Electricity and Magnetism, Slovakia, SMU (Slovensky Metrologicky Ustav)

Calibration or Measurement Services			Measurand Level or Range			Measurement Conditions/Independent variables		Expanded Uncertainty					
Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	NMI Service Identifier
DC voltage sources: single values	DC voltage solid state standards	Direct method	1	1	V	Laboratory pressure	atmospheric pressure	200	nV	2	95%	No	2
DC voltage sources: single values	DC voltage solid state standards	Direct method	10	10	V	Laboratory pressure	atmospheric pressure	200	nV	2	95%	No	1
DC voltage sources: single values	Standard Weston cells	Direct method	1.018	1.018	V	Laboratory temperature	20 °C	200	nV	2	95%	No	3
DC voltage sources: low values	Digital voltmeters and calibrators	Direct method	0.01	10	V	Laboratory temperature	20 °C	500	nV	2	95%	No	4a
DC voltage sources: low values	Multifunction calibrator	Comparison with reference standard	100	100	mV			7	µV/V	2	95%	Yes	5
DC voltage sources: low values	Multifunction calibrator	Comparison with reference standard	1	1	V			4	µV/V	2	95%	Yes	6
DC voltage sources: low values	Multifunction calibrator	Comparison with reference standard	10	10	V			0.6	µV/V	2	95%	Yes	7
DC voltage sources: intermediate values	Multifunction calibrator	Comparison with reference standard	100	100	V			4	µV/V	2	95%	Yes	8
DC voltage sources: intermediate values	Multifunction calibrator	Comparison with reference standard	1000	1000	V			4	µV/V	2	95%	Yes	9
DC voltage meters: intermediate values	Digital voltmeters and calibrators	Direct method	0.01	10	V	Laboratory temperature	20 °C	500	nV	2	95%	No	4b

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DC voltage meters: intermediate values	Digital multimeter	Direct measurement	10	10	V			0.6	µV/V	2	95%	Yes	10
DC voltage meters: intermediate values	Digital multimeter	Resistive divider and DC voltage standard	100	100	V			4	µV/V	2	95%	Yes	11
DC voltage meters: intermediate values	Digital multimeter	Resistive divider and DC voltage standard	1000	1000	V			4	µV/V	2	95%	Yes	12
DC voltage meters: intermediate values	Digital multimeter	Direct with calibrator	100	100	mV			8	µV/V	2	95%	Yes	13
DC voltage meters: intermediate values	Digital multimeter	Direct with calibrator	1	1	V			4	µV/V	2	95%	Yes	14
DC voltage meters: intermediate values	Digital multimeter	Direct with calibrator	10	10	V			1.5	µV/V	2	95%	Yes	15
DC voltage meters: intermediate values	Digital multimeter	Direct with calibrator	100	100	V			4	µV/V	2	95%	Yes	16
DC voltage meters: intermediate values	Digital multimeter	Direct with calibrator	1	1	kV			4	µV/V	2	95%	Yes	17

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	NMI Service Identifier
DC resistance standards and sources: low values	Fixed resistor, resistance boxes	DCC bridge	0.01	0.1	mΩ	Power	10 mW	30	μΩ/Ω	2	95%	Yes	18
DC resistance standards and sources: low values	Fixed resistor, resistance boxes	DCC bridge	0.1	1	mΩ	Power	10 mW	10	μΩ/Ω	2	95%	Yes	19
DC resistance standards and sources: low values	Fixed resistor, resistance boxes	DCC bridge	1	10	mΩ	Power	10 mW	5	μΩ/Ω	2	95%	Yes	20
DC resistance standards and sources: low values	Fixed resistor, resistance boxes	DCC bridge	10	100	mΩ	Power	10 mW	2	μΩ/Ω	2	95%	Yes	21
DC resistance standards and sources: low values	Fixed resistor, resistance boxes	DCC bridge	0.1	1	Ω	Power	10 mW	1.2	μΩ/Ω	2	95%	Yes	22
DC resistance standards and sources: low values	Fixed resistor, resistance boxes	DCC bridge	1	1	Ω	Power	10 mW	1	μΩ/Ω	2	95%	Yes	23
DC resistance standards and sources: intermediate values	Fixed resistor, resistance boxes	DCC bridge	10	10	kΩ	Power	10 mW	1.2	μΩ/Ω	2	95%	Yes	24
DC resistance standards and sources: intermediate values	Fixed resistor, resistance boxes	DCC bridge	1	100	Ω	Power	10 mW	1.2	μΩ/Ω	2	95%	Yes	25

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	NMI Service Identifier
DC resistance standards and sources: intermediate values	Fixed resistor, resistance boxes	DCC bridge	100	10000	Ω	Power	10 mW	1.8	μΩ/Ω	2	95%	Yes	26
DC resistance standards and sources: intermediate values	Fixed resistor, resistance boxes	Resistance ratio bridge	10	100	kΩ	Voltage	< 12 V	3	μΩ/Ω	2	95%	Yes	27
DC resistance standards and sources: intermediate values	Fixed resistor, resistance boxes	Resistance ratio bridge	0.1	1	MΩ	Voltage	< 12 V	5	μΩ/Ω	2	95%	Yes	28
DC resistance standards and sources: high values	Fixed resistor, three terminal resistor, resistance boxes	High resistance ratio bridge	1	10	MΩ	Voltage	10 V to 100 V	8	μΩ/Ω	2	95%	Yes	29
DC resistance standards and sources: high values	Fixed resistor, three terminal resistor, resistance boxes	High resistance ratio bridge	10	100	MΩ	Voltage	10 V to 100 V	15	μΩ/Ω	2	95%	Yes	30
DC resistance standards and sources: high values	Fixed resistor, three terminal resistor, resistance boxes	High resistance ratio bridge	0.1	1	GΩ	Voltage	10 V to 100 V	30	μΩ/Ω	2	95%	Yes	31
DC resistance standards and sources: high values	Fixed resistor, three terminal resistor, resistance boxes	High resistance ratio bridge	1	10	GΩ	Voltage	10 V to 100 V	100	μΩ/Ω	2	95%	Yes	32
DC resistance standards and sources: high values	Fixed resistor, three terminal resistor, resistance boxes	High resistance ratio bridge	10	100	GΩ	Voltage	40 V to 100 V	300	μΩ/Ω	2	95%	Yes	33

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Quantity	**Instrument or artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**NMI Service Identifier**
DC resistance standards and sources: high values	Fixed resistor, three terminal resistor, resistance boxes	High resistance ratio bridge	0.1	1	TΩ	Voltage	40 V to 100 V	1000	μΩ/Ω	2	95%	Yes	34
DC resistance standards and sources: standards for high current	Fixed resistor, DC shunt	DCC bridge	0.01	100	mΩ	Current	1 A to 100 A	50	μΩ/Ω	2	95%	Yes	35
DC resistance standards and sources: multiple ranges	Multifunction calibrator	DCC bridge, resistance ratio bridge	0.001	10000	kΩ	Power	10 mW	8	μΩ/Ω	2	95%	Yes	36
DC resistance standards and sources: temperature coefficients	Fixed resistor	DCC bridge, resistance ratio bridge	0.5	50	μΩ/Ω/K	Temperature	18 °C to 25 °C	1 to 5	μΩ/Ω/K	2	95%	No	37
						Resistance	0.1 mΩ to 100 kΩ						
DC resistance meters: low values	Microohmmeter, multimeter, transfer standards, resistance bridge	Direct measurement standards resistor or direct comparison	0.0001	1	Ω	Resistance	decadic values	100 to 2	μΩ/Ω	2	95%	Yes	38
						Power	10 mW						
DC resistance meters: intermediate values	Ohmmeter, multimeter, multifunction transfer standard, resistance bridge	Direct measurement standards resistor or direct comparison	1	1E+06	Ω	Resistance	decadic values	2 to 15	μΩ/Ω	2	95%	Yes	39
						Power	10 mW						

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Quantity	**Instrument or artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**NMI Service Identifier**
DC resistance meters: intermediate values	Multimeter, multifunction transfer standard, teraohmmeter, resistance bridge	Direct measurement standards resistor or direct comparison	1E+06	1E+09	Ω	Resistance	decadic values	15 to 150	μΩ/Ω	2	95%	Yes	40a
						Voltage	10 V to 100 V						
DC resistance meters: high values	Multimeter, multifunction transfer standard, teraohmmeter, resistance bridge	Direct measurement standards resistor or direct comparison	1E+09	1E+12	Ω	Resistance	decadic values	150 to 5000	μΩ/Ω	2	95%	Yes	40b
						Voltage	10 V to 100 V						
DC current sources: low values	Multifunction calibrator	Shunt and multimeter, voltage drop accross resistor	20	100	μA			5.7	μA/A	2	95%	Yes	41a
DC current sources: intermediate values	Multifunction calibrator	Shunt and multimeter, voltage drop accross resistor	0.1	200	mA			5.7	μA/A	2	95%	Yes	42
DC current sources: intermediate values	Multifunction calibrator	Shunt and multimeter, voltage drop accross resistor	0.2	2	A			7.3	μA/A	2	95%	Yes	45
DC current sources: intermediate values	Transconductance amplifier	Shunt and multimeter, voltage drop accross resistor	2	20	A			6.1	μA/A	2	95%	Yes	46
DC current meters: low values	Digital multimeter	Calibrator, shunt and multimeter, voltage drop accross resistor	20	100	μA			5.7	μA/A	2	95%	Yes	47a

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	NMI Service Identifier
DC current meters: intermediate values	Digital multimeter	Calibrator, shunt and multimeter, voltage drop accross resistor	0.1	200	mA			5.7	µA/A	2	95%	Yes	48
DC current meters: intermediate values	Digital multimeter	Calibrator, shunt and multimeter, voltage drop accross resistor	0.2	2	A			7.3	µA/A	2	95%	Yes	51
DC current meters: intermediate values	Digital multimeter	Calibrator, shunt and multimeter, voltage drop accross resistor	2	20	A			6.1	µA/A	2	95%	Yes	52
AC resistance: real component	Fixed resistor, resistance boxes	Comparison with AC ratio bridge	1	10	Ω	Frequency	50 Hz to 1600 Hz	4	µΩ/Ω	2	95%	Yes	53
AC resistance: real component	Fixed resistor, resistance boxes	Comparison with AC ratio bridge	10	100	Ω	Frequency	50 Hz to 1600 Hz	2	µΩ/Ω	2	95%	Yes	54
AC resistance: real component	Fixed resistor, resistance boxes	Comparison with AC ratio bridge	100	1000	Ω	Frequency	50 Hz to 1600 Hz	3	µΩ/Ω	2	95%	Yes	55
AC resistance: real component	Fixed resistor, resistance boxes	Comparison with AC ratio bridge	1	10	kΩ	Frequency	50 Hz to 1600 Hz	5	µΩ/Ω	2	95%	Yes	56
Capacitance: low loss capacitors	Standard capacitor (air, fused silica)	Comparison with transformer bridge	10	10	pF	Frequency	1 kHz	5	µF/F	2	95%	Yes	57
Capacitance: low loss capacitors	Standard capacitor (air, fused silica)	Comparison with transformer bridge	10	100	pF	Frequency	1 kHz	10	µF/F	2	95%	Yes	58
Capacitance: low loss capacitors	Standard capacitor (air, fused silica)	Comparison with transformer bridge	1	1	nF	Frequency	1 kHz	20	µF/F	2	95%	Yes	59
Capacitance: low loss capacitors	Standard capacitor (air, fused silica)	Comparison with transformer bridge	10	10	nF	Frequency	1 kHz	40	µF/F	2	95%	Yes	60
Capacitance: low loss capacitors	Standard capacitor (air, fused silica)	Comparison with transformer bridge	100	100	nF	Frequency	1 kHz	60	µF/F	2	95%	Yes	61

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	NMI Service Identifier
Capacitance: dielectric capacitors	Fixed capacitor, variable capacitor	Comparison with transformer bridge	1	1	µF	Frequency	1 kHz	120	µF/F	2	95%	Yes	62
Capacitance: dielectric capacitors	Fixed capacitor, variable capacitor	Comparison with transformer bridge	10	10	µF	Frequency	1 kHz	300	µF/F	2	95%	Yes	63
Capacitance: dielectric capacitors	Variable capacitor, capacitance box	Comparison with transformer bridge	0.001	10000	nF	Frequency	1 kHz	10 to 500	µF/F	2	95%	Yes	64
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	0.5	500	V	Frequency	40 Hz	120	µV/V	2	95%	Yes	65
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	0.5	500	V	Frequency	1 kHz	120	µV/V	2	95%	Yes	66
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	0.5	500	V	Frequency	10 kHz	120	µV/V	2	95%	Yes	67
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	0.5	500	V	Frequency	20 kHz	120	µV/V	2	95%	Yes	68
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	0.5	500	V	Frequency	40 kHz	120	µV/V	2	95%	Yes	69
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	500	1000	V	Frequency	40 Hz	240	µV/V	2	95%	Yes	70
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	500	1000	V	Frequency	1 kHz	240	µV/V	2	95%	Yes	71
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	500	1000	V	Frequency	10 kHz	240	µV/V	2	95%	Yes	72

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	NMI Service Identifier
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	500	1000	V	Frequency	20 kHz	240	µV/V	2	95%	Yes	73
AC voltage up to 1000 V: sources	Multifunction calibrator	Comparison with reference standard	500	1000	V	Frequency	40 kHz	480	µV/V	2	95%	Yes	74
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	0.5	500	V	Frequency	40 Hz	120	µV/V	2	95%	Yes	75
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	0.5	500	V	Frequency	1 kHz	120	µV/V	2	95%	Yes	76
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	0.5	500	V	Frequency	10 kHz	120	µV/V	2	95%	Yes	77
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	0.5	500	V	Frequency	20 kHz	120	µV/V	2	95%	Yes	78
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	0.5	500	V	Frequency	40 kHz	120	µV/V	2	95%	Yes	79
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	1000	1000	V	Frequency	40 Hz	240	µV/V	2	95%	Yes	80
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	1000	1000	V	Frequency	1 kHz	240	µV/V	2	95%	Yes	81
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	1000	1000	V	Frequency	10 kHz	240	µV/V	2	95%	Yes	82
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	1000	1000	V	Frequency	20 kHz	240	µV/V	2	95%	Yes	83

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Quantity	**Instrument or artifact**	**Instrument Type or Method**	**Minimum value**	**Maximum value**	**units**	**Parameter**	**Specifications**	**Value**	**Units**	**Coverage Factor**	**Level of Confidence**	**Is the expanded uncertainty a relative one?**	**NMI Service Identifier**
AC voltage up to 1000 V: meters	Digital multimeter	Comparison with reference standard	1000	1000	V	Frequency	40 kHz	480	µV/V	2	95%	Yes	84
AC current up to 100 A: sources	Multifunction calibrator	AC/DC transfer standard and shunt	20	200	mA	Frequency	50 Hz	120	µA/A	2	95%	Yes	85
AC current up to 100 A: sources	Multifunction calibrator	AC/DC transfer standard and shunt	0.2	2	A	Frequency	50 Hz	120	µA/A	2	95%	Yes	86
AC current up to 100 A: meters	Digital multimeter	Calibrator AC/DC transfer standard and shunt	20	200	mA	Frequency	50 Hz	120	µA/A	2	95%	Yes	87
AC current up to 100 A: meters	Digital multimeter	Calibrator AC/DC transfer standard and shunt	0.2	2	A	Frequency	50 Hz	120	µA/A	2	95%	Yes	88
AC power and energy: single phase (*f* <= 400 Hz), active power	Power meter	Direct comparison with reference standard	12.5	1100	W	Power factor	1, 0.5 (inductive or capacitive)	(120 to 160), depending on power factor	µW/W	2	95%	Yes	89
						Voltage	50 V to 220 V						
						Current	0.5 A to 5 A						
						Frequency	50 Hz						

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AC power and energy: single phase (*f* <= 400 Hz), active energy	Energy meter	Direct comparison with reference standard	125	11000	Ws	Power factor	1, 0.5 (inductive or capacitive)	(120 to 160), depending on power factor	µWh/Wh	2	95%	Yes	90
						Voltage	50 V to 220 V						
						Current	0.5 A to 5 A						
						Frequency	50 Hz						
						Time	10 s						
RF power: absolute power on coaxials	Power meters	Power sensors	10	100	µW	Frequency	10 MHz to 18 GHz	25	mW/W	2	95%	Yes	91
						Coaxial line	50 Ω						
						Connector	N						
RF power: absolute power on coaxials	Power meters	Power sensors	1	1000	mW	Frequency	10 MHz to 18 GHz	16	mW/W	2	95%	Yes	92
						Coaxial line	50 Ω						
						Connector	N						
RF power: absolute power on waveguides	Power meters	Power sensors	1	10	mW	Frequency	8.2 GHz to 12.4 GHz	8.5	mW/W	2	95%	Yes	93
						Waveguide	WR-90						
RF voltage sources	RF generators	RF/DC transfer	0.2	2	V	Frequency	1 MHz to 50 MHz	0.5 to 5	mV/V	2	95%	Yes	94a
RF voltage sources	RF generators	RF/DC transfer	0.2	2	V	Frequency	0.05 MHz	0.2	mV/V	2	95%	Yes	95a

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Quantity	Instrument or artifact	Instrument Type or Method	Minimum value	Maximum value	units	Parameter	Specifications	Value	Units	Coverage Factor	Level of Confidence	Is the expanded uncertainty a relative one?	NMI Service Identifier
RF voltage sources	RF generators	RF/DC transfer	2	30	V	Frequency	0.05 MHz to 30 MHz	2 to 10	mV/V	2	95%	Yes	96a
RF voltage sources	RF generators	Bolometer method	0.1	1	V	Frequency	20 MHz to 1000 MHz	4 to 16	mV/V	2	95%	Yes	97a
RF voltage sources	RF generators	Attenuation of RF voltage	1	1E+05	µV	Frequency	0.1 MHz to 1000 MHz	20 to 100	mV/V	2	95%	Yes	98a
RF voltage meters	RF voltmeters	RF/DC transfer	0.2	2	V	Frequency	1 MHz to 50 MHz	0.5 to 5	mV/V	2	95%	Yes	94b
RF voltage meters	RF voltmeters	RF/DC transfer	0.2	2	V	Frequency	0.05 MHz	0.2	mV/V	2	95%	Yes	95b
RF voltage meters	RF voltmeters	RF/DC transfer	2	30	V	Frequency	0.05 MHz to 30 MHz	2 to 10	mV/V	2	95%	Yes	96b
RF voltage meters	RF voltmeters	Bolometer method	0.1	1	V	Frequency	20 MHz to 1000 MHz	4 to 16	mV/V	2	95%	Yes	97b
RF voltage meters	RF voltmeter	Attenuation of RF voltage	1	1E+05	µV	Frequency	0.1 MHz to 1000 MHz	20 to 100	mV/V	2	95%	Yes	98b