

Report Number: CT/ESD/664/23

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**MATERIALS (ESD) TESTING REPORT  
FOR  
MISUMI (THAILAND) Co.,Ltd**

**PRODUCT NAME: ESD GLOVES THICK TYPE TOP FIT  
PRODUCT CODE: MESD-TF**

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TESTED AND PREPARED BY:



CESSTECH (S) PTE LTD  
15, YISHUN INDUSTRIAL STREET 1  
#02-31, WIN5, SINGAPORE 768091

**SEPTEMBER 2023**

## SUMMARY

Foreword	:	The surface & volume resistance of materials (Gloves) were tested per the appropriate ESDA standards to ascertain the resistance classification of these materials and to determine if these materials could be used as static control items and/or to protect ESD sensitive parts
Standards	:	The samples were tested according to the following standards: <ul style="list-style-type: none"> <li>• ANSI/ESD STM15.1: Methods for Resistance Measurement of Gloves and Finger Cots</li> </ul>
Sample Description	:	1 material (consisting of 6 samples) were tested
Conditioning	:	The samples were conditioned at a temperature of $23 \pm 3$ Deg C and at $12\% \pm 3\%$ RH including $50\% \pm 5\%$ RH within an environmental chamber for 48hrs prior to testing for ANSI/ESD STM11.11 and ANSI/ESD STM11.12 and Two-Point Resistance Measurement & Constant Area and Force Electrode (CAFÉ) test.

## SUMMARY STATEMENT

The data presented in this report is an exact record of the materials testing done on the specified dates and in accordance to the stipulated environmental conditions. The results were obtained in accordance with test methods per ANSI/ESD STM11.11: Surface Resistance Measurement of Planar Materials & ANSI/ESD STM11.12: Volume Resistance Measurements of Planar Materials & Constant Area and Force Electrode (CAFÉ) test.

**Certified By :**




**WONG TZE LIANG**

*iNARTE Certified ESD Engineer, #ESD-010658-E*

**Date : 22 September 2023**



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CERT NO: FS 68089

# TEST PROCEDURE

## **TESTING PROCEDURE & INSTRUCTIONS FOR SURFACE RESISTANCE MEASUREMENT OF GLOVES**

### **AIM**

To measure the surface resistance of Gloves per ANSI/ESD STM11 .11.

### **REFERENCE DOCUMENT / STANDARD**

ANSI/ESD STM11.11-2021 Surface resistance Measurement of Planar Materials

- Within a range of  $1.0 \times 10^4$  ohms  $\geq R < 1.0 \times 10^{11}$  ohms

### **TEST EQUIPMENT**

- #5532 Environmental chamber (to condition the samples)
- 5lb Conductive Rubber Electrode(s)
- PRF-911 Concentric Ring Fixture with test bed
- PRS 801 or 812 Wide range resistance meter / Megohmmeter (Open Circuit) with application voltage of 10VDC / 100VDC with 5lb Conductive Rubber Electrode(s), Test lead(s) of sufficient length & accessories

### **SAMPLE PREPARATION**

1. A minimum of 6 representative specimen of the sample material shall be prepared.
2. Sample Size shall be at least 76 mm X 127mm.
3. The material should be clearly marked to identify the specimen's orientation (eg: Front, Back, Inside, Outside etc).

### **TEST CONDITIONS**

The samples will be tested under the following conditions:

- Temp :  $23 \pm 3$  Deg C , RH : 12%  $\pm 3\%$  - conditioning for at least 48 hrs (but no longer than 72hrs) prior to testing
- Temp :  $23 \pm 3$  Deg C , RH : 50%  $\pm 5\%$  - conditioning for at least 48 hrs (but no longer than 72hrs) prior to testing

## **TEST PROCEDURE**

1. Install the BNC adapter on the PRF911 fixture (concentric ring).
2. Install the negative lead (-) of the resistance meter to the RED BNC adapter receptacle connected to the centre INNER RING electrode.
3. Install the positive lead (+) of the resistance meter to the BLACK receptacle connected to the OUTER RING electrode.
4. To enhance the accuracy of the measurement, connect the GREEN auxiliary ground lead to the BLACK BNC adapter receptacle and the other end of the lead to the meter's ground reference.
5. Take one of the Samples and label it as sample 1 using a marker.
6. Insert the PTB-920 Dual test Bed into the glove with the insulated black acrylic surface facing up towards the surface to be tested.
7. Place the PRF-911 Concentric Ring Fixture on sample 1, arrange it so that it is approximately in the centre of the sample.
8. Place a 5lbs electrode on the PRF911 concentric ring (With the 5lbs electrode positioned on the PRF911 fixture, this ensures that both the outer ring & centre electrodes of the PRF911 fixture have approximately 5 lbs of total pressure across both surfaces).
9. Switch ON the PRS 801 resistance meter.
10. Ensure that it is in the "AUTO" mode.
11. Press the Green "TEST" button to initiate the measurement sequence.
12. Record the reading in ohms and the application voltage as shown on the meter.
13. Repeat for another 2 readings.
14. Repeat steps (6) to (13) for the remaining FIVE samples and mark each sample from (2) to (6) accordingly.
15. Calculate and report the minimum, maximum & Average reading for each sample as well.



**Figure 1: Surface Resistance Test (Inside)**



**Figure 2: Surface Resistance Test (Outside)**

## **TESTING PROCEDURE & INSTRUCTIONS FOR VOLUME RESISTANCE MEASUREMENT OF GLOVES**

### **AIM**

To measure the volume resistance of Gloves per ANSI/ESD STM11.12

### **REFERENCE DOCUMENT / STANDARD**

ANSI/ESD STM11.12-2021 Volume resistance Measurements of planar materials

- Volume resistance within a range of  $1.0 \times 10^4$  ohms  $\geq R < 1.0 \times 10^{11}$  ohms

### **TEST EQUIPMENT**

- #5532 Environmental chamber (to condition the samples)
- 5lb Conductive Rubber Electrode(s)
- PRF-911 Concentric Ring Fixture with test bed
- PRS 801 or 812 Wide range resistance meter / Megohmmeter (Open Circuit) with application voltage of 10VDC / 100VDC with 5lb Conductive Rubber Electrode(s), Test lead(s) of sufficient length & accessories

### **SAMPLE PREPARATION**

1. A minimum of 6 representative specimen of the sample material shall be prepared.
2. Sample Size shall be at least 76 mm X 127mm.
3. The material should be clearly marked to identify the specimen's orientation (eg: Front, Back, Inside, Outside etc).

### **TEST CONDITIONS**

The samples will be tested under the following conditions:

- Temp :  $23 \pm 3$  Deg C , RH : 12%  $\pm 3\%$  - conditioning for at least 48 hrs (but no longer than 72hrs) prior to testing
- Temp :  $23 \pm 3$  Deg C , RH : 50%  $\pm 5\%$  - conditioning for at least 48 hrs (but no longer than 72hrs) prior to testing



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## **TEST PROCEDURE**

1. Install the BNC adapter on the PRF911 fixture (concentric ring).
2. Install the negative lead (-) of the resistance meter to the RED BNC adapter receptacle connected to the centre INNER RING electrode.
3. Install the positive lead (+) of the resistance meter to the banana receptacle located on the edge of the PTB-920 metal test Bed.
4. To enhance the accuracy of the measurement, connect the GREEN auxiliary ground lead to the BLACK BNC adapter receptacle and the other end of the lead to the meter's ground reference.
5. Take one of the Samples and label it as sample 1 using a marker.
6. Place the PTB-920 Dual test Bed with the conductive metal surface facing up.
7. Place the PRF-911 Concentric Ring Fixture on the sample, arrange it so that it is approximately in the centre of the sample.
8. Place a 5lbs electrode on the PRF911 concentric ring (With the 5lbs electrode positioned on the PRF911 fixture, this ensures that both the outer ring & centre electrodes of the PRF911 fixture have approximately 5 lbs of total pressure across both surfaces).
9. Switch ON the PRS 801 resistance meter.
10. Ensure that it is in the "AUTO" mode.
11. Press the Green "TEST" button to initiate the measurement sequence.
12. Record the reading in ohms and the application voltage as shown on the meter.
13. Repeat for another 2 readings.
14. Repeat steps (6) to (13) for the remaining FIVE samples and mark each sample from (2) to (6) accordingly.
15. Calculate and report the minimum, maximum & Average reading for each sample as well.





**Figure 1: Volume Resistance Test (Inside)**



**Figure 2: Volume Resistance Test (Outside)**

## **TESTING PROCEDURE & INSTRUCTIONS FOR IN-USE RESISTANCE TESTING OF GLOVES**

### **AIM :**

To verify the resistance of gloves used to handle ESD sensitive items/devices.

### **REFERENCE DOCUMENT / STANDARD :**

ANSI/ESD STM15.1-2019 Methods for Resistance Measurement of Gloves and Finger Cots

- Resistance measured with personnel as a system of less than  $1.0 \times 10^{11}$  ohms

### **TEST EQUIPMENT**

- PCF-825 CAFÉ – Constant Area & Force Electrode
- Wrist Strap
- Wrist Strap cord without 1Mohm resistor
- Wrist Strap cord with 1Mohm resistor
- PRS 801 or 812 Wide range resistance meter / Megohmmeter (Open Circuit) with application voltage of 10VDC / 100VDC with 5lb Conductive Rubber Electrode(s), Test lead(s) of sufficient length & accessories

### **SAMPLE PREPARATION**

1. A minimum of 6 representative specimen of the sample material shall be prepared.
2. The material should be clearly marked to identify the specimen's orientation (eg : Top, Bottom, Inside, Outside etc).

### **TEST CONDITIONS**

The samples will be tested under the following conditions:

- Temp :  $23 \pm 3$  Deg C , RH : 12%  $\pm 3\%$  - conditioning for at least 48 hrs (but no longer than 72hrs) prior to testing
- Temp :  $23 \pm 3$  Deg C , RH : 50%  $\pm 5\%$  - conditioning for at least 48 hrs (but no longer than 72hrs) prior to testing



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## **TEST PROCEDURE**

1. Set the Megohmmeter to "AUTO" mode.
2. Put on the wrist strap/cuff on the same hand that would be used to wear the glove for testing. Make sure that it makes good contact with the skin.
3. Attach one end of the wrist strap's ground cord **without the 1 Mohm resistor** to the wrist strap or cuff and the other end to one input of the resistance meter.
4. Attach one end of the other test lead of the resistance meter to the CAFÉ fixture and the other end of the test lead to the second input of the resistance meter.
5. Wear the glove to be tested and wait a minimum of 15 secs to begin the electrical testing.
6. Balance the CAFÉ fixture on the Thumb and/or fingers of the hand selected for testing.
7. Press the TEST button on the Megohmmeter.
8. Record the resistance reading and the applied voltage (i.e., 10V or 100V).
9. If the applied voltage shown is 10V and the resistance measured is less than  $1 \times 10^6$  ohms, then record the resistance reading.
10. If the applied voltage shown is 100V and the resistance measured is more than  $1 \times 10^6$  ohms, then do the following:
  - i. Remove the existing ground cord without the 1 Mohm resistor and replace it with a ground cord **with a 1 Mohm resistor**.
  - ii. Attach one end of the wrist strap's ground cord to the wrist strap or cuff and the other end to one input of the resistance meter.
  - iii. Balance the CAFÉ fixture on the finger print side of the Index finger of the hand selected for testing.
  - iv. Press the TEST button on the Megohmmeter.
  - v. Record the resistance reading and repeat the measurement for the rest of the fingers and the Thumb (For Glove only).



**Figure 1: In-Use Resistance Test (RH at 12%)**



**Figure 2: In-Use Resistance Test (RH at 50%)**



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# TEST DATA

**Material Testing Report  
(For Static Control Item)**



<b>Date : 21 September 2023</b>	<b>Report No : CT/ESD/664/23</b>
<b>Customer : Misumi (Thailand) Co.,Ltd.</b>	<b>Environmental Conditions :</b>
<b>Item to be tested : Gloves</b>	<b>Ambient Temp : 23.3°C Ambient RH : 55.6%</b>
	<b>Chamber Temp : 23.6°C Chamber RH : 12.1%</b>

**Surface Resistance Test**

Applicable Standard : ESD Association's ANSI/ESD STM11.11:2021

No of samples : 06

**Test Instrument Used :**

No	Instrument	Serial No	Cal Due Date	Remarks
1	PRS801 Wide Range resistance meter	1105AB0046	15-Aug-24	
2	PRF-911 Concentric Ring	653	7-Aug-24	

**Test Results:**

Sample	Surface Resistance (ohms Ω)			Test Voltage (V)	Surface Resistance (ohms Ω)			Test Voltage (V)	Remarks
	Reading 1(Outside)	Reading 2(Outside)	Reading 3(Outside)		Reading 1(Inside)	Reading 2(Inside)	Reading 3(Inside)		
1	8.30E+05	9.10E+05	8.50E+05	10	2.00E+06	1.90E+06	2.30E+06	100	
2	6.10E+05	6.30E+05	5.90E+05	10	1.20E+06	1.10E+06	1.10E+06	100	
3	9.30E+05	8.70E+05	9.40E+05	10	1.10E+06	1.40E+06	1.20E+06	100	
4	4.80E+05	4.60E+05	4.80E+05	10	1.50E+06	1.40E+06	1.90E+06	100	
5	8.90E+05	9.40E+05	9.30E+05	10	1.10E+06	1.10E+06	1.30E+06	100	
6	9.40E+05	9.30E+05	9.10E+05	10	1.50E+06	1.20E+06	1.80E+06	100	

Summary of Test Data for Conditioning at 23 Deg C ± 3 Deg C & RH at 12% ± 3%

	Surface Resistance (ohms Ω)	Remark
Minimum	4.60E+05	
Maximum	2.30E+06	
Average	1.12E+06	

Tested By:

See Chun Keong  
Project Engineer

**Material Testing Report**  
**(For Static Control Item)**



<b>Date : 15 September 2023</b>	<b>Report No : CT/ESD/664/23</b>
<b>Customer : Misumi (Thailand) Co.,Ltd.</b>	<b>Environmental Conditions :</b>
<b>Item to be tested : Gloves</b>	<b>Ambient Temp : 23.2°C Ambient RH : 55.6%</b>
	<b>Chamber Temp : 23.5°C Chamber RH : 50.6%</b>

**Surface Resistance Test**

Applicable Standard : ESD Association's ANSI/ESD STM11.11:2021

No of samples : 06

**Test Instrument Used :**

No	Instrument	Serial No	Cal Due Date	Remarks
1	PRS801 Wide Range resistance meter	1105AB0046	15-Aug-24	
2	PRF-911 Concentric Ring	653	7-Aug-24	

**Test Results:**

Sample	Surface Resistance (ohms Ω)			Test Voltage (V)	Surface Resistance (ohms Ω)			Test Voltage (V)	Remarks
	Reading 1(Outside)	Reading 2(Outside)	Reading 3(Outside)		Reading 1(Inside)	Reading 2(Inside)	Reading 3(Inside)		
1	9.60E+05	9.30E+05	9.10E+05	10	9.40E+05	9.80E+05	9.30E+05	10	
2	1.30E+06	1.10E+06	1.00E+06	100	2.40E+06	2.10E+06	2.50E+06	100	
3	8.70E+05	8.40E+05	8.80E+05	10	9.10E+05	9.00E+05	9.10E+05	10	
4	9.50E+05	9.20E+05	9.00E+05	10	1.80E+06	1.60E+06	1.50E+06	100	
5	9.20E+05	9.10E+05	9.40E+05	10	2.00E+06	1.40E+06	1.90E+06	100	
6	1.10E+06	1.30E+06	1.00E+06	100	9.70E+05	9.50E+05	9.10E+05	10	

Summary of Test Data for Conditioning at 23 Deg C ± 3 Deg C & RH at 50% ± 5%

	Surface Resistance (ohms Ω)	Remark
Minimum	8.40E+05	
Maximum	2.50E+06	
Average	1.20E+06	

Tested By:

See Chun Keong  
 Project Engineer

**Material Testing Report  
(For Static Control Item)**



<b>Date : 21 September 2023</b>	<b>Report No : CT/ESD/664/23</b>
<b>Customer : Misumi (Thailand) Co.,Ltd.</b>	<b>Environmental Conditions :</b>
<b>Item to be tested : Gloves</b>	<b>Ambient Temp : 23.3°C Ambient RH : 55.6%</b>
	<b>Chamber Temp : 23.6°C Chamber RH : 12.1%</b>

**Volume Resistance Test**

Applicable Standard : ESD Association's ANSI/ESD STM11.12:2021

No of samples : 06

**Test Instrument Used :**

No	Instrument	Serial No	Cal Due Date	Remarks
1	PRS801 Wide Range resistance meter	1105AB0046	15-Aug-24	
2	PRF-911 Concentric Ring	653	7-Aug-24	

**Test Results:**

Sample	Volume Resistance (ohms Ω)			Test Voltage (V)	Volume Resistance (ohms Ω)			Test Voltage (V)	Remarks
	Reading 1(Outside)	Reading 2(Outside)	Reading 3(Outside)		Reading 1(Inside)	Reading 2(Inside)	Reading 3(Inside)		
1	1.10E+06	1.20E+06	1.20E+06	100	5.30E+05	5.20E+05	5.40E+05	10	
2	4.30E+05	4.80E+05	4.40E+05	10	2.00E+05	2.00E+05	2.20E+05	10	
3	6.30E+05	6.50E+05	6.20E+05	10	4.70E+05	4.90E+05	4.50E+05	10	
4	7.50E+05	7.40E+05	7.10E+05	10	1.80E+05	1.60E+05	1.90E+05	10	
5	6.90E+05	7.10E+05	6.90E+05	10	2.10E+05	2.20E+05	2.40E+05	10	
6	7.00E+05	7.20E+05	7.00E+05	10	3.20E+05	3.00E+05	3.10E+05	10	

Summary of Test Data for Conditioning at 23 Deg C ± 3 Deg C & RH at 12% ± 3%

	Volume Resistance (ohms Ω)	Remark
Minimum	1.60E+05	
Maximum	1.20E+06	
Average	5.25E+05	

Tested By:

See Chun Keong  
Project Engineer



**Material Testing Report**  
**(For Static Control Item)**



<b>Date : 15 September 2023</b>	<b>Report No : CT/ESD/664/23</b>
<b>Customer : Misumi (Thailand) Co.,Ltd.</b>	<b>Environmental Conditions :</b>
<b>Item to be tested : Gloves</b>	<b>Ambient Temp : 23.2°C Ambient RH : 55.8%</b>
	<b>Chamber Temp : 23.5°C Chamber RH : 50.3%</b>

**Volume Resistance Test**

Applicable Standard : ESD Association's ANSI/ESD STM11.12:2021

No of samples : 06

**Test Instrument Used :**

No	Instrument	Serial No	Cal Due Date	Remarks
1	PRS801 Wide Range resistance meter	1105AB0046	15-Aug-24	
2	PRF-911 Concentric Ring	653	7-Aug-24	

**Test Results:**

Sample	Volume Resistance (ohms Ω)			Test Voltage (V)	Volume Resistance (ohms Ω)			Test Voltage (V)	Remarks
	Reading 1(Outside)	Reading 2(Outside)	Reading 3(Outside)		Reading 1(Inside)	Reading 2(Inside)	Reading 3(Inside)		
1	8.60E+05	8.30E+05	8.70E+05	10	5.20E+05	5.10E+05	5.40E+05	10	
2	7.10E+05	7.30E+05	7.00E+05	10	2.00E+05	2.00E+05	2.20E+05	10	
3	5.60E+05	5.90E+05	5.80E+05	10	2.00E+05	2.30E+05	2.30E+05	10	
4	1.10E+06	1.20E+06	1.10E+06	100	4.60E+05	4.50E+05	4.80E+05	10	
5	8.00E+05	8.40E+05	8.20E+05	10	4.30E+05	4.10E+05	4.50E+05	10	
6	7.30E+05	7.60E+05	7.10E+05	10	4.90E+05	5.20E+05	5.00E+05	10	

Summary of Test Data for Conditioning at 23 Deg C ± 3 Deg C & RH at 50% ± 5%

	Volume Resistance (ohms Ω)	Remark
Minimum	2.00E+05	
Maximum	1.20E+06	
Average	5.98E+05	

Tested By:

See Chun Keong  
 Project Engineer

**Material Testing Report  
(For Static Control Item)**



<b>Date :</b> 21 September 2023	<b>Report No :</b> CT/ESD/664/23
<b>Customer :</b> Misumi (Thailand) Co.,Ltd.	<b>Environmental Conditions :</b>
<b>Item to be tested :</b> Gloves	<b>Ambient Temp :</b> 23.3°C <b>Ambient RH :</b> 55.6%
	<b>Chamber Temp :</b> 23.2°C <b>Chamber RH :</b> 13.4%

**Resistance Test**

Applicable Standard : ESD Association's ANSI/ESD STM15.1:2019 No of samples : 06

**Test Instrument Used :**

No	Instrument	Serial No	Cal Due Date	Remarks
1	PRS801 Wide Range resistance meter	1105AB0046	15-Aug-24	
2	PCF-825 CAFÉ Fixture	NA	NA	

**Test Results:**

Sample	Resistance Test with Wrist Strap					Test Voltage (V)	Remarks
	Thumb	Finger 1	Finger 2	Finger 3	Finger 4		
1	1.90E+07	5.00E+06	5.20E+06	7.50E+06	9.40E+06	100	
2	7.10E+06	2.30E+06	2.80E+06	3.20E+06	4.60E+06	100	
3	1.20E+07	7.70E+06	5.10E+06	3.80E+06	5.40E+06	100	
4	6.70E+06	5.60E+06	8.50E+06	5.70E+06	4.90E+06	100	
5	4.80E+06	1.00E+07	3.70E+06	9.70E+06	6.50E+06	100	
6	8.60E+06	8.90E+06	5.50E+06	4.60E+06	7.20E+06	100	

Summary of Test Data for Conditioning at 23 Deg C ± 3 Deg C & RH at 12% ± 3%

	Resistance Test with Wrist Strap	Remarks
Minimum	2.30E+06	
Maximum	1.90E+07	
Average	6.70E+06	

**Tested By:**

See Chun Keong  
Project Engineer

**Material Testing Report  
(For Static Control Item)**



Date : 15 September 2023	Report No : CT/ESD/664/23
Customer : Misumi (Thailand) Co.,Ltd.	Environmental Conditions :
Item to be tested : Gloves	Ambient Temp : 23.2°C Ambient RH : 55.6%
	Chamber Temp : 23.6°C Chamber RH : 50.3%

**Resistance Test**

Applicable Standard : ESD Association's ANSI/ESD STM15.1:2019 No of samples : 06

**Test Instrument Used :**

No	Instrument	Serial No	Cal Due Date	Remarks
1	PRS801 Wide Range resistance meter	1105AB0046	15-Aug-24	
2	PCF-825 CAFÉ Fixture	NA	NA	

**Test Results:**

Sample	Resistance Test with Wrist Strap					Test Voltage (V)	Remarks
	Thumb	Finger 1	Finger 2	Finger 3	Finger 4		
1	3.50E+07	3.90E+07	2.50E+07	3.30E+07	2.90E+07	100	
2	2.80E+07	2.10E+07	3.40E+07	2.70E+07	3.00E+07	100	
3	1.90E+07	1.40E+07	1.00E+07	1.20E+07	1.50E+07	100	
4	2.50E+07	2.80E+07	2.00E+07	2.40E+07	2.10E+07	100	
5	1.70E+07	1.50E+07	1.30E+07	2.00E+07	1.80E+07	100	
6	3.40E+07	3.00E+07	2.80E+07	3.20E+07	2.70E+07	100	

Summary of Test Data for Conditioning at 23 Deg C ± 3 Deg C & RH at 50% ± 5%

	Resistance Test with Wrist Strap	Remarks
Minimum	1.00E+07	
Maximum	3.90E+07	
Average	2.41E+07	

Tested By:

See Chun Keong  
Project Engineer



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# CALIBRATION CERTIFICATES FOR TEST INSTRUMENTS

## CERTIFICATE OF CALIBRATION

Model Number : PRF-911  
 Equipment Description : Concentric Ring Fixture  
 Serial Number : PRF653

Level of Calibration : 2  
 Ambient Temperature : 23.0 ±2°C  
 Relative Humidity : 50.0 ±10%RH

Date Calibrated : August 07, 2023  
 Date Due : August 07, 2024

*Dou Yee Enterprises (S) Pte Ltd certifies that the above-named unit-under-test has been calibrated under the environmental conditions as stated above and the result meets or exceeds all specification listed in the calibration test procedures. Dou Yee recommends re-calibration be performed annually.*

*The calibration was carried out with reference to the following calibration and measurement standards which are traceable to SPRING Singapore, NIST (US) and/or other recognized national calibration laboratories.*

**Method of Calibration:**

*The method of calibration is based on the procedures "Calibration test procedures LCP319 Rev 2" by Prostat Corporation.*

**Reference Standard(s) Used During Calibration:**

Standard(s) Used	Model No	Serial No	Report No	Due Date	Tracea
Electrometer / High Resistance Meter	Keithley, 6517B	4398606	10544943/2.1	05-Oct-23	SGS
Resistor bank (Surface)	ETS, 809B	476	SV001-230113DYS04	13-Jan-24	DYS
Resistor bank (Volume)	ETS, 819	068	SV001-230116DYS01	16-Jan-24	DYS

**Results:**

**Initial Reading (As received)**

	TARGET	MINIMUM	ACTUAL	MAXIMUM	RESULT
Surface Resistance @ 10V	4.98E+05	4.88E+05	5.00E+05	5.08E+05	PASS
Surface Resistance @ 100V	4.98E+05	4.93E+05	4.98E+05	5.03E+05	PASS
Volume Resistance @ 10V	4.97E+05	4.87E+05	4.98E+05	5.07E+05	PASS
Volume Resistance @ 100V	4.97E+05	4.92E+05	5.00E+05	5.02E+05	PASS

**Final Reading**

	TARGET	MINIMUM	ACTUAL	MAXIMUM	RESULT
Surface Resistance @ 10V	4.98E+05	4.88E+05	5.00E+05	5.08E+05	PASS
Surface Resistance @ 100V	4.98E+05	4.93E+05	4.98E+05	5.03E+05	PASS
Volume Resistance @ 10V	4.97E+05	4.87E+05	4.98E+05	5.07E+05	PASS
Volume Resistance @ 100V	4.97E+05	4.92E+05	5.00E+05	5.02E+05	PASS

**Remarks:**

- The user is recommended to determine the suitability of the instrument for its intended usage.



**Calibration Officer:**

*Tan CH*



**Verified By:**

*Ker CP*



MICRO PRECISION CALIBRATION PTE LTD  
 BLOCK 5008 ANG MO KIO AVENUE 5 #07-02/03  
 TECHPLACE II SINGAPORE 569874  
 65 67484384



# Certificate of Calibration

**Date:** August 15, 2023

**Cert No.** 5523631030274875

**Customer:**

CESSTECH (S) PTE LTD  
 15 YISHUN INDUSTRIAL STREET 1, #02-31, WIN5  
 SINGAPORE 768091.

**Work Order #:** SG-111028611

**MPC Control #:** 1105AB0046

**Serial Number:** 1105AB0046

**Asset ID:** N/A

**Department:** N/A

**Gage Type:** RESISTANCE SYSTEM

**Performed By:** YIOK TEE CHUA

**Manufacturer:** PROSTAT

**Received Condition:** IN TOLERANCE

**Model Number:** PRS-801

**Returned Condition:** IN TOLERANCE

**Size:** N/A

**Cal. Date:** August 15, 2023

**Temp/RH:** 23°C / 50 %

**Cal. Interval:** 12 MONTHS

**Location:** Calibration performed at MPC facility

**Cal. Due Date:** August 15, 2024

**Calibration Notes:**

Performance Test Passed. See attached data (2 Pages)

**Standards Used to Calibrate Equipment**

I.D.	Description.	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
CA8100	DECADE RESISTANCE BOX	2793	00060U	YOKOGAWA	May 31, 2024	5523631030093966
CA8198	PRECISION DECADE DC RESISTANCE BOX	SB2015-3	CA8198	CEPREI	Feb 10, 2024	551220085674015

**Procedures Used in this Event**

Procedure Name	Description
PROSTAT PRS-801	Resistance System, Prostat PRS-801, Apr-01-2009

Calibrating Technician:

YIOK TEE CHUA

QC Approval:

DIVIEERNRAJ CHANDRAN

**STATEMENTS OF PASS OR FAIL CONFORMANCE:** The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/NCSL Z540.3-2006.

**THE CALIBRATION REPORT STATUS:**

**PASS**- Term used when compliance statement is given, and the measurement result is PASS.  
**PASS<sup>2</sup>**- Term used when compliance statement is given, and the measurement result is conditional passed or PASS.  
**FAIL**- Term used when compliance statement is given, and the measurement result is FAIL.  
**FAIL<sup>2</sup>**- Term used when compliance statement is given, and the measurement result is conditional failed or FAIL.  
**REPORT OF VALUE** - Term used when reported measurement is not requiring compliance statement in report.  
**ADJUSTED**- When adjustments are made to an instrument which changes the value of measurement from what was measured as found to new value as left.  
**LIMITED** - When an instrument fails calibration but is still functional in a limited manner.

The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated. This calibration report complies with ISO/IEC 17025:2017, ANSI/NCSL Z540.3-2006 and ANSI/NCSL Z540.1-1994. Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. All standards are traceable to SI through the National Institute of Standards and Technology (NIST) and/or recognized national or international standards laboratories. Services rendered include proper manufacturer's service instruction and are warranted for no less than thirty (30) days. The information on this report pertains only to the instrument identified, this may not be reproduced in part or in a whole without the prior written approval of the issuing MP Calibration Laboratory.



## Calibration Report of Prostat PRS-801 Resistance System

MPC Control #: <u>1105AB0046</u>	Serial Number: <u>1105AB0046</u>
Asset ID: <u>N/A</u>	Calibration Date: <u>August 15, 2023</u>

### Resistance Accuracy Test

< 10 V Range

Function Tested	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
500 Ω	5.0 E+02 Ω	4.8 E+02 Ω	5.0 E+02 Ω	5.0 E+02 Ω	5.3 E+02 Ω	PASS	0.0057 E+02 Ω
1 kΩ	1.0 E+02 Ω	1.0 E+02 Ω	1.0 E+02 Ω	1.0 E+02 Ω	1.1 E+02 Ω	PASS	0.0057 E+03 Ω
2 kΩ	2.0 E+02 Ω	1.9 E+02 Ω	2.0 E+02 Ω	2.0 E+02 Ω	2.1 E+02 Ω	PASS	0.0057 E+03 Ω
4 kΩ	4.0 E+02 Ω	3.8 E+02 Ω	4.0 E+02 Ω	4.0 E+02 Ω	4.2 E+02 Ω	PASS	0.0057 E+03 Ω
6 kΩ	6.0 E+02 Ω	5.7 E+02 Ω	6.0 E+02 Ω	6.0 E+02 Ω	6.3 E+02 Ω	PASS	0.0057 E+03 Ω
10 kΩ	1.0 E+02 Ω	1.0 E+02 Ω	1.0 E+02 Ω	1.0 E+02 Ω	1.1 E+02 Ω	PASS	0.0057 E+04 Ω

10 V Range

Function Tested	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
10 kΩ	1.0 E+04 Ω	1.0 E+04 Ω	1.0 E+04 Ω	1.0 E+04 Ω	1.1 E+04 Ω	PASS	0.0057 E+04 Ω
30 kΩ	3.0 E+04 Ω	2.9 E+04 Ω	3.0 E+04 Ω	3.0 E+04 Ω	3.2 E+04 Ω	PASS	0.0059 E+04 Ω
50 kΩ	5.0 E+04 Ω	4.8 E+04 Ω	5.0 E+04 Ω	5.0 E+04 Ω	5.3 E+04 Ω	PASS	0.0062 E+04 Ω
70 kΩ	7.0 E+04 Ω	6.7 E+04 Ω	7.0 E+04 Ω	7.0 E+04 Ω	7.4 E+04 Ω	PASS	0.0067 E+04 Ω
100 kΩ	1.0 E+04 Ω	1.0 E+04 Ω	1.0 E+04 Ω	1.0 E+04 Ω	1.1 E+04 Ω	PASS	0.0057 E+05 Ω
300 kΩ	3.0 E+04 Ω	2.9 E+04 Ω	3.0 E+04 Ω	3.0 E+04 Ω	3.2 E+04 Ω	PASS	0.0059 E+05 Ω
500 kΩ	5.0 E+04 Ω	4.8 E+04 Ω	5.0 E+04 Ω	5.0 E+04 Ω	5.3 E+04 Ω	PASS	0.0062 E+05 Ω
700 kΩ	7.0 E+04 Ω	6.7 E+04 Ω	7.0 E+04 Ω	7.0 E+04 Ω	7.4 E+04 Ω	PASS	0.0067 E+05 Ω
1 MΩ	1.0 E+04 Ω	1.0 E+04 Ω	1.0 E+04 Ω	1.0 E+04 Ω	1.1 E+04 Ω	PASS	0.0057 E+06 Ω

100 V Range

Function Tested	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
1 MΩ	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.1 E+06 Ω	PASS	0.00050 E+06 Ω
3 MΩ	3.0 E+06 Ω	2.9 E+06 Ω	3.0 E+06 Ω	3.0 E+06 Ω	3.2 E+06 Ω	PASS	0.0069 E+06 Ω
5 MΩ	5.0 E+06 Ω	4.8 E+06 Ω	5.0 E+06 Ω	5.0 E+06 Ω	5.3 E+06 Ω	PASS	0.0086 E+06 Ω
7 MΩ	7.0 E+06 Ω	6.7 E+06 Ω	7.0 E+06 Ω	7.0 E+06 Ω	7.4 E+06 Ω	PASS	0.011 E+06 Ω
10 MΩ	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.1 E+06 Ω	PASS	0.0058 E+07 Ω
30 MΩ	3.0 E+06 Ω	2.9 E+06 Ω	3.0 E+06 Ω	3.0 E+06 Ω	3.2 E+06 Ω	PASS	0.0069 E+07 Ω
50 MΩ	5.0 E+06 Ω	4.8 E+06 Ω	5.0 E+06 Ω	5.0 E+06 Ω	5.3 E+06 Ω	PASS	0.0086 E+07 Ω
70 MΩ	7.0 E+06 Ω	6.7 E+06 Ω	7.0 E+06 Ω	7.0 E+06 Ω	7.4 E+06 Ω	PASS	0.011 E+07 Ω
100 MΩ	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.1 E+06 Ω	PASS	0.0058 E+08 Ω
300 MΩ	3.0 E+06 Ω	2.9 E+06 Ω	3.0 E+06 Ω	3.0 E+06 Ω	3.2 E+06 Ω	PASS	0.016 E+08 Ω
500 MΩ	5.0 E+06 Ω	4.8 E+06 Ω	5.0 E+06 Ω	5.0 E+06 Ω	5.3 E+06 Ω	PASS	0.026 E+08 Ω
700 MΩ	7.0 E+06 Ω	6.7 E+06 Ω	6.9 E+06 Ω	6.9 E+06 Ω	7.4 E+06 Ω	PASS	0.035 E+08 Ω
1 GΩ	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.1 E+06 Ω	PASS	0.0075 E+09 Ω
3 GΩ	3.0 E+06 Ω	2.9 E+06 Ω	3.1 E+06 Ω	3.1 E+06 Ω	3.2 E+06 Ω	PASS	0.016 E+09 Ω
5 GΩ	5.0 E+06 Ω	4.8 E+06 Ω	5.1 E+06 Ω	5.1 E+06 Ω	5.3 E+06 Ω	PASS	0.026 E+09 Ω
7 GΩ	7.0 E+06 Ω	6.7 E+06 Ω	7.1 E+06 Ω	7.1 E+06 Ω	7.4 E+06 Ω	PASS	0.035 E+09 Ω
10 GΩ	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.0 E+06 Ω	1.1 E+06 Ω	PASS	0.0075 E+10 Ω





## Calibration Report of Prostat PRS-801 Resistance System

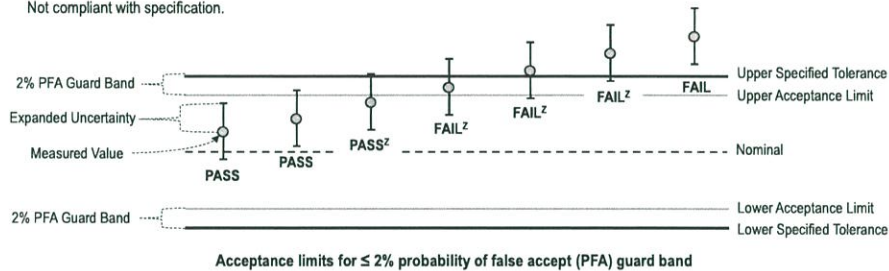
MPC Control #: <u>1105AB0046</u>	Serial Number: <u>1105AB0046</u>
Asset ID: <u>N/A</u>	Calibration Date: <u>August 15, 2023</u>

### Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification.  
 All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/NCSL Z540.3-2006

The status of compliance with the acceptance criteria is reported as:

- PASS** — Compliant with specification.
- PASS<sup>z</sup>** — The measured value is within acceptance limits.  
However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.
- FAIL<sup>z</sup>** — The measured value is not within the acceptance limits.  
However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
- FAIL** — Not compliant with specification.



The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated.

This calibration report complies with ISO/IEC 17025:2017 and ANSI/NCSL Z540.3-2006, Method 6 — Guard Bands Based on Test Uncertainty Ratio.

- End of Calibration Report -



Device Type : **SMART**

Serial No : **SMART2206240234A**

ZOGLAB Environment used in Calibration

Temperature : 20.7 °C

Relative Humidity : 60.5% RH

Barometric Pressure : 1001.9 hPa

### Caution:

1. The calibration results of this certificate only effective for inspected meter.
2. Recommendation for re-calibration after 12 months period.

### Test Points Value and Readings

Temperature (°C)

Reference	Actual Value	Permissible Tolerance
22.0	22.1	±0.5

### Relative Humidity (% RH)

39.7	40.4	±3.0%
61.2	61.0	±3.0%
79.4	79.6	±3.0%

06.02.2023

Date

K.C.

Inspector



**CESSTECH (S) PTE LTD**  
An ISO 9001:2015 Certified Company  
CERT NO: FS 68089

# ACCREDITATION / QUALIFICATION CERTIFICATES

# *Electrostatic Discharge Control Engineer*

*Certified: Apr 05 2017  
Certificate Number: ESD-010658-E  
Date of Expiration: Apr 30 2024*



*finds*

*Tze Liang Wong*

*has demonstrated knowledge, proficiency, education and experience in Electrostatic Discharge Control Engineer.*

*Issued in accordance with iNARTE administrative rules and guidelines in accordance with memoranda of agreement and guidelines as prescribed by specific elements of government and industry.*

*ASBaines*  
Andrew Baines, CEO

*iNARTE is a brand of Exemplar Global*



Advanced Static Control  
CONSULTING

*is pleased to present this Certificate of Attendance to*

**See Chun Keong**

*who has completed the two day training course*

**ESD Lab Technician Training for:**

**ANSI/ESD STM 11.11  
ANSI/ESD STM 11.12  
ANSI/ESD STM 11.13  
ANSI/ESD STM 11.31  
ANSI/ESD STM 15.1**



Ronald J. Gibson  
President

August 7-8, 2014