HIOKI

# DC HIPOT TESTER ST5680

NEW


## Bring additional inspection performance to safety testing. Accelerate battery quality improvements with waveform analysis.

### *Product concept*

Growing adoption of electric vehicles (EVs) and self-driving technology is leading to more rigorous reliability requirements for automotive components, pushing up quality.Degradation of EV batteries and related issues can lead to serious accidents, including fire.Consequently, safety and quality control are becoming even more important than in the past.

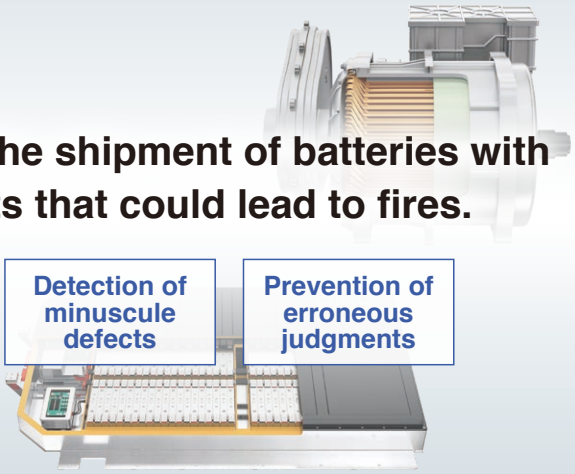
**Market requirements**

**“Manufacturers want to manage test results using waveform data to verify battery quality.”**

**“Manufacturers want to conduct shipping inspections (DC withstand voltage tests) that comply with a range of international standards.”**

The ST5680 is a DC Hipot tester that was developed to meet these battery market requirements.

CE 3 year Warranty

# Preventing the shipment of batteries with latent defects that could lead to fires.

**Test waveform display**

**Detection of minuscule defects**

**Prevention of erroneous judgments**

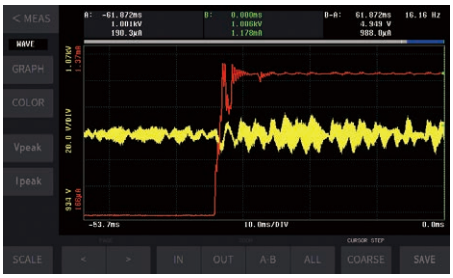
**Waveform display function**

## Verify insulation performance with waveforms and values.

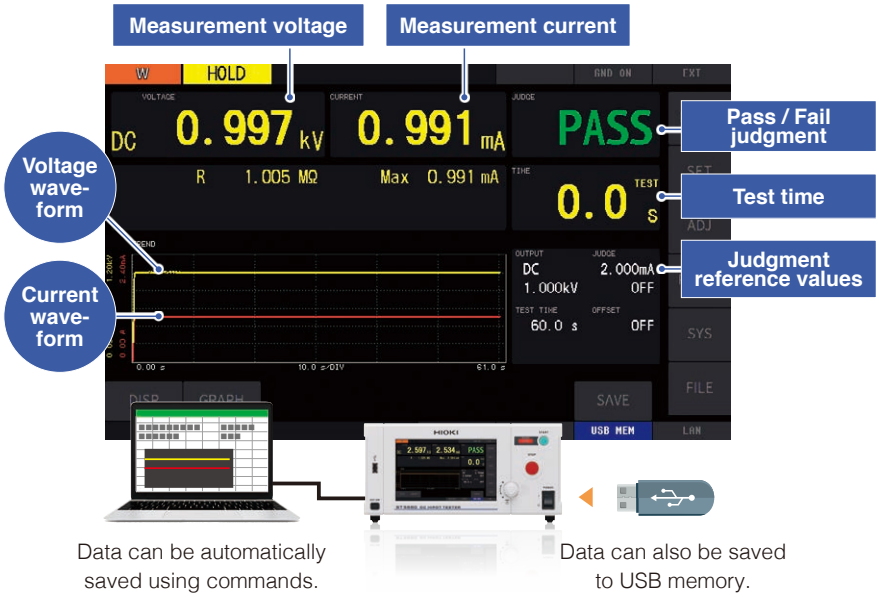
The ST5680 is a DC Hipot tester that can perform DC withstand voltage testing and insulation resistance testing in compliance with a variety of safety standards. In addition to generating PASS/FAIL judgments, the instrument can display and record applied voltage waveforms and leakage current waveforms acquired during testing. Its ability to visualize and analyze testing is useful from a test traceability standpoint.

### Waveform display of applied voltage and measured current

The behavior of the applied voltage and measured current can be checked by monitoring the waveforms. In addition, the instrument can display voltage, current, and resistance measured values as a time series so that behavior can be reviewed.
It can also display an enlarged view of just the waveforms for more detailed review. In this way, the ST5680 lets you analyze results immediately in the field, without using a computer.




Enlarged display of waveforms only




Data can be automatically saved using commands.

Data can also be saved to USB memory.

## Advantages of the waveform display

### Improving production processes

By analyzing waveforms during testing, you can infer the causes of defects in production processes.
And by identifying those causes and improving the processes, you can improve production efficiency.

Improving production efficiency

### Analyzing defective parts returned from the market

You can also look back at results, at the waveform level, from shipping inspections of products that were later returned due to defects. By improving the standards based on which PASS judgments are made, you can boost production quality.

Improving production quality

### Promoting inspection quality

The ability to record and manage waveforms is useful from an inspection traceability standpoint.
By developing higher-quality testing structures, you can increase the trust of customers.

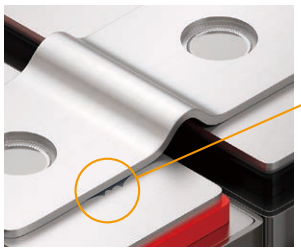
Improving reliability

## Arc discharge detection function

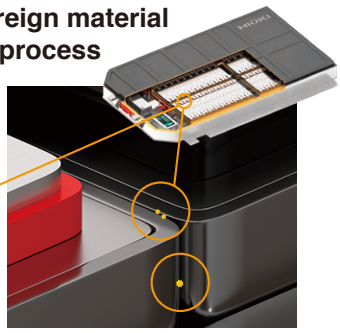
# Prevent minuscule failures due to arc discharges.

The ST5680 can detect arc discharges, which are caused by residual materials like burrs and cuttings.
By correctly identifying parts with minuscule insulation defects as defective,
the instrument helps prevent the risk of hazards such as fires and accidents caused by heating after shipment.

### Contamination with foreign material during the production process

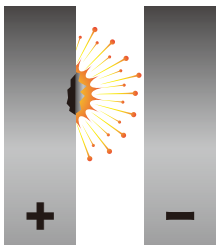


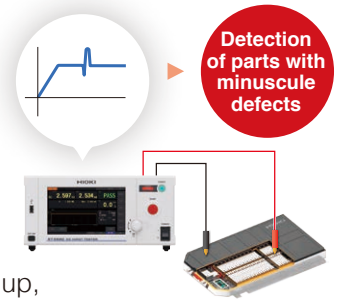
Burrs at a weld location



Foreign material between cells

### Detection of arc discharges triggering a FAIL judgment



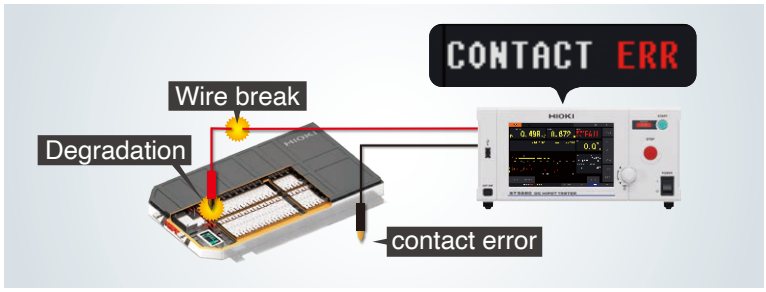



The foreign material burns up, causing damage.

## Contact check function

# Preventing testing do-overs due to erroneous judgments

The instrument can determine whether it has made proper contact with the test target by measuring the capacitance between the measurement terminals (stray capacitance and the capacitance of the test target).




**Preventing erroneous judgments that classify defective parts as non-defective**

·When the measurement leads become disconnected during testing
·When the resistance between test locations increases
Examples: Measurement lead degradation
Jig or high-voltage relay degradation, etc.

**Simple operation**

· Simple wiring connections thanks to use of 2 terminals

## Functionality

The instrument offers convenient functionality that helps perform withstand voltage testing safely.

### Voltage limitation function

Sets an upper limit for the voltage output by the instrument. This function helps prevent accidents due to erroneous settings.
The setting range is 0.010 kV to 8.000 kV.

### Auto discharge function

Once each test is complete, the instrument switches automatically to an internal discharge circuit to discharge any residual charge held by the test target. This function helps prevent electric shock due to contact with a circuit in a charged state.

### Interlock function

This function disables instrument output based on the status of an external device or other hardware to ensure worker safety. It can be disabled using the included interlock cancellation jig, which is affixed to the EXT I/O port.

### Auto range function

When the range is fixed, measured values outside the range are not displayed. When using the auto range function, the range is switched automatically according to measured values, allowing measured values to be displayed at all times.

### Panel memory function

This function stores test conditions in the instrument's memory for future recall as necessary. The memory can hold up to 64 sets conditions each for DC withstand voltage testing mode and insulation resistance testing mode.

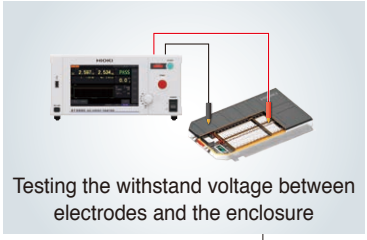

**High-performance model specifically designed for DC withstand voltage testing**

High output | High stability | Detection of minuscule currents

# Featuring testing quality that's a step above. Accommodate the full array of DC withstand voltage testing applications with specs that comply with a broad range of international standards.

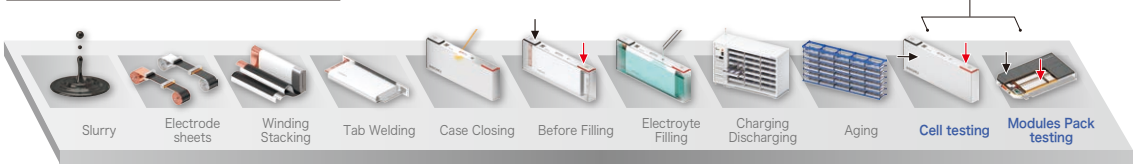
### Ideal for withstand voltage testing of batteries, motors, electronic components, and other parts

The ST5680 tests insulation performance by applying a high voltage to the test target. It's capable of performing safety testing for a broad assortment of targets, including electronic devices, electronic components, and materials, in settings ranging from R&D labs to production lines. For batteries, it's used to perform withstand voltage testing between the enclosures and electrodes of modules, packs, and cells.



Testing the withstand voltage between electrodes and the enclosure

LIB production line processes



## 1 Power supply performance that satisfies test conditions defined by international standards

### Output voltage: Max. 8 kV
### Output current: Max. 20 mA

The ST5680 provides two modes: DC withstand voltage test mode, which evaluates insulation by measuring the leakage current in the test target, and insulation resistance test mode, which evaluates insulation by measuring resistance. In DC withstand voltage testing, it can output up to 8 kV, one of the highest values for any instrument of its kind. Test cycle times can be reduced since it can charge test targets quickly with high-capacity, 20 mA output, even if the target includes a capacitance component.

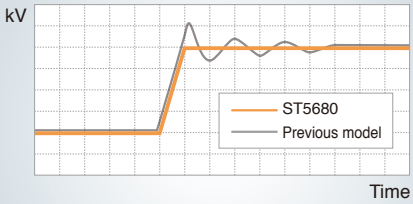

**Support for standard-defined test conditions**

## 2 Stable high-voltage output

### Perform tests without worrying about the capacitance component.

Even if your test target includes a capacitance component, an overshoot-resistant design ensures the ST5680 won't exceed the set voltage when applying voltage to the target, allowing you to perform tests with peace of mind.
In addition, you can set a delay time so that no judgments are made while the charging current continues to flow, helping prevent erroneous judgments.

Note: Maximum measurable capacitance value: 200 nF (When measuring larger capacitance values, the measurement time may increase and the measurement results may vary significantly.)




**The capacitance component has no effect.**

## 3 Precise testing of insulation by generating judgments based on minuscule current values

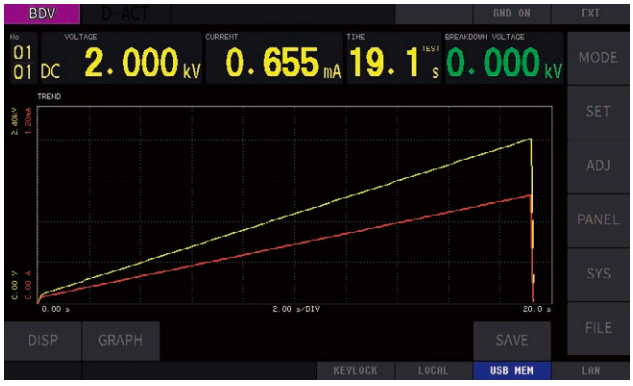
### High-precision judgments with a maximum resolution of 0.001 µA

As the insulation performance of batteries and motors improves, there's growing demand for the ability to use ever more minuscule current values to generate PASS/FAIL judgments in withstand voltage testing. If you use a withstand voltage tester with low resolution, you won't be able to accurately measure leakage current. Since the ST5680 realizes high-precision performance with a maximum resolution of 0.001 µA, it can accurately measure minuscule leakage currents and use them to generate PASS/FAIL judgments.


## Insulation breakdown voltage (BDV) measurement function

The ST5680's BDV function can check the insulation breakdown voltage of the test target. It can increase the applied voltage at a set speed and check the voltage that leads to insulation breakdown. Test methods are defined by standards, including continuous voltage rise testing and stepped voltage rise testing. The ST5680 can perform both tests. The instrument can be used to evaluate insulation performance (dielectric strength) in R&D work.

**IEC 60243, JIS C2110, etc.**
**Support for standard-compliant testing**



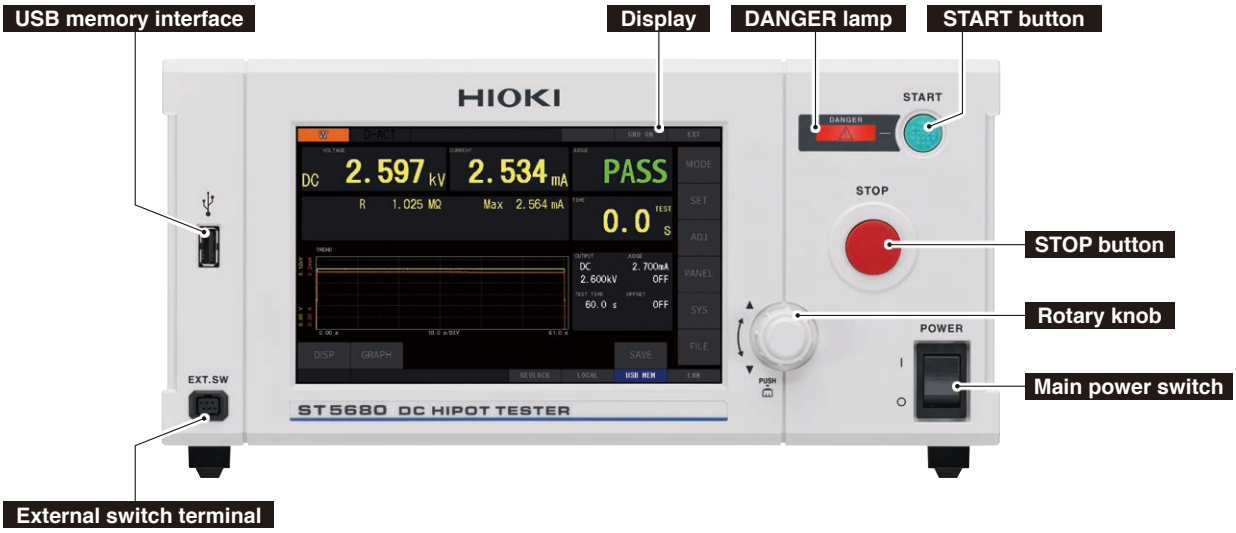

**Example of continuous voltage rise test**

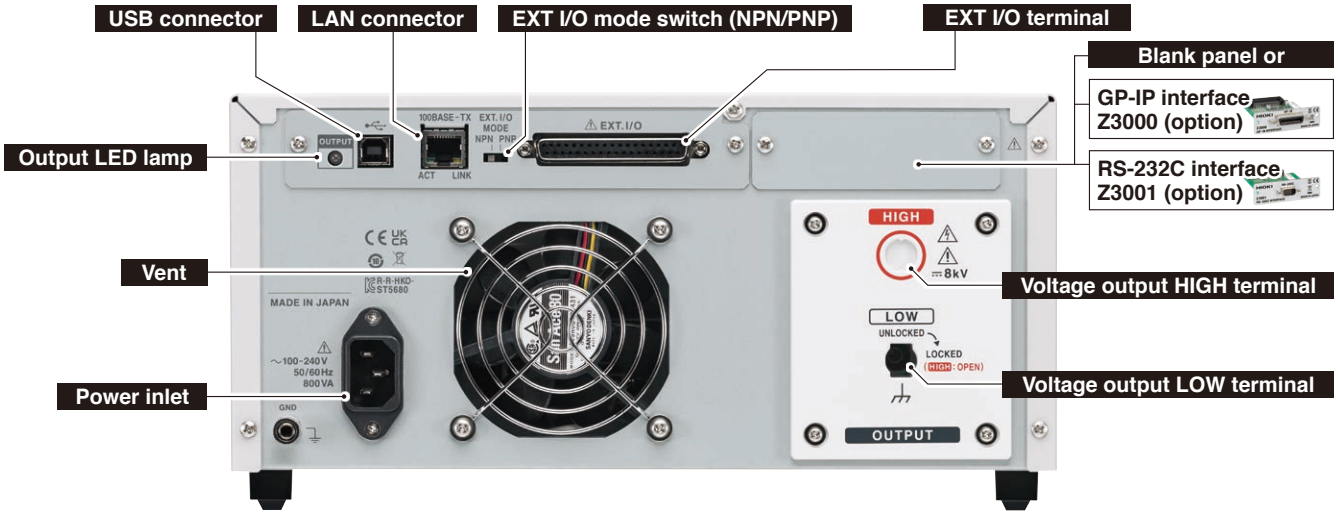
MODE: RATE, START VOLTAGE: 100 V,
RISE RATE (voltage rise per second): 100 V,
END VOLTAGE: 2 kV,
allowable value (judgment standard): 2 mA


**Example of stepped voltage rise testing**

MODE: STEP, START VOLTAGE: 100 V,
STEP VOLT: 100 V,
HOLD TIME: 1 s, number of steps: 20,
allowable value (judgment standard): 2 mA

## Interfaces




## Options

**HIGH VOLTAGE TEST LEAD L2260**
Clip to special connector, red and black, 1.5 m

**UNPROCESSED LEAD CABLE L2261**
Bare wire to special connector, red and black, 5 m

**GP-IB INTERFACE Z3000**
For external control use

**RS-232C INTERFACE Z3001**
For external control use

**GP-IB CONNECTOR CABLE 9151-02**
For the Z3000, 2 m

**RS-232C CABLE L9637**
For the Z3001, 9-pin to 9-pin, cross, 3 m

**REMOTE CONTROL BOX (SINGLE) 9613**
For starting/stopping measurement, one-handed use, 1.5 m

**REMOTE CONTROL BOX (DUAL) 9614**
For starting/stopping measurement, two-handed use, 1.5 m

## External control and other communications interfaces

**EXT I/O** **LAN** **USB** **GP-IB (option)** **RS-232C (option)**

The instrument ships standard with LAN and USB connectors. An optional GP-IB or RS-232C interface can also be added.
The instrument can be connected to a PC or programmable logic controller (PCL), which can be used to control it and retrieve test results. Furthermore, the instrument provides external I/O terminals to facilitate instrument control and retrieval of instrument status and judgment results.

### EXT I/O interface

The EXT I/O connector on the rear of the instrument can be used to control the instrument by outputting TEST signals and judgment result signals and inputting START and STOP signals.

IN: Signal input to instrument OUT: Signal output from instrument

| Signal name | Functionality | I/O |
|---|---|---|
| START | Test start and W-IR/IR-W, program, and BDV mode trigger signal | In |
| INTERLOCK | Interlock cancellation | In |
| LOAD1 | Panel load | In |
| LOAD3 | | In |
| LOAD5 | | In |
| LOAD7 | | In |
| ISO_5V | Insulated power supply +5 V (-5 V) output | – |
| ISO_COM | Insulated power supply common | – |
| ERR | Measurement error output | Out |
| U_FAIL | Output at UPPER_FAIL judgment | Out |
| L_FAIL | Output at LOWER_FAIL judgment | Out |
| H.V.ON | Output during voltage generation | Out |
| W-FAIL | Output at FAIL state during withstand voltage testing | Out |
| W-MODE | Output during withstand voltage testing | Out |
| STEP_END | Output at completion of each step during program testing | Out |
| ARC_DET | Output at arc detection | Out |
| PASS | Output at PASS judgment | Out |
| TEST | Output during testing (customer function) | Out |
| STOP | Test stop and PASS/FAIL hold cancellation | In |
| EXT_EN | Input signal enable for external I/O signals | In |
| LOAD0 | Panel load | In |
| LOAD2 | | In |
| LOAD4 | | In |
| LOAD6 | | In |
| LD_VALID | Panel load execution | In |
| ISO_COM | Insulated power supply common | – |
| READY | Output at standby state | Out |
| PROTECTION | Output at protection function operation | Out |
| CONT_ERR | Output at contact error | Out |
| IR-FAIL | Output at FAIL state during insulation resistance testing | Out |
| IR-MODE | Output during insulation resistance testing | Out |
| PROG_END | Output at completion of final step during program testing | Out |
| OUT0 | General-purpose output | Out |
| OUT1 | General-purpose output | Out |

About interlock functionality

Interlock functionality serves to shut off instrument output. When the interlock function operates, START key operation is disabled. Similarly, test operation cannot be started using the EXT I/O START signal or communications commands.
To start testing, use the included interlock cancellation jig to turn off the interlock function.

### LAN interface

The instrument provides an Ethernet 100Base-TX interface. A 10Base-T or 100Base-TX compatible LAN cable can be used to connect the instrument to a network so that it can be controlled by a PC or other device.

### EXT I/O mode switch (NPN/PNP)

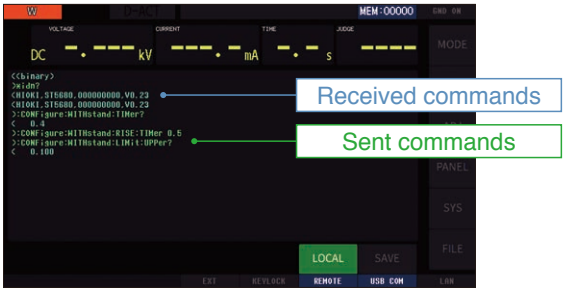
The EXT I/O mode switch (NPN/PNP), which switches between current sink (NPN) and current source (NPN) operation, can be used to change the type of programmable logic controller (PLC) that the instrument supports.

### I/O handler test function

This function lets you check whether output signals are being properly output from the EXT I/O terminal and whether input signals are being properly read.


### Command monitor function

This function, which displays commands and responses on the measurement screen, is a useful tool when creating programs. It can be used to display communications commands and query responses on the screen.




### Color LCD display with touch screen

The instrument has a 7-inch color LCD display with a touch screen, improving visibility and making possible intuitive operation.

# Specifications

(Accuracy guaranteed for 1 year)

| Main functions | |
|---|---|
| DC Hipot test | |
| Insulation resistance test | |
| Breakdown voltage test | |
| Waveform display functionality | |
| Arc discharge detection | |
| Contact check function | |

| DC Hipot test | |
|---|---|
| Output voltage | DC 0.010 kV to 8.000 kV (1 V resolution) |
| Output setting accuracy | ±(1.2% of setting + 20 V) |
| Output current/cutoff current | Max. 20 mA |
| Current accuracy | > 3.00 mA: ±(1.5% rdg. + 2 μA) |
| | ≤ 3.00 mA: ±1.5% rdg.<br>*When the ambient temperature t is less than 5°C: Add ±(1% rdg × [5-t])<br>*When the ambient temperature t is more than35°C: Add ±(1% rdg × [t-35]) |
| Maximum resolution | 0.001 μA |
| Test time | 0.1 s to 999 s, continuous (timer off) |
| Voltage ramp up / ramp down time | 0.1 s to 300 s / 0.1 s to 300 s, off |
| Short-circuit current | 200 mA or more |
| Test modes | W to IR, IR to W, program test |

| Insulation resistance test | |
|---|---|
| Output voltage | DC 10 V to 2000 V (1 V resolution) |
| Output setting accuracy | ±(1.2% of setting + 20 V) |
| Resistance value display range | 100.0 kΩ to 200.0 GΩ (0.01 kΩ resolution) |
| Accuracy guarantee range | 100.0 kΩ to 99.99 GΩ |
| Resistance accuracy | ±(1.5% rdg. + 3 dgt.) *See below for details |
| Test time | 0.1 s to 999 s, continuous (timer off) |
| Voltage rise / fall time | 0.1 s to 300 s / 0.1 s to 300 s, off |

| Breakdown voltage test | |
|---|---|
| Test method | Continuous voltage rise test, stepped voltage rise test |
| Settings | Insulation breakdown voltage (kV), insulation breakdown strength (kV/mm) |
| Setting description | Start voltage, end voltage, rise speed, arc detection, electrode distance, upper limit current |

| Waveform display functionality | |
|---|---|
| Waveform display content | Voltage, current, insulation resistance |
| Sampling rate | Max. 500 kS/s |
| Display length setting | 0.5 s to 128 s (9 variables) |
| Memory capacity | 512 K words |

| Arc discharge detection | |
|---|---|
| Detection method | Monitoring of fluctuations in the test voltage |
| Setting description | Test voltage variability: 1% to 50% |

| Contact check functionality | |
|---|---|
| Detection method | Capacitance measurement method |
| Setting description | Threshold (capacitance) setting: 1.0 nF to 100.0 nF |

| Memory functionality | |
|---|---|
| Saving of waveforms/ graphs | Save to USB memory<br>Save formats: BMP, PNG, CSV |
| Panel memory function | Saves test condition settings internally in the instrument. |
| | DC withstand voltage testing/insulation resistance testing: Up to 64 sets of settings each |
| | Program testing: Up to 30 programs (max. 50 steps) |
| | Insulation breakdown voltage testing: Up to 10 sets of settings |
| Data memory function | Saves measured values in the instrument's internal memory (up to 32,000 values). |

| Judgment functionality | |
|---|---|
| Judgment output | PASS judgment, FAIL judgment (UPPER FAIL, LOWER FAIL) |
| | UPPER_FAIL: Measured value > upper limit value |
| | PASS : Upper limit value ≥ measured value ≥ lower limit value |
| | LOWER_FAIL : Measured value < lower limit value |

| List of major functions | |
|---|---|
| Interlock | Disables output based on the status of an external device. |
| Auto discharge | Discharges the target via internal circuitry at the end of the test. Discharge resistance: 726 kΩ |
| Offset cancellation | Measures the current flowing along the test path and subtracts it from measurement results. |
| Measurement speed | NORMAL (100 ms) / FAST (20 ms) / FAST2 (10 ms) |
| Momentary out | Outputs the test voltage only while the START button is being pressed. |
| Command monitor | Displays commands being sent and received on the screen. |
| I/O handler test | Allows you to check whether signals are being input and output properly via the EXT I/O terminal. |
| Key lock | Disables changes to test conditions. |
| Self-check | Checks the touch screen, display, LED, instrument memory, and EXT I/O. |
| Calibration deadline check | Lets you set a calibration deadline in advance and displays a warning once it's passed. |
| EXT SW | Allows the instrument to be operated using a remote control. |
| | Options: Remote control box (single) 9613, Remote control box (dual) 9614 |

| Basic specifications | |
|---|---|
| Operating temperature and humidity range | 0°C to 40°C, 80% RH or less (non-condensing) |
| Standard compliance | Safety: IEC 61010 |
| | EMC: IEC 61326 |
| Power supply | 100 to 240 V AC |
| Power consumption | Approx. 180 VA |
| | *Power supply conditions are 220 V power supply voltage, 50/60 Hz power supply frequency, DC withstand voltage test mode, 2.5 kV test voltage, and 5 mA load current (500 kΩ load resistance). |
| Maximum rated power | 800 VA |
| Interface | Communications: USB, LAN, EXT I/O |
| | Options: RS-232C (Z3001), GP-IB (Z3000) |
| | Memory: USB drive |
| External dimensions | 305 mm (12.01 in) W × 142 mm (5.59 in) H × 430 mm (16.93 in) D (excluding protruding parts) |
| Weight | 10.0 kg (352.74 oz) ±0.2 kg (7.05 oz) |
| Product warranty | 3 years |
| Accessories | Power cord, CD-ROM (PDF: User Manual, Communications Manual), EXT I/O male connector, EXT I/O connector cover, EXT I/O interlock cancellation jig, Startup Guide |

## Insulation resistance measurement accuracy* (Accuracy guaranteed test voltage range: 50 V to 2000 V)

| | Measurement range | | 100 kΩ to 99.99 GΩ | |
|---|---|---|---|---|
| IR | Accuracy | 10 nA ≤ I ≤ 3 μA | 100 MΩ to 999.9 MΩ | ±(20% rdg.) |
| | | | 1.00 GΩ to 99.99 GΩ | |
| | | 100 nA ≤ I ≤ 30 μA | 10.00 MΩ to 99.99 MΩ | ±(5% rdg.) |
| | | | 100.0 MΩ to 999.9 MΩ | |
| | | 1 μA ≤ I ≤ 300 μA | 1.000 MΩ to 9.999 MΩ | ±(2% rdg. + 5 dgt.) |
| | | | 10.00 MΩ to 99.99 MΩ | |
| | | 10 μA ≤ I ≤ 3 mA | 100.0 kΩ to 999.9 kΩ | ±(1.5% rdg. + 3 dgt.) |
| | | | 1.000 MΩ to 9.999 MΩ | |
| | | 100 μA ≤ I ≤ 20 mA | 100.0 kΩ to 999.9 kΩ | |

* If the test voltage is 50 V to 99 V, add ±10% to the measurement accuracy.
* If the test voltage is 100 V to 999 V, add ±5% to the measurement accuracy.
* If the test voltage is 1000 V to 2000 V, add ±2% to the measurement accuracy.
* When the ambient temperature t is less than 5°C
  Measurement current I < 100 nA: Add ±(5% rdg × [5-t]), Measurement current I ≥ 100 nA: Add ±(1% rdg × [5-t])
* When the ambient temperature t is more than 35°C
  Measurement current I < 100 nA: Add ±(5% rdg × [t-35]), Measurement current I ≥ 100 nA: Add ±(1% rdg × [t-35])
* Multiply the resistance meter accuracy by 2 when using the [FAST2] measurement speed.

## Product name

**DC HIPOT TESTER ST5680**

Model number (order code) : ST5680


The instrument is not able to perform measurement by itself. The HIGH and LOW terminals use dedicated Hioki connectors to which only Hioki options L2260 and L2261 can be connected. Please purchase optional test leads as appropriate for your measurement application.



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