

TOS SERIES SELECTION GUIDE

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.

Hipot Tester with Insulation Resistance Test






Hipot Tester

High-End

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

TOS9201 P.62

ACW 5 kV/100 mA(500 VA)
DCW 6 kV/10 mA
IR 0.01 MΩ to 9.99 GΩ (DC-25 V to -1000 V)






CE

D 430(16.93")W × 132(5.2")H × 370(14.57")Dmm
W 19kg(41.89 lbs)

TOS9200 P.62

ACW 5 kV/100 mA(500 VA)
IR 0.01 MΩ to 9.99 GΩ (DC-25 V to -1000 V)



CE

D 430(16.93")W × 132(5.2")H × 370(14.57")Dmm
W 19kg(41.89 lbs)

TOS9220/9221 P.65

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



CE





D 430(16.93")W × 88(3.47")H × 370(14.57")Dmm
W 6.5kg(14.33 lbs)

Standard

Standard type suitable for production and inspection lines

TOS5302 P.70

ACW 5 kV/100 mA(500 VA)
IR 0.03 MΩ to 5 GΩ (DC-25 V to -1000 V)







CE

D 320(12.60")W × 132(5.2")H × 350(13.78")Dmm
W 14 kg(30.9 lbs)

TOS5301 P.70

ACW 5 kV/100 mA(500 VA)
DCW 6 kV/10 mA(50 W)



CE

D 320(12.60")W × 132(5.2")H × 350(13.78")Dmm
W 15 kg(33.1 lbs)

TOS5300 P.70

ACW 5 kV/100 mA(500 VA)



CE

D 320(12.60")W × 132(5.2")H × 350(13.78")Dmm
W 14 kg(30.9 lbs)

Costsaving

Low-cost type

TOS5200 P.75

ACW 5 kV/100 mA(500 VA)



CE

D 320(12.60")W × 132(5.2")H × 350(13.78")Dmm
W 14 kg(30.9 lbs)

Ground Bond Tester

TOS6210 P.76

0.001 Ω to 0.600 Ω (6 A to 60 A)










CE

D 430(16.93")W × 88(3.47")H × 270(10.63")Dmm
W 11kg(24.25 lbs)

TOS6200 P.76

0.001 Ω to 1.200 Ω (3 A to 30 A)



CE

D 430(16.93")W × 88(3.47")H × 270(10.63")Dmm
W 9kg(19.84 lbs)







Options

- Remote Control Box
- Test Probe
- Test Lead
- Warning Light Unit
- Buzzer Unit
- Load resistor for calibration of a Hipot Tester



 P.80

- ACW** Max. output-voltage of AC hipot testing
DCW Max. output-voltage of DC hipot testing
IR Measurement range of insulation resistance testing
D Dimensions
W Weight

-  Equipped with rise time control function
 Equipped with fall time control function
 Equipped with GPIB interface as standard
 Equipped with RS-232C interface as standard
 Equipped with USB interface as standard
 Equipped with timer function

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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.

Hipot Tester with Insulation Resistance Test

TOS9200/9201



TOS9200(AC)



TOS9201(AC/DC)

Dimensions / Weight

TOS9201/9200 :430(16.93")W × 132(5.2")H × 370(14.57")Dmm /
19kg(41.89 lbs)

Accessories

AC Power cable, High-voltage test lead wire TL01-TOS (1.5 m), Interlock jumper, High-Voltage Danger seal, Fuse, Operation Manual(Operation Manual for Tester, Operation for GPIB/RS-232C Interface)

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-

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.

Features

- 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

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*.

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.

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

■ 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.

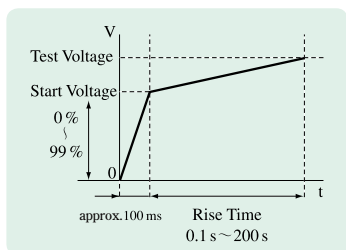
Type	Display accuracy
Voltmeter for hipot testing	$\pm(1\% \text{ of reading} + 30 \text{ V})$
Ammeter for hipot testing	$\pm(3\% \text{ of reading} + 20 \mu\text{A})$
Voltmeter for insulation resistance testing	$\pm(1\% \text{ of reading} + 1 \text{ V})$
Insulation resistance meter	$\pm(2\% \text{ of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

*At $1 \mu\text{A} < \text{measured current} \leq 1 \text{ mA}$

Diverse functions

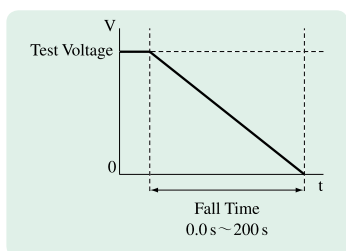
■ Rise-time control function

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 $\pm(10\% \text{ of setting} + 50 \text{ V})$, 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 Hipot testing	DC Hipot 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, 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.

High-voltage scanner

TOS9220/9221

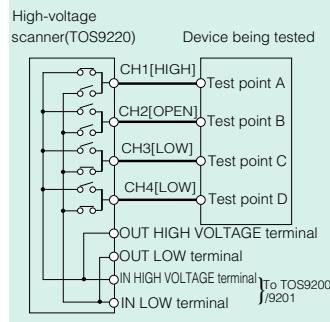


TOS9220 (same for TOS9221)

Functions

■ 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. To specify these settings, you can use the TOS9200/9201 panel or the GPIB/RS-232C.



Extended features of TOS9200/9201 for multi-channel Testing Application

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 TOS9221 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.

Dimensions / Weight

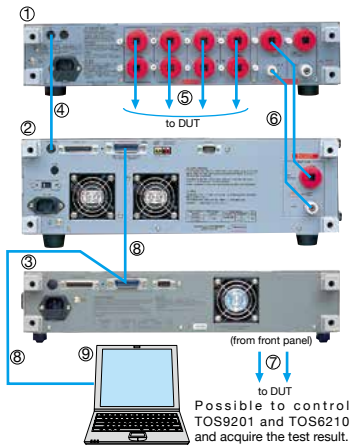
TOS9220/9221 : 430(16.93")W × 88(3.47")H × 370(14.57")Dmm
/ 6.5kg(14.33 lbs)

Accessories

AC power cable, High-voltage test leadwires, red (1.5 m each), High-voltage leads for parallel connection(0.5 m each), Interface cable(0.5 m), Channel-indication stickers(For the panel face, for the test leadwires), “HIGH VOLTAGE, DANGER” stickers, Fuses, Operation Manual

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	0.5 m *1	1 pc.
⑤ High-Voltage Test Lead (red)	TL07-TOS	1.5 m	4 pc.
⑥ High-Voltage Leads for Parallel connection	TL06-TOS	0.5 m *2	1 set
⑦ Low-Voltage Test Lead	TL12-TOS	1.5 m	1 set
⑧ GPIB Cable	408J-102	2 m *3	2 pc.
⑨ PC (with GPIB Interface cable)			1 pc.

*1: If the length of cable is required more than 0.5 m, please contact with our local distributor.

*2: Also available for 1.5 m(59.06 lbs) cable, TL04-TOS

*3: Also available for 1 m(39.37 lbs) cable, 408J-101 and 4 m cable, 408J-104

[Rack mount bracket]

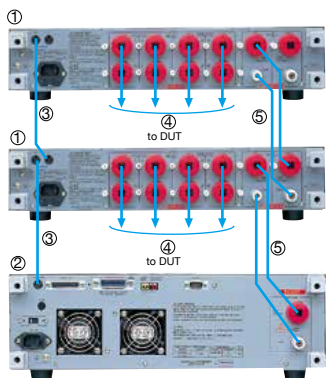
TOS9200 / 9201 (JIS) KRB150-TOS (EIA) KRB3-TOS

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

[CAUTION] In case of use for combining more than 2 sets 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 2 sets of High Voltage Scanner units.

For Multiple Channel Testing by High Voltage Scanner...

Example of system consisting TOS9201 and TOS9221 X 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	0.5 m *1	2 pc.
④ High-Voltage Test Lead (red)	TL07-TOS	1.5 m	8 pc.
⑤ High-Voltage Leads for Parallel connection	TL06-TOS	0.5 m *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 1.5 m(59.06 lbs) 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 2 sets 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 2 sets of High Voltage Scanner units.

TOS9200 Series Specifications

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	No load at 5 kV	—	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
$t \leq 40^\circ\text{C}$	AC	$50 < i \leq 110 \text{ mA}$	At least as long as the output time	Maximum of 30 minutes
		$i \leq 50 \text{ mA}$	Not necessary	Continuous output possible
	DC	$5 < i \leq 11 \text{ mA}$	At least as long as the output time	Maximum of 1 minute
		$i \leq 5 \text{ mA}$	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 					
Measurement range	0.00 mA to 110 mA AC			0.00 mA to 110 mA AC/0.00 mA to 11 mA DC	
Display	<div><div>i < 1 mA</div><div>□□□ μA</div></div>	<div><div>1 mA ≤ i < 10 mA</div><div>□.□□ mA</div></div>	<div><div>10 mA ≤ i < 100 mA</div><div>□□.□ mA</div></div>	<div><div>100 mA ≤ i</div><div>□□□ mA</div></div>	i = measured current
Accuracy	±(3% of the reading + 20 μA) [after the offset cancel function is activated, if the scanner is mounted]				
Response	Mean-value responsive / root-mean-square value display (response time of 200 ms)				
Hold function	The measured current at the end of the test is held during the PASS judgment time period.				
Offset cancel function	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).				
Calibration	Performs calibration using the root-mean-square value of a sine wave with a pure resistive load				
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.				
	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).			
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)				

TOS9200 Series Specifications

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
	<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 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	±(3% of setting + 20 μA) [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 $\mu\text{A/kV}$ 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	1 kV	2 kV	3 kV	4 kV	5 kV
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	±(1.5 % of Setting + 2 V)				
Maximum rated load		1 W (-1000 V DC/1 mA)				
Maximum rated current		1 mA				
Ripple	1 kV no-load	2 Vp-p or less				
	Maximum rated load	10 Vp-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 kΩ)				
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 V to -1200 V				
	Resolution	1 V				
	Accuracy	±(1 % of reading + 1 V)				
Resistance meter						
Measurement range		0.01 MΩ - 9.99 GΩ (Within the maximum rated current range of 1 mA to 50 nA)				
Display	R < 10.0 MΩ		10.0 MΩ ≤ R < 100.0 MΩ	100.0 MΩ ≤ R < 1.00 GΩ	1.00 GΩ ≤ R ≤ 9.99 GΩ	R = measured insulation resistance
	□.□□ MΩ		□□.□ MΩ	□□□ MΩ	□.□□ GΩ	
Accuracy	50 nA ≤ i ≤ 100 nA		100 nA < i ≤ 200 nA	200 nA < i ≤ 1 μA	1 μA < i ≤ 1 mA	i = measured current
	± (20 % of reading)		± (10 % of reading)	± (5 % of reading)	± (2 % 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		Selection permitted for current measurement between the mode for the GND point connected to the LOW terminal, and the mode using guard.				
	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 Specifications

Item	TOS9200	TOS9201
Judgement function		
Judgement method/action	Judgement	Judgement method
	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).
	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.
	PASS	When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement.
Display Buzzer SIGNAL I/O		
The FAIL LED lights up. Displayed on the LCD ON Outputs the U FAIL signal		
The FAIL LED lights up. Displayed on the LCD ON Outputs the L FAIL signal		
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 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	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) ± (2 % of setting + 3digit)
		50.0 ≤ R < 100 MΩ — — ± (5 % of setting + 5digit) ± (2 % of setting + 3digit)
		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 = 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.]		
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 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 *6 *7	Conforms to the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC, EN61010-1, Class I, Pollution degree 2	
Dimensions (mm(inch)) (maximum)	430(16.93") (455(17.91")) W x 132(5.2") (150(5.91")) H x 370(14.57") (440(17.32")) D mm	
Weight	Approx. 19 kg (41.89 lbs)	

TOS9200 Series Specifications

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.

High-voltage scanner (TOS9220/9221)

Item		TOS9220	TOS9221
Maximum rating voltage	AC	5.0 kV	
	DC	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	Lights as it is interlocked with the POWER switch of the TOS9200/9201 tester	
	DANGER	Lights as it is interlocked with the DANGER lamp of the TOS9200/9201 tester	
	CHANNEL	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	Approx. 12 VA	
	During test	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 (mm(inch))(maximum)		430(16.93")(435(17.13"))W × 88(3.46")(105(4.13"))H × 370(14.57")(415(16.34")) D	
Weight		Approx. 6.5 kg (14.33 lbs)	
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	

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

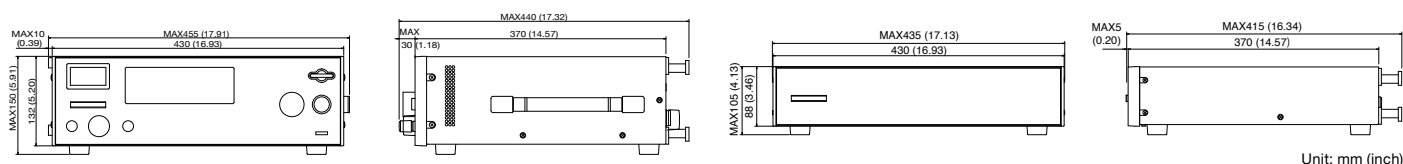
*2 Only on models that have CE marking on the panel. Not applicable to custom order models.

*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.

[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



Hipot Tester / Hipot Tester with Insulation Resistance Test

TOS5300 Series



TOS5301



TOS5302

TOS5300



Dimensions / Weight

TOS5302: 320(12.60")W × 132(5.20")H × 350(13.78")Dmm / 14kg(30.9 lbs)

TOS5301: 320(12.60")W × 132(5.20")H × 350(13.78")Dmm / 15kg(33.1 lbs)

TOS5300: 320(12.60")W × 132(5.20")H × 350(13.78")Dmm / 14kg(30.9 lbs)

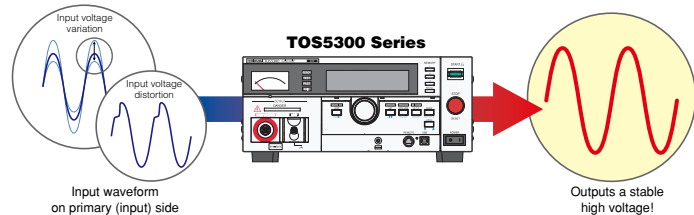
Accessories

Power cord, High-voltage test lead wire: TL31-TOS, High-voltage warning sticker, D-sub 25-pin plug, User's Manual, CD-R(Contains the Communication Interface Manual, the KI-VISA library, and the Safety evaluation test.)

Features and Functions

- The PWM amplifier provides highly stable output!
[Input voltage variation: $\pm 0.3\%$]

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.



- 6 kV/50 WDC Hipot (Withstanding voltage) test [Model TOS5301]
Capable to perform DC Hipot (Withstanding voltage) 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.

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

The TOS5300 Series are 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/50 W (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.

Features

- TOS5302: ■Hipot (Withstanding voltage): AC 5 kV/100 mA
Insulation Resistance: 25 V - 1000 V
- TOS5301: ■Hipot (Withstanding voltage): AC 5 kV/100 mA, DC 6 kV/50 W
- TOS5300: ■Hipot (Withstanding voltage): AC 5 kV/100 mA
- Common: ■The PWM amp system provides highly-stable output
■High-precision measurement $\pm 1.5\%$ of reading
■Rise/Fall time control function
■Key lock function and Protection cover on the panel operation
■Limit voltage function
■Monitoring output voltage function
■Calibration due notice and warning function
■Equipped with USB interface

- 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 $\pm 1.5\%$ of reading (500 V or greater)/minimum resolution of 1V, and an Ammeter with $\pm 1.5\%$ of reading (1 mA or more)/minimum resolution of 1 μ A.

In addition, it is also equipped with an Auto range function, with achieving a judgment accuracy of $\pm 1.5\%$ 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.



Capable of precision measurement from 0.00 mA

▲ AC Hipot (Withstanding voltage) test settings display (example)

Features and Functions

■ Insulation resistance test for 25 V to 1000 V* [Model TOS5302]

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

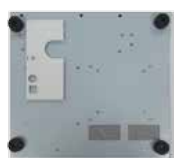
*At 500 V and above, measurements up to 5.00 GΩ are possible.

■ Protection cover prevents physical operation error in the production site

In many cases, workers on electronic equipment production lines and inspection lines are not technical experts. Therefore, it is possible that the operators may change setting conditions and make operation errors. In order to prevent from such cases, the TOS5300 is equipped with a key lock function and a protection cover to disable a physical key operation from the front panel.



▲ View with the protection cover removed



▲ Storing the protection cover for the key operation to the base of unit.

■ New design of output terminal improves safety and functionality

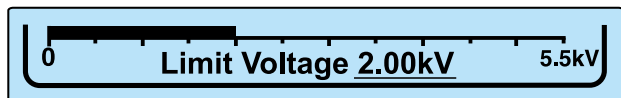
The free rotation mechanism protects from twisting (or breaking) of the cable. Also, with having the lock function for the LOW terminal on the main unit, the metal plate is no longer attached to the test lead of LOW-side, and it makes to resist damage to the test lead. Because of elimination of these projected components, the TOS5300 can avoid from unexpected accidents such as when the unit travels to other location. And also when the test lead is snagged on something, or unexpected stress is applied on the test lead, the High (High-voltage) test lead is designed to disconnect easily, but the Low (ground) test lead is designed to resist disconnection.



▲ Flat surface design of the HIGH terminal with free rotation mechanism, and the LOW terminal with lock function

■ Limit voltage function

Prevents the user from setting a test voltage that exceeds the preset voltage.



▲ LIMIT VOLTAGE setting (example)

■ Monitoring output voltage function

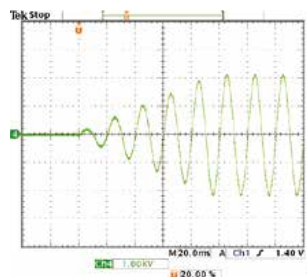
If the output voltage exceeds the setting voltage of (± 350 V), it turns off the output and the system switches to PROTECTION mode.

In order to handle kilo's of high voltage when the Hipot (Withstand voltage) and insulation tests are conducted, there are number of safety measures are required to take place. Having with these functions improve, the operational safety and the protection for the EUT.

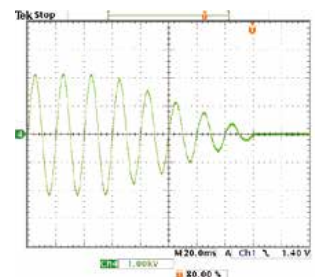
■ Rise/Fall time control function

The Rise time control function enables you to increase the test voltage gradually to reach the setting voltage while the AC Hipot (Withstanding voltage) test is conducted. The voltage rise time can be set from 0.1 s to 10.0 s at a resolution of 0.1 s.

The Fall time control function enables you to decrease the test voltage gradually when the PASS judgment is made at the AC Hipot (Withstanding voltage) test. The voltage fall time is fixed at 0.1 s. (OFF is also selectable).



▲ Rise time control waveform (example)



▲ Fall time control waveform (example)

■ Interlock feature

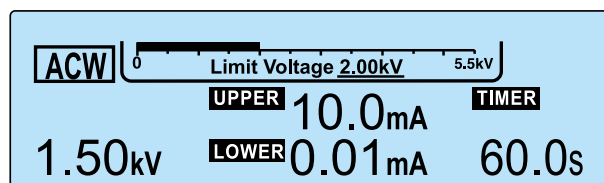
The product is equipped with an interlock function that operates together with external devices to interrupt output. To ensure the safe operation of tester, the interlock function activates when the SIGNAL I/O connector pins number 1 and 13 are opened, and when they are short-circuited, the interlock function is released.

■ Discharge feature [Model TOS5301/TOS5302]

Equipped with a forced discharge function that forcibly discharge the electricity which has been charged in the EUT after the completion of DC Hipot (Withstanding voltage) test or insulation resistance test.

■ Upper limits/Lower limits setting function

It automatically detects connector lead breaks and disconnections of wiring by measuring extremely small amounts of current that flows when voltage is applied to the EUT.



▲ Example setting display of Upper limit, Lower limit, and Test time

■ Calibration due notice and Warning function

To assure the traceability of periodic calibration of the product, this function gives a notice of calibration due managed by the builtin real-time clock. Even if the due data has elapsed, it is possible to avoid the oversight of operator with limiting the operation with a display of warning message.

■ AUTO TEST feature for consecutive testing [Model TOS5302]

The TOS5302 can perform an AC Hipot (Withstanding voltage) test and an insulation resistance test consecutively.

Either of the following can be conducted :

Insulation resistance test → AC Hipot (Withstanding voltage) test, or
AC Hipot (Withstanding voltage) test → Insulation resistance test.

TOS5300 Series Specifications

Unless specified otherwise, the specifications are for the following settings and conditions.

- The warm-up time is 30 minutes.
- TYP: These are typical values. These values do not guarantee the performance of the product.
- rdng: Indicates the readout value.
- set: Indicates a setting.
- f.s: Indicates full scale.

Withstanding Voltage Test Mode

			TOS5300	TOS5301	TOS5302
AC output section	Output range		0.05 kV to 5.00 kV		
		Accuracy	±(2 % of set + 20 V) when no load is connected		
		Setting range	0.00 kV to 5.50 kV		
		Resolution	10 V steps		
	Max. rated output *1		500 VA (5 kV/100 mA)		
	Max. rated voltage		5 kV		
	Max. rated current		100 mA (when the output voltage is 0.5 kV or greater)		
	Transformer rating		500 VA		
	Output voltage waveform *2		Sine		
		Distortion	If the output voltage is 0.5 kV or more: 3 % or less (when no load or a pure resistive load is connected).		
	Frequency		50 Hz or 60 Hz		
	Accuracy		±0.5 % (excluding during voltage rise time)		
	Voltage regulation		10 % or less (when changing from maximum rated load to no load)		
Input voltage variation		±0.3 % (5 kV when no load is connected; power supply voltage: 90 V to 250 V)			
Short-circuit current		200 mA or more (when the output voltage is 1.0 kV or greater)			
Output method		PWM switching			
DC output section	Output range		0.05 kV to 6.00 kV		
		Accuracy	± (2 % of set + 20 V) When no load is connected		
		Setting range	0.00 kV to 6.20 kV		
		Resolution	10 V STEP		
	Max. rated output *1		50 W (5 kV/10 mA)		
	Max. rated voltage		6 kV		
	Max. rated current		10 mA		
	Ripple (TYP)	5 kV when no load is connected	50 Vp-p		
		Max. rated load	100 Vp-p		
	Voltage regulation		3% or less (When changing from maximum rated load to no load)		
	Short-circuit current (TYP)		40 mA (when generation 6 kV output)		
	Discharge feature		Forced discharge after test completion (discharge resistance: 125 kΩ)		
	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	Analog	Scale	6 kV AC/DC f.s		
		Accuracy	± 5 % f.s		
		Indication	Average value response/rms scale		
	Digital	Measurement range	0.000 kV to 6.500 kV AC/DC		
		Display	□ . □□□ kV		
		Accuracy	V < 500 V: ±(1.5 % of rdng + 20 V); V ≥ 500 V: ±1.5 % of rdng		
Ammeter	Digital	Response	True rms (response time: 50 ms)		
		Hold feature	After a test is finished, the measured voltage is retained until the PASS or FAIL judgment is cleared.		
		Measurement range	AC: 0.00 mA to 110 mA	AC: 0.00 mA to 110 mA DC: 0.00 mA to 11 mA	AC: 0.00 mA to 110 mA
Ammeter	Digital	Display	i = measured current		
			i < 1 mA		1 mA ≤ i < 10 mA
			□□□ μA		□ . □□□ mA
			10 mA ≤ i < 100 mA		100 mA ≤ i
			□□ . □□ mA		□□□ . □ mA
	Accuracy *3	1.00 mA ≤ i: ±(1.5 % of rdng); i < 1.00 mA: ±(1.5 % of rdng + 30 μA)			
	Response	True rms (response time: 50 ms)			
Hold feature	After a test is finished, the measured voltage is retained until the PASS judgment is cleared.				

Withstanding Voltage Test Mode

		TOS5300	TOS5301	TOS5302			
Judgment feature	Judgment method and judgment operation	Judgment	Judgment method	Display	Buzzer	SIGNAL I/O	
		UPPER FAIL	If a current that is greater than or equal to the upper limit is detected, the output is turned off, and an UPPER FAIL judgment occurs. During the voltage rise time (Rise Time) of DC withstanding voltage tests, an UPPER FAIL judgment also occurs if there is a problem with the voltage rise ratio.	FAIL LED lights OVER is displayed on the screen	ON	Generates a U-FAIL signal	
		LOWER FAIL	If a current that is less than or equal to the lower limit is detected, the output is turned off, and a LOWER FAIL 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 withstanding voltage tests.	FAIL LED lights UNDER is displayed on the screen	ON	Generates a L-FAIL signal	
		PASS	If the specified time elapses without any problems, the output is turned off, and a PASS judgment occurs.	PASS LED lights	ON	Generates a PASS signal	
	• 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	AC: 0.01 mA to 110 mA DC: 0.01 mA to 11 mA	AC: 0.01 mA to 110 mA			
	Lower limit setting	AC: 0.01 mA to 110 mA / OFF	AC: 0.01 mA to 110 mA / OFF DC: 0.01 mA to 11 mA / OFF	AC: 0.01 mA to 110 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	Voltage rise time	0.1 s to 10.0 s				
		Resolution	0.1 s				
Voltage fall time		0.1 s / OFF (only enabled when a PASS judgment occurs)					
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) excluding Fall Time						

*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 withstanding voltage 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.

Ambient temperature		Upper limit	Pause time	Output time
$t \leq 40^\circ\text{C}$	AC	$50 \text{ mA} < i \leq 110 \text{ mA}$	Greater than or equal to the output time	30 min. max.
		$i \leq 50 \text{ mA}$	Not necessary	Continuous output possible
	DC	$5 \text{ mA} < i \leq 11 \text{ mA}$	Greater than or equal to the output time	1 min. max.
		$i \leq 5 \text{ mA}$	Greater than or equal to the wait time (WAIT TIME)	Continuous output possible

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

*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 withstanding voltage 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.

Output voltage	1 kV	2 kV	3 kV	4 kV	5 kV
When using 350 mm long test leads that are suspended in air (TYP)	2 μA	4 μA	6 μA	8 μA	10 μA
When using the accessory, high test lead TL31-TOS (TYP)	16 μA	32 μA	48 μA	64 μA	80 μA

TOS5300 Series Specifications

Insulation resistance test section

		TOS5302													
Output section	Output voltage		25 V, 50 V, 100 V, 125 V, 250 V, 500 V, 1000 VDC (negative)												
		Accuracy	-0 %, +5 V												
	Max. rated load		1 W (-1000 V DC / 1 mA)												
	Max. rated current		1 mA												
	Ripple	1000 V when no load is connected	2 Vp-p or less												
		Max. rated load	10 Vp-p or less												
	Voltage regulation		1 % or less (when changing from maximum rated load to no load)												
	Short-circuit current		12 mA or less												
	Discharge feature		Forced discharge after test completion (discharge resistance: approx. 25 kΩ												
Limit voltage		The test voltage upper limit can be set : 25 V, 50 V, 100 V, 125 V, 250 V, 500 V, 1000 V													
Output voltage monitor feature		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.													
Voltmeter	Analog	Scale	6 kV AC/DC f.s												
		Accuracy	± 5 % f.s												
		Indication	Average value response/rms scale												
	Digital	Measurement range	0 V to -1200 V												
		Display	<table><tr><td>Measured voltage</td><td>V < 100 V</td><td>100 V ≤ V < 1000 V</td><td>1000 V ≤ V</td></tr><tr><td>Display</td><td>□□ V</td><td>□□□ V</td><td>□□□□ V</td></tr></table>	Measured voltage	V < 100 V	100 V ≤ V < 1000 V	1000 V ≤ V	Display	□□ V	□□□ V	□□□□ V				
		Measured voltage	V < 100 V	100 V ≤ V < 1000 V	1000 V ≤ V										
Display	□□ V	□□□ V	□□□□ V												
Accuracy	± (1 % of rdng + 1 V)														
Resistance meter	Measurement range / measurement accuracy *4 *5	25 V	0.03 MΩ ≤ R ≤ 25 MΩ / ±(2 % of rdng + 2 digits) 25 MΩ < R ≤ 125 MΩ / ±5 % of rdng 125 MΩ < R ≤ 250 MΩ / ±10 % of rdng												
		50 V	0.05 MΩ ≤ R ≤ 50 MΩ / ±(2 % of rdng + 2 digits) 50 MΩ < R ≤ 250 MΩ / ±5 % of rdng 250 MΩ < R ≤ 500 MΩ / ±10 % of rdng												
		100 V	0.100 MΩ ≤ R ≤ 100 MΩ / ±2 % of rdng 100 MΩ < R ≤ 500 MΩ / ±5 % of rdng 500 MΩ < R ≤ 1 GΩ / ±10 % of rdng												
		125 V	0.125 MΩ ≤ R ≤ 125 MΩ / ±2 % of rdng 125 MΩ < R ≤ 625 MΩ / ±5 % of rdng 625 MΩ < R ≤ 1.25 GΩ / ±10 % of rdng												
		250 V	0.250 MΩ ≤ R ≤ 250 MΩ / ±2 % of rdng 250 MΩ < R ≤ 1.25 GΩ / ±5 % of rdng 1.25 GΩ < R ≤ 2.5 GΩ / ±10 % of rdng												
		500 V	0.50 MΩ ≤ R ≤ 500 MΩ / ±2 % of rdng 500 MΩ < R ≤ 2.5 GΩ / ±5 % of rdng 2.5 GΩ < R ≤ 5 GΩ / ±10 % of rdng												
		1000 V	1 MΩ ≤ R < 1 GΩ / ±2 % of rdng 1 GΩ ≤ R ≤ 5 GΩ / ±5 % of rdng												
	Display *5	<table><tr><td>25 kΩ ≤ R < 1.00 MΩ</td><td>1.00 MΩ ≤ R < 10.0 MΩ</td><td>10.0 MΩ ≤ R < 100 MΩ</td><td>100.0 MΩ ≤ R < 1.00 GΩ</td><td>1.00 GΩ ≤ R ≤ 9.99 GΩ</td></tr><tr><td>□□□ kΩ</td><td>□ . □□ MΩ</td><td>□□ . □ MΩ</td><td>□□□ MΩ</td><td>□ . □□ GΩ</td></tr></table>	25 kΩ ≤ R < 1.00 MΩ	1.00 MΩ ≤ R < 10.0 MΩ	10.0 MΩ ≤ R < 100 MΩ	100.0 MΩ ≤ R < 1.00 GΩ	1.00 GΩ ≤ R ≤ 9.99 GΩ	□□□ kΩ	□ . □□ MΩ	□□ . □ MΩ	□□□ MΩ	□ . □□ GΩ			
	25 kΩ ≤ R < 1.00 MΩ	1.00 MΩ ≤ R < 10.0 MΩ	10.0 MΩ ≤ R < 100 MΩ	100.0 MΩ ≤ R < 1.00 GΩ	1.00 GΩ ≤ R ≤ 9.99 GΩ										
	□□□ kΩ	□ . □□ MΩ	□□ . □ MΩ	□□□ MΩ	□ . □□ GΩ										
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, Mid, Slow													
Judgment feature	Judgment method and judgment operation	Judgment	Judgment method		Display	Buzzer	SIGNAL I/O								
		UPPER FAIL	If a resistance that is greater than or equal to the upper limit is detected, the output is turned off, and an UPPER FAIL judgment occurs. This judgment is not performed during voltage rise time (Rise Time).		FAIL LED lights; OVER is displayed on the screen	ON	Generates a U-FAIL signal								
		LOWER FAIL	If a resistance that is less than or equal to the lower limit is detected or if a problem occurs during the voltage rise time (Rise Time), the output is turned off, and a LOWER FAIL judgment occurs.		FAIL LED lights; UNDER is displayed on the screen	ON	Generates a L-FAIL signal								
		PASS	If the specified time elapses without any problems, the output is turned off, and a PASS judgment occurs.		PASS LED lights	ON	Generates a PASS signal								
	<ul style="list-style-type: none">• 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 range	0.03 MΩ to 5.00 GΩ													
Lower limit setting range	0.03 MΩ to 5.00 GΩ														
Judgment accuracy (the same for UPPER and LOWER)	Measurement accuracy + 2 digits Humidity: 20 %rh to 70 %rh (no condensation). No interference caused by wobbly test leads or other problems. For judgments of 200 nA or less, a test time of at least 1.0 seconds is necessary. If the current detection response speed is set to Mid, a test time of at least 0.3 seconds is necessary. If the current detection response speed is set to Slow, a test time of at least 0.5 seconds is necessary.														
Time	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

TOS5300 Series Specifications

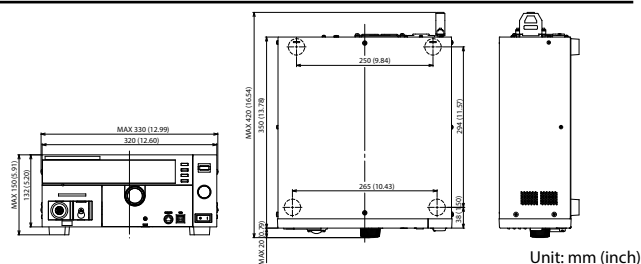
Other features/Interfaces

	TOS5300	TOS5301	TOS5302
Double action feature	Tests can only be started by pressing and releasing STOP and then pressing START within 0.5 seconds of releasing the STOP switch.		
Length of time to maintain a PASS judgment result	You can set the length of time to maintain a PASS judgment: 50 ms, 100 ms, 200 ms, 1 s, 2 s, 5 s, or HOLD.		
Momentary feature	Tests are only executed while the START switch is held down.		
Fail mode feature	This feature enables you to prevent remotely transmitted stop signals from clearing FAIL judgments and PROTECTION modes.		
Timer feature	This feature finishes tests when the specified time elapses.		
Output voltage monitor feature	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.		
Memory	Up to three sets of test conditions can be saved to memory.		
Key lock	Locks panel key operations (settings and changes).		
Protective features	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.		
Interlock Protection	An interlock signal has been detected.		
Power Supply Protection	An error was detected in the power supply.		
Volt Error Protection	While monitoring the output voltage, a voltage outside of the rated limits was detected. AC or DC withstanding voltage tests: ± 350 V Insulation resistance test: $\pm (10\% \text{ of set} + 10 \text{ V})$		
Over Load Protection	During a withstanding voltage test, a value that is greater than or equal to the output limit power was specified. AC withstanding voltage test: 550 VA. DC withstanding voltage test: 55 VA.		
Over Heat Protection	The internal temperature of the TOS5300 Series became too high.		
Over Rating Protection	During a withstanding voltage test, the output current was generated for a length of time that exceeds the regulated time.		
Calibration Protection	The specified calibration period has elapsed.		
Remote Protection	A connection to or disconnection from the front-panel REMOTE connector was detected.		
SIGNAL I/O Protection	The rear-panel SIGNAL I/O connector's ENABLE signal has changed.		
USB Protection	The USB connector has been disconnected while the TOS5300 Series was being controlled through the USB interface.		
System clock	Set in the following format: year/month/day hour/minutes/seconds.		
Calibration date	Set when the TOS5300 Series is calibrated.		
Calibration period setting	Sets the period before the next calibration is necessary.		
Notification of when the calibration period elapses	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.		
USB	USB Specification 2.0		
Interfaces	REMOTE	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.	
SIGNAL I/O		Rear-panel D-sub 25-pin connector	

General

	TOS5300	TOS5301	TOS5302
Display	VFD: 256 × 64 dots + 4 status indicators		
Backup battery life	3 years (at 25 °C or 77 °F)		
Environment	Installation location	Indoors, at a height of up to 2000 m	
	Spec guaranteed range	Temperature	5 °C to 35 °C (41 °F to 95 °F)
		Humidity	20 %rh to 80 %rh (no condensation)
	Operating range	Temperature	0 °C to 40 °C (32 °F to 104 °F)
		Humidity	20 %rh to 80 %rh (no condensation)
	Storage range	Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
		Humidity	90 %rh or less (no condensation)
Power supply	Nominal voltage range (allowable voltage range)		100 VAC to 240 VAC (90 VAC to 250 VAC)
	Power consumption	When no load is connected (READY)	100 VA or less
		When rated load is connected	800 VA max.
	Allowable frequency range		47 Hz to 63 Hz
Insulation resistance (between AC LINE and the chassis)		30 MΩ or more (500 VDC)	
Withstanding voltage (between AC LINE and the chassis)		1390 VAC, 2 seconds, 20 mA or less	
Earth continuity		25 AAC, 0.1 Ω or less	
Safety *6		Complies with the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC, EN 61010-1 Class I Pollution degree 2	
Electromagnetic compatibility (EMC) *6 *7		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 Applicable under the following conditions The maximum length of all cabling and wiring connected to the TOS5300 Series must be less than 3 m. The high test lead TL31-TOS is being used. Electrical discharges are not occurring outside the DUT.	
Dimensions		See "Outline drawing."	
Weight		Approx. 14 kg (30.9 lbs)	Approx. 15 kg (33.1 lbs)
Accessories		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	

External Dimensional Diagrams



*6. Does not apply to specially ordered or modified TOS5300 Series testers.

*7. Limited to products that have the CE mark on their panels.

*8. Contains the User's Manual, the Communication Interface Manual, the KI-VISA library, and the Safety evaluation test.

Hipot Tester

TOS5200

*A Perfect AC Hipot Test solution,
with 500 VA capacity and equipped PWM amplifier
at very affordable investment*

TOS5200 is designated model for AC Hipot Test with 500 VA capacity and 200 mA short circuit current output capability. With equipped PWM amplifier, this model can provide a stable & reliable output without being affected by AC power line. Therefore, it is a perfect AC Hipot Test solution for electronic equipment or devices based upon IEC, EN, UL, VDE and JIS etc. requirement. As TOS5200 maintains most of all features of our upper class model for AC Hipot Test, it achieves the superb cost / performance ratio for those who needs 200 VA or 500 VA capacity, or both. Also, as it equips Interlock function together with other safety features, operator can carry out the Test with higher current value in safe.

Dimensions / Weight

320(12.60")W × 132(5.20")H × 350(13.78")Dmm / 14kg(30.9 lbs)

Accessories

Power cord, High-voltage test lead wire: TL31-TOS, High-voltage warning sticker, D-sub 25-pin plug, Setup Guide, Quick Reference, Safety information, CD-R(Contains the Communication Interface Manual, the KI-VISA library, and the Safety evaluation test.)

Features

- Hipot (Withstanding voltage): AC 5 kV/100 mA
- High-precision measurement ± 1.5 % of reading
- Rise/Fall time control function
- Key lock function and Protection cover on the panel operation
- Limit voltage function
- Monitoring output voltage function
- Equipped with USB and RS232C interface as standard

Ground Bond Tester

TOS6210



Dimensions / Weight

430(16.93")W × 88(3.47")H × 270(10.63")Dmm / 11kg(24.25 lbs)

Accessories

AC power cord, Test leadwire TL12-TOS, Short bar(2pcs., these are inserted between the OUTPUT and SAMPLING terminals.), AC power fuse(2pcs., including one spare in the fuse holder), Operation manual

Supports UL60950-1 - New Standard for Information Technology Equipment (ITE)

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 earthing 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.

Features

- Test current value: 6 A to 62 A AC / Resistance value: 0.001 Ω to 0.600 Ω
- Voltage judgement function
- 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 (TL12-TOS)

Ground Bond Tester

TOS6200



Dimensions / Weight

430(16.93")W × 88(3.47")H × 270(10.63")Dmm / 9kg(19.84 lbs)

Accessories

AC power cord, Test leadwire TL11-TOS, Short bar(2pcs., these are inserted between the OUTPUT and SAMPLING terminals.), AC power fuse(2pcs., including one spare in the fuse holder), Operation manual

Pursuing to maximize an easy operation, stylish design of Ground Bond Tester

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.

Features

- Test current value: 3 A to 30 A AC / Resistance value: 0.001 Ω to 1.200 Ω
- 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)

TOS6210 Specifications

Output block		
Current setting range *1		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)
Resolution		0.1 A
Accuracy		± (1 % of setting + 0.4 A)
Maximum rated output		220 VA (at the output terminals)
Distortion factor		2% or less (with respect to 0.1 Ω pure resistance load of 20 A or greater)
Frequency		50/60 Hz, sine wave (selectable)
Accuracy		±200 ppm
Open terminal voltage		6 Vrms or less
Output method		PWM switching method
Output ammeter		
Measurement range		0.0 to 66.0 A AC
Resolution		0.1 A
Accuracy		± (1 % of reading + 0.4 A)
Response		Mean value response/rms value display (response time: 200 ms)
Holding function		The current measured at the end of test is held during the PASS or FAIL interval
Output voltmeter		
Measurement range		0.00 to 6.00 V AC
Resolution		0.01 V
Offset cancel function		0.00 to 5.40 V (Offset ON/OFF function provided)
Accuracy		± (1 % of reading + 0.02 V)
Response		Mean value response/rms value display (response time: 200 ms)
Holding function		The voltage measured at the end of test is held during the PASS or FAIL interval
Ohmmeter *2		
Measurement range		0.001 to 0.600 Ω
Resolution		0.001 Ω
Offset cancel function		0.000 to 0.600 Ω (Offset ON/OFF function provided)
Accuracy		± (2 % of reading + 0.003 Ω)
Holding function		The resistance measured at the end of test is held during the PASS or FAIL interval
Pass/fail judgement function *3		
Resistance value-based judgement		Window comparator system •If a resistance value equal to or greater than the upper reference value is detected, a FAIL determination is returned. •If a resistance value equal to or less than the lower reference value is detected, a FAIL determination is returned. •If a resistance value has been judged as FAIL, the tester shuts off the output and generates a FAIL signal •If the set time elapses without abnormalities, the tester shuts off the output and generates a PASS signal.
Setting range for the upper reference value (UPPER)		0.001 to 0.600 Ω
Setting range for the lower reference value (LOWER)		0.001 to 0.600 Ω
Resolution		0.001 Ω
Judgement accuracy		± (2 % of UPPER + 0.003 Ω)
Sampled voltage value-based judgement		Window comparator system •If a voltage value equal to or greater than the upper reference value is detected, a FAIL determination is returned. •If a voltage value equal to or less than the lower reference value is detected, a FAIL determination is returned. •If a voltage value has been judged as FAIL, the tester shuts off the output and generates a FAIL signal. •If the set time elapses without abnormalities, the tester shuts off the output and generates a PASS signal.
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
Resolution		0.01 V
Judgement accuracy		± (2 % of UPPER + 0.05 V)
Calibration		Calibration is performed with the rms value of the sine wave, using a pure resistance load.
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	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.
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.

*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.

Output time limitation			
Ambient temperature t (°C)	Test current I (A)	Pause time	Maximum allowable continuous test time
t ≤ 40 °	40 < I ≤ 60	Equal to or greater than the test time	≤ 10 minutes
	20 < I ≤ 40	Equal to or greater than the test time	≤ 30 minutes
	I ≤ 20	Not required	Continuous output possible

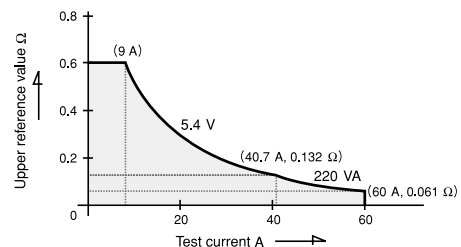
*2 About ohmmeter's response time

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 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.

Allowable range in which to determine the test current value and upper reference value



TOS6210 Specifications

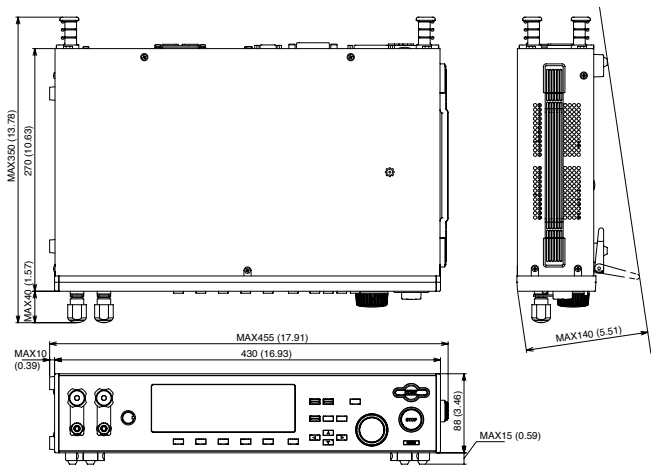
Time		
Test time	Setting range	Setting range 0.3 to 999 s Timer ON/OFF function is available.
	Accuracy	± (100 ppm of setting + 20 ms)
Environment		
Operating environment		Indoor use, Overvoltage Category II
Warranty range	Temperature	5 ° to 35 °C
	Humidity	20 %rh to 80 %rh (non condensing)
Operating 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		85 to 250 V AC
Power consumption	At no load (READY)	60 VA or less
	At rated load	420 VA max.
Allowable frequency range		47 Hz to 63 Hz
Insulation resistance		30 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.
Electromagnetic compatibility (EMC) *5, *6		

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 (TL12-TOS) which is supplied.
2. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.

Safety *5		
Conforms to the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC EN61010-1 Class I Pollution degree 2		
Physical dimensions (mm)(inch)(maximum)		430(16.93")(455(17.91")) W × 88(3.46")(140(5.51")) H × 270(10.63")(350(13.78"))D
Weight		Approx. 11 kg (24.25 lbs)
Accessories		
AC power cord		1 piece
Test leadwire TL12-TOS		1 set
Short bar		2 pieces (These are inserted between the OUTPUT and SAMPLING terminals.)
AC power fuse		2 pieces (2, including one spare in the fuse holder)
Operation manual		1 copy

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

External Dimensional Diagrams

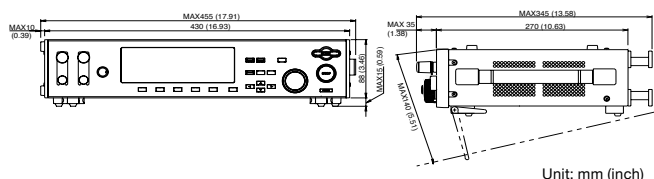


Unit: mm (inch)

TOS6200 Specifications

Output block		
Current setting range *1		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)
	Resolution	0.1 A
	Accuracy	± (1 % of setting + 0.2 A)
Maximum rated output		150 VA (at the output terminals)
Distortion factor		2 % or less (with respect to 0.1 Ω pure resistance load of 10 A or greater)
Frequency		50/60 Hz, sine wave (selectable)
	Accuracy	±200 ppm
Open terminal voltage		6 Vrms or less
Output method		PWM switching method
Output ammeter		
Measurement range		0.0 to 33.0 A AC
Resolution		0.1 A
Accuracy		± (1 % of reading + 0.2 A)
Response		Mean value response/rms value display (response time: 200 ms)
Holding function		The current measured at the end of test is held during the PASS or FAIL interval
Output voltmeter		
Measurement range		0.00 to 6.00 V AC
Resolution		0.01 V
Accuracy		± (1 % of reading + 0.02 V)
Response		Mean value response/rms value display (response time: 200 ms)
Holding function		The voltage measured at the end of test is held during the PASS or FAIL interval
Ohmmeter *2		
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 resistance measured at the end of test is held during the PASS interval
Pass/fail judgement function		
Resistance value-based judgement		Window comparator system • If a resistance value equal to or greater than the upper reference value is detected, a FAIL determination is returned. • If a resistance value equal to or less than the lower reference value is detected, a FAIL determination is returned. • If a resistance value has been judged as FAIL, the tester shuts off the output and generates a FAIL signal. • If the set time elapses without abnormalities, the tester shuts off the output and generates a PASS signal.
	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)
Calibration		Calibration is performed with the rms value of the sine wave, using a pure resistance load.
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	Lights if a resistance value equal to or greater than the upper reference value is detected and judged FAIL.
	LOWER FAIL	Lights if a resistance value equal to or greater than the upper reference value is detected and judged FAIL.

External Dimensional Diagrams



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.
	Time	
Test	Setting range	0.3 to 999 s Timer ON/OFF function is available.
Time	Accuracy	± (100 ppm of setting + 20 ms)
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 no load (READY)	100 V model: 70 VA or less 100 V/200 V model : 60 VA or less
	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		30 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 *3 Confirms to the requirements of the following directive and standard.		
Low Voltage Directive 2006/95/EC, EN61010-1, Class I, Pollution degree 2		
Electromagnetic compatibility (EMC) *3 *4		
Confirms 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 shielded cable which length is less than three meters when the SIGNAL I/O is used.		
Physical dimensions (mm)(inch)(maximum)		430(16.93)×455(17.91)W × 88(3.46)×140(5.51)H × 270(10.63)×345(13.58)D
Weight		Approx. 9 kg (19.84 lbs)
Accessories		
AC power cord		1 piece
Test leadwire TL11-TOS		1 set
Short bar		2 pieces (These are inserted between the OUTPUT and SAMPLING terminals.)
AC power fuse		2 pieces (2, including one spare in the fuse holder)
Operation manual		1 copy

*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.

Output time limitation			
Ambient temperature t (°C)	Test current I (A)	Pause time	Maximum allowable continuous test time
t ≤ 40°	15 < I ≤ 30	Equal to or greater than the test time	≤ 30 minutes
	I ≤ 15	Not required	Continuous output possible

*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.

Options for Electrical Safety Testers

■ Test Lead

TL01-TOS

[cable length: 1.5 m/max. operating voltage: 5 kV]



TL02-TOS

[cable length: 3 m/max. operating voltage: 5 kV]



TL03-TOS

[cable length: 1.5 m/max. operating voltage: 10 kV]



TL06-TOS

[cable length: 0.5 m/max. operating voltage: 5 kV (for parallel connection of TOS9220/9221)]



TL07-TOS

[cable length: 1.5 m/max. operating voltage: 5 kV (for TOS9220/9221)]



TL12-TOS

[cable length: 1.5 m/max. operating current: 60 A (for TOS6210)]



■ DIN Cable

DD-3 5P

[Cable length: 3 m/
DIN plug to DIN plug]



DD-5P/6P

[Adaptor/DIN to Mini DIN]



■ Test Probe

HP01A-TOS *

[cable length: 1.8 m/max. operating voltage: 4 kV AC(RMS), 5kV DC]

HP02A-TOS *

[cable length: 3.5 m/max. operating voltage: 4 kV AC(RMS), 5kV DC]



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)]



* The optional adaptor DD-5P/9P is required for the connection with TOS5300 Series.

■ Buzzer Unit

BZ01-TOS (for 100 V AC)

*This can not be used with TOS6200, TOS9200/9201, TOS5300 Series.



■ Remote Control Box

RC01-TOS *

[one-hand operation/
dimensions: 200(7.87")W
× 70(2.76")H × 39(1.54")
D mm/cable length: 1.5 m]



RC02-TOS *

[both-hands operation/
dimensions: 330(12.99")W
× 70(2.76")H × 39(1.54")
D mm/cable length: 1.5 m]



* The optional adaptor DD-5P/6P is required for the connection with TOS5300 Series.

■ Warning Light Unit

PL01-TOS (for 100 V AC)

*This can not be used with TOS6200, TOS9200/9201, TOS5300 Series.



PL02-TOS (for 24 V DC)

* for TOS9200/9201, TOS5300 Series.



■ Terminal Unit

TU01-TOS

TOS5300 series signal
I/O converter unit
(25 pin to 14 pin)



EIA Standard Rack (Inch Size) Mounting Options

Product name	Bracket	
	Model name	Panel width (*1)
TOS9201	KRB3-TOS	3
TOS9200	KRB3-TOS	3
TOS9220	KRB2-TOS	2
TOS9221	KRB2-TOS	2
TOS5300	KRA4-TOS	4
TOS5301	KRA4-TOS	4
TOS5302	KRA4-TOS	4
TOS5200	KRA4-TOS	4
TOS6210	KRB2-TOS	2
TOS6200	KRB2-TOS	2

*1 : EIA panel width is 44.45 mm (1 3/4 inch). The panel width does not include the rubber feet, casters, and levelers.

JIS Standard Rack (Millimeter Size) Mounting Options

Product name	Bracket	
	Model name	Panel width (*2)
TOS9201	KRB150-TOS	3
TOS9200	KRB150-TOS	3
TOS9220	KRB100-TOS	2
TOS9221	KRB100-TOS	2
TOS5300	KRA200-TOS	4
TOS5301	KRA200-TOS	4
TOS5302	KRA200-TOS	4
TOS6210	KRB100-TOS	2
TOS6200	KRB100-TOS	2

*2 : JIS panel width is 50 mm. The panel width does not include the rubber feet, casters, and levelers.