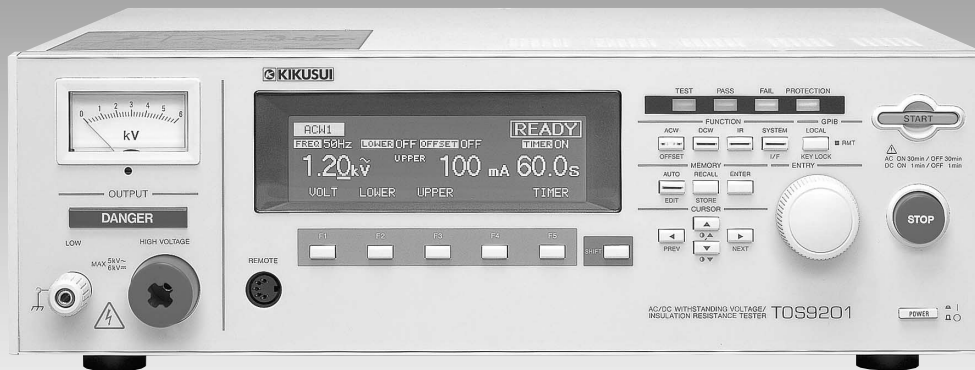


# TOS9200 series

## WITHSTANDING VOLTAGE AND INSULATION RESISTANCE TESTER

NEW



High-end models of Kikusui's withstanding voltage/insulation resistance testers complying with a variety of safety standards.

### Outline

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.

### Features

- Fully programmable (GPIB/RS-232C)
- High-power design (AC 5 kV, 100 mA, over 200 mA in short-circuiting the output)
- A rise-time and fall-time control function (AC withstanding voltage testing)
- A discharge function (after DC withstanding voltage and insulation resistance testing)
- Setting of up to 16 channels realized by a high-voltage scanner (TOS9221/TOS9220)
- Read back of measurement data

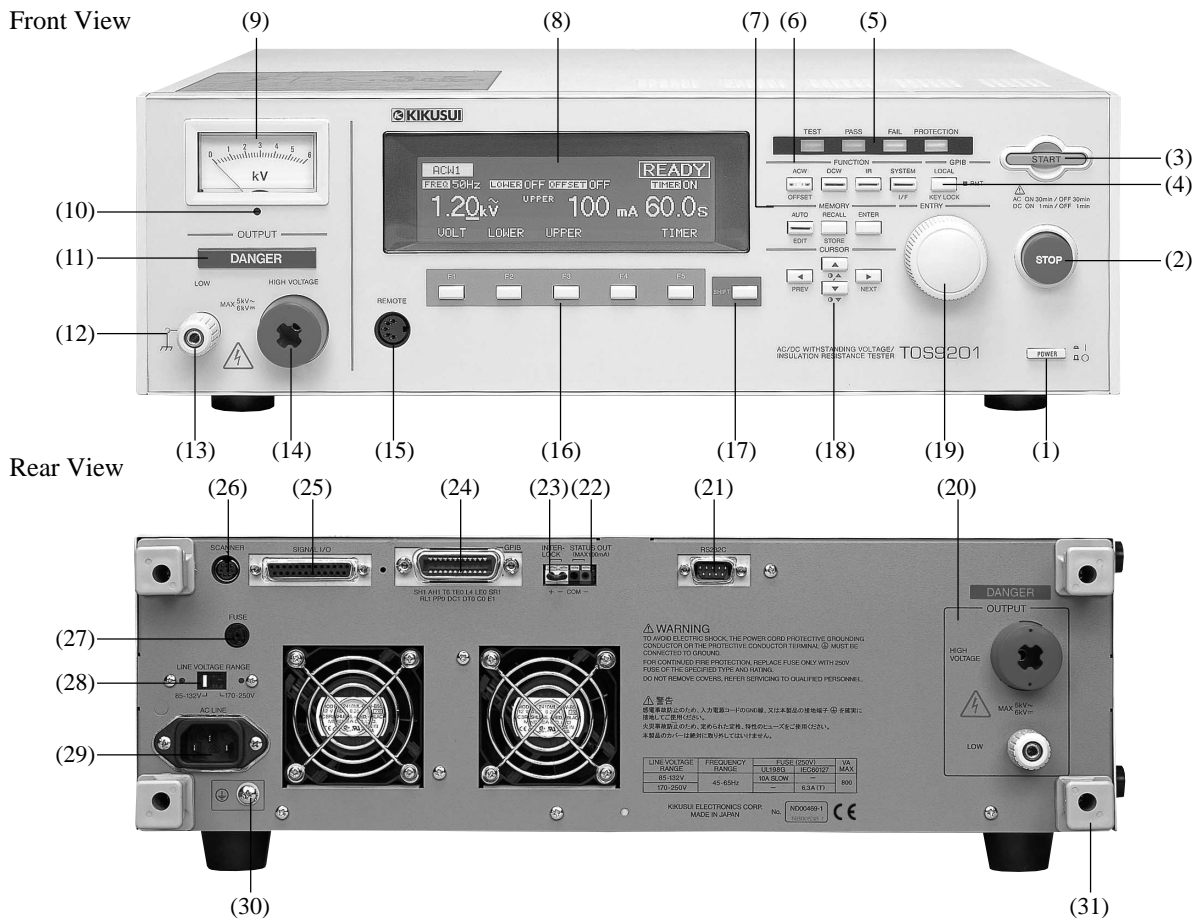
### Functions

- Improving upon Kikusui's TOS9000 Series, the TOS9200 Series offers withstanding voltage and insulation resistance testers complying with a variety of safety standards, such as IEC, EN, VDE, BS, UL, CSA, JIS and Japan's Electrical Appliance and the Material Safety Law.
- Various functions to meet operator needs  
For various test needs, the TOS9200/9201 has the following functions:
  - Rise-time control function  
Gradually increases the test voltage.
  - Fall-time control function  
Gradually decreases the test voltage.
  - Offset cancel function  
Cancels stray current in the test lead wire and jigs.
  - Measured-value hold function  
Display and hold the measurement of maximum leakage current and voltage at the end of a test, maximum and minimum resistance after the judgment wait time.
  - Output voltage monitoring function  
Automatically suspends the test as soon as the output voltage deviates from the preset range.
  - Memory function  
Stores 100 test conditions for each test and enables timely test settings.
  - Program function  
Stores 100 test processes with a total of 500 steps and permits the execution of the processes using a single manual operation.
- High power & high stability  
The TOS9200 Series uses a high-efficiency switching power supply and a PWM-based switching amplifier, in addition to a 500 VA high-voltage transformer. These components combine to realize stable outputs highly resistant to load effects (3% for AC and 1% for DC) and independent of the supply voltage. This series permits a voltage and current of 5 kV and 100 mA (\*1), 2.5 times those for Kikusui's former models. It can even handle instantaneous circuit currents over 200 mA. The TOS9201 can conduct DC withstanding voltage tests for up to 6 kV (\*2). In insulation resistance testing, the test voltage can be set at a resolution of 1 V in the 25 V-1000 V range, permitting resistance measurement in a wide range from 0.01 MΩ to 9.99 GΩ.  
  
\*1: Continuous operation for up to 30 minutes.  
\*2: Continuous operation for up to 1 minute, maximum output of 50 W.
- Reinforced operating safety  
For enhanced safety, the TOS9200 Series equipped with several new features. The output terminal originally designed by Kikusui has a smaller inlet to prevent the accidental insertion of fingers. The analog voltmeter constantly measures the output terminal voltage during an AC/DC withstanding voltage test or insulation resistance test. Even when no test is underway, the tester watches at all times for a voltage on the output terminal, turning on the DANGER lamp as soon as a voltage is detected. The DC discharge function forces out a electrical charge remaining in the device under test at the end of the test. The interlock function cuts off outputs in coordination with an external device.
- Checking actual values of the device under test  
During a test the actual leak current or insulation resistance, is displayed on the tester. To keep the actual measured data of a production lot, such as the failure rate, the read back function is utilized.
- Highly accurate real-time display  
The TOS9200 Series equips with a digital display with a high accuracy of  $\pm(1\%$  of reading + 30 V) for voltage and  $\pm(3\%$  of reading + 20 mA) for the current in withstanding testing. In insulation resistance testing, the tester realizes a voltage accuracy of  $\pm(1\%$  of reading + 1 V). In AC and DC withstanding voltage testing, measured values are displayed in real time while a program executes, as well as during a test.
- A 30% reduction in size and weight  
For AC withstanding testing, the tester is provided with 2.5 times higher power supply than Kikusui former models. Also equipped with an AC withstanding voltage testing function and an insulation resistance testing function, the TOS9200 Series nevertheless realizes a 30% reduction in size and weight from its predecessor.
- Expandability for automatic testing systems  
To flexibly handle full-fledged automated systems, as well as simple instruments such as jigs, the TOS9200/TOS9201 includes fully programmable GPIB and RS-232C interfaces, in addition to a "SIGNAL I/O connector" to permit input of external signals and output of various types of status signals. These GPIB and RS-232C interfaces allow you to control the POWER switch and all functions EXCEPT the KEYLOCK function and the program execution (AUTO) function. When used jointly with the optional high-voltage scanner TOS9220/TOS9221 or the earth continuity tester TOS6200, these interfaces permit a comprehensive system capable of conducting withstanding voltage and insulation resistance tests on test points with up to 16 channels. Thus, the TOS9200/TOS9201 as a whole helps not only save labor but also construct a highly safe and reliable automatic testing system.

# TOS9200 series

## WITHSTANDING VOLTAGE AND INSULATION RESISTANCE TESTER

### Panel description



- (1) POWER : Used to turn the power on/off. When the power is turned ON ( I ), the tester starts under the same test conditions as when the power was turned off ( O ) at the end of the preceding test. To start using the factory settings, press the SHIFT key + the POWER switch to initialize the settings.
- (2) STOP : Used to stop a test. Also used to cancel the PASS, FAIL, and PROTECTION statuses. After this switch is pressed, the tester enters the READY status.
- (3) START : Used to start a test.
- (4) LOCAL/KEYLOCK : Used to return to the LOCAL mode during remote control with the GPIB or RS-232C interface. In remote control, the LED lights up to the right of the key.
- (5) Indicator : LED indicates the test results, the status operation for such as TEST, PASS, FAIL and PROTECTION.
- (6) FUNCTION : Used to select the test-mode settings, system settings, or interface settings.
- (7) MEMORY : When this key is pressed, the LED lights up.Used to recall the panel memory.
- (8) LCD : Displays settings and measurements.
- (9) Analog voltmeter : Voltmeter used to display the output voltage. Directly reads the voltage between the HIGH VOLTAGE terminal and the LOW terminal.
- (10) Analog-voltmeter zero adjuster : Adjuster used to adjust the analog voltmeter to the zero point.
- (11) DANGER lamp : Red lamp indicating that a high voltage is being output. This lamp lights up during testing and automatic testing, or while an output voltage remains in the output terminal.
- (12) FLOAT/GND : Lights when the FLOAT/GND for the LOW terminal is set to GND for each test.
- (13) LOW terminal : Low-voltage terminal for outputting the test voltage.
- (14) HIGH VOLTAGE terminal : High-voltage terminal for outputting the test voltage. The test voltage is output between this terminal and the LOW terminal.
- (15) REMOTE terminal : Terminal used to connect the optional remote-control box or the exclusive probe.
- (16) F1 to F5 : Functions corresponding to the F1 to F5 keys on the LCD.
- (17) SHIFT : Used to switch the function menus and expand key functions.
- (18) CURSOR : Used to move the cursor to set test conditions. When pressed together with the SHIFT key, it enables screen contrast adjustment and the switching of setting screens.
- (19) Rotary knob : Used to set test conditions on the LCD
- (20) OUTPUT :
  - LOW terminal - Low-voltage terminal for outputting the test voltage. This terminal is connected to the LOW terminal on the front panel.
  - HIGH VOLTAGE terminal - High-voltage terminal for outputting the test voltage. This terminal is connected to the HIGH VOLTAGE terminal on the front panel.
- (21) RS-232C
- (22) STATUS OUT : Connector for connecting a warning light. Maximum output voltage of DC 24 V and maximum output current of 100 mA.
- (23) INTERLOCK : If the line between these terminals is opened, the tester enters the PROTECTION status and disables the execution of a test.
- (24) GPIB
- (25) SIGNAL I/O : 25-pin D-SUB connector. Used to start and end a test by remote control, and to check the status of the tester using a signal.
- (26) SCANNER : Connector used to connect the optional high-voltage scanner.
- (27) FUSE
- (28) LINE VOLTAGE RANGE : Switch for selecting an input-voltage range.
- (29) AC LINE
- (30) Protective conductor terminal
- (31) Cord holder

## 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.

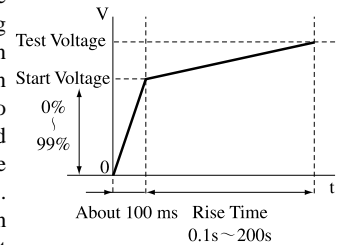
■ Enhanced measurement accuracy  
The TOS9200/9201 is provided with a digital voltmeter for withstanding voltage testing at an accuracy of  $\pm(1\%$  of reading + 30 V) and another one for insulation resistance testing at an accuracy of  $\pm(1\%$  of reading + 1 V). Measured values are displayed not only during a test, but while a program is being executed. A digital ammeter with an accuracy of  $\pm(3\%$  of reading + 20  $\mu$ 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  $\pm(3\%$  of reading + 20  $\mu$ 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	$\pm(1\%$ of reading + 30V)
Ammeter for withstanding voltage testing	$\pm(3\%$ of reading + 20 $\mu$ A)
Voltmeter for insulation resistance testing	$\pm(1\%$ of reading + 1V)
Insulation resistance meter	$\pm(2\%$ of reading)*

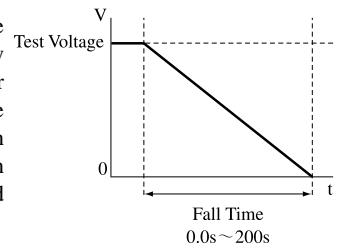
\*At 1  $\mu$ A < measured current  $\leq$  1 mA

### 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 (GPIB or RS-232C).

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

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

# TOS9200 series

## WITHSTANDING VOLTAGE AND INSULATION RESISTANCE TESTER

### Diverse functions

#### ■ 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.

### Interfaces

#### ■ REMOTE connector & SIGNAL I/O connector

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

#### [SIGNAL I/O]

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

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

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

#### ■ GPIB/RS-232C interface

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

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

GPIB [Remote control of all functions except the POWER switch, the KEYLOCK function, and the program execution (AUTO) function/SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E1]



## WITHSTANDING VOLTAGE AND INSULATION RESISTANCE TESTER

### Peripheral devices

#### ■ High-voltage scanner TOS9220/TOS9221

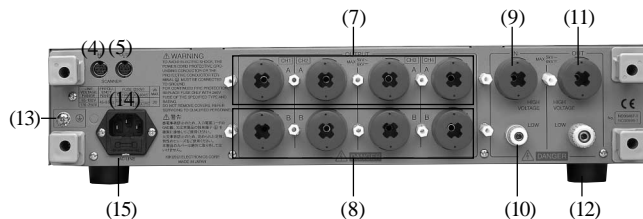


TOS9221 Front View (same for TOS9220)

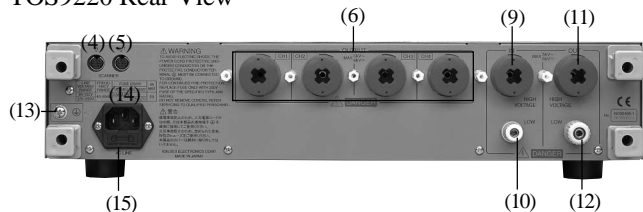
The high-voltage scanner TOS9220/TOS9221 has a function that distributes the test voltage provided by the TOS9200/9201 to multiple test points. Up to four channels can be used for outputs on this scanner. Each channel can be set to one of the three electric potential modes – HIGH, LOW, or OPEN. Operator 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



- (1) **DANGER** : This red lamp indicates that a high voltage is being output. Since it is interlocked with the DANGER lamp of the tester proper, it lights up during tests, as long as an output voltage remains at the output terminals, or during automatic testing.
- (2) **CHANNEL** : Indicates the status of each channel during a test. The channel status is represented as shown below, depending on the color of the LED lit.  
Red: The channel has been set to HIGH.  
Green: The channel has been set to LOW.  
Orange: A contact check is being conducted. Following the check, it also lights up if the corresponding channel has failed.
- (3) **POWER** :When the scanner is connected to the TOS9200/9201 tester, this indicator lights up (in green), as it is interlocked with the POWER switch of the tester.
- (4) **SCANNER IN** : This connector connects to the SCAN connector of the TOS9200/9201 tester. When multiple scanners are connected in parallel, it connects to the SCANNER OUT connector of another TOS9220/9221 scanner.
- (5) **SCANNER OUT** : When multiple scanners are connected in parallel, this connector connects to the SCANNER IN connector of another TOS9220/9221 scanner.

- (6) **OUTPUT (TOS9220 only)** : This part provides the output terminal of each channel. Of the four output terminals, the output terminal of a channel configured for the high-voltage side (HIGH) on the tester is connected to the high-voltage side (HIGH VOLTAGE) . In addition, the output terminal of a channel configured for the low-voltage side (LOW) is connected to the low-voltage side (LOW) of the test voltage.
- (7) **OUTPUT A (TOS9221 only)** : The A-output terminal of each channel is an output terminal on the high-voltage side (HIGH VOLTAGE).  
The A-output terminal of a channel set to HIGH on the TOS9200/9201 tester is connected to the high-voltage side (HIGH VOLTAGE) of the test voltage. The A-output terminal of a channel not set to HIGH is in the open state (not connected to any point).
- (8) **OUTPUT B (TOS9221 only)** : The B-output terminal of each channel is an output terminal on the low-voltage side (LOW). The B-output terminal of a channel set to LOW on the TOS9200/9201 tester is connected to the low-voltage side (LOW) of the test voltage. The B-output terminal of a channel not set to LOW is in the open state (not connected to any point).  
When the tester has activated the contact check function, voltage is temporarily applied to the B-output terminals of channels set to both the high-voltage and low-voltage sides, in order to check the contact condition. Since in this wiring configuration, high voltage is also applied to the four terminals provided as the low-voltage side output terminals, they should be handled in the same way as the A-output terminals.
- (9) **IN HIGH VOLTAGE** : This terminal connects to the OUT HIGH VOLTAGE terminal of the tester or to another TOS9220/9221 scanner when connected in parallel, in order to receive the test voltage from the TOS9200/9201 tester. During a test, the test voltage is supplied continuously.
- (10) **IN LOW** : This terminal connects to the LOW terminal of the TOS9200/9201 tester or to the OUT LOW terminal of another TOS9220/9221 scanner when connected in parallel.
- (11) **OUT HIGH VOLTAGE** : This terminal supplies the test voltage supplied from the tester to the IN HIGH VOLTAGE terminal of another TOS9220/9221 scanner connected in parallel when multiple scanners are used in parallel connection. During a test, the test voltage is supplied at all times.
- (12) **OUT LOW** : This terminal connects to the IN LOW terminal of another TOS9220/9221 scanner when multiple scanners are used in parallel configurations.
- (13) Protective conductor terminal
- (14) AC LINE
- (15) Fuse holder

#### ■ Earth continuity tester TOS6200 \*For more information, see the catalog.



The TOS6200 is a tester for earth continuity testing, which is required for Class-I equipment under various safety standards, including IEC, EN, VDE, BS, UL, JIS, and Japan’s Electric Appliance and Material Safety Law. Using the constant-current method, the TOS6200 eliminates the need to reset the test voltage, even if there is a change in the resistance of the device under test. The test time can be set starting at 0.3 s, making the TOS6200 best suited to the testing of production lines that require reduced tact time. For smooth operation, this earth continuity tester has a large display, in addition to a memory function that permits user to store up to 100 test conditions. These test conditions can be programmed to conduct automatic tests. Equipped with a GPIB and RS-232C interface as standard features, the tester facilitates the control of test conditions, such as an externally provided test current, judgment resistance, and test time, as well as the reading of test results.

# TOS9200 series

## WITHSTANDING VOLTAGE AND INSULATION RESISTANCE TESTER

### Specifications

#### 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	-----	0.05 kV to 6.00 kV DC	
	Resolution	-----	10 V	
	Accuracy	-----	±(1.5% of the setting + 20 V)	
	Maximum rated load (*1)	-----	50 W (5 kV/10 mA)	
	Maximum rated current	-----	10 mA	
	Ripple	No load at 5 kV	-----	50 Vp-p Typ.
		Maximum rated load	-----	150 Vp-p Typ.
	Voltage regulation	-----	1% or less [maximum rated load → no load]	
	Short-circuit current	-----	40 mA Typ.	
	Discharge function	-----	Forced discharge at the end of test (discharge resistance: 125 kΩ)	
Start voltage	The voltage at the start of the test can be set as the start voltage.			
Setting range	0% to 99% of the test voltage (resolution of 1%)			
Output-voltage monitoring function	If the output voltage exceeds ±(10% of the setting + 50 V), output is cut off and the protection function activates.			
Voltmeter				
Analog	Scale	6 kV AC/DC F.S		
	Accuracy	±5% F.S		
	Indicator	Mean-value responsive/root-mean-square value scale		
Digital	Measurement range	0.0 kV to 6.00 kV AC/DC		
	Resolution	10 V		
	Accuracy	±(1.0% of the reading + 30 V)		
	Response	Mean-value responsive/root-mean-square value display (response time of 200 ms)		
	HOLD function	The voltage measured at the end of test is held during the PASS and FAIL judgment time period.		
*1 Time limitation on output				
The tester's 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 ≤ 40 °C	AC	50 < i ≤ 110 mA	At least as long as the output time	Maximum of 30 minutes
		i ≤ 50 mA	Not necessary	Continuous output possible
	DC	5 < i ≤ 11 mA	At least as long as the output time	Maximum of 1 minute
		i ≤ 5 mA	At least as long as the judgement wait time (WAIT TIME)	Continuous output possible
(Output time = voltage rise time + test time + voltage fall time)				
*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			
	i < 1 mA	1 mA ≤ i < 10 mA	10 mA ≤ i < 100 mA	100 mA ≤ i
	□ □ □ μA	□ □ □ mA	□ □ □ mA	□ □ □ mA
Accuracy	±(3% of the reading + 20 μA) [after the offset cancel function is activated, if the scanner is mounted]			
Response	Mean-value responsive / root-mean-square value display (response time of 200 ms)			
Hold function	The measured current at the end of the test is held during the PASS judgment time period.			
Offset cancel function	The current flowing to the insulation resistor between the output cables and the stray capacity is cancelled up to 100 μA/kV (in AC 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 border="1"> <thead> <tr> <th>Judgement</th> <th>Judgement method</th> <th>Display</th> <th>Buzzer</th> <th>SIGNAL I/O</th> </tr> </thead> <tbody> <tr> <td>UPPER FAIL</td> <td>When the tester detects a 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> </tbody> </table> <ul style="list-style-type: none"> <li>• 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.</li> <li>• The UPPER FAIL signal and the LOWER FAIL signal are output continuously until the STOP signal is input.</li> <li>• The FAIL and PASS buzzer volumes are adjustable. However, they cannot be adjusted individually, as they are set in common.</li> </ul>		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																		
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																		
Setting range for the upper current (UPPER)	0.01 mA to 110 mA AC	0.01 mA to 110 mA AC / 0.01 mA to 11 mA DC																				
Setting range for the lower current (LOWER)	0.01 mA to 110 mA AC (With the LOWER OFF function)	0.01 mA to 110 mA AC / 0.01 mA to 11 mA DC (With the LOWER OFF function)																				
Judgement accuracy (*3)	$\pm(3\% \text{ of setting} + 20 \mu\text{A})$ [After the offset cancel function is activated, if the scanner is mounted]																					
Current detection method	The absolute current values are integrated and compared with the reference value.																					
Response-speed switching function	The current-detection response speed for UPPER FAIL judgement can be set to FAST/MID/SLOW (for AC 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	$\pm(100 \text{ ppm} + 20 \text{ ms})$																					

\*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  $\mu\text{A}/\text{kV}$  flows into the stray capacity of each scanner. The table below shows the approximate currents flowing into such stray capacity.

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

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

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

\*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	$\pm(1.5\% \text{ of Setting} + 2 \text{ V})$	
Maximum rated load	1 W (-1000 V DC/1 mA)	
Maximum rated current	1 mA	
Ripple	2 Vp-p or less	
Maximum rated load	10 Vp-p or less	
Voltage regulation	1% or less [Maximum rated load $\rightarrow$ no load]	
Short-circuit current	12 mA or less	
Discharge function	Forced discharge at the end of test (discharge resistance : 25 k $\Omega$ )	
Output-voltage monitoring function	If the output voltage exceeds $\pm(10\% \text{ of the setting} + 50 \text{ V})$ , output is cut off and the protection function activates.	

# 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 border="1"> <tr> <td>R &lt; 10.0 MΩ</td> <td>10.0MΩ ≤ R &lt; 100.0MΩ</td> <td>100.0MΩ ≤ R &lt; 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
R < 10.0 MΩ	10.0MΩ ≤ R < 100.0MΩ	100.0MΩ ≤ R < 1.00GΩ	1.00GΩ ≤ R ≤ 9.99GΩ									
□.□ □ MΩ	□ □ □ MΩ	□ □ □ MΩ	□.□ □ GΩ									
Accuracy	<table border="1"> <tr> <td>50 nA ≤ i ≤ 100 nA</td> <td>100 nA &lt; i ≤ 200 nA</td> <td>200 nA &lt; i ≤ 1 μA</td> <td>1 μA &lt; 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)
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)									
Hold function	The measured current at the end of the test is held during the PASS period.											
Selection of GND/FLOAT for the LOW terminal (*4)												
	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 measurement).										
Judgement function												
Judgement method/action												
	Judgement	Judgement method	Display	Buzzer	SIGNAL I/O							
	UPPER FAIL	When the tester detects a resistance exceeding the upper cutoff resistance, it cuts off the output and makes an UPPER FAIL judgement. However, no judgement is made during a voltage rise time (RISE TIME).	The FAIL LED lights up. Displayed on the LCD	ON	Outputs the U FAIL signal							
	LOWER FAIL	When the tester detects a resistance below the lower cutoff resistance, it cuts off the output and makes a LOWER FAIL judgement. However, no judgement is made until the judgement wait time (WAIT TIME) has elapsed.	The FAIL LED lights up. Displayed on the LCD	ON	Outputs the L FAIL signal							
	PASS	When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement.	The PASS LED lights up. Displayed on the LCD	ON	Outputs the PASS signal							
<ul style="list-style-type: none"> <li>• 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.</li> <li>• The UPPER FAIL signal and the LOWER FAIL signal are output continuously until the STOP signal is input.</li> <li>• The FAIL and PASS buzzer volumes are adjustable. However, they cannot be adjusted individually, as they are set in common.</li> </ul>												
Setting range for the upper resistance (UPPER)		0.01 MΩ to 9.99 GΩ [Below the maximum rated current]										
Setting range for the lower resistance (LOWER)		0.01 MΩ to 9.99 GΩ [Below the maximum rated current]										
Judgement accuracy		For both UPPER and LOWER										
	Judgement current	50 nA ≤ i ≤ 100 nA	100 nA < i ≤ 200 nA	200nA < i ≤ 1 μA	1 μA < i ≤ 1 mA							
	UPPER, LOWER	0.01 ≤ R < 10.0 MΩ	—	—	± (2 % of setting + 3digit)							
		10.0 ≤ R < 50.0 MΩ	—	—	± (5 % of setting + 5digit)							
		50.0 ≤ R < 100 MΩ	—	—	± (5 % of setting + 5digit)							
		100 MΩ ≤ R < 200 MΩ	—	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)							
		200 MΩ ≤ R < 500 MΩ	± (20 % of setting + 5digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)							
		500 MΩ ≤ R < 1.00 GΩ	± (20 % of setting + 5digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)							
		1.00 GΩ ≤ R < 2.00 GΩ	± (20 % of setting + 10digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)							
		2.00 GΩ ≤ R < 5.00 GΩ	± (20 % of setting + 20digit)	± (10 % of setting + 10digit)	± (5 % of setting + 5digit)							
		5.00 GΩ ≤ R < 10.0 GΩ	± (20 % of setting + 20digit)	± (10 % of setting + 10digit)	—							
		Judgement current = test voltage/(UPPER,LOWER)										
[In the humidity range of 20% to 70% R.H (no condensation), with no disturbance such as swinging of the test leadwire]												
[In LOWER judgement, at least 0.5 s is necessary for testing after the WAIT TIME has elapsed. In LOWER judgement for 200 nA or lower, a wait time of at least 1.0 s is necessary.]												
Time												
Setting range for the voltage rise time (RISE TIME)		0.1 s to 200 s										
Setting range for the test time (TEST TIME)		0.5 s to 999 s With the TIMER OFF function										
Setting range for the judgement wait time (WAIT TIME)		0.3 s to 10 s [RISE TIME + TEST TIME > WAIT TIME]										
Accuracy		± (100 ppm + 20 ms)										

\*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.)	<p>Complied with the following standards:</p> <p>IEC61326-1:1997-03 / A1:1998-05 Electrical Equipment for Measurement, Control and Laboratory Use - EMC requirements</p> <p>Radiated Emissions Class A</p> <p>Conducted Emissions Class A</p> <p>IEC61000-4-2:1995-01/A1:1998-01 IEC61000-4-3:1995-02 Radiated, radio-frequency, electromagnetic field</p> <p>IEC61000-4-4:1995-01 IEC61000-4-4:1995-01 Electrical fast transient/Burst</p> <p>IEC61000-4-5:1995-02 IEC61000-4-5:1995-02 Surge</p> <p>IEC61000-4-6:1996-04 IEC61000-4-6:1996-04 Conducted disturbances</p> <p>IEC61000-4-11:1994-06 IEC61000-4-11:1994-06 Voltage dips, short interruptions and voltage variations</p> <p>Under following conditions</p> <ol style="list-style-type: none"> <li>1. Used test leadwire TL01-TOS which is supplied.</li> <li>2. No discharge occurs at outside of the tester.</li> <li>3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.</li> </ol>	
Safety (A custom order model does not apply to.)	<p>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.</p> <p>IEC61010-1:1990-09 / A2:1995-07 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use</p> <p>The equipment is designed to operate from overvoltage category II.</p>	
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 MΩ 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 requirements Radiated Emissions Class A Conducted Emissions Class A IEC61000-4-2:1995-01/A1:1998-01 IEC61000-4-3:1995-02 Radiated, radio-frequency, electromagnetic field IEC61000-4-4:1995-01 IEC61000-4-4:1995-01 Electrical fast transient/Burst IEC61000-4-5:1995-02 IEC61000-4-5:1995-02 Surge IEC61000-4-6:1996-04 IEC61000-4-6:1996-04 Conducted disturbances IEC61000-4-11:1994-06 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	Indoors and at altitudes up to 2000 m	
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 X 88(105)H X 370(415) Dmm	
Weight	Approx. 6.5 kg	
Accessories	1 pc.	
AC power cable	1 pc.	
High-voltage test leadwires, red	4 pc. (1.5 m each)	8 pc. (1.5 m each)
High-voltage leads for parallel connection	1 set (0.5 m each)	
Interface cable	1 pc.(0.5 m)	
Channel-indication stickers	For the panel face: 1 sheet; for the test leadwires: 1	
“HIGH VOLTAGE, DANGER” stickers	2 sheets	
Fuses	2 pc. (including a spare contained in the fuse holder)	
Operation Manual	1 copy	

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

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

### 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 OPEN, and CH3 (test point C) CH4 (test point D) to LOW. To specify these settings, you can use the TOS9200/9201 panel or the GPIB/RS-232C.

