

Scope of Accreditation For PLC Electronic Solutions Ltd.

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In recognition of a successful assessment to ISO/IEC 17025:2005 to the following Calibration and Measurement Capabilities, accreditation has been granted to **PLC Electronic Solutions Ltd** for the following:

Accreditation granted through: **October 17, 2019**

Calibration

Electrical – Capacitance

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Capacitance Generate	(0.22 to 0.4) nF	12 pF	Fluke 5522A
	(0.4 to 1.1) nF	0.3% + 10 pF	
	(1.1 to 3.3) nF	0.4% + 9 pF	
	(3.3 to 11) nF	0.2% + 9 pF	
	(11 to 33) nF	0.2% + 9.0 pF	
	(33 to 110) nF	0.21% + 5.5 pF	
	(0.11 to 0.33) μ F	0.21% + 30 pF	
	(0.33 to 1.1) μ F	0.21% + 0.8 nF	
	(1.1 to 3.3) μ F	0.21% + 2.5 nF	
	(3.3 to 11) μ F	0.21% + 8 nF	
	(11 to 33) μ F	0.33% + 25 nF	
	(33 to 110) μ F	0.38% + 80 nF	
	(0.11 to 0.33) mF	0.35% + 0.25 μ F	
	(0.33 to 1.1) mF	0.35% + 0.8 μ F	
	(1.1 to 3.3) mF	0.35% + 2.5 μ F	
	(3.3 to 11) mF	0.35% + 8 μ F	
	(11 to 33) mF	0.6% + 25 μ F	
(33 to 110) mF	0.86% + 80 μ F		

Electrical – Current

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
DC Current Generate	(0 to 0.33) mA	120 μ A/A + 16 nA	Fluke 5522A
	(0.33 to 3.3) mA	80 μ A/A + 0.04 μ A	
	(3.3 to 33) mA	82 μ A/A + 0.21 μ A	
	(33 to 330) mA	82 μ A/A + 2.1 μ A	
	(0.33 to 1.1) A	170 μ A/A + 32 μ A	
	(1.1 to 3) A	300 μ A/A + 34 μ A	
	(3 to 11) A	430 μ A/A + 0.3 mA	
	(11 to 20.5) A	920 μ A/A - 0.84 mA	
DC Current Generate Clamp Meters	(20 to 55) A	0.34% + 0.23 A	Fluke 5522A with Fluke 5500A/COIL
	(55 to 150) A	0.34% + 0.75 A	
	(150 to 550) A	0.36% + 1 A	
	(550 to 1 025) A	0.36% + 2.4 A	
DC Current Measure	(0 to 0.1) mA	28 μ A/A + 1 nA	Agilent 3458A with Option 002
	(0.1 to 1) mA	21 μ A/A + 8.1 nA	
	(1 to 10) mA	21 μ A/A + 0.08 μ A	
	(10 to 100) mA	37 μ A/A + 0.8 μ A	
	(100 to 1 050) mA	110 μ A/A + 12 μ A	
DC Current Measure with shunt	(1 to 20) A	220 μ A/A + 13 μ A	Agilent 3458A / 002 with Fluke Y5020
AC Current Generate	(29 to 330) μ A	0.16% + 90 nA 0.12% + 90 nA 0.1% + 90 nA 0.23% + 0.13 μ A 0.62% + 0.16 μ A 0.16% + 0.32 μ A	Fluke 5522A
	(10 to 20) Hz		
	(20 to 45) Hz		
	(45 to 1 000) Hz		
	(1 to 5) kHz		
	(5 to 10) kHz		
	(10 to 30) kHz		
	(0.33 to 3.3) mA	0.16% + 0.12 μ A 0.1% + 0.12 μ A 0.08% + 0.12 μ A 0.16% + 0.16 μ A 0.4% + 0.24 μ A 0.8% + 0.5 μ A	
	(10 to 20) Hz		
	(20 to 45) Hz		
	(45 to 1 000) Hz		
	(1 to 5) kHz		
	(5 to 10) kHz		
	(10 to 30) kHz		

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Current Generate	(3.3 to 33) mA (10 to 20) Hz (20 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14% + 1.6 μ A 0.072% + 1.6 μ A 0.04% + 1.6 μ A 0.07% + 1.6 μ A 0.16% + 2.4 μ A 0.31% + 4.5 μ A	Fluke 5522A
	(33 to 330) mA (10 to 20) Hz (20 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14% + 16 μ A 0.072% + 16 μ A 0.04% + 16 μ A 0.08% + 40 μ A 0.16% + 80 μ A 0.32% + 0.16 mA	
	(0.33 to 1.1) A (10 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.16% + 8.5 μ A 0.05% + 46 μ A 0.47% + 0.77 mA 2% + 3.9 mA	
	(1.1 to 3) A (10 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.16% + 25 μ A 0.051% + 90 μ A 0.47% + 0.8 mA 2% + 3.9 mA	
	(3 to 11) A (45 to 100) Hz (100 to 1 000) Hz (1 to 5) kHz	0.051% + 2.4 mA 0.08% + 1.6 mA 2.4% + 1.6 mA	
	(11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz (1 to 5) kHz	0.097% + 3.6 mA 1.2% + 3.6 mA 2.4% + 4 mA	
AC Current Generate Clamp Meters (45 to 65) Hz	(20 to 55) A	0.68% + 0.42 A	Fluke 5522A with Fluke 5500A/COIL
	(55 to 150) A	0.68% + 0.65 A	
	(150 to 550) A	0.68% + 2 A	
	(550 to 1 025) A	0.69% + 4.8 A	
AC Current Measure	(10 to 100) μ A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz	0.4% + 31 nA 0.15% + 31 nA 0.6 % + 31 nA 0.6% + 31 nA	Agilent 3458A with Option 002
	(0.1 to 1) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz	0.4% + 0.2 μ A 0.15% + 0.2 μ A 0.061% + 0.2 μ A 0.031% + 0.2 μ A	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Current Measure	(1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz	0.4% + 2 μ A 0.15% + 2 μ A 0.061% + 2 μ A 0.031% + 2 μ A	Agilent 3458A with Option 002
	(10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz	0.4% + 20 μ A 0.15% + 20 μ A 0.061% + 20 μ A 0.031% + 20 μ A	
	(0.1 to 1.05) A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz	0.4% + 0.2 mA 0.061% + 0.2 mA 0.081% + 0.2 mA 0.1% + 0.2 mA	
	(1 to 20) A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz	0.07% + 0.4 mA 0.07% + 0.4 mA 0.06% + 0.4 mA 0.12% - 0.15 mA	

Electrical – Power

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
DC Power Generate 33 mV to 1020V	0.33 mA to 3 A	0.027%	Fluke 5522A
	(3 to 20.5) A	0.1%	
AC Power Generate (45 to 65) Hz 33 mV to 1020V 3mA to 20.5A	Power Factor (PF) 0.5 to 1	$(-0.34 \times \text{PF} + 0.59) \%$	Fluke 5522A

Electrical – Resistance

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Resistance Generate	(0 to 11) Ω	30 $\mu\Omega/\Omega$ + 60 $\mu\Omega$	Fluke 5522A
	(11 to 33) Ω	28 $\mu\Omega/\Omega$ + 30 $\mu\Omega$	
	(33 to 110) Ω	24 $\mu\Omega/\Omega$ + 30 $\mu\Omega$	
	(110 to 330) Ω	24 $\mu\Omega/\Omega$ + 0.1 m Ω	
	(330 to 1 100) Ω	24 $\mu\Omega/\Omega$ - 75 $\mu\Omega$	
	(1.1 to 3.3) k Ω	24 $\mu\Omega/\Omega$ - 0.55 m Ω	
	(3.3 to 11) k Ω	24 $\mu\Omega/\Omega$ + 1.5 m Ω	
	(11 to 33) k Ω	24 $\mu\Omega/\Omega$ + 0.9 m Ω	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Resistance Generate	(33 to 110) kΩ	24 μΩ/Ω + 2.1 mΩ	Fluke 5522A
	(110 to 330) kΩ	27 μΩ/Ω - 10 mΩ	
	(330 to 1 100) kΩ	27 μΩ/Ω - 0.15 Ω	
	(1.1 to 3.3) MΩ	50 μΩ/Ω - 0.42 Ω	
	(3.3 to 11) MΩ	75 μΩ/Ω + 0.15 kΩ	
	(11 to 33) MΩ	230 μΩ/Ω - 0.13 kΩ	
	(33 to 110) MΩ	410 μΩ/Ω - 36 Ω	
	(110 to 330) MΩ	0.26% - 12 kΩ	
	(330 to 1 100) MΩ	1.2% - 10 kΩ	
Resistance Measure	(0 to 12) Ω	17 μΩ/Ω + 55 μΩ	Agilent 3458A with Option 002
	(12 to 120) Ω	17 μΩ/Ω + 0.32 mΩ	
	(120 to 1 200) Ω	12 μΩ/Ω + 0.5 mΩ	
	(1.2 to 12) kΩ	12 μΩ/Ω + 3.8 mΩ	
	(12 to 120) kΩ	12 μΩ/Ω + 32 mΩ	
	(120 to 1 200) kΩ	18 μΩ/Ω + 1.1 Ω	
	(1.2 to 12) MΩ	24 μΩ/Ω + 22 Ω	
	(12 to 120) MΩ	0.51 mΩ/Ω + 0.58 kΩ	
	(120 to 1 200) MΩ	5.1 mΩ/Ω + 4.9 kΩ	
RTD Temperature Generate Electrical Simulation Pt 385, 100 Ohm	(-200 to -80) °C	0.04 °C	Fluke 5522A
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 630) °C	0.09 °C	
	(630 to 800) °C	0.18 °C	
Pt 3926, 100 Ohm	(-200 to -80) °C	0.04 °C	Fluke 5522A
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 630) °C	0.09 °C	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Pt 3916, 100 Ohm	(-200 to -190) °C	0.19 °C	Fluke 5522A
	(-190 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 260) °C	0.06 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 400) °C	0.07 °C	
	(400 to 600) °C	0.08 °C	
	(600 to 630) °C	0.18 °C	
Pt 385, 200 Ohm	(-200 to -80) °C	0.03 °C	Fluke 5522A
	(-80 to 0) °C	0.03 °C	
	(0 to 100) °C	0.03 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 600) °C	0.11 °C	
	(600 to 630) °C	0.12 °C	
Pt 385, 500 Ohm	(-200 to -80) °C	0.03 °C	Fluke 5522A
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 400) °C	0.06 °C	
	(400 to 600) °C	0.07 °C	
	(600 to 630) °C	0.09 °C	
Pt 385, 1000 Ohm	(-200 to -80) °C	0.02 °C	Fluke 5522A
	(-80 to 0) °C	0.02 °C	
	(0 to 100) °C	0.03 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.05 °C	
	(300 to 400) °C	0.06 °C	
	(400 to 600) °C	0.06 °C	
	(600 to 630) °C	0.18 °C	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Pt 385, 120 Ohm	(-80 to 0) °C	0.06 °C	Fluke 5522A
	(0 to 100) °C	0.06 °C	
	(100 to 260) °C	0.11 °C	
Cu 427, 10 Ohm	(-100 to 260) °C	0.23 °C	

Electrical - RF Power

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
RF Power Measure ³ Absolute (0.01 to 1.4) GHz (1.4 to 4) GHz (0.01 to 1.4) GHz (1.4 to 4) GHz (4 to 18) GHz	(-30 to 20) dBm	0.14 dB	R&S FSMR 27 with NRP-Z22
		0.15 dB	
	(20 to 33) dBm	0.21 dB	
		0.22 dB	
(-30 to 20) dBm (20 to 33) dBm	0.21 dB + M		
	0.25 dB + M		
RF Power Measure ³ Relative 100 kHz to 26.5 GHz	(0 to -160) dB	390 µdB/dB + 0.09 dB + M	R&S FSMR 27

Electrical – Voltage

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
DC Voltage Generate	(0 to 0.33) V	16 µV/V + 1 µV	Fluke 5522A
	(0.33 to 3.3) V	9 µV/V + 2 µV	
	(3.3 to 33) V	10 µV/V + 20 µV	
	(33 to 330) V	14 µV/V + 0.15 mV	
	(330 to 1 020) V	14 µV/V + 1.5 mV	
DC Voltage Measure	(0 to 0.1) V	8 µV/V + 0.32 µV	Agilent 3458A with Option 002
	(0.1 to 1) V	6 µV/V + 0.32 µV	
	(1 to 10) V	6 µV/V + 0.8 µV	
	(10 to 100) V	8.2 µV/V + 32 µV	
	(100 to 1 050) V	8.2 µV/V + 0.1 mV	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Voltage Generate	(1 to 33) mV (10 to 45) Hz	740 $\mu\text{V/V} + 5 \mu\text{V}$	Fluke 5522A
	45 Hz to 10 kHz (10 to 20) kHz	130 $\mu\text{V/V} + 5 \mu\text{V}$ 160 $\mu\text{V/V} + 6 \mu\text{V}$	
	(20 to 50) kHz (50 to 100) kHz	760 $\mu\text{V/V} + 6 \mu\text{V}$ 2 700 $\mu\text{V/V} + 12 \mu\text{V}$	
	(100 to 500) kHz	5 800 $\mu\text{V/V} + 60 \mu\text{V}$	
	(33 to 330) mV (10 to 45) Hz	220 $\mu\text{V/V} + 13 \mu\text{V}$	
	45 Hz to 10 kHz (10 to 20) kHz	120 $\mu\text{V/V} + 7 \mu\text{V}$ 130 $\mu\text{V/V} + 7 \mu\text{V}$	
	(20 to 50) kHz (50 to 100) kHz	280 $\mu\text{V/V} + 8 \mu\text{V}$ 560 $\mu\text{V/V} + 50 \mu\text{V}$	
(100 to 500) kHz	1 600 $\mu\text{V/V} + 65 \mu\text{V}$		
AC Voltage Generate	(0.33 to 3.3) V (10 to 45) Hz	240 $\mu\text{V/V} + 40 \mu\text{V}$	Fluke 5522A
	45 Hz to 10 kHz (10 to 20) kHz	130 $\mu\text{V/V} + 50 \mu\text{V}$ 160 $\mu\text{V/V} + 50 \mu\text{V}$	
	(20 to 50) kHz (50 to 100) kHz	240 $\mu\text{V/V} + 40 \mu\text{V}$ 630 $\mu\text{V/V} + 80 \mu\text{V}$	
	(100 to 500) kHz	1 900 $\mu\text{V/V} + 0.46 \text{ mV}$	
	(3.3 to 33) V (10 to 45) Hz	250 $\mu\text{V/V} + 0.51 \text{ mV}$	
	45 Hz to 10 kHz (10 to 20) kHz	120 $\mu\text{V/V} + 0.5 \text{ mV}$ 200 $\mu\text{V/V} + 0.5 \text{ mV}$	
	(20 to 50) kHz (50 to 100) kHz	300 $\mu\text{V/V} + 0.5 \text{ mV}$ 710 $\mu\text{V/V} + 1.2 \text{ mV}$	
AC Voltage Generate	(33 to 330) V (45 to 1 000) Hz	160 $\mu\text{V/V} + 1.5 \text{ mV}$	Fluke 5522A
	(1 to 10) kHz (10 to 20) kHz	170 $\mu\text{V/V} + 5 \text{ mV}$ 220 $\mu\text{V/V} + 5 \text{ mV}$	
	(20 to 50) kHz (50 to 100) kHz	330 $\mu\text{V/V} + 1.8 \text{ mV}$ 1 600 $\mu\text{V/V} + 40 \text{ mV}$	
	(330 to 1 020) V (45 to 1 000) Hz	240 $\mu\text{V/V} + 7.2 \text{ mV}$	
	(1 to 5) kHz (5 to 10) kHz	190 $\mu\text{V/V} + 25 \text{ mV}$ 230 $\mu\text{V/V} + 25 \text{ mV}$	
AC Voltage Measure	(12 to 120) mV (10 to 40) Hz	380 $\mu\text{V/V} + 5.8 \mu\text{V}$	Agilent 3458A with Option 002
	(40 to 1 000) Hz (1 to 20) kHz	240 $\mu\text{V/V} + 4.3 \mu\text{V}$ 230 $\mu\text{V/V} + 4.5 \mu\text{V}$	
	(20 to 50) kHz (50 to 100) kHz	550 $\mu\text{V/V} + 9.3 \mu\text{V}$ 0.45% + 6.9 μV	
	(100 to 300) kHz	4.0% + 4.5 μV	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
AC Voltage Measure	(1 to 12) mV (10 to 40) Hz	53 $\mu\text{V/V} + 7.5 \mu\text{V}$	Agilent 3458A with Option 002
	(40 to 1 000) Hz	48 $\mu\text{V/V} + 6.0 \mu\text{V}$	
	(1 to 20) kHz	120 $\mu\text{V/V} + 5.3 \mu\text{V}$	
	(20 to 50) kHz	250 $\mu\text{V/V} + 8.5 \mu\text{V}$	
	(50 to 100) kHz	760 $\mu\text{V/V} + 6.5 \mu\text{V}$	
	(100 to 300) kHz (300 to 1 000) kHz	0.3% + 13 μV 1% + 11 μV	
AC Voltage Measure	(0.12 to 1.2) V (10 to 40) Hz	60 $\mu\text{V/V} + 62 \mu\text{V}$	Agilent 3458A with Option 002
	(40 to 1 000) Hz	60 $\mu\text{V/V} + 40 \mu\text{V}$	
	(1 to 20) kHz	120 $\mu\text{V/V} + 42 \mu\text{V}$	
	(20 to 50) kHz	290 $\mu\text{V/V} + 40 \mu\text{V}$	
	(50 to 100) kHz	800 $\mu\text{V/V} + 35 \mu\text{V}$	
	(100 to 300) kHz (300 to 1 000) kHz	0.3% + 0.11 mV 1% + 0.11 mV	
AC Voltage Measure	(1.2 to 12) V (10 to 40) Hz	51 $\mu\text{V/V} + 0.8 \text{ mV}$	Agilent 3458A with Option 002
	(40 to 1 000) Hz	53 $\mu\text{V/V} + 0.49 \text{ mV}$	
	(1 to 20) kHz	120 $\mu\text{V/V} + 0.42 \text{ mV}$	
	(20 to 50) kHz	290 $\mu\text{V/V} + 0.38 \text{ mV}$	
	(50 to 100) kHz	800 $\mu\text{V/V} + 0.24 \text{ mV}$	
	(100 to 300) kHz (300 to 1 000) kHz	0.3% + 1.1 mV 1% + 1.7 mV	
AC Voltage Measure	(12 to 120) V (10 to 40) Hz	190 $\mu\text{V/V} + 5.1 \text{ mV}$	Agilent 3458A with Option 002
	(40 to 1 000) Hz	190 $\mu\text{V/V} + 3.6 \text{ mV}$	
	(1 to 20) kHz	190 $\mu\text{V/V} + 3.6 \text{ mV}$	
	(20 to 50) kHz	340 $\mu\text{V/V} + 3.5 \text{ mV}$	
	(50 to 100) kHz	1 200 $\mu\text{V/V} + 3.2 \text{ mV}$	
	(100 to 300) kHz (300 to 1 000) kHz	0.4% + 10 mV 1.5% + 10 mV	
AC Voltage Measure	(120 to 700) V (10 to 40) Hz	380 $\mu\text{V/V} + 4.4 \text{ mV}$	Agilent 3458A with Option 002
	(40 to 1 000) Hz	380 $\mu\text{V/V} + 3.3 \text{ mV}$	
	(1 to 20) kHz	590 $\mu\text{V/V} + 3.0 \text{ mV}$	
	(20 to 50) kHz	1 200 $\mu\text{V/V} + 2.3 \text{ mV}$	
	(50 to 100) kHz	3 000 $\mu\text{V/V} + 1.8 \text{ mV}$	
Thermocouple Temperature Generate and Measure Electrical Simulation Type B	(600 to 800) °C	0.42 °C	Fluke 5522A
	(800 to 1 000) °C	0.36 °C	
	(1 000 to 1 550) °C	0.34 °C	
	(1 550 to 1 820) °C	0.35 °C	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Type C	(0 to 150) °C	0.29 °C	Fluke 5522A
	(150 to 650) °C	0.33 °C	
	(650 to 1 000) °C	0.29 °C	
	(1 000 to 1 800) °C	0.42 °C	
	(1 000 to 2 316) °C	0.67 °C	
Type E	(-250 to -100) °C	0.42 °C	
	(-100 to -25) °C	0.2 °C	
	(-25 to 350) °C	0.19 °C	
	(350 to 650) °C	0.2 °C	
	(650 to 1 000) °C	0.23 °C	
Type J	(-210 to -100) °C	0.23 °C	
	(-100 to -30) °C	0.16 °C	
	(-30 to 150) °C	0.14 °C	
	(150 to 760) °C	0.16 °C	
	(760 to 1 200) °C	0.2 °C	
Type K	(-200 to -100) °C	0.2 °C	
	(-100 to -25) °C	0.13 °C	
	(-25 to 120) °C	0.11 °C	
	(120 to 1 000) °C	0.16 °C	
	(1 000 to 1 372) °C	0.35 °C	
Type L	(-200 to -100) °C	0.3 °C	
	(-100 to 800) °C	0.22 °C	
	(800 to 900) °C	0.15 °C	
Type N	(-200 to -100) °C	0.35 °C	
	(-100 to -25) °C	0.23 °C	
	(-25 to 120) °C	0.21 °C	
	(120 to 410) °C	0.21 °C	
	(410 to 1 300) °C	0.26 °C	
Type R	(0 to 250) °C	0.52 °C	
	(250 to 400) °C	0.38 °C	
	(400 to 1 000) °C	0.37 °C	
	(1 000 to 1 767) °C	0.41 °C	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Type S	(0 to 250) °C	0.45 °C	Fluke 5522A
	(250 to 1 000) °C	0.39 °C	
	(1 000 to 1 400) °C	0.39 °C	
	(1 400 to 1 767) °C	0.45 °C	
Type T	(-250 to -150) °C	0.54 °C	
	(-150 to 0) °C	0.3 °C	
	(0 to 120) °C	0.26 °C	
	(120 to 400) °C	0.26 °C	
Type U	(-200 to 0) °C	0.44 °C	
	(0 to 600) °C	0.23 °C	

Time and Frequency – Frequency / Period

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Frequency Generate	(0.01 to 120) Hz	2 µHz/Hz + 60 µHz	Fluke 5522A
	(120 to 1 200) Hz	2 µHz/Hz + 10 µHz	
	1.2 kHz to 2 MHz	2 µHz/Hz + 5 µHz	
Frequency Generate	10 MHz	41 pHz/Hz	GPS10RBN
	10 Hz to 40 GHz	0.58 nHz/Hz + 0.18 mHz	GPS10RBN with Signal Generator
Frequency Measure	20 Hz to 4 GHz (4 to 26.5) GHz	0.58 nHz/Hz + 0.12 Hz 1.3 nHz/Hz	GPS10RBN with R&S FSMR26 Receiver

Time and Frequency – Oscilloscopes

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
DC Voltage 50 Ohm 1 M Ohm	1 mV to 6.6 V	0.2% + 35 µV	5522A/SC1100
	1 mV to 130 V	0.04% + 35 µV	
Square Wave into 50Ω (10 Hz to 10 kHz)	(1 to 25) mVpp	0.2% + 40 µV	
	(25 to 110) mVpp	0.2% + 40 µV	
	(0.11 to 2.2) Vpp	0.2% + 40 µV	
	(2.2 to 6.6) Vpp	0.2% + 120 µV	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Square Wave Into 1MΩ (10 Hz to 1 kHz)	(1 to 25) mVpp (25 to 110) mVpp (0.11 to 2.2) Vpp (2.2 to 11) Vpp (11 to 130) Vpp	0.085% + 35 μV 0.085% + 35 μV 0.085% + 45 μV 0.085% + 150 μV 0.085% + 2 mV	5522A/SC1100
Square Wave Into 1MΩ (1 to 10) kHz)	(1 to 25) mVpp (25 to 110) mVpp (0.11 to 2.2) Vpp (2.2 to 11) Vpp (11 to 130) Vpp	0.2% + 40 μV 0.2% + 40 μV 0.2% + 40 μV 0.2% + 80 μV 0.2% + 800 μV	
Rise time 5 mV to 2.5 V	(200 to 300) pS 10 kHz to 2 MHz (100 to 350) pS (2 to 10) MHz	75 pS 75 pS	
Sine Level Flatness 5 mV to 5.5 V	50 kHz Ref 50 kHz-100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1 100) MHz	1.7% + 0.25 mV 3.7% + 0.25 mV 4.2% + 0.26 mV 5.7% + 0.27 mV 6.6% + 0.25 mV	
Time Marker ⁴	(5 to 0.05) S 20 mS to 1 nS	(800 x t + 20) μS/S 2 μS/S	
Pulse Width	(4 to 500) nS	2 μS/S	
Frequency	10 Hz to 1 100 MHz	2.1 μHz/Hz	

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and remarks. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 (k=2), corresponding to a confidence level of approximately 95%.

Notes:

- 1) Laboratory offers calibration services at the laboratory's own facilities.
- 2) % refers to percent of reading unless otherwise indicated
- 3) M = mismatch error
- 4) t = period in seconds

Approved by:



R. Douglas Leonard
Chief Technical Officer

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