

The maximum system voltage is the key for insulation test of PV (photovoltaic) modules. It can also be used to check for PID.

The insulation tests in international standards IEC61215 Edition 2.0 2005-04, IEC61646 Edition 2.0 2008-05, and IEC61730-2 2004-10 are composed of 3 tests: the withstanding voltage test, insulation resistance test, and wet leakage test. The TOS9213AS is capable of insulation tests up to a maximum system voltage of 1500 V.

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NEW

DC WITHSTANDING VOLTAGE/ INSULATION RESISTANCE TESTER **TOS9213AS**

● IEC61730-2 standard test

The applied voltage varies depending on the applicable class in IEC61730-2. For Class A, the voltage is raised at a speed of 500 V/s or less to [2000 V + 4 times of the maximum system voltage] and then maintained for 1 min. Example: With a mega-solar system that has a maximum system voltage of 1500 V, the applied voltage is [2000 + 4 x 1500] V = 8000 V.

* (Excluding tester accuracy and similar factors)

● Insulation resistance test and wet leakage test

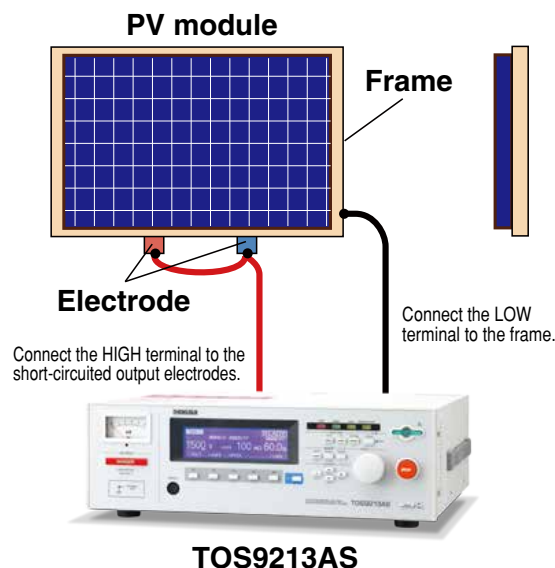
With each standard, the voltage is raised to a speed of 500 V/s or less to 500 V or the module maximum system voltage (whichever is higher) and maintained at that voltage.

As the maximum system voltage in solar power generation projects continues to trend higher, the TOS9213AS can raise the DC voltage that is applied at the insulation resistance test up to 1500 V.

● Reproduction of PID

When performing tests for PID (Potential Induced Degradation), which is a problem with current PV modules, a negative polarity DC power source is required. By turning OFF the timer setting in the TOS9213AS insulation resistance test mode, it is possible to perform these tests with the TOS9213AS in the same way. (Maximum current capacity: 1 mA up to 1020 V, 0.1 mA at or above 1020 V)

Image of insulation tests with the TOS9213AS



* The module connection method for PID reproduction is the same as for the insulation tests. By selecting the TOS9213AS insulation resistance test mode (IR), the applied voltage will have negative polarity.

Features/ Functions

- 10 kV / 5 mA, maximum output power of 50 W in DC withstanding voltage test.
- -25 V to -1500 V / 0.01 MΩ to 9.99 MΩ insulation resistance test.
- Conforms to international standards including IEC61215 Ed2.0, IEC61646 Ed2.0, and IEC61730-2.
- Low output ripple of (100 Vp-p at 10 kV) in consideration of capacitive load.
- The rise time control function allows the voltage build-up rate to be set. Also includes a discharge function.
- Judgment of the insulation resistance test can be selected between resistance value and current value.
- Capable to apply high-voltage and monitor current for PID. (-1500 VDC / 100 μA)

Specifications

DC Withstanding Voltage Test Mode

| Output section (DC) | |
|------------------------------------|---|
| Output-voltage range | 0.05V ~ 10.0kV |
| Resolution | 10V |
| Accuracy | ± (1.5% of setting + 20V) |
| Maximum rated load ※ 1 | 50W (10kV/5mA) |
| Maximum rated current | 5mA |
| Ripple | No load at 10 kV 100Vp-p Typ. Maximum rated load 100Vp-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: 500 k Ω) The discharge time can be set to a value from 0.5 s to 300 s (*2). |
| 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 setting + 50 V), output is cut off and the protection function activates. |
| Voltmeter | |
| Scale | 10kV DC F.S |
| Accuracy | ± 5% F.S |
| Indicator | Mean-value responsive |
| Measurement range | 0.00 ~ 10.5kV DC |
| Resolution | 10V |
| Accuracy | ± (1.0% of reading + 20V) |
| Response | Mean-value responsive(response time of 200 ms) |
| HOLD function | The voltage measured at the end of test is held during the PASS and FAIL period. |

*1 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 reference | Pause | Output time |
|---------------------|-----------------|---|---|
| t ≤ 40°C | DC | 2.5mA ≤ i | At least as long as the output time Maximum of 1 minute |
| | i < 2.5 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 About the discharge time setting

If you set the discharge time to 0.0 s or if the voltage between the output terminals exceeds approximately 30 V even after the specified discharge time has passed, the TOS9213S/ TOS9213AS will continue discharging until the voltage between the output terminals falls below approximately 30 V.

Ammeter

| | |
|-------------------|---|
| Measurement range | 0.00 ~ 5.5mA DC |
| Accuracy (*3) | 0 μA ~ 2.00mA : ± (3% of reading + 5 μA) 2.01mA ~ 5.50mA : ± (3% of reading + 10 μA) |
| Response | Mean-value responsive (response time of 200 ms) |
| Hold function | The measured current at the end of the test is held during the PASS period. |

Judgement function

| Setting range for the upper reference (UPPER) | 1 μA ~ 999 μA 1 μA STEP 1.00mA ~ 5.50mA 0.01mA STEP |
|---|---|
| Setting range for the lower reference (LOWER) | 1 μA ~ 999 μA 1 μA STEP 1.00mA ~ 5.50mA 0.01mA STEP (With the LOWER OFF function) |
| Judgement accuracy (*3) | 0 μA ~ 2.00mA : ± (3% of setting + 5 μA) 2.01mA ~ 5.50mA : ± (3% of setting + 10 μA) |
| Response switching function | The current detection response for UPPER FAIL judgement can be set to FAST/ MID/SLOW (*4) |
| Time | |
| Setting range for the voltage rise time (RISE TIME) | 0.1s ~ 200s |
| Setting range for the test time (TEST TIME) | 0.3s ~ 999s (With the TIMER OFF function) |

*3 When the GND LOW/GUARD setting is set to LOW, the humidity must not exceed 70 % rh.

*4 In the MID and SLOW modes, depending on the discharge method, the voltage monitoring function may operate and the TOS9213S/ TOS9213AS may enter the PROTECTION status before UPPER FAIL detection takes place.

Insulation Resistance Test Mode

| Output section | | | |
|--|--|--------------------|--------------------|
| Output-voltage range | - 25V ~ - 1500V | | |
| Resolution | 1V | | |
| Accuracy | ± (1.5% of setting + 2V) | | |
| Maximum rated load | 1W (- 1000V/1mA) , 0.15W (- 1500V/0.1mA) | | |
| Maximum rated current | 1mA (0.1 mA maximum when the test voltage setting exceeds -1020 V) | | |
| Ripple | No load at 1 kV 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 k Ω) The discharge time can be set to a value from 0.5 s to 300 s (*2). | | |
| 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 | | | |
| Scale | 10kV DC F.S | | |
| Accuracy | ± 5% F.S | | |
| Indicator | Mean-value responsive / root-mean-square value scale | | |
| Measurement range | 0 ~ - 1700V | | |
| Resolution | 1V | | |
| Accuracy | ± (1.0% of reading + 1V) | | |
| Resistance meter | | | |
| Measurement range | 0.01 M Ω - 9.99 G Ω (at rated current range of 50 nA to 1 mA maximum) | | |
| Accuracy | | | |
| 50nA ≤ i ≤ 100nA | 100nA < i ≤ 200nA | 200nA < i ≤ 1 μA | 1 μA < i ≤ 1mA |
| ± (20% of reading.) | ± (10% of reading.) | ± (5% of reading.) | ± (2% of reading.) |
| [i=measured current] | | | |
| [In the humidity range of 20 % to 70 % R.H (no condensation), with no disturbance such as swinging of the test leadwire] | | | |

Judgement function

| Judgement method | In UPPER and LOWER judgement, you can switch between resistance value-based judgement and current value-based judgement. The action for the judgement method by the current value-based judgement, Display, Buzzer, SIGNAL I/O can be referred to the action in Withstanding Voltage Test Mode. |
|---|---|
| Setting range for the upper reference (UPPER) | Resistance value-based judgment 0.01M Ω ~ 9.99G Ω [Below the maximum rated current] Current value-based judgment 0.1 μA ~ 1.00mA |
| Setting range for the lower reference (LOWER) | Resistance value-based judgment 0.01M Ω ~ 9.99G Ω [Below the maximum rated current] Current value-based judgment 0.1 μF ~ 1.00mA |
| Time | |
| Setting range for the voltage rise time (RISE TIME) | 0.1s ~ 200s |
| Setting range for the test time (TEST TIME) | 0.5 s to 999 s With the TIMER OFF function |

General Specifications

| | |
|--|---|
| Power requirements | Nominal voltage range AC100V ~ 120V/200V ~ 240V Selectable (Allowable voltage range) AC85V ~ 132V/170V ~ 250V) |
| Power consumption | Using no load (READY) 100 VA or less Using the rated load Maximum of 200 VA |
| 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 | 1390 V AC, 2 seconds, 20 mA or less [between the AC LINE and chassis] |
| Earth continuity | 25 A AC/0.1 Ω or less |
| Safety | Conforms to the requirements of the following standard. EN61010-1 (Class I, Pollution degree 2) |
| Warranty range Temperature / Humidity | 5 °C to 35 °C / 20 % to 80 % rh (No condensation) |
| Operating range Temperature / Humidity | 20 °C to 40 °C / 20 % to 80 % rh (No condensation) |
| Storage range Temperature / Humidity | - 20 °C to 70 °C / 90 % RH or less (No condensation) |
| Dimensions | 430 (455) W × 132 (150) × 400 (440) Dmm |
| Weight | Approx. 13 kg |
| Accessory | AC Power cord: 1 pc, High-voltage test leadwire TL01- TOS (1.5 m): 1 set, Interlock jumper: 1 pc, [HIGH VOLTAGE DANGER sticker: 1 sheet, Fuse: 1 pc, Operation Manual: 1 copy |



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