

TOS9200 SERIES

Hipot Tester with Insulation Resistance Test

Perfect design for System Operation, introducing our top of the line of Hipot / Insulation Resistance Testers



TOS9201(AC/DC)
TOS9200(AC)



Capable of performing hipot and insulation testing in compliance with safety standards, including IEC, EN, VDE, BS, UL, CSA, JIS and the Electrical Application and Material Safety Law (Japan)

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.

- Rise-time control function
- Fall-time control function
- Offset cancel function
- Measured-value hold function
- Output voltage monitoring function
- Memory function
- Program function
- Interlock function
- DC discharge function



The Right Source For Your Test & Measurement Needs

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TOS9200 SERIES

Hipot Tester with Insulation Resistance Test

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.

*Maximum output of 50 W for up to 1 minute.

Insulation resistance testing at 25 V to 1000 V and 0.01 MΩ to 9.99 GΩ

The test voltage can be set to 25 V through 1000 V at a resolution of 1 V. Insulation resistance covers a wide measurement range from 0.01 MΩ to 9.99 GΩ *.

| Test voltage | Resistance measurement range |
|--------------|------------------------------|
| 25V | 0.03 MΩ to 500 MΩ |
| 50V | 0.05 MΩ to 1.00 GΩ |
| 100V | 0.10 MΩ to 2.00 GΩ |
| 125V | 0.13 MΩ to 2.50 GΩ |
| 250V | 0.25 MΩ to 5.00 GΩ |
| 500V | 0.50 MΩ to 9.99 GΩ |
| 1000V | 1.00 MΩ to 9.99 GΩ |

A single unit of the TOS9200/9201 is capable of handling all test voltages required by JIS C 1302 1994 (Insulation Resistor Meter) and fully meets the JIS requirements.

*At a maximum rated current of 1 mA to 50 nA.

Enhanced measurement accuracy

The TOS9200/9201 is provided with a digital voltmeter for hipot testing at an accuracy of $\pm(1\% \text{ of reading} + 30 \text{ V})$ and another one for insulation resistance testing at an accuracy of $\pm(1\% \text{ of reading} + 1 \text{ V})$. Measured values are displayed not only during a test, but while a program is being executed. A digital ammeter with an accuracy of $\pm(3\% \text{ of reading} + 20 \mu\text{A})$ is also provided for hipot testing. Kikusui's predecessors had the highest measurement resolution of about 1 mA, with an accuracy of $\pm 5\%$ 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 $\pm(3\% \text{ of reading} + 20 \mu\text{A})$, 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.

| Type | Display accuracy |
|---|---|
| Voltmeter for hipot testing | $\pm(1\% \text{ of reading} + 30\text{V})$ |
| Ammeter for hipot testing | $\pm(3\% \text{ of reading} + 20\mu\text{A})$ |
| Voltmeter for insulation resistance testing | $\pm(1\% \text{ of reading} + 1\text{V})$ |
| Insulation resistance meter | $\pm(2\% \text{ of reading})^*$ |

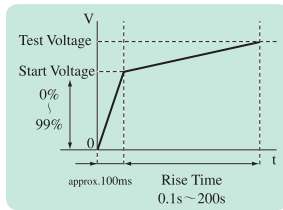
*At 1 μA < measured current \leq 1 mA



Diverse functions

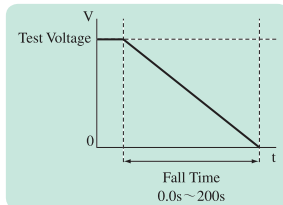
Rise-time control function

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 $\pm(10\%$ 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.

[Storable test conditions]

| | AC withstanding voltage testing | DC withstanding voltage testing | Insulation resistance testing |
|--|---------------------------------|---------------------------------|-------------------------------|
| Test voltage | ✓ | ✓ | ✓ |
| Test frequency | ✓ | | |
| Lower cutoff value | ✓ | ✓ | ✓ |
| ON/OFF of the lower judgment function | ✓ | ✓ | ✓ |
| Upper cutoff value | ✓ | ✓ | ✓ |
| ON/OFF of the upper judgment function | | | ✓ |
| ON/OFF of the offset function | ✓ | | |
| Test time and ON/OFF of the timer function | ✓ | ✓ | ✓ |
| Start voltage | ✓ | ✓ | |
| Voltage rise time | ✓ | ✓ | ✓ |
| Voltage fall time | ✓ | | |
| Judgment wait time | | ✓ | ✓ |
| Test voltage range | ✓ | | |
| SLOW/MID/FAST settings for the response filter | ✓ | | |
| FLOAT/GND of the LOW terminal | ✓ | ✓ | ✓ |
| HIGH/LOW/OPEN settings for the scanner channel | ✓ | ✓ | ✓ |
| ON/OFF of the contact check function | ✓ | ✓ | ✓ |

Program function

By coordinating 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]

| Step 00 | | Step 01 | | Step 02 | | END |
|---------|----------|---------|----------|---------|----------|-----|
| Memory | Interval | Memory | Interval | Memory | Interval | |
| ACW01 | 0.2s | DCW01 | 0.2s | IR01 | 0.2s | |

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.

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Hipot Tester with Insulation Resistance Test

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.



[SIGNAL I/O]

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

[Pin Configuration for the SIGNAL I/O Connector]



- 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.
- *1 2-digit BCD low active input Signal input terminal for selection between the panel memory for ACW, DCW, and IR, and the program memory for AUTO Memory recall by latching this selection signal at the rise of the strobe signal
- *2 2-bit low active input

| Test mode | ACW | DCW | IR | AUTO |
|-----------|-----|-----|----|------|
| MODE0 | H | L | H | L |
| MODE1 | H | H | L | L |

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/SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E1]



The Right Source For Your Test & Measurement Needs

Peripheral devices

High-voltage scanner TOS9220/TOS9221

TOS9221 Front View (same for TOS9220)



TOS9221

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.

*Pictures below are showing rear views of the units with cable clamp of output terminal removed.

TOS9221 Rear View

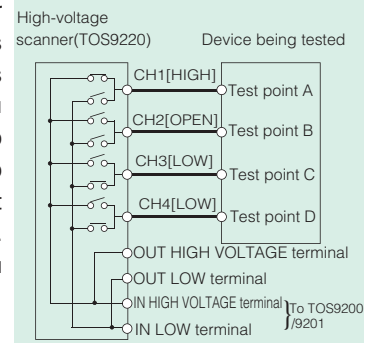


TOS9220 Rear View



Operation of the high-voltage scanner

On the TOS9200/TOS9201, you can select an electric potential mode for each channel—HIGH(high voltage side), LOW (low voltage side), and OPEN (open mode). The high-voltage scanner permits AC/DC hipot or insulation resistance tests on any of the four test points A to D. For instance, you can set CH1 (test point A) to HIGH, CH2 (test point B) to OPEN, and CH3 (test point C) to LOW, and CH4 (test point D) to LOW. To specify these settings, you can use the TOS9200/9201 panel or the GPIB/RS-232C.



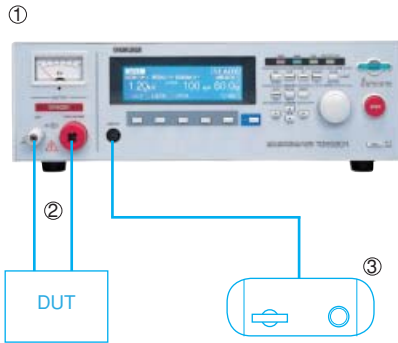
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TOS9200 SERIES

Hipot Tester with Insulation Resistance Test

For Stand alone use...

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

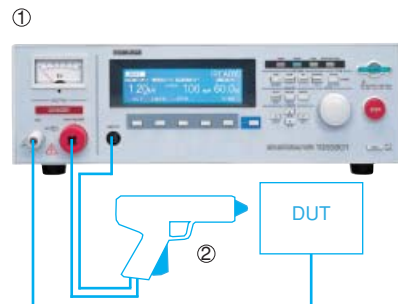


| Item | Model | cable length | Required numbers |
|--|-------------|--------------|------------------|
| ① Hipot / Insulation Resistance Tester AC/DC | TOS9201 | | 1 pc. |
| ② High-Voltage Test Lead | TL01-TOS | 1.5m *1 | 1 set |
| ③ Remote Control Box | RC01-TOS *2 | 1.5m | 1 pc. |

*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.

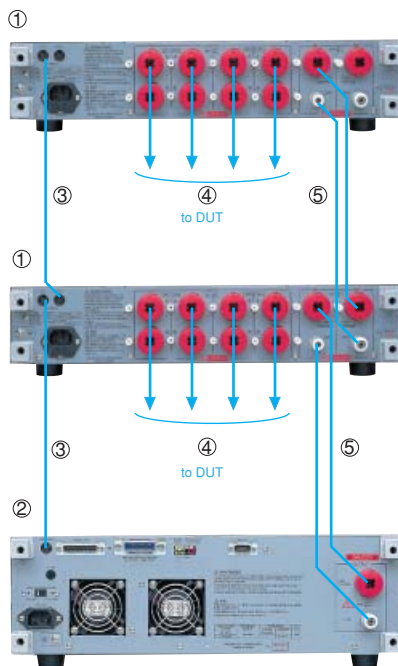


| Item | Model | cable length | Required numbers |
|--|-----------|--------------|------------------|
| ① Hipot / Insulation Resistance Tester AC/DC | TOS9201 | | 1 pc. |
| ② High-Voltage Test Lead | HP01A-TOS | 1.5m *1 | 1 pc. |

*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)



| Item | Model | cable length | Required numbers |
|--|------------|--------------|------------------|
| 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: Also available for 2m cable, DD2M-8P

*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 |

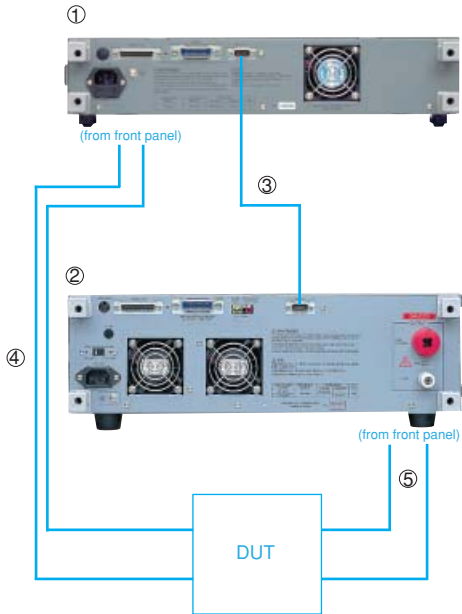
[CAUTION] In case of using more than 2sets of High Voltage Scanner, it is required to rack mount or locate these units to the side of Hipot / Insulation Resistance Tester, and it should not be piled up more than 2sets of High Voltage Scanner units.

TOS9200 SERIES

Hipot Tester with Insulation Resistance Test

Single process to apply until ground bond test...

Example of system consisting TOS9201 and TOS6210



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

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

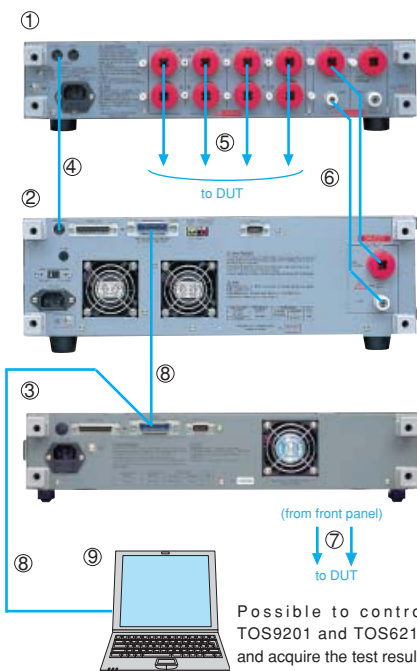
[Rack mount bracket]

| | | |
|----------------|-------|------------|
| TOS9200 / 9201 | (JIS) | KRB150-TOS |
| | (EIA) | KRB3-TOS |
| TOS6210 / 6200 | (JIS) | KRB100-TOS |
| | (EIA) | KRB2-TOS |

It is capable to perform for hipot / Insulation Resistance and Ground bond testing in one single process by controlling TOS6210 from TOS9201.

Fully Automated System by PC...

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



| Item | Model | cable length | Required numbers |
|--|------------|--------------|------------------|
| ① High-Voltage Scanner | TOS9221 | | 1 pc. |
| ② Hipot / Insulation Resistance Tester AC/DC | TOS9201 | | 1 pc. |
| ③ Ground Bond Tester | TOS6210 | | 1 pc. |
| ④ Interface cable | 85-50-0210 | 0.5m *1 | 1 pc. |
| ⑤ High-Voltage Test Lead (red) | TL07-TOS | 1.5m | 4 pc. |
| ⑥ High-Voltage Leads for Parallel connection | TL06-TOS | 0.5m *2 | 1 set |
| ⑦ Low-Voltage Test Lead | TL12-TOS | 1.5m | 1 set |
| ⑧ GPIB Cable | 408J-102 | 2m *3 | 2 pc. |
| ⑨ PC (with GPIB Interface cable) | | | 1 pc. |

*1: Also available for 2m cable, DD2M-8P

*2: Also available for 1.5m cable, TL04-TOS

*3: Also available for 1m cable, 408J-101 and 4m cable, 408J-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.

TOS9200 SERIES

Hipot Tester with Insulation Resistance Test

Hipot test mode

| Item | TOS9200 | TOS9201 | |
|------------------------------------|--|--|--|
| Output section | | | |
| AC | Output-voltage range | 0.05 kV to 5.00 kV AC | |
| | Resolution | 10 V | |
| | Accuracy | ±(1.5% of setting + 20 V) [with no load] | |
| | Maximum rated load (*1) | 500 VA (5 kV/100 mA) | |
| | Maximum rated current | 100 mA [output voltage of 0.2 kV or more] | |
| | Transformer capacity | 500 VA | |
| | Output-voltage waveform(*2) | Sine wave | |
| | Distortion | 2% or less [with no load or pure resistive load at output voltage of 0.5 kV or more applied] | |
| | Frequency | 50 Hz/60 Hz | |
| | Accuracy | ±0.1% | |
| | Voltage regulation | ±3% or less [maximum rated load → no load] | |
| | Short-circuit current | 200 mA or more, 350 mA or less [at output voltage of 0.5 kV or more] | |
| | Type of output | PWM switching | |
| DC | Output-voltage range | 0.05 kV to 6.00 kV DC | |
| | Resolution | 10 V | |
| | Accuracy | ±(1.5% of the setting + 20 V) | |
| | Maximum rated load (*1) | 50 W (5 kV/10 mA) | |
| | Maximum rated current | 10 mA | |
| | Ripple | 50 Vp-p Typ. | |
| | Maximum rated load | 150 Vp-p Typ. | |
| | Voltage regulation | 1% or less [maximum rated load → no load] | |
| | Short-circuit current | 40 mA Typ. | |
| | Discharge function | Forced discharge at the end of test(discharge resistance: 125 kΩ) | |
| 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 | | | |
| Analog | Scale | 6 kV AC/DC F.S | |
| | Accuracy | ±5% F.S | |
| | Indicator | Mean-value responsive/root-mean-square value scale | |
| Digital | Measurement range | 0.0 kV to 6.00 kV AC/DC | |
| | Resolution | 10 V | |
| | Accuracy | ±(1.0% of the reading + 30 V) | |
| | Response | Mean-value responsive/root-mean-square value display (response time of 200 ms) | |
| | HOLD function | The voltage measured at the end of test is held during the PASS and FAIL judgment time period. | |

*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)]

| Ambient temperature | Upper current | Pause Time | Output time |
|---------------------|---------------|-----------------|---|
| t ≤ 40 °C | AC | 50 < i ≤ 110 mA | At least as long as the output time |
| | | i ≤ 50 mA | Maximum of 30 minutes |
| | DC | 5 < i ≤ 11 mA | Not necessary |
| | | i ≤ 5 mA | At least as long as the judgement wait time (WAIT TIME) |
| | | | Continuous output possible |

*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.

| Item | TOS9200 | TOS9201 |
|---|--|--|
| Ammeter(*3) | | |
| Measurement range | 0.00 mA to 110 mA AC | 0.00 mA to 110 mA AC/0.00 mA to 11 mA DC |
| Display | i < 1 mA □ □ □ μA | 1 mA ≤ i < 10 mA □ □ □ mA |
| Accuracy | 10 mA ≤ i < 100 mA □ □ □ mA | 100 mA ≤ i □ □ □ mA |
| Response | i = measured current | |
| Hold function | ±(3% of the reading + 20 μA) [after the offset cancel function is activated, if the scanner is mounted] | |
| Offset cancel function | Mean-value responsive / root-mean-square value display (response time of 200 ms) | |
| Calibration | The measured current at the end of the test is held during the PASS judgment time period. | |
| Selection of LOW/GUARD for the GND (*4) | 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). | |
| | LOW | Performs calibration using the root-mean-square value of a sine wave with a pure resistive load |
| | GUARD | Selection permitted for current measurement between the mode for the GND point connected to the LOW terminal, and the mode using guard. |
| | | Connects the GND point to the LOW terminal. Measures the current flowing to the LOW terminal (chassis) (for normal operation). |
| | | 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). |
| Time | | |
| Setting range for the voltage rise time (RISE TIME) | 0.1 s to 200 s | |
| Setting range for the voltage fall time (FALL TIME) | 0 s to 200 s (Valid only with PASS judgement) | 0 s to 200 s (Valid only with PASS judgement in AC hipot testing) |
| Setting range for the test time (TEST TIME) | 0.3 s to 999 s With the TIMER OFF function | |
| Setting range for the judgement wait time (WAIT TIME) | | 0.3 s to 10 s (Only for DC hipot testing) (RISE TIME + TEST TIME > WAIT TIME) |
| Accuracy | ± (100 ppm + 20 ms) | |



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TOS9200 SERIES

Hipot Tester with Insulation Resistance Test

| Item | TOS9200 | TOS9201 | | | |
|-------------------------|------------|--|--|--------|---------------------------|
| Judgement function | | | | | |
| Judgement method/action | Judgement | Judgement method | Display | Buzzer | SIGNAL I/O |
| | UPPER FAIL | When the tester detects a current exceeding the upper current, it cuts off the output and makes an UPPER FAIL judgement. In DC hipot testing, however, no judgement is made until the judgement wait time (WIT TIME) has elapsed. | The FAIL LED lights up. Displayed on the LCD | ON | Outputs the U FAIL signal |
| | LOWER FAIL | 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. | The FAIL LED lights up. Displayed on the LCD | ON | Outputs the L FAIL signal |
| | PASS | When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement. | The PASS LED lights up. Displayed on the LCD | ON | Outputs the PASS signal |

- 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 signal and the LOWER FAIL signal 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 | 0.01 mA to 110 mA AC / 0.01 mA to 11 mA DC |
| Setting range for the lower current (LOWER) | 0.01 mA to 110 mA AC (With the LOWER OFF function) | 0.01 mA to 110 mA AC / 0.01 mA to 11 mA DC (With the LOWER OFF function) |
| Judgement accuracy (*3) | $\pm(3\% \text{ of setting} + 20 \mu\text{A})$ [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). | |

*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 $\mu\text{A}/\text{kV}$ 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 stray capacity is negligible. If the offset cancel function is used, the current flowing into the stray capacity can be eliminated from the measurement.

| Output voltage | 1kV | 2kV | 3kV | 4kV | 5kV |
|--|------------------|------------------|------------------|------------------|-------------------|
| Hanging a 350-mm test lead wire (Typ. value) | 2 μA | 4 μA | 6 μA | 8 μA | 10 μA |
| Using the accessory leadwire TL01-TOS (Typ. value) | 16 μA | 32 μA | 48 μA | 64 μA | 80 μA |
| High-voltage scanner (Typ. value, not including the test leadwire) | 22 μA | 44 μA | 66 μA | 88 μA | 110 μA |

*4 With the GND 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.

Insulation Resistance Testing Mode

| Item | TOS9200 | TOS9201 |
|------------------------------------|--|---------|
| Output section | | |
| Output-voltage range | -25 V to -1000 V DC | |
| Resolution | 1 V | |
| Setting accuracy | $\pm(1.5\% \text{ of Setting} + 2 \text{ V})$ | |
| Maximum rated load | 1 W (-1000 V DC/1 mA) | |
| Maximum rated current | 1 mA | |
| Ripple | 2 V _{p-p} or less | |
| 1 kV no-load | 10 V _{p-p} or less | |
| Maximum rated load | 10 V _{p-p} 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 k Ω) | |
| Output-voltage monitoring function | If the output voltage exceeds $\pm(10\% \text{ of the setting} + 50 \text{ V})$, output is cut off and the protection function activates. | |

| Voltmeter | | |
|-----------|-------------------|--|
| Analog | Scale | 6 kV AC/DC F.S |
| | Accuracy | $\pm 5\% \text{ F.S}$ |
| | Indicator | Mean-value responsive / root-mean-square value scale |
| Digital | Measurement range | 0 V to -1200 V |
| | Resolution | 1 V |
| | Accuracy | $\pm(1\% \text{ of reading} + 1 \text{ V})$ |

| Resistance meter | | | | |
|-------------------|---|--|---|--|
| Measurement range | 0.01 M Ω - 9.99 G Ω (Within the maximum rated current range of 1 mA to 50 nA) | | | |
| Display | R < 10.0 M Ω | 10.0M Ω ≤ R < 100.0M Ω | 100.0M Ω ≤ R < 1.00G Ω | 1.00G Ω ≤ R ≤ 9.99G Ω |
| | $\square.\square\square \text{ M}\Omega$ | $\square\square.\square \text{ M}\Omega$ | $\square\square\square \text{ M}\Omega$ | $\square.\square\square \text{ G}\Omega$ |

| | | | | | |
|--|--------------------------------|--------------------------------|-------------------------------|-------------------------------|----------------------|
| Accuracy | 50 nA ≤ i ≤ 100 nA | 100 nA < i ≤ 200 nA | 200 nA < i ≤ 1 μA | 1 μA < i ≤ 1 mA | i = measured current |
| | $\pm(20\% \text{ of reading})$ | $\pm(10\% \text{ of reading})$ | $\pm(5\% \text{ of reading})$ | $\pm(2\% \text{ of reading})$ | |
| [In the humidity range of 20 %rh to 70 %rh (no condensation), with no disturbance such as swinging of the test leadwire] | | | | | |

| | | | | | |
|---|---|--|--|--|--|
| Hold function | The measured current at the end of the test is held during the PASS period. | | | | |
| Selection of LOW/GUARD for the GND (*5) | LOW | Connects the GND point to the LOW terminal. Measures the current flowing to the LOW terminal (chassis) (for normal operation). | | | |
| | GUARD | 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). | | | |

TOS9200 SERIES

Hipot Tester with Insulation Resistance Test

| Item | TOS9200 | TOS9201 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|-------------------------------|-----------------------------|-----------------------------|------------------|-----------------|---|--|----|---------------------------|-----------------------------|---|--|----|-----------------------------|-------------------|--|--|-----------------------------|-------------------------|---|------------------------------|-----------------------------|-----------------------------|---------------------|------------------------------|------------------------------|-----------------------------|-----------------------------|----------------------|------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------|-------------------------------|------------------------------|-----------------------------|---|-----------------------|-------------------------------|-------------------------------|-----------------------------|---|--|-----------------------|-------------------------------|-------------------------------|---|
| Judgement function | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Judgement method/action | <table border="1"> <thead> <tr> <th>Judgement</th> <th>Judgement method</th> <th>Display</th> <th>Buzzer</th> <th>SIGNAL I/O</th> </tr> </thead> <tbody> <tr> <td>UPPER FAIL</td> <td>When the tester detects a resistance exceeding the upper cutoff resistance, it cuts off the output and makes an UPPER FAIL judgement. However, no judgement is made during a voltage rise time (RISE TIME).</td> <td>The FAIL LED lights up. Displayed on the LCD</td> <td>ON</td> <td>Outputs the U FAIL signal</td> </tr> <tr> <td>LOWER FAIL</td> <td>When the tester detects a resistance below the lower cutoff resistance, it cuts off the output and makes a LOWER FAIL judgement. However, no judgement is made until the judgement wait time (WAIT TIME) has elapsed.</td> <td>The FAIL LED lights up. Displayed on the LCD</td> <td>ON</td> <td>Outputs the L 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>ON</td> <td>Outputs the PASS signal</td> </tr> </tbody> </table> | Judgement | Judgement method | Display | Buzzer | SIGNAL I/O | UPPER FAIL | When the tester detects a resistance exceeding the upper cutoff resistance, it cuts off the output and makes an UPPER FAIL judgement. However, no judgement is made during a voltage rise time (RISE TIME). | The FAIL LED lights up. Displayed on the LCD | ON | Outputs the U FAIL signal | LOWER FAIL | When the tester detects a resistance below the lower cutoff resistance, it cuts off the output and makes a LOWER FAIL judgement. However, no judgement is made until the judgement wait time (WAIT TIME) has elapsed. | The FAIL LED lights up. Displayed on the LCD | ON | Outputs the L FAIL signal | PASS | When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement. | The PASS LED lights up. Displayed on the LCD | ON | Outputs the PASS signal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Judgement | Judgement method | Display | Buzzer | SIGNAL I/O | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| UPPER FAIL | When the tester detects a resistance exceeding the upper cutoff resistance, it cuts off the output and makes an UPPER FAIL judgement. However, no judgement is made during a voltage rise time (RISE TIME). | The FAIL LED lights up. Displayed on the LCD | ON | Outputs the U FAIL signal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LOWER FAIL | When the tester detects a resistance below the lower cutoff resistance, it cuts off the output and makes a LOWER FAIL judgement. However, no judgement is made until the judgement wait time (WAIT TIME) has elapsed. | The FAIL LED lights up. Displayed on the LCD | ON | Outputs the L FAIL signal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PASS | When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement. | The PASS LED lights up. Displayed on the LCD | ON | Outputs the PASS signal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | <ul style="list-style-type: none"> 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 signal and the LOWER FAIL signal 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 resistance (UPPER) | 0.01 MΩ to 9.99 GΩ [Below the maximum rated current] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Setting range for the lower resistance (LOWER) | 0.01 MΩ to 9.99 GΩ [Below the maximum rated current] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Judgement accuracy For both UPPER and LOWER | <table border="1"> <thead> <tr> <th>Judgement current</th> <th>50 nA ≤ i ≤ 100 nA</th> <th>100 nA < i ≤ 200 nA</th> <th>200nA < i ≤ 1 μA</th> <th>1 μA < i ≤ 1 mA</th> </tr> </thead> <tbody> <tr> <td rowspan="8">UPPER, LOWER</td> <td>0.01 ≤ R < 10.0 MΩ</td> <td>—</td> <td>—</td> <td>± (2 % of setting + 3digit)</td> </tr> <tr> <td>10.0 ≤ R < 50.0 MΩ</td> <td>—</td> <td>—</td> <td>± (5 % of setting + 5digit)</td> </tr> <tr> <td>50.0 ≤ R < 100 MΩ</td> <td>—</td> <td>—</td> <td>± (5 % of setting + 5digit)</td> </tr> <tr> <td>100 MΩ ≤ R < 200 MΩ</td> <td>—</td> <td>± (10 % of setting + 5digit)</td> <td>± (5 % of setting + 5digit)</td> <td>± (2 % of setting + 3digit)</td> </tr> <tr> <td>200 MΩ ≤ R < 500 MΩ</td> <td>± (20 % of setting + 5digit)</td> <td>± (10 % of setting + 5digit)</td> <td>± (5 % of setting + 5digit)</td> <td>± (2 % of setting + 3digit)</td> </tr> <tr> <td>500 MΩ ≤ R < 1.00 GΩ</td> <td>± (20 % of setting + 5digit)</td> <td>± (10 % of setting + 5digit)</td> <td>± (5 % of setting + 5digit)</td> <td>± (2 % of setting + 3digit)</td> </tr> <tr> <td>1.00 GΩ ≤ R < 2.00 GΩ</td> <td>± (20 % of setting + 10digit)</td> <td>± (10 % of setting + 5digit)</td> <td>± (5 % of setting + 5digit)</td> <td>—</td> </tr> <tr> <td>2.00 GΩ ≤ R < 5.00 GΩ</td> <td>± (20 % of setting + 20digit)</td> <td>± (10 % of setting + 10digit)</td> <td>± (5 % of setting + 5digit)</td> <td>—</td> </tr> <tr> <td></td> <td>5.00 GΩ ≤ R < 10.0 GΩ</td> <td>± (20 % of setting + 20digit)</td> <td>± (10 % of setting + 10digit)</td> <td>—</td> </tr> </tbody> </table> <p>Judgement current = test voltage/(UPPER,LOWER) [In the humidity range of 20 %rh to 70 %rh (no condensation), with no disturbance such as swinging of the test leadwire] [In LOWER judgement, at least 0.5 s is necessary for testing after the WAIT TIME has elapsed. In LOWER judgement for 200 nA or lower, a wait time of at least 1.0 s is necessary.]</p> | | Judgement current | 50 nA ≤ i ≤ 100 nA | 100 nA < i ≤ 200 nA | 200nA < i ≤ 1 μA | 1 μA < i ≤ 1 mA | UPPER, LOWER | 0.01 ≤ R < 10.0 MΩ | — | — | ± (2 % of setting + 3digit) | 10.0 ≤ R < 50.0 MΩ | — | — | ± (5 % of setting + 5digit) | 50.0 ≤ R < 100 MΩ | — | — | ± (5 % of setting + 5digit) | 100 MΩ ≤ R < 200 MΩ | — | ± (10 % of setting + 5digit) | ± (5 % of setting + 5digit) | ± (2 % of setting + 3digit) | 200 MΩ ≤ R < 500 MΩ | ± (20 % of setting + 5digit) | ± (10 % of setting + 5digit) | ± (5 % of setting + 5digit) | ± (2 % of setting + 3digit) | 500 MΩ ≤ R < 1.00 GΩ | ± (20 % of setting + 5digit) | ± (10 % of setting + 5digit) | ± (5 % of setting + 5digit) | ± (2 % of setting + 3digit) | 1.00 GΩ ≤ R < 2.00 GΩ | ± (20 % of setting + 10digit) | ± (10 % of setting + 5digit) | ± (5 % of setting + 5digit) | — | 2.00 GΩ ≤ R < 5.00 GΩ | ± (20 % of setting + 20digit) | ± (10 % of setting + 10digit) | ± (5 % of setting + 5digit) | — | | 5.00 GΩ ≤ R < 10.0 GΩ | ± (20 % of setting + 20digit) | ± (10 % of setting + 10digit) | — |
| Judgement current | 50 nA ≤ i ≤ 100 nA | 100 nA < i ≤ 200 nA | 200nA < i ≤ 1 μA | 1 μA < i ≤ 1 mA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| UPPER, LOWER | 0.01 ≤ R < 10.0 MΩ | — | — | ± (2 % of setting + 3digit) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 10.0 ≤ R < 50.0 MΩ | — | — | ± (5 % of setting + 5digit) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 50.0 ≤ R < 100 MΩ | — | — | ± (5 % of setting + 5digit) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 100 MΩ ≤ R < 200 MΩ | — | ± (10 % of setting + 5digit) | ± (5 % of setting + 5digit) | ± (2 % of setting + 3digit) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 200 MΩ ≤ R < 500 MΩ | ± (20 % of setting + 5digit) | ± (10 % of setting + 5digit) | ± (5 % of setting + 5digit) | ± (2 % of setting + 3digit) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 500 MΩ ≤ R < 1.00 GΩ | ± (20 % of setting + 5digit) | ± (10 % of setting + 5digit) | ± (5 % of setting + 5digit) | ± (2 % of setting + 3digit) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1.00 GΩ ≤ R < 2.00 GΩ | ± (20 % of setting + 10digit) | ± (10 % of setting + 5digit) | ± (5 % of setting + 5digit) | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2.00 GΩ ≤ R < 5.00 GΩ | ± (20 % of setting + 20digit) | ± (10 % of setting + 10digit) | ± (5 % of setting + 5digit) | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5.00 GΩ ≤ R < 10.0 GΩ | ± (20 % of setting + 20digit) | ± (10 % of setting + 10digit) | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Time | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Setting range for the voltage rise time (RISE TIME) | 0.1 s to 200 s | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Setting range for the test time (TEST TIME) | 0.5 s to 999 s With the TIMER OFF function | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Setting range for the judgement wait time (WAIT TIME) | 0.3 s to 10 s [RISE TIME + TEST TIME > WAIT TIME] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Accuracy | ± (100 ppm + 20 ms) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *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. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| General Specifications | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Item | TOS9200 | TOS9201 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Environment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Installation location | Indoors at an altitude of 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) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Power requirements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nominal voltage range (Allowable voltage range) | 100 V to 120 V AC / 200 V to 240 V AC (85 V to 130 V AC / 170 V to 250 V AC) Selectable | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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) (*6) | Conforms to the requirements of the following directive and standard. EMC Directive 89/336/EEC, 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 (*6,7) | Conforms to the requirements of the following directive and standard. Low Voltage Directive 73/23/EEC, 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

TOS9200 SERIES

Hipot Tester with Insulation Resistance Test

| Item | TOS9200 | TOS9201 |
|--|---|---------|
| Accessory | | |
| AC Power cable | 1 pc. | |
| High-voltage test lead wire TL01-TOS (1.5 m) | 1 set | |
| Interlock jumper | 1 pc. | |
| High-Voltage Danger seal | 1 sheet | |
| Fuse | 1 pc. | |
| Operation Manual | Operation Manual for Tester: 1 copy, Operation for GPIB/RS-232C Interface: 1 copy | |

*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.

Electrical performance

| Item | TOS9200 | TOS9201 |
|---|--|--|
| Maximum rating voltage | AC DC | 5.0 kV 6.0 kV |
| Number of channels | 4 (Each channel is settable to HIGH, LOW, or OPEN.) | |
| Maximum number of scanners connected | 4 scanners, Channel numbers are determined in order of connection to the TOS9200/9201 tester. 1 st scanner CH1 to CH4 2 nd scanner CH5 to CH8 3 rd scanner CH9 to CH12 4 th scanner CH13 to CH16 | |
| Contact check function | None (*1) | Provided |
| Lamps and LEDs | POWER DANGER CHANNEL | Lights as it is interlocked with the POWER switch of the TOS9200/9201 tester Lights as it is interlocked with the DANGER lamp of the TOS9200/9201 tester Lights during a test at each channel HIGH: red; LOW: green; Under contact check: orange |
| Power requirements | | |
| Nominal voltage range (allowable voltage range) | 100 V to 120 V AC/200 V to 240 V AC (85 V to 132 V AC/170 V to 250 V AC) Automatic switching | |
| Power consumption | In READY state During test | Approx. 12 VA 40 VA maximum |
| Allowable frequency range | 47 Hz to 63 Hz | |
| Insulation resistance | 30 M Ω or more (500 V DC) [between the AC LINE and chassis] | |
| Hipot | 1390 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 89/336/EEC, 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 73/23/EEC, 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 × 88(105)H × 370(415)Dmm | |
| Weight | Approx. 6.5 kg | |

Accessories

| | | |
|--|--|--------------------|
| AC power cable | 1 pc. | |
| High-voltage test leadwires, 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 | |

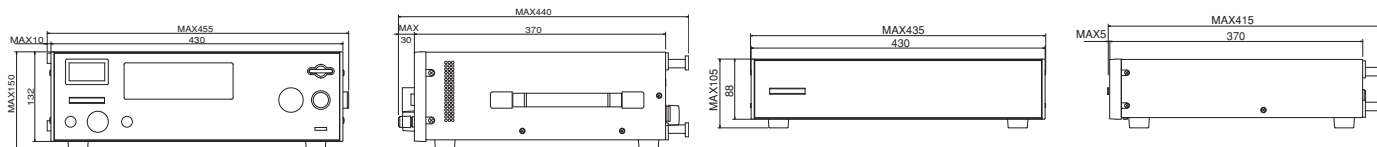
*2 Only on models that have CE marking on the panel. Not applicable to custom order models.

*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.

[Measurement accuracy achieved when the scanner and the TOS9220/9201 tester are connected]

In an AC hipot test, a current of approx. 22 μ A/kV flows per scanner due to stray capacitance in the scanner in comparison with use of the TOS9220/9201 tester alone. Note that this current may contribute to errors in current measurements conducted by the TOS9220/9201 tester.

External dimensional diagrams



Unit: mm

TOS5101

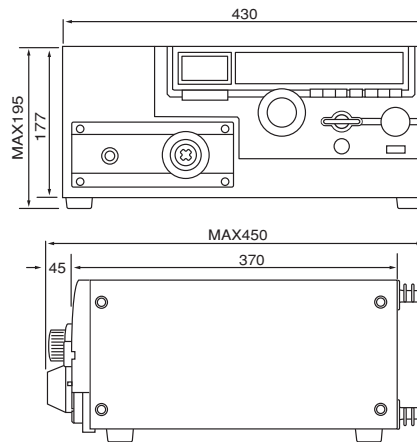
Hipot Tester

| | |
|---|---|
| Output block | |
| Applied Voltage | 0 to 5/ 0 to 10 kV AC and DC |
| AC | |
| Maximum Rated*1 | 500VA / 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 | 50W / 10 kV, 5 mA |
| Ripple | 100 Vp-p typ. at 10 kV, no load 200 Vp-p typ. at max. rated output |
| Maximum Rated*1 | Max. 3% (for max. rated load to no load) |
| Output Voltmeters | |
| Analog | |
| Scale | 10 kV full scale , AC/DC |
| Class | JIS Class 2.5 |
| Accuracy | ±5% of full scale |
| AC Indication | Mean value response / rms value scale |
| 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% + 20µA) 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 |
| Lower cutoff current setting range | AC: 0.1 to 55 mA DC: 0.1 to 5.5 mA |
| Judgement Accuracy | ±(5% of upper cutoff current + 20µA) |
| 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 | 100V±10%, 50/60 Hz (Nominal voltages of 110V, 120V, 220V, 230V and 240V 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) | Conforms to the requirements of the following directive and standard.*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. |

| | |
|------------------------------------|---|
| Safety | Conforms to the requirements of the following directive and standard. *2,4 Low Voltage Directive 73/23/EEC EN61010-1 Class I Pollution degree 2 |
| Insulation resistance | 30 M Ω or more (500 V DC) |
| Hipot | 1390 VAC, 2 seconds [between the AC LINE and chassis] 1200 VAC, 1 second [UL-approved products only] |
| Environment | Specification range : 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 |
| Dimensions (MAX) | 430W × 177(195)H × 370(450)Dmm |
| Weight | |
| for line voltage of 100 V | Approx. 21 kg |
| for line voltage of 100 V to 120 V | Approx. 23 kg |
| for line voltage of 220 V to 240 V | Approx. 24 kg |
| Accessories | |
| High-voltage test lead | TL01-TOS (max.allowablevoltage: 5 kV /1.5m) TL03-TOS (max.allowablevoltage: 10 kV /1.5m) |
| Others | 14-pin amphenol plug (assembled) |

- *1: Continuous output time may be limited depending on current high limit reference value and ambient temperature.
*2: Only on models that have CE marking on the panel. Not applicable to custom order models.
*3: 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



Unit: mm

