(Transforming Motor Winding Testing

New Quantification of response waveforms

- Test rotor assembly status
- Detect single-turn faults
  * Depends on measurement conditions
- Improve quality by capturing accumulated turn fault data as feedback for upstream processes

New DISCHARGE DETECTION UPGRADE

- Detect partial discharges at high precision
- Identify insulation defects (pseudo-shorts) between motor windings
- Easily detect discharges
  No need for peripheral equipment
  (discharge detection antenna, etc.)
The new standard in winding testing

Detect defects that were impossible to detect in the past

Detect minuscule changes in response waveforms

High-speed sampling × high resolution

High-frequency components caused by discharges

100 MHz
Past issue
Difficult to detect instantaneous variations

200 MHz
ST4030A
Instantaneous variations can be captured at a higher level of detail

High resolution

It’s difficult to detect the difference between defective and non-defective parts.

Differences between waveforms can be captured at a higher level of detail.

10 bit

2047

12 bit

2048

1024

- 512

- 2048
The new approach of using LC and RC values makes it possible to detect discrepancies between defective and non-defective windings, including when the differences between waveforms are too minuscule to detect using conventional means*. Since detection thresholds can be clearly defined, the instrument can give a clear pass/fail decision.

Pass/fail judgments are difficult when area differences do not exceed several percentage points. Pass/fail judgments are made by calculating the difference in area between the master waveform and the test waveform for the interval specified by the A and B cursors.

The distributions of values differ for defective and non-defective windings.

*See “Testable inductance range” in the specifications on the last page for more information about motors for which detection is possible. Performance may depend on conditions. Please consult with your local Hioki distributor for a test demonstration prior to purchase.
Detect defective parts with a high degree of repeatability

The ST4030A can detect defective parts with a high degree of precision thanks to low variability in the applied voltage it generates. In addition, differences between instruments when testing the same workpiece are slight, so you can continue to use master workpiece data even after one instrument is swapped out for another.

Ample sampling data for proper detection

Capture minuscule variations in response waveforms

However, since the ST4030A supports a large number of sampling points, the instrument can capture waveforms of sufficient length to support detection, even when sampling at 200 MHz.

Improved applied voltage reproducibility

Detect defective parts with a high degree of repeatability

The ST4030A can detect defective parts with a high degree of precision thanks to low variability in the applied voltage it generates. In addition, differences between instruments when testing the same workpiece are slight, so you can continue to use master workpiece data even after one instrument is swapped out for another.

Applied voltage variability

Conventional instruments

Variability in waveforms makes it difficult to detect shorts.

ST4030A

Low waveform variability allows defective windings to be detected with a high degree of precision.

Reduced damage thanks to lower applied voltages

LC and RC values can be used to distinguish between defective and non-defective parts, without regard to the magnitude of the applied voltage. As a result, the applied voltage can be lowered, reducing damage to workpieces.
Detect pseudo-shorts with a high degree of precision

By detecting minuscule partial discharges that are obscured by noise, the ST9000 makes it possible to detect insulation defects (pseudo-shorts) between motor windings.

Proprietary Hioki filtering process

Of the high-frequency components that appear in response waveforms, noise components that appear throughout the waveform are rejected so that the instrument can extract and make judgments based solely on partial discharge components.

**High-precision waveform detection**

- 200 MHz, 12-bit sampling

**Isolation of noise components**

- Proprietary Hioki filtering process

**Easy discharge detection**

- No need for peripheral equipment (discharge detection antenna, etc.)

Insulation breakdown voltage testing (Break Down Voltage)

The ST4030A also provides functionality for performing insulation breakdown voltage testing, which is required by various standards. An impulse test is performed while the voltage applied to the workpiece is gradually increased, and the insulation breakdown voltage is evaluated based on factors such as the response waveform’s LC and RC values, the amount of discharge, and the waveform area.

**Stable detection with an extensive range of judgment parameters**

- LC and RC values
- Discharge magnitude
- Waveform area comparison
- Peak voltage value
- Oscillation frequency

**Example PASS judgment**

If all judgments yielded a PASS result, testing continues to the maximum voltage.

**BDV setting range**

- Setting range: 100 V to 4200 V
- Setting resolution: 10 V
- Number of steps: Up to 32

**Example FAIL judgment (discharge FAIL at 2000 V)**

If any of the judgments yields a FAIL result, the insulation is considered to have started to break down, and testing is halted at that point. The breakdown voltage waveform is shown in red.
Testing after rotor assembly

Once the rotor has been attached to the motor’s stator, the stray capacitance between the rotor and stator will vary depending on the position at which the rotor was attached. This variation in stray capacitance means that the response waveform obtained during impulse testing varies, preventing use of the conventional waveform comparison method. Although the LC and RC values used to quantify response waveforms also vary due to variations in those waveforms, the distributions of those values vary for defective and non-defective parts. Consequently, impulse testing can be performed after the rotor has been installed as long as defective and non-defective part judgment areas have been created.

Conventional waveform detection

Clear judgment standards cannot be defined due to differences in the response waveforms depending on the position and angle at which the rotor has been attached.

Variations in the voltage waveform when the rotor is rotated (simplified illustration)

Since the waveform varies depending on the locations at which rotor angles A and B occur, it is difficult to determine a standard to use to compare the waveforms.

Numerical judgment using LC and RC values

If the non-defective part area is set using healthy phases, impulse testing can be performed following rotor assembly.

Distribution of LC and RC values when the rotor is rotated (at 50 points)

When LC and RC values are sampled while rotating the rotor, the distribution for defective phases differs from the distribution for healthy phases.
Accommodating differences in response waveform caused by motor characteristics

When testing a motor whose response waveform exhibits reduced resonance due to rotor core loss, the ST4030A automatically adjusts the judgment interval so that evaluations can be made over an interval with high voltage amplitude.

When a rotor is present, the ST4030A reduces the amount of electrical energy supplied to the motor, causing attenuation of the response waveform.

Attenuation of response waveforms

Reductions in electrical energy are primarily the result of the following types of loss:

Core loss
(1) Hysteresis loss
Loss caused by changes in the orientation of the magnetic molecules in the iron core
(2) Eddy current loss
Loss caused when an eddy current occurs in the iron core

Output
Conversion of electrical energy into mechanical energy that tries to rotate the rotor

Improve parts quality by using quantified test results as feedback for upstream processes

Quantitatively manage testing by quantifying response waveforms

Clarify judgment standard values

Clearly determine judgment standards based on numerical data for defective and non-defective workpieces. This information provides a basis for understanding how much the two can differ.

Use test results to manage manufacturing quality

Utilize statistical quality control techniques and accumulate statistical data to estimate when winding defects will occur so as to properly take steps to prevent such issues.

As long as the response waveforms for defective and non-defective motors differ, even if they are attenuated, the motors can be tested.

<table>
<thead>
<tr>
<th>Workpiece</th>
<th>LC [ p ]</th>
<th>RC [ µ ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>228</td>
<td>4.21</td>
</tr>
<tr>
<td>2</td>
<td>227</td>
<td>4.22</td>
</tr>
<tr>
<td>3</td>
<td>226</td>
<td>4.22</td>
</tr>
<tr>
<td>4</td>
<td>228</td>
<td>4.23</td>
</tr>
<tr>
<td>5</td>
<td>227</td>
<td>4.22</td>
</tr>
<tr>
<td>6</td>
<td>226</td>
<td>4.21</td>
</tr>
<tr>
<td>7</td>
<td>227</td>
<td>4.23</td>
</tr>
<tr>
<td>8</td>
<td>225</td>
<td>4.22</td>
</tr>
<tr>
<td></td>
<td>218</td>
<td>6.51</td>
</tr>
<tr>
<td>17</td>
<td>227</td>
<td>4.22</td>
</tr>
<tr>
<td>18</td>
<td>228</td>
<td>4.21</td>
</tr>
<tr>
<td>19</td>
<td>218</td>
<td>6.52</td>
</tr>
<tr>
<td>20</td>
<td>220</td>
<td>4.23</td>
</tr>
</tbody>
</table>
Create a PASS judgment area from the distribution of LC and RC values

Full support to assist in setting testing conditions

Automatic configuration of the PASS judgment area

To make PASS and FAIL judgments, capture master LC and RC values from a known-good master workpiece. The ST4030A will automatically create a PASS judgment area based on those values.

Choose the shape of the PASS judgment area.

- **HI-LO** Rectangular PASS judgment area
  - Select when the master workpiece’s LC and RC values are distributed in close proximity

- **FIT** Trapezoidal PASS judgment area
  - Select when the motor’s rotor has been attached and the distribution of the LC and RC values assumes a belt shape according to the rotor position or angle

Captured LC and RC master values

Set the margin

Set the margin to use when the PASS judgment area is automatically created.

Create

Automatically create the area by touching this button.

The created PASS judgment area will be shown as a quadrilateral on the LC/RC graph.

Automatic configuration of the waveform capture range

The oscillation frequency of response waveforms varies with the type of workpiece. To allow a sufficient amount of waveform data to be used in LC/RC value calculation and waveform judgment, the sampling frequency and sampling data count are automatically adjusted so as to optimize the waveform capture range.

**Workpiece A** (low oscillation frequency)

The captured waveform length is inadequate due to the response waveform’s low oscillation frequency. The sampling frequency needs to be decreased.

Optimizing the waveform capture range

**Workpiece B** (high oscillation frequency)

An unnecessary amount of waveforms is being captured due to the response waveform’s high oscillation frequency. Either the sampling frequency needs to be increased, or the sampling data count needs to be decreased.
Easily analyze test results on a computer

**Memory function and USB memory stick**

The ST4030A can save the results of up to 1000 tests in its internal memory. You can then copy that data to a USB memory stick, open the measurement data using a spreadsheet application, and use it to analyze variability and manage testing data.

**Support for PLC and computer programming**

Build testing lines quickly

**EXT. I/O test**

Verify whether signals output from the external control terminal (EXT. I/O) are being properly output and whether input signals are being properly read.

**I/O OUT**: The signal is output (turned on) from the I/O output pin with the name of the selected button.

**I/O IN**: The names of signals being input (turned on) are shown in green. Signals for which no input is being received are grayed out.

**Communications monitor**

Since you can display communications and query responses on the screen, you can build a testing line while checking the status of instrument operation in real time.

Commands are shown on the communications monitor in different colors to simplify the process of verifying proper operation.
Ideal for embedding in winding inspection systems
Space-saving Half-rack Size

Extensive range of interfaces

**Interfaces**
The ST4030A can be controlled from a computer using communications commands sent via its USB, LAN, GP-IB, or RS-232C interface.

<table>
<thead>
<tr>
<th>Interfaces</th>
<th>LAN</th>
<th>USB (for PC connectivity)</th>
<th>GP-IB (optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Connector</td>
<td>RJ-45 connector</td>
<td>USB Type B receptacle</td>
</tr>
<tr>
<td></td>
<td>Electrical specifications</td>
<td>IEEE802.3 compliant</td>
<td>Electrical specifications</td>
</tr>
<tr>
<td></td>
<td>Transmission method</td>
<td>10BASE-T/ 100BASE-TX/ 1000BASE-T Auto detected</td>
<td>Transmission method</td>
</tr>
<tr>
<td></td>
<td>Protocol</td>
<td>TCP/IP</td>
<td>Protocol</td>
</tr>
</tbody>
</table>

**GP-IB (optional)**
- Reference standard: IEEE-488.2
- Functional specifications: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0
- Device address: 0 to 30

*The GP-IB and RS-232C interfaces are optional.*
EXT. I/O

The EXT. I/O interface allows you to output signals such as the measurement complete signal (EOM) and the judgment results signal (PASS/FAIL) to an external device and to control the instrument based on input such as a START signal from an external device.

Connectors

Connectors to use (unit side)
- D- sub 37-pin
- Female connector with #4-40 inch screws

Compliant connectors
- DC-2F7-JULP (solder type)
- DCSP-JB37PR (pressure weld type)
- Japan Aviation Electronics Industry, Ltd.

Input signals

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pin name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>START</td>
<td>The instrument starts testing at the START signal's ON edge.</td>
</tr>
<tr>
<td>20</td>
<td>STOP</td>
<td>The instrument stops testing when it detects the ON edge of the STOP signal during testing.</td>
</tr>
<tr>
<td>3</td>
<td>INTERLOCK</td>
<td>If the instrument's interlock setting is enabled, the interlock state is canceled while the INTERLOCK signal is ON.</td>
</tr>
<tr>
<td>4 to 7</td>
<td>TBL0 to 7</td>
<td>Selects the table number in which switchable test conditions have been saved.</td>
</tr>
</tbody>
</table>

Output signals

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pin name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>INDEX</td>
<td>Indicates that analog measurement (pulse application and sampling) has ended. When this signal changes from OFF to ON, the probes can be placed in the open state.</td>
</tr>
<tr>
<td>28</td>
<td>EOM</td>
<td>This signal is output when testing is complete. The judgment results and ERR signals are refreshed once the EOM signal is output.</td>
</tr>
<tr>
<td>10</td>
<td>ERR</td>
<td>This signal is output when a measurement error such as an open error or hardware error occurs.</td>
</tr>
<tr>
<td>18</td>
<td>PASS</td>
<td>This signal is output when the overall judgment result is PASS.</td>
</tr>
<tr>
<td>37</td>
<td>FAIL</td>
<td>This signal is output when the overall judgment result is FAIL.</td>
</tr>
<tr>
<td>TBL signal loaded</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Insulated power source output

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pin name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>ISO_5V</td>
<td>NPN switch settings</td>
</tr>
<tr>
<td>9, 27</td>
<td>ISO_COM</td>
<td>Insulated power source common</td>
</tr>
</tbody>
</table>

Example of measurement timing

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>time</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>START signal ON time</td>
<td>1 ms or greater</td>
</tr>
<tr>
<td>12</td>
<td>Trigger detection time</td>
<td>1 ms (typical value)</td>
</tr>
<tr>
<td>13</td>
<td>Table selection time</td>
<td>10 ms (typical value)</td>
</tr>
<tr>
<td>14</td>
<td>Trigger delay time</td>
<td>0.00 s to 9.999 s</td>
</tr>
<tr>
<td>15</td>
<td>Analog measurement time</td>
<td>50 ms (typical value for a set value of 3000 V, sampling frequency of 200 MHz, and 1 pulse application)</td>
</tr>
<tr>
<td>16</td>
<td>Calculation and judgment time</td>
<td>15 ms (typical value when the AREA, DIFF, FLUTTER, or LAPLACIAN judgment function is enabled)</td>
</tr>
</tbody>
</table>

Test times (reference values)

Measurement times (EOM)

EOM = (INDEX + software processing time + judgment times × number of pulses applied)
- Degaussing pulses do not entail software processing time or judgment time.
- When applying multiple pulses, the testing process is controlled so that each pulse application interval is not less than the minimum pulse application interval set time.
- Calculation interval: 1500 pt
- *2 Calculation interval: 1500 pt
- *3 Calculation interval: 1500 pt

Analog measurement times (INDEX)

Time through charging, application, and sampling (typical value)

<table>
<thead>
<tr>
<th>Set voltage</th>
<th>INDEX time</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 V</td>
<td>30 ms</td>
</tr>
<tr>
<td>1000 V</td>
<td>30 ms</td>
</tr>
<tr>
<td>2000 V</td>
<td>40 ms</td>
</tr>
<tr>
<td>3000 V</td>
<td>50 ms</td>
</tr>
</tbody>
</table>

Software processing time

Software processing time covering data transfers, etc. (typical value), Processing time: 10 ms

<table>
<thead>
<tr>
<th>%/s: 200 MHz, DISP: THIN</th>
</tr>
</thead>
</table>

Judgment time

Processing time when each judgment function is enabled (typical value)

<table>
<thead>
<tr>
<th>Judgment</th>
<th>Processing time</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREA*1</td>
<td>1 ms</td>
</tr>
<tr>
<td>FLTR*1</td>
<td>1 ms</td>
</tr>
<tr>
<td>LAPL*1</td>
<td>1 ms</td>
</tr>
<tr>
<td>LC RC*1</td>
<td>100 ms</td>
</tr>
<tr>
<td>DISCHARGE*1</td>
<td>75 ms</td>
</tr>
</tbody>
</table>

- *1 Judgment area: 1500 pt
- *2 Calculation interval: 1500 pt
- *3 Judgment interval with sampling speed of 200 MHz: 800 pt

Electrical specifications

**Input signals**
- Input type: Photocoupler-isolated non-voltage contact input (with current sink/source output support)
- Input ON: Residual voltage of 1 V or less; input ON current of 4 mA (reference values)
- Input OFF: OPEN (breaking current of 100 μA or less)

**Output signals**
- Output type: Photocoupler-isolated open-drain output (non-polar)
- Maximum load voltage: DC 30 V
- Maximum load current: 50 mA/ch
- Residual voltage: 1 V or less (load current of 50 mA) / 0.5 V or less (load current of 10 mA)
- Output voltage: Sink output support: +5.0 V ±0.8 V; source output support: -5.0 V ±0.8 V
- Maximum output current: 100 mA

**Internally isolated power supply**
- Insulation: Floating from protective ground potential and measurement circuit
- Insulation rating: Terminal-to-ground voltage of 50 V DC, 30 V AC rms, 42.4 V AC peak or less

---

Sample table content

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pin name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>START</td>
<td>The instrument starts testing at the START signal's ON edge.</td>
</tr>
<tr>
<td>20</td>
<td>STOP</td>
<td>The instrument stops testing when it detects the ON edge of the STOP signal during testing.</td>
</tr>
<tr>
<td>3</td>
<td>INTERLOCK</td>
<td>If the instrument's interlock setting is enabled, the interlock state is canceled while the INTERLOCK signal is ON.</td>
</tr>
<tr>
<td>4 to 7</td>
<td>TBL0 to 7</td>
<td>Selects the table number in which switchable test conditions have been saved.</td>
</tr>
</tbody>
</table>

---

**Example of measurement timing**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>time</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>START signal ON time</td>
<td>1 ms or greater</td>
</tr>
<tr>
<td>12</td>
<td>Trigger detection time</td>
<td>1 ms (typical value)</td>
</tr>
<tr>
<td>13</td>
<td>Table selection time</td>
<td>10 ms (typical value)</td>
</tr>
<tr>
<td>14</td>
<td>Trigger delay time</td>
<td>0.00 s to 9.999 s</td>
</tr>
<tr>
<td>15</td>
<td>Analog measurement time</td>
<td>50 ms (typical value for a set value of 3000 V, sampling frequency of 200 MHz, and 1 pulse application)</td>
</tr>
<tr>
<td>16</td>
<td>Calculation and judgment time</td>
<td>15 ms (typical value when the AREA, DIFF, FLUTTER, or LAPLACIAN judgment function is enabled)</td>
</tr>
</tbody>
</table>

**Test times (reference values)**

Measurement times (EOM)

EOM = (INDEX + software processing time + judgment times × number of pulses applied)
- Degaussing pulses do not entail software processing time or judgment time.
- When applying multiple pulses, the testing process is controlled so that each pulse application interval is not less than the minimum pulse application interval set time.

Analog measurement times (INDEX)

Time through charging, application, and sampling (typical value)

<table>
<thead>
<tr>
<th>Set voltage</th>
<th>INDEX time</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 V</td>
<td>30 ms</td>
</tr>
<tr>
<td>1000 V</td>
<td>30 ms</td>
</tr>
<tr>
<td>2000 V</td>
<td>40 ms</td>
</tr>
<tr>
<td>3000 V</td>
<td>50 ms</td>
</tr>
</tbody>
</table>

Software processing time

Software processing time covering data transfers, etc. (typical value), Processing time: 10 ms

<table>
<thead>
<tr>
<th>%/s: 200 MHz, DISP: THIN</th>
</tr>
</thead>
</table>

Judgment time

Processing time when each judgment function is enabled (typical value)

<table>
<thead>
<tr>
<th>Judgment</th>
<th>Processing time</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREA*1</td>
<td>1 ms</td>
</tr>
<tr>
<td>FLTR*1</td>
<td>1 ms</td>
</tr>
<tr>
<td>LAPL*1</td>
<td>1 ms</td>
</tr>
<tr>
<td>LC RC*1</td>
<td>100 ms</td>
</tr>
<tr>
<td>DISCHARGE*1</td>
<td>75 ms</td>
</tr>
</tbody>
</table>

- *1 Judgment area: 1500 pt
- *2 Calculation interval: 1500 pt
- *3 Judgment interval with sampling speed of 200 MHz: 800 pt

---

**Electrical specifications**

**Input signals**
- Input type: Photocoupler-isolated non-voltage contact input (with current sink/source output support)
- Input ON: Residual voltage of 1 V or less; input ON current of 4 mA (reference values)
- Input OFF: OPEN (breaking current of 100 μA or less)

**Output signals**
- Output type: Photocoupler-isolated open-drain output (non-polar)
- Maximum load voltage: DC 30 V
- Maximum load current: 50 mA/ch
- Residual voltage: 1 V or less (load current of 50 mA) / 0.5 V or less (load current of 10 mA)
- Output voltage: Sink output support: +5.0 V ±0.8 V; source output support: -5.0 V ±0.8 V
- Maximum output current: 100 mA

**Internally isolated power supply**
- Insulation: Floating from protective ground potential and measurement circuit
- Insulation rating: Terminal-to-ground voltage of 50 V DC, 30 V AC rms, 42.4 V AC peak or less
### Specifications

**Applied voltage**
100 V to 4200 V (resolution set in 10 V steps)

**Testable inductance range**
10 µH to 100 mH

**Sampling speed**
200 MHz / 100 MHz / 50 MHz / 20 MHz / 10 MHz

**Sampling resolution**
12 bit

**Voltage detection accuracy**
DC accuracy: ±5% of setting, AC band: 100 kHz, ±1 dB
Accuracy guarantee conditions: 23°C ±5°C, 80% RH or less

**Number of samples**
1001 to 8001 points (set in 1000 point steps)

**Judgment method**
- The same impulse voltage is applied to a master workpiece and the workpiece under test, and a PASS/FAIL judgment is made by comparing the shapes, LC and RC values, and discharge component magnitudes of the respective response waveforms.

<table>
<thead>
<tr>
<th>LC/RC value judgment</th>
<th>LC/RC value judgment (LCRC AREA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waveform judgment</td>
<td>Waveform area comparison judgment (AREA)</td>
</tr>
<tr>
<td></td>
<td>Waveform differential area comparison judgment (DIFF-AREA)</td>
</tr>
<tr>
<td></td>
<td>Waveform flutter detection judgment (FLUTTER)</td>
</tr>
<tr>
<td></td>
<td>Waveform second derivative detection judgment (LAPLACIAN)</td>
</tr>
</tbody>
</table>

**Insulation breakdown voltage testing mode**
The workpiece is subjected to impulse testing while gradually raising the applied voltage to determine the voltage at which the insulation breaks down. Waveform area judgment, discharge judgment, and LC/RC value judgment are used to judge insulation breakdown.

**Number of test condition tables**
255 (test condition settings, detection condition settings, master waveforms)

**Test duration**
Approx. 60 ms (reference value when tester is configured for 3000 V, 1 pulse, detection off)

**Display**
Touch screen display: 8.4-inch SVGA color TFT LCD (800 × 600 dots)

**Safety functionality**
- Key lock, interlock, double-action design (to prevent erroneous operation when starting testing)

**General specifications**

<table>
<thead>
<tr>
<th>Operating environment</th>
<th>Use indoors at an elevation of 2,000 m or less in an environment with a maximum pollution level of 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature and humidity range</td>
<td>0°C to 40°C (32°F to 104°F), 80% RH or less (no condensation)</td>
</tr>
<tr>
<td>Storage temperature and humidity</td>
<td>-10°C to 50°C (14°F to 122°F), 80% RH or less (no condensation)</td>
</tr>
<tr>
<td>Standards compliance</td>
<td>Safety: EN 61010, EMC: EN 61326 Class A</td>
</tr>
<tr>
<td>Power supply</td>
<td>AC100 V to 240V, 50 Hz/60 Hz</td>
</tr>
<tr>
<td>External interface</td>
<td>Standard equipment: EXT. I/O, USB host (memory stick), USB device (for communications), LAN Options: RS-232C (Z3001), GP-IB (Z3000)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Approx. 215 mm (8.46 in) W × 200 mm (7.87 in) H × 348 mm (13.7 in) D (excluding protrusions)</td>
</tr>
<tr>
<td>Mass</td>
<td>Approx. 6.7 kg (236.3 oz)</td>
</tr>
<tr>
<td>Accessories</td>
<td>Power cord, instruction manual, application disc, operating precautions</td>
</tr>
</tbody>
</table>

**Model: IMPULSE WINDING TESTER ST4030A**

**Model No. (Order Code)**
ST4030A

**Additional function options**

**DISCHARGE DETECTION UPGRADE ST9000**
The Discharge Detection Upgrade ST9000 is a factory option for the Impulse Winding Tester ST4030A. Please specify at the time of order.

**Options**

- **CLIP TYPE LEAD L2250**
  - Maximum rated voltage: 3300 V AC peak, 1.5 m (4.92 ft) length

- **UNPROCESSED LEAD CABLE L2252**
  - Maximum rated voltage: 4200 V AC peak, 2 m (6.56 ft) length

**Caution:** Effect of cable parasitic components
The oscillation waveform varies with the length of the cable. Please contact your Hioki distributor concerning availability of special-order cables whose capacitance values fall within the acceptable range.

**Note:** Company names and product names appearing in this catalog are trademarks or registered trademarks of various companies.