ELECTRICAL SAFETY TESTERS

Hipot and Insulation Resistance Testers
Hipot Testers
Insulation Resistance Testers
Ground Bond Testers
Leakage Current Testers
**TOS SERIES**

**ELECTRICAL SAFETY TESTER**

**High-End**

TOS9201  
5kV/100mA (500VA)  
ACW  
DCW  
IR  
0.01MΩ – 9.99GΩ (DC25V – 1000V)  
GPIB  
RS-232C  
Timer

TOS9200  
5kV/100mA (500VA)  
ACW  
DCW  
IR  
0.01MΩ – 9.99GΩ (DC25V – 1000V)  
GPIB  
RS-232C  
Timer

TOS9213S  
10kV/5mA  
ACW  
DCW  
IR  
0.01MΩ – 9.99GΩ (DC25V – 1000V)  
GPIB  
RS-232C  
Timer

**Standard**

TOS5302  
5kV/100mA (500VA)  
ACW  
IR  
0.03MΩ – 500MΩ (DC25V – 1000V)  
USB

TOS5301  
5kV/100mA (500VA)  
ACW  
IR  
0.03MΩ – 500MΩ (DC25V – 1000V)  
USB

TOS5300  
5kV/100mA (500VA)  
ACW  
IR  
0.03MΩ – 500MΩ (DC25V – 1000V)  
USB

TOS8870A  
5kV/100mA (500VA)  
ACW  
IR  
0.03MΩ – 500MΩ (DC25V – 1000V)  
USB

TOS5101  
10kV/50mA (500VA)  
ACW  
DCW  
IR  
0.03MΩ – 500MΩ (DC25V – 1000V)  
USB

TOS5051A  
5kV/100mA (500VA)  
ACW  
DCW  
IR  
0.03MΩ – 500MΩ (DC25V – 1000V)  
USB

TOS8030  
5kV/100mA (500VA)  
ACW  
IR  
0.03MΩ – 500MΩ (DC25V – 1000V)  
USB

TOS8040  
5kV/100mA (500VA)  
ACW  
IR  
0.03MΩ – 500MΩ (DC25V – 1000V)  
USB

**Costsaving**

TOS8830  
4kV/100mA (500VA)  
ACW  
IR  
0.50MΩ – 9.99MΩ (DC500V)  
USB

TOS8030  
3kV/10mA (30VA)  
ACW  
IR  
0.03MΩ – 500MΩ (DC25V – 1000V)  
USB

For simplified tests

High-performance type suitable for R&D, Quality Assurance, and Automatic Testing Systems

High-voltage scanner (4ch) for TOS9201/9200  
* TOS9221 is equipped with a contact check function

Low-cost type most suitable for plants/factories
The Electrical Appliance & Material Safety Low (Japan), UL (U.S.A.), CSA (Canada), VDE (Germany) and BS (U.K) are some major examples of safety standards in use throughout the world that require the performing of hipot testing. For this reason, it is necessary to confirm for what portion of what standard testing is to be performed when purchasing a hipot tester. Although the 500 VA capacity hipot testers available from KIKUSUI can basically be applied to tests specified in all safety standards, we recommend that you consult with us prior to purchase in order to select the model that best matches your specific application.

For the withstanding test and the insulation resistance test of the EUT (Equipment Under Test) with turned on electricity. Our Hipot Testers and Insulation Resistance Testers are designed to test the EUT (Equipment Under Test) with turned off electricity. In case the test requires the EUT (Equipment Under Test) with turned on electricity, please contact with our distributor or agent.
Perfect design for System Operation, introducing our top of the line of Hipot / Insulation Resistance Testers

The TOS9200 Series has been developed to meet a wide diversity of customer needs. Including the refinement and enforcement of Kikusui’s former series, its specifications reflect the results of detailed study of our large database of user’s requirements including special orders and modifying specifications.

The TOS9200 Series consists of four products: the testers TOS9200 and TOS9201, and the high-voltage scanners TOS9221 and TOS9220.

The TOS9200 is equipped with AC hipot and insulation resistance testing functions, while the TOS9201 has a DC hipot testing function in addition to these two functions. The power block, a core component, employs a high-efficiency switching power supply and a switching amplifier based on PWM systems. These features realize high power and enhanced stability, as well as reducing the size and weight of the unit. When combined with the ground bond tester TOS6200, the TOS9200 Series integrates three or four types of tests in a single process.

Furthermore, when used together with the high-voltage scanner TOS9220/9221 (equipped with a contact check function), the tester is capable of automatically checking test points for up to 16 channels, thereby facilitating a safe, reliable automatic testing system.
Basic performance

Three functions - AC hipot testing, DC hipot testing and insulation resistance testing

The TOS9200 can perform AC hipot tests and insulation resistance tests, while the TOS9201 can also conduct DC withstanding tests. Once connected to a device being tested, the TOS9201 executes an AC hipot test, DC hipot test, and insulation resistance testing in succession in one process.

AC hipot testing at 5 kV and 100 mA

Equipped with a high-efficiency switching power supply in its high-voltage power block, a PWM-based switching amplifier and a 500 VA high-voltage transformer, the TOS9200/TOS9201 realizes a maximum output of 5 kV/100 mA (continuous output for 30 minutes), or 2.5 times the output of Kikusui’s former models. At a test voltage of 500 V or more and an upper current of 100 mA, or greater the tester instantaneously satisfies the requirements of a short-circuit current of 200 mA or more which is required by the IEC standard * . In addition, the tester ensures a load effects of 30% or less and the generation of a consistent 50 Hz/60 Hz test voltage free from the affect of the supply voltage. These features eliminate the need to readjust the output voltage once the test voltage is preset.

*Continuous outputs are impossible because the output is cut off if an overcurrent is detected.

DC hipot testing at 6 kV and a maximum output of 50 W

The TOS9201 permits DC hipot testing at up to 6 kV *. The tester is equipped with a stable, low-ripple DC/DC converter with a load factor of 1% or less.

Enhanced measurement accuracy

The TOS9200/9201 is provided with a digital voltmeter for hipot testing at an accuracy of ±(1% of reading + 30 V) and another one for insulation resistance testing at an accuracy of ±(1% of reading + 1 V). Measured values are displayed not only during a test, but while a program is being executed. A digital ammeter with an accuracy of ±(3% of reading + 20 µA) is also provided for hipot testing. Kikusui’s predecessors had the highest measurement resolution of about 1 mA, with an accuracy of ±5% of the upper cutoff current when it is set to 100 mA. In contrast, the digital ammeter allows the TOS9200/9201 to make measurements at an accuracy of ±(3% of reading + 20 µA), even if the upper current is set to 100 mA. The ammeter displays measured values while the program executes, as well as during an AC or DC hipot test.

<table>
<thead>
<tr>
<th>Type</th>
<th>Display accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltmeter for hipot testing</td>
<td>±(1% of reading + 30 V)</td>
</tr>
<tr>
<td>Ammeter for hipot testing</td>
<td>±(3% of reading + 20 µA)</td>
</tr>
<tr>
<td>Voltmeter for insulation resistance testing</td>
<td>±(1% of reading + 1 V)</td>
</tr>
<tr>
<td>Insulation resistance meter</td>
<td>±(2% of reading)*</td>
</tr>
</tbody>
</table>

*At 1 µA< measured current ≤ 1 mA
Diverse functions

Rise-time control function
In AC hipot testing, DC hipot testing and insulation resistance testing, you can apply a voltage gradually to reach the test voltage, instead of applying the test voltage directly at the start of a test. The voltage increase time can be set to 0.1 s through 99.9 s at a resolution of 0.1 s, and to 100 s to 200 s at a resolution of 1 s. The start voltage is also adjustable between 0% and 99% at a resolution of 1%.

Fall-time control function
In AC hipot testing, you can gradually decrease the test voltage after a PASS judgment. The voltage fall time is adjustable between 0.0 s and 99.9 s at a resolution of 0.1 s, and between 100 s and 200 s at a resolution of 1 s.

Offset cancel function
In AC hipot tests that require high sensitivity and high voltages, currents flowing into the stray capacity of the test lead wire, jigs, and other components can cause measurement errors. The TOS9200/9201 features a function to cancel these offset currents.

Voltage hold function
During measurement, this function allows you to hold the value of the voltage measured at the end of an AC or DC hipot test, as long as the test results are being displayed. When combined with the rise-time control function, this function enables to observe the insulation breakdown voltage.

Maximum Leakage current and minimum resistance hold function
By selecting “MIN/MAX Mode” in the measurement mode settings, you can hold the maximum current in hipot testing and the minimum resistance after the judgment wait time in insulation resistance testing. These values are shown on the tester's display. They can also be read back via interface (GPIB or RS-232C).

Output voltage monitoring function
When the output voltage deviates from ±(10% of setting + 50 V), the monitoring function activates to suspend the test, thus ensuring highly reliable testing.

Current detection response speed adjustment function
This function switches current detection response speeds for UPPER judgment by adjusting the integrated time constant of the current detection circuit. Three modes are available for the integrated time constant: SLOW (about 40 ms), MID (about 4 ms) and FAST (about 0.4 ms). SLOW mode is used in normal operations. MID and FAST modes are more effective in detecting a discharge occurring instantaneously or containing a large number of frequency components. They are also useful for hipot tests of test devices that insulation likely be breakdown, such as small electronic components.

Memory function
Up to 100 test conditions used in AC and DC hipot testing and insulation resistance testing, such as the test voltage, judgment value and test time, can be stored with a specific name. For instance, you can store the name of an applied safety standard and the destination of the product to be tested. If test conditions are preset, operator can recall relevant test conditions simply by entering the memory number. If you previously assigned a special name to each of these test conditions, operator can check recalled test conditions by name. The memory function allows you to recall test conditions not only through the recall operation on the front panel, but also by remote control.

Program function
By coordinatng test conditions stored in an AC hipot test, DC hipot test, and insulation resistance test, operator can sequentially run tests that comprise up to 100 steps. When used together with the ground bond tester TOS6200/6210, the TOS9200 Series permits continuous tests combining test conditions stored in the TOS6200, as well as on the TOS9200 itself. Sequential tests are possible, for example, on AC hipot, insulation resistance, DC hipot, and ground bond, in order. The TOS9200 Series stores up to 500 steps and 100 programs, which can be recalled through the recall operation on the front panel or by remote control.

[Sample program]

<table>
<thead>
<tr>
<th>Step 00</th>
<th>Step 01</th>
<th>Step 02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>Interval</td>
<td>Memory</td>
</tr>
<tr>
<td>ACW01</td>
<td>0.2 s</td>
<td>Memory</td>
</tr>
<tr>
<td>DCW01</td>
<td>0.2 s</td>
<td>Interval</td>
</tr>
<tr>
<td>IR01</td>
<td>0.2 s</td>
<td>END</td>
</tr>
</tbody>
</table>

At Step 00, Step 01 and Step 02, memory ACW01 (AC hipot test), DCW (DC hipot test: TOS9201 only) and IR01 (insulation resistance test) are performed, receptively, in succession at 0.2-second intervals.
**Peripheral devices**

**TOS9221**

The high-voltage scanner TOS9220/TOS9221 has a function that distributes the test voltage provided by the TOS9200/9201 to multiple test points. Up to four channels can be used for outputs on this scanner. Each channel can be set to one of the three electric potential modes – HIGH, LOW, or OPEN. Operator can conduct AC/DC hipot and insulation resistance tests on any of the four test points. Furthermore, up to four scanners can be connected to the tester, allowing a maximum of 16 channels. The TOS9200 is equipped with a “contact check function” to check the contact between the output of each channel and a test point. These features ensure highly reliable and labor-saving hipot and insulation resistance tests for electrical and electronic equipment with multiple test points.

**TOS9220**

The high-voltage scanner TOS9220/TOS9221 has a function that distributes the test voltage provided by the TOS9200/9201 to multiple test points. Up to four channels can be used for outputs on this scanner. Each channel can be set to one of the three electric potential modes – HIGH, LOW, or OPEN. Operator can conduct AC/DC hipot and insulation resistance tests on any of the four test points. Furthermore, up to four scanners can be connected to the tester, allowing a maximum of 16 channels. The TOS9200 is equipped with a “contact check function” to check the contact between the output of each channel and a test point. These features ensure highly reliable and labor-saving hipot and insulation resistance tests for electrical and electronic equipment with multiple test points.

**Interfaces**

**REMOTE connector & SIGNAL I/O connector**

The REMOTE connector on the front panel is intended exclusively for Kikusui’s options (remote control/test probe). It allows start and stop operations by remote control. The SIGNAL I/O connector on the rear panel permits operator to recall panel memory and program memory contents by remote control, as well as controlling start and stop operations. Seven different signals are output from the SIGNAL I/O connector through the open collector.

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal name</th>
<th>I/O</th>
<th>Details of signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PM0</td>
<td>I</td>
<td>LSD, LSD’ “1”</td>
</tr>
<tr>
<td>2</td>
<td>PM1</td>
<td>I</td>
<td>LSD’ “1”</td>
</tr>
<tr>
<td>3</td>
<td>PM2</td>
<td>I</td>
<td>LSD’ “1”</td>
</tr>
<tr>
<td>4</td>
<td>PM3</td>
<td>I</td>
<td>MSD’ “1”</td>
</tr>
<tr>
<td>5</td>
<td>PM4</td>
<td>I</td>
<td>MSD’ “1”</td>
</tr>
<tr>
<td>6</td>
<td>PM5</td>
<td>I</td>
<td>MSD’ “1”</td>
</tr>
<tr>
<td>7</td>
<td>PM6</td>
<td>I</td>
<td>MSD’ “1”</td>
</tr>
<tr>
<td>8</td>
<td>PM7</td>
<td>I</td>
<td>MSB, MSD’ “1”</td>
</tr>
<tr>
<td>9</td>
<td>STB</td>
<td>I</td>
<td>Input terminal for the strobe signal of the panel memory and program memory</td>
</tr>
<tr>
<td>10</td>
<td>MODE0</td>
<td>I</td>
<td>Selects a test mode “2”</td>
</tr>
<tr>
<td>11</td>
<td>MODE1</td>
<td>I</td>
<td>Selects a test mode “2”</td>
</tr>
<tr>
<td>12</td>
<td>NC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>COM</td>
<td></td>
<td>Circuit common (chassis potential)</td>
</tr>
<tr>
<td>14</td>
<td>H.V ON</td>
<td>O</td>
<td>ON during a test and an automatic test (AUTO) or while a voltage remains between the output terminals</td>
</tr>
<tr>
<td>15</td>
<td>TEST</td>
<td>O</td>
<td>ON during a test (except for voltage rise and voltage fall)</td>
</tr>
<tr>
<td>16</td>
<td>PASS</td>
<td>O</td>
<td>ON during the preset in the PASS HOLD settings when a PASS judgement is made</td>
</tr>
<tr>
<td>17</td>
<td>U.FAUL</td>
<td>O</td>
<td>Continuously ON in a LOWER FAIL judgement</td>
</tr>
<tr>
<td>18</td>
<td>L.FAUL</td>
<td>O</td>
<td>Continuously ON in an UPPER FAIL judgement with the scanner connected</td>
</tr>
<tr>
<td>19</td>
<td>READY</td>
<td>O</td>
<td>ON during the READY status</td>
</tr>
<tr>
<td>20</td>
<td>PROTECTION</td>
<td>O</td>
<td>ON when the PROTECTION function is activated</td>
</tr>
<tr>
<td>21</td>
<td>START</td>
<td>I</td>
<td>Input terminal for the START signal</td>
</tr>
<tr>
<td>22</td>
<td>STOP</td>
<td>I</td>
<td>Input terminal for the STOP signal</td>
</tr>
<tr>
<td>23</td>
<td>ENABLE</td>
<td>I</td>
<td>Input terminal for the ENABLE signal for the START signal</td>
</tr>
<tr>
<td>24</td>
<td>+24V</td>
<td>O</td>
<td>Output terminal for +24 V internal power, with a maximum output current of 100 mA</td>
</tr>
<tr>
<td>25</td>
<td>COM</td>
<td></td>
<td>Circuit common (chassis potential)</td>
</tr>
</tbody>
</table>

- **Input signal** [Low active control input High-level input voltage: 11 V to 15 V / Low-level input voltage: 0 V to 4 V / Low-level input current: Maximum –5 mA / Input interval: Minimum 5 ms]
- **Output signal** [Open collector output (DC4.5V to 30V) / hipot: DC 30 V / Output saturation voltage: Approximately 1.1 V (25 °C) / Maximum output current: 400 mA (TOTAL)]
- The input signal circuit is pulled up to +12V. Therefore, opening the input terminal is equivalent to inputting a high-level signal.
- 12-bit BCD low active input Signal input terminal for selection between the panel memory and program memory. Continuously ON in a CONTACT FAIL judgement with the scanner connected.
- 2-bit low active input Test mode |
<table>
<thead>
<tr>
<th>ACW</th>
<th>DCW</th>
<th>IR</th>
<th>AUTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODE0</td>
<td>H</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>MODE1</td>
<td>H</td>
<td>H</td>
<td>L</td>
</tr>
</tbody>
</table>

**GPIB/RS-232C interface**

A GPIB/RS-232C interface is provided as a standard feature to facilitate the remote control of all functions of the TOS9200/9201 except the POWER switch, the KEYLOCK function, and the program execution (AUTO) function.

RS-232C [Baud rate: 9600/19200/38400 bps/TOS6200/6210 interface (AUTO mode only): START/STOP control, test condition settings, reading of TOS6200/6210 measured values, and measurement results]

GPIB [Remote control of all functions except the POWER switch, the KEYLOCK function, and the program execution (AUTO) function]
For Stand alone use...

Example of system for applying voltage by Test Lead or start/stop operation by Remote Control Box.

1. Hipot / Insulation Resistance Tester AC/DC TOS9201 1 pc.
2. High-Voltage Test Lead TL01-TOS 1.5m *1 1 set
3. Remote Control Box RC01-TOS *2 1.5m 1 pc.

*1: Also available for 3m cable, TL02-TOS
*2: Also available for both-hands operation, RC02-TOS

Example of system for applying voltage or start/stop operation by High-Voltage Test Probe.

1. Hipot / Insulation Resistance Tester AC/DC TOS9201 1 pc.
2. High-Voltage Test Lead HP01A-TOS 1.5m *1 1 pc.

*1: Also available for 3m cable, HP02A-TOS

For Multiple Channel Testing by High Voltage Scanner...

Example of system consisting TOS9201 and TOS9221 × 2sets (8CH)

1. High-Voltage Scanner TOS9221 2 pc.
2. Hipot / Insulation Resistance Tester AC/DC TOS9201 1 pc.
3. Interface cable 85-50-0210 0.5m *1 2 pc.
4. High-Voltage Test Lead (red) TL07-TOS 1.5m 8 pc.
5. High-Voltage Leads for Parallel connection TL06-TOS 0.5m *2 2 set

*1: If the length of cable is required more than 0.5m, please contact with our local distributor.
*2: Also available for 1.5m cable, TL04-TOS

[Rack mount bracket]
TOS9200 / 9201 (JIS) KRB150-TOS
(EIA) KRB3-TOS
TOS9220 / 9221 (JIS) KRB100-TOS
(EIA) KRB2-TOS

[CAUTION] In case of using more than 2sets of High Voltage Scanner, it is required to rack mount or locate these units to the side of Hipot / Insulation Resistance Tester, and it should not be piled up more than 2sets of High Voltage Scanner units.
**TOS9200 SERIES**

**Hipot Tester with Insulation Resistance Test**

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### Single process to apply until ground bond test...

Example of system consisting TOS9201 and TOS6210

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>cable length</th>
<th>Required numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ground Bond Tester</td>
<td>TOS6210</td>
<td></td>
<td>1 pc.</td>
</tr>
<tr>
<td>2. Hipot / Insulation Resistance Tester AC/DC</td>
<td>TOS9201</td>
<td></td>
<td>1 pc.</td>
</tr>
<tr>
<td>3. RS-232 Cross Cable (9pin female-9pin female)</td>
<td></td>
<td></td>
<td>1 pc.</td>
</tr>
<tr>
<td>4. Low-Voltage Test Lead</td>
<td>TL12-TOS</td>
<td>1.5m</td>
<td>1 set</td>
</tr>
<tr>
<td>5. High-Voltage Test Lead</td>
<td>TL01-TOS</td>
<td>1.5m</td>
<td>1 set</td>
</tr>
</tbody>
</table>

*1: Also available for 3m cable, TL02-TOS

[Rack mount bracket]

TOS9200 / 9201 (JIS) KRB150-TOS
(JIS) KRB150-TOS

(TOS9200 / 9201 (EIA) KRB3-TOS
(EIA) KRB3-TOS)

TOS6210 / 6200 (JIS) KRB100-TOS
(JIS) KRB100-TOS

(EIA) KRB2-TOS
(EIA) KRB2-TOS

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### Fully Automated System by PC...

Example of system consisting TOS9201, TOS9221 (4CH) and TOS6210

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>cable length</th>
<th>Required numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. High-Voltage Scanner</td>
<td>TOS9221</td>
<td></td>
<td>1 pc.</td>
</tr>
<tr>
<td>2. Hipot / Insulation Resistance Tester AC/DC</td>
<td>TOS9201</td>
<td></td>
<td>1 pc.</td>
</tr>
<tr>
<td>3. Ground Bond Tester</td>
<td>TOS6210</td>
<td></td>
<td>1 pc.</td>
</tr>
<tr>
<td>4. Interface cable</td>
<td>85-50-0210</td>
<td>0.5m</td>
<td>*1 1 pc.</td>
</tr>
<tr>
<td>5. High-Voltage Test Lead (red)</td>
<td>TL07-TOS</td>
<td>1.5m</td>
<td>4 pc.</td>
</tr>
<tr>
<td>6. High-Voltage Leads for Parallel connection</td>
<td>TL06-TOS</td>
<td>0.5m</td>
<td>*2 1 set</td>
</tr>
<tr>
<td>7. Low-Voltage Test Lead</td>
<td>TL12-TOS</td>
<td>1.5m</td>
<td>1 set</td>
</tr>
<tr>
<td>8. GPIB Cable</td>
<td>40BJ-102</td>
<td>2m</td>
<td>*3 2 pc.</td>
</tr>
<tr>
<td>9. PC (with GPIB Interface cable)</td>
<td></td>
<td></td>
<td>1 pc.</td>
</tr>
</tbody>
</table>

*1: If the length of cable is required more than 0.5m, please contact with our local distributor.
*2: Also available for 1.5m cable, TL04-TOS
*3: Also available for 1m cable, 40BJ-101 and 4m cable, 40BJ-104

[Rack mount bracket]

TOS9200 / 9201 (JIS) KRB150-TOS
(EIA) KRB3-TOS

TOS9220 / 9221 / 6210 / 6200 (JIS) KRB100-TOS
(EIA) KRB2-TOS

[CAUTION] In case of use for combining more than 2sets of High Voltage Scanner unit and Ground Bond Tester, it is required to rack mount or locate these units to the side of Hipot / Insulation Resistance Tester, and it should not be piled up more than 2sets of High Voltage Scanner units.
## Hipot Tester

### Item | TOS9200 | TOS9201
--- | --- | ---
### Output section
<table>
<thead>
<tr>
<th>Output-voltage range</th>
<th>0.05 kV to 5.00 kV AC</th>
<th>0.05 kV to 6.00 kV DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>10 V</td>
<td>10 V</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±(1.5% of setting + 20 V) [no load]</td>
<td>±5% F.S</td>
</tr>
<tr>
<td>Maximum rated load (*1)</td>
<td>500 VA (5 kV/100 mA)</td>
<td>150 Vp-p Typ.</td>
</tr>
<tr>
<td>Maximum rated current</td>
<td>100 mA [output voltage of 0.2 kV or more]</td>
<td>40 mA Typ.</td>
</tr>
<tr>
<td>Transformer capacity</td>
<td>500 VA</td>
<td>50 W (5 kV/10 mA)</td>
</tr>
<tr>
<td>Output-voltage waveform(*2)</td>
<td>Sine wave</td>
<td></td>
</tr>
<tr>
<td>Distortion</td>
<td>2% or less [no load or pure resistive load at output voltage of 0.5 kV or more]</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>50 Hz/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1%</td>
<td></td>
</tr>
<tr>
<td>Voltage regulation</td>
<td>±3% or less [maximum rated load → no load]</td>
<td></td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>200 mA or more, 330 mA or less [at output voltage of 0.5 kV or more]</td>
<td></td>
</tr>
</tbody>
</table>

### DC

<table>
<thead>
<tr>
<th>Output-voltage range</th>
<th>0.0 kV to 6.00 kV AC/DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>10 V</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±(1.5% of the setting + 20 V)</td>
</tr>
<tr>
<td>Maximum rated load</td>
<td>50 W (5 kV/10 mA)</td>
</tr>
<tr>
<td>Maximum rated current</td>
<td>10 mA</td>
</tr>
<tr>
<td>Ripple</td>
<td>No load at 5 kV</td>
</tr>
<tr>
<td>Max. at 5 kV</td>
<td>50 Vp-p Typ.</td>
</tr>
<tr>
<td>Voltage regulation</td>
<td>1% or less [maximum rated load → no load]</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>40 mA Typ.</td>
</tr>
<tr>
<td>Discharge function</td>
<td>Forced discharge at the end of test/discharge resistance: 125 kΩ</td>
</tr>
</tbody>
</table>

### Start voltage

The voltage at the start of the test can be set as the start voltage.

| Setting range | 0% to 99% of the test voltage (resolution of 1%) |

### Output-voltage monitoring function

If the output voltage exceeds ±10% of the setting + 50 V, output is cut off and the protection function activates.

### Voltmeter

<table>
<thead>
<tr>
<th>Analog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale</td>
</tr>
<tr>
<td>Accuracy</td>
</tr>
<tr>
<td>Indiator</td>
</tr>
<tr>
<td>Measurement range</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
</tr>
<tr>
<td>Response</td>
</tr>
<tr>
<td>HOLD function</td>
</tr>
</tbody>
</table>

### Selection of LOW/GUARD for the GND (*4)

<table>
<thead>
<tr>
<th>LOW</th>
<th>GUARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connects the GND point to the LOW terminal. Measures the current flowing to the LOW terminal (chassis) (for normal operation).</td>
<td>Sets the GND point as guard. Measures the current flowing to the LOW terminal (chassis) (for high-sensitivity, high-accuracy measurements).</td>
</tr>
</tbody>
</table>

### Time

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS9200</th>
<th>TOS9201</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>0.1 s to 200 s</td>
<td></td>
</tr>
<tr>
<td>Setting range for the rise time (RISE TIME)</td>
<td>0 s to 200 s (Valid only with PASS judgement)</td>
<td>0.3 s to 999 s (Valid only with PASS judgement in AC hipot testing)</td>
</tr>
<tr>
<td>Setting range for the fall time (FALL TIME)</td>
<td>0 s to 200 s (Valid only with PASS judgement)</td>
<td>0.3 s to 999 s (Valid only with PASS judgement in AC hipot testing)</td>
</tr>
<tr>
<td>Setting range for the test time (TEST TIME)</td>
<td>0.1 s to 200 s (Valid only with PASS judgement)</td>
<td>0.3 s to 999 s (Valid only with PASS judgement in AC hipot testing)</td>
</tr>
<tr>
<td>Setting range for the judgment wait time (WAIT TIME)</td>
<td>0 s to 200 s</td>
<td>0 s to 200 s</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±(100 ppm + 20 ms)</td>
<td></td>
</tr>
</tbody>
</table>

---

*1 Time limitation on output

The tester’s hipot generator is designed to radiate half as much heat as the rated output, in consideration of the size, weight, cost, and other factors of the tester. It is therefore necessary to use the tester within the ranges specified below. Operations deviating from these ranges may heat the output section excessively, thereby activating the protective circuit. In such a case, suspend the test and wait until the temperature falls to the normal level.

[Output limitation in hipot testing: (Output time + voltage rise time + test time + voltage fall time)]

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Upper current</th>
<th>Pause Time</th>
<th>Output time</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°C ≤ 110 mA</td>
<td>At least as long as the test time</td>
<td>Maximum of 30 minutes</td>
<td></td>
</tr>
<tr>
<td>1 ≤ 50 mA</td>
<td>Continuous output possible</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

*2 Test-voltage waveform

When an AC test voltage is applied to a capacitive load, it is possible that the voltage becomes higher even than that when in the no load state. Furthermore, waveform distortion also may occur if the capacitance of the load is voltage-dependent (such as of ceramics capacitors). When the test voltage is not higher than 1.5 kV and the capacitance is not larger than 1000 pF, such test voltage changes are only of negligible levels. As the output type of the high-voltage generator block of the tester is PWM switching, switching noise and spike noise that the test voltage includes increase when the test voltage is 500 V or less. The lower the test voltage is, the more the waveform distortion increases.

---

*3** Time limitation on output

The tester’s hipot generator is designed to radiate half as much heat as the rated output, in consideration of the size, weight, cost, and other factors of the tester. It is therefore necessary to use the tester within the ranges specified below. Operations deviating from these ranges may heat the output section excessively, thereby activating the protective circuit. In such a case, suspend the test and wait until the temperature falls to the normal level.

[Output limitation in hipot testing: (Output time + voltage rise time + test time + voltage fall time)]

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Upper current</th>
<th>Pause Time</th>
<th>Output time</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°C ≤ 110 mA</td>
<td>At least as long as the test time</td>
<td>Maximum of 30 minutes</td>
<td></td>
</tr>
<tr>
<td>1 ≤ 50 mA</td>
<td>Continuous output possible</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

*4 Selection of LOW/GUARD for the GND

Selection permitted for current measurement between the mode for the GND point connected to the LOW terminal and the mode using guard. Selection permit for current measurement between the mode for the GND point connected to the LOW terminal and the mode using guard.

### TOS9200 SERIES

<table>
<thead>
<tr>
<th>Item</th>
<th>Measurement range: 0.00 mA to 110 mA AC/DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>i = measured current</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3% of the reading + 20 μA [after the offset cancel function is activated, if the scanner is mounted]</td>
</tr>
<tr>
<td>Response</td>
<td>Mean-value responsive/root-mean-square value display (response time of 200 ms)</td>
</tr>
<tr>
<td>Hold function</td>
<td>The measured current at the end of the test is held during the PASS judgment time period.</td>
</tr>
<tr>
<td>Offset cancel function</td>
<td>The current flowing to the insulation resistor between the output cables, and the stray capacity is cancelled up to 100 μA/kV (in AC hipot testing only).</td>
</tr>
<tr>
<td>Calibration</td>
<td>Performs calibration using the root-mean-square value of a sine wave with a pure resistive load</td>
</tr>
</tbody>
</table>

---

Kikusui Electronics Corporation
In ordinary operation, set the GND to LOW.

Insulation Resistance Tester

*3 In AC hipot testing, a current flows into the stray capacity of measurement leadwire and fixtures. When the optional high-voltage scanner TOS9220/9221 is used, a current of approximately 22\(\mu\)A flows into the stray capacity of each scanner. The table below shows the approximate currents flowing into such stray capacity.

When the LOW terminal is set to GND, a current flowing into the stray capacity is added for measurement purposes to the current flowing into the DUT. In particular, for high-sensitivity, high-accuracy judgement, it is necessary to add the current flowing into the stray capacity to the lower/upper current.

When the LOW terminal is set to FLOAT, the effect of the current flowing into the chassis (for high-sensitivity, high-accuracy measurements).

Judgement

<table>
<thead>
<tr>
<th>Judgement</th>
<th>Judgement method</th>
<th>Display</th>
<th>Buzzer</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPER FAIL</td>
<td>When the tester detects a current exceeding the upper current, it cuts off the output and makes an UPPER FAIL judgement.</td>
<td>The FAIL LED lights up displayed on the LCD</td>
<td>Outputs the U FAIL signal</td>
</tr>
<tr>
<td>LOWER FAIL</td>
<td>When the tester detects a current below the lower current, it cuts off the output and makes a LOWER FAIL judgement. However, no judgement is made during the voltage rise time (RISE TIME) or voltage fall time (FALL TIME) in AC hipot testing.</td>
<td>The FAIL LED lights up displayed on the LCD</td>
<td>Outputs the U FAIL signal</td>
</tr>
<tr>
<td>PASS</td>
<td>When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement.</td>
<td>The PASS LED lights up displayed on the LCD</td>
<td>Outputs the PASS signal</td>
</tr>
</tbody>
</table>

• The PASS signal is output at the timing preset on PASS HOLD. If HOLD is set, the PASS signal is output continuously until the STOP signal is input.

• The UPPER FAIL and the LOWER FAIL signals are output continuously until the STOP signal is input.

• The FAIL and PASS buzzer volumes are adjustable. However, they cannot be adjusted individually, as they are set in common.

Setting range for the upper current (UPPER) 0.01 mA to 110 mA AC (With the LOWER OFF function)
Setting range for the lower current (LOWER) 0.01 mA to 110 mA AC / 0.01 mA to 11 mA DC (With the LOWER OFF function)

Judgement accuracy (\*5) ±(3% of setting + 20 \(\mu\)A) [After the offset cancel function is activated, if the scanner is mounted]

Current detection method The absolute current values are integrated and compared with the reference value.

Response-speed switching function The current-detection response speed for UPPER FAIL judgement can be set to FAST/MID/SLOW (for AC hipot testing only).

Current detection method

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS9200</th>
<th>TOS9201</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output-voltage range</td>
<td>-25 V to -1000 V DC</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>1 V</td>
<td></td>
</tr>
<tr>
<td>Setting accuracy</td>
<td>±(1.5 % of Setting + 2 V)</td>
<td></td>
</tr>
<tr>
<td>Maximum rated load</td>
<td>1 W (-1000 V DC/1 mA)</td>
<td></td>
</tr>
<tr>
<td>Maximum rated current</td>
<td>1 mA</td>
<td></td>
</tr>
<tr>
<td>Ripple</td>
<td>1 kV no-load</td>
<td>2 Vp-p or less</td>
</tr>
<tr>
<td>Maximum rated load</td>
<td></td>
<td>10 Vp-p or less</td>
</tr>
<tr>
<td>Voltage regulation</td>
<td>1% or less [Maximum rated load → no load]</td>
<td></td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>12 mA or less</td>
<td></td>
</tr>
<tr>
<td>Discharge function</td>
<td>Forced discharge at the end of test (discharge resistance: 25 kΩ)</td>
<td></td>
</tr>
<tr>
<td>Output-voltage monitoring function</td>
<td>If the output voltage exceeds ±(10% of the setting + 50 V), output is cut off and the protection function activates.</td>
<td></td>
</tr>
</tbody>
</table>

Voltmeter

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS9200</th>
<th>TOS9201</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Scale</td>
<td>6 kV AC/DC FS</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>±5% FS</td>
<td></td>
</tr>
<tr>
<td>Indicator</td>
<td>Mean-value responsive / root-mean-square value scale</td>
<td></td>
</tr>
<tr>
<td>Digital Measurement range</td>
<td>0 V to -1200 V</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>1 V</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>±(1 % of reading + 1 V)</td>
<td></td>
</tr>
</tbody>
</table>

Resistance meter

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS9200</th>
<th>TOS9201</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>0.01 MΩ - 9.99 GΩ (Within the maximum rated current range of 1 mA to 50 nA)</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>R &lt; 10.0 MΩ</td>
<td>10.0 MΩ ≤</td>
</tr>
<tr>
<td>Accuracy</td>
<td>50 nA ≤</td>
<td>i ≤ 100 nA</td>
</tr>
<tr>
<td>[In the humidity range of 20%rh to 70%rh (no condensation), with no disturbance such as swinging of the test leadwire]</td>
<td>±(20 % of reading)</td>
<td>±(10 % of reading)</td>
</tr>
<tr>
<td>Hold function</td>
<td>The measured current at the end of the test is held during the PASS period.</td>
<td></td>
</tr>
<tr>
<td>Selection of LOW/GUARD for the GND (*5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td>Connects the GND point to the LOW terminal. Measures the current flowing to the LOW terminal (chassis) (for normal operation).</td>
<td></td>
</tr>
<tr>
<td>GUARD</td>
<td>Sets the GND point as guard. Measures the current flowing to the LOW terminal, but does not measure the current flowing to the chassis (for high-sensitivity, high-accuracy measurements).</td>
<td></td>
</tr>
</tbody>
</table>
When the GND is set to GUARD, current measurement is disabled if the part of the DUT connected to the LOW terminal is grounded, which poses extreme danger. Never ground the DUT.

**General Specifications**

**Hipot Tester with Insulation Resistance Test**

**Storage range**
- Temperature: -20°C to 40°C
- Humidity: 20% rh to 80% rh (No condensation)

**Environment**
- Warranty range: Temperature 5°C to 35°C, Humidity 20% rh to 80% rh (No condensation)
- Operating range: Temperature 0°C to 40°C, Humidity 20% rh to 80% rh (No condensation)
- Storage range: Temperature -20°C to 70°C, Humidity 90% rh or less (No condensation)

**Power requirements**
- Nominal voltage range (Allowable voltage range): 100 V to 120 V AC / 200 V to 240 V AC
- Power consumption: Using no load (READY) 100 VA or less, Using the rated load Maximum of 800 VA
- Allowable frequency range: 47 Hz to 63 Hz
- Insulation resistance: 30 MΩ or more (500 V DC) [between the AC LINE and chassis]
- Hipot: 1390 V AC, 2 seconds, 20 mA or less [between the AC LINE and chassis]
- Ground bond: ≤ 25 A AC/0.1 Ω or less

**Electromagnetic compatibility (EMC) (**
- Conforms to the requirements of the following directive and standard:
  - EMC Directive 2004/108/EC, EN61326, EN61000-3-2, EN61000-3-3
  - Under following conditions:
    1. Used test leadwire TL01-TOS which is supplied. 2. No discharge occurs at outside of the tester. 3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.

**Safety (**
- Conforms to the requirements of the following directive and standard:
  - Low Voltage Directive 2006/95/EC, EN61010-1, Class I, Pollution degree 2

**Dimensions (maximum)**
- 430 (455) W x 132 (150) H x 370 (440) D mm

**Weight**
- Approx. 19 kg

*5 When the GND is set to GUARD, current measurement is disabled if the part of the DUT connected to the LOW terminal is grounded, which poses extreme danger. Never ground the DUT.

In ordinary operation, set the GND to LOW.
**TOS9200 SERIES**

**Hipot Tester with Insulation Resistance Test**

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS9200</th>
<th>TOS9201</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessory</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC Power cable</td>
<td>1 pc.</td>
<td></td>
</tr>
<tr>
<td>High-voltage test lead wire TL01-TOS (1.5 m)</td>
<td>1 set</td>
<td></td>
</tr>
<tr>
<td>Interlock jumper</td>
<td>1 pc.</td>
<td></td>
</tr>
<tr>
<td>High Voltage Danger seal</td>
<td>1 sheet</td>
<td></td>
</tr>
<tr>
<td>Fuse</td>
<td>1 pc.</td>
<td></td>
</tr>
</tbody>
</table>

*6. Only on models that have CE marking on the panel. Not applicable to custom order models.*

*7. This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument. The safety of the instrument is not guaranteed unless the instrument is grounded properly.*

### High-Voltage Scanner (TOS9220/9221)

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS9220</th>
<th>TOS9221</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum rating voltage AC</td>
<td>5.0 kV</td>
<td></td>
</tr>
<tr>
<td>Maximum rating voltage DC</td>
<td>6.0 kV</td>
<td></td>
</tr>
<tr>
<td>Number of channels</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Maximum number of scanners</td>
<td>4 scanners (Each channel is settable to HIGH, LOW, or OPEN.)</td>
<td></td>
</tr>
<tr>
<td>Contact check function</td>
<td>None (*1)</td>
<td>Provided</td>
</tr>
<tr>
<td>Lamps and LEDs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POWER</td>
<td>Lights as it is interlocked with the POWER switch of the TOS9200/9201 tester</td>
<td></td>
</tr>
<tr>
<td>DANGER</td>
<td>Lights as it is interlocked with the DANGER lamp of the TOS9200/9201 tester</td>
<td></td>
</tr>
<tr>
<td>CHANNEL</td>
<td>Lights during a test at each channel HIGH: red; LOW: green; Under contact check: orange</td>
<td></td>
</tr>
</tbody>
</table>

### Power requirements

- **Nominal voltage range (allowable voltage range):** 100 V to 120 V AC/220 V to 240 V AC (85 V to 132 V AC/170 V to 250 V AC) Automatic switching
- **Power consumption:**
  - In READY state: Approx. 12 VA
  - During test: 40 VA maximum
- **Allowable frequency range:** 47 Hz to 63 Hz
- **Insulation resistance:** 30 MΩ or more (500 V DC) between the AC LINE and chassis
- **Hipot:** 1900 V AC, 2 seconds, 10 mA or less (between the AC LINE and chassis)
- **Ground bond:** 25 A AC/0.1 Ω or less

### Electromagnetic compatibility (EMC) (*2)

Conforms to the requirements of the following directive and standard:

- **EMC Directive 2004/108/EC, EN61326, EN61000-3-2, EN61000-3-3**
- Under following conditions:
  1. Used test leadwire TL07-TOS which is supplied.
  2. No discharge occurs at outside of the tester.
  3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.

### Safety (*2,3)

Conforms to the requirements of the following directive and standard:

- **Low Voltage Directive 2006/95/EC, EN61010-1, Class I, Pollution degree 2**

### Environment

- **Installation location:** Indoors and at altitudes up to 2000 m
- **Warranty range:**
  - Temperature: 5 °C to 35 °C
  - Humidity: 20 %rh to 80 %rh (no condensation)
- **Operating range:**
  - Temperature: 0 °C to 40 °C
  - Humidity: 20 %rh to 80 %rh (no condensation)
- **Storage range:**
  - Temperature: -20 °C to 70 °C
  - Humidity: 90 %rh or less (no condensation)
- **Dimensions:** 430(435)W x 88(105)H x 370(415)Dmm
- **Weight:** Approx. 6.5 kg

### Accessories

- **AC power cable:** 1 pc.
- **High-voltage test lead wires, red:** 4 pc. (1.5 m each) 8 pc. (1.5 m each)
- **High-voltage leads for parallel connection:** 1 set (0.5 m each)
- **Interface cable:** 1 pc. (0.5 m)
- **Channel-indication stickers:** For the panel face: 1 sheet; for the test leadwires: 1
- **“HIGH VOLTAGE, DANGER” stickers:** 2 sheets
- **Fuses:** 2 pc. (including a spare contained in the fuse holder)
- **Operation Manual:** 1 copy

*1. When the contact check function is activated on the TOS9220/9201 tester, the tester conducts a contact check up to the output terminals of the TOS9220 scanner.

*2. Only on models that have CE marking on the panel. Not applicable to custom order models.

*3. This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument. The safety of the instrument is not guaranteed unless the instrument is grounded properly.

---

**External dimensional diagrams**

[External dimensional diagrams image]

Unit: mm
Accompanied with the features and performance of TOS9200 series, and it extends additional features and specifications exclusively applied to the PV module testing.

The TOS9213S, DC Withstanding Voltage/Insulation Resistance Tester, is the test instrument that can handle the insulation test with high voltage and high resolution required for the evaluation of the PV module, Cable, Connector, and Junction Box. The TOS9213S is equipped with functions of the DC withstanding voltage testing and the insulation resistance testing accompanied with the features and performance of Kikusui’s high-end model TOS9200 series, and it extends additional features and specifications exclusively applied to the PV module testing. Furthermore, the TOS9213S improves the current measurement accuracy of the DC withstanding voltage testing from the original specification of the TOS9000 series.

- Up to 10 kV/5 mA with a maximum output of 50 W in DC withstanding voltage test
- Perform insulation resistance testing in the range of -25 V to -1000 V / 0.01 M to 9.99 G
- Applies for the testing of IEC61730-2 standard
- High-precision current measurement, 1 µA of the setting resolution for judgement
- Low output ripple of 100V p-p at 10 kV with consideration of capacitive load
- Rise-time control function makes a voltage to be increased slowly and it will not give effect of the stress to the PV module
- The judgement method of the insulation resistance test can be selected by using the current value in addition to the resistance value
- The phenomena of voltage appearance by the dielectric absorption, the forcible discharge timer function can be set up to 300 seconds
### Hipot Tester with Insulation Resistance Test

**Hipot Tester**

- **Output-voltage range (DC):** 0.05V to 10.0kV
- **Accuracy:** ±(1.0% of reading + 1V)
- **Resolution:** 1V
- **Maximum rated current:** 5mA
- **Ripple:** No load at 50kV
- **Maximum rated load (100V):** 50W(10kV/5mA)
- **Voltage regulation:** ±(5% of setting + 10µA)
- **Short-circuit current:** 40mA Typ.
- **Discharge function:** Forced discharge at the end of test (discharge resistance: 500k)
- **Start voltage:** The voltage at the start of the test can be set as the start voltage.
- **Setting range:** 0% to 99% of the test voltage (resolution of 1%)
- **Output-voltage monitoring function:** If the output voltage exceeds ±10% of the setting + 50V, output is cut off and the protection function activates.

**Voltmeter**

- **Analog**
  - **Scale:** 10kV DC F.S.
  - **Accuracy:** ±5% F.S.
  - **Indicator:** Mean-value responsive
  - **Measurement range:** 0.00 to 10.5kV DC
  - **Resolution:** 10V
  - **Response:** Mean-value responsive (response time of 200 ms)
  - **HOLD function:** The voltage measured at the end of the test is held during the PASS and FAIL period.

- **Digital**
  - **Accuracy:** ±(10% of reading + 20V)
  - **Resolution:** 10V
  - **Response:** Mean-value responsive (response time of 200 ms)
  - **Measurement range:** 0.01 to 1200V
  - **Accuracy:** ±(10% of reading + 1V)
  - **Scale:** 10kV DC F.S.
  - **Resolution:** 10V
  - **Response:** Mean-value responsive (response time of 200 ms)
  - **HOLD function:** The measured current at the end of the test is held during the PASS and FAIL period.

**Accessories**

- 1pc., Operation Manual 1 copy
- AC Power cord 1 pc., High-voltage test leadwire

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### Insulation Resistance Tester

**Insulation Resistance Tester**

- **Output-voltage range:** -25V to -1000V
- **Accuracy:** ±(1.5% of setting +2V)
- **Maximum rated load:** 1W-1000V(1mA)
- **Maximum rated current:** 1mA
- **Ripple:** 1kV no-load
- **Maximum rated load:** 10 V/µA or less
- **Voltage regulation:** ±(1% or less [Maximum rated load no load ]
- **Short-circuit current:** 12 mA or less
- **Discharge function:** Forced discharge at the end of test (discharge resistance: 25 kΩ; The discharge time can be set to a value from 0.5s to 300s) *(1)*
- **Output-voltage monitoring function:** If the output voltage exceeds ±10% of the setting + 50V, output is cut off and the protection function activates.

**Voltmeter**

- **Analog**
  - **Scale:** 10kV DC F.S.
  - **Accuracy:** ±5% F.S.
  - **Indicator:** Mean-value responsive
  - **Measurement range:** 0.00 to 10.5kV DC
  - **Resolution:** 10V
  - **Response:** Mean-value responsive (response time of 200 ms)
  - **HOLD function:** The voltage measured at the end of the test is held during the PASS and FAIL period.

- **Digital**
  - **Measurement range:** 0.01 M - 9.99 G
  - **Accuracy:** ±5% F.S.
  - **Scale:** 10kV DC F.S.

**Response switching function**

- **Mean-value responsive (response time of 200 ms)**
- **HOLD function:** The measured current at the end of the test is held during the PASS and FAIL period.

**Judgement function**

- **Median voltage-based judgement**
  - 0.01 M to 9.99 G [Below the maximum rated current]
  - 0.1 µk to 1.0 mA
- **Judgement method**
  - The UPPER/LOWER judgement can be switched between the resistance-based judgement and current-based judgement. The action for the judgement method by the current value-based judgement, Display, Buzz, SIGNAL IO can be referred to the action in the Withstanding Voltage Test Mode.

**General Specifications**

- **Power requirements:** Nominal voltage range: 100 V to 120 V AC / 200 V to 240 V AC
- **Power con-sumption:** Using no load (READY) Maximum of 200 VA
- **Allowable frequency range:** 47Hz to 63Hz
- **Insulation resistance:** 30 MΩ or more (500 V DC) [between the AC LINE and chassis]
- **Withstanding voltage:** 1390 V AC, 2 seconds, 20 mA or less [between the AC LINE and chassis]
- **Earth continuity:** 25 A AC/0,1 g or less
- **Safety:** Conforms to the requirements of the following standard: IEC 61010-1, Class I, Pollution degree 2
- **Warranty range:** Temperature / Humidity 5°C to 35°C/20% to 80%RH (No condensation)
- **Operating range:** Temperature / Humidity 0°C to 40°C/20% to 80%RH (No condensation)
- **Dimensions:** 430(455)W×132(150)×400(440)Dmm
- **Weight:** Approx. 13 kg (Approx. 28.66 lb)
- **Accessory:** AC Power cord 1 pc., High-voltage test leadwire TL01-TOS (1.5 m) 1 set, Interlock jumper 1 pc., HIGH VOLTAGE DANGER sticker 1 sheet, Fuse 1 pc., Operation Manual 1 copy

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1. Limitation on output
   - The tester's withstand voltage generator is designed to radiate half as much heat as the rated output, in consideration of the size, weight, cost, and other factors of the tester. It is therefore necessary to use the tester within the ranges specified below. Operations deviating from these ranges may heat the output section excessively, thereby activating the protection circuit. As such, suspend the test and wait until the temperature falls to the normal level.

2. Output limitation in withstand testing
   - 

3. When the GND LOW/GAUGED setting is set to LOW, the humidity must not exceed 70 ± 10%.

4. In the MEDIUM and SLOW modes, depending on the discharge method, the voltage monitoring function may operate and the TOS9213S may enter the PROTECTION status before UPPER FAIL detection takes place.
The “TOS5300 Series” is a series of test instruments used in Hipot tests and insulation resistance tests, two of the four tests regarded as necessary for ensuring the safety of electrical products. With an output of 5 kV/100 mA (AC) and 6 kV/10 mA (DC), the series can be used in Hipot & insulation resistance testing of electronic equipment and electronic parts, based on the requirements of IEC, EN, UL, VDE, JIS, and other international safety standards and the Electrical Appliance and Material Safety Law. Also, the test voltage stability is improved with the adoption of a newly developed switching amplifier. Since the output voltage can be kept constant even when the AC line voltage or frequency changes, consistent testing can be performed, even when the power supply environment is in an unstable region. The TOS5300 is also equipped with a number of features that are capable of meeting a variety of test needs. It is a new low-cost standard model that provides thorough operability, reliability and safety.

- The PWM amp system provides highly-stable output
- 5kV/100mA (500VA) AC Hipot test
- 6kV/maximum output 50W DC Hipot tester (TOS5301)
- 25V-1000V (7 steps), 500V or greater, up to 5.00G Ω Insulation Resistance test
- High-precision measurement ±1.5% of reading (with voltmeter 500V or higher, Ammeter 1mA or higher)
- Rise time(AC/DC) / Fall time(AC) control
- Key lock function and Protection cover for key operation
- Equipped with USB interface

New low-cost standard model that provides thorough operability, reliability and safety.

A new standard for Hipot & Insulation resistance testing
Applied to World-Wide input voltage
Basic performance

The achievement of AC Hipot testing with a constant stable output! [Input voltage variation: ±0.3%]

A conventional Hipot tester boosts and outputs the AC line’s input voltage through the use of a slide transformer. With this slide transformer system, input voltage fluctuations will affect the output, preventing tests from being performed properly. At times, the application of distortion voltage applied to the EUT may cause a failure of new product (accelerating a deterioration of components). Since the TOS5300 Series equips with a high-efficient PWM amplifier that can output a stable high-voltage without being affected by the variation of AC power line, users can perform “safe”, “stable”, and highly “reliable” tests with confidence, even in regions with large voltage variations.

Realizing high-precision measurement with high-resolution and high-speed judgement

Equipped with a high-accuracy, high-resolution of True RMS measurement circuit, including a Voltmeter with ±1.5% of reading (500V or greater) / minimum resolution of 1V, and an Ammeter with ±1.5% of reading (1 mA or more) / minimum resolution of 1µA. In addition, it is also equipped with an Auto range function, with achieving a judgment accuracy of ±1.5% of reading. The Lower limit judgment accuracy achieves a level of performance equivalent to the Upper limit judgment accuracy that enables to detect for such a poor contact or disconnections of test leads. Moreover, it realizes the fast judgment by the test time of 0.1 second, while reliable testing can be performed, thanks to high-precision, high-resolution, high-speed measurement and the judgment functions.

Supporting the World-wide input voltage

Usable in any country, without changing the input power supply. The instrument not rely on the input power environment. Supplying the stable test voltage with 50/60 Hz frequencies.

Reducing the tact time

Reduction of the tact time leads to improve the productivity. However, it has been an issue that reducing the tact time may cause to worsen the measurement accuracy when the test time is faster than the measuring response speed. The TOS5300 series has been achieved to set the test time from 0.1s.

6kV/500WDC Hipot test (Model TOS5301)

Capable to perform DC Hipot test up to 6 kV. (Model TOS5301) Equipped with a stable DC/DC converter with a low-ripple and the load variation of 3% or less.

Insulation resistance test for 25V to 1000V*

The TOS5302 is equipped with an insulation resistance tester. The test voltages can be set from 25V, 50V, 100V, 125V, 250V, 500V and 1000V. And for setting at 500V and above, it can perform the insulation resistance test up to 5.00 GΩ.

*At 500V and above, measurements up to 5.00 GΩ are possible.
**AC output section**

<table>
<thead>
<tr>
<th>Feature</th>
<th>TOS5300</th>
<th>TOS5301</th>
<th>TOS5302</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output range</strong></td>
<td>0.05 kV to 5.00 kV</td>
<td>±(2 % of set + 20 V) when no load is connected</td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±(2 % of set + 20 V) when no load is connected</td>
<td>±(2 % of set + 20 V) when no load is connected</td>
<td></td>
</tr>
<tr>
<td><strong>Setting range</strong></td>
<td>0.00 kV to 5.50 kV</td>
<td>0.00 kV to 5.50 kV</td>
<td></td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>10 V steps</td>
<td>10 V steps</td>
<td></td>
</tr>
<tr>
<td><strong>Max. rated output</strong> *1</td>
<td>500 VA (5 kV/100 mA)</td>
<td>500 VA (5 kV/100 mA)</td>
<td></td>
</tr>
<tr>
<td><strong>Max. rated voltage</strong></td>
<td>5 kV</td>
<td>5 kV</td>
<td></td>
</tr>
<tr>
<td><strong>Max. rated current</strong></td>
<td>100 mA (when the output voltage is 0.5 kV or greater)</td>
<td>100 mA (when the output voltage is 0.5 kV or greater)</td>
<td></td>
</tr>
<tr>
<td><strong>Transformer rating</strong></td>
<td>500 VA</td>
<td>500 VA</td>
<td></td>
</tr>
<tr>
<td><strong>Output voltage waveform</strong> *2</td>
<td>Sine</td>
<td>Sine</td>
<td></td>
</tr>
<tr>
<td><strong>Distortion</strong></td>
<td>If the output voltage is 0.5 kV or more: 3 % or less (when no load or a pure resistive load is connected)</td>
<td>If the output voltage is 0.5 kV or more: 3 % or less (when no load or a pure resistive load is connected)</td>
<td></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>50 Hz or 60 Hz</td>
<td>50 Hz or 60 Hz</td>
<td></td>
</tr>
<tr>
<td><strong>Voltage regulation</strong></td>
<td>±0.5 % (excluding during voltage rise time)</td>
<td>±0.5 % (excluding during voltage rise time)</td>
<td></td>
</tr>
<tr>
<td><strong>Input voltage variation</strong></td>
<td>±0.3 % (5 kV when no load is connected; power supply voltage: 90 V to 250 V)</td>
<td>±0.3 % (5 kV when no load is connected; power supply voltage: 90 V to 250 V)</td>
<td></td>
</tr>
<tr>
<td><strong>Short-circuit current</strong></td>
<td>200 mA or more (when the output voltage is 1.0 kV or greater)</td>
<td>200 mA or more (when the output voltage is 1.0 kV or greater)</td>
<td></td>
</tr>
<tr>
<td><strong>Output method</strong></td>
<td>PWM switching</td>
<td>PWM switching</td>
<td></td>
</tr>
</tbody>
</table>

**DC output section**

<table>
<thead>
<tr>
<th>Feature</th>
<th>TOS5300</th>
<th>TOS5301</th>
<th>TOS5302</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output range</strong></td>
<td>0.05 kV to 6.00 kV</td>
<td>±(2 % of set + 20 V) when no load is connected</td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±(2 % of set + 20 V) when no load is connected</td>
<td>±(2 % of set + 20 V) when no load is connected</td>
<td></td>
</tr>
<tr>
<td><strong>Setting range</strong></td>
<td>0.00 kV to 6.20 kV</td>
<td>0.00 kV to 6.20 kV</td>
<td></td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>10 V STEP</td>
<td>10 V STEP</td>
<td></td>
</tr>
<tr>
<td><strong>Max. rated output</strong> *1</td>
<td>50 W (5 kV / 10 mA)</td>
<td>50 W (5 kV / 10 mA)</td>
<td></td>
</tr>
<tr>
<td><strong>Max. rated voltage</strong></td>
<td>6 kV</td>
<td>6 kV</td>
<td></td>
</tr>
<tr>
<td><strong>Max. rated current</strong></td>
<td>10 mA</td>
<td>10 mA</td>
<td></td>
</tr>
<tr>
<td><strong>Ripple (TYP)</strong></td>
<td>50 Vp-p</td>
<td>50 Vp-p</td>
<td></td>
</tr>
<tr>
<td><strong>Max. rated load</strong></td>
<td>100 Vp-p</td>
<td>100 Vp-p</td>
<td></td>
</tr>
<tr>
<td><strong>Voltage regulation</strong></td>
<td>3% or less (When changing from maximum rated load to no load)</td>
<td>3% or less (When changing from maximum rated load to no load)</td>
<td></td>
</tr>
<tr>
<td><strong>Short-circuit current</strong> (TYP)</td>
<td>40 mA (when generation 6 kV output)</td>
<td>40 mA (when generation 6 kV output)</td>
<td></td>
</tr>
<tr>
<td><strong>Discharge feature</strong></td>
<td>Forced discharge after test completion (discharge resistance: 125 kΩ)</td>
<td>Forced discharge after test completion (discharge resistance: 125 kΩ)</td>
<td></td>
</tr>
</tbody>
</table>

**Start Voltage**
The voltage at the start of withstanding voltage tests can be set to 50% of the test voltage.

**Limit Voltage**
The test voltage upper limit can be set. AC: 0.00 kV to 5.50 kV, DC: 0.00 kV to 6.20 kV

**Output voltage monitor feature**
If output voltage exceeds the specified value ± 350 V or is lower than the specified value ± 350 V, output is turned off, and protective features are activated.

**Voltmeter**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Analog</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scale</strong></td>
<td>6 kV AC/DC f.s</td>
<td>0.000 kV to 6.500 kV AC/DC</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>± 5 % f.s</td>
<td>True rms (response time: 50 ms)</td>
</tr>
<tr>
<td><strong>Indication</strong></td>
<td>Average value response/rms scale</td>
<td>Display</td>
</tr>
<tr>
<td><strong>Measurement range</strong></td>
<td></td>
<td>V &lt; 500 V: ±(1.5 % of rdng + 20 µA); V ≥ 500 V: ±1.5 % of rdng</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td></td>
<td>True rms (response time: 50 ms)</td>
</tr>
<tr>
<td><strong>Hold feature</strong></td>
<td></td>
<td>After a test is finished, the measured voltage is retained until the PASS or FAIL judgment is cleared.</td>
</tr>
</tbody>
</table>

**Ammeter**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measurement range</strong></td>
<td>AC: 0.00 mA to 110 mA</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>i = measured current</td>
</tr>
<tr>
<td></td>
<td>i &lt; 1 mA</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>1.00 mA ≤ i ±(1.5 % of rdng); i &lt; 1.00 mA: ±(1.5 % of rdng + 30 µA)</td>
</tr>
<tr>
<td><strong>Response</strong></td>
<td>True rms (response time: 50 ms)</td>
</tr>
<tr>
<td><strong>Hold feature</strong></td>
<td>After a test is finished, the measured voltage is retained until the PASS judgment is cleared.</td>
</tr>
</tbody>
</table>
**Hipot Tester**

**TOS5300**  
**TOS5301**  
**TOS5302**

### Judgment feature

<table>
<thead>
<tr>
<th>Judgment</th>
<th>Judgment method</th>
<th>Display</th>
<th>Buzzer</th>
<th>SIGNAL I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UPPER FAIL</strong></td>
<td>If a current that is greater than or equal to the upper limit is detected, the output is turned off, and an <strong>UPPER FAIL</strong> judgment occurs. During the voltage rise time (Rise Time) of DC hipot tests, an <strong>UPPER FAIL</strong> judgment also occurs if there is a problem with the voltage rise ratio.</td>
<td>FAIL LED lights OVER is displayed on the screen</td>
<td>ON</td>
<td>Generates a <strong>U-FAIL</strong> signal</td>
</tr>
<tr>
<td><strong>LOWER FAIL</strong></td>
<td>If a current that is less than or equal to the lower limit is detected, the output is turned off, and a <strong>LOWER FAIL</strong> judgment occurs. This judgment is not performed during voltage rise time (Rise Time) of all tests and during the voltage fall time (Fall Time) of AC hipot tests.</td>
<td>FAIL LED lights UNDER is displayed on the screen</td>
<td>ON</td>
<td>Generates a <strong>L-FAIL</strong> signal</td>
</tr>
<tr>
<td><strong>PASS</strong></td>
<td>If the specified time elapses without any problems, the output is turned off, and a <strong>PASS</strong> judgment occurs.</td>
<td>PASS LED lights</td>
<td>ON</td>
<td>Generates a <strong>PASS</strong> signal</td>
</tr>
</tbody>
</table>

- If **PASS HOLD** is enabled, the **PASS** signal is generated continuously until the TOS5300 Series receives a **STOP** signal.
- The **UPPER FAIL** and **LOWER FAIL** signals are generated continuously until the TOS5300 Series receives a **STOP** signal.
- The **FAIL** and **PASS** buzzer volume levels can be changed.
- For **PASS** judgments, the length of time that the buzzer sounds for is fixed to 0.2 seconds.
- Even if **PASS HOLD** is enabled, the buzzer turns off after 0.2 seconds.

#### Upper limit setting

- AC: 0.01 mA to 110 mA  
- DC: 0.01 mA to 11 mA

#### Lower limit setting

- AC: 0.01 mA to 110 mA / OFF  
- DC: 0.01 mA to 11 mA / OFF

#### Judgment accuracy *3

1.00 mA ≤ i ≤ 1.5 % of set, i < 1.00 mA: ±1.5 % of set + 30 µA

#### Current detection method

Calculates the current's true rms value and compares this value with the reference value

#### Calibration

Calibrated with the rms of a sine wave using a pure resistive load

### Time

<table>
<thead>
<tr>
<th>Voltage rise time</th>
<th>0.1 s to 10.0 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.1 s</td>
</tr>
<tr>
<td>Voltage fall time</td>
<td>0.1 s to OFF (only enabled when a <strong>PASS</strong> judgment occurs)</td>
</tr>
<tr>
<td>Test time</td>
<td>0.1 s to 999 s, can be turned off (TIMER OFF)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 s to 999 s: 0.1 s. 100 s to 999 s: 1 s.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±(100 ppm + 20 ms) excluding Fall Time</td>
</tr>
</tbody>
</table>

#### Ambient temperature

<table>
<thead>
<tr>
<th>Upper limit</th>
<th>Pulse time</th>
<th>Output time</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>50 mA &lt; i ≤ 110 mA</td>
<td>Greater than or equal to the output time</td>
</tr>
<tr>
<td></td>
<td>i ≤ 50 mA</td>
<td>Not necessary</td>
</tr>
<tr>
<td>DC</td>
<td>5 mA &lt; i ≤ 11 mA</td>
<td>Greater than or equal to the output time</td>
</tr>
<tr>
<td></td>
<td>i ≤ 5 mA</td>
<td>Greater than or equal to the wait time (WAIT TIME)</td>
</tr>
</tbody>
</table>

(Output time = voltage rise time + test time + voltage fall time)

#### Output voltage

<table>
<thead>
<tr>
<th>Voltage (kV)</th>
<th>1 kV</th>
<th>2 kV</th>
<th>3 kV</th>
<th>4 kV</th>
<th>5 kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>2 µA</td>
<td>4 µA</td>
<td>6 µA</td>
<td>8 µA</td>
<td>10 µA</td>
</tr>
<tr>
<td>DC</td>
<td>16 µA</td>
<td>32 µA</td>
<td>48 µA</td>
<td>64 µA</td>
<td>80 µA</td>
</tr>
</tbody>
</table>

*1. Regarding the output time limits:
Taking size, weight, and cost into consideration, the heat dissipation capability of the voltage generator that is used for hipot tests has been designed to be one half that of the rated output. Use the TOS5300 Series within the following limits. If you use the product in a manner that exceeds these limits, the output section may overheat, and the internal protection circuits may be activated. If this happens, stop testing, and wait until the TOS5300 Series returns to its normal temperature.

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Upper limit</th>
<th>Pulse time</th>
<th>Output time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ≤ 40 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i ≤ 50 mA</td>
<td>Not necessary</td>
<td>Continuous output possible</td>
<td></td>
</tr>
<tr>
<td>DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i ≤ 5 mA</td>
<td>Greater than or equal to the output time</td>
<td>1 min. max.</td>
<td></td>
</tr>
</tbody>
</table>

*2. Regarding the test voltage waveform:
Waveform distortions may occur if an **DUT** whose capacitance is dependent on voltage (for example, an **DUT** that consists of ceramic capacitors) is connected as the load. However, if the test voltage is 1.5 kV, the effect of a capacitance of 1000 pF or less can be ignored. Because the product’s high-voltage power supply uses the PWM switching method, if the test voltage is 500 V or less, the switching and spike noise proportions are large. The lower the test voltage, the greater the waveform is distorted.

*3. Regarding ammeter and judgment accuracy:
During AC hipot tests, current also flows in the stray capacitance of items such as the measurement leads and jigs. This current that flows in the stray capacitances is added to the current that flows in the **DUT**, and the sum of these currents is measured. Especially if you want to perform judgments with high sensitivity and accuracy, it is necessary to consider methods to limit the current that flows in these stray capacitances, such as by adding upper and lower limits.
## Insulation Resistance Tester

### Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>TOS5302</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>25 V, 50 V, 100 V, 125 V, 250 V, 500 V, 1000 VDC (negative)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0 %, +5 %</td>
</tr>
<tr>
<td>Max. rated load</td>
<td>1 W (~1000 V DC / 1 mA)</td>
</tr>
<tr>
<td>Max. rated current</td>
<td>1 mA</td>
</tr>
<tr>
<td>Ripple</td>
<td>1000 V when no load is connected, 2 Vp-p or less</td>
</tr>
<tr>
<td>Max. rated load</td>
<td>10 Vp-p or less</td>
</tr>
<tr>
<td>Voltage regulation</td>
<td>1 % or less (when changing from maximum rated load to no load)</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>12 mA or less</td>
</tr>
<tr>
<td>Discharge feature</td>
<td>Forced discharge after test completion (discharge resistance: approx. 25 kΩ)</td>
</tr>
<tr>
<td>Limit voltage</td>
<td>The test voltage upper limit can be set: 25 V, 50 V, 100 V, 125 V, 250 V, 500 V, 1000 V</td>
</tr>
<tr>
<td>Output voltage monitor feature</td>
<td>If output voltage exceeds “10 % of set + 10 V” or is lower than “(~10 % of set + 10 V)” output is turned off, and protective features are activated.</td>
</tr>
</tbody>
</table>

### Voltage Meter

<table>
<thead>
<tr>
<th>Feature</th>
<th>TOS5302</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Scale</td>
<td>6 kV AC/DC f.s</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±5 % f.s</td>
</tr>
<tr>
<td>Indication</td>
<td>Average value response/rms scale</td>
</tr>
<tr>
<td>Measurement range</td>
<td>0 V to -1200 V</td>
</tr>
<tr>
<td>Display</td>
<td>Normal</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± (1 % of rdng ± 1 V)</td>
</tr>
<tr>
<td>Measurement range / measurement accuracy *4 *5</td>
<td></td>
</tr>
<tr>
<td><strong>25 V</strong></td>
<td>0.03 MΩ ≤ R ≤ 25 MΩ (±2 % of rdng ± 2 digits)</td>
</tr>
<tr>
<td></td>
<td>25 MΩ &lt; R ≤ 125 MΩ (± 5 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>125 MΩ &lt; R ≤ 250 MΩ (± 10 % of rdng)</td>
</tr>
<tr>
<td><strong>50 V</strong></td>
<td>0.05 MΩ ≤ R ≤ 50 MΩ (±2 % of rdng ± 2 digits)</td>
</tr>
<tr>
<td></td>
<td>50 MΩ &lt; R ≤ 250 MΩ (± 5 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>250 MΩ &lt; R ≤ 500 MΩ (± 10 % of rdng)</td>
</tr>
<tr>
<td><strong>100 V</strong></td>
<td>0.10 MΩ ≤ R ≤ 100 MΩ (±2 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>100 MΩ &lt; R ≤ 500 MΩ (± 5 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>500 MΩ &lt; R ≤ 1 GΩ (± 10 % of rdng)</td>
</tr>
<tr>
<td><strong>125 V</strong></td>
<td>0.125 MΩ ≤ R ≤ 125 MΩ (±2 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>125 MΩ &lt; R ≤ 625 MΩ (± 5 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>625 MΩ &lt; R ≤ 1.25 GΩ (± 10 % of rdng)</td>
</tr>
<tr>
<td><strong>250 V</strong></td>
<td>0.250 MΩ ≤ R ≤ 250 MΩ (±2 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>250 MΩ &lt; R ≤ 1.25 GΩ (± 5 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>1.25 GΩ &lt; R ≤ 5 GΩ (± 10 % of rdng)</td>
</tr>
<tr>
<td><strong>500 V</strong></td>
<td>0.500 MΩ ≤ R ≤ 500 MΩ (±2 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>500 MΩ &lt; R ≤ 2.5 GΩ (± 5 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>2.5 GΩ &lt; R ≤ 5 GΩ (± 10 % of rdng)</td>
</tr>
<tr>
<td><strong>1000 V</strong></td>
<td>1 MΩ ≤ R ≤ 1 GΩ (±2 % of rdng)</td>
</tr>
<tr>
<td></td>
<td>1 GΩ &lt; R ≤ 5 GΩ (± 5 % of rdng)</td>
</tr>
</tbody>
</table>

### Hold feature

After a test is finished, the measured resistance is retained until the PASS judgment is cleared.

### Current detection response speed

Can be switched between three levels: Fast, Med, Slow

### Judgment feature

<table>
<thead>
<tr>
<th>Judgment</th>
<th>Judgment method</th>
<th>Display</th>
<th>Buzzer</th>
<th>SIGNAL</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPER FAIL</td>
<td>FAIL LED lights; OVER is displayed on the screen</td>
<td>ON</td>
<td>Generates a U-FAIL signal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOWER FAIL</td>
<td>FAIL LED lights; UNDER is displayed on the screen</td>
<td>ON</td>
<td>Generates a L-FAIL signal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>PASS LED lights</td>
<td>ON</td>
<td>Generates a PASS signal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- If PASS HOLD is enabled, the PASS signal is generated continuously until the TOS530 Series receives a STOP signal.
- The UPPER FAIL and LOWER FAIL signals are generated continuously until the TOS530 Series receives a STOP signal.
- The FAIL and PASS buzzer volume levels can be changed.
- For PASS judgments, the length of time that the buzzer sounds for is fixed to 0.2 seconds. Even if PASS HOLD is enabled, the buzzer turns off after 0.2 seconds.
- For PASS judgments, the buzzer sounds for 0.2 seconds. Even if PASS HOLD is enabled, the buzzer turns off after 0.2 seconds.

### Upper limit setting range

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03 MΩ</td>
<td>5.00 GΩ</td>
</tr>
</tbody>
</table>

### Lower limit setting range

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03 MΩ</td>
<td>5.00 GΩ</td>
</tr>
</tbody>
</table>

### Measurement accuracy

- Measurement accuracy ± 2 digits
- Humidity: 20 %rh to 70 %rh (no condensation). No interference caused by wobbly test leads or other problems.

### Voltage rise time

10 ms (TYP)

### Test time

0.1 s to 999 s, can be turned off (TIMER OFF)

### Resolution

0.1 s to 99.9 s ± 0.1 s. 100 s to 999 s ± 1 s.

### Accuracy

±(100 ppm ± 20 ms)

---

4. Humidity: 20 %rh to 70 %rh (no condensation). No bends in the test leads.  
5. R = measured insulation resistance
Other Features / Interfaces

<table>
<thead>
<tr>
<th>Feature</th>
<th>TOS5300</th>
<th>TOS5301</th>
<th>TOS5302</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double action feature</td>
<td>Tests can only be started by pressing and releasing STOP and then pressing START within 0.5 seconds of releasing the STOP switch.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of time to maintain a PASS judgment result</td>
<td>You can set the length of time to maintain a PASS judgment: 50 ms, 100 ms, 200 ms, 1 s, 2, 5 s, or HOLD.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Momentary feature</td>
<td>Tests are only executed while the START switch is held down.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fail mode feature</td>
<td>This feature enables you to prevent remotely transmitted stop signals from clearing FAIL judgments and PROTECTION modes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timer feature</td>
<td>This feature finishes tests when the specified time elapses.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output voltage monitor feature</td>
<td>If output voltage exceeds “setting + 350 V” or is lower than “setting - 350 V,” the TOS5300 Series switches to PROTECTION mode, output is turned off, and testing finishes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>Up to three sets of test conditions can be saved to memory.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key lock</td>
<td>Locks panel key operations (settings and changes).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective features</td>
<td>Under any of the following conditions, the TOS5300 Series switches to the PROTECTION state, immediately turns output off, and stops testing. A message is displayed on the screen.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interlock Protection</td>
<td>An interlock signal has been detected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Supply Protection</td>
<td>An error was detected in the power supply.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volt Error Protection</td>
<td>While monitoring the output voltage, a voltage outside of the rated limits was detected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over Load Protection</td>
<td>During a withstand voltage test, a value that is greater than or equal to the output limit power was specified. AC hipot test: 550 VA. DC hipot test: 55 VA.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over Heat Protection</td>
<td>The internal temperature of the TOS5300 Series became too high.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over Rating Protection</td>
<td>During a withstand voltage test, the output current was generated for a length of time that exceeds the regulated time.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration Protection</td>
<td>The specified calibration period has elapsed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote Protection</td>
<td>A connection to or disconnection from the front-panel REMOTE connector was detected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIGNAL I/O Protection</td>
<td>The rear-panel SIGNAL I/O connector’s ENABLE signal has changed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USB Protection</td>
<td>The USB connector has been disconnected while the TOS5300 Series was being controlled through the USB interface.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration date</td>
<td>Set when the TOS5300 Series is calibrated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration period setting</td>
<td>Sets the period before the next calibration is necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notification of when the calibration period elapses</td>
<td>Sets the operation that is performed when the specified calibration period elapses. When the TOS5300 Series turns on, it can display a notification or switch to the protection mode and disable testing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interfaces</td>
<td>USB Specification 2.0</td>
<td>REMOTE</td>
<td>SIGNAL I/O</td>
</tr>
<tr>
<td></td>
<td>Front-panel 9-pin MINI DIN connector. By connecting an optional device to this connector, you can control the starting and stopping of tests remotely.</td>
<td>Rear-panel D-sub 25-pin connector</td>
<td></td>
</tr>
</tbody>
</table>

General Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>TOS5300</th>
<th>TOS5301</th>
<th>TOS5302</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>VFD: 256 x 64 dots + 4 status indicators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backup battery life</td>
<td>3 years (at 25 °C or 77 °F)</td>
<td>3 years (at 25 °C or 77 °F)</td>
<td>3 years (at 25 °C or 77 °F)</td>
</tr>
<tr>
<td>Environment</td>
<td>Indoors, at a height of up to 2000 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spec guaranteed range</td>
<td>5 °C to 35 °C (41 °F to 95 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>20 % rh to 80 % rh (no condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating range</td>
<td>0 °C to 40 °C (32 °F to 104 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>20 % rh to 80 % rh (no condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage range</td>
<td>-20 °C to 70 °C (4 °F to 158 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>90 % rh or less (no condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>100 VAC to 240 VAC (90 VAC to 250 VAC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal voltage range (allowable voltage range)</td>
<td>100 VA or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>800 VA max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable frequency range</td>
<td>47 Hz to 63 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal voltage range (allowable voltage range)</td>
<td>47 Hz to 63 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation resistance (between AC LINE and the chassis)</td>
<td>30 MΩ or more (500 VDC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Withstanding voltage (between AC LINE and the chassis)</td>
<td>1390 VAC, 2 seconds, 20 mA or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth continuity</td>
<td>25 A AC, 0.1 Ω or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety *6</td>
<td>Complies with the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC, EN 61010-1 Class I Pollution degree 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electromagnetic compatibility (EMC) *6 *7</td>
<td>Complies with the requirements of the following directive and standard. EMC Directive 2004/108/EC, EN 61326-1, EN 61000-3-2, EN 61000-3-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>See &quot;Outline drawing.&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 14 kg (30.9 lb.)</td>
<td>Approx. 15 kg (33.1 lb.)</td>
<td>Approx. 14 kg (30.9 lb.)</td>
</tr>
<tr>
<td>Accessories</td>
<td>Power cord : 1pc / High test lead (TL31-TOS) : 1set (1 red wire and 1 black wire, each with alligator clips); 1.5 m / D-sub 25-pin plug : 1set ; assembly type / High voltage warning sticker : 1pc / User’s manual : 1pc / CD-R : 1pc *8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*6. Does not apply to specially ordered or modified TOS5300 Series testers.
*7. Limited to products that have the CE mark on their panels.
Applying to various safety standards

Capable to perform the continuous Withstanding Insulation Resistance Testing.

TOS8870A is a combination of a Hipot tester and an insulation resistance tester, and it is capable of performing Hipot Test and Insulation Resistance Test in one continuous process.

(Choice of setting arrangement: AUTO ACW→IR, AUTO IR→ACW, MANU.ACW, MANU.IR.)

The Tester can provide a maximum output of 5kV and an output capacity of 500VA (AC), and can be used for hipot test for the electrical equipment and components in compliance with major electrical standards and ordinances. As for the insulation resistance tester, the tester has two ranges of 500V/1000MΩ and 1000V/2000MΩ.

- Capable of performing hipot test and insulation resistance test in one continuous process.
- Hipot Tester: Maximum Output AC 5kV/100mA and Output Capacity 500VA
- Insulation resistance in 2 ranges: 500V/1000MΩ and 1000V/2000MΩ
- Output characteristics complied with JIS C 1302-1994 for Insulation/Resistance testing
- Voltmeter: JIS class 1, Accuracy: ±1.5% f.s
- GO-NOGO judgment with a window comparator type
- Remote control function
- PASS, FAIL contact signal output
- Equipped with Digital Timer: 0.2sec to 99.9sec/1sec to 999sec
- Downsized approximately 30% in volume (compared to the existing type)
**Hipot Tester**

**Test Voltage**
- Output AC Voltage: 0 V to 2.5 kV/0 V to 5 kV (two ranges)
- Output Rating: 500 VA (5 kV, 100 mA with 100 V line voltage) *1
- Waveform: AC line waveform
- Voltage regulation: Better than 20% (for maximum rated load to no load, with 100 V line voltage)
- Switching: With zero-start type switch

**Output Voltmeter**
- Scales: 2.5 kV f.s / 5 kV f.s, two ranges linear scales
- Class of meter: JIS Class 1
- Accuracy:
  - 5 °C to 15 °C: ±3 % f.s  
  - 15 °C to 35 °C: ±1.5 % f.s (with a sine wave) *2
- Indication:
  - Mean-value response, effective-value scale graduation

**Judgment of Test Result**
- PASS-FAIL: Judgment
  - Judgment: Window comparator system
  - FAIL judgment also when leakage current is smaller than low limit reference value is detected.
- Output cutoff by leakage current detection
  - High limit reference value: 0.5/1/2/4/8/10/100 mA (7 values)
  - Low limit reference value: 0 to one-half of high limit reference values (continuously variable)
- Accuracy of judgment *3
  - ±5 % of high limit
  - 220 % of low limit reference value (one-half of high limit reference values at maximum counterclockwise). (Other are non-calibrated.)
- Judging method: Absolute value of leakage current is integrated and compared with preset limit reference value
- Calibration: Calibrated with rms value of sine wave, using a pure resistance load.
- No-load output voltage need for detection *4
  - 2.5 kV range: Approx. 450 V when set at 100 mA
  - 5 kV range: Approx. 550 V when set at 100 mA

**Test time**
- Timer: 0.2 s to 99.9 s (x 0.1 range) ±50 ms
- 1 s to 999 s (x 1 range) ±0.5 s

**Others**
- Terminals for monitoring of leakage current

---

*1. The heat radiation of the output section of the tester is designed to be 1/2 of the rated output, taking the size, weight, cost, etc., into consideration. Therefore, use it within the limitations shown in Table 1. If it is used in excess of these limitations, the temperature of the output section rises excessively and the internal protection circuit may be activated. In this case, cancel the test for a while and wait until the normal temperature is restored.
*2. Crest factor of 1.35 to 1.41, distortion of 3% or less
*3. The current which flows due to stray capacitances of the output circuit and leadwires causes an error. The overall accuracy of judgement is the above-mentioned accuracy of judgement plus a factor caused by this current. Typical values of this type of currents are shown in the Table 2. Note that, when a test is made with a high voltage and high sensitivity, the current which flows through the stray capacitances may become larger than the preset low limit reference value and low limit judgement may become unavailable.
*4. When making an FAIL judgement test with the output terminals shorted, a certain level of no-load output voltage is needed due to the internal resistance of the output circuit. The voltages shown here are this type of output voltages.

**Table 1.**

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Test current I</th>
<th>Pause time</th>
<th>Maximum test time</th>
<th>Output voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>t ≤ 40 °C</td>
<td>25.5 ≤ I ≤ 100</td>
<td>Test time or longer</td>
<td>30 minutes or less</td>
<td>1 kV</td>
</tr>
<tr>
<td>1 &lt; 25.5</td>
<td>Not required</td>
<td>Continuous test possible</td>
<td></td>
<td>4 µA</td>
</tr>
</tbody>
</table>

*When no/mm long leadwires are hung in air*

---

**Test Voltage Waveform**

When an AC output voltage is applied to a capacitive load, it is possible that the voltage becomes higher than when in the no-load state due to the capacitance of the load. Moreover, when the capacitance of the load is voltage dependent (typical examples are ceramic capacitors), the voltage waveform may be distorted. When the test voltage is 1.5kV, however, effects caused by a capacitance of 1000pF or less are negligible.

---

**Insulation Resistance Tester**

**Measuring Voltage**
- 500 V or 1000 V DC, negative polarity (two ranges)

**Measuring terminal voltage**
- 0% to + 5% of rated measuring voltage (At rated measuring current or less)

**Output current**
- Rated measuring current: 1.0 mA
- Short circuit current: 12 mA or less

**Effective Measuring Ranges**
- 500 V range: 1 MΩ to 1000 MΩ
- 1000 V range: 2 MΩ to 2000 MΩ

**Values center of scale**
- 500 V range: 20 MΩ
- 1000 V range: 50 MΩ

**Accuracy**
- 1st effective measuring range: ±5 % of the indicated value *1
- 2nd effective measuring range: ±10 % of the indicated value *1

**Judgment of Test Result**
- PASS-FAIL: Judgment
  - Judgment: Window comparator system (mutually independent settings of high limit and low limit)
  - FAIL judgment when measured resistance is smaller than low limit reference value.
  - When FAIL judgment is made, output is cutoff and FAIL alarm is generated.
- Limit reference value setting range: Low and high limit reference values can be set at any points within the effective measuring range of the Tester.
- Accuracy of judgment: 1st effective measuring range: ±10 % of set value *1
- Waiting time for judgment: Approx. 0.3 s

**Test time**
- Timer: 0.5 s to 99.9 s (x 0.1 range) ±50 ms
- 1 s to 999 s (x 1 range) ±0.5 s

---

*1. At 25 °C ± 10 °C
The 1st effective measuring range is from 1/1000 to 1/2 of the maximum effective scale value. The 2nd effective measuring range is from the above to the maximum effective scale value.
General Specifications

Types of test
1. AUTO ACW → IR Hipot test first and insulation resistance test next
2. AUTO IR → ACW Insulation resistance test first and hipot test next
3. MANUAL ACW Hipot test alone
4. MANUAL IR Insulation resistance test alone

Remote Control
Test / Reset control Low active control
Input conditions *1
- High level input voltage: 11 V to 15 V
- Low level input voltage: 0 V to 4 V
- Low level sweep out current: 5 mA or less
- Input pulse width: 20 ms minimum

Interlock
Protection is effected when INTERLOCK terminal is made open (test is disabled).

Output signals *2
<table>
<thead>
<tr>
<th>Signal Name</th>
<th>Conditions for Signal Generation</th>
<th>Type of Signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST ON signal</td>
<td>Delivered during entire test-on period.</td>
<td>Make-contact signal and lamp</td>
</tr>
<tr>
<td>PASS signal</td>
<td>Delivered when PASS judgment is made, for approximately 50 ms.</td>
<td>Make-contact signal, lamp and buzzer</td>
</tr>
<tr>
<td>ACW/FAIL alarm</td>
<td>Delivered continuously when FAIL judgment of hipot test is made,</td>
<td>Make-contact signal, lamp and buzzer</td>
</tr>
<tr>
<td>IR/FAIL alarm</td>
<td>Delivered continuously when FAIL judgment of insulation resistance test is made.</td>
<td>Make-contact signal, lamp and buzzer</td>
</tr>
<tr>
<td>READY signal</td>
<td>Delivered when in the READY state.</td>
<td>Make-contact signal</td>
</tr>
</tbody>
</table>

Special Test Mode
1. DOUBLE ACTION Test starts only when the START switch is pressed within approximately 0.5 s after pressing the STOP switch.
2. PASS HOLD The PASS state is held.
3. MOMENTARY Test is executed only during the period the START switch is kept pressed.
4. FAIL ALARM FAIL alarm and PROTECTION state cannot be reset by the remote-control STOP signal.

Ambient Temperature and Humidity
- Warranty: 5 °C to 35°C / 20 %rh to 80 %rh
- Operable range: 0 °C to 40 °C / 20 %rh to 80 %rh
- Storage range: -20 °C to 70 °C / 80 %rh or less

EMC *3 Conforms to the requirements of the following directive and standard.
- EMC Directive 2004/108/EC, EN61326, EN61000-3-2, EN61000-3-3
- Under following conditions
  1. Used HV test leadwire TL01-TOS.
  2. No discharge in testing.

Safety *3,4 Conforms to the requirements of the following directive and standard.
- Low Voltage Directive 2006/95/EC, EN61010-1 (Class I, Pollution degree 2)

Power Requirements
- Line voltage: 100 V AC ± 10 %, 50/60 Hz *5
- Power consumption:
  - When no load (RESET state): 15 VA or less *6
  - When with rated load: Approx. 600 VA
- Insulation resistance: 30 MΩ or more, 500 VDC
- Hipot: 1390 V AC, 2 seconds [between the AC LINE and chassis]

Dimensions (maximum)
- 430 (435) W x 132 (155) H x 370 (440) Dmm

Weight
- Approx. 23 kg

Standard accessories
- TL01-TOS High Voltage Test Leadwires, approx. 1.5 m long. 1
- AC Power cable 1
- Operation Manual 1

Options
- RC01-TOS Remote Control Box
- RC02-TOS Remote Control Box
- HP01A-TOS High Voltage Test Probe, approx. 1.5 m long
- HP02A-TOS High Voltage Test Probe, approx. 3 m long
- TL02-TOS High Voltage Test Readwires, approx. 3 m long
- KRB150-TOS Rackmount Bracket (for JIS)
- KRB3-TOS Rackmount Bracket (for EIA)

*1. The input terminal is pulled up to +15V supply voltage by resistor. Opening of the input terminal is equivalent to a high level input.
*2. The rating of the signal contacts is 125VAC, 1A, or 30VDC, 1A.
*3. Only on models that have CE marking on the panel. Not applicable to custom order models.
*4. This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument. The safety of the instrument is not guaranteed unless the instrument is grounded properly.

External Dimensional Diagrams
For use in production and inspection lines

The model TOS8830, TOS8040, TOS8030 are the hipot and insulation resistance testers developed by KIKUSUI, an international brand in the field of electrical safety testers, and are designed specifically for use in production and inspection lines in factories and plants. While retaining the high levels of quality and reliability inherent to our products, these testers are geared to provide what manufacturers want - compactness, light weight, and reasonable price.

**TOS8830**

Hipot and insulation resistance tests in one model supporting the standard tests

- Withstanding Voltage: AC 4kV/100 mA
- Transformer capacity: 500VA
- Insulation resistance: 500V/999.9 MΩ
- The voltmeter provides a 3-digit digital display.
- The insulation resistance meter provides a 4-digit digital display.
- The window comparator method is adopted for judgment.
- Remote control function
- Output of contact point signals such as PASS and FAIL
- Digital timer adjustable to 1 to 99 seconds

**TOS8040**

Hipot tester supporting standard tests

- Withstanding Voltage: AC 4kV/100 mA
- Transformer capacity: 500VA
- The voltmeter provides a 3-digit digital display.
- The window comparator method is adopted for judgment.
- Remote control function
- Output of contact point signals such as PASS and FAIL
- Digital timer (0.5 to 9.9 s; 1 to 99 s, Resolution: 0.1 s)

**TOS8030**

Compact model for the simplified test

- Withstanding Voltage: AC 3kV/100 mA
- Compact and lightweight (approx. 6 kg)
- Digital timer (0.5 to 9.9 s; 1 to 99 s, Resolution: 0.1 s)
- Judgment range: 0.1 mA to 10 mA
- Zero turn-on switch
- Safety-conscious high-voltage output terminal and large DANGER lamp
- Remote control function
- Output of contact point signals such as PASS and FAIL
The specifications are based on the following conditions and settings, unless otherwise specified.

- **Warm-up time:** 30 minutes • Temperature: 5°C to 35°C • Relative humidity: 20% to 80% (with no dew condensation)
- “xx% of reading” represents xx% of voltmeter (or resistance meter) reading.

### Hipot Tester

#### Output block

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS8830</th>
<th>TOS8040</th>
<th>TOS8030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage range</td>
<td>0.05 kV to 4.00 kV/single range</td>
<td>0.05 kV to 3.00 kV/single range</td>
<td></td>
</tr>
<tr>
<td>Maximum rated load (*1)</td>
<td>400 VA (4 kV/100 mA) (at an input voltage of 220V; Transformer capacity 500VA)</td>
<td>30 VA (3 kV/10 mA) (at a nominal input rating)</td>
<td></td>
</tr>
<tr>
<td>Output voltage waveform (*2)</td>
<td>AC line waveform</td>
<td>AC line waveform</td>
<td></td>
</tr>
</tbody>
</table>

#### Voltage regulation

- 10% or less (during transition from the maximum rated load to no-load, models for a nominal input rating of 220 V)
- 15% or less (during transition from the maximum rated load to no-load, models for a nominal input rating of 120 V or 100 V)

#### Switching

A zero-start switch is used.

#### Voltmeter

- Measurement range: 0.00 kV to 5.00 kV (Display resolution: 10 V)
- Accuracy: ± 1.5% full scale or
  - Vm ≥ 1.00 kV: ± (5% of reading + 10 V)
  - Vm < 1.00 kV: ± (2% of reading + 20 V)
- Response: Mean value response/rms value indication

#### Judgment function

- Upper reference limit: 1/24/8/10/25/100 mA, 7 ranges. May be set from 1 mA to 30 mA in 1 mA steps by a combination.
- Lower reference limit: Continuously variable from 0 to 1/2 of the upper reference limit.
- Judgment accuracy (*3): ± (5% + 20 µA) with respect to the upper reference limit, ± 20% with respect to the lower reference limit (*4)

#### Time

- Test time: 1 s to 99 s (the TIMER off function provided), Resolution : x0.1 s range: 0.1 s, x1 s range: 1 s, Accuracy : -0 ms, +50 ms

### Insulation Resistance Tester

#### Output section

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS8830</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated output voltage</td>
<td>-500 Vdc</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±(500%) Vdc</td>
</tr>
<tr>
<td>Maximum rated load</td>
<td>0.5 W (-500 V / 1 mA)</td>
</tr>
</tbody>
</table>

#### Resistance meter

- Effective measurement range: 0.50 MΩ to 999.9 MΩ
- Accuracy: Rm < 20 MΩ: ± (5% of reading)
  - Rm ≥ 20 MΩ: ± (10% of reading)
  - Rm: measured insulation resistance value

### Other Functions / General Specifications

- Remote control
  - 5-pin DIN connector on the front panel
- Connector
  - 14-pin screw-less terminal on the rear panel (Output of a READY signal / HV ON signal / PASS signal / FAIL signal / PROTECTION signal)
- Optional devices connectable
  - Remote control boxes: RC01-TOS and RC02-TOS / High-voltage test probes: HP01A-TOS and HP02A-TOS
- Signal I/O
  - Remote 5-pin DIN connector on the rear panel

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*1: Time limitations on the output
The heat radiation capacity of the output voltage generator section of the tester is designed to be 1/2 of the rated output, in consideration of the instrument dimensions, weight, costs, and other factors. The tester, therefore, must be used under the following time constraints (interval time and output time). If used beyond these limits, the output section may overheat, activating the internal protection circuit. In such cases, always halt testing for a duration equal to or greater than the test duration.

*2: Test voltage waveform
If AC voltage is applied to a capacitive load, the output voltage in certain cases may rise above the value at no-load, depending on the value of the capacitive element of the load. Moreover, for samples whose capacitance values show voltage dependency (as with ceramic capacitors), waveform distortions may result. However, for a test voltage of 1.5 kV, the effects of a capacitance of 1000 pF or less may be ignored.

*3: In an AC hipot test, a current also flows in stray capacities such as measurement leads and devices. The approximate current values flowing in these stray capacities are as shown in the table below.

*4: When the lower reference value is 1/2 of the upper reference limit (i.e., the variable resistor is turned fully clockwise). No calibration is made for other values.
## Environment

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS8830/8040/8030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation environment</td>
<td>Indoor use, Altitude : Up to 2000 m</td>
</tr>
<tr>
<td>Temperature</td>
<td>Specifications assured range : 5°C to 35°C, Operating range : 0°C to 40°C, Storage range : -40°C to 70°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>Specifications assured range, Operating range : 20% to 80% (with no dew condensation), Storage range : 90% or less (with no dew condensation)</td>
</tr>
</tbody>
</table>

## General Specifications

| Nominal input rating (Input voltage range) | 220 V(200 V to 240 V), 120 V(110 V to 130 V), or 100 V(90 V to 110 V), 50 Hz or 60 Hz |
| At rated load               | 650 VA maximum                                      |
| Insulation resistance      | AC INPUT to chassis 30 MΩ or more (at 500 Vdc)      |
| Withstand voltage          | AC INPUT to chassis 20 mA or less when 1390 Vac is applied for 2 seconds |
| Ground bond                | 25 AAC/Ω or less                                    |
| Dimensions (maximum)       | 320 (330) W x 132 (165) H x 370 (410) D mm         |
| Weight                     | Approx. 18 kg/models for a nominal input rating of 220 V |
|                           | Approx. 21 kg/models for a nominal input rating of 120 V or 100 V |
|                           | Approx. 17 kg/models for a nominal input rating of 220 V |
|                           | Approx. 21 kg/models for a nominal input rating of 120 V or 100 V |
| Standard accessories       | High-voltage test leads: TL01C-TOS (approx. 1.5 m): 1 set |
|                           | Power cord: 1                                      |
|                           | INTERLOCK jumper: 1                                  |
|                           | Operation Manual: 1 copy                           |

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### External dimensional diagrams

**TOS8830/8040**

**TOS8030**

Unit: mm
TOS5101 is designed exclusively for withstand voltage testing of electronic equipment and components conforming to various safety standards. The use of a high lumirance, large fluorescent display tube for the display enables data including measured values, status and judgment results to be extremely legible. The PASS/FAIL function employs a window comparator method that enables TOS5101 to make fail judgment of current leakage over the upper reference value and below the lower reference value which can be set on the front panel. Thus, highly reliable testing can be performed including that for test lead disconnection and defective contact. In addition, in order to prevent erroneous operation and accidents, the TOS5101 is also equipped with a Key Lock function and Interlock function, a high-voltage output terminal having a narrowed insertion port, a large DANGER lamp, and an automatic discharge function (during DC operation) that removes charge from the test piece. These features give the TOS5101 a high degree of safety and reliability.

*In general, when the capacitance of DUT has a voltage dependence (such as a “High-dielectric constant ceramic capacitor”), please take a caution that the waveform distortion may occurs.
**Output block**

**Applied Voltage**
- AC: 0 to 5/0 to 10 kV AC and DC

**Maximum Rated**
- AC: 500 VA / 10 kV, 50 mA

**Waveform**
- Commercial line waveform

**Voltage Regulation**
- Max. 15% (for max. rated load to no load)

**Switching**
- Use of a zero turn-on switch

**DC**
- Applied Voltage: 50 W / 10 kV, 5 mA
- Ripple: 100 Vp-p typ. at 10 kV, no load
  
**Maximum Rated**
- Max. 3% (for max. rated load to no load)

**Output Voltmeters**

**Analogue**
- Scale: 10 kV full scale, AC/DC
- Class: JIS Class 2.5
- Accuracy: ±5% of full scale
- AC Indication: Mean value response / rms value display

**Digital**
- Full Scale: 5 kV / 10 kV full scale
- Accuracy: ±1.5% of full scale
- AC Response: Mean value response / rms value display

**Ammeter**
- Digital Accuracy: ±(5% + 20 μA) of upper cutoff current
- AC Response: Mean value response / rms value display

**Pass/fail Judgement Function**

**Type of Judgement**
- Window comparator type
- ● FAIL judgement
  - When current detected above upper cutoff current
  - When current detected below lower cutoff current
  - Fail signal generated when FAIL judgement made
- ● PASS judgement
  - When set time has elapsed and no abnormality is detected

**Upper cutoff current setting range**
- AC: 0.1 to 55 mA
- DC: 0.1 to 5.5 mA

**Judgement Accuracy**
- ±5% of upper cutoff current + 20 μA

**Current Detection**
- Integration of current absolute value followed by comparison with reference value.

**Calibration**
- With rms value of sine wave using a pure resistance load.

**No-load output voltage required for detection**
- Approx. 970 V when set to 50 mA AC
- Approx. 160 V when set to 5 mA DC

**Test Time Setting Range**
- 0.5 to 999 sec (±10 ms) timer-off function provided

**Accuracy**
- ±20 ms

**Line Voltage**
- 100 V ±10%, 50/60 Hz (Nominal voltages of 110 V, 120 V, 220 V, 230 V and 240 V available as factory options.)

**Power Requirements**

for line voltage of 100 V
- Max. 50 VA under no-load conditions
  - Approx. 600 VA at rated load
for line voltage of 100 V to 200 V
- Max. 50 VA under no-load conditions
  - Approx. 600 VA at rated load
for line voltage of 220 V to 240 V
- Max. 50 VA under no-load conditions
  - Approx. 610 VA at rated load

**Electromagnetic compatibility (EMC) +3**
- Conforms to the requirements of the following directive and standard:
  - *Low Voltage Directive 73/23/EEC EN61010-1 Class I*
  - *Pollution degree 2*
  - *EMC Directive 89/336/EEC EN61326 EN61000-3-2 EN61000-3-3*
  - Under following conditions
    1. Used HV test leadwires which is supplied.
    2. No discharge in testing.
    3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.
Supports best-selling model's performance while featuring RS-232C as standard interface

TOS5050A(ACW)
TOS5051A(ACW/DCW)

Capable of record and storage of the test data

The TOS5000A series offers testers specifically designed to conduct hipot testing on electronic devices and components in accordance with the relevant safety standards. Two models are available - TOS5051A with 5 kV AC/DC output and TOS5050A with 5 kV AC output. While inheriting the basic performance of our best-selling TOS5000 series testers, TOS5000A has an additional feature - RS-232C interface - that comes standard with the tester. Because the tester can be connected directly to a PC and a serial printer, test data can be recorded and saved with ease, leading to further enhancement in quality control.

- Complies with various safety standards
- AC/DC output (TOS5051A)
- Large color display
- Digital voltmeter and ammeter
- Digital timer
- Window comparator type employed for PASS/FAIL judgement.
- Equipped with remote control function
- Various signal outputs
- Automatic discharge function (TOS5051A: during DC operation)
- Provided with zero turn-on switch
- Equipped with RS-232C as standard
- Data acquisition software (SD004-TOS5000A/Option)
### Output block

<table>
<thead>
<tr>
<th>Item</th>
<th>TOS5050A</th>
<th>TOS5051A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Voltage</td>
<td>0 to 2.5 / 0 to 5 kV AC</td>
<td>0 to 2.5 / 0 to 5 kV AC and DC</td>
</tr>
</tbody>
</table>

### AC

| Output Rating (with nominal line voltage) | 500VA / 5 kV, 100 mA |
| Waveform | Commercial line waveform |
| Voltage Regulation (with nominal line voltage) | Max. 15% (for max. rated load to no load) |
| Switching | Use of a zero turn-on switch |

### DC

| Maximum Output Rating (with nominal line voltage) | 50W / 5 kV, 10 mA |
| Ripple | 100 Vp-p typ. at 5 kV, no load 100 Vp-p typ. at max. rated output |
| Voltage Regulation (with nominal line voltage) | 3% or better (against change from maximum rated load to no load) |

### Output Voltmeters

| Analog | 5 kV full scale (no mirrors), AC 5 kV full scale (no mirrors), AC/DC |
| Class | JIS Class 2.5 |
| Accuracy | ±5% of full scale |
| AC Indication | Mean value response / rms value scale |
| Digital | Full Scale 2.5 kV/5kV full scale |
| Accuracy | ±1.5% of full scale |
| AC Response | Mean value response / rms value display |

### Ammeter

| Digital | Accuracy | ±(5% + 20μA) of upper cutoff current |
| AC Response | Mean value response / rms value display |

### Pass/fail Judgement Function

**Type of Judgement**
- Window comparator type
- If the current detected is larger than the preset upper cutoff current, the tester gives a FAIL judgement.
- If the current detected is less than the preset lower cutoff current, the tester gives a FAIL judgement.
- As the tester gives a FAIL judgement, it cuts off the output and delivers a FAIL signal.
- If the test period elapses without any unacceptable conditions, the tester gives a PASS judgement

**Upper cutoff current setting range**
- AC: 0.1 to 110 mA
- DC: 0.1 to 11 mA

**Lower cutoff current setting range**
- AC: 0.1 to 110 mA
- DC: 0.1 to 11 mA

**Judgement Accuracy**
- ±5% of upper cutoff current + 20μA

**Current Detection**
The absolute value of current is integrated and compared with the preset cutoff current value.

**Calibration**
Calibrated for rms value of sine wave, with pure-resistive load

**No-load output voltage required for detection**
- Approx. 460 V when set to 100 mA AC
- Approx. 100 V when set to 10 mA DC

**Test Time Setting Range**
0.5 to 999 sec (±10 ms) (timer-off function provided)

**Acuuracy**
±20 ms

**Line Voltage**
100V±10%, 50/60 Hz (Nominal voltages of 110V, 120V, 220V, 230V and 240V available as factory options.)

**RS-232C**
D-SUB 9-pin connector on the rear panel (conforms to EIA-232-D)Outputs test data and test results

**Protocol**
9600 bps, 8 bits Data Length, None-Parity, Stop bit 1 bit

**Function**
Query test result, status and measured value, and start and stop test (Incapable of setting test condition)

**Power Requirements**
- for line voltage of 100 V
  - Max. 25 VA under no-load conditions/ Approx. 600 VA at rated load
- for line voltage of 100 V to 200 V
  - Max. 25 VA under no-load conditions/ Approx. 600 VA at rated load
- for line voltage of 220 V to 240 V
  - Max. 25 VA under no-load conditions/ Approx. 640 VA at rated load

**Electromagnetic compatibility (EMC) *1**
Conforms to the following directive and standard: EMC Directive 2004/108/EC, EN61326, EN61000-3-2, EN61000-3-3

**Safety *1,2**
Low Voltage Directive 2006/95/EC, EN61010-1, Class I, Pollution degree 2

**Environment**
- Ambient temperature and humidity : 5 °C to 35°C / 20 %rh to 80 %rh
- Operable temperature and humidity : 0 °C to 40°C / 20 %rh to 80 %rh
- Storage temperature and humidity : -20 °C to 70 °C / 80 %rh or less

**Dimensions (MAX)**
320x330W × 132(150)H × 300/365Dmm

**Weight**
- for line voltage of 100 V
  - Approx. 15 kg
  - Approx. 16 kg
- for line voltage of 100 V to 120 V
  - Approx. 17 kg
  - Approx. 18 kg
- for line voltage of 220 V to 240 V
  - Approx. 18 kg
  - Approx. 19 kg

**Accessories**
- High-voltage test lead TL01-TOS (max_allowablevoltage: 5 kV/1.5m)
- Others 14-pin amphenol plug (assembled)

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*1: Only on models that have CE marking on the panel. Not applicable to custom order models.
*2: Not applicable to custom order models.
External dimensional diagrams

SD004-TOS5000A
(Data Acquisition for TOS5051A/5050A)

Providing an easy way to collect, manage, and save test results
Highly reliable quality control can be achieved!
SD004-TOS5000A is a software that lets you collect and manage test results generated by our TOS5000A Series hipot testers. Also, SD004-TOS5000A allows you to save, search, and print data with ease. What's more, you can execute or stop the test through a simple operation using a PC.

Features
- Test mode: Execution/stop function and automatic serial number incrementing function
- Search mode: Data item rearrangement and ascending/descending order function, search function ("sounds-like" search supported), print function (layout change supported), and text and HTML file output function.

Operating Environment
Pentium III or later, Windows XP/Windows 2000/Windows Me, CD-ROM drive, mouse, display supporting 800 x 600 resolution, 128 MB or more of memory (recommended), 50 MB or more of free space in hard disk drive (for installation) plus sufficient disk capacity to store necessary files, and RS-232C (data rate of 9600 bps; use an RS-232C cross cable for connection.)
Rise Time Control function is enable to comply to the Standard requirements for those degradation, destructive testing of sensitive materials

TOS5052 is a special tester designed for withstand voltage testing of electronic equipment and components conforming to various official safety standards. In addition to having an output of 5 kV AC at 100 mA, this model permits output voltage presetting, selection of output frequency (50 or 60 Hz), and rise-time control to control time for voltage to reach a preset level.

The display uses a large, high-brightness, color fluorescent tube for clear display of numbers, operation status, results, and other information.

For fast and accurate testing, the TOS5052 permits dual-axis operation of the test voltage range selector switch and voltage setting knob, and separate up-down keys for determination current and timer settings.

Easier to use than ever before, the TOS5052 also incorporates various safety and security features, including key lock, interlock, high-voltage output terminals limiting the number of insertion holes, and large “DANGER” warning lamps. These features make using the TOS5052 safe and reliable.

- Complies with various standards
- Rise-time control function
- High-output test voltage
- Acceptance determination by the window comparator method
## OUTPUT BLOCK

**Output voltage range** 0.50 kV to 5.00 kV VAC (100 mA output possible range)

**Voltage setting range** 0.00 to 2.95 kV/0.00 to 5.45 kV, 2 ranges (3-digit digital setting)

**Setting accuracy** ±2% of setting + 2 digits at 0.20 kV or higher with no load

**Resolution** 10V

**Maximum rated output** 500V (5kV/100mA)

**Transformer capacity** 500VA

**Output waveform shape** Sine wave

**Distortion factor** Output voltage of 0.5 kV or higher: 2% or less (under no load or resistive load)

**Frequency** 50 or 60 Hz selectable

**Voltage regulation** 9% or less (maximum rated load to no load)

**Output block**

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output current**

**Output**

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output rating** 500 kV A

**Output regulation** 50 or 60 Hz selectable

**Output voltage waveform** Sine wave

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output current**

**Output**

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

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**Output voltage waveform** Sine wave

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**Output**

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output rating** 500 kV A

**Output regulation** 50 or 60 Hz selectable

**Output voltage waveform** Sine wave

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**Output voltage waveform** Sine wave

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**Output rating** 500 kV A

**Output regulation** 50 or 60 Hz selectable

**Output voltage waveform** Sine wave

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output current**

**Output**

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output rating** 500 kV A

**Output regulation** 50 or 60 Hz selectable

**Output voltage waveform** Sine wave

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output current**

**Output**

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output rating** 500 kV A

**Output regulation** 50 or 60 Hz selectable

**Output voltage waveform** Sine wave

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output current**

**Output**

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output rating** 500 kV A

**Output regulation** 50 or 60 Hz selectable

**Output voltage waveform** Sine wave

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output current**

**Output**

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output rating** 500 kV A

**Output regulation** 50 or 60 Hz selectable

**Output voltage waveform** Sine wave

**Output voltage** Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.

**Output block**

**Output current**

**Output**

**Output voltage** Output is shut off and protection is effec
Testing voltage range -25V to -1000V,
Resistance measurement range 0.01MΩ to 5,000MΩ

The TOS7200 is an insulation resistance tester available for a wide range of various electric and electronic components, as well as electric and electronic equipment. The output voltage can be set at desired value in the range of -25 V to -1,000 V with a resolution of 1 V. (conforms with the output characteristics of the JIS C 1302-2002). As it is fitted with a window comparator and timer function, the tester is capable of efficiently conducting insulation resistance tests based on various safety standards. In addition, this product is equipped with panel memory as standard feature, which can be recalled by remote control, SIGNAL I/O connector, and the RS-232C interface for easy automatic testing system construction.

- Provided with the discharge function
- Equipped with the window comparator
- Hold function (which holds the measured resistance at the end of testing while PASS judgment is being output)
- Provided with the timer function
- Rear output terminals
- Measured-value monitoring terminals
- Equipped with the panel memory (enabling 10 different settings to be stored)
- Equipped with the SIGNAL I/O connector and remote control terminal
- Equipped with the RS-232C interface as standard
**Output section**

<table>
<thead>
<tr>
<th>Output voltage range</th>
<th>-25 V to -1000 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>1 V</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±(1.5 % of setting + 2 V)</td>
</tr>
</tbody>
</table>

**Maximum rated load**

1 W (< 1000 V DC/1 mA)

**Maximum rated current**

1 mA

**Output terminals**

- **Output type**
  - Floating
- **Isolation voltage**
  - ±1000 VDC

**Ripple**

- 1000 V / under no load
- 2 Vp-p or less
- Maximum rated load 10 Vp-p or less

**Short-circuited current**

12 mA or less

**Output rise time**

50 ms or less (10 % to 90 %) [no load]

**Discharge function**

Forced discharge at the end of test (discharge resistance: 25 kΩ)

**Time**

- **Setting range for the test duration (TEST TIME)**
  - 0.5 s to 999 s (TIMER OFF function provided)
- **Setting range for the wait time (WAIT TIME)**
  - 0.3 s to 10 s (TEST TIME > WAIT TIME)

**Accuracy**

- ±(100 ppm + 20 ms)

**Resolution**

- ±(100 ppm + 20 ms)

**Accuracy**

- ±(100 ppm + 20 ms)

**Display**

- Measurement range 0.01 MΩ to 5000 MΩ (In the range of over 100 nA to a maximum rated current of 1 mA)

**Accuracy**

- ±(1 % of reading + 1 V)

**Discharge function**

Forced discharge at the end of test (discharge resistance: 25 kΩ)

**Output rise time**

50 ms or less (10 % to 90 %) [no load]

**Discharge function**

Forced discharge at the end of test (discharge resistance: 25 kΩ)

**Time**

- **Setting range for the test duration (TEST TIME)**
  - 0.5 s to 999 s (TIMER OFF function provided)
- **Setting range for the wait time (WAIT TIME)**
  - 0.3 s to 10 s (TEST TIME > WAIT TIME)

**Accuracy**

- ±(100 ppm + 20 ms)

**Resolution**

- ±(100 ppm + 20 ms)

**Accuracy**

- ±(100 ppm + 20 ms)

**Display**

- Measurement range 0.01 MΩ to 5000 MΩ (In the range of over 100 nA to a maximum rated current of 1 mA)

**Accuracy**

- ±(1 % of reading + 1 V)

**Discharge function**

Forced discharge at the end of test (discharge resistance: 25 kΩ)

**Time**

- **Setting range for the test duration (TEST TIME)**
  - 0.5 s to 999 s (TIMER OFF function provided)
- **Setting range for the wait time (WAIT TIME)**
  - 0.3 s to 10 s (TEST TIME > WAIT TIME)

**Accuracy**

- ±(100 ppm + 20 ms)
Interface and Other Functions

REMOTE
6-pin mini-DIN connector on the front panel
The optional remote controller RC01-TOS or RC02-TOS is connected to remotely control starting/stopping of a test (note that a DIN-mini DIN adapter is required).

SIGNAL I/O
D-SUB 25-pin connector on the rear panel
For names and descriptions of connector signals.

No. Signal name I/O Description of signal
1 PM0 I LSB *1
2 PM1 I *1
3 PM2 I *1
4 PM3 I MSB *1
5 N.C
6 N.C
7 N.C
8 N.C
9 STB I Input terminal for the strobe signal of the panel memory
10 N.C
11 N.C
12 N.C
13 COM Circuit common (chassis potential)
14 HV ON O ON during a test or while a voltage remains between the output terminals
15 TEST O ON during a test
16 PASS O ON for approx. 0.2 seconds when PASS judgment is made, or continuously ON while PASS HOLD is activated
17 U FAIL O Continuously ON if an insulation resistance equal to or exceeding the lower resistance is detected, resulting in FAIL judgment
18 L FAIL O Continuously ON if an insulation resistance equal to or falling below the lower resistance is detected, resulting in FAIL judgment
19 READY O ON during standby
20 N.C
21 START I Input terminal for the START signal
22 STOP I Input terminal for the STOP signal
23 ENABLE I Remote control enable signal input terminal
24 N.C
25 COM Circuit common (chassis potential)
*1: 1-digit BCD active LOW input
*2: 1-digit BCD active HIGH input

Memory recall by latching this selection signal at the rise of the strobe signal (note that a DIN-mini DIN adapter is required).

Panel memory’s selection signal input terminal
*1: 1-digit BCD active LOW input
*2: 1-digit BCD active HIGH input

Input specifications
High-level input voltage 11 V to 15 V
Low-level input voltage 0 V to 4 V
Low-level input current -5 mA maximum
Input time width 5 ms minimum

Output specifications
Output method Open collector output (4.5 V to 30 V DC)
Output withstand voltage 30 V DC
Output saturation voltage Approx. 1.1 V (at 25°C)
Maximum output current 400 mA (TOTAL)

ANALOG OUT
Outputs a logarithmically compressed voltage corresponding to the measured resistance value
Vo = \log \left(\frac{1 + Rx}{1 M \Omega}\right)
where Rx = measured resistance value (1 M \Omega: 0.30 V;
10 M \Omega: 1.04 V; 100 M \Omega: 2.00 V; 1000 M \Omega: 3.00 V; 10000 M \Omega or more: 4.00 V). Output impedance: 1 k \Omega

COM Analog output-circuit common
Accuracy ±2 % of full scale)

RS-232C
D-SUB 9-pin connector on the rear panel (compliant with EIA-232-D)
Functions other than the POWER switch and KEY-LOCK function are remotely controllable.

Baud rate
9600 bps/19200 bps/38400 bps
(data: 8 bits; parity: none; stop bit: 2 bits fixed)

Display
7-segment LED, 4-digit voltage display, 4-digit insulation resistance display, and 3-digit time display

Memory function
A maximum of 10 types of test conditions can be stored in memory.

Backup battery life
3 years or more (at 25°C)

TEST MODE
MOMENTARY A test is conducted only when the START switch is pressed.
FAIL MODE Disables cancellation of FAIL judgment using a stop signal via remote control.
DOUBLE ACTION Starts a test only when the STOP switch is pressed and the START switch is pressed within approximately a half second.
PASS HOLD Allows the time of holding PASS judgment to be set to 0.2 s or HOLD.
KEYLOCK Places the tester in a state in which no keystroke other than the START/STOP switch is accepted.

General Specifications

Environment
Installation location Indoors and at altitudes up to 2000 m
Warranty range Temperature 5°C to 35°C
Operating range Temperature 0°C to 40°C
Humidity 20 %rh to 80 %rh (no condensation)
Storage range Temperature -20°C to 70°C
Humidity 90 %rh or less (no condensation)

Power requirements
Nominal voltage range 100 V to 240 V AC
allowable voltage range 85 V to 250 V AC

Power consumption
At rated load 30 VA maximum
Allowable frequency range 47 Hz to 63 Hz
Insulation resistance 30 MΩ or more (500 V DC) [AC LINE to chassis]
Hipot 1390 V AC for 2 seconds, 10 mA or less [AC LINE to chassis]
Ground bond 25 A AC/0.1 μA or less

Electromagnetic compatibility (EMC)*1
Conforms to the requirements of the following directive and standard.
EMC Directive 2004/108/EC
EN61326
EN61000-3-2
EN61000-3-3

Under following conditions
1. Used HV test leadwires TL08-TOS which is supplied.
2. No discharge occurs at outside of the tester.
3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.

Safety*1, 2
Conforms to the requirements of the following directive and standard.
Low Voltage Directive 2006/95/EC
EN61010-1

Pollution degree 2

Dimensions (max.)
215 (215) W x 66 (85) H x 230 (260) D mm
Weight Approx. 2 kg

Accessories
AC power cable 1 pc.
TL08-TOS high-voltage test leadwires (1.5 m) 1 set

Operation Manual 1 copy

*1: Only on models that have CE marking on the panel. Not applicable to custom order models.
*2: This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument. The safety of the instrument is not guaranteed unless the instrument is grounded properly.

External dimensional diagrams
Test up to 60A is possible!

While inheriting the basic performance and functions of its predecessor (TOS6200), such as a constant current driving system that provides current waveforms with little skew and high measurement accuracy, the TOS6210 tester extends the maximum test current from 30 A to 60 A, which is demanded by the new standard. In addition, the tester also lets you judge the acceptability of the device under test based on the drop in voltage, as required in the standard. What's more, you can preset test conditions of up to 20 different types of safety standards, such as those for information technology equipment, home appliances, medical devices, and measuring instruments, in the memory on the main unit's panel.

A simple memory call operation allows you to set up a protective earth or protective bonding continuity test as stipulated in UL60950-1 and other relevant specifications including IEC and JIS standards. The tester also features a set of functions that meet the specific needs of testing personnel, such as an offset cancellation function and a memo function that allows you to input calibration dates, production numbers, and other test-related information and read the input information later via the GPIB or RS-232C interface.
### Output block

<table>
<thead>
<tr>
<th>Current setting range (*1)</th>
<th>6.0 to 62.0 A AC (With respect to resistance resulting in output power of the maximum rated Output or less and an output terminal voltage of 5.4 V or less)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.1A</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± (1% of reading + 0.02 A)</td>
</tr>
<tr>
<td>Maximum rated output</td>
<td>220 VA at the output terminals</td>
</tr>
<tr>
<td>Distortion factor</td>
<td>2% or less (with respect to 0.1 Ω pure resistance load of 20 A or greater)</td>
</tr>
<tr>
<td>Frequency</td>
<td>50/60 Hz, sine wave (selectable)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±200 ppm</td>
</tr>
</tbody>
</table>

### Output voltmeter

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0.00 to 6.00 V AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.01 V</td>
</tr>
<tr>
<td>Offset cancel function</td>
<td>0.00 to 5.40 V (Offset ON/OFF function provided)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± (1% of reading + 0.02 V)</td>
</tr>
<tr>
<td>Response</td>
<td>Mean value response/rms value display (response time: 200 ms)</td>
</tr>
</tbody>
</table>

### Output ammeter

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0.001 to 600 Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.001 Ω</td>
</tr>
<tr>
<td>Offset cancel function</td>
<td>0.001 to 600 Ω (Offset ON/OFF function provided)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± (2% of reading + 0.003 Ω)</td>
</tr>
</tbody>
</table>

### Output method

- PWM switching method
- Open terminal voltage: 6 Vrms or less

### Output block settings

<table>
<thead>
<tr>
<th>Setting range for the upper reference value (UPPER)</th>
<th>0.001 to 600 Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting range for the lower reference value (LOWER)</td>
<td>0.001 to 600 Ω</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.001 Ω</td>
</tr>
</tbody>
</table>

### Calibration

- Calibration is performed with the rms value of the sine wave, using a pure resistance load.
- Calibration accuracy: ± 12% of UPPER + 0.05 V

### LED

- **PASS**: Lights for approximately 0.2 sec when the measured value has been judged as PASS. It is lit continuously when the PASS holding time is set to HOLD.
- **UPPER FAIL** and **LOWER FAIL**: Lights if a resistance or voltage value equal to or greater than the upper or lower reference value is detected and judged FAIL.

### Buzzer

- The buzzer sounds continuously when the measured value has been judged as PASS.
- The buzzer sounds continuously under the following conditions:
  - If a resistance value equal to or greater than the upper reference value is detected, a FAIL determination is returned.
  - If the set time elapses without abnormalities, the tester shuts off the output and generates a FAIL signal.

### Setting range for the lower reference value (LOWER)

<table>
<thead>
<tr>
<th>Setting range for the lower reference value (LOWER)</th>
<th>0.01 to 5.40 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.01 V</td>
</tr>
</tbody>
</table>

### Sampled voltage value-based judgement

- Setting range for the upper reference value (UPPER)(*4): 0.01 to 5.40 V
- Setting range for the lower reference value (LOWER): 0.01 to 5.40 V

### Judgement accuracy

- Calibration: ± 12% of UPPER + 0.05 V

### Support

- **UPPER FAIL**: Lights if a resistance or voltage value equal to or greater than the upper reference value is detected and judged FAIL.
- **LOWER FAIL**: Lights if a resistance or voltage value equal to or greater than the upper reference value is detected and judged FAIL.

---

*1: Time limitation with respect to output

The heat radiation capacity at the output block of the tester is designed to be one-third of the rated output, accounting for size, weight, cost, and other factors.

- Always use the tester within the limitation values given below. Use of the tester beyond these limits will cause the temperature of the output block to rise excessively, potentially tripping the internal protection circuit. In this case, suspend testing for approximately 30 minutes, then press the STOP switch. When temperatures fall to normal levels, the tester will revert to ready status.

*2: About omitteter’s response time

A resistance value is instantaneously obtained, calculated using the measured voltage and current values. The response time of the ohmmeter complies with the response times of the voltmeter and ammeter.

*3: Resistance value-based and sampled voltage value-based judgments cannot be simultaneously conducted.

*4: Limited by the maximum rated output and the output terminal voltage.

The tester can be used within the range shown below.

<table>
<thead>
<tr>
<th>Ambient temperature (°C)</th>
<th>Test current I (A)</th>
<th>Pause time</th>
<th>Maximum allowable continuous test time</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 40°</td>
<td>40 ≤ I ≤ 60</td>
<td>≥ 10 minutes</td>
<td>≤ 10 minutes</td>
</tr>
<tr>
<td></td>
<td>20 ≤ I ≤ 40</td>
<td>≥ 10 minutes</td>
<td>≤ 30 minutes</td>
</tr>
<tr>
<td></td>
<td>I ≤ 20</td>
<td>Not required</td>
<td>Continuous output possible</td>
</tr>
</tbody>
</table>

*5: About ambient temperature

The accuracy of measurements is provided at a temperature of 20 ± 5°C (68 ± 9°F). The tester will revert to ready status if the ambient temperature falls to normal levels.

---

*Kikusui Electronics Corporation*
<table>
<thead>
<tr>
<th><strong>Time</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test time</strong></td>
<td>Setting range: 0.3 to 999 s. Timer ON/OFF function is available.</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>± (100 ppm of setting + 20 ms)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environment</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating environment</strong></td>
<td>Indoor use, Overvoltage Category II</td>
</tr>
<tr>
<td><strong>Warranty range</strong></td>
<td>Temperature: 5° to 35°C</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>20 %rh to 80%rh (non condensing)</td>
</tr>
<tr>
<td><strong>Operating range</strong></td>
<td>Temperature: 0° to 40°C</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>20 %rh to 80%rh (non condensing)</td>
</tr>
<tr>
<td><strong>Storage range</strong></td>
<td>Temperature: -20° to 70°C</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>90 %rh or less (non condensing)</td>
</tr>
</tbody>
</table>

| **Altitude** | Up to 2000m |

<table>
<thead>
<tr>
<th><strong>Power requirement</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Allowable voltage range</strong></td>
<td>85 to 250 V AC</td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>At no load (READY): 60 VA or less</td>
</tr>
<tr>
<td><strong>At rated load</strong></td>
<td>420 VA max.</td>
</tr>
<tr>
<td><strong>Allowable frequency range</strong></td>
<td>47 Hz to 63 Hz</td>
</tr>
<tr>
<td><strong>Insulation resistance</strong></td>
<td>30 MΩ min. (500 V DC), between AC line and chassis</td>
</tr>
<tr>
<td><strong>Hipot</strong></td>
<td>1390 V AC (2 seconds), between AC line and chassis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Electromagnetic compatibility (EMC)</strong> (*5, 6)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Conforms to the requirements of the following directive and standard.</td>
<td></td>
</tr>
<tr>
<td>EMC Directive 2004/108/EC</td>
<td></td>
</tr>
<tr>
<td>EN61326</td>
<td></td>
</tr>
<tr>
<td>EN61000-3-2</td>
<td></td>
</tr>
<tr>
<td>EN61000-3-3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Safety</strong> (*5)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Conforms to the requirements of the following directive and standard.</td>
<td></td>
</tr>
<tr>
<td>Low Voltage Directive 2006/95/EC</td>
<td></td>
</tr>
<tr>
<td>EN61010-1</td>
<td></td>
</tr>
<tr>
<td>Class I</td>
<td></td>
</tr>
<tr>
<td>Pollution degree 2</td>
<td></td>
</tr>
</tbody>
</table>

| **Physical dimensions (max)** | 430/455 W × 88/140 H × 270/350 D mm  |
| **Weight** | Approx. 11 kg  |

<table>
<thead>
<tr>
<th><strong>Accessories</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AC power cord</strong></td>
<td>1 piece</td>
</tr>
<tr>
<td><strong>Test leadwire TL12-TOS</strong></td>
<td>1 set</td>
</tr>
<tr>
<td><strong>Short bar</strong></td>
<td>2 pieces (These are inserted between the OUTPUT and SAMPLING terminals.)</td>
</tr>
<tr>
<td><strong>AC power fuse</strong></td>
<td>2 pieces (2, including one spare in the fuse holder)</td>
</tr>
<tr>
<td><strong>Operation manual</strong></td>
<td>1 copy</td>
</tr>
</tbody>
</table>

---

External dimensional diagrams

---

*5: Not applicable to custom order models.  
*6: Only on models that have CE marking on the panel.
Adopting the constant current method to apply automated testing system
Perfect feature for the Production line which requires reduced tact time

The TOS6200 tester is designed to perform the ground bond tests required for class-I devices by safety standards such as IEC, EN, VDE, BS, UL, JIS, and the Electrical Appliance and Material Safety Low (Japan). Equipped with a new high-efficiency power supply, it is compact and lightweight, about half the size and weight of our conventional products, while achieving a large output of 150 VA. Use of the constant current method eliminates the need to reset test currents even in the face of fluctuating resistance values for the device being tested. The test duration can also be set from 0.3 s, making the tester suitable for production line testing, which requires reduced cycle time. This tester is also designed for ease of use, featuring a large, easy-to-read display, memory capacity for storage of 100 types of test conditions, and incorporation of test conditions into programs to enable automatic testing. Standard GPIB and RS-232C interfaces allow the user to use PCs or other devices to control test conditions such as test current, resistance value for judgement, and test duration, and enables read-back of measured values and test results. The tester is also provided with test leads as standard and provides high cost effectiveness.

- Test current value: 3 to 30 A AC
- Resistance value: 0.001 to 1.200Ω
- Offset cancelling function
- Stores 100 test conditions in memory
- Incorporates test conditions into program
- Contact check function
- Equipped with standard GPIB and RS-232C interfaces
- Equipped with standard test lead (TL11-TOS)
## Output block

**Current setting range:** 3.0 to 30.0 A AC  
(With respect to resistance resulting in output power of the maximum rated output or less and an output terminal voltage of 5.4 V or less)

<table>
<thead>
<tr>
<th>Resolution</th>
<th>0.1 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>± (1% of setting + 0.2 A)</td>
</tr>
<tr>
<td>Maximum rated output</td>
<td>150 VA (at the output terminals)</td>
</tr>
<tr>
<td>Distortion factor</td>
<td>2% or less (with respect to 0.1 Ω pure resistance load of 10 A or greater)</td>
</tr>
<tr>
<td>Frequency</td>
<td>50/60 Hz, sine wave (selectable)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 200 ppm</td>
</tr>
<tr>
<td>Open terminal voltage</td>
<td>6 Vrms or less</td>
</tr>
<tr>
<td>Output method</td>
<td>PWM switching method</td>
</tr>
</tbody>
</table>

### Buzzer
- The buzzer sounds for the pass holding time has been set if the measured value has been judged as PASS.
- The buzzer sounds continuously under the following condition:
  - The measured value has been judged as PASS when the PASS holding time is set to HOLD.
- The measured value has been judged as UPPER FAIL.
- The measured value has been judged as LOWER FAIL.
- The buzzer volume for FAIL or PASS judgment are adjustable.
- Note that it cannot be adjusted individually since setting is shared with the setting for PASS.

### Environment
- **Operating environment:** Indoor use, Overvoltage Category II

### Warranty range
- **Temperature:** 5° to 35°C
- **Humidity:** 20 %rh to 80 %rh (non condensing)

### Operating range
- **Temperature:** 0° to 40°C
- **Humidity:** 20 %rh to 80 %rh (non condensing)

### Storage range
- **Temperature:** -20° to 70°C
- **Humidity:** 90 %rh or less (non condensing)

### Altitude
- Up to 2000 m

### Power requirement
- **Allowable voltage range:**
  - 100 V model: 85 to 132 V AC
  - 100 V/200 V model: 85 to 132 V AC/170 to 250 V AC

### Power consumption
- **At rated load:**
  - 100 V model: 450 VA max.
  - 100 V/200 V model: 330 VA max.

### Allowable frequency range
- 47 Hz to 63 Hz

### Insulation resistance
- 10 MΩ min. (500 V DC), between AC line and chassis

### Hipot
- 1390 V AC (2 seconds), between AC line and chassis

### Ground bond
- 25 A AC/0.1 Ω max.

### Safety
- Conforms to the requirements of the following directive and standard.

### Electromagnetic compatibility (EMC)
- Conforms to the requirements of the following directive and standard.

### EMC Directive 2004/108/EC, EN61326, EN61000-3-2, EN61000-3-3

### Under following conditions
1. Used test leadwire (TL11-TOS) which is supplied.
2. Used the shielding cable which length is less than three meters when the SIGNAL I/O is used.

## Ground bond tester

### TOS6200

### Ground bond 25 A AC/0.1 Ω max.

### Accessories
- **AC power cord:** 1 piece
- **Test leadwire TL11-TOS:** 1 set
- **2 pieces (These are inserted between the OUTPUT and SAMPLING terminals.)
- **2 pieces (including one spare in the fuse holder)

### Operation manual
- 1 copy

### External dimensional diagrams

### Measuring terminal diagram

| Unit: mm |
|----------|---|
| Holding function | The resistance measured at the end of test is held during the PASS or FAIL interval |
| Measurement range | 0.001 to 1.200 Ω |
| Resolution | 0.001 Ω |
| Offset cancel function | 0.000 to 1.200 Ω (Offset ON/OFF function provided) |
| Accuracy | ± (2% of reading + 0.003 Ω) |
| Holding function | The measured value has been judged as PASS when the PASS holding time is set to HOLD. |
| Load pull function | The resistance measured at the end of test is held during the PASS interval |
| Overload judgment function | The buzzer sounds for approximately 0.2 sec when the measured value has been judged as PASS. It is lit continuously when the PASS holding time is set to HOLD. |

### LED

<table>
<thead>
<tr>
<th>LED</th>
<th>PASS</th>
<th>UPPER FAIL</th>
<th>LOWER FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration</td>
<td>Calibration is performed with the rms value of the sine wave, using a pure resistance load.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration accuracy</td>
<td>± (2% of UPPER + 0.003 Ω)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>Lights for approximately 0.2 sec when the measured value has been judged as PASS. It is lit continuously when the PASS holding time is set to HOLD.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>Lights if a resistance value equal to or greater than the upper reference value is detected and judged FAIL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>Lights if a resistance value equal to or greater than the upper reference value is detected and judged FAIL.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Measuring terminal diagram

| Unit: mm |
|----------|---|

---

*1: Time limitation with respect to output
The heat radiation capacity of the output block of the tester is designed to be one-third of the rated output, accounting for size, weight, cost, and other factors. Always use the tester within the limitation values given below. Use of the tester beyond these limits will cause the temperature of the output block to rise excessively, potentially tripping the internal protection circuit. In this case, suspend testing for approximately 30 minutes, then press the STOP switch. When temperatures fall to normal levels, the tester will revert to ready status.

### Physical dimensions (max)
- 430(455)W × 88(140)H × 270(345)D mm

### Weight
- Approx. 9 kg

### Accessories

### Output block

| Setting range for the upper reference value (UPPER) | 0.001 to 1.200 Ω |
| Setting range for the upper reference value (LOWER) | 0.001 to 1.200 Ω |
| Resolution | 0.001 Ω |
| Judgement accuracy | ± (2% of UPPER + 0.003 Ω) |

### LED

<table>
<thead>
<tr>
<th>LED</th>
<th>PASS</th>
<th>UPPER FAIL</th>
<th>LOWER FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration</td>
<td>Calibration is performed with the rms value of the sine wave, using a pure resistance load.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration accuracy</td>
<td>± (2% of UPPER + 0.003 Ω)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>Lights for approximately 0.2 sec when the measured value has been judged as PASS. It is lit continuously when the PASS holding time is set to HOLD.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>Lights if a resistance value equal to or greater than the upper reference value is detected and judged FAIL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>Lights if a resistance value equal to or greater than the upper reference value is detected and judged FAIL.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### External dimensional diagrams

---

*2: About ohmmeter’s response time
A resistance value is instantaneously obtained, calculated using the measured voltage and current values. The response time of the ohmmeter complies with the response times of the voltmeter and ammeter.

*3: Not applicable to custom order models.

*4: Only on models that have CE marking on the panel.
A leakage current tester has now been added to the TOS Series...
Conforms to international standard IEC 60990 (“Methods of measurement of touch current and protective conductor current”).

The Leakage Current Tester TOS3200 is designed to test for leakage current (Touch Current and Protective Conductor Current) of general electrical apparatuses, excluding those used for medical purposes.

With this tester, you can conduct tests conforming to various standards including IEC, UL, JIS and Electrical Appliance and Material Safety Law (Japan). You can set test conditions through simple operations on the panel because this tester holds in its memory the 51 types of test conditions for IT-related electrical equipment, electrical appliances, audio & visual equipment, lighting fixtures, power tools, and measuring and control instruments, accordingly with the standards of IEC/JIS and Electrical Appliance and Material Safety Law.

- Capable of measuring leakage current in three modes
- Eight built-in measurement circuit networks
- Up to 30 mA for RMS measurement
- Easy-to-understand operation
- Enables the continuous execution of tests
- Capable of saving test results
- 51 types of standard test conditions are preset
- Lets you manage the calibration time limit
- USB interface provided as standard

【Pin Configuration for the SIGNAL I/O Connector】

[Diagram of pin configuration]
Capable of measuring leakage current in three modes

- **Touch current (TC) operating mode**
  Enables you to measure the touch current flowing between the enclosure (accessible portion) of the electrical equipment under test (EUT) and the power line incorporating the earth wire, via Measuring Devices. For Measuring Devices, eight measurement circuit networks (NTWks) conforming to the applicable standards are provided as standard. The switching of the polarities of the power line to the EUT, as well as single-fault conditions, are automatically set with relays inside the tester.

- **Protective conductor current (PCC) operating mode**
  Enables you to measure the current flowing through the protective conductor (earth wire) by connecting the power plug (NEMA5-15 or an equivalent) of an item of 100 V electrical equipment to the socket on the front panel. A multi-outlet is available as an option (sold separately) to accommodate the different plugs used around the world.

- **Meter (METER) operating mode**
  In the same way as an ordinary multimeter, enables you to measure voltage and current while measuring terminal A and B on the front panel. For voltage measurement, it offers a “safety extra low voltage” (SELV) detection function; for current measurement, it offers a measurement function using measurement circuit networks (NTWks).

### Easy-to-understand operation

Simple operation is possible thanks to the intuitively understandable test condition menu and the function keys/rotary knobs.

### Enables the continuous execution of tests

Allows you to automatically conduct TC and PCC tests as a single sequence program by setting their test conditions as up to 100 independent tests (steps). You can set up to 100 sequence programs, with up to 500 steps in total. To support automation test, measurement point (probe setting) can be switched without turning off EUT power line.

### Up to 30 mA for RMS measurement

Capable of measuring 30 μA to 30 mA for DC/RMS measurement and 50 μA to 90 mA for PEAK measurement, both in three ranges. Two range switching functions are provided, namely, a fixed range function (FIX) and auto range function (AUTO), which conform to the current to be measured. For RMS measurement, the “true root-mean-square value” is achieved.

### Eight built-in measurement circuit networks

It offers built-in eight measurement circuit networks for measuring the touch current of general electrical equipment.

#### Measurement circuit network (network A)

- **Measurement circuit network (network D)**

#### Measurement circuit network (network E)

- **Measurement circuit network (network F)**

#### Measurement circuit network (network G)

- **Measurement circuit network (network H)**

### Capable of saving test results

For independent tests, enables you to save not only test results but also the test date and time and the test conditions for up to 50 tests; for auto tests, you can save this data for up to 50 programs. You can also save the test results as external records using the USB and other interfaces.

#### 51 types of standard test conditions are preset

The memory in the main unit is pre-written with 51 types of test conditions for general electrical equipment, which conform to IEC 60990 and the standards listed below. You can set the standard test conditions merely by calling them.

#### Lets you manage the calibration time limit

For independent tests, enables you to save not only test results but also the test date and time and the test conditions for up to 50 tests; for auto tests, you can save this data for up to 50 programs. You can also save the test results as external records using the USB and other interfaces.

#### USB interface provided as standard

In addition to the SIGNAL I/O, GPIB, and RS-232C interfaces, a USB interface is also provided as standard.

#### Range of other functions

- “MAX function,” which retains the largest current measured.
- “CONV function,” which converts the measured current value into the corresponding value for the preset power voltage.
- “SELV function,” which causes the DANGER lamp to turn ON if a preset safety extra low voltage (SELV) is exceeded in meter measurement mode.
- “CHECK function,” which performs self-analysis of the measurement circuit networks.
### Measured value conversion (CONV)

- Converts the measured current value into the corresponding value at the point power source.
- Setting range: 80.0 V to 300.0 V, OFF function provided.

### MEASURE MODE

- Selects a measured value from those below.
- NORM: Displays the measured value in the measurement period.
- MAX: Displays the largest measured value in the measurement period.

### Power groundstop phase selection (PZS)

- NORM: Positive phase connection; RES: Negative phase connection.

### Single fault selection (COND)

- NORM: Normal, FLTNEU: Disconnection of the neutral wire, FLTPLE: Disconnection of the protective earth wire.

### Earth check

- Generates CORD/PWRSW if the enclosure is grounded in a PC/AC/BusBar Non-hazardous circuit.

### MEASURE CHECK

- Checks the measurement function between measurement terminals A and B, and places the tester in the PROTECTION state if an error is detected.

### Voltage measurement (EUT)

- Measurement range: 300 V to 2400 V, therefore 0.1 V accuracy ±0.1% of rdg (1σ).

### Current measurement (EUT)

- Measurement range: 0.1 A to 15.00 A, resolution: 0.01 A, accuracy: ±(5% of rdg + 30 mA).

### Power measurement (effective power)

- Measurement range: 10 W to 1500 W

### System clock

- Recording time: 0.1 s (1 s, 5 s, 10 s)
- Timing accuracy ±(10 ppm of set + 20 ms)
- Time code: 8-digit time code

### Protective operation

- Relay output: mains, earth, range measurement/fail lock, failure (external battery)

### Interface

- RS-232C: D-Sub 9-pin connector (conforming to EIA-232D), baud rate: 9600/19200/38400 (for connection to a PC, use a "pin female-female reverse" cable).
- USB: USB Specification 2.0
- REMOTE: 6-pin MINI DIN connector (for HP-2112: compatibly sold as option)
- SIGNAL I/O: 25-pin D-Sub connector

### General

- Rated voltage/current: Terminals A to B: 250 V, terminal to chassis: 250 V, 100 mA
- Measurement category: CAT II

### Measurement

- Effective terminal display: Terminals effective to measurement are indicated with LED lamps.
- Specification assured range: Temperature: 5°C to 35°C, humidity: 20% rh to 80% rh (no condensation)
- Operating range: Temperature: 0°C to 40°C, humidity: 20% rh to 80% rh (no condensation)

### Environment

- Storage range: Temperature: −20°C to 70°C, humidity: 30% rh or less (no condensation)
- Mounting location: Indoors, altitude of 2000 m or less
- Input power: Nominal input rating: 100Vac to 240Vac, 50/60Hz
- Power consumption: 70 V A max.
- Isolation resistance: 1500 V A, maximum current: 15 A, rush current: 70 A peak max. (within 20 ms)
- Insulation resistance: 50 MΩ or greater (500 V dc between AC line and chassis, between measurement terminal and chassis)
- Withstand voltage: 1950 V, 2 second 20 or less or (between AC line and chassis)

### Ground bond

- 25 A max. (1/L or less)

### Safety

- Conforms to the requirements of the directive and standard below:
  - Low Voltage Directive 2006/95/EC, EN61010-1 (Class I, Pollution degree 2).
  - Electromagnetic compatibility: (1, 2)
  - Conforms to the requirements of the directive and standard below:
    - EMC Directive 2004/108/EC, EN61010-1, EN61326, EN61000-3-3, EN61100-3-2, EN61000-3-3, Applicable conditions: All cables and wires used to connect to this product must be shorter than 3 meters. Use the supplied test leads.
    - Outside dimensions, weight:
      - 120 (345) W x 88 (105) H x 270 (335) D mm, approx. 3.5 kg
      - Accessories
        - 10 test leads (TL2-TOL: red and black, one each, with alligator clips)
        - 1 flat probe (FP01-TOS), 1 spare fuse (15A, for EUT power)
        - 1 instruction manual, 1 circuit principle diagram sticker
        - 2 power cords (for the tester and for the EUT AC line)

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**Kikusui Electronics Corporation**

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### Current instrument section

#### Current measurement section

- **Measurement item, measurement mode**
  - 3 types, namely, touch current (TC) measurement, protective conductor current (PCC) measurement, and METER measurement.

- **Measurement method**
  - TC: Measure the voltage drop across the reference resistor, using a measurement network (NTWK), and then calculate the current.
  - PCC: Measure the voltage drop across the reference resistor connected to the protective earth wire, and then calculate the current.
  - METER: Measure the voltage and current using the measurement terminals.

- **Measurement mode**
  - DC/DC/AC/PEAK (using the true root-mean-square value)

- **Maximum range is indicated. The range differs depending on the measurement circuit network.**

- **Limited to products with CE marking on their panels.**

- **May not apply to custom-made or modified products.**

- **The warm-up time must be 30 minutes or longer.**

- **Current measurement (i) display/resolution**
  - i < 1mA: ±(1% of rdg + 0.2 μA)
  - 1mA < i < 100 mA: ± (2% of rdg + 50 μA)
  - 100 mA < i < 850 mA (*3): ± (2% of rdg + 100 μA)

- **Range switching**
  - AUTO/FIX

- **Measuring current (i) display/resolution**
  - i < 1mA: ±(1% of rdg + 0.2 μA)
  - 1mA < i < 100 mA: ± (2% of rdg + 50 μA)
  - 100 mA < i < 850 mA (*3): ± (2% of rdg + 100 μA)

### Measurement

#### Measurement range

<table>
<thead>
<tr>
<th>Range</th>
<th>DC</th>
<th>DC/DC/AC/PEAK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15 Hz &lt; f &lt; 10 kHz: ±(2% of rdg + 10 μA)</td>
<td>10 kHz &lt; f ≤ 1 MHz: ±(5% of rdg + 10 μA)</td>
</tr>
<tr>
<td>2</td>
<td>15 Hz &lt; f &lt; 10 kHz: ±(2% of rdg + 10 μA)</td>
<td>10 kHz &lt; f ≤ 1 MHz: ±(5% of rdg + 10 μA)</td>
</tr>
</tbody>
</table>

### Measurement accuracy (*5)

- **Input resistance, input capacitance**
  - Range 1: 1300 Ω/12 pF
  - Range 2: 1300 Ω/12 pF
  - Range 3: 1300 Ω/12 pF

### Judgement function

- **Judgement method**
  - Failure judgement by setting upper and lower current limits in Network mode.
- **Measurement**
  - AUTO/FIX

### Rated output capacity: 1500 V A, maximum current: 15 A, rush current: 70 A peak max. (within 20 ms)

### Rated voltage/current: Terminals A to B: 250 V, terminal to chassis: 250 V, 100 mA

### Measurement category: CAT II

### Effective terminal display: Terminals effective to measurement are indicated with LED lamps.

### Specification assured range: Temperature: 5°C to 35°C, humidity: 20% rh to 80% rh (no condensation)

### Operating range: Temperature: 0°C to 40°C, humidity: 20% rh to 80% rh (no condensation)

### Storage range: Temperature: −20°C to 70°C, humidity: 30% rh or less (no condensation)

### Mounting location: Indoors, altitude of 2000 m or less

### Power consumption: 70 V A max.

### Isolation resistance: 50 MΩ or greater (500 V dc between AC line and chassis, between measurement terminal and chassis)

### Withstand voltage: 1950 V, 2 second 20 or less or (between AC line and chassis)

### Ground bond: 25 A max. (1/L or less)

### Safety

- Conforms to the requirements of the directive and standard below:
  - Low Voltage Directive 2006/95/EC, EN61010-1 (Class I, Pollution degree 2).
- Electromagnetic compatibility: (1, 2)
  - Conforms to the requirements of the directive and standard below:
    - EMC Directive 2004/108/EC, EN61010-1, EN61326, EN61000-3-3, EN61000-3-2, EN61100-3-3, Applicable conditions: All cables and wires used to connect to this product must be shorter than 3 meters. Use the supplied test leads.

### Accessories

- 10 test leads (TL2-TOL: red and black, one each, with alligator clips)
- 1 flat probe (FP01-TOS), 1 spare fuse (15A, for EUT power)
- 1 instruction manual, 1 circuit principle diagram sticker
- 2 power cords (for the tester and for the EUT AC line)
**High-Voltage Digital Voltmeter**

| Model   | 149-10A |

- Measurement of high voltages (AC/DC) of up to 10 kV maximum.
- Large 4½-digit LED display.
- High measuring accuracy and input resistance.
- Light weight of only 3.2 kg.
- Compact design.
- Excellent ease of maintenance.

**Specifications**

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Double integration system (sampling cycle: 3 times/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Voltage</td>
<td>Measuring range: 0.500kV to 10,000kV&lt;br&gt;Accuracy: ±0.5% of reading ± 0.03% of range&lt;br&gt;Input resistance: 1000 MΩ ± 2%</td>
</tr>
<tr>
<td>AC Voltage</td>
<td>Measuring range: 0.500kV to 10,000kV&lt;br&gt;Accuracy: ±1% of reading ± 0.05% of range&lt;br&gt;Frequency characteristics: 50/60 Hz&lt;br&gt;Input resistance: 1000 MΩ ± 2%</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>100V±10%, approx. 10 VA</td>
</tr>
<tr>
<td>Dimensions (MAX)</td>
<td>134W × 164H × 270D mm (140W × 189H × 295D mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 3 kg</td>
</tr>
<tr>
<td>Accessories</td>
<td>TL04-TOS high-voltage test lead: 1&lt;br&gt;HTL-2.5DH high-voltage coaxial cable: 1</td>
</tr>
</tbody>
</table>

**Hipot Tester Current Calibrator**

| Model   | TOS1200 * While Supplies Last |

- Calibration of Leakage Current Detection Sensitivity.
- Direct Reading of Error from Error Display Scale.
- Ammeter Ranges.
- Eliminates Need for Power Supply.
- AC/DC Selection Switch.

**Specifications**

<table>
<thead>
<tr>
<th>Measuring Function</th>
<th>Measurement of current values and error(%) for AC (50/60 Hz) and DC at a test voltage of 1000 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring Ranges</td>
<td>8 ranges consisting of 0.5/1/2.5/5/10/20/50/100 mA along with values equal to 0.8 times the values of those ranges (for 1, 2, 4 and 8 steps)</td>
</tr>
<tr>
<td>Ammeter Scale</td>
<td>Main scale: Direct-reading error display scale over a range of ±10% of the above full scale values&lt;br&gt;Secondary scale: Ratio scale of 0 to 1.1 times the above full scale values (equivalent to 0% display of main scale when the ratio is equal to 1)</td>
</tr>
<tr>
<td>Ammeter Accuracy</td>
<td>Main scale: ±1% of reading ± 0.05% of full scale value&lt;br&gt;Secondary scale: ±3% of full scale value</td>
</tr>
<tr>
<td>Ammeter Indication</td>
<td>DC/AC sine wave rms value calibration of mean value response</td>
</tr>
<tr>
<td>Load Resistance</td>
<td>Allowed Input Time: 0.5/25 mA ranges: Continuous 10/20/50/100 mA ranges: 60 sec. Max. 1/3 of duty cycle</td>
</tr>
<tr>
<td>Dimensions (MAX)</td>
<td>134W × 164H × 270D mm (140W × 189H × 320D mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 3.5 kg</td>
</tr>
<tr>
<td>Accessories</td>
<td>TL04-TOS high-voltage test lead: 1</td>
</tr>
</tbody>
</table>

**UL Resistance Load**

| Model   | RL01-TOS |

- This device is described in section 125, paragraph 2-1B1 of UL1492. The RL01-TOS is a variable lead resistor for checking the output voltage of hipot testers used in dielectric strength testing on production lines. (Complies with UL regulations including UL1270, UL1409 and UL1410.)

**Specifications**

| Resistors: | 120, 159, 210, 279, 369, 489, 648, 858, 1,137, 1,500, 1,989 and 2,148 kΩ |
| Resistance Accuracy | +1%, 0% of nominal value when set to 120 kΩ, ±1% of nominal value when set to other values |
| Maximum Operating Voltage | 1300 V (continuous rating) |
| Minimum Breakdown Voltage | 1400 V for 5 seconds (application may not be repeated within 1 minute) |
| Dimensions (MAX) | 200W × 100H × 260D mm (210W × 120H × 295D mm) |
| Weight            | approx. 2.6 kg |
| Accessories       | TL04-TOS high-voltage test lead: 2<br>TL05-TOS high-voltage test lead: 1 |

**Calibration Resistor for Insulation Resistance Tester**

| Model   | 929-1M<br>929-10M<br>929-100M |

- The 929 Series Standard Resistors are for calibration of Insulation Testers.

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>929-1M&lt;br&gt;929-10M&lt;br&gt;929-100M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Resistance</td>
<td>1MΩ&lt;br&gt;10MΩ&lt;br&gt;100MΩ</td>
</tr>
<tr>
<td>Accuracy of resistance</td>
<td>±1% at 25°C ± 0°C</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>100 ppm/°C or better</td>
</tr>
<tr>
<td>Voltage coefficient</td>
<td>1 ppm/V or better</td>
</tr>
<tr>
<td>Working voltage rating</td>
<td>1.5 kV</td>
</tr>
<tr>
<td>Dimensions (MAX)</td>
<td>64W × 24H × 30D mm</td>
</tr>
</tbody>
</table>

*The 929 series standard resistors can not be installed directly to the TOS series. Please use the test lead for connection.*

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Kikusui Electronics Corporation
### Test Lead

<table>
<thead>
<tr>
<th>TL01-TOS</th>
<th>[cable length: 1.5 m, max. operating voltage: 5 kV]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL02-TOS</td>
<td>[cable length: 3 m, max. operating voltage: 5 kV]</td>
</tr>
<tr>
<td>TL03-TOS</td>
<td>[cable length: 1.5 m, max. operating voltage: 10 kV]</td>
</tr>
<tr>
<td>TL04-TOS</td>
<td>[cable length: 1.5 m, max. operating voltage: 5 kV (for TOS1200, RL01-TOS)]</td>
</tr>
<tr>
<td>TL05-TOS</td>
<td>[cable length: 1.5 m, max. operating voltage: 5 kV (for 149-10A, RL01-TOS)]</td>
</tr>
<tr>
<td>TL06-TOS</td>
<td>[cable length: 0.5 m, max. operating voltage: 5 kV (for parallel connection of TOS9220/9221)]</td>
</tr>
<tr>
<td>TL07-TOS</td>
<td>[cable length: 1.5 m, max. operating voltage: 5 kV (for TOS9230/9231)]</td>
</tr>
<tr>
<td>TL08-TOS</td>
<td>[cable length: 1.5 m, max. operating voltage: 1 kV (for TOS7200)]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TL11-TOS</th>
<th>[cable length: 1.5 m, max. operating current: 30 A (for TOS6200)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL12-TOS</td>
<td>[cable length: 1.5 m, max. operating current: 60 A (for TOS6210)]</td>
</tr>
<tr>
<td>TL21-TOS</td>
<td>[cable length: 1.5 m (for TOS3200)]</td>
</tr>
<tr>
<td>TL31-TOS</td>
<td>[cable length: 1.5 m, max. operating voltage: 5 kV (for TOS5300 Series)]</td>
</tr>
<tr>
<td>TL32-TOS</td>
<td>[cable length: 3 m, max. operating voltage: 5 kV (for TOS5300 Series)]</td>
</tr>
<tr>
<td>HTL-2.5DH</td>
<td>[cable length: 1.5 m, max. operating voltage: 10 kV (for 149-10A)]</td>
</tr>
</tbody>
</table>

### DIN Cable

<table>
<thead>
<tr>
<th>DD-3 5P</th>
<th>[cable length: 3 m, DIN plug to DIN plug]</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD-5P/6P</td>
<td>[Adaptor / DIN to Mini DIN]</td>
</tr>
<tr>
<td>DD-5P/9P</td>
<td>[Adaptor / DIN to Mini DIN]</td>
</tr>
</tbody>
</table>

### Test Probe

<table>
<thead>
<tr>
<th>HP01A-TOS</th>
<th>[cable length: 1.8 m, max. operating voltage: 4 kV AC (RMS), 5 kV DC]</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP02A-TOS</td>
<td>[cable length: 3.5 m, max. operating voltage: 4 kV AC (RMS), 5 kV DC]</td>
</tr>
</tbody>
</table>

*3: The optional Adaptor DD-5P/9P is required for the connection with TOS5300 Series
*4: This can not be used with TOS7200

### Remote Control Box

<table>
<thead>
<tr>
<th>RC01-TOS</th>
<th>[one-hand operation/dimensions: 200W x 70H x 39D mm] Accessory cable length: 1.5 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC02-TOS</td>
<td>[both-hands operation/dimensions: 330W x 70H x 39D mm] Accessory cable length: 1.5 m</td>
</tr>
</tbody>
</table>

*1: The optional Adaptor DD-SP9P is required for the connection with TOS7200.
*2: The optional Adaptor DD-SP9P is required for the connection with TOS5300 Series.

### Test Lead

<table>
<thead>
<tr>
<th>TL11-TOS</th>
<th>[cable length: 1.5 m, max. operating voltage: 5 kV]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL12-TOS</td>
<td>[cable length: 1.5 m, max. operating voltage: 60 A (for TOS6210)]</td>
</tr>
<tr>
<td>TL21-TOS</td>
<td>[cable length: 1.5 m (for TOS3200)]</td>
</tr>
<tr>
<td>TL31-TOS</td>
<td>[cable length: 1.5 m, max. operating voltage: 5 kV (for TOS5300 Series)]</td>
</tr>
<tr>
<td>TL32-TOS</td>
<td>[cable length: 3 m, max. operating voltage: 5 kV (for TOS5300 Series)]</td>
</tr>
<tr>
<td>HTL-2.5DH</td>
<td>[cable length: 1.5 m, max. operating voltage: 10 kV (for 149-10A)]</td>
</tr>
</tbody>
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### Remote Control Box

<table>
<thead>
<tr>
<th>RC01-TOS</th>
<th>[one-hand operation/dimensions: 200W x 70H x 39D mm] Accessory cable length: 1.5 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC02-TOS</td>
<td>[both-hands operation/dimensions: 330W x 70H x 39D mm] Accessory cable length: 1.5 m</td>
</tr>
</tbody>
</table>

*1: The optional Adaptor DD-SP9P is required for the connection with TOS7200.
*2: The optional Adaptor DD-SP9P is required for the connection with TOS5300 Series.
Buzzer Unit

- **BZ01-TOS (for 100V AC)**
  *This can not be used with TOS6200, TOS9200/9201, TOS7200*

- **PL01-TOS (for 100V AC)**
  *This can not be used with TOS6200, TOS9200/9201, TOS7200*

- **PL02-TOS (for 24V DC)**
  *for TOS9200/9201, TOS5300 Series*

Multi Outlet

- **OT01-TOS**
  (multi outlet for TOS3200)

Warning Light Unit

- **PL01-TOS (for 100V AC)**
  *for TOS9200/9201, TOS5300 Series*

Option

- **LP01-TOS**
  [cable length: 2 m/max. operating current: 30 A (for TOS6200)]

- **LP02-TOS**
  [cable length: 2 m/max. operating current: 60 A (for TOS6210)]

- **FP01-TOS**
  (flat probe for TOS3200)

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### Rack Mount Bracket

<table>
<thead>
<tr>
<th>Product Name</th>
<th>JIS Standard</th>
<th>ELA Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bracket Model No.</td>
<td>Bracket Model No.</td>
</tr>
<tr>
<td>TOS9201</td>
<td>KRB150-TOS</td>
<td>KRB3-TOS</td>
</tr>
<tr>
<td>TOS9213S</td>
<td>KRB150-TOS</td>
<td>KRB3-TOS</td>
</tr>
<tr>
<td>TOS9200</td>
<td>KRB150-TOS</td>
<td>KRB3-TOS</td>
</tr>
<tr>
<td>TOS9220</td>
<td>KRB100-TOS</td>
<td>KRB2-TOS</td>
</tr>
<tr>
<td>TOS9221</td>
<td>KRB100-TOS</td>
<td>KRB2-TOS</td>
</tr>
<tr>
<td>TOS8870A</td>
<td>KRB150-TOS</td>
<td>KRB3-TOS</td>
</tr>
<tr>
<td>TOS5302</td>
<td>KRA200-TOS</td>
<td>KRA4-TOS</td>
</tr>
<tr>
<td>TOS5301</td>
<td>KRA200-TOS</td>
<td>KRA4-TOS</td>
</tr>
<tr>
<td>TOS5300</td>
<td>KRA200-TOS</td>
<td>KRA4-TOS</td>
</tr>
<tr>
<td>TOS6200</td>
<td>KRB100-TOS</td>
<td>KRB2-TOS</td>
</tr>
<tr>
<td>TOS6210</td>
<td>KRB100-TOS</td>
<td>KRB2-TOS</td>
</tr>
<tr>
<td>TOS3200</td>
<td>KRB150-TOS</td>
<td>KRB3-TOS</td>
</tr>
</tbody>
</table>

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