



LAB SCOPE

REV 6 - 08.30.16

McHale Performance Lab Scope

CALIBRATION

THERMODYNAMIC

PARAMETER / EQUIPMENT	RANGE	REFERENCE STANDARD
Low Temperature Measuring Equipment (RTD's, Thermocouples, Thermometers)	-30~200°F	Cole Parmer Liquid Bath, Rosemount 162CE SPRT, Hart 1529 Thermometer or Fluke 8508A Multimeter
High Temperature Measuring Equipment (RTD's, Thermocouples, Thermometers)	100~1220°F	High Temp Dry Well, Rosemount 162CE SPRT, Hart 1529 Thermometer or Fluke 8508A Multimeter
Full Range Temperature (ovens, dry block calibrators, environmental conditions, coolers etc.)	-40~1220°F	Rosemount 162CE SPRT, Hart 1529 Thermometer
Humidity Sensors	11.3%, 33%, 73.5%	LiCl, MgCl, NaCl salt mixtures
Pressure Measuring Instruments (Transmitters, Digital & Analog Pressure Gages, Transducers)	Vacuum~30psi	DHI PPC4 Pressure Calibrator, DHI RPM4 Pressure Monitor
Pressure Measuring Instruments (Transmitters, Digital & Analog Pressure Gages, Transducers)	30~1000psi	DHI PPC4 Pressure Calibrator
Pressure Measuring Instruments (Transmitters, Digital & Analog Pressure Gages, Transducers)	1000~5000psi	M2000 Pressurements Hydraulic Dead Weight Tester
Pressure Measuring Instruments (Transmitters, Digital & Analog Pressure Gages, Transducers)	5000~10000psi	Hydraulic Dead Weight Tester
Pressure Measuring Instruments (Transmitters, Digital & Analog Pressure Gages, Transducers)	12~800 InH2O	T1100/2 Dead Weight Tester
Pressure Measuring Instruments (Transmitters, Digital & Analog Pressure Gages, Transducers)	1.6~4 InH2O	V1600D Dead Weight Tester
Pressure Measuring Instruments (Transmitters, Digital & Analog Pressure Gages, Transducers)	4~64 InH2O	V1600D Dead Weight Tester

ELECTRICAL

PARAMETER / EQUIPMENT	RANGE	UNCERTAINTY	REFERENCE STANDARD
DC Voltage – Source	Up to 329.9999 mV 329.999 mV ~ 3.299999 V 3.299999 V ~ 32.99999 V 30 V ~ 329.999 V 329.9999 V ~ 1000.000 V	(20ppm, 1µV 11ppm, 2µV 12ppm, 20µV 18ppm, 150µV 18ppm, 1500µV)	Fluke 5520A
DC Voltage – Measure	Up to 100 mV 100 mV ~ 1 V 1 V ~ 10 V 10 V ~ 100 V 100 V ~ 1 kV		Agilent 3458A
DC Voltage – Measure	Up to 200 mV 200 mV ~ 2 V 2 V ~ 20 V 20 V ~ 200 V 200 V ~ 1.05 kV		Fluke 8508A

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PARAMETER / EQUIPMENT	RANGE	UNCERTAINTY	REFERENCE STANDARD
DC Current – Source	Up to 329.999 mA 329.999 mA ~ 3.29999 mA 3.29999 mA ~ 32.9999 mA 32.9999 mA ~ 329.999 mA 329.999 mA ~ 1.09999 A 1.1 A ~ 2.99999 A 2.99999 A ~ 10.9999 A 11 A ~ 20.5 A 20.5 A ~ 1000 A	(150ppm, 0.02µA 100ppm, 0.05µA 100ppm, 0.25µA 100ppm, 2.5µA 200ppm, 40µA 380ppm, 40µA 500ppm, 500µA 1000ppm, 750µA, 1500µA floor)	Fluke 5520A Fluke 5520A w/ 50-turn Coil
DC Current – Measure	Up to 100 nA 100 nA ~ 1 µA 1 µA ~ 10 µA 10 µA ~ 100 µA 100 µA ~ 1 mA 1 mA ~ 10 mA 10 mA ~ 100 mA 100 mA ~ 1 A		Agilent 3458A
DC Current – Measure	Up to 200 µA 200 µA ~ 2 mA 2mA ~ 20 mA 20mA ~ 200 mA 200 mA ~ 2 A 2 A ~ 20 A		Fluke 8508A
Resistance – Source	Up to 10.9999Ω 11Ω ~ 32.9999Ω 33Ω ~ 109.9999Ω 110Ω ~ 329.9999Ω 330Ω ~ 1.099999kΩ 1.1kΩ ~ 3.299999kΩ 3.3kΩ ~ 10.99999kΩ 11kΩ ~ 32.99999kΩ 33kΩ ~ 109.9999kΩ 110kΩ ~ 329.9999kΩ 330kΩ ~ 1.099999MΩ 3.3MΩ ~ 10.99999MΩ 11MΩ ~ 32.9999MΩ 33MΩ ~ 109.9999MΩ 110MΩ ~ 329.9999MΩ 330MΩ ~ 1100MΩ		Fluke 5520A
Resistance – Measure Normal Mode	Up to 2Ω 2Ω ~ 20Ω 20Ω ~ 200Ω 200Ω ~ 2kΩ 2kΩ ~ 20kΩ 20kΩ ~ 200kΩ 200kΩ ~ 2MΩ 2MΩ ~ 20MΩ 20MΩ ~ 200MΩ		Fluke 8508A
Resistance – Measure High Voltage Mode	200kΩ ~ 2MΩ 2MΩ ~ 20MΩ 20MΩ ~ 200MΩ 200MΩ ~ 2GΩ 2GΩ ~ 20Ω		Fluke 8508A
Resistance – Measure	Up to 10Ω 10Ω ~ 100Ω 100Ω ~ 1kΩ 1kΩ ~ 10kΩ 10kΩ ~ 100kΩ 100kΩ ~ 1MΩ 1MΩ ~ 10MΩ 10MΩ ~ 100MΩ 100MΩ ~ 1GΩ		Agilent 3458A

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PARAMETER / EQUIPMENT	RANGE	UNCERTAINTY	REFERENCE STANDARD
AC Voltage – Source	1 mV ~ 32.999 mV 10~45Hz 45Hz~10kHz 10~20kHz 20~50kHz 50~100kHz 100~500kHz 0.33 mV ~ 329.999 mV 10~45Hz 45Hz~10kHz 10~20kHz 20~50kHz 50~100kHz 100~500kHz 0.33 V ~ 3.29999 V 10~45Hz 45Hz~10kHz 10~20kHz 20~50kHz 50~100kHz 100~500kHz 3.3 V ~ 32.9999V 10~45Hz 45Hz~10kHz 10~20kHz 20~50kHz 50~100kHz 33 V ~ 329.999 V 45Hz~1kHz 1~10kHz 10~20kHz 20~50kHz 50~100kHz 330 V ~ 1020 V 45Hz~1kHz 1~5kHz 5~10kHz		Fluke 5520A
AC Voltage Harmonics – Source 10~45Hz 45~65Hz 65~500Hz 500Hz~5kHz 5~10kHz	32 mV ~ 33 V 33 mV ~ 1 kV 33 mV ~ 1 kV 330 mV ~ 1 kV 3.3 V ~ 1 kV		Fluke 5520A

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PARAMETER / EQUIPMENT	RANGE	UNCERTAINTY	REFERENCE STANDARD
AC Voltage – Measure Bandwidth < 2MHz	<p>Up to 10 mV 1~40Hz 40Hz~1kHz 1~20kHz 20~50kHz 50~100kHz 100~300kHz</p> <p>10 mV ~ 100 mV 1~40Hz 40Hz~1kHz 1~20kHz 20~50kHz 50~100kHz 100~300kHz 300kHz~1MHz 1~2MHz</p> <p>100 mV ~ 1 V 1~40Hz 40Hz~1kHz 1~20kHz 20~50kHz 50~100kHz 100~300kHz 300kHz~1MHz 1~2MHz</p> <p>1 V ~ 10 V 1~40Hz 40Hz~1kHz 1~20kHz 20~50kHz 50~100kHz 100~300kHz 300kHz~1MHz 1~2MHz</p> <p>10 V ~ 100 V 1~40Hz 40Hz~1kHz 1~20kHz 20~50kHz 50~100kHz 100~300kHz 300kHz~1MHz</p> <p>100 V to 1 kV 1~40Hz 40Hz~1kHz 1~20kHz 20~50kHz 50~100kHz</p>		Agilent 3258A

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PARAMETER / EQUIPMENT	RANGE	UNCERTAINTY	REFERENCE STANDARD
AC Voltage – Measure Bandwidth < 1MHz	<p>Up to 200 mV 1~10Hz 10~40Hz 40~100Hz 100Hz~2kHz 2~10kHz 10~30kHz 30~100kHz</p> <p>200 mV ~ 2 V 1~10Hz 10~40Hz 40~100Hz 100Hz~2kHz 2~10kHz 10~30kHz 30~100kHz 100~300kHz 300kHz~1MHz</p> <p>2 V ~ 20 V 1~10Hz 10~40Hz 40~100Hz 100Hz~2kHz 2~10kHz 10~30kHz 30~100kHz 100~300kHz 300kHz~1MHz</p> <p>20 V ~ 200 V 1~10Hz 10~40Hz 40~100Hz 100Hz~2kHz 2~10kHz 10~30kHz 30~100kHz 100~300kHz 300kHz~1MHz</p> <p>200 V to 1.05 kV 1~10Hz 10~40Hz 40Hz~10kHz 10~30kHz 30~100kHz</p>		Fluke 8508A

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PARAMETER / EQUIPMENT	RANGE	UNCERTAINTY	REFERENCE STANDARD
AC Current – Source	29 μA ~ 329.99 μA 10~20Hz 20~45Hz 45Hz~1kHz 1~5kHz 5~10kHz 10~30kHz		Fluke 5520A
	0.33 mA ~ 3.2999 mA 10~20Hz 20~45Hz 45Hz~1kHz 1~5kHz 5~10kHz 10~30kHz		Fluke 5520A
	33 mA ~ 329.99 mA 10~20Hz 20~45Hz 45Hz~1kHz 1~5kHz 5~10kHz 10~30kHz		
	0.33 A ~ 1.09999 A 10~45Hz 45Hz~1kHz 1~5kHz 5~10kHz		
	1.1A ~ 2.99999A 10~45Hz 45Hz~1kHz 1~5kHz 5~10kHz		Fluke 5520A w/ 50-turn Coil
	3A ~ 10.9999A 45~100Hz 100Hz~1kHz 1~5kHz		
	11A ~ 20.5A 45~100Hz 100Hz~1kHz 1~5kHz		
	20.5A ~ 1000A 45~65Hz		
	20.5 A ~ 150 A 65~440Hz		
	AC Current Harmonics – Source		
10~45Hz 45~65Hz 65~500Hz 500Hz~5kHz 5~10kHz	3.3 mA ~ 3 A 3.3 mA ~ 20.5 A 33 mA ~ 20.5 A 33 mA ~ 20.5 A 33 mA ~ 330 mA		Fluke 5520A

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PARAMETER / EQUIPMENT	RANGE	UNCERTAINTY	REFERENCE STANDARD
AC Current – Measure	Up to 100μA 10~20Hz 20~45Hz 45~100Hz 100Hz~5kHz		Agilent 3258A
	100 μA ~ 1 mA 10~20Hz 20~45Hz 45~100Hz 100Hz~5kHz 5~20kHz 20~50kHz 50~100kHz		Agilent 3258A
	1 mA ~ 10 mA 10~20Hz 20~45Hz 45~100Hz 100Hz~5kHz 5~20kHz 20~50kHz 50~100kHz		
	10 mA ~ 100 mA 10~20Hz 20~45Hz 45~100Hz 100Hz~5kHz 5~20kHz 20~50kHz 50~100kHz		
	100 mA ~ 1 A 10~20Hz 20~45Hz 45~100Hz 100Hz~5kHz 5~20kHz 20~50kHz		

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PARAMETER / EQUIPMENT	RANGE	UNCERTAINTY	REFERENCE STANDARD
Type E	-250~ -100C -100~ -25C -25~350C 350~650C 650~1000C		
Type J	-210~ -100C -100~ -30C -30~150C 150~760C 760~1200C		
Type L	-200~ -100C -100~ -25C -25~120C 120~1000C 1000~1372C		
Type N	-200~ -100C -100~800C 800~900C		
Type R	-200~ -100C -100~ -25C -25~ 120C 120~410C 410~1300C		Fluke 5520A
Type S	0~250C 250~400C 400~1000C 1000~1767C		
Type T	0~250C 250~400C 400~1000C 1000~1767C -250~ -150C -150~ 0C 0~120C 120~400C		
Type U	-200~0C 0~600C		
Electrical Simulation of RTDs			
PT 395, 100Ω	-200~ -80C -80~0C 0~100C 100~300C 300~400C 400~630C 630~800C		Fluke 5520A
PT 3926, 100Ω	-200~ -80C -80~0C 0~100C 100~300C 300~400C 400~630C		
PT 3916, 100Ω	-200~ -190C -190~ -80C -80~0C 0~100C 100~260C 260~300C 300~400C 400~600C 600~630C		Fluke 5520A

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PARAMETER / EQUIPMENT	RANGE	UNCERTAINTY	REFERENCE STANDARD
PT 385, 200Ω	-200~ -190C -190~ -80C -80~0C 0~100C 100~260C 260~300C 300~400C 400~600C 600~630C		
PT 385, 500Ω	-200~ -80C -80~0C 0~100C 100~260C 260~300C 300~400C 400~600C 600~630C		
PT 385, 1000 Ω	-200~ -80C -80~0C 0~100C 100~260C 260~300C 300~400C 400~600C 600~630C		
PtNi 385, 120Ω (Ni120)	-200~ -80C -80~0C 0~100C 100~260C		
Cu 427, 10Ω	-100~260C		

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DIMENSIONAL

Indicators	0.05~6"	Gage Blocks
Calipers	Up to 8" 8~24"	Gage Blocks, Kalmaster
Micrometers, OD	Up to 8" 8~24"	Gage Blocks, Kalmaster
Micrometers, ID	Up to 8" 8~24"	Gage Blocks, Kalmaster
Thickness Gage (Thickness Micrometer)	Any	Gage Blocks
Depth Gage	Up to 8" 8~24"	Gage Blocks
Height Gage	Up to 12" 12~24"	Gage Blocks
Optical Comparator (linearity only)	Up to 24"	Gage Blocks
ULM (length only)	Up to 24"	Gage Blocks

SAMPLING & TESTING

Field of Test	Items, Materials, or Products Tested	Specific Tests or Properties Measured	Specification, Standard Method, or Technique Used	Key Equipment or Technology*
Chemical	Field Sampling	Natural Gas and Similar Gaseous Mixtures for Analysis by Gas Chromatography	GPA 2166	
Chemical	Natural Gas and Similar Gaseous Mixtures	Analysis by Gas Chromatography	GPA 2261, ASTM D1945. ASTM D 3588-98	Agilent 3000 Gas Chromatograph