

Schedule

CE-TEST & MEASUREMENT (S) PTE. LTD.
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Certificate No. : LA-2018-0686-C

Issue No. 2

Date 3 June 2019

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FIELD OF TESTING : Calibration and Measurement

MEASURED QUANTITIES/ INSTRUMENT/RANGE TO BE CALIBRATED	METHOD / FREQUENCY	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
<p>A. <u>Electrical Calibration</u></p> <p>1. DC Voltage Measuring Instrument 0 to 329.9999 mV 0 to 3.299999 V 0 to 32.99999 V 30 V to 329.9999 V 100 V to 1020.000 V</p> <p>2. DC Current Measuring Instrument 0 to 329.999 uA 0 to 3.29999 mA 0 to 32.9999 mA 0 to 329.999 mA 0 to 1.09999 A 1.1 A to 2.99999 A 3 A to 10.9999 A 11 A to 20.5 A</p> <p>DC Current Clamp 20 A to 149.999 A 150 A to 1025 A</p>	<p>Direct Input</p> <p>5500A / COIL</p>	<p>16 ppm + 0.7 uV 8.6 ppm + 1.6 uV 9.3 ppm + 16 uV 14 ppm + 110 uV 14 ppm + 1200 uV</p> <p>120 ppm + 15 nA 78 ppm + 39 nA 78 ppm + 0.20 uA 78 ppm + 2.0 uA 160 ppm + 30 uA 290 ppm + 30 uA 390 ppm + 390 uA 780 ppm + 580 uA</p> <p>0.39 % + 0.11 A 0.39 % + 0.39 A</p>

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<p>3. Resistance Measuring Instrument</p> <p>0 to 10.9999 Ω 11 Ω to 32.9999 Ω 33 Ω to 109.9999 Ω 110 Ω to 329.9999 Ω 330 Ω to 1.099999 kΩ 1.1 kΩ to 3.299999 kΩ 3.3 kΩ to 10.99999 kΩ 11 kΩ to 32.99999 kΩ 33 kΩ to 109.9999 kΩ 110 kΩ to 329.9999 kΩ 330 kΩ to 1.099999 MΩ 1.1 MΩ to 3.299999 MΩ 3.3 MΩ to 10.99999 MΩ 11 MΩ to 32.99999 MΩ 33 MΩ to 109.9999 MΩ 110 MΩ to 329.9999 MΩ</p>	<p>Direct Input, Variable Resistance</p>	<p>30 ppm + 0.78 mΩ 24 ppm + 1.2 mΩ 22 ppm + 1.1 mΩ 22 ppm + 1.5 mΩ 22 ppm + 1.5 mΩ 22 ppm + 15 mΩ 22 ppm + 15 mΩ 22 ppm + 0.15 Ω 22 ppm + 0.15 Ω 25 ppm + 1.5 Ω 25 ppm + 1.5 Ω 47 ppm + 23 Ω 100 ppm + 39 Ω 200 ppm + 1.8 kΩ 390 ppm + 2.4 kΩ 2300 ppm + 78 kΩ</p>
<p>1 Ω 10 Ω 25 Ω 50 Ω 75 Ω 100 Ω 200 Ω 400 Ω 1 kΩ 2 kΩ 4 kΩ</p>	<p>Direct Input, Fixed Resistance</p>	<p>24 ppm 14 ppm 12 ppm 12 ppm 12 ppm 12 ppm 12 ppm 12 ppm 12 ppm 12 ppm 12 ppm</p>

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4. AC Voltage Measuring Instrument 1.0 mV to 32.999 mV	Direct Input	
	10 Hz to 45 Hz	620 ppm + 4.7 uV
	45 Hz to 10 kHz	120 ppm + 4.6 uV
	10 kHz to 20 kHz	150 ppm + 4.7 uV
	20 kHz to 50 kHz	780 ppm + 4.6 uV
	50 kHz to 100 kHz	2700 ppm + 9.3 uV
33 mV to 329.999 mV	10 Hz to 45 Hz	230 ppm + 6.2 uV
	45 Hz to 10 kHz	110 ppm + 6.2 uV
	10 kHz to 20 kHz	120 ppm + 6.2 uV
	20 kHz to 50 kHz	270 ppm + 6.2 uV
	50 kHz to 100 kHz	620 ppm + 25 uV
	0.33 V to 3.29999 V	10 Hz to 45 Hz
45 Hz to 10 kHz		110 ppm + 49 uV
10 kHz to 20 kHz		140 ppm + 50 uV
20 kHz to 50 kHz		230 ppm + 39 uV
50 kHz to 100 kHz		550 ppm + 97 uV
3.3 V to 32.9999 V		10 Hz to 45 Hz
	45 Hz to 10 kHz	120 ppm + 440 uV
	10 kHz to 20 kHz	190 ppm + 440 uV
	20 kHz to 50 kHz	270 ppm + 470 uV
	50 kHz to 100 kHz	690 ppm + 1300 uV
	33 V to 329.999 V	45 Hz to 1 kHz
1 kHz to 10 kHz		150 ppm + 5.7 mV
10 kHz to 20 kHz		190 ppm + 5.3 mV
20 kHz to 50 kHz		230 ppm + 4.9 mV
50 kHz to 100 kHz		1600 ppm + 36 mV
330 V to 1020 V		45 Hz to 1 kHz
	1 kHz to 5 kHz	200 ppm + 5.8 mV
	5 kHz to 10 kHz	230 ppm + 9.5 mV

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5. AC Current Measuring Instrument	Direct Input	
29 uA to 329.99 uA	20 Hz to 45 Hz 45 Hz to 1 kHz 1 to 5 kHz 5 to 10 kHz 10 to 30 kHz	0.12 % + 78 nA 0.097 % + 78 nA 0.23 % + 120 nA 0.62 % + 160 nA 1.2 % + 330 nA
0.33 uA to 3.29999 mA	20 Hz to 45 Hz 45 Hz to 1 kHz 1 to 5 kHz 5 to 10 kHz 10 to 30 kHz	0.097 % + 120 nA 0.078 % + 110 nA 0.16 % + 140 nA 0.39 % + 240 nA 0.78 % + 470 nA
3.3 mA to 32.9999 mA	20 Hz to 45 Hz 45 Hz to 1 kHz 1 to 5 kHz 5 to 10 kHz 10 to 30 kHz	0.070 % + 1.5 uA 0.031 % + 1.6 uA 0.062 % + 1.6 uA 0.15 % + 2.5 uA 0.31 % + 3.1 uA
33 mA to 329.999 mA	20 Hz to 45 Hz 45 Hz to 1 kHz 1 to 5 kHz 5 to 10 kHz 10 to 30 kHz	0.068 % + 16 uA 0.031 % + 16 uA 0.080 % + 39 uA 0.15 % + 89 uA 0.31 % + 160 uA
0.33 A to 1.09999 A	20 Hz to 45 Hz 45 Hz to 1 kHz 1 to 5 kHz 5 to 10 kHz	0.14 % + 78 uA 0.039 % + 78 uA 0.47 % + 750 uA 2.0% + 3900 uA
1.1 A to 2.99999 A	20 Hz to 45 Hz 45 Hz to 1 kHz 1 to 5 kHz 5 to 10 kHz	0.14 % + 78 uA 0.047 % + 76 uA 0.47 % + 760 uA 2 % + 3400 uA

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3 A to 10.9999 A	45 Hz to 100 Hz 100 Hz to 1 kHz 1 to 5 kHz	0.046 % + 1.6 mA 0.077 % + 1.6 mA 2.3 % + 1.7 mA
11 A to 20.5 A	45 Hz to 100 Hz 100 Hz to 1 kHz 1 to 5 kHz	0.093 % + 4.0 mA 0.11 % + 5.0 mA 2.3 % + 9.0 mA
<u>AC Toroidal-Type Current Clamp</u>	5500A/COIL	
20 A to 149.999 A	45 Hz to 65 Hz 65 Hz to 100 Hz 100 Hz to 440 Hz	0.22 % + 0.046 A 0.62 % + 0.030 A 0.65 % + 0.054 A
150 A to 1025 A	45 Hz to 65 Hz 65 Hz to 100 Hz	0.24 % + 0.10 A 0.62 % + 0.11 A
150 A to 600 A	100 Hz to 440 Hz	0.99 % + 0.21 A
<u>AC Current Clamp</u>	5500A / COIL	
20 A to 149.999 A	45 Hz to 65 Hz 65 Hz to 100 Hz 100 Hz to 440 Hz	0.44 % + 0.20 A 0.78 % + 0.20 A 0.81 % + 0.20 A
150 A to 1025 A	45 Hz to 65 Hz 65 Hz to 100 Hz	0.44 % + 0.70 A 0.78 % + 0.70 A
150 A to 600 A	100 Hz to 300 Hz	1.1 % + 0.70 A

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<p>6. Capacitance Measuring Instrument (DC Charge/Discharge and AC RCL Meters)</p> <p>0.4 nF to 1.0999 nF 1.1 nF to 3.2999 nF 3.3 nF to 10.9999 nF 11 nF to 32.9999 nF 33 nF to 109.999 nF 110 nF to 329.999 nF 0.33 uF to 1.09999 uF 1.1 uF to 3.29999 uF 3.3 uF to 10.9999 uF 11 uF to 32.9999 uF 33 uF to 109.999 uF 110 uF to 329.999 uF 0.33 mF to 1.09999 mF</p>	Direct Input	<p>0.38 % + 7.7 pF 0.39 % + 7.8 pF 0.20 % + 7.8 pF 0.20 % + 78 pF 0.20 % + 78 pF 0.19 % + 240 pF 0.20 % + 0.78 nF 0.19 % + 2.4 nF 0.20 % + 7.8 nF 0.31 % + 23 nF 0.35 % + 78 nF 0.35 % + 240 nF 0.35 % + 0.78 uF</p>
<p>7. Frequency Measuring Instrument 20 Hz to 1 MHz</p>	Direct Input	2.1 ppm + 1 uHz
<p>8. Frequency Sourcing Instrument 20 Hz to 100 Hz 100 Hz to 1 MHz</p>	Direct Input	<p>10 ppm + 0.2 mHz 12 ppm</p>
<p>9. DC Voltage Sourcing Instrument 0 to 199.99 mV 0 to 1.9999 V 0 to 19.999 V 0 to 199.99 V 0 to 1050 V</p>	Direct Input	<p>4.5 ppm + 0.1 uV 3.0 ppm + 0.4 uV 3.0 ppm + 4 uV 4.5 ppm + 40 uV 4.5 ppm + 1 mV</p>

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10. DC Current Sourcing Instrument 0 to 199.99 uA 0 to 1.9999 mA 0 to 19.999 mA 0 to 199.99 mA 0 to 1.9999 A 0 to 19.999 A 20 mA to 100 mA	Direct Input Via Shunt	12 ppm + 0.4 nA 12 ppm + 4 nA 13 ppm + 40 nA 36 ppm + 0.8 uA 170 ppm + 16 uA 380 ppm + 0.4 mA 15 ppm
11. Resistance Sourcing Instrument 0 to 1.9999 Ω 0 to 19.999 Ω 0 to 199.99 Ω 0 to 1.9999 kΩ 0 to 19.999 kΩ 0 to 199.99 kΩ 0 to 1.9999 MΩ 0 to 19.999 MΩ 0 to 199.99 MΩ	Direct Input Lo Current Lo Current Lo Current Lo Current	15 ppm + 4 uΩ 9 ppm + 14 uΩ 7.5 ppm + 50 uΩ 7.5 ppm + 0.5 mΩ 7.5 ppm + 5 mΩ 7.5 ppm + 100 mΩ 10 ppm + 1 Ω 35 ppm + 100 Ω 520 ppm + 100 kΩ
12 AC Voltage Sourcing Instrument 2.0 mV to 199.99 mV 20 mV to 1.9999 V	Direct Input 40 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz 50 kHz to 100 kHz 40 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz 50 kHz to 100 kHz	110 ppm + 4 uV 110 ppm + 1 uV 110 ppm + 3 uV 310 ppm + 7 uV 710 ppm + 20 uV 85 ppm + 20 uV 65 ppm + 20 uV 85 ppm + 20 uV 210 ppm + 30 uV 510 ppm + 200 uV

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200 mV to 19.999 V	40 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz 50 kHz to 100 kHz	85 ppm + 200 uV 65 ppm + 200 uV 85 ppm + 200 uV 210 ppm + 300 uV 510 ppm + 2000 uV
2 V to 199.99 V	40 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz 50 kHz to 100 kHz	85 ppm + 2 mV 65 ppm + 2 mV 85 ppm + 2 mV 210 ppm + 3 mV 510 ppm + 20 mV
20 V to 1050 V	40 Hz to 10 kHz	95 ppm + 40 mV
13. AC Current Sourcing Instrument	Direct Input	
2.0 uA to 199.99 uA	10 Hz to 5 kHz	480 ppm + 19 nA
20 uA to 1.9999 mA	10 Hz to 10 kHz	280 ppm + 200 nA
200 uA to 19.999 mA	10 Hz to 10 kHz	280 ppm + 2 uA
2 mA to 199.99 mA	10 Hz to 10 kHz	250 ppm + 20 uA
20 mA to 1.9999 A	10 Hz to 2 kHz 2 kHz to 10 kHz	600 ppm + 200 uA 710 ppm + 200 uA
200 mA to 19.999 A	10 Hz to 2 kHz 2 kHz to 10 kHz	800 ppm + 2 mA 0.25 % + 2 mA

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MEASURED QUANTITIES/ INSTRUMENT/RANGE TO BE CALIBRATED	METHOD / FREQUENCY	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
B. <u>Temperature Calibration</u>		
1. RTD Thermometer (Exclude sensor)		
<u>Pt385 - 100Ω</u>	Direct Input	
-75 to 0 °C		0.040 °C
0 to 100 °C		0.055 °C
100 to 300 °C		0.070 °C
300 to 400 °C		0.078 °C
400 to 630 °C		0.094 °C
2. Thermocouple Thermometer (Exclude sensor)		
<u>Type-J</u>	Direct Input	
-210 to -100 °C		0.22 °C
-100 to -30 °C		0.14 °C
-30 to 150 °C		0.13 °C
150 to 760 °C		0.15 °C
760 to 1200 °C		0.19 °C
<u>Type-K</u>		
-200 to -100 °C	Direct Input	0.27 °C
-100 to -25 °C		0.16 °C
-25 to 120 °C		0.14 °C
120 to 1000 °C		0.22 °C
1000 to 1372 °C		0.32 °C
3. <u>Digital Thermometer</u> (with liquid immersion probe)		
0 °C	Ice Fixed-Point	0.012 °C
-5 °C to 125 °C	Direct Comparison with Reference Thermometer through Silicone Oil Bath	0.050 °C

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4. <u>Bath and Dry Block</u> (Indicator/Display Accuracy) -5 °C to 125 °C	Direct Measurement with PRT Reference Thermometer	0.029 °C

* CMC is expressed as an expanded uncertainty estimated at a level of confidence of approximately 95%.

Approved Signatories:

Mr Anthony Ng) For all items

Mr Jay Yeo)

Note :

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025. A laboratory's fulfilment of the requirements of ISO/IEC 17025 means the laboratory meets both the technical competence requirements and **management system requirements** that are necessary for it to consistently deliver technically valid calibrations. The **management system requirements** in ISO/IEC 17025 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001.