

TOS SERIES SELECTION GUIDE

High-End Multi-type Hipot, Insulation Resistance, Ground Bond, Leakage or Partial discharge,

TOS9303LC P.86

AC/DC Hipot Tester with Insulation Resistance, Ground Bond, and Leakage Current Test

- ACW** 5 kV/100 mA(500 VA)
- DCW** 5 kV/20 mA, 7.2 kV/13.9 mA(100 W)
- IR** 0.001 MΩ to 100.0 GΩ(DC-25 V to -1000 V/DC+50 V to +7200 V)
- EC** 0.001 Ω to 0.600 Ω (3.0 A to 42.0 A)
- LC** 1 μA to 100 mA(rms)



D 430(16.93")x440(17.32")x132(5.2")x155(6.10")H
x500(19.69")x550(21.65")Dmm
W 22 kg(48.5 lbs)

TOS9303 P.85

AC/DC Hipot Tester with Insulation Resistance and Ground Bond Test

- ACW** 5 kV/100 mA(500 VA)
- DCW** 5 kV/20 mA, 7.2 kV/13.9 mA(100 W)
- IR** 0.001 MΩ to 100.0 GΩ(DC-25 V to -1000 V/DC+50 V to +7200 V)
- EC** 0.001 Ω to 0.600 Ω (3.0 A to 42.0 A)



D 430(16.93")x440(17.32")x132(5.2")x155(6.10")H
x500(19.69")x540(21.26")Dmm
W 21 kg(46.3 lbs)

TOS9302 P.85

AC Hipot Tester with Ground Bond Test

- ACW** 5 kV/100 mA(500 VA)
- EC** 0.001 Ω to 0.600 Ω (3.0 A to 42.0 A)



D 430(16.93")x440(17.32")x132(5.2")x155(6.10")H
x500(19.69")x540(21.26")Dmm
W 20 kg(44.1 lbs)

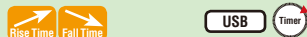
Hipot Tester with Insulation Resistance Test

Hipot Tester

Standard Standard type suitable for production and inspection lines

TOS5302 P.94

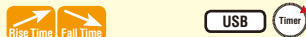
- ACW** 5 kV/100 mA(500 VA)
- IR** 0.03 MΩ to 5 GΩ (DC-25 V to -1000 V)



D 320(12.60")x132(5.2")x350(13.78")Dmm
W 14 kg(30.9 lbs)

TOS5301 P.94

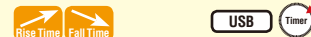
- ACW** 5 kV/100 mA(500 VA)
- DCW** 6 kV/10 mA(50 W)



D 320(12.60")x132(5.2")x350(13.78")Dmm
W 15 kg(33.1 lbs)

TOS5300 P.94

- ACW** 5 kV/100 mA(500 VA)



**Fall Time* can be set at 0.1 s or OFF



D 320(12.60")x132(5.2")x350(13.78")Dmm
W 14 kg(30.9 lbs)

- ACW** Max. output-voltage of AC hipot testing
- DCW** Max. output-voltage of DC hipot testing
- IR** Measurement range of insulation resistance testing
- EC** Measurement range of ground bond testing
- LC** Measurement range of leakage current testing
- PD** Measurement range of partial discharge testing
- D** Dimensions
- W** Weight

- Equipped with rise time control function
- Equipped with fall time control function
- Equipped with LAN interface as standard
- Equipped with GPIB interface as standard
- Equipped with RS232C interface as standard
- Equipped with USB interface as standard
- Equipped with timer function

Low-cost type

TOS5200 P.99

- ACW** 5 kV/100 mA(500 VA)



**Fall Time* can be set at 0.1 s or OFF



D 320(12.60")x132(5.2")x350(13.78")Dmm
W 14 kg(30.9 lbs)

this analyzer covers it all!

Under development

TOS9301PD P.84

AC/DC Hipot Tester with Insulation Resistance and Partial Discharge Test

- ACW** 5 kV/100 mA(500 VA)
- DCW** 5 kV/20 mA, 7.2 kV/13.9 mA(100 W)
- IR** 0.001 MΩ to 100.0 GΩ (DC-25 V to -1000 V/ DC+50 V to +7200 V)

PD



D 430(16.93")x440(17.32")x132(5.2")(155(6.10"))H
 x500(19.69")(540(21.26"))Dmm
W 24 kg(52.9 lbs)

TOS9301 P.84

AC/DC Hipot Tester with Insulation Resistance Test

- ACW** 5 kV/100 mA(500 VA)
- DCW** 5 kV/20 mA, 7.2 kV/13.9 mA(100 W)
- IR** 0.001 MΩ to 100.0 GΩ (DC-25 V to -1000 V/ DC+50 V to +7200 V)



D 430(16.93")x440(17.32")x132(5.2")(155(6.10"))H
 x370(14.57")(410(16.14"))Dmm
W 18 kg(39.7 lbs)

TOS9300 P.84

AC Hipot Tester with Insulation Resistance Test

- ACW** 5 kV/100 mA(500 VA)
- IR** 0.001 MΩ to 100.0 GΩ (DC-25 V to -1000 V)



D 430(16.93")x440(17.32")x132(5.2")(155(6.10"))H
 x370(14.57")(410(16.14"))Dmm
W 17 kg(37.5 lbs)

TOS9320 P.86

High-voltage Scanner

High voltage scanner for TOS9300 series multi-channel testing systems



D 430(16.93")x440(17.32")x88(3.46")(105(4.13"))H
 x370(14.57")(390(15.35"))Dmm
W 8 kg(17.6 lbs)

Ground Bond Tester

High-End

TOS6210 P.103

0.001 Ω to 0.600 Ω (6 A to 62 A)



D 430(16.93")x88(3.47")x270(10.63")Dmm
W 11kg(24.25 lbs)

TOS6200A P.103

0.001 Ω to 1.200 Ω (3 A to 31 A)



D 430(16.93")x88(3.47")x270(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.106

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

For the withstanding test and the insulation resistance test of the EUT (Equipment Under Test) with turned on electricity.

Our Hipot Testers and Insulation Resistance Testers are designed to test the EUT (Equipment Under Test) with turned off electricity. In case the test requires the EUT (Equipment Under Test) with turned on electricity, please contact with our distributor or agent.

Hipot Tester with Insulation Resistance Test

TOS9300/9301



TOS9300(AC)



TOS9301(AC/DC)

Dimensions / Weight

TOS9300: 430(16.93")W × 132(5.2")H × 370(14.57")Dmm(inch) / 17 kg(37.5 lbs)
 TOS9301: 430(16.93")W × 132(5.2")H × 370(14.57")Dmm(inch) / 18 kg(39.7 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information
 TOS9301 only: Heavy object warning label(Affix this to the product as necessary.)

High-performance hipot tester with insulation resistance capabilities

The TOS9300/9301 is a high performance electrical safety analyzer with hipot tester and insulation resistance capabilities for international safety standards. Wide-ranging hipot capabilities and insulation resistance capabilities make the TOS9300/9301 the perfect safety analyzer for R&D equipment, quality assurance testing, standard compliance tests and product line equipment. Combined with the high voltage scanner TOS9320, the TOS9300 series can be automated into a safe, reliable test system with up to 16 channels.

Features

- AC5 kV/100 mA, DC7.2 kV/100 W Hipot test
- Electrical breakdown inspection setting available
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

Hipot Tester with Insulation Resistance and Partial Discharge Test

TOS9301PD



AC/DC Hipot tester with insulation resistance and partial discharge test capabilities

The TOS9301PD is an electrical safety analyzer capable of AC and DC hipot, insulation resistance, and partial discharge testing. Wide-ranging hipot capabilities, insulation resistance and partial discharge testing features make the TOS9301PD the perfect safety analyzer for R&D equipment, quality assurance testing, standard compliance tests and product line equipment. Combined with the high voltage scanner TOS9320, the TOS9301PD can be automated into a safe, reliable test system with up to 16 channels.

Dimensions / Weight

430(16.93")W × 132(5.2")H × 500(19.69")Dmm(inch) / 24 kg(52.9 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information, Heavy object warning label(Affix this to the product as necessary.)

Features

- AC5 kV/100 mA, DC7.2 kV/100 W Hipot test
- Insulation diagnosis available with partial discharge model
- Electrical breakdown inspection setting available
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

Hipot Tester with Ground Bond Test

TOS9302*AC Hipot tester with ground bond test capabilities*

The TOS9302 is an electrical safety analyzer capable of AC hipot tester and ground bond test capabilities. Accurate AC hipot and ground bond testing features make the TOS9302 the perfect safety analyzer for R&D equipment, quality assurance testing, standard compliance tests and product line equipment. Combined with the high voltage scanner TOS9320, the TOS9302 can be automated into a safe, reliable test system with up to 16 channels.

Dimensions / Weight

430(16.93")W × 132(5.2")H × 500(19.69")Dmm(inch) / 20 kg(44.1 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information, Heavy object warning label(Affix this to the product as necessary.), Test leads for earth continuity test [TL13-TOS]

Features

- AC5 kV/100 mA Hipot test
- New amplifier type allows for 40 A AC/DC ground bond testing
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

Hipot Tester with Insulation Resistance and Ground Bond Test

TOS9303*AC/DC Hipot tester with insulation resistance and ground bond test capabilities*

The TOS9303 is a highly versatile electrical safety analyzer capable of AC/DC hipot, insulation resistance, and ground bond testing. Combined with the high voltage scanner TOS9320, the TOS9303 can be automated into a safe, reliable test system with up to 16 channels.

Dimensions / Weight

430(16.93")W × 132(5.2")H × 500(19.69")Dmm(inch) / 21 kg(46.3 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information, Heavy object warning label(Affix this to the product as necessary.), Test leads for earth continuity test [TL13-TOS]

Features

- AC5 kV/100 mA, DC7.2 kV/100 W Hipot test
- New amplifier type allows for 40 A AC/DC ground bond testing
- Electrical breakdown inspection setting available
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

Hipot Tester with Insulation Resistance, Ground Bond, and Leakage Current Test

TOS9303LC



Dimensions / Weight

430(16.93")W × 132(5.2")H × 500(19.69")Dmm(inch) / 22 kg(48.5 lbs)

Accessories

Power cord(2 pcs), High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information, Heavy object warning label(Affix this to the product as necessary.), Test leads for earth continuity test [TL13-TOS], Spare fuse(15 A, 250 V *Stored in the fuse holder), Test leads for leakage current test [TL22-TOS], Flat probe [FP01-TOS]

The all-in-one multi analyzer capable of AC/DC hipot tester, insulation resistance, ground bond, and leakage current testing

The TOS9303LC is the "all-rounder" electrical safety analyzer capable of conducting AC/DC hipot, insulation resistance, ground bond and leakage current testing in a single model. Combined with the high voltage scanner TOS9320, the TOS9303LC can be automated into a safe, reliable test system with up to 16 channels.

Features

- AC5 kV/100 mA, DC7.2 kV/100 W Hipot test
- New amplifier type allows for 40 A AC/DC ground bond testing
- Touch current/protective conductor current/leakage current testing
- Electrical breakdown inspection setting available
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

High-voltage scanner

TOS9320



Dimensions / Weight

430(16.93")W × 132(5.2")H × 500(19.69")Dmm(inch) / 8 kg(17.6 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], Lead for high voltage parallelconnection [TL33-TOS], Interface cable, CONTROLLER INTERFACE plug (Assembly type)[D-sub plug unit], High-voltage warningsticker(2 pc.), Channel labels(For the panel , For the test leads), User's manual, Safety Information

High voltage scanner for TOS9300 series multi-channel testing systems

The TOS9320 high voltage scanner allows for rapid distribution of testing voltage from the main unit to multiple testing points for withstanding voltage and insulation resistance testing. Channels can be controlled via an external device through the rear panel CONTROLLER INTERFACE connector. The scanner can also be used standalone or with an external control device for other Kikusui withstanding voltage and insulation resistance testing instruments. Hipot tests for electronic devices with multiple testing points have never been easier.

Features

- Output can be expanded to four channels with one high-voltage scanner. The electric potential of each channel can be arbitrarily set to high, low, or open, and can be tested at any of these four points.
- Up to four high voltage scanners (total 16 channels) can be connected to each unit.
- Output of each channel and contact with testing points can be easily monitored.
- High voltage scanner capable of output distribution both standalone and when connected with existing withstanding voltage/insulation resistance testing equipment models [TOS5300 series, etc.]

TOS9300 Series Specifications

Withstanding Voltage Test

Output function		TOS9300	TOS9301	TOS9302	TOS9303	TOS9303LC	
AC output section	Output range	0.050 kV to 5.000 kV					
		Resolution	1 V				
		Setting accuracy	$\pm(1.2\% \text{ of setting} + 0.02 \text{ kV})$ (at no load)				
	Max. rated load *1	500 VA(5 kV / 100 mA)					
	Max. rated current	100 mA (when the output voltage is 0.2 kV or higher)					
	Transformer rating	500 VA					
	Output voltage waveform	Sine					
	*2	Distortion	2 % or less. (when the output voltage is 0.5 kV or higher and no load or a pure resistive load is connected)				
		Crest factor	$\sqrt{2} \pm 3\%$ (0.8 kV or more)				
	Frequency	Accuracy	$\pm 0.1\%$				
Voltage regulation		$\pm 3\%$ or less (when changing from maximum rated load to no load)					
Short-circuit current	200 mA or more (output voltage 0.5 kV or higher)						
Output method	PWM switching						
Start voltage	The voltage at the start of the test can be set.						
	Setting range	0 % to 99 % of the test voltage					
Resolution	1 %						
Output voltage monitor function	If the output voltage exceeds $\pm(10\% \text{ of setting} + 0.05 \text{ kV})$, the output is turned off, and the protection function is activated.						

DC Output function		TOS9301	TOS9303	TOS9303LC	
DC output section	Output voltage range	0.050 kV to 7.200 kV			
		Resolution	1 V		
		Setting accuracy	$\pm(1.2\% \text{ of setting} + 0.02 \text{ kV})$		
	Max. rated load *1	100 W (5 kV/20 mA, 7.2 kV/13.9 mA)			
	Max. rated current	20 mA			
	Ripple	7.2 kV no load	20 Vp-p (TYP)		
		Max. rated load	50 Vp-p (TYP)		
	Voltage regulation	1 % or less (when changing from maximum rated load to no load)			
	Short-circuit current	100 mA (TYP) (200 mA peak)			
	Discharge function	Forced discharge after test completion (discharge resistance: 125 k Ω)			
Start voltage	The voltage at the start of the test can be set.				
	Setting range	1 % to 99 % of the test voltage			
Resolution	1 %				
Output voltage monitor function	If the output voltage exceeds $\pm(10\% \text{ of setting} + 0.05 \text{ kV})$, the output is turned off, and the protection function is activated.				

*1 When tests are performed consecutively, output time limit and rest time may become necessary depending on the upper limit setting

*2 If an AC voltage is applied to a capacitive load, the output voltage may rise higher than at no load depending on the load capacitance. Further, waveform distortions may occur if an EUT whose capacitance is dependent on voltage (for example, an EUT 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.

Measurement function		TOS9300	TOS9301	TOS9302	TOS9303	TOS9303LC
Voltmeter	Measurement range	0.00 kV to 7.50 kV AC/DC				
	Resolution	0.1 V				
	Accuracy	$\pm(1.2\% \text{ of reading} + 0.005 \text{ kV})$				
	Response	Can be switched between true rms and mean-value response rms conversion.				
	Hold function	The voltage measurement after a test is finished is held while the pass/fail judgment is displayed.				
	Ammeter *3 *4	Measurement range	AC: 0.00 mA to 110 mA, DC: 0.00 mA to 22 mA (Current including the active component and reactive component)			
Accuracy		$\pm(1\% \text{ of reading} + 2 \mu\text{A})$ (active component)				
Response		Can be switched between true rms and mean-value response rms conversion.				
Hold function		The current measurement after a test is finished is held while the pass judgment is displayed.				
Offset cancel function		Cancels up to 10 mA of the current flowing through the insulation resistance and stray capacitance components across output cables and the like (resistance component only for DC tests). OFF function available.				
Calibration		Active component: Calibrated with the rms of a sine wave using a pure resistive load. Reactive component: Not calibrated.				

*3 During AC voltage tests, current also flows in the stray capacitance of items such as the test leads and tools.

For details on stray capacitance, see "Stray Capacitance of AC Withstanding Voltage Tests"

*4 When the temperature and humidity are high, erroneous current from the product's internal and external high-voltage wiring sections to ground increases. When the humidity exceeds 70 %, an erroneous current of about 50 μA may be generated.

Judgment function		TOS9300	TOS9301	TOS9302	TOS9303	TOS9303LC
Current judgment operation	UPPER FAIL	Judgment method	The output is shut off when a judgment is made. Buzzer volume level can be set in the range of 0 (OFF) to 10 for pass and fail separately. In an auto test, the buzzer is valid only for the judgment that takes place at the end of the program.			
		Display	UPPER FAIL results when a current greater than or equal to the Upper limit is detected. For DCW, judgment is not made during the judgment delay (Judge Delay).			
		Buzzer	"U-FAIL" is displayed.			
		SIGNAL I/O	On			
		Judgment method	The U-FAIL signal is generated continuously until a STOP signal is received.			
		Display	LOWER FAIL results when a current less than or equal to the Lower limit is detected. Judgment is not made during Voltage rise time or Voltage fall time of an ACW test.			
		Buzzer	"L-FAIL" is displayed.			
		SIGNAL I/O	On			
		Judgment method	The L-FAIL signal is generated continuously until a STOP signal is received.			
		Display	PASS judgment is made if U-FAIL or L-FAIL has not occurred when the test time elapses.			
PASS	Buzzer	"PASS" is displayed.				
	SIGNAL I/O	On (fixed to 50 ms)				
	Judgment method	The PASS signal is generated for the length of time specified by the Pass Hold setting. If Pass Hold is set to Infinity, the PASS signal is generated continuously until a STOP signal is received.				
Voltage rise rate judgment operation	dV/dt FAIL	Judgment method	Monitors the voltage rise rate during Voltage rise time. This is valid when Auto set-ting of the judgment delay (Delay Auto) is set to on and the output voltage is 0.2 kV or more. The output is shut off when a judgment is made. Buzzer volume level can be set in the range of 0 (OFF) to 10 for pass and fail separately.			
		Display	When the voltage rise rate (dV/dt) is less than approx. 1 V/s, UPPER FAIL results.			
		Buzzer	"↗ U-FAIL" is displayed.			
		SIGNAL I/O	ON			
Upper limit setting range	AC: 0.01 mA to 110.00 mA, DC: 0.01 mA to 21.00 mA					
Lower limit setting range	AC: 0.00 mA to 109.99 mA, DC: 0.00 mA to 20.99 mA, OFF. Setting 0.00 is equivalent to OFF.					
Judgment accuracy *5 *6	$\pm(1\% \text{ of setting} + 5 \mu\text{A})$					
Current detection method	Compares to the reference value using the following method. Calculate true rms values, convert mean-value responses to rms values					
Response speed (filter) switching	Switches the current detection response speed (sensitivity) used in UPPER FAIL judgment between five levels in ACW and DCW tests.					

*5 During AC voltage tests, current also flows in the stray capacitance of items such as the test leads and tools. For details on stray capacitance, see "Stray Capacitance of AC Withstanding Voltage Tests"

*6 When the temperature and humidity are high, erroneous current from the product's internal and external high-voltage wiring sections to ground increases. When the humidity exceeds 70 %, an erroneous current of about 50 μA may be generated.

Timer function		TOS9300	TOS9301	TOS9302	TOS9303	TOS9303LC
Voltage rise time settings range	0.1 s to 200.0 s					
Voltage fall time setting time *7	0.1 s to 200.0 s, OFF					
Test time setting range	0.1 s to 1000 s, OFF					
Judgment delay (Judge Delay) setting range *8	0.1 s to 100.0 s, AUTO *9 (DCW only)					
Accuracy	$\pm(100 \text{ ppm of setting} + 20 \text{ ms})$ (excluding the fall time)					

*7 This setting is used only when a PASS judgment occurs in ACW and DCW tests. During a DCW test, the voltage may not drop all the way within the set time because of the electrostatic capacity inside the product and the EUT.

*8 Less than the sum of the rise time and fall time.

*9 If Delay Auto is set to on, LOWER judgment is not made until the charge time ends.

Other specifications		TOS9300	TOS9301	TOS9302	TOS9303	TOS9303LC
Analog monitor *10	I	Outputs a voltage signal according to the current waveform or voltage waveform				
	V	Current waveform: Scale 50 mA/1 V Voltage waveform: Scale 1 kV/1 V				
Grounding mode (GND)	Low	Can be switched between Low and Guard.				
	Guard *11	GND is connected to the low terminal. Measures the current flowing across the low terminal and chassis (normal applications). GND is connected to Guard. Measures only the current flowing through the low terminal (current flowing through the chassis is not measured) (high sensitivity, high accuracy measurement applications).				

*10 Monitor signal output is isolated from the chassis (earth). If you connect an oscilloscope or an external device whose BNC shield is grounded, be sure to set the grounding mode (GND) to Guard. The value is not calibrated.

*11 If there is a possibility that the EUT or tools and the like will be grounded or if you are uncertain, do not set GND to Guard. Doing so is extremely dangerous because the ammeter will be shorted and will not be able to measure current. For normal applications, set GND to Low.

TOS9300 Series Specifications

Insulation Resistance Test

Output function	TOS9300	TOS9301	TOS9303	TOS9303LC	
Negative polarity	Output voltage range	-0.025 kV to -1 kV			
	Resolution	1 V			
	Setting accuracy	±(1.2 % of setting + 0.002 kV)			
	Max. rated load	1 W (-1 kV/1 mA)			
	Ripple	1 kV no load	2 Vp-p or less		
Positive polarity ^{*1}	Max. rated load	10 Vp-p or less			
	Short-circuit current	12 mA or less			
	Output voltage range	+0.05 kV to +7.2 kV			
	Resolution	1 V			
	Setting accuracy	±(1.2 % of setting + 0.02 kV)			
Max. rated load	-		7.2 W(7.2 kV/1 mA)		
	1 kV no load		20 Vp-p or less		
	Max. rated load		50 Vp-p or less		
	Short-circuit current		100 mA (TYP) (200 mA peak)		
Max. rated current	1 mA				
Voltage regulation	1 % or less (when changing from maximum rated load to no load)				
Discharge function	Forced discharge after test completion (discharge resistance: 20 kΩ)				
Output voltage monitor function	If the output voltage exceeds ±(10 % of setting + 0.05 kV), the output is turned off, and the protection function is activated.				

*1 TOS9300 are not supported.

Measurement function	TOS9300	TOS9301	TOS9303	TOS9303LC	
Voltmeter	Measurement range	Negative polarity: 0 Vdc to -1.2 kVdc, positive polarity: 0 Vdc to 7.5 kVdc			
	Resolution	0.1 V			
	Accuracy	Negative polarity: ±(1 % of reading + 0.001 kV), positive polarity: ±(1.2 % of reading + 0.001 kV)			
Resistance meter	Measurement range	0.001 MΩ to 100.0 GΩ (in the range of maximum rated current of 1 mA to 5 nA)			
		5 nA ≤ i ≤ 50 nA ^{*4}	500.0 MΩ ≤ R < 1.000 GΩ: ±(15 % of reading + 0.5 MΩ)		
			1.000 GΩ ≤ R < 10.00 GΩ: ±(15 % of reading + 5 MΩ)		
			10.00 GΩ ≤ R ≤ 100.0 GΩ: ±(20 % of reading + 200 MΩ)		
		50 nA < i ≤ 100 nA ^{*4}	200.0 MΩ ≤ R < 1.000 GΩ: ±(10 % of reading + 0.5 MΩ)		
			1.000 GΩ ≤ R < 10.00 GΩ: ±(10 % of reading + 5 MΩ)		
			10.00 GΩ ≤ R < 50.00 GΩ: ±(10 % of reading + 50 MΩ)		
		100 nA < i ≤ 200 nA ^{*5}	50.00 GΩ ≤ R ≤ 100.0 GΩ: ±(20 % of reading + 200 MΩ)		
			100.0 MΩ ≤ R < 1.000 GΩ: ±(7 % of reading + 0.5 MΩ)		
			2.000 GΩ ≤ R < 10.00 GΩ: ±(7 % of reading + 10 MΩ)		
		200 nA < i ≤ 1 μA ^{*5}	10.00 GΩ ≤ R < 50.00 GΩ: ±(7 % of reading + 100 MΩ)		
			10.00 MΩ ≤ R < 100.0 MΩ: ±(5 % of reading + 0.05 MΩ)		
			100.0 MΩ ≤ R < 1.000 GΩ: ±(5 % of reading + 0.5 MΩ)		
		1 μA < i ≤ 1 mA ^{*5}	1.000 GΩ ≤ R < 10.00 GΩ: ±(5 % of reading + 5 MΩ)		
			10.00 MΩ ≤ R < 100.0 MΩ: ±(2 % of reading + 0.03 MΩ)		
100.0 MΩ ≤ R < 1.000 GΩ: ±(2 % of reading + 0.3 MΩ)					
Accuracy ^{*2 *3} (when GND is set to Guard)(i: measured current)(R: measurement resistance)	Measurement range	500.0 MΩ ≤ R < 1.000 GΩ: ±(25 % of reading + 0.5 MΩ)			
		1.000 GΩ ≤ R < 10.00 GΩ: ±(25 % of reading + 5 MΩ)			
		10.00 GΩ ≤ R ≤ 100.0 GΩ: ±(30 % of reading + 200 MΩ)			
		200.0 MΩ ≤ R < 1.000 GΩ: ±(20 % of reading + 0.5 MΩ)			
		1.000 GΩ ≤ R < 10.00 GΩ: ±(20 % of reading + 5 MΩ)			
		10.00 GΩ ≤ R < 50.00 GΩ: ±(10 % of reading + 10 MΩ)			
		50.00 GΩ ≤ R ≤ 100.0 GΩ: ±(30 % of reading + 200 MΩ)			
		100.0 MΩ ≤ R < 1.000 GΩ: ±(10 % of reading + 0.5 MΩ)			
		1.000 GΩ ≤ R < 2.000 GΩ: ±(10 % of reading + 5 MΩ)			
		2.000 GΩ ≤ R < 10.00 GΩ: ±(10 % of reading + 10 MΩ)			
		10.00 GΩ ≤ R < 50.00 GΩ: ±(10 % of reading + 100 MΩ)			
		10.00 MΩ ≤ R < 100.0 MΩ: ±(5 % of reading + 0.05 MΩ)			
		100.0 MΩ ≤ R < 1.000 GΩ: ±(5 % of reading + 0.5 MΩ)			
		1.000 GΩ ≤ R < 10.00 GΩ: ±(2 % of reading + 0.003 MΩ)			
		10.00 MΩ ≤ R < 100.0 MΩ: ±(2 % of reading + 0.03 MΩ)			
100.0 MΩ ≤ R < 1.000 GΩ: ±(2 % of reading + 0.3 MΩ)					
Accuracy ^{*6} (when GND is set to Low)(i: measured current)(R: measurement resistance)	Measurement range	500.0 MΩ ≤ R < 1.000 GΩ: ±(25 % of reading + 0.5 MΩ)			
		1.000 GΩ ≤ R < 10.00 GΩ: ±(25 % of reading + 5 MΩ)			
		10.00 GΩ ≤ R ≤ 100.0 GΩ: ±(20 % of reading + 200 MΩ)			
		200.0 MΩ ≤ R < 1.000 GΩ: ±(20 % of reading + 0.5 MΩ)			
		1.000 GΩ ≤ R < 10.00 GΩ: ±(20 % of reading + 5 MΩ)			
		10.00 GΩ ≤ R < 50.00 GΩ: ±(10 % of reading + 10 MΩ)			
		50.00 GΩ ≤ R ≤ 100.0 GΩ: ±(30 % of reading + 200 MΩ)			
		100.0 MΩ ≤ R < 1.000 GΩ: ±(10 % of reading + 0.5 MΩ)			
		1.000 GΩ ≤ R < 2.000 GΩ: ±(10 % of reading + 5 MΩ)			
		2.000 GΩ ≤ R < 10.00 GΩ: ±(10 % of reading + 10 MΩ)			
		10.00 GΩ ≤ R < 50.00 GΩ: ±(10 % of reading + 100 MΩ)			
		10.00 MΩ ≤ R < 100.0 MΩ: ±(5 % of reading + 0.05 MΩ)			
		100.0 MΩ ≤ R < 1.000 GΩ: ±(5 % of reading + 0.5 MΩ)			
		1.000 GΩ ≤ R < 10.00 GΩ: ±(2 % of reading + 0.003 MΩ)			
		10.00 MΩ ≤ R < 100.0 MΩ: ±(2 % of reading + 0.03 MΩ)			
100.0 MΩ ≤ R < 1.000 GΩ: ±(2 % of reading + 0.3 MΩ)					
Hold function	The resistance measurement after a test is finished is held while the pass judgment is displayed.				
Offset cancel function	Cancels up to 2000 GΩ of the unnecessary insulation resistance across output cables and the like. OFF function available.				

*2 Humidity: 70 %rh or less (no condensation), when there is no interference caused by wobbly test leads or other prob-lems.

*3 If the grounding mode (GND) is set to low in a highly humid environment, leakage current to ground will be generated from the high-voltage wiring sections inside the product and the high-voltage wiring sections between the product and the EUT. This leakage current ranges from several nA to several tens of nA depending on the usage and wiring conditions of the optional TOS9320 high voltage scanner and greatly affects measurement accuracy. The effects of leakage current can be reduced by making measurements with the offset enabled.

*4 Add 10 % to the accuracy when measuring 100 V or less.

*5 Add 5 % to the accuracy when measuring 100 V or less.

*6 When the measured current is limited to 100 nA or more (no condensation) when the humidity is 50 %rh or less, no external disturbance is present such as swinging test leads, and the offset is enabled.

Judgment function	TOS9300	TOS9301	TOS9303	TOS9303LC	
Behavior based on judgment	The output is shut off when a judgment is made. Buzzer volume level can be set in the range of 0 (OFF) to 10 for pass and fail separately. In an auto test, the buzzer is valid only for the judgment that takes place at the end of the program.				
	UPPER FAIL	Judgment method	UPPER FAIL results when a resistance greater than or equal to the Upper limit is detected. Judgment is not made during or Voltage rise time.		
		Display	"U-FAIL" is displayed.		
		Buzzer	On		
	LOWER FAIL	SIGNAL I/O	The U-FAIL signal is generated continuously until a STOP signal is received.		
		Judgment method	LOWER FAIL results when a resistance less than or equal to the Lower limit is detected. Judgment is not made during the judgment delay (Judge Delay).		
		Display	"L-FAIL" is displayed.		
	PASS	Buzzer	On		
		SIGNAL I/O	The L-FAIL signal is generated continuously until a STOP signal is received.		
		Judgment method	PASS judgment is made if U-FAIL or L-FAIL has not occurred when the test time elapses.		
Voltage rise rate judgment operation	dV/dt FAIL	Display	"V" L-FAIL" is displayed.		
		Buzzer	On		
		SIGNAL I/O	The L FAIL signals are generated continuously until a STOP signal is received.		
	Upper limit setting range	0.001 MΩ to 100.0 GΩ (in the range up to the maximum rated current), OFF			
	Lower limit setting range	0.000 MΩ to 99.99 GΩ (in the range up to the maximum rated current), OFF. Setting 0.000 is equivalent to OFF.			
	Accuracy ^{*7 *8 *9} (i: measured current)(R: measurement resistance)	Measurement range	5 nA ≤ i ≤ 50 nA ^{*10}		
			500.0 MΩ ≤ R < 1.000 GΩ: ±(15 % of setting + 0.51 MΩ)		
			1.000 GΩ ≤ R < 10.00 GΩ: ±(15 % of setting + 15 MΩ)		
			10.00 GΩ ≤ R ≤ 100.0 GΩ: ±(20 % of setting + 210 MΩ)		
			200.0 MΩ ≤ R < 1.000 GΩ: ±(10 % of setting + 0.51 MΩ)		
1.000 GΩ ≤ R < 10.00 GΩ: ±(10 % of setting + 15 MΩ)					
10.00 GΩ ≤ R < 50.00 GΩ: ±(10 % of setting + 60 MΩ)					
50.00 GΩ ≤ R ≤ 100.0 GΩ: ±(20 % of setting + 210 MΩ)					
100.0 MΩ ≤ R < 1.000 GΩ: ±(7 % of setting + 0.51 MΩ)					
1.000 GΩ ≤ R < 2.000 GΩ: ±(7 % of setting + 15 MΩ)					
2.000 GΩ ≤ R < 10.00 GΩ: ±(7 % of setting + 20 MΩ)					
10.00 GΩ ≤ R < 50.00 GΩ: ±(7 % of setting + 110 MΩ)					
10.00 MΩ ≤ R < 100.0 MΩ: ±(5 % of setting + 0.06 MΩ)					
100.0 MΩ ≤ R < 1.000 GΩ: ±(5 % of setting + 0.51 MΩ)					
1.000 GΩ ≤ R < 10.00 GΩ: ±(5 % of setting + 15 MΩ)					
10.00 GΩ ≤ R < 25.00 GΩ: ±(5 % of setting + 60 MΩ)					
Accuracy ^{*12} (when GND is set to Low)(i: measured current)(R: measurement resistance)	Measurement range	1 μA < i ≤ 1 mA ^{*11}			
		500.0 MΩ ≤ R < 1.000 GΩ: ±(2 % of setting + 0.013 MΩ)			
		10.00 MΩ ≤ R < 100.0 MΩ: ±(2 % of setting + 0.04 MΩ)			
		100.0 MΩ ≤ R < 1.000 GΩ: ±(2 % of setting + 0.31 MΩ)			
		1.000 GΩ ≤ R < 5.000 GΩ: ±(2 % of setting + 13 MΩ)			
		5 nA ≤ i ≤ 50 nA ^{*10}			
		500.0 MΩ ≤ R < 1.000 GΩ: ±(25 % of setting + 0.51 MΩ)			
		1.000 GΩ ≤ R < 10.00 GΩ: ±(25 % of setting + 15 MΩ)			
		10.00 GΩ ≤ R ≤ 100.0 GΩ: ±(30 % of setting + 210 MΩ)			
		200.0 MΩ ≤ R < 1.000 GΩ: ±(20 % of setting + 0.51 MΩ)			
		1.000 GΩ ≤ R < 2.000 GΩ: ±(20 % of setting + 15 MΩ)			
		10.00 GΩ ≤ R < 50.00 GΩ: ±(20 % of setting + 60 MΩ)			
		50.00 GΩ ≤ R ≤ 100.0 GΩ: ±(30 % of setting + 210 MΩ)			
		100.0 MΩ ≤ R < 1.000 GΩ: ±(10 % of setting + 0.51 MΩ)			
		1.000 GΩ ≤ R < 2.000 GΩ: ±(10 % of setting + 15 MΩ)			
2.000 GΩ ≤ R < 10.00 GΩ: ±(10 % of setting + 20 MΩ)					
10.00 GΩ ≤ R < 50.00 GΩ: ±(10 % of setting + 110 MΩ)					
10.00 MΩ ≤ R < 100.0 MΩ: ±(5 % of setting + 0.06 MΩ)					
100.0 MΩ ≤ R < 1.000 GΩ: ±(5 % of setting + 0.51 MΩ)					
1.000 GΩ ≤ R < 10.00 GΩ: ±(5 % of setting + 15 MΩ)					
10.00 GΩ ≤ R < 25.00 GΩ: ±(5 % of setting + 60 MΩ)					
10.00 MΩ ≤ R < 100.0 MΩ: ±(5 % of setting + 0.06 MΩ)					
100.0 MΩ ≤ R < 1.000 GΩ: ±(5 % of setting + 0.51 MΩ)					
1.000 GΩ ≤ R < 10.00 GΩ: ±(5 % of setting + 15 MΩ)					
10.00 GΩ ≤ R < 25.00 GΩ: ±(5 % of setting + 60 MΩ)					

*7 Making judgments on 200 μA or less requires at least 3 seconds after the rise time ends. Making judgments when the low pass filter is set to on requires at least 10 seconds after the rise time ends.

*8 Humidity: 70 %rh or less (no condensation), when there is no interference caused by wobbly test leads or other prob-lems.

*9 If the grounding mode (GND) is set to low in a highly humid environment, leakage current to ground will be generated from the high-voltage wiring sections inside the product and the high-voltage wiring sections between the product and the EUT. This leakage current ranges from several nA to several tens of nA depending on the usage and wiring conditions of the optional TOS9320 high voltage scanner and greatly affects measurement accuracy. The effects of leakage current can be reduced by making measurements with the offset enabled.

*10 Add 10 % to the accuracy when measuring 100 V or less.

*11 Add 5 % to the accuracy when measuring 100 V or less.

*12 When the measured current is limited to 100 nA or more (no condensation) when the humidity is 50 %rh or less, no external disturbance is present such as swinging test leads, and the offset is enabled.

TOS9300 Series Specifications

Timer function	TOS9300	TOS9301	TOS9303	TOS9303LC
Voltage rise time settings range	0.1 s to 200.0 s			
Test time setting range	0.1 s to 1000 s, OFF			
Judgment delay (Judge Delay) setting range *13	0.1 s to 100.0 s, AUTO *14			
Accuracy *15	±(100 ppm of setting + 20 ms)			

*13 Less than the sum of the rise time and fall time.

*14 If Delay Auto is set to on, UPPER judgment is not made until the charge time ends.

*15 This excludes fall time.

Other specifications	TOS9300	TOS9301	TOS9303	TOS9303LC
Grounding mode (GND)	Can be switched between Low and Guard.			
	Low	GND is connected to the low terminal. Measures the current flowing across the low terminal and chassis (normal applications).		
	Guard *16	GND is connected to Guard. Measures only the current flowing through the low terminal (current flowing through the chassis is not measured) (high sensitivity, high accuracy measurement applications).		
Filter function	A low-pass filter can be inserted into the ammeter measurement circuit. *17			

*16 If there is a possibility that the EUT or tools and the like will be grounded or if you are uncertain, do not set GND to Guard. Doing so is extremely dangerous because the ammeter will be shorted and will not be able to measure current. For normal applications, set GND to Low.

*17 When the low pass filter is on, a judgment delay of at least 5 seconds and a test time are required.

Earth Continuity Test

Output function	TOS9302	TOS9303	TOS9303LC
Current setting range *1	3.0 A to 42.0 A AC/DC		
Resolution	0.1 A		
	Accuracy ±(1 % of setting + 0.4 A)		
AC	Maximum rated output *2	220 VA (at the output terminal)	
	Distortion	2 % or less (20 A or more, using a 0.1 Ω pure resistive load)	
	Frequency	Select 50 Hz or 60 Hz. Sine	
	Accuracy	±200 ppm	
Open terminal voltage	6 Vrms or less		
Output method	PWM switching		
DC	Maximum rated output	220 W (at the output terminal)	
Ripple	±0.4 A _{p-p} or less (TYP)		
Open terminal voltage	6.0 V or less		

*1 No greater than the maximum rated output and resistance no greater than the output terminal voltage 5.4 V.

*2 When tests are performed consecutively, output time limit and rest time may become necessary depending on the up-per limit setting.

Measurement function	TOS9302	TOS9303	TOS9303LC
Output ammeter	Measurement range	0.0 A to 45.0 A AC/DC	
	Resolution	0.1 A	
	Accuracy	±(1 % of reading + 0.2 A)	
	Response	AC: true rms value; DC: mean value	
Hold function	The current measurement after a test is finished is held while the pass or fail judgment is displayed.		
Output voltmeter	Measurement range	AC: 0.00 V to 6.00 V, DC: 0.00 V to 8.50 V	
	Resolution	0.001 V	
	Offset cancel function	Cancels up to 5 V (AC/DC) of the unnecessary voltage from measurements. OFF function available.	
	Accuracy	±(1 % of setting + 0.02 V)	
	Response	AC: true rms value; DC: mean value	
Hold function	The voltage measurement after a test is finished is held while the pass or fail judgment is displayed.		
Resistance meter	Measurement range *3	1 mΩ to 600 mΩ	
	Resolution	1 mΩ	
	Offset cancel function	Cancels up to 10 Ω of the unnecessary resistance from measurements. OFF function available.	
	Accuracy	±(2 % of reading + 3 mΩ)	
	Hold function	The resistance measurement after a test is finished is held while the pass judgment is displayed.	

*3 Calculated from the measured output voltage and measured output current.

Judgment function	TOS9302	TOS9303	TOS9303LC	
Behavior based on judgment	Judgment based on resistance or sensing voltage can be selected. The output is shut off when a judgment is made. Buzzer volume level can be set in the range of 0 (OFF) to 10 for pass and fail separately. In an auto test, the buzzer is valid only for the judgment that takes place at the end of the program.			
	UPPER FAIL	Judgment method	UPPER FAIL results when a resistance greater than or equal to the Upper limit is detected or when a sensing voltage is detected. Judgment is not made during a contact check.	
		Display	"U-FAIL" is displayed.	
		Buzzer	On	
	LOWER FAIL	SIGNAL I/O	The U-FAIL signal is generated continuously until a STOP signal is received.	
		Judgment method	LOWER FAIL results when a resistance less than or equal to the lower limit (Lower) is detected or when a sensing voltage is detected.	
		Display	"L-FAIL" is displayed.	
	PASS	Buzzer	On	
		SIGNAL I/O	The L-FAIL signal is generated continuously until a STOP signal is received.	
		Judgment method	PASS judgment is made if U-FAIL or L-FAIL has not occurred when the test time elapses.	
Resistance judgment	Display	"PASS" is displayed.		
	Buzzer	On (fixed to 50 ms)		
	SIGNAL I/O	The PASS signal is generated for the length of time specified by the Pass Hold setting. If Pass Hold is set to Infinity, the PASS signal is generated continuously until a STOP signal is received.		
	Judgment accuracy	±(2 % of UPPER + 3 mΩ)		
Voltage judgment	Upper limit setting range	0.001 V to 5.000 V AC/DC		
	Lower limit setting range	0.000 V to 4.999 V AC/DC		
	Judgment accuracy	±(2 % of UPPER + 0.05 V)		
Calibration	Calibrated using a pure resistive load (with the rms of a sine wave for AC)			
Contact check function	Checks that current flows through the test leads and then starts the test. (OFF setting available)			

Timer function	TOS9302	TOS9303	TOS9303LC
Voltage rise time settings range	0.1 s to 200.0 s		
Voltage fall time setting time *4	0.1 s to 200.0 s, OFF		
Test time	0.1 s to 1000 s, OFF		
Accuracy	±(100 ppm of setting + 20 ms) (excluding the fall time)		

*4 This setting is used only when a PASS judgment occurs. During a DC test, the voltage may not drop all the way within the set time because of the electrostatic capacity inside the product and the EUT.

TOS9300 Series Specifications

Leakage Current Test

Measurement function		TOS9303LC	
Measurement Item	TC	Measurement mode	Touch current measurement Uses a measurement circuit network representing the impedance of a human body and measures the voltage drop across a reference resistance to calculate the touch current.
			Probe settings
	Enc - Enc A and B terminals: measurement terminal (for connecting to the enclosure of the EUT)		
	Enc - Liv Enc - Neu A terminal: measurement terminal (for connecting to the enclosure of the EUT) B terminal: open		
	PCC	Measurement method	Protective conductor current measurement
			Measures the voltage drop across a reference resistance inserted in the middle of the protective ground line to calculate the protective conductor current. The measurement impedance is 150 Ω.
	Patient	Measurement method	Patient leakage current measurement
			Uses a network conforming to IEC 60601 and measures the voltage drop across a reference resistance to calculate the patient leakage current.
	Meter	Measurement method	Measures the current flowing or voltage applied across the A and B terminals (simultaneous measurement not possible).
			Current measurement Uses a measurement circuit network representing the impedance of a human body and measures the voltage drop across a reference resistance to calculate the current flowing across the A and B terminals.
Voltage measurement Measures the voltage applied across the A and B terminals.			
Current measurement mode		DC Eliminates AC components and measures only the DC component.	
		RMS Measures the true rms value (switch AC and AC+DC)	
		Peak *1 Measures waveform peak values	

*1 Current measurements may not be stable due to the effects of the power supply line waveform or the wiring environment between the product and the EUT.

Measurement circuit network		TOS9303LC	
Network	A (IEC 60990 compliant) *2	(1.5 kΩ // 0.22 μF) + 500 Ω, reference measurement element: 500 Ω	
	B (IEC 60990 compliant)	(1.5 kΩ // 0.22 μF) + 500 Ω // (10 kΩ + 22 nF), reference measurement element: 500 Ω, voltage measurement U1 and U3 switchable	
	C (IEC 60990 compliant)	(1.5 kΩ // 0.22 μF) + 500 Ω // (10 kΩ + (20 kΩ + 6.2 nF) // 9.1 nF), reference measurement element: 500 Ω, voltage measurement U1 and U3 switchable	
	D (Electrical Appliances and Materials Safety Act, etc.)	1 kΩ, reference measurement element: 1 kΩ	
	E (Electrical Appliances and Materials Safety Act)	1 kΩ // (10 kΩ + 11.225 nF + 579 Ω), reference measurement element: 1 kΩ	
	F (UL and the like)	1.5 kΩ // 0.15 μF, reference measurement element: 1.5 kΩ	
	G	2 kΩ, reference measurement element: 2 kΩ	
	H (IEC 61010-1, 60601-1wet)	375 Ω // 0.22 μF + 500 Ω, reference measurement element: 500 Ω	
	I (Patient)	1 kΩ // 10 kΩ + 0.015 μF, reference measurement element: 1 kΩ	
	J (through)	For voltmeter calibration	
Network constant tolerance	PCC-1	150 Ω, reference measurement element: 150 Ω	
	PCC-2 (IEC 60598-1)	150 Ω // 1.5 μF, reference measurement element: 150 Ω	
		Resistance: ±0.1 %, capacitor 0.15 μF: ±2 %, others: ±1 %	
Network accuracy	A, B, C, H	Input voltage vs. output voltage ratio: logical value ± 5 % (according to IEC 60990 Annex L and F)	
	E	Input voltage vs. output voltage ratio: logical value ± 5 %	
	D, G	Reference measurement element (resistance) ± 1 %	
I	Input voltage vs. output voltage ratio: logical value ± 5 %		

*2 Current measurements may not be stable due to the effects of the power supply line waveform or the wiring environment between the product and the EUT.

Measurement section		TOS9303LC		
Measured current display (I: measured current) (□: measurement display)	< 100 μA	□□.□□ μA, resolution 0.01 μA		
	100 μA ≤ I < 1 mA	□□□.□ μA, resolution 0.1 μA		
	1 mA ≤ I < 10 mA	□.□□□ mA, resolution 0.001 mA		
	10 mA ≤ I < 100 mA	□□.□□ mA, resolution 0.01 mA		
Measurement range *3	Range 1	DC, RMS: 1 μA(min.) to 200 μA(max), Peak: 1 μA(min.) to 282 μA(max)		
	Range 2	DC, RMS: 12.5 μA(min.) to 2.00 mA(max), Peak: 17.5 μA(min.) to 2.83 mA(max)		
	Range 3	DC, RMS: 125 μA(min.) to 20.00 mA(max), Peak: 175 μA(min.) to 28.3 mA(max)		
	Range 4	DC, RMS: 1.25 mA(min.) to 100 mA(max), Peak: 1.75 mA(min.) to 100 mA(max)		
	Range switching	Auto	The range is set automatically according to the measurements.	
		Fix	For TC and PCC measurements, the measurement range is selected automatically according to the UPPER value. For meter measurements, the range is fixed to the specified range.	
	Bandwidth switching		Can be expanded to a bandwidth that allows measurements from 0.1 Hz, which is required in the measurement of medical instruments and the like.	
		Normal	Normal measurement bandwidth: 15 Hz to 1 MHz	
		Expand	Expands the measurement range to 0.1 Hz to 1 MHz	
	Total accuracy *4 (when network A, B, or C is used) *5	Range 1	DC	±(5.0 % of reading + 2 μA)
RMS			0.1 Hz ≤ f < 15 Hz	±(10.0 % of reading + 2 μA)
			15 Hz ≤ f ≤ 100 kHz	±(7.0 % of reading + 2 μA)
			100 kHz < f ≤ 1 MHz	±(10.0 % of reading + 2 μA)
Peak		0.1 Hz ≤ f < 15 Hz	±(10.0 % of reading + 10 μA)	
		15 Hz ≤ f ≤ 1 kHz	±(10.0 % of reading + 10 μA)	
		1 kHz < f ≤ 100 kHz	±(10.0 % of reading + 10 μA)	
		100 kHz < f ≤ 1 MHz	±(20.0 % of reading + 10 μA)	
Range 2		DC	±(5.0 % of reading + 20 μA)	
		RMS	0.1 Hz ≤ f < 15 Hz	±(10.0 % of reading + 10 μA)
	15 Hz ≤ f ≤ 100 kHz		±(7.0 % of reading + 8 μA)	
	100 kHz < f ≤ 1 MHz		±(10.0 % of reading + 10 μA)	
Peak	0.1 Hz ≤ f < 15 Hz	±(10.0 % of reading + 10 μA)		
	15 Hz ≤ f ≤ 1 kHz	±(10.0 % of reading + 10 μA)		
	1 kHz < f ≤ 100 kHz	±(10.0 % of reading + 10 μA)		
	100 kHz < f ≤ 1 MHz	±(20.0 % of reading + 10 μA)		
Range 3	DC	±(5.0 % of reading + 50 μA)		
	RMS	0.1 Hz ≤ f < 15 Hz	±(10.0 % of reading + 20 μA)	
		15 Hz ≤ f ≤ 100 kHz	±(7.0 % of reading + 20 μA)	
		100 kHz < f ≤ 1 MHz	±(10.0 % of reading + 20 μA)	
Peak	0.1 Hz ≤ f < 15 Hz	±(10.0 % of reading + 50 μA)		
	15 Hz ≤ f ≤ 1 kHz	±(7.0 % of reading + 50 μA)		
	1 kHz < f ≤ 100 kHz	±(10.0 % of reading + 50 μA)		
	100 kHz < f ≤ 1 MHz	±(20.0 % of reading + 50 μA)		
Range 4	DC	±(5.0 % of reading + 0.5 mA)		
	RMS	0.1 Hz ≤ f < 15 Hz	±(10.0 % of reading + 0.2 mA)	
		15 Hz ≤ f ≤ 100 kHz	±(7.0 % of reading + 0.2 mA)	
		100 kHz < f ≤ 1 MHz	±(10.0 % of reading + 0.2 mA)	
Peak	0.1 Hz ≤ f < 15 Hz	±(10.0 % of reading + 0.5 mA)		
	15 Hz ≤ f ≤ 1 kHz	±(7.0 % of reading + 0.5 mA)		
	1 kHz < f ≤ 100 kHz	±(10.0 % of reading + 0.5 mA)		
	100 kHz < f ≤ 1 MHz	±(20.0 % of reading + 0.5 mA)		
Input resistance	1 MΩ ± 1 %			
Input capacitance	200 pF or less (internal voltmeter input capacitance: 100 pF or less)			
Common mode rejection ratio	10 kHz or less: 60 dB or more, 10 kHz to 1 MHz: 40 dB or more			
Offset cancel function	Cancels up to 10 mA of the unnecessary current from measurements. OFF function available.			

*3 Voltmeter band expansion is possible when network I is selected.

*4 0.1 Hz ≤ f < 15 Hz is for when voltmeter band expansion (VoltMeter BandWidth) is set to Expand. Requires at least 120 second of test time.

*5 A value converted to current for measurements using Network A, B, C or H with voltmeter accuracy of this product as the reference.

If a network other than A, B, C or H is used, calculate as follows:

For Network D, E, or I, the ■ part of ±(□% of reading + ■A) is half the value.

For F, the ■ part is one-third the value.

For G, the ■ part is one-fourth the value.

For PCC-1 or PCC-2, the ■ part is 3.3 times the value.

Timer function		TOS9303LC	
Judgment delay (Judge Delay)	Setting range	1.0 s to 1000 s, OFF	
	Accuracy	±(100 ppm of setting + 20 ms)	
Test time	Setting range	1.0 s to 1000 s, OFF	
	Accuracy	±(100 ppm of setting + 20 ms)	

TOS9300 Series Specifications

Judgment function		TOS9303LC	
Behavior based on judgment	UPPER FAIL	Judgment method	UPPER FAIL results when a current greater than or equal to the upper limit (Upper) is detected.
		Display	"U-FAIL" is displayed.
		Buzzer	On
	LOWER FAIL	Judgment method	LOWER FAIL results when a current less than or equal to the lower limit (Lower) is detected.
		Display	"L-FAIL" is displayed.
		Buzzer	On
	PASS	Judgment method	PASS judgment is made if U-FAIL or L-FAIL has not occurred when the test time elapses.
		Display	"PASS" is displayed.
		Buzzer	On (fixed to 50 ms)
	Upper Setting range	RANGE 1	DC, RMS: 0.1 μA(min.) to 200 μA(max), Peak: 0.1 μA(min.) to 282 μA(max)
		RANGE 2	DC, RMS: 15.1 μA(min.) to 2.00 mA(max), Peak: 21.3 μA(min.) to 2.83 mA(max)
		RANGE 3	DC, RMS: 151 μA(min.) to 20.00 mA(max), Peak: 213 μA(min.) to 28.3 mA(max)
RANGE 4		DC, RMS: 1.51 mA(min.) to 100 mA(max), Peak: 2.13 mA(min.) to 100 mA(max)	
Lower Setting range		A value that is -1 digit from the upper setting range.	
Judgment accuracy		Conforms to total accuracy(Read "reading" as "upper setting" of total accuracy.)	

Other specifications		TOS9303LC	
Voltage conversion		Displays the estimated current converted with the preset supply voltage (Conv Voltage), based on the voltage supplied to the EUT and the measured current. (This is invalid in meter mode.)	
	Setting range	80.0 V to 300.0 V, OFF	
	Resolution	0.1 V	
Power supply line polarity selection		Set the polarity of the power supply line to supply to the EUT to positive or negative.	
Single fault mode (Condition) selection		Set the EUT single fault mode to normal, neutral line disconnection (Fault Neu), or protective ground wire disconnection (Fault PE).	
Ground check		In the touch current test between the enclosure and power supply line, if the EUT enclosure is grounded, CONTACT FAIL occurs.	
Measurement check		Checks the measurement function by shorting across the A and B terminals. If an error is found, the protection function is activated.	
Supply voltage measurement AC LINE (EUT)	Measurement range	80.0 V to 250.0 V	
	Resolution	0.01 V	
	Accuracy	±(3 % of reading + 1 V)	
Supply current measurement AC LINE (EUT)	Measurement range	0.1 A to 15.00 A	
	Resolution	0.001 A	
	Accuracy	±(5 % of reading + 30 mA)	
Power measurement (active power)	Measurement range	10 W to 1500 W	
	Accuracy	±(5 % of reading + 8 W) (with the supply voltage at 80 V or more, at a load power factor of 1)	
Voltage measurement across the A and B terminals	Measurement range	DC	10.00 V to 300.0 V
		RMS	10.00 V to 300.0 V
		Peak	15.00 V to 430.0 V
	Input impedance	Approx. 40 MΩ	
	Accuracy *6	±(3 % of reading + 2 V) (measurement range fixed to AUTO)	
	SELV detection	Set a voltage for detecting SELV. When the value is exceeded, the DANGER LED lights.	
		Setting range	10.0 V to 99.9 V, OFF
Measurement terminal	Rated voltage	Between the A and B terminals	250 V
		Between the terminals and chassis	250 V
	Rated current	100 mA	
	Measurement category	CAT-II	
	Valid terminal display	Terminals valid for measurement are indicated on the display.	
	110% terminal	Terminal for supplying 110% voltage of the AC line.	
Power supply for the EUT	Nominal voltage range	100 V to 240 V, 50 Hz/60 Hz	
	Input voltage range (allowable voltage range)	85 Vac to 250 Vac	
	Rated output capacity	1500 VA	
	Maximum operating current	15 A (Overcurrent protection is activated at approximately 15.75 A.)	
Inrush current	70 A peak max. (within 20 ms)		

*6 If voltage is measured with the A and B terminals open, measurements will be easily affected by induced voltage.

Interface (Common)

	TOS9300	TOS9301	TOS9302	TOS9303	TOS9303LC
REMOTE	5-pin DIN connector. Connect the following option to remotely control the starting and stopping of tests. • Remote control box RC01-TOS, RC02-TOS • High voltage test probe HP01A-TOS, HP02A-TOS (when the test voltage is 4 kVac 5 kVdc or less)				
SIGNAL I/O	D-sub 37-pin connector. For the pin arrangement				
Function	Enable/disable interlock, recall setup memories, recall auto test programs, start/stop testing, monitor the test and voltage generation status, monitor the test status, monitor judgment results, monitor the step execution status of auto tests, monitor the activation status of protection functions				
	The input signals are all low-active control. The input terminal is pulled up to +12 V by a resistor. Leaving the input terminal open is equivalent to applying a high level signal.				
Input specifications	High-level input voltage	11 V to 15 V			
	Low-level input voltage	0 V to 4 V			
	Low-level input current	-5 mA max.			
	Input time width	5 ms min.			
	Output method	Open collector output (4.5 Vdc to 30 Vdc)			
Output specifications	Output withstanding voltage	30 Vdc			
	Output saturation voltage	Approx. 1.1 V (25 °C)			
	Maximum output current	400 mA(TOTAL)			
	STATUS OUT	Output terminal of an option product.			
Positive terminal (red)	Outputs +24 V. Use Status Out of CONFIG settings to set the output conditions.				
	Negative terminal (black)	+24 V circuit common.			
SCANNER	MINI DIN 8-pin connector. Terminal for the optional TOS9320 high voltage scanner. The maximum number of connections is 4 devices(16 channels).				
USB (host)	Standard type A socket, FAT32, 32 GB or less Complies with the USB 2.0 specifications; data rate: 12 Mbps (full speed)				
Remote control	All functions except turning on and off the power, key lock, and auto test can be remotely controlled.				
RS232C	Hardware	D-sub 9-pin connector (EIA-232D compliant) Baudrate: 9600, 19200, 38400, 57600, 115200 bps Data length: 8 bits; stop bits: 1 bit; parity bit: none, flow control: none/CTS-RTS			
		Message terminator	LF during reception, LF during transmission.		
USB (device)	Hardware	Standard Type B connector. Complies with the USB 2.0 specifications; data rate: 480 Mbps (high speed)			
	Message terminator	LF or EOM during reception, LF + EOM during transmission.			
	Device class	Complies with the USBTMC-USB488 device class specifications.			
LAN	Hardware	IEEE 802.3 100Base-TX/10Base-T Ethernet. Auto-MDIX compliant. IPv4, RJ-45 connector.			
	Compliant standards	LXI 1.4 Core Specification 2011			
	Communication protocol	VXI-11, HiSLIP, SCPI-RAW, SCPI-Telnet			
	Message terminator	VXI-11, HiSLIP: LF or END during reception, LF + END during transmission. SCPI-RAW: LF during reception, LF during transmission.			
Display	7-inch LCD				

TOS9300 Series Specifications

Other Functions (Common)

		TOS9300	TOS9301	TOS9302	TOS9303	TOS9303LC
Auto test		Auto execution by combining ACW, DCW, IR, and EC. For LC, a combination is possible only using TC, PCC, and Patient.				
Test condition memory	Setup memory	Up to 50 test conditions (ACW, DCW, IR, EC, LC) can be saved.				
	Program memory	Up to 125 program (ACW, DCW, IR, EC) combinations, each containing 100 steps, can be saved.				
	Program memory (LC)	Up to 125 program (TC, PCC, Patient) combinations, each containing 100 steps, can be saved.				
Test result memory		Records up to 1000 latest test result of independent tests and auto tests. These are cleared when the power is turned off. Test results can be saved in CSV format to a USB memory device.				
System clock		For recording the calibration time and test times				
	Recordable time	Up to year 2038				
	Calibration period setting	Displays a warning at power-on when the specified period passes. Select whether to activate a protection function or only display a warning in the display area when a warning occurs.				
Measurement display		Maximum and minimum measurements can be displayed.				
	Normal	Displays measurements during a test. Maximum and minimum values are not held.				
	Maximum and minimum value display	Displays the maximum current measurement for withstanding voltage (ACW/DCW) tests, the minimum resistance measurement for insulation resistance (IR) tests, the resistance measurement or voltage measurement for earth continuity (EC) tests.				
Test start method	Double Action	When you press STOP, "READY" is shown for 0.5 seconds. A test starts only when you press START within this period.				
	Momentary	Tests are only executed while the START switch is held down.				
	Start Long	A test starts only when the START switch is held down for at least 1 second.				
PASS judgment display time (Pass Hold)		Set the time to hold the pass judgment result display (0.05 s to 10.00 s) or hold it until STOP is pressed (Infinity).				
STOP signal disable (Fail Mode)		It is possible to set the instrument so that fail judgment results and PROTECTION mode cannot be released from a device connected to the SIGNAL I/O connector or REMOTE connector.				
Key lock		Lock the operation of the keys to prevent changing the settings or overwriting memory or programs by mistake.				
Protection functions		If a protection function is activated during a test, the output is shut off and the test is stopped immediately. In an LC test, the power supply to the EUT is stopped, and the A and B terminals are opened. Conditions that cause a protection function to be activated are as follows.				
	Interlock	Interlock is activated.				
	Power Supply	There is an error in the power supply section.				
	Output Error	An output voltage outside of the following range is detected. ACW, DCW, IR test: $\pm(10\% \text{ of setting} + 50 \text{ V})$ EC test: $\pm(10\% \text{ of setting} + 2 \text{ A})$				
	Over Load	An output power outside of the following range is detected. ACW: 550 VA, DCW: 110 W, EC: 240 VA, LC: AC LINE OUT current exceeded approx. 15.75 A or the power exceeded 1600 VA.				
	Over Heat	The internal temperature of the product is abnormally high.				
	Over Rating	During a withstanding voltage test, an output current is generated for a length of time that exceeds the output time limit				
	Cal	The preset calibration period is exceeded.				
	Remote	The REMOTE connector is connected or disconnected.				
	Signal I/O	There is a change in the SIGNAL I/O connector's ENABLE signal.				
	Communication	An internal communication error is occurring.				
	Over Range	A value exceeding the maximum value of the measurement range is detected.				
	Measure	An error is detected in the LC test measurement check.				
	Short	A relay operation error is detected in an LC test.				
	Earth Fault	When the grounding mode (GND) is set to Guard, abnormal current flows from the high voltage output of this product to ground.				
	Scan I/F	While scanning, the interface cable is disconnected. Or, the channel-assigned scanner is not detected.				

General Specifications (Common)

		TOS9300	TOS9301	TOS9302	TOS9303	TOS9303LC
Backup battery life		3 years (at 25 °C)				
Environment	Installation location	Indoors, 2000 m or less				
	Spec guaranteed range	Temperature	5 °C to 35 °C (41 °F to 95 °F)			
		Humidity	20 %rh to 80 %rh (no condensation)			
	Operating rang	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 120 V, 200 V to 240 V (90 Vac to 132 V, 170 V to 250 V)			
	Power consumption	No load (READY state)	100 VA or less			
		Rated load	800 VA max.			
	Allowable frequency range		47 Hz to 63 Hz			
Insulation resistance (between AC LINE and chassis)		30 MΩ or more (500 Vdc)				
Withstanding voltage (between AC LINE and chassis)		1500 Vac, 1 minute, 20 mA or less				
Earth continuity		25 Aac, 0.1 Ω or less				
Weight		TOS9300: Approx. 17 kg (37.5 lb.), TOS9301: Approx. 18 kg (39.7 lb.), TOS9302: Approx. 20 kg (44.1 lb.), TOS9303: Approx. 21 kg (46.3 lb.), TOS9303LC: Approx. 22 kg (48.5 lb.)				
Accessories		Power cord (1 pc., *length: 2.5 m : The attached power cord varies depending on the shipment destination.) High-voltage test lead [TL31-TOS] (1 pair), SIGNAL I/O plug (1 set), High-voltage warning sticker (1 pc.), Setup Guide (1 copy), CD-ROM (1 disc), Safety Information (1 copy), Heavy object warning label (1 pc., *Not included with the TOS9300) Test leads for earth continuity test [TL13-TOS] (1 pair., *TOS9302, TOS9303, TOS9303LC only) [TOS9303LC only: Spare fuse (1 pc.), Test leads for leakage current test (2 red, 1 black), Flat probe (1 sheet)]				
Electromagnetic compatibility *1 *2		Complies with the requirements of the following directive and standards. EMC Directive 2014/30/EU EN 61326-1 (Class A *3), EN 55011 (Class A *3, Group 1 *4), EN 61000-3-2, EN 61000-3-3 Applicable under the following conditions The maximum length of all cabling and wiring connected to the prod-uct must be less than 2.5 m. Shielded cables are being used when using the SIGNAL I/O. The high-voltage test lead TL31-TOS is in use. Electrical discharges are applied only to the EUT.				
Safety *1		Complies with the requirements of the following directive and standards. Low Voltage Directive 2014/35/EU *2, EN 61010-1 (Class I *5, Pollution Degree 2 *6)				

*1 Does not apply to specially ordered or modified products.

*2 Limited to products that have a CE mark.

*3 This is a Class A instrument. This product is intended for use in an industrial environment. This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

*4 This is a Group 1 instrument. This product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/anal-ysis purpose.

*5 This is a Class I instrument. Be sure to ground this product's protective conductor terminal. The safety of this product is guaranteed only when the product is properly grounded.

*6 Pollution is addition of foreign matter (solid, liquid or gaseous) that may produce a reduction of dielectric strength or surface resistivity. Pollution Degree 2 assumes that only non-conductive pollution will occur except for an occasional temporary conductivity caused by condensation.

TOS9300 Series Specifications

High Voltage Scanner

Basic specifications		TOS9320
Maximum operating voltage	AC	5 kV
	DC	7.2 kV
Number of channels	4 (Each channel can be set to high, low, or open.)	
Maximum connections	4 units Channel numbers are assigned according to the order in which connections are made to the TOS9300 series tester. 1st scanner: CH1 to CH4, 2nd scanner: CH5 to CH8, 3rd scanner: CH9 to CH12, 4th scanner: CH13 to CH16	
Contact check function	Available	
Indicators	DANGER	Lights in sync with the TOS9300 series tester
	CHANNEL	Indicates the setting of each channel with color. Red: High, Green: Low, Orange: Contact being checked, Off: Open
	EXTERNAL	Lights when external control is on
	POWER	Lights when the power is on

Interface and other functions		TOS9320
Control switch	EXTERNAL I/O switch for switching the following controls. ON: External control through the CONTROLLER INTERFACE OFF: Control from the TOS9300 series tester	
CONTROLLER INTERFACE (external control)	D-sub 25-pin connector.	
Function	Sets each channel to high or low or all channels to open. Outputs the setting of each channel.	
	The input signals are all low-active control. The input terminal is pulled up to +12 V by a resistor. Leaving the input terminal open is equivalent to applying a high level signal.	
	High-level input voltage	11 V to 15 V
	Low-level input voltage	0 V to 4 V
	Low-level input current	-5 mA max.
Input	Input time width	5 ms min.
	Output method	Open collector output (4.5 Vdc to 30 Vdc)
	Output withstanding voltage	30 Vdc
	Output saturation voltage	Approx. 1.1 V (25°C, 77°F)
	Maximum output current	400 mA (TOTAL)
TOS9300 series tester interface	MINI DIN 8-pin connector. Accuracy guaranteed up to 4 units (16 channels)	

General specifications		TOS9320	
Environment	Installation location	Indoors, 2000 m or less	
	Spec guaranteed range	Temperature	5°C to 35°C (41°F to 95°F)
		Humidity	20%rh to 70%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	50 VA max.	
	Allowable frequency range	47 Hz to 63 Hz	
Insulation resistance (between AC LINE and chassis)	30 MΩ or more (500 Vdc)		
Withstanding voltage (between AC LINE and chassis)	1500 Vac for 1 minute, 20 mA or less		
Earth continuity	25 Aac/0.1 Ω or less		
Weight	Approx. 8 kg (17.6 lb)		
Accessories	Power cord (1 pc., length: 2.5 m: The attached power cord varies depending on the shipment destination.) High-voltage test lead [TL31-TOS] (8 red), Lead for high voltage parallel connection [TL33-TOS] (1 pair), Interface cable (1 pc.), CONTROLLER INTERFACE plug (1 set), High-voltage warning sticker (2 pc.), Channel labels (For the panel (1 sheet), For the test leads (1 sheet)), User's manual (1 copy), Safety Information (1 copy)		
	Electromagnetic compatibility *1 *2	Complies with the requirements of the following directive and standards. EMC Directive 2014/30/EU, EN 61326-1 (Class A *3), EN 55011 (Class A *3, Group 1 *4), EN 61000-3-2, EN 61000-3-3 Applicable under the following conditions The maximum length of all cabling and wiring connected to this product is less than 2.5 m. A shielded cable is used for the connection to the CONTROLLER INTERFACE. The high-voltage test lead TL31-TOS is in use. Electrical discharges are applied only to the EUT.	
Safety *1	Complies with the requirements of the following directive and standards. Low Voltage Directive 2014/35/EU *2, EN 61010-1 (Class I *5, Pollution Degree 2 *6)		

*1 Does not apply to specially ordered or modified products.

*2 Limited to products that have a CE mark.

*3 This is a Class A instrument. This product is intended for use in an industrial environment. This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

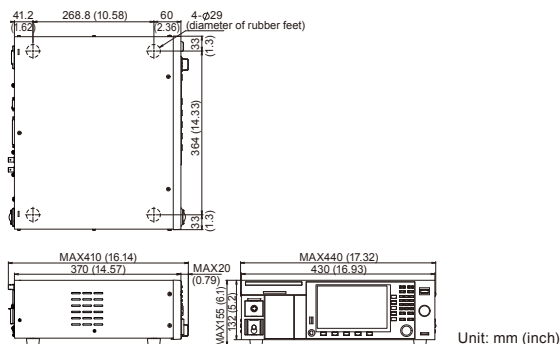
*4 This is a Group 1 instrument. This product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/analysis purpose.

*5 This is a Class I instrument. Be sure to ground this product's protective conductor terminal. The safety of this product is guaranteed only when the product is properly grounded.

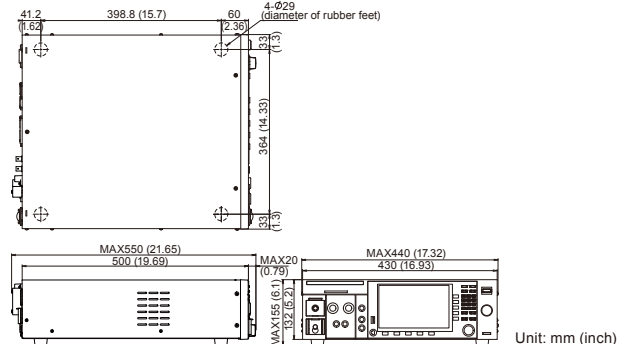
*6 Pollution is addition of foreign matter (solid, liquid or gaseous) that may produce a reduction of dielectric strength or surface resistivity. Pollution Degree 2 assumes that only non-conductive pollution will occur except for an occasional temporary conductivity caused by condensation.

External Dimensional Diagrams

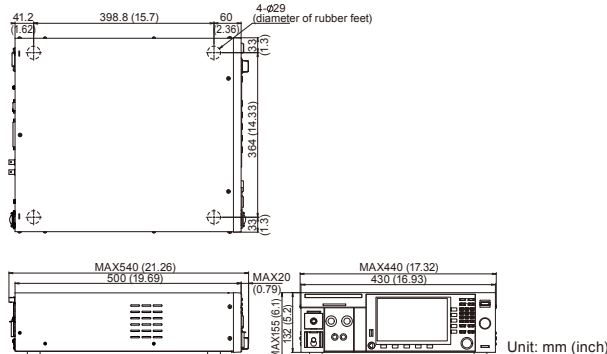
TOS9300, TOS9301



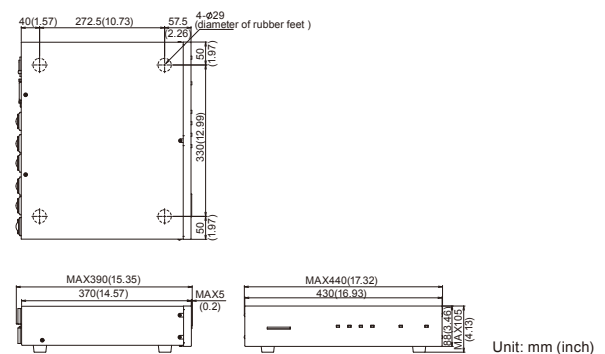
TOS9303LC



TOS9302, TOS9303



TOS9320



Hipot Tester / Hipot Tester with Insulation Resistance Test

TOS5300 Series



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.



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

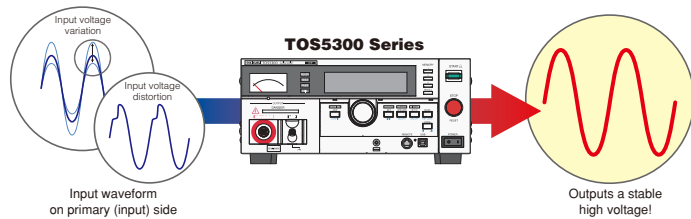
Power cord, High-voltage test lead wire: TL31-TOS, High-voltage warning sticker, D-sub 25-pin plug, User's Manual, CD-R(Contains the Communication Interface Manual, the KI-VISA library, and the Safety evaluation test.)

Features

- 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 ± 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

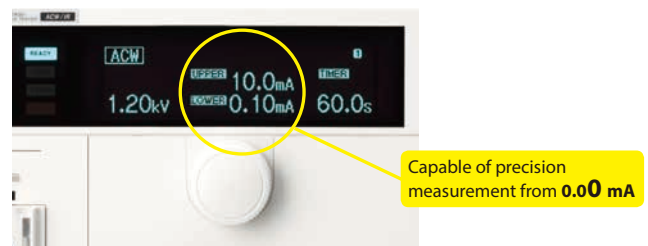
Features and Functions

- The PWM amplifier provides highly stable output!
 [Input voltage variation: ± 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 W DC 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.

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



▲ 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.



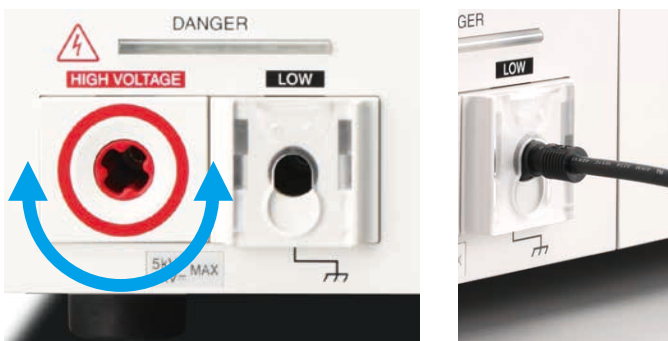
▲ View with the protection cover removed



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

■ New design of output terminal improves safety and functionality

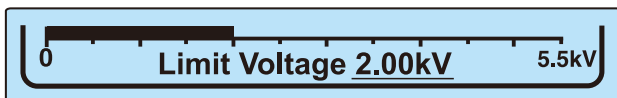
The free rotation mechanism protects from twisting (or breaking) of the cable. Also, with having the lock function for the LOW terminal on the main unit, the metal plate is no longer attached to the test lead of LOW-side, and it makes to resist damage to the test lead. Because of elimination of these 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

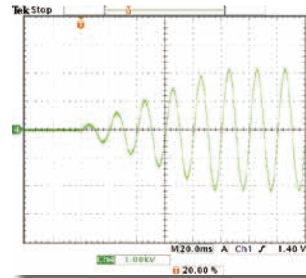
If the output voltage exceeds the setting voltage of (± 350 V), it turns off the output and the system switches to PROTECTION mode.

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.

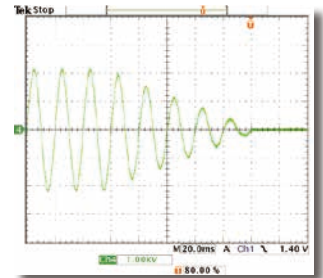
■ Rise/Fall time control function

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

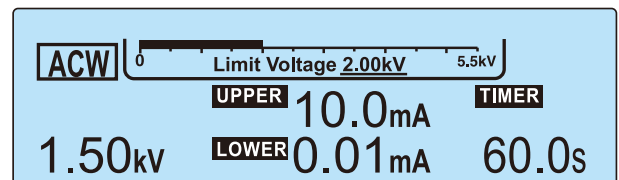
The product is equipped with an interlock function that operates together with external devices to interrupt output. To ensure the safe operation of tester, the interlock function activates when the SIGNAL I/O connector pins number 1 and 13 are opened, and when they are short-circuited, the interlock 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. • fs: 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			
	Digital	Indication	Average value response/rms scale			
		Measurement range	0.000 kV to 6.500 kV AC/DC			
Ammeter	Digital	Display	□ . □□□ kV			
		Accuracy *3	V < 500 V: ±(1.5 % of rdng + 20 V); V ≥ 500 V: ±1.5 % of rdng			
	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.			
Ammeter	Digital	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	
		Display	i = measured current			
	Digital	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)			
Digital	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	
Time	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)				
Time	Voltage rise time	Resolution	0.1 s to 10.0 s				
		Resolution	0.1 s				
		Resolution	0.1 s / OFF (only enabled when a PASS judgment occurs)				
		Resolution	0.1 s to 999 s, can be turned off (TIMER OFF)				
Time	Voltage fall time	Resolution	0.1 s to 99.9 s: 0.1 s, 100 s to 999 s: 1 s.				
		Resolution	±(100 ppm + 20 ms) excluding Fall Time				
		Resolution					
		Resolution					
Time	Accuracy	Resolution					
		Resolution					
		Resolution					
		Resolution					
Time	Ambient temperature	Upper limit	Pause time	Output time			
		AC	50 mA < i ≤ 110 mA	Greater than or equal to the output time	30 min. max.		
		AC	i ≤ 50 mA	Not necessary	Continuous output possible		
		DC	5 mA < i ≤ 11 mA	Greater than or equal to the output time	1 min. max.		
Time	Ambient temperature	DC	i ≤ 5 mA	Greater than or equal to the wait time (WAIT TIME)	Continuous output possible		
		(Output time = voltage rise time + test time + voltage 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 ≤ 40 °C	AC	50 mA < i ≤ 110 mA	Greater than or equal to the output time
	AC	i ≤ 50 mA	Not necessary
t ≤ 40 °C	DC	5 mA < i ≤ 11 mA	Greater than or equal to the output time
	DC	i ≤ 5 mA	Greater than or equal to the wait time (WAIT TIME)

(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 border="1"> <thead> <tr> <th>Measured voltage</th> <th>V < 100 V</th> <th>100 V ≤ V < 1000 V</th> <th>1000 V ≤ V</th> </tr> </thead> <tbody> <tr> <td>Display</td> <td>□□ V</td> <td>□□□ V</td> <td>□□□□ V</td> </tr> </tbody> </table>	Measured voltage	V < 100 V	100 V ≤ V < 1000 V	1000 V ≤ V	Display	□□ V	□□□ V	□□□□ V														
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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 border="1"> <thead> <tr> <th>25 kΩ ≤ R < 1.00 MΩ</th> <th>1.00 MΩ ≤ R < 10.0 MΩ</th> <th>10.0 MΩ ≤ R < 100 MΩ</th> <th>100.0 MΩ ≤ R < 1.00 GΩ</th> <th>1.00 GΩ ≤ R ≤ 9.99 GΩ</th> </tr> </thead> <tbody> <tr> <td>□□□ kΩ</td> <td>□ . □□ MΩ</td> <td>□□ . □ MΩ</td> <td>□□□ MΩ</td> <td>□ . □□ GΩ</td> </tr> </tbody> </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									
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□□□ 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	<table border="1"> <thead> <tr> <th>Judgment</th> <th>Judgment method</th> <th>Display</th> <th>Buzzer</th> <th>SIGNAL I/O</th> </tr> </thead> <tbody> <tr> <td>UPPER FAIL</td> <td>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).</td> <td>FAIL LED lights; OVER is displayed on the screen</td> <td>ON</td> <td>Generates a U-FAIL signal</td> </tr> <tr> <td>LOWER FAIL</td> <td>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.</td> <td>FAIL LED lights; UNDER is displayed on the screen</td> <td>ON</td> <td>Generates a L-FAIL signal</td> </tr> <tr> <td>PASS</td> <td>If the specified time elapses without any problems, the output is turned off, and a PASS judgment occurs.</td> <td>PASS LED lights</td> <td>ON</td> <td>Generates a PASS signal</td> </tr> </tbody> </table>				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
		Judgment	Judgment method	Display	Buzzer	SIGNAL I/O																			
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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. <ul style="list-style-type: none"> 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

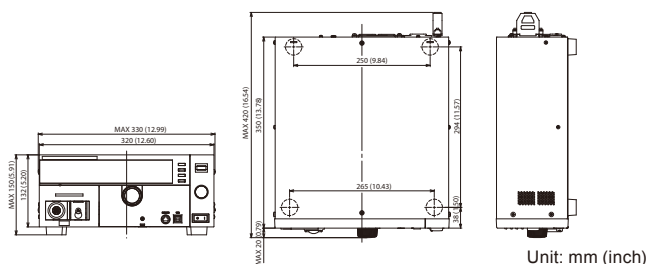
Other features/Interfaces

	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: $\pm(10\%$ of set + 10 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.		
Interfaces	USB Specification 2.0		
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 consumptio	When no load is connected (READY)	100 VA or less
		When rated load is disconnected	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 2014/35/EU, 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 2014/30/EU EN 61326-1 (Class A), EN 55011 (Class A, Group 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)	Approx. 14 kg (30.9 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 safety.

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.)

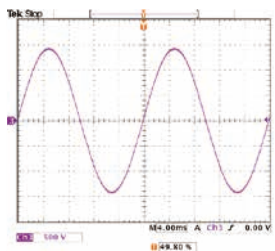
Features

- 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

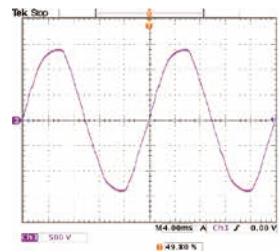
Features and Functions

- Highly stable output is realized with PWM Switching Amplifier!
Equipped with the PWM switching amplifier system, the TOS5200 realizes highly stable output not affected by input form AC line. A conventional Hipot Tester boosts and outputs the AC line's input voltage using a slide transformer system and which, the input voltage fluctuations will affect the output, preventing test from being performed properly. Since the TOS5200 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.

The output waveform is essential factor in Hipot (Withstanding oltage) testing!



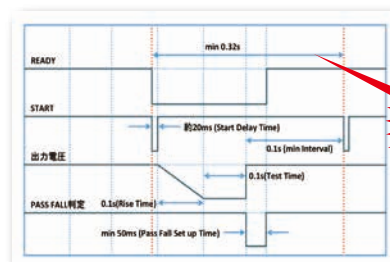
▲ AC output waveform of TOS5200



▲ AC output waveform of the slide transformer system

- Capable of Test Time setting from 0.1s, which enables to reduce the tact time !

The TOS5200 can set the test time from 0.1 sec without sacrificing measurement accuracy. This makes test time 5 times faster compared to the TOS5050A (max test time:0.5sec) and it leads to reduce the tact time. Reduction of the tact time leads to improve the productivity, so it has been an issue that reducing the tact time may cause to worsen the measurement accuracy when the test time is faster than measurement respond speed.

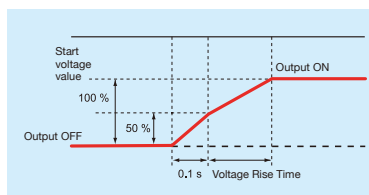


Cycle time
minimize to
0.32s

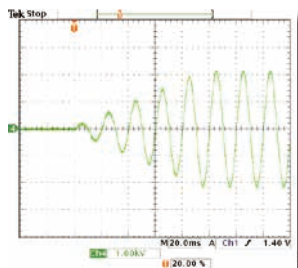
Features and Functions

■ Rise time / Fall time control function

The rise time control function is to prevent the excessive stress that is being applied to the EUT (equipment under test). The Hipot (Withstanding voltage) test is conducted to verify the safety performance of the EUT and which test voltage for Hipot (Withstanding voltage) test is applied approximately five to ten times greater than the voltage that handles by the EUT. If a high voltage is applied rapidly with no rise time, the transitional large voltage (current) will be occurred, and it may cause a damage to the EUT. For this reason, safety standards stipulate the procedure of Hipot (Withstanding voltage) test, and the test voltage must be gradually increased to the specified voltage when the test is performed. The rise time control function adopted in the TOS5200 can set the voltage rise time from 0.1s to 10.0s (at a resolution of 0.1s) and also it is capable to set the 50% (fixed) of the applied test voltage. In addition, the fall time control function enables to decrease the test voltage gradually after the completion of a PASS judgement. The voltage fall time is fixed at 0.1s (OFF is also selectable).

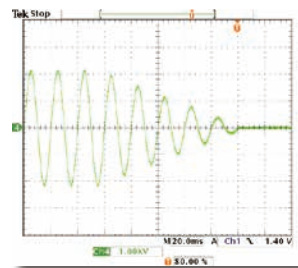


▲ Start voltage can be set at 50 % of the test voltage



▲ Rise time control waveform (example)

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 0.1s to 10.0s at a resolution of 0.1s.



▲ Fall time control waveform (example)

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

■ High Precision, High Resolution, Realizing high-speed judgment

High-precision measurement $\pm 1.5\%$ of reading (with voltmeter 500 V or higher, Ammeter 1 mA or higher) The auto-range function achieves the equivalent specifications of the judgment accuracy for the upper and lower fail, and it makes effective to detect the contact failure or the disconnected status of the test lead. Moreover, the test time as fast as 0.1s realize the high-speed judgment. It assures to perform testing with the high-precision, high-resolution, high-speed-measurement, and the judgment function.

■ Improved the setting resolution of the leak current by 0.01 mA !

TOS5200 can set the current limit from 0.01 mA to 110 mA.
(TOS5050A: 0.1 mA to 110 mA)

!Enables to clarify the actual value of device under test (DUT)

!The setting resolution of the lower limit setting has been improved from the previous model, it enables to detect the failure more accurately.

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.

TOS5200 Specifications

Withstanding voltage tester

AC Output section	Output range	0.05 kV to 5.00 kV		
	Accuracy	± (2 % of set + 20 V) when no load is connected		
	Operating 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)		
	Crest factor	√ 2 ± 3 % less than (when the output voltage is 800 V or greater, no load)		
	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			
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			
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	Digital	Measurement range	0.000 kV to 6.500 kV AC	
		Display	□ . □□□ kV	
		Accuracy	V < 500 V: ± (1.5 % of reading + 20 V), V ≥ 500 V: ±1.5 % of reading	
		Response *3	True rms, Average value response/rms display switchable	
Hold feature	After a test is finished, the measured voltage is retained until the PASS or FAIL judgment is cleared.			
Ammeter	Digital	Measurement range	0.00 mA to 110 mA	
		Display	i = measured current	
			i < 1 mA	1 mA ≤ i < 10 mA
			□ . □□□ mA	□ . □□□ mA
			10 mA ≤ i < 100 mA	100 mA ≤ i
		□□ . □□ mA	□□□ . □ mA	
		Accuracy *4	1.00 mA ≤ i: ± (1.5 % of reading), i < 1.00 mA: ± (1.5 % of reading + 30 μA)	
		Response *3	True rms, Average value response/rms display switchable	
Hold feature	After a test is finished, the measured current value is retained until the PASS judgment is cleared.			

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.	FAIL LED lights; UPPER 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; LOWER is displayed on the screen	ON	Generates a U-FAIL signal
	PASS	If the specified time elapses without any problems, the output is turned off, and a PASS judgment occurs.	PASS LED lights; displayed on the screen	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	0.01 mA to 110 mA			
	Lower limit setting	0.01 mA to 110 mA / OFF			
	Judgment accuracy *4	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	Pause time	Output time
t ≤ 40 °C	50 mA < i ≤ 110 mA	Greater than or equal to the output time 30 min. max.
	i ≤ 50 mA	Not necessary 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. For both True rms and Mean-value response, 50 ms or above response time is required to satisfy the measurement accuracy.

*4. 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	5 kV
When using 350 mm long test leads that are suspended in air (TYP)	2 μA	4 μA	10 μA
When using the accessory, high test lead TL31-TOS (TYP)	16 μA	32 μA	80 μA

In case of 70 % humidity or higher, it is considerable to add 50 μA on the Limit value.

TOS5200 Specifications

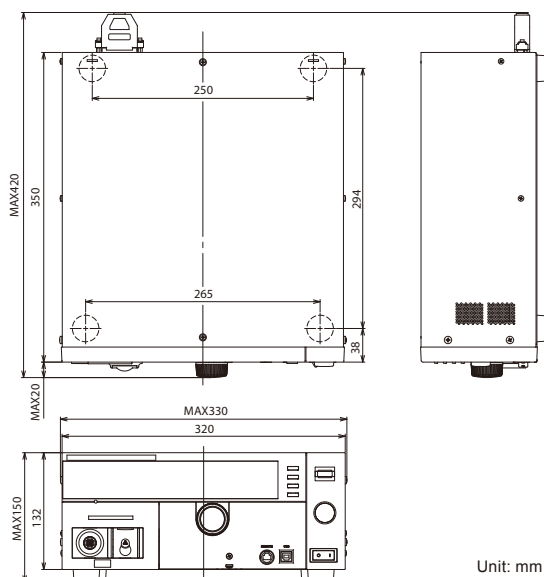
Other features / Interfaces

Test mode		
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 TOS5200 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 TOS5200 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	
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.	
Over Heat Protection	The internal temperature of the TOS5200 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.	
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 TOS5200 was being controlled through the USB interface.	
Interfaces	USB	USB Specification 2.0
	RS232C *1	D-SUB 9-pin connector on the rear panel (compliant with EIA-232-D) All functions other than the POWER switch and KEY-LOCK
	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

*1. "Talk mode" can be set, when RS232C is used as communication interface.

Talk mode	Description
0	It responds only for commands from PC. (Default setting) It responds automatically for start and end test, and returns the status, setting value, measured value.
1	Response at start
	Response at end of test

External Dimensional Diagrams



Unit: mm

General

Display		LCD: LED backlight	
Environment	Installation location	Indoors, at a height of up to 2000 m	
	Spec guaranteed range temperature/humidity	5 °C to 35 °C (41 °F to 95 °F)/ 20 %rh to 80 %rh (no condensation)	
	Operating range temperature/humidity	0 °C to 40 °C (32 °F to 104 °F)/ 20 %rh to 80 %rh (no condensation)	
	Storage range temperature/humidity	-20 °C to 70 °C (-4 °F to 158 °F)/ 90 %rh or less (no condensation)	
Nominal voltage range (allowable voltage range)		100 Vac to 240 Vac (90 Vac to 250 Vac)	
Power supply	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)		1500 Vac, one minute	
Earth continuity		25 Aac, 0.1 Ω or less	
Electromagnetic compatibility (EMC) *1		Complies with the requirements of the following directive and standard. EMC Directive 2014/30/EU, EN 61326-1(ClassA *2), EN 55011(ClassA *2, Group1 *3), EN 61000-3-2, EN 61000-3-3 Applicable under the following conditions The maximum length of all cabling and wiring connected to the TOS5200 must be less than 2.5 m. The shielded cable is being used when using the SIGNAL I/O. The high test lead TL31-TOS	
Safety *1		Complies with the requirements of the following directive and standard. Low Voltage Directive 2014/35/EU, EN 61010-1 (Class I *4, Pollution degree 2)	
Dimensions (mm(inches))(maximum)		320 (12.6") (330(12.99")) W × 132(5.2") (150(5.91")) H × 350(13.78") (420(16.54")) D	
Weight		Approx. 14 kg (30.9 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. / Setup Guide / Quick Reference (1 each for English and Japanese) / Safety information / CD-R *5	

- *1 Only on models that have the CE marking on the panel. Although signals are insulated with output terminals, each signal is common. Logic setting is also possible.
- *2 This is a Class A equipment. This product is intended for use in an industrial environment. This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.
- *3 This is a Group 1 equipment. This product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/analysis purpose.
- *4 This is a Class I equipment. Be sure to ground this product's protective conductor terminal. The safety of this product is only guaranteed when the product is properly grounded.
- *5 Contains the User's Manual, the Communication Interface Manual, VISA library (KI-VISA), IVI-COM driver, and Safety evaluation test.

TU01-TOS Option(s) for Electrical Safety Testers

The TU01-TOS is a terminal unit that converts the 25 pin SIGNAL I/O connector of the Kikusui TOS5200/5300/5301/5302 Withstanding Voltage Tester to the 14 pin SIGNAL I/O connector of the TOS5050A/ 5051A. You can insert this unit between a controller and a TOS5200/5300/5301/5302 to perform the same external control that you can perform on the TOS5050A/ 5051A.



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 RS232C interfaces
- Equipped with standard test lead (TL12-TOS)

Ground Bond Tester

TOS6200A**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

Suitable design for the automated ground bond testing adopted with the constant current method.

The TOS6200A 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 RS232C interfaces
- Equipped with standard test lead (TL11-TOS)
- Capable to judge by the resistance value and the voltage drop

TOS6210 Specifications

Output block	
Current setting range *1	6.0 Aac to 62.0 Aac (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 Aac to 66.0 Aac
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 Vac to 6.00 Vac
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)	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.
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 °C to 35 °C Humidity: 20 %rh to 80 %rh (non condensing)
Operating range	Temperature: 0 °C to 40 °C Humidity: 20 %rh to 80 %rh (non condensing)
Storage range	Temperature: -20 °C to 70 °C Humidity: 90 %rh or less (non condensing)
Altitude	Up to 2000 m

Power requirement		
Allowable voltage range	85 Vac to 250 Vac	
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 Vdc), between AC line and chassis	
Hipot	1390 Vac (2 seconds), between AC line and chassis	
Ground bond	25 Aac/0.1 Ω max.	
Electromagnetic compatibility (EMC) *5 *6		
Conforms to the requirements of the following directive and standard. EMC Directive 2014/30/EU EN 61326-1 (Class A), EN 55011 (Class A, Group 1), EN 61000-3-2, EN 61000-3-3 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 2014/35/EU EN61010-1 (Class I, Pollution degree 2)		
Physical dimensions (mm(inch)(maximum)/ Weight		
430(16.93")(455(17.91"))W×88(3.46")(140(5.51"))H×270(10.63")(350(13.78"))D/ 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	

*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.

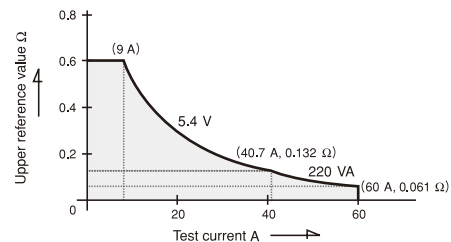
Ambient temperature t (°C)	Output time limitation		
	Test current I (A)	Pause time	Maximum allowable continuous test time
t ≤ 40 °C	40 < I ≤ 60	Equal to or greater than the test time	≤ 10 minutes
	20 < I ≤ 40	Equal to or greater than the test time	≤ 30 minutes
	I ≤ 20	Not required	Continuous output possible

*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.

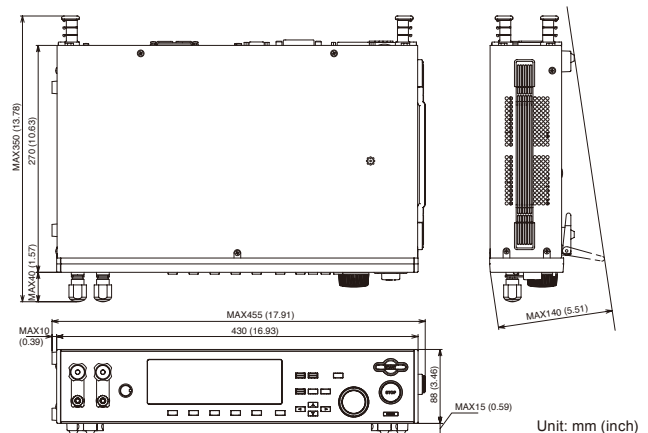
Allowable range in which to determine the test current value and upper reference value



*5 Not applicable to custom order models.

*6 Only on models that have CE marking on the panel.

External Dimensional Diagrams



TOS6200A Specifications

Output block		
Current setting range *1	3.0 Aac to 30.0 Aac (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 Aac to 33.0 Aac	
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 Vac to 6.00 Vac	
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 Ω to 1.200 Ω	
Resolution	0.001 Ω	
Offset cancel function	0.000 Ω 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 <ul style="list-style-type: none"> 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 Ω to 1.200 Ω	
Setting range for the lower reference value (LOWER)	0.001 Ω to 1.200 Ω	
Resolution	0.001 Ω	
Judgement accuracy	± (2 % of UPPER + 0.003 Ω)	
Sampled voltage value-based judgement	Window comparator system <ul style="list-style-type: none"> 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)	0.01 V to 5.40 V	
Setting range for the lower reference value (LOWER)	0.01 V to 5.40 V	
Resolution	0.01 V	
Judgment accuracy	± (2 % of setting + 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 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.

Buzzer	<ul style="list-style-type: none"> 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 Time	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 °C to 35 °C Humidity: 20 %rh to 80 %rh (non condensing)	
Operating range	Temperature: 0 °C to 40 °C Humidity: 20 %rh to 80 %rh (non condensing)	
Storage range	Temperature: -20 °C to 70 °C Humidity: 90 %rh or less (non condensing)	
Altitude	Up to 2000 m	
Power requirement		
Allowable voltage range	85 Vac to 250 Vac	
Power consumption	At no load (READY)	60 VA or less
	At rated load	280 VA max.
Allowable frequency range	47 Hz to 63 Hz	
Insulation resistance	30 MΩ min. (500 Vdc), between AC line and chassis	
Hipot	1390 Vac (2 seconds), between AC line and chassis	
Ground bond	25 Aac/0.1 Ω max.	
Safety *3 Conforms to the requirements of the following directive and standard.		
Low Voltage Directive 2014/35/EU, EN61010-1, Class I, Pollution degree 2		
Electromagnetic compatibility (EMC) *3 *4		
Conforms to the requirements of the following directive and standard. EMC Directive 2014/30/EU, EN61326-1 (Class A), EN55011 (Class A, Group 1), 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

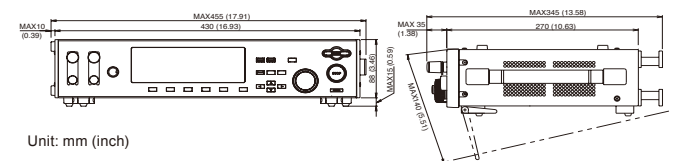
*2 About ohmmeter's response time

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.

External Dimensional Diagrams



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]



TL11-TOS

[cable length: 1.5 m/max.
operating current: 30 A]



TL12-TOS

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



TL13-TOS

[cable length: 1.6 m/max.
operating current: 40 A]



TL22-TOS

[cable length: 1.7 m/max.
rating: 1000 V, 10 A]



TL31-TOS

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



TL32-TOS

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



TL33-TOS

[cable length: 0.5 m/max.
operating voltage: 5 kV]



■ Buzzer Unit

BZ01-TOS (for 100 V AC)

*This can not be used
with TOS5300 Series.



■ 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]



* The optional adaptor DD-5P/9P is
required for the connection with
TOS5300, TOS5200 series and
TOS9300 series.

LP02-TOS

[cable length: 2 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]



■ 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, TOS5200 series and TOS9300 series..

■ Warning Light Unit

PL01-TOS (for 100 V AC)

*This can not be used with
TOS5300 Series.



PL02-TOS (for 24 V DC)

* for TOS5300 Series.



■ Terminal Unit

TU01-TOS

TOS5300/TOS5200 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)
TOS9300/9301	KRB3-TOS	3
TOS9301PD	KRB3-TOS	3
TOS9302	KRB3-TOS	3
TOS9303	KRB3-TOS	3
TOS9303LC	KRB3-TOS	3
TOS9320	KRB2-TOS	2
TOS5300	KRA4-TOS	4
TOS5301	KRA4-TOS	4
TOS5302	KRA4-TOS	4
TOS5200	KRA4-TOS	4
TOS6210	KRB2-TOS	2
TOS6200A	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)
TOS9300/9301	KRB150-TOS	3
TOS9301PD	KRB150-TOS	3
TOS9302	KRB150-TOS	3
TOS9303	KRB150-TOS	3
TOS9303LC	KRB150-TOS	3
TOS9320	KRB100-TOS	2
TOS5300	KRA200-TOS	4
TOS5301	KRA200-TOS	4
TOS5302	KRA200-TOS	4
TOS5200	KRA200-TOS	4
TOS6210	KRB100-TOS	2
TOS6200A	KRB100-TOS	2

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