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ELECTRICAL SAFETY TESTERS

Withstanding Voltage and Insulation Resistance Testers

Withstanding Voltage Testers

Insulation Resistance Testers

Earth Continuity Testers



JQA-EM1176
JQA-1100

Oscilloscopes
Withstanding Voltage Testers
Power Supply Equipment

TOS SERIES

ELECTRICAL SAFETY TESTER

ELECTRICAL SAFETY TESTERS LINEUP

TOS9201

AC/DC WITHSTANDING VOLTAGE AND
INSULATION RESISTANCE TESTER

GPIB RS-232C DRIVERS



TOS9200

AC WITHSTANDING VOLTAGE AND
INSULATION RESISTANCE TESTER

GPIB RS-232C DRIVERS



TOS9221

HIGH-VOLTAGE SCANNER
(CONTACT CHECK FUNCTION)



TOS9220

HIGH-VOLTAGE SCANNER



TOS8870A

AC WITHSTANDING VOLTAGE AND
INSULATION RESISTANCE TESTER



TOS5101

AC/DC WITHSTANDING VOLTAGE TESTER



TOS5051

AC/DC WITHSTANDING VOLTAGE TESTER



TOS5050

AC WITHSTANDING VOLTAGE TESTER



TOS5030

AC WITHSTANDING VOLTAGE TESTER



TOS5052

AC WITHSTANDING VOLTAGE TESTER
(RISE-TIME CONTROL FUNCTION)



TOS7200

INSULATION RESISTANCE TESTER

RS-232C



TOS6200

EARTH CONTINUITY TESTER

GPIB RS-232C DRIVERS



NOTE: Marking



Products equipped with these interfaces as standard.



Products adapted to either VisualBasic, LabVIEW and LabWindows / CVI.

Refer to the download service for drivers at Kikusui Web site.



CE marked products



These products are limited to available for CE marking model in the specific input voltage, please contact our local distributor for further detailed information.

ELECTRICAL SAFETY TESTERS

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 withstanding voltage testing. For this reason, it is necessary to confirm for what portion of what standard testing is to be performed when purchasing a withstanding voltage tester. Although the 500 VA capacity withstanding voltage 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.

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ELECTRICAL SAFETY TESTERS QUICK REFERENCE

Item		Withstanding Voltage and Insulation Resistance tester TOS9201	Withstanding Voltage and Insulation Resistance tester TOS9200	Withstanding Voltage and Insulation Resistance tester TOS8870A	Withstanding Voltage Tester TOS5101	
AC Withstanding Voltage test mode	Output-voltage Range	0.05kV to 5.00kV	0.05kV to 5.00kV	0 to 2.5kV/0 to 5.0kV (two ranges)	0 to 5kV/0 to 10kV (two ranges)	
	Output-voltage Resolution	10V	10V	-	-	
	Output-voltage Accuracy	±(1.5 % of setting + 20 V)	±(1.5 % of setting + 20 V)	-	-	
	Maximum rated load	500VA	500VA	500VA	500VA	
	Output-voltage Waveform	Sine wave	Sine wave	AC line waveform	AC line waveform	
	Frequency	50Hz/60Hz	50Hz/60Hz	AC line frequency	AC line frequency	
	Output Voltmeter Accuracy	Analog	±5%fs	±1.5%fs (with limited conditions)	±5%fs	
		Digital	±(1.0% of reading+30V)	±(1.0% of reading+30V)	±1.5%fs	
	Current Measurement Range	0.00mA to 110mA	0.00mA to 110mA	0.5mA to 100mA (seven ranges)	0.1mA to 55mA	
	Current Measurement Accuracy	±(3% of reading+20µA)	±(3% of reading+20µA)	-	±(5% of upper limit+20µA)	
	Current Judgement Accuracy	±(3% of setting+20µA)	±(3% of setting+20µA)	±5% of upper limit	±(5% of upper limit+20µA)	
	Setting Range for the Test Time	0.3s to 999s	0.3s to 999s	0.2s to 99.9s(X0.1 range) 1s to 999s(X1 range)	0.5s to 999s	
	Acceptance Determination by the Window Comparator Method	✓	✓	✓	✓	
	Rise-Time Control Function	✓	✓	-	-	
DC Withstanding Voltage test mode	Output-voltage Range	0.05kV to 6.00kV	-	-	0 to 5kV/0 to 10kV (two ranges)	
	Output-voltage Resolution	10V	-	-	-	
	Output-voltage Accuracy	±(1.5 % of setting + 20 V)	-	-	-	
	Output Voltmeter Accuracy	Analog	±5%fs	-	±5%fs	
		Digital	±(1.0 % of setting + 30 V)	-	±1.5%fs	
	Current Measurement Range	0.00mA to 11mA	-	-	0.1mA to 5.5mA	
	Current Measurement Accuracy	±(3% of reading+20µA)	-	-	±(5% of upper limit+20µA)	
	Current Judgement Accuracy	±(3% of setting+20µA)	-	-	±(5% of upper limit+20µA)	
	Setting Range for the Test Time	0.3s to 999s	-	-	0.5s to 999s	
	Acceptance Determination by the Window Comparator Method	✓	-	-	✓	
	Rise-Time Control Function	✓	-	-	-	
Insulation Resistance test mode	Output-voltage Range	-25V to -1000V DC	-25V to -1000V DC	-500V/-1000V DC (two ranges)	-	
	Output-voltage Resolution	1V	1V	-	-	
	Output-voltage Accuracy	±(1.5 % of setting + 2 V)	±(1.5 % of setting + 2 V)	-	-	
	Maximum Rated Load	1mA	1mA	-	-	
	Output Voltmeter Accuracy	Analog	±5%fs	-	-	
		Digital	±(1% of reading + 1 V)	±(1% of reading + 1 V)	-	
	Resistance Meter Measurement Range	0.01MΩ to 9.99GΩ	0.01MΩ to 9.99GΩ	1 to 1000MΩ(500V ranges) 2 to 2000MΩ(1000V ranges)	-	
	Setting Range for the Test Time	0.5s to 999s	0.5s to 999s	0.5s to 99.9s(X0.1 range) 1s to 999s(X1 range)	-	
	Acceptance Determination by the Window Comparator Method	✓	✓	✓	-	
Earth Continuity test mode	Output Current Setting Range	-	-	-	-	
	Output Current Setting Resolution	-	-	-	-	
	Output Ammeter Accuracy	-	-	-	-	
	Output Voltmeter Accuracy	-	-	-	-	
	Output Frequency	-	-	-	-	
	Ohmmeter Measurement Range	-	-	-	-	
	Ohmmeter Measurement Resolution	-	-	-	-	
	Setting Range for the Test Time	-	-	-	-	
Others	External Remote I/F	GPIO/RS-232C	GPIO/RS-232C	-	-	
	Readback of the measured data to the external	GPIO/RS-232C	GPIO/RS-232C	-	-	
	Memory Function	✓	✓	-	-	
	Multi Channels Capability	High Voltage Scanner Unit	High Voltage Scanner Unit	-	-	
	Power Nominal Voltage Range	100V to 120V AC/200V to 240V AC Selectable	100V to 120V AC/200V to 240V AC Selectable	100V±10% Can be Factory-modified to nominal 110V, 120V, 220V, 230V and 240V	100V±10% Can be Factory-modified to nominal 110V, 120V, 220V, 230V and 240V	
	CE Marking	✓	✓	✓	230V AC Input model only	
Reference page		6 to 16	6 to 16	17 to 19	20, 23	

	Withstanding Voltage Tester TOS5051	Withstanding Voltage Tester TOS5050	Withstanding Voltage Tester TOS5030	Withstanding Voltage Tester TOS5052	Insulation Resistance Tester TOS7200	Earth Continuity Tester TOS6200
	0 to 2.5kV/0 to 5.0kV (two ranges)	0 to 2.5kV/0 to 5.0kV (two ranges)	0 to 3kV	0 to 2.5kV/0 to 5.0kV (two ranges)	-	-
	-	-	-	10V	-	-
	-	-	-	±(2 % of setting + 2digits) at 0.20kV or higher with no load	-	-
	500VA	500VA	30VA	500VA	-	-
	AC line waveform	AC line waveform	AC line waveform	Sine wave	-	-
	AC line frequency	AC line frequency	AC line frequency	50Hz/60Hz	-	-
	±5%fs	±5%fs	±5%fs	±5%fs	-	-
	±1.5%fs	±1.5%fs	-	±1.5%fs	-	-
	0.1mA to 110mA	0.1mA to 110mA	0.5/1/2/5/10mA	0.00mA to 110mA	-	-
	±(5% of upper limit+20μA)	±(5% of upper limit+20μA)	-	±(5% of upper limit+20μA)	-	-
	±(5% of upper limit+20μA)	±(5% of upper limit+20μA)	±5% of preset cutoff current	±(5% of upper limit+20μA)	-	-
	0.5s to 999s	0.5s to 999s	-	0.3s to 999s	-	-
	✓	✓	-	✓	-	-
	-	-	-	✓	-	-
	0 to 2.5kV/0 to 5.0kV (two ranges)	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	±5%fs	-	-	-	-	-
	±1.5%fs	-	-	-	-	-
	0.1mA to 11mA	-	-	-	-	-
	±(5% of upper limit+20μA)	-	-	-	-	-
	±(5% of upper limit+20μA)	-	-	-	-	-
	0.5s to 999s	-	-	-	-	-
	✓	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-25V to -1000V DC	-
	-	-	-	-	1V	-
	-	-	-	-	±(1.5 % of setting + 2 V)	-
	-	-	-	-	1mA	-
	-	-	-	-	-	-
	-	-	-	-	±(1% of reading + 1 V)	-
	-	-	-	-	0.01MΩ to 5000MΩ	-
	-	-	-	-	0.5s to 999s	-
	-	-	-	-	✓	-
	-	-	-	-	-	3.0 to 30.0A AC
	-	-	-	-	-	0.1A
	-	-	-	-	-	±(1 % of reading + 0.2A)
	-	-	-	-	-	±(1 % of reading + 0.02V)
	-	-	-	-	-	50/60Hz
	-	-	-	-	-	0.001 to 1.200Ω
	-	-	-	-	-	0.001Ω
	-	-	-	-	-	0.3s to 999s
	-	-	-	-	RS-232C	GPIO/RS-232C
	-	-	-	-	RS-232C	GPIO/RS-232C
	-	-	-	-	✓	✓
	-	-	-	-	-	-
	100V±10% Can be Factory-modified to nominal 110V, 120V, 220V, 230V and 240V	100V±10% Can be Factory-modified to nominal 110V, 120V, 220V, 230V and 240V	100V±10% Can be Factory-modified to nominal 110V, 120V, 220V, 230V and 240V	100V±10% Can be Factory-modified to nominal 110V, 120V, 220V, 230V and 240V	100V to 240V	100V model: 85 to 132V AC 100V/200V model: 85 to 132V AC 170 to 250V AC
	230V AC Input model only	230V AC Input model only	230V AC Input model only	230V AC Input model only	✓	✓
	21, 23	21, 23	22, 23	24, 25	26 to 28	29, 30

TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

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



TOS9201(AC/DC)
TOS9200(AC)

GPIB **RS-232C** **DRIVERS** **CE**

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

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

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

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

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

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

TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

Basic performance

Three functions - AC withstanding voltage testing, DC withstanding voltage testing and insulation resistance testing

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

AC withstanding voltage testing at 5 kV and 100 mA

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

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

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

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

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

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

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

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

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

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

Enhanced measurement accuracy

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

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

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



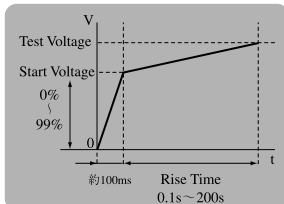
TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

Diverse functions

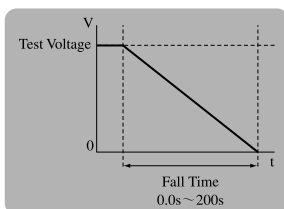
Rise-time control function

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



Fall-time control function

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



Offset cancel function

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

Voltage hold function

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

Maximum Leakage current and minimum resistance hold function

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

Output voltage monitoring function

When the output voltage deviates from $\pm(10\% \text{ of setting} + 50 \text{ V})$, the monitoring function activates to suspend the test, thus ensuring highly reliable testing.

Current detection response speed adjustment function

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

Memory function

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

[Storable test conditions]

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

Program function

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

[Sample program]

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

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

TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

Interfaces

REMOTE connector & SIGNAL I/O connector

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



[SIGNAL I/O]

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

[Pin Configuration for the SIGNAL I/O Connector]



- Input signal [Low active control input High-level input voltage: 11 V to 15 V / Low-level input voltage: 0 V to 4 V / Low-level input current: Maximum -5 mA / Input interval: Minimum 5 ms]
- Output signal [Open collector output Output withstanding voltage: DC 30 V / Output saturation voltage : Approximately 1.1 V (25 °C) /Maximum output current : 400 mA (TOTAL)]
- * The input signal circuit is pulled up to +12V. Therefore, opening the input terminal is equivalent to inputting a high-level signal.
- *12-digit BCD low active input Signal input terminal for selection between the panel memory for ACW, DCW, and IR, and the program memory for AUTO Memory recall by latching this selection signal at the rise of the strobe signal
- *2 2-bit low active input

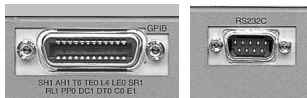
Test mode	ACW	DCW	IR	AUTO
MODE0	H	L	H	L
MODE1	H	H	L	L

GPIO/RS-232C interface

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

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

GPIO [Remote control of all functions except the POWER switch, the KEYLOCK function, and the program execution (AUTO) function/SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, CO, E1]



Peripheral devices

High-voltage scanner TOS9220/TOS9221

TOS9221 Front View (same for TOS9220)



TOS9221

TOS9220

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

TOS9221 Rear View

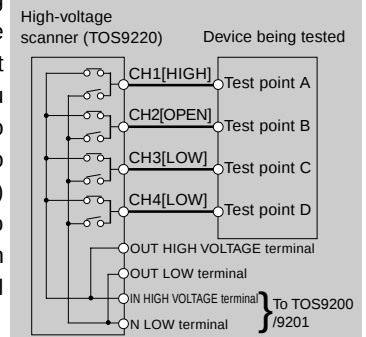


TOS9220 Rear View



Operation of the high-voltage scanner

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

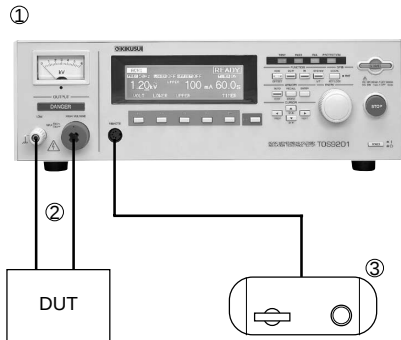


TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

For Stand alone use--

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

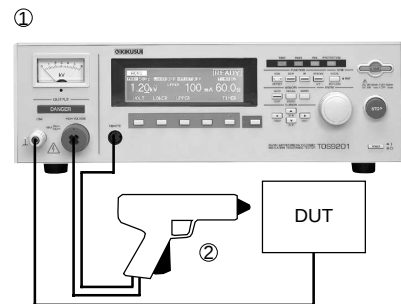


Item	Model	cable length	Required numbers
① Withstanding Voltage / Insulation Resistance Tester AC/DC	TOS9201		1 pc.
② High-Voltage Test Lead	TL01-TOS	1.5m *1	1 set
③ Remote Control Box	RC01-TOS *2	1.5m	1 pc.

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

*2: Also available for both-hands operation, RC02-TOS

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

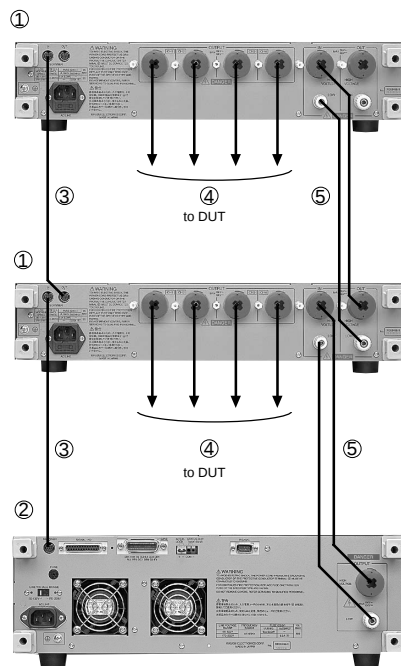


Item	Model	cable length	Required numbers
① Withstanding Voltage / Insulation Resistance Tester AC/DC	TOS9201		1 pc.
② High-Voltage Test Lead	HP01A-TOS	1.5m *1	1 pc.

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

For Multiple Channel Testing by High Voltage Scanner--

Example of system consisting TOS9201 and TOS9220 X 2sets (8CH)



Item	Model	cable length	Required numbers
① High-Voltage Scanner	TOS9220		2 pc.
② Withstanding Voltage / Insulation Resistance Tester AC/DC	TOS9201		1 pc.
③ Interface cable	85-50-0210	0.5m *1	2 pc.
④ High-Voltage Test Lead (red)	TL07-TOS	1.5m	8 pc.
⑤ High-Voltage Leads for Parallel connection	TL06-TOS	0.5m *2	2 set

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

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

[Rack mount bracket]

TOS9200 / 9201	(JIS)	KRB150-TOS
	(EIA)	KRB3-TOS
TOS9220 / 9221	(JIS)	KRB100-TOS
	(EIA)	KRB2-TOS

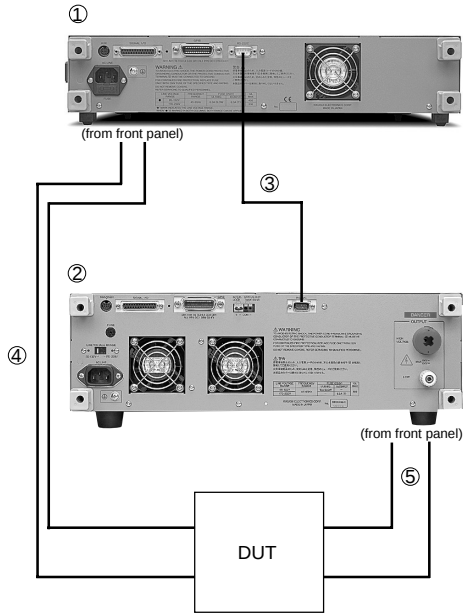
[CAUTION] In case of using more than 2sets of High Voltage Scanner, it is required to rack mount or locate these unit to the side of Withstanding / Insulation Resistance Tester, And it should not be piled up more than 2sets of High Voltage Scanner units.

TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

Single process to apply until earth continuity test...

Example of system consisting TOS9201 and TOS6200



Item	Model	cable length	Required numbers
① Earth Continuity Tester	TOS6200		1 pc.
② Withstanding Voltage / Insulation Resistance Tester AC/DC	TOS9201		1 pc.
③ RS-232C Cross Cable			1 pc.
④ Low-Voltage Test Lead	TL11-TOS	1.5m	1 set
⑤ High-Voltage Test Lead	TL01-TOS	1.5m *1	1 set

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

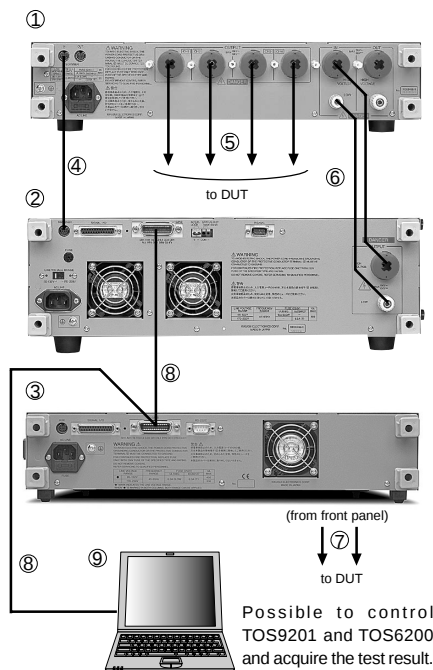
[Rack mount bracket]

TOS9200 / 9201	(JIS)	KRB150-TOS
	(EIA)	KRB3-TOS
TOS6200	(JIS)	KRB100-TOS
	(EIA)	KRB2-TOS

It is capable to perform for withstanding voltage / Insulation Resistance and Earth continuity testing in one single process by controlling TOS6200 from TOS9201.

Fully Automated System by PC...

Example of system consisting TOS9201, TOS9200 (4CH) and TOS6200



Item	Model	cable length	Required numbers
① High-Voltage Scanner	TOS9220		1 pc.
② Withstanding Voltage / Insulation Resistance Tester AC/DC	TOS9201		1 pc.
③ Earth Continuity Tester	TOS6200		1 pc.
④ Interface cable	85-50-0210	0.5m *1	1 pc.
⑤ High-Voltage Test Lead (red)	TL07-TOS	1.5m	4 pc.
⑥ High-Voltage Leads for Parallel connection	TL06-TOS	0.5m *2	1 set
⑦ Low-Voltage Test Lead	TL11-TOS	1.5m	1 set
⑧ GPIB Cable	408J-102	2m *3	2 pc.
⑨ PC (with GPIB Interface cable)			1 pc.

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

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

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

[Rack mount bracket]

TOS9200 / 9201	(JIS)	KRB150-TOS
	(EIA)	KRB3-TOS
TOS9220 / 9221 / 6200	(JIS)	KRB100-TOS
	(EIA)	KRB2-TOS

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

TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

Withstanding Voltage test mode

Item		TOS9200	TOS9201
Output section			
AC	Output-voltage range		0.05 kV to 5.00 kV
	Resolution	10 V	
	Accuracy	±(1.5% of setting + 20 V) [with no load]	
	Maximum rated load (*1)		500 VA (5 kV/100 mA)
	Maximum rated current		100 mA [output voltage of 0.2 kV or more]
	Transformer capacity		500 VA
	Output-voltage waveform(*2)		Sine wave
	Distortion	2% or less [with no load or pure resistive load at output voltage of 0.5 kV or more applied]	
	Frequency	50 Hz/60 Hz	
	Accuracy	±0.1%	
	Voltage regulation		±3% or less [maximum rated load → no load]
	Short-circuit current		200 mA or more, 350 mA or less [at output voltage of 0.5 kV or more]
	Type of output		PWM switching
	DC	Output-voltage range	
Resolution		10 V	
Accuracy		±(1.5% of the setting + 20 V)	
Maximum rated load (*1)		50 W (5 kV/10 mA)	
Maximum rated current		10 mA	
Ripple		No load at 5 kV	50 Vp-p Typ.
		Maximum rated load	150 Vp-p Typ.
Voltage regulation		1% or less [maximum rated load → no load]	
Short-circuit current		40 mA Typ.	
Discharge function		Forced discharge at the end of test(discharge resistance: 125 kΩ)	
Start voltage		The voltage at the start of the test can be set as the start voltage.	
	Setting range	0% to 99% of the test voltage (resolution of 1%)	
Output-voltage monitoring function		If the output voltage exceeds ±(10% of the setting + 50 V), output is cut off and the protection function activates.	
Voltmeter			
Analog	Scale	6 kV AC/DC F.S	
	Accuracy	±5% F.S	
	Indicator	Mean-value responsive/root-mean-square value scale	
Digital	Measurement range	0.0 kV to 6.00 kV AC/DC	
	Resolution	10 V	
	Accuracy	±(1.0% of the reading + 30 V)	
	Response	Mean-value responsive/root-mean-square value display (response time of 200 ms)	
	HOLD function	The voltage measured at the end of test is held during the PASS and FAIL judgment time period.	

*1 Time limitation on output

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

[Output limitation in withstanding voltage testing]

Ambient temperature		Upper current	Pause Time	Output time
$t \leq 40^\circ\text{C}$	AC	$50 < i \leq 110 \text{ mA}$	At least as long as the output time	Maximum of 30 minutes
		$i \leq 50 \text{ mA}$	Not necessary	Continuous output possible
	DC	$5 < i \leq 11 \text{ mA}$	At least as long as the output time	Maximum of 1 minute
		$i \leq 5 \text{ mA}$	At least as long as the judgement wait time (WAIT TIME)	Continuous output possible

*2 Test-voltage waveform

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

Item		TOS9200	TOS9201								
Ammeter (*3)											
Measurement range		0.00 mA to 110 mA AC	0.00 mA to 110 mA AC/0.00 mA to 11 mA DC								
Display		i = measured current <table border="1"> <tr> <td>$i < 1 \text{ mA}$</td><td>$1 \text{ mA} \leq i < 10 \text{ mA}$</td><td>$10 \text{ mA} \leq i < 100 \text{ mA}$</td><td>$100 \text{ mA} \leq i$</td></tr> <tr> <td>□ □ □ μA</td><td>□ □ □ mA</td><td>□ □ □ mA</td><td>□ □ □ mA</td></tr> </table>		$i < 1 \text{ mA}$	$1 \text{ mA} \leq i < 10 \text{ mA}$	$10 \text{ mA} \leq i < 100 \text{ mA}$	$100 \text{ mA} \leq i$	□ □ □ μA	□ □ □ mA	□ □ □ mA	□ □ □ mA
$i < 1 \text{ mA}$	$1 \text{ mA} \leq i < 10 \text{ mA}$	$10 \text{ mA} \leq i < 100 \text{ mA}$	$100 \text{ mA} \leq i$								
□ □ □ μA	□ □ □ mA	□ □ □ mA	□ □ □ mA								
Accuracy		$\pm(3\%$ of the reading + 20 μA) [after the offset cancel function is activated, if the scanner is mounted]									
Response		Mean-value responsive / root-mean-square value display (response time of 200 ms)									
Hold function		The measured current at the end of the test is held during the PASS judgment time period.									
Offset cancel function		The current flowing to the insulation resistor between the output cables and the stray capacity is cancelled up to 100 $\mu\text{A/kV}$ (in AC withstanding voltage testing only).									
Calibration		Performs calibration using the root-mean-square value of a sine wave with a pure resistive load									

TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

Item	TOS9200	TOS9201																							
Selection of GND/FLOAT for the LOW terminal (*4)	Selection permitted for current measurement between the mode for the LOW terminal grounded to the chassis, and the floating mode																								
	GND	Connects the LOW terminal to the chassis (ground). Measures the current flowing to the LOW terminal (chassis) (for normal operation).																							
	FLOAT	Sets the LOW terminal to the floating mode. Measures the current flowing to the LOW terminal, but does not measure the current flowing to the chassis (for high-sensitivity, high-accuracy measurements).																							
Judgement function																									
Judgement method/action	<table><tr><th>Judgement</th><th>Judgement method</th><th>Display</th><th>Buzzer</th><th>SIGNAL I/O</th></tr><tr><td>UPPER FAIL</td><td>When the tester detects a current exceeding the upper current, it cuts off the output and makes an UPPER FAIL judgement. In DC withstanding voltage testing, however, no judgement is made until the judgement wait time (WIT TIME) has elapsed.</td><td>The FAIL LED lights up. Displayed on the LCD</td><td>ON</td><td>Outputs the U FAIL signal</td></tr><tr><td>LOWER FAIL</td><td>When the tester detects a current below the lower current, it cuts off the output and makes a LOWER FAIL judgement. However, no judgement is made during the voltage rise time (RISE TIME) or voltage fall time (FALL TIME) in AC withstanding voltage testing.</td><td>The FAIL LED lights up. Displayed on the LCD</td><td>ON</td><td>Outputs the L FAIL signal</td></tr><tr><td>PASS</td><td>When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement.</td><td>The PASS LED lights up. Displayed on the LCD</td><td>ON</td><td>Outputs the PASS signal</td></tr></table> • The PASS signal is output at the timing preset on PASS HOLD. If HOLD is set, the PASS signal is output continuously until the STOP signal is input. • The UPPER FAIL signal and the LOWER FAIL signal are output continuously until the STOP signal is input. • The FAIL and PASS buzzer volumes are adjustable. However, they cannot be adjusted individually, as they are set in common.					Judgement	Judgement method	Display	Buzzer	SIGNAL I/O	UPPER FAIL	When the tester detects a current exceeding the upper current, it cuts off the output and makes an UPPER FAIL judgement. In DC withstanding voltage testing, however, no judgement is made until the judgement wait time (WIT TIME) has elapsed.	The FAIL LED lights up. Displayed on the LCD	ON	Outputs the U FAIL signal	LOWER FAIL	When the tester detects a current below the lower current, it cuts off the output and makes a LOWER FAIL judgement. However, no judgement is made during the voltage rise time (RISE TIME) or voltage fall time (FALL TIME) in AC withstanding voltage testing.	The FAIL LED lights up. Displayed on the LCD	ON	Outputs the L FAIL signal	PASS	When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement.	The PASS LED lights up. Displayed on the LCD	ON	Outputs the PASS signal
Judgement	Judgement method	Display	Buzzer	SIGNAL I/O																					
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PASS	When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement.	The PASS LED lights up. Displayed on the LCD	ON	Outputs the PASS signal																					
Setting range for the upper current (UPPER)	0.01 mA to 110 mA AC		0.01 mA to 110 mA AC / 0.01 mA to 11 mA DC																						
Setting range for the lower current (LOWER)	0.01 mA to 110 mA AC (With the LOWER OFF function)		0.01 mA to 110 mA AC / 0.01 mA to 11 mA DC (With the LOWER OFF function)																						
Judgement accuracy (*3)	±(3% of setting + 20 µA) [After the offset cancel function is activated, if the scanner is mounted]																								
Current detection method	The absolute current values are integrated and compared with the reference value.																								
Response-speed switching function	The current-detection response speed for UPPER FAIL judgement can be set to FAST/MID/SLOW (for AC withstanding voltage testing only).																								
Time																									
Setting range for the voltage rise time (RISE TIME)	0.1 s to 200 s																								
Setting range for the voltage fall time (FALL TIME)	0 s to 200 s (Valid only with PASS judgement)		0 s to 200 s (Valid only with PASS judgement in AC withstanding voltage testing)																						
Setting range for the test time (TEST TIME)	0.3 s to 999 s With the TIMER OFF function																								
Setting range for the judgement wait time (WAIT TIME)	—		0.3 s to 10 s (Only for DC withstanding voltage testing) [RISE TIME + TEST TIME > WAIT TIME]																						
Accuracy	± (100 ppm + 20 ms)																								

*3

In AC withstanding voltage testing, a current flows into the stray capacity of measurement leadwire and fixtures.

When the optional high-voltage scanner TOS9220/9221 is used, a current of approximately 22 µA/kV flows into the stray capacity of each scanner. The table below shows the approximate currents flowing into such stray capacity.

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

When the LOW terminal is set to FLOAT, the effect of the current flowing into the stray capacity is negligible. If the offset cancel function is used, the current flowing into the stray capacity can be eliminated from the measurement.

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

*4

With the LOW terminal set to FLOAT, current measurement is disabled when the part of the DUT connected to the LOW terminal is grounded, which is extremely danger. Do not ground the DUT. In ordinary operation, set the LOW terminal to GND.

Insulation Resistance Testing Mode

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

TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

Item		TOS9200		TOS9201																																																						
Voltmeter																																																										
Analog	Scale	6 kV AC/DC F.S																																																								
	Accuracy	±5% F.S																																																								
	Indicator	Mean-value responsive / root-mean-square value scale																																																								
Digital	Measurement range	0 V to -1200 V																																																								
	Resolution	1 V																																																								
	Accuracy	±(1 % of reading + 1 V)																																																								
Resistance meter																																																										
Measurement range		0.01 MΩ - 9.99 GΩ (Within the maximum rated current range of 1 mA to 50 nA)																																																								
Display		<table><tr><td>R < 10.0 MΩ</td><td>10.0MΩ ≤ R < 100.0MΩ</td><td>100.0MΩ ≤ R < 1.00GΩ</td><td>1.00GΩ ≤ R ≤ 9.99GΩ</td></tr><tr><td>□.□ □ MΩ</td><td>□ □.□ MΩ</td><td>□ □ □ MΩ</td><td>□.□ □ GΩ</td></tr></table> R = measured insulation resistance				R < 10.0 MΩ	10.0MΩ ≤ R < 100.0MΩ	100.0MΩ ≤ R < 1.00GΩ	1.00GΩ ≤ R ≤ 9.99GΩ	□.□ □ MΩ	□ □.□ MΩ	□ □ □ MΩ	□.□ □ GΩ																																													
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Accuracy		<table><tr><td>50 nA ≤ i ≤ 100 nA</td><td>100 nA < i ≤ 200 nA</td><td>200 nA < i ≤ 1 μA</td><td>1 μA < i ≤ 1 mA</td></tr><tr><td>± (20 % of reading)</td><td>± (10 % of reading)</td><td>± (5 % of reading)</td><td>± (2 % of reading)</td></tr></table> i = measured current [In the humidity range of 20% to 70% RH (no condensation), with no disturbance such as swinging of the test leadwire]				50 nA ≤ i ≤ 100 nA	100 nA < i ≤ 200 nA	200 nA < i ≤ 1 μA	1 μA < i ≤ 1 mA	± (20 % of reading)	± (10 % of reading)	± (5 % of reading)	± (2 % of reading)																																													
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Setting range for the upper resistance (UPPER)		0.01 MΩ to 9.99 GΩ [Below the maximum rated current]																																																								
Setting range for the lower resistance (LOWER)		0.01 MΩ to 9.99 GΩ [Below the maximum rated current]																																																								
Judgement accuracy																																																										
For both UPPER and LOWER		<table><tr><td colspan="2">Judgement current</td><td>50 nA ≤ i ≤ 100 nA</td><td>100 nA < i ≤ 200 nA</td><td>200nA < i ≤ 1 μA</td><td>1 μA < i ≤ 1 mA</td></tr><tr><td rowspan="8">UPPER, LOWER</td><td>0.01 ≤ R < 10.0 MΩ</td><td>—</td><td>—</td><td>—</td><td>± (2 % of setting + 3digit)</td></tr><tr><td>10.0 ≤ R < 50.0 MΩ</td><td>—</td><td>—</td><td>± (5 % of setting + 5digit)</td><td>± (2 % of setting + 3digit)</td></tr><tr><td>50.0 ≤ R < 100 MΩ</td><td>—</td><td>—</td><td>± (5 % of setting + 5digit)</td><td>± (2 % of setting + 3digit)</td></tr><tr><td>100 MΩ ≤ R < 200 MΩ</td><td>—</td><td>± (10 % of setting + 5digit)</td><td>± (5 % of setting + 5digit)</td><td>± (2 % of setting + 3digit)</td></tr><tr><td>200 MΩ ≤ R < 500 MΩ</td><td>± (20 % of setting + 5digit)</td><td>± (10 % of setting + 5digit)</td><td>± (5 % of setting + 5digit)</td><td>± (2 % of setting + 3digit)</td></tr><tr><td>500 MΩ ≤ R < 1.00 GΩ</td><td>± (20 % of setting + 5digit)</td><td>± (10 % of setting + 5digit)</td><td>± (5 % of setting + 5digit)</td><td>± (2 % of setting + 3digit)</td></tr><tr><td>1.00 GΩ ≤ R < 2.00 GΩ</td><td>± (20 % of setting + 10digit)</td><td>± (10 % of setting + 5digit)</td><td>± (5 % of setting + 5digit)</td><td>—</td></tr><tr><td>2.00 GΩ ≤ R < 5.00 GΩ</td><td>± (20 % of setting + 20digit)</td><td>± (10 % of setting + 10digit)</td><td>± (5 % of setting + 5digit)</td><td>—</td></tr><tr><td></td><td>5.00 GΩ ≤ R < 10.0 GΩ</td><td>± (20 % of setting + 20digit)</td><td>± (10 % of setting + 10digit)</td><td>—</td><td>—</td></tr></table> Judgement current = test voltage/(UPPER,LOWER) [In the humidity range of 20% to 70% R.H (no codensation), with no disturbance such as swinging of the test leadwire] [In LOWER judgement, at least 0.5 s is necessary for testing after the WAIT TIME has elapsed. In LOWER judgement for 200 nA or lower, a wait time of at least 1.0 s is necessary.]				Judgement current		50 nA ≤ i ≤ 100 nA	100 nA < i ≤ 200 nA	200nA < i ≤ 1 μA	1 μA < i ≤ 1 mA	UPPER, LOWER	0.01 ≤ R < 10.0 MΩ	—	—	—	± (2 % of setting + 3digit)	10.0 ≤ R < 50.0 MΩ	—	—	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)	50.0 ≤ R < 100 MΩ	—	—	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)	100 MΩ ≤ R < 200 MΩ	—	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)	200 MΩ ≤ R < 500 MΩ	± (20 % of setting + 5digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)	500 MΩ ≤ R < 1.00 GΩ	± (20 % of setting + 5digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)	1.00 GΩ ≤ R < 2.00 GΩ	± (20 % of setting + 10digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	—	2.00 GΩ ≤ R < 5.00 GΩ	± (20 % of setting + 20digit)	± (10 % of setting + 10digit)	± (5 % of setting + 5digit)	—		5.00 GΩ ≤ R < 10.0 GΩ	± (20 % of setting + 20digit)	± (10 % of setting + 10digit)	—	—
Judgement current		50 nA ≤ i ≤ 100 nA	100 nA < i ≤ 200 nA	200nA < i ≤ 1 μA	1 μA < i ≤ 1 mA																																																					
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	500 MΩ ≤ R < 1.00 GΩ	± (20 % of setting + 5digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)																																																					
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	5.00 GΩ ≤ R < 10.0 GΩ	± (20 % of setting + 20digit)	± (10 % of setting + 10digit)	—	—																																																					
Time																																																										
Setting range for the voltage rise time (RISE TIME)		0.1 s to 200 s																																																								
Setting range for the test time (TEST TIME)		0.5 s to 999 s With the TIMER OFF function																																																								
Setting range for the judgement wait time (WAIT TIME)		0.3 s to 10 s [RISE TIME + TEST TIME > WAIT TIME]																																																								
Accuracy		± (100 ppm + 20 ms)																																																								

*4

When the LOW terminal is set to FLOAT, current measurement is disabled if the part of the DUT connected to the LOW terminal is grounded, which is extremely danger. Do not ground the DUT. In ordinary operation, set the LOW terminal to GND.

TOS9200 SERIES

Withstanding Voltage and Insulation Resistance Tester

General Specifications

Item		TOS9200	TOS9201
Environment			
Installation location		Indoors at an altitude of up to 2000 m	
Warranty range	Temperature	5 °C to 35 °C	
	Humidity	20 % to 80 % RH (No condensation)	
Operating range	Temperature	0 °C to 40 °C	
	Humidity	20 % to 80 % RH (No condensation)	
Storage range	Temperature	-20 °C to 70 °C	
	Humidity	90% RH or less (No condensation)	
Power requirements			
Nominal voltage range (Allowable voltage range)		100 V to 120 V AC / 200 V to 240 V AC (85 V to 130 V AC / 170 V to 250 V AC) Selectable	
Power consumption	Using no load (READY)	100 VA or less	
	Using the rated load	Maximum of 800 VA	
Allowable frequency range		47 Hz to 63 Hz	
Insulation resistance		30 MΩ or more (500 V DC) [between the AC LINE and chassis]	
Withstanding voltage		1350 V AC, 1 minute, 10 mA or less [between the AC LINE and chassis]	
Earth continuity		25 A AC/0.1 Ω or less	
EMC (A custom order model does not apply to.)		Complied with the following standards: IEC61326-1:1997-03 / A1:1998-05 Electrical Equipment for Measurement, Control and Laboratory Use - EMC require-ments Radiated Emissions Class A Conducted Emissions ClassA IEC61000-4-2:1995-01/A1:1998-01 IEC61000-4-3:1995-02 Radiated, radio-frequency, electromagnetic field IEC61000-4-4:1995-01 Electrical fast transient/Burst IEC61000-4-5:1995-02 Surge IEC61000-4-6:1996-04 Conducted disturbances IEC61000-4-11:1994-06 Voltage dips, short interruptions and voltage variations Under following conditions 1. Used test leadwire TL01-TOS which is supplied. 2. No discharge occurs at outside of the tester. 3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.	
Safety (A custom order model does not apply to.)		This instrument is designed to comply with the requirements of following standard for class I portable equipment and is for use in a pollution degree 2 environment. IEC61010-1:1990-09 / A2:1995-07 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use The equipment is designed to operate from overvoltage category II.	
Dimensions (maximum)		430 (455) W x 132 (150) H x 370 (440) D mm	
Weight		Approx. 19 kg	
Accessory			
AC Power cable		1 pc.	
High-voltage test lead wire TL01-TOS (1.5 m)		1 set	
Interlock jumper		1 pc.	
High-Voltage Danger seal		1 sheet	
Fuse		1 pc.	
Operation Manual		Operation Manual for Tester: 1 copy, Operation for GPIB/RS-232C Interface: 1 copy	

Electrical performance

Item		TOS9220	TOS9221
Maximum rating voltage	AC	5.0 kV	
	DC	6.0 kV	
Number of channels		4 (Each channel is settable to HIGH, LOW, or OPEN.)	
Maximum number of scanners connected		4 scanners Channel numbers are determined in order of connection to the TOS9200/9201 tester. 1 st scanner CH1 to CH4 2 nd scanner CH5 to CH8 3 rd scanner CH9 to CH12 4 th scanner CH13 to CH16	
Contact check function		None (*1)	Provided
Lamps and LEDs	POWER	Lights as it is interlocked with the POWER switch of the TOS9200/9201 tester	
	DANGER	Lights as it is interlocked with the DANGER lamp of the TOS9200/9201 tester	
	CHANNEL	Lights during a test at each channel HIGH: red; LOW: green; Under contact check: orange	
Power requirements			
Nominal voltage range (allowable voltage range)		100 V to 120 V AC/200 V to 240 V AC (85 V to 132 V AC/170 V to 250 V AC) Automatic switching	
Power consumption	In READY state	Approx. 12 VA	
	During test	30 VA maximum	
Allowable frequency range		47 Hz to 63 Hz	
Insulation resistance		30 M Ω or more (500 V DC) [between the AC LINE and chassis]	
Withstanding voltage		1350 V AC, 1 minute, 20 mA or less [between the AC LINE and chassis]	
Earth continuity		25 A AC/0.1 Ω or less	

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

TOS9200 SERIES

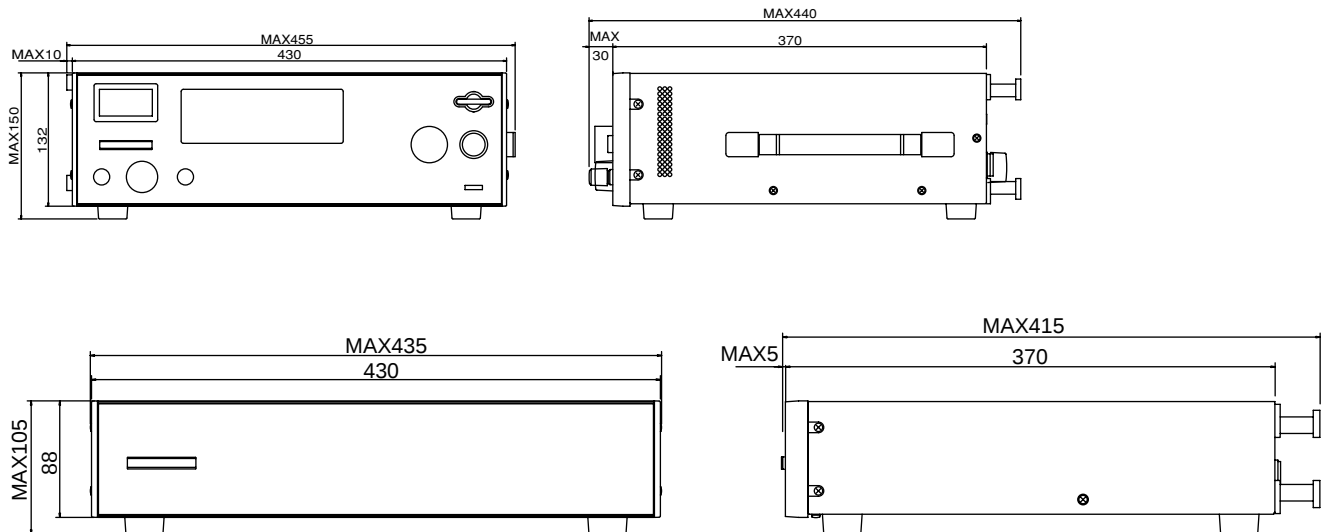
Withstanding Voltage and Insulation Resistance Tester

Item	TOS9220	TOS9221
EMC (A custom order model does not apply.)	Complied with the following standards: IEC61326-1:1997-03 / A1:1998-05 Electrical Equipment for Measurement, Control and Laboratory Use - EMC require-ments Radiated Emissions Class A Conducted Emissions ClassA IEC61000-4-2:1995-01/A1:1998-01 IEC61000-4-3:1995-02 Radiated, radio-frequency, electromagnetic field IEC61000-4-4:1995-01 Electrical fast transient/Burst IEC61000-4-5:1995-02 Surge IEC61000-4-6:1996-04 Conducted disturbances IEC61000-4-11:1994-06 Voltage dips, short interruptions and voltage variations Under following conditions 1. Used test leadwire TL07-TOS which is supplied. 2. No discharge occurs at outside of the tester. 3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.	
Safety (A custom order model does not apply.)	This instrument is designed to comply with the requirements of following standard for class I portable equipment and is for use in a pollution degree 2 environment. IEC61010-1:1990-09 / A2:1995-07 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use The equipment is designed to operate from overvoltage category II.	
Environment		
Installation location		Indoors and at altitudes up to 2000 m
Warranty range	Temperature	5 °C to 35 °C
	Humidity	20 % to 80 % R.H. (no condensation)
Operating range	Temperature	0 °C to 40 °C
	Humidity	20 % to 80 % R.H. (no condensation)
Storage range	Temperature	-20 °C to 70 °C
	Humidity	90 % or less R.H. (no condensation)
Dimensions		430(435)W × 88(105)H × 370(415) Dmm
Weight		Approx. 6.5 kg
Accessories		
AC power cable		1 pc.
High-voltage test leadwires, red		4 pc. (1.5 m each)

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

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

— External dimensional diagrams —



TOS8870A

Withstanding Voltage and Insulation Resistance Tester

Global Standard of the Withstanding Voltage / Insulation / Resistance Testers



TOS8870A



Applying to various safety standards

Capable to perform the continuous Withstanding Insulation Resistance Testing.

TOS8870A is a combination of a withstanding voltage tester and an insulation resistance tester, and it is capable of performing Withstanding Voltage Test and Insulation Resistance Test in one continuous process. (Choice of setting arrangement: AUTO ACW→IR, AUTO IR→ACW, MANU.ACW, MANU.IR.)

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

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

TOS8870A

Withstanding Voltage and Insulation Resistance Tester

Withstanding Voltage test mode

Test Voltage	Output AC Voltage	0 V to 2.5 kV/0 V to 5 kV (two ranges)
	Output Rating	500 VA (5 kV, 100 mA with 100 V line voltage) *1
	Waveform	AC line waveform
	Voltage regulation	Better than 20% (for maximum rated load to no load, with 100 V line voltage)
	Switching	With zero-start type switch
Output Voltmeter	Scales	2.5 kV f.s / 5 kV f.s, two ranges linear scales
	Class of meter	JIS Class 1
	Accuracy	5 °C to 15°C : ±3 % f.s 15 °C to 35 °C : ±1.5 % f.s (with a sine wave) *2
	Indication	Mean-value response, effective-value scale graduation
Judgment of Test Result PASS-FAIL judgment. Output cutoff by leakage current detection	Judgment	Window comparator system
		FAIL judgment when leakage current larger than high limit reference value is detected.
		FAIL judgment also when leakage current smaller than low limit reference value is detected.
		When FAIL judgment is made, output is cutoff and FAIL alarm is generated.
		If no FAIL judgment is made after preset period has elapsed, PASS signal is generated.
	High limit reference value	0.5/1/2/4/8/10/100 mA (7 values) By combinations of above values, a range of 0.5 mA to 25.5 mA can be covered in 0.5 mA steps.
	Low limit reference value	0 to one-half of high limit reference values (continuously variable)
	Accuracy of judgment *3	±5 % of high limit ±20 % of low limit reference value (one-half of high limit reference values at maximum counterclockwise). (Other are non-calibrated.)
	Judging method	Absolute value of leakage current is integrated and compared with preset limit reference value
	Calibration	Calibrated with rms value of sine wave, using a pure resistance load.
Test time	No-load output voltage need for detection *4	2.5 kV range Approx. 450 V when set at 100 mA 5 kV range Approx. 550 V when set at 100 mA
		Timer :0.2 s to 99.9 s (× 0.1 range) ±50 ms 1 s to 999 s (× 1 range) ±0.5 s
Others		Terminals for monitoring of leakage current

*1. The heat radiation of the output section of the tester is designed to be 1/2 of the rated output, taking the size, weight, cost, etc., into consideration. Therefore, use it within the limitations shown in Table 1. If it is used in excess of these limitations, the temperature of the output section rises excessively and the internal protection circuit may be activated. In this case, cancel the test for a while and wait until the normal temperature is restored.

*2. Crest factor of 1.35 to 1.41, distortion of 3% or less

*3. The current which flows due to stray capacitances of the output circuit and leadwires causes an error. The overall accuracy of judgement is the above-mentioned accuracy of judgement plus a factor caused by this current. Typical values of this type of currents are shown in the Table 2. Note that, when a test is made with a high voltage and high sensitivity, the current which flows through the stray capacitances may become larger than the preset low limit reference value and low limit judgement may become unavailable.

*4. When making an FAIL judgement test with the output terminals shorted, a certain level of no-load output voltage is needed due to the internal resistance of the output circuit. The voltages shown here are this type of output voltages.

[Table 1.]

Ambient temperature	Test current I	Pause time	Maximum test time
$t \leq 40\text{ °C}$	$25.5 < I \leq 100$	Test time or longer	30 minutes or less
	$I < 25.5$	Not required	Continuous test possible

[Table 2.]

Output voltage	1 kV	2 kV	3 kV	4 kV	5 kV
Test alone (without leadwires)	4 μ A	8 μ A	12 μ A	16 μ A	20 μ A
When 350mm long leadwires are hung in air	6 μ A	12 μ A	18 μ A	24 μ A	30 μ A
When the accessory leadwire (TL01-TOS) are used	20 μ A	40 μ A	60 μ A	80 μ A	100 μ A

Test Voltage Waveform

When an AC output voltage is applied to a capacitive load, it is possible that the voltage becomes higher than when in the no-load state due to the capacitance of the load.

Moreover, when the capacitance of the load is voltage dependent (typical examples are ceramic capacitors), the voltage waveform may be distorted. When the test voltage is 1.5kV, however, effects caused by a capacitance of 1000pF or less are negligible.

Insulation resistance Tester

Measuring Voltage		500 V or 1000 V DC, negative polarity (two ranges)
Measuring terminal voltage		0% to + 5% of rated measuring voltage (At rated measuring current or less)
Output current	Rated measuring current	1.0 mA
	Short circuit current	12 mA or less
Effective Measuring Ranges	500 V range	1 M Ω to 1000 M Ω
	1000 V range	2 M Ω to 2000 M Ω
Values center of scale	500 V range	20 M Ω
	1000 V range	50 M Ω
Accuracy		1st effective measuring range : $\pm 5\%$ of the indicated value *1
		2nd effective measuring range : $\pm 10\%$ of the indicated value *1
Judgment of Test Result PASS-FAIL judgment	Judgment	Window comparator system (mutually independent settings of high limit and low limit)
		FAIL judgment when measured resistance is smaller than low limit reference value.
		FAIL judgment when measured resistance is larger than high limit reference value.
		When FAIL judgment is made, output is cutoff and FAIL alarm is generated.
		If no FAIL judgment is made after preset period has elapsed, PASS signal is generated.
	Limit reference value setting range	Low and high limit reference values can be set at any points within the effective measuring range of the Tester.
	Accuracy of judgment	1st effective measuring range : $\pm 10\%$ of set value *1 2nd effective measuring range : $\pm 15\%$ of set value *1
	Waiting-time for judgment	Approx. 0.3 s
Test time	Timer	:0.5 s to 99.9 s ($\times 0.1$ range) ± 50 ms
		1 s to 999 s ($\times 1$ range) ± 0.5 s

*1. At 25 °C ± 10 °C

The 1st effective measuring range is from 1/1000 to 1/2 of the maximum effective scale value. The 2nd effective measuring range is from the above to the maximum effective scale value.

TOS8870A

Withstanding Voltage and Insulation Resistance Tester

Common Specifications

Types of test	1.AUTO ACW→IR	Withstanding voltage test first and insulation resistance test next	
	2.AUTO IR→ACW	Insulation resistance test first and withstanding voltage test next	
	3.MANUAL ACW	Withstanding voltage test alone	
	4.MANUAL IR	Insulation resistance test alone	
Remote Control	Test / Reset control	Low active control	
		Input conditions *1	
		High level input voltage	11 V to 15 V
Low level input voltage		0 V to 4 V	
	Low level sweep out current	5 mA or less	
	Input pulse width	20 ms minimum	
	Interlock	Protection is effected when INTERLOCK terminal is made open (test is disabled).	
Output signals *2	Signal Name	Conditions for Signal Generation	Type of Signals
	TEST ON signal	Delivered during entire test-on period.	Make-contact signal and lamp
	PASS signal	Delivered when PASS judgment is made, for approximately 50 ms.	Make-contact signal, lamp and buzzer
	ACW/FAIL alarm	Delivered continuously when FAIL judgment of withstanding voltage test is made.	Make-contact signal, lamp and buzzer
	IR/FAIL alarm	Delivered continuously when FAIL judgment of insulation resistance test is made.	Make-contact signal, lamp and buzzer
	READY signal	Delivered when in the READY state.	Make-contact signal
Special Test Mode	1.DOUBLE ACTION	Test starts only when the START switch is pressed within approximately 0.5 s after pressing the STOP switch.	
	2.PASS HOLD	The PASS state is held.	
Selectable with DIP switches at rear of Tester	3.MOMENTARY	Test is executed only during the period the START switch is kept pressed.	
	4.FAIL ALARM	FAIL alarm and PROTECTION state cannot be reset by the remote-control STOP signal.	
Ambient Temperature and Humidity		Warranty	5 °C to 35°C /20 % to 80 % RH
		Operable range	0 °C to 40 °C /20 % to 80 % RH
		Storage range	-20 °C to 70 °C /80 % RH or less
EMC	Complied with the following standards	IEC61326, EMISSION Class A, Immunity, Minimum Requirements	
	Under following conditions	1. Used HV test leadwire TL01-TOS. 2. No discharge in testing.	
Safety	Complied with the following standards	IEC61010-1, Overvoltage category II, Pollution degree 2	
Power Requirements	Line voltage	100 VAC ± 10 %, 50/60 Hz *3	
	Power consumption	When no load (RESET state) : 15 VA or less *4	
		When with rated load : Approx. 600 VA	
	Insulation resistance	30 MΩ or more, 500 VDC	
Withstanding voltage	1350 VAC, 1 minute		
Dimensions (maximum)		430 (435) W x 132 (155) H x 370 (440) Dmm	
Weight		Approx. 23 kg	
Standard accessories		TL01-TOS High Voltage Test Leadwires, approx. 1.5 m long. 1	
		AC Power cable 1	
		Operation Manual 1	
Options	RC01-TOS Remote Control Box		
	RC02-TOS Remote Control Box		
	HP01A-TOS High Voltage Test Probe, approx. 1.5 m long		
	HP02A-TOS High Voltage Test Probe, approx. 3 m long		
	TL02-TOS High Voltage Test Readwires, approx. 3 m long		
	KRB150-TOS Rackmount Bracket (for JIS)		
	KRB3-TOS Rackmount Bracket (for EIA)		

*1.The input terminal is pulled up to +15V supply voltage by resistor. Opening of the input terminal is equivalent to a high level input.

*2.The rating of the signal contacts is 125VAC, 1A, or 30VDC, 1A.

Loudness of the buzzer is adjustable with a knob in common for the PASS signal and FAIL alarm.

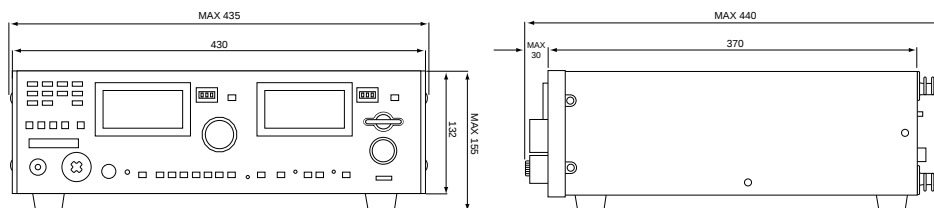
*3.Can be factory-modified to nominal 110V, 120V, 220V, 230V and 240V.

*4.Power consumption of the instrument modified to operate on an AC line voltage other than 100V is as follows.

110V / 120V: 25VA or less

220V / 230V / 240V: 45VA or less

— External dimensional diagrams —



TOS5000 SERIES

Withstanding Voltage Tester

Basic model series with excellent cost performance.



TOS5101(AC/DC)



High-end model of TOS series having AC, DC10kV output Conforming to demands of various component standards testing and margin test

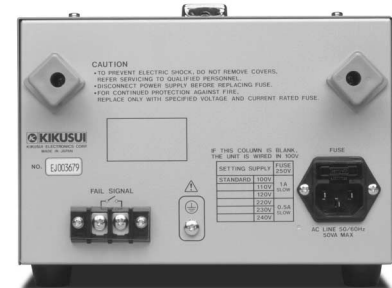
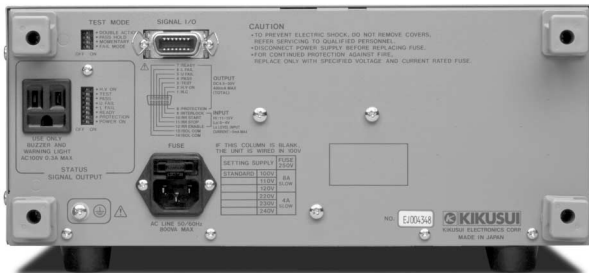
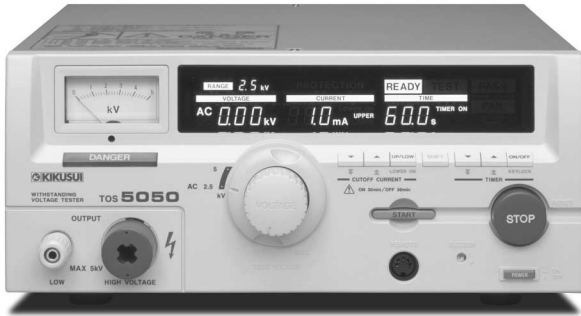
TOS series (TOS5101/5051/5050) are designed exclusively for withstand-voltage testing of electronic equipment and components conforming to various safety standards. The use of a high luminance, large fluorescent display tube for the display enables data including measured values, status and judgment results to be extremely legible. The Pass/fail function employs a window comparator method that enables TOS5101 to make fail judgment of current leakage over the upper reference value and below the lower reference value which can be set on the front panel.

Thus, highly reliable testing can be performed including that for test lead disconnection and defective contact. In addition, in order to prevent erroneous operation and accidents, the TOS5101 is also equipped with a Key Lock function and Interlock function, a high-voltage output terminal having a narrowed insertion port, a large DANGER lamp, and an automatic discharge function (during DC operation) that removes charge from the test piece. These features give the TOS5101 a high degree of safety and reliability.

- Complies with various safety standards
- AC/DC output (0 to 10 kV)
- Large color display
- Digital voltmeter and ammeter
- Digital timer
- Window comparator type employed for Pass / fail judgement.
- Equipped with remote control function
- Various signal outputs
- Automatic discharge function (during DC operation)
- Provided with zero turn-on switch
- Compact size

TOS5000 SERIES

Withstanding Voltage Tester



TOS5051(AC/DC) TOS5050(AC)



TOS5051 : outstanding performance on practical use, AC, DC output 5kV
TOS5050 : Top selling model for production line etc.

- Complies with various safety standards
- AC/DC output (TOS5051)
- Large color display
- Digital voltmeter and ammeter
- Digital timer
- Window comparator type employed for Pass/fail judgement.
- Equipped with remote control function
- Various signal outputs
- Automatic discharge function (TOS5051: during DC operation)
- Provided with zero turn-on switch

TOS5030(AC)



Reliable function on practicability and safety equipment enable it to be used easily for inspections of devices and testing of electronic components.

The Model TOS5030 is an AC withstanding voltage tester having an AC output of 3 kV and 10 mA. Despite being an economy model, the TOS5030 is equipped with a zero turn-on switch, remote control function for start and stop operations and a FAIL signal output function.

- Compact size, light weight(approx. 4.8kg)
 - Economy model for simplified test
 - Provided with zero turn-on switch
 - Provided with remote control terminal
 - Featuring safety high voltage output terminal
- Large "DANGER" warning lamp

*TOS5030 is for simplified test and does not comply with various safety standards.

TOS5000 SERIES

Withstanding Voltage Tester

Item	TOS5101	TOS5051	TOS5050	TOS5030
Output block				
Applied Voltage	0 to 5/ 0 to 10 kV AC and DC	0 to 2.5/ 0 to 5 kV AC and DC	0 to 2.5/ 0 to 5 kV AC	0 to 3 kV AC
AC				
Maximum Rated*1	500VA / 10 kV, 50 mA	500VA / 5 kV, 100 mA		30VA / 3 kV, 10 mA
Waveform	Commercial line waveform			
Voltage Regulation	Max. 15% (for max. rated load to no load)			
Switching	Use of a zero turn-on switch			
DC				
Applied Voltage	50W / 10 kV, 5 mA	50W / 5 kV, 5 mA		
Ripple	100 Vp-p typ. at 10 kV, no load 200 Vp-p typ. at max. rated output	100 Vp-p typ. at 5 kV, no load 100 Vp-p typ. at max. rated output		
Maximum Rated*1	Max. 3% (for max. rated load to no load)			
Output Voltmeters				
Analog				
Scale	10 kV full scale, AC/DC	5 kV full scale, AC/DC	5 kV full scale, AC	3 kV full scale, AC
Type of Meter	JIS Class 2.5			
Accuracy	±5% of full scale			
AC Indication	Mean value response / rms value scale			
Digital				
Full Scale	5 kV/ 10 kV full scale	2.5 kV/ 5kV full scale		
Accuracy	±1.5% of full scale			
AC Response	Mean value response / rms value display			
Ammeter				
Digital				
Accuracy	±(5% + 20μA) of upper cutoff current			
AC Response	Mean value response / rms value display			
Pass/fail Judgement Function				
Type of Judgement	Window comparator type ● FAIL judgement *When current detected above upper cutoff current *When current detected below lower cutoff current (FAIL signal generated when FAIL judgement made) ● PASS judgement *When set time has elapsed and no abnormality is detected			FAIL judgement *When current detected above reference value *FAIL signal generated when FAIL judgement made
Upper cutoff current setting range	AC: 0.1 to 55 mA DC: 0.1 to 5.5 mA	AC: 0.1 to 110 mA DC: 0.1 to 11 mA	AC: 0.1 to 110 mA	AC: 0.5/1/2/5/10 mA
Lower cutoff current setting range	AC: 0.1 to 55 mA DC: 0.1 to 5.5 mA	AC: 0.1 to 110 mA DC: 0.1 to 11 mA	AC: 0.1 to 110 mA	
Judgement Accuracy	±(5% of upper cutoff current + 20μA)			±5% of preset cutoff current
Current Detection	Integration of current absolute value followed by comparison with reference value			
Calibration	With rms value of sine wave using a pure resistance load			
No-load output voltage	Approx. 970 V when set to 50 mA AC Approx. 160 V when set to 5 mA DC	Approx. 460 V when set to 100 mA AC Approx. 100 V when set to 10 mA DC		Approx. 400 V when set to 10 mA AC
Test Time Setting Range	0.5 to 999 sec (±10 ms) (timer-off function provided)			
Accuracy	±20 ms			
Line Voltage	100V±10%, 50/60 Hz (Nominal voltages of 110V, 120V, 220V, 230V and 240V available as factory options.)			
Power Requirements				
for line voltage of 100 V	Max. 50 VA under no-load conditions / Approx. 600 VA at rated load	Max. 50 VA under no-load conditions / Approx. 610 VA at rated load	Max. 25 VA under no-load conditions / Approx. 600 VA at rated load	Max. 10 VA under no-load conditions / Approx. 45 VA at rated load
for line voltage of 100 V to 200 V	Max. 50 VA under no-load conditions / Approx. 600 VA at rated load	Max. 50 VA under no-load conditions / Approx. 630 VA at rated load	Max. 25 VA under no-load conditions / Approx. 600 VA at rated load	Max. 10 VA under no-load conditions / Approx. 45 VA at rated load
for line voltage of 220 V to 240 V	Max. 50 VA under no-load conditions / Approx. 610 VA at rated load	Max. 50 VA under no-load conditions / Approx. 640 VA at rated load	Max. 25 VA under no-load conditions / Approx. 640 VA at rated load	Max. 10 VA under no-load conditions / Approx. 25 VA at rated load
EMC*2	Complied with the following standards IEC61362-1: 1997-03/A1: 1998-05 Electrical Equipment for Measurement, Control and Laboratory Use- EMC requirements Radiated Emissions Class A Conducted Emissions Class A IEC61000-4-2: 1995-01/ A1: 1998-01 Electro-static Discharge IEC61000-4-3: 1995-02 Radiated, radio-frequency, electromagnetic field IEC61000-4-4: 1995-01 Electrical fast transient / Burst IEC61000-4-5: 1995-02 Surge IEC61000-4-6: 1996-04 Conducted disturbances IEC61000-4-11: 1994-06 Voltage dips, short interruptions and voltage variations Under following conditions 1. Used HV test leadwires which is supplied. 2. No discharge in testing 3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.			
Safety*2	This instrument is designed to comply with the requirements of following standard for class I portable equipment and is for use in a pollution degree 2 environment. IEC61010-1: 1990-07/A2: 1995-07 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use This equipment is designed to operate from overvoltage category II.			

*1: Continuous output time may be limited depending on current high limit reference value and ambient temperature.

*2: Availability of CE Marked Products may be referred in page 4-5 for "Quick Reference"

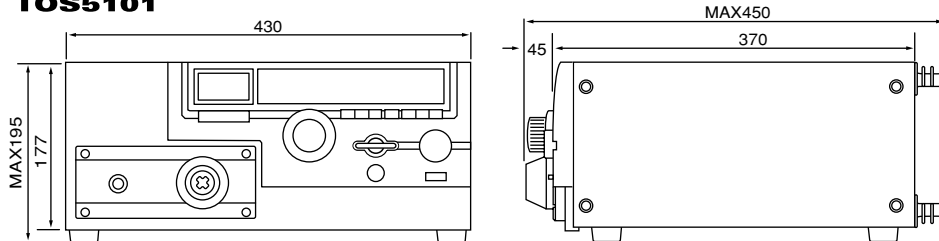
TOS5000 SERIES

Withstanding Voltage Tester

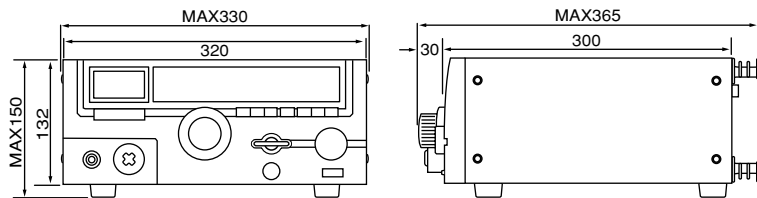
Item	TOS5101	TOS5051	TOS5050	TOS5030
Dimensions (MAX)	430W X 177(195)H X 370(450)Dmm	320W X 132(150)H X 300(365)Dmm		200W X 132(160)H X 215(280)Dmm
Weight				
for line voltage of 100 V	Approx. 21 kg	Approx. 16 kg	Approx. 15 kg	Approx. 4.8 kg
for line voltage of 100 V to 120 V	Approx. 23 kg	Approx. 18 kg	Approx. 17 kg	Approx. 5.8 kg
for line voltage of 220 V to 240 V	Approx. 24 kg	Approx. 19 kg	Approx. 18 kg	Approx. 5.8 kg
Accessories				
High-voltage test lead	TL01-TOS (max.allowablevoltage: 5 kV /1.5m) TL03-TOS (max.allowablevoltage: 10 kV /1.5m)	TL01-TOS (max.allowablevoltage: 5 kV /1.5m)		TL01-TOS (max.allowablevoltage: 5 kV /1.5m)
Others	14-pin amphenol plug (assembled)	14-pin amphenol plug (assembled)		5P DIN plug (assembled)

— External dimensional diagrams —

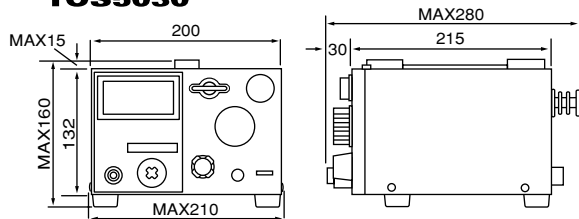
TOS5101



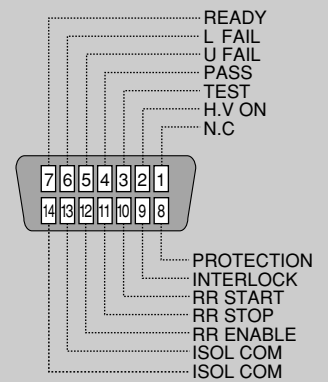
TOS5051/5050



TOS5030



[Pin Configuration for the SIGNAL I/O Connector]



*SIGNAL I/O connector is not available for Model TOS5030

TOS5052

Withstanding Voltage Tester

Equipped with Rise Time Control Function



TOS5052



Rise Time Control function is enable to comply to the Standard requirement for those degradation, destructive testing of sensitive materials

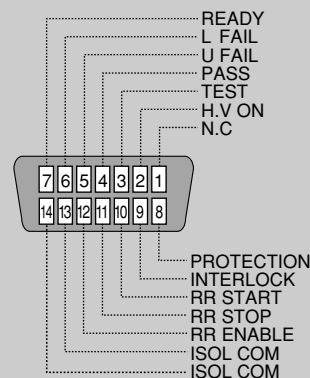
TOS5052 is a special tester designed for withstand-voltage testing of electronic equipment and components conforming to various official safety standards. In addition to having an output of 5 kV AC at 100 mA, this model permits output voltage presetting, selection of output frequency (50 or 60 Hz), and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

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

For fast and accurate testing, the TOS5052 permits dual-axis operation of the test voltage range selector switch and voltage setting knob, and separate up-down keys for determination current and timer settings. Easier to use than ever before, the TOS5052 also incorporates various safety and security features, including key lock, interlock, high-voltage output terminals limiting the number of insertion holes, and large "DANGER" warning lamps. These features make using the TOS5052 safe and reliable.

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

[Pin Configuration for the SIGNAL I/O Connector]



TOS5052

Withstanding Voltage Tester

Output block		
Output voltage range		0.50 kV to 5.00 kVAC (100 mA output possible range)
Voltage setting range		0.00 to 2.95 kV/0.00 to 5.45 kV, 2 ranges (3-digit digital setting)
	Setting accuracy	±(2% of setting + 2 digits) at 0.20 kV or higher with no load
	Resolution	10V
Maximum rated output *1		500VA (5kV/100mA)
Transformer capacity		500VA
Output voltage waveform		Sine wave
Distortion factor		Output voltage of 0.5 kV or higher: 2% or less (under no load or resistive load)
Frequency		50 or 60 Hz selectable (0.5% of setting, except during voltage rise)
Voltage regulation		9% or less (maximum rated load to no load)
Output type		PWM switching
Output voltage		Output is shut off and protection is effected when the output voltage exceeds the set value plus 200V. “kV” blinks when the output voltage falls below the set voltage minus 100V.
Output voltmeter		
Analog	Scale	5 kV f.s
	Accuracy	±5% f.s
	Indication	Mean-value response/rms-value indication
Digital	Scale	2.5 kV/5 kV f.s
	Accuracy	±1.5% f.s when the measured voltage does not change within the digital voltmeter’s response time.
	Response	Mean-value response/rms-value indication (400 ms response time)
	Hold function	The voltage measured at the end of test is held during the PASS or FAIL interval.
Ammeter		
Digital	Measuring range	0.00 to 110mA
	Accuracy	±(5% of upper cutoff current+ 20μA) when the measured current does not change within the digital ammeter’s response time.
	Response	Mean-value response/rms-value indication (400 ms response time)
	Hold function	The current measured at the end of test is held during the PASS interval.
Judgement function		
Judgement system		Window comparator system ●FAIL is judged when a current greater than the upper cutoff current is detected. ●FAIL is judged when a current smaller than the lower cutoff current is detected. ●OUTPUT is shut off and FAIL SIGNAL is generated when FAIL is judged. ●PASS SIGNAL is generated when no anomaly is found within the set time.
Upper cutoff current range		0.1 to 110mA
Lower cutoff current range		0.1 to 110mA The TOS5052 makes no lower pass/fail judgment while the voltage is rising and for approximately 0.2s after the voltage is made constant.
Judgement accuracy		±(5% of upper cutoff current +20μA)
Current detection method		Absolute value of current is integrated and compared against the reference value.
Calibration		The root mean square value of sine wave is calibrated using the pure resistive load.
Illuminators and LEDs		
	PASS	Lit for approximately 0.2 s when PASS is judged. Held on when PASS HOLD is enabled.
	UPPER FAIL	Lit when a current greater than the upper cutoff current is detected and FAIL is judged.
	LOWER FAIL	Lit when a current smaller than the lower cutoff current is detected and FAIL is judged.

Buzzer	•Turned on for approximately 0.2 s when PASS is judged. •Held on in the following cases: PASS is judged – when PASS HOLD is enabled. UPPER FAIL is judged. LOWER FAIL is judged. The volume of the FAIL or PASS buzzer may be adjusted. The volume setting is common to both FAIL and PASS conditions because the same adjuster is used.	
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Time		
Voltage	Range	0.1 to 99.9s 0.1s step
	Accuracy	±20ms
Test time	Range	0.3 to 999 s(TIMER OFF function available)
	Accuracy	±20ms
Environment		
Warranty range	Temperature	5 to 35°C
	Humidity	20 to 80% RH (non condensing)
Operating range	Temperature	0 to 40°C
	Humidity	20 to 80% RH (non condensing)
Storage range	Temperature	-20 to 70°C
	Humidity	90% RH or less (non condensing)
Power requirement		
Allowable voltage range		90V to 110V The following power voltage options are factory options: (104 V to 125 V)(194 V to 236V) (207 V to 250 V)
Power consumption	No load time (READY)	150 VA or less
	Rated load time	1,000 VA max.
Allowable frequency range		45Hz to 65Hz
Insulation resistance		30MΩ min. (500VDC), between AC line and chassis
Withstanding voltage		1,200 V AC (1 second), between AC line and chassis
Ground continuity		25 A AC/ 0.1Ω max.
EMC*2		

Complied with the following standards

- IEC61362-1: 1997-03/A1: 1998-05 Electrical Equipment for Measurement,
Control and Laboratory Use- EMC requirements
Radiated Emissions Class A Conducted Emissions Class A
IEC61000-4-2: 1995-01/ A1: 1998-01 Electro-static Discharge
IEC61000-4-3: 1995-02 Radiated, radio-frequency, electromagnetic field
IEC61000-4-4: 1995-01 Electrical fast transient / Burst
IEC61000-4-5: 1995-02 Surge
IEC61000-4-6: 1996-04 Conducted disturbances
IEC61000-4-11: 1994-06 Voltage dips, short interruptions and voltage variations

Under following conditions

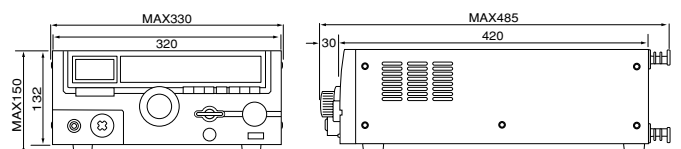
1. Used HV test leadwires which is supplied.
2. No discharge in testing
3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.

Safety*2	
Complied with the following standards	
European Community Requirements (73/23/EEC)	
Dimensions (MAX)	320(330) W × 132(150) H × 420(485) Dmm
Weight	Approx. 22kg
Accessories	
AC Power cable	1 Piece.
High-voltage test leadwire	TL01-TOS (1.5m) 1 set
14-pin Amphenol plug	1 piece., assembly type
“DANGER HIGH VOLTAGE” sticker	1 sheet
AC power fuse	2 pieces. (One in present use and the other as spare in the fuse holder cap)
Operation manual	1 copy

*1: Maximum testing time is 30 minutes. However, it may limit the continuous duration (time) of output by upper current limit and the environmental temperature.

*2: Availability of CE Marked Products may be referred in page 5 for “Quick Reference”

— External dimensional diagrams —



TOS7200

Insulation Resistance Tester

High cost performance, compact size with full features of Insulation Resistance Tester



T07200



Testing voltage range -25 to -1,000V, Resistance measurement range 0.01MΩ to 5,000MΩ

The TOS7200 is an insulation resistance tester available for a wide range of various electric and electronic components, as well as electric and electronic equipment. Output voltage can be optionally set in the range of 25 to 1000 V (negative polarity) with a resolution of 1 V. As it is fitted with a window comparator and timer function, the tester is capable of efficiently conducting insulation resistance tests based on various safety standards. In addition, this product is equipped with panel memory as standard feature, which can be recalled by remote control, SIGNAL I/O connector, and the RS-232C interface for easy automatic testing system construction.

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

TOS7200

Insulation Resistance Tester

Withstanding Voltage test mode

Output section																																					
Output voltage range	-25 V to -1000 V																																				
Resolution	1 V																																				
Accuracy	±(1.5 % of setting + 2 V)																																				
Maximum rated load	1 W (-1000 V DC/1 mA)																																				
Maximum rated current	1 mA																																				
Output terminals	Output type																																				
	Floating																																				
	Isolation voltage																																				
	±1000 VDC																																				
Ripple	1000 V / under no load																																				
	2 Vp-p or less																																				
	Maximum rated load																																				
	10 Vp-p or less																																				
Voltage regulation	1% or less (maximum rated load → no load)																																				
Short-circuiting current	12 mA or less																																				
Output rise time	50 ms or less (10 % to 90 %) [no load]																																				
Discharge function	Forced discharge at the end of test (discharge resistance: 25 k Ω)																																				
Voltmeter																																					
Measurement range	0 V to -1200 V																																				
Resolution	1 V																																				
Accuracy	±(1 % of reading +1 V)																																				
Resistance meter																																					
Measurement range	0.01 M Ω to 5000 M Ω (In the range of over 100 nA to a maximum rated current of 1 mA)																																				
Display	<table><tr><td>R < 10.0 MΩ</td><td>10.0MΩ ≤ R < 100.0MΩ</td><td>100.0MΩ ≤ R < 1000MΩ</td><td>1000MΩ ≤ R ≤ 5000MΩ</td></tr><tr><td>□.□ □ MΩ</td><td>□ □.□ MΩ</td><td>□ □ □ MΩ</td><td>□ □ □ □ MΩ</td></tr></table> R = measured insulation resistance	R < 10.0 MΩ	10.0MΩ ≤ R < 100.0MΩ	100.0MΩ ≤ R < 1000MΩ	1000MΩ ≤ R ≤ 5000MΩ	□.□ □ MΩ	□ □.□ MΩ	□ □ □ MΩ	□ □ □ □ MΩ																												
R < 10.0 MΩ	10.0MΩ ≤ R < 100.0MΩ	100.0MΩ ≤ R < 1000MΩ	1000MΩ ≤ R ≤ 5000MΩ																																		
□.□ □ MΩ	□ □.□ MΩ	□ □ □ MΩ	□ □ □ □ MΩ																																		
Accuracy	<table><tr><td>100 nA < i ≤ 200 nA</td><td>200 nA < i ≤ 1 μA</td><td>1 μA < i ≤ 1 mA</td></tr><tr><td>± (10 % of reading)</td><td>± (5 % of reading)</td><td>± (2 % of reading)</td></tr></table> i =measured output-voltage value/measured resistance value [In the humidity range of 20% to 70% RH (no condensation), with no disturbance such as swinging of the test leadwire]	100 nA < i ≤ 200 nA	200 nA < i ≤ 1 μA	1 μA < i ≤ 1 mA	± (10 % of reading)	± (5 % of reading)	± (2 % of reading)																														
100 nA < i ≤ 200 nA	200 nA < i ≤ 1 μA	1 μA < i ≤ 1 mA																																			
± (10 % of reading)	± (5 % of reading)	± (2 % of reading)																																			
Measurement range	The current measurement range is selectable between AUTO and FIX.																																				
AUTO	Automatically changes the current measurement range according to the measured current value.																																				
FIX	Fixes the current measurement range based on the output voltage set value and LOWER set value (in UPPER OFF status).																																				
Holding function	Holds the resistance value obtained at the end of testing while a PASS judgment is being output.																																				
Judgment function																																					
Judgement method/action	<table><tr><td>Judgement</td><td>Judgement method</td><td>Display</td><td>Buzzer</td><td>SIGNAL I/O</td></tr><tr><td>UPPER FAIL</td><td>If a resistance value equal or higher than the upper resistance is detected, the tester shuts off the output and returns an UPPER FAIL judgment.</td><td>FAIL LED lights. UPPER LED lights.</td><td>ON</td><td>Outputs an U FAIL signal</td></tr><tr><td>LOWER FAIL</td><td>If a resistance value equal or less than the lower resistance is detected, the tester shuts off the output and returns a LOWER FAIL judgment. Note that no judgment is made within the judgment wait time (WAIT TIME) after the start of the test.</td><td>FAIL LED lights. LOWER LED lights.</td><td>ON</td><td>Outputs a L FAIL signal</td></tr><tr><td>PASS</td><td>If no abnormality is found when the set test time has elapsed, the tester shuts off the output and returns a PASS judgment.</td><td>PASS LED lights.</td><td>ON</td><td>Outputs a PASS signal</td></tr></table> • A PASS signal is output for approx. 200 ms. However, if the PASS HOLD function is set to “HOLD,” the signal is continuously output until a STOP signal is input. • An UPPER FAIL or LOWER FAIL signal is continuously output until a STOP signal is input. • The FAIL and PASS buzzer volumes are adjustable. However, they cannot be adjusted individually, as they are set in common.	Judgement	Judgement method	Display	Buzzer	SIGNAL I/O	UPPER FAIL	If a resistance value equal or higher than the upper resistance is detected, the tester shuts off the output and returns an UPPER FAIL judgment.	FAIL LED lights. UPPER LED lights.	ON	Outputs an U FAIL signal	LOWER FAIL	If a resistance value equal or less than the lower resistance is detected, the tester shuts off the output and returns a LOWER FAIL judgment. Note that no judgment is made within the judgment wait time (WAIT TIME) after the start of the test.	FAIL LED lights. LOWER LED lights.	ON	Outputs a L FAIL signal	PASS	If no abnormality is found when the set test time has elapsed, the tester shuts off the output and returns a PASS judgment.	PASS LED lights.	ON	Outputs a PASS signal																
Judgement	Judgement method	Display	Buzzer	SIGNAL I/O																																	
UPPER FAIL	If a resistance value equal or higher than the upper resistance is detected, the tester shuts off the output and returns an UPPER FAIL judgment.	FAIL LED lights. UPPER LED lights.	ON	Outputs an U FAIL signal																																	
LOWER FAIL	If a resistance value equal or less than the lower resistance is detected, the tester shuts off the output and returns a LOWER FAIL judgment. Note that no judgment is made within the judgment wait time (WAIT TIME) after the start of the test.	FAIL LED lights. LOWER LED lights.	ON	Outputs a L FAIL signal																																	
PASS	If no abnormality is found when the set test time has elapsed, the tester shuts off the output and returns a PASS judgment.	PASS LED lights.	ON	Outputs a PASS signal																																	
Setting range for the upper resistance (UPPER)	0.01 M Ω to 5000 M Ω [In the range of the maximum rated current or less]																																				
Setting range for the lower resistance (LOWER)	0.01 M Ω to 5000 M Ω [In the range of the maximum rated current or less]																																				
Judgement accuracy																																					
For both UPPER and LOWER	<table><tr><td>Judgement current</td><td>100 nA < i ≤ 200 nA</td><td>200nA < i ≤ 1 μA</td><td>1 μA < i ≤ 1 mA</td></tr><tr><td>UPPER, LOWER</td><td>0.01 ≤ R < 10.0 MΩ</td><td>—</td><td>—</td></tr><tr><td></td><td>10.0 ≤ R < 50.0 MΩ</td><td>—</td><td>—</td></tr><tr><td></td><td>50.0 ≤ R < 100 MΩ</td><td>—</td><td>—</td></tr><tr><td></td><td>100 MΩ ≤ R < 200 MΩ</td><td>± (10 % of setting + 5digit)</td><td>± (5 % of setting + 5digit)</td></tr><tr><td></td><td>200 MΩ ≤ R < 500 MΩ</td><td>± (10 % of setting + 5digit)</td><td>± (5 % of setting + 5digit)</td></tr><tr><td></td><td>500 MΩ ≤ R < 1000 MΩ</td><td>± (10 % of setting + 5digit)</td><td>± (2 % of setting + 3digit)</td></tr><tr><td></td><td>1000 MΩ ≤ R < 2000 MΩ</td><td>± (10 % of setting + 50digit)</td><td>± (5 % of setting + 50digit)</td></tr><tr><td></td><td>2000 MΩ ≤ R < 5000 MΩ</td><td>± (10 % of setting + 100digit)</td><td>± (5 % of setting + 50digit)</td></tr></table> Judgement current = test voltage /(UPPER,LOWER) [The humidity must be in the range of 20 % to 70 % R.H (no condensation permitted), and there must be no disturbance such as swinging of the test leadwires.] [The lower judgment requires a test duration of 0.5 s or more after the wait time has expired. It also requires a wait time of 1.0 s or morefor a lower judgment of 200 nA or less.]	Judgement current	100 nA < i ≤ 200 nA	200nA < i ≤ 1 μA	1 μA < i ≤ 1 mA	UPPER, LOWER	0.01 ≤ R < 10.0 MΩ	—	—		10.0 ≤ R < 50.0 MΩ	—	—		50.0 ≤ R < 100 MΩ	—	—		100 MΩ ≤ R < 200 MΩ	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)		200 MΩ ≤ R < 500 MΩ	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)		500 MΩ ≤ R < 1000 MΩ	± (10 % of setting + 5digit)	± (2 % of setting + 3digit)		1000 MΩ ≤ R < 2000 MΩ	± (10 % of setting + 50digit)	± (5 % of setting + 50digit)		2000 MΩ ≤ R < 5000 MΩ	± (10 % of setting + 100digit)	± (5 % of setting + 50digit)
Judgement current	100 nA < i ≤ 200 nA	200nA < i ≤ 1 μA	1 μA < i ≤ 1 mA																																		
UPPER, LOWER	0.01 ≤ R < 10.0 MΩ	—	—																																		
	10.0 ≤ R < 50.0 MΩ	—	—																																		
	50.0 ≤ R < 100 MΩ	—	—																																		
	100 MΩ ≤ R < 200 MΩ	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)																																		
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	500 MΩ ≤ R < 1000 MΩ	± (10 % of setting + 5digit)	± (2 % of setting + 3digit)																																		
	1000 MΩ ≤ R < 2000 MΩ	± (10 % of setting + 50digit)	± (5 % of setting + 50digit)																																		
	2000 MΩ ≤ R < 5000 MΩ	± (10 % of setting + 100digit)	± (5 % of setting + 50digit)																																		
Time																																					
Setting range for the test duration (TEST TIME)	0.5 s to 999 s (TIMER OFF function provided)																																				
Setting range for the wait time (WAIT TIME)	0.3 s to 10 s [TEST TIME > WAIT TIME]																																				
Accuracy	±(100 ppm + 20 ms)																																				

TOS7200

Insulation Resistance Tester

Interface and Other Functions

REMOTE	6-pin mini-DIN connector on the front panel The optional remote controller RC01-TOS or RC02-TOS is connected to remotely control starting/stopping of a test (note that a DIN-mini DIN adapter is required).
SIGNAL I/O	D-SUB 25-pin connector on the rear panel For names and descriptions of connector signals.

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

*1: 1-digit BCD active LOW input

Panel memory's selection signal input terminal

Memory recall by latching this selection signal at the rise of the strobe signal

Input specifications

High-level input voltage	11 V to 15 V	All input signals are active Low controlled. The input terminal is pulled up to +12 V using a resistor. Opening the input terminal is equivalent to inputting a high-level signal.
Low-level input voltage	0 V to 4 V	
Low-level input current	-5 mA maximum	
Input time width	5 ms minimum	

Output specifications

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

ANALOG OUT	Outputs a logarithmically compressed voltage corresponding to the measured resistance value
+	$V_o = \log(1 + R_x / 1M\Omega)$ where R_x = measured resistance value (1 M Ω : 0.30 V; 10 M Ω : 1.04 V; 100 M Ω : 2.00 V; 1000 M Ω : 3.00 V; 10000 M Ω or more: 4.00 V). Output impedance: 1 k Ω
COM	Analog output-circuit common
Accuracy	$\pm(2\%$ of full scale)

RS-232C	D-SUB 9-pin connector on the rear panel (compliant with EIA-232-D) All functions other than the POWER switch and KEY-LOCK function are remotely controllable.
Baud rate	9600 bps/19200 bps/38400 bps (data: 8 bits; parity: none; stop bit: 2 bits fixed)
Display	7-segment LED, 4-digit voltage display, 4-digit insulation resistance display, and 3-digit time display
Memory function	A maximum of 10 types of test conditions can be stored in memory.
Backup battery life	3 years or more (at 25 °C)

TEST MODE

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

General Specifications

Environment	
Installation location	Indoors and at altitudes up to 2000 m
Warranty range	Temperature 5 °C to 35 °C
	Humidity 20 % to 80 % R.H (no condensation)
Operating range	Temperature 0 °C to 40 °C
	Humidity 20 % to 80 % R.H (no condensation)
Storage range	Temperature -20 °C to 70 °C
	Humidity 90 % or less R.H (no condensation)
Power requirements	
Nominal voltage range	100 V to 240 V AC
(allowable voltage range)	(85 V to 250 V AC)
Power consumption	30 VA maximum
At rated load	
Allowable frequency range	47 Hz to 63 Hz
Insulation resistance	30 M Ω or more (500 V DC) [AC LINE to chassis]
Withstand voltage	1350 V AC for 1 minute, 10 mA or less [AC LINE to chassis]
Earth continuity	25 A AC/0.1 Ω or less
EMC	

A custom order Complied with the following standards model does not apply.

IEC61326-1:1997-03/A1:1998-05 Electrical Equipment for Measurement, Control and Laboratory Use - EMC requirements

Radiated Emissions Class A

Conducted Emissions Class A

IEC61000-4-2:1995-01/A1:1998-01 Electrostatic discharge

IEC61000-4-3:1995-02 Radiated, radio-frequency, electromagnetic field

IEC61000-4-4:1995-01 Electrical fast transient/Burst

IEC61000-4-5:1995-02 Surge

IEC61000-4-6:1996-04 Conducted disturbances

IEC61000-4-11:1994-06 Voltage dips, short interruptions and voltage variations

Under following conditions

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

Safety

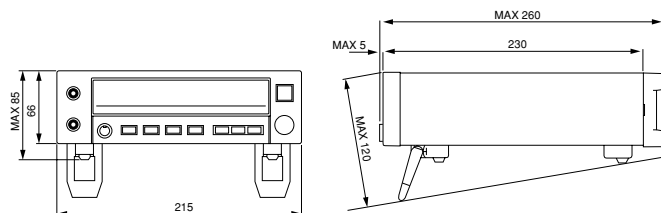
A custom order model does not apply.

This instrument is designed to comply with the requirements of following standard for class I portable equipment and is for use in a pollution degree 2 environment.

IEC61010-1:1990-07/A2:1995-07 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use This equipment is designed to operate from overvoltage category II.

Dimensions (max.)	215 (215) W x 66 (85) H x 230 (260) Dmm
Weight	Approx. 2 kg
Accessories	AC power cable 1 pc. TL08-TOS high-voltage test leadwires (1.5 m) 1 set Operation Manual 1 copy

External dimensional diagrams



TOS6200

Earth Continuity Tester

Pursuing to maximize an easy operation, stylish design of Earth Continuity Tester



TOS6200



Adopting the constant current method to apply Automated testing system

Perfect feature for the Production line which requires reduced tact time

The TOS6200 tester is designed to perform the earth continuity tests required for class-I devices by safety standards such as IEC, EN, VDE, BS, UL, JIS, and the Electrical Appliance and Material Safety Low (Japan).

Equipped with a new high-efficiency power supply, it is compact and lightweight, about half the size and weight of our conventional products, while achieving a large output of 150 VA.

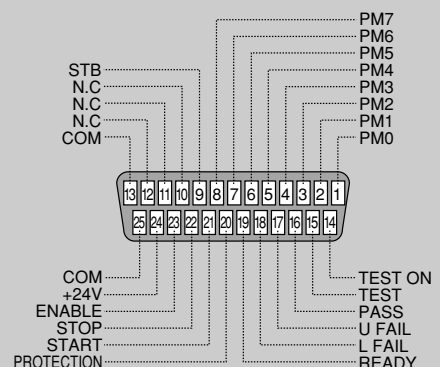
Use of the constant current method eliminates the need to reset test currents even in the face of fluctuating resistance values for the device being tested. The test duration can also be set from 0.3 s, making the tester suitable for production line testing, which requires reduced cycle time.

This tester is also designed for ease of use, featuring a large, easy-to-read display, memory capacity for storage of 100 types of test conditions, and incorporation of test conditions into programs to enable automatic testing. Standard GPIB and RS-232C interfaces allow the user to use PCs or other devices to control test conditions such as test current, resistance value for judgement, and test duration, and enables read-back of measured values and test results.

The tester is also provided with test leads as standard and provides high cost effectiveness.

- Test current value: 3 to 30 A AC / Resistance value: 0.001 to 1.200Ω
- Offset cancelling function
- Stores 100 test conditions in memory
- Incorporates test conditions into program
- Contact Check function
- Equipped with standard GPIB and RS-232C interfaces
- Equipped with standard test lead

[Pin Configuration for the SIGNAL I/O Connector]



TOS6200

Earth Continuity Tester

Output block		
Current setting range (*1)		3.0 to 30.0 A AC (With respect to resistance resulting in output power of the maximum rated Output or less and an output terminal voltage of 5.4 V or less)
	Resolution	0.1A
	Accuracy	± (1% of setting + 0.2A)
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	±200ppm
Open terminal voltage		6 Vrms or less
Output method		PWM switching method
Output ammeter		
Measurement range		0.0 to 33.0 A AC
Resolution		0.1A
Accuracy		± (1% of reading + 0.2A)
Response		Mean value response/rms value display (response time: 200 ms)
Holding function		The current measured at the end of test is held during the PASS or FAIL interval
Output voltmeter		
Measurement range		0.00 to 6.00 V AC
Resolution		0.01 V
Accuracy		± (1% of reading + 0.02A)
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		
Measurement range		0.001 to 1.200 Ω
Resolution		0.001 Ω
Offset cancel function		0.000 to 1.200 Ω (Offset ON/OFF function provided)
Accuracy		± (2% of reading + 0.003 Ω)
Holding function		The resistance measured at the end of test is held during the PASS or FAIL interval
Pass/fail judgement function		
Judgement system		Window comparator system ●If a resistance value equal to or greater than the upper reference value is detected, a FAIL determination is returned. ●If a resistance value equal to or less than the lower reference value is detected, a FAIL determination is returned. ●If a resistance value has been judged as FAIL, the tester shuts off the output and generates a FAIL signal. ●If the set time elapses without abnormalities, the tester shuts off the output and generates a PASS signal.
Setting range for the upper reference value (UPPER)		0.001 to 1.200 Ω
Setting range for the lower reference value (LOWER)		0.001 to 1.200 Ω
Judgement accuracy		± (2% of UPPER + 0.003 Ω)
Calibration		Calibration is performed with the rms value of the sine wave, using a pure resistance load.
LED	PASS	Lights for approximately 0.2 sec when the measured value has been judged as PASS. It is lit continuously when the PASS holding time is set to HOLD.
	UPPER FAIL	Lights if a resistance value equal to or greater than the upper reference value is detected and judged FAIL.
	LOWER FAIL	Lights if the resistance value equal to or less than the lower reference value is detected and judged FAIL.
Buzzer		●The buzzer sounds for approximately 0.2 sec 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	± (100ppm of setting + 20ms)
Environment		
Installation		Indoors and the altitude is less than 2,000 m

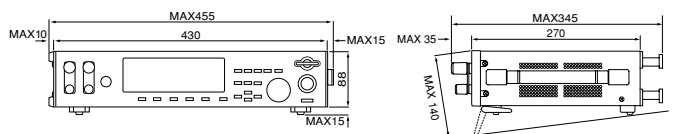
Warranty range	
Temperature	5° to 35°C
Humidity	20% to 80% R.H (non condensing)
Operating range	
Temperature	0° to 40°C
Humidity	20% to 80% R.H (non condensing)
Storage range	
Temperature	-20° to 70°C
Humidity	90% or less R.H (non condensing)
Power requirement	
Allowable voltage range	100 V model : 85 to 132 V AC 100 V/200 V model : 85 to 132 V AC/170 to 250 V AC
Power consumption	
At no load (READY)	100 V model : 70 VA or less 100 V/200 V model : 45 VA or less
At rated load	100 V model : 450 VA max. 100 V/200 V model : 330 VA max.
Allowable frequency range	45 Hz to 65 Hz
Insulation resistance	30MΩ min. (500 V dc), between AC line and chassis
Withstanding voltage	1350 V AC (1 second), between AC line and chassis
Earth continuity	25 A AC/0.1 Ω max.
EMC	
Complied with the following standards	
IEC61362-1: 1997-03/A1:1998-05	
Electrical Equipment for Measurement, Control and Laboratory Use - EMC requirements	
Radiated Emissions Class A	
Conducted Emissions Class A	
IEC61000-4-2:1995-01/A1:1998-01 Electro-static Discharge	
IEC61000-4-3:1995-02 Radiated, radio-frequency, electromagnetic field	
IEC61000-4-4:1995-01 Electrical fast transient / Burst	
IEC61000-4-5:1995-02 Surge	
IEC61000-4-6:1996-04 Conducted disturbances	
IEC61000-4-11:1994-06 Voltage dips, short interruptions and voltage variations Under following conditions	
1. Used test leadwires (TL11-TOS) which is supplied.	
2. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.	
Safety	
Complied with the following standards	
IEC61010-1: 1990-09/A2:1995-07	
Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use TOS6200 is designed so that it is connected to a power supply of overvoltage category II as Class I equipment in environment of pollution degree 2.	
Physical dimensions (max)	430(450)W × 88(140)H × 270(345)Dmm
Weight	Approx. 9kg
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 half 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)	Quiescent time	Maximum test duration
t ≤ 40°	15 < I ≤ 30	Equal to or greater than test duration	30 minutes or less
	I ≤ 15	Not required	Continuous output possible

External dimensional diagrams



Remote Control Box

■RC01-TOS

[one-hand operation/dimensions:
200W × 70H × 39D mm]

Note:The optional Adapter DD-5P/6P (DIN to Mini DIN) is required
for the connection with TOS7200



■RC02-TOS

[both-hands operation/dimensions:
330W × 70H × 39D mm]
Accessory cable length: 1.5 m

Note:The optional Adapter DD-5P/6P (DIN to Mini DIN) is required
for the connection with TOS7200



Buzzer Unit

■BZ01-TOS (for 100V AC)

* This can not be used with TOS6200,
TOS9200/9201, TOS7200



Warning Light Unit

■PL01-TOS (for 100V AC)

* This can not be used with TOS6200,
TOS9200/9201, TOS7200



■PL02-TOS (for 24V DC)

* for TOS9200/9201



High-Voltage 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]

* This can not be used with TOS7200.



High-Voltage 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]



■TL04-TOS

[cable length: 1.5 m/max. operating voltage: 5 kV
(for TOS1200, RL01-TOS)]



■TL05-TOS

[cable length: 1.5 m/max. operating voltage: 5 kV
(for 149-10A, RL01-TOS)]



■TL06-TOS

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



■TL07-TOS

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



■TL08-TOS

[cable length: 1.5 m/max. operating voltage: 1 kV
(for TOS7200)]



■HTL-2.5DH

[cable length: 1.5 m/max. operating voltage: 10 kV
(for 149-10A)]



Low-Voltage Test Leads

■LTP-2

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



Warning Light Unit

■TL11-TOS

[cable length: 1.5 m/max. operating current: 30 A
(for TOS6200)]



Withstanding Voltage Tester Current Calibrator

■TOS1200



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

Specifications

Measuring Function	Measurement of current values and error (%) for AC (50/60 Hz) and DC at a test voltage of 1000 V
Measuring Ranges	8 ranges consisting of 0.5/1/2/5/10/20/50/100 mA along with values equal to 0.8 times the values of those ranges (for 1, 2, 4 and 8 steps)
Ammeter Scale	Main scale: Direct-reading error display scale over a range of $\pm 10\%$ of the above full scale values Auxiliary scale: Ratio scale of 0 to 1.1 times the above full scale values (equivalent to 0% display of main scale when the ratio is equal to 1)
Ammeter Accuracy	Main scale: $\pm 1\%$ of reading Auxiliary scale: $\pm 3\%$ of full scale value
Ammeter Indication	DC/AC(sine wave rms value calibration of mean value response)

Load Resistance

Range[mA]	Resistance[kΩ]	Range[mA]	Resistance[kΩ]
0.5	2000	10	100
1	1000	20	50
2	500	50	20
5	200	100	10

Allowed Input Time	0.5/1/2/5 mA ranges: Continuous 10/20/50/100 mA ranges: 60 sec. Max. 1/3 of duty cycle
Dimensions (MAX)	134W × 164H × 270D mm (140W × 189H × 320D mm)
Weight	approx. 3.5 kg
Accessories	TL04-TOS high-voltage test lead: 1

High-Voltage Digital Voltmeter

■149-10A



- Measurement of high voltages (AC/DC) of up to 10 kV maximum.
- Large 4 1/2 digit LED display
- High measuring accuracy and input resistance
- Light weight of only 3.2 kg
- Compact design
- Excellent ease of maintenance

Specifications

Operating System	Double integration system (sampling cycle: 3 times/sec)
DC Voltage	Measuring range: 0.500kV to 10,000kV Accuracy: $\pm(0.5\%$ of reading + 0.03% of range) Input resistance: 1000 MΩ $\pm$ 2%
AC Voltage	Measuring range: 0.500kV to 10,000kV Accuracy: $\pm(1\%$ of reading + 0.05% of range) Frequency characteristics: 50/60 Hz (sine wave rms value display of mean value response) Input resistance: 1000 MΩ $\pm$ 2%
Power Requirements	100V $\pm$ 10%, approx. 10 VA
Dimensions (MAX)	134W × 164H × 270D mm (140W × 189H × 350D mm)
Weight	approx. 3 kg
Accessories	TL05-TOS high-voltage test lead: 1 HTL-2.5DH high-voltage coaxial cable: 1

UL Resistance Load

■RL01-TOS



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

Specifications

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



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