and equipment to be connected.

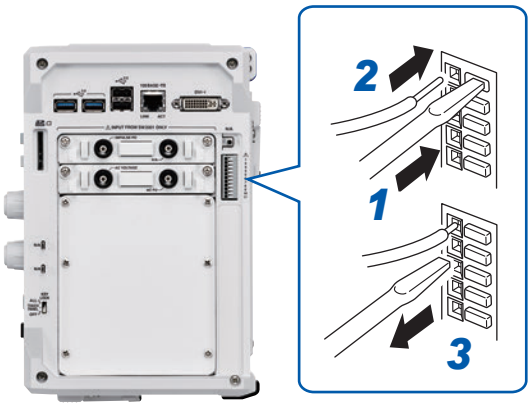
Failure to so may cause the user to experience an electrical shock or the ST4200 to be damaged.

Wires to be connected



Compatible wire	Solid wire: ø0.32 mm to ø0.65 mm (AWG28 to AWG22) Stranded wire: 0.08 mm^2 to 0.32 mm^2 (AWG28 to AWG22) Strand diameter: ø0.12 mm or more (per wire)
Standard insulation stripping length	9 mm to 10 mm
Button pressing tool	Flat-blade screwdriver (tip width: 2.6 mm)

How to connect wires



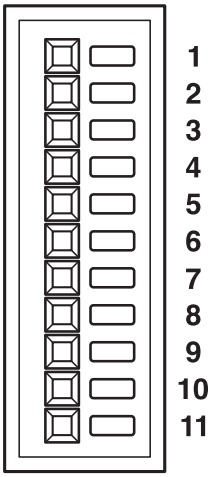
1 **Depress a button of the external control terminals with a flat-blade screwdriver.**

2 **Insert the wire into the wire connection hole while depressing the button.**

3 **Release the button.**

The wire is secured.

Terminal block



Pin	Signal name	I/O	Function	Operation
1	GND	–	GND potential	–
2	START	IN	Start measurement	Edge
3	STOP	IN	Stop measurement	Edge
4	GND	–	GND potential	–
5	PASS	OUT	Overall judgment: PASS	–
6	FAIL	OUT	Overall judgment: FAIL	–
7	GND	–	GND potential	–
8	N/A	–	Not used	–
9	N/A	–	Not used	–
10	GND	–	GND potential	–
11	GND	–	GND potential	–

How to assemble the included connector

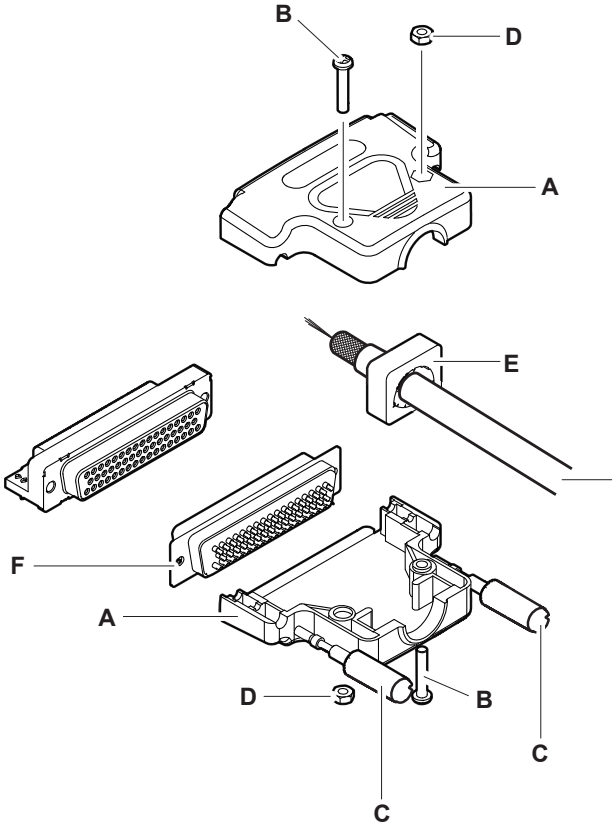
The SW2001 includes an EXT. I/O connector and EXT. I/O connector cover.
Assembly by referring to the following instructions.

IMPORTANT

- Use shielded wire for the cables connecting the EXT. I/O connector to the PLC (programmable logic controller), etc. Not using shielded wire may cause the system to malfunction due to noise-related factors.
- Connect the shielded portion to the ISO_COM terminal of the EXT. I/O.
- If you have lost any of the included screws or find that any screws are damaged, please contact your authorized Hioki distributor or reseller.

Required items

Screwdriver, shielded wire, soldering iron, included accessories (A-F)



A Cover (same shape for top and bottom) × 1 set (2 pcs.)

B Screws (+/−) M3 fine thread (total length: 18 mm) × 2 pcs.

C Screws (−) #4-40UNC (total length: 42.5 mm) × 2 pcs.

D Nuts: M3 fine thread × 2 pcs.

E Fastener (for cable) × 1 pc.

F Connector × 1 pc.

Assembly instructions

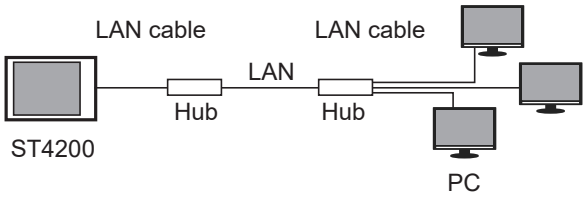
1. **Run the cable (shielded wire) through the fastener (E).**
2. **Solder the cable to the included EXT. I/O connector (F).**
3. **Place the connector (F), fastener (E), and two screws (C) on one side of the cover (A).**
4. **Place the other cover (A) on top from above.**
5. **Fasten the screws (B) and nuts (D) into the two locations on the top and bottom of the cover (A).**

   Be careful not to damage the cover by tightening the screws too much.

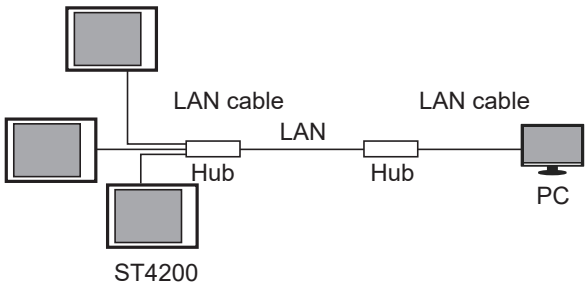
2.6 Connecting the ST4200 and PC

Connecting the ST4200 with a PC via a LAN cable allows the ST4200 to be controlled and monitored from a PC. Connect LAN cables to the ST4200 and the LAN connector of the PC. The following two ways are available:

(1) Connecting the ST4200 to an existing network



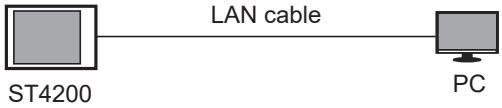
Connecting one ST4200 unit to multiple PCs



Connecting multiple ST4200 units to a single PC

Use either a commercially available 100BASE-TX or 10BASE-T LAN cable.
Either a straight-through cable or crossover cable can be used.

(2) One-to-one connection between the ST4200 and a PC



Use either a commercially available 100BASE-TX or 10BASE-T LAN cable.
Either a straight-through cable or crossover cable can be used.

Configuration instructions

1. **Set the IP address for the ST4200 via the [System Settings] > [Equipment Connection] screen.**

2. **Configure the communications settings for the PC based on the settings shown on the ST4200's [Equipment Connection] screen.**

2.7 Preparing Storage Devices (Recording Media)

You can use the following recording media on the ST4200: SD memory cards, USB flash drives, and a built-in drive.
Use only the following Hioki options, which are more reliable than their commercial equivalents.

- Z4001 SD Memory Card (2 GB)
- Z4003 SD Memory Card (8 GB)
- Z4006 USB Drive (16 GB)

Internal drive (Option available only when ordered with the instrument)

- U8332 SSD Unit (256 GB)
  Once the drive has been formatted, the actual capacity available decreases.
  You cannot remove the internal drive.

⚠ CAUTION

■ **Do not accidentally force the SD card in upside down or backwards.**

This could damage the ST4200.

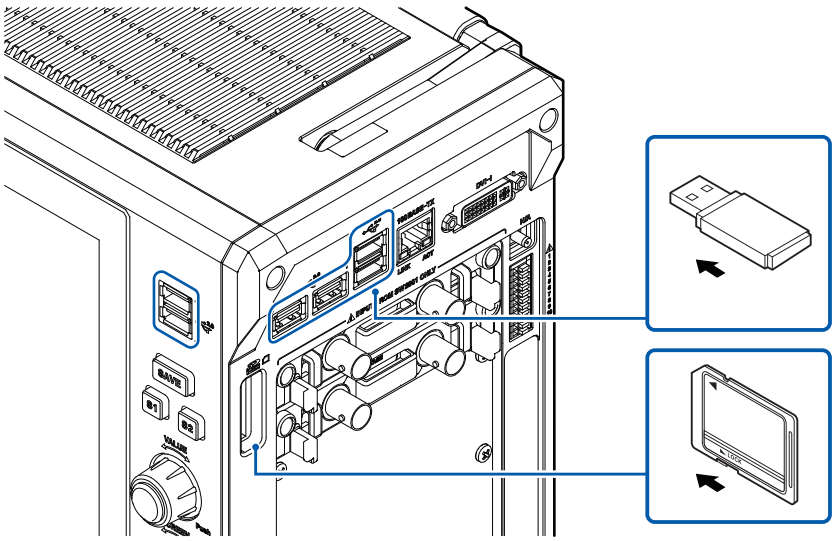
■ **Do not unplug the storage device when the ST4200 is accessing it.**

This could damage data stored on the device.

■ **Eliminate any static from your body before handling the storage device.**

■ **Power the instrument on before inserting the storage device into the ST4200.**

The storage device may be damaged or the instrument may malfunction. Additionally, the instrument may not start up at all.



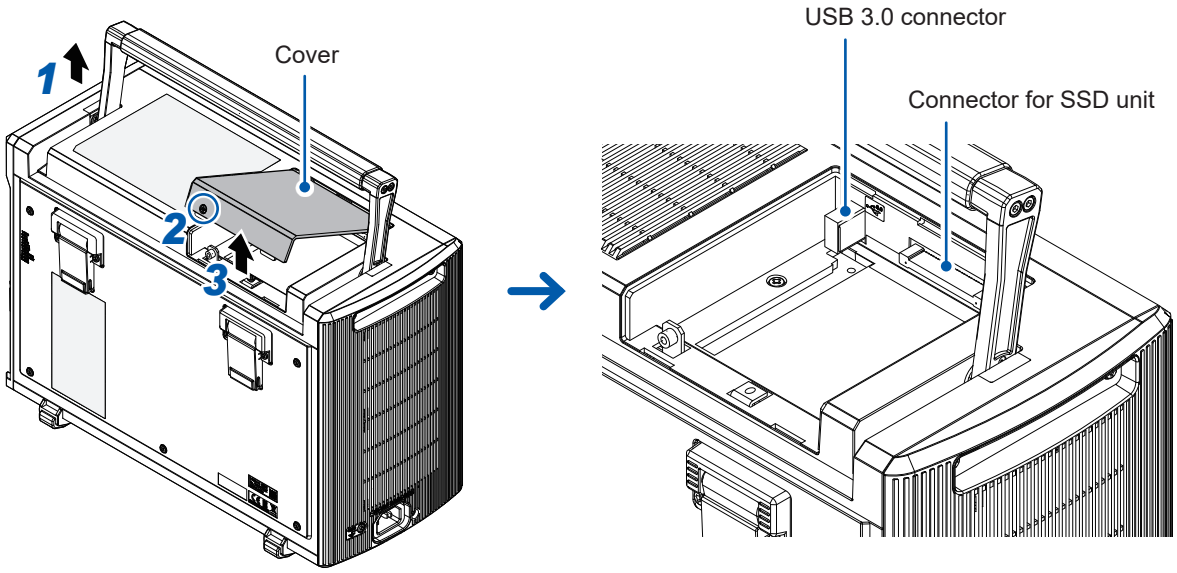
2.8 How to Open the Media Box

The USB 3.0 connector in the media box is specifically for USB flash drives.
Be sure to use the ST4200 with the cover closed. Before handling a USB flash drive, eliminate any static on your body.

1 **Extend the handle.**

2 **Loosen the cover screw until its head is completely removed from the cover.**

3 **Lift the front of the cover.**



2.9 Zero-Adjustment

Adjust the zero positions of ST4200 input channels to suit the reference potential of the ST4200.

Before executing zero-adjustment

- Warm up the ST4200 for about 30 minutes after the power-on to stabilize the internal temperature of the modules before executing calibration.
- Execute zero-adjustment with no signals inputted. Zero-adjustment may not correctly be executed with a signal inputted.
- Note that you can not execute zero-adjustment during measurement.
- No key operation is acceptable during zero-adjustment.

To execute zero-adjustment

1 **On the measurement screen, tap [Zero Adjust].**

The Zero Adjust pop-up window will appear.

2 **Tap [Execute].**

Zero-adjustment will be performed automatically. Once zero-adjustment is complete, the **[Success]** message will be displayed.

3 **Tap [Close].**

The Zero Adjust pop-up window will close.

IMPORTANT

Re-execute zero-adjustment in the following cases:

- After cycling the ST4200
- After initializing the ST4200 settings
- When the ambient temperature has significantly changed

The zero position may drift.

2.10 Power Supply

Supply power to the ST4200 and the SW2001. Connect the power cords and ground the GND terminals.

⚠ WARNING

■ **Connect the power cords to a grounded-type (2-pole) power outlet.**

If the power cords are connected to an outlet that is not grounded, the user may experience an electrical shock.

⚠ CAUTION

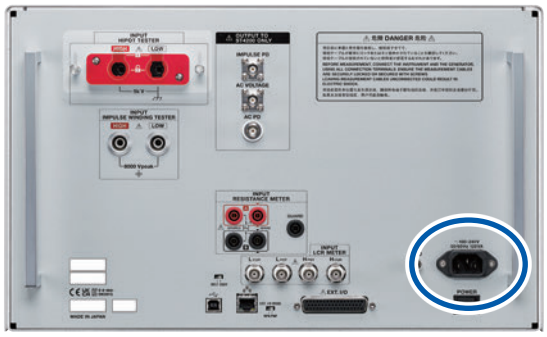
■ **Before connecting power cords, confirm that the power supply voltage to be used is within the voltage range indicated on the device's power connector.**

If the input voltage is outside the range, the device may be damaged and cause bodily injury.

1 **Confirm that the power switch is OFF.**

2 **Confirm that the power supply voltage is within the indicated range and connect the power cord to the power inlet.**

ST4200



SW2001

3 **Insert the power cord plug into the outlet.**

4 **Ground the GND terminal (functional earth terminal) to the earth.**

5 **Power on the ST4200 and the SW2001.**

Wait around 30 minutes for the ST4200 interior temperature to stabilize for an accurate measurement. (Warming up)

6 **Execute zero-adjustment on the ST4200 measurement screen.**

Configure the clock on the **[System Settings]** > **[System]** screen.

2.11 Instruction Manual Display Function

Use this function to display an HTML file of the instruction manual.

1 **Tap [Func] > [Help] > [Instruction Manual].**

3 Measurement Method

3.1 Inspection Before Measurement

⚠ DANGER

■ **Before use. check that the insulation of the cables is neither ripped nor torn and that no metal parts are exposed.**

■ **Before use, inspect the ST4200 and SW2001 and confirm that they operate normally.**

Using a damaged cable or measuring instrument may cause serious bodily harm. Replace the connection cords with those specified by Hioki.

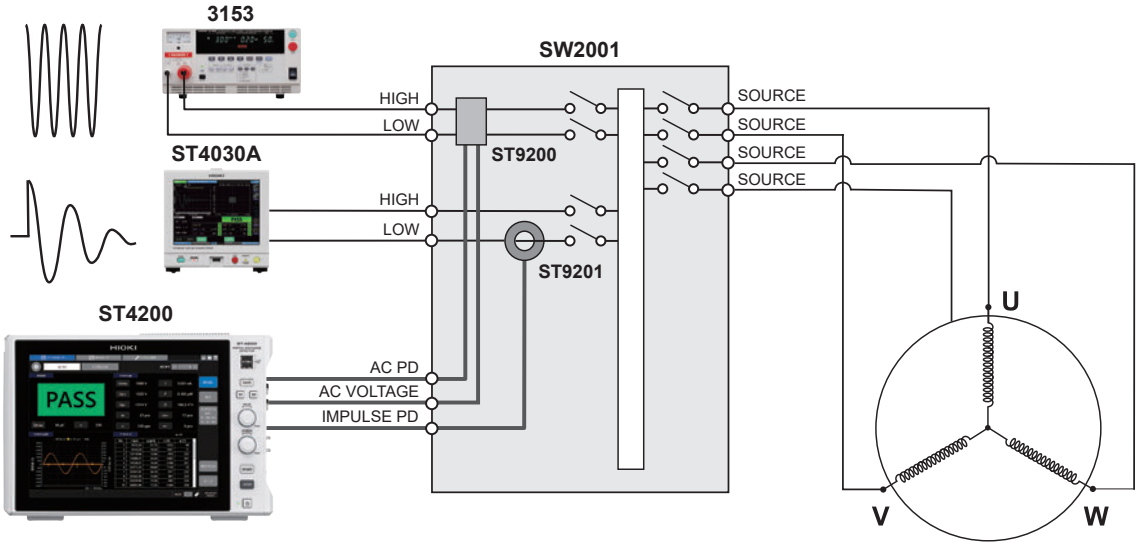
Inspection Item	Solution
The insulation of the power cord is neither ripped nor torn and no metal parts are exposed.	If damaged, do not use them because it may cause an electric shock or short-circuit. Contact your authorized Hioki distributor or reseller.
The insulation of measurement cables or connection cables is not damaged and no metal parts are exposed.	If there is damage, replace without using because it may result in an electric shock.
The measuring instrument is not damaged.	If damaged, request repairs.

3.2 Choose a Measurement Mode

The ST4200 has the following two measurement modes. Each measurement mode has an AC PD measurement function and an impulse PD measurement function.

Normal Mode	This mode applies constant voltage to measure the magnitude of a partial discharge.
PDIV Mode	This mode performs measurement while adjusting measurement voltage up and down to measure partial discharge inception voltage (PDIV) and partial discharge extinction voltage (PDEV).

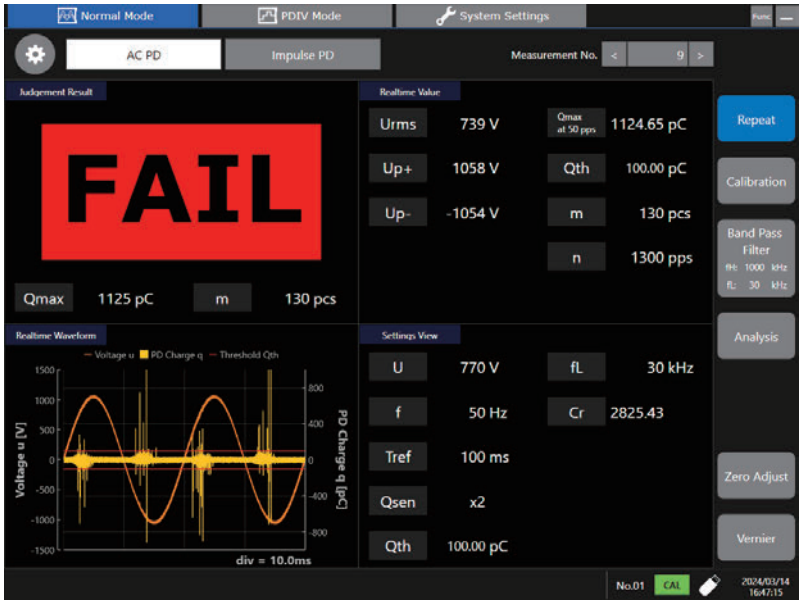
Connection Examples



When the object under measurement is a neutral point-connected three-phase stator

Normal Mode

This mode applies constant voltage to measure the magnitude of a partial discharge. Press the **START** key to control the high-voltage power supply, apply voltage to the object under measurement, and begin measuring. For single measurements, high-voltage output and the measurement operation will stop automatically once measurement is complete. For repeat measurements (freely running), measurement will continue until the **STOP** key is pressed.



PDIV Mode

This mode performs automatic PDIV, PDEV, RPDIV, and RPDEV measurements in conformance with IEC standards. For AC PD measurements, output voltages will be consecutively increased and decreased to measure PDIV and PDEV. For impulse PD measurements, impulse voltage will be repeatedly applied while voltage is increased and decreased to measure PDIV, PDEV, RPDIV, and RPDEV.

PDIV	PD Inception Voltage
PDEV	PD Extinction Voltage
RPDIV	Repetitive PD Inception Voltage
RPDEV	Repetitive PD Extinction Voltage

AC PD measurement (IEC 60034-27-1)

This measurement is used to check for internal discharge (holes in insulation, internal delamination), creeping discharge due to insufficient coil clearance, and contamination.
The partial discharge value when performing an AC PD measurement will be displayed as Qmax (repeatedly occurring maximum PD intensity).

Impulse PD measurement (IEC 61934)

This measurement is used to check durability against surge voltage associated with sharp inverter spikes. Impulse voltage is used as a surrogate for inverter switching voltage.
The partial discharge value when performing an impulse PD measurement will be displayed as Qpk (partial discharge peak value).

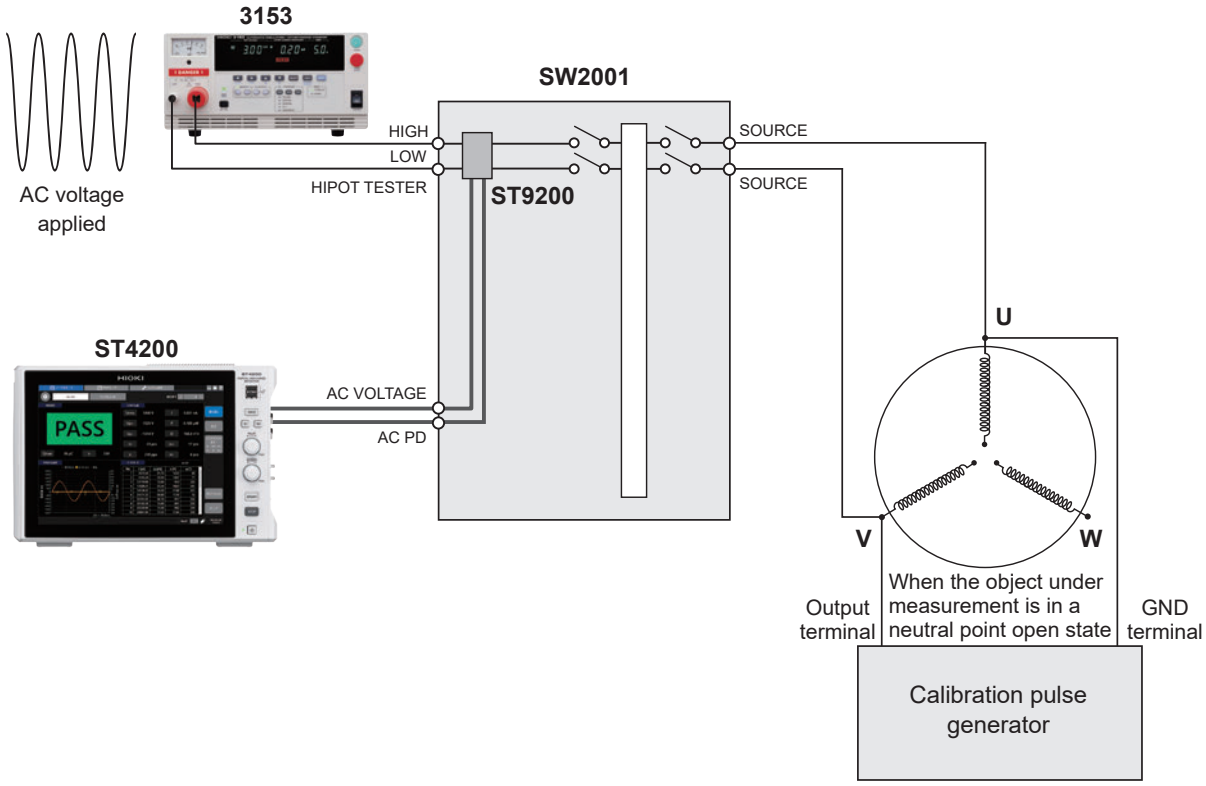
3.3 Calibration Method (Only for AC PD Measurement)

During AC PD measurement, choose a calibration value for converting the PD waveform signal that is input into a charge.
The calibration values depend on the capacitance of the object under measurement, including connectioncables, clips, etc. Decide on the routing of the connection cables and connect the object under measurement, and perform calibration. The correct values will also depend on the value set for the Band Pass Filter. When you have changed the Band Pass Filter setting, recalibrate it.

1 **Confirm that the withstand voltage tester is powered ON and that output is OFF, and confirm that the cables are connected as shown in the following diagram.**

In order to take into account the effects of noise generated by the withstand voltage tester's power supply and control units, it is recommended that the withstand voltage tester be turned ON.

Connection Examples



2 **Choose the calibration pulse charge to be used for configuration.**

The largest value in the charge range to be measured is recommended.
Using the calibration pulse generator, configure the pulse charge (pC) to be generated.

3 **Tap [AC PD] > [Calibration].**

The Calibration screen will be displayed.

4 **Input the charge to be applied to the object under measurement into [Charge Value].**

IMPORTANT

The charge value must be the same as the setting value and charge determined in step 2. If calibration is performed when they are not the same, an incorrect calibration will be performed.

5 **Have the calibration pulse generator generate a calibration pulse.**

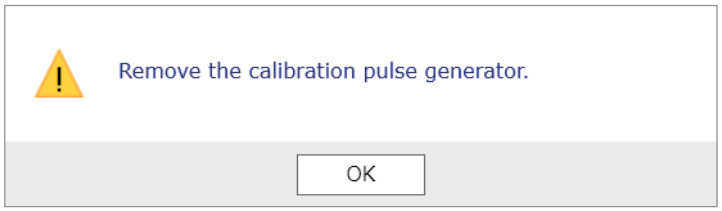
6 **Tap [Start].**

The execution screen will be shown and the calibration will be performed automatically. Calibration can take anywhere from a few seconds to a minute to complete. Wait until the calibration completion message is displayed.
If the calibration fails, increase the charge to be calibrated and re-calibrate.

7 **Stop the calibration pulse generator.**

8 **Tap [Close] and detach the calibration pulse generator.**

Review the warning message, and then tap **[OK]**. The calibration screen closes.



⚠ CAUTION

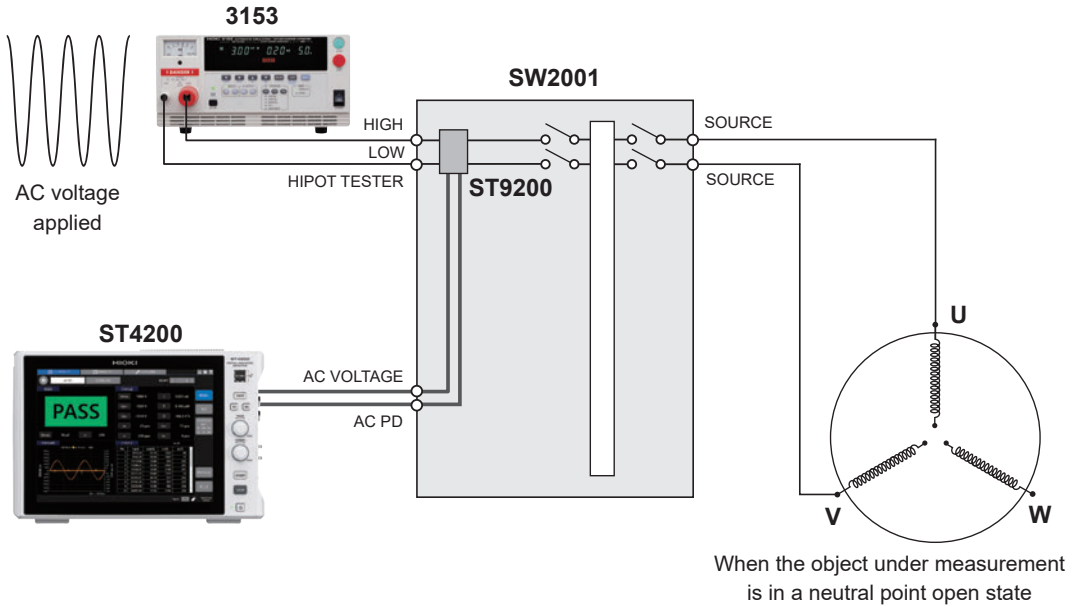
■ **Start AC PD measurement after detaching the calibration pulse generator.**

Failure to do so may damage the calibration pulse generator.

3.4 AC PD Measurement (AC Partial Discharge Measurement)

Isolated parts will be tested. Measure U-V before connecting the neutral point of the three-phase motor.

Connection example for three-phase motor U-V measurement



When the object under measurement is in a neutral point open state

Prepare for AC PD measurement by referring to “2 Preparing for Measurement” (p.21).

Warming up and zero adjustment

1 **Turn on the ST4200 and SW2001 and allow them to warm up for about 30 minutes.**

2 **Execute zero-adjustment for the ST4200.**

See:“2.9 Zero-Adjustment” (p.35)

Connect the PC and SW2001 via LAN or USB. LAN port configurations for modes other than fixed settings mode can be checked by connecting the SW2001 and PC via USB cable and launching the SW2001 application software.

Band pass filter

A bandpass filter is a function that reduces the effects of noise.
First, measure with the initial value (fH = 1000 kHz, fL = 30 kHz).
If there is a noisy effect, see instruction manual 3.10 Configuring the Band Pass Filter (for AC PD measurement only) on ST4200.

SW2001 configuration

1 **Install the application software used to control the SW2001 to the PC.**

Download the sample application software from the Hioki website.

2 **Configure the SW2001 using the application software.**

You can also configure by sending commands from the PC or PLC.

Example of operation settings for U-V

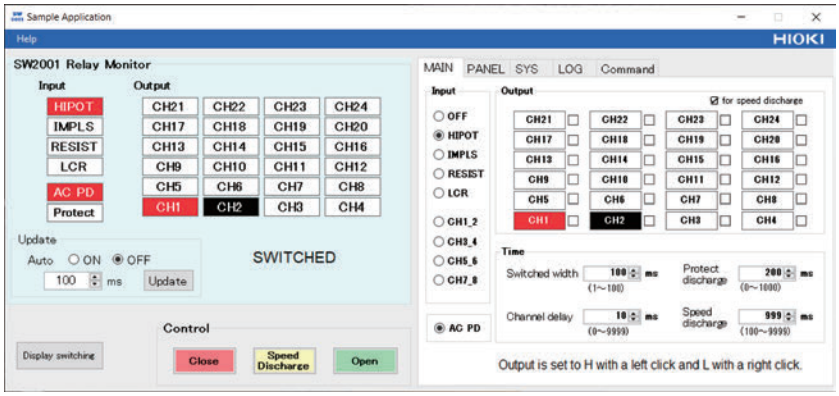
For the SW2001, set CH1 to “Hi” and CH2 to “Low”.

3 **In the [Input] area, click [HIPOT].**

4 **Click [AC PD].**

5 **In the [Control] area, click [Close].**

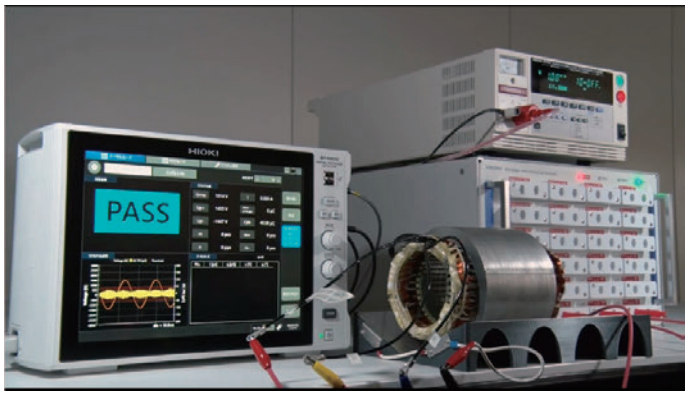
If **[Update]** is clicked when the Auto setting in the **[Display Update]** area is set to OFF, the connection status of the current relay will be displayed in the **[Relay Monitor]** area.



Charge calibration

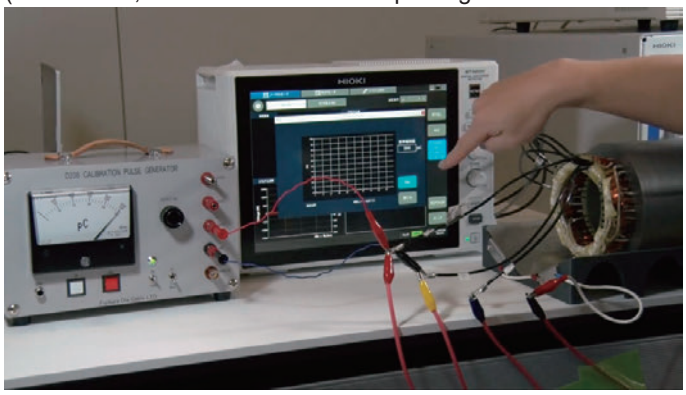
Perform charge calibration.
Connect the ST4200, SW2001, withstand voltage tester, and calibration pulse generator with the object under measurement via connection cables. For details, refer to “2 Preparing for Measurement” (p.21).
Calibrate U-V for the three-phase motor.

1 **Using Unterminated Lead Cables L2265, connect U, V, W, and the grounding cable of the object under measurement to the SW2001.**



2 **Connect the cables of the calibration pulse generator to U and V on the object under measurement.**

(In this case, connect the calibration pulse generator’s GND terminal cable to V.)



3 **Choose the calibration pulse charge to be used for configuration (500 pC is used here) and have the calibration pulse generator generate a calibration pulse.**

4 **On the ST4200 [Normal Mode] > [AC PD] screen, tap [Calibration].**

5 **Confirm that the charge value is 500 pC.**

6 **Tap [Start].**

Calibration will be performed. Once calibration is complete, perform operation settings for the ST4200.

7 **Stop and detach the calibration pulse generator.**

⚠ CAUTION

■ **Start AC PD measurement after detaching the calibration pulse generator.**

Failure to do so may damage the calibration pulse generator.

ST4200 Operation Settings

Using the ST4200, configure the withstand voltage tester's test voltage and frequency.
Reference values: Applied voltage is 500 V, AC PD Threshold Direct Value Qth is 40 pC

Starting a measurement

⚠ DANGER

- **Before beginning measurement, check that no one is touching the connection cables or the object under measurement.**

- **Check that the object under measurement and its surroundings are insulated.**

  Once measurement is started, the AC power supply (insulation/withstand voltage tester) will automatically output high voltage, which may cause a shock.

Press the **START** key and begin measurement.

The withstand voltage tester will automatically output a high voltage. Once measurement is complete, the withstand voltage tester output and ST4200 measurement will come to a halt.

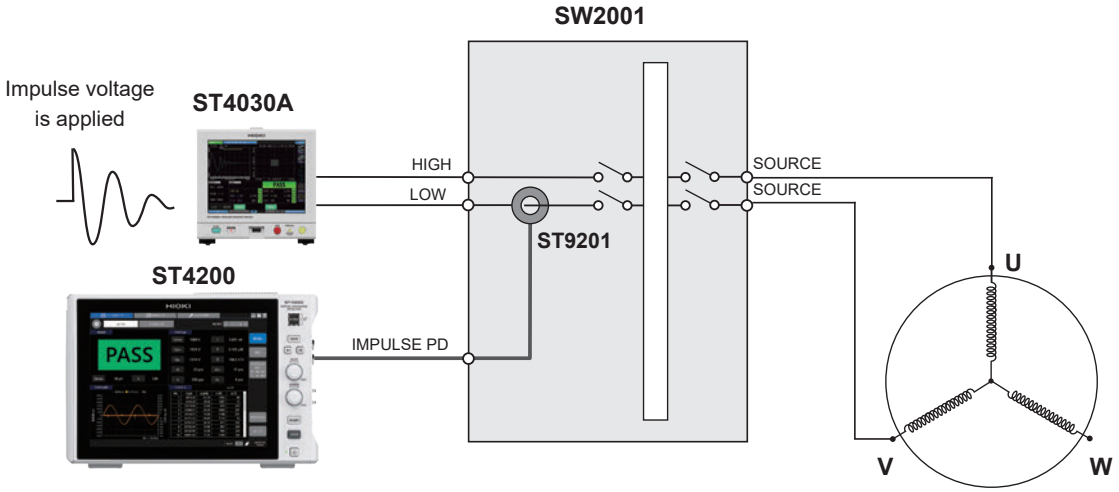
IMPORTANT

If a discharge greater than the operation settings Qth (threshold value for distinguishing between discharge and environmental noise) is not generated, the Qmax (repeatedly occurring maximum PD intensity) on the measurement screen will be displayed as 0 pC. Begin measuring at a low voltage.
If the Qmax value is 0 pC, no partial discharge will be generated. Increase the applied voltage and perform measurement. When the Qmax value is greater than 0 pC, it can be confirmed that a discharge is being generated.

3.5 Impulse PD Measurement (Impulse Partial Discharge Measurement)

Areas with continuity will be tested, such as between coils.

Connection Examples



When the object under measurement is a neutral point-connected three-phase stator

Prepare for impulse PD measurement while referring to “2 Preparing for Measurement” (p.21). Also, configure measurement conditions and judgment conditions.

Warming up and zero adjustment

1 **Turn on the ST4200 and SW2001 and allow them to warm up for about 30 minutes.**

2 **Execute zero-adjustment for the ST4200.**

See:“2.9 Zero-Adjustment” (p.35)

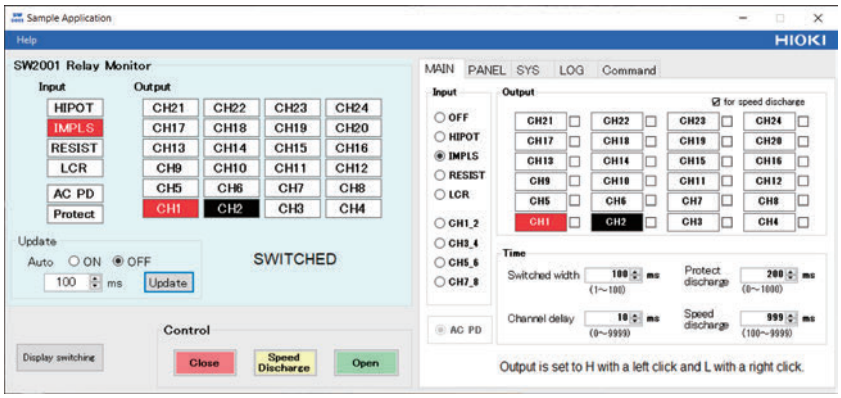
Connect the PC and SW2001 via LAN or USB. LAN port configurations for modes other than fixed settings mode can be checked by connecting the SW2001 and PC via USB cable and launching the SW2001 application software.

SW2001 configuration

1 **In the [Input] area, click [IMPLS].**

2 **In the [Control] area, click [Close].**

If **[Update]** is clicked when the Auto setting in the **[Display Update]** area is set to OFF, the connection status of the current relay will be displayed in the **[Relay Monitor]** area.



Measurement conditions and judgment conditions

Tap ⚙ to open the settings screen and input the measurement conditions, judgment conditions, and screen display conditions. Also, configure the save settings for measured data. Once finished inputting these conditions, tap ⚙ again and close the settings screen to return to the measurement screen.

1 **Choose a measurement mode, then tap [Impulse PD].**

The measurement screen will be displayed.

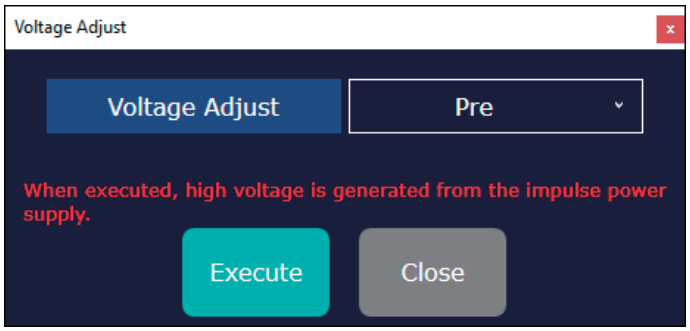
2 **Activate the voltage adjustment function.**

Adjust the output voltage of the impulse power supply so that the maximum peak voltage when theimpulse is applied becomes the same as the set voltage.
The voltage adjustment function can be used only when **[ST4030/ST4030A]** is specified for the impulse power supply of the connected device and that power supply is controlled from the ST4200.

Tap **[Volt Adjust]** and select the voltage adjustment method to use.

OFF	The voltage adjustment is not performed.
Pre	The voltage adjustment is performed before measurements.Recommended) For the PD measurement with the other two adjustment methods, eachtime the voltage to be applied is changed, the impulse for adjustment thatwould not normally be required is applied, and the impulse for PDdetection is applied after gradually increasing the voltage from a lowvoltage to the set voltage. When the voltage adjustment is performed in advance, the voltage canbe applied according to the settings with only the impulse for PDdetection during the PD measurement.
Auto	The voltage adjustment is performed by using degaussing pulses duringmeasurements. For the automatic voltage adjustment function, refer to the ST4030A instruction manual.
Calibration	Calibration is performed during measurements. For the calibrationfunction, refer to the ST4030A instruction manual.

Depending on the object under measurement, voltage adjustment may not be possible using anymethod.



⚠ DANGER

- **Before executing the advance voltage adjustmen, beginning measurement, check that no one is touching the connection cables or the object under measurement.**

  Using a measuring instrument while it is damaged may cause serious bodily harm. If you find any damage, contact your authorized Hioki distributor or reseller.

- **Check that the object under measurement and its surroundings are insulated.**

  When the advance voltage adjustment is executed, high voltage will automatically be output from impulse power (impulse winding tester), which may cause a shock.

Tap the **[Execute]** to perform the voltage adjustment by applying voltage from the impulse powersupply multiple times.

The voltage that serves as the adjustment reference is the impulse voltage **[U]** in normal mode and the startimpulse voltage **[Uis]** in PDIV mode.

Starting a measurement

⚠ DANGER

- **Before beginning measurement, check that no one is touching the connection cables or the object under measurement.**

- **Check that the object under measurement and its surroundings are insulated.**

  Once measurement is started, high voltage will automatically be output from impulse power (impulse winding tester), which may cause a shock.

Press the **START** key and begin measurement.

Voltage will automatically be output to the object under measurement from impulse power (impulse winding tester) and impulse PD measurement will begin.

4 Specifications

For more information on specifications, see the instruction manuals for the ST4200 and SW2001.

4.1 ST4200 Partial Discharge Detector

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 EMC: EN 61326 Class A
Power supply	Commercial power supply Rated supply voltage: 100 V to 240 V AC (Assuming voltage fluctuation of ±10%.) Rated power-supply frequency: 50 Hz/60 Hz Anticipated transient overvoltage: 2500 V Maximum rated power: 300 VA Normal power consumption (reference value): 70 W (during AC PD measurement)
Dimensions	Approx. 353W × 235H × 154.8D mm (13.9W × 9.3H × 6.1D in.) (excluding protrusions)
Weight	Approx. 7.1 kg (15.7 lbs) (with the U8332 removed) Approx. 7.3 kg (16.1 lbs) (with the U8332 installed)
Product warranty duration	3 years
Included accessories	p.6
Options	p.7
Function	Judgment Linked control Data saving Data loading

Measurement specifications

Shared for AC PD and impulse PD

Measurement mode	Normal Mode: Applies a constant voltage and conducts single or consecutive measurements. PDIV Mode: Changes applied voltage in conformance with standards while measuring.
Input channels	AC VOLTAGE: Voltage monitor signal (BNC terminal) AC PD: AC PD current sensor signal (BNC terminal) IMPULSE PD: Impulse PD current sensor signal (BNC terminal)

AC PD

Detection Method	Discharge measurement method using detection impedance and band pass filter based on IEC 60270 and IEC 60034-27-1
Sampling rate	100 MS/s

Measurement item	• Normal Mode Repeatedly occurring maximum PD intensity (Qmax), number of PD pulses generated (m, m+, m-), PD pulse generation rate (n), voltage RMS value (Urms), peak voltage value (Up+, Up-), voltage peak to peak (Upp), average discharge current (I), discharge power (P), quadratic rate (D), PD pulse apparent charge (q), PD pulse phase angle (ϕ) • PDIV Mode (adds the following values to Normal Mode values) PD inception voltage (Ui), PD extinction voltage (Ue)
Sampling window time width (Tref)	100 ms to 1000 ms
Measured value display update interval	100 ms to 1000 ms (linked to the value set for the sampling window time width)
Test frequency range (applied voltage)	45 Hz to 1.1 kHz
Frequency characteristics (AC PD)	30 kHz to 1 MHz (−6 dB)
Charge measurable range	**Tested object capacitance C** / **Charge measurable range Q** 200 pF ≤ C < 2 nF / 10 pC ≤ Q ≤ 500 pC 2 nF ≤ C ≤ 10 nF / 10 pC ≤ Q ≤ 2500 pC
PD pulse time resolution	10 µs

Impulse PD

Detection method	Discharge current detection using CT and digital filters based on IEC 61934 Edition 2.0 and IEC 60034-27-5
Sampling rate	200 MS/s
Measurement item	• Normal Mode PD peak discharge (Qpk), peak partial discharge generation time (tpk), number of PD in a pulse train (m), peak impulse voltage (Upk), impulse voltage peak to peak (Upp) • PDIV Mode (adds the following values to Normal Mode values) PD inception voltage (PDIV), repetitive PD inception voltage (RPDIV), repetitive PD extinction voltage (RPDEV), PD extinction voltage (PDEV), repetitive PD peak discharge (RQpk)
Waveform recording length	2000 to 200000 points
Frequency characteristics	7 Hz to 20 MHz (−3 dB)

Accuracy specifications

PD pulse phase angle measurement accuracy (Reference value)	**Voltage input frequency** / **PD pulse phase angle error (°)** 45 Hz ≤ f ≤ 100 Hz / ±0.4 100 Hz < f ≤ 400 Hz / ±1.0 400 Hz < f ≤ 1 kHz / ±2.5
Effect of radiated radio-frequency electromagnetic field	50 pC or less (at 10 V/m)
Effect of conducted radio-frequency electromagnetic field	50 pC or less (at 10 V)
Impact of superimposed pulse noise on the power supply	50 pC or less (with 1 kV and superimposed pulse noise of pulse width 50 ns)

Linked control function

High voltage generator

Control description	Linked control of impulse winding tester and withstand voltage tester as partial discharge test high voltage generators
Compatible devices	• Hioki 3153 Automatic Insulation/Withstanding HiTester ST4030, ST4030A Impulse Winding Testers • Kikusui Electronics Corp. TOS5200 series TOS5300 series TOS9300 series Withstand voltage/insulation resistance testers • ECG Kokusai Co. Impulse Winding Tester DWX-05A

Partial discharge detector

Control description	Only connect the partial discharge detector to the test circuit during AC PD testing. Disconnect at all other times.
Compatible devices	SW2001-04 High Voltage Multiplexer SW2001-08 High Voltage Multiplexer SW2001-16 High Voltage Multiplexer SW2001-24 High Voltage Multiplexer (Specification with PD Sensor ST9200 [for AC partial discharge])
Control authority conflict with host device	When the ST4200 controls the above devices, the ST4200 has exclusive control. At other times, the host device can execute command control via ST4200.

EXT. I/O

Terminal block	Push-button type		
Input	Maximum input voltage	10 V DC	
	Input voltage	High level: Low level:	2.5 V to 10 V 0 V to 0.8 V
	Acceptable pulse width	High period: Low period:	50 ms or more 50 ms or more
	Pulse interval	200 ms or more	
Output	Output type	Open-drain output (equipped with a 5-volt voltage output, active-low)	
	Output voltage	High level: Low level:	4.0 V to 5.0 V 0 V to 0.5 V
	Maximum input voltage	50 V DC, 50 mA, 200 mW	

See:“Terminal block” (p.30)

4.2 SW2001 High Voltage Multiplexer

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 EMC: EN 61326 Class A
Power supply	Commercial power supply Rated supply voltage: 100 V to 240 V AC (Assuming voltage fluctuation of ±10%.) Rated supply frequency: 50 Hz/60 Hz Anticipated transient overvoltage: 2500 V Maximum rated power: 120 VA Normal power consumption (reference value): 17 W (during low-voltage system measurement)
Displays	Power supply LED, remote LED, high voltage output LED, error LED
Interfaces	USB, LAN, EXT. I/O
Dimensions	Approx. 439.2W × 265.9H × 770D mm (17.3W × 10.5H × 30.3D in.) (excluding protrusions)
Weight	SW2001-04: Approx. 20.5 kg (45.2 lbs) SW2001-08: Approx. 22.5 kg (49.6 lbs) SW2001-16: Approx. 27.0 kg (59.5 lbs) SW2001-24: Approx. 31.5 kg (69.4 lbs) (None including the ST9200 or ST9201 options available only at the time of purchase order issuance for the instrument) If ST9200 is included: Add 1.2 kg (2.6 lbs) If ST9201 is included: Add 0.139 kg (0.3 lbs)
Product warranty duration	3 years
Included accessories	p.6
Options	p.8
Function	• Channel switching • Interlock • Channel delay • Settings backup • Panel functions • Communication setting mode switching • Protective discharge • Speed discharge • LED display
Maximum input voltage	No measurement categories • High-voltage two-terminal input HIPOT (withstand voltage tester input terminals) 5 kV AC rms, 5 kV DC, 7.071 kV peak • High-voltage two-terminal input IMPULSE (impulse input terminal) 8 kV peak (impulse) • Low-voltage four-terminal input LCR and RESISTANCE 30 V AC rms, 60 V DC, 42.4 V peak
Rated output voltage	5 kV AC rms, 5 kV DC, 8 kV peak (impulse)

Maximum rated terminal-to-ground voltage	No measurement categories Anticipated transient overvoltage: 0 V • High-voltage two-terminal input HIPOT (withstand voltage tester input terminals) 5 kV AC rms, 5 kV DC, 7.07 kV peak • High-voltage two-terminal input IMPULSE (impulse input terminal) 8 kV peak (impulse) • Low-voltage four-terminal input LCR and RESISTANCE 30 V AC rms, 60 V DC, 42.4 V peak • Output terminal 5 kV AC rms, 5 kV DC, 8 kV peak (impulse)
Maximum allowable impulse current	100 A peak

EXT. I/O

Connector	D-SUB 50-pin female locking #4-40 inch screw		
Polarity	Method of switching between PNP (source of current)/NPN (current sink)		
Input	Electrical specifications	Isolation	Photo coupler isolated no-voltage contact input (Current sink/source output compatible)
		Input ON	Residual voltage of 1 V or less Input ON: Current of 4 mA (reference value)
		Input OFF	Open (Breaking current of 100 µA or less)
		Response time	ON edge: Max. 5 ms OFF edge: Max. 5 ms
Output	Electrical specifications	Isolation	Photo coupler isolated open-drain output (Non-polar)
		Maximum load voltage	30 V DC
		Residual voltage	1 V or less (load current of 50 mA) 0.5 V or less (load current of 10 mA)
		Maximum output current	50 mA/channel
Power supply output	Output voltage	For sink output: +4.5 V to +5.5 V Source output compatible: −4.5 V to −5.5 V	
	Maximum output current	100 mA	
	External power supply input	None	
	Isolation	Floating from protective grounding potential and the measurement circuit Line-to-earth voltage of 33 V rms, 46.7 V AC or less peak	

4.3 Options

L2005 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 (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
Dimensions	Total length: Approx. 1500 mm (59.1 in.)
Weight	Approx. 220 g (7.8 oz.)
Maximum rated voltage	30 V peak
Maximum rated terminal-to-ground voltage	30 V DC or less, no measurement categories
Maximum rated current	2.5 A peak
Characteristic impedance	50 Ω
Cable used	Coaxial cable Characteristic impedance of 50 Ω
Connector used	BNC

L2111 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 (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
Dimensions	Total length: Approx. 1500 mm (59.1 in.)
Weight	Approx. 189 g (6.7 oz.)
Maximum rated current	3 A AC/DC continuous
Maximum rated voltage	60 V DC or less, 30 V AC rms or less, 42.4 V AC peak or less
Maximum rated terminal-to-ground voltage	60 V DC or less, 30 V AC rms or less, 42.4 V AC peak or less

L2255 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 (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
Dimensions	Total length: Approx. 1500 mm (59.1 in.)
Weight	Approx. 254 g (9.0 oz.)
Maximum rated terminal-to-ground voltage	4200 V peak, no measurement categories Anticipated transient overvoltage: 0 V

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 (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
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 terminal-to-ground voltage	5000 V AC/DC rms, 8 kV peak, no measurement categories 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 (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
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 terminal-to-ground voltage	5000 V AC/DC rms, no measurement categories 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 (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
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 (non-condensing)
Storage temperature and humidity range	−10°C to 50°C (14°F to 122°F), 80% RH or less (non-condensing)
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 terminal-to-ground voltage	30 V AC rms

ST9200 PD Sensor (for AC Partial Discharge)

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)
Dimensions	Approx. 100W × 82H × 180D mm (3.9W × 3.2H × 7.1D in.) (excluding protrusions)
Weight	Approx. 1.2 kg (2.6 lbs)
Product warranty duration	1 year
Number of measurement channels	1 channel
Maximum input voltage	5 kV AC rms
Maximum rated terminal-to-ground voltage	No measurement categories High side: 5 kV AC rms
Output terminal	BNC terminal
Blocking coil inductance	14 mH ±20%
Coupling capacitor capacitance	1.33 nF ±10%
Tested object measurable capacitance range	10 nF or less

ST9201 PD Sensor (for Impulse Partial Discharge)

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)
Dimensions	Approx. 77.2W × 53.6H × 54.2D mm (3.0W × 2.1H × 2.1D in.) (excluding protrusions)
Weight	Approx. 139 g (4.9 oz.)
Product warranty duration	Not covered
Input rated current	2 A AC rms
Maximum input current	100 A peak
Output terminal	BNC terminal

ST9210 PD Sensor

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 standard	Safety: EN 61010
Dimensions	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 duration	3 years
Options	Instruction manual, Operating Precautions (0990A907)
Number of measurement channels	1
Maximum input voltage	No measurement category 5 kV rms AC, 5 kV DC, 7.07 kV peak
Maximum rated terminal-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

5 Maintenance and Service

⚠ WARNING

■ **Do not alter, dismantle, or repair the ST4200 or SW2001.**

There are high-voltage points inside these measuring instruments. Workers may receive an electric shock or cause a fire.

Backing up the Data

The ST4200 may be initialized (returned to the factory default settings) when it is repaired. Before you ask for repairs, it is recommended to back up (save or record) the measurement conditions and waveform data.

Precautions During Shipment

⚠ CAUTION

Be sure to observe the following precautions:

■ **Detach cables from the measuring instrument.**

■ **Keep written descriptions of any failures.**

■ **Use the original packing materials the instrument was shipped in and double-pack to provide extra protection.**

Failure to do may result in the measuring instrument being damaged during shipping.

5.1 Replaceable Parts and Operating Lifetimes

The characteristics of some of the parts used in the instrument may deteriorate with extended use. To ensure that products can be used over the long term, it is recommended to replace these parts on a periodic basis. When replacing batteries, please contact your authorized Hioki distributor or reseller.
The service life of parts varies with the operating environment and frequency of use. These parts are not guaranteed to operate throughout the recommended replacement cycle.

Part name	Recommended replacement cycle	Remarks/conditions
Fan motor	Approx. 5 years	–
LCD (Backlight) (Half-life of brightness)	Approx. 80,000 hours	At an ambient temperature of 25°C (77°F) The service life varies significantly depending on the ambient environment. In particular, the service life reduces in an environment containing sulfur and halogen, and high temperature environment.
SSD Unit U8332	Approx. 1,400 hours (If written to repeatedly)	At an ambient temperature of 25°C (77°F) Total bytes written (TBW): Approx. 300 TB Data retention period: About one year (When the instrument is turned off) Data backup at regular intervals is recommended.
Electrolytic capacitors	Approx. 10 years	Printed circuit boards that include this component must be replaced. Deteriorates in approx. 10 years when the instrument is used in a severe environment (at an ambient temperature of 40°C [104°F]).
Lithium battery	Approx. 10 years	The ST4200 contains a built-in backup lithium battery. The backup battery has a service life of about 10 years. If the date and time deviate substantially at power-on, it is time to replace the battery. Contact your authorized Hioki distributor or reseller.

The fuse is housed in the power unit of the ST4200. If the instrument does not power on, the fuse may be blown. Customers cannot replace or repair this themselves. Contact your authorized Hioki distributor or reseller.

5.2 Cleaning the Instrument

⚠ CAUTION

■ **Regularly clean the air vents of the ST4200.**

If air vents become clogged, the internal cooling capacity of the ST4200 will be hampered, and can lead to damage to the ST4200.

■ **To clean the measuring instrument, wipe it gently with a soft cloth moistened with water or mild detergent.**

Using solvents such as benzene, alcohol, acetone, ether, ketone, thinners or gasoline, or wiping too strongly, may cause deformation or discoloration of the measuring instrument.

Wipe the LCD of the ST4200 gently with a soft, dry cloth.

5.3 Troubleshooting

See "Before Requesting Repairs" if you think there is a problem. If this does not help you resolve your problem, contact your authorized Hioki distributor or reseller.

Before Requesting Repairs

Condition	Cause	Solution
Nothing appears on the screen even if you turn on the power.	• The power cord is disconnected. • The power cord is not connected properly.	Connect the power cord properly.
The ST4200 does not operate even if you press the keys.	Some key is being held down.	Check if the key are stuck.
	The key lock is engaged.	Disengage the key lock.
The instrument cannot save any data on a storage device including an SD card.	You are not using Hioki's optional SD memory card.	Use Hioki's optional SD card.
	The storage device does not have sufficient free space.	Initialize or replace the storage device.
	The storage device is not properly inserted.	Properly insert the storage device.
	The storage device has not been formatted.	Format the storage device before initial use.
	The number of files in the folder has reached 5,000.	Up to 5000 files can be saved in a folder. If you would like to create more files, adjust the quantity.

If the cause cannot be revealed

Initialize the ST4200. Settings will be restored to the factory default.

See:"5.4 Initializing the ST4200 (System Reset)" (p.65)

5.4 Initializing the ST4200 (System Reset)

Choose settings configured on the ST4200 and restore them to the factory default.

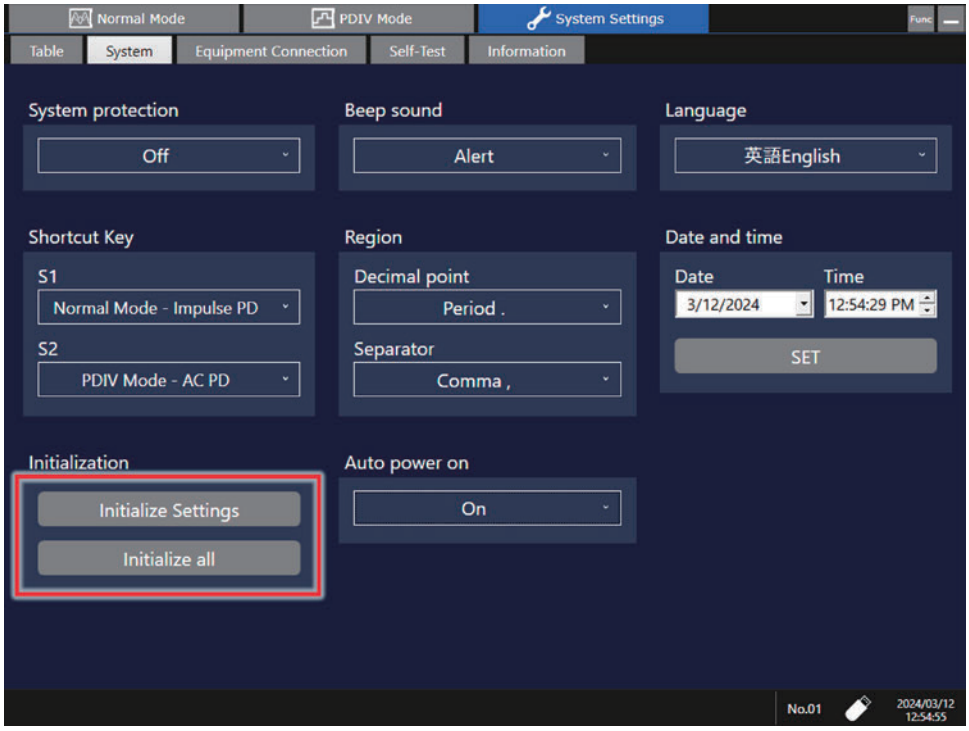
1 **Disconnect the measurement sample.**

2 **Tap [System Settings] > [System].**

The System screen is displayed.

3 **Tap [Initialize Settings] or [Initialize all].**

The ST4200 will be initialized.
It is also possible to conduct a system reset with the `*RST` communications command.



5.5 Message

If any problem is found, the ST4200 screen will display an error message or warning message.
It also displays an informational message with advice for usage.

Action that should be taken after a message

If a message remains

If an error or warning message remains, check the details and tap **[OK]**.

If a message disappears after several seconds

Some warnings and informational messages disappear after several seconds. Check the details while the screen is displaying the message.

To inform of a message with a beep sound

Tap **[System Settings]** > **[System]**.

Error messages

The list of error messages is as follows. Check the solution.
If an error is displayed on the screen, the instrument must be repaired. Contact your authorized Hioki distributor or reseller.

No.	Message	Solution
176	Internal temperature is abnormal. Please turn the power off.	Check the operating temperature environment and fan rotation before requesting instrument repair.
195	Fan malfunction detected. Power off immediately.	High internal temperatures may damage the ST4200. Immediately turn off the instrument and request instrument repair.
639	Hardware error	A hardware error was detected. Immediately turn off the instrument and request instrument repair.
643	Hardware error	
645	Hardware error	
646	Hardware error	
647	Hardware error	
648	Hardware error	
649	Hardware error	
651	Hardware error	A system power supply malfunction was detected. Immediately turn off the instrument and request instrument repair.
652	Hardware error	A hardware error was detected. Immediately turn off the instrument and request instrument repair.
653	Processing could not be successfully completed.	An error occurred during an internal process of the ST4200. Press the power key and tap **[Shutdown]** to turn off the instrument. Then, turn on the instrument again. You can continue the measurement by tapping **[Continue]**; however, you should turn off the instrument once.

Warning messages

The list of warning messages is as follows. Check the solution.

No.	Message	Solution
10	Please insert media.	Insert an SD memory card or USB flash drive.
11	Manual save setting for Realtime Waveform is not checked. Manual save setting for Data Series is not checked. Manual save setting for Q=f(U) Graph is not checked. Manual save setting for SBS Graph is not checked.	On the Save Data Settings screen, check the item for manual saving.
13	Disk full.	The instrument cannot save any files because of insufficient free space on the storage device. Delete unnecessary files to free up enough space or use a new storage device.
14	Cannot load this file.	The selected file cannot be loaded in thefollowing cases: • The file is a CSV file to which a Q=f(U)graph was saved. • The file was saved when the **[Region]** settings were different than the current settings. • The file contents are corrupted.
15	Unable to access file.	Check that the storage device is properly inserted.
22	No waveform data to save.	Perform a measurement.
23	No data series data to save.	Perform another measurement or load a file.
25	This device cannot be removed.	The instrument is accessing the device. Remove the device after the **SAVE** key turns off.
26	Folder is full.	Delete files in the folder or change the saving destination folder.
72	Zero adjustment failed.	–
112	Aborted.	–
209	LAN disconnected.	Check the network environment.
210	LAN timed out.	Check the network environment.
226	Network error.	A network error occurred during communication. Check the network environment.
232	File processing could not be successfully completed.	An unexpected error occurred while a file is being processed in the SD memory card or USB flash drive. Replace the storage device with another or cycle the ST4200.
241	File processing error.	
400	IMPULSE PD input is not triggering the instrument. Check the input.	Please check for the following possible causes. • Small applied impulse voltage value • Large impulse current measurement range • Large trigger level • No voltage applied to object under measurement
401	The current exceeds the measurable range. Please change the "Qsen" setting so that it does not exceed the range.	–
402	The current exceeds the measurable range. Please change the “Range” setting so that it does not exceed the range.	–

5.6 Disposal (Removing the Lithium Battery)

The ST4200 contains a lithium battery for memory backup. When disposing of the ST4200, remove the lithium battery and dispose of the battery and instrument in accordance with local regulations.

⚠ WARNING

■ **When removing the lithium battery, turn off the instrument and disconnect any power cords and connection cables.**

Failure to do so may cause the user to experience an electrical shock.

■ **Do not short-circuit the lithium battery.**

■ **Do not dismantle.**

■ **Do not dispose in fire.**

The battery may explode and cause bodily injury.

■ **After removing the battery, store it where it cannot be reached by children.**

Failure to do so may result in children accidentally swallowing the battery.

Dispose of the battery in accordance with local regulations.

CALIFORNIA, USA ONLY
Perchlorate Material - special handling may apply.
See https://dtsc.ca.gov/perchlorate/

Removing the lithium battery

Required items
Flat-head screwdriver (No.2), Torx screwdriver (T10), hex wrench (2.5), nippers (one of each tool)

1 **Turn off the ST4200 and remove any cords and storage media.**

2 **Remove the rear and left panels.**
Pushing the left panel downward enables easy removal from the body.

3 **Remove the right panel.**
Pushing the right panel downward enables easy removal from the body.

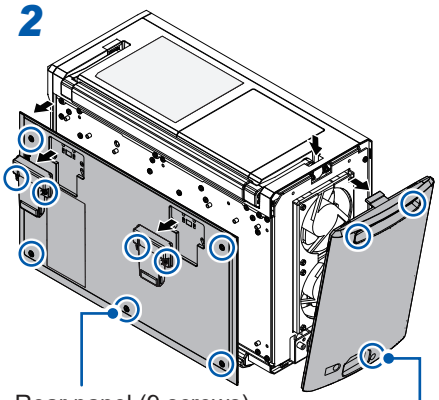
4 **Remove the handle.**

5 **Remove the cover of the media box.**

6 **Remove the upper panel.**

7 **Use nippers to remove the lithium battery from the printed circuit board.**
Pull the lithium battery up from the circuit board, and cut the positive and negative leads with the nippers.

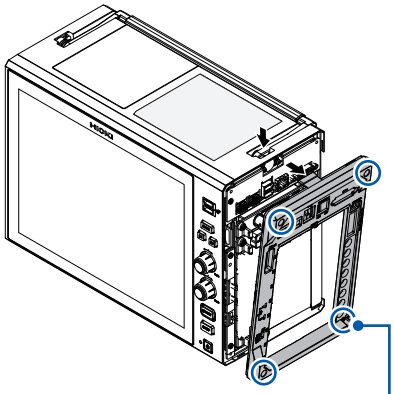
2



Rear panel (9 screws)

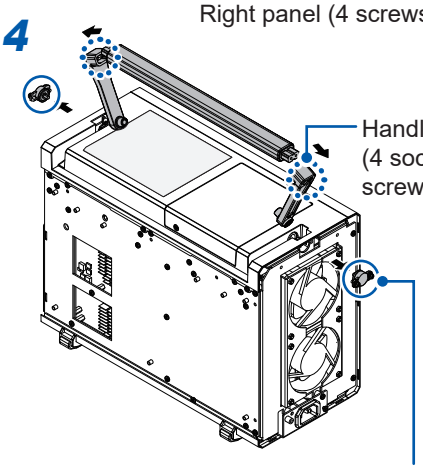
Left panel (3 screws)

3



Right panel (4 screws)

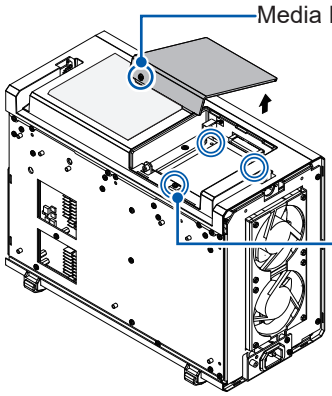
4



Handle (4 socket head screws)

Fastener (4 screws)

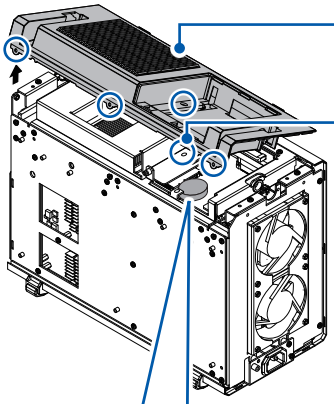
5



Media box cover (1 screw)

If SSD unit is installed (3 Torx screws)

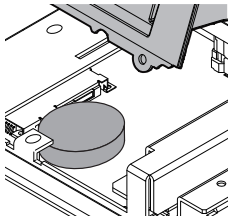
6



Upper panel (4 screws)

Media box (1 screw)

7 Lithium battery



Do not connect the positive and negative (positive and chassis) with each other.

Tools used

- ◯ : Phillips-head screwdriver (No.2)
- ◎ : Torx screwdriver (T10)
- ⬡ : Hex wrench (2.5)

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.

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HIOKI

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