

Laboratory **Electronics and Quality Development Centre, C1-641/ 648, GIDC Industrial Estate, Makarpura, Vadodara, Gujarat**

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

Discipline **Electro-Technical Calibration** Issue Date **14.07.2014**

Certificate Number **C-0418** Valid Until **13.07.2016**

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
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**SOURCE**

<b>1. DC Voltage<sup>§</sup></b>	1mV to 10 mV	0.26 %	Using Multifunction Calibrator- Datron 4700 by Direct Method	
	10 mV to 100 mV	0.0088%		
	100 mV to 100 V	0.0021%		
	1mV to 10 mV	0.13 % to 0.02%		Using Multifunction Calibrator- Fluke 5520A by Direct Method
	10 mV to 100 mV	0.02% to 0.003%		
100 mV to 10 V	0.003% to 0.001%			
10 V to 500 V	0.0016% to 0.0025%			
500 V to 1000 V	0.0025%			
<b>DC Voltage*</b>	1 mV to 100 mV	1.9%	Using Multifunction Calibrator 9100 by Direct Method	
	10 mV to 100 V	0.02%		
	100 V to 1000 V	0.02%		
<b>2. AC Voltage<sup>§</sup></b>	<b>50Hz</b>		Using Multifunction Calibrator- Fluke 5520A by Direct Method	
	1 mV	0.81 %		
	10 mV to 100 mV	0.16% to 0.044%		
	100 mV to 10 V	0.044% to 0.043%		
	10 V to 500 V	0.043% to 0.037%		
	500 V to 1000 V	0.037% to 0.035%		
	<b>50 Hz to 10 kHz</b>			Using Multifunction Calibrator- Datron 4700 by Direct Method
	10 mV	0.25 %		
	10 mV to 100 mV	0.05%		
	100 mV to 100 V	0.023%		

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<b>AC Voltage<sup>s</sup></b>	<b>1kHz</b> 1 mV	0.81 %	Using Multifunction Calibrator- Fluke 5520A by Direct Method
	10 mV to 100 mV	0.096% to 0.027%	
	100 mV to 10 V	0.027% to 0.025%	
	10 V to 500 V	0.025% to 0.038%	
	500 V to 1000 V	0.038% to 0.036%	
	<b>10kHz</b> 1 mV	0.74 %	Using Multifunction Calibrator- Fluke 5520A by Direct Method
	10 mV to 100 mV	0.097% to 0.027%	
	100 mV to 10 V	0.027% to 0.025%	
	10 V to 500 V	0.025% to 0.037%	
	500 V to 1000 V	0.036% to 0.24%	
<b>AC Voltage*</b>	<b>50 Hz</b> 10 mV to 100 mV	1.02% to 0.1%	Using Multifunction Calibrator 9100 by Direct Method
	100 mV to 100 V	0.1%	
	100 V to 1000 V	0.1%	
	<b>1 kHz</b> 10 mV to 100 mV	1.02% to 0.1%	
	100 mV to 100 V	0.1%	
	100 V to 1000 V	0.1%	
	<b>10 kHz</b> 10 mV to 100 mV	1.02% to 0.1%	
	100 mV to 100 V	0.1%	
	100 V to 1000 V	0.1%	

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<b>Quantity Measured/ Instrument</b>	<b>Range / Frequency</b>	<b>*Calibration Measurement Capability (<math>\pm</math>)</b>	<b>Remarks</b>
<b>3. DC Current<sup>s</sup></b>	10 $\mu$ A to 100 $\mu$ A	0.071%	Using Multifunction Calibrator- Datron 4700 By Direct Method
	10 $\mu$ A to 100 mA	0.013%	
	100 mA to 1 A	0.13%	
	10 $\mu$ A	0.25%	
	100 $\mu$ A to 10 mA	0.040% to 0.015%	Using Multifunction Calibrator- Fluke 5520A with Current Coil by Direct Method
	10 mA to 100 mA	0.015% to 0.016 %	
	100 mA to 1 A	0.016% to 0.028%	
	1 A to 10 A	0.028% to 0.065%	
	10 A to 500 A	0.065%	
<b>DC Current<sup>a</sup></b>	10 $\mu$ A	2.52%	Using Multifunction Calibrator 9100 by Direct Method
	10 $\mu$ A to 100 $\mu$ A	0.029%	
	100 $\mu$ A to 100 mA	0.031%	
	100 mA to 1 A	0.084%	
	1 A to 10 A	0.075%	
	10 A to 20 A	0.1%	
	20 A to 1000 A	1.22%	Using Multifunction Calibrator -9100 with 10 & 50 Turn coil by Direct Method

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<b>4. AC Current<sup>#</sup></b>	<b>50 Hz</b>		
	30 $\mu$ A	0.57%	Using Multifunction Calibrator- Fluke 5520A by Direct Method
	100 $\mu$ A to 10 mA	0.26% to 0.080%	
	10 mA to 100 mA	0.079% to 0.076 %	
	100 mA to 1 A	0.076% to 0.027%	
	1 A to 10 A	0.027 % to 0.094 %	
	10 A to 500 A	0.094% to 0.17%	Using Multifunction Calibrator- Fluke 5520A with Current Coil by Direct Method
<b>AC Current <sup>\$</sup></b>	<b>50 Hz to 1 kHz</b>		
	100 $\mu$ A	0.16%	Using Multifunction Calibrator- Datron 4700 by Direct Method
	100 $\mu$ A to 100 mA	0.10%	
	100 mA to 1A	0.30%	
	<b>1 kHz</b>		
	10 mA to 100 mA	0.57% to 0.08 %	Using Multifunction Calibrator- Fluke 5520A by Direct Method
	100 mA to 1 A	0.08% to 0.21%	
	1 A to 10 A	0.21% to 0.78 %	
<b>AC Current<sup>*</sup></b>	<b>1k Hz</b>		
	10 $\mu$ A to 100 $\mu$ A	0.50%	Using Multifunction Calibrator 9100 by Direct Method
	100 $\mu$ A to 100 mA	0.13%	
	100 mA to 1A	0.17%	
	1 A to 20 A	0.2%	

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
5. DC Resistance <sup>\$</sup>	1 $\Omega$	0.13%	Using Multifunction Calibrator- Fluke 5520A by Direct Method
	10 $\Omega$ to 100 $\Omega$	0.016% to 0.0049 %	
	100 $\Omega$ to 1k $\Omega$	0.0049% to 0.0035 %	
	1 k $\Omega$ to 100 k $\Omega$	0.0035% to 0.0033 %	
	100 k $\Omega$ to 1M $\Omega$	0.0033% to 0.0040%	
	1 M $\Omega$ to 100M $\Omega$	0.0040% to 0.13 %	
DC Resistance <sup>*</sup>	10 $\Omega$ to 100 $\Omega$	0.70%	Using Multifunction Calibrator 9100 by Direct Method
	100 $\Omega$ to 10 k $\Omega$	0.69% to 0.16%	
	10 k $\Omega$ to 100 k $\Omega$	0.16 to 0.027%	
	100 k $\Omega$ to 1 M $\Omega$	0.05% to 0.07%	
	1 M $\Omega$ to 300 M $\Omega$	0.07% to 1.74%	
DC Resistance <sup>#</sup>	1 m $\Omega$ to 1 $\Omega$	0.027% to 0.0084%	Using Standard Resistor Yokogawa -2792 by Direct Method
	1 $\Omega$ to 10 $\Omega$	0.012%	
	10 $\Omega$ to 1 M $\Omega$	0.012% to 0.013%	Using Standard Resistor GR -1440 by Direct Method
	1 k $\Omega$ to 100 k $\Omega$	0.24%	
	100 k $\Omega$ to 100 M $\Omega$	0.24% to 0.28 %	Using Decade Resistance Box Biddle-726349 by Direct Method
	100 M $\Omega$ to 1 G $\Omega$	0.28% to 0.63 %	
	1 G $\Omega$ to 100 G $\Omega$	2.11% to 2.35 %	

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<b>6. AC Resistance<sup>§</sup></b>	<b>1 kHz</b>		
	10 $\Omega$	0.023%	Using Standard Resistor GR -1440 by Direct Method
	1 k $\Omega$	0.014%	
	10 k $\Omega$	0.025%	
<b>AC Resistance<sup>*</sup></b>	<b>1 kHz</b>		
	10 $\Omega$	0.023%	Using Standard Resistor GR -1440 by Direct Method
	1 k $\Omega$	0.014%	
	10 k $\Omega$	0.025%	
	100 k $\Omega$	0.014%	
1 M $\Omega$	0.024%		
<b>7. Frequency<sup>§</sup></b>	10 Hz to 100 kHz	0.01 % to 0.0012 %	Using Multifunction Calibrator- Fluke 5520A by Direct Method
	10 kHz to 6 GHz	0.0064% to 0.96%	Using Signal Generator SMT-06 by Direct Method
<b>Frequency<sup>*</sup></b>	10 Hz to 10 MHz	0.05%	Using Multifunction Calibrator 9100 by Direct Method
<b>Frequency<sup>#</sup></b>	1 Hz to 15 MHz	0.0068 % to 0.0023%	Using Function Generator Agilent /33120A by Direct Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
<b>8. Oscilloscope<sup>s</sup></b>			
<b>Time Base</b>	2 ns to 5 sec.	0.05 % to 0.4%	Using Multifunction Calibrator- Fluke 5520A by Direct Method
<b>Amplitude</b>	1 mV to 100 V	0.5 %	
<b>Bandwidth</b>	50 kHz to 100 MHz 100 MHz to 300 MHz 300 MHz to 500 MHz	15.68 % 15.68 % 15.68 %	
<b>Oscilloscope<sup>*</sup></b>			
<b>Time Base</b>	5 ns to 5 sec.	0.15 %	Using Multifunction Calibrator 9100 by Direct Method
<b>Amplitude</b>	1 mV to 120 V AC/DC(50 $\Omega$ / 1M $\Omega$ )	0.35 %	
<b>Bandwidth</b>	10 MHz to 100 MHz 100 MHz to 300 MHz 300 MHz to 600 MHz	3.5 % 4.0 % 5 %	
<b>9. AC Power/ Energy<sup>s</sup></b>	<b>@ 50 Hz, 120V to 240V, 0.2A to 10A 0.5 Lag /0.8, UPF 20 W to 2.4 kW</b>	0.35 %	Using Multifunction Calibrator- Fluke 5520A by Direct Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
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10. Temperature Simulation \$  
(Indicator/ Controller/ Recorder)

RTD- PT-100	-200 °C to 800 °C	0.09°C to 0.3 °C	Using Multifunction Calibrator 5520A by ohm Measurement Method
T/C-B-Type	-250°C to 1800 °C	0.6 °C	Using Multifunction Calibrator 5520A by Simulation Method
T/C-E-Type	-250°C to 1800 °C	0.6 °C	
T/C-J-Type	-250°C to 1800 °C	0.6 °C	
T/C-K-Type	-250°C to 1800 °C	0.6 °C	
T/C-N-Type	-250°C to 1800 °C	0.6 °C	
T/C-R-Type	-250°C to 1800 °C	0.6 °C	
T/C-S-Type	-250°C to 1800 °C	0.6 °C	
T/C-T-Type	-250°C to 1800 °C	0.6 °C	

Temperature Simulation \*  
(Indicator/ Controller/ Recorder)

RTD- PT-100	-200 to 800 °C	0.15°C to 0.35°C	Using Multifunction Calibrator 9100 by ohm Measurement method
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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
<b>Temperature Simulation *</b> (Indicator/ Controller/ Recorder)			
T/C B Type	-200 °C to 1820 °C	0.6 °C	Using Multifunction Calibrator 9100 by mV Measurement method
T/C E Type ,	-200 °C to 1820 °C	0.6 °C	
T/C J Type,	-200 °C to 1820 °C	0.6 °C	
T/C K Type ,	-200 °C to 1820 °C	0.6 °C	
T/C N Type,	-200 °C to 1820 °C	0.6 °C	
T/C R Type,	-200 °C to 1820 °C	0.6 °C	
T/C S Type,	-200 °C to 1820 °C	0.6 °C	
T/C T Type,	-200 °C to 1820 °C	0.6 °C	
T/C U Type	-200 °C to 1820 °C	0.6 °C	
<b>11. Capacitance<sup>§</sup></b>	1 nF to 300 nF 300 nF to 100 $\mu$ F	1.03% to 0.95% 0.95 % to 0.9 %	Using Multifunction Calibrator 5520A by Direct Method
<b>Capacitance<sup>#</sup></b>	<b>1 kHz</b> 1 pF 10 pF to 100 pF	0.74 % 0.16 %	Using Standard Capacitor –GR-1403 by Direct Method
	1 nF to 1000 nF	0.15% to 0.11 %	Using Standard Capacitor set –GR-1409 by Direct Method
<b>Capacitance<sup>*</sup></b>	1 nF to 500 nF 500 nF to 50 $\mu$ F 50 $\mu$ F to 110 mF	2.20 % to 0.84 % 0.84 % to 0.96 % 0.96 % to 1.94 %	Using Multifunction Calibrator 9100 by Direct Method

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12. Inductance <sup>#</sup>	1 kHz		
	100 $\mu$ H	0.68%	Using Standard Inductor set –GR-1482 by Direct Method
	1 mH	0.18 %	
	10 mH	0.18 %	
	100 mH	0.18 %	
	1 H	0.18 %	
10 H	0.18 %		
13. Level <sup>\$</sup>	10 kHz to 1 GHz		
	-50dBm to 13dBm	1.2 dB	Using Signal Generator SMT-06 by Direct Method
1 GHz to 5 GHz			
	-50dBm to 13dBm	2.3 dB	
14. Amplitude Modulation <sup>\$</sup>	10% to 30 %	2.98%	Using Signal Generator SMT-06 by Direct Method
	30% to 50 %	3.77%	
	50% to 90 %	5.87%	
15. Frequency Modulation <sup>\$</sup>	10 kHz to 300 kHz	6.75% to 4.93%	Using Signal Generator SMT-06 by Direct Method

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<b><u>MEASURE</u></b>			
<b>1. DC Voltage<sup>§</sup></b>	1 mV to 10 mV	0.058% to 0.0063%	Using Self Cal Digital Multimeter -1271 by Direct Method
	10 mV to 100 mV	0.0063% to 0.0015%	
	100 mV to 10 V	0.0015% to 0.00093%	
	10 V to 500 V	0.00093% to .0016%	
	500 V to 1000 V	0.0016% to 0.0013%	
<b>DC Voltage<sup>*</sup></b>	1 mV to 10 mV	1.95% to 0.195%	Using 6 ½ Digital Multimeter –Fluke 8846A by Direct Method
	10 mV to 100 mV	0.195% to 0.0011%	
	100 mV to 100 V	0.011% to 0.0057%	
	100 V to 1000 V	0.0057% to 0.0064%	
<b>2. AC Voltage<sup>§</sup></b>	<b>50 Hz</b>		Using Self Cal Digital Multimeter -1271 by Direct Method
	1 mV to 10 mV	1.68 % to 0.23%	
	10 mV to 100 mV	0.23% to 0.047%	
	100 mV to 10 V	0.047% to 0.036%	
	10 V to 500 V	0.036% to 0.046%	
	500 V to 1000 V	0.046% to 0.039%	
	<b>1 kHz</b>		Using Self Cal Digital Multimeter -1271 by Direct Method
	1 mV to 10 mV	1.68 % to 0.23%	
	10 mV to 100 mV	0.23% to 0.047%	
	100 mV to 10 V	0.047% to 0.035%	
10 V to 500 V	0.035% to 0.046%		
<b>AC Voltage<sup>*</sup></b>	<b>50 Hz</b>		Using 6 ½ Digital Multimeter –Fluke 8846A by Direct Method
	1mV	4.77%	
	10 mV to 100 mV	1.03% to 0.15%	
	100 mV to 100 V	0.15% to 0.11%	
	100 V to 1000 V	0.11% to 0.10%	
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	<b>1 kHz</b> 1mV 10 mV to 100 mV 100 mV to 100 V 100 V to 1000 V	4.83% 1.05% to 0.15% 0.15% to 0.37% 0.37% to 0.10%	Using 6 ½ Digital Multimeter –Fluke 8846A by Direct Method
<b>3. DC Current<sup>\$</sup></b>	10 $\mu$ A to 100 $\mu$ A 100 $\mu$ A to 10 mA 10 mA to 100 mA 100 mA to 1 A	0.012% to 0.007% 0.007% to .0072% 0.0072% to 0.013% 0.013% to 0.02%	Using Self Cal Digital Multimeter -1271 by Direct Method
<b>DC Current*</b>	10 $\mu$ A to 100 $\mu$ A 100 $\mu$ A to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 10 A	2.52% to 0.26% 0.26% to 0.084% 0.084 % to 0.066% 0.066% to 0.086% 0.086% to 0.20%	Using 6 ½ Digital Multimeter –Fluke 8846A by Direct Method
<b>4. AC Current<sup>\$</sup></b>	<b>50 Hz</b> 10 $\mu$ A to 100 $\mu$ A 100 $\mu$ A to 100 mA 100 mA to 1 A	0.26 % to 0.13% 0.13 % to 0.052% 0.052% to 0.11%	Using Self Cal Digital Multimeter -1271 by Direct Method
	<b>1 k Hz</b> 10 $\mu$ A to 100 $\mu$ A 100 $\mu$ A to 100 mA 100 mA to 1 A	0.26 % to 0.047% 0.047 % to 0.052% 0.052% to 0.12%	Using Self Cal Digital Multimeter -1271 by Direct Method

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<b>AC Current*</b>	<b>50 Hz</b>		
	10 $\mu$ A to 100 $\mu$ A	0.63% to 0.36%	Using 6 1/2 Digital Multimeter –Fluke 8846A by Direct Method
	100 $\mu$ A to 10mA	0.36% to 0.26%	
	10mA to 100mA	0.26 % to 0.19%	
	100mA to 1A	0.19%	
1A to 10A	0.19% to 0.48%		
<b>AC Current*</b>	<b>1 k Hz</b>		
	10 $\mu$ A to 100 $\mu$ A	0.88% to 0.36%	Using 6 1/2 Digital Multimeter – Fluke 8846A by Direct Method
	100 $\mu$ A to 10 mA	0.36% to 0.26%	
	10 mA to 100 mA	0.26 % to 0.19%	
	100 mA to 1 A	0.19%	
1 A to 10 A	0.19% to 0.34%		
<b>5. Resistance*</b>	1 $\Omega$ to 10 $\Omega$	0.39% to 0.049%	Using 6 1/2 Digital Multimeter – Fluke 8846A by Direct Method
	10 $\Omega$ to 100 $\Omega$	0.049% to 0.017%	
	100 $\Omega$ to 1 k $\Omega$	0.017% to 0.013%	
	1 k $\Omega$ to 1 M $\Omega$	0.013% to 0.028%	
	1 M $\Omega$ to 100 M $\Omega$	0.028% to 0.95%	
<b>Resistance<sup>s</sup></b>	100 M $\Omega$ to 1G $\Omega$	0.95% to 3.02%	Using Self Cal Digital Multimeter -1271 by Direct Method
	1 $\Omega$ to 10 $\Omega$	0.010% to 0.0028%	
	10 $\Omega$ to 100 $\Omega$	0.0028% to 0.0026%	
	100 $\Omega$ to 10 k $\Omega$	0.0026% to 0.0013%	
	10 k $\Omega$ to 1 M $\Omega$	0.0013% to 0.0023%	
1 M $\Omega$ to 100M $\Omega$	0.0023% to 0.058%		

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
6. Inductance <sup>\$</sup>	1 kHz 100 $\mu$ H to 10H	0.68% to 0.18%	Using Multi Frequency LCR Meter-4274A by Direct Method
7. Capacitance <sup>\$</sup>	1 kHz 1 nF to 1000 nF	0.97% to 0.12%	Using Multi Frequency LCR Meter-4274A by Direct Method
8. AC Resistance <sup>\$</sup>	1 kHz 10 $\Omega$ to 100 k $\Omega$	0.12%	Using Multi Frequency LCR Meter-4274A by Direct Method
9. Frequency <sup>\$</sup>	1 Hz to 1 kHz 1 kHz to 100 kHz 100kHz to 10 MHz 10 MHz to 500 MHz 500 MHz to 1 GHz 1GHz to 6 GHz	0.00042 Hz to 0.00058 Hz 0.00058 Hz to 0.058 Hz 0.058 Hz to 8.6 Hz 8.6 Hz to 12.92 Hz 12.92 Hz to 686 Hz 686 Hz	Using Frequency Counter Pendulum CNT- 90 by Direct Method

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

**Discipline**                      **Electro-Technical Calibration**                      **Issue Date**    **14.07.2014**

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
10. Level <sup>\$</sup>	10 MHz to 5 GHz -40 dBm to 13dBm	1.19 dB	Using Power Meter with Sensor Boonton -5321 (Meter), 51075A (Sensor) & Directional Coupler AR DC7144A, AR DC6180A by Direct Method
11. Amplitude Modulation <sup>\$</sup>	Fm: 1kHz; Fc: 10MHz Depth: 10 % to 90 %	2.75%	Using Modulation Analyzer – FMA by Direct Method
12. Frequency Modulation <sup>\$</sup>	Rate: 10kHz Range: 10MHz to 1GHz Dev. Up to 200kHz	4.2%	Using Modulation Analyzer – FMA by Direct Method
13. DC High Voltage <sup>#</sup>	1 kV to 26 kV	2.8%	Using Fluke 80K-40 kV Probe by Direct Method
14. AC High Voltage <sup>#</sup>	50 Hz 1 kV to 15 kV	5.9%	Using Fluke 80K-40 kV Probe by Direct Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
15. Temperature Simulation <sup>\$</sup> (Indicator/ Controller/ Recorder)			
RTD- PT-100	-200 °C to 800 °C	0.006°C to 0.051°C	Using Self Cal Digital Multimeter -1271 by Direct Method
T/C-B-Type	600°C to 1800°C	0.3°C to 0.6°C	Using Multi function Calibrator Fluke 5520A by Direct Method
T/C-E-Type	-250°C to 1000°C	0.01°C to 0.03°C	
T/C-J-Type	-200°C to 1200°C	0.01°C to 0.02°C	
T/C-K-Type	-200°C to 1350°C	0.01°C to 0.03°C	
T/C-N-Type	-200°C to 1300°C	0.01°C to 0.02°C	
T/C-R-Type	0°C to 1750°C	0.18°C to 0.04°C	
T/C-S-Type	0°C to 1750°C	0.02°C to 0.07°C	
T/C-T-Type	-250°C to 400°C	0.06°C to 0.07°C	

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

<sup>\$</sup>Only in Permanent Laboratory

\*Only for Site Calibration

<sup>#</sup>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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