

Laboratory **Electronics Test & Development Centre, 30, GMC-NIO Road,
P.O. Goa University, Goa**

Accreditation Standard **ISO/IEC 17025: 2005**

Certificate Number **CC-2049**

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Validity **29.11.2018 to 28.11.2020**

Last Amended on **-**

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
<u>ELECTRO-TECHNICAL CALIBRATION</u>				
I.	SOURCE			
1.	DC Voltage [#]	1 mV to 100 mV 100 mV to 10 V 10 V to 1000 V	0.13 % to 0.004 % 0.004 % to 0.002 % 0.002 %	Using Fluke 5520A by Direct Method
2.	DC Current [#]	100 μ A to 1 A 1 A to 20 A	0.04 % to 0.027 % 0.027 % to 0.12 %	Using Fluke 5520A by Direct Method
		20 A to 1000 A	0.4 % to 0.5 %	Using Fluke 5520A, 50 Turn Current Coil by Direct Method
3.	Resistance [#]	1 m Ω to 10 m Ω 0.01 Ω to 1 Ω 1 Ω to 100 Ω 100 Ω to 1 M Ω 1 M Ω to 10 M Ω 10 M Ω to 1 G Ω	0.70 % to 0.088 % 0.088 % to 0.01 % 0.01 % to 0.005 % 0.005 % to 0.01 % 0.012 % 0.01 % to 0.57 %	Using Vaiseshika 9409B, Fluke 5520A, ESI SR1 Series, ZMSR Series by Direct Method
4.	AC Voltage [#]	50 Hz to 8 kHz 10 mV to 100 mV 100 mV to 10 V 10 V to 1000 V	0.10 % to 0.03 % 0.03 % 0.03 % to 0.04 %	Using Fluke 5520A by Direct Method
5.	AC Current [#]	50 Hz to 5 kHz 100 μ A to 100 mA 100 mA to 3 A 3 A to 20 A	0.2 % to 0.08 % 0.08 % to 0.1 % 0.1 % to 0.17 %	Using Fluke 5520A by Direct Method
		50 Hz 20 A to 1000 A	0.39 % to 0.71 %	Using Fluke 5520A, 50 Turn Current Coil by Direct Method

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6.	Capacitance [#]	1 kHz 100 pF to 1000 pF 1000 pF to 1 μ F 1 μ F to 10 mF	0.16 % to 0.05 % 0.05 % 0.05 % to 1.8 %	Using GR STD Capacitors, Fluke 5520A, Fluke 9100 by Direct Method
7.	Inductance [#]	1 kHz 100 μ H to 1 mH 1 mH to 10 H	0.4 % to 0.11 % 0.11 % to 0.12 %	Using GR STD Inductors (Discrete Values in Decades) by Direct Method
8.	Frequency [#]	1 Hz to 10 kHz 10 kHz to 100 MHz 100 MHz to 3 GHz	0.0021 % to 0.00002 % 0.00002 % to 0.00001 % 0.00001 %	Using Fluke 5520A, R&S SMB 100A by Direct Method
9.	Oscilloscope Level, Time Marker, Bandwidth [#]	1 mVpp to 100 Vpp 5 s to 2 ns 10 kHz to 600 MHz	0.4 % to 0.14 % 0.05 % to 0.02 % 4 %	Using Fluke 5520A with Scope Option by Direct Method
10.	Temperature Simulation [#]			Using Eurotron Microcal 200+ in Source Mode by Simulation Method
	RTD Pt-100	(-) 200 °C to 800 °C	0.15 °C	
	J Type Thermocouple	(-) 190 °C to 1200 °C	0.25 °C	
	K Type Thermocouple	(-) 100 °C to 1260 °C	0.28 °C	
	T Type Thermocouple	(-) 100 °C to 400 °C	0.16 °C	
	R Type Thermocouple	150 °C to 1750 °C	0.44 °C	
	S Type Thermocouple	170 °C to 1750 °C	0.44 °C	
	B Type Thermocouple	920 °C to 1800 °C	0.54 °C	
	E Type Thermocouple	(-) 190 °C to 1000 °C	0.23 °C	
	N Type Thermocouple	100 °C to 1300 °C	0.26 °C	

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II.	MEASURE			
1.	DC Voltage #	1 mV to 100 mV 100 mV to 10 V 10 V to 1000 V	0.035 % to 0.001 % 0.001 % 0.0012 %	Using HP 3458A DMM by Direct Method
2.	DC Current #	100 μ A to 100 mA 100 mA to 1 A	0.004 % 0.004 % to 0.014 %	Using HP 3458A DMM by Direct Method
		1 A to 20 A	0.014 % to 1.14 %	Using Shunt UDL4-Z2 with DMM by V/R Method
3.	Resistance #	1 m Ω to 10 m Ω 0.01 Ω to 1 Ω 1 Ω to 100 Ω 100 Ω to 10 M Ω 10 M Ω to 100 M Ω 100 M Ω to 1 G Ω	5.74 % to 0.57 % 0.57 % to 0.008 % 0.008 % to 0.002 % 0.002 % to 0.009 % 0.009 % to 0.05 % 0.05 % to 0.572 %	Using HP 3458A DMM by Direct Method
4.	AC Voltage #	50 Hz to 1 kHz 10 mV to 100 mV 100 mV to 1 V 1 V to 700 V	0.036 % to 0.01 % 0.01 % 0.01 % to 0.07 %	Using HP 3458A DMM by Direct Method
		50 Hz 700 V to 1000 V	0.07 % to 0.13 %	Using Voltech PM 3000A by Direct Method
5.	AC Current #	50 Hz to 1 kHz 100 μ A to 100 mA 100 mA to 1 A	0.1 % to 0.09 % 0.09 % to 0.11 %	Using HP 3458A DMM by Direct Method
		1 A to 20 A	0.11 % to 0.6 %	Using Shunt UDL4-Z2 with DMM by V/R Method

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6.	DC High Voltage #	1 kV to 30 kV	2.5 % to 1.5 %	Using Fluke 80K40 / Fluke 87V by Direct Method
7.	AC High Voltage #	50 Hz 1 kV to 15 kV	5.92 %	Using Fluke 80K40 / Fluke 87V by Direct Method
8.	Capacitance #	1 kHz 100 pF to 1 μ F	0.15 % to 0.07 %	Using HP 4274 A LCR Meter by Direct Method
9.	Inductance #	1 kHz 100 μ H to 10 H	0.31 % to 0.155 %	Using HP 4274 A LCR Meter by Direct Method
10.	Frequency #	10 Hz to 10 kHz 10 kHz to 3.0 GHz	0.00012 % to 0.00006 % 0.00006 % to 0.000002 %	Using CNT 90 Pendulum Counter Timer by Direct Method
11.	Temperature Simulation #			
	RTD Pt-100	(-) 200 $^{\circ}$ C to 800 $^{\circ}$ C	0.15 $^{\circ}$ C	Using Eurotron Microcal 200+ in Measure Mode by Simulation Method
	J Type Thermocouple	(-) 190 $^{\circ}$ C to 1200 $^{\circ}$ C	0.26 $^{\circ}$ C	
	K Type Thermocouple	(-) 100 $^{\circ}$ C to 1350 $^{\circ}$ C	0.37 $^{\circ}$ C	
	T Type Thermocouple	(-) 190 $^{\circ}$ C to 400 $^{\circ}$ C	0.17 $^{\circ}$ C	
	R Type Thermocouple	145 $^{\circ}$ C to 1750 $^{\circ}$ C	0.44 $^{\circ}$ C	
	S Type Thermocouple	165 $^{\circ}$ C to 1750 $^{\circ}$ C	0.44 $^{\circ}$ C	
	B Type Thermocouple	915 $^{\circ}$ C to 1800 $^{\circ}$ C	0.55 $^{\circ}$ C	
	E Type Thermocouple	(-) 190 $^{\circ}$ C to 1000 $^{\circ}$ C	0.41 $^{\circ}$ C	
	N Type Thermocouple	1 $^{\circ}$ C to 1300 $^{\circ}$ C	0.27 $^{\circ}$ C	

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
12.	Time Interval #	1 s to 3600 s	0.035 s to 0.04 s	Using CNT 90 Pendulum Counter Timer by Comparison Method

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<u>MECHANICAL CALIBRATION</u>				
I.	DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)			
1.	External Micrometer Analog/Digital [§] L.C.: 0.01 mm	0 to 25 mm	6.5 μ m	Using Gauge Blocks Grade "O"
2.	Vernier Calipers Analog/Dial/Digital [§] L.C.: 0.01 mm	0 to 300 mm	9.0 μ m	Using Gauge Blocks Grade "O"
3.	Dial Gauge: Plunger Type Analog/ Digital [§] L.C.: 0.01 mm	0 to 20 mm	7.0 μ m	Using Gauge Blocks Grade "O" & Comparator Stand
4.	Vernier Height Gauge Analog/Dial/Digital [§] L.C.: 0.02 mm	0 to 600 mm	16.0 μ m	Using Slip Gauges, Long Slip Gauges & Surface Plate
II.	WEIGHTS			
1.	Mass/Weights [§]	1 mg 2 mg 5 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g	0.05 mg 0.05 mg 0.05 mg 0.05 mg 0.05 mg 0.05 mg 0.05 mg 0.05 mg 0.06 mg 0.06 mg 0.06 mg	Using E2 Class Standard Weights & Digital Semi Micro Balance L.C. 0.01/0.1 mg for M1 Class Weights and Coarser

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		5 g 10 g 20 g 50 g 100 g 200 g	0.06 mg 0.06 mg 0.08 mg 0.15 mg 0.15 mg 0.15 mg	
III.	PRESSURE INDICATING DEVICES			
1.	Pneumatic Pressure Pressure Gauges, Pressure Indicators, Pressure Calibrators [§]	(-) 0.85 bar to 0 bar 0 to 25 bar	0.0065 bar 0.013 bar	Using Pneumatic Digital Pressure Calibrator by Comparison Method as per DKD-R-6
2.	Hydraulic Pressure Pressure Gauges, Pressure Indicators, Pressure Calibrators [§]	0 to 400 bar	0.183 bar	Using Pressurement Dead Weight Tester by Comparison Method as per DKD-R-6
3.	Pneumatic Pressure Pressure Gauges, Pressure Indicators, Pressure Calibrators [*]	(-) 0.85 bar to 0 bar 0 to 25 bar	0.0068 bar 0.139 bar	Using Pneumatic Digital Pressure Calibrator by Comparison Method as per DKD-R-6
4.	Hydraulic Pressure Pressure Gauges, Pressure Indicators, Pressure Calibrators [*]	0 to 400 bar	0.38 bar	Using Digital Hydraulic Pressure Calibrator by Comparison Method as per DKD-R-6

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<u>THERMAL CALIBRATION</u>				
I.	TEMPERATURE			
1.	Glass Thermometers [§]	35 °C to 180 °C	0.32 °C	Using Oil Bath, SSPRT & Temperature Calibrator by Comparison Method
2.	Temperature gauges, RTD / Thermocouple with or without Temp. Indicator/Recorder/ Data Logger [§]	35 °C to 200 °C	0.14 °C	Using Oil Bath, Dry Block, SSPRT & Temperature Calibrator by Comparison Method
		200 °C to 600 °C	0.5 °C	Using Dry Block, SSPRT & Temperature Calibrator by Comparison Method
3.	Thermocouple with or without Temp. Indicator/ Recorder/ Data Logger [§]	600 °C to 1000 °C	1.8 °C	Using "S" Type Thermocouple, Temperature Calibrator, Dry Block Furnace by Comparison Method
4.	Temperature Indicator with Sensor of Baths, Dry Blocks [#]	(-) 35 °C to 50 °C 50 °C to 200 °C 200 °C to 600 °C 600 °C to 1000 °C	0.14 °C 0.24 °C 0.5 °C 1.9 °C	Using SSPRT/ "S" Type Thermocouple, Temperature Calibrator Single Position Calibration (At Measuring Location in DUC)

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5.	Calibration of Environmental Chambers, Air Ovens, Deep Freezers etc.*	(-) 35 °C to 250 °C	1.2 °C	Using PT-100 Sensors (Minimum Nine) with Data Logger at Multi Position Calibration
6.	Temperature Indicator with Sensor of Ovens, Chambers, Deep Freezers*	(-) 35 °C to 250 °C	1.2 °C	Using SSPRT & Temperature Calibrator Single Position Calibration (At Measuring Location in DUC)
7.	Temperature Indicator with Sensor of Ovens, Furnace*	250 °C to 1000 °C	1.9 °C	Using S Type Thermocouple & Temperature Calibrator Single Position Calibration (At Measuring Location in DUC)
II.	SPECIFIC HEAT AND HUMIDITY			
1.	Humidity and Temperature Indicator with Inbuilt or External Sensor, Thermo Hygrometer [§]	35% RH to 95% RH @25 °C to 35 °C 25 °C to 55 °C 35% RH to 95% RH	2.4 % RH 0.38 °C	Using Digital Thermo Hygrometer, Temperature / Humidity Chamber by Comparison Method

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2.	Humidity Indicator with Sensor of Humidity Chambers, Test Cabinets Etc. [^]	30% RH to 95% RH @ 25 °C to 55 °C	2.3 % RH	Using Digital Thermo Hygrometer with Probe Single Position Calibration (At Measuring Location in DUC)

* Measurement Capability is expressed as an uncertainty (\pm) at a confidence probability of 95%

[§] Only in Permanent Laboratory

[^] Only for Site Calibration

[#] The laboratory is also capable for site calibration however, the uncertainty at site depends on the prevailing actual environmental conditions and master equipment used.

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